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Dimensions and Weights

NTV600

Wheelbase	1465 mm
Overall length	150 mm
Overall width	710 mm
Overall height	080 mm
Seat height	790 mm
Minimum ground clearance	165 mm
Weight (dry)	189 kg

NTV650

Wheelbase	1465 mm
Overall length	2190 mm
Overall width	765 mm
Overall height	1080 mm
Seat height	810 mm
Minimum ground clearance	165 mm
Weight (dry)	192 kg

Conversion Factors

Length (distance)

Inches (in)	x 25.4	=	Millimetres (mm)	x 0.0394	=	inches (in)
Feet (ft)	x 0.305	=	Metres (m)	x 3.281	=	Feet (ft)
Miles	x 1.609	=	Kilometres (km)	x 0.621	=	Miles

Volume (capacity)

Cubic inches (cu in; in^3)	x 16.387	=	Cubic centimetres (cc; cm^3)	x 0.061	=	Cubic inches (cu in; in^3)
Imperial pints (Imp pt)	x 0.568	=	Litres (l)	x 1.76	=	Imperial pints (Imp pt)
Imperial quarts (Imp qt)	x 1.137	=	Litres (l)	x 0.88	=	Imperial quarts (Imp qt)
Imperial quarts (Imp qt)	x 1.201	=	US quarts (US qt)	x 0.833	=	Imperial quarts (Imp qt)
US quarts (US qt)	x 0.946	=	Litres (l)	x 1.057	=	US quarts (US qt)
Imperial gallons (Imp gal)	x 4.546	=	Litres (l)	x 0.22	=	Imperial gallons (Imp gal)
Imperial gallons (Imp gal)	x 1.201	=	US gallons (US gal)	x 0.833	=	Imperial gallons (Imp gal)
US gallons (US gal)	x 3.785	=	Litres (l)	x 0.264	=	US gallons (US gal)

Mass (weight)

Ounces (oz)	x 28.35	=	Grams (g)	x 0.035	=	Ounces (oz)
Pounds (lb)	x 0.454	=	Kilograms (kg)	x 2.205	=	Pounds (lb)

Force

Ounces-force (ozf; oz)	x 0.278	=	Newtons (N)	x 3.6	=	Ounces-force (ozf; oz)
Pounds-force (lbf; lb)	x 4.448	=	Newtons (N)	x 0.225	=	Pounds-force (lbf; lb)
Newtons (N)	x 0.1	=	Kilograms-force (kgf; kg)	x 9,81	=	Newtons (N)

Pressure

Pounds-force per square inch (psi; lbf/in²; lb/in²)	x 0.070	=	Kilograms-force per square centimetre (kgf/cm²; kg/cm²)	x 14.223	=	Pounds-force per square inch (psi; lbf/in²; lb/in²)
Pounds-force per square inch (psi; lbf/in²; lb/in²)	x 0.068	=	Atmospheres (atm)	x 14.696	=	Pounds-force per square inch (psi; lbf/in²; lb/in²)
Pounds-force per square inch (psi; lbf/in²; lb/in²)	x 0.069	=	Bars	x 14.5	=	Pounds-force per square inch (psi; lbf/in²; lb/in²)
Pounds-force per square inch (psi; lbf/in²; lb/in²)	x 6.895	=	Kilopascals (kPa)	x 0.145	=	Pounds-force per square inch (psi; lbf/in²; lb/in²)
Kilopascals (kPa)	x 0.01	=	Kilograms-force per square centimetre (kgf/cm²; kg/cm²)	x 98.1	=	Kilopascals (kPa)
Millibar (mbar)	x 100	=	Pascals (Pa)	x 0.01	=	Millibar (mbar)
Millibar (mbar)	x 0.0145	=	Pounds-force per square inch (psi; lbf/in²; lb/in²)	x 68.947	=	Millibar (mbar)
Millibar (mbar)	x 0.75	=	Millimetres of mercury (mmHg)	x 1.333	=	Millibar (mbar)
Millibar (mbar)	x 0.401	=	Inches of water (inH_2O)	x 2.491	=	Millibar (mbar)
Millimetres of mercury (mmHg)	x 0.535	=	Inches of water (inH_2O)	x 1.868	=	Millimetres of mercury (mmHg)
Inches of water (inH_2O)	x 0.036	=	Pounds-force per square inch (psi; lbf/in²; lb/in²)	x 27.68	=	Inches of water (inH_2O)

Torque (moment of force)

Pounds-force inches (lbf in; lb in)	x 1.152	=	Kilograms-force centimetre (kgf cm; kg cm)	x 0.868	=	Pounds-force inches (lbf in; lb in)
Pounds-force inches (lbf in; lb in)	x 0.113	=	Newton metres (Nm)	x 8.85	=	Pounds-force inches (lbf in; lb in)
Pounds-force inches (lbf in; lb in)	x 0.083	=	Pounds-force feet (lbf ft; lb ft)	x 12	=	Pounds-force inches (lbf in; lb in)
Pounds-force feet (lbf ft; lb ft)	x 0.138	=	Kilograms-force metres (kgf m; kg m)	x 7.233	=	Pounds-force feet (lbf ft; lb ft)
Pounds-force feet (lbf ft; lb ft)	x 1.356	=	Newton metres (Nm)	x 0.738	=	Pounds-force feet (lbf ft; lb ft)
Newton metres (Nm)	x 0.102	=	Kilograms-force metres (kgf m; kg m)	x 9.804	=	Newton metres (Nm)

Power

Horsepower (hp)	x 745.7	=	Watts (W)	x 0.0013	=	Horsepower (hp)

Velocity (speed)

Miles per hour (miles/hr; mph)	x 1.609	=	Kilometres per hour (km/hr; kph)	x 0.621	=	Miles per hour (miles/hr; mph)

Fuel consumption*

Miles per gallon (mpg)	x 0.354	=	Kilometres per litre (km/l)	x 2.825	=	Miles per gallon (mpg)

Temperature

Degrees Fahrenheit = (°C x 1.8) + 32

Degrees Celsius (Degrees Centigrade; °C) = (°F - 32) x 0.56

* *It is common practice to convert from miles per gallon (mpg) to litres/100 kilometres (l/100km), where mpg x l/100 km = 282*

Basic maintenance techniques

There are a number of techniques involved in maintenance and repair that will be referred to throughout this manual. Application of these techniques will enable the amateur mechanic to be more efficient, better organised and capable of performing the various tasks properly, which will ensure that the repair job is thorough and complete.

Fastening systems

Fasteners, basically, are nuts, bolts and screws used to hold two or more parts together. There are a few things to keep in mind when working with fasteners. Almost all of them use a locking device of some type (either a lock washer, locknut, locking tab or thread locking compound). All threaded fasteners should be clean, straight, have undamaged threads and undamaged corners on the hex head where the spanner fits. Develop the habit of replacing all damaged nuts and bolts with new ones.

Rusted nuts and bolts should be treated with a penetrating oil to ease removal and prevent breakage. After applying the rust penetrant, let it work for a few minutes before trying to loosen the nut or bolt. Badly rusted fasteners may have to be chiselled off or removed with a special nut breaker, available at tool shops.

If a bolt or stud breaks off in an assembly, it can be drilled out and removed with a special tool called an E-Z out (or screw extractor). Most dealer service departments and motorcycle repair shops can perform this task, as well as others (such as the repair of threaded holes that have been stripped out).

Washers should always be replaced exactly as removed. Replace any damaged washers with new ones. Always use a flat washer between a lock washer and any soft metal surface (such as aluminium), thin sheet metal or plastic. Special locknuts can only be used once or twice before they lose their locking ability and must be replaced.

Tightening sequences and procedures

When threaded fasteners are tightened, they are often tightened to a specific torque value (torque is basically a twisting force). Over-tightening the fastener can weaken it and cause it to break, while under-tightening can cause it to eventually come loose. Each bolt, depending on the material it's made of, the diameter of its shank and the material it is threaded into, has a specific torque value, which is noted in the Specifications. Be sure to follow the torque recommendations closely.

Fasteners laid out in a pattern (ie cylinder head bolts, engine case bolts, etc.) must be loosened or tightened in a sequence to avoid warping the component. Initially, the bolts/nuts should go on finger-tight only. Next, they should be tightened one full turn each, in a criss-cross or diagonal pattern. After each one has been tightened one full turn, return to the first one tightened and tighten them all one half turn, following the same pattern. Finally, tighten each of them one quarter turn at a time until each fastener has been tightened to the proper torque. To loosen and remove the fasteners the procedure would be reversed.

Disassembly sequence

Component disassembly should be done with care and purpose to help ensure that the parts go back together properly during reassembly. Always keep track of the sequence in which parts are removed. Take note of special characteristics or marks on parts that can be installed more than one way (such as convex washers and gear pinions). It's a good idea to lay the disassembled parts out on a clean surface in the order that they were removed. It may also be helpful to make sketches or take instant photos of components before removal.

When removing fasteners from a component, keep track of their locations. Sometimes threading a bolt back in a part, or putting the washers and nut back on a stud, can prevent mix-ups later. If nuts and bolts can't be returned to their original locations, they should be kept in a compartmented box or a series of small boxes or labelled plastic bags. A box of this type is especially helpful when working on assemblies with very small parts (such as the carburettors, tappets, shims etc).

Whenever wiring looms, harnesses or connectors are separated, it's a good idea to identify the two halves with numbered pieces of masking tape so they can be easily reconnected.

Gasket sealing surfaces

Gaskets are used to seal the mating surfaces between components and keep lubricants, fluids, vacuum or pressure contained in an assembly.

Many times these gaskets are coated with a liquid or paste type gasket sealing compound before assembly. Age, heat and pressure can sometimes cause the two parts to stick together so tightly that they are very difficult to separate. In most cases, the part can be loosened by striking it with a soft-faced hammer near the mating surfaces. A normal hammer can be used if a block of wood is placed between the hammer and the part. Do not hammer on cast parts or parts that could be easily damaged. With any particularly stubborn part, always recheck to make sure that every fastener has been removed.

Avoid using a screwdriver or bar to pry apart components, as they can easily mark the gasket sealing surfaces of the parts (which must remain smooth). If prying is absolutely necessary, use a piece of wood, but keep in mind that extra clean-up will be necessary if the wood splinters.

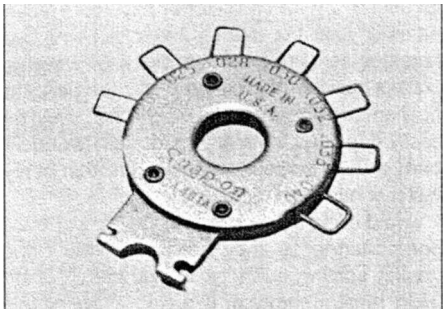
After the parts are separated, the old gasket must be carefully scraped off and the gasket surfaces cleaned. Stubborn gasket material can be soaked with a gasket remover (available in aerosol cans) to soften it so it can be easily scraped off. A scraper can be fashioned from a piece of copper tubing by flattening and sharpening one end. Copper is recommended because it is usually softer than the surfaces to be scraped, which reduces the chance of gouging the part. Some gaskets can be removed with a wire brush, but regardless of the method used, the mating surfaces must be left clean and smooth. If for some reason the gasket surface is gouged, then a gasket sealant thick enough to fill scratches will have to be used during reassembly of the components. For most applications, a non-drying (or semi-drying) gasket sealant is best.

Hose removal tips

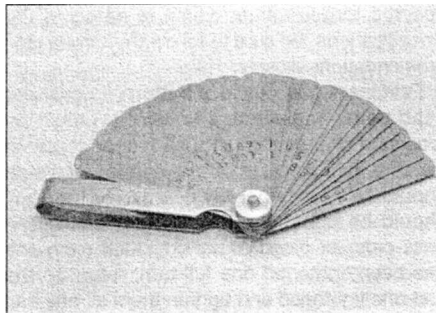
Hose removal precautions closely parallel gasket removal precautions. Avoid scratching or gouging the surface that the hose mates against or the connection may leak. Because of various chemical reactions, the rubber in hoses can bond itself to the metal union that the hose fits over. To remove a hose, first loosen the hose clamps that secure it to the union. Then, with slip joint pliers, grab the hose at the clamp and rotate it around the union. Work it back and forth until it is completely free, then pull it off (silicone or other lubricants will ease removal if they can be applied between the hose and the outside of the union). Apply the same lubricant to the inside of the hose and the outside of the union to simplify installation.

If the hose is particularly stubborn, slit the hose with a sharp knife and peel it off the union. The hose will obviously be destroyed using this method.

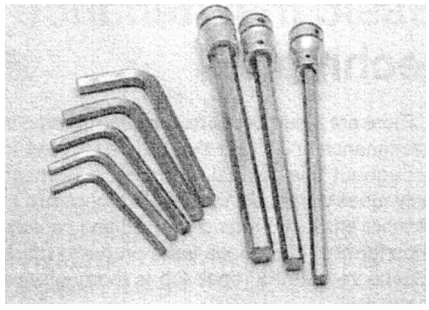
If a hose clamp is broken or damaged, do not reuse it. Also, do not reuse hoses that are cracked, split or torn.



Spark plug gap adjusting tool



Feeler blade set



Alien keys (left), and Alien key sockets (right)

Tools

A selection of good tools is a basic requirement for anyone who plans to maintain and repair a motorcycle. For the owner who has few tools, if any, the initial investment might seem high, but when compared to the spiralling costs of routine maintenance and repair, it is a wise one.

To help the owner decide which tools are needed to perform the tasks detailed in this manual, the following tool lists are offered: Maintenance and minor repair, Repair and overhaul and Special. The newcomer to practical mechanics should start off with the Maintenance and minor repair tool kit, which is adequate for the simpler jobs. Then, as confidence and experience grow, the owner can tackle more difficult tasks, buying additional tools as they are needed. Eventually the basic kit will be built into the Repair and overhaul tool set. Over a period of time, the experienced do-it-yourselfer will assemble a tool set complete enough for most repair and overhaul procedures and will add tools from the Special category when it is felt that the expense is justified by the frequency of use.

Maintenance and minor repair tool kit

The tools in this list should be considered the minimum required for performance of routine maintenance, servicing and minor repair work. We recommend the purchase of combination spanners (ring end and open end combined in one spanner); while more expensive than open-ended ones, they offer the advantages of both types of wrench.

Combination spanner set (6 mm to 22 mm)
Adjustable wrench - 8 in
Spark plug socket (with rubber insert)
Spark plug gap adjusting tool
Feeler blade set
Standard flat-bladed screwdriver set
Phillips screwdriver set
Alien key set (4 mm to 12 mm)
Torx key set (4 mm to 12 mm)
Combination (slip-joint) pliers - 6 in
Hacksaw and assortment of blades
Tyre pressure gauge
Tyre tread depth gauge
Control cable pressure luber
Grease gun
Oil can
Fine emery cloth
Wire brush
Hand impact screwdriver and bits
Funnel (medium size)
Safety goggles
Drain tray

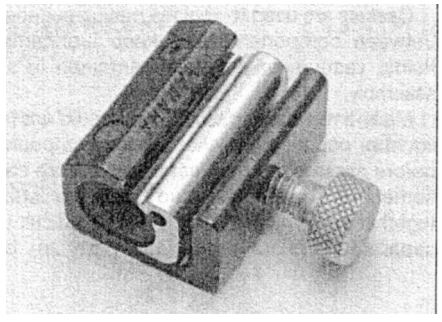
Repair and overhaul tool set

These tools are essential for anyone who plans to perform major repairs and are intended to supplement those in the Maintenance and minor repair tool kit. Included is a comprehensive set of sockets which, though expensive, are invaluable because of their versatility (especially when various extensions and drives are available). We recommend the 3/8 inch drive over the 1/2 inch drive for general motorcycle maintenance and repair (ideally, the mechanic would have a 3/8 inch drive set and a 1/2 inch drive set).

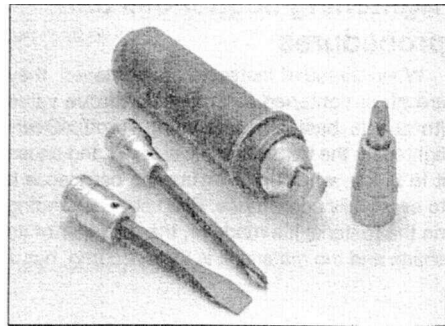
Socket set(s)
Reversible ratchet
Extension - 6 in
Universal joint
Torque wrench (same size drive as sockets)
Ball pein hammer - 8 oz
Soft-faced hammer (plastic/rubber)
Pliers - needle nose
Pliers - circlip (internal and external)
Cold chisel - 1/2 in
Scriber
Scraper
Centre punch
Pin punches (1/16, 1/8, 3/16 in)
Steel rule/straightedge - 12 in
A selection of files
Wire brush (large)
Clutch boss holder tool
Multimeter

Note: *Another tool which is often useful is an electric drill with a chuck capacity of 3/8 inch (and a set of good quality drill bits).*

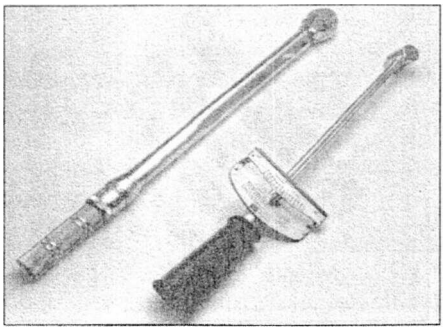
Torx bit set



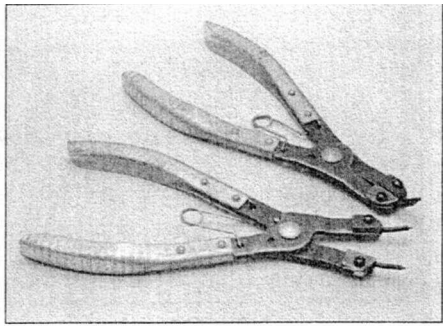
Control cable pressure luber



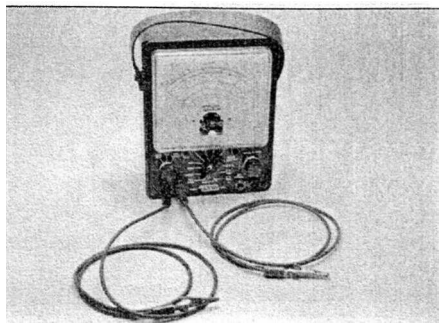
Hand impact screwdriver and bits



Torque wrenches
(left - click; right - beam type)



Circlip pliers
(top - external; bottom - internal)



Multimeter (volt/ohm/ammeter)

Special tools

The tools in this list include those which are not used regularly, are expensive to buy, or which need to be used in accordance with their manufacturer's instructions. Unless these tools will be used frequently, it is not very economical to purchase many of them. A consideration would be to split the cost and use between yourself and a friend or friends (ie members of a motorcycle club).

This list primarily contains tools and instruments widely available to the public, as well as some special tools produced by the motorcycle manufacturer for distribution to dealers. As a result, references to the manufacturer's special tools are occasionally included in the text of this manual. Generally, an alternative method of doing the job without the special tool is offered. However, sometimes there is no alternative to their use. Where this is the case, and the tool can't be purchased or borrowed, the work should be entrusted to a dealer.

Valve spring compressor
Piston ring removal and installation tool
Piston pin puller
Oil pressure gauge
Telescoping gauges
Micrometer and Vernier calipers
Dial indicator set
Manometer or vacuum gauge set
Cylinder compression gauge
Cylinder surfacing hone
Small air compressor with blow gun and tyre chuck
Stud extractor set

Buying tools

For the do-it-yourselfer who is just starting to get involved in motorcycle maintenance and repair, there are a number of options available when purchasing tools. If maintenance and minor repair is the extent of the work to be done, the purchase of individual tools is satisfactory. If, on the other hand, extensive work is planned, it would be a good idea to purchase a modest tool set from one of the large retail chain stores. A set can usually be bought at a substantial savings over the individual tool prices (and they often come with a tool box). As additional tools are needed, add-on sets, individual tools and a larger tool box can be purchased to expand the tool selection. Building a tool set gradually allows the cost of the tools to be spread over a longer period of time and gives the mechanic the freedom to choose only those tools that will actually be used.

Tool shops and motorcycle dealers will often be the only source of some of the special tools that are needed, but regardless of where tools are bought, try to avoid cheap ones (especially when buying screwdrivers and sockets) because they won't last very long. There are plenty of tools around at reasonable prices, but always aim to purchase items which meet the relevant national safety standards. The expense involved in replacing cheap tools will eventually be greater than the initial cost of quality tools.

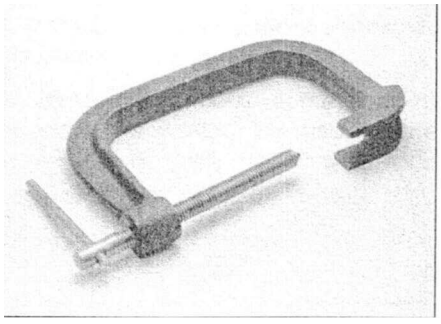
It is obviously not possible to cover the subject of tools fully here. For those who wish to learn more about tools and their use, there is a book entitled *Motorcycle Workshop Practice Manual* (Book no. 1454) available from the publishers of this manual. It also provides an introduction to basic workshop practice which will be of interest to a home mechanic working on any type of motorcycle.

Care and maintenance of tools

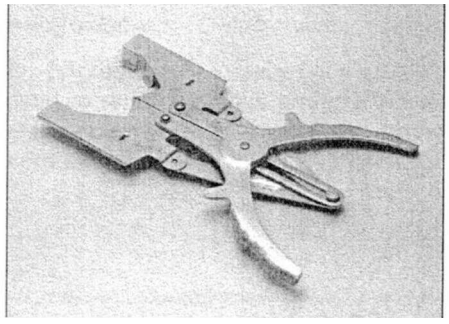
Good tools are expensive, so it makes sense to treat them with respect. Keep them clean and in usable condition and store them properly when not in use. Always wipe off any dirt, grease or metal chips before putting them away. Never leave tools lying around in the work area.

Some tools, such as screwdrivers, pliers, spanners and sockets, can be hung on a panel mounted on the garage or workshop wall, while others should be kept in a tool box or tray. Measuring instruments, gauges, meters, etc. must be carefully stored where they can't be damaged by weather or impact from other tools.

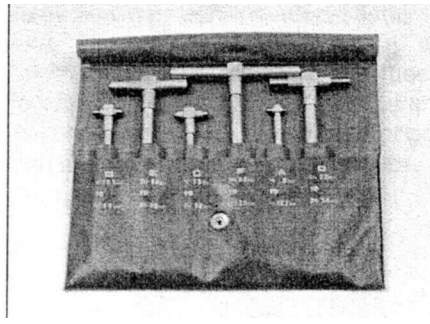
When tools are used with care and stored properly, they will last a very long time. Even with the best of care, tools will wear out if used frequently. When a tool is damaged or worn out, replace it; subsequent jobs will be safer and more enjoyable if you do.



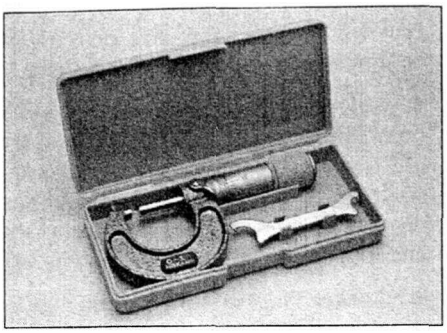
Valve spring compressor



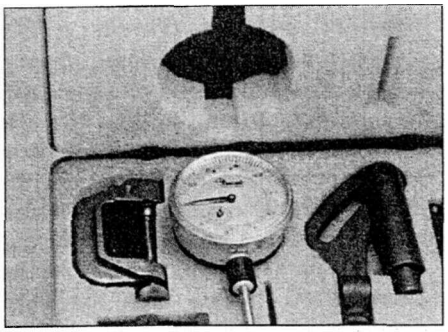
Piston ring removal/installation tool



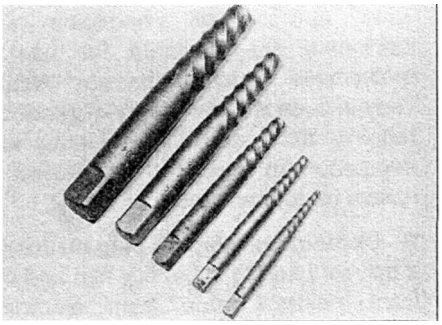
Telescoping gauges



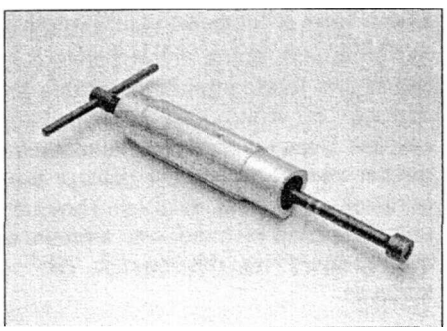
Micrometer



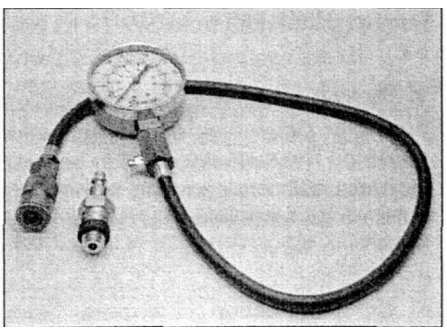
Dial indicator set



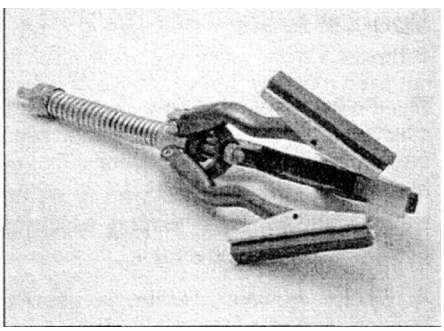
Stud extractor set



Piston pin puller



Cylinder comprerssion gauge



Cylinder surfacing hone

Working facilities

Not to be overlooked when discussing tools is the workshop. If anything more than routine maintenance is to be carried out, some sort of suitable work area is essential.

It is understood, and appreciated, that many home mechanics do not have a good workshop or garage available and end up removing an engine or doing major repairs outside (it is recommended, however, that the overhaul or repair be completed under the cover of a roof).

A clean, flat workbench or table of comfortable working height is an absolute necessity. The workbench should be equipped with a vice that has a jaw opening of at least four inches.

As mentioned previously, some clean, dry storage space is also required for tools, as well as the lubricants, fluids, cleaning solvents, etc. which soon become necessary.

Sometimes waste oil and fluids, drained from the engine or cooling system during normal maintenance or repairs, present a disposal problem. Do not pour them on the ground or into the drainage system, simply pour the used fluids into large containers, seal them with caps and take them to an authorised disposal site or garage.

Always keep a supply of old newspapers and clean rags available. Old towels are excellent for mopping up spills. Many mechanics use rolls of paper towels for most work because they are readily available and disposable. To help keep the area under the motorcycle clean, a large cardboard box can be cut open and flattened to protect the garage or workshop floor.

Whenever working over a painted surface (such as the fuel tank) cover it with an old blanket or bedspread to protect the finish.

A number of chemicals and lubricants are available for use in motorcycle maintenance and repair. They include a wide variety of products ranging from cleaning solvents and degreasers to lubricants and protective sprays for rubber, plastic and vinyl.

• **Contact point/spark plug cleaner is** a solvent used to clean oily film and dirt from points, grime from electrical connectors and oil deposits from spark plugs. It is oil free and leaves no residue. It can also be used to remove gum and varnish from carburettor jets and other orifices.

• **Carburettor cleaner** is similar to contact point/spark plug cleaner but it usually has a stronger solvent and may leave a slight oily reside. It is not recommended for cleaning electrical components or connections.

• **Brake system cleaner** is used to remove grease or brake fluid from brake system components (where clean surfaces are absolutely necessary and petroleum-based solvents cannot be used); it also leaves no residue.

• **Silicone-based lubricants** are used to protect rubber parts such as hoses and grommets, and are used as lubricants for hinges and locks.

• **Multi-purpose grease** is an all purpose lubricant used wherever grease is more practical than a liquid lubricant such as oil. Some multi-purpose grease is coloured white and specially formulated to be more resistant to water than ordinary grease.

• **Gear oil** (sometimes called gear lube) is a specially designed oil used in transmissions and final drive units, as well as other areas where high friction, high temperature lubrication is required. It is available in a number of viscosities (weights) for various applications.

• **Motor oil,** of course, is the lubricant specially formulated for use in the engine. It normally contains a wide variety of additives to prevent corrosion and reduce foaming and wear. Motor oil comes in various weights (viscosity ratings) of from 5 to 80. The recommended weight of the oil depends on the seasonal temperature and the demands on the engine. Light oil is used in cold climates and under light load conditions; heavy oil is used in hot climates and where high loads are encountered. Multi-viscosity oils are designed to have characteristics of both light and heavy oils and are available in a number of weights from 5W-20 to 20W-50.

• **Petrol additives** perform several functions, depending on their chemical makeup. They usually contain solvents that help dissolve gum and varnish that build up on carburettor and inlet parts. They also serve to break down carbon deposits that form on the inside surfaces of the combustion chambers. Some additives contain upper cylinder lubricants for valves and piston rings.

• **Brake and clutch fluid** is a specially formulated hydraulic fluid that can withstand the heat and pressure encountered in brake/clutch systems. Care must be taken that this fluid does not come in contact with painted surfaces or plastics. An opened container should always be resealed to prevent contamination by water or dirt.

• **Chain lubricants** are formulated especially for use on motorcycle final drive chains. A good chain lube should adhere well and have good penetrating qualities to be effective as a lubricant inside the chain and on the side plates, pins and rollers. Most chain lubes are either the foaming type or quick drying type and are usually marketed as sprays. Take care to use a lubricant marked as being suitable for 0-ring chains.

• **Degreasers** are heavy duty solvents used to remove grease and grime that may accumulate on engine and frame components. They can be sprayed or brushed on and, depending on the type, are rinsed with either water or solvent.

• **Solvents** are used alone or in combination with degreasers to clean parts and assemblies during repair and overhaul. The home mechanic should use only solvents that are non-flammable and that do not produce irritating fumes.

• **Gasket sealing compounds** may be used in conjunction with gaskets, to improve their sealing capabilities, or alone, to seal metal-to-metal joints. Many gasket sealers can withstand extreme heat, some are impervious to petrol and lubricants, while others are capable of filling and sealing large cavities. Depending on the intended use, gasket sealers either dry hard or stay relatively soft and pliable. They are usually applied by hand, with a brush, or are sprayed on the gasket sealing surfaces.

• **Thread locking compound** is an adhesive locking compound that prevents threaded fasteners from loosening because of vibration. It is available in a variety of types for different applications.

• **Moisture dispersants** are usually sprays that can be used to dry out electrical components such as the fuse block and wiring connectors. Some types can also be used as treatment for rubber and as a lubricant for hinges, cables and locks.

• **Waxes and polishes** are used to help protect painted and plated surfaces from the weather. Different types of paint may require the use of different types of wax polish. Some polishes utilise a chemical or abrasive cleaner to help remove the top layer of oxidised (dull) paint on older vehicles. In recent years, many non-wax polishes (that contain a wide variety of chemicals such as polymers and silicones) have been introduced. These non-wax polishes are usually easier to apply and last longer than conventional waxes and polishes.

About the MOT Test

In the UK, all vehicles more than three years old are subject to an annual test to ensure that they meet minimum safety requirements. A current test certificate must be issued before a machine can be used on public roads, and is required before a road fund licence can be issued. Riding without a current test certificate will also invalidate your insurance.

For most owners, the MOT test is an annual cause for anxiety, and this is largely due to owners not being sure what needs to be checked prior to submitting the motorcycle for testing. The simple answer is that a fully roadworthy motorcycle will have no difficulty in passing the test.

This is a guide to getting your motorcycle through the MOT test. Obviously it will not be possible to examine the motorcycle to the same standard as the professional MOT tester, particularly in view of the equipment required for some of the checks. However, working through the following procedures will enable you to identify any problem areas before submitting the motorcycle for the test.

It has only been possible to summarise the test requirements here, based on the regulations in force at the time of printing. Test standards are becoming increasingly stringent, although there are some exemptions for older vehicles. More information about the MOT test can be obtained from the HMSO publications, How Safe *is your Motorcycle* and *The MOT Inspection Manual for Motorcycle Testing.*

Many of the checks require that one of the wheels is raised off the ground. If the motorcycle doesn't have a centre stand, note that an auxiliary stand will be required. Additionally, the help of an assistant may prove useful.

Certain exceptions apply to machines under 50 cc. machines without a lighting system, and Classic bikes - if in doubt about any of the requirements listed below seek confirmation from an MOT tester prior to submitting the motorcycle for the test.

Check that the frame number is clearly visible.

If a component is in borderline condition, the tester has discretion in deciding whether to pass or fail it. If the motorcycle presented is clean and evidently well cared for, the tester may be more inclined to pass a borderline component than if the motorcycle is scruffy and apparently neglected.

ElectricalSystem

Lights, turn signals, horn and reflector

• With the ignition on, check the operation of the following electrical components. **Note:** *The e/ectrica! components on certain small-capacity machines are powered by the generator, requiring that the engine is run for this check.*

a) Headlight and tail light. Check that both illuminate in the low and high beam switch positions.

b) Position lights. Check that the front position (or sidelight) and tail light illuminate in this switch position.

c) Turn signals. Check that all flash at the correct rate, and that the warning light(s) function correctly. Check that the turn signal switch works correctly.

c) Hazard warning system (where fitted). Check that all four turn signals flash in this switch position.

d) Brake stop light. Check that the light comes on when the front and rear brakes are independently applied. Models first used on or after 1st April 1986 must have a brake light switch on each brake.

e) Horn. Check that the sound is continuous and of reasonable volume.

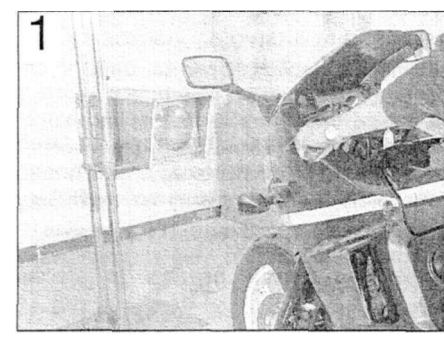
• Check that there is a red reflector on the rear of the machine, either mounted separately or as part of the tail light lens.

• Check the condition of the headlight, tail light and turn signal lenses.

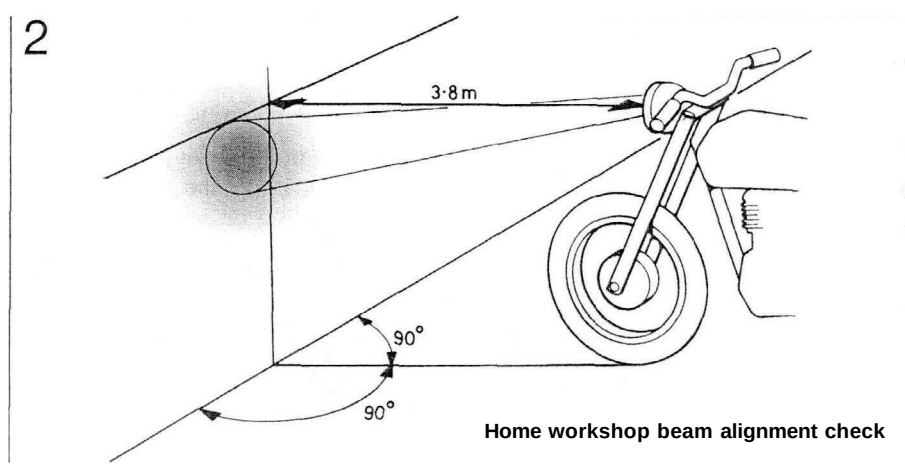
Headlight beam height

• The MOT tester will perform a headlight beam height check using specialised beam setting equipment **(see illustration 1).** This equipment will not be available to the home mechanic, but if you suspect that the headlight is incorrectly set or may have been maladjusted in the past, you can perform a rough test as follows.

• Position the bike in a straight line facing a brick wall. The bike must be off its stand, upright and with a rider seated. Measure the height from the ground to the centre of the headlight and mark a horizontal line on the wall at this height. Position the motorcycle 3.8 metres from the wall and draw a vertical line up the wall central to the centreline of the motorcycle. Switch to dipped beam and check that the beam pattern falls slightly lower than the horizontal line and to the left of the vertical line **(see illustration 2).**



Headlight beam height checking equipment



Home workshop beam alignment check

Final Drive

Exhaust

• Check that the exhaust mountings are secure and that the system does not foul any of the rear suspension components.

✔ Start the motorcycle. When the revs are increased, check that the exhaust is neither holed nor leaking from any of its joints. On a linked system, check that the collector box is not leaking due to corrosion.

• Note that the exhaust decibel level ("loudness" of the exhaust) is assessed at the discretion of the tester. If the motorcycle was first used on or after 1st January 1985 the silencer must carry the BSAU 193 stamp, or a marking relating to its make and model, or be of OE (original equipment) manufacture. If the silencer is marked NOT FOR ROAD USE, RACING USE ONLY or similar, it will fail the MOT.

Final drive

• On chain or belt drive machines, check that the chain/belt is in good condition and does not have excessive slack. Also check that the sprocket is securely mounted on the rear wheel hub. Check that the chain/belt guard is in place.

✔ On shaft drive bikes, check for oil leaking from the drive unit and fouling the rear tyre.

Steering Suspension

Steering

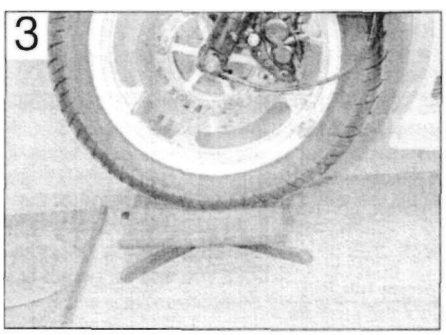
• With the front wheel raised off the ground, rotate the steering from lock to lock. The handlebar or switches must not contact the fuel tank or be close enough to trap the rider's hand. Problems can be caused by damaged lock stops on the lower yoke and frame, or by the fitting of non-standard handlebars.

✔ When performing the lock to lock check, also ensure that the steering moves freely without drag or notchiness. Steering movement can be impaired by poorly routed cables, or by overtight head bearings or worn bearings. The tester will perform a check of the steering head bearing lower race by mounting the front wheel on a surface plate, then performing a lock to lock check with the weight of the machine on the lower bearing (see illustration 3).

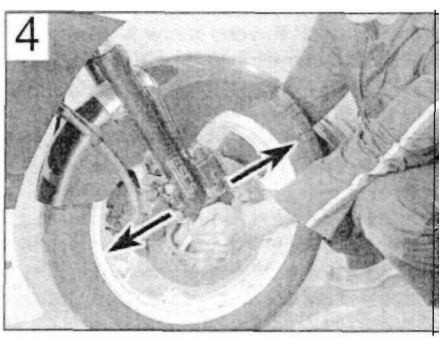
• Grasp the fork sliders (lower legs) and attempt to push and pull on the forks (see illustration 4). Any play in the steering head bearings will be felt. Note that in extreme cases, wear of the front fork bushes can be misinterpreted for head bearing play.

• Check that the handlebars are securely mounted.

• Check that the handlebar grip rubbers are secure. They should by bonded to the bar left end and to the throttle cable pulley on the right end.



Front wheel mounted on a surface plate for steering head bearing lower race check



Checking the steering head bearings for freeplay

Front suspension

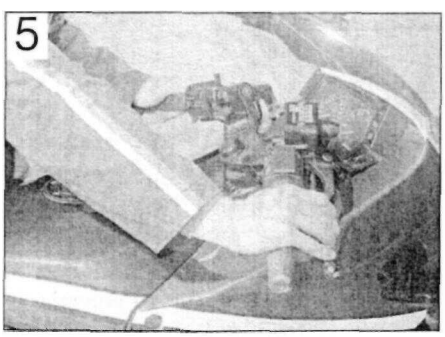
• With the motorcycle off the stand, hold the front brake on and pump the front forks up and down **(see illustration 5).** Check that they are adequately damped.

• Inspect the area above and around the front fork oil seals **(see illustration 6).** There should be no sign of oil on the fork tube (stanchion) nor leaking down the slider (lower leg). On models so equipped, check that there is no oil leaking from the anti-dive units.

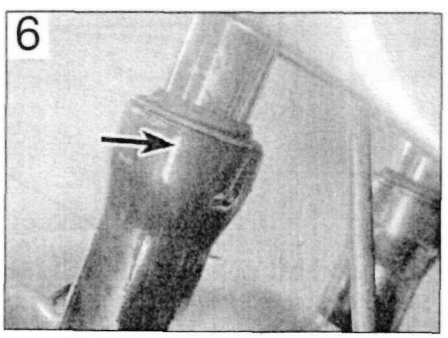
• On models with swingarm front suspension, check that there is no freeplay in the linkage when moved from side to side.

Rear suspension

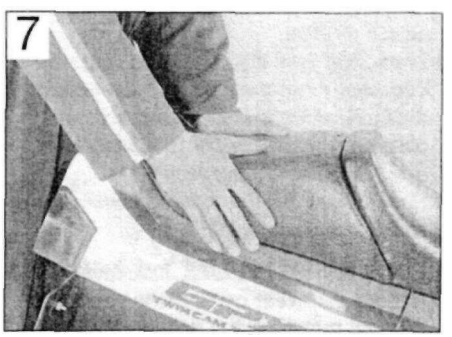
• With the motorcycle off the stand and an assistant supporting the motorcycle by its handlebars, bounce the rear suspension (see illustration 7). Check that the suspension components do not foul on any of the cycle parts and check that the shock absorber(s) provide adequate damping.



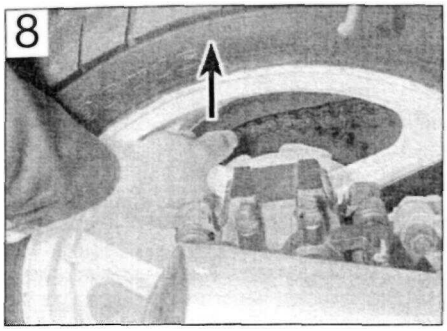
Hold the front brake on and pump the front forks up and down to check operation



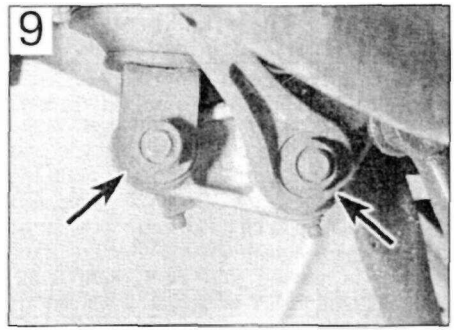
Inspect the area around the fork dust seal for oil leakage (arrow)



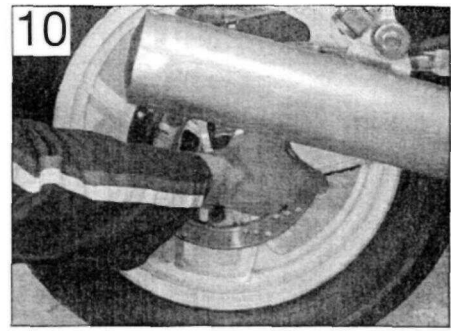
Bounce the rear of the motorcycle to check rear suspension operation



Checking for rear suspension linkage play



Worn suspension linkage pivots (arrows) are usually the cause of play in the rear suspension



Grasp the swingarm at the ends to check for play in its pivot bearings

• Visually inspect the shock absorber(s) and check that there is no sign of oil leakage from its damper. This is somewhat restricted on certain single shock models due to the location of the shock absorber.

• With the rear wheel raised off the ground, grasp the wheel at the highest point and attempt to pull it up **(see illustration** 8). Any play in the swingarm pivot or suspension linkage bearings will be felt as movement. **Note:** *Do not confuse play with actual suspension movement.* Failure to lubricate suspension linkage bearings can lead to bearing failure **(see illustration 9).**

✔ With the rear wheel raised off the ground, grasp the swingarm ends and attempt to move the swingarm from side to side and forwards and backwards - any play indicates wear of the swingarm pivot bearings **(see illustration 10).**

Brakes, Wheels and Tyres

Brakes

• With the wheel raised off the ground, apply the brake then free it off, and check that the wheel is about to revolve freely without brake drag.

• On disc brakes, examine the disc itself. Check that it is securely mounted and not cracked.

• On disc brakes, view the pad material through the caliper mouth and check that the pads are not worn down beyond the limit **(see illustration 11).**

• On drum brakes, check that when the brake is applied the angle between the operating lever and cable or rod is not too great **(see illustration 12).** Check also that the operating lever doesn't foul any other components.

• On disc brakes, examine the flexible hoses from top to bottom. Have an assistant hold the brake on so that the fluid in the hose is under pressure, and check that there is no sign of fluid leakage, bulges or cracking. If there are any metal brake pipes or unions, check that these are free from corrosion and damage. Where a brake-linked anti-dive system is fitted, check the hoses to the anti-dive in a similar manner.

• Check that the rear brake torque arm is secure and that its fasteners are secured by self-locking nuts or castellated nuts with split-pins or R-pins **(see illustration 13).**

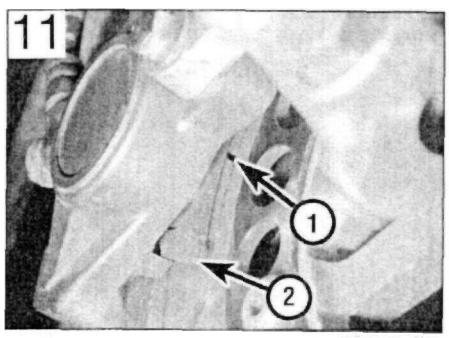
• On models with ABS, check that the self-check warning light in the instrument panel works.

• The MOT tester will perform a test of the motorcycle's braking efficiency based on a calculation of rider and motorcycle weight. Although this cannot be carried out at home, you can at least ensure that the braking systems are properly maintained. For hydraulic disc brakes, check the fluid level, lever/pedal feel (bleed of air if its spongy) and pad material. For drum brakes, check adjustment, cable or rod operation and shoe lining thickness.

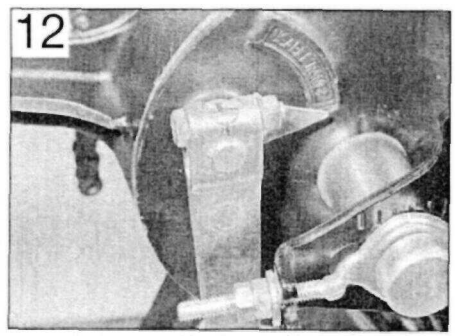
Wheels and tyres

• Check the wheel condition. Cast wheels should be free from cracks and if of the built-up design, all fasteners should be secure. Spoked wheels should be checked for broken, corroded, loose or bent spokes.

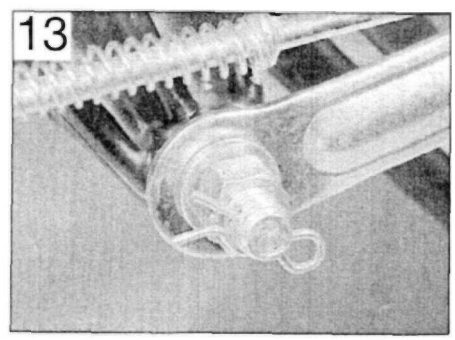
✔ With the wheel raised off the ground, spin the wheel and visually check that the tyre and wheel run true. Check that the tyre does not foul the suspension or mudguards.



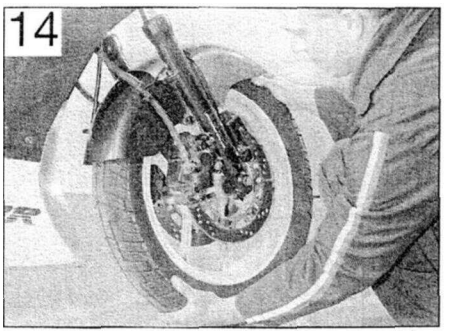
Brake pad wear can usually be viewed without removing the caliper. Most pads have wear indicator grooves (1) and some also have indicator tangs (2)



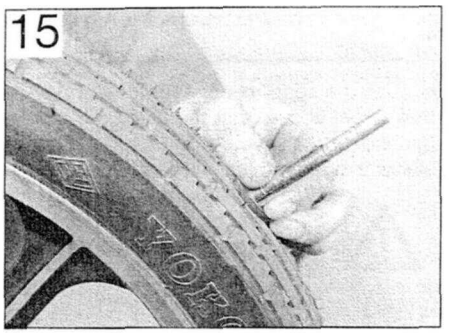
On drum brakes, check the angle of the operating lever with the brake fully applied. Most drum brakes have a wear indicator pointer and scale.



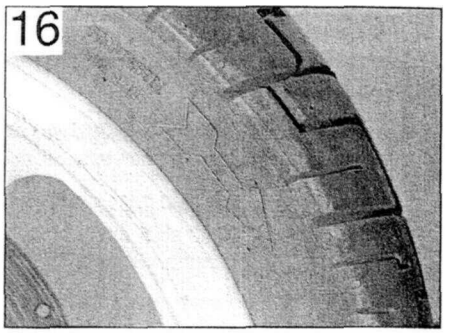
Brake torque arm must be properly secured at both ends



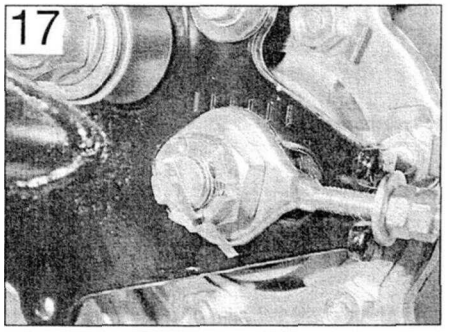
Check for wheel bearing play by trying to move the wheel about the axle (spindle)



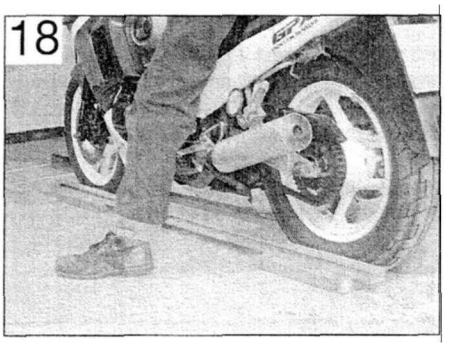
Checking the tyre tread depth



Tyre direction of rotation arrow can be found on tyre sidewall



Castellated type wheel axle (spindle) nut must be secured by a split pin or R-pin



Two straightedges are used to check wheel alignment

• With the wheel raised off the ground, grasp the wheel and attempt to move it about the axle (spindle) **(see illustration 14).** Any play felt here indicates wheel bearing failure.

• Check the tyre tread depth, tread condition and sidewall condition **(see illustration 15).**

• Check the tyre type. Front and rear tyre types must be compatible and be suitable for road use. Tyres marked NOT FOR ROAD USE, COMPETITION USE ONLY or similar, will fail the MOT.

• If the tyre sidewall carries a direction of rotation arrow, this must be pointing in the direction of normal wheel rotation **(see illustration 16).**

• Check that the wheel axle (spindle) nuts (where applicable) are properly secured. A self-locking nut or castellated nut with a split-pin or R-pin can be used **(see illustration 17).**

• Wheel alignment is checked with the motorcycle off the stand and a rider seated. With the front wheel pointing straight ahead, two perfectly straight lengths of metal or wood and placed against the sidewalls of both tyres **(see illustration 18)**. The gap each side of the front tyre must be equidistant on both sides. Incorrect wheel alignment may be due to a cocked rear wheel (often as the result of poor chain adjustment) or in extreme cases, a bent frame.

General checks and condition

• Check the security of all major fasteners, bodypanels, seat, fairings (where fitted) and mudguards.

• Check that the rider and pillion footrests, handlebar levers and brake pedal are securely mounted.

• Check for corrosion on the frame or any load-bearing components. If severe, this may affect the structure, particularly under stress.

Sidecars

A motorcycle fitted with a sidecar requires additional checks relating to the stability of the machine and security of attachment and swivel joints, plus specific wheel alignment (toe-in) requirements. Additionally, tyre and lighting requirements differ from conventional motorcycle use. Owners are advised to check MOT test requirements with an official test centre.

Preparing for **storage**

Before you start

If repairs or an overhaul is needed, see that this is carried out now rather than left until you want to ride the bike again.

Give the bike a good wash and scrub all dirt from its underside. Make sure the bike dries completely before preparing for storage.

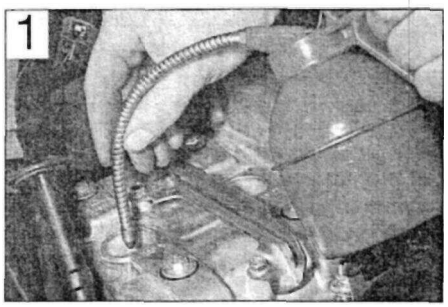
Engine

9 Remove the spark plug(s) and lubricate the cylinder bores with approximately a teaspoon of motor oil using a spout-type oil can **(see illustration 1).** Reinstall the spark plug(s). Crank the engine over a couple of times to coat the piston rings and bores with oil. If the bike has a kickstart, use this to turn the engine over. If not, flick the kill switch to the OFF position and crank the engine over on the starter **(see illustration 2).** If the nature on the ignition system prevents the starter operating with the kill switch in the OFF position, remove the spark plugs and fit them back in their caps; ensure that the plugs are earthed (grounded) against the cylinder head when the starter is operated **(see illustration 3).**

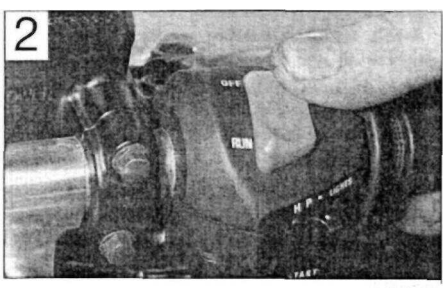
Warning: It is important that the plugs are earthed (grounded) I away from the spark plug holes otherwise there is a risk of atomised fuel from the cylinders igniting.

HAYNES HiNT

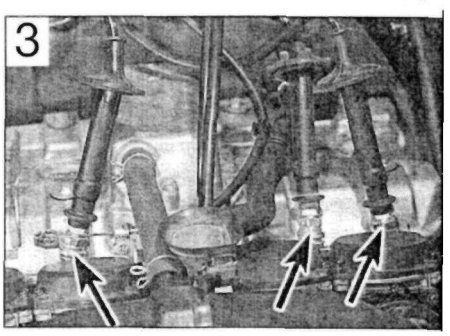
On a single cylinder four-stroke engine, you can seal the combustion chamber completely by positioning the piston at TDC on the compression stroke.



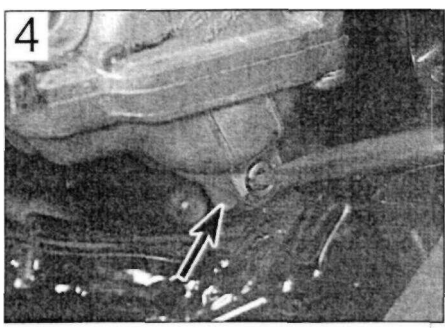
Squirt a drop of motor oil into each cylinder



Flick the kill switch to OFF . . .



. . and ensure that the metal bodies of the plugs (arrows) are earthed against the cylinder head



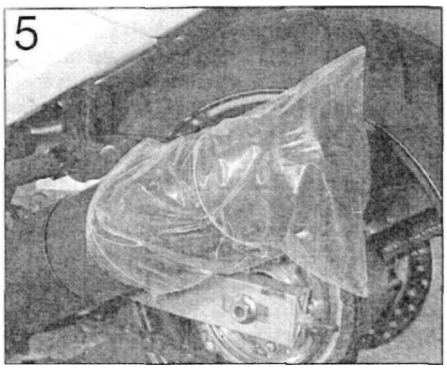
Connect a hose to the carburettor float chamber drain stub (arrow) and unscrew the drain screw

• Drain the carburettor(s) otherwise there is a risk of jets becoming blocked by gum deposits from the fuel **(see illustration 4).**

• If the bike is going into long-term storage, consider adding a fuel stabiliser to the fuel in the tank. If the tank is drained completely, corrosion of its internal surfaces may occur if left unprotected for a long period. The tank can be treated with a rust preventative especially for this purpose. Alternatively, remove the tank and pour half a litre of motor oil into it, install the filler cap and shake the tank to coat its internals with oil before draining off the excess. The same effect *can* also be achieved by spraying WD40 or a similar water-dispersant around the inside of the tank via its flexible nozzle.

• Make sure the cooling system contains the correct mix of antifreeze. Antifreeze also contains important corrosion inhibitors.

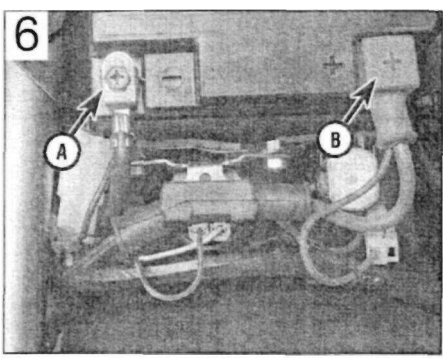
• The air intakes and exhaust can be sealed off by covering or plugging the openings. Ensure that you do not seal in any condensation; run the engine until it is hot, then switch off and allow to cool. Tape a piece of thick plastic over the silencer end(s) **(see illustration 5).** Note that some advocate pouring a tablespoon of motor oil into the silencer(s) before sealing them off.



Exhausts can be sealed off with a plastic bag

Battery

• Remove it from the bike - in extreme cases of cold the battery may freeze and crack its **case (see illustration 6).**

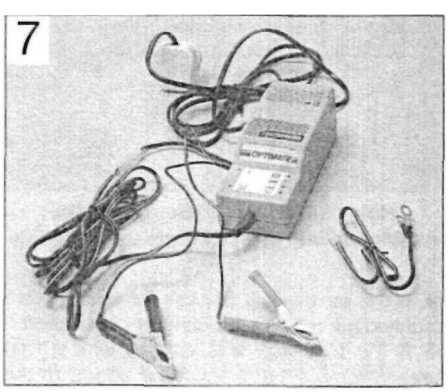


Disconnect the negative lead (A) first, followed by the positive lead (B)

• Check the electrolyte level and top up if necessary (conventional refillable batteries). Clean the terminals.

• Store the battery off the motorcycle and away from any sources of fire. Position a wooden block under the battery if it is to sit on the ground.

• Give the battery a trickle charge for a few hours every month **(see illustration 7).**



Use a suitable battery charger - this kit also assess battery condition

Tyres

9 Place the bike on its centrestand or an auxiliary stand which will support the motorcycle in an upright position. Position wood blocks under the tyres to keep them off the ground and to provide insulation from damp. If the bike is being put into long-term storage, ideally both tyres should be off the ground; not only will this protect the tyres, but will also ensure that no load is placed on the steering head or wheel bearings.

• Deflate each tyre by 5 to 10 psi, no more or the beads may unseat from the rim, making subsequent inflation difficult on tubeless tyres.

Pivots and controls

• Lubricate all lever, pedal, stand and footrest pivot points. If grease nipples are fitted to the rear suspension components, apply lubricant to the pivots.

• Lubricate all control cables.

Cycle components

• Apply a wax protectant to all painted and plastic components. Wipe off any excess, but don't polish to a shine. Where fitted, clean the screen with soap and water.

• Coat metal parts with Vaseline (petroleum jelly). When applying this to the fork tubes, do not compress the forks otherwise the seals will rot from contact with the Vaseline.

• Apply a vinyl cleaner to the seat.

Storage conditions

• Aim to store the bike in a shed or garage which does not leak and is free from damp.

• Drape an old blanket or bedspread over the bike to protect it from dust and direct contact with sunlight (which will fade paint). This also hides the bike from prying eyes. Beware of tight-fitting plastic covers which may allow condensation to form and settle on the bike.

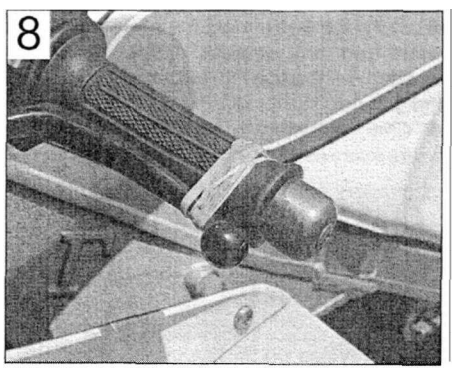
Getting back *on* the road

Engine and transmission

9 Change the oil and replace the oil filter. If this was done prior to storage, check that the oil hasn't emulsified - a thick whitish substance which occurs through condensation.

• Remove the spark plugs. Using a spout-type oil can, squirt a few drops of oil into the cylinder(s). This will provide initial lubrication as the piston rings and bores comes back into contact. Service the spark plugs, or fit new ones, and install them in the engine.

• Check that the clutch isn't stuck on. The plates can stick together if left standing for some time, preventing clutch operation. Engage a gear and try rocking the bike back and forth with the clutch lever held against the handlebar. If this doesn't work on cable-operated clutches, hold the clutch lever back against the handlebar with a strong elastic band or cable tie for a couple of hours **(see illustration 8).**



Hold clutch lever back against the handlebar with elastic bands or a cable tie

9 If the air intakes or silencer end(s) were blocked off, remove the bung or cover used.

• If the fuel tank was coated with a rust preventative, oil or a stabiliser added to the fuel, drain and flush the tank and dispose of the fuel sensibly. If no action was taken with the fuel tank prior to storage, it is advised that the old fuel is disposed of since it will go off over a period of time. Refill the fuel tank with fresh fuel.

Frame and running gear

• Oil all pivot points and cables.

• Check the tyre pressures. They will definitely need inflating if pressures were reduced for storage.

• Lubricate the final drive chain (where applicable).

• Remove any protective coating applied to the fork tubes (stanchions) since this may well destroy the fork seals. If the fork tubes weren't protected and have picked up rust spots, remove them with very fine abrasive paper and refinish with metal polish.

• Check that both brakes operate correctly. Apply each brake hard and check that it's not possible to move the motorcycle forwards, then check that the brake frees off again once released. Brake caliper pistons can stick due to corrosion around the piston head, or on the sliding caliper types, due to corrosion of the slider pins. If the brake doesn't free after repeated operation, take the caliper off for examination. Similarly drum brakes can stick due to a seized operating cam, cable or rod linkage.

• If the motorcycle has been in long-term storage, renew the brake fluid and clutch fluid (where applicable).

• Depending on where the bike has been stored, the wiring, cables and hoses may have been nibbled by rodents. Make a visual check and investigate disturbed wiring loom tape.

Battery

• If the battery has been previously removal and given top up charges it can simply be reconnected. Remember to connect the positive cable first and the negative cable last.

• On conventional refillable batteries, if the battery has not received any attention, remove it from the motorcycle and check its electrolyte level. Top up if necessary then charge the battery. If the battery fails to hold a charge and a visual checks show heavy white sulphation of the plates, the battery is probably defective and must be renewed. This is particularly likely if the battery is old. Confirm battery condition with a specific gravity check.

• On sealed (MF) batteries, if the battery has not received any attention, remove it from the motorcycle and charge it according to the information on the battery case - if the battery fails to hold a charge it must be renewed.

Starting procedure

• If a kickstart is fitted, turn the engine over a couple of times with the ignition OFF to distribute oil around the engine. If no kickstart is fitted, flick the engine kill switch OFF and the ignition ON and crank the engine over a couple of times to work oil around the upper cylinder components. If the nature of the ignition system is such that the starter won't work with the kill switch OFF, remove the spark plugs, fit them back into their caps and earth (ground) their bodies on the cylinder head. Reinstall the spark plugs afterwards.

• Switch the kill switch to RUN, operate the choke and start the engine. If the engine won't start don't continue cranking the engine - not only will this flatten the battery, but the starter motor will overheat. Switch the ignition off and try again later. If the engine refuses to start, go through the fault finding procedures in this manual. **Note:** *If the bike has been in storage for a long time, old fuel or a carburettor blockage may be the problem. Gum deposits in carburettors can block jets - if a carburettor cleaner doesn't prove successful the carburettors must be dismantled for cleaning.*

• Once the engine has started, check that the lights, turn signals and horn work properly.

• Treat the bike gently for the first ride and check all fluid levels on completion. Settle the bike back into the maintenance schedule.

Fault Finding

This Section provides an easy reference-guide to the more common faults that are likely to afflict your machine. Obviously, the opportunities are almost limitless for faults to occur as a result of obscure failures, and to try and cover all eventualities would require a book. Indeed, a number have been written on the subject.

Successful troubleshooting is not a mysterious 'black art' but the application of a bit of knowledge combined with a systematic and logical approach to the problem. Approach any troubleshooting by first accurately identifying the symptom and then checking through the list of possible causes, starting with the simplest or most obvious and progressing in stages to the most complex.

Take nothing for granted, but above all apply liberal quantities of common sense.

The main symptom of a fault is given in the text as a major heading below which are listed the various systems or areas which may contain the fault. Details of each possible cause for a fault and the remedial action to be taken are given, in brief, in the paragraphs below each heading. Further information should be sought in the relevant Chapter.

1 Engine doesn't start or is difficult to start

P Starter motor doesn't rotate
☐ Starter motor rotates but engine does not turn over
☐ Starter works but engine won't turn over (seized
O No fuel flow
☐ Engine flooded
☐ No spark or weak spark
☐ Compression low
☐ Stalls after starting
☐ Rough idle

2 Poor running at low speed

P Spark weak
☐ Fuel/air mixture incorrect
☐ Compression low
D Poor acceleration

3 Poor running or no power at high speed

☐ Firing incorrect
☐ Fuel/air mixture incorrect
☐ Compression low
☐ Knocking or pinging
☐ Miscellaneous causes

4 Overheating

☐ Engine overheats
n Firing incorrect
D Fuel/air mixture incorrect
D Compression too high
☐ Engine load excessive
☐ Lubrication inadequate
n Miscellaneous causes

5 Clutch problems

P Clutch slipping
P Clutch not disengaging completely (dragging)

6 Gear shifting problems

P Doesn't go into gear, or lever doesn't return
☐ Jumps out of gear
Q Overshifts

7 Abnormal engine noise

☐ Knocking or pinging
☐ Piston slap or rattling
☐ Valve noise
☐ Other noise

8 Abnormal driveline noise

☐ Clutch noise
D Transmission noise
☐ Final drive noise

9 Abnormal frame and suspension noise

☐ Front end noise
☐ Shock absorber noise
☐ Brake noise

10 Oil pressure indicator light comes on

P Engine lubrication system
O Electrical system

11 Excessive exhaust smoke

P White smoke
P Black smoke
☐ Brown smoke

12 Poor handling or stability

p Handlebar hard to turn
P Handlebar shakes or vibrates excessively
☐ Handlebar pulls to one side
P Poor shock absorbing qualities

13 Braking problems

P Brakes are spongy, don't hold
P Brake lever or pedal pulsates
P Brakes drag

14 Electrical problems

p Battery dead or weak
P Battery overcharged

1 Engine doesn't start or is difficult to start

Starter motor doesn't rotate

D Engine kill switch OFF.
D Fuse blown. Check main fuse and starter circuit fuse (Chapter 9).
D Battery voltage low. Check and recharge battery (Chapter 9).
☐ Starter motor defective. Make sure the wiring to the starter is secure. Make sure the starter relay clicks when the start button is pushed. If the relay clicks, then the fault is in the wiring or motor.
☐ Starter relay faulty. Check it according to the procedure in Chapter 9.
☐ Starter switch not contacting. The contacts could be wet, corroded or dirty. Disassemble and clean the switch (Chapter 9).
☐ Wiring open or shorted. Check all wiring connections and harnesses to make sure that they are dry, tight and not corroded. Also check for broken or frayed wires that can cause a short to ground (earth) (see wiring diagram, Chapter 9).
☐ Ignition (main) switch defective. Check the switch according to the procedure in Chapter 9. Replace the switch with a new one if it is defective.
D Engine kill switch defective. Check for wet, dirty or corroded contacts. Clean or replace the switch as necessary (Chapter 9).
☐ Faulty neutral, side stand or clutch switch. Check the wiring to each switch and the switch itself according to the procedures in Chapter 9.

Starter motor rotates but engine does not turn over

☐ Starter motor clutch defective. Inspect and repair or replace (Chapter 2).
☐ Damaged idler or starter gears. Inspect and replace the damaged parts (Chapter 2).

Starter works but engine won't turn over (seized)

☐ Seized engine caused by one or more internally damaged components. Failure due to wear, abuse or lack of lubrication. Damage can include seized valves, followers, camshafts, pistons, crankshaft, connecting rod bearings, or transmission gears or bearings. Refer to Chapter 2 for engine disassembly.

No fuel flow

☐ No fuel in tank.
☐ Fuel pump failure or in-line filter blockage (see Chapters 1 and 9 respectively).
☐ Fuel tank breather hose obstructed (not California models).
☐ Fuel tap filter clogged. Remove the tap and clean it and the filter (Chapter 1).
☐ Fuel line clogged. Pull the fuel line loose and carefully blow through it.
☐ Float needle valve clogged. For all of the valves to be clogged, either a very bad batch of fuel with an unusual additive has been used, or some other foreign material has entered the tank. Many times after a machine has been stored for many months without running, the fuel turns to a varnish-like liquid and forms deposits on the inlet needle valves and jets. The carburetors should be removed and overhauled if draining the float chambers doesn't solve the problem.

Engine flooded

☐ Float height too high. Check as described in Chapter 4.
☐ Float needle valve worn or stuck open. A piece of dirt, rust or other debris can cause the valve to seat improperly, causing excess fuel to be admitted to the float chamber. In this case, the float chamber should be cleaned and the needle valve and seat inspected. If the needle and seat are worn, then the leaking will persist and the parts should be replaced with new ones (Chapter 4).
☐ Starting technique incorrect. Under normal circumstances (ie, if all the carburetor functions are sound) the machine should start with little or no throttle. When the engine is cold, the choke should be operated and the engine started without opening the throttle. When the engine is at operating temperature, only a very slight amount of throttle should be necessary. If the engine is flooded, turn the fuel tap OFF and hold the throttle open while cranking the engine. This will allow additional air to reach the cylinders. Remember to turn the fuel tap back ON after the engine starts.

Wo *spark or weak spark*

☐ Ignition switch OFF.
☐ Engine kill switch turned to the OFF position.
☐ Battery voltage low. Check and recharge the battery as necessary (Chapter 9).
☐ Spark plugs dirty, defective or worn out. Locate reason for fouled plugs using spark plug condition chart and follow the plug maintenance procedures (Chapter 1).
☐ Spark plug caps or secondary (HT) wiring faulty. Check condition. Replace either or both components if cracks or deterioration are evident (Chapter 5).
☐ Spark plug caps not making good contact. Make sure that the plug caps fit snugly over the plug ends.
☐ Ignition control module defective. Check the module, referring to Chapter 5 for details.
☐ Pulse generator defective. Check the unit, referring to Chapter 5 for details.
☐ Ignition HT coils defective. Check the coils, referring to Chapter 5.
☐ Ignition or kill switch shorted. This is usually caused by water, corrosion, damage or excessive wear. The switches can be disassembled and cleaned with electrical contact cleaner. If cleaning does not help, replace the switches (Chapter 9).
D Wiring shorted or broken between:

a) Ignition (main) switch and engine kill switch (or blown fuse)
b) Ignition control module and engine kill switch
c) Ignition control module and ignition HT coils
d) Ignition HT coils and spark plugs
e) Ignition control module and pulse generator

☐ Make sure that all wiring connections are clean, dry and tight. Look for chafed and broken wires (Chapters 5 and 9).

1 Engine doesn't start or is difficult to start (continued)

Compression low

- ☐ Spark plugs loose. Remove the plugs and inspect their threads. Reinstall and tighten to the specified torque (Chapter 1).
- ☐ Cylinder head not sufficiently tightened down. If the cylinder head is suspected of being loose, then there's a chance that the gasket or head is damaged if the problem has persisted for any length of time. The head bolts should be tightened to the proper torque in the correct sequence (Chapter 2).
- ☐ Improper valve clearance. This means that the valve is not closing completely and compression pressure is leaking past the valve. Check and adjust the valve clearances (Chapter 1).
- D Cylinder and/or piston worn. Excessive wear will cause compression pressure to leak past the rings. This is usually accompanied by worn rings as well. A top-end overhaul is necessary (Chapter 2).
- ☐ Piston rings worn, weak, broken, or sticking. Broken or sticking piston rings usually indicate a lubrication or carburation problem that causes excess carbon deposits or seizures to form on the pistons and rings. Top-end overhaul is necessary (Chapter 2).
- ☐ Piston ring-to-groove clearance excessive. This is caused by excessive wear of the piston ring lands. Piston replacement is necessary (Chapter 2).
- ☐ Cylinder head gasket damaged. If the head is allowed to become loose, or if excessive carbon build-up on the piston crown and combustion chamber causes extremely high compression, the head gasket may leak. Retorquing the head is not always sufficient to restore the seal, so gasket replacement is necessary (Chapter 2).
- ☐ Cylinder head warped. This is caused by overheating or improperly tightened head bolts. Machine shop resurfacing or head replacement is necessary (Chapter 2).
- ☐ Valve spring broken or weak. Caused by component failure or wear; the springs must be replaced (Chapter 2).
- ☐ Valve not seating properly. This is caused by a bent valve (from over-revving or improper valve adjustment), burned valve or seat (improper carburation) or an accumulation of carbon deposits on the seat (from carburation or lubrication problems). The valves must be cleaned and/or replaced and the seats serviced if possible (Chapter 2).

Stalls after starting

- ☐ Improper choke action. Make sure the choke linkage shaft is getting a full stroke and staying in the out position (Chapter 4).
- ☐ Ignition malfunction. See Chapter 5.
- ☐ Carburetor malfunction. See Chapter 4.
- ☐ Fuel contaminated. The fuel can be contaminated with either dirt or water, or can change chemically if the machine is allowed to sit for several months or more. Drain the tank and float chambers (Chapter 4).
- ☐ Intake air leak. Check for loose carburetor-to-intake manifold connections, loose or missing vacuum gauge adapter screws or hoses, or loose carburetor tops (Chapter 4).
- CD Engine idle speed incorrect. Turn idle adjusting screw until the engine idles at the specified rpm (Chapter 1).

Rough idle

- ☐ Ignition malfunction. See Chapter 5.
- ☐ Idle speed incorrect. See Chapter 1.
- ☐ Carburetors not synchronized. Adjust carburetors with vacuum gauge or manometer set as described in Chapter 1.
- ☐ Carburetor malfunction. See Chapter 4.
- ☐ Fuel contaminated. The fuel can be contaminated with either dirt or water, or can change chemically if the machine is allowed to sit for several months or more. Drain the tank and float chambers (Chapter 4).
- ☐ Intake air leak. Check for loose carburetor-to-intake manifold connections, loose or missing vacuum gauge adapter screws or hoses, or loose carburetor tops (Chapter 4).
- ☐ Air filter clogged. Replace the air filter element (Chapter 1).

2 Poor running at low speeds

Spark weak

- ☐ Battery voltage low. Check and recharge battery (Chapter 9).
- ☐ Spark plugs fouled, defective or worn out. Refer to Chapter 1 for spark plug maintenance.
- ☐ Spark plug cap or HT wiring defective. Refer to Chapters 1 and 5 for details on the ignition system.
- ☐ Spark plug caps not making contact.
- ☐ Incorrect spark plugs. Wrong type, heat range or cap configuration. Check and install correct plugs listed in Chapter 1.
- ☐ Ignition control module defective. See Chapter 5.
- ☐ Pulse generator defective. See Chapter 5.
- ☐ Ignition HT coils defective. See Chapter 5.

Fuel/air mixture incorrect

- ☐ Pilot screws out of adjustment (Chapter 4).
- ☐ Pilot jet or air passage clogged. Remove and overhaul the carburetors (Chapter 4).
- ☐ Air bleed holes clogged. Remove carburetor and blow out all passages (Chapter 4).
- ☐ Air filter clogged, poorly sealed or missing (Chapter 1).
- ☐ Air filter housing poorly sealed. Look for cracks, holes or loose clamps and replace or repair defective parts.
- ☐ Fuel level too high or too low. Check the float height (Chapter 4).
- ☐ Fuel tank breather hose obstructed (not California models).
- ☐ Carburetor intake manifolds loose. Check for cracks, breaks, tears or loose clamps. Replace the rubber intake manifold joints if split or perished.

2 Poor running at low speeds (continued)

Compression low

- ☐ Spark plugs loose. Remove the plugs and inspect their threads. Reinstall and tighten to the specified torque (Chapter 1).
- ☐ Cylinder head not sufficiently tightened down. If the cylinder head is suspected of being loose, then there's a chance that the gasket and head are damaged if the problem has persisted for any length of time. The head bolts should be tightened to the proper torque in the correct sequence (Chapter 2).
- ☐ Improper valve clearance. This means that the valve is not closing completely and compression pressure is leaking past the valve. Check and adjust the valve clearances (Chapter 1).
- ☐ Cylinder and/or piston worn. Excessive wear will cause compression pressure to leak past the rings. This is usually accompanied by worn rings as well. A top end overhaul is necessary (Chapter 2).
- ☐ Piston rings worn, weak, broken, or sticking. Broken or sticking piston rings usually indicate a lubrication or carburation problem that causes excess carbon deposits or seizures to form on the pistons and rings. Top-end overhaul is necessary (Chapter 2).
- ☐ Piston ring-to-groove clearance excessive. This is caused by excessive wear of the piston ring lands. Piston replacement is necessary (Chapter 2).
- ☐ Cylinder head gasket damaged. If the head is allowed to become loose, or if excessive carbon build-up on the piston crown and combustion chamber causes extremely high compression, the head gasket may leak. Retorquing the head is not always sufficient to restore the seal, so gasket replacement is necessary (Chapter 2).
- D Cylinder head warped. This is caused by overheating or improperly tightened head bolts. Machine shop resurfacing or head replacement is necessary (Chapter 2).
- LJ Valve spring broken or weak. Caused by component failure or wear; the springs must be replaced (Chapter 2).
- ☐ Valve not seating properly. This is caused by a bent valve (from over-revving or improper valve adjustment), burned valve or seat (improper carburation) or an accumulation of carbon deposits on the seat (from carburation, lubrication problems). The valves must be cleaned and/or replaced and the seats serviced if possible (Chapter 2).

Poor *acceleration*

- ☐ Carburetors leaking or dirty. Overhaul the carburetors (Chapter 4).
- ☐ Timing not advancing. The pulse generator or the ignition control module may be defective. If so, they must be replaced with new ones, as they can't be repaired.
- ☐ Carburetors not synchronized. Adjust them with a vacuum gauge set or manometer (Chapter 1).
- ☐ Engine oil viscosity too high. Using a heavier oil than that recommended in Chapter 1 can damage the oil pump or lubrication system and cause drag on the engine.
- ☐ Brakes dragging. Usually caused by debris which has entered the brake piston seals, or from a warped disc or bent axle. Repair as necessary (Chapter 7).

3 Poor running or no power at high speed

Firing incorrect

- ☐ Air filter restricted. Clean or replace filter (Chapter 1).
- ☐ Spark plugs fouled, defective or worn out. See Chapter 1 for spark plug maintenance.
- D Spark plug caps or HT wiring defective. See Chapters 1 and 5 for details of the ignition system.
- ☐ Spark plug caps not in good contact. See Chapter 5.
- ☐ Incorrect spark plugs. Wrong type, heat range or cap configuration. Check and install correct plugs listed in Chapter 1.
- ☐ Ignition control module defective. See Chapter 5.
- ☐ Ignition coils defective. See Chapter 5.

Fuel/air mixture incorrect

- ☐ Main jet clogged. Dirt, water or other contaminants can clog the main jets. Clean the fuel tap filter, the in-line filter, the float chamber area, and the jets and carburetor orifices (Chapter 4).
- ☐ Main jet wrong size. The standard jetting is for sea level atmospheric pressure and oxygen content.
- D Throttle shaft-to-carburetor body clearance excessive. Refer to Chapter 4 for inspection and part replacement procedures.
- D Air bleed holes clogged. Remove and overhaul carburetors (Chapter 4).
- ☐ Air filter clogged, poorly sealed, or missing (Chapter 1).
- ☐ Air filter housing poorly sealed. Look for cracks, holes or loose clamps, and replace or repair defective parts.
- ☐ Fuel level too high or too low. Check the float height (Chapter 4).
- ☐ Fuel tank breather hose obstructed (not California models).
- ☐ Carburetor intake manifolds loose. Check for cracks, breaks, tears or loose clamps. Replace the rubber intake manifolds if they are split or perished (Chapter 4).

Compression low

- ☐ Spark plugs loose. Remove the plugs and inspect their threads. Reinstall and tighten to the specified torque (Chapter 1).
- ☐ Cylinder head not sufficiently tightened down. If the cylinder head is suspected of being loose, then there's a chance that the gasket and head are damaged if the problem has persisted for any length of time. The head bolts should be tightened to the proper torque in the correct sequence (Chapter 2).
- ☐ Improper valve clearance. This means that the valve is not closing completely and compression pressure is leaking past the valve. Check and adjust the valve clearances (Chapter 1).
- ☐ Cylinder and/or piston worn. Excessive wear will cause compression pressure to leak past the rings. This is usually accompanied by worn rings as well. A top-end overhaul is necessary (Chapter 2).
- ☐ Piston rings worn, weak, broken, or sticking. Broken or sticking piston rings usually indicate a lubrication or carburation problem that causes excess carbon deposits or seizures to form on the pistons and rings. Top-end overhaul is necessary (Chapter 2).
- ☐ Piston ring-to-groove clearance excessive. This is caused by excessive wear of the piston ring lands. Piston replacement is necessary (Chapter 2).
- ☐ Cylinder head gasket damaged. If the head is allowed to become loose, or if excessive carbon build-up on the piston crown and combustion chamber causes extremely high compression, the head gasket may leak. Retorquing the head is not always sufficient to restore the seal, so gasket replacement is necessary (Chapter 2).
- ☐ Cylinder head warped. This is caused by overheating or improperly tightened head bolts. Machine shop resurfacing or head replacement is necessary (Chapter 2).

3 Poor running or no power at high speed (continued)

Compression low (continued)

D Valve spring broken or weak. Caused by component failure or wear; the springs must be replaced (Chapter 2).

☐ Valve not seating properly. This is caused by a bent valve (from over-revving or improper valve adjustment), burned valve or seat (improper carburation) or an accumulation of carbon deposits on the seat (from carburation or lubrication problems). The valves must be cleaned and/or replaced and the seats serviced if possible (Chapter 2).

Knocking or pinking

☐ Carbon build-up in combustion chamber. Use of a fuel additive that will dissolve the adhesive bonding the carbon particles to the crown and chamber is the easiest way to remove the build-up. Otherwise, the cylinder head will have to be removed and decarbonized (Chapter 2).

☐ Incorrect or poor quality fuel. Old or improper grades of fuel can cause detonation. This causes the piston to rattle, thus the knocking or pinking sound. Drain old fuel and always use the recommended fuel grade.

☐ Spark plug heat range incorrect. Uncontrolled detonation indicates the plug heat range is too hot. The plug in effect becomes a glow plug, raising cylinder temperatures. Install the proper heat range plug (Chapter 1).

☐ Improper air/fuel mixture. This will cause the cylinder to run hot, which leads to detonation. Clogged jets or an air leak can cause this imbalance. See Chapter 4.

Miscellaneous causes

☐ Throttle valve doesn't open fully. Adjust the throttle grip freeplay (Chapter 1).

☐ Clutch slipping. May be caused by loose or worn clutch components. Refer to Chapter 2 for clutch overhaul procedures.

☐ Timing not advancing.

☐ Engine oil viscosity too high. Using a heavier oil than the one recommended in Chapter 1 can damage the oil pump or lubrication system and cause drag on the engine.

☐ Brakes dragging. Usually caused by debris which has entered the brake piston seals, or from a warped disc or bent axle. Repair as necessary.

4 Overheating

Engine overheats

☐ Coolant level low. Check and add coolant (Chapter 1).

☐ Leak in cooling system. Check cooling system hoses and radiator for leaks and other damage. Repair or replace parts as necessary (Chapter 3).

☐ Thermostat sticking open or closed. Check and replace as described in Chapter 3.

☐ Faulty radiator cap. Remove the cap and have it pressure tested.

☐ Coolant passages clogged. Have the entire system drained and flushed, then refill with fresh coolant.

☐ Water pump defective. Remove the pump and check the components (Chapter 3).

☐ Clogged radiator fins. Clean them by blowing compressed air through the fins from the backside.

☐ Cooling fan or fan switch fault (Chapter 3).

Firing incorrect

☐ Spark plugs fouled, defective or worn out. See Chapter 1 for spark plug maintenance.

☐ Incorrect spark plugs.

☐ Faulty ignition HT coils (Chapter 5).

Fuel/air mixture incorrect

☐ Main jet clogged. Dirt, water and other contaminants can clog the main jets. Clean the fuel tap filter, the fuel pump in-line filter, the float chamber area and the jets and carburetor orifices (Chapter4).

☐ Main jet wrong size. The standard jetting is for sea level atmospheric pressure and oxygen content.

☐ Air filter clogged, poorly sealed or missing (Chapter 1).

D Air filter housing poorly sealed. Look for cracks, holes or loose clamps and replace or repair.

☐ Fuel level too low. Check float height (Chapter 4).

☐ Fuel tank breather hose obstructed (not California models).

☐ Carburetor intake manifolds loose. Check for cracks, breaks, tears or loose clamps. Replace the rubber intake manifold joints if split or perished.

Compression too high

☐ Carbon build-up in combustion chamber. Use of a fuel additive that will dissolve the adhesive bonding the carbon particles to the piston crown and chamber is the easiest way to remove the build-up. Otherwise, the cylinder head will have to be removed and decarbonized (Chapter 2).

☐ Improperly machined head surface or installation of incorrect gasket during engine assembly.

Engine load excessive

☐ Clutch slipping. Can be caused by damaged, loose or worn clutch components. Refer to Chapter 2 for overhaul procedures.

☐ Engine oil level too high. The addition of too much oil will cause pressurization of the crankcase and inefficient engine operation. Check Specifications and drain to proper level (Chapter 1).

D Engine oil viscosity too high. Using a heavier oil than the one recommended in Chapter 1 can damage the oil pump or lubrication system as well as cause drag on the engine.

☐ Brakes dragging. Usually caused by debris which has entered the brake piston seals, or from a warped disc or bent axle. Repair as necessary.

Lubrication inadequate

☐ Engine oil level too low. Friction caused by intermittent lack of lubrication or from oil that is overworked can cause overheating. The oil provides a definite cooling function in the engine. Check the oil level (Chapter 1).

☐ Poor quality engine oil or incorrect viscosity or type. Oil is rated not only according to viscosity but also according to type. Some oils are not rated high enough for use in this engine. Check the Specifications section and change to the correct oil (Chapter 1).

Miscellaneous causes

☐ Modification to exhaust system. Most aftermarket exhaust systems cause the engine to run leaner, which make them run hotter. When installing an accessory exhaust system, always rejet the carburetors.

5 Clutch problems

Clutch slipping

- ☐ Cable freeplay insufficient. Check and adjust cable (Chapter 1).
- ☐ Friction plates worn or warped. Overhaul the clutch assembly (Chapter 2).
- ☐ Plain plates warped (Chapter 2).
- ☐ Clutch springs broken or weak. Old or heat-damaged (from slipping clutch) springs should be replaced with new ones (Chapter 2).
- ☐ Clutch release mechanism defective. Replace any defective parts (Chapter 2).
- D Clutch center or outer drum unevenly worn. This causes improper engagement of the plates. Replace the damaged or worn parts (Chapter 2).

Clutch not disengaging completely (dragging)

- ☐ Cable freeplay excessive. Check and adjust cable (Chapter 1).
- ☐ Clutch plates warped or damaged. This will cause dutch drag, which in turn will cause the machine to creep. Overhaul the clutch assembly (Chapter 2).
- ☐ Clutch spring tension uneven. Usually caused by a sagged or broken spring. Check and replace the springs as a set (Chapter 2).
- D Engine oil deteriorated. Old, thin, worn out oil will not provide proper lubrication for the plates, causing the clutch to drag. Replace the oil and filter (Chapter 1).
- ☐ Engine oil viscosity too high. Using a heavier oil than recommended in Chapter 1 can cause the plates to stick together, putting a drag on the engine. Change to the correct weight oil (Chapter 1).
- ☐ Clutch outer drum guide seized on mainshaft. Lack of lubrication, severe wear or damage can cause the guide to seize on the shaft. Overhaul of the clutch, and perhaps transmission, may be necessary to repair the damage (Chapter 2).
- ☐ Clutch release mechanism defective. Overhaul the clutch cover components (Chapter 2),
- ☐ Loose clutch center nut. Causes drum and center misalignment putting a drag on the engine. Engagement adjustment continually varies. Overhaul the clutch assembly (Chapter 2).

6 Gear shifting problems

Doesn't go *into gear or lever doesn't return*

- G Clutch not disengaging. See Section 5.
- D Shift fork(s) bent or seized. This is often caused by dropping the machine or from lack of lubrication. Overhaul the transmission (Chapter 2).
- ☐ Gear(s) stuck on shaft. Most often caused by a lack of lubrication or excessive wear in transmission bearings and bushings. Overhaul the transmission (Chapter 2).
- ☐ Gearshift drum binding. Caused by lubrication failure or excessive wear. Replace the drum and bearing (Chapter 2).
- ☐ Gearshift lever return spring weak or broken (Chapter 2).
- D Gearshift lever broken. Splines stripped out of lever or shaft, caused by allowing the lever to get loose or from dropping the machine. Replace necessary parts (Chapter 2).
- ☐ Gearshift mechanism stopper arm broken or worn. Full engagement and rotary movement of shift drum results. Replace the arm (Chapter 2).
- ☐ Stopper arm spring broken. Allows arm to float, causing sporadic shift operation. Replace spring (Chapter 2).

Jumps out of gear

- ☐ Shift fork(s) worn. Overhaul the transmission (Chapter 2).
- ☐ Gear groove(s) worn. Overhaul the transmission (Chapter 2).
- ☐ Gear dogs or dog slots worn or damaged. The gears should be inspected and replaced. No attempt should be made to service the worn parts.

Overshifts

- ☐ Stopper arm spring weak or broken (Chapter 2).
- D Gearshift shaft return spring post broken or distorted (Chapter 2).

7 Abnormal engine noise

Knocking or pinking

- D Carbon build-up in combustion chamber. Use of a fuel additive that will dissolve the adhesive bonding the carbon particles to the piston crown and chamber is the easiest way to remove the build-up. Otherwise, the cylinder head will have to be removed and decarbonized (Chapter 2).
- ☐ Incorrect or poor quality fuel. Old or improper fuel can cause detonation. This causes the pistons to rattle, thus the knocking or pinking sound. Drain the old fuel and always use the recommended grade fuel (Chapter 4).
- ☐ Spark plug heat range incorrect. Uncontrolled detonation indicates that the plug heat range is too hot. The plug in effect becomes a glow plug, raising cylinder temperatures. Install the proper heat range plug (Chapter 1).
- ☐ Improper air/fuel mixture. This will cause the cylinders to run hot and lead to detonation. Clogged jets or an air leak can cause this imbalance. See Chapter 4.

Piston slap or rattling

- ☐ Cylinder-to-piston clearance excessive. Caused by improper assembly. Inspect and overhaul top-end parts (Chapter 2).
- ☐ Connecting rod bent. Usually caused by over-revving, trying to start a badly flooded engine or from ingesting a foreign object into the combustion chamber. Replace the damaged parts (Chapter 2).
- ☐ Piston pin or piston pin bore worn or seized from wear or lack of lubrication. Replace damaged parts (Chapter 2).
- ☐ Piston ring(s) worn, broken or sticking. Overhaul the top-end (Chapter 2),
- ☐ Piston seizure damage. Usually from lack of lubrication or overheating. Replace the pistons and bore the cylinders, as necessary (Chapter 2).
- ☐ Connecting rod upper or lower end clearance excessive. Caused by excessive wear or lack of lubrication. Replace worn parts.

Valve noise

- ☐ Incorrect valve clearances. Adjust the clearances (see Chapter 1).
- ☐ Valve spring broken or weak. Check and replace weak valve springs (Chapter 2).
- ☐ Camshaft or cylinder head worn or damaged. Lack of lubrication at high rpm is usually the cause of damage. Insufficient oil or failure to change the oil at the recommended intervals are the chief causes. Since there are no replaceable bearings in the head, the head itself will have to be replaced if there is excessive wear or damage (Chapter 2).

7 Abnormal engine noise (continued)

Other noise

- ☐ Cylinder head gasket leaking.
- ☐ Exhaust pipe leaking at cylinder head connection. Caused by improper fit of pipe(s) or loose exhaust flange. All exhaust fasteners should be tightened evenly and carefully. Failure to do this will lead to a leak.
- ☐ Crankshaft runout excessive. Caused by a bent crankshaft (from ... over-revving) or damage from an upper cylinder component failure. Can also be attributed to dropping the machine on either of the crankshaft ends.
- ☐ Engine mounting bolts loose. Tighten all mountings (Chapter 2).
- ☐ Crankshaft bearings worn (Chapter 2).
- D Cam chain tensioner defective. Replace according to the procedure in Chapter 2.
- ☐ Cam chain, sprockets or guides worn (Chapter 2).

8 Abnormal driveline noise

Clutch noise

- ☐ Clutch outer drum/friction plate clearance excessive (Chapter 2).
- ☐ Loose or damaged clutch pressure plate and/or bolts (Chapter 2).

Transmission noise

- ☐ Bearings worn. Also includes the possibility that the shafts are worn. Overhaul the transmission (Chapter 2).
- ☐ Gears worn or chipped (Chapter 2).
- D Metal chips jammed in gear teeth. Probably pieces from a broken clutch, gear or shift mechanism that were picked up by the gears. This will cause early bearing failure (Chapter 2).
- ☐ Engine oil level too low. Causes a howl from transmission. Also affects engine power and clutch operation (Chapter 1).

Final drive noise

- ☐ Final drive oil level low (Chapter 1).
- ☐ Final drive gear lash incorrect. Refer to a Honda dealer for advice.
- ☐ Final drive gears worn or damaged (Chapter 6).
- ☐ Final drive bearings worn (Chapter 6).
- ☐ Driveshaft splines worn and slipping (Chapter 6).

9 Abnormal frame and suspension noise

Front end noise

- ☐ Low fluid level or improper viscosity oil in forks. This can sound like spurting and is usually accompanied by irregular fork action (Chapter 6).
- ☐ Spring weak or broken. Makes a clicking or scraping sound. Fork oil, when drained, will have a lot of metal particles in it (Chapter 6).
- ☐ Steering head bearings loose or damaged. Clicks when braking. Check and adjust or replace as necessary (Chapters 1 and 6).
- ☐ Fork triple clamps loose. Make sure all clamp pinch bolts are tight (Chapter 6).
- ☐ Fork tube bent. Good possibility if machine has been dropped. Replace tube with a new one (Chapter 6).
- ☐ Front axle or axle clamp bolt loose. Tighten them to the specified torque (Chapter 6).

Shock absorber noise

- ☐ Fluid level incorrect. Indicates a leak caused by defective seal. Shock will be covered with oil. Replace shock or seek advice on repair from a Honda dealer (Chapter 6).
- ☐ Defective shock absorber with internal damage. This is in the body of the shock and can't be remedied. The shock must be replaced with a new one (Chapter 6),
- ☐ Bent or damaged shock body. Replace the shock with a new one (Chapter 6).

Brake noise

- ☐ Squeal caused by pad shim not installed or positioned correctly - rear caliper (Chapter 7).
- ☐ Squeal caused by dust on brake pads. Usually found in combination with glazed pads. Clean using brake cleaning solvent (Chapter 7).
- ☐ Contamination of brake pads. Oil, brake fluid or dirt causing brake to chatter or squeal. Clean or replace pads (Chapter 7).
- D Pads glazed. Caused by excessive heat from prolonged use or from contamination. Do not use sandpaper, emery cloth, carborundum cloth or any other abrasive to roughen the pad surfaces as abrasives will stay in the pad material and damage the disc. A very fine flat file can be used, but pad replacement is suggested as a cure (Chapter 7).
- ☐ Disc warped. Can cause a chattering, clicking or intermittent squeal. Usually accompanied by a pulsating lever and uneven braking. Replace the disc (Chapter 7).
- ☐ Loose or worn wheel bearings. Check and replace as needed (Chapter 7).

10 Oil pressure indicator light comes on

Engine lubrication system

- ☐ Engine oil pump defective, blocked oil strainer gauze or failed relief valve. Carry out oil pressure check (Chapter 2).
- ☐ Engine oil level low. Inspect for leak or other problem causing low oil level and add recommended oil (Chapter 1).
- ☐ Engine oil viscosity too low. Very old, thin oil or an improper weight of oil used in the engine. Change to correct oil (Chapter 1).
- ☐ Camshaft or journals worn. Excessive wear causing drop in oil pressure. Replace cam and/or/cylinder head. Abnormal wear could be caused by oil starvation at high rpm from low oil level or improper weight or type of oil (Chapter 1).
- ☐ Crankshaft and/or bearings worn. Same problems as paragraph 4. Check and replace crankshaft and/or bearings (Chapter 2).

Electrical system

- ☐ Oil pressure switch defective. Check the switch according to the procedure in Chapter 9. Replace it if it is defective.
- ☐ Oil pressure indicator light circuit defective. Check for pinched, shorted, disconnected or damaged wiring (Chapter 9).

11 Excessive exhaust smoke

White smoke

- ☐ Piston oil ring worn. The ring may be broken or damaged, causing oil from the crankcase to be pulled past the piston into the combustion chamber. Replace the rings with new ones (Chapter 2).
- ☐ Cylinders worn, cracked, or scored. Caused by overheating or oil starvation. The cylinders will have to be rebored and new pistons installed.
- D Valve oil seal damaged or worn. Replace oil seals with new ones (Chapter 2).
- ☐ Valve guide worn. Perform a complete valve job (Chapter 2).
- ☐ Engine oil level too high, which causes the oil to be forced past the rings. Drain oil to the proper level (Chapter 1).
- ☐ Head gasket broken between oil return and cylinder. Causes oil to be pulled into the combustion chamber. Replace the head gasket and check the head for warpage (Chapter 2).
- ☐ Abnormal crankcase pressurization, which forces oil past the rings. Clogged breather hose is usually the cause.

Black smoke

- ☐ Air filter clogged. Clean or replace the element (Chapter 1).
- ☐ Main jet too large or loose. Compare the jet size to the Specifications (Chapter 4).
- D Choke cable or linkage shaft stuck, causing fuel to be pulled through choke circuit (Chapter 4).
- D Fuel level too high. Check and adjust the float height(s) as necessary (Chapter 4).
- ☐ Float needle valve held off needle seat. Clean the float chambers and fuel line and replace the needles and seats if necessary (Chapter 4).

Brown smoke

- ☐ Main jet too small or clogged. Lean condition caused by wrong size main jet or by a restricted orifice. Clean float chambers and jets and compare jet size to Specifications (Chapter 4).
- ☐ Fuel flow insufficient. Float needle valve stuck closed due to chemical reaction with old fuel. Float height incorrect. Restricted fuel line. Clean line and float chamber and adjust floats if necessary.
- ☐ Carburetor intake manifold clamps loose (Chapter 4).
- ☐ Air filter poorly sealed or not installed (Chapter 1).

12 Poor handling or stability

Handlebar hard to turn

- D Steering head bearing adjuster nut too tight. Check adjustment as described in Chapter 1.
- ☐ Bearings damaged. Roughness can be felt as the bars are turned from side-to-side. Replace bearings and races (Chapter 6).
- ☐ Races dented or worn. Denting results from wear in only one position (eg, straightahead), from a collision or hitting a pothole or from dropping the machine. Replace races and bearings (Chapter 6).
- ☐ Steering stem lubrication inadequate. Causes are grease getting hard from age or being washed out by high pressure car washes. Disassemble steering head and repack bearings (Chapter 6).
- ☐ Steering stem bent. Caused by a collision, hitting a pothole or by dropping the machine. Replace damaged part. Don't try to straighten the steering stem (Chapter 6).
- ☐ Front tire air pressure too low (Chapter 1).

Handlebar shakes or vibrates excessively

- ☐ Tires worn or out of balance (Chapter 7).
- ☐ Swingarm bearings worn. Replace worn bearings by referring to Chapter 6.
- ☐ Rim(s) warped or damaged. Inspect wheels for runout (Chapter 7).
- ☐ Wheel bearings worn. Worn front or rear wheel bearings can cause poor tracking. Worn front bearings will cause wobble (Chapter 7).
- D Handlebar clamp bolts loose (Chapter 6).
- ☐ Fork triple clamp bolts loose. Tighten them to the specified torque (Chapter 6).
- ☐ Engine mounting bolts loose. Will cause excessive vibration with increased engine rpm (Chapter 2).

Handlebar pulls to one side

- D Frame bent. Definitely suspect this if the machine has been dropped. May or may not be accompanied by cracking near the bend. Replace the frame (Chapter 6).
- ☐ Wheels out of alignment. Caused by improper location of axle spacers or from bent steering stem or frame (Chapter 6).
- ☐ Swingarm bent or twisted. Caused by age (metal fatigue) or impact damage. Replace the arm (Chapter 6).
- ☐ Steering stem bent. Caused by impact damage or by dropping the motorcycle. Replace the steering stem (Chapter 6).
- ☐ Fork tube bent. Disassemble the forks and replace the damaged parts (Chapter 6).
- D Fork oil level uneven. Check and add or drain as necessary (Chapter 6).

Poor *shock absorbing qualities*

☐ Too hard:

a) Fork oil level excessive (Chapter 6).
b) Fork oil viscosity too high. Use a lighter oil (see the Specifications in Chapter 6).
c) Fork tube bent. Causes a harsh, sticking feeling (Chapter 6).
d) Shock shaft or body bent or damaged (Chapter 6).
e) Fork internal damage (Chapter 6).
f) Shock internal damage.
g) Tire pressure too high (Chapter 1).

☐ Too soft:

a) Fork or shock oil insufficient and/or leaking (Chapter 6).
b) Fork oil level too low (Chapter 6).
c) Fork oil viscosity too light (Chapter 6).
d) Fork springs weak or broken (Chapter 6).
e) Shock internal damage or leakage (Chapter 6).

13 Braking problems

Brakes are spongy, don't hold

G Air in brake line. Caused by inattention to master cylinder fluid level or by leakage. Locate problem and bleed brakes (Chapter 7).
G Pad or disc worn (Chapters 1 and 7).
☐ Brake fluid leak. See paragraph 1.
☐ Contaminated pads. Caused by contamination with oil, grease, brake fluid, etc. Clean or replace pads. Clean disc thoroughly with brake cleaner (Chapter 7).
⌴ Brake fluid deteriorated. Fluid is old or contaminated. Drain system, replenish with new fluid and bleed the system (Chapter 7).
Master cylinder internal parts worn or damaged causing fluid to bypass (Chapter 7).
Master cylinder bore scratched by foreign material or broken spring. Repair or replace master cylinder (Chapter 7).
D Disc warped. Replace disc (Chapter 7).

Brake lever or pedal pulsates

☐ Disc warped. Replace disc (Chapter 7).
☐ Axle bent. Replace axle (Chapter 7).
☐ Brake caliper bolts loose (Chapter 7).
☐ Brake caliper sliders damaged or sticking (rear caliper), causing caliper to bind. Lube the sliders or replace them it they are corroded or bent (Chapter 7).
☐ Wheel warped or otherwise damaged (Chapter 7).
G Wheel bearings damaged or worn (Chapter 7).

Brakes drag

⌴ Master cylinder piston seized. Caused by wear or damage to piston or cylinder bore (Chapter 7).
G Lever balky or stuck. Check pivot and lubricate (Chapter 7).
G Brake caliper binds. Caused by inadequate lubrication or damage to caliper sliders (Chapter 7).
G Brake caliper piston seized in bore. Caused by wear or ingestion of dirt past deteriorated seal (Chapter 7).
G Brake pad damaged. Pad material separated from backing plate. Usually caused by faulty manufacturing process or from contact with chemicals. Replace pads (Chapter 7).
G Pads improperly installed (Chapter 7).

14 Electrical problems

Battery dead or weak

☐ Battery faulty. Caused by sulfated plates which are shorted through sedimentation. Also, broken battery terminal making only occasional contact (Chapter 9). Refer to *Fault Finding Equipment* for battery voltage and specific gravity checks.
☐ Battery cables making poor contact (Chapter 9).
G Load excessive. Caused by addition of high wattage lights or other electrical accessories.
G Ignition (main) switch defective. Switch either grounds (earths) internally or fails to shut off system. Replace the switch (Chapter 9).
G Regulator/rectifier defective (Chapter 9).
G Alternator stator coil open or shorted (Chapter 9).
☐ Wiring faulty. Wiring grounded (earthed) or connections loose in ignition, charging or lighting circuits (Chapter 9).

Battery overcharged

G Regulator/rectifier defective. Overcharging is noticed when battery gets excessively warm (Chapter 9).
☐ Battery defective. Replace battery with a new one (Chapter 9).
n Battery amperage too low, wrong type or size. Install manufacturer's specified amp-hour battery to handle charging load (Chapter 9).

Fault Finding Equipment

Checking engine compression

● Low compression will result in exhaust smoke, heavy oil consumption, poor starting and poor performance. A compression test will provide useful information about an engine's condition and if performed regularly, can give warning of trouble before any other symptoms become apparent.

• A compression gauge will be required, along with an adapter to suit the spark plug hole thread size. Note that the screw-in type gauge/adapter set up is preferable to the rubber cone type.

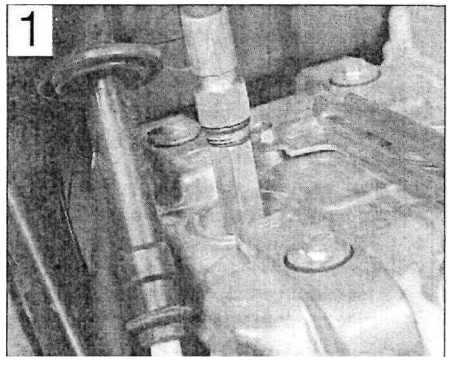
• Before carrying out the test, first check the valve clearances as described in Chapter 1.

1 Run the engine until it reaches normal operating temperature, then stop it and remove the spark plug(s), taking care not to scald your hands on the hot components.

2 Install the gauge adapter and compression gauge in No. 1 cylinder spark plug hole (see illustration 1).

3 On kickstart-equipped motorcycles, make sure the ignition switch is OFF, then open the throttle fully and kick the engine over a couple of times until the gauge reading stabilises.

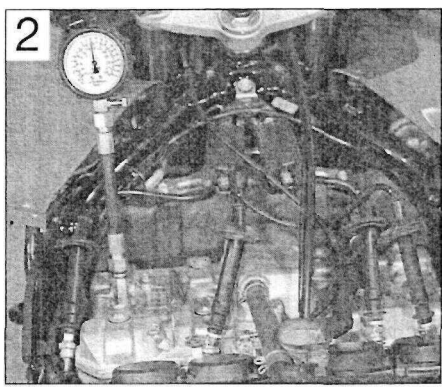
4 On motorcycles with electric start only, the procedure will differ depending on the nature of the ignition system. Flick the engine kill switch (engine stop switch) to OFF and turn



Screw the compression gauge adapter into the spark plug hole, then screw the gauge into the adapter

the ignition switch ON: open the throttle fully and crank the engine over on the starter motor for a couple of revolutions until the gauge reading stabilises. If the starter will not operate with the kill switch OFF, turn the ignition switch OFF and refer to the next paragraph.

5 Install the spark plugs back into their suppressor caps and arrange the plug electrodes so that their metal bodies are earthed (grounded) against the cylinder head; this is essential to prevent damage to the ignition system as the engine is spun over **(see illustration 2).** Position the plugs well away from the plug holes otherwise there is a risk of atomised fuel escaping from the combustion chambers and igniting. As a safety precaution, cover the top of the valve cover with rag. Now turn the ignition switch ON and kill switch ON, open the throttle fully and crank the engine over on the starter motor for a coupie of revolutions until the gauge reading stabilises.



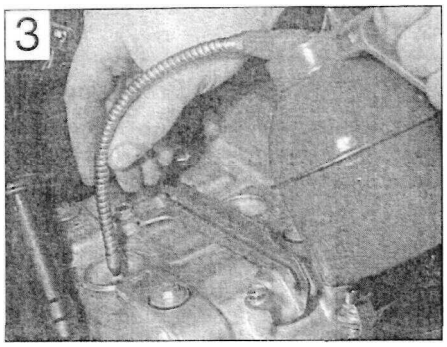
All spark plugs must be earthed (grounded) against the cylinder head

6 After one or two revolutions the pressure should build up to a maximum figure and then stabilise. Take a note of this reading and on multi-cylinder engines repeat the test on the remaining cylinders.

7 The correct pressures are given in Chapter 2 Specifications. If the results fall within the specified range and on multi-cylinder engines all are relatively equal, the engine is in good condition. If there is a marked difference between the readings, or if the readings are lower than specified, inspection of the top-end components will be required.

8 Low compression pressure may be due to worn cylinder bores, pistons or rings, failure of the cylinder head gasket, worn valve seals, or poor valve seating.

9 To distinguish between cylinder/piston wear and valve leakage, pour a small quantity of oil into the bore to temporarily seal the piston rings, then repeat the compression tests **(see illustration 3).** If the readings show a noticeable increase in pressure this confirms that the cylinder bore, piston, or rings are worn. If, however. no change is indicated, the cylinder head gasket or valves should be examined.



Bores can be temporarily sealed with **a squirt of motor oil**

10 High compression pressure indicates excessive carbon build-up in the combustion chamber and on the piston crown. If this is the case the cylinder head should be removed and the deposits removed. Note that excessive carbon build-up is less likely with the used on modern fuels.

Checking battery open-circuit voltage

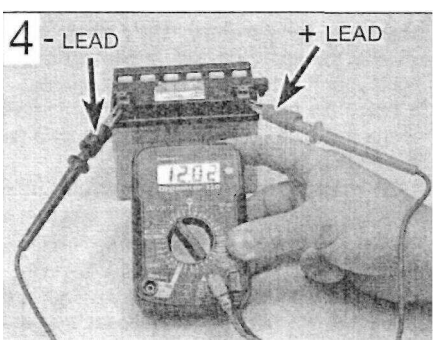
Warning: The gases produced by the battery are explosive - never smoke or create any sparks in the vicinity of the battery. Never allow the electrolyte to contact your skin or clothing - if it does, wash it off and seek immediate medical attention.

● Before any electrical fault is investigated the battery should be checked.

9 You'll need a dc voltmeter or multimeter to check battery voltage, Check that the leads are inserted in the correct terminals on the meter, red lead to positive (+ve), black lead to negative (-ve). Incorrect connections can damage the meter.

9 A sound fully-charged 12 volt battery should produce between 12.3 and 12.6 volts across its terminals (12.8 voits for a maintenance-free battery). On machines with a 6 volt battery, voltage should be between 6.1 and 6.3 volts.

1 Set a multimeter to the 0 to 20 volts dc range and connect its probes across the battery terminals. Connect the meter's positive (+ve) probe, usually red, to the battery positive (+ve) terminal, followed by the meter's negative (-ve) probe, usually black, to the battery negative terminal (-ve) **(see illustration 4).**



Measuring open-circuit **battery voltage**

2 If battery voltage is low (below 10 volts on a 12 volt battery or below 4 volts on a six volt battery), charge the battery and test the voltage again. If the battery repeatedly goes flat, investigate the motorcycle's charging system.

Checking battery specific gravity (SG)

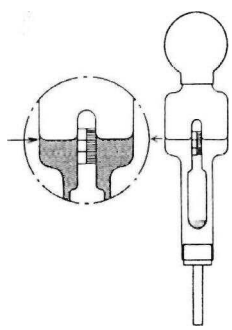
Warning: The gases produced by the battery are explosive - never smoke or create any sparks in the vicinity of the battery. Never allow the electrolyte to contact your skin or clothing - if it does, wash it off and seek immediate medical attention.

• The specific gravity check gives an indication of a battery's state of charge.

• A hydrometer is used for measuring specific gravity. Make sure you purchase one which has a small enough hose to insert in the aperture of a motorcycle battery.

• Specific gravity is simply a measure of the electrolyte's density compared with that of water. Water has an SG of 1.000 and fully-charged battery electrolyte is about 26% heavier, at 1.260.

• Specific gravity checks are not possible on maintenance-free batteries. Testing the open-circuit voltage is the only means of determining their state of charge.



Float-type hydrometer for measuring battery specific gravity

1 To measure SG, remove the battery from the motorcycle and remove the first cell cap. Draw some electrolyte into the hydrometer and note the reading **(see illustration 5).** Return the electrolyte to the cell and install the cap.

2 The reading should be in the region of 1.260 to 1.280. If SG is below 1.200 the battery needs charging. Note that SG will vary with temperature; it should be measured at 20°C (68°F). Add 0.007 to the reading for

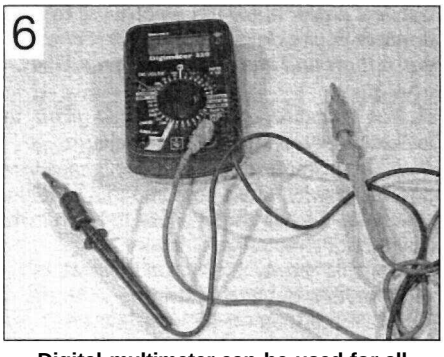
every 10°C above 20°C, and subtract 0.007 from the reading for every 10°C below 20°C. Add 0.004 to the reading for every 10°F above 68°F, and subtract 0.004 from the reading for every 10°F below 68°F.

3 When the check is complete, rinse the hydrometer thoroughly with clean water.

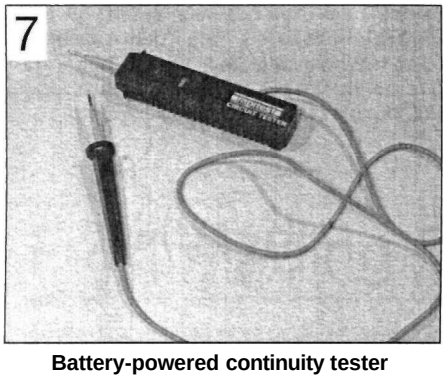
Checking for continuity

• The term continuity describes the uninterrupted flow of electricity through an electrical circuit. A continuity check will determine whether an **open-circuit** situation exists.

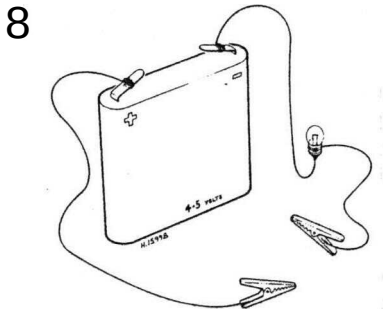
• Continuity can be checked with an ohmmeter, multimeter, continuity tester or battery and bulb test circuit **(see illustrations 6, 7 and 8).**



Digital multimeter can be used for all electrical tests



Battery-powered continuity tester



Battery and bulb test circuit

• All of these instruments are self-powered by a battery, therefore the checks are made with the ignition OFF.

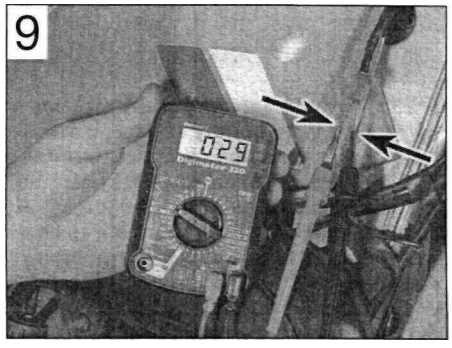
• As a safety precaution, always disconnect the battery negative (-ve) lead before making checks, particularly if ignition switch checks are being made.

• If using a meter, select the appropriate ohms scale and check that the meter reads infinity (∞). Touch the meter probes together and check that meter reads zero; where necessary adjust the meter so that it reads zero.

• After using a meter, always switch it OFF to conserve its battery.

Switch checks

1 If a switch is at fault, trace its wiring up to the wiring connectors. Separate the wire connectors and inspect them for security and condition. A build-up of dirt or corrosion here will most likely be the cause of the problem - clean up and apply a water dispersant such as WD40.

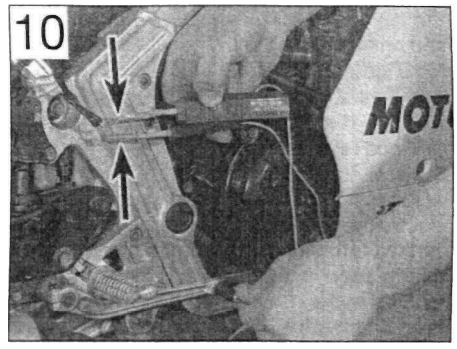


Continuity check of front brake light switch using a meter - note split pins used to access connector terminals

2 If using a test meter, set the meter to the ohms x 10 scale and connect its probes across the wires from the switch **(see illustration 9).** Simple ON/OFF type switches, such as brake light switches, only have two wires whereas combination switches, like the ignition switch, have many internal links. Study the wiring diagram to ensure that you are connecting across the correct pair of wires. Continuity (low or no measurable resistance - 0 ohms) should be indicated with the switch ON and no continuity (high resistance) with it OFF.

3 Note that the polarity of the test probes doesn't matter for continuity checks, although care should be taken to follow specific test procedures if a diode or solid-state component is being checked.

4 A continuity tester or battery and bulb circuit can be used in the same way. Connect its probes as described above **(see illustration 10).** The light should come on to indicate continuity in the ON switch position, but should extinguish in the OFF position.



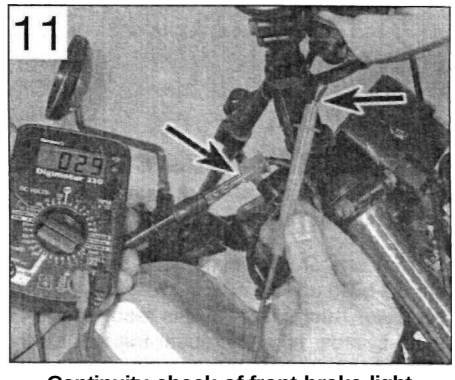
Continuity check of rear brake light switch using a continuity tester

Wiring checks

• Many electrical faults are caused by damaged wiring, often due to incorrect routing or chaffing on frame components.

• Loose, wet or corroded wire connectors can also be the cause of electrical problems, especially in exposed locations.

1 A continuity check can be made on a single length of wire by disconnecting it at each end and connecting a meter or continuity tester across both ends of the wire **(see illustration 11).**



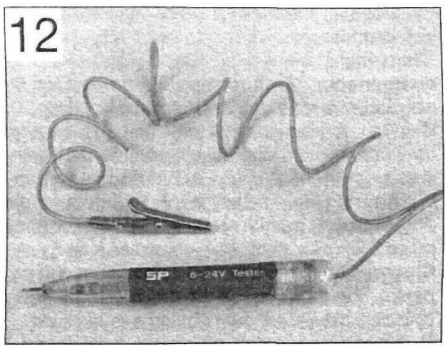
Continuity check of front brake light switch sub-harness

2 Continuity (low or no resistance - 0 ohms) should be indicated if the wire is good. If no continuity (high resistance) is shown, suspect a broken wire.

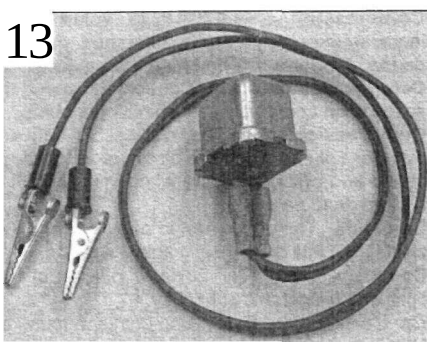
Checking for voltage

• A voltage check can determine whether current is reaching a component.

• Voltage can be checked with a dc voltmeter, multimeter set on the dc volts scale, test light or buzzer **(see illustrations 12 and 13).** A meter has the advantage of being able to measure actual voltage.



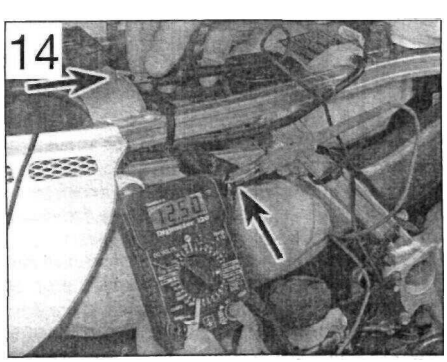
A simple test light can be used for voltage checks



A buzzer is useful for voltage checks

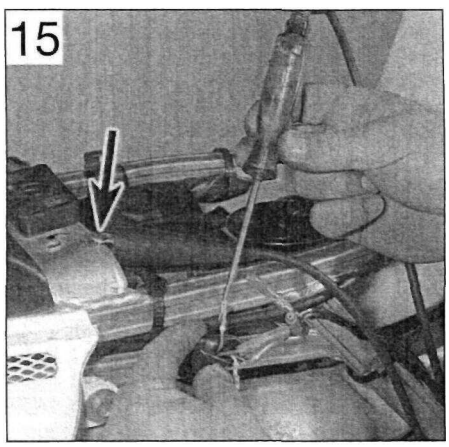
• When using a meter, check that its leads are inserted in the correct terminals on the meter, red to positive (+ve), black to negative (-ve). Incorrect connections can damage the meter.
• A voltmeter (or multimeter set to the dc volts scale) should always be connected in parallel (across the load). Connecting it in series will destroy the meter.
• Voltage checks are made with the ignition ON.

1 First identify the relevant wiring circuit by referring to the wiring diagram at the end of this manual. If other electrical components share the same power supply (ie are fed from the same fuse), take note whether they are working correctly - this is useful information in deciding where to start checking the circuit.



Checking for voltage at the rear brake light power supply wire using a meter . . .

2 If using a meter, check first that the meter leads are plugged into the correct terminals on the meter (see above). Set the meter to the dc volts function, at a range suitable for the battery voltage. Connect the meter red probe (+ve) to the power supply wire and the black probe to a good metal earth (ground) on the motorcycle's frame or directly to the battery negative (-ve) terminal **(see illustration 14).** Battery voltage should be shown on the meter with the ignition switched ON.
3 If using a test light or buzzer, connect its positive (+ve) probe to the power supply terminal and its negative (-ve) probe to a good earth (ground) on the motorcycle's frame or directly to the battery negative (-ve) terminal **(see illustration 15).** With the ignition ON, the test light should illuminate or the buzzer sound.



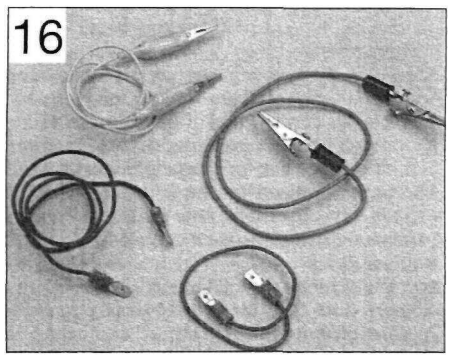
. . . or a test light - note the earth connection to the frame (arrow)

4 If no voltage is indicated, work back towards the fuse continuing to check for voltage. When you reach a point where there is voltage, you know the problem lies between that point and your last check point.

Checking the earth (ground)

• Earth connections are made either directly to the engine or frame (such as sensors, neutral switch etc. which only have a positive feed) or by a separate wire into the earth circuit of the wiring harness. Alternatively a short earth wire is sometimes run directly from the component to the motorcycle's frame.
• Corrosion is often the cause of a poor earth connection.
• If total failure is experienced, check the security of the main earth lead from the negative (-ve) terminal of the battery and also the main earth (ground) point on the wiring harness. If corroded, dismantle the connection and clean all surfaces back to bare metal.

1 To check the earth on a component, use an insulated jumper wire to temporarily bypass its earth connection **(see illustration 16).** Connect one end of the jumper wire between the earth terminal or metal body of the component and the other end to the motorcycle's frame.



A selection of jumper wires for making earth (ground) checks

2 If the circuit works with the jumper wire installed, the original earth circuit is faulty. Check the wiring for open-circuits or poor connections. Clean up direct earth connections, removing all traces of corrosion and remake the joint. Apply petroleum jelly to the joint to prevent future corrosion.

Tracing a short-circuit

• A short-circuit occurs where current shorts to earth (ground) bypassing the circuit components. This usually results in a blown fuse.

• A short-circuit is most likely to occur where the insulation has worn through due to wiring chafing on a component, allowing a direct path to earth (ground) on the frame.

1 Remove any bodypanels necessary to access the circuit wiring.

2 Check that all electrical switches in the circuit are OFF, then remove the circuit fuse and connect a test light, buzzer or voltmeter (set to the dc scale) across the fuse terminals. No voltage should be shown.

3 Move the wiring from side to side whilst observing the test light or meter. When the test light comes on, buzzer sounds or meter shows voltage, you have found the cause of the short. It will usually shown up as damaged or burned insulation.

4 Note that the same test can be performed on each component in the circuit, even the switch.

Technical Terms Explained

A

ABS (Anti-lock braking system) A system, usually electronically controlled, that senses incipient wheel lockup during braking and relieves hydraulic pressure at wheel which is about to skid.

Aftermarket Components suitable for the motorcycle, but not produced by the motorcycle manufacturer.

Alien key A hexagonal wrench which fits into a recessed hexagonal hole.

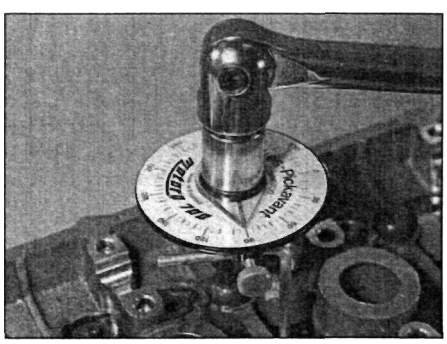
Alternating current (ac) Current produced by an alternator. Requires converting to direct current by a rectifier for charging purposes.

Alternator Converts mechanical energy from the engine into electrical energy to charge the battery and power the electrical system.

Ampere (amp) A unit of measurement for the flow of electrical current. Current = Volts ˆ Ohms.

Ampere-hour (Ah) Measure of battery capacity.

Angle-tightening A torque expressed in degrees. Often follows a conventional tightening torque for cylinder head or main bearing fasteners **(see illustration).**



Angle-tightening cylinder head bolts

Antifreeze A substance (usually ethylene glycol) mixed with water, and added to the cooling system, to prevent freezing of the coolant in winter. Antifreeze also contains chemicals to inhibit corrosion and the formation of rust and other deposits that would tend to clog the radiator and coolant passages and reduce cooling efficiency.

Anti-dive System attached to the fork lower leg (slider) to prevent fork dive when braking hard.

Anti-seize compound A coating that reduces the risk of seizing on fasteners that are subjected to high temperatures, such as exhaust clamp bolts and nuts.

API American Petroleum Institute. A quality standard for 4-stroke motor oils.

Asbestos A natural fibrous mineral with great heat resistance, commonly used in the composition of brake friction materials. Asbestos is a health hazard and the dust created by brake systems should never be inhaled or ingested.

ATF Automatic Transmission Fluid. Often used in front forks.

ATU Automatic Timing Unit. Mechanical device for advancing the ignition timing on early engines.

ATV All Terrain Vehicle. Often called a Quad.

Axial play Side-to-side movement.

Axle A shaft on which a wheel revolves. Also known as a spindle.

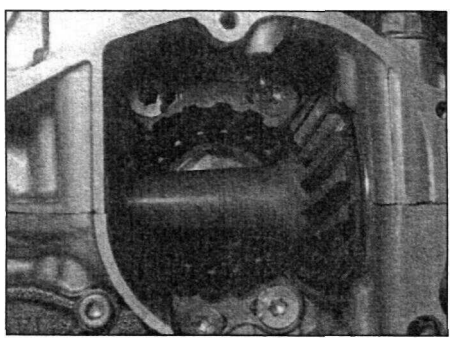
B

Backlash The amount of movement between meshed components when one component is held still. Usually applies to gear teeth.

Ball bearing A bearing consisting of a hardened inner and outer race with hardened steel balls between the two races.

Bearings Used between two working surfaces to prevent wear of the components and a build-up of heat. Four types of bearing are commonly used on motorcycles: plain shell bearings, ball bearings, tapered roller bearings and needle roller bearings.

Bevel gears Used to turn the drive through 90°. Typical applications are shaft final drive and camshaft drive **(see illustration).**



Bevel gears are used to turn the drive through 90°

BHP Brake Horsepower. The British measurement for engine power output. Power output is now usually expressed in kilowatts (kW).

Bias-belted tyre Similar construction to radial tyre, but with outer belt running at an angle to the wheel rim.

Big-end bearing The bearing in the end of the connecting rod that's attached to the crankshaft.

Bleeding The process of removing air from an hydraulic system via a bleed nipple or bleed screw.

Bottom-end A description of an engine's crankcase components and all components contained there-in.

BTDC Before Top Dead Centre in terms of piston position. Ignition timing is often expressed in terms of degrees or millimetres BTDC.

Bush A cylindrical metal or rubber component used between two moving parts.

Burr Rough edge left on a component after machining or as a result of excessive wear.

C

Cam chain The chain which takes drive from the crankshaft to the camshaft(s).

Canister The main component in an evaporative emission control system (California market only); contains activated charcoal granules to trap vapours from the fuel system rather than allowing them to vent to the atmosphere.

Castellated Resembling the parapets along the top of a castle wall. For example, a castellated wheel axle or spindle nut.

Catalytic converter A device in the exhaust system of some machines which converts certain pollutants in the exhaust gases into less harmful substances.

Charging system Description of the components which charge the battery, ie the alternator, rectifer and regulator.

Circlip A ring-shaped clip used to prevent endwise movement of cylindrical parts and shafts. An internal circlip is installed in a groove in a housing; an external circlip fits into a groove on the outside of a cylindrical piece such as a shaft. Also known as a snap-ring.

Clearance The amount of space between two parts. For example, between a piston and a cylinder, between a bearing and a journal, etc.

Coil spring A spiral of elastic steel found in various sizes throughout a vehicle, for example as a springing medium in the suspension and in the valve train.

Compression Reduction in volume, and increase in pressure and temperature, of a gas, caused by squeezing it into a smaller space.

Compression damping Controls the speed the suspension compresses when hitting a bump.

Compression ratio The relationship between cylinder volume when the piston is at top dead centre and cylinder volume when the piston is at bottom dead centre.

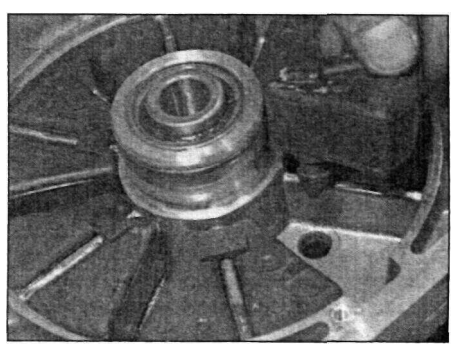
Continuity The uninterrupted path in the flow of electricity. Little or no measurable resistance.

Continuity tester Self-powered bleeper or test light which indicates continuity.

Cp Candlepower. Bulb rating common found on US motorcycles.

Crossply tyre Tyre plies arranged in a criss-cross pattern. Usually four or six plies used, hence 4PR or 6PR in tyre size codes.

Cush drive Rubber damper segments fitted between the rear wheel and final drive sprocket to absorb transmission shocks **(see illustration).**



Cush drive rubbers dampen out transmission shocks

D

Degree disc Calibrated disc for measuring piston position. Expressed in degrees.

Dial gauge Clock-type gauge with adapters for measuring runout and piston position. Expressed in mm or inches.

Diaphragm The rubber membrane in a master cylinder or carburettor which seals the upper chamber.

Diaphragm spring A single sprung plate often used in clutches.

Direct current (dc) Current produced by a dc generator.

Decarbonisation The process of removing carbon deposits - typically from the combustion chamber, valves and exhaust port/system.
Detonation Destructive and damaging explosion of fuel/air mixture in combustion chamber instead of controlled burning.
Diode An electrical valve which only allows current to flow in one direction. Commonly used in rectifiers and starter interlock systems.
Disc valve (or rotary valve) A induction system used on some two-stroke engines.
Double-overhead camshaft (DOHC) An engine that uses two overhead camshafts, one for the intake valves and one for the exhaust valves.
Drivebelt A toothed belt used to transmit drive to the rear wheel on some motorcycles. A drivebelt has also been used to drive the camshafts. Drivebelts are usually made of Kevlar.
Driveshaft Any shaft used to transmit motion. Commonly used when referring to the final driveshaft on shaft drive motorcycles.

E

Earth return The return path of an electrical circuit, utilising the motorcycle's frame.
ECU (Electronic Control Unit) A computer which controls (for instance) an ignition system, or an anti-lock braking system.
EGO Exhaust Gas Oxygen sensor. Sometimes called a Lambda sensor.
Electrolyte The fluid in a lead-acid battery.
EMS (Engine Management System) A computer controlled system which manages the fuel injection and the ignition systems in an integrated fashion.
Endfloat The amount of lengthways movement between two parts. As applied to a crankshaft, the distance that the crankshaft can move side-to-side in the crankcase.
Endless chain A chain having no joining link. Common use for cam chains and final drive chains.
EP (Extreme Pressure) Oil type used in locations where high loads are applied, such as between gear teeth.
Evaporative emission control system Describes a charcoal filled canister which stores fuel vapours from the tank rather than allowing them to vent to the atmosphere. Usually only fitted to California models and referred to as an EVAP system.
Expansion chamber Section of two-stroke engine exhaust system so designed to improve engine efficiency and boost power.

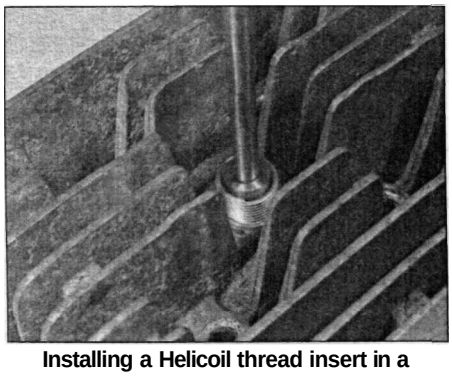
Feeler blade or gauge A thin strip or blade of hardened steel, ground to an exact thickness, used to check or measure clearances between parts.
Final drive Description of the drive from the transmission to the rear wheel. Usually by chain or shaft, but sometimes by belt.
Firing order The order in which the engine cylinders fire, or deliver their power strokes, beginning with the number one cylinder.
Flooding Term used to describe a high fuel level in the carburettor float chambers, leading to fuel overflow. Also refers to excess fuel in the combustion chamber due to incorrect starting technique.
Free length The no-load state of a component when measured. Clutch, valve and fork spring lengths are measured at rest, without any preload.
Freeplay The amount of travel before any action takes place. The looseness in a linkage, or an assembly of parts, between the initial application of force and actual movement. For example, the distance the rear brake pedal moves before the rear brake is actuated.
Fuel injection The fuel/air mixture is metered electronically and directed into the engine intake ports (indirect injection) or into the cylinders (direct injection). Sensors supply information on engine speed and conditions.
Fuel/air mixture The charge of fuel and air going into the engine. See **Stoichiometric ratio.**
Fuse An electrical device which protects a circuit against accidental overload. The typical fuse contains a soft piece of metal which is calibrated to melt at a predetermined current flow (expressed as amps) and break the circuit.

G

Gap The distance the spark must travel in jumping from the centre electrode to the side electrode in a spark plug. Also refers to the distance between the ignition rotor and the pickup coil in an electronic ignition system.
Gasket Any thin, soft material - usually cork, cardboard, asbestos or soft metal - installed between two metal surfaces to ensure a good seal. For instance, the cylinder head gasket seals the joint between the block and the cylinder head.
Gauge An instrument panel display used to monitor engine conditions. A gauge with a movable pointer on a dial or a fixed scale is an analogue gauge. A gauge with a numerical readout is called a digital gauge.
Gear ratios The drive ratio of a pair of gears in a gearbox, calculated on their number of teeth.
Glaze-busting see Honing
Grinding Process for renovating the valve face and valve seat contact area in the cylinder head.
Gudgeon pin The shaft which connects the connecting rod small-end with the piston. Often called a piston pin or wrist pin.

H

Helical gears Gear teeth are slightly curved and produce less gear noise that straight-cut gears. Often used for primary drives.



Installing a Helicoil thread insert in a cylinder head

Helicoil A thread insert repair system. Commonly used as a repair for stripped spark plug threads **(see illustration).**
Honing A process used to break down the glaze on a cylinder bore (also called glaze-busting). Can also be carried out to roughen a rebored cylinder to aid ring bedding-in.
HT High Tension Description of the electrical circuit from the secondary winding of the ignition coil to the spark plug.
Hydraulic A liquid filled system used to transmit pressure from one component to another. Common uses on motorcycles are brakes and clutches.
Hydrometer An instrument for measuring the specific gravity of a lead-acid battery.
Hygroscopic Water absorbing. In motorcycle applications, braking efficiency will be reduced if DOT 3 or 4 hydraulic fluid absorbs water from the air - care must be taken to keep new brake fluid in tightly sealed containers.

I

lbf ft Pounds-force ,feet. An imperial unit of torque. Sometimes written as ft-lbs.
lbf in Pound-force inch. An imperial unit of torque, applied to components where a very low torque is required. Sometimes written as in-lbs.
IC Abbreviation for Integrated Circuit.
Ignition advance Means of increasing the timing of the spark at higher engine speeds. Done by mechanical means (ATU) on early engines or electronically by the ignition control unit on later engines.
Ignition timing The moment at which the spark plug fires, expressed in the number of crankshaft degrees before the piston reaches the top of its stroke, or in the number of millimetres before the piston reaches the top of its stroke.
Infinity (∞) Description of an open-circuit electrical state, where no continuity exists.
Inverted forks (upside down forks) The sliders or lower legs are held in the yokes and the fork tubes or stanchions are connected to the wheel axle (spindle). Less unsprung weight and stiffer construction than conventional forks.

J

JASO Quality standard for 2-stroke oils.
Joule The unit of electrical energy.
Journal The bearing surface of a shaft.

K

Kickstart Mechanical means of turning the engine over for starting purposes. Only usually fitted to mopeds, small capacity motorcycles and off-road motorcycles.
Kill switch Handebar-mounted switch for emergency ignition cut-out. Cuts the ignition circuit on all models, and additionally prevent starter motor operation on others.
km Symbol for kilometre.
kph Abbreviation for kilometres per hour.

L

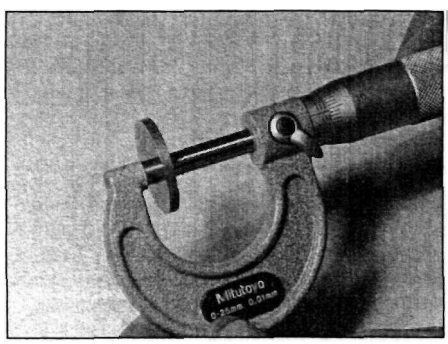
Lambda (λ) sensor A sensor fitted in the exhaust system to measure the exhaust gas oxygen content (excess air factor).

Technical Terms Explained

Lapping see **Grinding.**
LCD Abbreviation for Liquid Crystal Display.
LED Abbreviation for Light Emitting Diode.
Liner A steel cylinder liner inserted in a aluminium alloy cylinder block.
Locknut A nut used to lock an adjustment nut, or other threaded component, in place.
Lockstops The lugs on the lower triple clamp (yoke) which abut those on the frame, preventing handlebar-to-fuel tank contact.
Lockwasher A form of washer designed to prevent an attaching nut from working loose.
LT Low Tension Description of the electrical circuit from the power supply to the primary winding of the ignition coil.

M

Main bearings The bearings between the crankshaft and crankcase.
Maintenance-free (MF) battery A sealed battery which cannot be topped up.
Manometer Mercury-filled calibrated tubes used to measure intake tract vacuum. Used to synchronise carburettors on multi-cylinder engines.
Micrometer A precision measuring instrument that measures component outside diameters **(see illustration).**



Tappet shims are measured with a micrometer

MON (Motor Octane Number) A measure of a fuel's resistance to knock.
Monograde oil An oil with a single viscosity, eg SAE80W.
Monoshock A single suspension unit linking the swingarm or suspension linkage to the frame.
mph Abbreviation for miles per hour.
Multigrade oil Having a wide viscosity range (eg 10W40). The W stands for Winter, thus the viscosity ranges from SAE10 when cold to SAE40 when hot.
Multimeter An electrical test instrument with the capability to measure voltage, current and resistance. Some meters also incorporate a continuity tester and buzzer.

N

Needle roller bearing Inner race of caged needle rollers and hardened outer race. Examples of uncaged needle rollers can be found on some engines. Commonly used in rear suspension applications and in two-stroke engines.
Nm Newton metres.
NOx Oxides of Nitrogen. A common toxic pollutant emitted by petrol engines at higher temperatures.

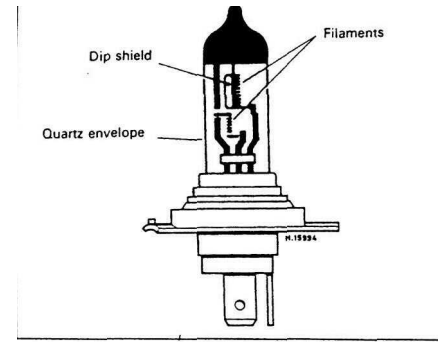
Octane The measure of a fuel's resistance to knock.
OE (Original Equipment) Relates to components fitted to a motorcycle as standard or replacement parts supplied by the motorcycle manufacturer.
Ohm The unit of electrical resistance. Ohms = Volts ÷ Current.
Ohmmeter An instrument for measuring electrical resistance.
Oil cooler System for diverting engine oil outside of the engine to a radiator for cooling purposes.
Oil injection A system of two-stroke engine lubrication where oil is pump-fed to the engine in accordance with throttle position.
Open-circuit An electrical condition where there is a break in the flow of electricity - no continuity (high resistance).
O-ring A type of sealing ring made of a special rubber-like material; in use, the O-ring is compressed into a groove to provide the
Oversize (OS) Term used for piston and ring size options fitted to a rebored cylinder.
Overhead cam (sohc) engine An engine with single camshaft located on top of the cylinder head.
Overhead valve (ohv) engine An engine with the valves located in the cylinder head, but with the camshaft located in the engine block or crankcase.
Oxygen sensor A device installed in the exhaust system which senses the oxygen content in the exhaust and converts this information into an electric current. Also called a Lambda sensor.

Plastigauge A thin strip of plastic thread, available in different sizes, used for measuring clearances. For example, a strip of Plastigauge is laid across a bearing journal. The parts are assembled and dismantled; the width of the crushed strip indicates the clearance between journal and bearing.
Polarity Either negative or positive earth (ground), determined by which battery lead is connected to the frame (earth return). Modern motorcycles are usually negative earth.
Pre-ignition A situation where the fuel/air mixture ignites before the spark plug fires. Often due to a hot spot in the combustion chamber caused by carbon build-up. Engine has a tendency to 'run-on'.
Pre-load (suspension) The amount a spring is compressed when in the unloaded state. Preload can be applied by gas, spacer or mechanical adjuster.
Premix The method of engine lubrication on older two-stroke engines. Engine oil is mixed with the petrol in the fuel tank in a specific ratio. The fuel/oil mix is sometimes referred to as "petroil".
Primary drive Description of the drive from the crankshaft to the clutch. Usually by gear or chain.
PS Pfedestärke - a German interpretation of BHP.
PSI Pounds-force per square inch. Imperial measurement of tyre pressure and cylinder pressure measurement.
PTFE Polytetrafluroethylene. A low friction substance.

Pulse secondary air injection system A process of promoting the burning of excess fuel present in the exhaust gases by routing fresh air into the exhaust ports.

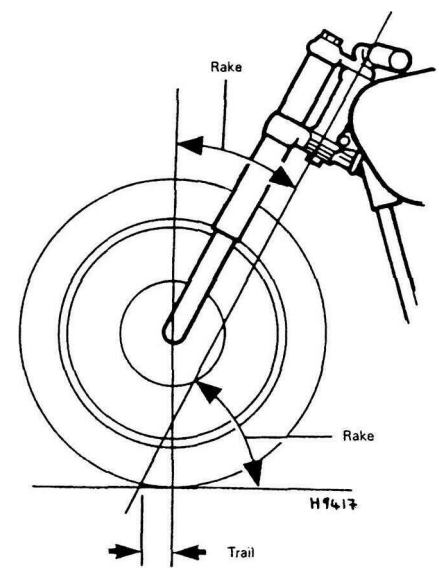
Q

Quartz halogen bulb Tungsten filament surrounded by a halogen gas. Typically used for the headlight **(see illustration).**



Quartz halogen headlight bulb construction

Rack-and-pinion A pinion gear on the end of a shaft that mates with a rack (think of a geared wheel opened up and laid flat). Sometimes used in clutch operating systems.
Radial play Up and down movement about a shaft.
Radial ply tyres Tyre plies run across the tyre (from bead to bead) and around the circumference of the tyre. Less resistant to tread distortion than other tyre types.
Radiator A liquid-to-air heat transfer device designed to reduce the temperature of the coolant in a liquid cooled engine.
Rake A feature of steering geometry - the angle of the steering head in relation to the vertical **(see illustration).**



Steering geometry

Rebore Providing a new working surface to the cylinder bore by boring out the old surface. Necessitates the use of oversize piston and rings.
Rebound damping A means of controlling the oscillation of a suspension unit spring after it has been compressed. Resists the spring's natural tendency to bounce back after being compressed.
Rectifier Device for converting the ac output of an alternator into dc for battery charging.
Reed valve An induction system commonly used on two-stroke engines.
Regulator Device for maintaining the charging voltage from the generator or alternator within a specified range.
Relay A electrical device used to switch heavy current on and off by using a low current auxiliary circuit.
Resistance Measured in ohms. An electrical component's ability to pass electrical current.
RON (Research Octane Number) A measure of a fuel's resistance to knock.
rpm revolutions per minute.
Runout The amount of wobble (in-and-out movement) of a wheel or shaft as it's rotated. The amount a shaft rotates `out-of-true'. The out-of-round condition of a rotating part.

S

SAE (Society of Automotive Engineers) A standard for the viscosity of a fluid.
Sealant A liquid or paste used to prevent leakage at a joint. Sometimes used in conjunction with a gasket.
Service limit Term for the point where a component is no longer useable and must be renewed.
Shaft drive A method of transmitting drive from the transmission to the rear wheel.
Shell bearings Plain bearings consisting of two shell halves. Most often used as big-end and main bearings in a four-stroke engine. Often called bearing inserts.
Shim Thin spacer, commonly used to adjust the clearance or relative positions between two parts. For example, shims inserted into or under tappets or followers to control valve clearances. Clearance is adjusted by changing the thickness of the shim.
Short-circuit An electrical condition where current shorts to earth (ground) bypassing the circuit components.
Skimming Process to correct warpage or repair a damaged surface, eg on brake discs or drums.
Slide-hammer A special puller that screws into or hooks onto a component such as a shaft or bearing; a heavy sliding handle on the shaft bottoms against the end of the shaft to knock the component free.
Small-end bearing The bearing in the upper end of the connecting rod at its joint with the gudgeon pin.
Spalling Damage to camshaft lobes or bearing journals shown as pitting of the working surface.
Specific gravity (SG) The state of charge of the electrolyte in a lead-acid battery. A measure of the electrolyte's density compared with water.
Straight-cut gears Common type gear used on gearbox shafts and for oil pump and water pump drives.
Stanchion The inner sliding part of the front forks, held by the yokes. Often called a fork tube.
Stoichiometric ratio The optimum chemical air/fuel ratio for a petrol engine, said to be 14.7 parts of air to 1 part of fuel.
Sulphuric acid The liquid (electrolyte) used in a lead-acid battery. Poisonous and extremely corrosive.
Surface grinding (lapping) Process to correct a warped gasket face, commonly used on cylinder heads.

T

Tapered-roller bearing Tapered inner race of caged needle rollers and separate tapered outer race. Examples of taper roller bearings can be found on steering heads.
Tappet A cylindrical component which transmits motion from the cam to the valve stem, either directly or via a pushrod and rocker arm. Also called a cam follower.
TCS Traction Control System. An electronically-controlled system which senses wheel spin and reduces engine speed accordingly.
TDC Top Dead Centre denotes that the piston is at its highest point in the cylinder.
Thread-locking compound Solution applied to fastener threads to prevent slackening. Select type to suit application.
Thrust washer A washer positioned between two moving components on a shaft. For example, between gear pinions on gearshaft.
Timing chain See Cam Chain.
Timing light Stroboscopic lamp for carrying out ignition timing checks with the engine running.
Top-end A description of an engine's cylinder block, head and valve gear components.
Torque Turning or twisting force about a shaft.
Torque setting A prescribed tightness specified by the motorcycle manufacturer to ensure that the bolt or nut is secured correctly. Undertightening can result in the bolt or nut coming loose or a surface not being sealed. Overtightening can result in stripped threads, distortion or damage to the component being retained.
Torx key A six-point wrench.
Tracer A stripe of a second colour applied to a wire insulator to distinguish that wire from another one with the same colour insulator. For example, Br/W is often used to denote a brown insulator with a white tracer.
Trail A feature of steering geometry. Distance from the steering head axis to the tyre's central contact point.
Triple clamps The cast components which extend from the steering head and support the fork stanchions or tubes. Often called fork yokes.
Turbocharger A centrifugal device, driven by exhaust gases, that pressurises the intake air. Normally used to increase the power output from a given engine displacement.
TWI Abbreviation for Tyre Wear Indicator. Indicates the location of the tread depth indicator bars on tyres.

U

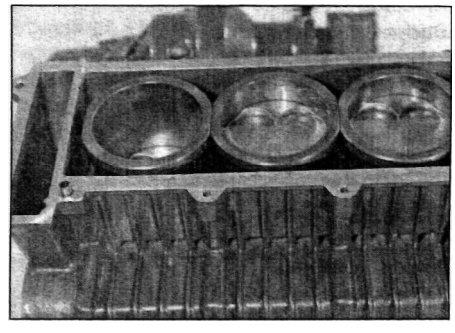
Universal joint or U-joint (UJ) A double-pivoted connection for transmitting power from a driving to a driven shaft through an angle. Typically found in shaft drive assemblies.
Unsprung weight Anything not supported by the bike's suspension (ie the wheel, tyres, brakes, final drive and bottom (moving) part of the suspension).

V

Vacuum gauges Clock-type gauges for measuring intake tract vacuum. Used for carburettor synchronisation on multi-cylinder engines.
Valve A device through which the flow of liquid, gas or vacuum may be stopped, started or regulated by a moveable part that opens, shuts or partially obstructs one or more ports or passageways. The intake and exhaust valves in the cylinder head are of the poppet type.
Valve clearance The clearance between the valve tip (the end of the valve stem) and the rocker arm or tappet/follower. The valve clearance is measured when the valve is closed. The correct clearance is important - if too small the valve won't close fully and will burn out, whereas if too large noisy operation will result.
Valve lift The amount a valve is lifted off its seat by the camshaft lobe.
Valve timing The exact setting for the opening and closing of the valves in relation to piston position.
Vernier caliper A precision measuring instrument that measures inside and outside dimensions. Not quite as accurate as a micrometer, but more convenient.
VIN Vehicle Identification Number. Term for the bike's engine and frame numbers.
Viscosity The thickness of a liquid or its resistance to flow.
Volt A unit for expressing electrical "pressure" in a circuit. Volts = current x ohms.

W

Water pump A mechanically-driven device for moving coolant around the engine.
Watt A unit for expressing electrical power. Watts = volts x current.
Wear limit see Service limit
Wet liner A liquid-cooled engine design where the pistons run in liners which are directly surrounded by coolant **(see illustration).**



Wet liner arrangement

Wheelbase Distance from the centre of the front wheel to the centre of the rear wheel.
Wiring harness or loom Describes the electrical wires running the length of the motorcycle and enclosed in tape or plastic sheathing. Wiring coming off the main harness is usually referred to as a sub harness.
Woodruff key A key of semi-circular or square section used to locate a gear to a shaft. Often used to locate the alternator rotor on the crankshaft.
Wrist pin Another name for gudgeon or piston pin.

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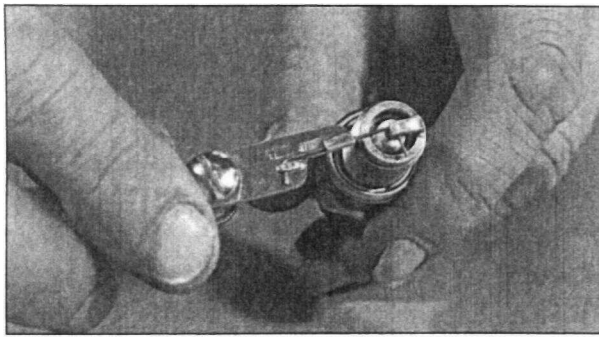
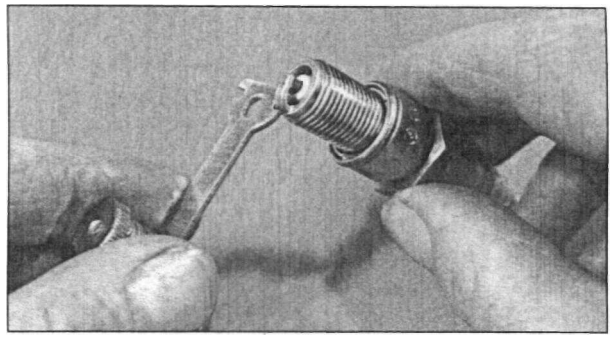
Spark Plug Condition Chart

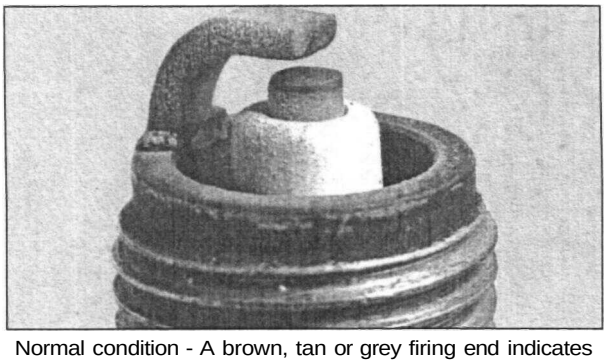
Refer to Chapter 1 for spark plug maintenance



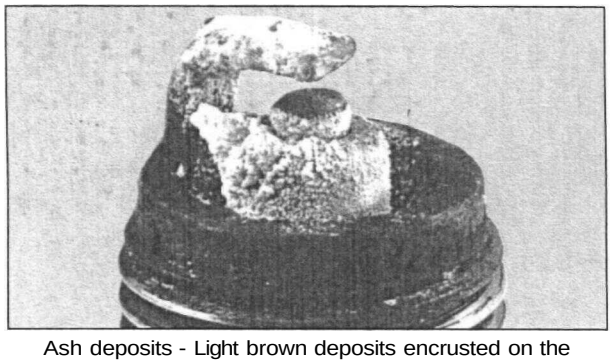
Electrode gap check - use a wire type gauge for best results



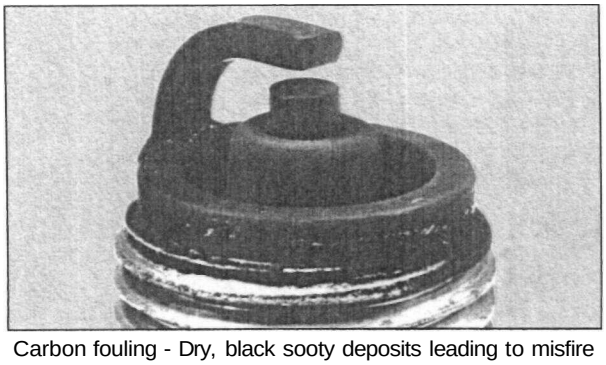
Electrode gap adjustment - bend the side electrode using the correct tool



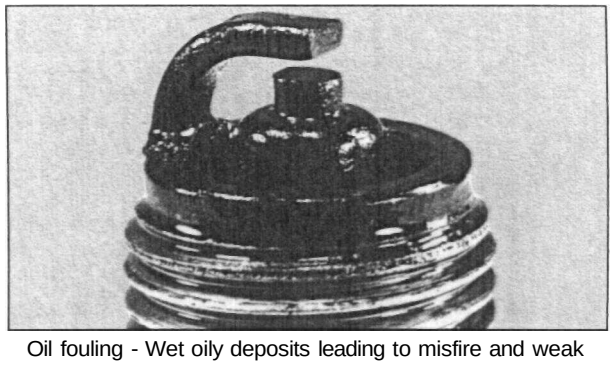
Normal condition - A brown, tan or grey firing end indicates that the engine is in good condition and that the plug type is correct



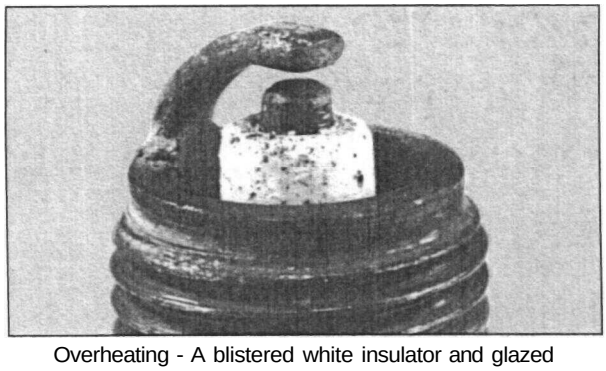
Ash deposits - Light brown deposits encrusted on the electrodes and insulator, leading to misfire and hesitation. Caused by excessive amounts of oil in the combustion chamber or poor quality fuel/oil



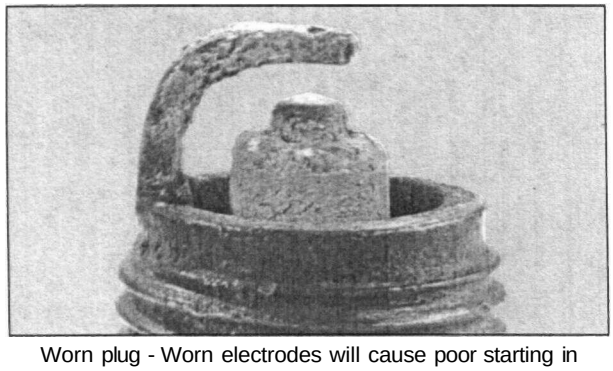
Carbon fouling - Dry, black sooty deposits leading to misfire and weak spark. Caused by an over-rich fuel/air mixture, faulty choke operation or blocked air filter



Oil fouling - Wet oily deposits leading to misfire and weak spark. Caused by oil leakage past piston rings or valve guides (4-stroke engine), or excess lubricant (2-stroke engine)



Overheating - A blistered white insulator and glazed electrodes. Caused by ignition system fault, incorrect fuel, or cooling system fault



Worn plug - Worn electrodes will cause poor starting in damp or cold weather and will also waste fuel

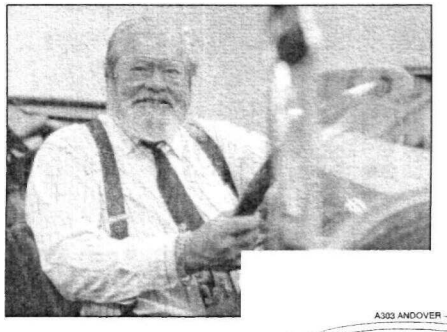
Preserving Our Motoring Heritage

The Model J Duesenberg Derham Tourster. Only eight of these magnificent cars were ever built - this is the only example to be found outside the United States of America

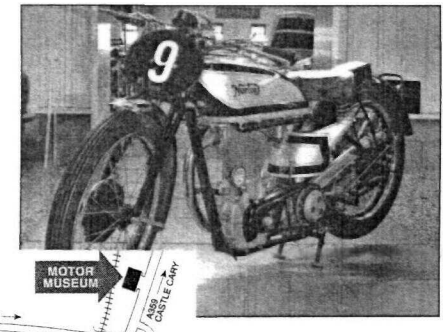
Almost every car you've ever loved, loathed or desired is gathered under one roof at the Haynes Motor Museum. Over 300 immaculately presented cars and motorbikes represent every aspect of our motoring heritage, from elegant reminders of bygone days, such as the superb Model J Duesenberg to curiosities like the bug-eyed BMW Isetta. There are also many old friends and flames. Perhaps you remember the 1959 Ford Popular that you did your courting in? The magnificent 'Red Collection' is a spectacle of classic sports cars including AC, Alfa Romeo, Austin Healey, Ferrari, Lamborghini, Maserati, MG, Riley, Porsche and Triumph.

A *Perfect Day Out*

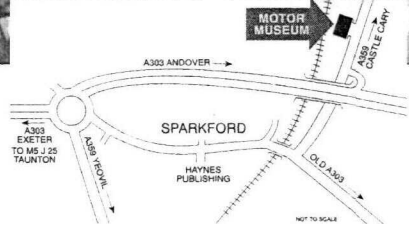
Each and every vehicle at the Haynes Motor Museum has played its part in the history and culture of Motoring. Today, they make a wonderful spectacle and a great day out for all the family. Bring the kids, bring Mum and Dad, but above all bring your camera to capture those golden memories for ever. You will also find an impressive array of motoring memorabilia, a comfortable 70 seat video cinema and one of the most extensive transport book shops in Britain. The Pit Stop Cafe serves everything from a cup of tea to wholesome, home-made meals or, if you prefer, you can enjoy the large picnic area nestled in the beautiful rural surroundings of Somerset.



John Haynes O.B.E., Founder and Chairman of the museum at the wheel of a Haynes Light 12.



The 1936 490cc sohc-engined International Norton - *well known Jor its racing success*



The Museum is situated on the A359 Yeovil to Frome road at Sparkford, just off the A303 in Somerset. It is about 40 miles south of Bristol, and 25 minutes drive from the M5 intersection at Taunton.

Open 9.30am - 5.30pm (10.00am - 4.00pm Winter) 7 days a week, *except Christmas Day, Boxing Day and* New *Years Day*

Special rates available for schools, coach parties and outings Charitable Trust No. 292048