KAWASAKI

EN450 & 500 Twins

1985 to 2004 □ 454cc □ 498cc

Owners Workshop Manual

Haynes

2053

Kawasaki EN450 & 500 Owners Workshop Manual

by Alan Ahlstrand and John H Haynes
Member of the Guild of Motoring Writers

Models covered:

Kawasaki EN450 A-1 through A-6 (454 LTD)
454cc. 1985 through 1990
Kawasaki EN500 A-1 through A-7 (Vulcan 500)
498cc. 1990 through 1996
Kawasaki EN500 C-1 through C-9 (Vulcan 500)
498cc. 1996 through 2004

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We take great pride in the accuracy of information given in this manual, but motorcycle manufacturers make alterations and design changes during the production run of a particular motorcycle of which they do not inform us. No liability can be accepted by the authors or publishers for loss, damage or injury caused by any errors in, or omissions from, the information given.

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Contents

Left side view of the Kawasaki LTD 450 (US 454 LTD similar)

Left side view of the Kawasaki EN500 (US Vulcan 500 similar)

About this manual

Its purpose

The purpose of this manual is to help you get the best value from your motorcycle. It can do so in several ways. It can help you decide what work must be done, even if you choose to have it done by a dealer service department or a repair shop; it provides information and procedures for routine maintenance and servicing; and it offers diagnostic and repair procedures to follow when trouble occurs.

We hope you use the manual to tackle the work yourself. For many simpler jobs, doing it yourself may be quicker than arranging an appointment to get the vehicle into a shop and making the trips to leave it and pick it up. More importantly, a lot of money can be saved by avoiding the expense the shop must pass on to you to cover its labor and overhead costs. An added benefit is the sense of satisfaction and accomplishment that you feel after doing the job yourself.

Using the manual

The manual is divided into Chapters. Each Chapter is divided into numbered Sections, which are headed in bold type between horizontal lines. Each Section consists of consecutively numbered paragraphs.

At the beginning of each numbered Section you will be referred to any illustrations which apply to the procedures in that Section. The reference numbers used in illustration captions pinpoint the pertinent Section and the Step within that Section. That is, illustration 3.2 means the illustration refers to Section 3 and Step (or paragraph) 2 within that Section.

Procedures, once described in the text, are not normally repeated. When it's necessary to refer to another Chapter, the reference will be given as Chapter and Section number. Cross references given without use of the word "Chapter" apply to Sections and/or paragraphs in the same Chapter. For example, "see Section 8" means in the same Chapter.

References to the left or right side of the vehicle assume you are sitting on the seat, facing forward.

Motorcycle manufacturers continually make changes to specifications and recommendations, and these, when notified, are incorporated into our manuals at the earliest opportunity.

Even though we have prepared this manual with extreme care, neither the publisher nor the author can accept responsibility for any errors in, or omissions from, the information given.

NOTE

A **Note** provides information necessary to properly complete a procedure or information which will make the procedure easier to understand.

CAUTION

A **Caution** provides a special procedure or special steps which must be taken while completing the procedure where the Caution is found. Not heeding a Caution can result in damage to the assembly being worked on.

WARNING

A **Warning** provides a special procedure or special steps which must be taken while completing the procedure where the Warning is found. Not heeding a Warning can result in personal injury.

Introduction to the Kawasaki EN450 and 500

The Kawasaki EN450 and EN500 are popular lightweight cruisers. The EN450 is known in the US as the 454 LTD and in the UK as the LTD 450. The EN500 is sold in the US as the Vulcan 500.

The engine is of the same basic design as the center two cylinders of the ZX600 Ninja/GPX. It's a double overhead camshaft type with four valves per cylinder and a counterbalance shaft. Fuel is delivered through two 34 mm Keihin carburetors.

The front suspension is a conventional telescopic fork design. The rear end uses a swingarm supported by twin shocks and coil springs.

The front brake is a hydraulic disc design, with a drum brake at the rear.

Identification numbers

The frame serial number is stamped into the right side of the steering head and the engine serial number is stamped into the right engine case. Both of these numbers should be recorded and kept in a safe place so they can be furnished to law enforcement officials in the event of theft.

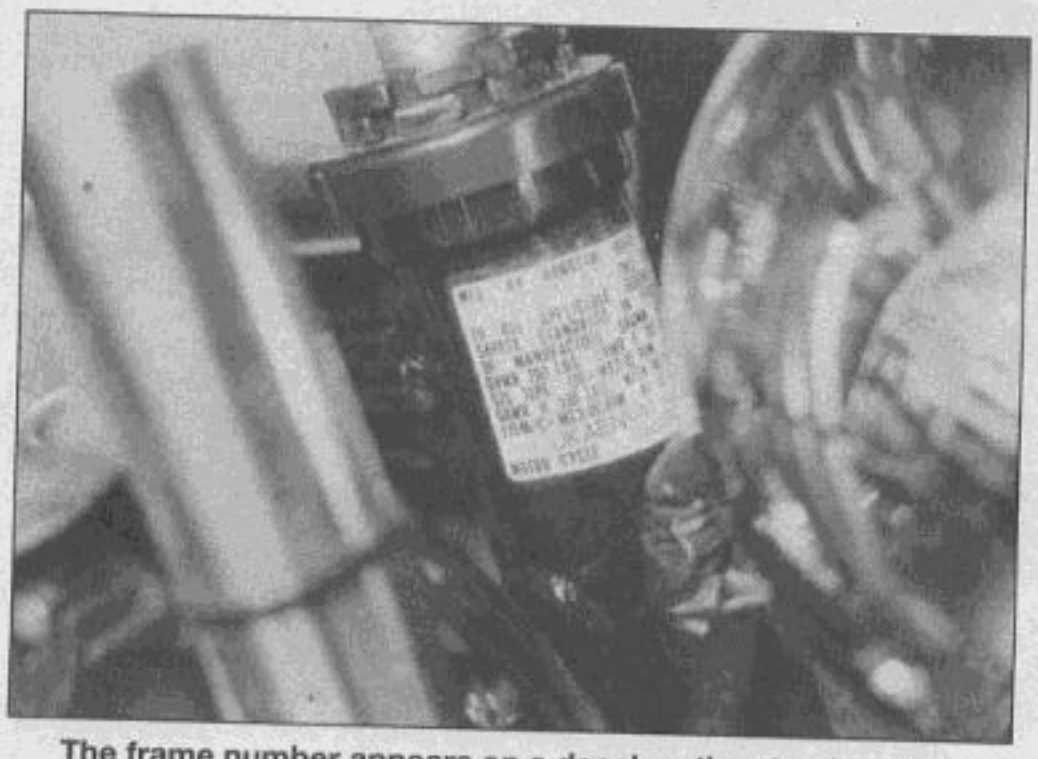
The frame serial number, engine serial number and carburetor identification number should also be kept in a handy place (such as with your driver's license) so they are always available when purchasing or ordering parts for your machine.

The models covered by this manual are as follows:

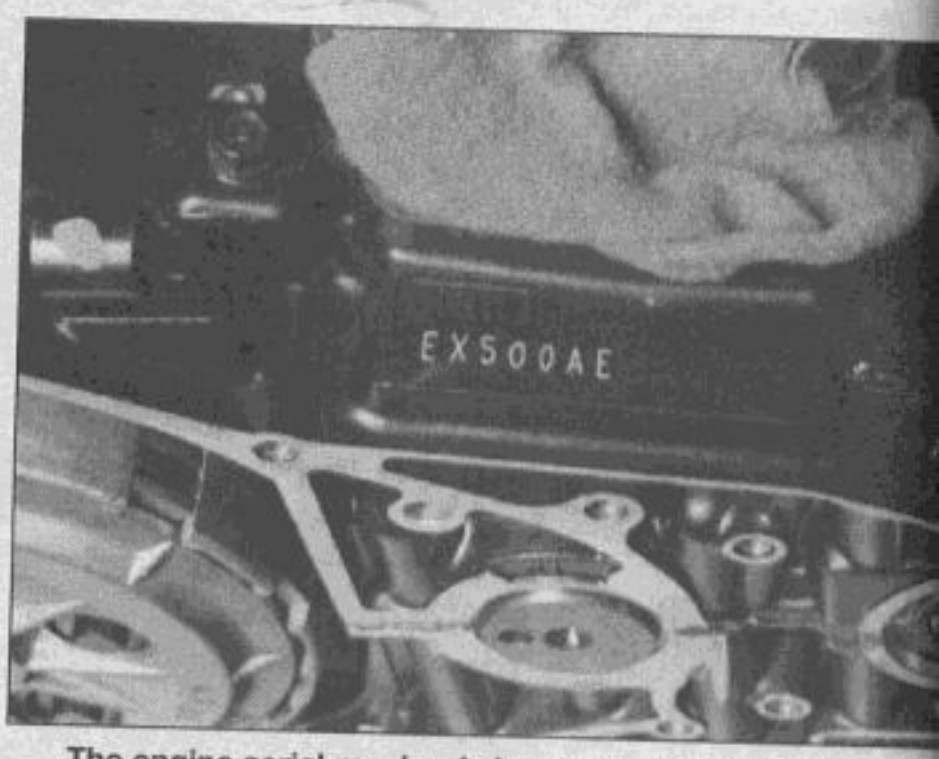
-EN450-A1 (454 LTD, LTD 450) - 1985
-EN450-A2 (454 LTD, LTD 450) - 1986
-EN450-A3 (454 LTD, LTD 450) - 1987
-EN450-A4 (454 LTD, LTD 450) - 1988
-EN450-A5 (454 LTD, LTD 450) - 1989
-EN450-A6 (454 LTD, LTD 450) - 1990
-EN500-A1 (Vulcan 500) - 1990
-EN500-A2 (Vulcan 500) - 1991
-EN500-A3 (Vulcan 500) - 1992
-EN500-A4 (Vulcan 500) - 1993
-EN500-A5 (Vulcan 500), 1994
-EN500-A6 (Vulcan 500), 1995
-EN500-A7 (Vulcan 500), 1997
-EN500-C1 (Vulcan 500), 1996
-EN500-C2 (Vulcan 500), 1997
-EN500-C3 (Vulcan 500), 1998
-EN500-C4 (Vulcan 500), 1999
-EN500-C5 (Vulcan 500), 2000
-EN500-C6 (Vulcan 500), 2001
-EN500-C7 (Vulcan 500), 2002
-EN500-C8 (Vulcan 500), 2003
-EN500-C9 (Vulcan 500), 2004

The following table is a breakdown of the engine and frame numbers by model and year of production:

Year	Model Code	Frame number range	Engine number range
1985	EN450 A1	US JKAENGA1-FA000001 to 013000 UK EN450A-000001 to 013000	EN450EA-000001 to 013000 EN450AE-000001 to 012000
1986	EN450 A2	US JKAENGA1-GA013001 to 028000 UK EN450A-013001 to 028000	ENG450AE-013001 to 028000 EN450A-012001 to 026000
1987	EN450 A3	US JKAENGA1-HA028001 to O32000 UK EN450A-028001 to 032000	EN450EA-028001 to 030300 EN450A-026001 to 030300
1988	EN450 A4	US JKAENGA1-JA032001 to 035300 UK EN450A-030301-on	EN450A-032001 to 033000 EN450A-030301-on
1989	EN450 A5	US JKAENGA1-KA035301-on UK EN450A-035301-on	EN450A-033301-on EN450A-033301-on
1990	EN450 A6	US JKAENGA1-LA040001-on UK model not imported	EN450AE-033301-on
1990	EN500 A1	US JKAENVA1-LA000001 to 007000 UK EN500A-000001-on	EX500-008186 to 010200/011051 to 015050 EN500AE-018001-on
1991	EN500 A2	US JKAENVA1-MA007001 to 0081851/ 010201 to 011050/015051 to 025000 UK EN500A1 continued	EX500AE-018001-on
1992	EN500 A3	JKAENVA1-NA025001 to O45000 UK EN500A-025001-on	EX500AE-018001-on EN500AE-018000-on
1993	EN500 A4	US JKAEXNA1-PA045001 UK EN500A3 continued	EN500AE-018000-on



The frame number appears on a decal on the steering head



The engine serial number is located on the right side of the engine case

The following table is a breakdown of 1994 and later initial frame numbers by model and year of production:

Year	Model	Initial frame number
1994	EN500-A5	JKAENVA1-RA090001 or EN500A-080001
1995	EN500-A6	JKAENVA1-SA090001 or EN500A-090001
1996	EN500-A7	JKAENVA1-TA090001 or EN500A-100001
1996	EN500-C1	JKAENVC1-TA000001 or EN500C-000001
1997	EN500-C2	JKAENVC1-TA005001 or EN500C-005001
1998	Not available	
1999	EN500-C4	JKAENVC1-XA156001 or JKAEN500ACA-156001
2000	EN500-C5	JKAENVC1-YA164001 or JKAEN500ACA-164001
2001	EN500-C6	JKAENVC1-1A168001 or JKAEN500ACA-168001
2002	EN500-C7	JKAENVC1-2A173001 or JKAEN500ACA-173001
2003	EN500-C8	JKAENVC1-3A180001 or JKAEN500ACA-180001
2004	EN500-C9	JKAENVC1-4A185001

Buying parts

Once you have found all the identification numbers, record them for reference when buying parts. Since the manufacturers change specifications, parts and vendors (companies that manufacture various components on the machine), providing the ID numbers is the only way to be reasonably sure that you are buying the correct parts.

Whenever possible, take the worn part to the dealer so direct comparison with the new component can be made. Along the trail from the manufacturer to the parts shelf, there are numerous places that the part can end up with the wrong number or be listed incorrectly.

The two places to purchase new parts for your motorcycle - the accessory store and the franchised dealer - differ in the type of parts they carry. While dealers can obtain virtually every part for your motorcycle, the accessory dealer is usually limited to normal high wear items such as shock absorbers, tune-up parts, various engine gaskets, cables, chains, brake parts, etc. Rarely will an accessory outlet have major suspension components, cylinders, transmission gears, or cases.

Used parts can be obtained for roughly half the price of new ones, but you can't always be sure of what you're getting. Once again, take your worn part to the wrecking yard (breaker) for direct comparison.

Whether buying new, used or rebuilt parts, the best course is to deal directly with someone who specializes in parts for your particular make.

General specifications

Frame and suspension

Wheelbase	
EN450	1485 mm (58.46 inches)
EN500 A	1555 mm (61.22 inches)
EN500 C	1595 mm (62.8 inches)
Overall length	
EN450	
US	2205 mm (86.81 inches)
UK	2210 mm (87.00 inches)
EN500 A	
Greece, Italy, Netherlands, Sweden , Germany	2290 mm 90.157 inches)
All other A models	2265 mm (89.17 inches)
EN500 C	2320 mm (91.3 inches)
Overall width	
EN450	820 mm (32.28 inches)
EN500 A	840 mm (33.07 inches)
EN500 C	830 mm (32.7 inches)
Overall height	
EN450	1220 mm (48.03 inches)
EN500 A	1230 mm (48.42 inches)
EN500 C	1125 mm (44.3 inches)
Seat height	
EN450	745 mm (29.33 inches)
EN500 A	730 mmm (28.74 inches)
EN500 C	715 mm (31.5 inches)
Dry weight	
EN450	
US except California	180 kg 396 lbs)
California	180.5 kg (397.1 lbs)
UK	181 kg (398.2 lbs)

Frame and suspension (continued)

EN500 A	
Except California	186 kg (409.2 lbs)
California	186.5 kg (410.3 lbs)
EN500 C	
Except California	199.0 kg (438 lbs)
California	199.5 kg (440 lbs)
Front suspension	Telescopic fork
Rear suspension	Twin shocks/coil springs
Front brake	Hydraulic disc
Rear brake	Mechanical drum
Fuel tank capacity	
EN450, EN500 A	11.0 liters (2.9 US gal, 2.51 Imp gal)
EN500 C	15.0 liters (3.9 US gal, 3.3 Imp gal)

Engine

Type	Liquid cooled, 4-stroke, DOHC parallel twin
Displacement	
EN450	454 cc (27.68 cubic inches)
EN500	498 cc (30.36 cubic inches)
Ignition system	Transistorized
Fuel system	
EN450, EN500 A	Two 34 mm Keihin carburetors
EN500 C	Two 32 mm Keihin carburetors
Clutch	Wet, multiplate
Transmission	5-speed, constant mesh

Maintenance techniques, tools and working facilities

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 organized 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 adhesive). All threaded fasteners should be clean, straight, have undamaged threads and undamaged corners on the hex head where the wrench 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. Some mechanics use turpentine in a spout type oil can, which works quite well. 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 chiseled off or removed with a special nut breaker, available at tool stores.

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).

Flat washers and lock washers, when removed from an assembly, 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 aluminum), 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

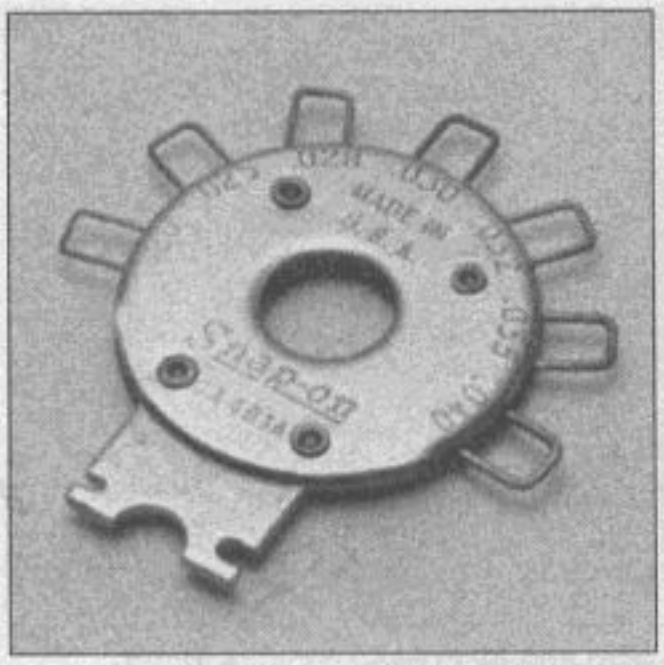
When threaded fasteners are tightened, they are often tightened to a specific torque value (torque is basically a twisting force). Over-tightening the fastener can weaken it and cause it to break, while under-tightening can cause it to eventually come loose. Each bolt, depending on the material it's 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 (i.e. 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.

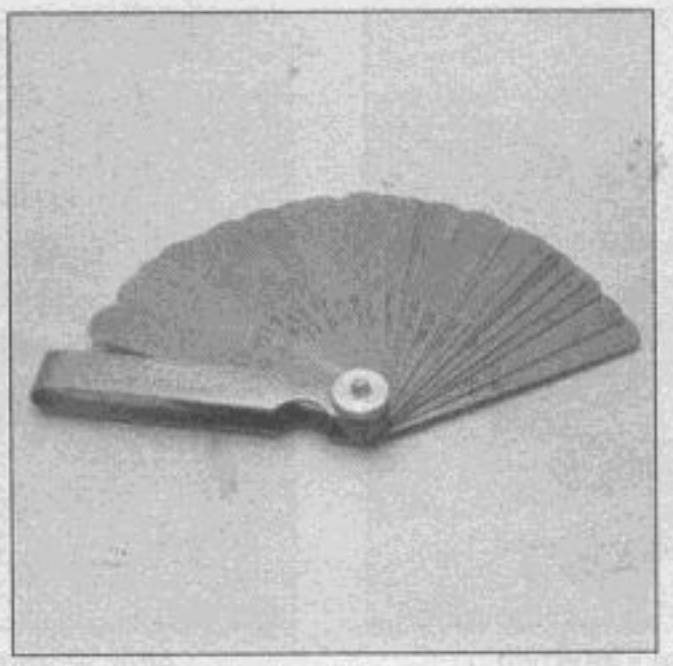
Disassembly sequence

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 a grooved thrust washer on a shaft). 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.

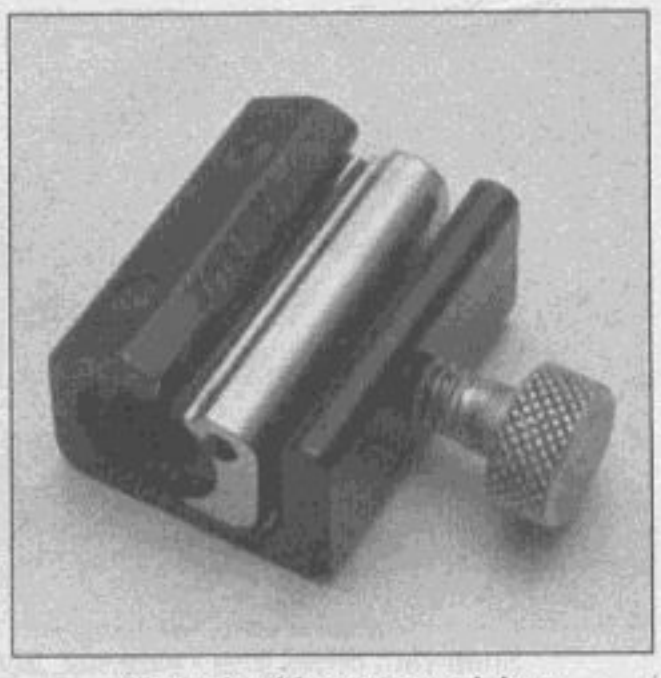
When removing fasteners from a component, keep track of their locations. Sometimes threading a bolt back in a part, or putting the washers and nut back on a stud, can prevent mixups later. If nuts and bolts can't be returned to their original locations, they should be kept in a compartmented box or a series of small boxes. A cupcake or muffin tin is ideal for this purpose, since each cavity can hold the bolts and



Spark plug gap adjusting tool



Feeler gauge set



Control cable pressure luber

nuts from a particular area (i.e. engine case bolts, valve cover bolts, engine mount bolts, etc.). A pan of this type is especially helpful when working on assemblies with very small parts (such as the carburetors and the valve train). The cavities can be marked with paint or tape to identify the contents.

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

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

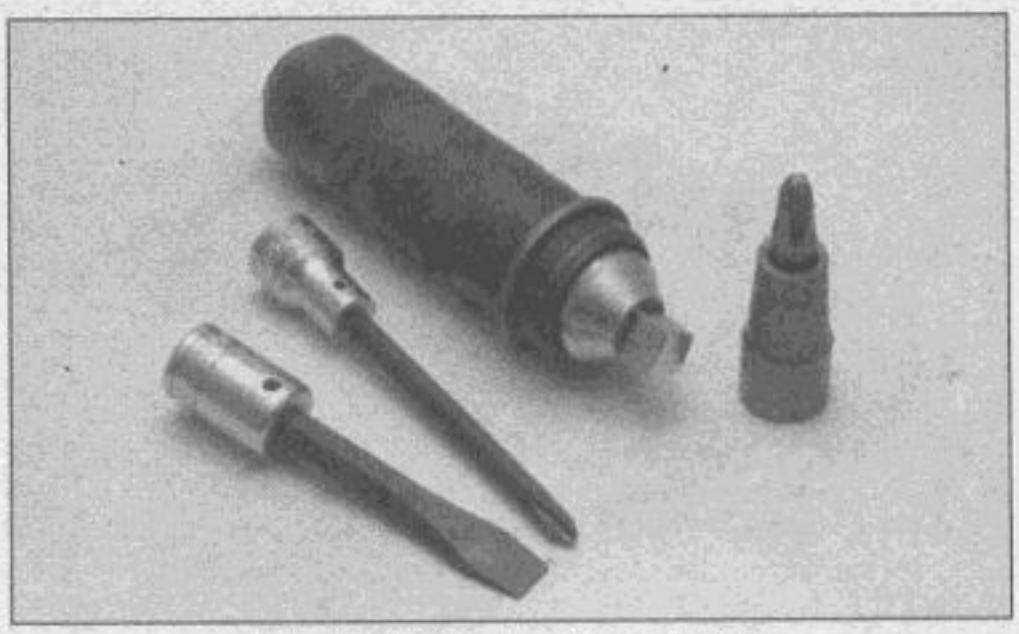
Many times these gaskets are coated with a liquid or paste type gasket sealing compound before assembly. Age, heat and pressure can sometimes cause the two parts to stick together so tightly that they are very difficult to separate. In most cases, the part can be loosened by striking it with a soft-faced hammer near the mating surfaces. A regular 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 mar 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.

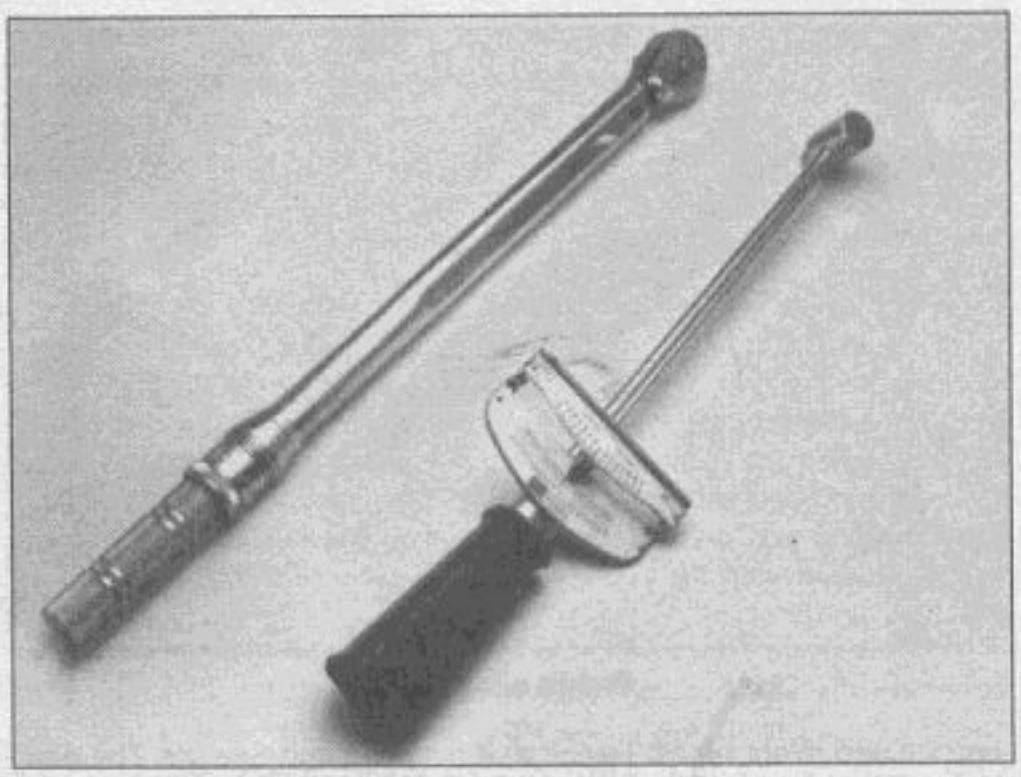
After the parts are separated, the old gasket must be carefully scraped off and the gasket surfaces cleaned. Stubborn gasket material can be soaked with a gasket remover (available in aerosol cans) to soften it so it can be easily scraped off. A scraper can be fashioned from a piece of copper tubing 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 sealer 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 sealer 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 spigot that the hose fits over. To remove a hose, first loosen the hose clamps that secure it to the spigot. Then, with slip joint pliers, grab the hose at the clamp and rotate it around the spigot. 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 spigot). Apply the same lubricant to the inside of the hose and the outside of the spigot to simplify installation.



Hand impact screwdriver and bits



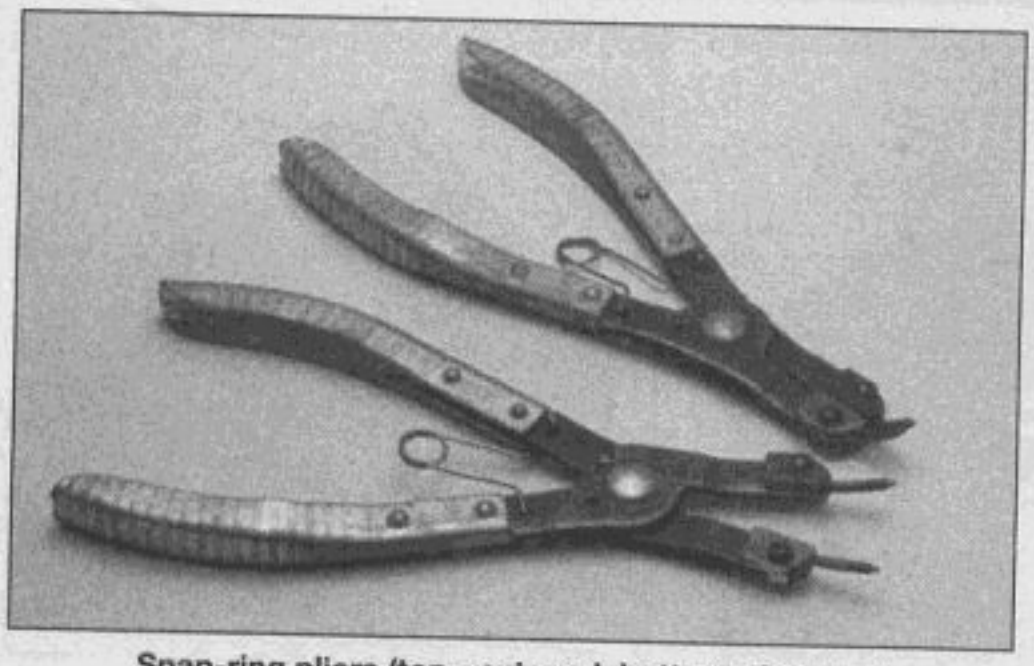
Torque wrenches (left - click type; right - beam type)

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

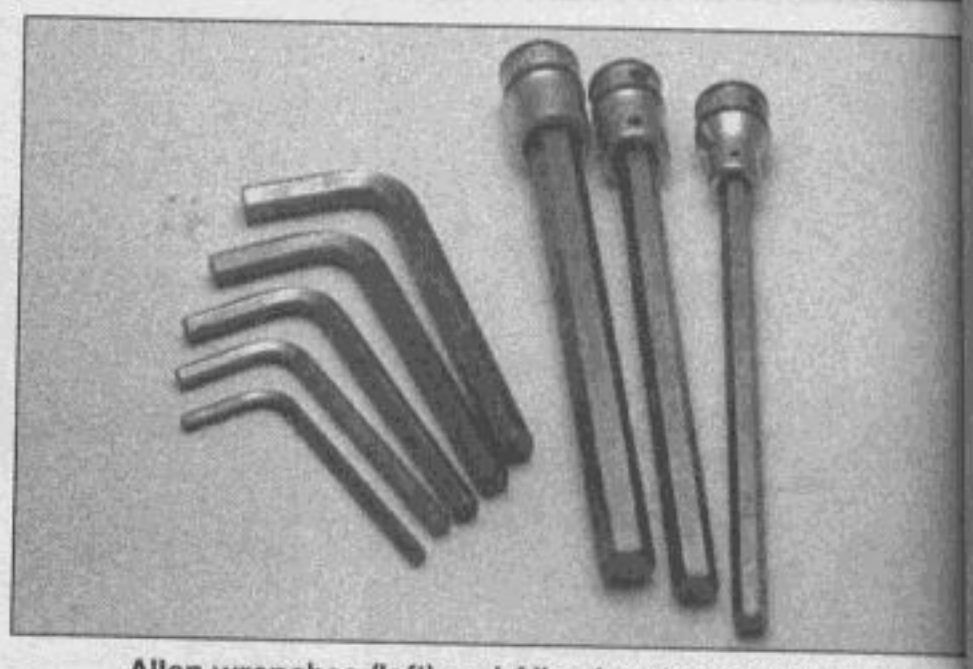
Tools

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 spiraling costs of routine maintenance and repair, it is a wise one.

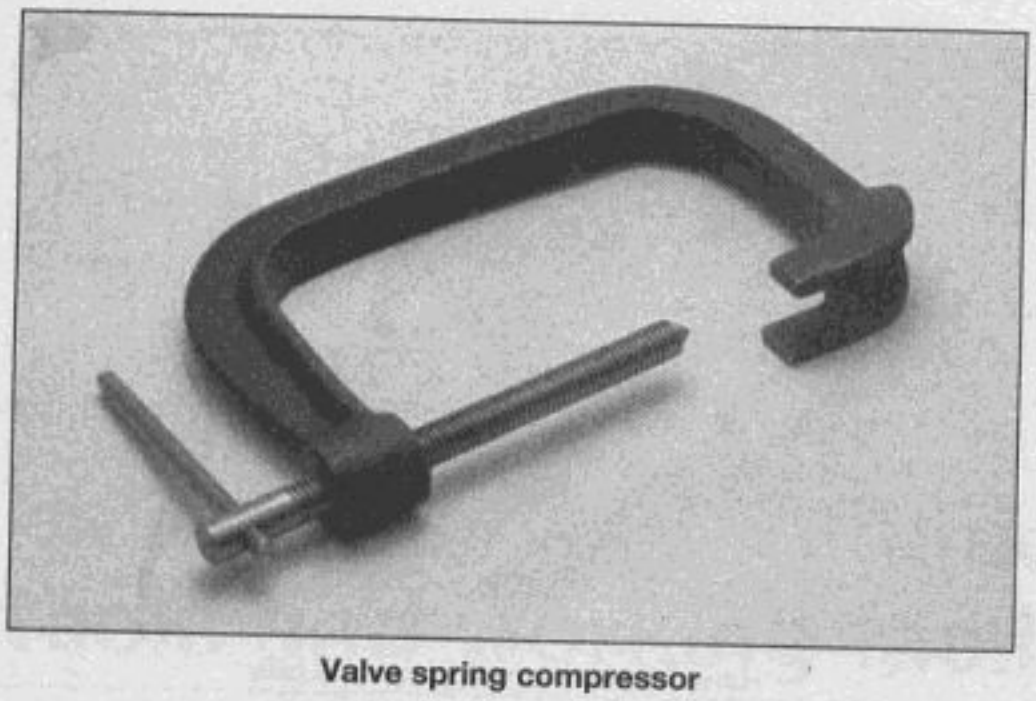
To help the owner decide which tools are needed to perform the tasks detailed in this manual, the following tool lists are offered: Main-



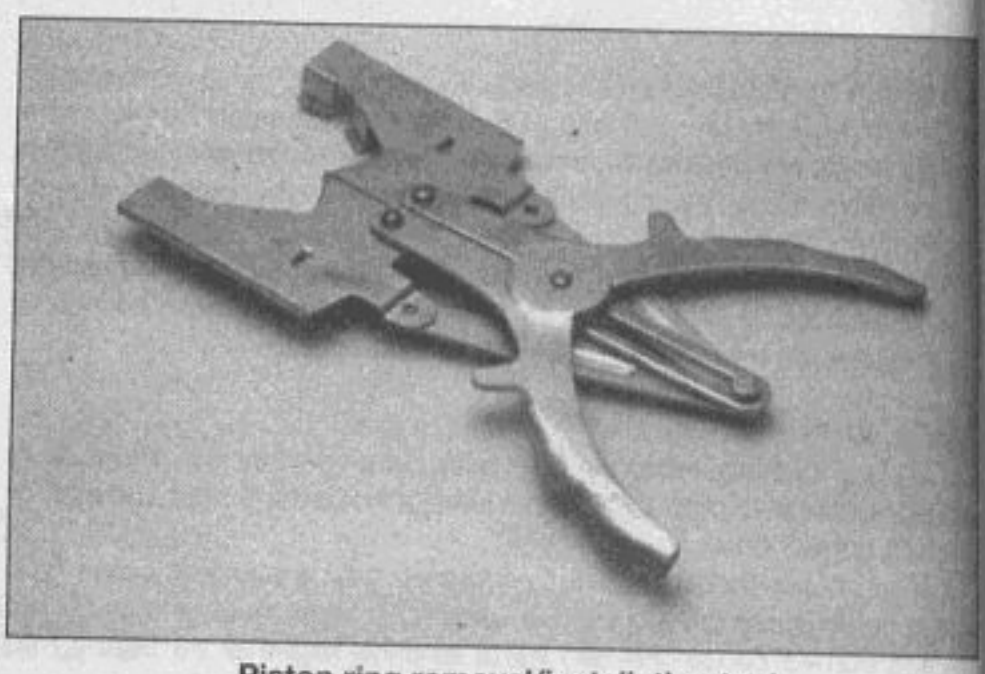
Snap-ring pliers (top - external; bottom - internal)



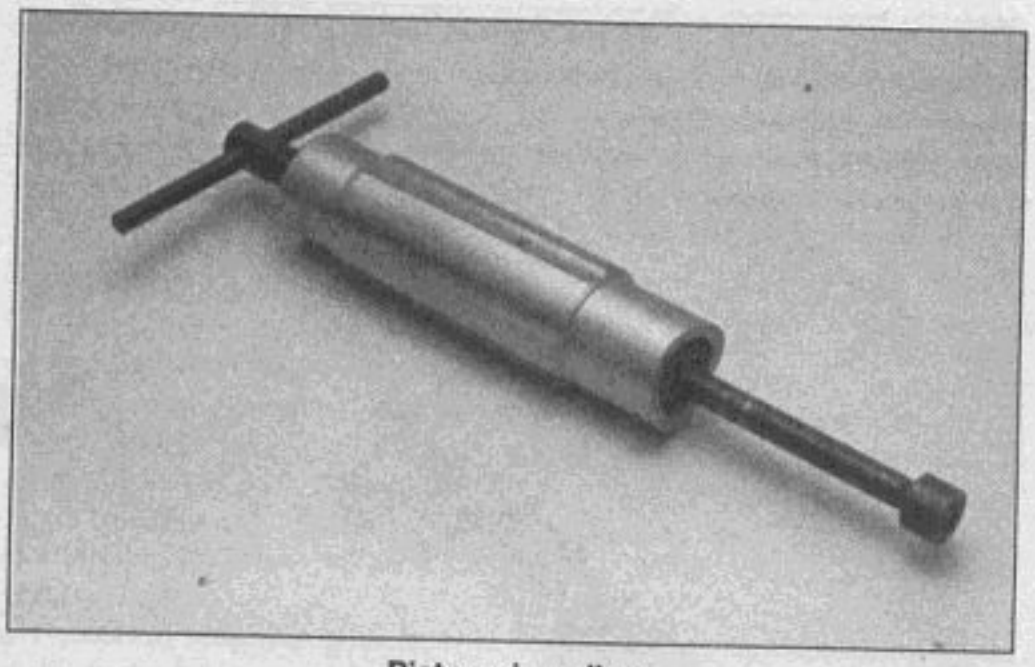
Allen wrenches (left) and Allen head sockets (right)



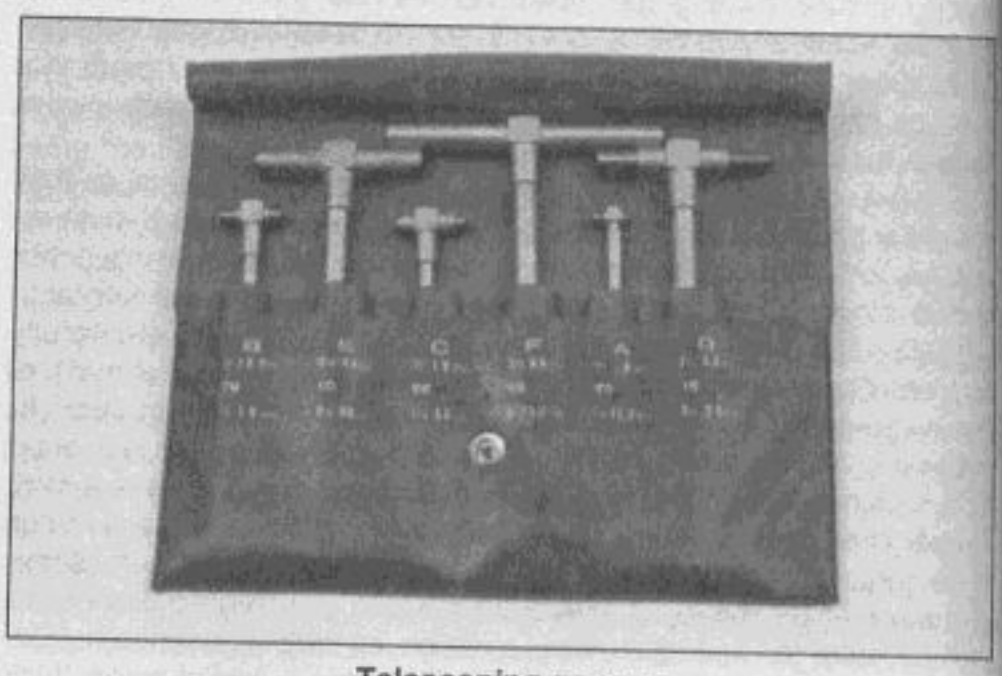
Valve spring compressor



Piston ring removal/installation tool



Piston pin puller



Telescoping gauges

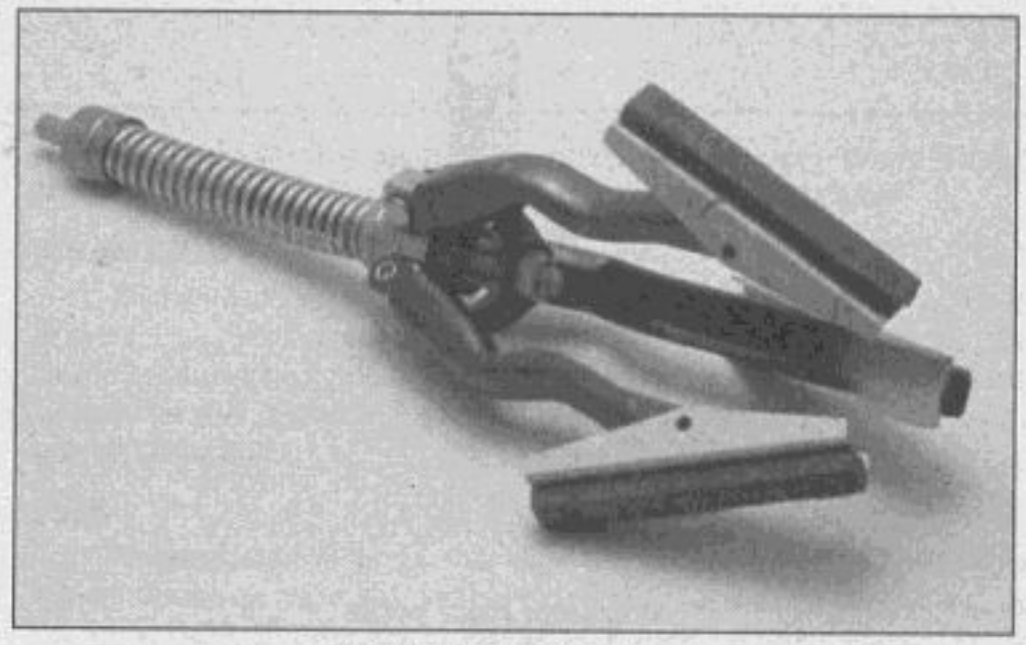
tenance and minor repair, Repair and overhaul and Special. The newcomer to practical mechanics should start off with the Maintenance and minor repair tool kit, which is adequate for the simpler jobs. Then, as confidence and experience grow, the owner can tackle more difficult tasks, buying additional 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

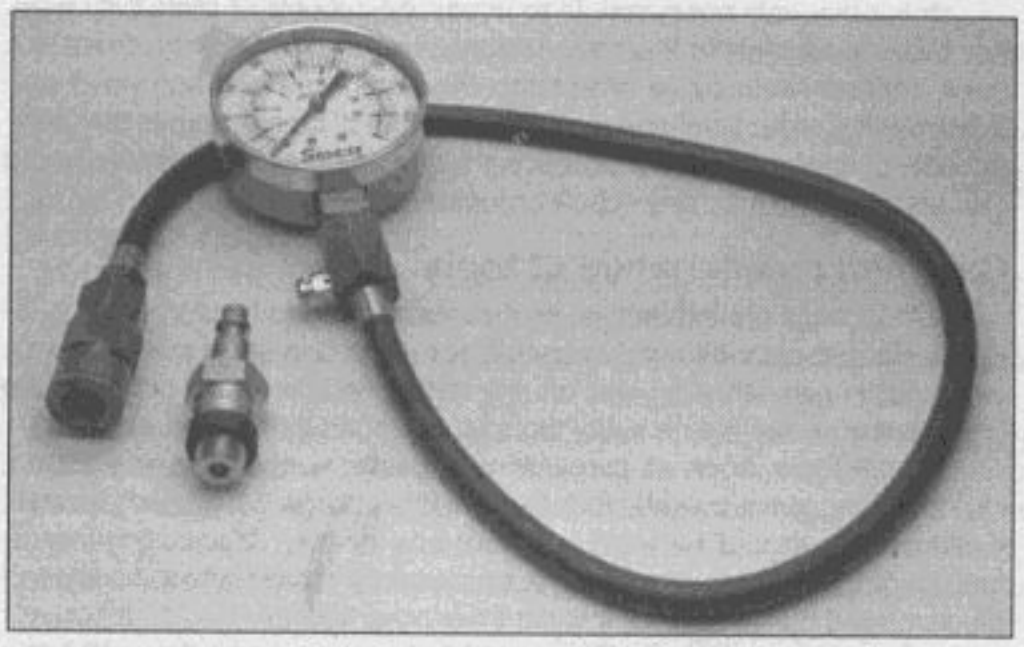
The tools in this list should be considered the minimum required for performance of routine maintenance, servicing and minor repair work. We recommend the purchase of combination wrenches (box end and open end combined in one wrench); while more expensive than open-ended ones, they offer the advantages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

Combination wrench set (6 mm to 22 mm)
Adjustable wrench - 8 in
Spark plug socket (with rubber insert)
Spark plug gap adjusting tool
Feeler gauge set
Standard screwdriver (5/16 in x 6 in)
Phillips screwdriver (No. 2 x 6 in)
Allen (hex) wrench set (4 mm to 12 mm)
Combination (slip-joint) pliers - 6 in
Hacksaw and assortment of blades
Tire pressure gauge

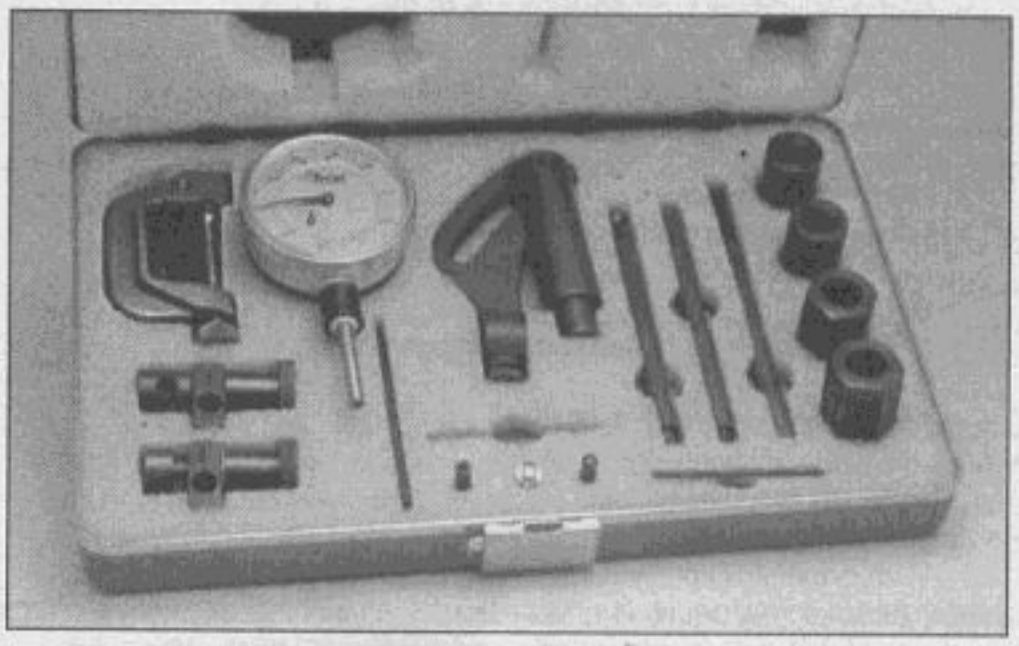
0-to1-inch micrometer



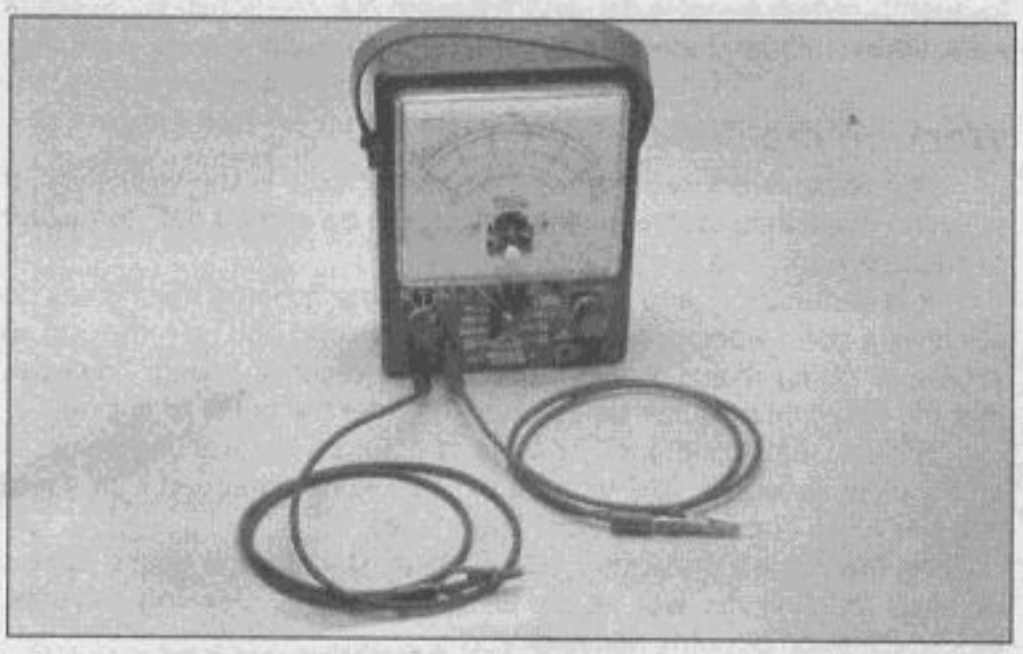
Cylinder surfacing hone



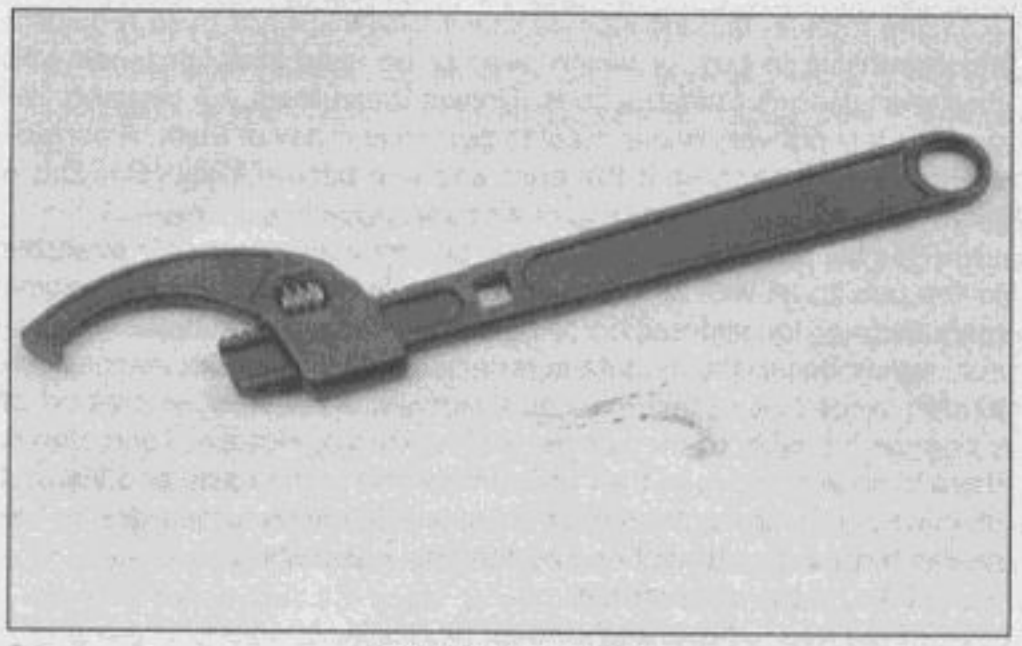
Cylinder compression gauge



Dial indicator set



Multimeter (volt/ohm/ammeter)



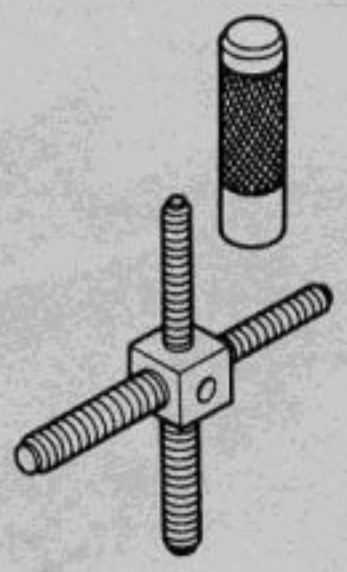
Adjustable spanner

Control cable pressure luber
Grease gun
Oil can
Fine emery cloth
Wire brush
Hand impact screwdriver and bits
Funnel (medium size)
Safety goggles
Drain pan
Work light with extension cord

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)



Alternator rotor puller

Standard screwdriver (1/4 in x 6 in)
Standard screwdriver (stubby - 5/16 in)
Phillips screwdriver (No. 3 x 8 in)
Phillips screwdriver (stubby - No. 2)
Pliers - locking
Pliers - lineman's
Pliers - needle nose
Pliers - snap-ring (internal and external)
Cold chisel - 1/2 in
Scriber
Scraper (made from flattened copper tubing)
Center punch
Pin punches (1/16, 1/8, 3/16 in)
Steel rule/straightedge - 12 in
Pin-type spanner wrench
A selection of files
Wire brush (large)

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).*

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 (e.g. 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 vehicle manufacturer for distribution to dealer service departments. 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 turned over to the dealer service department or a motorcycle repair shop.

Valve spring compressor
Piston ring removal and installation tool
Piston pin puller
Telescoping gauges
Micrometer(s) and/or dial/Vernier calipers
Cylinder surfacing hone
Cylinder compression gauge
Dial indicator set
Multimeter
Adjustable spanner
Alternator rotor holder
Alternator rotor puller
Manometer or vacuum gauge set
Small air compressor with blow gun and tire chuck

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 stores 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, wrenches 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.

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 vise 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. To avoid pouring them on the ground or into a sewage system, simply pour the used fluids into large containers, seal them with caps and take them to an authorized disposal site or service station. Plastic jugs (such as old antifreeze containers) are ideal for this purpose.

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 shop floor.

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

Safety first

Professional mechanics are trained in safe working procedures. However enthusiastic you may be about getting on with the job at hand, take the time to ensure that your safety is not put at risk. A moment's lack of attention can result in an accident, as can failure to observe simple precautions.

There will always be new ways of having accidents, and the following is not a comprehensive list of all dangers; it is intended rather to make you aware of the risks and to encourage a safe approach to all work you carry out on your bike.

Essential DOs and DON'Ts

DON'T start the engine without first ascertaining that the transmission is in neutral.
DON'T suddenly remove the filler cap from a hot cooling system - cover it with a cloth and release the pressure gradually first, or you may get scalded by escaping coolant.
DON'T attempt to drain oil until you are sure it has cooled sufficiently to avoid scalding you.
DON'T grasp any part of the engine or exhaust system without first ascertaining that it is cool enough not to burn you.
DON'T allow brake fluid or antifreeze to contact the machine's paint work or plastic components.
DON'T siphon toxic liquids such as fuel, hydraulic fluid or antifreeze by mouth, or allow them to remain on your skin.
DON'T inhale dust - it may be injurious to health (see Asbestos heading).
DON'T allow any spilled oil or grease to remain on the floor - wipe it up right away, before someone slips on it.
DON'T use ill fitting wrenches or other tools which may slip and cause injury.
DON'T attempt to lift a heavy component which may be beyond your capability - get assistance.
DON'T rush to finish a job or take unverified short cuts.
DON'T allow children or animals in or around an unattended vehicle.
DON'T inflate a tire to a pressure above the recommended maximum. Apart from over stressing the car case and wheel rim, in extreme cases the tire may blow off forcibly.
DO ensure that the machine is supported securely at all times. This is especially important when the machine is blocked up to aid wheel or fork removal.
DO take care when attempting to loosen a stubborn nut or bolt. It is generally better to pull on a wrench, rather than push, so that if you slip, you fall away from the machine rather than onto it.
DO wear eye protection when using power tools such as drill, sander, bench grinder etc.
DO use a barrier cream on your hands prior to undertaking dirty jobs - it will protect your skin from infection as well as making the dirt easier to remove afterwards; but make sure your hands aren't left slippery. Note that long-term contact with used engine oil can be a health hazard.
DO keep loose clothing (cuffs, ties etc. and long hair) well out of the way of moving mechanical parts.
DO remove rings, wristwatch etc., before working on the vehicle- especially the electrical system.
DO keep your work area tidy - it is only too easy to fall over articles left lying around.
DO exercise caution when compressing springs for removal or installation. Ensure that the tension is applied and released in a controlled manner, using suitable tools which preclude the possibility of the spring escaping violently.
DO ensure that any lifting tackle used has a safe working load rating adequate for the job.
DO get someone to check periodically that all is well, when working alone on the vehicle.
DO carry out work in a logical sequence and check that everything is correctly assembled and tightened afterwards.
DO remember that your vehicle's safety affects that of yourself and others. If in doubt on any point, get professional advice.

IF, in spite of following these precautions, you are unfortunate enough to injure yourself, seek medical attention as soon as possible.

Asbestos

Certain friction, insulating, sealing and other products - such as brake pads, clutch linings, gaskets, etc. - may contain asbestos. Extreme care must be taken to avoid inhalation of dust from such products since it is hazardous to health. If in doubt, assume that they do contain asbestos.

Fire

Remember at all times that gasoline (petrol) is highly flammable. Never smoke or have any kind of naked flame around, when working on the vehicle. But the risk does not end there - a spark caused by an electrical short-circuit, by two metal surfaces contacting each other, by careless use of tools, or even by static electricity built up in your body under certain conditions, can ignite gasoline (petrol) vapor, which in a confined space is highly explosive. Never use gasoline (petrol) as a cleaning solvent. Use an approved safety solvent.

Always disconnect the battery ground (earth) terminal before working on any part of the fuel or electrical system, and never risk spilling fuel on to a hot engine or exhaust.

It is recommended that a fire extinguisher of a type suitable for fuel and electrical fires is kept handy in the garage or workplace at all times. Never try to extinguish a fuel or electrical fire with water.

Fumes

Certain fumes are highly toxic and can quickly cause unconsciousness and even death if inhaled to any extent. Gasoline (petrol) vapor comes into this category, as do the vapors from certain solvents such as trichloroethylene. Any draining or pouring of such volatile fluids should be done in a well ventilated area.

When using cleaning fluids and solvents, read the instructions carefully. Never use materials from unmarked containers - they may give off poisonous vapors.

Never run the engine of a motor vehicle in an enclosed space such as a garage. Exhaust fumes contain carbon monoxide which is extremely poisonous; if you need to run the engine, always do so in the open air or at least have the rear of the vehicle outside the workplace.

The battery

Never cause a spark, or allow a naked light near the vehicle's battery. It will normally be giving off a certain amount of hydrogen gas, which is highly explosive.

Always disconnect the battery ground (earth) terminal before working on the fuel or electrical systems (except where noted).

If possible, loosen the filler plugs or cover when charging the battery from an external source. Do not charge at an excessive rate or the battery may burst.

Take care when topping up, cleaning or carrying the battery. The acid electrolyte, even when diluted, is very corrosive and should not be allowed to contact the eyes or skin. Always wear rubber gloves and goggles or a face shield. If you ever need to prepare electrolyte yourself, always add the acid slowly to the water; never add the water to the acid.

Electricity

When using an electric power tool, inspection light etc., always ensure that the appliance is correctly connected to its plug and that, where necessary, it is properly grounded (earthed). Do not use such appliances in damp conditions and, again, beware of creating a spark or applying excessive heat in the vicinity of fuel or fuel vapor. Also ensure that the appliances meet national safety standards.

A severe electric shock can result from touching certain parts of the electrical system, such as the spark plug wires (HT leads), when the engine is running or being cranked, particularly if components are damp or the insulation is defective. Where an electronic ignition system is used, the secondary (HT) voltage is much higher and could prove fatal.

Motorcycle chemicals and lubricants

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 carburetor jets and other orifices.

Carburetor 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 colored 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.

Gas (petrol) additives perform several functions, depending on their chemical makeup. They usually contain solvents that help dissolve gum and varnish that build up on carburetor and intake 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 fluid is a specially formulated hydraulic fluid that can withstand the heat and pressure encountered in brake 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.

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 gasoline 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 cement 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 utilize a chemical or abrasive cleaner to help remove the top layer of oxidized (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.

Troubleshooting

Contents

Engine doesn't start or is difficult to start

1 Starter motor does not rotate

1 Engine stop switch Off.
2 Fuse blown. Check main fuse under the seat (EN450) or the starter relay (EN500) (Chapter 9).
3 Battery voltage low. Check and recharge battery (Chapter 9).
4 Starter motor defective. Make sure the wiring to the starter is secure. Make sure the starter solenoid (relay) clicks when the start button is pushed. If the solenoid clicks, then the fault is in the wiring or motor.
5 Starter solenoid (relay) faulty. It is located under the seat. Check it according to the procedure in Chapter 9.
6 Starter button not contacting. The contacts could be wet, corroded or dirty. Disassemble and clean the switch (Chapter 9).
7 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).
8 Ignition switch defective. Check the switch according to the procedure in Chapter 9. Replace the switch with a new one if it is defective.
9 Engine stop switch defective. Check for wet, dirty or corroded contacts. Clean or replace the switch as necessary (Chapter 9).
10 Faulty starter lockout switch. Check the wiring to the switch and the switch itself according to the procedures in Chapter 9.

2 Starter motor rotates but engine does not turn over

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

3 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, valve lifters, camshaft, pistons, crankshaft, connecting rod bearings, or transmission gears or bearings. Refer to Chapter 2 for engine disassembly.

4 No fuel flow

1 No fuel in tank.
2 Fuel tap vacuum hose broken or disconnected.
3 Tank cap air vent obstructed. Usually caused by dirt or water. Remove it and clean the cap vent hole.
4 Fuel tap clogged. Remove the tap and clean it and the filter (Chapter 4).
5 Fuel line clogged. Pull the fuel line loose and carefully blow through it.
6 Inlet needle valves clogged. For both the valves to be clogged, either a very bad batch of fuel with an unusual additive has been used, or some other foreign object 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 bowls does not alleviate the problem.

5 Engine flooded

1 Float level too high. Check and adjust as described in Chapter 4.
2 Inlet needle valve worn or stuck open. A piece of dirt, rust or other debris can cause the inlet needle to seat improperly, causing excess fuel to be admitted to the float bowl. In this case, the float chamber should be cleaned and the needle 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).
3 Starting technique incorrect. Under normal circumstances (i.e., 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 back on after the engine starts.

6 No spark or weak spark

1 Ignition switch Off.
2 Engine stop switch turned to the Off position.
3 Battery voltage low. Check and recharge battery as necessary (Chapter 9).
4 Spark plug dirty, defective or worn out. Locate reason for fouled plug(s) using spark plug condition chart and follow the plug maintenance procedures in Chapter 1.
5 Spark plug cap or high-tension wiring faulty. Check condition. Replace either or both components if cracks or deterioration are evident.
6 Spark plug cap not making good contact. Make sure that the plug cap fits snugly over the plug end.
7 IC igniter defective. Check the unit, referring to Chapter 5 for details.
8 Pickup coil defective. Check the unit, referring to Chapter 5 for details.
9 Ignition coil(s) defective. Check the coils, referring to Chapter 5.
10 Ignition or stop 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).
11 Wiring shorted or broken between:
a) Ignition switch and engine stop switch
b) IC igniter and engine stop switch
c) IC igniter and ignition coil
d) Ignition coil and plug
e) IC igniter and pickup coils
Make sure that all wiring connections are clean, dry and tight. Look for chafed and broken wires (Chapters 5 and 9).

7 Compression low

1 Spark plug loose. Remove the plug and inspect the threads. Reinstall and tighten to the specified torque (Chapter 1).
2 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).
3 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).
4 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).
5 Piston rings worn, weak, broken, or sticking. Broken or sticking piston rings usually indicate a lubrication or carburetion problem that causes excess carbon deposits or seizures to form on the pistons and rings. Top end overhaul is necessary (Chapter 2).
6 Piston ring-to-groove clearance excessive. This is caused by ex-

cessive wear of the piston ring lands. Piston replacement is necessary (Chapter 2).
7 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).
8 Cylinder head warped. This is caused by overheating or improperly tightened head bolts. Machine shop resurfacing or head replacement is necessary (Chapter 2).
9 Valve spring broken or weak. Caused by component failure or wear; the spring(s) must be replaced (Chapter 2).
10 Valve not seating properly. This is caused by a bent valve (from over-revving or improper valve adjustment), burned valve or seat (improper carburetion) or an accumulation of carbon deposits on the seat (from carburetion, lubrication problems). The valves must be cleaned and/or replaced and the seats serviced if possible (Chapter 2).

8 Stalls after starting

1 Improper choke action. Make sure the choke rod is getting a full stroke and staying in the "out" position.
2 Ignition malfunction. See Chapter 5.
3 Carburetor malfunction. See Chapter 4.
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 bowls (Chapter 4).
5 Intake air leak. Check for loose carburetor-to-intake manifold connections, loose or missing vacuum gauge access port cap or hose, or loose carburetor top (Chapter 4).
6 Idle speed incorrect. Turn idle speed adjuster screw until the engine idles at the specified rpm (Chapters 1 and 4).

9 Rough idle

1 Ignition malfunction. See Chapter 5.
2 Idle speed incorrect. See Chapter 1.
3 Carburetors not synchronized. Adjust carburetors with vacuum gauge set or manometer as outlined in Chapter 1.
4 Carburetor malfunction. See Chapter 4.
5 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 bowls. If the problem is severe, a carburetor overhaul may be necessary (Chapters 1 and 4).
6 Intake air leak.
7 Air filter clogged. Service or replace air filter element (Chapter 1).

Poor running at low speed

10 Spark weak

1 Battery voltage low. Check and recharge battery (Chapter 9).
2 Spark plug fouled, defective or worn out. Refer to Chapter 1 for spark plug maintenance.
3 Spark plug cap or high tension wiring defective. Refer to Chapters 1 and 5 for details on the ignition system.
4 Spark plug cap not making contact.
5 Incorrect spark plug. Wrong type, heat range or cap configuration. Check and install correct plugs listed in Chapter 1. A cold plug or one with a recessed firing electrode will not operate at low speeds without fouling.
6 IC igniter defective. See Chapter 5.
7 Pickup coil defective. See Chapter 5.
8 Ignition coil(s) defective. See Chapter 5.

11 Fuel/air mixture incorrect

1 Pilot screw(s) out of adjustment (Chapters 1 and 4).
2 Pilot jet or air passage clogged. Remove and overhaul the carburetors (Chapter 4).
3 Air bleed holes clogged. Remove carburetor and blow out all passages (Chapter 4).
4 Air filter clogged, poorly sealed or missing.
5 Air filter-to-carburetor boot poorly sealed. Look for cracks, holes or loose clamps and replace or repair defective parts.
6 Fuel level too high or too low. Adjust the floats (Chapter 4).
7 Fuel tank air vent obstructed. Make sure that the air vent passage in the filler cap is open.
8 Carburetor intake manifolds loose. Check for cracks, breaks, tears or loose clamps or bolts. Repair or replace the rubber boots.

12 Compression low

1 Spark plug loose. Remove the plug and inspect the threads. Reinstall and tighten to the specified torque (Chapter 1).
2 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).
3 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).
4 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).
5 Piston rings worn, weak, broken, or sticking. Broken or sticking piston rings usually indicate a lubrication or carburetion problem that causes excess carbon deposits or seizures to form on the pistons and rings. Top end overhaul is necessary (Chapter 2).
6 Piston ring-to-groove clearance excessive. This is caused by excessive wear of the piston ring lands. Piston replacement is necessary (Chapter 2).
7 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).
8 Cylinder head warped. This is caused by overheating or improperly tightened head bolts. Machine shop resurfacing or head replacement is necessary (Chapter 2).
9 Valve spring broken or weak. Caused by component failure or wear; the spring(s) must be replaced (Chapter 2).
10 Valve not seating properly. This is caused by a bent valve (from over-revving or improper valve adjustment), burned valve or seat (improper carburetion) or an accumulation of carbon deposits on the seat (from carburetion, lubrication problems). The valves must be cleaned and/or replaced and the seats serviced if possible (Chapter 2).

13 Poor acceleration

1 Carburetors leaking or dirty. Overhaul the carburetors (Chapter 4).
2 Timing not advancing. The pickup coil unit or the IC igniter may be defective. If so, they must be replaced with new ones, as they cannot be repaired.
3 Carburetors not synchronized. Adjust them with a vacuum gauge set or manometer (Chapter 1).
4 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.
5 Brakes dragging. In front, usually caused by debris which has entered the brake piston sealing boot, or from a warped disc or bent axle.

Repair as necessary (Chapter 7). In the rear, may be caused by a sticking brake cable. Clean and lubricate (see Chapter 1).

Poor running or no power at high speed

14 Firing incorrect

1 Air filter restricted. Clean or replace filter (Chapter 1).
2 Spark plug fouled, defective or worn out. See Chapter 1 for spark plug maintenance.
3 Spark plug cap or high tension wiring defective. See Chapters 1 and 5 for details on the ignition system.
4 Spark plug cap not in good contact. See Chapter 5.
5 Incorrect spark plug. Wrong type, heat range or cap configuration. Check and install correct plugs listed in Chapter 1. A cold plug or one with a recessed firing electrode will not operate at low speeds without fouling.
6 IC igniter defective. See Chapter 5.
7 Ignition coil(s) defective. See Chapter 5.

15 Fuel/air mixture incorrect

1 Main jet clogged. Dirt, water and other contaminants can clog the main jets. Clean the fuel tap filter, the float bowl area, and the jets and carburetor orifices (Chapter 4).
2 Main jet wrong size. The standard jetting is for sea level atmospheric pressure and oxygen content.
3 Throttle shaft-to-carburetor body clearance excessive. Refer to Chapter 4 for inspection and part replacement procedures.
4 Air bleed holes clogged. Remove and overhaul carburetors (Chapter 4).
5 Air filter clogged, poorly sealed or missing.
6 Air filter-to-carburetor boot poorly sealed. Look for cracks, holes or loose clamps, and replace or repair defective parts.
7 Fuel level too high or too low. Adjust the float(s) (Chapter 4).
8 Fuel tank air vent obstructed. Make sure the air vent passage in the filler cap is open.
9 Carburetor intake manifolds loose. Check for cracks, breaks, tears or loose clamps or bolts. Repair or replace the rubber boots (Chapter 2).
10 Fuel tap clogged. Remove the tap and clean it and the filter (Chapter 1).
11 Fuel line clogged. Pull off the fuel line loose and carefully blow through it.

16 Compression low

1 Spark plug loose. Remove the plugs and inspect threads. Reinstall and tighten to the specified torque (Chapter 1).
2 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).
3 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).
4 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).
5 Piston rings worn, weak, broken, or sticking. Broken or sticking piston rings usually indicate a lubrication or carburetion problem that causes excess carbon deposits or seizures to form on the pistons and rings. Top end overhaul is necessary (Chapter 2).
6 Piston ring-to-groove clearance excessive. This is caused by excessive wear of the piston ring lands. Piston replacement is necessary (Chapter 2).
7 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).
8 Cylinder head warped. This is caused by overheating or improperly tightened head bolts. Machine shop resurfacing or head replacement is necessary (Chapter 2).
9 Valve spring broken or weak. Caused by component failure or wear; the spring(s) must be replaced (Chapter 2).
10 Valve not seating properly. This is caused by a bent valve (from over-revving or improper valve adjustment), burned valve or seat (improper carburetion) or an accumulation of carbon deposits on the seat (from carburetion, lubrication problems). The valves must be cleaned and/or replaced and the seats serviced if possible (Chapter 2).

17 Knocking or pinging

1 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).
2 Incorrect or poor quality fuel. Old or improper grades of gasoline (petrol) can cause detonation. This causes the piston to rattle, thus the knocking or pinging sound. Drain old fuel and always use the recommended fuel grade.
3 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).
4 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.

18 Miscellaneous causes

1 Throttle valve doesn't open fully. Adjust the cable slack (Chapter 1).
2 Clutch slipping. Caused by a cable that is improperly adjusted or snagging or damaged, loose or worn clutch components. Refer to Chapters 1 and 2 for adjustment and overhaul procedures.
3 Timing not advancing.
4 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.
5 Brakes dragging. In front, usually caused by debris which has entered the brake piston sealing boot, or from a warped disc or bent axle. Repair as necessary. In the rear, may be caused by a sticking brake cable. Clean and lubricate (see Chapter 1).

Overheating

19 Cooling system not operating properly

1 Coolant level low. Check coolant level as described in Chapter 1. If coolant level is low, the engine will overheat.
2 Leak in cooling system. Check cooling system hoses and radiator for leaks and other damage. Repair or replace parts as necessary (Chapter 3).
3 Thermostat sticking open or closed. Check and replace as described in Chapter 3.
4 Faulty radiator cap. Remove the cap and have it pressure checked at a service station.
5 Coolant passages clogged. Have the entire system drained and

flushed, then refill with new coolant.
6 Water pump defective. Remove the pump and check the components.
7 Clogged radiator fins. Clean them by blowing compressed air through the fins from the back side.

20 Firing incorrect

1 Spark plug fouled, defective or worn out. See Chapter 1 for spark plug maintenance.
2 Incorrect spark plugs.
3 Faulty ignition coils (Chapter 5).

21 Fuel/air mixture incorrect

1 Main jet clogged. Dirt, water and other contaminants can clog the main jets. Clean the fuel tap filter, the float bowl area and the jets and carburetor orifices (Chapter 4).
2 Main jet wrong size. The standard jetting is for sea level atmospheric pressure and oxygen content.
3 Air filter poorly sealed or missing.
4 Air filter-to-carburetor boot poorly sealed. Look for cracks, holes or loose clamps and replace or repair.
5 Fuel level too low. Adjust the float(s) (Chapter 4).
6 Fuel tank air vent obstructed. Make sure that the air vent passage in the filler cap is open.
7 Carburetor intake manifolds loose. Check for cracks, breaks, tears or loose clamps or bolts. Repair or replace the rubber boots (Chapter 2).

22 Compression too high

1 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).
2 Improperly machined head surface or installation of incorrect gasket during engine assembly. Check Specifications (Chapter 2).

23 Engine load excessive

1 Clutch slipping. Caused by an out of adjustment or snagging cable or damaged, loose or worn clutch components. Refer to Chapters 1 and 2 for adjustment and overhaul procedures.
2 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).
3 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.
4 Brakes dragging. In front, usually caused by debris which has entered the brake piston sealing boot, or from a warped disc or bent axle. Repair as necessary (Chapter 7). In the rear, may be caused by a sticking brake cable. Clean and lubricate (Chapter 1).

24 Lubrication inadequate

1 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).
2 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).

25 Miscellaneous causes

Modification to exhaust system. Most aftermarket exhaust systems cause the engine to run leaner, which makes it run hotter. When installing an accessory exhaust system, always check whether you need to rejet the carburetors.

Clutch problems

26 Clutch slipping

1 No clutch lever play. Adjust clutch lever free play according to the procedure in Chapter 1.
2 Friction plates worn or warped. Overhaul the clutch assembly (Chapter 2).
3 Steel plates worn or warped (Chapter 2).
4 Clutch springs broken or weak. Old or heat-damaged (from slipping clutch) springs should be replaced with new ones (Chapter 2).
5 Clutch release not adjusted properly. See Chapter 1.
6 Clutch inner cable hanging up. Caused by a frayed cable or kinked outer cable. Replace the cable. Repair of a frayed cable is not advised.
7 Clutch release mechanism defective. Check the release shaft, pushrod and bearings. Replace any defective parts (Chapter 2).
8 Clutch hub or housing unevenly worn. This causes improper engagement of the plates. Replace the damaged or worn parts (Chapter 2).

27 Clutch not disengaging completely

1 Clutch lever play excessive. Adjust at bars or at engine (Chapter 1).
2 Clutch plates warped or damaged. This will cause clutch drag, which in turn causes the machine to creep. Overhaul the clutch assembly (Chapter 2).
3 Clutch spring tension uneven. Usually caused by a sagged or broken spring. Check and replace the springs (Chapter 2).
4 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).
5 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).
6 Clutch housing seized on shaft. Lack of lubrication, severe wear or damage can cause the housing to seize on the shaft. Overhaul of the clutch, and perhaps transmission, may be necessary to repair damage (Chapter 2).
7 Clutch release mechanism defective. Worn or damaged release mechanism parts can stick and fail to apply force to the pressure plate. Overhaul the clutch cover components (Chapter 2).
8 Loose clutch hub nut. Causes housing and hub misalignment putting a drag on the engine. Engagement adjustment continually varies. Overhaul the clutch assembly (Chapter 2).

Gear shifting problems

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

1 Clutch not disengaging. See Section 27.
2 Shift fork(s) bent or seized. Often caused by dropping the machine or from lack of lubrication. Overhaul the transmission (Chapter 2).

3 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).
4 Shift drum binding. Caused by lubrication failure or excessive wear. Replace the drum and bearings (Chapter 2).
5 Shift lever return spring weak or broken (Chapter 2).
6 Shift 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).
7 Shift arm pawl broken or worn. Full engagement and rotary movement of shift drum results. Replace shaft assembly (Chapter 2).
8 Pawl spring broken. Allows pawl to "float", causing sporadic shift operation. Replace spring (Chapter 2).

29 Jumps out of gear

1 Shift fork(s) worn. Overhaul the transmission (Chapter 2).
2 Gear groove(s) worn. Overhaul the transmission (Chapter 2).
3 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.

30 Overshifts

1 Pawl spring weak or broken (Chapter 2).
2 Shift drum positioning lever not functioning (Chapter 2).

Abnormal engine noise

31 Knocking or pinging

1 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).
2 Incorrect or poor quality fuel. Old or improper fuel can cause detonation. This causes the piston to rattle, thus the knocking or pinging sound. Drain the old fuel and always use the recommended grade fuel (Chapter 4).
3 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).
4 Improper air/fuel mixture. This will cause the cylinder to run hot and lead to detonation. Clogged jets or an air leak can cause this imbalance. See Chapter 4.

32 Piston slap or rattling

1 Cylinder-to-piston clearance excessive. Caused by improper assembly. Inspect and overhaul top end parts (Chapter 2).
2 Connecting rod bent. 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).
3 Piston pin or piston pin bore worn or seized from wear or lack of lubrication. Replace damaged parts (Chapter 2).
4 Piston ring(s) worn, broken or sticking. Overhaul the top end (Chapter 2).
5 Piston seizure damage. Usually from lack of lubrication or overheating. Replace the pistons and bore the cylinders, as necessary (Chapter 2).
6 Connecting rod bearing and/or piston pin-end clearance excessive. Caused by excessive wear or lack of lubrication. Replace worn parts.

33 Valve noise

1 Incorrect valve clearances. Adjust the clearances by referring to Chapter 1.
2 Valve spring broken or weak. Check and replace weak valve springs (Chapter 2).
3 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).

34 Other noise

1 Cylinder head gasket leaking. This will cause compression leakage into the cooling system (which may show up as air bubbles in the coolant in the radiator). Also, coolant may get into the oil (which will turn the oil gray). In either case, have the cooling system checked by a dealer service department.
2 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.
3 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.
4 Engine mounting bolts loose. Tighten all engine mount bolts to the specified torque (Chapter 2).
5 Crankshaft bearings worn (Chapter 2).
6 Camshaft chain tensioner defective. Replace according to the procedure in Chapter 2.
7 Camshaft chain, sprockets or guides worn (Chapter 2).
8 Loose alternator rotor. Tighten the mounting bolt to the specified torque (Chapter 2).

Abnormal driveline noise

35 Clutch noise

1 Clutch housing/friction plate clearance excessive (Chapter 2).
2 Loose or damaged clutch pressure plate and/or bolts (Chapter 2).

36 Transmission noise

1 Bearings worn. Also includes the possibility that the shafts are worn. Overhaul the transmission (Chapter 2).
2 Gears worn or chipped (Chapter 2).
3 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).
4 Engine oil level too low. Causes a howl from transmission. Also affects engine power and clutch operation (Chapter 1).

37 Final drive noise

1 Belt not adjusted properly (Chapter 1).
2 Pulley (engine or rear wheel) loose. Tighten fasteners (Chapter 6).
3 Pulley(s) worn. Replace pulley(s) (Chapter 6).
4 Rear pulley warped. Replace (Chapter 6).
5 Wheel coupling worn. Replace coupling (Chapter 6).

Abnormal frame and suspension noise

38 Front end noise

1 Low fluid level or improper viscosity oil in forks. This can sound like "spurting" and is usually accompanied by irregular fork action (Chapter 6).
2 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).
3 Steering head bearings loose or damaged. Clicks when braking. Check and adjust or replace as necessary (Chapters 1 and 6).
4 Fork clamps loose. Make sure all fork clamp pinch bolts are tight (Chapter 6).
5 Fork tube bent. Good possibility if machine has been dropped. Replace tube with a new one (Chapter 6).
6 Front axle or axle clamp bolt loose. Tighten them to the specified torque (Chapter 7).

39 Shock absorber noise

1 Fluid level incorrect. Indicates a leak caused by defective seal. Shock will be covered with oil. Replace shock (Chapter 6).
2 Defective shock absorber with internal damage. This is in the body of the shock and cannot be remedied. The shock must be replaced with a new one (Chapter 6).
3 Bent or damaged shock body. Replace the shock with a new one (Chapter 6).

40 Brake noise

1 Squeal caused by pad shim not installed or positioned correctly (Chapter 7).
2 Squeal caused by dust on brake pads. Usually found in combination with glazed pads. Clean using brake cleaning solvent (Chapter 7).
3 Contamination of brake pads. Oil, brake fluid or dirt causing brake to chatter or squeal. Clean or replace pads (Chapter 7).
4 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).
5 Disc warped. Can cause a chattering, clicking or intermittent squeal. Usually accompanied by a pulsating lever and uneven braking. Replace the disc (Chapter 7).
6 Drum brake linings worn or contaminated. Can cause scraping or squealing. Replace the linings (Chapter 7).
7 Drum brake linings warped or worn unevenly. Can cause chattering. Replace the linings (Chapter 7).
8 Brake drum out of round. Can cause chattering. Replace brake drum (Chapter 7).
9 Loose or worn wheel bearings. Check and replace as needed (Chapter 7).

Oil pressure indicator light comes on

41 Engine lubrication system

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

42 Electrical system

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

Excessive exhaust smoke

43 White smoke

1 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).
2 Cylinders worn, cracked, or scored. Gaused by overheating or oil starvation. The cylinders will have to be rebored and new pistons installed.
3 Valve oil seal damaged or worn. Replace oil seals with new ones (Chapter 2).
4 Valve guide worn. Perform a complete valve job (Chapter 2).
5 Engine oil level too high, which causes oil to be forced past the rings. Drain oil to the proper level (Chapter 1).
6 Head gasket broken between oil return and cylinder. Causes oil to be pulled into combustion chamber. Replace the head gasket and check the head for warpage (Chapter 2).
7 Abnormal crankcase pressurization, which forces oil past the rings. Clogged breather or hoses usually the cause.

44 Black smoke

1 Air filter clogged. Clean or replace the element (Chapter 1).
2 Main jet too large or loose. Compare the jet size to the Specifications (Chapter 4).
3 Choke stuck, causing fuel to be pulled through choke circuit (Ghapter 4).
4 Fuel level too high. Check and adjust the float height as necessary (Chapter 4).
5 Inlet needle held off needle seat. Clean float bowl and fuel line and replace needle and seat if necessary (Chapter 4).

45 Brown smoke

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

Poor handling or stability

46 Handlebar hard to turn

1 Steering stem locknut too tight (Chapter 6).
2 Bearings damaged. Roughness can be felt as the bars are turned

from side-to-side. Replace bearings and races (Chapter 6).
3 Races dented or worn. Denting results from wear in only one position (e.g., straight ahead) from striking an immovable object or hole or from dropping the machine. Replace races and bearings (Chapter 6).
4 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).
5 Steering stem bent. Caused by hitting a curb or hole or from dropping the machine. Replace damaged part. Do not try to straighten stem (Chapter 6).
6 Front tire air pressure too low (Chapter 1).

47 Handlebar shakes or vibrates excessively

1 Tires worn or out of balance (Chapter 7).
2 Swingarm bearings worn. Replace worn bearings by referring to Chapter 6.
3 Rim(s) warped or damaged. Inspect wheels for runout (Chapter 7).
4 Wheel bearings worn. Worn front or rear wheel bearings can cause poor tracking. Worn front bearings will cause wobble (Chapter 7).
5 Handlebar clamp bolts loose (Chapter 6).
6 Steering stem or fork clamps loose. Tighten them to the specified torque (Chapter 6).
7 Engine mount bolts loose. Will cause excessive vibration with increased engine rpm (Chapter 2).

48 Handlebar pulls to one side

1 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).
2 Wheel out of alignment. Caused by improper location of axle spacers or from bent steering stem or frame (Chapter 6).
3 Swingarm bent or twisted. Caused by age (metal fatigue) or impact damage. Replace the arm (Chapter 6).
4 Steering stem bent. Caused by impact damage or from dropping the motorcycle. Replace the steering stem (Chapter 6).
5 Fork leg bent. Disassemble the forks and replace the damaged parts (Chapter 6).
6 Fork oil level uneven.

49 Poor shock absorbing qualities

1 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 (Chapters 1 and 7).
2 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).

Braking problems

50 Front brakes are spongy, don't hold

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

51 Brake lever or pedal pulsates

1 Disc warped. Replace disc (Chapter 7).
2 Axle bent. Replace axle (Chapter 7).
3 Brake caliper bolts loose (Chapter 7).
4 Brake caliper shafts damaged or sticking, causing caliper to bind. Lube the shafts and/or replace them if they are corroded or bent (Chapter 7).
5 Wheel warped or otherwise damaged (Chapter 7).
6 Wheel bearings damaged or worn (Chapter 7).
7 Brake drum out of round. Replace brake drum (Chapter 7).

52 Brakes drag

1 Master cylinder piston seized. Caused by wear or damage to piston or cylinder bore (Chapter 7).
2 Lever balky or stuck. Check pivot and lubricate (Chapter 7).
3 Brake caliper binds. Caused by inadequate lubrication or damage to caliper shafts (Chapter 7).
4 Brake caliper piston seized in bore. Caused by wear or ingestion of dirt past deteriorated seal (Chapter 7).
5 Brake pad damaged. Pad material separating from backing plate. Usually caused by faulty manufacturing process or from contact with chemicals. Replace pads (Chapter 7).
6 Pads improperly installed (Chapter 7).
7 Rear brake pedal free play insufficient (Chapter 1).
8 Rear brake springs weak. Replace the springs (Chapter 7).

Electrical problems

53 Battery dead or weak

1 Battery faulty. Caused by sulfated plates which are shorted through the sedimentation or low electrolyte level. Also, broken battery terminal making only occasional contact (Chapter 9).
2 Battery cables making poor contact (Chapter 9).
3 Load excessive. Caused by addition of high wattage lights or other electrical accessories.
4 Ignition switch defective. Switch either grounds/earths internally or fails to shut off system. Replace the switch (Chapter 9).
5 Regulator/rectifier defective (Chapter 9).
6 Stator coil open or shorted (Chapter 9).
7 Wiring faulty. Wiring grounded/earthed or connections loose in ignition, charging or lighting circuits (Chapter 9).

54 Battery overcharged

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

Chapter 1 Tune-up and routine maintenance

Contents

Specifications

Engine

Spark plugs	
Type	
1985 through 1989	
US and Canadian models	NGK D9EA or ND X27ES-U
UK models	NGK DR8ES or ND X27ESR-U
1990 through 1996 (A7)	
US and Canadian models	NGK D9EA or ND X27ES-U
Korean models	NGK DR9EA or ND X27ESR-U
All others	NGK DR8ES or ND X27ESR-U
1996 (C1) and later (all)	NGK DR9EA or ND X27ESR-U, NGK DR8EA or ND X24ESR-U
Gap	0.6 to 0.7 mm (0.024 to 0.028 inch)
Engine idle speed	
1985 through 1996 (A7)	
Except California models	1200 +/- 50 rpm
California models	1300 +/- 50 rpm
1996 (C1) and later	1300 +/- 50 rpm
Valve clearances (COLD engine)	
Intake	0.13 to 0.18 mm (0.005 to 0.007 inch)
Exhaust	0.18 to 0.23 mm (0.007 to 0.009 inch)
Cylinder compression pressure	
EN450 models	119 to 185 psi (8.19 to 12.74 Bars)
EN500 models	139 to 213 psi (8.88 to 14.67 Bars)
Carburetor synchronization (vacuum difference between cylinders)	Less than 2 cm Hg (0.391 inch)
Cylinder numbering (from left side to right side of bike)	1-2

Chassis

Brake pad minimum thickness	1.0 mm (0.040 inch)
Brake pedal position	50 to 60 mm (1.97 to 2.36 inches)*
Freeplay adjustments	
Throttle grip	2 to 3 mm (0.08 to 0.12 inch)
Clutch lever (gap between lever and lever bracket when freeplay is taken up)	2 to 3 mm (0.08 to 0.12 inch)
Brake pedal	20 to 30 mm (0.8 to 1.2 inch)
Choke lever (EN450 only)	2 to 3 mm (0.08 to 0.12 inch)

Drive belt	
Slack (at 4.5 kg/9.9 lbs pressure)	
EN450 models	8.5 to 18.5 mm (0.33 to 0.73 inch)
EN500 models	6.0 to 12.5 mm (0.24 to 0.49 inch)
Drive chain slack	25 to 35 mm
Battery electrolyte specific gravity	1.280 at 68 degrees F (20 degrees C)
Minimum tire tread depth	
Front	1.0 mm (0.04 inch)
Rear	2.0 mm (0.08 inch)
Tire pressures (cold)	
Front	28 psi (1.9 Bars)
Rear (US, Canada and South Africa)	
Up to 215 lbs (97.5 kg)	28 psi (2.2 Bars)
215 to 406 lbs (97.5 to 184 kg)	32 psi (2.5 Bars)
Rear (others)	28 psi (2.2 Bars)

**Measured from top of footpeg to top of brake pedal*

Torque specifications

Oil drain plug	29 Nm (22 ft-lbs)
Oil filter	17 Nm (12.5 ft-lbs)
Coolant drain bolt	
1985 through 1996 (A7) models	12 Nm (104 in-lbs)
1997 and later (C1) models	11 Nm (95 in-lbs)
Spark plugs	14 Nm (120 in-lbs)
Valve cover bolts	See Chapter 2

Recommended lubricants and fluids

Engine/transmission oil	
Type	
1985 through 2000	API grade SE, SF or SG
2001 and later	API grade SH or SJ meeting the JASO MA standard*

**Don't use SH or SJ oils that don't meet the JASO MA standard. The friction modifiers used in these oils may cause clutch slippage.*

Viscosity	
1985 through 2000	
In cold climates	SAE 10W40 or 10W50
In warm climates	SAE 20W-40 or 20W-50
2001 and later	SAE 10W-40
Capacity	
With filter change	3.2 liters (3.2 US qt, 5.3 Imp pt)
Without filter change	2.8 liters (3.0 US qt, 4.9 Imp pt)
Dry engine (after overhaul)	3.4 liters (3.6 US qt, 6.17 Imp pt)
Coolant	
Type	50/50 mixture of ethylene glycol-based antifreeze and water
Capacity	
1985 through 1996 (A7)	1.4 liters (1.5 US qt, 2.46 Imp pt)
1996 (C1) and later	1.3 liters (1.37 US qt, 2.36 Imp pt)
Brake fluid	
Through 1991	DOT 3
1992 and later	DOT 4
Fork oil	
Type	SAE 10W-20 fork oil
Amount (EN450 models)	
Dry fill	355 +/- 2.5 cc (12.0 +/- 0.084 US fl oz, 12.49 +/- 0.09 Imp fl oz)
At oil change	Approximately 300 cc (10.14 US fl oz, 10.56 Imp fl oz)
Amount (EN500 models)	
Through 1996 (A7)	
Dry fill	385 +/- 2.5 cc (13.0 +/- 0.084 US fl oz, 13.55 +/- 0.09 Imp fl oz)
At oil change	Approximately 330 cc (11.15 US fl oz, 11.62 Imp fl oz)
1996 (C1) and later	
Dry fill	Not specified
At oil change	507 +/- 4 cc (17.1 +/- 0.14 US fl oz, 14.28 +/- 0.11 Imp fl oz)
Oil level (fully compressed)	
EN450 models	162 +/- 2 mm (6.38 +/- 0.08 inches)
EN500 models	128 +/- 2 mm (5.04 +/- 0.08 inches)
Miscellaneous	
Wheel bearings	Medium weight, lithium-based multi-purpose grease
Swingarm pivot bearings	Medium weight, lithium-based multi-purpose grease
Cables and lever pivots	Chain and cable lubricant or 10W30 motor oil
Sidestand/centerstand pivots	Medium-weight, lithium-based multi-purpose grease
Brake pedal/shift lever pivots	Chain and cable lubricant or 10W30 motor oil
Throttle grip	Multi-purpose grease or dry film lubricant

1 Kawasaki EN450 & 500 Routine maintenance intervals

Note: *The pre-ride inspection outlined in the owner's manual covers checks and maintenance that should be carried out on a daily basis. It's condensed and included here to remind you of its importance. Always perform the pre-ride inspection at every maintenance interval (in addition to the procedures listed). The intervals listed below are the shortest intervals recommended by the manufacturer for each particular operation during the model years covered in this manual. Your owner's manual may have different intervals for your model.*

Daily or before riding

Check the engine oil level
Check the fuel level and inspect for leaks
Check the engine coolant level and look for leaks
Check the operation of both brakes - also check the fluid level and look for leakage (front)
Check the tires for damage, the presence of foreign objects and correct air pressure
Check the throttle for smooth operation and correct freeplay
Check the operation of the clutch - make sure the freeplay is correct
Make sure the steering operates smoothly, without looseness and without binding
Check for proper operation of the headlight, taillight, brake light, turn signals, indicator lights, speedometer and horn
Make sure the sidestand and centerstand return to their fully up positions and stay there under spring pressure
Make sure the engine STOP switch works properly

After the initial 500 miles (800 km)

Perform all of the daily checks plus:
Check and adjust the valve clearances
Clean the air filter element
Check/adjust the idle speed
Check/adjust the carburetor synchronization
Check/adjust the drive belt slack
Change the engine oil and oil filter
Check the evaporative emission control system (California models)
Check the cooling system hoses
Check the battery electrolyte level
Check the tightness of all fasteners
Check the steering
Check/adjust clutch freeplay
Check the brake fluid level
Check/adjust the brake pedal position
Check the operation of the brake light

Every 3000 miles (5000 km)

Check the drive belt and pulleys for wear
Check/adjust the drive belt tension
Clean and gap the spark plugs
Check the operation of the air suction valve (if equipped)
Check/adjust the idle speed
Check/adjust the carburetor synchronization
Check the evaporative emission control system (California models)
Adjust the clutch freeplay
Check the brake fluid level
Check the brake discs, pads, drum and shoes
Check/adjust the brake pedal position
Check the operation of the brake light
Lubricate all cables
Lubricate the clutch and brake lever pivots
Lubricate the shift/brake lever pivots and the sidestand/centerstand pivots
Check the steering
Check the tires and wheels
Check the battery electrolyte level

Every 6000 miles (10,000 km)

All of the items above plus:
Adjust the valve clearances
Change the engine oil and oil filter
Clean the air filter element
Check the cleanliness of the fuel system and the condition of the fuel and vacuum hoses
Lubricate the swingarm needle bearings (Chapter 6)
Replace the spark plugs
Check the exhaust system for leaks and check the tightness of the fasteners

Every year

Replace the coolant filter - later UK models (Chapter 3)

Every 12,000 miles (20,000 km) or two years

Change the brake fluid
Lubricate the steering head bearings
Lubricate the drum brake cam (Chapter 7)
Replace the air filter element. (Also replace after every five cleanings).

Every 18,000 miles (30,000 km) or two years

Check the cooling system and replace the coolant

Every 18,000 miles (30,000 km)

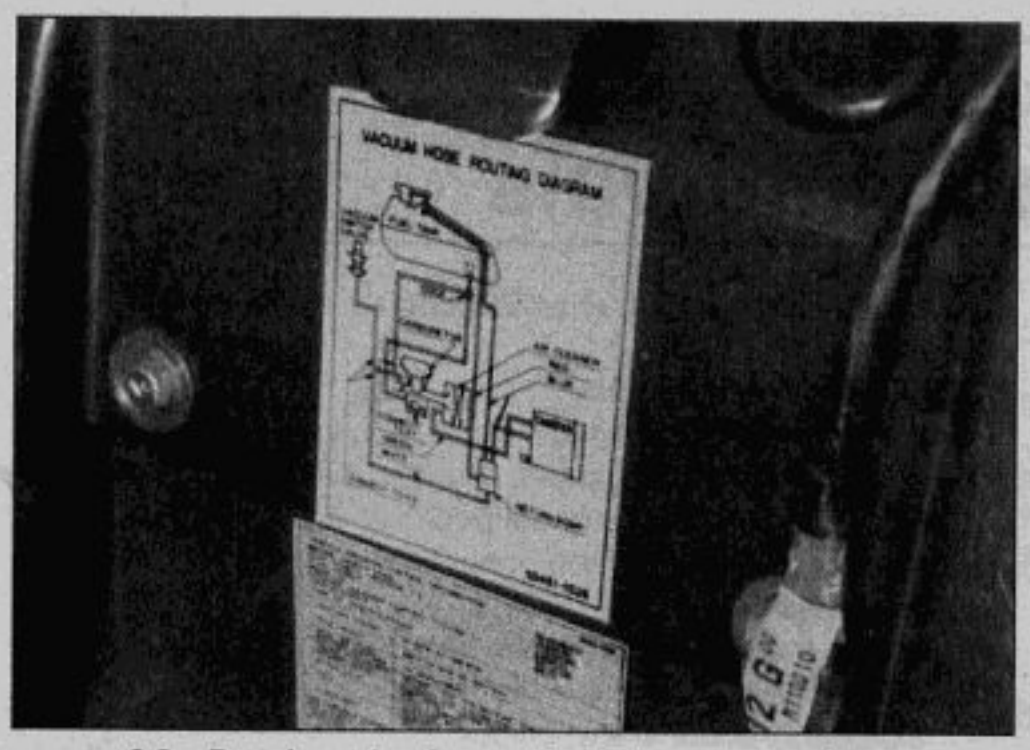
Change the fork oil

Every two years

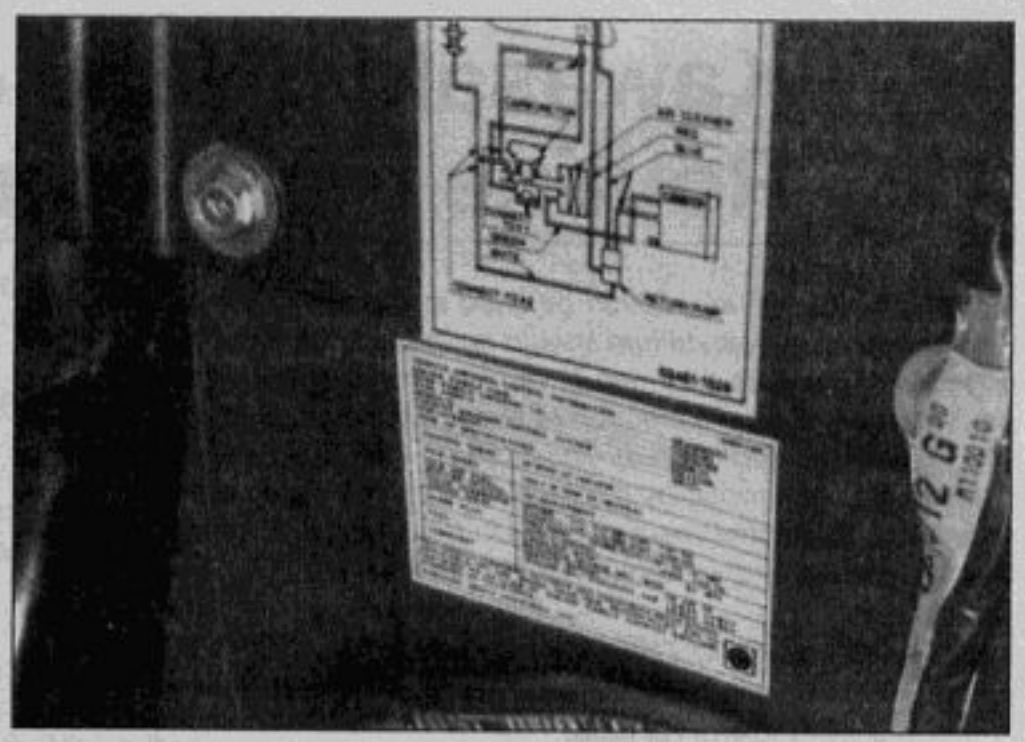
Overhaul the brake caliper and master cylinder (Chapter 7)
Check and lubricate the wheel bearings (Chapter 7)
Lubricate the speedometer gear

Every four years

Replace the fuel hoses (Chapter 4)
Replace the brake hose (Chapter 7)

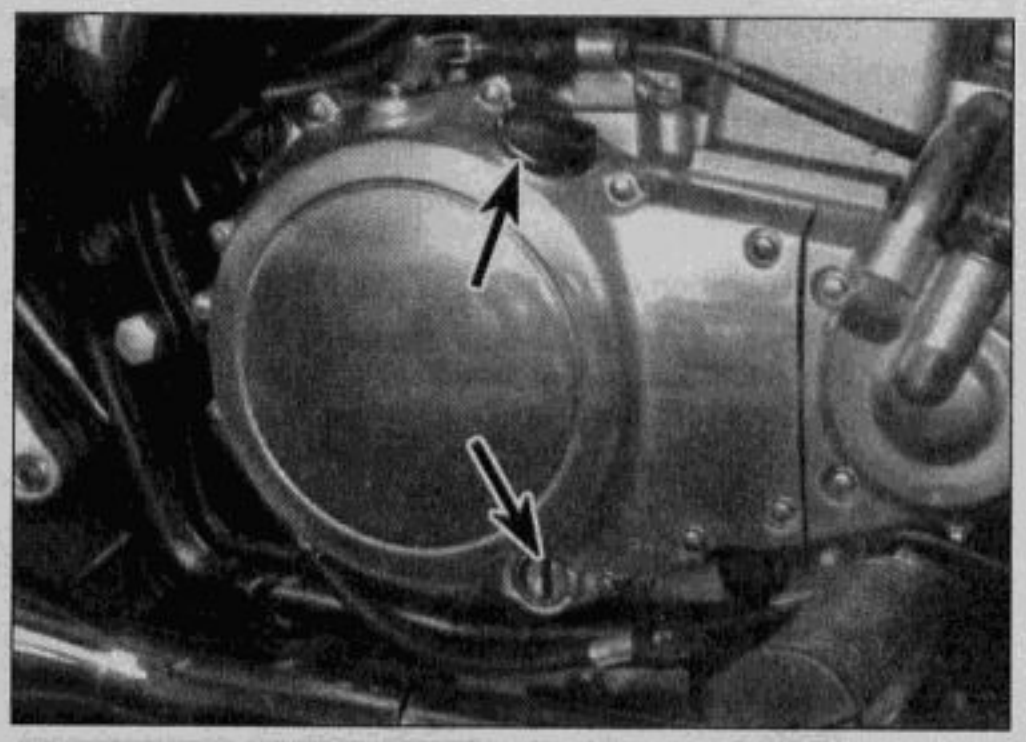


2.3a Decals under the seat include a vacuum hose routing diagram . . .



2.3b . . . and emissions and tune-up information

2.3c A decal on the drive belt guard lists belt maintenance intervals



3.3 Check the oil level at the inspection window (lower arrow); to add oil, remove the filler cap (upper arrow)

2 Introduction to tune-up and routine maintenance

Refer to illustrations 2.3a, 2.3b and 2.3c

1 This Chapter covers in detail the checks and procedures necessary for the tune-up and routine maintenance of your motorcycle. Section 1 includes the routine maintenance schedule, which is designed to keep the machine in proper running condition and prevent possible problems. The remaining Sections contain detailed procedures for carrying out the items listed on the maintenance schedule, as well as additional maintenance information designed to increase reliability.

2 Since routine maintenance plays such an important role in the safe and efficient operation of your motorcycle, it is presented here as a comprehensive check list. For the rider who does all his/her own maintenance, these lists outline the procedures and checks that should be done on a routine basis.

3 Maintenance information is printed on decals under the seat and on the belt guard **(see illustrations)**. If the information on the decals differs from that included here, use the information on the decal.

4 Deciding where to start or plug into the routine maintenance schedule depends on several factors. If you have a motorcycle whose warranty has recently expired, and if it has been maintained according to the warranty standards, you may want to pick up routine maintenance as it coincides with the next mileage or calendar interval. If you have owned the machine for some time but have never performed any maintenance on it, then you may want to start at the nearest interval and include some additional procedures to ensure that nothing important is overlooked. If you have just had a major engine overhaul, then you may want to start the maintenance routine from the beginning. If you have a used machine and have no knowledge of its history or maintenance record, you may desire to combine all the checks into one large service initially and then settle into the maintenance schedule prescribed.

5 The Sections which outline the inspection and maintenance procedures are written as step-by-step comprehensive guides to the performance of the work. They explain in detail each of the routine inspections and maintenance procedures on the check list. References to additional information in applicable Chapters is also included and should not be overlooked.

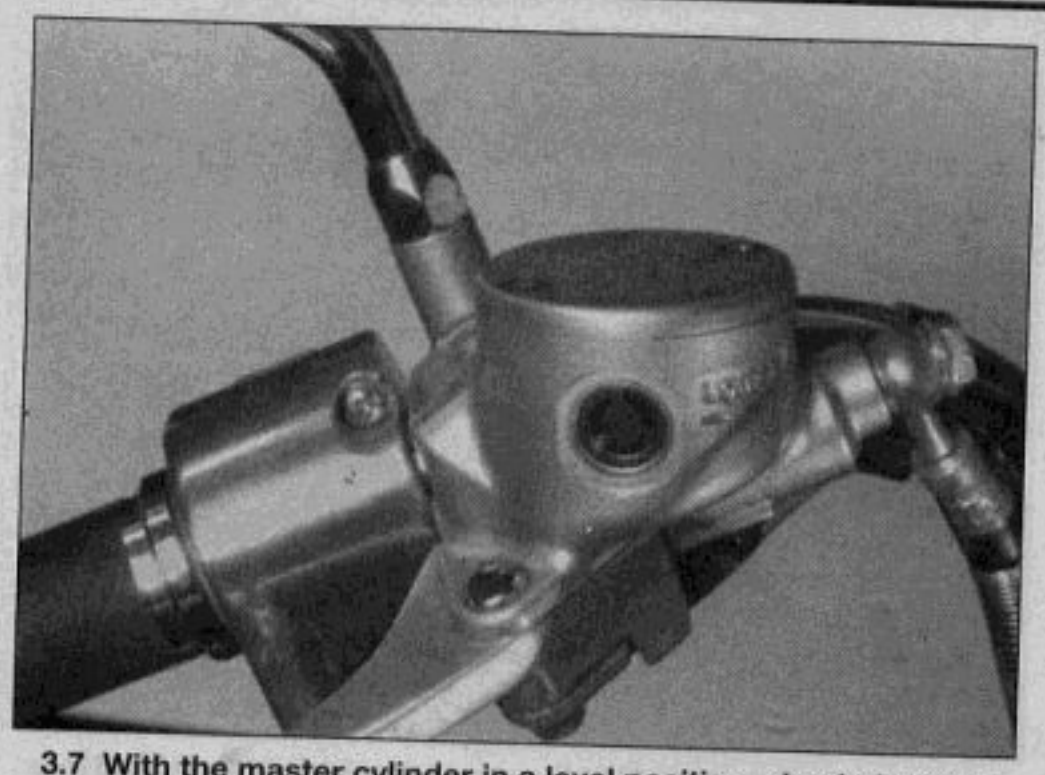
6 Before beginning any maintenance or repair, the machine should be cleaned thoroughly, especially around the oil filter, spark plugs, cylinder head covers, side covers, carburetors, etc. Cleaning will help ensure that dirt does not contaminate the engine and will allow you to detect wear and damage that could otherwise easily go unnoticed.

3 Fluid levels - check

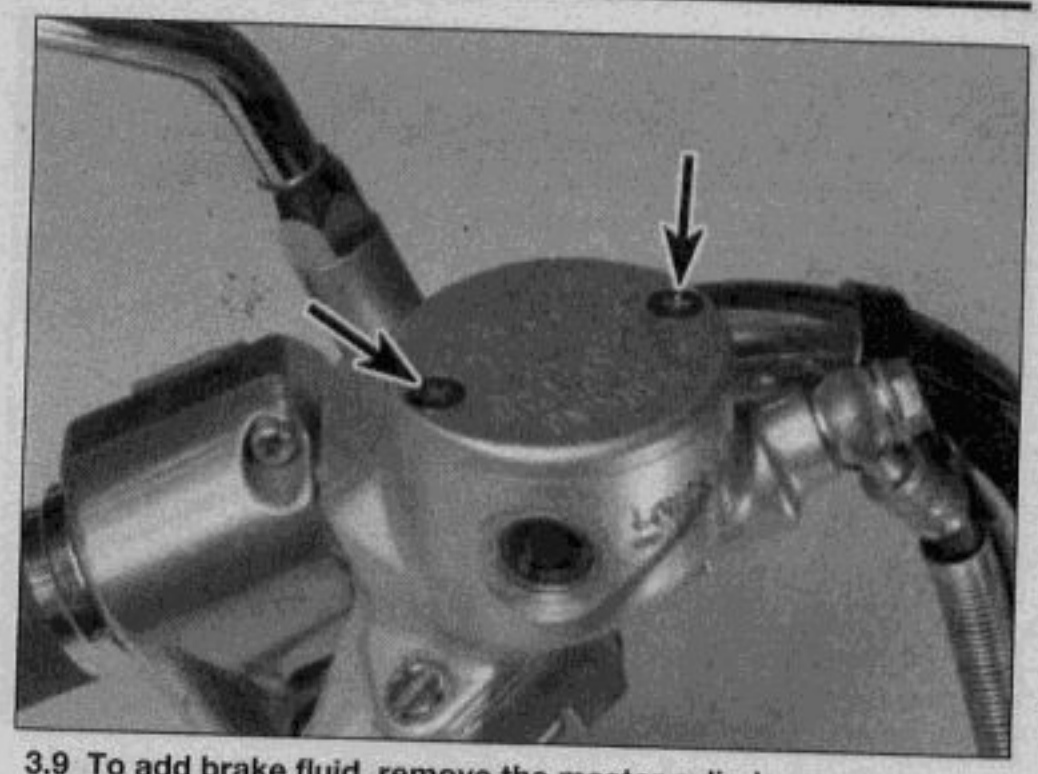
Engine oil

Refer to illustration 3.3

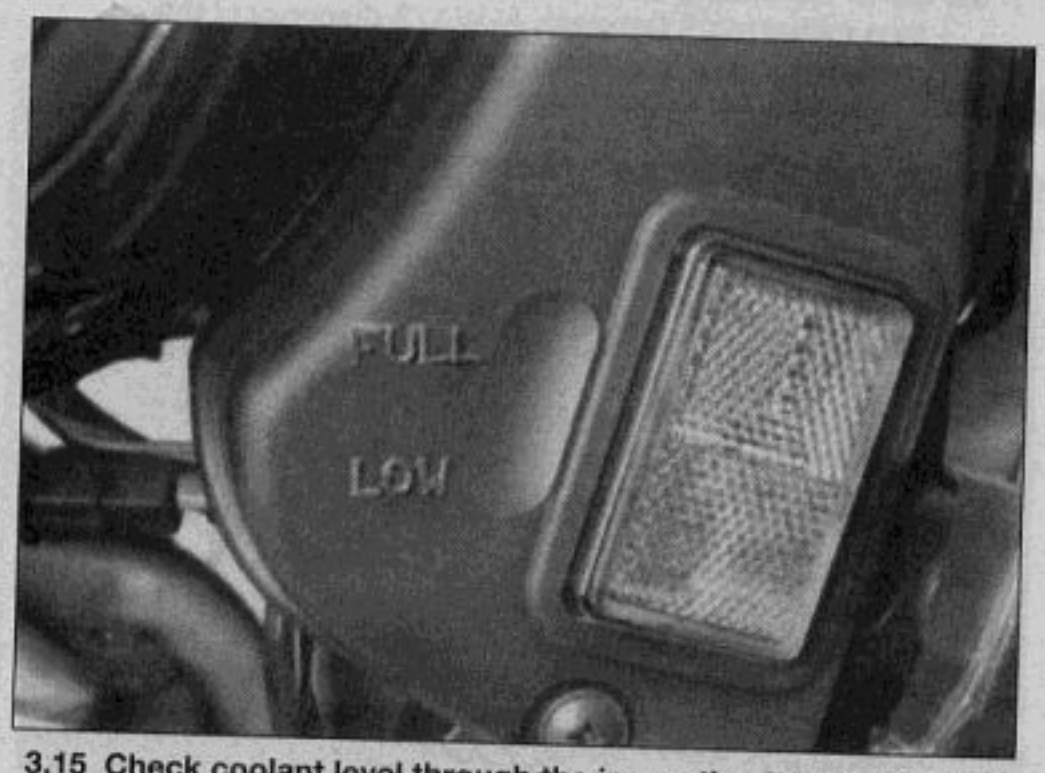
1 Place the motorcycle on the centerstand, then start the engine and allow it to reach normal operating temperature. **Caution**: *Do not run the engine in an enclosed space such as a garage or workshop.*



3.7 With the master cylinder in a level position, check the fluid level in the inspection window



3.9 To add brake fluid, remove the master cylinder cover screws (arrows) and lift off the cover and diaphragm



3.15 Check coolant level through the inspection hole in the right side cover; it should be between the Full and Low marks with the engine cold

3.16 The reservoir is located inside the right side cover; to add coolant, remove the filler cap (arrow)

2 Stop the engine and allow the machine to sit undisturbed on the centerstand for about five minutes.

3 With the engine off, check the oil level in the window located at the lower part of the right crankcase cover. The oil level should be between the Maximum and Minimum level marks next to the window **(see illustration)**.

4 If the level is below the Minimum mark, remove the oil filler cap from the right crankcase cover **(see illustration 3.3)** and add enough oil of the recommended grade and type to bring the level up to the Maximum mark. Do not overfill.

Brake fluid

Refer to illustrations 3.7 and 3.9

5 In order to ensure proper operation of the hydraulic disc brake, the fluid level in the master cylinder reservoir must be properly maintained.

6 Turn the handlebars until the top of the master cylinder is as level as possible. If necessary, tilt the bike slightly to make the master cylinder level.

7 Look closely at the inspection window in the master cylinder reservoir. Make sure that the fluid level is above the Lower mark on the reservoir **(see illustration)**.

8 If the level is low, the fluid must be replenished. Before removing the master cylinder cap, cover the fuel tank to protect it from brake fluid spills (which will damage the paint) and remove all dust and dirt from the area around the cap.

9 Remove the screws **(see illustration)** and lift off the cap and rubber diaphragm. **Note**: *Do not operate the brake lever with the cap removed.*

10 Add new, clean brake fluid of the recommended type until the level is above the inspection window. Do not mix different brands of brake fluid in the reservoir, as they may not be compatible.

11 Replace the rubber diaphragm and the cover. Tighten the screws evenly, but do not overtighten them.

12 Wipe any spilled fluid off the reservoir body and reposition and tighten the brake lever and master cylinder assembly if it was moved.

13 If the brake fluid level was low, inspect the front brake system for leaks.

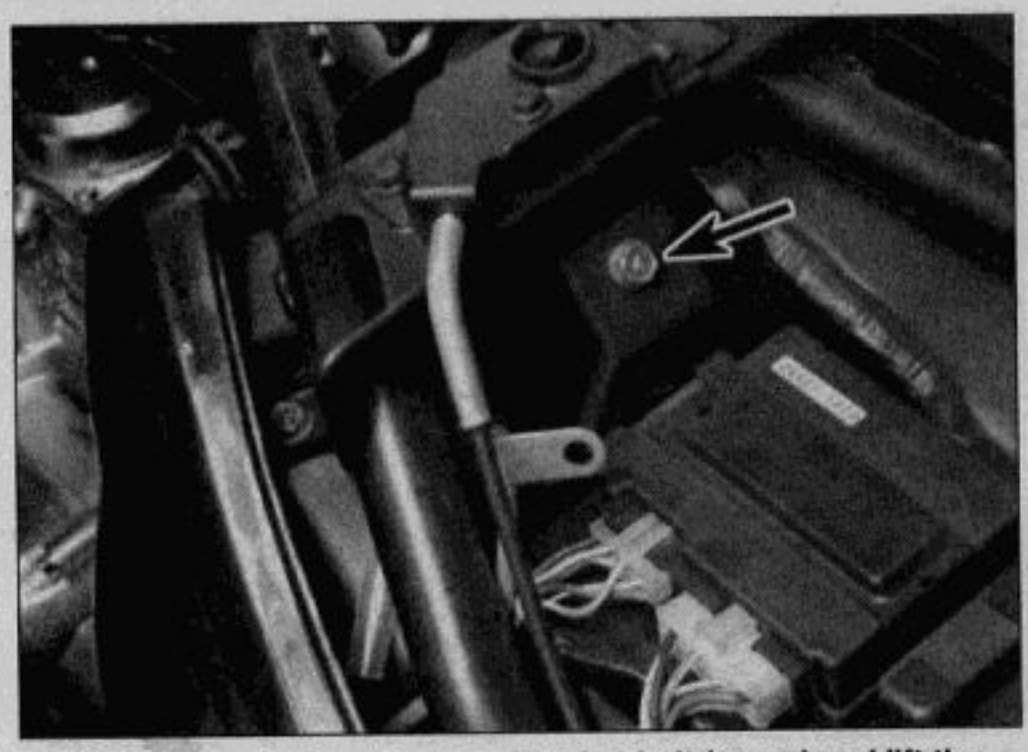
Coolant

Refer to illustrations 3.15 and 3.16

14 The engine must be cold for the results to be accurate, so always perform this check before starting the engine for the first time each day. The reservoir is located on the right side of the frame near the front of the bike.

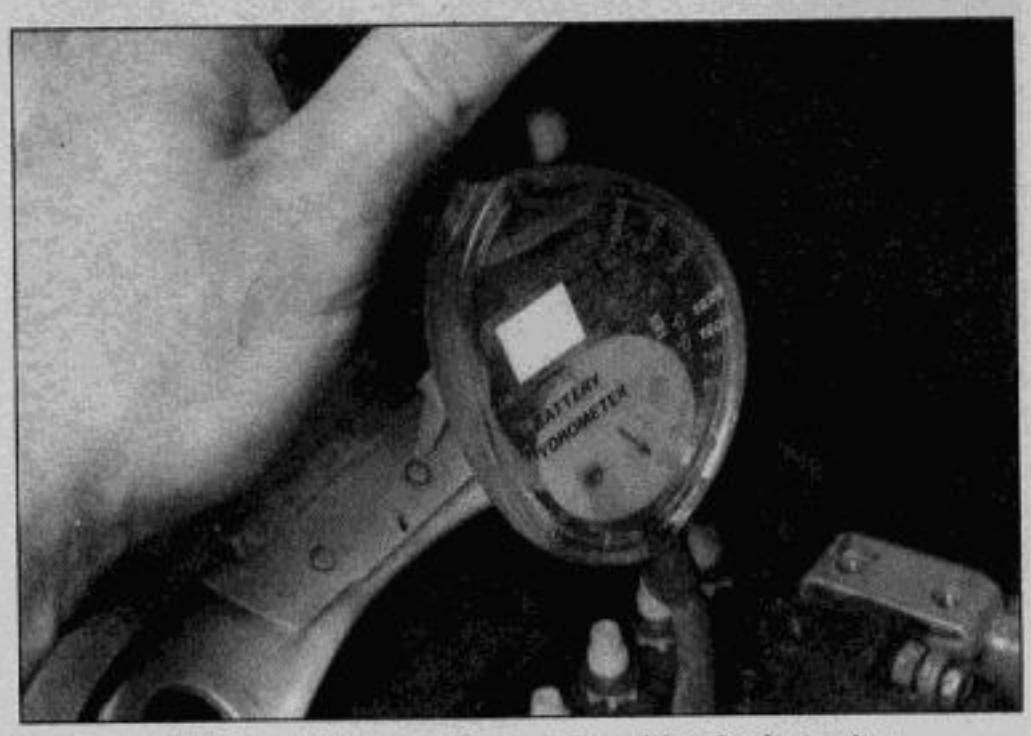
15 Check the coolant level through the inspection window in the side cover **(see illustration)**.

16 The coolant level is satisfactory if it is between the Low and Full marks on the reservoir. If the level is at or below the Low mark, remove the reservoir cap and add the recommended coolant mixture (see this Chapter's Specifications) until the Full level is reached **(see illustration)**. If the coolant level seems to be consistently low, check the entire cooling system for leaks.

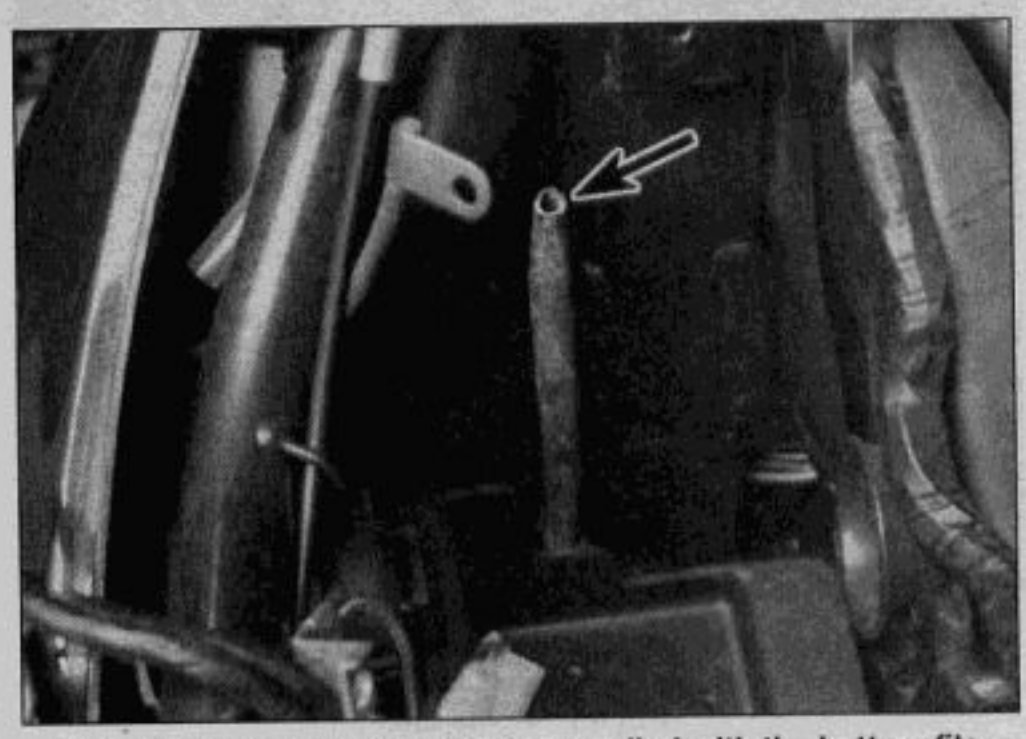


4.3 Remove the junction box bracket bolt (arrow) and lift the junction box to uncover the battery

4.4 The positive terminal is identified by a plus mark molded into the top of the battery and the negative terminal is identified by a minus mark (arrows); ALWAYS disconnect the negative cable first and connect it last to prevent sparks which could cause a battery explosion



4.7 Check the specific gravity with a hydrometer



4.11 The clear plastic vent tube supplied with the battery fits inside the motorcycle's drain tube (arrow) when the battery is installed

4 Battery electrolyte level/specific gravity - check

Refer to illustrations 4.3, 4.4, 4.7 and 4.11

Caution: *Be extremely careful when handling or working around the battery. The electrolyte is very caustic and an explosive gas (hydrogen) is given off when the battery is charging.* **Note**: *The first Steps describe battery removal. If the electrolyte level is known to be sufficient it won't be necessary to remove the battery.*

1 Remove the seat (see Chapter 8).

2 Remove the fuel tank and bracket (see Chapter 4).

3 On EN450 models, remove its bolts and lift off the igniter, then release the battery holder bracket. On EN500 models, unbolt the junction box bracket and lift it off together with the junction box and battery cover **(see illustration)**. Note the position of the carburetor vent tube and battery vent tube.

4 Remove the bolts securing the battery cables to the battery terminals (remove the negative cable first, positive cable last) **(see illustration)**. Pull the battery straight up to remove it. The electrolyte level will now be visible through the translucent battery case - it should be between the Upper and Lower level marks.

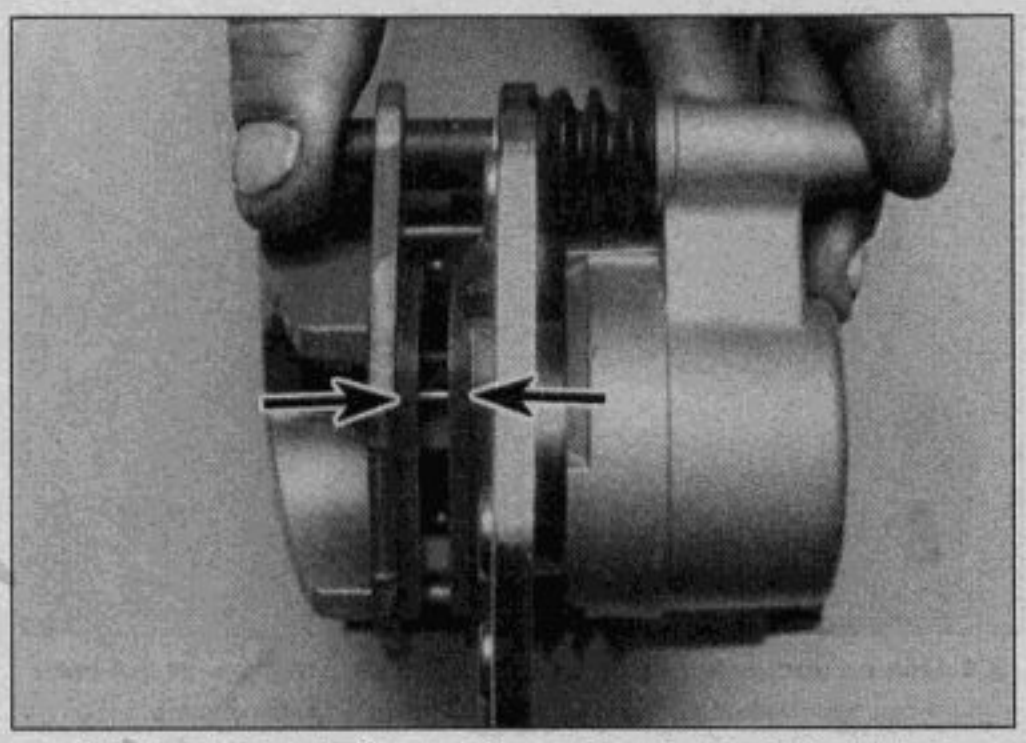
5 If it is low, remove the cell caps and fill each cell to the upper level mark with distilled water. Do not use tap water (except in an emergency), and do not overfill. The cell holes are quite small, so it may help to use a plastic squeeze bottle with a small spout to add the water. If the level is within the marks on the case, additional water is not necessary.

6 Next, check the specific gravity of the electrolyte in each cell with a small hydrometer made especially for motorcycle batteries. These are available from most dealer parts departments or motorcycle accessory stores.

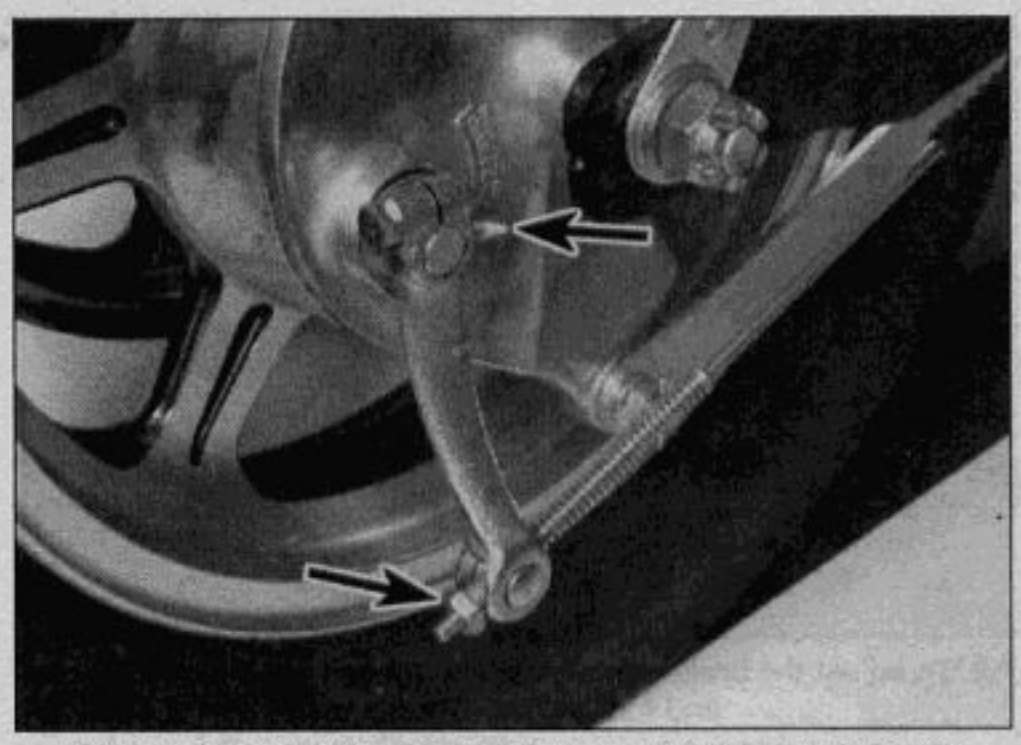
7 Remove the caps, draw some electrolyte from the first cell into the hydrometer **(see illustration)** and note the specific gravity. Compare the reading to the Specifications listed in this Chapter. **Note**: *Add 0.004 points to the reading for every 10-degrees F above 68-degrees F (20-degrees C) - subtract 0.004 points from the reading for every 10-degrees below 68-degrees F (20-degrees C). Return the electrolyte to the appropriate cell and repeat the check for the remaining cells. When the check is complete, rinse the hydrometer thoroughly with clean water.*

8 If the specific gravity of the electrolyte in each cell is as specified, the battery is in good condition and is apparently being charged by the machine's charging system.

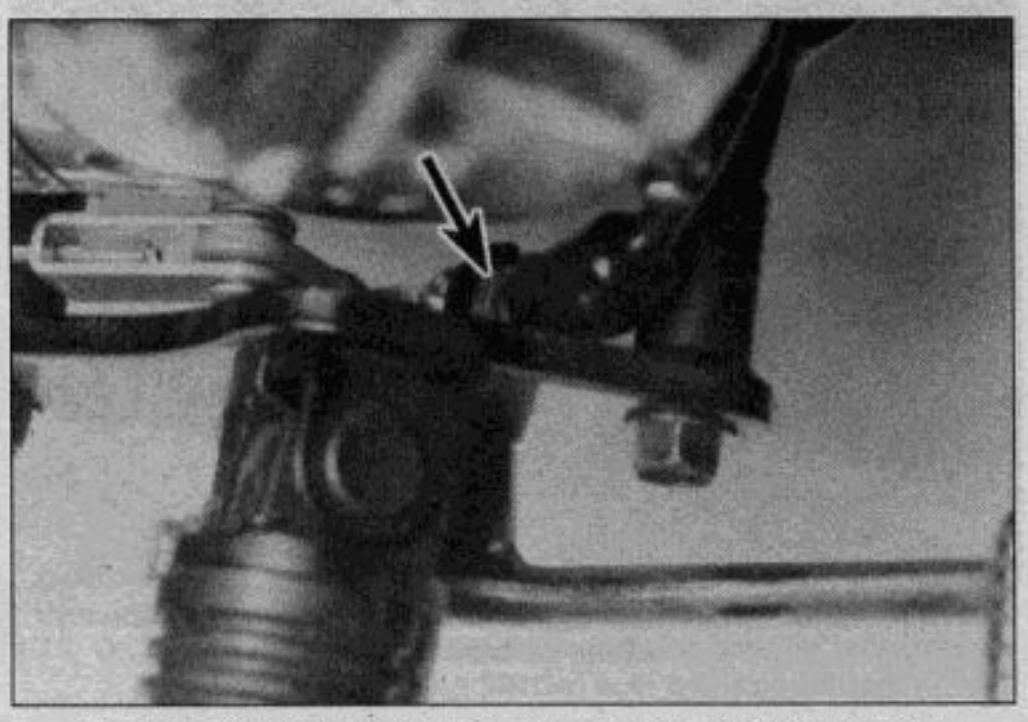
9 If the specific gravity is low, the battery is not fully charged. This may be due to corroded battery terminals, a dirty battery case, a malfunctioning charging system, or loose or corroded wiring connections. On the other hand, it may be that the battery is worn out, especially if



5.2 Look into the front of the caliper to check the brake pads for wear (arrows)



5.4 If the pointer (upper arrow) goes past the Usable Range indicator toward the rear of the bike, the linings are worn and must be replaced; the adjuster (lower arrow) is used to set brake pedal freeplay



6.6 To adjust the rear brake light switch, hold the switch body and turn the locknut (arrow)

the machine is old, or that infrequent use of the motorcycle prevents normal charging from taking place.

10 Be sure to correct any problems and charge the battery if necessary. Refer to Chapter 9 for additional battery maintenance and charging procedures.

11 Install the battery cell caps, tightening them securely. Reconnect the cables to the battery, attaching the positive cable first and the negative cable last. Make sure to install the plastic cap over the positive terminal. Install the junction box, fuel tank and bracket and the seat. Be very careful not to pinch or otherwise restrict the battery vent tube **(see illustration)**, as the battery may build up enough internal pressure during normal charging system operation to explode.

5 Brake pads and linings - wear check

Refer to illustrations 5.2 and 5.4

1 The front brake pads and rear brake linings should be checked at the recommended intervals and replaced with new ones when worn beyond the limit listed in this Chapter's Specifications (front) or Chapter 7 (rear).

2 To check the brake pads, remove the caliper (without disconnecting the brake hose) so you can see clearly into the front of the brake caliper (see Chapter 7). The brake pads should have at least the specified minimum amount of lining material remaining on the metal backing plate **(see illustration)**.

3 If the pads are worn excessively, they must be replaced with new ones (see Chapter 7).

4 To check the rear brake linings, press the brake pedal firmly and look at the indicator on the brake drum **(see illustration)**. If the pointer is beyond the Usable Range scale, replace the brake shoes (see Chapter 7).

6 Brake system - general check

Refer to illustration 6.6

1 A routine general check of the brakes will ensure that any problems are discovered and remedied before the rider's safety is jeopardized.

2 Check the brake lever and pedal for loose connections, excessive play, bends, and other damage. Replace any damaged parts with new ones (see Chapter 7).

3 Make sure all brake fasteners are tight. Check the brake pads and linings for wear (see Section 5) and make sure the fluid level in the reservoir is correct (see Section 3). Look for leaks at the hose connections and check for cracks in the hoses. If the lever is spongy, bleed the brakes as described in Chapter 7.

4 Make sure the brake light operates when the brake lever is depressed.

5 Make sure the brake light is activated when the rear brake pedal is depressed approximately 15 mm (0.6 inch).

6 If adjustment is necessary, hold the switch and turn the adjusting nut on the switch body **(see illustration)** until the brake light is activated when required. Turning the switch out will cause the brake light to come on sooner, while turning it in will cause it to come on later. If the switch doesn't operate the brake lights, check it as described in Chapter 9.

7 The front brake light switch is not adjustable. If it fails to operate properly, replace it with a new one (see Chapter 9).

7 Brake pedal position and play - check and adjustment

Refer to illustration 7.2

1 Rear brake pedal position is largely a matter of personal preference. Locate the pedal so that the rear brake can be engaged quickly and easily without excessive foot movement. The recommended factory setting is listed in this Chapter's Specifications.

2 To adjust the position of the pedal, loosen the locknut on the adjusting bolt, turn the bolt to set the pedal position and tighten the