YAMAHA

XS 250, 360 & 400 Twins

248cc-358cc-391cc 1975 to 1978

OWNERS WORKSHOP MANUAL



Yamaha XS250, 360 and 400 Twins Owners Workshop Manual

by Mansur Darlington

Models covered:

XS250	248 cc (15.13 cu in)	Introduced UK 1977
XS 360C	358 cc (21.85 cu in)	Introduced US 1975
XS360 2-D		Introduced US 1976
XS360 D		Introduced US 1976
XS400	392 cc (23.92 cu in)	Introduced UK and US 1977

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We would also like to thank the following Companies who kindly supplied advice and information relating to their products: The Avon Rubber Company, NGK Spark Plugs (UK) Ltd. and Renold Limited.

About this manual

The author of this manual has the conviction that the only way in which a meaningful and easy to follow text can be written is first to do the work himself, under conditions similar to those found in the average household. As a result, the hands seen in the photographs are those of the author. Unless specially mentioned, and therefore considered essential, Yamaha special service tools have not been used. There is invariably some alternative means of loosening or removing a vital component when service tools are not available, but risk of damage should always be avoided.

Each of the six Chapters is divided into numbered sections. Within these section are numbered paragraphs. Cross reference throughout the manual is quite straightforward and logical. When reference is made 'See Section 8.10' it means Section 8, paragraph 10 in the same Chapter. If another Chapter were meant, the reference would read, for example, 'See Chapter 2, Section 8.10'. All the photographs are captioned with a section/paragraph number to which they refer and are relevant to the Chapter text adjacent.

Figures (usually line illustrations) appear in a logical but numerical order, within a given Chapter. Fig. 1.1 therefore refers to the first figure in Chapter 1.

Left-hand and right-hand descriptions of the machines and their components refer to the left and right of a given machine when the rider is seated normally.

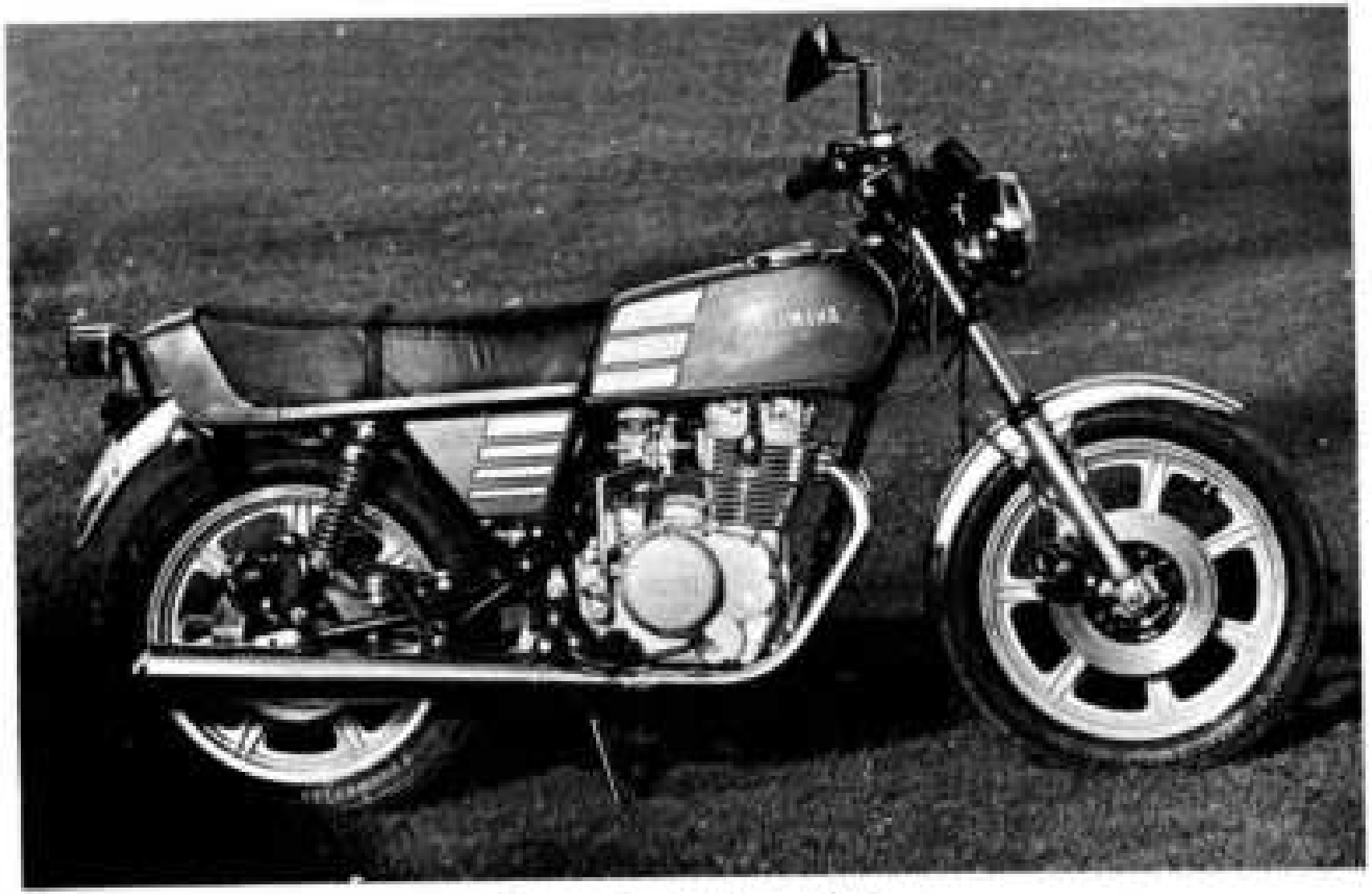
Whilst every care is taken to ensure that the information in this manual is correct no liability can be accepted by the authors or publishers for loss, damage or injury caused by any errors in or omissions from the information given.

Contents

Chapter	Section	Page	Section	Page
Introductory sections	Acknowledgements	2	Routine maintenance	9-13
	About this manual	3	Summary of routine maintenance adjustments and capacities	14
	Introduction to Yamaha XS250, 360 & 400 Twins	4	Recommended lubricants	14
	Dimensions	6	Working conditions and tools	15
	Ordering spare parts	7		
Chapter 1 Engine, clutch and gearbox	Operations: Unit in frame	18	Examination and renovation:	
	Engine/gearbox removal	18	clutch and gearbox	35
	Dismantling: general	23	Engine/gearbox:	
	Examination and renovation: general	29	reassembly: general	38
	Decarbonising	32	Replacing unit in frame	54
	Valve grinding	33	Starting and running a rebuilt engine	56
Chapter 2 Fuel system and lubrication	Petrol tank / removal and		Air filters	66
	Petrol tap / replacement	58	Exhaust system	69
	Carburettors	60-65	Oil pump	69
	Carburettor settings	65	Oil filters	71
Chapter 3 Ignition system	Charging system – checking	73	Coils	77
	Contact breaker	73	Automatic timing unit	77
	Condenser	77	Spark plugs	79
Chapter 4 Frame and forks	Front forks	80-82	Centre and prop stands	83
	Steering head	82	Foot rests	85
	Frame examination	85	Rear brake pedal	88
	Swinging arm rear fork	87	Dualseat	89
	Rear suspension units	89	Cleaning the machine	90
Chapter 5 Wheels, brakes and tyres	Front wheel	91-93	Rear wheel – removal	98
	Front disc brake	93-94	Bleeding hydraulic system	102
	Master cylinder	95	Final drive chain	105
	Front drum brake	97	Tyres	104-105
Chapter 6 Electrical system	Checking alternator	109	Handlebar switches	113
	Voltage regulator	110	Flasher lamps	113
	Battery	110	Starter motor	114
	Headlamp	110	Speedometer & tachometer	117
	Fuse location	112	Ignition & lighting switch	117

Note: General description and specifications are given in each Chapter immediately after list of contents.
Fault diagnosis is given where applicable at the end of the Chapter.

Wiring diagrams	119-120
Metric conversion tables	121-122
Index	123-126



Right-hand view of 1977 Yamaha XS400

Ordering spare parts

When ordering spare parts for the Yamaha four-stroke range it is advisable to deal direct with an official Yamaha agent, who will be able to supply many of the items required ex-stock. Although parts can be ordered from Yamaha direct, it is preferable to route the order via a local agent even if the parts are not available from stock. He is in a better position to specify exactly the parts required and to identify the relevant spare part numbers so that there is less chance of the wrong part being supplied by the manufacturer due to a vague or incomplete description.

When ordering spares, always quote the frame and engine numbers in full, together with any prefixes or suffixes in the form of letters. The frame number is found stamped on the right-hand side of the steering head, in line with the forks. The engine number is stamped on the right-hand side of the upper crankcase, immediately below the left-hand carburettor.

Use only parts of genuine Yamaha manufacture. A few pattern parts are available, sometimes at cheaper prices, but there is no guarantee that they will give such good service as the originals they replace. Retain any worn or broken parts until the replacements have been obtained; they are sometimes needed as a pattern to help identify the correct replacement when design changes have been made during a production run.

Some of the more expendable parts such as spark plugs, bulbs, tyres, oils and greases etc., can be obtained from accessory shops and motor factors, who have convenient opening hours, and can often be found not far from home. It is also possible to obtain parts on Mail Order basis from a number of specialists who advertise regularly in the motor cycle magazines.



Frame number location



Engine number location

Routine maintenance

Periodic routine maintenance is a continuous process that commences immediately the machine is used and continues until the machine is no longer fit for service. It must be carried out at specified mileage recordings or on a calendar basis if the machine is not used regularly, whichever is the soonest. Maintenance should be regarded as an insurance policy, to help keep the machine in the peak of condition and to ensure long, trouble-free service. It has the additional benefit of giving early warning of any faults that may develop and will act as a safety check, to the obvious advantage of both rider and machine alike.

The various maintenance tasks are described under their respective mileage and calendar headings. Accompanying photos or diagrams are provided, where necessary. It should be remembered that the interval between the various maintenance tasks serves only as a guide. As the machine gets older, is driven hard, or is used under particularly adverse conditions, it is advisable to reduce the period between each check.

For ease of reference each service operation is described in detail under the relevant heading. However, if further general information is required it can be found within the manual in the relevant Chapter.

Although no special tools are required for routine maintenance, a good selection of general workshop tools are essential. Included in the tools must be a range of metric ring or combination spanners, a selection of cross-head screwdrivers, and two pairs of circlip pliers, one external opening and the other internal opening. Additionally, owing to the extreme tightness of most casing screws on Japanese machines, an impact screwdriver together with a choice of large or small cross head screw bits, is absolutely indispensable. This is particularly so if the engine has not been dismantled since leaving the factory.

Weekly or every 200 miles (300 km)

1 Tyre pressures

Check the tyre pressures with a pressure gauge that is known to be accurate. Always check the pressures when the tyres are cool. If the tyres are checked after the machine has travelled a number of miles, the tyres will have become hot and consequently the pressure will have increased, possibly as much as 8 psi. A false reading will therefore always result.

Tyre pressures	*Solo*	*Pillion or continuous high speed*
Front tyre	*26 psi (1.8 kg/cm²)*	*28 psi (2.0 kg/cm²)*
Rear tyre	*28 psi (2.0 kg/cm²)*	*32 psi (2.2 kg/cm²)*

2 Engine/transmission oil level check

Check the engine/transmission oil level by means of the dipstick integral with the filler cap in the primary drive casing. To ascertain the level, unscrew the cap, wipe the dipstick clean, and then insert the dipstick so that the cap rests on the top edge



Check engine oil level by means of dipstick



Replenish with SAE 20W/50 engine oil

of the casting. Do not screw the cap in to determine the level. If necessary, replenish with SAE 20W/50 engine oil.

3 Hydraulic fluid level (disc brake models only)

Check the level of the hydraulic fluid in the front brake master cylinder reservoir, on the handlebars, and also the rear brake reservoir, behind the right hand frame side cover. The level in both reservoirs should be between the upper and lower level marks. During normal service, it is unlikely that the hydraulic fluid level will fall dramatically, unless a leak has developed in the system. If this occurs, the fault should be rectified AT ONCE. The level will fall slowly as the brake linings wear and the fluid deficiency should be corrected, when required. Always use an hydraulic fluid of DOT 3 or SAE J1703 specification, and if possible do not mix different types of fluid, even if the specifications appear the same. This will preclude the possibility of two incompatible fluids being mixed and the resultant chemical reactions damaging the seals.

If the level in either reservoir has been allowed to fall below the specified limit, and air has entered the system, the brake in question must be bled, as described in Chapter 5, Section 17.

4 Control cable lubrication

Apply a few drops of motor oil to the exposed inner portion of each control cable. This will prevent drying-out of the cables between the more thorough lubrication that should be carried out during the 2000 mile/3 monthly service.

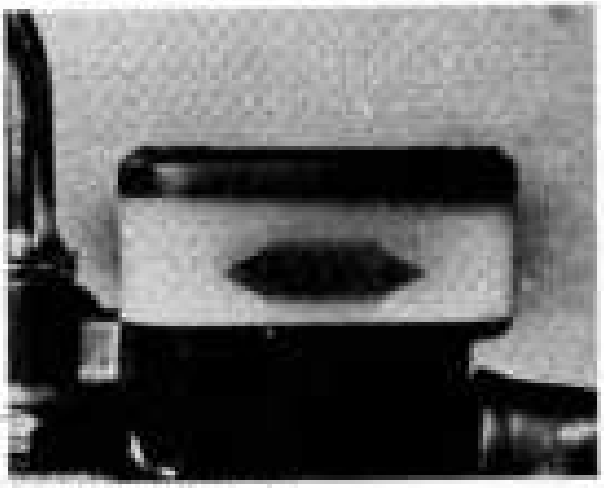
5 Rear chain lubrication and adjustment

In order that the life of the rear chain be extended as much as possible, regular lubrication and adjustment is essential.

Ideally, lubrication should take place at the weekly or 200 mile service interval with the chain in situ. Application of one of the proprietary chain greases contained in an aerosol can is ideal. Ordinary engine oil can be used, though owing to the speed with which it is flung off the rotating chain, its effectiveness is limited.

Adjust the chain after lubrication, so that there is approximately 20 mm (¾ in) slack in the middle of the lower run. Always check with the chain at the tightest point as a chain rarely wears evenly during service.

Adjustment is accomplished after placing the machine on the centre stand and slackening the wheel nut, so that the wheel can be drawn backwards by means of the drawbolt adjusters in the fork ends. On drum brake models the torque arm nut must also be slackened during this operation. Adjust the drawbolts an equal amount to preserve wheel alignment. The fork ends are clearly marked with a series of parallel lines above the adjusters, to provide a simple visual check.



Check fluid level of front and ...



... rear brake fluid reservoirs



Remove cap and diaphragm to replenish



Use aerosol chain lubricant to lubricate chain, on machine

6 Safety check

Give the machine a close visual inspection, checking for loose nuts and fittings, frayed control cables etc. Check the tyres for damage, especially sidewall cuts. Remove any stones or other objects caught between the treads. This is particularly important on the front tyre, where rapid deflation due to penetration of the inner tube will almost certainly cause total loss of control.

7 Legal check

Ensure that the lights, horn and trafficators function correctly, also the speedometer.

Monthly or every 1600 miles (1600 km)

Carry out the checks listed under the weekly/200 mile heading and then complete the following:

1 Final drive chain lubrication

The final drive chain should be removed from the machine for thorough cleaning and lubrication if long service life is to be expected. This is in addition to the intermediate lubrication carried out with the chain on the machine, as described under the weekly/200 mile service heading.

Separate the chain by removing the master link and run it off the sprockets. If an old chain is available, interconnect the old and new chain, before the new chain is run off the sprockets. In this way the old chain can be pulled into place on the sprockets and then used to pull the regreased chain into place with ease.

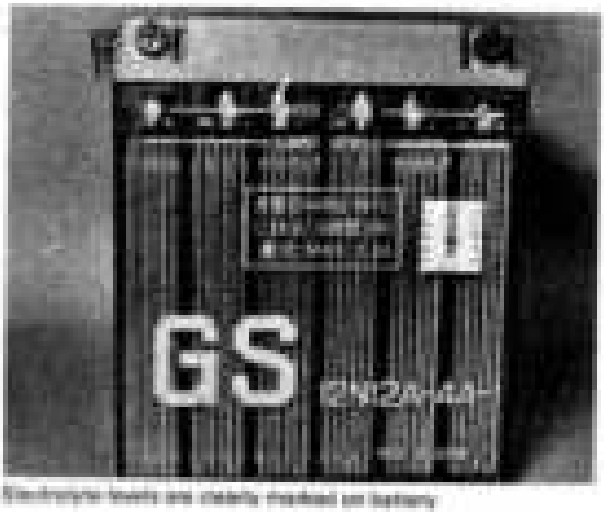
Clean the chain thoroughly in a paraffin bath and then finish with petrol. The petrol will wash the paraffin out of the links and rollers which will then dry more quickly.

Allow the chain to dry and then immerse it in a molten lubricant such as Linklyde or Chainguard. These lubricants must be used hot and will achieve better penetration of the links and rollers, and are less likely to be thrown off by centrifugal force when the chain is in motion.

Refit the newly greased chain onto the sprocket, replacing the master link. This is accomplished most easily when the free ends of the chain are pushed into mesh on the rear wheel sprocket. The spring-link must be fitted so that the closed end faces the normal direction of chain travel.

2 Battery electrolyte level

A conventional lead-acid battery is fitted to all models.



Electrolyte levels are clearly marked on battery

The transparent plastic case of the battery permits the upper and lower levels of the electrolyte to be observed when the battery is lifted from its housing below the dual seat. Maintenance is normally limited to keeping the electrolyte level between the prescribed upper and lower limits and by making sure that the vent pipe is not blocked. The lead plates and their separators can be seen through the transparent case, a further guide to the general condition of the battery.

Unless acid is spilt, as may occur if the machine falls over, the electrolyte should always be topped up with distilled water, to restore the correct level. If acid is spilt on any part of the machine, it should be neutralised with an alkali such as washing soda and washed away with plenty of water, otherwise serious corrosion will occur. Top up with sulphuric acid of the correct specific gravity (1.260 – 1.280) only when spillage has occurred. Check that the vent pipe is well clear of the frame tubes or any of the other cycle parts, for obvious reasons.

3 Adjusting the front and rear brakes (drum brake models only)

The front brake should be adjusted so that there is 0.8 mm (0.1 – 0.3 in) movement, measured between the handlebar lever and the lever stock, before the brake starts to bite. Adjustment may be made either at the cable adjuster on the handlebar lever or the cable adjuster on the brake back plate.

If uneven brake shoe wear reduces the efficiency of the brake, the brake arm link rod should be adjusted as described in Chapter 5, Section 10.

Adjust the rear brake by means of the adjuster nut on the brake rod so that there is approximately 20 mm (1.2 in) vertical movement at the brake pedal foot just before the brake commences operation.

Three monthly or every 3000 miles (3200 km)

Complete the tasks enumerated in the weekly/200 mile and monthly/1000 mile maintenance schedules, and then carry out the following:

1 Changing the engine/transmission oil

Place a container of more than 3.0 litres (5.4/5.3 US/Imp pints) below the crankcase. Remove the filler cap from the primary drive case and unscrew the oil drain plug from the base of the crankcase. A second plug fitted to the left-hand wall of the crankcase below the alternator cover may also be removed. Drain the oil after the engine has been allowed to reach normal working temperature, preferably after a run; the oil will be thinner when hot and so drain more rapidly and completely.

Replace the drain plugs and refill the engine with 3.0 litres (4.2/3.8 US/Imp pints) of SAE 20W/50 engine oil. Allow the oil to settle for a few moments and then check the level by means of the dipstick in the filler cap. Add more oil, if required.

2 Cleaning the air filter elements

Two identical air filter boxes are fitted, each of which contains a woven fabric air filter element. One box is fitted behind each frame side cover which must be detached to gain access. Remove and clean each filter separately, in the same manner as follows:

Slacken the air hose/air filter box screw clip and remove the single bolt securing the lower end of the air filter box retaining strap. Hinge the strap up and pull the air filter box from place. The air filter box is a two-piece moulding held together by two screws. After removal of the screws, separate the two box halves and withdraw the element.

The air filter is best cleaned using a compressed air line directed from the inside. If this is not available, the dust should be loosened using a soft brush, and then blown out, using a tyre pump.

A badly soiled or oily element will restrict the flow of air to the engine and so reduce performance. In addition, the mixture

will be richened, increasing the fuel consumption unnecessarily.

Do not on any account run the machine with the air filter removed or with the air cleaner hoses disconnected. If this precaution is not observed, the engine will run with a permanently rapid mixture, which will cause overheating and possible seizure.

3 Control cable lubrication

Lubricate the control cables thoroughly with motor oil or an all-purpose oil. A good method of lubricating the cables is shown in the accompanying illustration, using a plastic/zinc funnel. This method has the disadvantage that the cables usually need removing from the machine. An hydraulic cable oiler which pressurises the lubricant overcomes this problem. Do not lubricate nylon lined cables (which may have been fitted as replacements), as the oil may cause the nylon to swell, thereby causing total cable seizure.



Oiling control cables

4 General lubrication

Apply grease or oil to the handlebar lever pivots and to the centre stand and prop stand pivots.

5 Wheel condition (spoke type)

Check the spoke tension by gently tapping each one with a metal object. A loose spoke is identifiable by the low pitch noise generated. If any one spoke needs considerable tightening, it will be necessary to remove the tyre and inner tube in order to file down the protruding spoke end. This will prevent the spoke from chafing through the rim band and piercing the inner tube. Rotate the wheel and test for rim runout. Excessive runout will cause handling problems and should be corrected by tightening or loosening the relevant spokes. Care must be taken, since altering the tension in the wrong spokes may create more problems.

6 Cleaning and checking spark plugs

Remove the spark plugs and clean them, using a wire brush. Clean the electrodes using fine emery paper or cloth and then reset the gaps to 0.7 – 0.8 mm (0.028 – 0.032 in) with the correct feeler gauge. Before replacing the plugs, smear the threads with a small amount of graphite grease to aid future removal.

7 Cleaning and adjusting the contact breaker points

To gain access to the contact breaker assembly, it is necessary to remove the cover plate which is held by two cross head screws to the cylinder head. Note that the cover has a paper gasket to prevent the ingress of water.

Remove the ignition inspection cover and rotate the engine until the left hand points are fully open. Removal of the spark plugs will aid rotation.

Inspect the faces of each of the two sets of contact breaker points. Slight burning or pitting can be removed whilst the contact breaker unit is in situ on the machine, using a very fine swiss file or emery paper (No. 400) backed by a thin strip of tin. If pitting or burning is excessive the contact breaker unit should be removed for points dressing or renewal. (See Chapter 3, Section 4). After the points have been cleaned, they should be adjusted to restore the correct gap as follows:

Adjustment is effected by slackening the two screws through the plate of the fixed contact breaker point and moving the point either closer to, or further away from the moving contact until the gap is correct as measured by a feeler gauge. The correct gap with the points FULLY OPEN is 0.3 – 0.4 mm (0.012 – 0.016 in).

Two small projections on the contact breaker base plate permit the insertion of a screwdriver to lever the adjustable point into its correct location. Repeat this operation if there is any doubt about the accuracy of the measurement. Although this adjustment is relatively easy, it is of prime importance.

Carry out the procedure on the right hand set of contact breakers after running the engine again so that the points are fully open.

After making contact breaker adjustments, the ignition timing should be checked, and if necessary adjusted, as described under the following heading.

8 Ignition timing

To ensure ignition timing is be carried out accurately, either manually or using a stroboscope, two sets of marks are made on the alternator rotor periphery, which may be aligned with an index pointer cast into the alternator cover. Each set of marks relates to a different cylinder.

Commence by checking, and if necessary adjusting the left-hand contact breaker points which control ignition timing of the left hand cylinder.

With the contact breakers having been gapped previously (see previous Section), turn the engine in an anti-clockwise direction so that the LF mark aligns and the left-hand cylinder is on its compression stroke. Note that the timing is accomplished in the fully retarded position, ie: with the balance weight of the auto-advance unit unrestrained.

If the timing is correct, the points should be just on the verge of opening as the LF mark comes into alignment.

To check when the opening occurs a 12 volt lamp bulb can be connected between the moving contact breaker point or the condenser connection and earth on the engine. The lamp will light up when the contact breaker points open if the ignition circuit is switched on.

If the timing is incorrect, slacken the two screws which pass into the cylinder head, clamping the contact breaker assembly base plate in position. Rotate the complete assembly until the right timing, and then tighten the screws. Recheck the timing by rotating the engine backwards about 45° and then forwards again until the LF mark aligns precisely with the index mark. The engine must be rotated one way and then the other to take up any backlash in the timing chain (camshaft chain).

Repeat the timing check procedure on the right-hand carburettor, using the dot mark on the alternator rotor in the timing inspection window. Slacken the two screws and carefully adjust the timing. The right-hand ignition breaker is mounted on a separate ignition base plate secured by two screws passing through elongated holes in the plate. The elongated holes allow a limited amount of plate movement for ignition timing.

Taking the engine manually as described above should be acceptable, provided that the correct procedure is to avoid oscillation and speed jerk is taken. The use of a stroboscopic lamp, however, which enables ignition timing to take place with the engine running is recommended. The 'J' in 40° marks on the alternator rotor represent one fully retarded ignition point. The single unmarked section that can be felt at each fully retarded firing mark in the full advance mark for the cylinder.

Use the stroboscope in accordance with the manufacturer's instructions. Adjustment of the timing is the same as that given for manual adjustment.

Before replacing the contact breaker cover apply a small amount of thin oil to the cam lubricating wicks. One or two drops will suffice. Too much oil will contaminate the points, hence causing ignition failure.

9 Adjusting the tick over speed

The engine tick over speed may be adjusted by means of the throttle stop screw which is located between the two carburettors. The screw can be identified by the serrated plastic knob. The correct tick over speed is 1,000 rpm.

If the two carburettors are not synchronised accurately, refer to Chapter 3 Section 7 for the correct adjustment procedure.

Six monthly or every 6000 miles (9600 km)

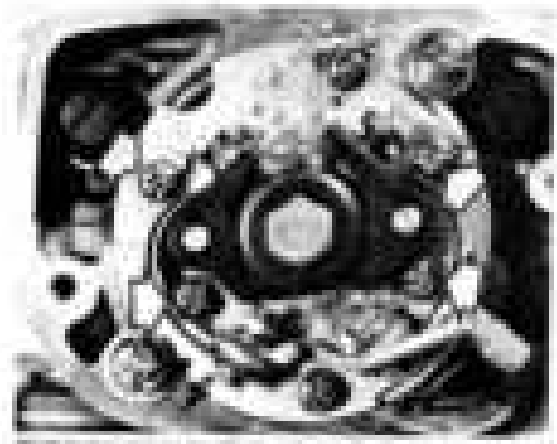
Carry out the tasks described in the weekly, monthly and three-monthly sections and then carry out the following:

1 Checking and adjusting the valve clearances

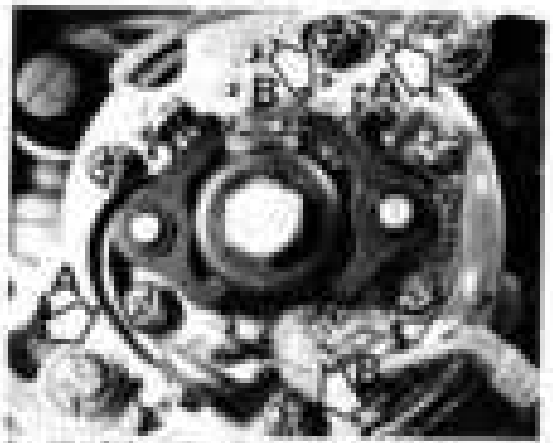
To gain access to the camshaft cover and so give adequate working room, the petrol tank should be removed from the machine. Remove all four tappet inspection caps from the camshaft cover. Rotate the crankshaft anti-clockwise until the 'J' mark aligns with the timing mark. In this position the left-hand cylinder is at TDC with both valves closed and can



Check points gap when in fully open position



Slacken two screws to adjust each set of points



A — LH cylinder timing adjustment screws. B — RH cylinder timing



Lubricate cam wick sparingly

therefore be checked for rocker clearance. The correct clearance with the engine cold is as follows:

Inlet valve 0.08 – 0.12 mm (0.003 – 0.005 in)
Exhaust valve 0.15 – 0.20 mm (0.006 – 0.008 in)

Insert a feeler gauge of the correct dimension through the rocker adjustment orifice and between the head of the valve stem and the rocker adjustment screw. If the clearance is correct the blade of the gauge will be a tight slip fit. To adjust the clearance, loosen the adjuster screw locknut and rotate the adjuster the required amount until the adjustment is correct. Hold the screw in the set position and tighten the locknut. Recheck the clearance, as it is all too easy to alter the position of the screw when tightening the locknut.

Where rocker adjustment on the left-hand cylinder has been carried out, rotate the crankshaft 180° and readjust until the right-hand cylinder is on TDC (no 6T timing mark on the alternator rotor will now be aligned with the timing mark). Repeat rocker adjustment as for the left-hand cylinder.

Replace and tighten the four rocker adjustment caps.

2 Changing the oil filter

During the 4000 mile service, or at every second oil change, the old oil filter should be removed and discarded, and a replacement standard fitted.

The oil filter is contained within a semi-sealed chamber at the back of the crankcase. Access to the element is made by unscrewing the filter cover centre bolt which will bring with it the cover and also the element. Before removing the retaining plate, a receptacle (already the engine to catch the engine oil contained in the filter chamber.

When renewing the filter element it is wise to renew the filter cover 'O' ring at the same time. This will obviate the possibility of any oil leaks. Do not overtighten the centre bolt on replacement, the correct torque setting is 1.3 – 1.7 kg m (9.5 – 12.0 lb ft).

The filter by-pass valve, comprising a plunger and spring, is situated in the base of the filter cover centre bolt. It is recommended that the by-pass valve be checked for free movement during every filter change. The spring and plunger are retained by a pin across the centre bolt. Extracting the pin will allow the spring and plunger to be removed for cleaning.

Never run the engine without the filter element or increase the period between the recommended oil changes or oil filter changes.

Every or every 8000 miles (12 815 km)

Again complete the checks listed under the previous routine maintenance interval headings. The following additional tasks are now necessary.

1 Front fork oil change

Drain and replenish the damping fluid in the front forks. Refer to the relevant section in Chapter 6 for the relevant information.

2 Removal, inspection and refurbishment of wheel bearings

Carry out the operations listed in the heading by following the procedure given in Chapter 5, Section 11 for the front wheel and Section 12 for the rear wheel.

3 Front and rear brake shoe inspection

As drum brake models have wheels should be removed and the brake shoes inspected for wear. Refer to Chapter 5 Sections 8, 10 and 14 for the relevant details.

4 Steering head bearings

During the every service, the steering head bearings should be inspected and repacked with grease as described in Chapter 4, Section 6. To gain access to the bearings, the front forks must be removed as described in Sections 2 and 3 of that Chapter.

5 Swinging arm bearings

The swinging arm should be removed from the machine and the bearings repacked with grease. See Chapter 4, Sections 8 and 10.

General maintenance adjustments

1 Clutch adjustment

The intervals at which the clutch should be adjusted will depend on the style of riding and the conditions under which the machine is used.

Adjust the clutch in two stages as follows:

Remove the clutch adjustment screen, which is retained by two screws. Loosen the cable adjuster screw locknut and turn the adjuster inwards fully, to give plenty of slack in the inner cable. Loosen the adjuster screw locknut in the lever and turn the screw clockwise until slight resistance is felt. Back off the screw about ¼ turn and tighten the locknut. The cover may be replaced.

Undo the cable adjuster screw at the handlebar lever, until there is approximately 2 – 3 mm (0.08 – 0.12 in) play measured between the inner face of the lever and the knob face. Finally, tighten the cable adjuster locknut.

2 Checking brake pad wear

Brake wear depends largely on the conditions to which the machine is ridden and at what speed. It is difficult therefore to give precise inspection intervals, but it follows that pad wear should be checked more frequently on a hard-ridden machine.

The condition of the brake pads can be determined with the pads in place in the caliper by viewing them through the inspection aperture in the caliper cover. The aperture is closed by a small plastic cap which may be hinged back to give access. Each pad has a pad material groove around the periphery. If it can be seen that one or both pads have worn down to or past this groove, the pads must be replaced as a set.

Pad removal can be accomplished without removing the front wheel, as follows:

Remove the circlip and shim which passes through the piston/cylinder casting and the caliper support bracket. It is seen this lies over the casting slotted. From the rear of the unit remove the single countersunk screw by passing the shank of a screwdriver through the wheel spindle. Unclip the piston/cylinder casting and lift it away, leaving the two pads in place on the support bracket either side of the disc.

To prevent the piston being expelled from the cylinder, in the event of the brake lever being applied inadvertently, insert a wooden wedge between the piston and outer wall of the casting.

Lift each pad away from the disc and out of the support bracket. Note that the outer pad on the XS 250SE model is fitted with an anti-rotation shim. This should be detached from the pad.

As stated above the pads must be renewed as a pair if either pad has worn down into the groove. The minimum pad thickness is 1.5 mm (0.06 in).

Replace the new pads by reversing the dismantling procedure. On XS 360C models, the anti-rotation spring must be fitted to the outer pad so that the stamped arrow mark is facing the direction of normal wheel travel. The outer faces of both pads should be smeared with a thin coating of silicon grease of the type supplied especially for disc brakes. Do not allow any grease to foul the disc as this will reduce the efficiency of the brake. If grease is allowed to foul the disc, it can be removed with a cloth soaked in petrol (gasoline). Wipe off any excess grease which may have been squeezed out from between the pad backing plate and the caliper piston.

Make sure that the brake pads are correctly located in the caliper and that the front wheel nevertheless quite freely when released by someone. Always check the brake action before riding the machine on the road.

Summary of routine maintenance, adjustments and capacities

Spark plugs		
Spark plug gap		
Contact breaker gap		
Valve tappet clearance (cold engine)		
Inlet		
Exhaust		
Tyre pressures		
Front		
Rear		
Fuel tank capacity		
Engine oil capacity		
Drain and filter change		
Without filter change		
Front fork leg capacity		

Recommended lubricants

Component	Lubricant
Engine/gearbox unit	
Telescopic forks	
Hydraulic front brake master cylinder	
Control cables	
Grease nipples and wheel bearings	
Chain	

Working conditions and tools

When a major overhaul is contemplated it is important that a clean, well-lit working space is available, equipped with a workbench and vice, and with space for laying out or moving the dismantled assemblies in an orderly manner where they are unlikely to be disturbed. The use of a good workshop will give the satisfaction of work done in comfort and without haste, where there is little chance of the machine being dismantled and reassembled for anything other than clean and thoroughgoing. Unfortunately, these ideal working conditions are not always practicable and under those latter circumstances, when improvisation is called for, extra care and time will be needed.

The other essential requirement is a comprehensive set of good quality tools. Quality is of prime importance since cheap tools will prove expensive in the long run if they slip or break and damage the components to which they are applied. A good quality tool will last a long time and more than justify the cost. The basis of any tool kit is a set of open-ended spanners, which can be used on almost any part of the machine to which there is reasonable access. A set of ring spanners makes a useful addition, since they can be used on nuts that are very tight or where access is restricted. Where the user has no fear of being misled, reasonable results a compromise can be effected with a set of combination spanners — open-ended at one end and having a ring of the same size on the other end. Socket spanners may also be considered a good investment; a basic 1/2 in or 1/2 in drive kit comprising a ratchet handle and a small number of socket inserts, to save (if money is limited) additional extensions can be purchased as and when they are required. Provided they are kept in profile, screws will resist rust or tarnish that are always unsightly. When purchasing spanners of any kind make sure the correct size standard is purchased. Almost all machine manufacturers outside the US and the USA have metric nuts and bolts, while those produced in Britain have BSF or BSW sizes. The standard used in the USA is AF, which is also found on some of the later British machines. Other tools that should be included in the kit are a range of countersunk screwdrivers, a pair of pliers and a hacksaw.

When considering the purchase of tools, it should be remembered that by carrying out the work oneself, a large proportion of the normal repair cost, made up by labour charges, will be saved. The economy made on even a minor overhaul will go a long way towards the improvement of a tool kit.

In addition to the basic tool kit, certain additional tools can prove invaluable when they are likely to have to be used on a **machine** of repetitive jobs. For example, an impact **screwdriver** will ease the removal of screws that have been tightened by a similar tool during assembly, without a risk of damaging the screw heads. And of course, it can be used again to retighten the screws, to ensure an all-round even results. Gunty pliers have their uses too, since jaw portions, shafts and similar components are frequently retained by circlips that are not too easily displaced by a screwdriver. There are two types of circlip pliers, one for internal and one for external circlips. They may also have straight or right-angled jaws.

One of the most useful of all tools is the torque wrench, a form of spanner that can be adjusted to any which a measured amount of force is applied to any bolt or nut. Torque wrench settings are given in almost every modern workshop or service manual, where the engine is given or where a complex component, such as a cylinder head, can be tightened without fear of distortion or leakage. The tightening of bearing caps is yet another example. Overtightening will stretch or even break bolts, necessitating extra work to extract the broken portions.

As may be expected, the more sophisticated the machine, the greater is the number of tools likely to be required if it is to be kept in first class condition by the home mechanic. Unfortunately there are certain jobs which cannot be accomplished successfully without the correct equipment and although there is invariably a specialist who will undertake the work for a fee, the home mechanic will have an eye more ready in his pocket for the purchase of similar equipment if he does not wish to undertake the services of others. Here a word of caution is necessary, since some of these jobs are best left to the expert. Although an electrical multimeter of the AVO type will prove helpful in making electrical tests, in inexperienced hands it may irrevocably damage some of the electrical components if a test current is passed through them in the wrong direction. The use leads to the indiscriminate fitting of leak-up multimeters into, where a certain amount of expertise is needed when testing them up with vacuum gauges. These are, however, exceptions. Some instruments, such as a strobe lamp, are virtually essential when checking the timing of a machine powered by CDI ignition system. In short, do not purchase any of these special items unless you have the experience to use them correctly.

Although this manual shows how components can be removed and replaced without the use of special service tools (unless absolutely essential), it is unavoidable giving consideration to the purchase of the more commonly used tools if the machine is regarded as a long term purchase. Whether the alternative methods suggested will remove and replace parts without risk of damage, the use of the special tools recommended and sold by the manufacturers will invariably save time,

Chapter 1 Engine, clutch and gearbox

Contents

General description ... 1
Operations with the engine/gearbox in the frame ... 2
Method of engine/gearbox removal ... 3
Removing the engine/gearbox unit ... 4
Dismantling the engine/gearbox: general ... 5
Dismantling the engine/gearbox: removing the contact breaker assembly and automatic timing unit ... 6
Dismantling the engine/gearbox: removing the camshaft cover and cylinder head ... 7
Dismantling the engine/gearbox: removing the cylinder block and pistons ... 8
Dismantling the engine/gearbox: removing the alternator rotor and starter motor ... 9
Dismantling the engine/gearbox: removing the neutral indicator switch ... 10
Dismantling the engine/gearbox: removing the primary drive cover and the oil pump ... 11
Dismantling the engine/gearbox: removing the kickstart assembly, the clutch and primary drive gears ... 12
Dismantling the engine/gearbox: removing the gearchange mechanism ... 13
Dismantling the engine/gearbox: separating the crankcase halves ... 14
Dismantling the engine/gearbox: removing the crankshaft and gearshaft assemblies ... 15
Dismantling the engine/gearbox: removing the gear selector mechanism ... 16
Dismantling the engine/gearbox: removing the oil baffle plate and the oil strainer cover and cover ... 17
Examination and renovation: general ... 18
Examination and renovation: main bearings and big-end bearings ... 19
Examination and renovation: crankshaft assembly ... 20
Examination and renovation: connecting rods ... 21
Examination and renovation: cylinder block ... 22
Examination and renovation: pistons and piston rings ... 23
Examination and renovation: cylinder head ... 24
Examination and renovation: camshaft, camshaft sprockets, chain and tensioner ... 25
Examination and renovation: rubber shoes and pins and sprocket drive shaft ... 26
Examination and renovation: primary drive gears ... 27
Examination and renovation: clutch assembly ... 28
Examination and renovation: gearbox components ... 29
Examination and replacement: kickstart shaft assembly ... 30
Engine/gearbox reassembly: general ... 31
Engine/gearbox reassembly: replacing the gear selector mechanism ... 32
Engine/gearbox reassembly: replacing the gearshaft assemblies ... 33
Engine/gearbox reassembly: replacing the crankshaft ... 34
Engine/gearbox reassembly: joining the crankcase halves ... 35
Engine/gearbox reassembly: replacing the gearchange mechanism ... 36
Engine/gearbox reassembly: replacing the primary drive gear, clutch and kickstart shaft ... 37
Engine/gearbox reassembly: replacing the oil pump, primary drive cover and the oil strainer covers ... 38
Engine/gearbox reassembly: replacing the alternator and starter motor ... 39
Engine/gearbox reassembly: replacing the neutral indicator switch and oil pressure warning switch ... 40
Engine/gearbox reassembly: refitting the pistons and cylinder block ... 41
Engine/gearbox reassembly: replacing the cylinder head ... 42
Engine/gearbox reassembly: replacing the camshaft and tensioner and timing the valves ... 43
Engine/gearbox reassembly: replacing the camshaft cover and carburettor drive shaft ... 44
Engine/gearbox reassembly: replacing the automatic timing unit and contact breaker assembly ... 45
Engine/gearbox reassembly: refitting the magneto assembly ... 46
Replacing the engine/gearbox unit in the frame ... 47
Starting and running the rebuilt engine ... 48
Taking the rebuilt machine on the road ... 49
Fault diagnosis: engine ... 50
Fault diagnosis: clutch ... 51
Fault diagnosis: gearbox ... 52

Specifications

Engine

	65 (1968)	65 (1969)	65 (1970)
Type	Vertical parallel twin cylinder, overhead camshaft, four-stroke		
Bore	55 mm (2.1653 in)	58 mm (2.3236 in)	64 mm (2.717 in)
Stroke		52.4 mm (2.063 in)	
Capacity	249 cc (15.12 cu in)	248 cc (21.85 cu in)	330 cc (20.85 cu in)
Compression ratio	9.8:1	9.8:1	9.2:1
bhp	27 at 9,000 rpm	34 at 9,000 rpm	—

Pistons and rings

Piston/cylinder clearance	[illegible]
Piston oversizes available	[illegible]
Piston ring end gap:	
Top and 2nd ring	[illegible]
Oil control ring	[illegible]
Ring side clearance:	
Top ring	[illegible]
Second ring	[illegible]

Cylinder barrel

Cylinder bore diameter	[illegible]	[illegible]	[illegible]
Bore taper limit	[illegible]		
Ovality limit	[illegible]		

Valves and springs

Valve clearance (cold):	
Inlet	[illegible]
Exhaust	[illegible]
Valve stem diameter:	
Inlet	[illegible]
Exhaust	[illegible]
Stem/guide clearance:	
Inlet	[illegible]
Exhaust	[illegible]
Valve spring free length:	
Inner	[illegible]
Outer	[illegible]

Camshaft

Bearing bobbin diameter	[illegible]
Journal outside diameter	[illegible]
Bearing/journal	[illegible]
Cam height (wear limit):	
Inlet (std)	[illegible]
Exhaust	[illegible]
Inlet (alt)	[illegible]
Exhaust	[illegible]

Valve timing

Valve opens	[illegible]
Inlet closes	[illegible]
Exhaust opens	[illegible]
Exhaust closes	[illegible]

Crankshaft

Big end clearance	[illegible]
Main bearing clearance	[illegible]
Connecting rod axial clearance	[illegible]
Connecting rod deflection	[illegible]
Gudgeon and bore diameter	[illegible]

Clutch

Type	[illegible]
Number of plates:	
Friction	[illegible]
Plain	[illegible]
Number of springs	[illegible]
Friction plate thickness	[illegible]
Wear limit	[illegible]
Spring free length	[illegible]
Wear limit	[illegible]

Gearbox

Type	5-speed, constant mesh		
Ratios			
1st gear	2.600:1	2.923:1	2.533:1
2nd gear	1.727:1	1.727:1	1.727:1
3rd gear	1.380:1	1.380:1	1.380:1
4th gear	1.130:1	1.125:1	1.125:1
5th gear	0.962:1	0.962:1	0.947:1
6th gear	0.808:1	0.808:1	0.808:1
Secondary ratio	4.667:1	3.500:1	3.313:1

Torque wrench settings

Cylinder head	
6 mm bolts	0.8 - 1.2 kgfm (5.8 - 8.7 lbfft)
8 mm nuts (XS400 and 440)	2.3 - 3.4 kgfm (14.5 - 17.4 lbfft)
10 mm nuts (XS650)	3.5 kgfm (23.0 lbfft)
Primary drive pinion bolt	4.8 kgfm (35 lbfft)
Crankcase bolts	
8 mm	1.0 kgfm (7.2 lbfft)
8 mm	2.2 kgfm (16 lbfft)
Connecting rod cap bolts	3.5 - 4.0 kgfm (23.5 - 27.5 lbfft)

1 General description

The Yamaha XS250, 360 and 400 models use an engine unit which is identical in all major respects, there being differences only in the size of pistons and other components relating to the engine capacity.

The engine is a vertical parallel twin with a 180° crankshaft, supported by three shell type main bearings. The 180° crankshaft has better inherent balance characteristics than the 360° crank more normally utilised in parallel twin engines, and dispenses with the necessity of a counter balance assembly which is often fitted on modern vertical twins. The valve gear consists of an overhead camshaft driven by a chain from the crankshaft passing through a tunnel between the two cylinders. The chain is automatically tensioned and rocker clearance is adjusted by means of adjuster screws on the rocker arms. All major engine castings are in light aluminium alloy, the cylinder block having dry steel liners. The engine/gearbox housings (crankcases) are split in a horizontal plane to facilitate dismantling and reassembly.

Engine lubrication is provided by a wet sump system as the oil reservoir is contained in the crankcase, not as a more usual, a separate oil tank mounted on the frame. Oil is pumped up from the sump through a gauze oil strainer and is then under pressure by a motor-driven oil pump through a cartridge paper filter to the working parts of the engine.

Primary drive to the double helical gears is by a multi-plate wet clutch. A six-speed constant mesh gearbox then transmits drive via a roller chain to the rear wheel.

Two Mikuni constant vacuum carburettors and two independent exhaust systems are fitted.

On an alternator (alternator) mounted on the left hand end of the crankshaft provides power to the electrical system, the electric starter motor is fitted to all but the XS 360 SE models, supplemented by a kickstart lever on the right hand side of the machine.

2 Operations with engine/gearbox in the frame

It is not necessary to remove the engine unit from the frame for dismantling the following items:

1 Cylinder head cover
2 Cylinder head, barrel and pistons
3 Alternator and left-hand crankcase cover
4 Clutch assembly and oil pump
5 Alternator and starter motor
6 Replacement of the crankcase breather spring

If work on the crankshaft or the gearbox components is to be carried out it will be necessary to remove the engine from the frame in order that the crankcases may be separated. If a great deal of work is anticipated, it would be advantageous to remove the complete unit, thereby affording greater access.

3 Method of engine/gearbox removal

As mentioned previously the engine/gearbox is built in unit and it is necessary to remove the complete unit in order to gain access to the components. Separation is accomplished after the engine unit has been removed from the frame, and refitting cannot take place until the crankcase has been reassembled.

4 Removing the engine/gearbox unit

1 Place the machine on its centre stand, making sure that it is standing securely on firm ground.

2 Place a receptacle of more than 3.0 litres (5.3/5.3 US/Imp pints) below the engine and remove the filler cap from the primary chaincase and the drain plug from the base of the crankcase. A secondary drain plug is fitted in the crankcase left-hand wall, below the alternator casing. Oil drainage will be facilitated if the engine has been allowed to reach normal working temperature, the oil will be thinner and so flow more easily. Detach the oil filter chamber and oil filter element from the front of the crankcase by unscrewing the central bolt. Allow the drain tank towards to catch the small quantity of oil contained within the filter housing.

3 Trace the markers and disconnect the negative lead (-) from the battery, followed by the positive lead. This will isolate the electrical system and so prevent accidental shorting during subsequent dismantling. It is anticipated that the machine is to be unused for an extended length of time, the battery should be removed for storage and given a refresher charge from an external source at approximately monthly intervals.

4 Turn the petrol tap to the On or Reserve position and disconnect the petrol feed pipe and the smaller gauge vacuum tube. Both tubes are secured on the unions by spring clips, the ears of which should be pinched together to release the tension. Drainage of the petrol tank for removal is not strictly necessary, although the reduction in weight will facilitate this operation. The petrol tank is supported at the front by two rubber buffers which engage with a cup seats side of the frame top tube, and is secured at the rear by a single bolt passing through a protecting ring. Remove the bolt and lower the petrol tank rearwards so that the buffers leave the cups. The tank may then be lifted upwards

away from the machine. Remove the twin side covers from either side of the machine. The covers are a three-point push fit in rubber grommets attached to the frame. Disconnect the breather which vents the carburettors to the inlet stubs, and the air hose joint to the carburettor manifold and the inlet air filter breather. Back on filter lens may be pulled from position when removing the retaining clamp which is secured at the lower end by a single bolt and at the top by a hook arrangement. Disconnect the air hose breather tube from the breather cover on the crankcase, after slackening the locking clip. The air hose joint can now be pulled off the carburettor manifold and inlet backwards and downwards so that it clears the carburettors. Careful manipulation may be required as the clearance is limited. Pull the carburettors back out of the inlet stubs and lift them towards the right-hand side of the machine, as a unit.

3 Disconnect the throttle cable at the carburettor end. Lift the outer cable from the slotted abutment and displace the nipple and inner cable end from the throttle pulley between the two instruments.

4 Remove the speedometer drive cable from the front right of the crankshaft cover. The cable is retained by a counterbore knurled screw.

5 Disconnect the starter motor lead from the upper terminal on the starter solenoid switch. Pull the wire through towards the engine, so that it will not get entangled when the engine is removed. The lead is secured by the machine at a number of points along its length by small rings projecting from the rear mudguard bracket fixing nut (fitted by BSA/B50-20 model).

6 Disconnect the main electrical connections to the engine. The crash pharmical leads are connected at two 4mm type multi pin sockets behind the frame left-hand lower. The two brown leads should be disconnected from the ignition coil knee connectors above the cylinder head. The main earth lead from the battery to the engine is retained by a cranksaw bolt to the rear of the gearbox. The lead may be disconnected by removing the bolt, or may be pulled through towards the engine and removed after lifting out the engine.

7 Undo the two nuts holding each exhaust clamp to the cylinder head port stubs the clamps back. Note the split collets and number each. Slacken the bolt securing the two exhaust pipe/silencer joint clamps. The exhaust pipes may be pulled from position individually, leaving the silencers in place. Silencer removal is not necessary when removing the engine unless you may be tipped forwards on the single mounting stud to clear the front of the engine. Prise out the silencer joint gaskets with a small screwdriver.

10 Remove the kickstart lever and the gear lever from their respective splined shafts. Both levers are retained by a pinch bolt which must be removed completely before the lever can be pulled off the shaft.

11 Remove the five screws which hold the final drive sprocket cover to the left-hand side of the engine. Pull the cover off until it is clear of the sprocket shaft. The clutch cable must be disconnected from the operating arm inside the case before the casing is completely free. Take care not to lose the - 'o' shaped ball which sits between the inner face of the clutch lifting mechanism and the clutch pushrod, in the centre of the sprocket.

12 Before removing the sealed link from the chain and running it off the sprockets, the operator operated nut should be loosened. Unscrewing this large nut after the engine has been removed can be accomplished but preventing the sprocket from rotating is more difficult. Bend down the tab washer before fitting the sprocket and then apply the rear brake pedal to hold the sprocket. The sprocket may be pulled off the shaft with the chain in mesh, or after separation of the chain.

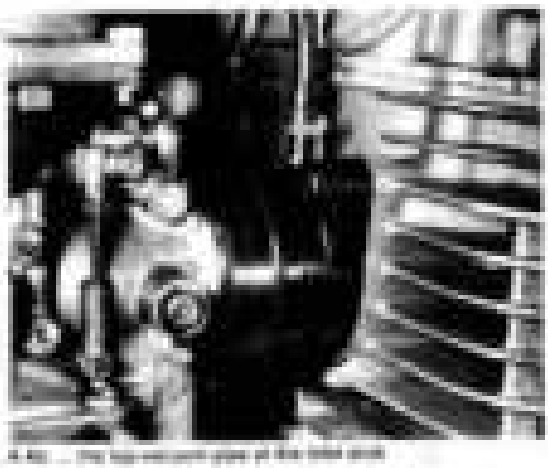
13 Remove the rear brake pedal from the splined pivot shaft after unscrewing completely the pivot bolt. Then detach both front footrests each on which is held on two protruding studs and retained by two bolts. Disconnect the stop lamp switch spring from the brake pivot arm and then lift the section out of the holding bracket. Lock the section out of harm's way, to the right of the battery carrier.

14 The engine is held in position by two short bolts at the front and two long through bolts at the rear, the upper of which passes through two detachable mounting brackets. In addition, a bolt passes through the rear engine plate and the two mounting plates, together with the stop lamp switch bracket. The lower bolt may now be removed, fitting the engine if necessary and then allowing it to rest on the frame legs. During engine removal the two left-hand exhaust port studs may foul the frame down tube. To prevent unnecessary damage to the paintwork, apply a thick covering of tape to the tubework.

15 The engine can now be lifted out of the frame on the right-hand side. It is recommended that an assistant is present during engine removal to avoid the danger of dropping the heavy assembly.



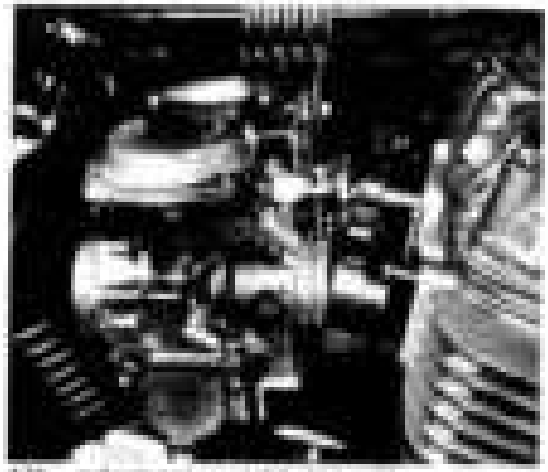
4 Air breather hose fixed clip at the top centre and ...



4 All ... the top and front plate on the inlet stub



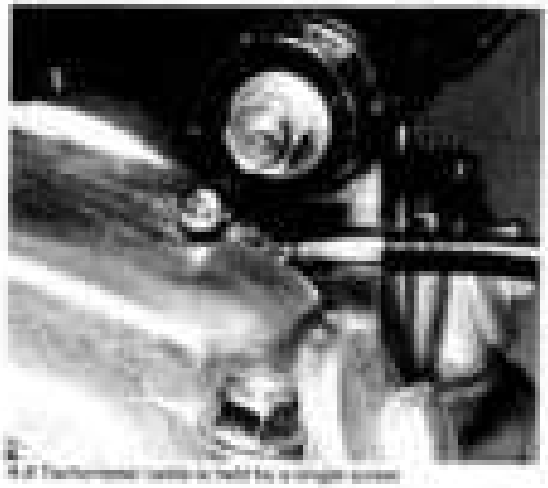
4.6a Pull air hose and from carburettor and ...



4.6b ... pull carburettor out of the inlet stub



4.6c Disconnect the throttle cable (1) by pulling



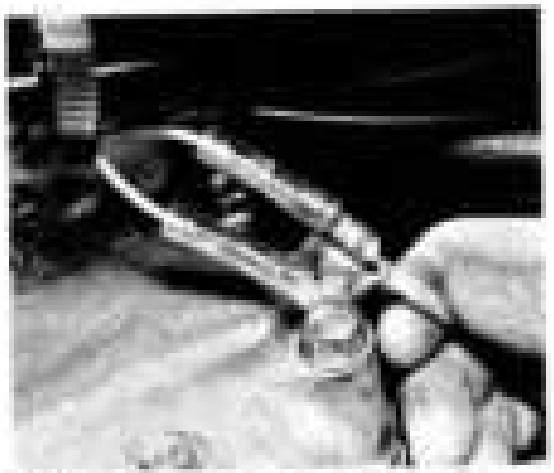
4.6d Tachometer cable is held by a single screw

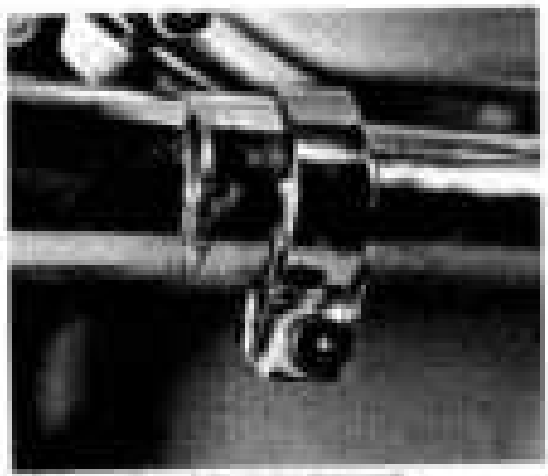


4.7 Detach starter lead at solenoid upper terminal



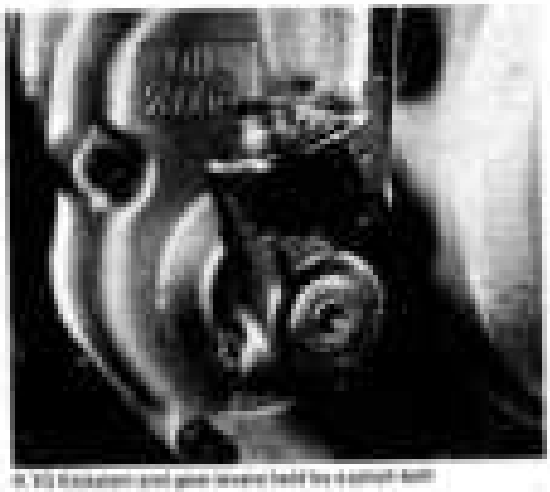
4.8a Main alternator leads connected by block connectors









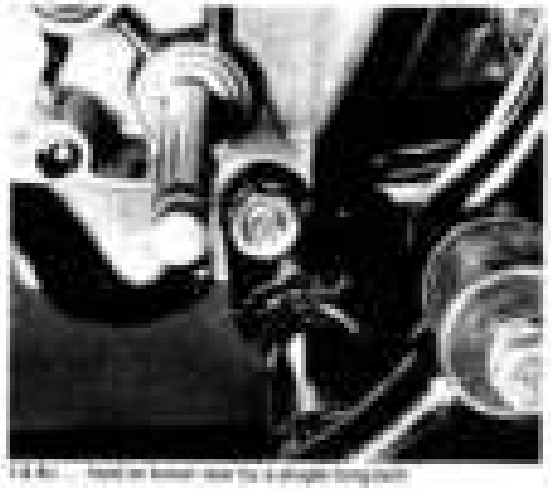


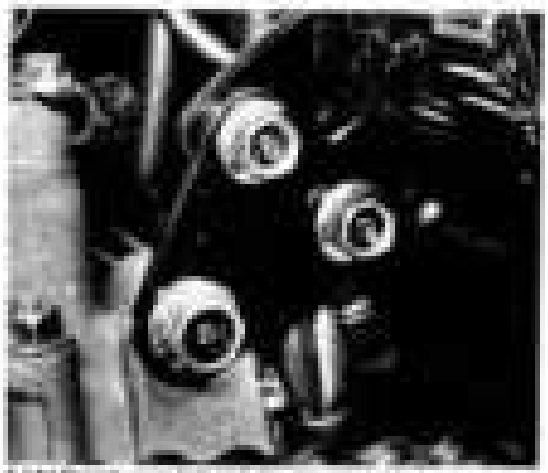














5 Disassembling the engine/gearbox: general

1 Before undertaking any work on the engine unit it should be thoroughly cleaned with a proprietary degreaser to remove the grease and grit which accumulates. If this precaution is not followed then there is a very likely possibility of foreign particles entering the internal engine and components. **Note:** Make sure to block up the inlet and exhaust ports when washing down, to stop water entering the engine.

2 If the engine has not been stripped before, it is strongly advisable to have an impact screwdriver complete with a set of screwdriver bits available. If an impact screwdriver is unavailable, it is sometimes possible to use a conventional screwdriver fitted with a T handle. Whichever an attempt to undo or slacken a screw, assume initially that it is very tight and proceed accordingly. Avoid a 'half-hearted' attempt at loosening as the screwdriver may slip, causing damage to the head and an eventual subsequent unnecessary removal.

3 Do not use force to remove any parts unless specific mention is made in the manual. If any component is difficult to remove, first check that everything has been dismantled and/or loosened in the correct sequence.

6 Disassembling the engine/gearbox: removing the contact breaker assembly and automatic timing unit

1 Remove the two screws which hold the contact breaker cover plate in the left-hand side of the cylinder head cover. The twin contact breaker assembly plate is retained in position by two clamping screws and large plain washers, the screws do not pass through the load plate but clamp it in place. Before loosening the screws, scribe a line across the plate and onto the edge of the casing. This will aid correct positioning on reassembly.

2 The automatic timing unit (ATU) is positioned behind the contact breaker base plate. Remove the centre bolt and pull the ATU off the end of the camshaft. Note that a dowel pin (fitted in the end of the camshaft locates with the ATU and ensures that the ATU/camshaft relationship is always correct.

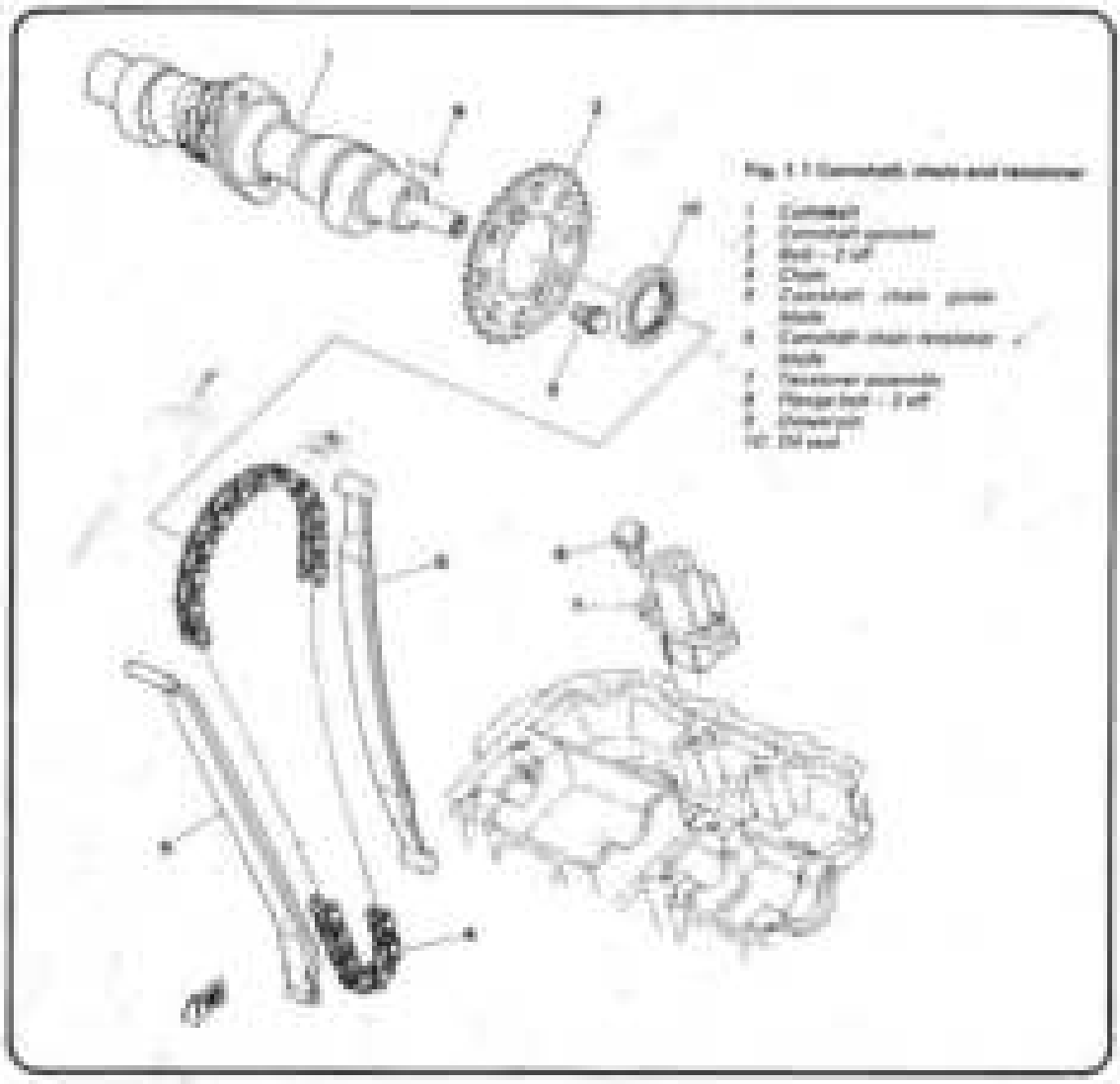


Fig. 1.1 Camshaft, chain and tensioner

1 Camshaft
2 Camshaft sprocket
3 Bolt – 2 off
4 Chain
5 Camshaft chain guide blade
6 Camshaft chain tensioner blade
7 Tensioner assembly
8 Flange bolt – 2 off
9 Dowel pin
10 Oil seal



6.1 Remove the contact breaker assembly complete



6.2 The 47cc is retained by a single bolt

7 Dismantling the engine/gearbox: removing the camshaft cover, and cylinder head

1 Position the engine on the workbench, resting it securely on the crankcase base with a sound block placed between the front mounting lugs and the bench.

2 The camshaft cover is retained by fourteen bolts which should be slackened in an even and diagonal sequence. The camshaft cover is under concern stress from those valves and springs on certain or complete 80 and therefore the holding down bolts must be undressed evenly to avoid distortion of the cover.

3 With all the bolts removed, lift the camshaft cover away. Note that no gasket or sealing 'O' ring is fitted between the mating surfaces of the camshaft cover and cylinder head.

4 Remove the two bolts which retain the cam chain guide holder. Lift off the holder and pull out the chain tensioner blade and also the chain guide blade, from the forward edge of the cam chain tunnel.

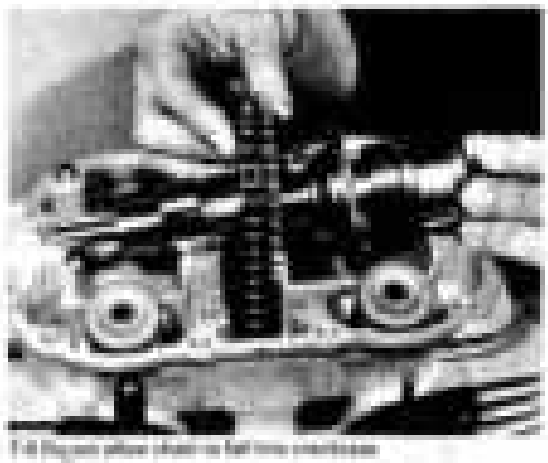
5 In order to gain access to the cam cam chain sprocket bolts it will be necessary to rotate the crankshaft through one-half turn. This is best accomplished after the alternator cover has been removed, when a spanner can be fitted on the alternator rotor bolt. The alternator cover and gasket are retained by three countersunk screws. Remove the two sprocket bolts and pull the sprocket towards the left-hand end of the camshaft, this will bring the sprocket off the locating dowel and allow the cam chain to be lifted off the sprocket.

6 The camshaft and sprocket can now be eased out of position in the cylinder head. To prevent the cam chain falling down into the crankcase, place a screwdriver or short rod through the chain so that it rests across the camshaft bush bearings. Although this is not too important if the engine is being dismantled completely, it may prove difficult to retrieve the cam chain if only the top end of the engine is being overhauled.

7 The cylinder head is retained by eight short studs and two bolts. Find loosen the two bolts which are fitted one each side of the head adjacent to the spark plug holes. Loosen the eight stud nuts in the reverse order given in Fig. 1.14 whilst accompanies Section 10. This procedure will prevent distortion of the complex aluminium structure.

8 The cylinder head can now be eased up, off the locating dowel studs. It may be necessary to use a soft mallet to aid removal. Do not lever the cylinder head this except where they are well supported by the porting. We see use levers to lift the head on broken or bent fins will result. When the head is clear of the cylinder block, slide another screwdriver between the cam chain and remove the screwdriver from the top of the cylinder head.

9 Pull the three hollow dowel pins from the top of the cylinder block, noting the rubber seal on the rear right hand dowel. Remove and discard the cylinder head gasket.



7.4 Chain guide blade on fuel line crankcase

8 Dismantling the engine/gearbox: removing the cylinder block and pistons

1 After removing the cylinder head, the block is free to be lifted off. If it is stuck to the gasket, careful use of a hide hammer may be required. When lifting the block off the cam mounting rods, the pistons should be supported to stop them falling against the edge of the crankcase mouth, which will damage them. After lifting the cylinder block from the base gasket, but before the piston skirt leaves the cylinder face completely, pad the crankcase mouths with paper rag. This will prevent pieces of broken piston ring, or gudgeon pin circlips from falling into the crankcase. This is particularly important where a top-end overhaul only is being carried out. After removing the cylinder block, pull out the dowel hollow dowels and the O-ring.

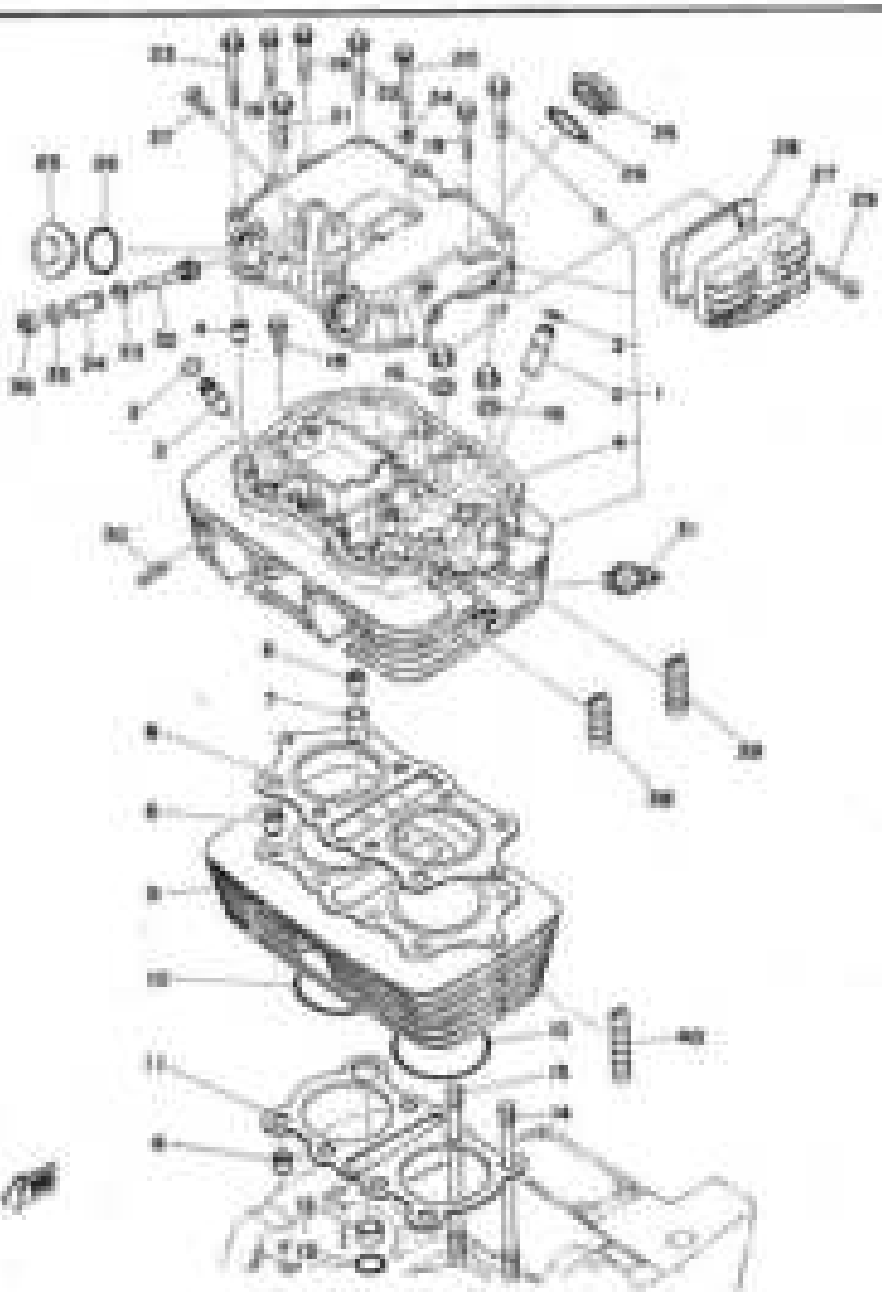


Fig. 1.2 Cylinder head and cover

1 Cylinder head assembly
2 Valve guide - 4 off
3 Circlip - 4 off
4 Dowel pin - 2 off
5 Bolt
6 Dowel pin - 4 off
7 Stud
8 Gasket
9 Cylinder block
10 'O' ring - 2 off
11 Gasket
12 Rubber duster
13 'O' ring
14 Bolt - 4 off
15 Bolt - 4 off
16 Washer - 8 off
17 Nut - 8 off
18 Bolt - 2 off
19 Bolt - 4 off
20 Bolt - 2 off
21 Bolt
22 Bolt - 4 off
23 Bolt - 2 off
24 Washer - 2 off
25 Camshaft cover - 4 off
26 'O' ring - 4 off
27 Contact breaker cover
28 Gasket
29 Pedestal screw - 2 off
30 Stud - 4 off
31 Spark plug - 2 off
32 Rubber - 1971
33 Circlip
34 Housing
35 Washer
36 Oil seal
37 Screw
38 Tension roller
39 Tension roller
40 Tension roller

2 Remove both the circlips from each piston and push the gudgeon pin using a correct diameter drift. Support both the piston and the connecting rod during this operation to prevent any undue sideways strain. Do not completely remove the gudgeon pin but leave it in its respective piston bore. After removing each piston, mark it on the inside of the skirt so it can be reassured to the correct bore on subsequent reassembly. If the gudgeon pin is a tight fit in the piston, the piston should be gently heated by placing a rag soaked in boiling water on the crown. Do not use excessive force or remove a gudgeon pin because of the possibility of bending a connecting rod.

3 There are no separate small end bearings, the gudgeon pin bosses directly onto the bearing surface of the connecting rod.

4 The piston rings can be removed by gently opening the gap and lifting them one at a time off the piston. Great care must be exercised since the rings are very brittle and thus easy to break. If it is intended to use the rings again note the order in which they were removed and also which way the top and bottom surface. A difficulty is encountered in removing the piston rings. Three thin strips of tin, cut from an oil can, may be used to aid removal (see illustration).



Fig. 1.3 Freeing gummed piston rings

9 Dismantling the engine/gearbox: removing the alternator rotor and the starter motor

1 Remove the alternator cover cover (if this has not already been done) to aid crankshaft rotation, as described in Section 7.1.

2 The inner cover, which houses the alternator field coils and encases the starter motor drive chain, is retained by six screw bolts. Remove the inner cover and gasket after disconnecting the neutral warning switch lead and all accessory warning switch leads from their respective switches. Each lead terminal is crimped to a small spade. Slightly flex the two alternator cables from the securing clip to free the leads completely.

3 Remove the circlip and plain washer which encases the starter motor shaft/field and which is retained by two bolts.

4 Unscrew the two crosshead screws at the top of the starter motor. Withdraw the starter motor whilst holding the starter motor sprocket. The starter motor sprocket is not retained on the motor shaft splines by any fixing system; it is a sliding fit. It may be necessary to lightly tap the starter motor out of the crankcase with a hide mallet, since it is often a tight fit in the housing. **Warning:** Do not hit the starter motor on the splined shaft as this will damage the planetary reduction gear. Lift the starter motor out of the chamber together with the main lead which is retained on the terminal on the underside of the motor by a nut.

5 The starter motor drive and sprocket are now free and can be lifted away from the large driven sprocket.

6 Remove the driven sprocket guide plate which is retained by a single bolt.

7 To remove the alternator rotor retaining bolt it is necessary to stop the engine turning. This is best achieved by placing a metal bar through one of the bolts and bosses. Bolt this bar on pieces of wood placed on top of the crankcase mouth. On no account must the metal bar be allowed to bear directly down onto the gasket face. It is does it will most certainly damage the jointing surface and cause oil leaks.

8 After jamming the engine to stop movement, remove the retaining bolt and washer from the alternator rotor. This will uncover an internal thread in the centre boss of the rotor. Fabricate by hand or purchase the use of the Yamaha extractor tool.

9 Remove the rotor from its tapered shaft. If the special tool is unavailable a two or three jaw puller can be used (taper). Note there are notches in the rotor which can be utilised by the puller's legs. Do not forget to remove the Woodruff key. Replace the centre bolt loosely during extraction with a washer to prevent damage to the internal thread.

10 The large sprocket is a push fit over the crankshaft and can be lifted clear after removal of the small retention tongue held by a single bolt.

11 The starter motor free running clutch is contained in the rear of the rotor. For further details refer to Chapter 8, Section 16.

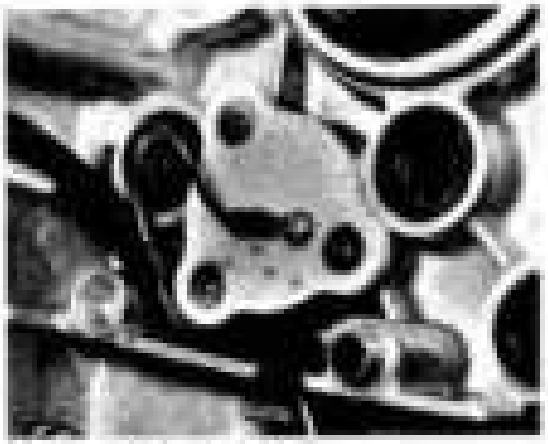
10 Dismantling the engine/gearbox: removing the neutral indicator switch

1 The neutral indicator switch is retained on the gearbox right-hand shaft by three countersunk screws. Slacken the screws evenly and remove them, followed by the switch body. Make a scribe mark on the body to aid correct repositioning on subsequent reassembly.

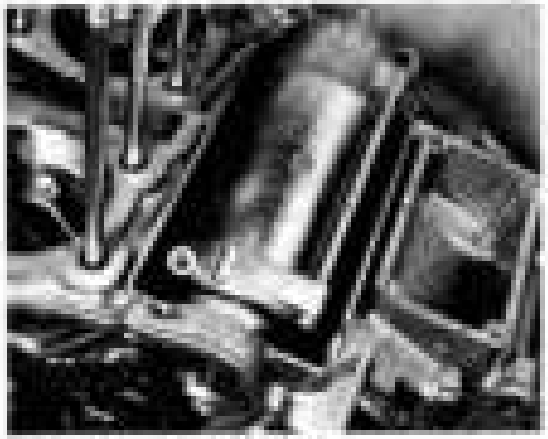
2 Remove all the wire connection from the body. Pull the rubber grommet from the gearchange shaft and is not necessary unless the contact is worn or the spring weakened.



9.3 b Detach oil pressure switch lead and



6.2b ... neutral indicator switch lead



6.3 Lift starter motor out of the chamber



6.8 Sprocket puller makes good substitute for Yamaha extractor

2 Unscrew the four bolts in the clutch pressure plate, and lift off the plate complete with bolts, springs and washers. Remove the clutch operating thrust plate and the clutch operating push-rod. Note that a small steel ball is fitted between these components. Withdraw the ball, using a length of stiff wire, and store it in a safe place. Lift out the clutch plates either one at a time or as a packet, and note their sequence to aid reassembly.

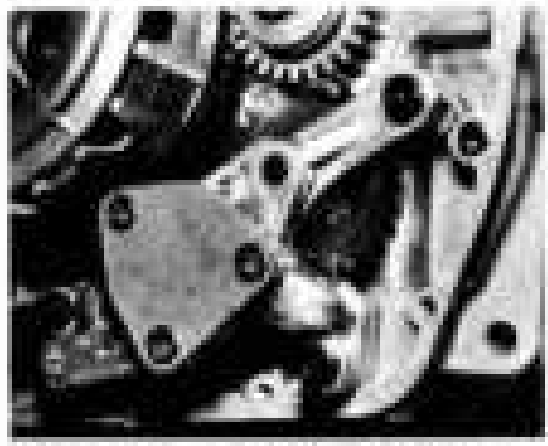
3 Remove the circlip from position on the mainshaft and pull off the clutch centre hub followed by the clutch outer drum.

4 The primary drive pinion is a light push fit on the crankshaft end, where it is retained by a single bolt and located by a Woodruff key. Lock the crankshaft with a close fitting bar through one small end eye, using the previously described method, remove the centre bolt and then draw the pinion off the shaft. If necessary, place two levers between the casing wall and the rear face of the pinion, to facilitate removal. Care must be taken not to damage the casing. Prise the Woodruff key from the recess in the shaft.

11 Disassembling the engine/gearbox: removing the primary drive cover and the oil pump

1 Loosen evenly and remove the screws which hold the primary drive cover in place. The cover is located on two dowel pins and may require tapping from position with a rawhide mallet.

2 The oil pump is secured by three large socket bolts and is located by a single dowel. Remove the bolts and lift the unit away from the casing, complete with the idler gear. The idler gear is a free sliding fit on the shaft.



11.2 Remove the three socket bolts holding the oil pump

12 Disassembling the engine/gearbox: removing the kickstart assembly, the clutch and primary drive pinion

1 Grasp the outer turned end of the kickstart return spring with a pair of pliers and ease it off the anchor lug projecting from the crankcase. Allow the tension on the spring to be released in a controlled manner. The kickstart assembly may be withdrawn from the casing as a complete unit and pressed to one side, for examination at a later stage.

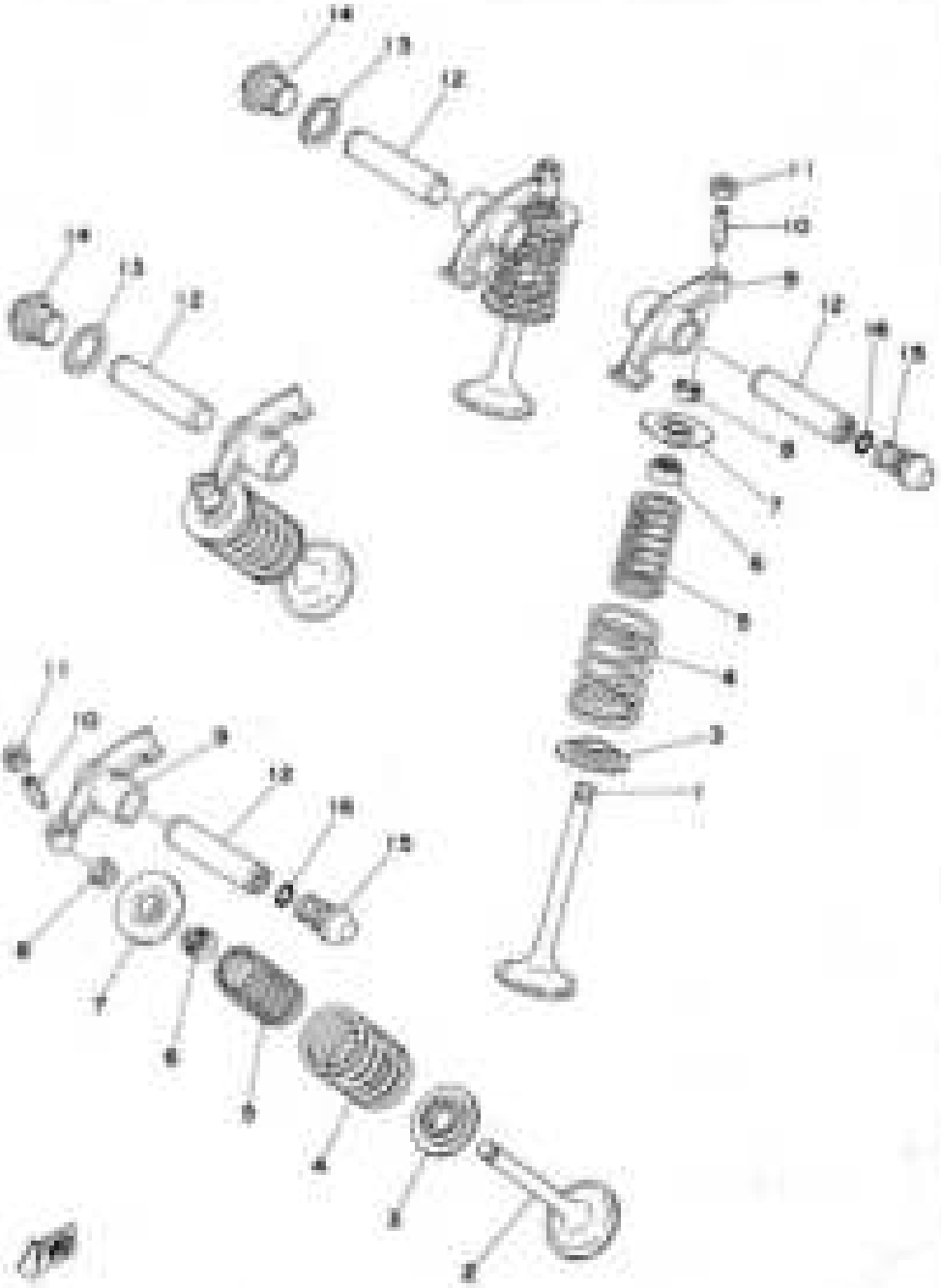


Fig. 1.4 Valves and rocker arms

1 Inlet valve – 2 off
2 Exhaust valve – 2 off
3 Valve spring seat – 4 off
4 Outer spring – 4 off
5 Inner spring – 4 off
6 Valve stem oil seal – 4 off
7 Valve collar – 4 off
8 Split collet – 8 off
9 Valve rocker arm – 4 off
10 Valve clearance adjusting screw – 4 off
11 Nut – 4 off
12 Rocker arm spindle – 1 off
13 Washer – 2 off
14 Plug – 2 off
15 Plug – 2 off
16 'O' ring – 2 off

13 Disassembling the engine/gearbox: removing the gearchange mechanism

1 Pull the rubber seal from the left-hand end of the gearchange shaft and unbolt the 'T' clip, removing it, together with the washer. Withdraw the shaft from the right-hand side of the engine and lift the small shouldered pivot boss from the stub shaft projecting from the gear selector arm. The arm is retained on the splined front gear selector fork rod by an 'E' clip. Remove the 'E' clip and hold the two pawl arms out, away from the change drum pins, to allow removal of the arm.

2 Loosen and remove the two screws which hold the two small plates either side of the change drum end. These screws are very tight and will require a concerted attempt to remove them. Special care should be taken when loosening the domed headed screws as the heads are easily damaged.

14 Disassembling the engine/gearbox: separating the crankcase halves

1 Invert the engine so that the lower crankcase faces upwards and the upper crankcase rests securely on the cylinder holding down studs and the rear portion of the upper gearbox casing.

2 Loosen the crankcase bolting bolts evenly by reversing the sequence given in Fig. 1.11 accompanying Section 56 of this Chapter. Each bolting bolt should be loosened initially about ¼ turn and then the sequence repeated.

Invert the crankcase once more and remove the upper bolts following the correct sequence. Double check that all the bolts have been removed before attempting to separate the cases. A rubber mallet may be used to separate the crankcase halves, the use of levers should be avoided as the mating surfaces are easily damaged, leading to oil loss when the engine is in service again.

3 The upper crankcase half should be lifted away, leaving the crankshaft and gearbox components in place in the casing lower half.

The three main bearing shells in the upper casing should be left in place on the edge. If they fall out when lifting the casing, replace them to their original positions to avoid confusion.

15 Disassembling the engine/gearbox: removing the crankshaft and gearshaft assemblies

1 The crankshaft assembly can be lifted out of position, and the cam shafts removed as soon as the crankcases have been separated.

2 Lift out the footshaft as a complete unit and then remove the mainshaft. Displace the half clips which locate the bearing assembly and remove from the mainshaft the circlip (external on post).

3 The three main assemblies should be placed to one side for later examination and dismantling.

16 Disassembling the engine/gearbox: removing the gear selector mechanism

1 Invert the crankcase lower half and using a large screwdriver remove the change drum detent housing bolt, spring and ball/ball plunger. Right the casing to gain access to the selector fork rods.

2 Prise the 'E' clip from the rear selector fork rod, where it locates in the annular groove adjacent to the gearbox (sh-rear) shift. Using a suitable drift, drive out gently the selector fork rod towards the left-hand side. This will displace the blind grommet in the gearbox wall. Pull the rod out completely to free the two selector forks. It is suggested that each of the four forks be marked clearly to aid reassembly. The guide pins are a light push fit in the forks and should be removed to avoid loss. Withdraw the remaining selector fork rod in a similar manner.

3 Pull the gearchange drum out of its bearing as far to the primary drive side as possible. Prise off the circlip on the drum end and remove the drum stepped cam plate. Remove the small peg from the drum end. The change drum is now free to be withdrawn completely.

17 Disassembling the engine/gearbox: removing the oil baffle plate and the oil strainer screen and cover

1 A sheet/wire baffle plate is fitted within the crankcase lower half, which may be removed to facilitate cleaning. The baffle plate is secured under its rear retainer by a manganese rod, which passes over the top of the plate and locates in castellations in the casing walls. Removal of the plate may be effected by pressing downwards firmly on the plate and withdrawing the rod.

2 A fine screen is fitted in the underside of the crankcase, positioned by a plate held by six bolts. Remove the bolts and lift the plate, then withdraw the strainer and gasket, using a rubber mallet, if the screen is firm in position.

18 Examination and renovation: general

1 Before examining the parts of the dismantled engine unit for wear, it is essential that they should be cleaned thoroughly. Use a paraffin/petrol mix to remove all traces of oil and sludge which may have accumulated within the engine. Most possible, although an admirable solvent, has a low evaporation rate. As a consequence of this difficulty is often encountered in drying cleaned components.

2 Examine the crankcase castings for cracks or other signs of damage. If a crack is discovered, it will require professional repair.

3 Examine carefully each part to determine the extent of wear, checking with the clearance figures listed in the Specifications section of this Chapter or accompanying this text. A certain gauge or external micrometer will be required for determining exterior dimensions. The running clearance between new working surfaces such as the piston and cylinder bore can often be checked using feelers/ taper gauges. Checking internal dimensions such as the diameter of a shell bearing or cylinder bore requires the use of an internal micrometer, the use of which may vary depending on the component concerned. After some experience has been gained it is often possible to determine by eye the extent of wear, and hence the need for renewal, without resorting the direct measurement. If there is any question of doubt, play safe and renew.

4 Use a clean, lint-free rag for cleaning and drying the various components. This will obviate the risk of small particles obstructing the internal oilways, causing the lubrication system to fail.

19 Examination and renovation: main bearings and big-end bearings

1 The KD series twins are fitted with shell type bearings on the crankshaft and the big-end assemblies.

2 Bearing shells are relatively inexpensive and it is unusual to renew the entire set of main bearing shells when the engine is dismantled completely, especially in view of the amount of work which will be necessary on a total basis if any of the bearings fail. Always renew the three sets of main bearings together. Replacement bearing shells are supplied on a selective fit basis. Bearings are selected for correct tolerance to fit the original journal diameter and the diameter of the bearing housings. Each bearing is selected by subtracting the crankshaft journal number from the crankcase housing number, and referring to the following selection table.

Housing No.	Journal No.	Shell No.
2	1	1 (Blue)
4	2	2 (Black)
6	—	3 (Brown)
—	—	4 (Green)

The identification numbers for the crankcase and journals are found on the crankcase upper half and the crankshaft webs respectively as shown in the accompanying illustrations. In practice, provided that the correct numbers are quoted, the supplier of the replacement bearings will be in a position to make the correct selection.

3 Wear is usually evident in the form of scuffing or score marks in the bearing surface. It is not possible to polish these marks out in view of the very soft nature of the bearing surface and the increased clearance that will result. If wear of this nature is observed, the crankshaft must be checked for suitability as described in the following Section.

4 Failure of the big-end bearings is invariably accompanied by a pronounced knock within the crankcase. The knock will become progressively worse and vibration will also be experienced. It is essential that bearing failure is attended to without delay because if the engine is used in this condition there is a risk of breaking a connecting rod or even the crankshaft causing more extensive damage.

5 Gross indication of big-end wear may be disclosed by measuring the side-to-side movement of the connecting rod at the small end eye. The connecting rod should be moved to one side (the crankshaft). A deflection of 0.50 mm (0.019 in) or more indicates the need for bearing renewal. Check the same type of play connecting rod between the big-end eye and the crankshaft cheeks, using a feeler gauge. A clearance of more than 0.254 mm (0.0100 in) indicates a worn crankshaft or connecting rod.

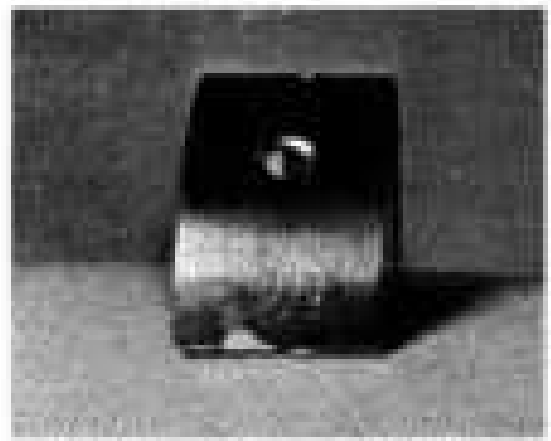
Before the big-end bearings can be examined, the bearing caps must be removed from each connecting rod. Each cap is retained by two high tensile bolts. Before removal, mark each cap in relation to its connecting rod so that it may be replaced correctly. As with the main bearings, wear will be evident as scuffing or scoring and the bearing shells must be replaced as new (2) complete sets.

Replacement big-end bearings are selected in a similar manner to that adopted for main bearing renewal, by referring to the same table. The housing numbers and journal size numbers will be found on the connecting rods and the remaining right-hand web on the crankshaft. Of the two numbers stamped side by side on the web, the first corresponds to the left-hand journal, and the second to the right-hand journal.

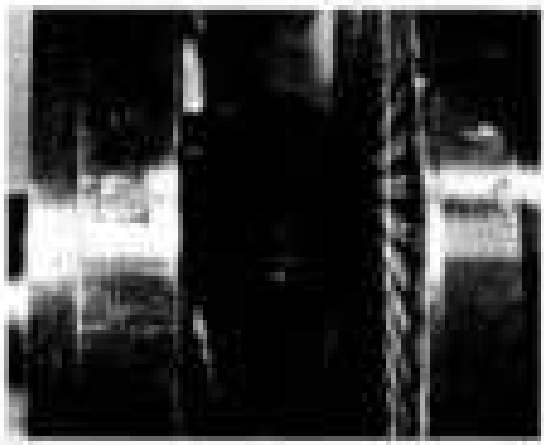
6 Both main bearing and big-end bearing shells are colour coded, as stated in the table. Check the colour marks to be doubly sure of the correct selection.



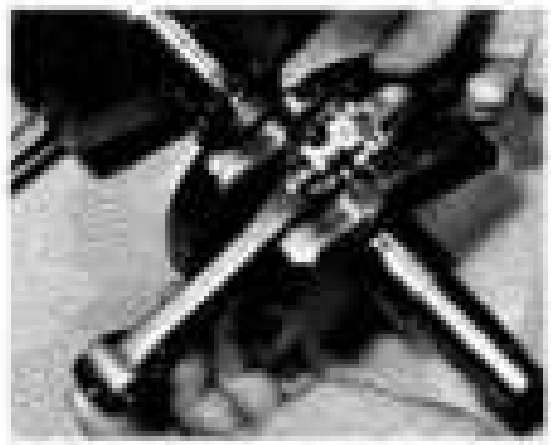
1/8 2a Check bearing shells for scoring or wear



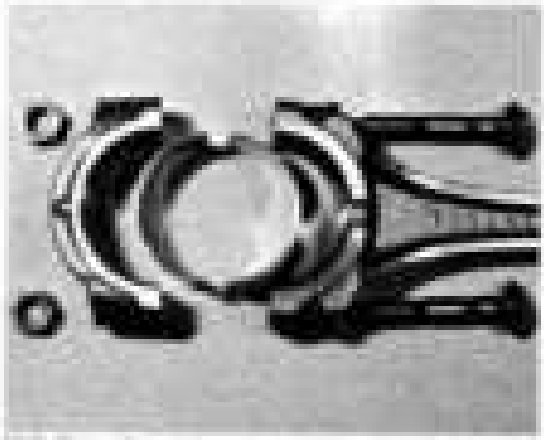
1/8 2b Main bearing shells are colour marked for ease identification



1/8 3a Main bearing journal numbers



1/8 3b Separate the big-end bearing caps from connecting rods



1.6 Big-end connecting rod assembly, general view

26 Examination and renovation: crankshaft assembly

1 If wear has necessitated the renewal of the big-end and/or main bearing shells, the crankshaft should be checked with a micrometer to verify whether ovality has occurred. If the reading on any one journal varies by more than 0.002 in (0.05 mm) the crankshaft should be renewed.

2 Mount the crankshaft by supporting both ends on V-blocks or between centres on a lathe and check the run-out on the centre main bearing surfaces by means of a dial gauge. The run-out will be half that of the gauge reading indicated. The correct run-out, as standard is under 0.002 mm (0.0008 in) and it is advisable that the crankshaft should be renewed.

3 If scoring or flaking of the crankshaft is evident, renewal is the only remedy. Regrinding of the journals is not possible due to undersize bearing shells not being available.

4 When refitting the connecting rods and shell bearings, note that under no circumstances should the shells be refitted with a file, scraper or on the fit connected by filing the connecting rod and bearing cap or the retaining screw slots or the bearing seatings. Treatment such as this will end in disaster. If the bearing fit is not good, the parts concerned have not been assembled correctly. This advice also applies to the main bearing shells. Use new big-end bolts (or – the originals may have stretched and weakened).

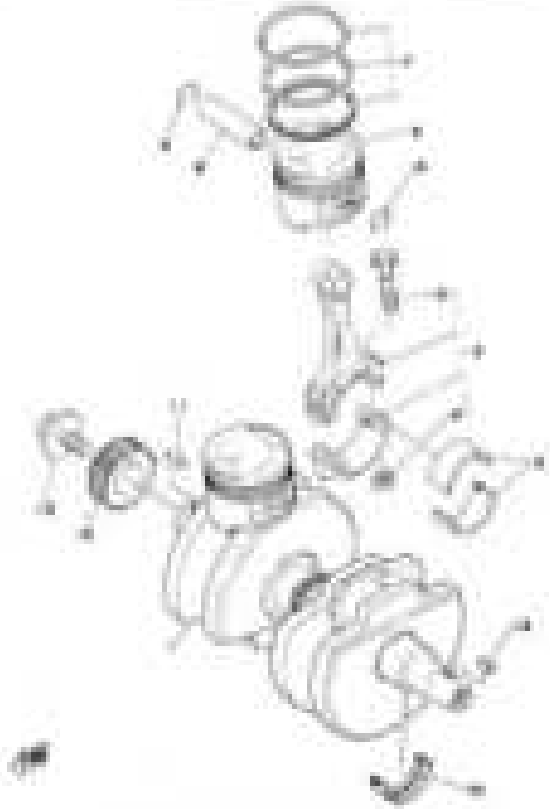
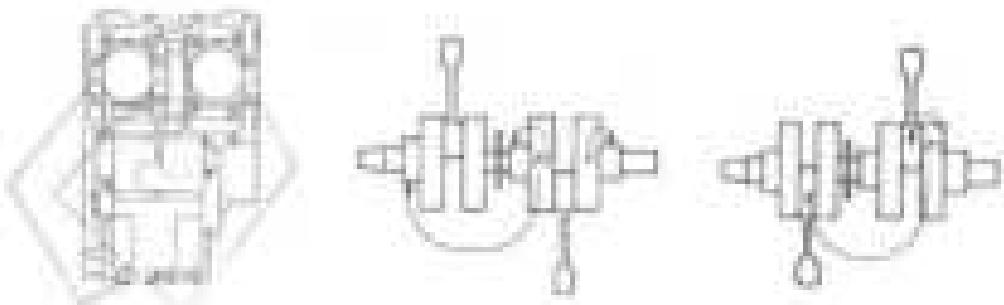


Fig. 1.6 Crankshaft and piston assembly

1 Crankshaft
2 Connecting rod assembly – 2 off
3 Connecting rod bolt – 4 off
4 Nut – 4 off
5 Big end bearing shell – 2 off
6 Piston – 2 off
7 Piston ring set – 2 off
8 Gudgeon pin – 2 off
9 Circlip – 4 off
10 Main bearing – 4 off
11 Woodruff key
12 Primary drive pinion (23/17)
13 Nut
14 Woodruff key



Main bearing housing numbers

Main bearing journal numbers

Big-end bearing journal numbers

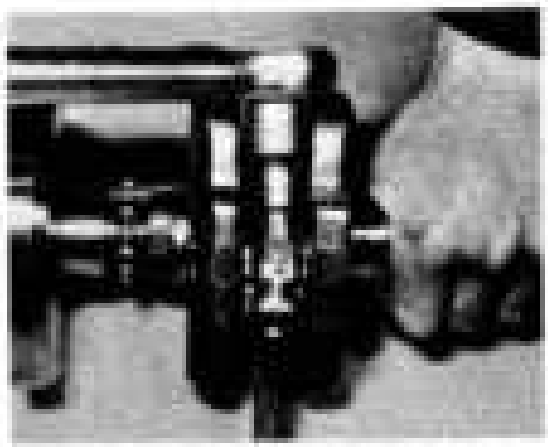
Fig. 1.7 Shell bearing selection number locations

6 Oil the bearing surfaces (before reassembly takes place) and make sure the legs of the bearing shells are located correctly. Fit each connecting rod and cap so that the lines and arrows on the rod and the cap mate (the arrow on each rod is facing towards the left-hand side of the engine). After the initial tightening of the connecting rod nuts, check that each connecting rod revolves freely, then tighten to a torque setting of 2.3 – 2.7 kgfm (24 – 27 Nfm). Check again that the bearing is correctly fitted.

21 Examination and renovation - connecting rods

1 It is unlikely that either of the connecting rods will bend during normal usage, unless an unusual occurrence such as a dropped valve has caused the engine to lock. Consequently, when removing a tight gudgeon pin can also give rise to a similar problem. It is not advisable to straighten a bent connecting rod, renewal is the only satisfactory solution.

2 The small end eye of the connecting rod is unbushed and it will be necessary to renew the connecting rod if the gudgeon pin becomes a slack fit. Always check that the oil hole in the small end eye is not blocked (when if the oil supply is cut off the bearing surfaces will seize very rapidly).



21.6 Tighten big end bolts to correct torque

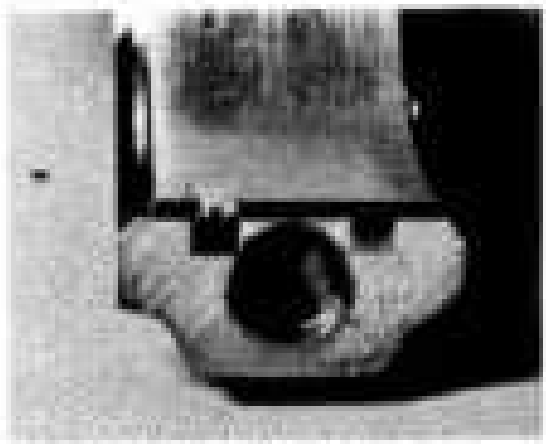
22 Examination and renovation: cylinder block

1 Cylinder bore wear is usually accompanied by excessive oil consumption and blue smoke from the exhaust. On examination of the top of the bores there will be a pronounced ridge at the limit of the travel of the top piston ring if wear has occurred. Do not mistake a ridge for a carbon deposit which can be scraped off.

2 Measure the bore with an internal micrometer just below the ridge (or at the limit of travel of the top piston ring) between the bore and the wall of the sprue, where most wear occurs. Also measure the bore at the bottom of the cylinder. A comparison of the two results will give the cylinder bore wear.

If no internal micrometer is available, place a piston ring squarely in the top of the bore, below the ridge, and measure the end gap with a feeler gauge. Repeat at the bottom of the bore. Subtract the later figure from the first and divide by three (more accurately 22.7). This will give the approximate wear. The bottom of the skirt of the piston can be used to position the ring squarely in the bore. Compare the results obtained with the specified limits.

3 Check the bores for score marks and deep damage and necessitate a rebore.



22.4 Ensure that bearing shell lugs locate correctly

4 Check that the cooling fins are not clogged with oil and dirt otherwise overheating will occur. The fins can be cleaned by judicious use of a small screwdriver and/or a wire brush.

23 Examination and renovation: pistons and piston rings

1 If a rebore is required, due to the condition of the bores, new oversize pistons and rings will have to be obtained.

2 Remove the carbon from the piston crown using a soft scraper (an old piece of aluminium has about right hardness) for the purpose and be most careful not to damage the ring grooves. Finally finish with metal polish. Emery cloth is not recommended but valve wool and oil can be successfully employed.

3 Wear is usually evident on the thrust side of the pistons and is noticeable as vertical streaky scoring marks. If the score marks are not severe they may be smoothed out for light fitting with a rounded or worn file.

4 The piston ring grooves may have become enlarged. Check them with a feeler gauge and compare the reading with the service limits.

5 Piston ring wear is difficult to estimate due to the variability in the end gap setting when the engine was last assembled. However, there is a service limit and the rings can be checked by placing them squarely in the bore and measuring the end gap with a feeler gauge. If the gap is greater than the maximum allowed, then renew the rings. However, if the gap is within the prescribed limits it does not particularly show that excessive wear has not taken place. Therefore if in doubt or if a high mileage has been covered renew the piston rings as a precaution.

24 Examination and renovation: cylinder head

1 The cylinder head, which was removed in an earlier stage, now concerns only the valves, valve springs and associated components.

2 Remove any carbon from the head with the valves still in position, using the same technique as in the previous Sections. It is advisable to put two old spark plugs in the sparking plug holes so that the grooves do not become either damaged or blocked.

3 A valve spring compressor is required to remove the valves. On compressing the spring the valve collars can be lifted out and then the pressure released. They will free from the valve, valve spring collar and valve springs. Note where the valves came from so that they can be replaced in their respective seats. The inlet valve has the larger diameter head. Remove and

Reverse the valve oil seals which are a push fit on the valve guides. The seals should be renewed as a matter of course. The spring seats (on new fat fitted) off.

4 If not cleaning the head and valves and remove any dirt from between the fixed fins to stop overheating.

5 Check that the valve guides are free from carbon, particularly the external.

6 Visually inspect the valves for wear on the stem and for the valve head. If excessive wear is evident or in doubt, replace the valves. Measure the valve stem in several places with a micrometer and compare readings with the service limits. If the valve is in good condition except for some deep pits in the seat, the valve can probably be refaced at a garage. Also check that the valve stem is straight by rolling the valve on a flat plate (whereby any irregularities will be noticed).

7 Measure the internal diameter of the valve guides and compare readings with the service limits. Renew if necessary. If replacement is required the head should be uniformly heated to 120°C (212°F) in an oven (a kitchen oven) and the old guide drifted out with a correct sized drift. The new guide should then be immediately drifted in whilst the head is still hot. Do not omit this small circlip which is fitted to the guide. On cooling the guide should be reamed out to the correct size using a reaming arbour(s) of six. If the guides have had to be replaced, the valve seats will also need recutting.

8 Inspect the valve seats and if they are deeply pitted, or have guides have been fitted, they will have to be recut at a garage. Both inlet and exhaust valve seats are cut to the same angle, see Specifications.

9 If the pitting of either the valves or valve seats is very slight, or if new valves have been fitted, the valves will require grinding in.

10 Valve grinding is basically a simple task - smear a little medium or fine grinding compound (carborundum paste), depending on the amount of pitting, onto the valve seat. Lightly oil the valve guide and place the valve into position. Rotate it backwards and forwards using a suction valve grinding tool. Occasionally lift the valve and rotate it to a different position on the valve seat so as to grind in the whole seat evenly. Repeat this operation, using first grinding paste, if this has not been used previously, the 'marks' can be seen on the valve stem or in the valve guide. The valve is ground in when there is a complete and unbroken ring of light grey matt finish on both the valve and seat. Alternatively, thoroughly wash off the grinding paste to prevent damage that will be caused by its abrasive action. Do not resort to excessive grinding as this will quickly thin the valve in the seat.

11 Check the valve collets for wear in slipping and renew them if necessary.

12 The valve springs should be checked for squareness, free length and compressing the measurements with the service limits. Also check that the springs are not starting to crack or have worn badly by rubbing against each other. Replace them as a set if any doubt.

13 Check that the cylinder head to block gasket face is in good condition and that the head is not warped. To check for warping use engineers blue on a surface plate, or a piece of plate glass. Rubbing this, check in several places, using a straight edge. Small high spots or slight warpage can be corrected by hand, with a flat oil stone.

20 Examination and renovation: camshaft, camshaft sprockets, chain and tensioner

1 The cam lobes should have a smooth surface, with no indentations. It is unusual to find wear where a lubrication fault has occurred. If anything is apparent but is not serious, it should be stoned out with a commercial stone and oil. If anything as the cam lobes is sufficient to alter the cam shape often enough has been carried out, then the camshaft will need renewing. Measure the overall height of each cam from the base circle to the tip of the lobe. If the measurement is less than the service limit or any one cam, the camshaft should be renewed.

2 The camshaft does not have any bearings as such but rubbs on the camshaft journals are bearing shell machined into the cylinder head and the camshaft cover. Check the condition of the bearing surfaces. It is unlikely that wear will have taken place on the cylinder head or camshaft cover, unless lubrication failure has occurred.

3 If wear has developed in the bearing surfaces as a whole the cylinder head, camshaft cover and camshaft must be renewed.

4 Check the camshaft sprocket for missing and/or chipped teeth. If wide wear is apparent, it is probably due to worn camshaft bearings or incorrect endfloat. The lower sprocket on the camshaft should only be checked. This component is an integral part of the camshaft, and as such if wear occurs the camshaft must be renewed. Excessive side play of sprocket rarely occurs because the camshaft sprocket operates in ideal conditions.

5 Inspect the camshaft chain for wear, cracked links or missing rollers. An indication of wear is given by bending the chain sideways across the line of the rollers. If a pronounced curve is formed, the chain is worn and should be renewed. Camshaft chains do not generally wear until considerable service has been given, as they function in an ideal environment, always correctly lubricated.

6 The chain tensioner blade and the chain guide blade are made of plastic and will wear eventually. Light grooves in the blades can be overlooked, but if excess wear has taken place the blade should be renewed. The chain tensioner unit is unlikely to suffer wear or damage. Check that the plunger moves in and out smoothly when depressing the spring end plate.

21 Examination and renovation: rocker arms and pins and camshaft bracket

1 Visually inspect the rocker arms for cracks and check the face for excessive wear.

2 Check the rocker arm pins for wear and see that there is not an excessive clearance between the pin and arm. If there is too much clearance there will be a general rattle on power from inside the cylinder. Inspect the tappet adjuster screw heads for hammering or flaking, renewing where necessary. The left-hand rocker pins are retained by rubber plugs which in turn are secured by the correct locater plate. The right-hand pins are secured by screw plugs. Each pin has an internal thread to the outer end into which may be screwed a suitable bolt, to aid extraction.

3 The camshaft driveshaft is fitted to the camshaft cover where it is driven by a small gear integral with the camshaft. The shaft is unlikely to wear unless lubrication failure occurs. To remove the shaft and housing displace the 'E' clip from inside the cover. The housing may then be drifted out, driving out the housing oil seal and tapping washer on the same side. Withdraw the shaft from inside the camshaft cover.

22 Examination and renovation: primary drive gears

1 Check the cam primary drive gears for wear or broken teeth. A damage on this type is sudden, both items should be renewed as a set, since the wear characteristics of one mesh gear will soon damage a new component with which it is meshed. The primary driven gear is supplied only complete with the clutch outer drum, to which it is riveted. If the basic work knew then refer for fullerwood using a ball pein hammer.

2 On original assembly the gears are fitted selectively to ensure that the back lash in the teeth is correct. When renewing gears, ensure that the correct gears components is fitted. Each gear is marked with a value 0 - 7, the replacement components should bear the same identification mark as the original part. Failure to match the parts correctly will lead to increased gear noise and accelerated wear.

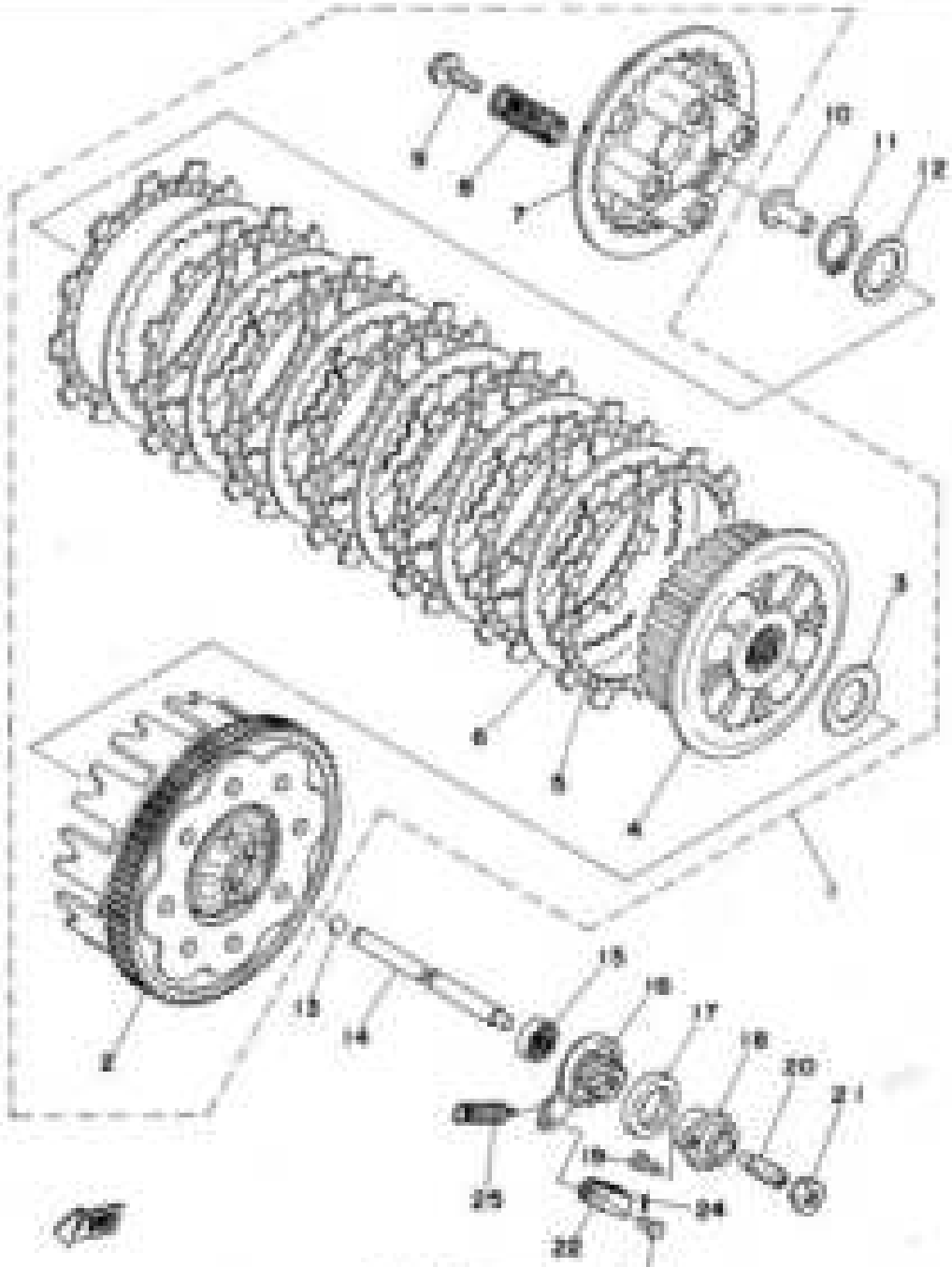
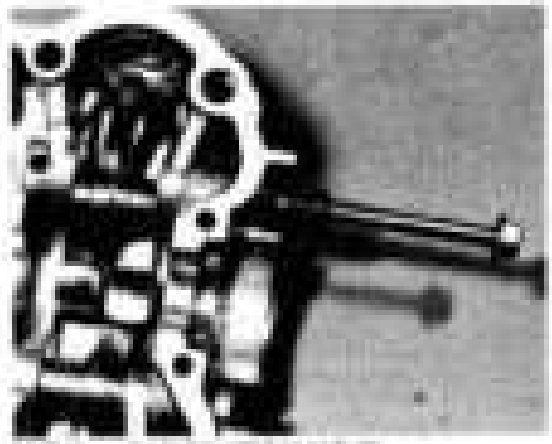


Fig. 1.7 Clutch assembly

1 Clutch assembly
2 Primary driven gear and clutch outer drum
3 Thrust washer
4 Clutch centre boss
5 Friction plate - 7 off
6 Clutch plate - 6 off
7 Pressure plate
8 Compression spring - 4 off
9 Clutch spring screw - 4 off
10 Clutch pushrod mushroom
11 Cluty
12 Plate
13 Ball bearing (¼ inch)
14 Pushrod
15 Pushrod seal
16 Clutch actuating quadrant screw
17 Seal seal
18 Actuating mechanism housing
19 Screw - 2 off
20 Adjusting screw
21 Nut
22 Cable anchor
23 Clevis pin
24 Split pin
25 Return spring



28.2a Left-hand cluster pins are held by rubber plugs



28.2b Use reading lamp on workbench each pin



28.3 Diaphragm 'B' clip via elbow removed on shaft

28 Examination and renovation: clutch assembly

1 After an extended period of service the clutch linings will wear and promote clutch slip. The loss of wear measured across each inserted plate and the standard measurement is as follows:

Clutch plate thickness

Standard	Service limit
3 mm (0.12 in)	2.7 mm (0.11 in)

When the overall width reaches the limit, the inserted plates must be renewed, preferably as a complete set.

2 The plain plates should not show any excess heating (blueing). Check the warpage of each plate using plate glass or surface plate and a feeler gauge. The maximum allowable warpage is 0.05 mm (0.002 in).

3 Check the condition of the steel spring rings which lie between the clutch plates. Replace any that are bent or broken.

4 Check the free length of each clutch spring with a vernier gauge. After considerable use the springs will take a permanent set thereby reducing the pressure applied to the clutch plates. The correct measurements are as follows:

Clutch springs

Standard	Service limit
24.6 mm (1.382 in)	23.6 mm (1.33 in)

5 Examine the clutch assembly for burrs or indentation on the edges of the protruding tangues of the inserted plates which are worn in the edges of the outer driven slots which they engage. Similar wear can occur between the inner tangues of the plain clutch plates and the slots in the clutch inner drum. Wear of this nature will cause clutch drag and poor disengagement during gear changes, since the plates will become tapered and will not free fully when the clutch is withdrawn. A small amount of wear can be corrected by dressing with a fine file, more extensive wear will necessitate renewal of the worn parts.

6 The clutch release mechanism attached to the final drive sprocket cover does not normally require attention provided it is greased at regular intervals. It is held to the cover by two countersunk screws and operates on the worm and quick worm thread principle.

29 Examination and renovation: gearbox components

1 Examine each of the gear pinions to ensure that there are no chipped or broken teeth and that the dogs on the end of the pinions are not rounded. Gear pinions with any of these defects must be renewed; there is no satisfactory method of reclaiming them. Dismantling the rear gearshaft assemblies is quite straightforward, requiring the removal of the thrust washers and locating washers to free each pinion in sequence. If necessary, make sketches to facilitate correct reassembly.

2 The gearbox bearings must be free from play and show no signs of roughness when they are rotated. After thorough washing in petrol the bearings should be examined for roughness and play. Also check for pitting on the roller tracks.

3 It is advisable to renew the gearbox oil seals irrespective of their condition. Should a oil seal sit seal fail or a new one is installed, a small amount of wash is required to gain access to renew it.

4 Check the gear selector rods for straightness by rolling them on a sheet of plate glass. A bent rod will cause difficulty in

selecting gears and will make the gear change particularly heavy.

5 The selector forks should be examined closely, to ensure that they are not bent or badly worn. The cam channels are easily recognisable if they are worn. Under normal conditions, the gear selector mechanism is unlikely to wear quickly, unless the gearbox oil level has been allowed to become low.

6 The inserts in the selector drums, with which the selector forks engage, should not show any undue signs of wear unless neglect has led to under-lubrication of the gearbox. Check the tension of the gearchange lever, gearchange arm and drum stopper arm springs. Weakness in the springs will lead to imprecise gear selection. Check the condition of the gear stopper arm roller and the pins in the change drum end plate which it engages. It is unlikely that wear will take place here except after considerable mileage.

22 Examination and replacement: kickstart shaft assembly

1 Check the condition of the kickstart components. If slipping has been encountered, a worn ratchet and gear may be traced as the cause.

2 The same symptom may be a result of the clip being either too tight or too loose on the pinion hubs. The condition of the clip may be checked by attaching a spring balance to the clip projections and applying off the force needed to promote slip. A reading of 14 lb - 1.5 kg (1 lb - 0.5 kg) indicates that the clip is in good condition.

3 Any other damage or wear to the components will be self-evident. If either the return or pawl is found to be faulty, both components must be renewed as a pair. Examine the kickstart return spring, which should be renewed if there is any doubt about its condition.

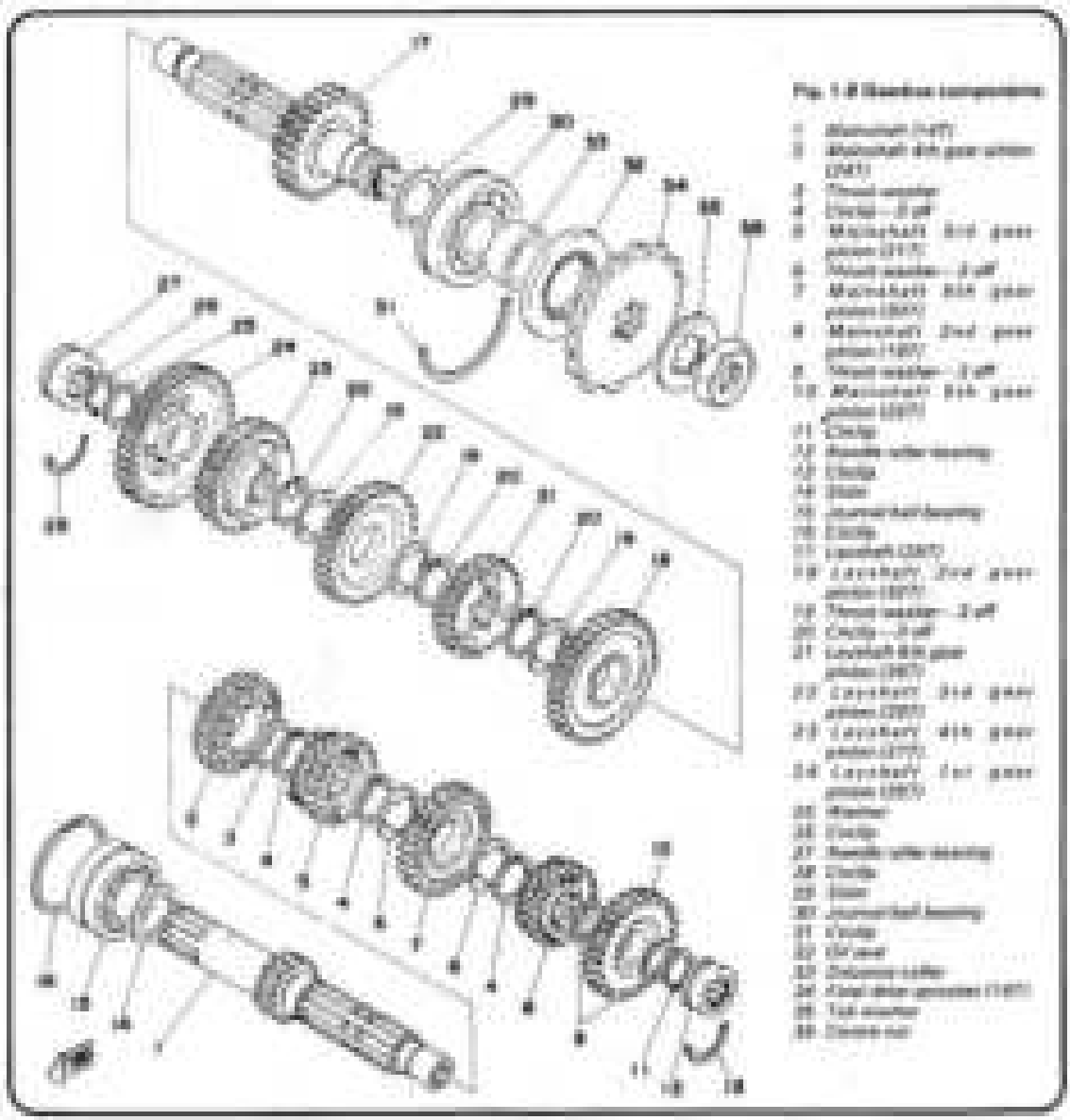
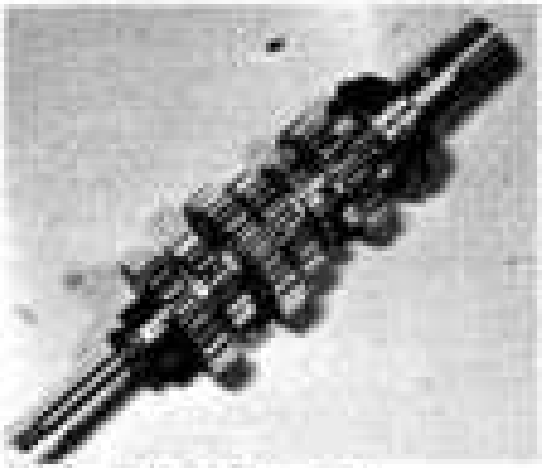
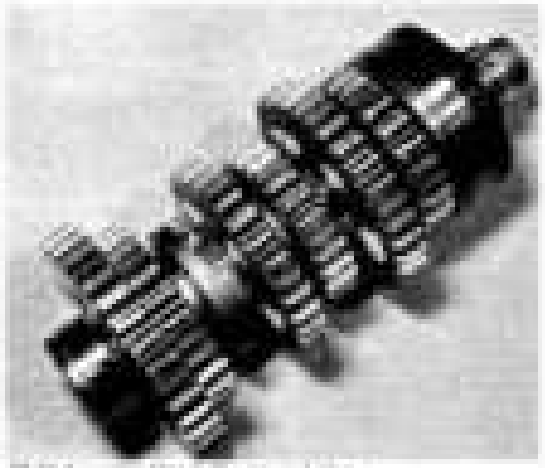


Fig. 1.8 Gearbox components

1 Mainshaft (1st)
2 Mainshaft 4th gear pinion (24T)
3 Thrust washer
4 Circlip - 2 off
5 Mainshaft 3rd gear pinion (21T)
6 Thrust washer - 2 off
7 Mainshaft 5th gear pinion (20T)
8 Mainshaft 2nd gear pinion (19T)
9 Thrust washer - 2 off
10 Mainshaft 6th gear pinion (22T)
11 Circlip
12 Needle roller bearing
13 Circlip
14 Shim
15 Journal ball bearing
16 Circlip
17 Layshaft (3/6T)
18 Layshaft 2nd gear pinion (22T)
19 Thrust washer - 2 off
20 Circlip - 2 off
21 Layshaft 6th gear pinion (26T)
22 Layshaft 3rd gear pinion (23T)
23 Layshaft 4th gear pinion (21T)
24 Layshaft 1st gear pinion (15T)
25 Washer
26 Circlip
27 Needle roller bearing
28 Circlip
29 Shim
30 Journal ball bearing
31 Circlip
32 Oil seal
33 Distance collar
34 Final drive sprocket (19T)
35 Tab washer
36 Centre nut

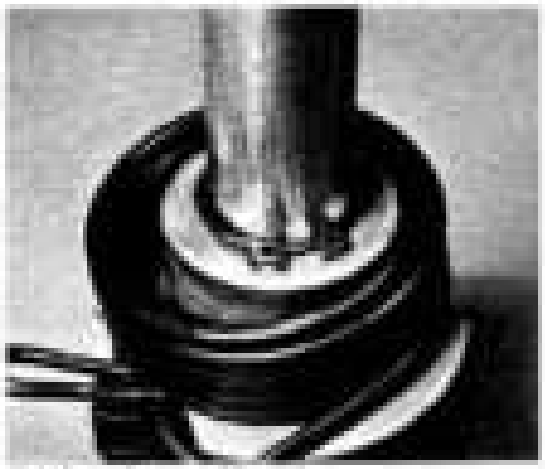












31 Engine/gearbox reassembly: general

1 Before reassembly of the engine/gear unit is commenced, the various component parts should be cleaned thoroughly and placed on a sheet of clean paper, close to the working area.

2 Make sure all traces of old gaskets have been removed and that the mating surfaces are clean and undamaged. One of the best ways to remove old gasket cement is to apply a rag soaked in methylated spirit. This acts as a solvent and will ensure that the cement is removed without resort to scraping and the consequent risk of damage.

3 Gather together all the necessary tools and have available an oil can filled with clean engine oil. Make sure all new gaskets and oil seals are to hand, also all the replacement parts required. Nothing is more frustrating than having to stop in the middle of a reassembly sequence because a vital gasket or replacement has been overlooked.

4 Make sure that the reassembly area is clean and that there is adequate working space. Refer to the torque and clearance settings wherever they are given. Many of the smaller bolts are easily sheared if overtightened. Always use the correct size screwdriver for the threaded screws and never an ordinary screwdriver or punch. If the existing screws show evidence of maltreatment in the past, it is advisable to renew them as a complete set.

32 Engine/gearbox reassembly: replacing the gear selector mechanism

1 Insert the gearchange drum through the aperture in the gearbox wall so that the drive engages into the gearbox. Replace the drive peg in the end of the change drum and then fit the drum stopper plate so that it locates with the peg. Secure the plate by means of the circlip. The circlip must be fitted so that the two wire ends are positioned as shown in the accompanying photograph. In any other position the circlip will foul the detent plunger. Lubricate the drum bearing surfaces and then slide the unit into place in the gearbox left-hand wall.

2 Insert the crankcase lower half and refit the detent plunger spring and locating bolt so that the plunger locates with the change drum. Check the bolt sealing washer before refitting. Rotate the change drum so that it is in the neutral position. This can be found by turning the change drum fully anti-clockwise and then one position back.

3 Place the crankcase lower half upright on the workbench, insert the longer of the two selector fork rods into the gearbox wall forward of the change drum. Position the two selector forks and slide the rod fully home. The forks should be placed as shown in the accompanying photograph, with the left-hand one locating with the left-hand cam track and the right-hand one locating with the selector right-hand cam track. Fit the rear selector forks in a similar manner, noting that the left-hand fork should locate with centre cam track. Fit the locating 'E' clip to the rear selector fork rod groove adjacent to the gearbox left-hand wall and then fit the nylon grommets to the rod ends.

33 Engine/gearbox reassembly: replacing the gearshaft assemblies

1 Before being fitted into the crankcase, the two gearshafts must be reassembled complete with the various sliding members, circlips and bearings. Assemble each shaft by referring to the relevant illustrations, ensuring that all components are fitted in the correct sequence. Even one misplaced washer or circlip may lead to incorrect gear selection and the need for considerable dismantling at a later stage.

2 Fit the two small and one large bearing locating bolt plate into the bearing recesses in the casing. Locate the mainshaft into position, followed by the layshaft, which should have the left-hand oil seal and circlip in place on the shaft. Ensure that the bearings enter the mounting slots and that the selector forks engage with the channels in the gear pinions.

3 Place the washered oil seal in the recess to the left of the mainshaft and

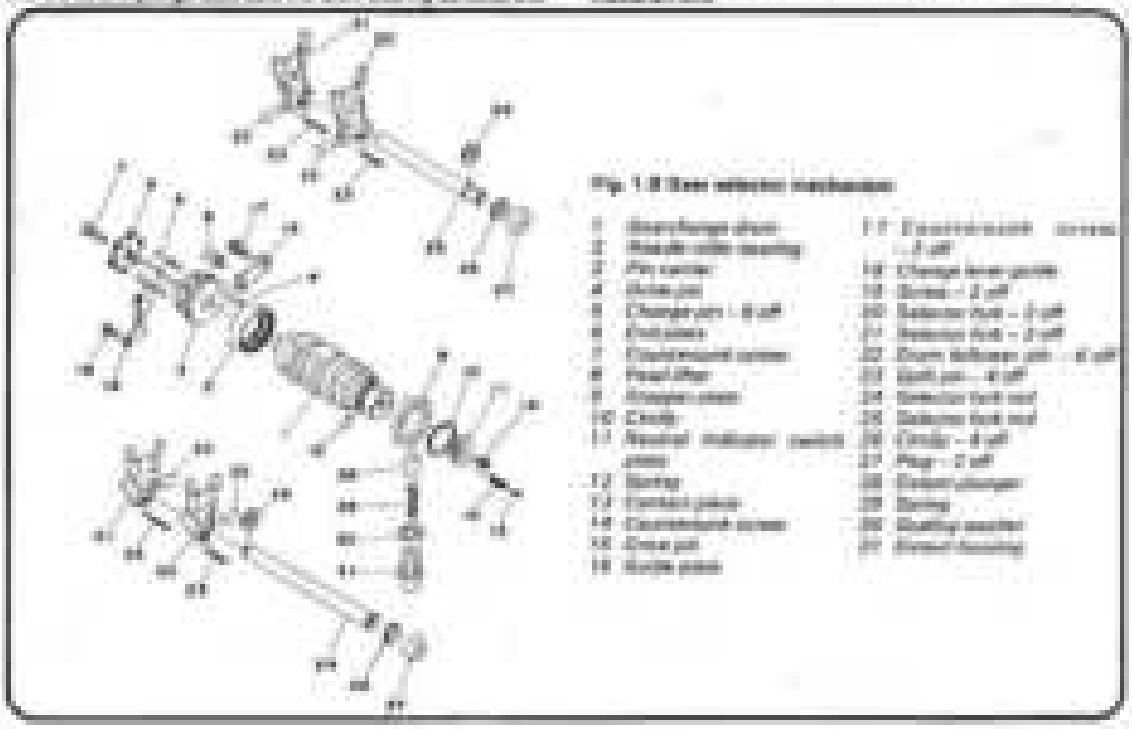
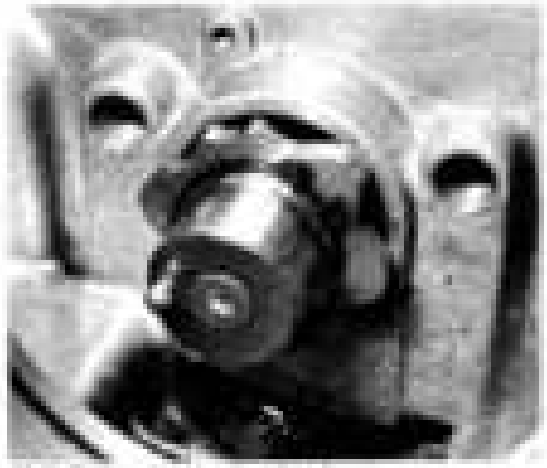


Fig. 1.8 Gear selector mechanism

1 Gearchange drum
2 Needle roller bearing
3 Pin circlip
4 Roller pin
5 Change pin - 6 off
6 Fork rollers
7 Countersunk screw
8 Head lifter
9 Stopper plate
10 Circlip
11 Neutral indicator switch plate
12 Spring
13 Contact piece
14 Countersunk screw
15 Cross pin
16 Guide plate
17 Countersunk screw - 2 off
18 Change lever pinch
19 Screw - 2 off
20 Selector fork - 2 off
21 Selector fork - 2 off
22 Drum stopper pin - 2 off
23 Shift pin - 4 off
24 Selector fork rod
25 Selector fork rod
26 Circlip - 4 off
27 Plug - 2 off
28 Detent plunger
29 Spring
30 Shafting washer
31 Dowel bushing

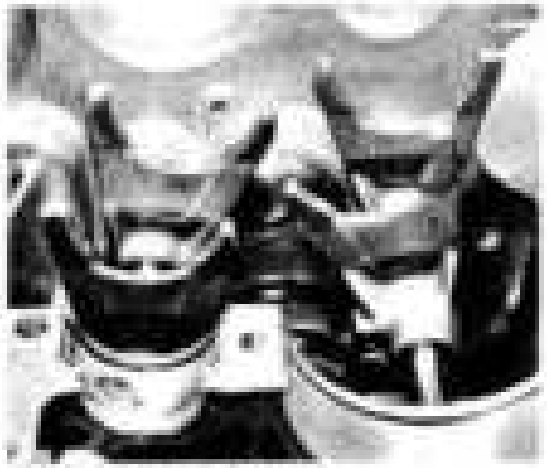








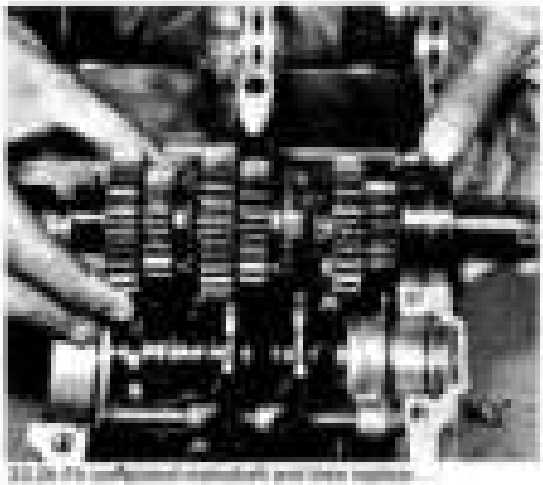


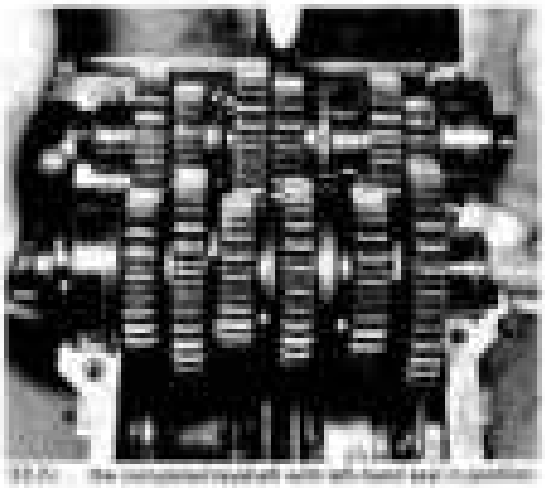














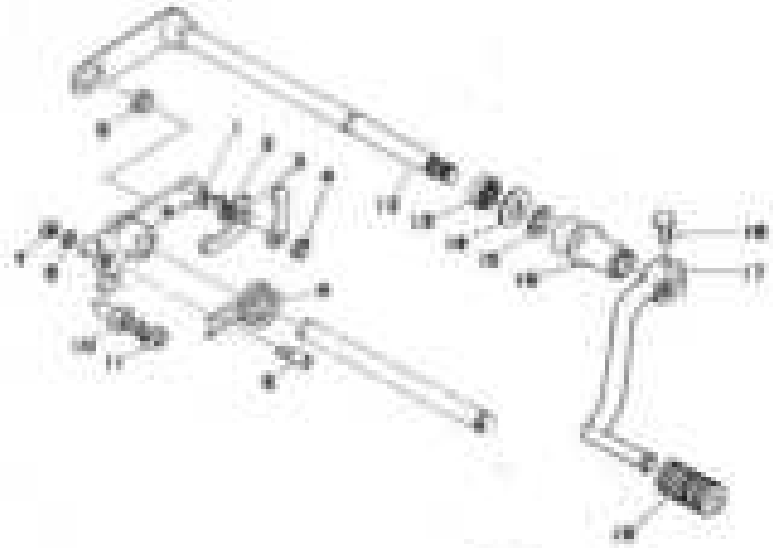


Fig. 1.19 Gearchange mechanism

1 Gear selector arm
2 Pedal spring
3 Gearchange lever - 2 off
4 Circlip
5 Gear selector arm roller
6 Circlip/flat washer
7 Nut
8 Spring washer
9 Return spring
10 Strap
11 Joint washer
12 Gearchange shaft
13 Oil seal
14 Washer
15 Circlip
16 Sealing rubber
17 Gearchange lever
18 Pivot bolt
19 Rubber

24 Engine/gearbox reassembly: replacing the crankshaft

1 Replace the oil baffle plates in the crankcase, depressing them firmly to enable the crankcase retaining rod to be fitted.

2 Clean the main bearing housings thoroughly and then refit the main bearing shells into the two crankcase halves. The bearing tags must engage with the relevant portion of each housing, and the ends of each shell should be flush with the crankcase mating surfaces.

3 Fit the cam drain cams (the crankshaft central journals and their lubricated) the main bearing journals (on the crankshaft up into position in the casting. Check that the main bearing shells have not been displaced.

25 Engine/gearbox reassembly: joining the crankcase halves

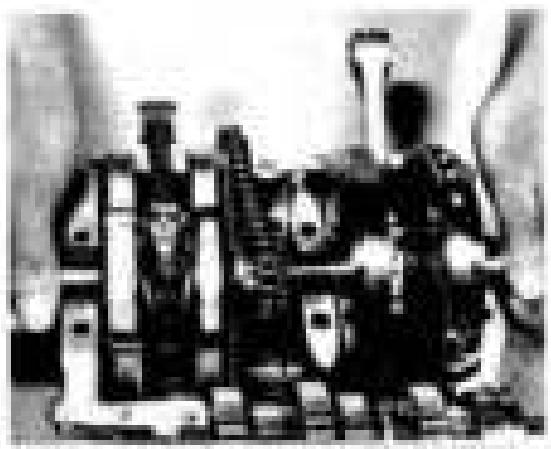
1 Ensure that both mating surfaces of the crankcase halves are clean and smear them with a light coating of gasket cement. Check again that the bearing shells are located correctly.

2 Fit the upper crankcase half into position on the lower half so that it locates with the dowel pins and gently tap it down with the ball of the hand. Check that the mating surfaces have contacted all round the cases. If any difficulty is encountered in fitting the two cases together, do not use force. Remove the upper half, check the components for correct positioning and then repeat the fitting operation.

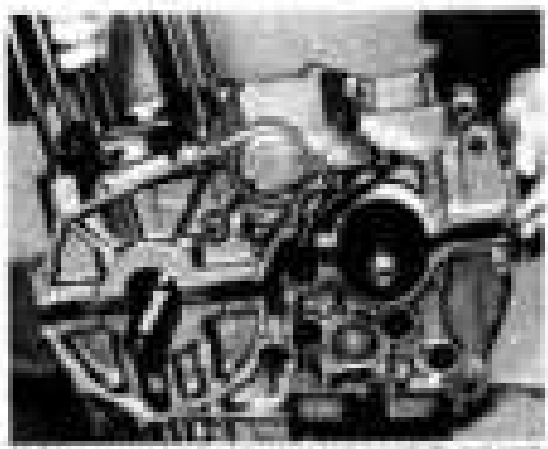
3 Refit the bolts into the crankcase upper half bearing in mind that the rear bolt behind and to the right of the breather chamber also retains the main earth lead. Do not omit the filler which secures the alternator leads. Tighten the bolts only to hand at this stage. Invert the crankcase and fit the lower bolts. Tighten all the bolts evenly, a little at a time, in the sequence given in the accompanying illustration. The final torque settings are as follows:

8 mm bolts	2.0 - 2.4 kg m (15-17)
6 mm bolts	0.8 - 1.2 kg m (6-9)

During tightening, check that the crankshaft and engine shafts rotate freely.



24.3 Lift crankshaft and camshaft into position in crankcase



25.2 Lower upper crankcase half onto dowel rods (gearshafts and crankshaft)

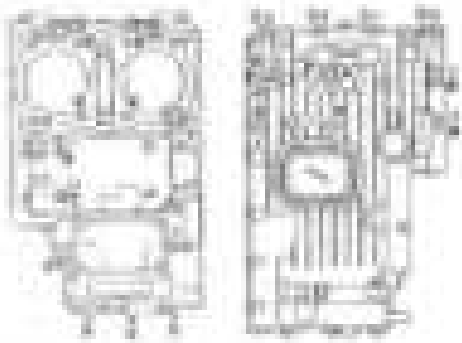


Fig. 1.11 Crankcase bolt tightening sequence

36 Engine/gearbox reassembly: replacing the gearchange mechanism

1 Fit the change shaft pawl plate and selector arm guide plate into the primary chaincase, tightening the screws fully. Fit the centraliser spring onto the selector arm boss as shown in the accompanying photograph. Fit the selector arm into the casing, simultaneously folding down the two change pawls so that they clear the end of the change drum. When released, the pawls should locate with the change pins. Secure the selector arm to inboard of the 'E' clip.

2 Place the shouldered plain bush onto the shaft protruding from the selector arm so that the smaller diameter is outermost. Lubricate the splined end of the gearchange shaft and then insert it into position in the casing pushing it fully home so that the elongated hole in the shaft arm engages onto the shouldered pivot bolt, shown the opposite side of the engine, to the inboard washer and 'E' clip which secure the gearchange shaft.

3 Before continuing with assembly, temporarily replace the gear change lever and selector to select each gear in turn. Rotating the new gearshafts with old selectors, if difficulty is encountered in selection and no obvious cause is evident, the centraliser spring must be suspected and the bush moved. Incorrect assembly of gear clusters or selector forks should be looked for. Sluggish gear selection may be caused by incorrect centralisation of the gear selector arm, which should be checked to vary clear as a matter of course.

4 Place the engine in first gear and check that the clearance between each of the two selector pawls and its adjacent change pin is equal. See the accompanying illustration. If the dimensions are unequal, slacken the locknut on the adjuster screw in the selector arm and rotate the screw as necessary to equalise the gaps. Tighten the locknut without allowing the screw to turn. Carry out this check in each gear. If necessary making further adjustment. It may be necessary to make a compromise in adjustment if any inaccuracies are seen.

37 Engine/gearbox reassembly: replacing the primary drive gear, clutch and kickstart shaft

1 Fit the Woodruff key into the right-hand end of the crankshaft so that the key face is parallel with the shaft. Slide the primary drive pinion onto the shaft so that the internal keyway engages with the key. The pinion must be fitted with the raised boss facing outwards. Replace the spring lock and washer with the convex face of the washer away from the pinion. Use a close fitting bar through one small end eye to lock the crankshaft and tighten the bolt to 4.0 – 4.5 kg m (29 – 33 lb ft).

2 Place the clutch outer drum over the clutch shaft splines/shaft after lubricating the bearing surface. Smear the clutch pushrod and insert it into the hollow shaft with the shouldered end towards the left hand side. Centralise fit the steel ball and the clutch operating thrust plate.

3 Install the clutch centre locating washer over the clutch shaft and then fit the centre hole securing it by means of the large washer and circlip. Check that the circlip is located securely in the groove. Replace the clutch plates commencing with a friction plate followed by a plain plate. Continue fitting the plates alternately and then replace the clutch pressure plate, springs and bolts. Note that the pressure plate is marked with a single arrow on the periphery. The arrow should be aligned with a similar mark on the outer raised face of the centre boss. Tighten the clutch bolts fully.

4 If the kickstart shaft assembly was dismantled for inspection or attention it should now be reassembled, prior to installation in the casing. Refer to the appropriate text showing for the correct assembly sequence. Insert the compressed unit into the casing, ensuring that the cut-away section enters the guideway in the lower edge of the casing. Grip the outer turned end of the kickstart return spring with a pair of pliers and rotate the spring in a clockwise direction through approximately one full turn, and hook the end over the projecting stop pin.

5 Temporarily refit the kickstart lever and check that the mechanism functions correctly.

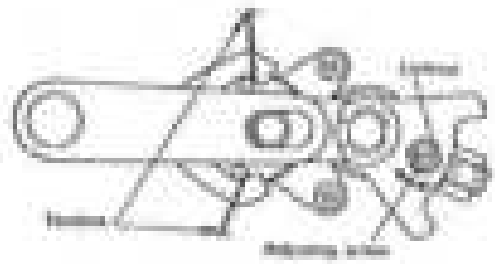
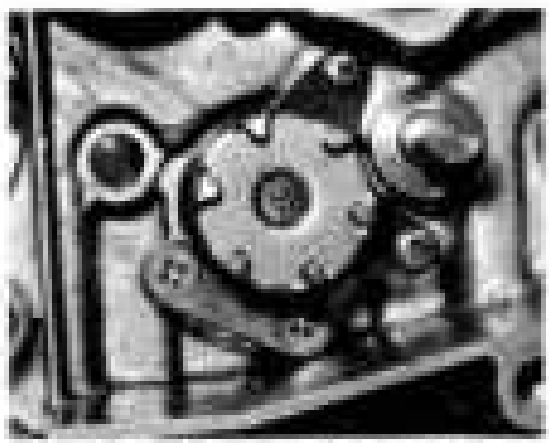
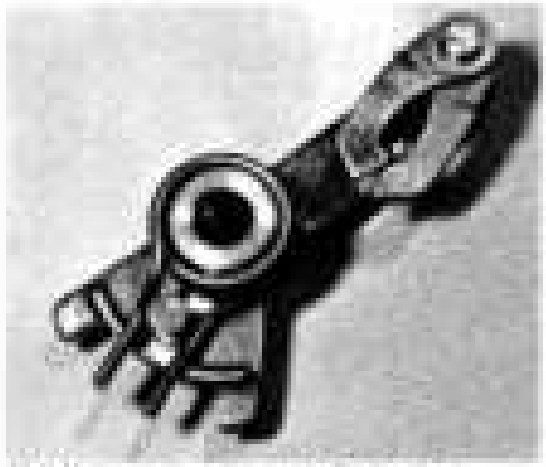


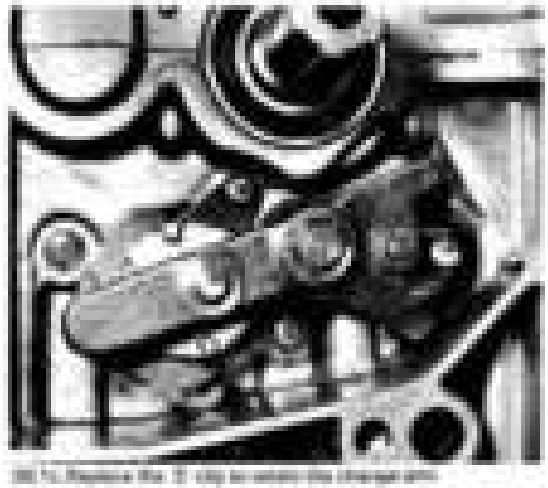
Fig. 1.12 Centralising the gearchange pawls



34 To install the timing gears align and selector arm guide



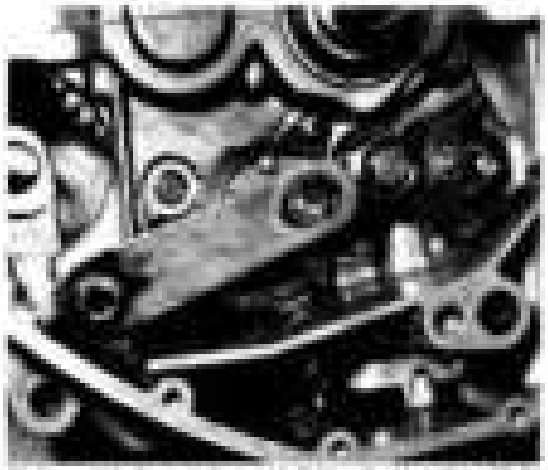
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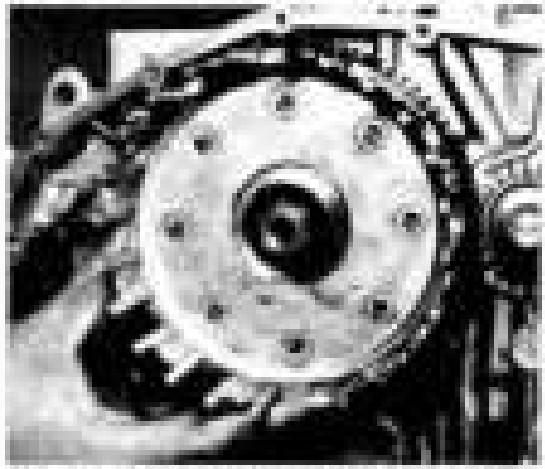
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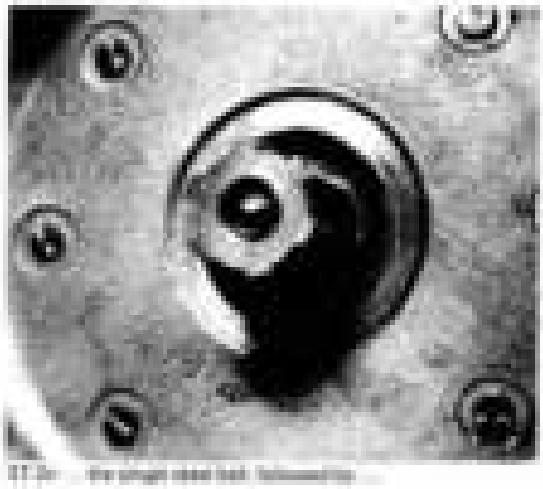
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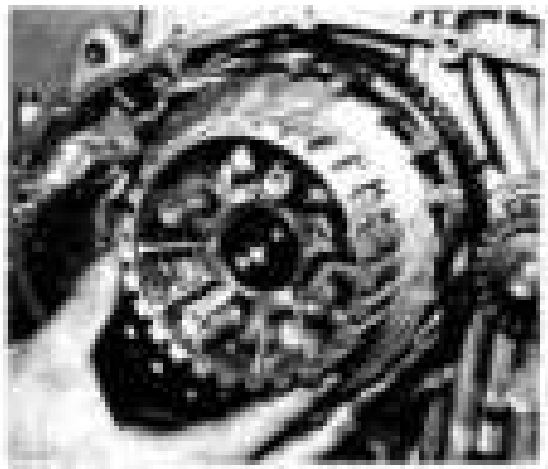
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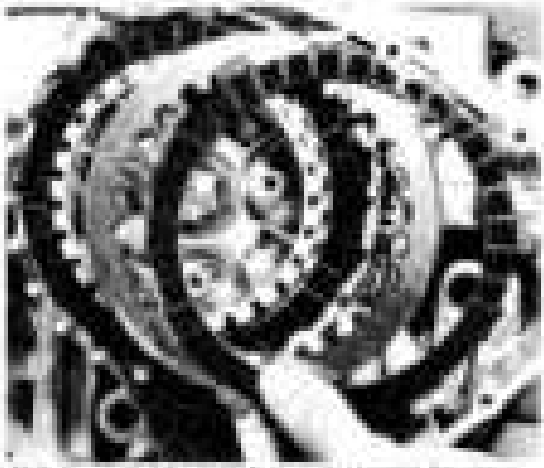


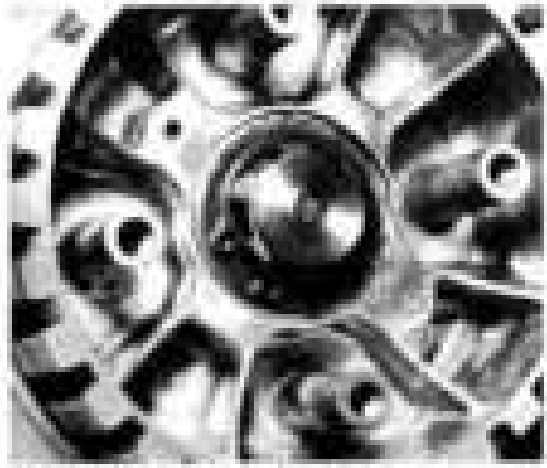


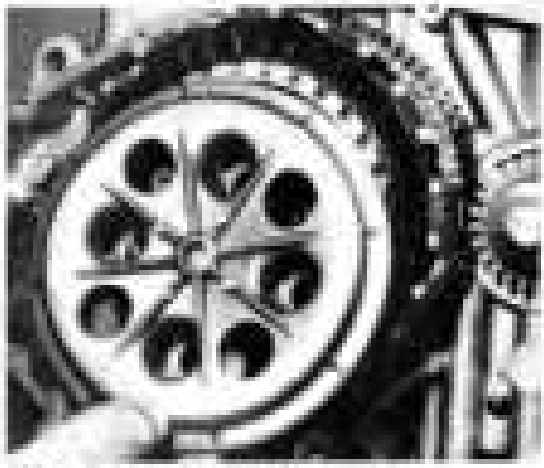




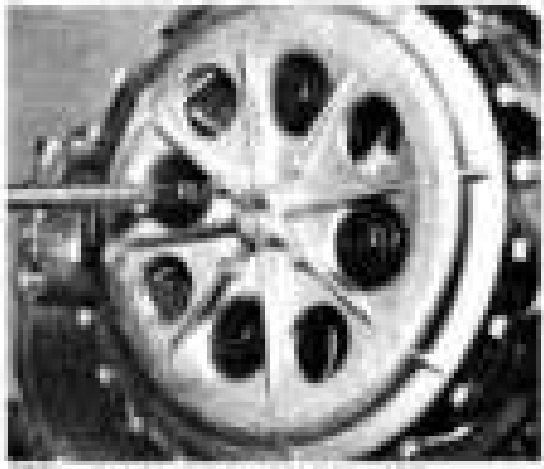














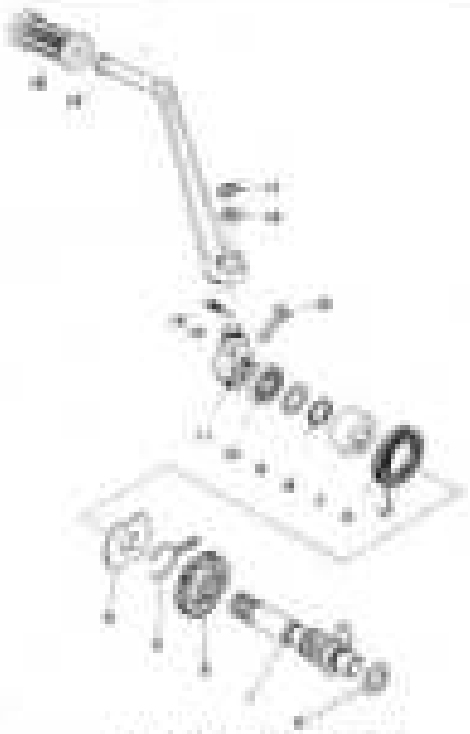


Fig. 1.13 Kickstart mechanism

1 Kickstart shaft	10 Oil seal
2 Bush	11 Splined boss
3 Kickstart pinion (23T)	12 Pivot bolt
4 Pinion clip	13 Kickstart pedal
5 Spring cover	14 Bolt/nut
6 Return spring	15 Compression spring
7 Spring anchor	16 Washer
8 Circlip	17 'O' clip
9 Washer	18 Pedal rubber

39 Engine/gearbox reassembly: replacing the oil pump, primary drive cover and the oil strainer screen

1 The oil pump should be refitted as a completed unit, together with the oil pump idler gear. Check that the single dowel is in position in the rear part of the casing and place the oil pump in position. Insert the three socket bolts, tightening them just in a just possible to move the pump up and down slightly in a vertical direction. The oil pump is fitted with a single dowel only, so that its position may be altered and the backlash between the pump idler pinion and the primary drive pinion can be adjusted. To make the adjustment, select a 0.4 mm (0.016 in) feeler gauge and slide it between the driven sides of the central meshed teeth of the two pinions. The position of the feeler gauge will be just to the right of an imaginary line drawn between the centres of the two pinions. Push the oil pump forward bracket pin upwards so that the feeler gauge is pressed lightly and then tighten the forward socket bolt. Tighten the remaining two bolts and recheck the backlash.

2 Lubricate liberally with engine oil the components within the primary drive chamber and fit a new gasket over the locating dowels. Grease the 'O' on the kickstart shaft oil seal and check that the kickstart shaft thrust washer is in place. Fit the primary drive cover and tighten the screws evenly, to a diagonal sequence.

3 Fit the engine forwards so that access can be made to the crankcase base. Install the oil strainer screen and fit the cover, together with a new gasket. The cover should be fitted with the arrow mark pointing forwards.

40 Engine/gearbox reassembly: replacing the alternator and stator rotor

1 Lubricate the starter clutch driven sprocket hub and slide the sprocket onto the left-hand end of the crankshaft. Fit the sprocket and replace the retaining tongue washer in field by a single bolt. The tongue should be fitted with the curved upper end abutting against the flat milled on the casing boss.

2 Replace the small Woodruff key in the tapered shaft and carefully install the alternator rotor so that the internal splines engage with the key. In order to allow the starter driven sprocket boss to enter the starter clutch rollers, rotate the sprocket clockwise as the rotor is being pushed home. Fit the alternator bolt, tightening it to 3.0 – 3.5 kg m (22 – 25 lb ft).

3 Lubricate the starter chain around the sprocket and install the starter motor sprocket towards the rear of the casing. The sprocket should be fitted with the cupped boss outwards. If the starter motor shaft was disconnected from the motor, it must be refitted now, before installation of the starter motor shaft. Lightly grease the starter motor base 'O' ring and insert the unit into the casing. Locate the sprocket on the splined motor shaft and push the motor fully home. Insert and tighten the two retaining bolts. Push the wiring loom and grommet into the recess in the side of the casing and fit the starter motor cover.

4 Place a new gasket on the alternator cover locating dowels and fit the cover, complete with the alternator stator. Fit and tighten the retaining screws.

41 Engine/gearbox reassembly: replacing the neutral indicator switch and oil pressure warning switch

1 Check the condition of the 'O' ring on the neutral indicator switch and then fit the switch into the casing. The switch should be positioned with the terminal screw towards the rear of the engine.

2 Apply a small quantity of sealing compound to the tapered threads of the oil pressure switch, insert and tighten the switch. Do not overtighten or the switch may shear off. Reconnect the wires to the two switches, by means of the small screws.

3 Trace the new alternator leads down behind the neutral indicator switch and through the recess in the bottom edge of the casing. Secure the cables by means of the two cable clamps.



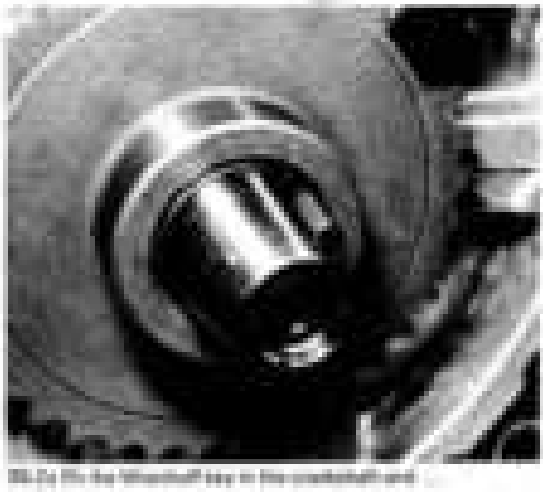
41.3 Install the oil pump sprocket with idler gear and dowel

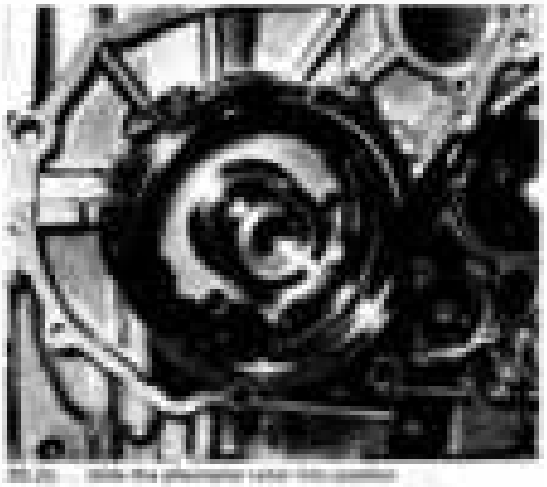






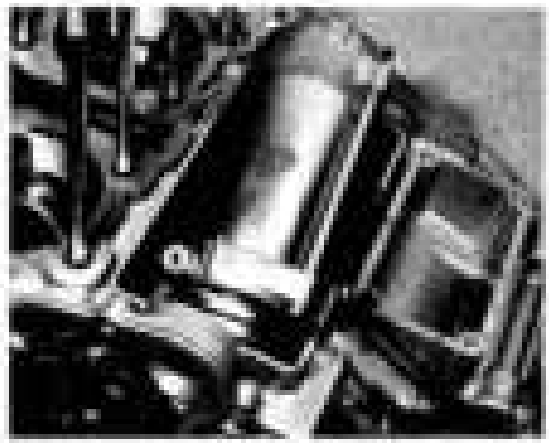








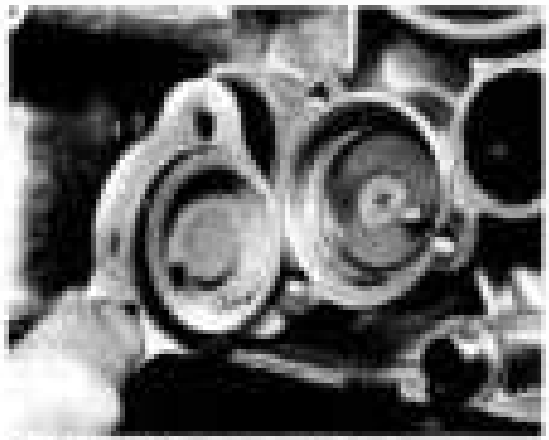
E2.2a Fit the starter sprocket with the tapered boss outwards



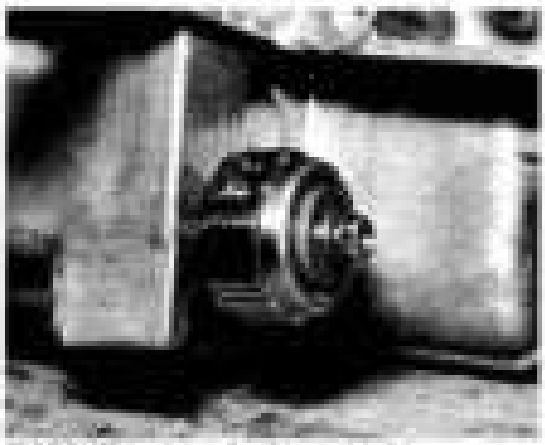
E2.2b Install the starter motor (together with the cable)



E2.2c Fit the alternator cover, using a new gasket



E2.3 Do not omit the 'O' ring on the neutral switch



E2.3 DO NOT overtighten the oil pressure switch

E1 Engine/gearbox: removing, refitting the mounts and cylinder block

1 Place the engine in the normal upright position so that it rests securely on the workbench.

2 Place clean rags in the crankcase mouths around the connecting rods to prevent any small components such as circlips from falling down into the crankcase.

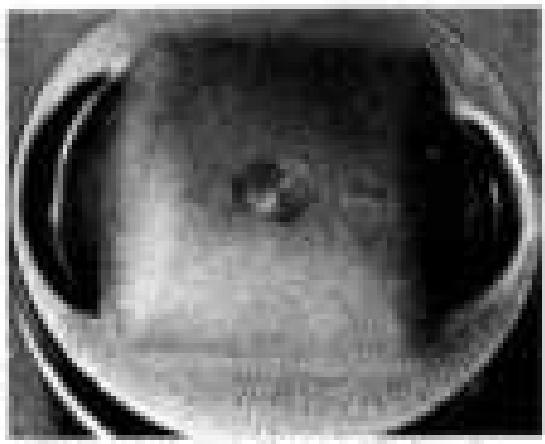
3 Carefully fit the rings on to each piston. The oil ring should be fitted first, the skirt of the piston and the second compression ring fitted over the crown. Make certain that the compression rings are fitted the correct way up with the stamped side facing upwards.

4 Fit each piston on to its respective small end and after thoroughly lubricating the gudgeon pin with clean engine oil. Make certain that the correct piston is fitted to the respective connecting rod and that it is the proper way round (ie with the arrow on the crown pointing forwards). If the gudgeon pin is a tight fit in the piston bosses, pre-heat the piston in boiling water. Do not force the gudgeon pin into place. Ensure that the piston is absolutely dry before fitting. Position the circlips making sure that they seat correctly in their retaining grooves.

Warning: Never re-use old circlips since they are likely to be distorted or weakened. A loose circlip will cause extensive damage to the cylinder bore and piston. Arrange the ring gaps so that they are at about 120° to each other.

5 Turn the crankshaft until both pistons are at equal height. Place a new cylinder base gasket over the holding down studs. Gasket sealant should not be necessary. Fit the two tensioner locating dowels and the large dowel on the rear right-hand cylinder holding stud around which is fitted an 'O' ring. Check that the large 'O' rings are correctly positioned on the cylinder sleeves, lightly oil them, the cylinder block, and liberally lubricate the cylinder bores with engine oil. Hold the connecting rods up and secure it with a screwdriver or rams. Check it is still engaged with the crankshaft sprocket.

6 Position the cylinder block over the holding down studs and slide it down until the pistons begin to enter the cylinder bores. Fit the ring clamps (these must be requested as the cylinder sleeves have a generous lead in, but care should be taken that the ring ends do not become dislodged from the ring grooves. Have the crankshaft drive up through the tunnel between the cylinder bores and place a screwdriver through the chain, at the rear. Remove the rag padding from the crankcase mouths and slide the cylinder block fully home.



41.4a Fit new cylinder base gasket over the holding down studs



41.4b Fit dowel ...



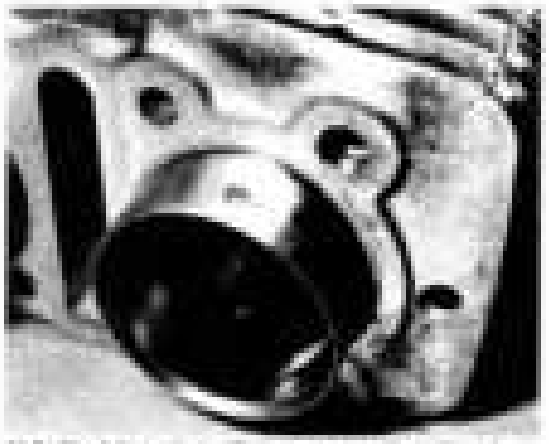
41.4c ... the circlips, ensuring that they seat correctly



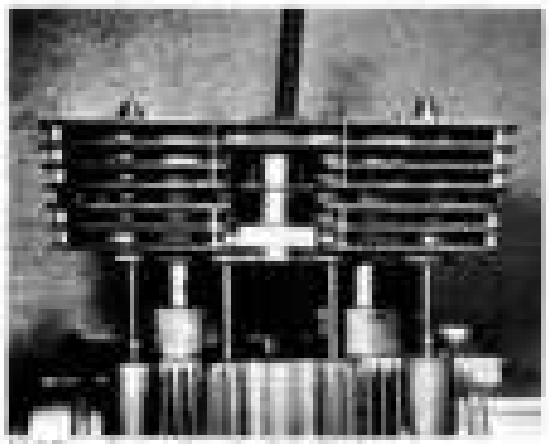
41.4d Fit the large dowel and the seal and ...



41.4e ... install a new base gasket and the two dowels



4.1 To check that cylinder 'O' rings are correctly positioned



4.1 B Drive chain up through cylinder block

4.2 Engine/gearbox reassembly: replacing the cylinder head

1 Before the cylinder head is refitted, the valves and associated components must be replaced. Reassemble the valve and valve springs by reversing the dismantling procedure. Fit new oil seals to each valve guide and oil both the valve stem and the valve guide, prior to reassembly. Take special care to ensure the valve guide oil seal is not damaged when the valve is inserted. As final check after assembly, give the end of each valve stem a light tap with a hammer, to make sure that both collets have located correctly. The valve springs are more closely wound at one end than the other. The springs must be fitted with the close wound pitch towards the cylinder head.

2 Fit a new cylinder head gasket to the top of the cylinder block (no gasket cement is required). Replace the two front dowels and the right-hand rear dowel and rubber seal.

3 Loop a length of wire around the camshaft chain and remove the screwdriver or rod. Position the cylinder head so that the wire can be run through the chain tunnel and slide the head down over the holding down studs. Place a screwdriver through the chain.

4 Replace the chain washers over the holding down studs and fit the domed nuts and also the two flange bolts either side of the plug holes. The cylinder head holding down nuts and bolts must be tightened down very evenly, otherwise there is considerable danger of distorting the large aluminium casting. Tighten the two bolt first and the rest bolts in the sequence given in the accompanying illustration. The torque figures are as follows:

10 mm bolts	3.45 – 3.8 kg-m (25 – 28 lb-ft)
8mm bolts	1.8 – 1.9 kg-m (13 – 14 lb-ft)

4.3 Engine/gearbox reassembly: replacing the camshaft and tensioner and timing the valves

1 Apply a spanner on the alternator rotor centre bolt and turn the engine in a forward direction until the LT mark on the rotor aligns with the index mark on the alternator cover. The cam chain must be kept taut to prevent it becoming an jamming on the lower sprocket. The left-hand piston is now at TDC (the dimple position from which valve timing is made).

2 Position the camshaft sprocket to the right of the cam chain so that the bars marked lines on the sprocket face are to the left-hand side. Insert the camshaft from the left, through the sprocket and chain. The sprocket has a slightly raised face around each bolt hole e.g. at which one has a small raised pip on the outer edge. Mesh the sprocket with the chain so that the bolt hole pip points vertically from the engine and so that the two lines marked on the sprocket face are parallel with the mating surface of the camshaft bearing housing. Push the camshaft fully into position and then rotate it so that the 4/7's drive pin in the camshaft and in at the top, insert the first sprocket retaining bolt and tighten it slightly. Before proceeding further, check that the LT mark on the alternator rotor is still in line with the index post that the camshaft and sprocket are still in the prescribed positions. If all is well, rotate the crankshaft to gain access to the second sprocket bolt hole and insert the bolt. Both sprocket retaining bolts should be secured by applying a small amount of locking fluid to the threads. Tighten the bolts evenly, turning the engine to gain access as required.

3 Insert the cam chain guide blade into the front of the chain tunnel, ensuring that it locates at the lower end with the recess in the crankcase. Fit the cam chain tensioner blade in a similar manner. The chain tensioner unit is spring loaded with a ratchet and pawl arrangement to prevent the plunger from being pushed back up into the body after it has moved down to tension the chain automatically. Before fitting the tensioner, depress the plunger and push the plunger in as far as possible. The plunger should be temporarily secured in this position by screwing a suitable small bolt or screw into the tiny threaded hole provided in the upper end of the tensioner body. Fit the tensioner so that the blade locates with the recessed plunger end and tighten the two bolts. The screw or bolt can now be removed to allow the plunger to move downwards and so tension the chain.

4 Fit and tighten the two spark plugs.

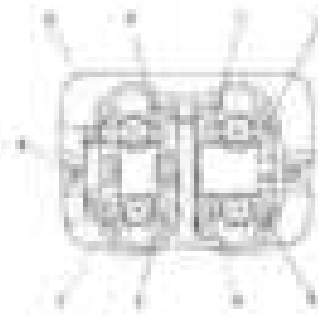
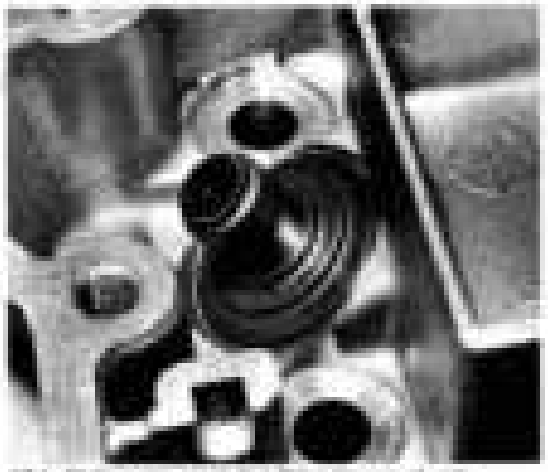
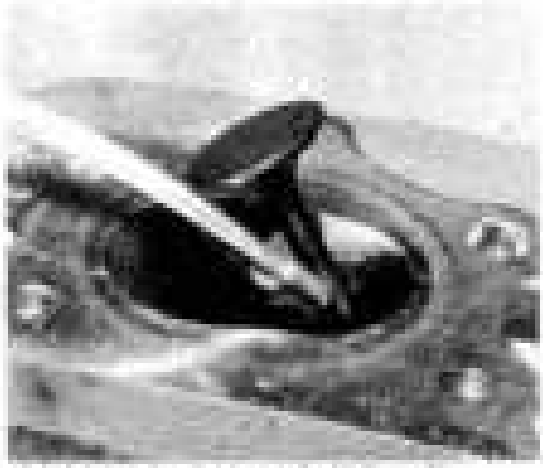
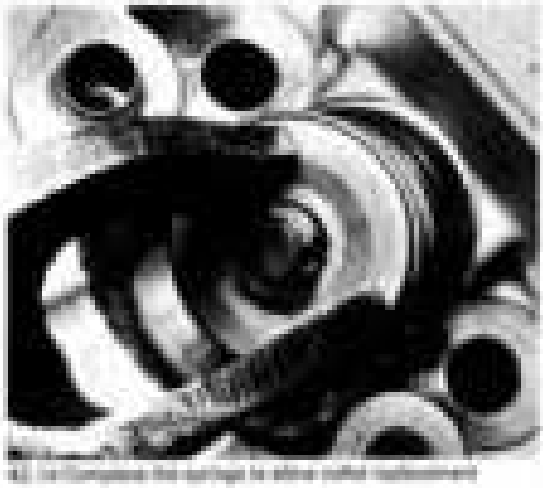


Fig. 1.14 Cylinder head nut & bolt tightening sequence

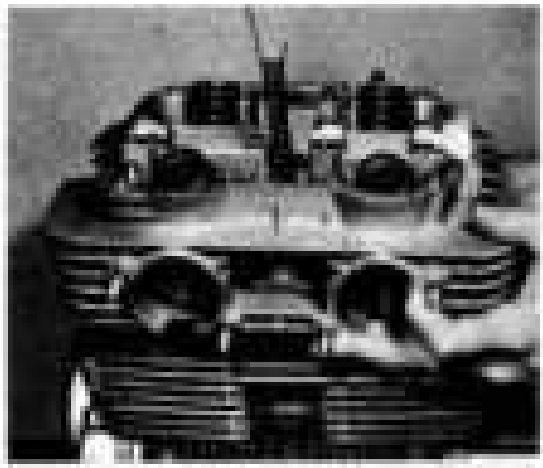


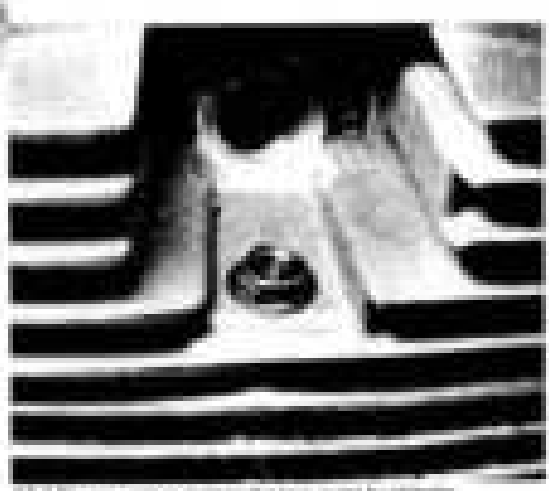


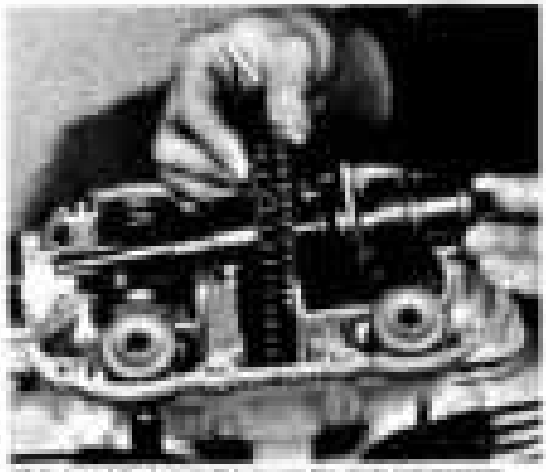


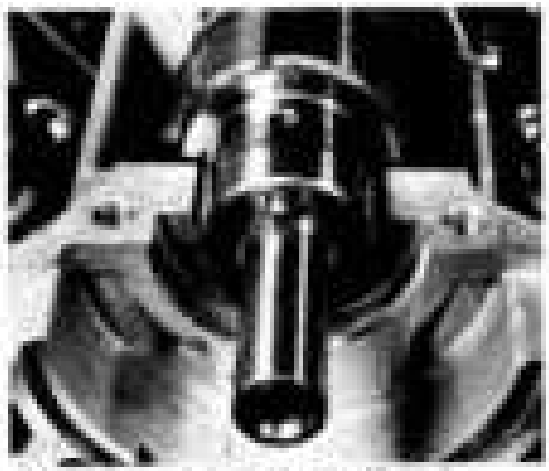


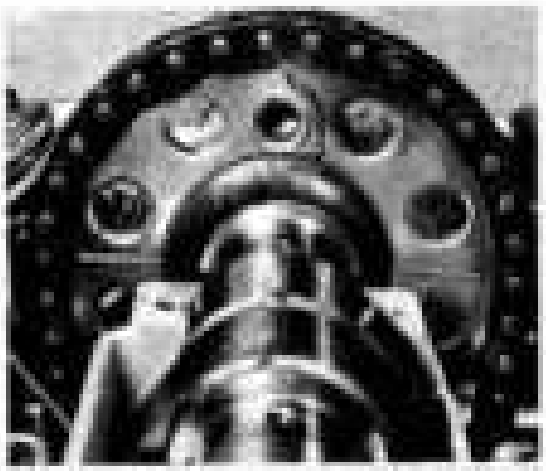






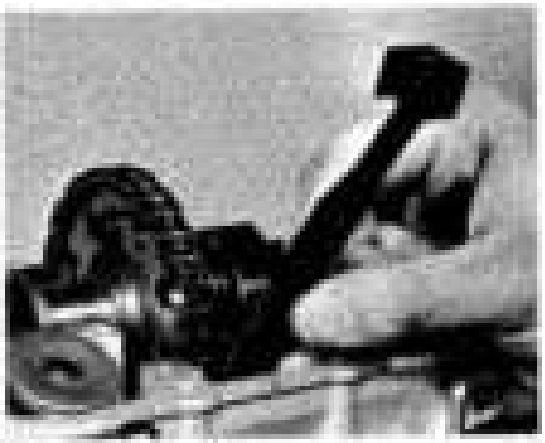








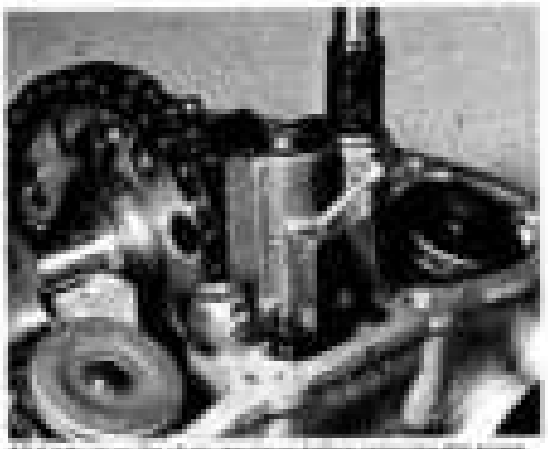




4.2, 3b — Rear tensioner blade



4.2, 3c Compress the tensioner plunger, securing it with screw



4.2, 3d Replace the chain tensioner before removing the screw

4.3 Engine/gearbox assembly: replacing the camshaft cover and tachometer driveshaft

1 If the rocker arms and pins have been removed they must have be replaced together with the tachometer driveshaft. If this has been disturbed, lubricate the pins before inserting them, with the threaded ends outwards so rocker ends remain in line, subsequent overhaul. Check the condition of the sealing washers on the plugs holding the right hand pins.

2 Insert the tachometer driveshaft and locating bolt/seal so the plain washers (if fitted) drive in the slight oil seal and then to the 'E' clip on the locating inside the camshaft cover.

3 Apply a non-hardening sealing compound to the mating surface of the camshaft cover. Check that the two locating dowels are in position in the cylinder head. Lubricate the camshaft and valve thoroughly and partially fill the cam feed troughs with engine oil. Place the camshaft cover in position and check that the two bolts fitted on the extreme left-hand end of the camshaft cover each have a single aluminium washer.

4 Tighten the bolts very evenly to a diagonal sequence so that the uneven upward pressure from the camshaft is spread and does not distort the cover. The correct torque setting is as follows:

8mm bolts	2.0 – 2.4 kg·m (14.5 – 17.0 ft·lb)
6 mm bolts	0.8 – 1.2 kg·m (6.0 – 8.5 ft·lb)

4.5 Engine/gearbox reassembly: replacing the automatic timing unit and contact breaker assembly

1 Fit the automatic timing unit on to the end of the camshaft, locating it with the dowel pin, insert and tighten the ACU locating bolt.

2 Position the contact breaker base plate, complete with the two contact breaker assemblies into position over the ACU so the locating bolt protrudes into the recess in the edge of the casting and replace the base plate displacing screws (Triger light). If an suppressed during dismantling, it has been marked on the base plate so align with a mark on the casting. Fit ignition timing will only require checking as described in Chapter 3, Section 2, paragraphs 1 – 4. If the timing is to be carried out from scratch, refer to Chapter 3, Section 6, paragraphs 2 – 6.

3 For the avoidance of ignition timing the correct breather cover seal, the alternator and cover should be left off until after the engine has been installed to the frame.



4.5, 2a Use gasket cement on camshaft cover joint



4.4 Fit new aluminium washers when refitting rocker shaft bolts



4.6 Check rocker clearances using a feeler gauge

4.6 Engine/gearbox reassembly: adjusting the rocker clearances

1 Remove all four rocker inspection caps from the camshaft cover. Rotate the crankshaft anti-clockwise until the UT mark aligns with the timing mark. In this position the left-hand cylinder is at TDC with both valves closed and can therefore be checked for rocker clearance. The correct clearance with the engine cold is as follows:

Inlet valve 0.08 – 0.12 mm (0.003 – 0.005 in)
Exhaust valve 0.15 – 0.20 mm (0.006 – 0.008 in)

2 Insert a feeler gauge of the correct dimension through the rocker adjustment orifice and between the head of the valve stem and the rocker adjustment screw. If the clearance is correct, the blade of the gauge will be a tight slide fit. To adjust the clearance, loosen the adjuster screw locknut and rotate the screw the required amount until the adjustment is correct. Hold the screw in the set position and tighten the locknut. Recheck the clearance, as it is all too easy to alter the position of the screw when tightening the locknut.

3 When rocker adjustment on the left-hand cylinder has been carried out, rotate the crankshaft 180° (anti-clockwise until the right-hand cylinder is at TDC. The IN (inlet) mark on the inlet camshaft sprocket will now be aligned with the timing mark. Repeat rocker adjustment as for the left-hand cylinder.

4 Replace and tighten the four rocker adjustment caps.

4.7 Replacing the engine/gearbox unit in the frame

1 As in the case with removal, engine replacement requires considerable care and patience. Replacing the engine/gearbox unit is a two-person job and it is important that the gearbox is standing firmly on level ground. Lift the engine in from the right-hand side of the machine, with the front of the engine going in first. Tip the engine back to the left and then lift the rear of the engine up and into place.

2 Lift the engine when necessary to align the bolt threads fouling the bulkhead and insert the bottom rear engine bolt from the left. Fit the two front bolts, again fitting the engine, if removed. Replace the rear engine mounting brackets to the rear of the engine, remembering that the strap is only needed on the bolt by the right-hand bracket (lower bolt). Before replacing the nuts on the engine mounting bolts, refit the head steady bracket which is fixed to the camshaft cover. The head steady is held to the cover by a single through bolt and to the frame lug (also by one bolt). Fit and tighten all the mounting bolt nuts, commencing with the lowest and finishing at the front levels.

3 Trace the starter motor lead across behind the engine, from left-to-right, and secure it to the multiguard before reconnection to the starter solenoid upper terminal. Route the two cables from the alternator up forward of the battery box, securing them by means of the clips provided, and reconnecting them to the two-block connectors. Reconnect the two contact breaker leads.

4 Feed the air hose unit on the rear of the crankcase, route to the frame down tubes. Position the carburettors on the right-hand side of the machine and reconnect the throttle cable to the pulley wheel between the carburettors. Slide the carburettors into place and then forwards, so they enter the inlet stubs. Ensure that the carburettors are correctly positioned before tightening the clamp clips. Manoeuvre the air hose unit upwards so that it runs far forward and down on the carburettor mounting. Replace the air filter boxes and retaining straps and then tighten the four screw clips holding the hose unit. Reconnect the breather pipe on the breather cover.

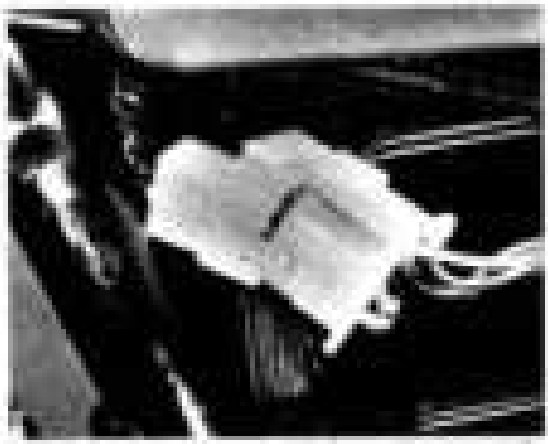
5 Replace the exhaust system after fitting a new gasket ring into each exhaust port. Tighten the flange nuts evenly and then tighten the pipe/silencer joint clamps.

6 Fit the final drive sprocket on the gearbox output shaft. Replace the tab washer and the nut, which should be placed with the recessed face towards the sprocket. Lock the final drive chain over the engine sprocket and mesh the two ends onto the rear wheel sprocket. Replace the master link, making certain that the spring link is replaced the correct way round. This is with the closed end facing the direction of travel. Apply the rear brake to prevent rotation of the sprocket and then tighten the centre nut fully. Bend up the tab washer to secure the nut.

7 Reconnect the clutch cable with the lifting mechanism in the final drive sprocket cover. Do not omit the cable abutment plate which fits into the top of the case. Check that the lifting mechanism is well lubricated with grease and that the small control plate bolt is in place. Fit the gearchange shaft splined lever and then replace the cover and screws. Refit the gearchange pedal, checking the operating angle before tightening the bolt.

8 Replace both hand levers. A small amount of lubricant or detergent applied on the rubber mounting dampers will aid reassembly.

9 Reconnect the tachometer drive cable at the cylinder head securing it with the single cross-head screw.



4.7.3 Disconnect crankcase breather hose from rocker cover



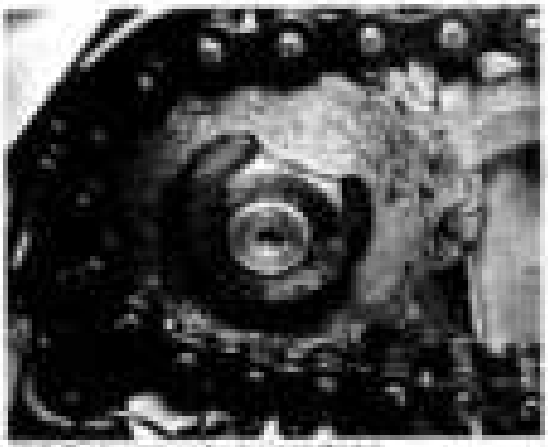
4.7 Fit a new ring gasket to each exhaust port



4.8 Air filter cover secured by thread as shown



4.9 Replace the spreader rod with rubber hose if necessary



4.11 Air filter cap nuts washer (to each side)



4.7 To Check that the steel ball is fitted to the clutch



4.8 To ... disconnect the clutch cable

4.6 Bleeding and running the rebuilt engine

1 Open the petrol tap, start the carburettor chokes and start the engine, using either the kickstart or the electric starter. Allow the chokes as soon as the engine will run evenly and keep it running at a low speed for a few minutes to allow oil pressure to build up and the oil to circulate. If the red oil pressure indicator lamp is not extinguished, stop the engine immediately and investigate the lack of oil pressure.

2 The engine may tend to smoke through the exhausts initially, due to the amount of oil used when assembling the various components. The excess oil should gradually burn away as the engine settles down.

3 Check the exterior of the machine for oil leaks or blowing gaskets. Make sure that each gear engages correctly and that all the controls function effectively, particularly the brakes. This is an essential last check before taking the machine on the road.

4.7 Taking the rebuilt machine on the road

1 Any rebuilt machine will need time to settle down, even if parts have been replaced in their original order. For this reason it is highly advisable to treat the machine gently for the first few miles to ensure oil has circulated throughout the lubrication system and that any new parts fitted have begun to bed down.

2 Even greater care is necessary if the engine has been rebored or if a new crankshaft has been fitted. In the case of a rebore, the engine will have to be run in again, as if the machine were new. This means greater use of the gearbox and a restraining hand on the throttle until an initial 1000 miles have been covered. There is no point in keeping to any set speed limit; the main requirement is to keep a light loading on the engine and to gradually work up performance until the 1000 mile mark is reached. Proper recommendations can be assessed on an odometer when only a new crankshaft is fitted. Experience is the best guide when it is easy to tell when an engine is running freely.

3 If at any time a lubrication failure is suspected, stop the engine immediately and investigate the cause. If an engine is run without oil, even for a short period, irreparable engine damage is inevitable.

4 When the engine has cooled down completely after the initial run, recheck the various settings, especially the valve clearances. During the run-in most of the engine components will have settled into their normal working locations.

4.8 Fault diagnosis: engine

Symptom	Cause	Remedy
Engine will not start	Defective spark plugs	Remove the plugs and lay on cylinder head. Check whether a good spark occurs when ignition is switched on and engine rotated.
	Dirty or closed contact breaker points	Check condition of points and whether gap is correct.
	Faulty or disconnected condenser	Check whether points are action correctly. Renew condenser if existence of arcing, or if a weak spark is observed (and ignition unit in good condition).
Engine runs unevenly	Ignition and/or fuel system fault	Check each system independently, as through engine will not start.
	Blowing cylinder head gasket	Look around the exterior from oil leakage where gas escapes.
	Incorrect ignition timing	Check accuracy and if necessary reset.

Lack of power	Fault in fuel system or incorrect ignition timing	See above
Heavy oil consumption	Cylinder block or head oil passage blocked	Check that bore wash, cylinder and lid overspill pipe is clear if required Check engine for oil leaks Check the seals and renew if necessary
	Damaged oil seals Worn valve guides and/or stems	
Excessive mechanical noise	Worn cylinder block (piston slap) Worn camshaft drive chain (rattle) Worn big-end bearings (knock) Worn main bearings (rumble)	Renew worn components Renew chain Fit replacement big-end shells Fit replacement main bearing shells
Engine overheats and seizes	Lubrication failure	Stop engine and check whether internal part are receiving oil. Check oil level is adequate

51 Fault diagnosis: clutch

Symptom	Cause	Remedy
Engine speed increases but drive not transmitted from machine does not respond	Clutch slip	Check clutch adjustment for free play at handlebar lever. Check thickness of friction plates
Difficulty in engaging gears. Gear changes jerky and machine creeps forward when clutch is withdrawn. Difficulty in selecting neutral	Clutch drag	Check clutch adjustment for too much free play. Check clutch drums for indentations in slots and clutch plates for burrs or wrapped. Dress with file if damage not too great
Clutch operates with	Damaged, misaligned or inadequate cable	Check cable and renew if necessary. Make sure cable is lubricated and has no sharp bends
	Worn operating pushrod	Check the pushrod for evenness

52 Fault diagnosis: gearbox

Symptom	Cause	Remedy
Difficulty in engaging gears	External linkage bent Gear striations not assembled correctly	Renew Check gear position arrangement and position of thrust washers
Machine jumps out of gear	Worn dogs on ends of gear pinions Broken teeth and selling correctly	Renew worn pinions Remove right hand crankcase cover and check broken with action
Gear change lever does not return to original position	Broken return spring	Renew spring
Kickstart does not return when engine is turned over or started	Broken or poorly mounted return spring	Renew spring or re-tension
Kickstart slips	Ratchet assembly or kickstart clip worn	Renew worn components

Chapter 2 Fuel System and Lubrication

Contents

General description ... 1
Petrol tank: removal and replacement ... 2
Petrol tap: removal and replacement ... 3
Carburettors: removal ... 4
Carburettors: dismantling and reassembly ... 5
Carburettors: adjusting float level ... 6
Carburettors: synchronisation and adjustment ... 7
Carburettor settings ... 8
Air filters: dismantling and cleaning ... 9
Exhaust system ... 10
Oil pump: removal, examination and replacement ... 11
Oil filter: renewing the element ... 12
Oil pressure warning lamp ... 13
Fault diagnosis: fuel system ... 14

Specifications

Fuel tank capacity	11.0 litres (2.4/2.9 US/Imp gallons)
Engine oil capacity	
Total	2.8 litres (5.0/4.9 US/Imp pints)
Oil filter change	2.0 litres (4.2/3.5 US/Imp pints)
Oil and filter change	2.3 litres (4.9/4.0 US/Imp pints)

Carburettor	932/30	932/60	932/60
Type	932/2	932/4	932/4
Make	Mikuni	Mikuni	Mikuni
Main jet	117.5	135	142.5
Air jet	0.8	0.8	#0
Jet needle	4Z7-4	4YW1-4	5E3-4
Needle jet	3-8	6-8	3-4
Needle position	4	3	4
Throttle valve	125	140	130
Pilot jet	22.5	11.5	42.5
Starter jet	25	#0	35
Air screw (number of turns out)	1 to 1½	1 to 1½	1 to 1½
Float height	28 ± 2.5 mm (1.097 ± 0.098 in)		33.0 ± 1 mm (1.29 ± 0.04 in)

Oil pump

Type	Trochoid
Inner rotor/outer rotor clearance	0.03–0.09 mm (0.001–0.0035 in)
Side clearance	0.03–0.09 mm (0.001–0.0035 in)

1 General description

The fuel system comprises a petrol tank, from which petrol is fed by gravity to the carburettors via a diaphragm type fuel cock. There are three positions: ON, RESERVE and PRIMING. Before starting the engine, turn the fuel tap to the ON position. This enables the fuel to flow to the carburettors when the engine has started.

If the fuel in the tank is too low to be fed to the carburettors in the ON position, turn the lever to RESERVE position which provides a limited amount of additional fuel. Only when there is no fuel in the carburettors is it necessary to turn to the PRIMING position, which will allow fuel to flow to the carburettors even with the engine stopped. Once the engine has started be sure to return the lever to the ON position or RESERVE position.

The tap is operated by means of the induction vacuum in the right-hand inlet tract, to which the tap diaphragm is interconnected by a small-bore hose.

Two Mikuni constant velocity carburettors are fitted to all models, interconnected by a throttle butterfly valve control rod and mounted on a rubber on a common mounting bar. Each carburettor is provided with a cranked system (choke) controlled by a plunger, the two being interconnected by a rod allowing simultaneous operation from a lever on push-pull knob on the right-hand carburettor. Two separate air filter units are fitted, one of which is hidden behind each frame side cover.

The lubrication system is fed by a trochoid type oil pump which is driven via an idler gear from the primary drive pinion. An unload slot for the pump is enclosed by a passage oil loop in the crankcase, where it is passed through a centrifugal oil filter to the working parts of the engine. A by-pass valve is provided in the system, which within the oil filter centre bolt, which allows an uninterrupted flow of oil in the event of oil filter blockage. The gearbox and primary drive share the same oil as that used by the engine proper, the gearbox mainshaft being fed under pressure and the layshaft being lubricated by the gravity fed return system.

8 Petrol tank: removal and replacement

1 The fuel tank is retained at the forward end by two rubber buffers fitted either side of the underside of the tank which fit into cups on the frame top tube. The rear of the tank sits on a small rubber saddle mounted on a frame cross-bar and is secured by a single bolt passing through a lug projecting from the tank.

2 To remove the tank, pull off the fuel feed and vacuum tubes at the petrol tap unions (there are clips for spring clips fitted over the seat, remove the seat, release and disconnect from the rear of the tank, and lift the tank backwards and away from the machine.

3 When replacing the tank, reverse the above procedure. Make sure the tank seats correctly and does not trap any loose cables or wires.

9 Petrol tap: removal and replacement

1 The petrol tap must be removed from the tank at regular intervals to gain access and allow cleaning of the filter gauze, which takes the form of a mesh gutter projecting into the petrol tank cavity. Before removing the tap, drain the fuel by returning a suitable length of tube to the tap union and turning the tap lever to the PRIME position, to allow an unrestricted flow of petrol. After draining the tank and detaching the vacuum pipe, unscrew the two retaining nuts and withdraw the tap body from the tank, taking care not to lose the sealing washer.

2 The fuel filter should be cleaned thoroughly in petrol, agitating any adhering deposits with a soft brush. Before replacing the tap, note that there is an 'O' ring seal between the petrol tap body and the petrol tank, which must be renewed if it is damaged or if petrol leakage has occurred.

3 It is seldom necessary to remove the lever which operates the petrol tap, although occasions may occur when a leakage develops at the joint. Although the tank must be drained before the lever assembly can be removed, there is no need to disturb the body of the tap.

4 To dismantle the lever assembly, remove the two countersunk screws passing through the plate on which the operating lever moves and withdraw the plate (on some models, followed by a spring), the lever itself and the seal behind the lever. The seal or lever 'O' ring will have to be renewed if leakage has occurred. Reassemble the tap in the reverse order. Gasket cement or any other sealing medium is NOT necessary to prevent a petrol tight seal.



2.1 Petrol tank is retained on the rear by a single bolt



2.2 Withdraw the tap to gain access to the filter



2.3a Tap lever is secured by plate and screw (arrow)



2.3b Lift out lever to gain access to seal and 'O' ring

4 Carburettor: removal

1 Remove the petrol tank as described in section 3 of this Chapter to gain access to the carburettors and then remove both frame side covers. Each side cover is a push fit as it rests on locating pegs.

2 Unhook the screw clips which hold the carburettors to the inlet stubs and the air hose unit to the twin air filter elements and carburettor rubber. Each air filter assembly is pulled from place after removing the retaining strap, which is secured on the lower end by a single bolt, and on the rear by a hook arrangement. Disconnect the air inlet breather tube from the breather cover union on the crankcase, after disconnecting the spring clip. The air hoses unit can now be pulled from the carburettors and inlet stubs/bends and downwards as one to clears the carburettors. Careful manipulation may be required on the clearance to achieve.

3 Pull the carburettors back out of the inlet stubs and rotate them out towards the right-hand side of the machine as a unit. Support the carburettors and disconnect the throttle cable at the carburettor end. Lift the cover cable from the slotted abutment and displace the nipple and inner cable end from the throttle pulley.

5 Carburettors: dismantling and reassembly

1 In order to dismantle the carburettors they must first be removed from the mounting brackets to which they are each retained by two screws. The carburettors are also connected via a linkage which acts as the throttle cable broker. The linkage is retained by two of the four diaphragm cover screws on each carburettor top.

2 Commence by removing the right-hand carburettor from the mounting brackets. On carburettors which have a lever operated choke bar, remove the operating lever, which is held by a single screw. Slacken the pilot screw holding each choke lever bar and withdraw the bar to free the forks. Some carburettors have a two-position lever and choke operating rod. The rod is located in any given position by a spring loaded steel ball in each carburettor, which locates with a series of degree-sided machined in the rod. To remove the rod, slacken the choke operating fork pivot screws and withdraw the rod. As the rod and levers the sixteen lug in each carburettor, the small ball and spring will work in by rod. Arrangements should be made to prevent this happening as the components are tiny and easily lost.

3 Slacken all four screws on each carburettor top, to prevent distortion, and then remove the inner four screws, to free the top bracket. Unscrew the two screws securing the right-hand carburettor to the mounting bracket and separate the two carburettors as the interconnecting petrol transfer pipe. The mounting screws are often very tight and are prone to shearing. Great care should be exercised to avoid removal.

4 Invert each carburettor and remove the four screws that hold the float chamber to its base. Remove the single pin that locates the main float assembly and lift the float from position. Tilt and remove the float needle. The needle is very small and should be put away in a safe place as this is a non-replaceable. Make sure that the float chamber gasket is in good condition. Do not discard the gasket unless leakage has occurred or is apparent damaged.

5 Check that the twin floats are in good condition and not punctured. Because they are made of brass it is possible to solder a damaged float. This form of repair should only be made in an emergency, when a set of new floats are not available. Soldering will affect the weight of the float assembly and result in a different petrol level.

XS250 and 360 models

6 The needle jet is a push fit in the base of the mixing chamber, being retained by a small 'O' ring. Check the needle jet for wear together with the jet needle. After lengthy service, these two components should be renewed together, or high petrol consumption will result.

7 The float needle and seat wear after lengthy service, and should be closely examined with a magnifying glass. Wear takes the form of a ridge or groove, which will cause the float needle to seat imperfectly. The needle and seating should always be renewed as a pair. The seating is a screw fit in the mixing chamber. Note the 'O' ring and seal that the float passes should be renewed as well.

8 The main jet and jet are both located in the float chamber. The main jet is situated below a plug, which will prevent fuel from the float chamber. Always use a close fitting screwdriver when removing jets, or damage will result.

XS400 models

9 The jet configuration on XS400 model carburettors is slightly different from the other types in that all jets are located within the float chamber unit. Remarks on inspection and wear characteristics remain the same.

10 Unscrew the main jet from the central boss and displace the needle jet from the boss towards the vertical side of the carburettor. The pilot jet is covered by a screw plug, which may be removed to allow the jet to be cleaned. Do not remove the jet unless it is to be renewed as any method of removal which might jet distorted will almost certainly enlarge the jet orifice. To remove the jet, insert a screwdriver and unscrew the jet until it can be felt to be free. The jet must now be unscrewed through the threads normally occupied by the retaining plug. In order to engage the jet with the screwed portion of threads, it must be pushed and turned simultaneously. To accomplish this, select a short length of cable which diameter is slightly greater than the inside diameter of the jet bore. Taper the ends of the wire so that it may be inserted into the jet bore and pushed in firmly to engage the jet. The jet may now be pulled outwards and unscrewed.

11 The starter jet jet is screwed into the left-hand side of the carburettor mouth and may be removed in the usual manner.

All models

12 Remove the two remaining screws which retain the carburettor top and lift the top from position, together with the piston spring. Carefully lift the diaphragm from position, bringing the slide and jet needle. Carefully unpick the circlip from the top of the diaphragm. It is then developed inside or holes, a small tab removed as a unit, with the plenum. The jet needle is retained by a metal clamp and is secured by a small circlip. The jet needle must be removed if worn, as described in paragraph 6.

13 Before reassembly, clean the carburettors as described in the previous Section. The manually operated choke is unlikely to require attention throughout the normal service life of the machine.

14 Before the carburettors are reassembled, using the reverse dismantling procedure, each should be cleaned out thoroughly, using compressed air. Avoid using a piece of rag since there is always a risk of particles of lint obstructing the internal passageways or the jet orifices.

15 Never use a piece of wire or any pointed metal object to clean a blocked jet. It is only too easy to enlarge the jet under these circumstances and increase the rate of petrol consumption. If compressed air is not available, a blast of air from a tyre pump will usually suffice.

16 Do not use excessive force when reassembling a carburettor because it is easy to shear a pin or screw of the smaller screws. Furthermore, the carburettors are cast in zinc-based alloy which does not have a high tensile strength.

17 After replacing the carburettors on the machine they should be synchronised and adjusted, as described in Section 7 of this Chapter. Before refitting the air hose unit, check the condition of the throttle valve butterflies.

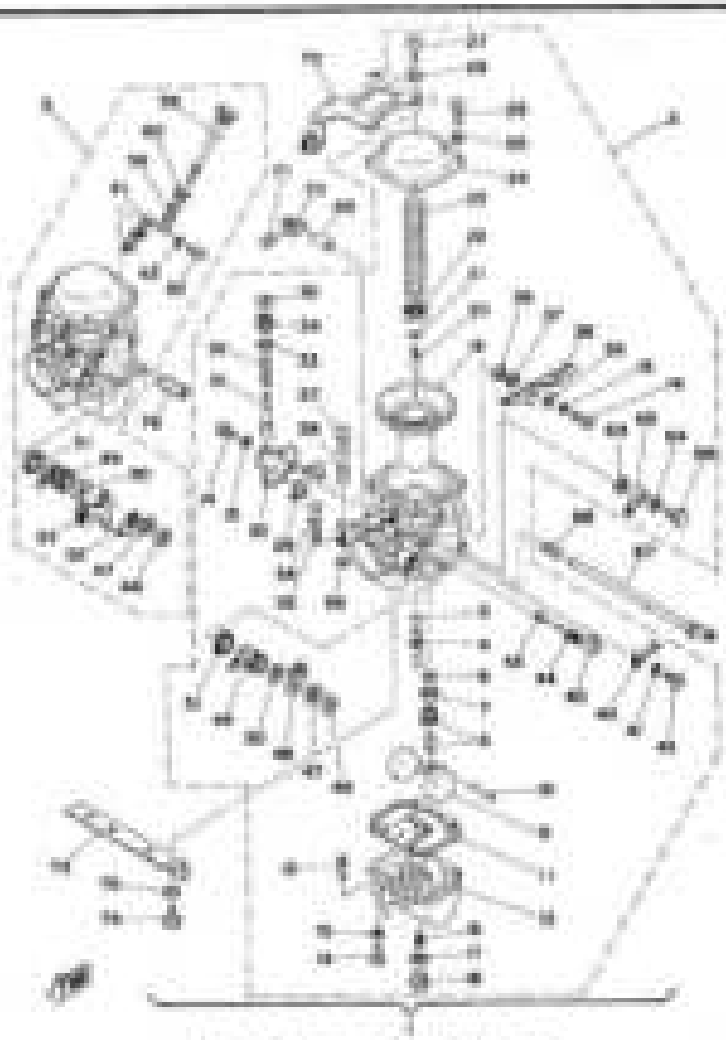
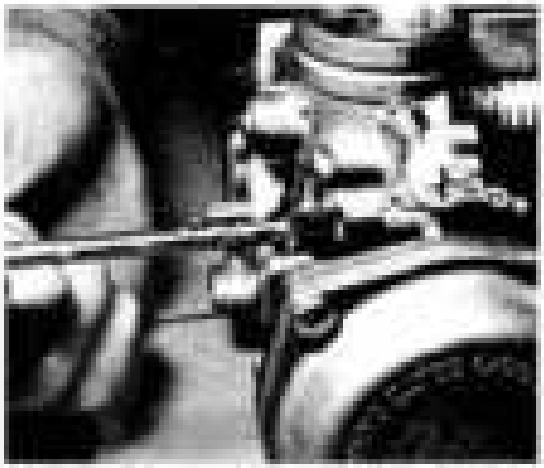


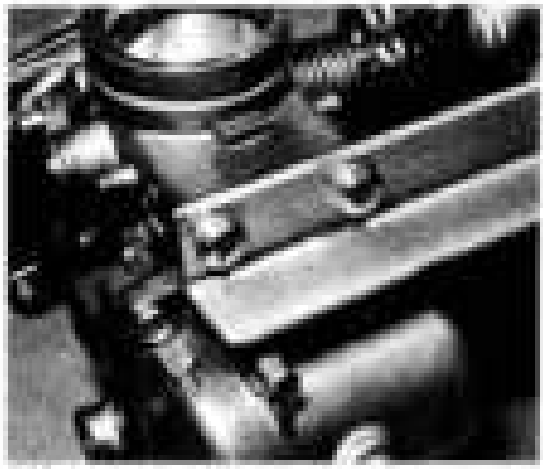
Fig. 2.1 Carburettor – lever choke type

1 Carburettor – complete
2 125 carburettor
3 400 carburettor
4 Needle jet (main nozzle) – 2 off
5 'O' ring – 2 off
6 Needle valve assembly – 2 off
7 Sealing washer – 2 off
8 Filter bowl – 2 off
9 Float assembly – 2 off
10 Float pivot pin – 2 off
11 Gasket – 2 off
12 Float bowl – 2 off
13 Pilot jet – 2 off
14 Screw – 10 off
15 Spring washer – 2 off
16 Bolt/pin – 2 off
17 Sealing washer – 2 off
18 Drain plug – 2 off
19 Pipe/adaptor/banjo union – 2 off
20 Needle – 2 off
21 Clip – 2 off
22 Needle jaw – 2 off
23 Piston spring – 2 off
24 Carburettor top – 2 off
25 Screw – 4 off
26 Spring washer – 4 off
27 Screw – 4 off
28 Spring washer – 4 off
29 Choke cover gasket – 2 off
30 Choke lever – 2 off
31 Choke plunger – 2 off
32 Choke spring – 2 off
33 Washer – 2 off
34 Retaining – 2 off
35 Dust cap – 2 off
36 Collar
37 Washer
38 Choke lever
39 Washer
40 Spring plate
41 Spring washer
42 Screw
43 Spring – 2 off
44 Pilot screw – 2 off
45 Anti-tamper cap – 2 off
46 Nut – 2 off
47 Special washer – 2 off
48 Throttle arm
49 Throttle return spring – 2 off
50 Collar – 2 off
51 Spacer – 2 off
52 Throttle link arm
53 Throttle control arm
54 Plunger
55 Spring
56 'E' clip
57 Throttle spindle/adaptor screw
58 Spring – 2 off
59 Balance throttle stop screw
60 Bush
61 Washer
62 Screw – 2 off
63 Spring washer – 2 off
64 Sealing washer – 4 off
65 Banjo
66 Banjo bolt
67 Choke rod
68 Spring
69 Collar
70 Choke lever – 2 off
71 Screw – 2 off
72 Bracket
73 Mounting nut
74 Screw – 2 off
75 Spring washer – 4 off
76 Tension nuts

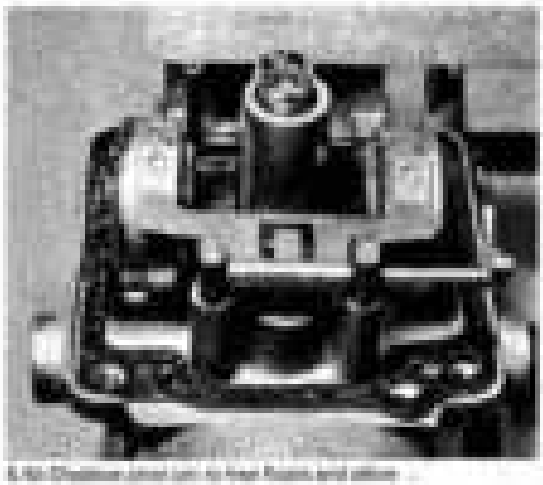




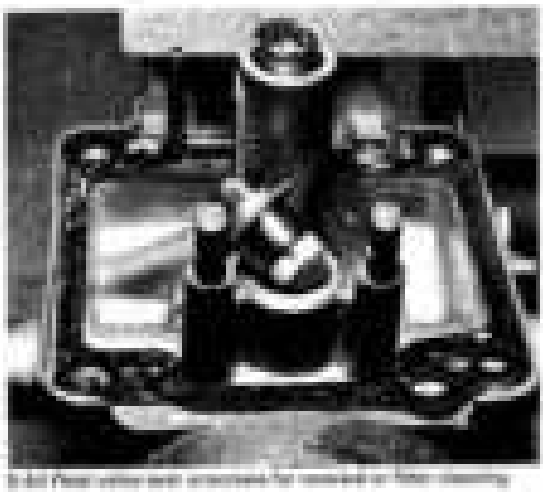




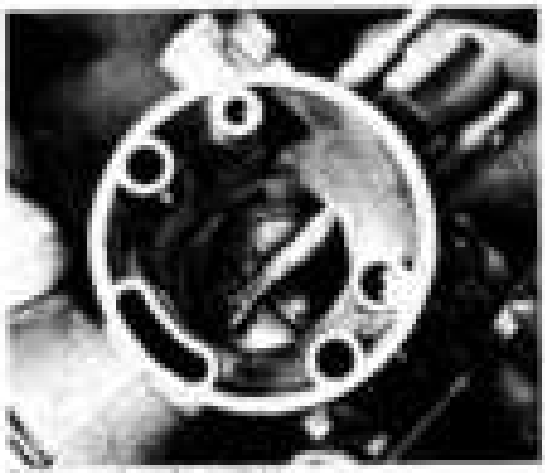








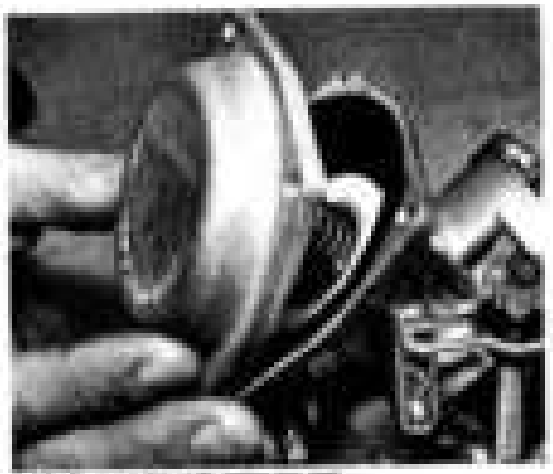


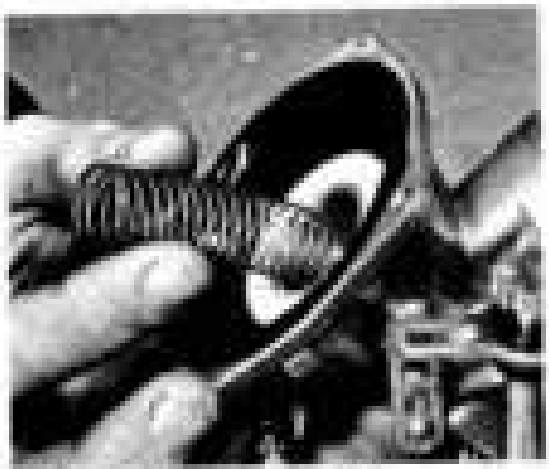












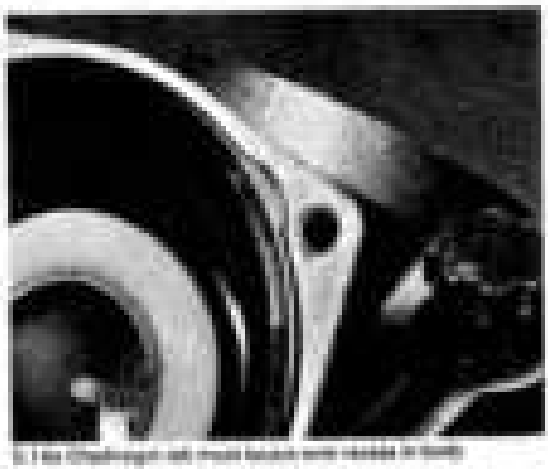




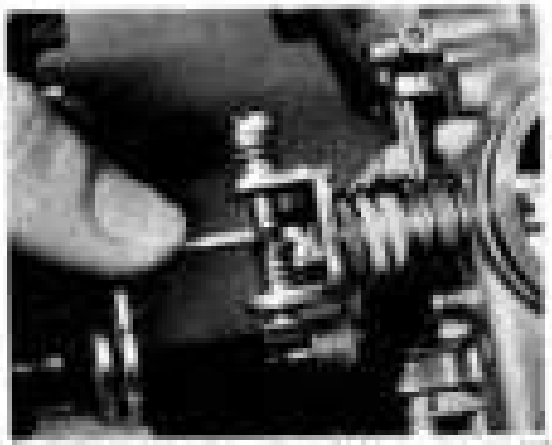




6.13 ... the correct needle clip (mid-spring)



6.14 The Weber-type idle mixture screw needle in detail



6.15 The throttle link rod must be clipped between washer and plunger

8 Carburettors - adjusting float level

1 If problems are encountered with fuel overflowing from the float chambers, which cannot be traced to the float/needle assembly, or if consistent fuel starvation is encountered, the float will probably be in need/adjustment of the float level. It will be necessary to remove the float chamber cover from each carburettor to check the float level.

2 If the float level is correct the distance between the uppermost edge of the floats and the flange of the mixing chamber body will be as follows:

32/32 and 34/2	29 ± 2.5 mm (1.0547 ± 0.1969 in)
35/40	32 ± 1.0 mm (1.26 ± 0.0394 in)

3 Adjustments are made by bending the float assembly tang (tongue), which engages with the float, in the direction required (see accompanying diagram).

9 Carburettors - synchronisation and adjustment

1 It is important that the two carburettors work in harmony with each other if maximum performance and fuel economy are to be expected. The slow running mixture of each carburettor is set by the manufacturer to give the correct mixture and the cleanest exhaust emission. The manufacturers recommend that the mixture is not altered and to this end the plastic caps on the two pilot adjuster screws, to prevent movement of the screws except within a narrow margin. Synchronisation of the carburettors is therefore controlled by the adjuster screw on the throttle valve/butterfly connecting arm.

2 Synchronisation of the butterfly valves can be made visually after removing the airboxes and then using a pair of vacuum gauges attached to the take-off unions provided, which project from the top of each inlet stub. When making the manual adjustment, screw the adjuster screw as necessary, so that both butterfly valves open simultaneously and close simultaneously. After setting the carburettors initially, remove the vacuum lines from the right-hand take-off union and connect the sealing lines from the left-hand union. Connect up the two vacuum gauges as advised by the manufacturer of the gauge set. Start the engine and adjust the reading on right-hand gauge so within 6 mg cm at 1,200 rpm. Adjustment is again made on the central throttle link screw. Synchronisation is now correct.

3 After completing synchronisation adjust the tick-over speed of the engine to 1,000 rpm by means of the remote throttle stop, which is located to the rear of the two carburettors and which has a serrated nylon head.

4 Stop the engine and adjust the throttle cable so that there is 0.5 mm (0.12 - 0.20 in) slack, measured between the outer cable and the abutment on the carburettor bracket. Slack may be increased or removed by means of the cable adjuster on the handlebar twist grip.

10 Carburettor settings

1 Some of the carburettor settings, such as the sizes of the needle jets, main jets and needle positions, etc., are predetermined by the manufacturer. Under normal circumstances it is unlikely that these settings will require modification, even though there is provision made, if a change appears necessary. It will often be shortsighted to a developing engine fault.

2 As stated previously, alteration of the idle mixture is not recommended. Some alterations however, can be made in the mid-range mixtures by altering the height of the jet needle. This is accomplished by changing the position of the needle clip. Raising the needle will richen the mixture and lowering the needle will weaken the mixture.

3 Allowing an slightly on the side of a rich mixture, since a weak mixture will cause the engine to overheat. Reference to Chapter 5 will show how the condition of the spark plugs can be interpreted with some experience as a reliable guide to carburettor mixture strength. Fuel supply to the carburettor can usually be traced to a defective timing adjustment. If the adjustment action is incorrect, it can be checked by checking the ignition timing with a strobe light.

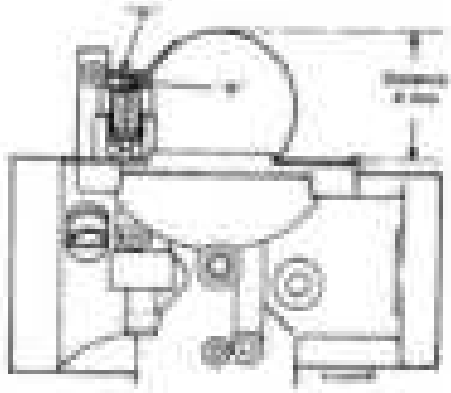


Fig. 3.2 Checking the float level height

9 Air filters: dismantling and cleaning

1 Two identical air filters are utilised, one of which is fitted behind each frame side cover. The inlet elements air filters are connected to the carburettors by an air hose and which incorporates a balancing pipe.

2 At regular intervals both air filters should be removed for cleaning in a manner detailed. Remove both frame side covers, each of which has a three-point push fit method of retention.



3.3 Remove throttle body screws positioned between carburettors

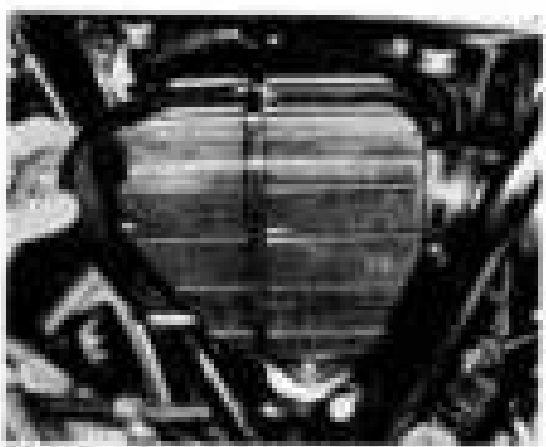
Slacken the air cleaner filter box screw clip and remove the single bolt holding the front part of the retaining strap. Hinge the strap up and pull the complete air filter box from position. The air filter box is a two-piece moulding held by two screws. After removal of the screws separate the two halves and withdraw the air filter element.

3 To clean the element, tap it lightly to loosen the particulate matter of dust and then use a soft brush to sweep the dust away. Alternatively, compressed air can be blown into the element from the engine.

4 If the element is dirty or oily it must be renewed. A damp or oily element will have a restrictive effect on the breathing of the carburettor and will almost certainly affect the engine performance.

5 Do not operate the engine without the air filters attached, or with any element missing. The jetting of the carburettors takes into account the presence of the air filters and engine performance will be seriously affected if this balance is upset.

6 To replace the element, reverse the dismantling procedure. Give a visual check to ensure that the inlet hoses are correctly located and not split or otherwise damaged. Check that the air filter covers are free from splits or cracks.



9.2 An air filter is fitted behind each frame side cover



9.3b Each filter box separates to allow element removal

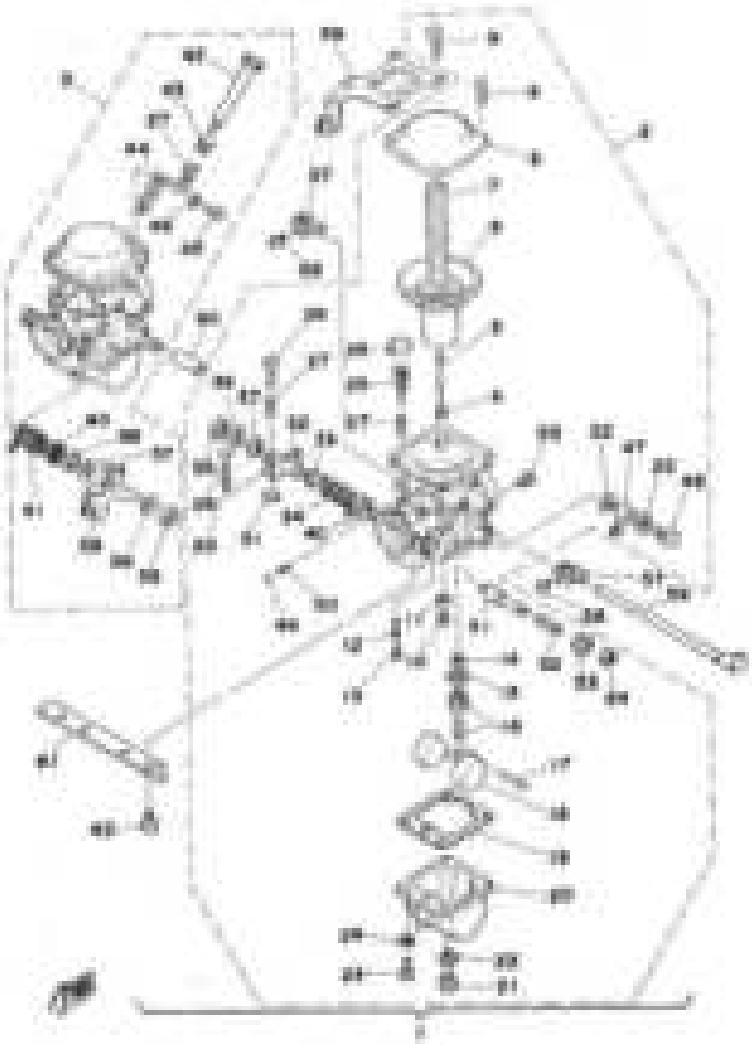


Fig. 3.4 Carburettor - two position choke type

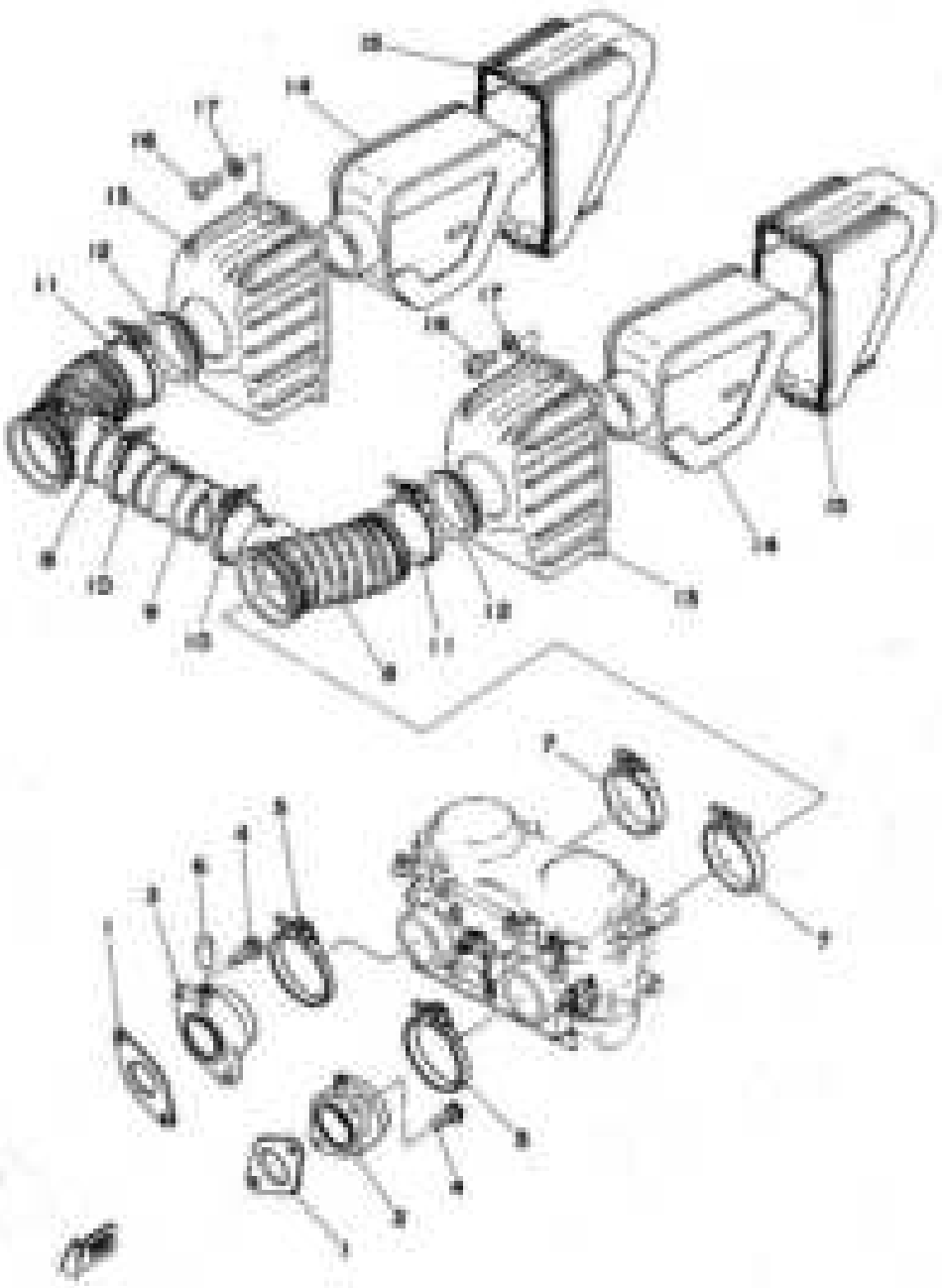


Fig. 2.4 Air filter assembly

1 Gasket – 2 off
2 Inlet stub
3 Inlet stub
4 Bracket screw – 4 off
5 Screw clip – 2 off
6 Front manifold
7 Screw clip – 2 off
8 Inlet stub – 2 off
9 Balance pipe
10 Screw clip – 2 off
11 Screw clip – 2 off
12 Grommet – 2 off
13 Air filter casing half – 2 off
14 Air filter element – 2 off
15 Air filter casing half – 2 off
16 Screw – 4 off
17 Plain washer – 4 off

10 Exhaust system

1 Unlike a new engine, the exhaust system does not require such frequent attention because the exhaust gases are mostly of a less oily nature.

2 Do not run the machine with the exhaust baffles removed, or with a quite different type of silencer fitted. The standard production silencers have been designed to give the best possible performance, whilst reducing the exhaust note to an acceptable level. Although a modified exhaust system or one without baffles, does give the illusion of greater speed as a result of the changed exhaust note, the chances are that performance will have suffered accordingly.

11 Oil pump - removal, examination and replacement

1 The oil pump is contained within the primary drive casing where it is driven via an idler gear from the primary drive pinion. The oil pump may be removed whilst the engine is still in the frame, after the oil has been drained and the primary drive cover removed.

2 The oil pump is retained by three socket bolts and is located by a single dowel pin, to allow adjustment of the primary drive chain/clutch pinion backlash. Remove the three bolts and lift the pump away, complete with the idler pinion. Slide the pinion off the inch-spindle which projects from the rear of the pump unit.

3 Commence dismantling by removing the three countersunk screws which secure the pump cover plate. The screws will be very tight and require careful loosening to avoid damage to the heads. When removed off the cover, lift out the outer rotor. The inner rotor shaft and oil pump pinion are integral units. No provision is made for their removal from the pump body after initial assembly.

4 Incorporated in the pump casting is the pressure release valve which allows control of the feed oil pressure. If excess pressure is created, the valve plunger lifts, allowing oil to flow directly to the sump. The valve is comprised of a plunger, spring and spring seat retained by a split pin. Straighten the split pin and depress the spring seat slightly with a screwdriver. Withdraw the split pin whilst maintaining the pressure on the spring seat. This action will prevent the spring and seat from flying out. Remove the seat, spring and plunger.

5 Wash all the pump components with petrol and allow them to dry before carrying out an examination. Before carefully reassembling the pump, an various measurements to be carried out. Check the casing for breakage or fracture, or scoring on the inside perimeter.

6 Refit the outer rotor and measure the clearance between the rib of the inner rotor and a point on the outer rotor. The clearance should be 0.03 - 0.08 mm (0.001 - 0.003 in). Check also the clearance between the side of the adjacent peak and rib. The clearance should be the same. If wear is evident, the pump should be renewed as a unit. Place a straight edge across the pump body face and check the clearance between the rotor faces and the straight edge. The side float should not exceed 0.10 - 0.15 mm (0.004 - 0.006 in). Excessive wear necessitates pump renewal.

7 Examine the rotors and the pump body for signs of scoring, chipping or other surface damage which will cause it metallic particles that may find their way into the oil pump assembly. Renewal of the pump is the only remedy under these circumstances.

8 Reassemble the pump and the pump casing by reversing the dismantling procedure. The pump components must be lubricated before assembly to commencement. The outer rotor should be fitted with the small punch mark on one face pointing towards. Make sure all parts of the pump are well lubricated before the outer cover is replaced and that there is plenty of oil between the inner and outer rotors. Tighten the end cover down evenly and continually rotate the drive pinion between fingers. A stiff pump is usually due to dirt on the rotor faces.

9 Fit the single location dowel into the casing and replace the pump complete with the idler pinion. Insert the three socket bolts and tighten them until it is just possible to move the pump up and down in line with the vertical plane of the engine. The backlash between the primary drive pinion and the oil pump idler pinion must now be adjusted. Select a 0.4 mm (0.016 in) feeler gauge and slide it between the drive sides of the central meshed teeth of the two pinions. The position of the feeler gauge will be just to the right of an imaginary line drawn between the centres of the two shafts. Push the oil pump movement bracket arm upwards so that the feeler gauge is tightened lightly and then tighten the socket bolt. Tighten the remaining two bolts and remove the backlash.



11.3 The oil pump side plate is retained by three countersunk screws



11.9a Displace the split pin to allow...













12 Oil filter: renewing the element

1 The oil filter is contained within a semi-isolated chamber at the front of the crankcase. Access to the element is made by unscrewing the filter cover centre bolt, which will bring with it the cover and also the element. Before removing the cover, place a receptacle beneath the engine to catch the engine oil contained in the filter chamber.

2 When renewing the filter element it is wise to renew the filter cover 'O' ring at the same time. This will assure the possibility of any oil leaks. Do not overtighten the centre bolt on replacement, the correct torque setting is 1.9 - 1.7 kg m (9.5 - 12.0 lb ft).

3 The filter by-pass valve, comprising a plunger and spring is situated in the base of the filter cover centre bolt. It is recommended that the by-pass valve be checked for free movement during every filter change. The spring and plunger are retained by a pin across the centre bolt. Extracting the pin out will allow the spring and plunger to be removed for cleaning.

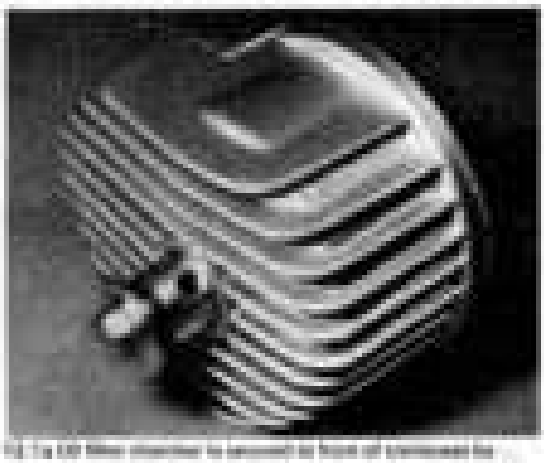
4 Never run the engine without the filter element as increase the period between the recommended oil changes or oil filter changes. Engine oil should be changed every 2,000 miles and the element changed every 4,000 miles. Use only the recommended viscosity.

13 Oil pressure warning lamp

1 An oil pressure warning lamp is incorporated in the lubrication system to give immediate warning of excessively low oil pressure.

2 The oil pressure switch is screwed into the crankcase, directly behind the final drive sprocket cover and is connected with a warning light in the lighting panel on the handlebars. The light should be non-illuminated like ignition is on but will usually go out at about 1,000 rpm.

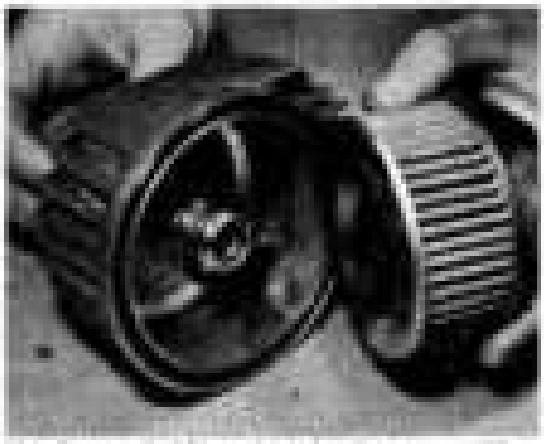
3 If the oil warning lamp comes on whilst the machine is being ridden, the engine should be switched off immediately, otherwise there is a risk of severe engine damage due to lubrication failure. The fault must be traced and rectified before the engine is re-started and may, even for a short moment. Machines fitted with plain shell bearings rely on high oil pressure to maintain a film of oil between the bearing surfaces. Failure of this oil pressure will cause the working surfaces to score into direct contact, causing overheating and eventual seizure.



12.1a Oil filter chamber is secured by front cylinder/case bo...



12.1b ... a Allen bolt containing the by-pass valve



12.1c Do not omit oil filter spring and washer on reassembly

1.6 Fault diagnosis: fuel system

Symptom	Cause	Remedy
Engine gradually fades and stops	Fuel starvation	Check vent hole in filler cap. Disconnect fuel feed on fuel chamber. Disconnect and clean
Engine runs badly. Black smoke from exhaust	Carburettor flooding	Dismantle and clean carburettor. Check for punctured float or sticking float needle
Engine lacks response and overheats	Weak mixture Air cleaner obstructed or dirty Manifold gaskets have upset carburation	Check for partial block in carburettors Disconnect and renew hose Replace with original design
Oil pressure warning light comes on	Lubrication system failure	Stop engine immediately. Trace and rectify fault before re-starting
Engine gets noisy	Failure to change engine oil when recommended	Drain off old oil and refill with new oil of correct grade. Renew oil filter element

Chapter 3 Ignition System

Contents

General description ... 1
Charging system: checking the output ... 2
Contact breaker: adjustment ... 3
Contact breaker points: removal, renovation and replacement ... 4
Ignition timing: checking and re-setting ... 5
Condenser: function, removal and replacement ... 6
Condenser: testing ... 7
Ignition coils: checking ... 8
Automatic timing unit: examination ... 9
Spark plugs: checking and re-setting the gaps ... 10
Fault diagnosis: ignition system ... 11

Specifications

Ignition timing (BTDC)			
Retarded	12°		
Advanced	38°		
Contact breaker gap	0.35–0.40 mm (0.014–0.016 in)		
Dwell angle	109°		
Ignition coil			
Primary winding resistance	4.0 ohms ± 10% at 20°C (68°F)		
Secondary winding resistance	9.5 K ohms ± 10% at 20°C (68°F)		
Sparking plugs	**XS100**	**XS200**	**XS400**
NGK	BP 7ES	BP 6ES	BP 7ES
A.C.	W22EP	W22EP	W22EP
Motorcraft	AG12	AG22	AG12
Ringpen	0.7–0.8 mm (0.028–0.032 in)		

1 General description

1 The Yamaha XS250, 360 and 400 twins are fitted with a 12 volt negative earth electrical system. Current derived from the crankshaft mounted alternator supplies twin ignition coils separately located which, in conjunction with a twin contact breaker assembly, provide the necessary spark at the correct time to ignite the mixtures in the cylinders.

2 The contact breakers are fitted within a chamber in the left-hand side of the cylinder head, where the cam and automatic timing unit are driven from the end of the camshaft.

3 Ignition source power is fed from the battery to the ignition coil primary windings. When the contact breaker opens, the low tension circuit is interrupted, and a high voltage is produced in the ignition coil secondary windings by magnetic induction. The high voltage passes through an HT lead to the spark plug.

4 A condenser in the contact breaker circuit prevents the contact breaker points from arcing as they open and closes to ensure that the spark at the spark plug gap has full intensity. The condenser is a resin unit contained within a single cannister mounted on the frame top tube or on the left-hand side of the battery box.

2 Charging system: checking the output

The charging system which includes the alternator, rectifier and voltage regulator, can be checked satisfactorily only by using test equipment of the multi-meter type. If the charging performance is suspect, some further tests may be made to determine the condition of the various components, as described in Chapter 9.

3 Contact breaker: adjustment

1 To gain access to the contact breaker assembly, it is necessary to remove the cover plate which is held by two cross head screws to the cylinder head. Note that the cover has a paper gasket to prevent the ingress of water.

2 Remove the alternator inspection cover and rotate the engine until the left hand points are fully open. Removal of the spark plugs will aid rotation. Examine the faces of the points. If they are blackened and burnt, or badly pitted, a unit the necessary to remove them for further attention. See Section 4 of this Chapter.

3 Adjustment is effected by slackening the two screws through the plate of the fixed contact breaker plate and moving the plate either clear, or further away from the moving contact until the gap is correct as measured by a feeler gauge. The correct gap with the points FULLY OPEN is 0.3 - 0.4 mm (0.012 - 0.016 in).

4 Two small indentations on the contact breaker base plate permit the insertion of a screwdriver to lever the adjustable plate into its correct location. Repeat this operation if there is any doubt about the accuracy of the measurement. Although the adjustment is relatively easy, it is of prime importance.

5 Repeat the same procedure for the right-hand set of contact breakers after turning the engine again so that the points are fully open.

6 Before replacing the cover and gasket, place a few drops of engine oil on the cam lubrication wick. Do not over lubricate, as excess oil will eventually find its way onto the two contact points causing the ignition circuit to malfunction.

4 Contact breaker points: removal, renovation and replacement

1 If the contact breaker points are burned, pitted or badly worn, they should be removed for dressing. If it is necessary to remove a substantial amount of material before the faces can be restored, the points should be renewed.

2 To remove the contact breaker points, unclip the contact breaker levers at their snap connectors. Remove the fixed and moveable screws thereby releasing both the contact breakers. Be sure not to lose the two smallhead screws that retain the contact breaker base plate, otherwise the ignition will have to be retimed.

3 The contact breakers can themselves be separated by removing their circlip and washers and pulling the moveable point off the pin. Inspect and clean.

4 The points should be cleaned with an oil stone or fine emery cloth. Keep them absolutely square throughout the dressing operation, otherwise they will make angular contact on reassembly, and rapidly burn away. If emery cloth is used, it should be backed by a flat strip of steel. This will ensure the flat on mounting the edges of the points.

5 Replace the contacts by reversing the dismantling procedure, making quite certain that the insulating washers are fitted in the correct way. In order for the ignition system to function at all, the moving contact and the base section must be perfectly insulated from the base plate and fixed contact. It is advantageous to apply a very light smear of grease to the pivot pin, prior to reassembly of the moving contact.

6 Check, and if necessary, re-adjust the contact breaker points setgap when they are in the fully open position.

5 Ignition timing: checking and re-setting

1 The ignition timing is the correct one accurately, either manually or using a stroboscope. Two sets of marks are made on the pulley/fan rotor periphery, which may be aligned with an index pointer (see illustration). Each set of marks relates to a specific cylinder.

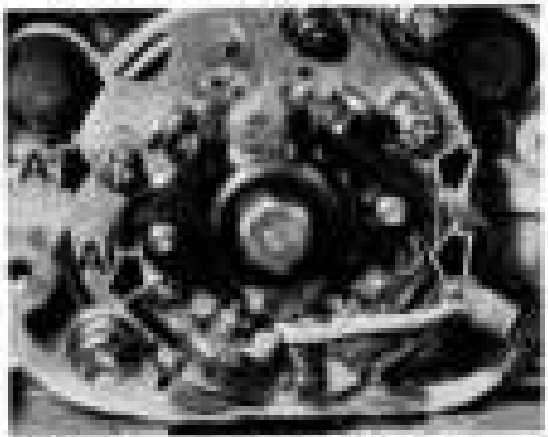
2 Commence by checking, and if necessary, adjusting the left-hand (contact breaker) points which control ignition timing of the left-hand cylinder. With the contact breakers having been gapped previously (see previous Section), turn the engine in an anti-clockwise direction (as viewed from the LH end) until the left-hand cylinder is on the compression stroke. Note that the timing is accomplished at the fully retarded position, ie: with the balance weights of the auto-advance unit counterpulled.

3 If the timing is correct, the points should be just on the verge of opening as the LF mark comes into alignment. To check when the opening occurs, a 12 volt lamp bulb can be connected between the moving contact breaker point or the condenser connection, and earth on the engine. The lamp will light up just when the contact breaker points open. If the light does not light, the ignition circuit is switched on.

4 If the timing is incorrect, slacken the two screws which pass into the cylinder head, clamping the contact breaker assembly base plate in position. Rotate the complete assembly until the light flickers and then tighten the screws. Recheck the timing by rotating the engine backwards about 45° past the forwards again, until the LF mark aligns precisely with the index mark. The engine must be rotated one way and then the other to take up any backlash in the timing gears (camshaft chain).

5 Repeat the timing check procedure on the right-hand contact breaker using the RH mark on the alternator rotor. If the timing is incorrect AND MUST slacken the two screws previously used for timing. The right-hand contact breaker is mounted on a separate smaller base plate, retained by two screws passing through elongated holes in the plate. The elongated holes allow a limited amount of plate movement for ignition timing.

6 Timing the engine manually as described above should be adequately accurate, provided that the contact breakers are in good condition and gapped with care. The use of a stroboscopic lamp, however, which enables ignition timing to take place with the engine running, is recommended. The LF or RF marks on the alternator rotor represent the fully retarded ignition timing positions for the crankshaft. The fully advanced timing marks for each cylinder are represented by two smaller notches scribed inside on the alternator rotor, the first of which is 2½° to the left of the relevant timing mark.



2.3 A = Points adjustment screws, LH cylinder, B = adjustment screws, RH cylinder



4.4 Ensure insulation washers are fitted in correct sequence

















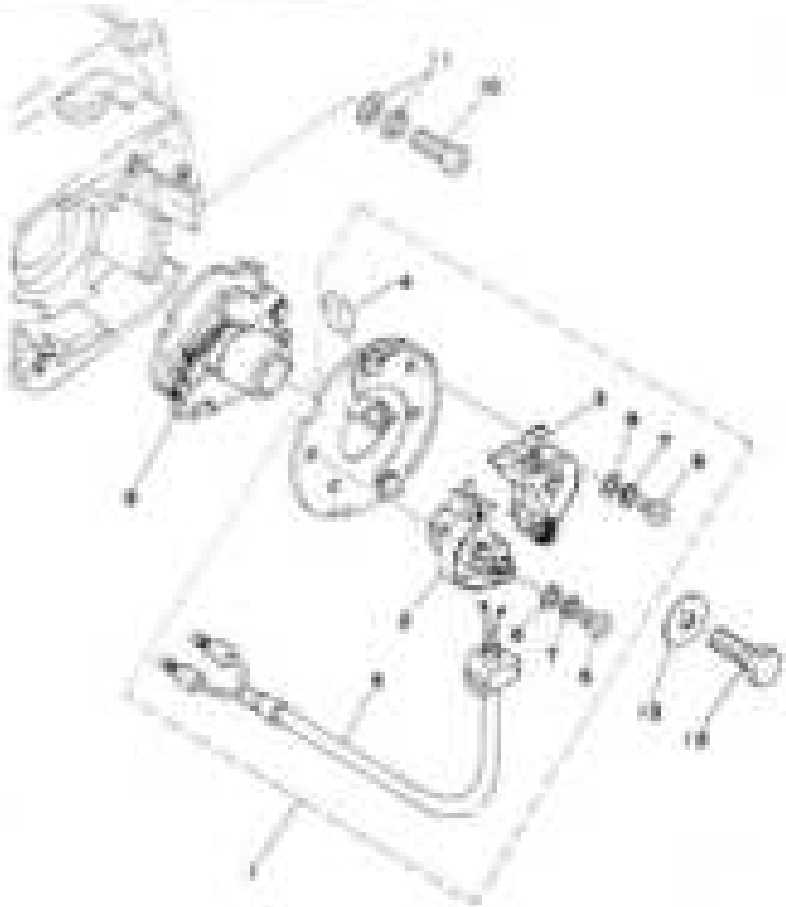
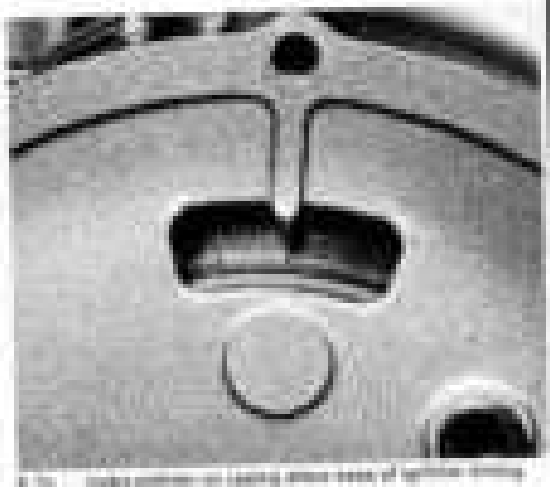
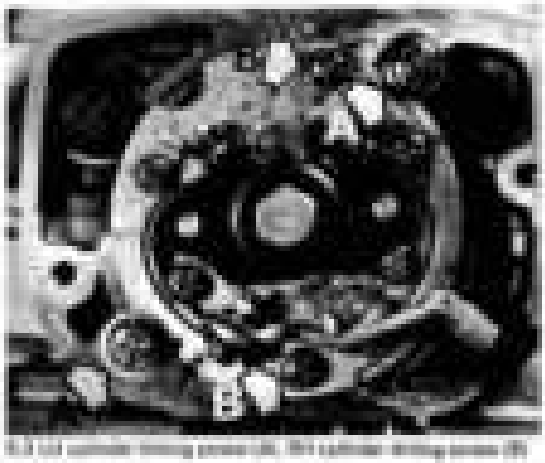


Fig. 6.1 Contact breaker assembly







5.3 1.3 cylinder timing pulse (A), 1.1 cylinder timing pulse (B)

6 Condenser: function, removal and replacement

1 The condenser unit, which is located on the top side of the frame, on to the left of the battery box, is comprised of two components within a common body, the body forming the common earth lead. Therefore good earthing of the mounting bracket is essential.

2 The condenser has two functions. Firstly, it reduces the sparking at the contacts (and hence prevents the rapid wear of the points), the second and most important function is to greatly increase the induced voltage in the secondary windings and hence strength of the high tension spark at break. Without the condenser the spark would be very weak.

3 If the engine is difficult to start, or if misfiring occurs, it is possible that a condenser is at fault. To check whether a condenser has failed, observe the points whilst the engine is running, after removing the contact breaker cover. If excessive sparking occurs across one pair of points, and they have a blackened or burnt appearance, it may be assumed the condenser or that circuit is no longer serviceable. In fairness then if one condenser fails the complete unit must be renewed.

4 Access to the condenser can be made after removal of the petrol tank (see Chapter 3, Section 2) or by raising the bodywork, depending on the model and the location of the condenser. Disconnect the condenser leads at the block connector and remove the single retaining screw.

7 Condenser: testing

1 Without the appropriate test equipment, there is no alternative means of verifying whether a condenser is still serviceable.

2 Bearing in mind the low cost of a condenser, it is far more satisfactory to merely replace it as a matter of course by direct replacement.

8 Ignition coils: checking

1 Each cylinder has its own ignition circuit and if one cylinder misfires, and both of the complete ignition system can be eliminated immediately, the components most likely to fail in this circuit that is defective are the condenser and the ignition coil since contact breaker faults should be obvious on close examination. Replacement of the existing condenser will often improve the misfire as an fault, bearing in the process of deterioration the ignition coil.

2 The ignition coil can best be checked using a multimeter set to the resistance position. Detach the ecological lead and coil/distributor HT lead connections and detach the spark plug cap from the spark plug. Measure the primary winding resistance and the secondary winding resistance by connecting the multimeter as shown in the accompanying diagram.

The resistance values for each circuit should be as follows:

Primary coil resistance 4.8 ohms ± 10% at 20°C
Secondary coil resistance 9.5K ohms ± 20% at 20°C

Slight variation may be encountered if the ambient temperature is not exactly that given. If the values differ from those given, the coil is faulty.

3 If the multimeter is not available, and by means of testing the other components have been found to be satisfactory, the following method may be used to give an estimation of the coil's condition. Remove the suppressor cap and pull the inner wire. Remove the contact breaker cover and turn the engine over until the contact breaker points are open so the coil to be tested are closed. Turn the ignition on and using an insulated screwdriver flick the points open and shut. If the lead end of the HT lead is held approximately 6 mm from an earthing point (the cylinder head) when this is done, a blue spark should jump the gap. If the spark is unable to jump a gap, or is extremely yellow, the coil is probably at fault.

4 The ignition coils are sealed units and it is not possible to effect a satisfactory repair in the event of failure. A new unit must be fitted.

5 The ignition coils are mounted as a pair underneath the petrol tank. They bolt direct to metal plates on the double top frame rails and face in a rearward direction, parallel to the axis of the machine.

9 Automatic timing unit: examination

1 The automatic timing mechanism rarely requires attention, although it is advisable to examine it periodically, when the contact breaker is receiving attention. It is retained by a small bolt and washer through the centre of the tongued contact breaker cam and can be pulled off the end of the camshaft when the contact breaker cover is removed.

2 The unit comprises spring loaded balance weights, which move outwards against the spring tension as centrifugal force increases. The balance weights must move freely on their pivots and be not free. The tensions springs must also be in good condition. Keep the pivots lubricated and make sure the balance weights move easily without binding. Most problems arise as a result of contamination, within the engine, which causes the unit to bind and balance weight movement to be restricted.

3 The automatic timing unit mechanism is fixed in relation to the crankshaft by means of a dowel, in consequence the mechanism cannot be replaced in anything other than the correct position. The assumed accuracy of ignition timing to within close limits, although a check should always be made when reassembly of the contact breakers is completed.

4 The correct functioning of the auto-advance unit can be checked when the engine is running by the use of a stroboscopic light. If a strobe light is available, connect it to the ignition circuit as directed by the manufacturer of the light. With the engine running, direct the beam of the light on the index mark on the alternator cover, and so that the alternator rotor is illuminated. Check that the fully advanced timing mark (either UF or BT depending on which contact breaker is connected to the light) is in alignment with the pointer with the engine at 1,2000 rpm (always increase the engine speed in small rpm steps as the speed increases through the range the firing mark should move smoothly away from the index mark so as opposed to the unadvanced (static) advance mark. Sluggishness or erratic movement indicates a worn performing unit).

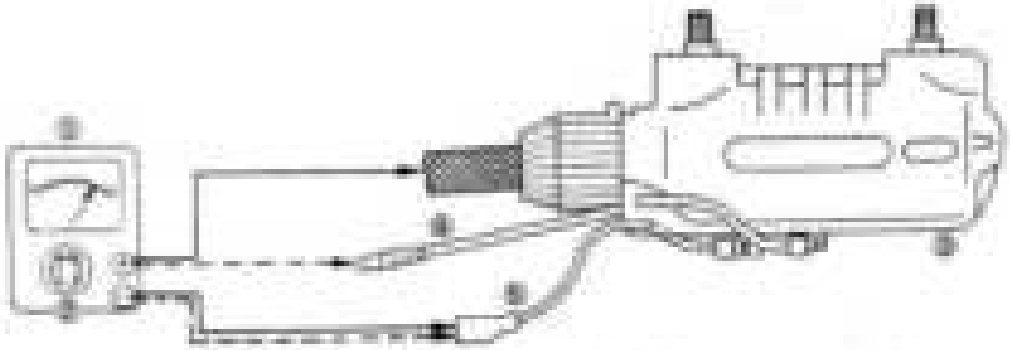


Fig. 3.6 Testing ignition coil resistance

1 Multimeter
2 Set meter on the 'Resistance' position
3 Ignition coil
4 Coil terminals
5 Distributor



3.5 Ignition coils are protected by heavy rubber sleeves (arrowed)



3.7 The ATU is fitted to the camshaft left-hand end



3.8 Check the condition of the ATU cam weights and springs

10 Spark plugs: checking and resetting the gaps

1 The XS250 and 400 models are fitted as standard with NGK BP-7HS or Nippon Denso W22EP spark plugs. The XS1100 model was either fitted with BP-8ES or Nippon Denso W24EP spark plugs. All plugs are gapped within the range 0.7 - 0.8 mm (0.028 - 0.032 in). Certain operating conditions may indicate a change in spark plug grade; the type recommended by the manufacturer gives the best all-round service.

2 Check the gap of the plug points during every three months or 3000 mile service. To reset the gap bend the outer electrode to bring it closer to the centre electrode and check that a 0.7 mm (0.028 in) feeler gauge can be inserted. Never bend the centre electrode or the insulator and crack, causing engine damage if the particles fall to where the engine is running.

3 With some experience, the condition of the spark plug electrodes and insulator can be used as a reliable guide to engine operating conditions. See accompanying photographs.

4 Beware of overtightening the spark plugs, otherwise there is risk of stripping the threads from the aluminium alloy cylinder heads. The plugs should be sufficiently tight to sit firmly on their copper sealing washers, and no more. Use a spanner which is a good fit on the spanner flats and tighten each plug to the specified torque.

5 If the threads in the cylinder head strip as a result of overtightening the spark plugs, it is possible to reclaim the head by the use of a Helicoil thread insert. This is a clever and convenient method of replacing the threads. Most motorcycle dealers operate a service of this kind.

6 Make sure the plug insulating caps are a good fit and have intact rubber seals. They should also be kept clean to prevent tracking. Check the HT connections that eliminate suppression caps and TV connections.

11 Fault diagnosis - ignition system

Symptom	Cause	Remedy
Engine will not start	Faulty ignition switch	Operate switch several times to clean contacts and dirty. If lights and other electrical functions, switch may need renewal.
	Starter motor not running	Discharged battery. Use kickstart until battery is recharged.
	Short circuit in wiring	Check whether fuse is intact. Eliminate fault before switching on again.
	Completely discharged battery	If lights do not work, remove battery and recharge.
Engine misfires	Faulty condenser in ignition circuit Fouled sparking plug Poor spark due to generator failure and discharged battery	Renew condenser and re-test. Renew plug and have original cleaned. Check output from generator. Remove and recharge battery.
Engine lacks power and overheats	Retarded ignition timing	Check timing and also contact breaker gap. Check whether auto timing unit has jammed.
Engine 'bullet' when under load	Pre-ignition	Check grade of plugs fitted; use recommended grade only.

Chapter 4 Frame and Forks

Contents

General description ... 1
Front forks: removal from the frame ... 2
Steering head yokes and bearings: removal from frame ... 3
Front forks: disassembly ... 4
Front forks: examination and renovation ... 5
Steering head bearings: examination and renovation ... 6
Front forks: reassembly ... 7
Frame: examination and repair ... 8
Swinging arm rear fork: removal and disassembly ... 9
Swinging arm rear fork: renovation and reassembly ... 10
Rear suspension units: examination ... 11
Centre stand: examination ... 12
Prop stand: examination ... 13
Footrests: examination and renovation ... 14
Rear brake pedal: examination and renovation ... 15
Rubbers: removal and replacement ... 16
Speedometer and tachometer heads: removal and replacement ... 17
Speedometer and tachometer drives: location and examination ... 18
Cleaning the machine ... 19
Front diagnostic frame and forks ... 20

Specifications

Front forks

Type	Telescopic hydraulically damped
Damping fluid capacity	1.83 cm³ (4.4 U.S. 7 US/Imp 4 oz)
Fluid grade/viscosity	SAE 10W/30 engine oil or similar
Fork spring free length	489.6 mm (19.65 in)

Rear suspension

Type	Swinging arm, two hydraulically damped suspension units
Spring length	239 mm (9.1 in)
Swinging arm free play (maximum)	1 mm (0.04 in)

1 General description

The Yamaha RS125D, 360 and 400 models share a similar frame of traditional design, constructed from welded tubular members and facing (if twin tube) except the downtube, sturdy and lightweight.

The front forks, as of the conventional telescopic type where the fork springs are contained within the fork stanchions and an oil damping medium is used. Rear suspension is of the swinging arm type, using oil filled suspension units to provide the necessary damping action. The units are adjustable so that the spring settings can be effectively changed within certain limits, to match the load carried.

2 Front forks: removal from the frame

1 It is unlikely that the front forks will have to be removed from the frame as a complete unit, unless the steering head assembly requires attention or if the machine suffers severe frontal damage. Removal of the individual fork legs for inspection and renovation can be accomplished easily, without the need for disturbing the fork yokes and steering head bearings. If required, removal of the fork legs as described in this section may be followed by steering yoke and bearing dismantling, referring to the procedure in the following section.

2 Place the machine on the centre stand so that it rests securely on level ground. Raise the front wheel well clear of the ground by placing wood blocks below the crankcase.

3 Remove the front wheel as described in Chapter 5 Section 4.

4 On disc brake models detach the front brake calliper unit from the fork leg by removing the two bolts which clamp through the fork leg boss into the calliper support bracket. Release the hydraulic hose by removing the hose clamp bolt(s) to the mudguard. Be well downwind and hose from the calliper as fluid will result, and the front brake system will have no fluid at all. Swing the calliper and hose out of the way and tie it to a suitable part of the frame.

5 Remove the front mudguard. It is held in place by two bolts passing into each fork leg. Slacken the pinch bolts on the fork upper yoke and lower yoke which clamps the fork legs in place. Each fork leg may be pulled down and out of the fork yokes as a complete unit. It may be necessary on leaving the clamps open with a screwdriver blade to release the grip on the fork stanchions. Care should be taken if this method is adopted because excess force will damage the yoke casting.

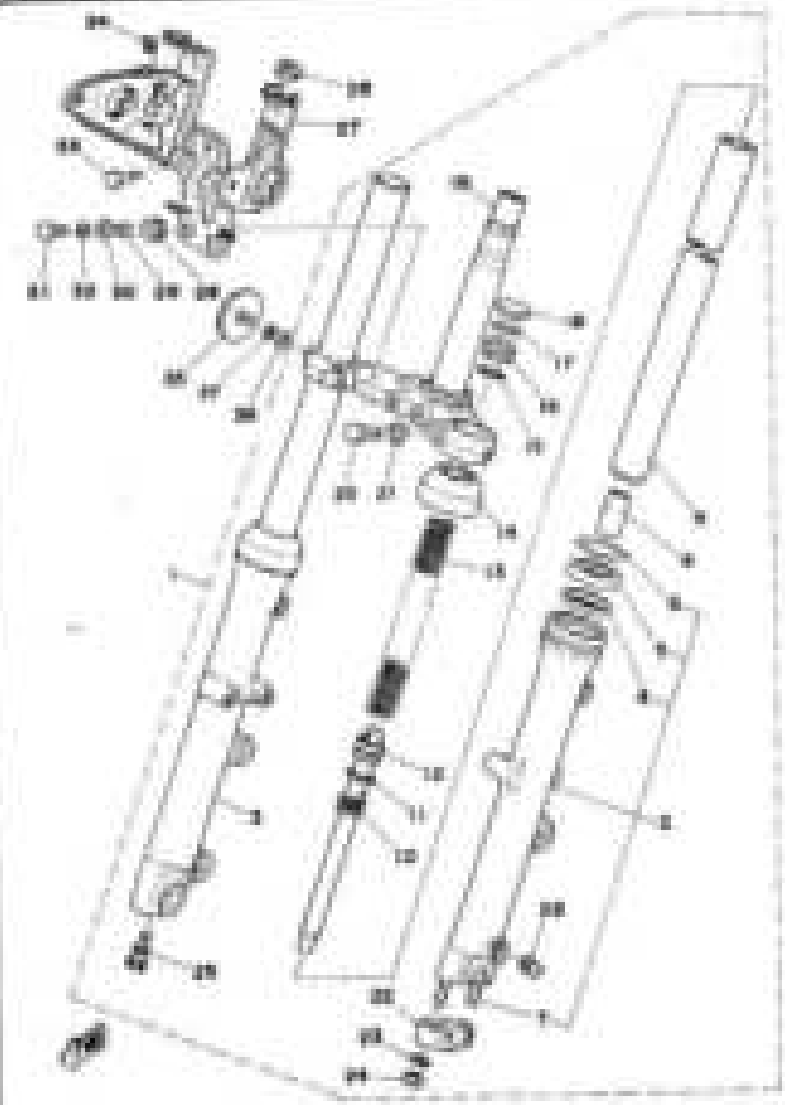


Fig. A.1 Front fork assembly

1 Front fork assembly
2 Left hand lower fork leg
3 Right hand lower fork leg
4 Oil seal spacer – 2 off
5 Oil seal – 2 off
6 'O' clip – 2 off
7 Dust – 2 off
8 Damper rod seal – 2 off
9 Fork stanchion (inner tube) – 2 off
10 Rebound spring – 2 off
11 Piston ring – 2 off
12 Fork stanchion (upper tube) – 2 off
13 Fork spring – 2 off
14 Dust seal – 2 off
15 'O' ring – 2 off
16 Spring retaining strap – 2 off
17 Circlip – 2 off
18 Fixed fork cap – 2 off
19 Sleeving – cover and bottom yoke
20 Pinch bolt – 2 off
21 Spring washer – 2 off
22 Bonnet clamp
23 Plain washer – 2 off
24 Nut – 2 off
25 Clamp bolt – 2 off
26 Drain plug – 2 off
27 Headlamp brackets
28 Grommet – 4 off
29 Spacer – 2 off
30 Plain washer – 2 off
31 Bolt – 2 off
32 Spring washer – 2 off
33 Bolt
34 Rubber plug – 4 off
35 Rubber – 2 off
36 Plain washer – 2 off
37 Spring washer



2.1a The mudguard is held by two bolts on each side



2.1b Slacken the upper pinch bolt and ...



3.3a ... the lower yoke bolt and ...



3.3b ... draw the fork leg downwards as a unit

3 Steering head yoke and bearings: removal from the frame

1 After removal of the fork legs as described in the preceding section, the steering head yoke and bearings may be detached to complete fork removal.

2 Raise the dualseat and disconnect the battery positive (+) lead. This will isolate the electrical system and prevent accidental shorting when the controls and headlamp leads are disconnected.

3 On ohc Ixion models, disconnect the front brake stop lamp switch leads and remove the rear bolt holding the master cylinder/reservoir unit to the handlebars. The master cylinder and caliper unit to which it is still interconnected by the brake hose may be removed from the machine. Do not allow the master cylinder to be inverted. This removal procedure precludes the need for bleeding the brake system on reassembly. On dohc Ixion models, disconnect the brake cable from the handlebar lever.

4 Detach the cockpit from the handlebars, disconnecting cables and electrical leads where required. The electrical connections are made by block or snap connectors and the wires are colour coded to aid reassembly. Remove the handlebars after detaching the two clamps held by two bolts each.

5 The speedometer and tachometer unit is secured on a mounting plate which is held on the fork upper yoke by two studs and nuts. Detach the instrument drive cables and remove the securing nuts to allow the complete unit to be lifted away from the machine.

6 The headlamp unit is mounted in a bracket secured by two bolts to the lower yoke. The upper part of the bracket locates on studs. Remove the two bolts, lower the bracket slightly to disengage the upper mountings, and lift the assembly away from the yokes.

7 Remove the crown bolt and washer from the centre of the upper yoke. After slackening the pinch bolt at the rear of the yoke, the yoke may be lifted upwards, off the steering stem.

8 To release the lower yoke and steering head stem, unscrew the domed sleeve nut at the top of the steering stem. A suitable "C" spanner is provided in the tool kit with which to loosen the sleeve nut, but a soft punch can be used in the absence of the correct tool. As the steering head is released, the uncaged ball bearings from the lower race will be released and care should be taken to catch them by wrapping a rag around the bearing area. The bearings in the upper race will always certainly remain in position.

4 Front forks: dismantling

1 It is advisable to dismantle each fork leg separately, using an identical procedure. There is less chance of unwittingly exchanging parts of the assembly if this approach is adopted. Commence by draining each fork leg of damping oil; there is a drain plug in each lower leg above and to the rear of each wheel spindle housing.

2 Place the fork assembly in a vice fitted with soft jaws, with a length of rubber hose tube around the stanchion, to prevent damage. Prise the rubber plug from the top of the stanchion. The fork spring is retained by a close fitting plug secured by an internal circlip within the stanchion end. To remove the circlip, the plug must be depressed slightly against the spring pressure and the circlip prised out with a small screwdriver. The help of a second person should be enlisted to depress the plug. After removal of the circlip, release the pressure and remove the plug, followed by the fork spring.

3 Place the fork lower leg in the vice and unscrew the socket screw developed into the mounting which clamps the front wheel spindle. Prise the dust excluder from position and slide it up the fork stanchion. The stanchion can be pulled out of the lower fork leg. Remove the damper rod seat, invert the upper tube and push the damper rod out of position inwards via the top end of the tube.

4 The oil seal which is fitted to the fork lower leg is retained by a circlip. Do not remove the oil seal unless it is to be renewed because the act of removal will almost certainly damage the fine sealing lip.

5 Front forks: examination and renovation

1 The parts most likely to cause you the oil seals and the bearing surfaces of the lower fork leg and the upper tube. As fourstars are not fitted, wear in the fork lower leg can only be remedied by renewal of the complete fork lower leg.

2 Both a personal guidance or dust sealing must be amended as immediately otherwise the ingress of road grit will accelerate wear of the oil seal and upper tube.

3 After an extended period of service the fork springs may take a permanent set. If the spring lengths are suspect, they should be compared with a new set. It is wise to fit new components if the overall length has decreased. Always fit new springs as a pair. NEVER separately.

d) Check the outer surface of the steerstem for scratches or roughness. It is very rare even for damage like oil seal during reassembly. If these high spots are not rubbed down. The consequences are unlikely to bend unless the machine is damaged in an accident. Any significant bend will be detected by eye, but if there is any doubt about straightness, roll the steerstem tube on a flat surface. If the steerstems are bent, they should be renewed. Unless specialist repair equipment is available, it is rarely economical to straighten bent steerstems, and in any event the safety of repaired components of this nature is always suspect.

3 Mount all the bearings and races in their locations, and fit the steerstem. Fit the steerstem nut and adjust the steering head bearings as described in Section 4. Fit the lockwasher and locknut, and tighten the locknut to the specified torque setting.

4 Fit the lower fairing, the headlamp unit and the upper fairing as described in Chapter 8.

4 Steering head bearings: examination and renovation

1 Clean and examine the cups and cones of the steering head bearings. They should have a polished appearance and show no signs of indentation. Renew the set if necessary.

2 Clean and examine the ball bearings which should also be polished and show no signs of surface cracks or blemishes. If any require replacement, the whole set must be renewed.

3 All the balls are 3 in diameter (do not mix sizes), and though sets of steering balls are slightly different, threaded balls are fitted over each top and bottom bearing race. This arrangement will leave a gap but no extra ball must not be fitted otherwise the balls will press against each other, accentuating wear and making the steering stiff.

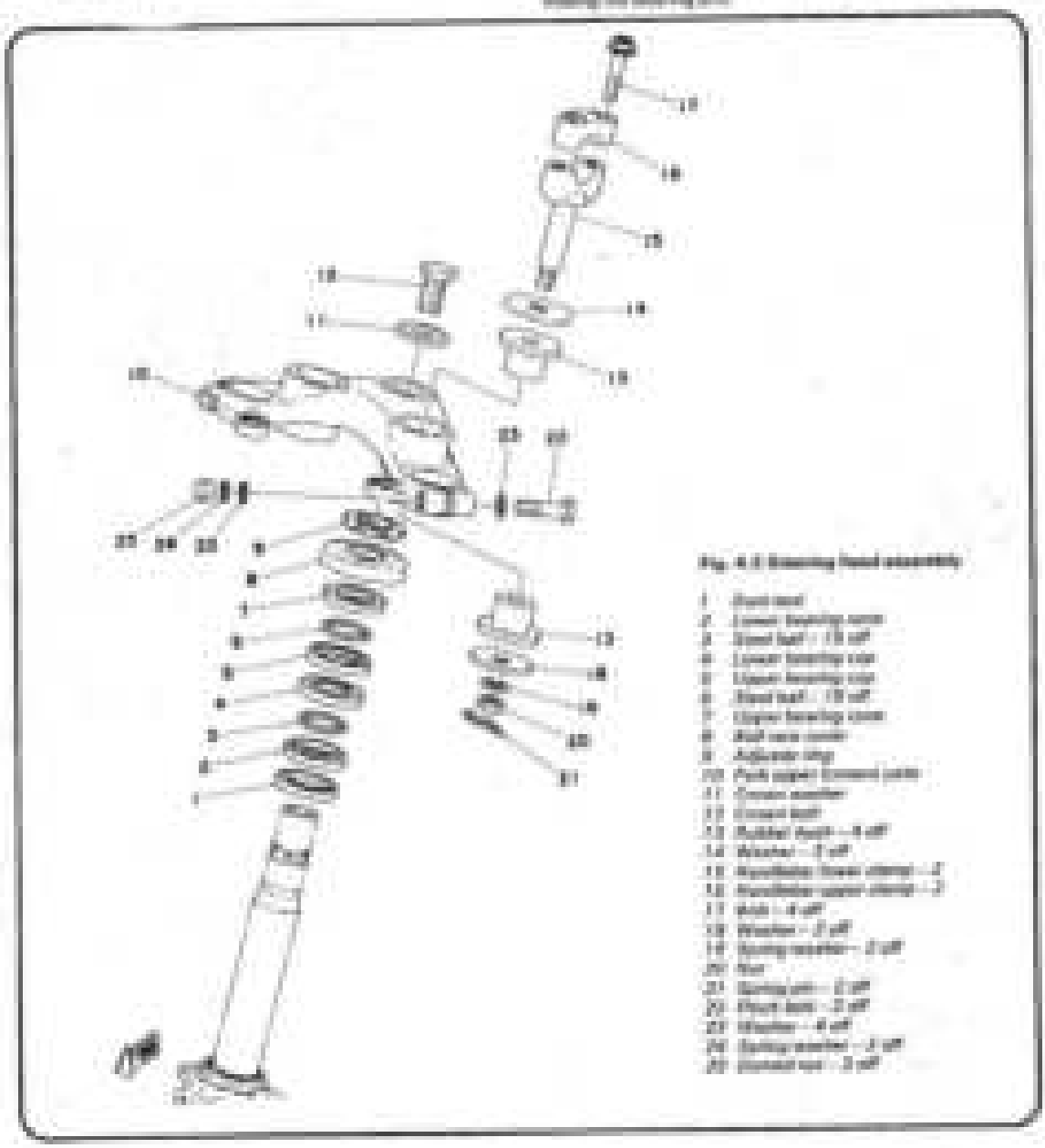
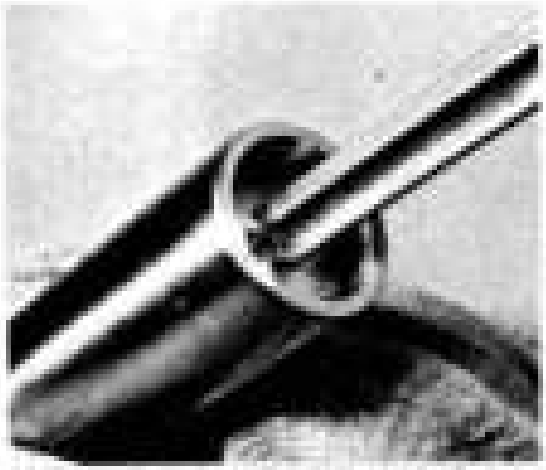
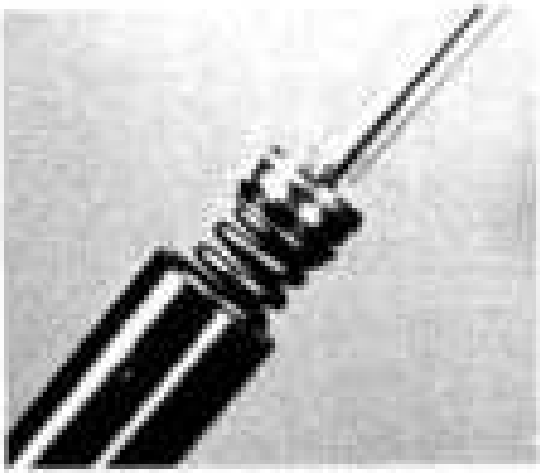


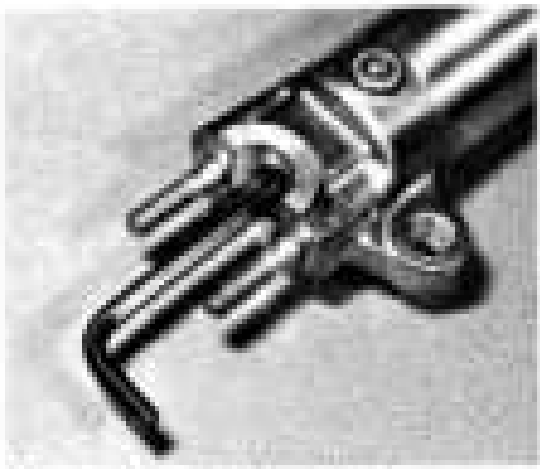
Fig. 6.3 Steering head assembly

1 Dust seal
2 Lower bearing cone
3 Steel ball – 19 off
4 Lower bearing cup
5 Upper bearing cup
6 Steel ball – 19 off
7 Upper bearing cone
8 Ball race cover
9 Adjuster ring
10 Fork upper (inward) pinch
11 Crown washer
12 Crown bolt
13 Rubber bush – 4 off
14 Washer – 2 off
15 Handlebar lower clamp – 2
16 Handlebar upper clamp – 2
17 Bolt – 4 off
18 Washer – 2 off
19 Spring washer – 2 off
20 Nut
21 Spring pin – 2 off
22 Pivot bolt – 2 off
23 Washer – 4 off
24 Spring washer – 2 off
25 Domed nut – 2 off

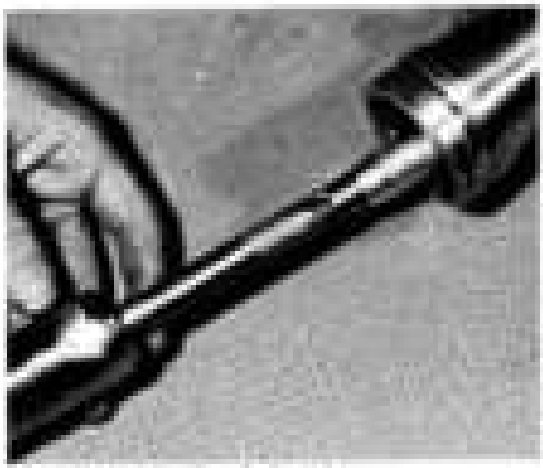














4.2e1 Withdraw the damper rod to slide out of the sleeve/stanchion



4.4 Oil seal to be secured by a circlip

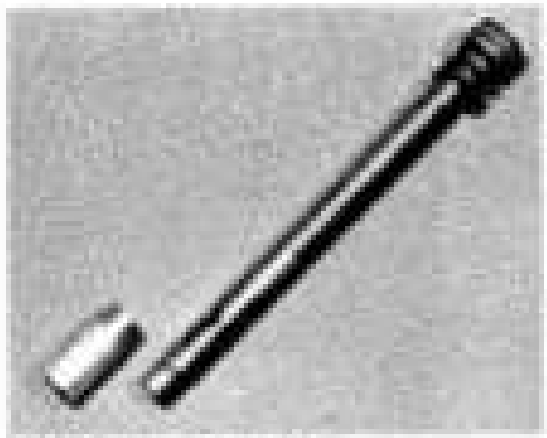
7 Front forks replacement

1 Replace the front forks by following in reverse the dismantling procedures described in Section 2, 3 and 4 of this Chapter. Before fully tightening the front wheel spindle clamps and the fork lower side pinch bolts, bounce the forks several times to ensure they work correctly and settle down into their original settings. Complete the final tightening from the wheel spindle upwards.

2 Refill each fork leg with 130 or 16 &0.5 US/imp fl oz of ATF (automatic transmission fluid or SAE 10W/30 fork oil) before the plug in the top of each fork leg is replaced. Check that the drain plugs have been re-inserted and tightened before the oil is added!

3 If the fork assemblies prove difficult to relocate through the fork yokes, make sure that outer surfaces are clean and polished, as this may well strip more seals. It is often advantageous to use a screwdriver blade to open up the clamps, as the tubes are moved upwards into position.

4 Before the machine is used on the road, check the adjustment of the steering head bearings. If they are too slack, judder will occur, especially during braking. There should be no detectable play in the head races when the handlebars are pulled and pushed with the front brake applied hard.



4.2e Damper assembly - general view

5 Overtight head races are equally undesirable. It is possible to unintentionally apply a loading of several tons on the head races when they have been overtightened, even though the handlebars appear to turn quite freely. Overtight bearings will make the machine roll at low speeds and give generally unpleasant handling with a tendency to wander. Adjustment is correct if there is no perceptible play in the bearings and the handlebars will swing to full lock in either direction when the machine is on the centre stand with the front wheel clear of the ground. Only a slight nip should cause the handlebars to swing.

8 Frame: examination and repair

1 The frame is unlikely to require attention unless an accident has caused damage. In this case the frame should be taken to a specialist for repair.

2 It is wise to check the frame occasionally for cracks especially around the welded junctions and those subjected to vibration and stress eg, footrest mounting lugs. Rust corrosion can also lead to weakness and should be eliminated in its early stages.

3 A frame which is out of alignment will cause handling problems. If this is suspect, it is usually necessary to remove all the components so that the bare frame can be checked and possibly realigned by a specialist in this type of work.



7.2 Refill each fork leg with the correct quantity of damping fluid



7.4 Adjust the steering head bearing using a 'C' spanner

1 Frame complete
2 Engine rear mounting plate
3 Engine rear mounting plate
4 Bolt - 4 off
5 Spring washer - 4 off
6 Cylinder head vessels plate
7 Cylinder head vessels plate
8 Bumper - 2 off
9 Bolt - 2 off
10 Nut - 2 off
11 Spring washer - 2 off
12 Bolt - 2 off
13 Bolt - 2 off
14 Bolt
15 Nut - 4 off
16 Nut
17 Spring washer - 4 off
18 Spring washer
19 Steering lock assembly
20 Control spring
21 Lock cover
22 Wave washer
23 Wiper
24 Cable strap
25 Cable strap
26 Bumper
27 Cable strap

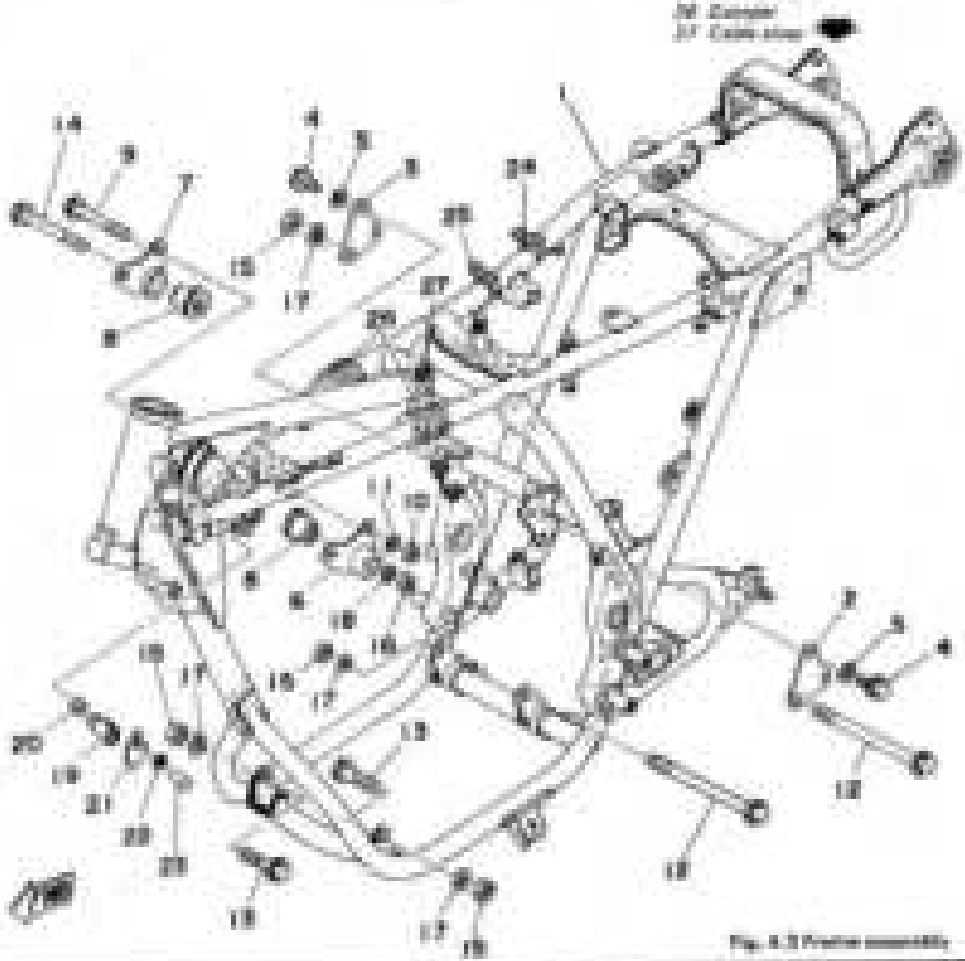


Fig. 4.3 Frame assembly

9 Swingarm rear fork: removal and dismantling

1 The swingarm rear fork/rear wheel/rear suspension assembly is removed as a complete unit. Begin by removing the rear wheel as described in Chapter 5 section 3.

2 On disc brake models, detach the two clamps which hold the brake hose to the swingarm rear fork. The clamps incorporate a locking tab which secures the heads of the bolts. Bend down the tabs before attempting to loosen each bolt. Remove the pivot bolt which secures the brake caliper unit to the mounting frame. Lift the caliper from position and move it forwards so that it may be suspended from the frame. If this method of removal is used, there is no necessity to disconnect the caliper from the hydraulic hose.

3 Remove the chain guard which is retained by a single bolt at the rear and detach both suspension units at their lower mountings.

4 Bend down the ear of the lockwasher which secures the swingarm pivot bolt nut. Remove the nut and lockwasher. The pivot bolt should be drifted out carefully, taking care not to damage the threads. Support the swingarm rear fork and withdraw it from the rear of the machine.

10 Swingarm rear fork: renovation and reassembly

1 Remove the dust caps from both ends of the swingarm rear fork/spindle and note the number of shims fitted at each side. The shims must be replaced in the same positions on reassembly. Push out the long inner bush.

2 After cleaning the inner bush and the outer bushes thoroughly, insert the inner bush again and check for play. If play is perceptible, the outer bushes must be renewed as a pair. The outer bushes may be drifted from position using a long drift inserted from the opposite side of the suspension. The bushes are made of a bronze material which will probably fracture during removal. For this reason they should not be disturbed unless they are to be renewed.

3 Reassemble the swingarm rear fork by reversing the dismantling procedure. Grease the pivot shaft and bearings (Bayolith balloon) reassembly as no facility is provided for greasing after assembly.

4 Worn swingarm rear pivot bearings will give incorrect handling with a tendency for the rear end of the machine to switch or hop particularly during the operation from power on to power off, or vice versa. Play can be detected by placing the machine on its centre stand and with the rear wheel clear of the ground, pushing and pulling on the fork ends in a horizontal direction. Any play will be greatly magnified by the leverage effect.

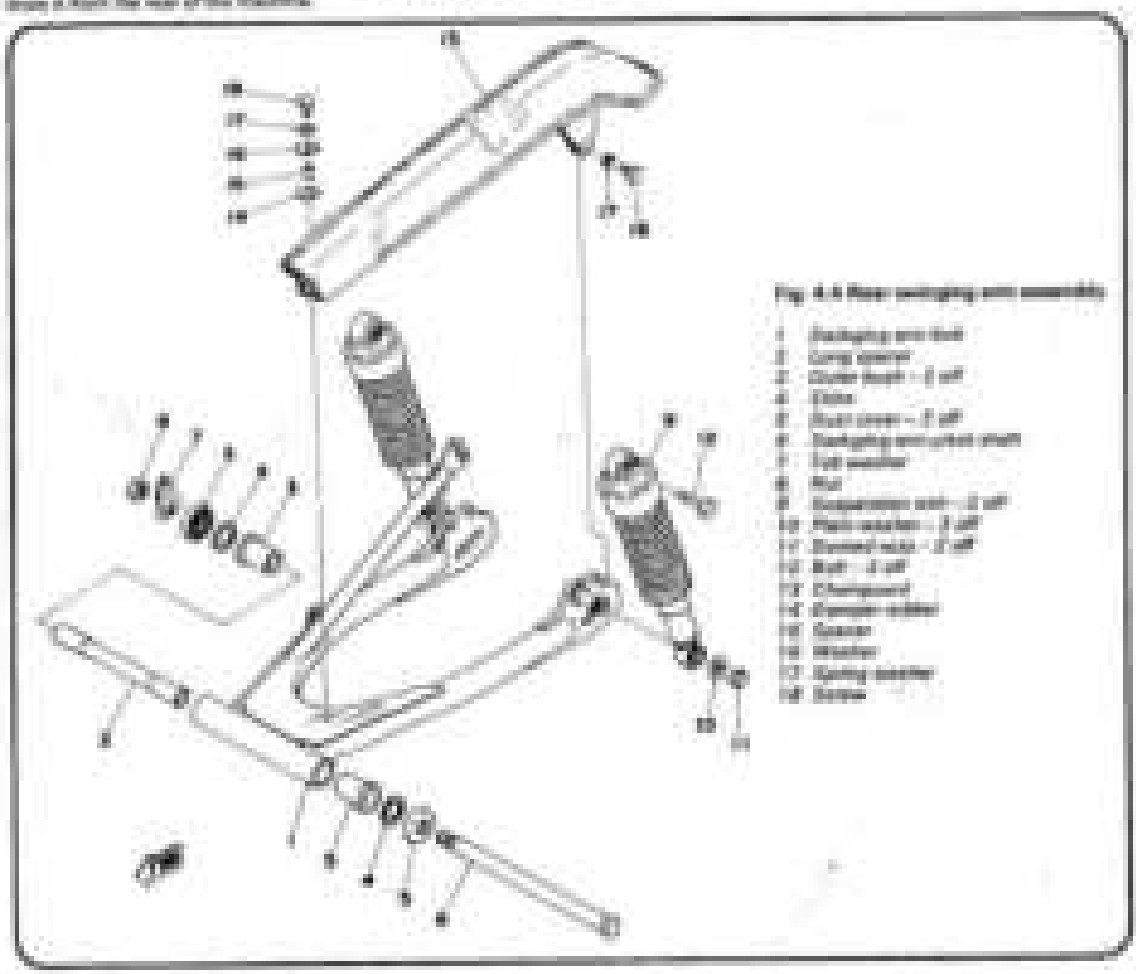
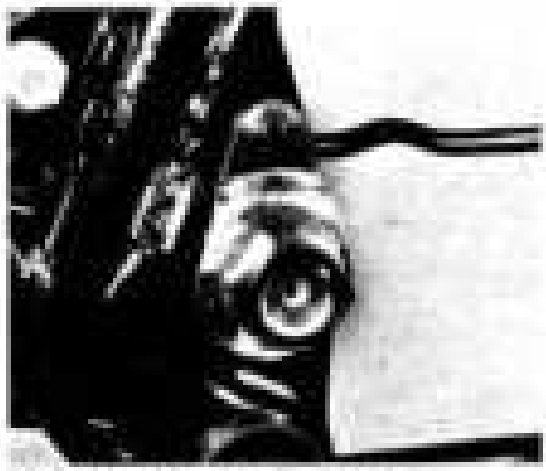


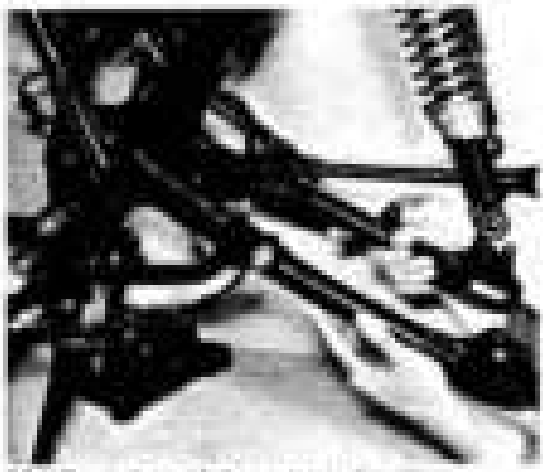
Fig. 4.4 Rear swingarm arm assembly

1 Swingarm arm fork
2 Long spacer
3 Outer Bush – 2 off
4 Shim
5 Dust cover – 2 off
6 Swingarm arm pivot shaft
7 Tab washer
8 Nut
9 Suspension unit – 2 off
10 Plain washer – 2 off
11 Domed nuts – 2 off
12 Bolt – 2 off
13 Chainguard
14 Damper rubber
15 Spacer
16 Washer
17 Spring washer
18 Screw

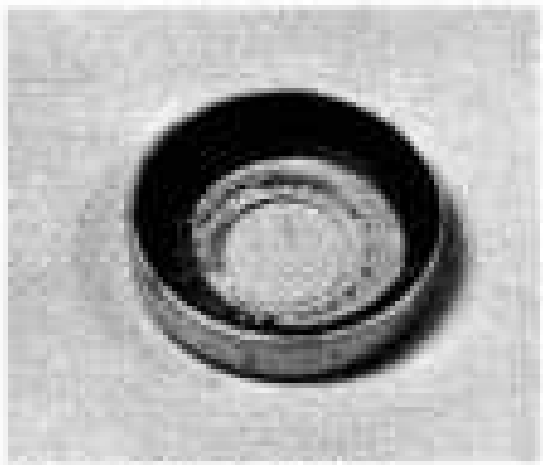






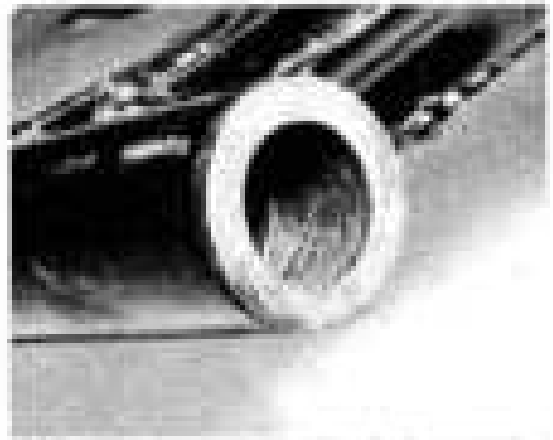








10.1c Check the fork seals



10.2 Outer tubes are very brittle and may break on removal

11 Rear suspension unit: examination

1 The rear suspension units fitted to the 650/700 1990 and 1991 models are of the manufacturers sealed type, adjustable to give five different spring settings. A 'C' spanner should be used to turn the lower spring seat and so alter the position on the adjustment protection. When the spring seat is turned so that the effective length of the spring is shortened the suspension will become heavier.

2 If a suspension unit leaks, or if the damping efficiency is reduced in any other way the two units must be replaced as a pair. For precise roadholding it is imperative that both units have an identical fit the same way. It follows that the units must always be set at the same spring rating.

12 Centre stand: examination

1 The centre stand is attached to the machine by two bolts on the bottom of the frame. It is secured by a centre spring. The bolts and spring should be checked for tightness and tension respectively. A weak spring can cause the centre stand to 'ground' on corners and cause the bike.

13 Prop stand: examination

1 The prop stand is secured to a plate on the frame with a bolt and nut, and is retained by a tension spring. Make sure the bolt is tight and the spring not overstretched, otherwise an accident can occur if the stand drops during cornering. For the same reason check that the pivot nut is tight and has not been tightened.

14 Footrests: examination and renovation

1 The front footrests are held on the frame by two bolts each, passing into threaded sleeves welded to the frame lugs. A damper rubber placed around each sleeve reduces vibration which can be transmitted to the rider's feet. The rear footrests are an integral part of the two piece mounting brackets, each of which is secured to the frame on a single stud. The footrests pivot outwards on their mounting brackets and are spring loaded to keep them in their horizontal positions. If an obstacle is struck they will first upswing, reducing the risk of damage or the rider's foot or to the main frame.

2 If the footrests are damaged in an accident, it is possible to dismantle the assembly one for components items. Detach each footrest from the frame lugs and assembly this bolting face place from the bracket on which it pivots by withdrawing the split pin and pulling out the pivot shaft. It is preferable to renew the damaged parts, but if necessary they can be bent straight by clamping them in a vice and tapping in a dull and with a soft hammer whilst the assembly is supported. Do not attempt to straighten the brackets while they are attached to the frame.

3 If heat is applied to the main footrest pivot during any straightening operations, it follows that the footrest rubber must be removed temporarily.

15 Rear brake pedal: examination and renovation

1 The rear brake pedal is secured to the shaft on which it pivots by a pinch bolt, and is located by splines. To allow removal of the pedal, the silencer must be removed completely.

2 In the event of damage, the rear brake pedal may be straightened in a manner similar to that described for footrest renovation. Bear in mind that the hose applied may damage the chrome finish.

16 Footrest: removal and replacement

1 The footrest is attached to two lugs on the left side of the frame by two cap bolts secured with split pins. It is necessary to remove the footrest to remove the rear split pins, take out the cap bolts, and the pivot will fall off as a complete unit.

17 Speedometer and tachometer heads: removal and replacement

1 The speedometer and tachometer are both mounted together on a single panel on top of the front forks. They are secured in rubber mounted cases by nine nuts with rubber washers and studs mounted on the bottom of the panel.

2 The instruments may be removed individually from their separate cases following the same procedure. Remove the two domed nuts and disconnect the drive cable by unscrewing the knurled ring. Pull the instrument head up and pull out the push fit warning and illumination bulb holders.

2 Unscrew the drive cables and pull out the push fit hub holders. Check for broken buffer pegs and slots.
4 Speedometer and tachometer heads cannot be repaired and if a defect arises it is best to fit a new instrument. Remember that a speedometer is correct working order is required by law on a machine in the UK and many other countries.
5 If an instrument becomes erratic in operation or fails, suspect first the drive cable, which should be renewed as a complete assembly if found to be damaged.

18 Speedometer and tachometer drives: location and maintenance

1 The speedometer is driven by a gear that is driven internally from the wheel hub, and is located inside the brake back plate (drum brake models) or in the rear of disc brake models by a separate gearbox driven from the hub fitted on the front wheel spindle, on the left of the wheel. The drive to both cases should be grease lubricated.
2 The tachometer drive is provided by a gear shaft fitting into the front of the camshaft cover, where it meshes with a worm gear on the camshaft. As noted in Chapter 1, failure of this gear is rare, as it works in clean conditions, being lubricated thoroughly and protected from contamination by full enclosure.

19 Cleaning the machine

1 Using a sponge, an surface dirt with warm water and a dig or sponge, use a cleaning compound such as 'Gunk' or 'Jizer' for the oily parts. Apply the cleaner with a brush when the cloths are dry so that it has an opportunity to work into the film of oil or grease. Wash off by washing down liberally, taking care that water does not enter into the carburettors, air cleaners or electrics. If desired, a polish such as Solvol Autosol can be applied to the alloy parts to give them full lustre. Application of a wax polish to the cycle parts and a good chrome cleaner to the chrome parts will also give a good finish. Always valve the machine down if used in the wet, and make sure the chain is well oiled. There is less chance of water getting into control cables if they are regularly lubricated, which will prevent later ease of action.

20 Fault diagnosis: frame and forks

Symptom	Cause	Remedy
Machine veers to left or right with hands off handlebars	Wheels out of alignment Forks twisted Frame bent	Check and adjust. Strip and repair. Strip and repair or renew.
Machine tends to pull at low speeds	Steering head bearing not adjusted correctly or worn	Check adjustment and renew bearings if necessary.
Machine tends to wander	Worn swinging arm bearings	Check and renew bearings. Check adjustment and renew.
Forks judder when front brake applied	Steering head bearings slack, worn fork components	Renew all worn parts. Check adjustment and renew.
Forks bottom	Shock oil	Replenish with correct viscosity oil.
Fork action stiff	Fractional out of alignment Worn shafts, or twisted in yokes	Strip and renew as stainless clamp bolts. Worn wheel spindles and top bolts. Forks twisted at crown and tighten fixed bottom spindle.
Machine whishes badly	Defective rear suspension units on inadequate tyre damping	Check damping action. Check grade and quantity of oil in front forks.

Chapter 5 Wheels, brakes and tyres

Contents

General description ... 1
Front wheel examination and renovation (standard wheel models) ... 2
Front wheel examination and renovation (cast alloy wheel models) ... 3
Front wheel removal and replacement ... 4
Front disc brake pad removal and replacement (RS240, 2600 and 4x4 models) ... 5
Front disc brake: removing, renovating and replacing the caliper unit ... 6
Master cylinder: examination and renewing seals ... 7
Removing and replacing the brake disc ... 8
Front brake drum: examination and renovation ... 9
Adjusting the twin leading shoe front brake ... 10
Front wheel bearings: examination and replacement ... 11
Rear wheel examination and renovation ... 12
Rear wheel removal and replacement ... 13
Rear brakes: removal, examination and replacement ... 14
Rear brake master cylinder: removal, examination and renewing seals ... 15
Rear brake pedal height adjustment ... 16
Disc brake: bleeding the hydraulic system ... 17
Rear wheel sprocket: examination and replacement ... 18
Rear wheel hub drive: examination and renovation ... 19
Final drive chain: examination and lubrication ... 20
Tyres: removal and replacement ... 21
Front wheel balancing ... 22
Tyre valve dust caps ... 23
Fault diagnosis: Wheels, brakes and tyres ... 24

Specifications

Tyres	**Front**	**Rear**
RS250	3.00 x 18 in	3.00 x 18 in
RS350	3.00 x 18 in	3.50 x 18 in
4x4/600	3.50 x 16 in	3.50 x 16 in
Brakes		
RS125C, RS250 and RS400	Single disc	
RS360C	Single disc	Single leading shoe drum
RS360 (3)	Twin leading shoe drum	Single leading shoe, drum
Tyre pressures	**Solo**	**Pillion or continuous high speed**
Front	28 psi (1.9 kg/cm²)	28 psi (2.0 kg/cm²)
Rear	28 psi (2.0 kg/cm²)	33 psi (2.3 kg/cm²)

1 General description

All models are fitted with 18 inch diameter wheels carrying a 3.00 in section tyre at the rear, and with the exception of the RS400 model which is fitted with a 3.00 in front tyre, a 3.00 in section tyre on the front.

Wheels are either of the traditional type having steel rims bolted to aluminium alloy hubs or one piece sports spoke cast units. The wheels fitted depend on the model, date of manufacture and specification of original delivery.

All RS240 and 400 models and also the RS360C are fitted with an hydraulic single disc brake on both wheels. The earlier RS360C model has a single leading shoe drum brake at the rear in place of the disc, and the RS360(3), manufactured as an economy model, has the drum rear brake and a twin leading shoe front brake.

2 Front wheel: examination and renovation (standard wheel models)

1 Place the machine on the centre stand so that the front wheel is raised clear of the ground. Spin the wheel and check the rim alignment. Small misalignments can be corrected by tightening the spokes in the affected area, although a certain amount of practice is necessary to ensure even correction. Any flats in the wheel rim should be evident at this same time. Those are more difficult to remove and in most cases it will be necessary to have the wheel rebuilt on a new rim. Apart from the effect on stability, a flat will expose the tyre bead and lead to an greater risk of damage.

2 Check for loose or broken spokes. Tapping the spokes with the hard plastic or tapping the spokes with a screwdriver should produce a ringing sound and should be tightened by turning the nipple in

on and clockwise direction. Always re-check for run-out by spinning the wheel again. If the spokes have to be tightened an excessive amount, it is advisable to remove the tyre and tube by the procedure detailed in Section 11 of this Chapter. Now is also the time to check that the protruding ends of the spokes can be prevented from passing from chafing the inner tube and causing punctures.

3 Front wheel: examination and renovation (cast alloy wheel models)

1 Carefully check the complete wheel for cracks and chipping, particularly on the spoke roots and the edge of the rim. As a general rule, a damaged wheel must be renewed as cracks and severe stress points which may lead to sudden failure under heavy load. Small cracks may be welded carefully with a TIG file and where cases this 4000 - Alu. 13000 to relieve the stress. If there is any doubt as to the condition of a wheel advice should be sought from a Yamaha dealer specialist.

2 Each wheel is covered with a coating of lacquer to prevent corrosion. If damage occurs to the wheel and the lacquer finish is penetrated, the bared aluminium alloy will soon start to corrode. A similar grey oxide will form over the damaged area, which in itself is a protective coating. This deposit however, should be removed carefully as soon as possible and a new protective coating of lacquer applied.

3 Check the bearings run out on the rim by spinning the wheel and placing a fixed pointer close to the rim edge. If the maximum run out is greater than 2.0 mm (0.08 in), Yamaha recommend that the wheel be renewed. This is, however, a counsel of perfection; a run out somewhat greater than this can probably be accommodated without noticeable effect on wear. Fig. No means is available for straightening a warped wheel without resorting to the expense of having the wheel dismissed as old fence. If warpage was caused by impact during an accident, the safest measure is to renew the wheel complete. Worn wheel bearings may cause rim run out. These should be renewed as described in Section 11 of this Chapter.

4 Front wheel: removal and replacement

1 Place the machine on the centre stand and place wooden blocks below the crankcase so that the front wheel is well clear of the ground.

2 Remove the speedometer drive cable from the drive within the front hub by releasing the spring clip (drum brake models) or unscrewing the knurled ring (disc brake models).

3 On drum brake models detach the front brake cable by removing the split pin through the clevis pin passing through the brake operating arm. When the clevis pin is withdrawn, the cable can be detached complete with rubber gaiter and cable adjuster, after the latter has been unscrewed from the brake plate. Removal of the disc brake caliper on disc brake models is not required when detaching the front wheel.

4 The front wheel can now be released by withdrawing the spindle, which passes through the left-hand fork leg and is retained by a castellated nut and split pin. Note that it will be necessary to slacken the two bolts which hold the clamp around the head of the spindle on the extreme end of the left-hand fork leg. The head of the spindle is drilled so that a tommy bar can be inserted to aid removal. On drum brake models the wheel will pull clear after the anchorage stud on the brake plate has disengaged from the abutment on the left-hand fork leg.

5 Refit the wheels by reversing the dismantling procedure. Ensure that the speedometer gearbox (disc brake models) and the brake back plate (drum brake models) engage with the fork leg as the wheel is being refitted.

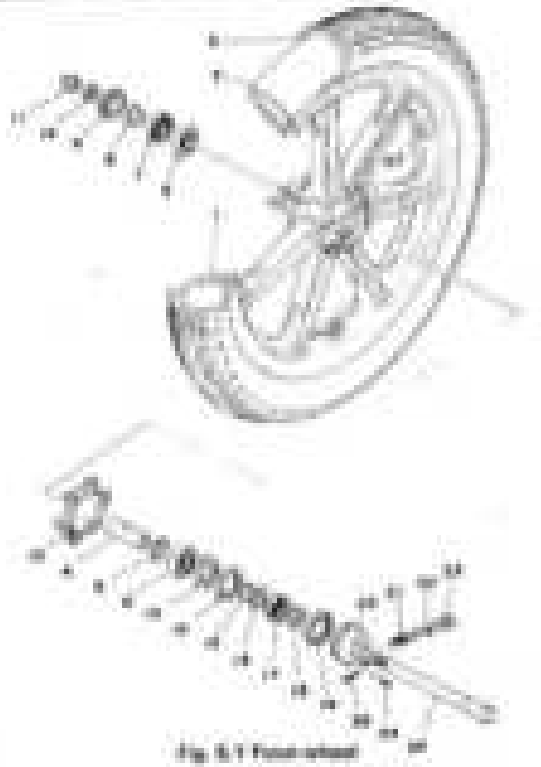


Fig. 5.1 Front wheel

1 Front wheel
2 Front inner tube
3 Front outer cover
4 Bearing spacer
5 Bearing spacer flange
6 Speedo bearing - 2 off
7 Oil seal
8 Spacer
9 Dust cover
10 Washer
11 Castellated nut
12 Retaining cover
13 Speedometer gearbox drive dog
14 Retainer
15 Circlip
16 Washer
17 Drive gear pinion (17T)
18 Washer
19 Oil seal
20 Speedometer drive gearbox
21 Driven shaft (15T)
22 Circlip
23 Spacer pinion
24 Axle pin
25 Front wheel spindle
26 Split pin
27 Wheel balance weight - 10g or 20g each



5.3a Remove the nut and spindle to allow ...



5.35 ... the front wheel to be inserted between the forks



5.36 Speedometer gearbox models must locate with lug protection



5.43a Wheel spindle clamp must be fitted with grooved forwards

6 Front disc brake: pad removal and replacement XS 250, 360/2S and 400 models

1 The condition of the brake pads can be determined with the pads in place in the caliper by viewing them through the inspection aperture in the caliper cover. The aperture is closed by a small plastic clip which may be hinged back to give access. Each pad has a red marked groove around the periphery. If in use the wear limit line on both pads have worn down to or past the grooves, the pads must be renewed as a set.

2 Pad removal can be accomplished without removing the front wheel, as follows. Remove the single bolt which passes through the piston/cylinder casting into the caliper support member. It is upon this bolt that the casting slides. From the rear of the unit remove the single countersunk screw by passing the blade of a screwdriver through the wheel spokes. Grasp the piston/cylinder casting and lift it away, leaving the two pads in place on the support bracket, either side of the disc. To prevent the pistons being expelled inadvertently, place a wooden wedge between one piston and outer part of the casing.

3 Lift each pad away from the disc and out of the support bracket. Note that the outer part of the XS250/S model is fitted with an anti-chatter shim. This should be detached from the pad.

4 As stated above, the pads must be renewed as a pair if either pad has worn down to the groove. The minimum pad thickness is 1.5 mm (0.06 in).

5 Replace the new pads by reversing the dismantling procedure. On XS250/S models, the anti-chatter spring must be fitted to the outer pad so that the exposed arrow head is facing the direction of normal wheel travel. The outer faces of both pads should be smeared with a thin coating of silicon grease at the rear supplied especially for disc brakes. Do not allow any grease to find its way onto the friction surfaces of the pad. If pads subsequently become contaminated with grease and lose friction efficiency, there is no satisfactory cure. Make sure that the brake pads are correctly located in the caliper and that the front wheel revolves freely when reassembly is complete. Always check the brake action before taking the machine on the road.

8 Front disc brake: removing, overhauling and replacing the caliper unit

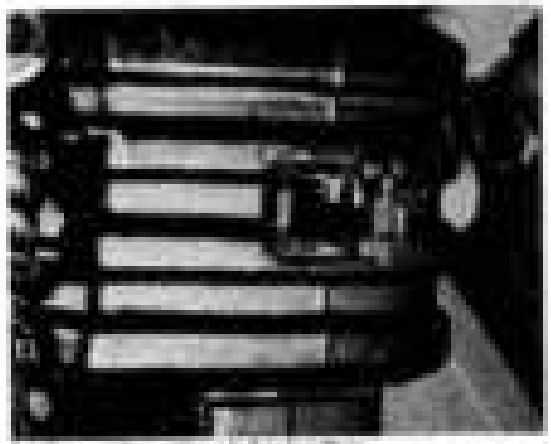
1 Before the caliper assembly can be removed from the right hand fork leg, it is first necessary to drain off the hydraulic fluid. Disconnect the brake pipe at the union connection. It makes sense with the caliper unit and allows the fluid to drain into a clean container. It is preferable to keep the front brake lever applied throughout this operation, to prevent the fluid from leaking out of the reservoir. A thick rubber band cut from a section of inner tube will suffice. If it is wrapped tightly around the lever and the handlebars.

2 Note that brake fluid is an extremely efficient paint stripper. Take care to keep it away from any paintwork on the machine or from any clear plastic, such as that sometimes used for instrument glasses.

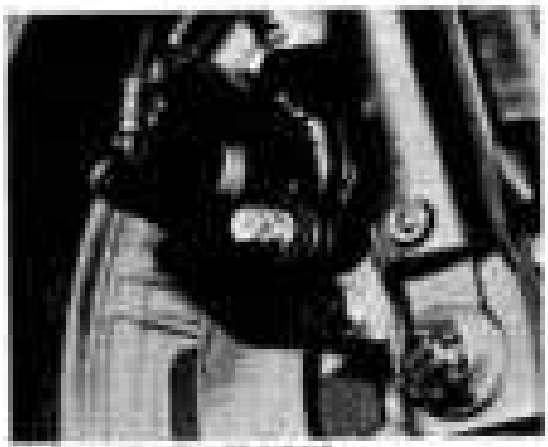
3 When the fluid has drained off, remove the caliper mounting bolts, then rotate the caliper unit upwards and lift it away from the disc and the machine. Separate the cylinder/cover casting from the support bracket as described for brake pad removal in the preceding Section, and remove the pads.

4 The rubber boot which protects the caliper piston is secured by a circlip. Displace the circlip and pull off the boot. The piston is best expelled from the cylinder by applying a blast of compressed air through the fluid inlet orifice. Take care no parts the piston as it emerges from its bore – if dropped or jarred out of position with a screwdriver, it may be damaged irreparably and will have to replaced. Remove the piston seal from the piston.

5 The parts removed should be cleaned thoroughly, using



9.1 Shaw pad inspection window in caliper



9.2a Remove the caliper slide bolt and ...



9.2b ... the angled screw from the rear and ...



9.2c ... pull the caliper casing off the pads



9.2d The outer pad will fall out as will ...



9.3b ... the inner pad



9.3 Dust and frame dirt can be perfect for efficient brake operation

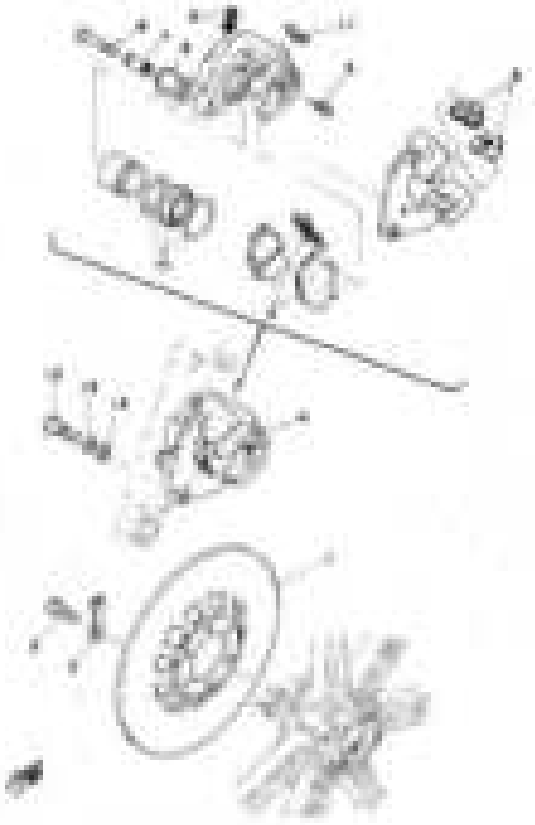


Fig. 9.2 Front disc brake caliper

1 Disc brake	8 Retaining bolt
2 Tab washer - 2 off	9 Bleed nipple
3 Bolt - 2 off	10 Caliper seal kit
4 Caliper assembly complete	11 Piston/dust cap
5 Caliper pad pin	12 Bolt - 2off
6 Bolt	13 Spring washer - 2 off
7 Sleeve	14 Washer - 2 off

4 Master cylinder: examination and renewing seals

1 The master cylinder and hydraulic fluid reservoir take the form of a combined unit mounted on the right-hand side of the handlebars, to which the front brake lever is attached.

2 Before the master cylinder unit can be removed and dismantled, the system must be drained. Place a clean container below the brake caliper unit and attach a plastic tube from the bleed screw of the caliper unit to the container. Lift off the master cylinder cover (cap), gasket and diaphragm, after removing the two countersunk retaining screws. Open the bleed screw one complete turn and pump the system by operating the brake lever until the master cylinder reservoir is empty. Close the bleed screw and remove the tube.

3 Before dismantling the master cylinder, it is essential that a clean working area is available on which the various components parts can be laid out. Also a sheet of white paper, so that none of the smaller parts can be overlooked.

4 Disconnect the stop lamp switch and front brake lever, taking care not to misplace the brake lever return spring. The stop lamp switch is a push fit in the lever stock. The lever pivots on a bolt retained by a single nut. Remove the brake hose by unscrewing the banjo union bolt. Take the master cylinder away from the handlebars by removing the two bolts that clamp it to the handlebars. Take care not to spill any hydraulic fluid on the paintwork or on plastic or rubber components.

5 Withdraw the rubber boot that protects the end of the master cylinder and remove the circlip that holds the piston assembly in position, using a pair of circlip pliers. The piston assembly can now be drawn out, followed by the return valve, spring cup and return spring.

6 The spring cup can now be separated from the end of the return valve spring and the return cup prised off the piston.

7 Examine the piston and the cylinder bore very carefully. If either is scratched or has the working surface impaired in any other way, it must be renewed without question. Reject the rubber seals, irrespective of their condition, and fit new ones in their place. In other words to refresh them a little before they are fitted by immersing them in a container of clean brake fluid.

8 When reassembling, follow the dismantling procedure in reverse, but take great care that none of the components parts is scratched or damaged in any way. Use brake fluid as the lubricant whilst reassembling. When assembly is complete, reconnect the brake fluid pipe and tighten the banjo union bolt. Use two new sealing washers on the union so that the banjo bolt does not require overtightening to effect a good seal. Refill the master cylinder with DOT 3 or SAE J1703 brake fluid and bleed the system of air by following the procedure described in Section 17 of this Chapter.

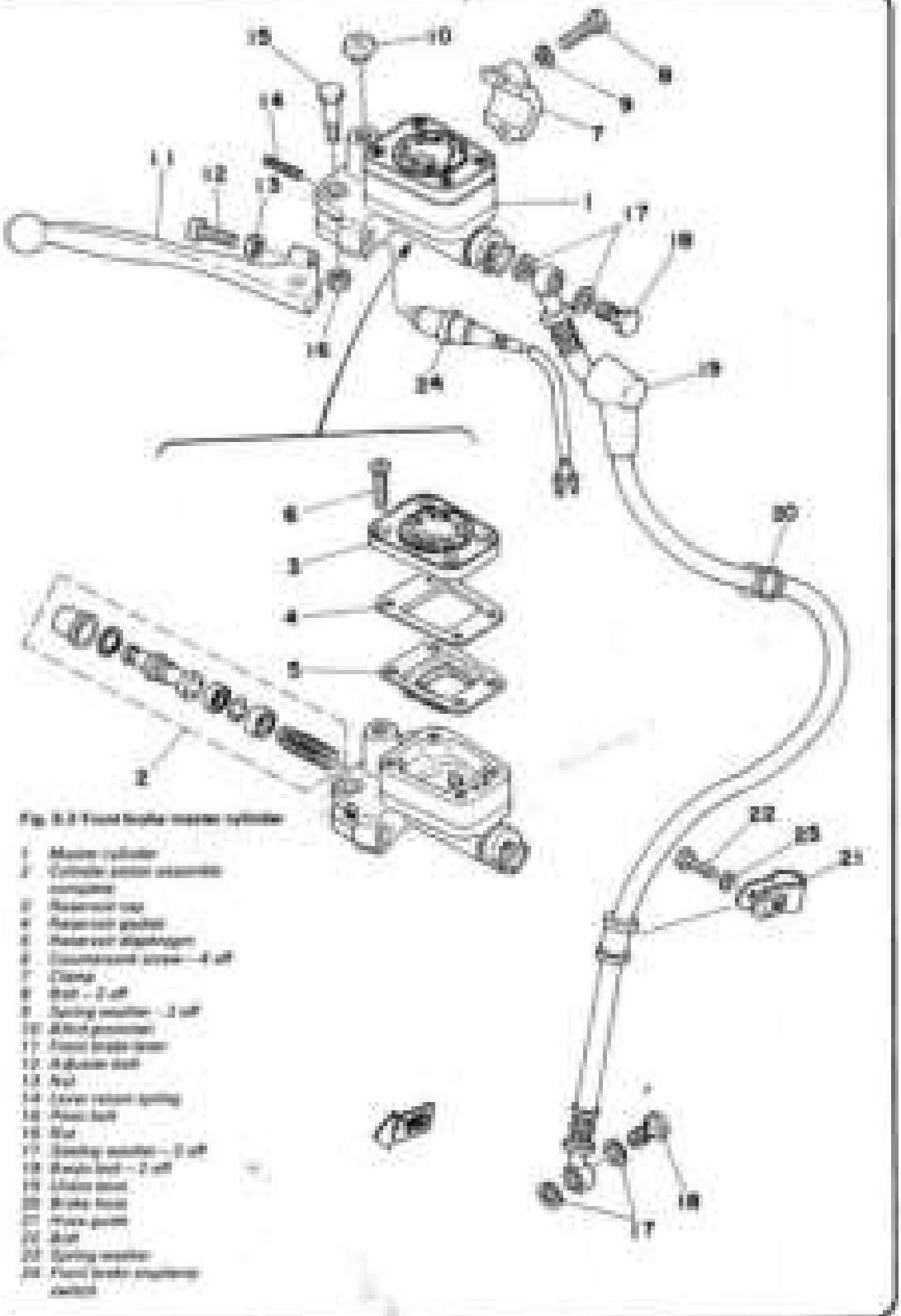


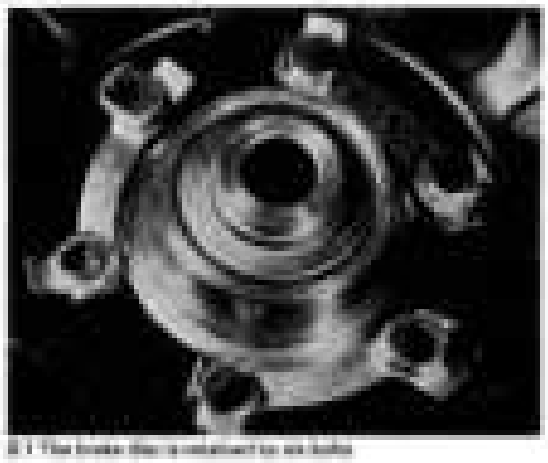
Fig. 9.3 Front brake master cylinder

1 Master cylinder
2 Cylinder piston assembly complete
3 Reservoir cap
4 Reservoir gasket
5 Reservoir diaphragm
6 Countersunk screw – 4 off
7 Clamp
8 Bolt – 2 off
9 Spring washer – 2 off
10 Pivot grommet
11 Front brake lever
12 Adjuster bolt
13 Nut
14 Lever return spring
15 Pivot bolt
16 Nut
17 Spacing washer – 2 off
18 Banjo bolt – 2 off
19 Union bolt
20 Brake hose
21 Hose guide
22 Bolt
23 Spring washer
24 Front brake stoplamp switch

8 Renewing and replacing the brake disc

1 It is unlikely that the disc will require attention until a considerable mileage has been covered, unless premature scoring of the disc has taken place (notably reducing braking efficiency).To remove the disc, first detach the front wheel as described in Section 4 of this Chapter. The disc is bolted to the front wheel on the right-hand side by six bolts, which are accessed in pairs by a common (as supplied, fixed) back the caliper and remove the bolts, to free the disc.

2 The brake disc can be checked for wear and for warpage whilst the front wheel is still in the machine. Using a micrometer, measure the thickness of the disc at the point of greatest wear. If the measurement is much less than the recommended service limit of 8.0 mm (0.177 in), the disc should be renewed. Check the warpage of the disc by setting up a suitable gauge close to the outer periphery of the disc and spinning the front wheel slowly. If the total warpage is more than 0.15 mm (0.006 in), the disc should be renewed. A surface after, apart from reducing the braking efficiency, is likely to cause juddering during braking and will also cause the brake to bind when it is not in use.



8.1 The brake disc is retained by six bolts

9 Front drum brake - examination and renovation

1 With the front wheel removed, as described Section 4 of this Chapter, the twin leading shoe brake mechanism and backplate can be pulled fast from the drum.

2 Examine the drum surface for signs of scoring or oil contamination. Both of these conditions will impair braking efficiency. Remove all traces of dust, preferably using a brake shoe brush. Take care not to inhale any of it, as it is of an asbestos nature, and consequently toxic. Remove oil or grease stains using a petrol soaked rag.

3 If deep scoring is evident, or the linings having worn through to the shoe at some time, the drum must be skimmed on a lathe, or renewed. Whilst there are firms who will undertake to skim a drum whilst fitted to the wheel, it should be borne in mind that excessive skimming will change the radius of the drum in relation to the brake shoes, therefore reducing the friction area and extensive bedding in may have taken place. Also full adjustment of the shoes may not be possible. It is doubt about this point, the advice of one of the specialist engineering firms who undertake this work should be sought.

4 If dust or grease from the wheel bearings has badly contaminated the linings, they should be renewed. There is no satisfactory way of degreasing the lining material, whilst in any case is relatively cheap to replace. It is a false economy to try to run on linings with brake components, the whole safety of both machine and rider being dependent on their condition.

5 The linings are bonded to the shoes, and the whole must be renewed complete with the new linings. This is accomplished by fitting the shoes together until the spring tension is relieved, and then lifting the shoes and springs off the brake plate. Fitting new shoes is a direct reversal of the above procedure.

6 Before refitting existing shoes, roughen the lining surface sufficiently to break the glaze which will have formed in use.

7 Examine the linkage which runs from the brake actuating lever to operate the second fulcrum. The rivet be removed after displacing the pinch bolts which retain it to the spindles. The linkage may be further dismantled, if desired, by removing the circlips and clevises which retain the connecting rod to the actuating levers.

8 Push out the fulcrums from the brake plate. If there is corrosion on the fulcrum faces or in the bore, this should be removed using wet or dry paper. Grease both fulcrums before installation. With the shoes, fulcrums and linkage in position on the brake plate, adjust the linkage by means of the turnbuckle and tighten on the connecting rod so that the fulcrum faces are parallel to each other. This is an important point as both shoes should commence to act on the drum surface at the same point. A misadjusted linkage can result in impaired braking efficiency, whilst a correctly set up twin leading shoe drum brake is both powerful and sensitive in use, giving most of the benefits of a disc brake without the risk of impaired and weather performance. After reinstallation of the wheel, the front brake should be adjusted finally, as described in the following Section.

10 Adjusting the twin leading shoe front brake

1 If the adjustment of the front brake cable is correct, there should be a clearance of 6 – 8 mm (0.2 – 0.3 in) measured between the brake lever and the lever stock when the brake has just commenced operation. Adjustment may be made either at the handlebar lever cable adjuster or at the adjuster on the brake back plate.

2 The only time the operating rod connecting the two operating levers requires adjustment is when the original setting has been disturbed, or if uneven wear of the brake shoes has led to reduced braking efficiency. It is imperative that the leading edge of each brake shoe contacts the brake drum at the same time, for maximum braking efficiency.

3 Check by detaching the clevis pin from the eye of one end of the operating rod so that the brake operating arms can be applied independently. Operate each arm separately and note when the brake shoe first makes contact with the brake drum surface. Make a mark on above the exact position of each operating arm when the initial contact is made. Replace the clevis pin and check that the marks coincide when the brake is applied in similar fashion. If they do not, withdraw the clevis pin and use the nut adjuster to extend or reduce the length of the operating rod until the marks correspond exactly. Replace the clevis pin and do not omit the 'E' clip over the end which retains the clevis pin in position. Reinstall the brake lever adjustment before taking the machine on the road. As a rough guide the two brake operating arms should be parallel with one another, when adjustment is correct.

4 Check that the brake pulls off correctly when the handlebar lever is released. Sluggish action can be due to a sports cable or one with a frayed inner.

11 Front wheel bearings: examination and replacement

All models

1 Place the machine on the centre stand and remove the front wheel as described in Section 4. On disc brake machines

remove the speedometer gearbox, drive gear and oil seal on the right-hand side of the hub and remove the spacer, oil seal and bearing retainer circlip from the left-hand side. To give access to the bearings on drum brake machines, first remove the brake shoes on the left-hand side of the hub and the drum extractor and oil seal from the right-hand side of the hub.

2 The wheel bearings can now be tapped out from each side with the use of a suitable long drift. Careful and even tapping will prevent the bearing 'tilting' and damage to the races.

3 Remove all the old grease from the hub and bearings, giving the latter a final wash in petrol. When the bearings are dry, lubricate them sparingly with a very light oil. Check the bearings for play and roughness when they are spun by hand. All used bearings will show a small amount of noise when spun but they should not appear rough. If there is any doubt about the serviceable of the bearings they should be renewed.

4 Before replacing the bearings pack them with high melting point grease. Do not overfill the hub centre with grease as it will expand when hot and may find its way past the oil seals. The hub space should be about 2/3 full of grease. Drift the bearings in, using a drift on the outside ring of the bearing. Do not drift the centre ring of the bearing or damage will be incurred. Replace the oil seals carefully, drifting them into place with a block shaped tube of approximately the same dimension as the oil seal. A large socket spanner is ideal.



5.3 Tip Remove spacers before drifting out bearings



5.4 Tip Old seals may be prised out on splayed iron with bearing



5.4 Tip Old and worn bearing opened on measurement



5.4 Tip Drive in bearings using suitable tubular drift

13 Rear wheel: examination and renovation

1 When inspecting the rear wheel follow the procedure given for front wheel inspection in either Section 3 or 9 of this Chapter, depending upon whether the wheel is of the spoked or cast alloy type.

2 The procedure for removal, examination and lubrication of the rear wheel bearings is essentially the same as that used when attending to the front wheel bearings. Follow the procedure given in the preceding Section.

14 Rear wheel: removal and replacement

1 Place the machine on the centre stand so that the rear wheel is clear of the ground. Separate the rear chain at the master link, and then replace the link on one end of the chain to avoid loss.

2 Remove the rear bolts which secure the chainguard and lift the guard away from the machine towards the rear.

XS 250 drum brake models

3 Detach the brake torque arm from the brake back plate by removing the special bolt, held by a nut and split pin. Unscrew the brake adjuster nut from the brake operating arm and disconnect the brake pedal, so that the nut leaves the operating arm. Push out the expander bolt, pin and washer to join the nut together with the adjuster nut. This will prevent loss of these last components and the brake rod spring.

Disc brake models

4 When removing the rear wheel on disc brake models, the rear suspension should be compressed a number of inches, to allow sufficient clearance between the brake caliper and the ground for the disc to be able to leave the caliper. A short length of steel tube with a hook or rubber end is supplied in the tool kit. When compressing the rear dampers this may be secured on two legs provided and we hold the suspension in the compressed position.

All models

5 Remove the split pin from the end of the wheel spindle and unscrew the nut. To free the wheel, withdraw the wheel spindle. If necessary, passing a screwdriver through the hole in the spindle head. As the spindle is withdrawn, the two chain adjuster units will fall free, together with the wheel spacer on the right-hand side of the spindle.

6 Lower the wheel and manoeuvre it from position between the swinging arm fork.

7 Refit the rear wheel by reversing the dismantling procedure. On drum brake models it is essential that the torque arm bolt is tightened fully and the split pin withheld. If the arm fails free in service, the rear brake will lock-up. The results of this are obvious.

Fig. 5.6 Rear wheel and final drive — components

1 Drive hub
2 Sprocket
3 Chain adjuster unit (RH unit)
4 Chain adjuster unit (LH unit)
5 Wheel distancer
6 Wheel rim
7 Rim tape
8 Inner tube
9 Tyre
10 Retaining sleeve
11 Spacer flange
12 Collar
13 Journal ball bearing
14 Oil seal
15 Journal ball bearing
16 Brake shoe - 2 off
17 Spring - 2 off
18 Fulcrum (cam shaft)
19 Drum
20 Brake band plate assembly
21 Grommet
22 Arm
23 Anchoring lever
24 Pivot bolt
25 Spacer
26 Chain adjuster - 2 off
27 Nut - 2 off
28 Bolt - 2 off
29 Wheel spindle
30 Split pin
31 Spacer
32 Bolt
33 Final drive sprocket
34 Locking plate - 2 off
35 Nut - 8 off
36 Chain
37 Joining link
38 Plate washer
39 Circlip
40 Collar
41 Dust cover
42 Washer
43 Countershaft nut
44 Torque arm
45 Bolt
46 Washer - 2 off
47 Spring washer
48 Nut
49 Split pin - 2 off
50 Bolt
51 Nut



13.3a Remove the right rear wheel trim to allow ...



13.3b ... the rear wheel nuts to be unscrewed



13.4 Pull road wheel and remove from disc face

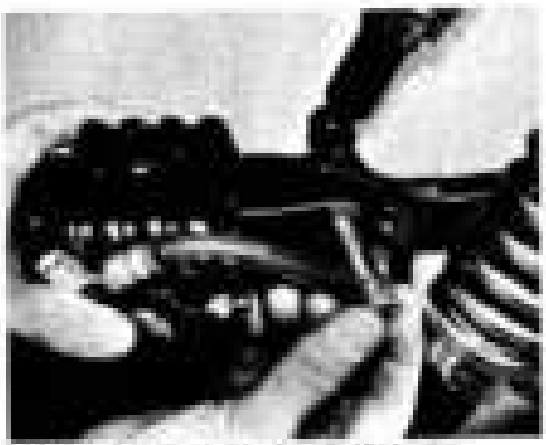
14 Rear brakes: removal, examination and replacement

Disc brake models

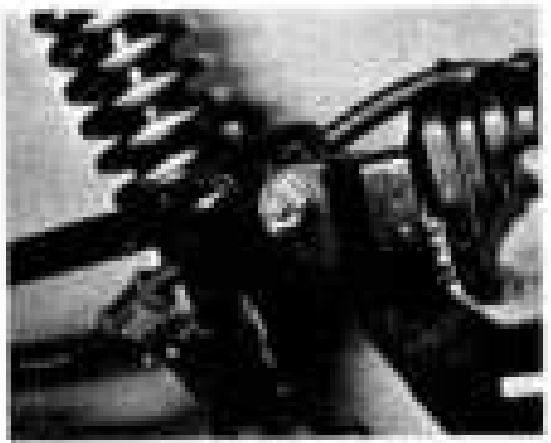
1 The rear disc brake calipers and discs are similar components to those used on the front brake of the machine, and for this reason basic maintenance and overhaul are fundamentally the same. Refer to the relevant section covering the front brake when carrying out any work.

XT 250 drum rear brake models

The rear drum brake fitted to the XG4800 and XG5000 – 01 is of the conventional single leading shoe type. When carrying out inspection refer to Section 9 which covers the twin leading shoe drum brake unit fitted to the front wheel of XG 3400-23 models. Bear in mind that only one fulcrum pin (camshaft) and operating arm is used and hence no trim nut is employed.



14.1a Rear disc caliper bolt has flat milled for location



14.1b Slacken the caliper bolt (arrowed)

19 Rear brake master cylinder - removal, examination and reassembly

1 The rear brake master cylinder is attached to the right-hand rear frame downtube and is operated from a foot pedal via a push rod connected to the pedal by a clevis fork and pin. The master cylinder reservoir is integral with the cylinder and has a cap held by three countersunk screws.

2 Disconnect the brake hose at the caliper unit by removing the banjo bolt. Drain the fluid by applying the rear brake until no more fluid emerges. Do not allow fluid to escape onto any cycle parts as rubber components. It is a first class solvent. Support the hose of the master cylinder where it is held by a banjo bolt.

3 The master cylinder is retained on the frame lug by two bolts. After removal of the bolts, the cylinder unit may be lifted upwards so that the operating pushrod leaves the cylinder.

4 Examination and dismantling of the master cylinder may be carried out in a manner similar to that given for the front brake master cylinder in Section 7.

5 After reassembly and replacement of the rear brake master cylinder components which may be made by reversing the dismantling procedure – bleed the rear brake system of air by referring to Section 11 of this Chapter.

20 Rear brake pedal height - adjustment

1 The pivot shaft upon which the rear brake pedal is mounted is splined to allow adjustment of the pedal height to suit individual requirements.

2 To adjust the height, loosen and remove the pivot bolt which passes into the rear of the pedal. Draw the pedal off the splines and refit it on the required angle. Ideally the pedal should be fitted so that it is positioned just below the rider's right foot, when the rider is seated normally, in this way the foot does not have to be lifted before the brake can be applied.

3 The upper limit of travel of the brake pedal may be adjusted by means of the push pod locknut fitted to the pedal pivot mounting bracket. On most brake models the rear brake adjustment should be checked after making pedal height adjustments by means of the pivot bolt.

4 On disc brake models it will be seen that adjustment of pedal height by this method will impart a small degree of movement to the master cylinder piston and so apply the brake slightly. To rectify this, slacken the locknut on the master cylinder pushrod and screw the rod into the clevis fork until free play can be felt between the end of the rod and the master cylinder piston (measure the rod until it contacts the piston lightly and

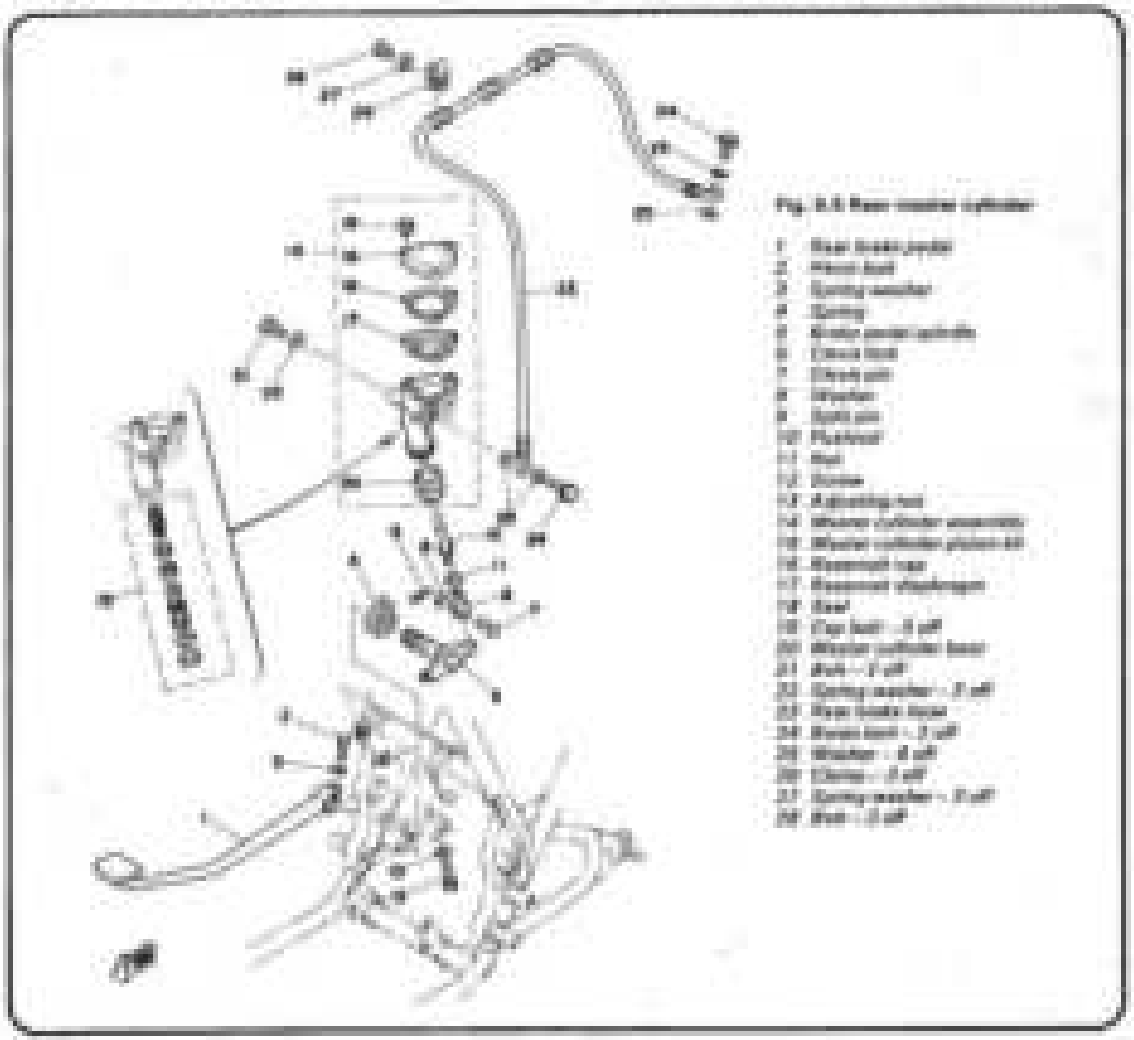


Fig. 9.6 Rear master cylinder

1 Rear brake pedal
2 Pivot bolt
3 Spring washer
4 Spring
5 Brake pedal spindle
6 Clevis fork
7 Clevis pin
8 Washer
9 Split pin
10 Pushrod
11 Nut
12 Screw
13 Adjusting nut
14 Master cylinder assembly
15 Master cylinder piston kit
16 Reservoir cap
17 Reservoir diaphragm
18 Seal
19 Cap bolt - 3 off
20 Master cylinder body
21 Bolt - 2 off
22 Spring washer - 2 off
23 Rear brake hose
24 Banjo bolt - 2 off
25 Washer - 4 off
26 Clamp - 2 off
27 Spring washer - 2 off
28 Bolt - 2 off

...turn, turn it back ½ – ¾ turns to give the correct free play. Without allowing the pushrod to turn, tighten the locknut. Note the pin hole in the pushrod is incorporated to show when the pushrod is screwed out of the clevis fork further than is safe. If the pin hole shows above the locknut there is some danger of the rod blowing at the threads. Re-adjust to correct this.

3 Adjustment of the pedal stop necessitates readjustment of the rear stop lamp switch.

17 Disc brake: bleeding the hydraulic system

1 Removal of all the air from the hydraulic system is essential for the efficiency of the braking system. Air can enter the system due to leaks or when any part of the system has been disconnected for repair or overhaul. Topping the system up will not suffice, as air pockets will still remain, even small amounts causing a dramatic loss of brake pressure.

2 Check the level in the reservoir, and fill almost to the top. Again, beware of spilling the fluid on to painted or plastic components.

3 Place a clean jar below the brake caliper unit and attach a clear plastic tube from the caliper bleed screw to the container. Pump some clean hydraulic fluid to the container so that the pipe is always immersed below the surface of the fluid.

4 Unscrew the bleed screw one complete turn and quickly the handbrake lever apply. As the fluid is ejected from the bleed screw the lever to the treatment will fall. Take care that the lever does not drop too low whilst the operation continues, otherwise air will be drawn into the system, necessitating a fresh start.

5 Continue the pumping action with the lever until no further air bubbles emerge from the end of the plastic pipe, apply one brake when applied the handbrake and tighten the caliper bleed screw. Release the plastic tube **after** the bleed screw is closed.

6 Check the brake action for spongyness, which usually denotes there is still air in the system. If the action is spongy, continue the bleeding operation in the same manner until all traces of air are removed.

7 When all traces of air have been removed from the system, top up the reservoir and refit the diaphragm and cap or cover as appropriate. Check the entire system for leaks, and check also that the brake system in general is functioning efficiently before using the machine on the road.

8 Bleeding of the rear brake system should be carried out in a similar manner, using the rear brake pedal to apply on the handlebar lever.

9 Brake fluid stored from the system will absorb certainly be contaminated, either by foreign matter or more commonly by the absorption of water from the air. All hydraulic fluids are to some degree hygroscopic (that is they are capable of drawing water from the atmosphere and thereby degrading their specifications to some of any, and the relative characteristics of the fluid, old fluid should always be discarded.

18 Rear wheel sprocket: examination and replacement

1 The rear wheel sprocket is mounted on the left hand side of the hub by a flange chimp, and is located by four pegs which take into the main drive in the hub and are retained by hexagonal nuts.

2 To remove the sprocket, detach the large circlip and the spacing plate which lies behind. The sprocket can be removed complete with drive pegs, but it is probable that the pegs are retained in the dead (wheel) bracket as the fixing nuts/bolts. If this is the case, knock down the tabs of the tab washers and remove the peg retaining nuts. The sprocket can then be lifted off with ease.

3 Check the condition of the sprocket teeth. If they are hooked, chipped or badly worn, the sprocket must be renewed. It is considered bad practice to renew one sprocket on its own. The final drive sprockets should always be renewed as a pair and a new chain fitted, otherwise rapid wear will occasioned soon after renewal on the new sprocket.

4 The sprocket may be refitted by reversing the dismantling procedure. It is important that the recesses in the rear of the sprocket are engaged correctly by the drilled flats on each main drive pin.

19 Rear wheel: examination and renovation

1 The main drive assembly consists of four rubber bushes located in the hub. The four splined pegs retained by nuts on the sprocket locate with these bushes, to give a cushioning effect to the sprocket and drive.

2 To obtain access to the bushes, the sprocket has to be removed by detaching the circlip and pulling it from the wheel hub. Removal of the bushes is sometimes rather more a awkward extraction requirement. As stated in the previous Section the pegs may serve after a considerable length of time. If this occurs, the sprocket complete with pegs should be driven from the hub using a hammer and drift. Mentioning plate of bar. Hammered from small steel, and have to be made and placed over the bushing. The sprocket bolted screws can then bear against the bar.

3 Removal of the bushing is known impossible without the use of a special expanding extractor. It is recommended that the wheel be returned to a Yamaha dealer who can carry out the work without risk of damage to the wheel.



10.2 A – Front engine bolt, B – Pivot rod adjuster bolts



10.2a Exploded view to remove sprocket and main drive pins



















18.2D To separate sprocket from drive centre note



18.2c Note spacers on inner drive pegs

20 Final drive chain: examination and lubrication

1 The final drive chain is fully exposed, with only a light shield over the top run. Periodically the tension will need to be adjusted, to compensate for wear. This is accomplished by slacking the nut/bolts on the centre stand and slackening the wheel nuts on the left hand side of the rear wheel so that the wheel can be drawn backward by means of the adjusters situated on the fork ends. On drum brake models the torque arm bolt should be slackened after removal of the split pin, to allow the brake back plate to move.

2 The chain is in correct tension if there is approximately 20 mm (¾ inch) slack in the middle of the lower run. Always check when the chain is at the tightest point as a chain rarely wears evenly during service.

3 Always adjust the drawbolts an equal amount in order to preserve wheel alignment. The fork ends are clearly marked with a series of vertical lines above the adjusters, to provide a simple, visual check. If desired, wheel alignment can be checked by running a piece of wood parallel to the machine, so that it touches the side of the rear tyre. If the wheel alignment is correct, the piece will be equidistant from each side of the front wheel tyre, when tested on both sides of the rear wheel. It will not touch the front wheel tyre because this tyre is of smaller cross section than accompanying engine.

4 Re-tighten the chain overnight to compensate for unseen wear. A tight chain will place undue stress on the gearbox and rear wheel bearings, leading to their early failure. It will absorb a surprising amount of power.

5 After a period of running, the chain will require lubrication. Lack of oil will greatly accelerate the rate of wear of both the chain and the sprockets and will lead to harsh transmission. The application of engine oil will act as a temporary expedient but it is preferable to remove the chain and clean it in a paraffin bath before it is immersed in motor lubricant such as 'Linklyfe' or 'Chainguard'. These lubricants achieve better penetration of the chain links and rollers and are less likely to be thrown off when the chain is in motion.

6 To check whether the chain is due for replacement, lay it lengthwise in a straight line and compress it endwise so that all the play is taken up. Another one and pull measure the length. Now pull the chain with one end anchored firmly, so that the chain is fully extended by the amount of play in the opposite direction. If there is a difference of more than ¼ inch per foot in the two measurements, the chain should be replaced in conjunction with the sprockets. Note that this check should be made AFTER the chain has been washed and but BEFORE any lubricant is applied, otherwise the lubricant may take up some of the play.

7 When replacing the chain, make sure that the spring link is fitted correctly, with the closed end facing the direction of travel.

8 Replacement chains are now available in standard chains sizes from Renold Limited, the British chain manufacturer. When ordering a new chain, always quote the size, the number of chain links and the type of machine to which the chain is to be fitted.

21 Tyres: removal and replacement

1 At some time or other the need will arise to remove and replace the tyres, either as a result of a puncture or because replacements are necessary to effect wear. To this inexperienced, tyre changing represents a formidable task, yet if a few simple rules are observed and the technique learned, the whole operation is surprisingly simple.

2 To remove the tyre from either wheel, first detach the wheel from the machine. Deflate the tyre by removing the valve insert and when it is fully deflated, push the bead from the tyre away from the wheel rim on both sides so that the bead enters the centre well of the rim. Remove the locking cap and push the tyre valve into the tyre itself.

3 Insert a tyre lever close to the valve and lever the edge of the tyre over the outside of the wheel rim. Very little force should be necessary. If resistance is encountered it is probably due to the fact that the tyre beads have not entered the well of the wheel rim on the area round the tyre.

4 Once the tyre has been edged over the wheel rim, it is easy to work around the wheel so that the tyre is completely free on one side. At this stage, the inner tube can be removed.

5 Working from the valve side of the wheel, ease the other edge of the tyre over the outside of the wheel rim, that is furthest away. Continue to work around the rim until the tyre is fully removed from the rim.

6 If a puncture has necessitated the removal of the tyre, confirm the inner tube and immerse in a bowl of water to locate the source of the leak. Mark its position and deflate the tube. Dry the tube and clean the area around the puncture with a petrol soaked rag. When the surface has dried, apply rubber solution and allow this to dry before removing the backing from the patch and applying the patch to the surface.

7 It is best to use a patch of self-vulcanising type, which will form a very permanent repair. Note that it may be necessary to remove a protective covering from the top surface of the patch, after it has sealed into position. Inner tubes made from synthetic rubber may require a special type of patch and adhesive. If a service tyre is to be purchased

8 Before removing the tyre, check the inside to make sure the agent that caused the puncture is not trapped. Check the outside of the tyre, particularly the tread area, to make sure nothing is present that may cause a further puncture.

9 If the inner tube has been patched on a number of past occasions, or if there is a tear or large hole, it is preferable to discard it and fit a replacement. Sudden deflation may cause an accident, particularly if it occurs with the front wheel.

10 To replace the tyre, inflate the inner tube sufficiently for it to become a circular shape but only just. Then push a little the tyre so that it is enclosed completely. Lay the tyre on the wheel at an angle and insert the valve through the rim base and the hole in the wheel rim. Inflate the locking cap on the first few threads sufficient to hold the valve captive in its correct location.

11 Starting at the point furthest from the valve, push the tyre bead over the edge of the wheel rim until it is located in the central well. Continue to work around the tyre in this fashion until the whole of one side of the tyre is on the rim. It may be necessary to use a tyre lever during the final stages.

12 Make sure there is no pull on the tyre valve and again commencing with the area furthest from the valve, ease the other bead of the tyre over the edge of the rim. Finish with the area close to the valve, pushing the valve up into the tyre until the locking cap touches the rim. This will ensure the inner tube is not crimped when the last section of the bead is edged over the rim with a tyre lever.

13 Check that the inner tube is not trapped at any point. Reinflate the inner tube, and check that the tyre is seating correctly around the wheel rim. There should be a thin rib moulded around the wall of the tyre on both sides, which should be equidistant from the wheel rim at all points. If the tyre is unevenly located on the rim, try bouncing the wheel when the tyre is at the recommended pressure. It is possible that one of the beads has not pulled clear of the centre well.

14 Always run the tyres at the recommended pressures and never under or over-inflate. The correct pressures for solo use are given in the Specifications Section of this Chapter.

15 Tyre replacement is aided by dusting the side walls, particularly in the vicinity of the beads, with a liberal covering of talcum chalk. Washing-up liquid can also be used to good effect, but this has the disadvantage of causing the inner surfaces of the wheel rim to rust or corrode.

16 Never replace the inner tube and tyre without first ensuring that the rim tape is positioned correctly so that it covers the entire well in the wheel rim. This is to prevent the ends of the spoke nipples chafing the inner tube which will result in a slow puncture.

17 Never fit a tyre that has a damaged tread or side wall. Apart from the legal aspects, there is a very great risk of a blowout, which can have serious consequences on any two-wheeled vehicle.

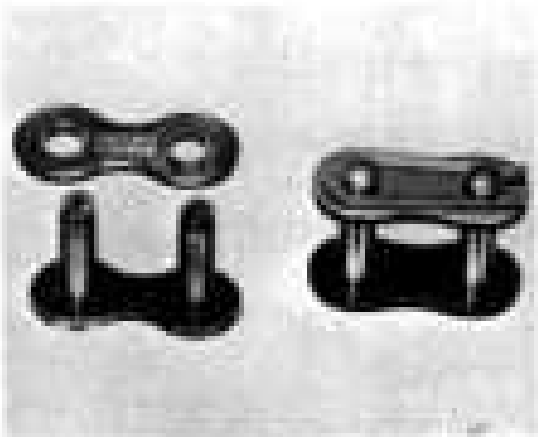
18 Tyre valves rarely give trouble, but it is always advisable to check whether the valve itself is leaking before removing the tyre. Do not forget to fit the dust cap, which forms an effective second seal.



33.3 Hub axle are marked to aid wheel realignment



33.7 Spring link closed end must point in direction of chain travel



33.8 A Bonair-made drain of equivalent type is available

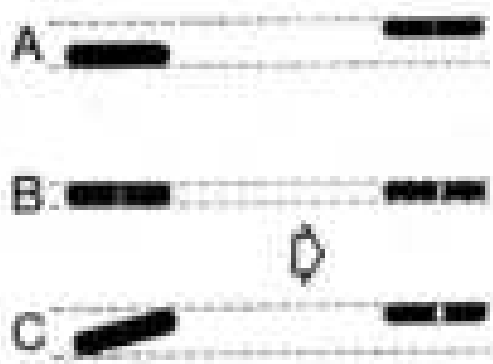


Fig. 8.8 Method of checking wheel alignment

A and C incorrect
B correct

22 Front wheel balancing

1 The front wheel should be statically balanced, complete with tyre. An out of balance wheel can produce dangerous wobbling at high speed.

2 Some tyres have a balance mark on the sidewall. This must be positioned adjacent to the valve. Even so, the wheel will require balancing.

3 With the front wheel clear of the ground, spin the wheel several times. Each time, it will probably come to rest in the same position. Balance weights should be attached diametrically opposite the heavy spot, until the wheel will not come to rest in any set position, when spun.

4 Balance weights, which clip round the spokes are available in 5, 10 or 20 grammes weights. If they are not available, wire (clear wrapped round the spokes and secured with insulating tape will make a substitute.

5 It is possible to have a wheel dynamically balanced at some dealers. This requires the removal.

6 There is no need to balance the rear wheel under normal road conditions, although any tyre balance mark should be aligned with the valve.

7 Machined finish with cast aluminium wheels require special balancing weights which are designed to clip onto the centre rim flange, much in the way that weights are affixed to car wheels. When fitting these weights, take care not to affix any weights near than 40 mm (1 5/8 in) to the radial centre line of any spoke. Refer to the accompanying diagram.

23 Tyre valve dust caps

1 Tyre valve dust caps are often left off when a new tyre has been replaced, despite the fact that they serve an important two fold function. Firstly they prevent dirt or other foreign matter from entering the valve and causing the valve to stick open when the tyre pump is next applied. Secondly, they form an effective second seal as that in the event of the tyre valve sticking, an well sort has been.

2 Isolated cases of sudden deflation at high speed have been traced to the omission of the dust cap. Centrifugal force has resulted in dirt the tyre valve off its seating and because the dust cap is missing, there may been no second seal. Rising hotel valley complain personal for this happening because the valve inserts was fitted with stronger springs, but standard brass tubes do not, hence the need for the dust cap.

3 Bear that when a dust cap is fitted for the first time the wheel may have to be rebalanced.

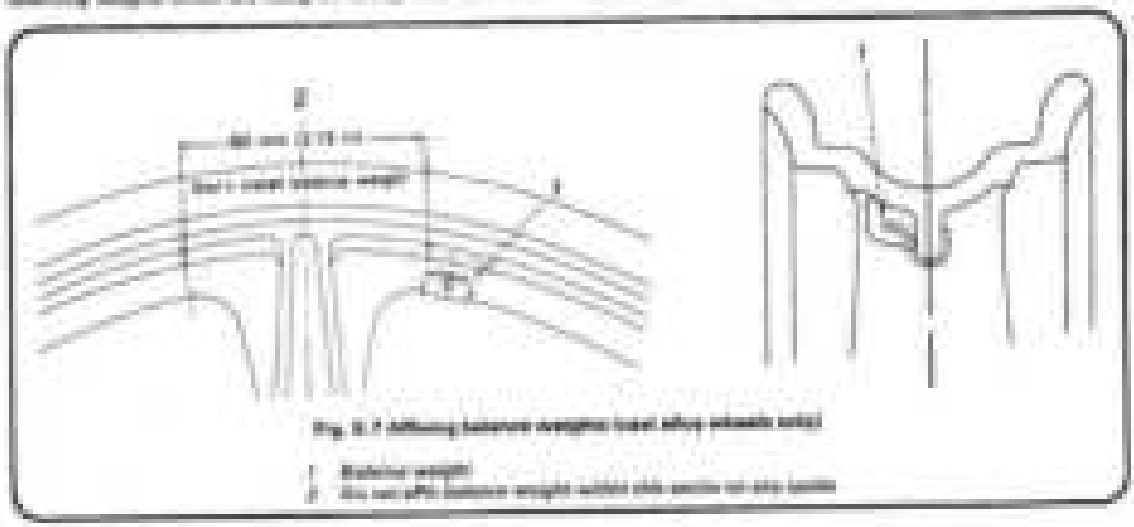


Fig. 5.7 Affixing balance weights (cast alloy wheels only)

1 Balance weight
2 Any two affix balance weight within this section not any beside

24 Fault diagnosis: wheels, brakes and tyres

Symptom	Cause	Remedy
Handlebars oscillate at low speeds	Buckle or flat in wheel rim; most probably front wheel	Check rim alignment by spinning wheel. Correct by retensioning spokes or having wheel rebuilt on new rim
	Tyre not straight on rim	Check tyre alignment
Machine tends to veer one way when brakes applied	Brakes binding	Hot brake drums provide best evidence. Readjust brakes (as described in text). Grease cable both ends, remove and lubricate both end bush
Brakes grab when applied gently	Brake shoes/pads worn out (indicated by groove in brake drum almost worn through)	Check with rider. Light cut (skim) in lathe (specialist attention needed)
Brake pull-off sluggish	Brake cam binding in bearing. Weak brake shoe return spring	Free and grease. Replace. If brake springs non-displaceable
Hands hot and bothered	Worn or badly adjusted chains. Seized or badly worn sprockets	Adjust or replace as necessary. Replace as a pair, together with chain

Chapter 6 Electrical System

Contents

General description ... 1
Charging system: general ... 2
Alternator: checking output performance ... 3
Silicon rectifier: location and testing ... 4
Voltage regulator: operating principles, testing and adjustment ... 5
Battery: examination and maintenance ... 6
Battery: charging procedure ... 7
Fuses: location and replacement ... 8
Headlamp: replacing bulbs and adjusting beam height ... 9
Handlebar switches: function and replacement ... 10
Stop and tail lamp: replacing the bulbs ... 11
Flashing indicator lamps ... 12
Flasher unit: location and replacement ... 13
Starter motor: removal, examination and reassembly ... 14
Starter solenoid switch: function and location ... 15
Starter motor: free running clutch: examination and renovation ... 16
Speedometer and tachometer heads: replacement of bulbs ... 17
Warning lamps: console: replacement of bulbs ... 18
Stop lamp switches: location and replacement ... 19
Horn: location and examination ... 20
Wiring: layout and examination ... 21
Ignition and lighting switch ... 22
Fault diagnosis: electrical system ... 23

Specifications

	SR500 model	All other models
Battery		
Make	GS	YUASA or Yuasa
Type	12N7-3A-1	12N12-4A-1
Voltage	12V	12V
Capacity	7Ah	12Ah
Earth	Negative	Negative
Alternator		
Type	Rectifier fixed coil	
Output	14.5V, 13A + 0.5V at 5,000 rpm	
Stator Coil resistance	0.72 ohms ± 10% at 23°C (68°F)	
Field Coil resistance	4.04 ohms ± 10% at 23°C (68°F)	
Voltage regulator		
Type	Electric mechanical, three point	
Regulating voltage	14.5 ± 0.5V	
Starter motor (except KS380E2D)		
Make	Mitsuba	
Type	MM123B	
Output	0.7Kw	
Brush length	11 – 12.5 mm (0.43 – 0.49 in)	
Wear limit	8.0 mm (0.31 in)	
Armature Coil resistance	0.035 ohms ± 10% at 23°C (68°F)	
Field Coil resistance	0.01 ohms ± 10% at 23°C (68°F)	
Commutator diameter (min)	27 mm (1.06 in)	
Mica undercut	0.7 mm (0.03 in)	

Bulbs

Headlamp	40/45W (US/Other USA)
Pilot lamp	3W (US only)
Tail/Stop lamp	8/27W x 2
Flashing indicators	27W x 4
Rear/fog warning lamp	3.4W x 2
Instrument light	3.4W x 2
Neutral indicator light	3.4W
Oil pressure warning light	3.4W
High beam indicator	3.4W

Air bubbles cleared out (12V)

1 General description

The Yamaha 650SE, 660 and 400 models are all fitted with electrical systems of similar type.

Power is generated by a 12 volt alternator, the fabricated rotor of which is fitted to the extreme left-hand end of the crankshaft. The stator unit is fitted within the alternator cover, together with a field coil which induces a magnetic field in the rotor. The AC current is converted to DC by a silicon rectifier, to allow the battery and electrical ancillaries to be fed. The charging voltage is controlled by an electro-mechanical voltage regulator which is interconnected with the field coil.

2 Charging system: General

1 As stated above, the electrical charging system consists of an alternator, a rectifier and a voltage control unit. If the charging system output is suspect, the performance of the system as a whole should be checked first. If the rotor is found lacking, the various components should be checked individually to eliminate the faulty item.

2 The tests described in the following section, all of which relate to the charging system, require the use of a multimeter with resistance functions. It is recommended that unless this equipment is available, and unless some previous experience in its operation has been gained, the machine be returned to a Yamaha Service Agent who will have the necessary equipment and expertise to carry out the work. Inappropriate damage to the electrical components may result from hookmeter use of the machine's charging circuit wiring.

3 If testing is to be carried out, the following points should be noted:

1) Ensure that the battery is fully charged when making voltage checks.
2) **NEVER** disconnect the leads from the battery whilst the alternator is operating.
3) **NEVER** reverse the polarity of the battery terminals.
4) Take especial care to avoid incorrect connection of wires or short circuiting the wires against earth points.
5) Do not operate the rectifier directly to the battery or use attempt to make a continuity test.
6) Always disconnect the battery before removing electrical components.

Disconnect the two main leads which run from the alternator casing to the black connectors behind the left-hand side panel. Separate the connectors. Select the field winding lead (Green, Green/ Orange, Green) and, using the multimeter set to the resistance function, check the resistance of the field winding across the two green wires. The resistance should be 4.0 ohms ± 10% at 20°C (68°F). If the reading does not conform to that given, the coil is faulty and should be renewed, or a wiring continuity fault has become loose. Select the second main lead from the alternator (three white wires) and test the resistance across each successive pair of wires. Three readings should be taken. Each reading should show a resistance of 0.72 ohms ± 10% at 20°C (68°F). Incorrect readings indicate faulty wiring or damaged coils.

5 When taking resistance readings, it should be noted that variations in ambient temperature will have a proportionate effect on the values that are given.

6 If the resistance value of the coils is found to be correct, the alternator can be considered to be in good condition. Continue the testing of the charging circuit by referring to the following Section.



2.7 Make a visual check of the alternator coil for loose wires

3 Alternator: checking output performance

1 Connect a dc voltmeter across the two battery terminals. Start the engine and raise the engine speed to 2000 rpm or more. The correct voltage reading is 14.5 ± 0.5V.

2 If a voltage reading above or below the recommended figure is recorded, the alternator winding resistance values should be checked as follows.

4 Silicon rectifier: location and testing

1 The rectifier is located behind the frame left-hand side cover, where it is secured to the battery box by a single screw. The rectifier is a sealed unit, which converts an current from the alternator to dc current. If the charging system has malfunctioned, but the alternator is found to be in good condition, the rectifier should be checked.

2 Disconnect the rectifier lead at the block connector. Set the multimeter to the resistance function and connect the positive probe to the red (+) rectifier terminal. Check the continuity between this terminal and each of the remaining four leads in turn. Continuity should be registered on each test. Now connect the positive probe to the black (-) terminal on the rectifier and repeat the test. Continuity should be registered. Reverse both meter leads with the multimeter probes reversed; in this latter case no continuity should be found.

3 If any incorrect readings are given, the rectifier should be renewed.

5 Voltage regulator: operating principle, testing and adjustment

1 The voltage regulator is fitted within the electrical system to control the current from the generator and keep it constant as engine speed variations would otherwise make the power output rise and fall. By decreasing the field current when the engine speed is high and increasing it when it is low, the generated voltage is maintained at a constant level regardless of engine speed variations. The voltage regulator has been designed to conform to these operating conditions.

2 If problems with the charging system have developed and the alternator and rectifier have been tested and found to be in working order, the regulator may be checked using a dc voltmeter with a range of 0-20 volts. The battery should be fully charged for this test.

3 Start the engine and disconnect the wire running from the battery positive (red) terminal to the fuse box. Connect the voltmeter from the wire to a suitable earth point. Increase the engine speed to 2500 rpm and check the reading, which should be 13.9 - 14.6 volts. If the voltage is outside the range given, stop the engine and remove the voltage regulator cover, which is held by two small screws. A small screw bearing against a spring steel plate is provided to allow a limited amount of adjustment to be made to the regulator. Turning the screw clockwise will increase the charging voltage and turning it counterwise will reduce the voltage.

4 If the voltage regulator will not respond to adjustment, or fluctuations are noticed, the complete unit should be renewed.



5.1 Voltage regulator is mounted below fuse box

6 Battery: examination and maintenance

1 A Yuasa sealed battery of 12 amp hours capacity is fitted as standard to all but the GS650 - 2G model. The GS650 - 2G has a battery of only 7 amperes per hour capacity because it is not fitted with a starter motor and therefore does not have to supply additional current.

2 The translucent plastic case of the battery permits the upper and lower levels of the electrolyte to be observed when the battery is fitted from its housing below the dualseat. Maintenance is normally limited to keeping the electrolyte level between the prescribed upper and lower limits and to making sure the vent pipe is not blocked. The lead plates and inter separators can be seen through the transparent case, a further guide to the general condition of the battery.

3 Unless acid is spilt, no more than the maximum falls when the electrolyte should always be topped up with distilled water, to restore the correct level. If acid is spilt on any of the machine, it should be neutralised with an alkali such as washing soda and washed away with plenty of water, otherwise serious corrosion will occur. Top up with sulphuric acid of the correct specific gravity (1.260 - 1.280) only when spillage has occurred. Check that the vent pipe is well clear of the frame tubes or any of the other cycle parts, for obvious reasons.

7 Battery: charging procedure

1 The correct charging rate for the 12 AA battery is 1.2 amps, and for the 7 AH battery is 0.7 amps. A higher charge rate should, if possible, be avoided since it will shorten the working life of the battery.

2 Make sure that the battery charger connections are correct, red to positive and black to negative. It is preferable to remove the battery from the machine while it is being charged and to remove the vent plug from each cell. When the battery is reconnected to the machine, the black lead must be connected to the negative terminal and the red lead to positive. This is most important, as the machine has a negative earth system. If the terminals are inadvertently reversed, the electrical system will be damaged permanently.

8 Fuse: location and replacement

1 A bank of fuses is contained within a small plastic box mounted to the rear of the battery box. The box contains four 10A fuses and two 20A fuses, of which one of each type is spare.

2 Before replacing a fuse that has blown, check that no obvious short circuit has occurred, otherwise the replacement fuse will blow immediately it is inserted. It is always wise to check the electrical circuit thoroughly to locate the fault and eliminate it.

3 When a fuse blows while the machine is running and no spare is available, a 'get you home' remedy is to remove the blown fuse and locate it in other cases before replacing it in the fuseholder. The silver paper will restore the electrical continuity by bridging the broken fuse wire. This expedient should **NEVER** be used if there is evidence of a short circuit or other major electrical fault, otherwise more serious damage will be caused. Replace the 'deceased' fuse at the earliest possible opportunity, to restore full circuit protection.

9 Headlamp: replacing bulbs and adjusting beam height

1 In order to gain access to the headlamp unit the rim must be removed. Remove the two screws from just below the rim at the 9 o'clock and 3 o'clock positions and pull the rim out at the lower edge. The rim complete with the unit will pull free. Pull the wiring socket off the rear of the reflector unit.

2 On UK models the headlamp bulb is secured in the rear of the reflector unit by a spring loaded bayonet fitting collar or by a plastic screw collar. The bulb in the bayonet type may be released by depressing the spring loaded collar and twisting it to the left. Release the collar and pull out the bulb. On the latter unit

shadows the notch. In both cases the bulb locates positively in the reflector so that it can be refitted only in one position.

3 The pilot light holder is a push fit in the reflector, the bulb being of the bayonet fitting type. To release, press the bulb inwards and twist to the left.

4 On machines of USA specification no bulb as such is fitted. A single sealed unit comprising the headlamp glass reflector and the twin light filament is utilised. Consequently if either or both filaments fail, the complete unit must be renewed. No provision is made for a pilot bulb.

5 To remove the rim from the sealed beam unit and the unit housing, first unscrew the long adjuster screw which passes through the rim on the left-hand side. Note the sequence of the spacer washer and spring. Unscrew the two screws at the outer and lower rim brackets and detach the rim. The replacement sealed unit can be fitted by reversing the dismantling procedure.

6 Vertical adjustment of the headlamp can be made by slackening the two mounting bolts. Provision for horizontal adjustment is given only on sealed beam units and is made using the screw in the headlamp rim. The headlamp adjustments should be arranged so that the main beam will not dazzle a person standing at a distance greater than 25 feet from the lamp, whose eye level is not less than 3 feet 6 inches above the ground.

7 To obtain the correct beam height, place the machine on level ground facing a wall 25 feet distant, with the rider seated normally. The height of the beam centre should be equal to the height of the centre of the headlamp from the ground, when the dip switch is in the main beam position. Furthermore, the non-dazzle area of light should be centrally disposed. Adjustments in either direction are made by rearranging the angle of the headlamp, as described in the preceding paragraph. Note that a different beam setting will be needed when a pillion passenger is carried. If a pillion passenger is carried regularly, the passenger should be present in addition to the rider when the beam setting adjustment is made.

8 The above instructions for beam setting relate to the requirements of the United Kingdom's transport lighting regulations. Other settings may be required in countries other than the UK.



9.7 Spare bulbs are contained in the tool box lid

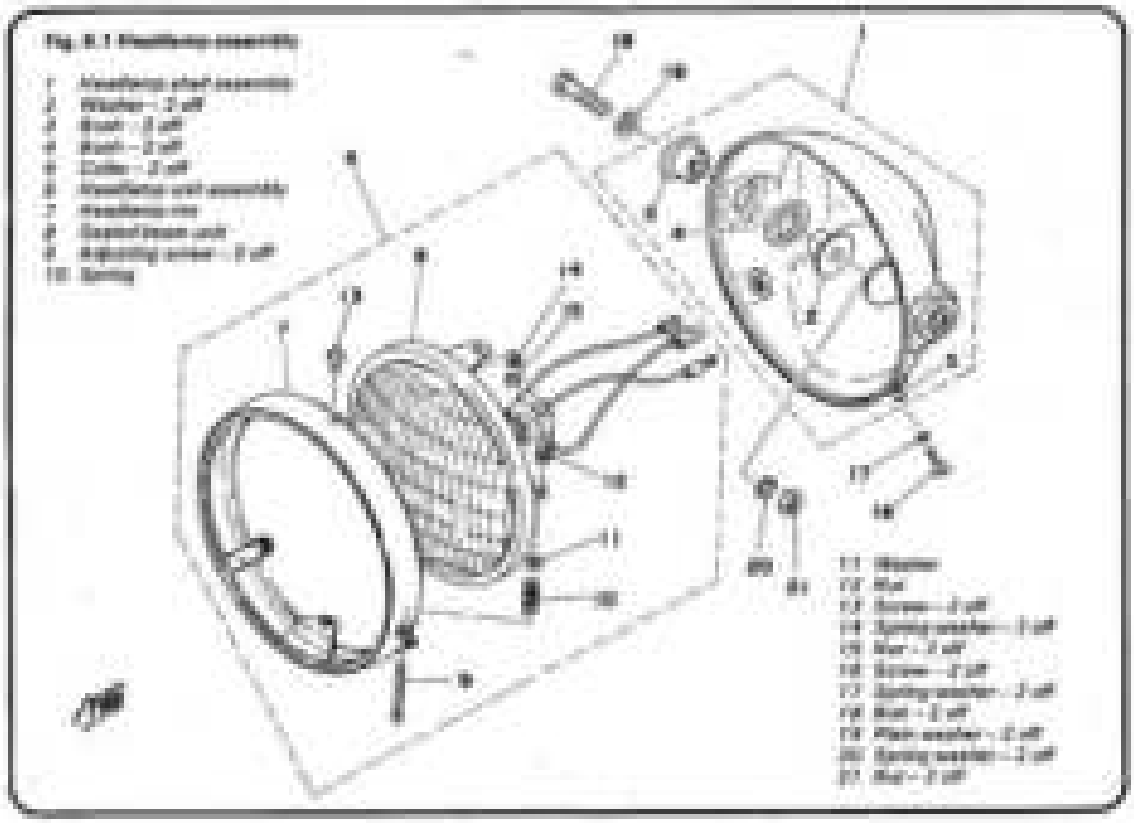


Fig. 9.1 Headlamp assembly













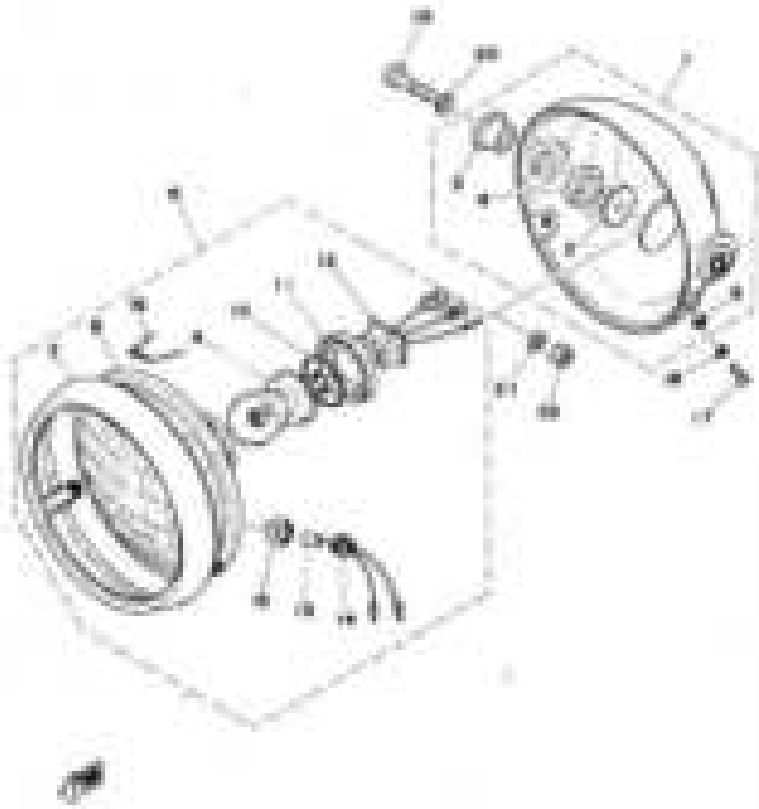


Fig. 8.2 Headlamp assembly

1 Headlamp shell assembly
2 Sealing washer - 2 off
3 Bezel - 2 off
4 Bezel - 2 off
5 Cable - 2 off
6 Reflector unit
7 Rim
8 Reflector/lens assembly
9 Headlamp bulb
10 Ring
11 Screw cutter
12 Spacer
13 Filler bulb
14 Bulb holder
15 Grommet
16 Spring clip - 4 off
17 Screw - 2 off
18 Washer - 2 off
19 Bolt - 2 off
20 Washer - 2 off
21 Spring washer
22 Nut - 2 off

10 Headlamp switches: function and replacement

1 The dipswitch horns part of the left-hand stainless steel grip which contains the horn button and the indicator lamp switch. The right-hand twist grip assembly incorporates the lighting master switch and a three position ignition position (on-test) switch.

2 In the event of failure of any of these switches, the switch assembly must be replaced as a complete unity since it is not practicable to effect a permanent repair.

11 Stop and tail lamps: replacing the bulbs

1 The tail lamp is fitted with twin bulbs (Standard bulbs of 12 volt, @21 rating) to illuminate the rear number plate and rear of the machine, and to give visual warning when the rear brake is applied. To gain access to the bulbs remove the plastic lens cover, which is retained by two Torq screws. Check that the gasket between the lens cover and the main body of the rear is in good condition.

2 The bulbs have a bayonet fitting and have staggered pins to prevent the bulb contacts from being reversed.

3 If the tail lamp bulbs keep blowing, suspect either alteration of the rear mudguard or more probably, an intermittent earth connection.

12 Flashing indicator lamps

1 The forward facing indicator lamps are connected to stalks which are attached to the ends of the fork shrouds. The hollow stalks carry the leads to the lens unit. The rear facing lamps are mounted on similar, shorter stalks, at a point immediately to the rear of the mudguard.

2 In each case access to the bulb is gained by removing the plastic lens cover, which is retained by two screws. Bayonet fitting bulbs of the single filament type are used, each with a 12 watt/21W rating.

13 Flasher unit: location and replacement

1 The flasher relay unit is located under the dualseat facing rubber mounted on the frame.

2 If the flasher unit is functioning correctly, a series of audible clicks will be heard when the ignition ignited and in action. If the unit malfunctions and all the bulbs are in working order, the usual symptom is one initial flash before the unit goes dead. It will be necessary to replace the unit complete if the fault cannot be attributed to any other cause.

3 In addition to the flasher unit, an electronic flasher cancelling unit is incorporated in the indicator system on all but RS/BD - 250 models. The unit automatically turns the flasher light off a certain time after the flasher switch has been operated. The time taken is dependent on the speed of the machine. If the machine is travelling fast, the unit cancels automatically after a short time. The slower the machine is travelling, the longer the time taken for cancellation. The system may be overridden manually by pushing the indicator switch button towards

4 Take great care when handling either unit because they are easily damaged if dropped.



13.1a Disconnect wiring here on models with fuse-box/relay unit and ...



13.1b ... disconnect wiring here on models with fuse-box/relay unit



13.1c Disconnect wiring here on models with fuse-box/relay unit



13.1d Disconnect wiring here on models with fuse-box/relay unit



13.2 Cold start warning flasher unit is located above flasher unit

14 Starter motor - removal, examination and replacement

All except 2.0 16V (X5) models

1 An electric starter motor, operated from a small push-button on the right-hand side of the handlebars, provides an effortless and more convenient method of starting the engine, without having to use the kickstart. The starter motor is mounted within a compartment at the rear of the cylinder block, covered by an oblong, chromium plated cover. Current is supplied from the battery via a heavy duty solenoid switch and a cable capable of carrying the very high current demanded by the starter motor on the initial start up.

2 The starter motor drives a free running clutch immediately behind the generator rotor. The clutch ensures the starter motor drive is disconnected from the primary transmission immediately the engine starts. It operates on the centrifugal principle, spring loaded rollers take up the drive until the centrifugal force of the rotating engine overcomes their resistance and the drive is automatically disconnected.

8 To remove the starter motor from the engine unit, first disconnect the positive lead from the battery, then the starter motor cable from the solenoid switch. Pull the starter cable down through the frame so that it may be detached still connected to the starter motor. The alternator cover must be removed from the left-hand side of the engine to enable rewinding the starter drive sprocket with the splined starter shaft, during reassembly. Remove the two bolts in the aluminium plated cover over the starter motor housing and lift the cover away, complete with gasket. The starter motor is secured to the crankcase by two bolts which pass through the right-hand end of the motor casing. When these bolts are withdrawn, the motor can be eased out of position and lifted out of its compartment, with the heavy duty cable still attached.

9 The parts of the starter motor most likely to require attention are the brushes. The end cover is retained by the two long screws which pass through the rigid cast on bosses and pinions. If the screws are withdrawn, the end cover can be lifted away and the brush gear exposed.

10 Lift up the spring clips which bear on the end of each brush and remove the brushes from their holders. Each brush should have a length of 11.0 - 12.5 mm (0.43 - 0.49 in). The minimum allowable brush length is 8 mm (0.315 in). If the brush is shorter it must be renewed.

11 Before the brushes are replaced, make sure that the commutator is clean. The commutator is the copper segments on which the brushes bear. Clean the commutator with a strip of glass paper. Never use emery cloth or 'wet-or-dry' as the small abrasive fragments may embed themselves in the soft bores of the commutator and cause excessive wear of the brushes. Finish off the commutator with metal polish to give a smooth surface and finally wipe the segments over with a methylated spirits soaked rag to ensure a grease free surface. Check that the mica insulators, which do between the segments of the commutator are undercut. The standard groove depth is 0.7 mm (0.028 in) but if the average groove depth is less than 0.2 mm (0.008 in) the armature should be renewed or returned to a Yamaha Service Agent for re-cutting.

12 Replace the brushes in their holders and check that they slide quite freely. Make sure the brushes are replaced in their original positions because they will have worn to the profile of the commutator. Replace and tighten the end cover, then replace the starter motor and cable in the housing, tighten down and reinstate the electrical connection to the solenoid switch. Check that the starter motor functions correctly before replacing the accessories cover and sealing gasket.

13 Starter solenoid switch - function and location

1 The starter motor switch is designed to work on the electromagnetic principle. When the starter button is depressed, current from the battery passes through windings in the switch solenoid and generates an electro-magnetic force which causes a set of contact points to close immediately the points close, the starter motor is energised and a very heavy current is drawn from the battery.

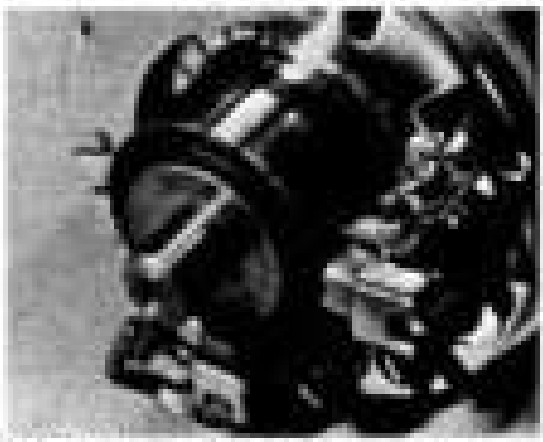
2 This arrangement is used for at least two reasons. Firstly, the starter motor current is drawn only when the button is depressed and is cut off again when pressure on the button is released. This ensures minimum drainage on the battery. Secondly, if the battery is in a low state of charge, there will not be sufficient current to cause the solenoid contacts to close. In consequence, it is not possible to place an excessive drain on the battery which, in some circumstances, can cause the starter to overheat and short their windings. If the starter will not operate, first suspect a discharged battery. This can be checked by trying the horn or switching on the lights. If this check shows the battery to be in good shape, suspect the starter switch which should come into action with a pronounced click. It is suggested below this disclosure to the right of the battery box and can be identified by the heavy duty starter cable connected to it. It is not possible to effect a satisfactory repair if the switch malfunctions it must be renewed.

14 Starter motor free running clutch: examination and renovation

1 To gain access to the starter clutch, the alternator cover and the alternator rotor must be removed as described in Chapter 1, Section 9.

2 To check whether the clutch is operating freely and smoothly push the starting sprocket into the clutch (and hence the rotor) and rotate it whilst holding the rotor. If the sprocket is rotated clockwise as viewed from the sprocket side it should lock the clutch. If caused to go anti-clockwise direction it should be free to run smoothly. If the movement is unsatisfactory, check the condition of the rollers and springs.

3 The rollers, plungers and springs may be prised from position for inspection. If there is any wear or obvious damage to the springs or rollers (see replacements will have to be obtained). Replacement of these items requires some dexterity due to spring loading and restricted access to the spring housings.



14.6a Check condition of commutator segments and ...



14.6b ... inspect brushes for excessive wear

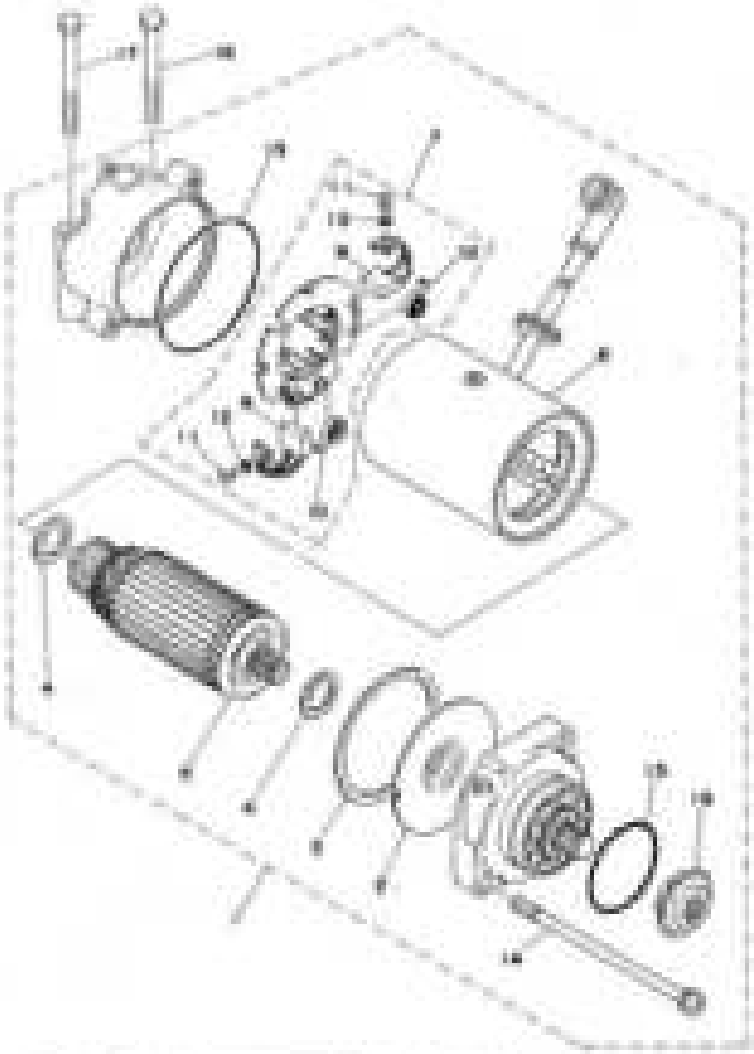
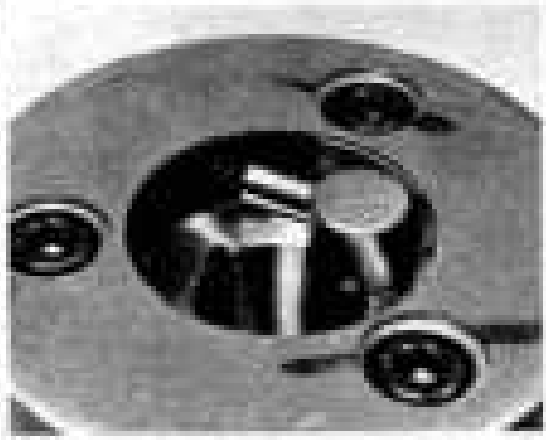


Fig. 6.3 Starter motor

1 Starter motor assembly complete
2 Plate
3 Gasket
4 Washer
5 Armature
6 Yoke
7 Brush holder
8 Positive brush
9 Negative brush
10 Brush spring - 2 off
11 Screw - 2 off
12 Washer - 2 off
13 'O' ring
14 Screw - 2 off
15 'O' ring
16 Drive assembly
17 Bolt
18 Bolt





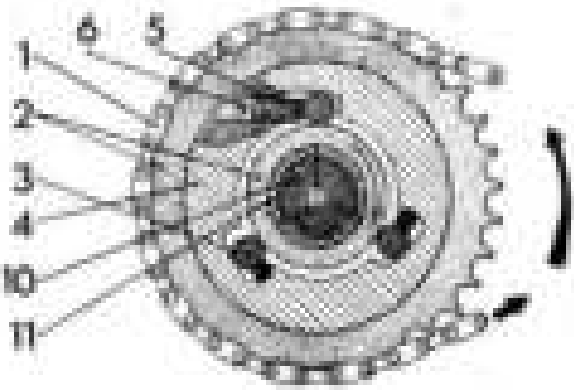


Fig. 9.4 Starter motor final running checks

1 Starting clutch
2 Starting sprocket
3 Roller
4 Clutch outer
5 Roller spring cap
6 Roller spring
10 Left crankshaft
11 Stud

15 Speedometer and tachometer head: replacement of bulbs

1 The speedometer and tachometer head contain inner and outer bulbs respectively, all of which are rated 12v, 3.4W and are of the bayonet fitting type.

2 The bulbholders are a push fit into the rear of the instrument where they are retained by their outer moulded rubber sleeves. Access to the bulbholders can be made after removing the two screw cross which hold each head in place in its respective outer shell.

16 Warning lamp console: replacement of bulbs

1 In addition to the two bulbs fitted within the instrument heads, a further four warning bulbs are fitted within a warning console to the rear of the instrument assembly. Again, each bulb is rated at 3.4W and is of the bayonet type.

2 Access to the bulbs may be made after removing the console top cover, which is held in place by four screws.

17 Stop lamp switches: location and replacement

1 Two stop lamp switches are fitted to the machine, which each independently of one another, depending on which brake is operated.

2 The front brake switch is fitted to the handlebar lever mounting and is a mechanical push-off type, being operated when the lever is moved. The switch is a push fit in the housing lever, and is retained by depressing a small pin in the underside with a piece of wire or a small screwdriver.

3 The rear brake switch is mounted on the frame on the right-hand side, above the rear brake pedal. It can be adjusted by means of a locknut, and should be set so that the light comes on as soon as the pedal is depressed. This is especially important when the rear brake has been readjusted.

18 Horn: location and examination

1 The horn is located on the top frame tube, immediately below the petrol tank. It has no external means of adjustment. If it malfunctions, it must be renewed. It is a statutory requirement that the machine can not be fitted with a horn of warning note.

19 Wiring: layout and examination

1 The wiring harness is colour-coded and will correspond with the accompanying wiring diagram. Where socket connectors are used, they are designed so they disconnect in one way only to the correct position only.

2 Visual inspection will show whether there are any breaks in insulation inside coverings which will give rise to short circuits. Another source of trouble may be dirty connections and sockets, where the connector has not been pushed fully home to the outer housing.

3 Intermittent short circuits can often be traced to a chafed wire that passes through or is close to a metal component such as a frame member. Avoid tight bends in the lead or situations where a build up becomes trapped between coverings.

20 Ignition and lighting switch

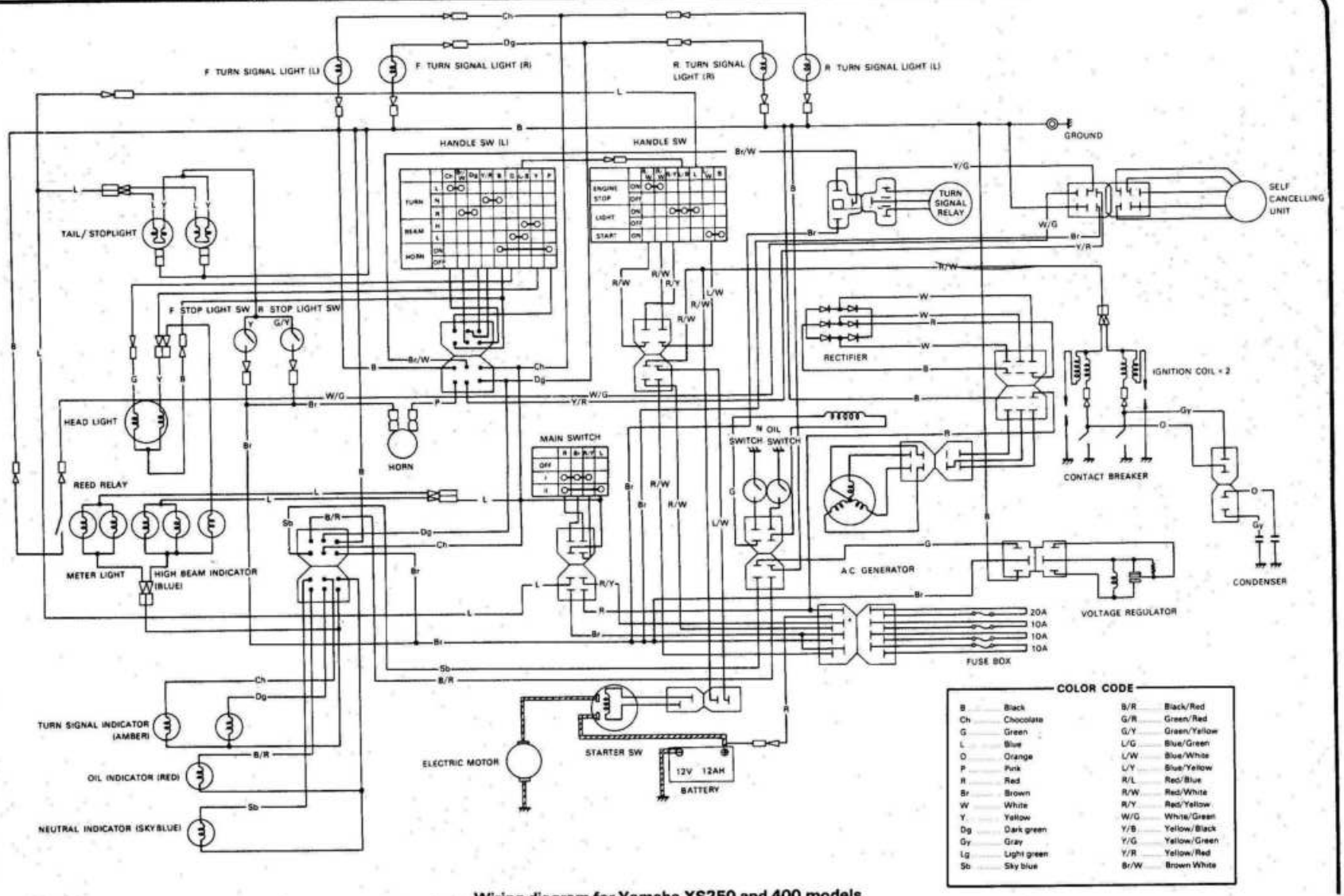
1 The ignition and lighting switch is combined in one unit, located on the top fork yoke. It is covered by a key, which cannot be removed when the ignition is switched on.

2 The number stamped on the [illegible] the number of the key covering fixed fork and that of the [illegible] to the petrol filler cap. A replacement key can be obtained from [illegible] supplied is ignition or either of the locks or the ignition [illegible] switch, additional keys will be required.

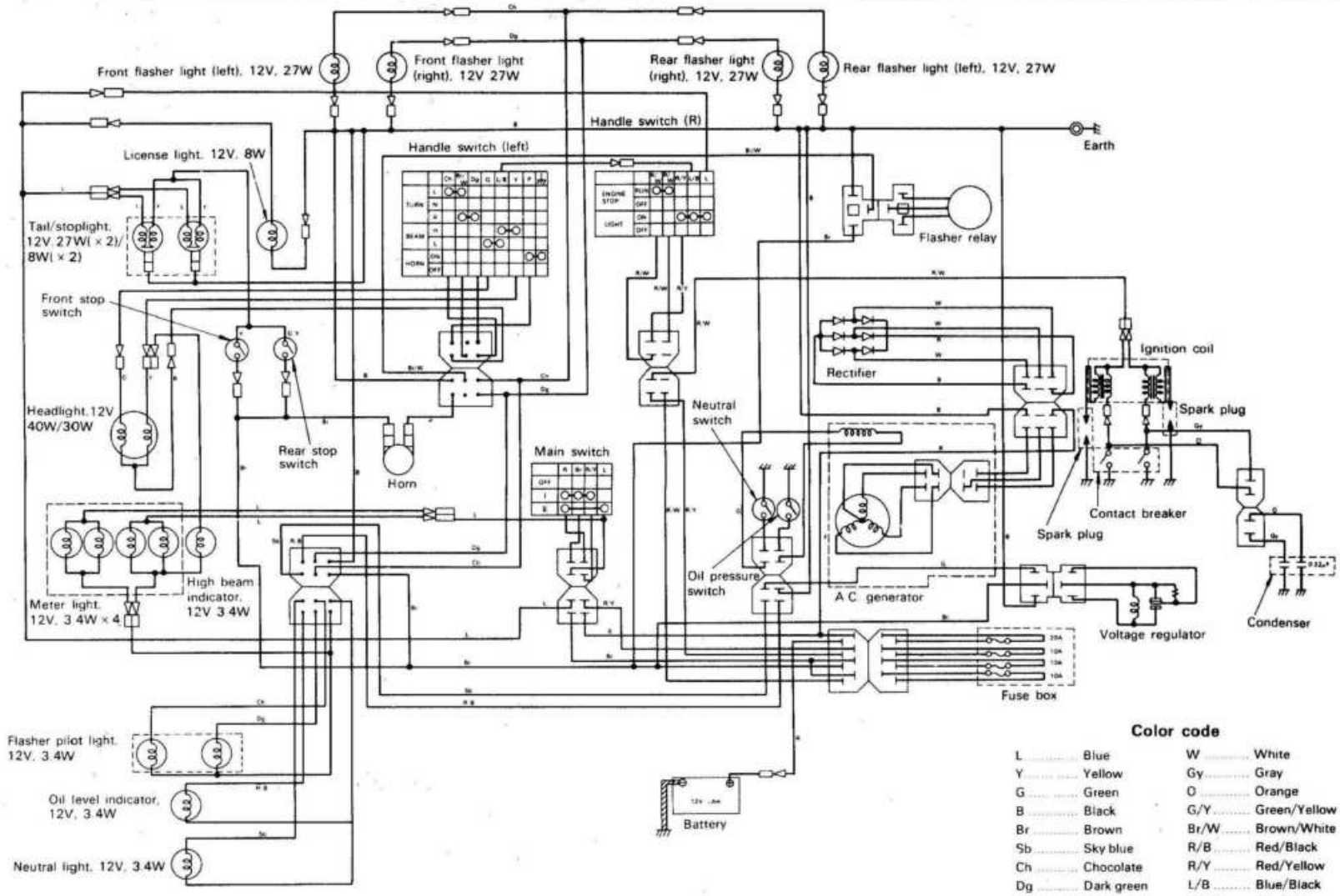
3 It is not practicable to [illegible] switch. If a malfunctions it should be renewed [illegible] switch and key as unit.

23 Fault diagnosis: electrical system

Symptom	Cause	Remedy
Complete electrical failure	Blown fuse	Check wiring and electrical components for short circuit before fitting new fuse. Check battery connections, also whether connections show signs of corrosion
	Isolated battery	
Dim lights, horn inoperative	Discharged battery	Recharge battery with battery charger and check whether alternator is giving correct output (electrical specialist)
Excessively 'thrashing' bulbs	Vibration, poor earth connection	Check whether bulb holders are secured correctly. Check earth returns or connections to frame



Wiring diagram for Yamaha XS250 and 400 models



Wiring diagram for Yamaha XS360 – 2D model

Metric conversion tables

1 Imperial gallon = 8 Imp pints = 1.19 US gallons = 277.42 cu in = 4.5459 litres

1 US gallon = 4 US quarts = 0.832 Imp gallon = 231 cu in = 3.785 litres

1 Litre = 0.2198 Imp gallon = 0.2642 US gallon = 61.0252 cu in = 1000 cc

Miles to Kilometres		Kilometres to Miles	
1	1.61	1	0.62
2	3.22	2	1.24
3	4.83	3	1.86
4	6.44	4	2.48
5	8.05	5	3.11
6	9.66	6	3.73
7	11.27	7	4.35
8	12.88	8	4.97
9	14.48	9	5.59
10	16.09	10	6.21
20	32.19	20	12.43
30	48.28	30	18.64
40	64.37	40	24.86
50	80.47	50	31.07
60	96.56	60	37.28
70	112.65	70	43.50
80	128.74	80	49.71
90	144.84	90	55.93
100	160.93	100	62.14

lbs/ft² to kg/cm²		kg/cm² to lbs/ft²		lb/in² : kg/cm²		kg/cm² : lb/in²	
1	0.195	1	5.033	1	0.07	1	14.22
2	0.376	2	10.486	2	0.14	2	28.56
3	0.614	3	31.069	3	0.21	3	42.67
4	0.783	4	39.633	4	0.28	4	56.89
5	0.977	5	49.166	5	0.35	5	71.12
6	1.172	6	59.699	6	0.42	6	85.34
7	1.367	7	69.631	7	0.49	7	99.56
8	1.748	8	87.894	8	0.56	8	113.79
9	1.944	9	98.427	9	0.63	9	128.00
10	1.953	10	72.890	10	0.70	10	142.23
20	3.765	20	144.8000	20	1.41	20	284.47
30	4.147	30	216.000	30	2.11	30	426.70

Index

A

B

C

D

Decarbonising 22
Description – general
Electric system 108
Engine, clutch & gearbox 19
Frame & forks 80
Fuel system 58
ignition system 73
Wheels, brakes & tyres 91
Dimensions and weights 6
Drain plugs – tyre valve 106
Dualseat – removal 59

E

Electrical system
Alternator 109
Battery 110
Fault diagnosis 118
Fuse location 110
Headlamp 115
Horn 117
Lamps 115, 116
Silicon rectifier 109
Specifications 108
Starter motor 114
Switches – handlebar 112
Switch – solenoid 114
Voltage regulator 110
Wiring diagrams 118–120
Wiring layout examination 117
Engine
Camshaft, sprockets, chain and tensioners 33
Camshaft cover 24
Clutch – removal 27
Connecting rods 52
Crankshaft – examination 51
Crankcase halves
Separating 29
Joining 47
Cylinder block and pistons – removal 24
Cylinder head 24, 32
Decarbonising 22
Dismantling – general 23
Examination and renovation – general 22
Fault diagnosis 56–57
Lubrication system 16–56
Oil pump
Removal 27–28
Replacement 46–49
Pistons and rings 32, 48
Reassembly – general
Refitting in frame 54
Removal from frame 20
Routine maintenance and tune 22
Specifications 16–17
Starting and running a rebuilt unit 55
Taper bore 52
Torque wrench settings 18
Valve grinding and renovation 33

F

Fault diagnosis
Clutch 56
Electrical system 118
Engine 56–57
Frame and forks 80
Fuel system 72
Gearbox 69
Ignition system 76
Lubrication system 73
Wheels, brakes and tyres 107
Filters
Air 86
Oil 23
Final drive chain 104
Fork oil/s 84
Frame and forks
Centre stand 88
Crankcase – removal 88
Fault diagnosis 80
Fork oil/s 89
Frame examination and repair 89
Front forks
Dismantling 82
Examination and renovation 83
Removal 80
Reassembly 85
Prop stand 89
Rear brake pedal 89
Rear suspension unit 85
Steering head bearings 83
Swinging arm fork 87
Front wheel 91, 92
Fuel system
Carburettors
Adjustment 63
Dismantling and reassembly 60
Float level adjustment 65
Synchronisation 66
Settings 63
Air filter 86
Fault diagnosis 72
Petrol tank 58
Petrol tap 58
Fuse location 110

G

Gearbox
Components – examination and renovation 38
Dismantling 33
Fault diagnosis 69
Gear change mechanism 62
Lubrication 56
Reassembly 66
Selector mechanism
Removal 33
Replacement 39
Specifications 18
Generator (Alternator) 109
Gudgeon pins 52

H

Handlebar switches 112
Headlamp – beam height adjustment 115
Horn 117
Hydraulic brake system – bleeding 102

I

Ignition system
A.T.U. 77
Coils – checking 77
Condenser 77
Contact breaker 75
Fault diagnosis 76
Charging system 79
Spark plugs
Checking and setting gap 78
Colour chart
Interpreting conditions 78
Specifications 73
Switch 117
Timing 77–78

S

Sidelights
  Removal 27
  Replacement 66

T

Tailgate 11, 113, 114
Tailgate sill gaiters 6, 109, 111
Tailgate and tailgate aperture 111
Tailgate lock 130, 132
Tailgate lock striker 130, 132
Tailgate lock - removal and replacement 114
Tailgate - removal and replacement 114

W

Washer jet, adjustment and assembly data 14
Washer cylinders 89, 121
Washer motor - remove & fit 13
Washer connection tubes 121, 122

Z

Zinc filler 71
Zinc enrichment painting 71
Zinc paints 69
Ordering
  Spare parts 6
  Tools 10

P

Pedal - clear brake 83
Petrol tank 69
Petrol tap 69
Petrol tank rings 82, 84
Plug wires 99

R

Rear chain - lubrication and adjustment 9
Rear suspension unit 89
Rear wheel 86, 89
Rear wheel
  Cush drive 103
  Sprocket 102
Rectifier with 109
Recommended lubricants 14
Rings and pinions 83
Routine maintenance 4 - 13

S

Safety check 6
Selector mechanism
  Removal 29
  Replacement 66
Spark plugs
  Checking and setting gaps 76
  Colour chart - operating conditions 75

Specifications
  Brake 108
  Clutch 17
  Electrical system 106
  Engine 16 - 17
  Frame and forks 85
  Fuel system 56
  Gearbox 18
  Ignition 75
  Lubrication 68
  Wheels brakes and tyres 81
Speedometer head and drive 88, 89
Statutory requirements 6, 109, 111
Starter motor 116
Steering head cones and bearings 83
Suspension unit - rear 89
Swinging arm fork 87
Switches
  Handlebar - function and replacement 113
  Lighting and ignition 111
  Neutral 29
  Oil pressure warning 66
  Starter motor - solenoid 116
  Stop lamp 117

T

Tachometer head and drive 88, 89
Tooling
  Charging system 79
  Condenser 31
  Electrical system 106
  Engine rectifier 109
  Timing ignition 77, 78
  Voltage regulator 116
Tools 10
Tyres
  Pressures 6, 81
  Removal and replacement 104, 105
  Colour instructions 103
  Valves and inner tubes 105

V

Valves
  Clearances 12
  Grinding 53
  Spring, seats and collars 53
Voltage regulator 116

W

Weights and dimensions 6
Wheels
  Alignment 104
  Balancing front wheel 105
  Bearings 87
  Front 81, 82
  Rear 86, 89
  Spoke conditions 11
Wiring diagrams 118, 120
Wiring layout and examination 117
Working conditions and tools 10