Tiger

Motorcycle Service Manual

Part Number 3850775 issue 3, 08.99

CONTENTS

INTRODUCTION

This manual is designed primarily for use by trained technicians in a properly equipped workshop. However, it contains enough detail and basic information to make it useful to the owner who desires to perform his own basic maintenance and repair work. The work can only be carried out if the owner has the necessary hand and special service tools to complete the job.

A basic knowledge of mechanics, including the proper use of tools and workshop procedures is necessary in order to carry out maintenance and repair work. satisfactorily. Whenever the owner has insufficient experience or doubts his ability to do the work, all adjustments, maintenance, and repair work must be undertaken by an authorised Triumph Dealer.

In order to perform the work efficiently and to avoid costly mistakes, read the text and thoroughly familiarise yourself with procedures before starting work.

All work should be performed with great care and in a clean working area with adequate lighting.

Always use the correct special service tools or equipment specified. Under no circumstances use makeshift tools or equipment since the use of substitutes may adversely affect safe operation.

Where accurate measurements are required, they can only be made using calibrated, precision instruments.

For the duration of the warranty period, all repairs and scheduled maintenance must be performed by an authorised Triumph Dealer.

To maximise the life of your Motorcycle:

- Accurately follow the maintenance requirements of the periodic maintenance chart in the service manual.
- Do not allow problems to develop. Investigate unusual noises and changes in the riding characteristics of the motorcycle. Rectify all problems as soon as possible (immediately if safety related).
- Use only genuine Triumph parts as listed in the parts catalogue/parts microfiche.
- Follow the procedures in this manual carefully and completely. Do not take short cuts.
- Keep complete records of all maintenance and repairs with dates and any new parts installed.
- Use only approved lubricants, as specified in the owner's handbook, in the maintenance of the motorcycle.

How to use this manual

To assist in the use of this manual, the section title is given at the top.

Each major section starts with a contents page, listing the information contained in the section.

The individual steps comprising repair operations are to be followed in the sequence in which they appear.

Adjustment and repair operations include reference to service tool numbers and the associated illustration depicts the tool.

Where usage is not obvious the tool is shown in use.

Adjustment and repair operations also include reference to wear limits, relevant data, torque figures, specialist information and useful assembly details.

Warning, Caution and Note

Particularly important information is presented in the following form:

WARNING: This warning symbol identifies special instructions or procedures which, if not correctly followed, could result in personal injury, or loss of life.

CAUTION: This caution symbol identifies special instructions or procedures which, if not strictly observed, could result in damage to or destruction of equipment.

NOTE:

- **This note symbol indicates points of particular interest for more efficient and convenient operation.**

TAMPERING WITH NOISE CONTROL SYSTEM PROHIBITED

Owners are warned that the law may prohibit:

(a) The removal or rendering inoperative by any person other than for purposes of maintenance, repair or replacement, of any device or element of design incorporated into any new vehicle for the purpose of noise control prior to its sale or delivery to the ultimate purchaser or while it is in use; and

(b) the use of the vehicle after such device or element of design has been removed or rendered inoperative by any person.

REFERENCES

References

References to the left-hand or right-hand side given in this manual are made when viewing the motorcycle from the rear.

Operations covered in this manual do not always include reference to testing the motorcycle after repair. It is essential that work is inspected and tested after completion and if necessary a road test of the motorcycle is carried out particularly where safety related items are concerned.

Dimensions

The dimensions quoted are to design engineering specification with service limits where applicable.

During the period of running-in from new, certain adjustments may vary from the specification figures given in this manual. These will be reset by the dealer at the 500 mile/800 km service, and thereafter should be maintained at the figures specified in this manual.

REPAIRS AND REPLACEMENTS

Before removal and disassembly, thoroughly clean the motorcycle. Any dirt entering the engine or other parts will work as an abrasive and shorten the life of the motorcycle. Particular attention should be paid when installing a new part, that any dust or metal filings are cleared from the immediate area.

Force

Common sense should dictate how much force is necessary in assembly and disassembly. If a part seems especially difficult to remove or install, stop and examine what may be causing the problem. Never lever a component as this will cause damage both to the component itself and to the surface being levered against.

Whenever tapping to aid removal of an item is necessary, tap lightly using a hide or plastic faced mallet.

Edges

Watch for sharp edges, especially during engine disassembly and assembly. Protect the hands with industrial quality gloves when lifting the engine or turning it over.

When replacement parts are required, it is essential that only genuine Triumph parts are used.

Safety features and corrosion prevention treatments embodied in the motorcycle may be impaired if other than genuine Triumph parts are fitted. In certain territories, legislation prohibits the fitting of parts not to the manufacturer's specification.

Tightening procedure

Generally, when installing a part with several bolts, nuts or screws, they should all be started in their holes and tightened to a snug fit, evenly and in a cross pattern. This is to avoid distortion of the part and/or causing gas or oil leakage. Conversely, bolts, nuts, or screws, should all be loosened (in sequence if specified) by about a quarter of a turn and then removed.

Where there is a tightening sequence specified in this Service Manual, the bolts, nuts, or screws must be tightened in the order and by the method indicated.

Torque wrench setting figures given in this Manual must be observed. The torque tools used must be of accurate calibration.

Locking devices, where specified, must be fitted. If the efficiency of a locking device is impaired during removal it must be renewed. This applies particularly to micro-encapsulated fixings which must always be replaced if disturbed. Where necessary, the text in this manual will indicate where such a fixing is used.

GENERAL INFORMATION

CONTENTS

CONTENTS cont'd

IGNITION SYSTEM SAFETY PRECAUTIONS

WARNING: The ignition system produces extremely high voltages. Do not touch any part of the ignition system or any cables while the engine is running.

An electric shock caused by contact with the ignition system may lead to illness, injury or death.

WARNING: Wearers of surgically implanted heart pacemaker devices should not be in close proximity to ignition circuits and or diagnostic equipment.

The ignition system and any diagnostic equipment may interrupt the normal operation of such devices causing illness or death.

DANGEROUS SUBSTANCES

WARNING: Many liquids and other substances used in motor vehicles are poisonous and should under no circumstances be consumed and should, as far as possible, be kept from contact with the skin. These substances among others include acid, anti-freeze, asbestos, brake fluid, fuel, lubricants, and various adhesives. Always pay close attention to the instructions printed on labels and obey the instructions contained within. These instructions are included for your safety and well being. NEVER DISREGARD THESE INSTRUCTIONS!

Fluoroelastomers

WARNING: fluoroelastomer material is used in the manufacture of various seals in Triumph motorcycles.

In fire conditions involving temperatures greater than 315°C this material will decompose and can then be potentially hazardous. Highly toxic and corrosive decomposition products, including hydrogen fluoride, carbonyl fluoride, fluorinated olefins and carbon monoxide can be generated and will be present in fumes from fires.

In the presence of any water or humidity hydrogen fluoride may dissolve to form extremely corrosive liquid hydrofluoric acid.

If such conditions exist, do not touch the material and avoid all skin contact. Skin contact with liquid or decomposition residues can cause painful and penetrating burns leading to permanent, irreversible skin and tissue damage.

ENGINE OILS

WARNING: The oil may be hot to the touch. Contact with hot oil may cause the skin to be scalded or burned.

WARNING: Prolonged or repeated contact with engine oil can lead to skin dryness, irritation and dermatitis. In addition used engine oil contains potentially harmful contaminants which can cause cancer. Wear suitable clothing and avoid skin contact.

Health Protection Precautions

- Avoid prolonged and repeated contact with oils, particularly used engine oils.
- Wear protective clothing, including impervious gloves where practicable.
- Do not put oily rags in pockets.
- Overalls must be cleaned regularly. Discard heavily soiled clothing and oil impregnated footwear.
- First aid treatment should be obtained immediately for open cuts and wounds. Always be aware of who your nearest first aider is and where the medical facilities are kept.
- Use barrier creams, applying before each work period to protect the skin from the effects of oil and grease and to aid removal of the same after completing work.
- Wash with soap and water to ensure all oil is removed (skin cleansers and nail brushes will help). Preparations containing lanolin replace the natural skin oils which have been removed.
- Do not use petrol, kerosene, diesel fuel, gas oil, thinners or solvents for cleaning skin.
- If skin disorders develop, obtain medical advice without delay.
- Where practicable, de-grease components prior to handling.

WARNING: Any risk of eye injury must be avoided. Always wear eye protection when using a hammer, air line, cleaning agent or where there is ANY risk of flying debris or chemical splashing

ENVIRONMENTAL PROTECTION PRECAUTIONS

CAUTION: Do not pour oil on the ground, down sewers or drains, or into water courses. To prevent pollution of water courses etc., dispose of used oil sensibly. If in doubt contact your local authority.

Burning of used engine oil in small space heaters or boilers can be recommended only for units of approved design. If in doubt check with the appropriate local authority and/or manufacturer of the approved appliance.

Dispose of used oil and used filters through authorised waste disposal contractors, to licensed waste disposal sites, or to the waste oil reclamation trade. If in doubt, contact the Local Authority for advice on disposal facilities.

BRAKES

WARNING: Brake fluid is hygroscopic which means it will absorb moisture from the air. Any absorbed moisture will greatly reduce the boiling point of the brake fluid causing a reduction in braking efficiency.

Replace brake fluid in line with the routine maintenance schedule. A dangerous riding condition could result if this important maintenance item is neglected!

Do not spill brake fluid onto any area of the bodywork as this will damage any painted or plastic surface.

Always use new brake fluid from a sealed container and never use fluid from an unsealed container or from one which has been previously opened.

Do not mix different brands of fluid. Check for fluid leakage around brake fittings, seals and joints.

Check regularly for brake hose damage.

FAILURE TO OBSERVE ANY OF THE ABOVE WARNINGS MAY REDUCE BRAKING EFFICIENCY LEADING TO AN ACCIDENT.

WARNING: If there has been an appreciable drop in the level of the fluid in either brake fluid reservoir, consult your authorised Triumph Dealer for advice before riding.

If the brake lever or pedal feels soft when it is applied, or if the lever/pedal travel becomes excessive, there may be air in the brake lines or the brake may be defective.

It is dangerous to operate the motorcycle under such conditions and remedial action must be taken by your authorised Triumph Dealer before riding the motorcycle.

Failure to take remedial action may reduce braking efficiency leading to an accident.

WARNING: Use only D.O.T. 4 specification brake fluid as listed in the general information section of this manual. The use of brake fluids other than those D.O.T. 4 fluids listed in the general information section may reduce the efficiency of the braking system leading to an accident.

Failure to change the brake fluid at the interval specified in the routine maintenance schedule may reduce braking efficiency resulting in an accident.

WARNING: Never use mineral based grease in any part of the braking system or in any area where contact with the braking system is possible. Mineral based grease will damage the hydraulic seals in the calipers and master cylinders.

Damage caused by contact with mineral based grease may reduce braking efficiency resulting in an accident.

SAFETY INSTRUCTIONS

Jacking and lifting

WARNING: Always ensure that any lifting apparatus has adequate load and safety capacity for the weight to be lifted. Ensure the motorcycle is well supported to prevent any possibility of the machine falling prior to, and during lifting or jacking.

Never rely on a single means of support when working with the motorcycle. Use additional safety supports.

Do not leave tools, lifting equipment, spilt oil, etc. in a place where they could become a hazard to health. Always work in a clean, tidy area and put all tools away when the work is finished.

Precautions against damage

Avoid spilling brake fluid or battery acid on any part of the bodywork. Wash spillages off with water immediately.

Disconnect the battery earth lead (black) before starting work, see **ELECTRICAL PRECAUTIONS.**

Always use the recommended service tool where specified.

Protect exposed bearing and sealing surfaces, and screw threads from damage.

Engine Coolant

WARNING: Coolant mixture which is blended with anti-freeze and corrosion inhibitors contains toxic chemicals which are harmful to the human body. Never swallow anti-freeze, corrosion inhibitors or any of the motorcycle coolant.

WARNING: Do not remove the radiator cap when the engine is hot. When the engine is hot, the coolant inside the radiator is hot and also under pressure. Contact with the pressurised coolant will cause scalds and skin damage.

CAUTION: The coolant anti-freeze contains a corrosion inhibitor which helps prevent damage to the metal surfaces inside the cooling system. Without this inhibitor, the coolant would 'attack' the metals and the resulting corrosion would cause blockages in the cooling system leading to engine overheating and damage. Always use the correct anti-freeze as specified in the Owner's Handbook. Never use a methanol based anti-freeze as this does not contain the required corrosion inhibition properties.

CAUTION: Distilled water must be used with the anti-freeze (see specification for anti-freeze) in the cooling system.

If hard water is used in the system, it causes scale accumulation in the water passages, and considerably reduces the efficiency of the cooling system. Reduced cooling system efficiency may lead to the engine overheating and suffering severe damage.

Cleaning components

A high flash-point solvent is recommended to reduce fire hazard.

Always follow container directions regarding the use of any solvent.

Always use the recommended cleaning agent or equivalent.

Do not use degreasing equipment for components containing items which could be damaged by the use of this process. Whenever possible, clean components and the area surrounding them before removal. Always observe scrupulous cleanliness when cleaning dismantled components.

Lubrication

Engine wear is generally at its maximum while the engine is warming up and before all the rubbing surfaces have an adequate lubricative film. During assembly, oil or grease (whichever is more suitable) should be applied to any rubbing surface which has lost its lubricative film. Old grease and dirty oil should be cleaned off. This is because used lubricants will have lost some lubricative qualities and may contain abrasive foreign particles.

Use recommended lubricants. Some oils and greases in particular should be used only in certain applications and may be harmful if used in an application for which they are not intended. This manual makes reference to molybdenum disulphide grease in the assembly of certain engine and chassis parts. Always check manufacturer recommendations before using such special lubricants.

Joints and joint faces

Assemble joints dry unless otherwise specified in this Manual.

If gaskets and/or jointing compound is recommended for use; remove all traces of old jointing material prior to reassembly. Do not use a tool which will damage the joint faces and smooth out any scratches or burrs on the joint faces using an oil stone. Do not allow dirt or jointing material to enter any tapped holes.

Gaskets, O-rings

Do not re-use a gasket or O-ring once it has been in service. The mating surfaces around the gasket should be free of foreign matter and perfectly smooth to avoid oil or compression leaks.

Liquid gasket, non-permanent locking agent

Follow manufacturer's directions for cleaning and preparing surfaces where these compounds will be used. Apply sparingly as excessive amounts of sealer may block engine oil passages and cause serious damage.

Prior to reassembly, blow through any pipes, channels or crevices with compressed air.

WARNING: To prevent injury, always use eye, face and ear protection when using compressed air. Always wear protective gloves if the compressed air is to be directed in proximity to the skin.

Screw threads

Metric threads to ISO standard are used.

Damaged nuts, bolts and screws must always be discarded.

Castellated nuts must not be slackened back to accept a split-pin, except in those recommended cases when this forms part of an adjustment.

Do not allow oil or grease to enter blind threaded holes. The hydraulic action on screwing in the bolt or stud could split the housing.

Always tighten a nut or bolt to the recommended torque figure. Damaged or corroded threads can affect the torque reading.

Unless specified, threaded fixings must always be fitted dry (no lubrication).

WARNING: Never lubricate a thread unless instructed to do so.

When a thread of a fixing is lubricated, the thread friction is reduced. When the fixing is tightened, reduced friction will cause overtightening and possible fixing failure.

A fixing which fails in service could cause component detachment leading to loss of control and an accident.

Locking devices

Always release locking tabs and fit new locking washers, do not re-use locking tabs.

Fitting a split pin

Always fit new split-pins of the correct size for the hole in the bolt or stud. Do not slacken back castle nuts when fitting split pin.

Always fit new roll pins of an interference fit in the hole.

Circlips, retaining rings

Replace any circlips and retaining rings that are removed. Removal weakens and deforms circlips causing looseness in the circlip groove. When installing circlips and retaining rings, take care to compress or expand them only enough to install them.

Always use the correct replacement circlip as recommended in the Triumph parts catalogue.

Self locking nuts

Self-locking nuts can be re-used, providing resistance can be felt when the locking portion passes over the thread of the bolt or stud.

DO NOT re-use self-locking nuts in critical locations, e.g. suspension components. Always use the correct replacement self-locking nut.

Encapsulated bolt

An encapsulated bolt can be identified by a coloured section of thread which is treated with a locking agent.

Unless a specified repair procedure states otherwise, encapsulated bolts cannot be re-used and MUST be replaced if disturbed or removed.

WARNING: Failure to replace an encapsulated bolt could lead to a dangerous riding condition. Always replace encapsulated bolts.

Oil and grease seals

Replace any oil or grease seals that are removed. Removal will cause damage to an oil seal which, if re-used, would cause an oil leak.

Ensure the surface on which the new seal is to run is free of burrs or scratches. Renew the component if the original sealing surface cannot be completely restored.

Protect the seal from any surface which could cause damage over which it has to pass when being fitted. Use a protective sleeve or tape to cover the relevant surface and avoid touching the sealing lip.

Lubricate the sealing lips with a recommended lubricant. This will help to prevent damage in initial use. On dual lipped seals, smear the area between the lips with grease.

When pressing in a seal which has manufacturer's marks, press in with the marks facing out.

Seals must be pressed into place using a suitable driver. Use of improper tools will damage the seal.

Press

A part installed using a press or driver, such as a wheel bearing, should first be coated with oil on its outer or inner circumference so that it will locate smoothly.

Ball bearing

When installing a ball bearing, the bearing race which is an interference fit should be pushed by a suitable driver. This prevents severe stress or damage to the load carrying components. Press a ball bearing until it touches the shoulder in the bore or on the shaft.

Press or drift seals to the depth of its housing, with the sealing lip facing the lubricant to be retained if the housing is shouldered, or flush with the face of the housing where no shoulder is provided.

FUEL HANDLING PRECAUTIONS

General

The following information provides basic precautions which must be observed if petrol (gasoline) is to be handled safely. It also outlines other areas of risk which must not be ignored. This information is issued for basic guidance only and, if in doubt, appropriate enquiries should be made of your local Fire Officer.

Petrol - Gasoline

When petrol (gasoline) evaporates it produces 150 times its own volume in vapour which when diluted with air becomes a readily ignitable mixture. The vapour is heavier than air and will always fall to the lowest level. It can readily be distributed throughout a workshop by air currents, consequently, even a small spillage of petrol (gasoline) is potentially very dangerous.

WARNING: Petrol (gasoline) is highly flammable and can be explosive under certain conditions. When opening the fuel tank cap always observe all the following items;

Turn the motorcycle ignition switch OFF.

Do not smoke.

Always have a fire extinguisher containing FOAM, CO^2, HALON or POWDER close at hand when handling or draining fuel or fuel systems. Fire extinguishers must also be present in areas where fuel is stored.

Always disconnect the vehicle battery, negative (black) lead first, before carrying out dismantling or draining work on a fuel system.

Whenever petrol (gasoline) is being handled, drained or stored or when fuel systems are being dismantled, make sure the area is well ventilated. All potential forms of ignition must be extinguished or removed (this includes any appliance with a pilot light). Any lead-lamps must be flame-proof and kept clear of any fuel spillage.

Warning notices must be posted at a safe distance from the site of the work to warn others that petrol is being openly handled. The notice must instruct the reader of the precautions which must be taken.

Failure to observe any of the above warnings may lead to a fire hazard which could result in personal injury.

WARNING: No one should be permitted to repair components associated with petrol/gasoline without first having specialist training on the fire hazards which may be created by incorrect installation and repair of items associated with petrol/gasoline.
Repairs carried out by untrained personnel could bring about a safety hazard leading to a risk of personal injury.

WARNING: Draining or extraction of petrol/gasoline from a vehicle fuel tank must be carried out in a well ventilated area.

The receptacle used to contain the petrol/ gasoline must be more than adequate for the full amount of fuel to be extracted or drained. The receptacle should be clearly marked with its contents, and placed in a safe storage area which meets the requirements of local authority regulations.

When petrol/gasoline has been extracted or drained from a fuel tank, the precautions governing naked lights and ignition sources should be maintained.
Failure to observe any of the above warnings could bring about a safety hazard leading to a risk of personal injury.

Fuel tank removal

Fuel tanks should have a 'PETROL (GASOLINE) VAPOUR' warning label attached to them as soon as they are removed from the vehicle. In all cases, they must be stored in a secured, marked area.

Chassis repairs

WARNING: If the motorcycle is involved in an accident or collision it must be taken to an authorised Triumph dealer for repair or inspection. Any accident can cause damage to the motorcycle which, if not correctly repaired, may cause a second accident which may result in injury or death.

The frame must not be modified as any modification to the frame such as welding or drilling may weaken the frame resulting in an accident.

ELECTRICAL PRECAUTIONS

The following guidelines are intended to ensure the safety of the operator whilst preventing damage to the electrical and electronic components fitted to the motorcycle. Where necessary, specific precautions are detailed in the relevant sections of this manual which should be referred to prior to commencing repair operations.

Equipment - Prior to commencing any test procedure on the motorcycle ensure that the relevant test equipment is working correctly and any harness or connectors are in good condition, in particular mains leads and plugs.

WARNING: The ignition system produces extremely high voltages. Do not touch any part of the ignition system or any cables while the engine is running.

An electric shock caused by contact with the ignition system may lead to illness, injury or death.

WARNING: Wearers of surgically implanted heart pacemaker devices should not be in close proximity to ignition circuits and or diagnostic equipment.

The ignition system and any diagnostic equipment may interrupt the normal operation of such devices causing illness or death.

WARNING: The battery contains harmful materials. Always keep children away from the battery whether or not it is fitted in the motorcycle.
Do not jump start the battery, touch the battery cables together or reverse the polarity of the cables as any of these actions may cause a spark which would ignite battery gasses causing a risk of personal injury.

High Voltage Circuits - Whenever disconnecting live H.T. circuits always use insulated pliers. Exercise caution when measuring the voltage on the coil terminals while the engine is running, high voltage spikes can occur on these terminals.

Connectors and Harness - The engine of a motorcycle is a particularly hostile environment for electrical components and connectors. Always ensure these items are dry and oil free before disconnecting and connecting test equipment. Never force connectors apart either by using tools or by pulling on the wiring itself. Always ensure locking mechanisms are disengaged before removal and note the orientation to enable correct reconnection. Ensure that any protective covers and substances are replaced if disturbed.

Having confirmed a component to be faulty, switch off the ignition and disconnect the battery negative (black) lead first. Remove the component and support the disconnected harness. When replacing the component keep oily hands away from electrical connection areas and push connectors home until any locking mechanism becomes fully engaged.

Battery disconnecting

Before disconnecting the battery, switch off all electrical equipment.

WARNING: To prevent the risk of a battery exploding and to prevent damage to electrical components *ALWAYS* disconnect the battery negative (black) lead first. When reconnecting the battery, always connect the positive (red) lead first, then the negative (black) lead. Always disconnect the battery when working on any part of the electrical system.
Failure to observe the above warnings may lead to electrical damage and a fire hazard which could cause personal injury.

Always ensure that battery leads are routed correctly and are not close to any potential chafing points.

Disciplines

Switch off the ignition prior to making any connection or disconnection in the system. An electrical surge can be caused by disconnecting 'live' connections which can damage electronic components.

Ensure hands and work surfaces are clean and free of grease, swarf, etc. as grease collects dirt which can cause tracking or high-resistance contacts.

Prior to commencing any test, and periodically during any test, touch a good earth to discharge body static. This is because some electronic components are vulnerable to static electricity.

Electrical wires

All the electrical wires are either single-colour or two-colour and, with only a few exceptions, must be connected to wires of the same colour. On any of the two-colour wires there is a greater amount of one colour and a lesser amount of a second colour. A two-colour wire is identified by first the primary colour and then the secondary colour. For example, a yellow wire with thin red stripes is referred to as a 'yellow/red' wire; it would be a 'red/yellow' wire if the colours were reversed to make red the main colour.

Inspection

Disassembled parts should be visually inspected and replaced with new ones if there are any signs of the following:

Abrasions, cracks, hardening, warping, bending, dents, scratches, colour changes, deterioration, seizure or damage of any nature.

Replacement Parts

WARNING: Only Triumph approved parts should be used to service, repair or convert Triumph motorcycles. To ensure that Triumph approved parts are used, always order parts, accessories and conversions from an authorised Triumph dealer. The fitting of non-approved parts, accessories or conversions may adversely affect the handling, stability or other aspects of the motorcycle operation which may result in an accident causing serious injury or death.

WARNING: Always have Triumph approved parts, accessories and conversions fitted by an authorised Triumph dealer. The fitment of parts, accessories and conversions by a dealer who is not an authorised Triumph dealer may affect the handling, stability or other aspects of the motorcycle operation which may result in an accident causing serious injury or death.

WARNING: Always have Triumph approved parts, accessories and conversions fitted by a trained technician. To ensure that a trained technician is used, have an authorised Triumph dealer fit the parts. The fitment of parts, accessories and conversions by personnel other than a trained technician at an authorised Triumph dealer may affect the handling, stability or other aspects of the motorcycle operation which may result in an accident causing serious injury or death.

Service data

The service data listed in this manual gives dimensions and specifications for brand new, original parts. Where it is permissible to allow a part to exceed these figures, then the service limit is given.

The terms of the motorcycle warranty will be invalidated by the fitting of other than genuine Triumph parts.

All genuine Triumph parts have the full backing of the motorcycle warranty. Triumph dealers are obliged to supply only genuine Triumph recommended parts.

Specification

Triumph are constantly seeking to improve the specification, design and production of their motorcycles and alterations take place accordingly.

While every effort has been made to ensure the accuracy of this Manual, it should not be regarded as an infallible guide to current specifications of any particular motorcycle.

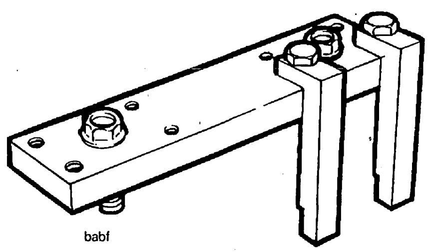
Authorised Triumph Dealers are not agents of Triumph and have no authority to bind the manufacturer by any expressed or implied undertaking or representation.

Service tools and garage equipment

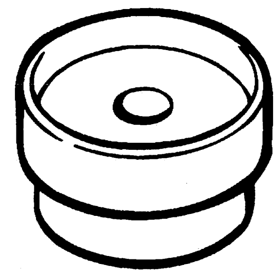
Special service tools have been developed to facilitate removal, dismantling and assembly of certain mechanical components in a practical manner without causing damage. Some operations in this Service Manual cannot be carried out without the aid of the relevant service tools. Where this is the case, the tools required will be described during the procedure.

Special service tools:-

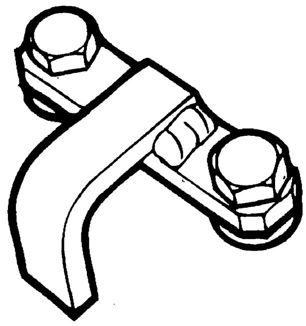
T3880012 - Valve Shim Removal Tool



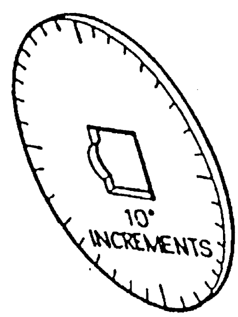
3880075-T0301 - Wheel Bearing Fitment



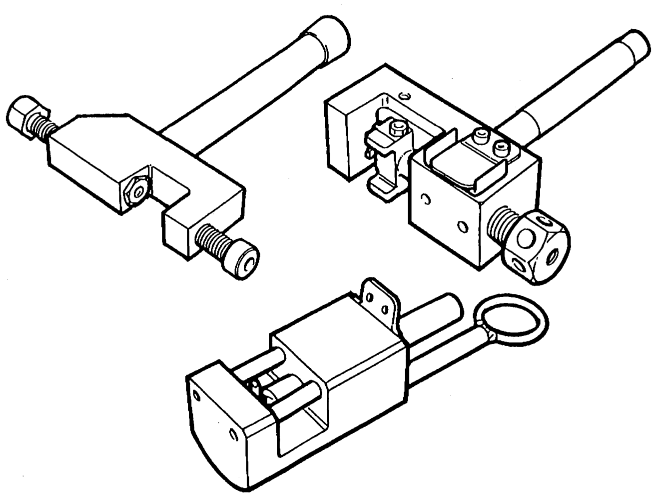
3880040-T0301 - Alternator Shaft Locking Jig



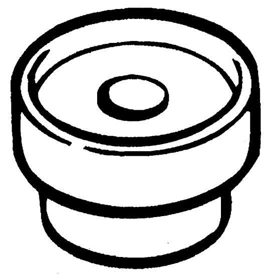
T3880105 - Angular Torque Gauge



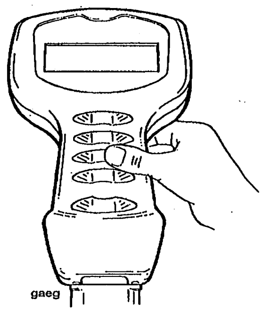
T3880205 - Drive Chain Service (3 tools)



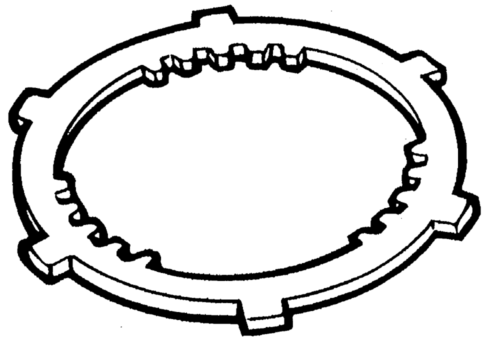
3880070-T0301 - Wheel Bearing Fitment



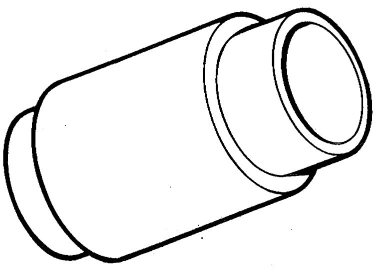
T3880250 - Engine Management Diagnostics



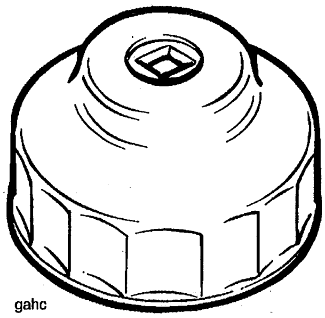
T3880305 - Clutch Anti-rotation Tool



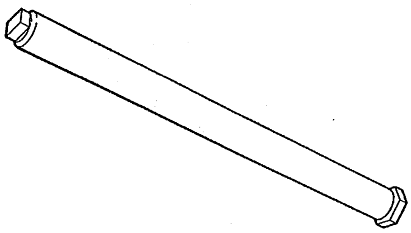
3880080-T0301 - Fork Seal/Bearing Drift



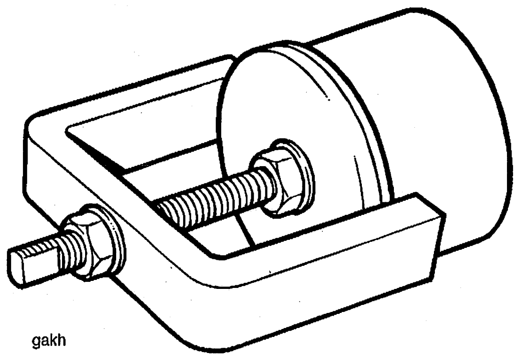
T3880311 - Oil Filter Wrench



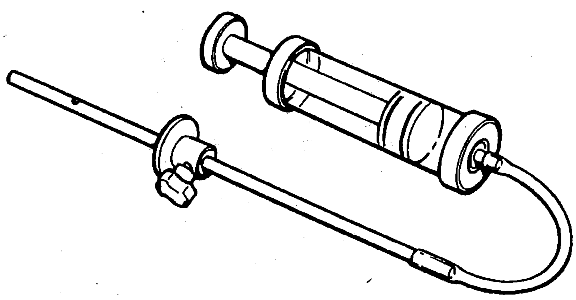
3880090-T0301 - Fork Piston Holder



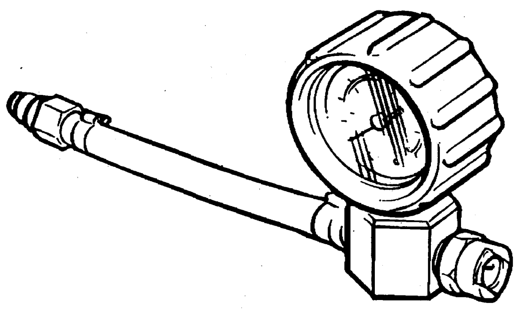
T3880315 - Extractor - Cylinder Liners



3880160-T0301 - Fork Filler/Evacuator



T3880048 - Fuel Pressure Gauge



Full Specification — Tiger

Engine		3 Cylinder 12 Valve DOHC
Arrangement		Transverse In-line
Displacement		885 cc
Bore x Stroke		76.0 mm x 65 mm
Compression Ratio		11.3 : 1
Cylinder Numbering		Left to Right (No.3 adjacent to camchain)
Firing order		1-2-3
Max. Power		87 PS @ 8200 RPM
Max. Torque		85 Nm @ 6400 RPM

Cylinder Head

Valve Head Dia.	In.	30.0 mm
	Ex.	26.0 mm
Valve Lift	In.	8.0 mm
	Ex.	7.6 mm
Valve Stem Dia.	In.	5.490 mm/5.475 mm (5.47 mm min.)
	Ex.	5.470 mm/5.455 mm (5.45 mm min.)
Valve Guide Bore Dia.		5.515 mm/5.500 mm
Valve Stem to Guide Clearance	In.	0.04 mm/0.01 mm (0.07 mm max.)
	Ex.	0.06 mm/0.03 mm (0.09 mm max.)
Valve Seat Width (in head)		1.1 mm/0.9 mm (1.5 mm max.)
Valve Seat Width (valve)		2.5 mm/1.8 mm
Valve Seat Angle		45°
Valve Spring 'Load at Length'	Inner	15 kg min. at 24.0 mm
	Outer	41 kg min. at 26.5 mm
Valve Clearance	In.	0.15 mm/0.10 mm
	Ex.	0.20 mm/0.15 mm
Valve Bucket Dia.		27.993 mm/27.987 mm
Valve Bucket Bore Dia.		28.021 mm/28.000 mm
Valve Timing — Inlet	Open	5° BTDC (@ 1.0 mm Lift)
	Close	34° ABDC (@ 1.0 mm Lift)
	Duration	219°
Exhaust	Open	37° BBDC (@ 1.0 mm Lift)
	Close	11° ATDC (@ 1.0 mm Lift)
	Duration	228°
Camshaft Journal Dia.		22.93 mm/22.90 mm
		22.936 mm/22.923 mm (Outrigger)
Camshaft Journal Clearance		0.12 Max
Camshaft Journal Bore Dia.		23.021 mm/23.000 mm
Camshaft End Float		0.13 mm/0.03 mm (0.2 mm max.)
Camshaft Run-out		0.05 mm max
Camchain Tensioner Spring Free Length		73.7 mm

Clutch/Primary Drive

Primary Drive	Type	Gear
	Reduction Ratio	1.75 (105/60)
Clutch	Type	Wet Multi-plate
No. of Friction Plates		9
Plate Flatness		0.15 mm (0.2 mm)
Friction Plate Thickness (new)		3.80mm - 0 +0.80mm
Friction Plate Thickness (service limit)		3.60mm
Clutch Shim Clearance		0.125 mm/0.075 mm
Clutch Actuation Method		Cable
Cable Free Play (at lever)		0.4 mm/0.8 mm

Full Specification — Tiger

Piston/Crankshaft

Cylinder Bore Dia.		76.030 mm/75.985 mm
Piston Dia. (at 90° to gudgeon pin)		75.975 mm/75.960 mm Cyl. Nos. 1 & 3
Service Limit		75.920 mm
		75.970 mm/75.960 mm Cyl. No. 2
Service Limit		75.900 mm
Piston Ring to Groove Clearance	Top	0.02 mm/0.06 mm
	Second	0.02 mm/0.06 mm
Piston Ring Groove Width	Top	1.03 mm/1.01 mm
	Second	1.03 mm/1.01 mm
	Oil	2.03 mm/2.01 mm
Piston Ring End Gap	Top	0.11 mm/0.26 mm
(new ring when fitted in bore)	Second	0.26 mm/0.41 mm
	Oil	0.20 mm/0.70 mm
Gudgeon Pin Bore Dia. In Piston		19.008 mm/19.002 mm
Gudgeon Pin Dia.		19.000 mm/18.995 mm
Connecting Rod Small End Dia.		19.034 mm/19.016 mm
Connecting Rod Big End Side Clearance		0.3 mm/0.15 mm (0.5 mm max.)
Crankshaft Big End Journal Dia.		40.960 mm/40.946 mm (40.932 mm min.)
Crankshaft Big End Bearing Clearance		0.066 mm/0.036 mm (0.1 mm max.)
Crankshaft Main Journal Dia.		37.976 mm/37.960 mm (37.936 mm min.)
Crankshaft Main Bearing Clearance		0.044 mm/0.020 mm (0.1 mm max.)
Crankshaft End Float		0.20 mm/0.05 mm (0.4 mm max.)

Transmission

Type		6 Speed Constant Mesh
Gear Ratios	1st	2.733 (41/15)
	2nd	1.947 (37/19)
	3rd	1.545 (34/22)
	4th	1.291 (31/24)
	5th	1.154 (30/26)
	6th	1.074 (29/27)
Gear Selector Fork Thickness		5.9 mm/5.8 mm (5.7 mm min.)
Gear Selector Groove Width		6.1 mm/6.0 mm (6.25 mm max.)
Gear Selector Fork to Groove Clearance		0.55 mm max.
Final Drive		Chain
Final Drive Ratio		2.666 (18/48)
Chain Type		Regina 136 ORP
No. of Links		116
20 Link Length		321 mm
Drive Chain Slack		35-40 mm
Chain lubrication		Mobil chain spray

Lubrication

Pressure Lubrication, Wet Sump	
Oil Capacity (dry fill)	4.00 litres
Recommended Oil	Fully synthetic 15w/40 oil meeting specification API/SH
Oil Pressure (in main gallery)	40.0 lb/in^2 min. (@ 80°C Oil Temp.) (@ 5000 rpm)
Oil Pump Rotor Tip Clearance	0.15 mm (0.2 mm max.)
Oil Pump Body Clearance	0.22 mm/0.15 mm (0.35 mm max.)
Oil Pump Rotor End Float	0.02 mm/0.007 (0.1 mm max.)

Ignition System

Type	Digital Inductive
Electronic Rev-Limiter	8750 rpm
Pick up Coil Air Gap	1.00 mm $\pm$ 0.2 mm
Pick up Coil Resistance	1.3 KΩ $\pm$ 10% @ 20°C
Ignition Coil Type	Plug-top
Spark Plug Type	NGK-DPR8EA-9
Spark Plug Gap	0.9 mm

Full Specification — Tiger

Full Specification	Tiger
Fuel System	
Fuel Type	Unleaded, 95 RON (U.S. 89 CLC/AKI)
Fuel Tank Capacity	23 Litres
Low Level Warning Lamp	3.5 litres remaining
Fuel Pump Type	Submerged
Fuel Pressure (nominal)	3 .0 Bar
Purge control system	Electronic via fuel system ECU
Fuel Injection System	
Type	Electronic, sequential
Idle Speed	1200 RPM
Injector Type	Twin pencil, solenoid operated plate valve
Throttle	Cable/twist grip/electronic throttle potentiometer
Control Sensors	Barometric Pressure Throttle Position, Crankshaft Position, Coolant Temperature Induction air temperature
Cooling System	
Coolant Mixture	50/50 Distilled Water/Anti-Freeze
Anti-Freeze Type	Mobil Antifreeze
Freezing Point	-35°C
Cooling System Capacity	2.8 Litres
Radiator Cap Opening Pressure	1.1 Bar
Thermostat Opening Temperature	85°C (nominal)
Cooling Fan Switch On Temperature	95°C
Temperature Gauge Sensor Resistance	2.9 - 3.3KΩ @ 15°C
Suspension	
Front Fork Travel	230 mm
Recommended Fork Oil Grade	Kayaba G10
Oil Level (fork fully compressed)	119 mm
Oil Volume (dry fill)	682cc
Front Fork Pull Through	Flush with upper face of top yoke
Rear Wheel Travel	200 mm
Rear Suspension Bearing Grease	Mobil Grease HP 222
Brakes	
Front type	Two hydraulically actuated two-piston calipers acting on twin discs
Caliper Piston Dia.	27 mm
Disc Dia.	310 mm
Disc Thickness	5.0 mm (4.5 mm minimum)
Disc Run-out	0.15 mm (0.3 mm max)
Master Cylinder Diameter	12.7 mm
Recommended Fluid	Mobil Universal Brake and Clutch Fluid DOT4
Rear Type	Hydraulically Actuated 2 Piston Caliper Single disc
Caliper Piston Dia.	27 mm
Disc Dia.	285 mm
Disc Thickness	6.0 mm (5.5 mm minimum)
Disc Run-out.	0.15 mm (0.3 mm max.)
Master Cylinder Diameter	14 mm
Recommended Fluid	Mobil Universal Brake and Clutch Fluid DOT4

Full Specification	**Tiger**
Wheels and Tyres	
Front Wheel Rim Axial Run-out	1.0 mm
Front Wheel Rim Radial Run-out	1.0 mm
Front Tyres	See owner's handbook
Front Tyre Pressure (cold)	2.5 kg/cm^2
Front Tyre Tread Depth min.	2.0 mm
Rear Wheel Rim Axial Run-out	1.0 mm
Rear Wheel Rim Radial Run-out	1.0 mm
Rear Tyres	See owner's handbook
Rear Tyre Pressure (cold)	2.9 kg/cm^2
Rear Tyre Tread Depth min.	2.0 mm - up to 80 mph (130 km/h) 3.0 mm - over 80 mph (130 km/h)

WARNING: Triumph motorcycles must not be operated above the legal road speed limit except in authorised closed course conditions.

Frame	
Frame Type	Twin-spar steel
Overall Length	2175 mm
Overall Width (to mirrors)	860 mm
Overall Height	1345 mm
Wheelbase	1550 mm
Seat Height	840-860 mm
Castor	28 °
Trail	92 mm
Dry Weight	215 kg
Max. Payload (rider, passenger, luggage & accessories)	207 kg
Electrical Equipment	
Battery Type	GS GTX14-BS
Battery Rating	12V - 12 Amp. hour
Alternator Rating	40A
Fuses #1	Fuel Pump, ECU
#2	Ignition control
#3	Fan
#4	Side and tail light
#5	Starter motor
#6	Instrument illumination
#7	Dip/main beam
#8	Dip/main beam (USA only)
#9	Stop lights & indicators
#10	Accessories

Torque Wrench Settings - Tiger

Cylinder Head Area

Application	Torque(Nm)	Notes
Cam cover to cylinder head	10	
Cam chain tensioner to crankcase	10	
Cam chain tensioner centre bolt	23	
Camshaft bearing caps to head	10	
Camshaft sprocket to camshaft	15	
Cam chain tensioner blade to crankcase	18	
Cam chain top pad to head	10	
Cylinder head to crankcase (M6 screws)	12	
Cylinder head to crankcase bolts	See Text	

Clutch

Application	Torque(Nm)	Notes
Clutch cover to crankcase	9	
Clutch centre nut	105	
Clutch pressure plate to centre	10	
Clutch cover sound suppression plate to cover	12	
Clutch lever pivot pin	6	
Clutch lever pivot pin locknut	3	

Balancer, Crankshaft and Crankcase

Application	Torque(Nm)	Notes
Crankcase upper to lower (M8 fixings)	See Text	
Crankcase upper to lower (M6 fixings)	See Text	
Balancer bearing caps	See text	
Balancer retaining bolt	40	
Connecting rod big end nut	See Text	
Crankshaft sensor disc to crankshaft	22	
Crankshaft sensor mounting plate to crankcase	10	
Breather disc to crankshaft	7	

Engine Covers

Application	Torque(Nm)	Notes
Crankshaft cover to crankcase	9	
Sprocket cover to crankcase	9	
Clutch cover to crankcase	9	
Oil sight glass to clutch cover	5	
Clutch cover sound suppression plate to cover	12	
Water outlet cover to cylinder head	9	

Transmission

Application	Torque(Nm)	Notes
Output sprocket to output shaft	132	
Detent wheel to selector drum	12	
Detent arm stud	9	
Detent arm nut	9	
Selector drum bearing retaining screw	12	
Stop plate to crankcase	9	
Selector shaft retainer	6	
Spring abutment bolt	28	
Alternator drive gear/housing to spindle	40	

Lubrication System

Application	Torque(Nm)	Notes
Sump to crankcase	12	
Sump drain plug to sump	25	
Oil pressure relief valve to crankcase	15	
Low oil pressure warning light switch to crankcase	13	
Oil filter to adapter	10	
Oil feed pipe to cylinder head	25	Use new washers
Oil cooler connections to sump	25	Use new washers
Oil cooler connections to cooler	25	Use new washers
Oil cooler to radiator mountings	9	
Oil pump to crankcase	12	

Final Drive

Application	Torque(Nm)	Notes
Rear sprocket to cush drive	85	
Chain guard to swinging arm	7	
Chain rubbing strip to swinging arm	9	

Cooling System

Application	Torque(Nm)	Notes
Water pump to crankcase	10	
Thermostat housing to frame	8	
Thermostat front housing to rear	7	
Radiator to frame	9	
Water elbow to cylinder head	12	
Coolant Drain Plug	13	Use a new washer

Fuel System and Airbox

Application	Torque(Nm)	Notes
Fuel tank to frame	9	
Fuel cap to fuel tank	3	
Fuel pump mounting plate to fuel tank	5	Never overtighten
Fuel pump clamp screw	4	
Fuel hose link pipe clamp screw	6	
Throttle body to cylinder head	12	
Throttle potentiometer to throttle body	2	
Fuel feed/return pipe connections to fuel rail	5	
Fuel rail to throttle bodies	5	
Exhaust mounting bracket to frame	15	
Airbox to bracket	5	
Oxygen sensor to exhaust system	40	

Wheels

Application	Torque(Nm)	Notes
Front wheel spindle/axle bolt	60	
Rear wheel spindle/axle bolt	85	

Rear Suspension

Application	Torque(Nm)	Notes
Swinging arm spindle bolt	85	
Rear hub/eccentric adjuster clamp bolt	35	
Rear suspension unit upper mounting bolt	95	
Rear suspension unit lower mounting bolt	48	
Pre-load adjuster to frame	9	

Front Suspension

Application	Torque(Nm)	Notes
Upper yoke pinch bolt	20	
Lower yoke pinch bolt	20	
Fork top cap to inner tube	30	
Upper yoke centre nut	65	
Damping cylinder bolt	25	
Handlebar to top yoke	26	

Brakes

Application	Torque(Nm)	Notes
Front brake lever pivot screw/nut	6	
Front brake caliper to fork	28	
Front brake pad retaining pin	18	
Front brake caliper bleed screw	5	
Front brake hose to caliper	25	Use new washers
Front brake master cylinder to handlebar	15	
Front brake hose to master cylinder	25	
Front brake disc to wheel	22	
Rear brake caliper to carrier	28	
Rear brake pad retaining pin	18	
Rear brake caliper bleed screw	5	
Rear brake hose to caliper	25	
Rear brake master cylinder to frame	27	
Rear brake master cylinder reservoir to mudguard	3	
Rear brake hose to master cylinder	25	
Rear brake disc to wheel	22	

Footrests, Control Plates and Engine Mountings

Application	Torque(Nm)	Notes
Upper crankcase to frame	95	
Lower crankcase to frame	95	
Cylinder head to frame	95	
Right hand control plate to frame	27	
Left hand control plate to frame	27	
Side stand mounting bracket	40	
Side stand pivot bolt	20	

Electrical

Application	Torque(Nm)	Notes
Alternator to crankcase	20	
Alternator drive to alternator	44	
Starter motor to crankcase	10	
Side stand switch to bracket	5	
Instruments housing to cockpit subframe	9	

Bodywork

Application	Torque(Nm)	Notes
Front mudguard to fork - front section	9	
Front mudguard to fork - rear section	7	
Front mudguard front section to rear section	3	
Side panels to frame	5	
Top rack to frame (M8 bolts)	27	
Top rack to frame (M6 bolts)	10	
Side panel	5	
Cockpit to brackets	5	

MAINTENANCE

CONTENTS

Page

INTRODUCTION

This maintenance schedule given overleaf describes the maintenance requirements for the Tiger model.

WARNING: The importance of good maintenance cannot be overestimated. The tasks described will help to ensure the safe and reliable operation of your Triumph motorcycle. Never attempt to cut costs by neglecting the maintenance requirements of your machine as this will result in the premature failure of the component(s) concerned and may lead to an unsafe riding condition and an accident.

Service Check Sheets

Triumph are pleased to be able to offer pads of service check sheets to aid technicians during servicing of Triumph motorcycles. Each pad has 50 single sided service sheets which have tick boxes to indicate the correct maintenance requirement at each mileage interval.

The pads are available from your Triumph parts department under the following part numbers:

T3854095 - Service Sheet Pad, English Language

T3854096 - Service Sheet Pad, French Language

T3854097 - Service Sheet Pad, German Language

SCHEDULED MAINTENANCE REQUIREMENTS - ALL FUEL INJECTED MODELS

Carry out all the operations specified below at the required intervals. Additional operations must be carried at the specified time/mileage interval whichever comes first.
IMPORTANT: under severe operating conditions, certain items require more frequent servicing, refer to the Owner's handbook for further information.

☑ = Complete

* Whichever comes first

First 500 Miles/800 Kms/1 Month*	Every 6000 miles/10000 Kms/1 Year*	Every 12000 miles/20000 Kms/2 Years*	Every 18000 miles/30000 Kms/3 Years*	Every 24000 miles/40000 Kms/4 Years*	No.	Operation
☐	☐	☐	☐	☐	1.	Position motorcycle in a position for repair. Ensure that the motorcycle is safely supported on/by any lifting equipment used.
☐	☐	☐	☐	☐	2.	Check lights, horn, indicators, instrument warning lights, brake lights and instruments for correct operation.
☐	☐	☐	☐	☐	3.	Check engine management system for stored diagnostic trouble codes.
		☐		☐	4.	Disconnect battery, negative (black) lead first. Remove bodywork, fuel tank and airbox as necessary. Always store displaced bodywork safely to prevent accidental damage and observe the fuel handling precautions in the service manual.
☐	☐	☐	☐	☐	5.	Check/adjust battery electrolyte level (Yuasa batteries only).
☐	☐	☐	☐	☐	6.	Inspect fuel system and hoses for leaks damage, cracks, deterioration and chafing.
		☐		☐	7.	Renew fuel filter.
☐	☐	☐	☐	☐	8.	Inspect cooling system and hoses for signs of leaks, damage, chafing, cracks and deterioration. Visually inspect hose clips for security.
☐	☐	☐	☐	☐	9.	Inspect for oil leaks from all areas including oil cooler, oil cooler pipes and engine area.
☐	☐	☐	☐	☐	10.	Add 50% coolant mixture to the expansion tank as necessary. Do not overfill.
☐	☐	☐	☐	☐	11.	Inspect throttle cable for damage, fraying and for correct level of free play. Adjust if necessary.†
☐	☐	☐	☐	☐	12.	Inspect brake pads for wear.
☐	☐	☐	☐	☐	13.	Check and top up both brake master cylinders.
☐	☐	☐	☐	☐	14.	Check and adjust clutch cable.
		☐		☐	15.	Renew air cleaner element.
☐	☐	☐	☐	☐	16.	Inspect wheels for cracks, kerb damage etc.
☐	☐	☐	☐	☐	17.	Inspect tyres for damage, tread wear, bulges, cuts and splits. Check/adjust tyre inflation pressures.
☐	☐	☐	☐	☐	18.	Remove sump plug and allow oil to drain out.
☐	☐	☐	☐	☐	19.	Renew the sump plug washer and refit sump plug.
☐	☐	☐	☐	☐	20.	Renew the engine oil filter.
☐	☐	☐	☐	☐	21.	Refill the engine with correct specification engine oil.
		☐			22.	Adjust spark plug gaps.
				☐	23.	Renew spark plugs.
		☐		☐	24.	Check all valve clearances, adjust as necessary.†
☐	☐	☐	☐	☐	25.	Inspect drive chain for wear.††
☐	☐	☐	☐	☐	26.	Inspect drive chain for correct adjustment. (also to be checked every 500 miles)
☐	☐	☐	☐	☐	27.	Lubricate drive chain. (also to be checked every 200 miles)
		☐		☐	28.	Lubricate rear wheel bearing (not Tiger)
		☐		☐	29.	Raise front wheel off the ground and inspect steering head (headstock) bearings for free play. Lower the front wheels to the ground when complete.
☐	☐	☐	☐	☐	30.	Check steering for free operation.
☐	☐	☐	☐	☐	31.	Inspect front forks for oil leaks/damage/smooth operation.
		☐		☐	32.	Lubricate the headstock bearing.
		☐		☐	33.	Renew fork oil.
		☐		☐	34.	Temporarily fit slave fuel supply.
		☐		☐	35.	Attach exhaust extraction equipment, refit the battery and start the engine. Check that low oil pressure warning light extinguishes. Stop the engine. Check and adjust the engine oil level.
		☐		☐	36.	Attach vacuum gauges to each throttle body. Start the engine and allow to reach normal operating temperature. Check/adjust the throttle body vacuum synchronisation.
		☐		☐	37.	Download latest tune software version to ECM then adjust idle CO setting (not closed loop catalyst models)
		☐		☐	38.	Reset the adaptive stepper position (not closed loop catalyst or pre 99 model-year models)
☐	☐	☐	☐	☐	39.	Visually inspect all fixings for security. Tighten to the correct torque as necessary.
		☐		☐	40.	Refit all items removed during operation 4.
		☐		☐	41.	Renew the pressure control valve in the evaporative loss control system. *(U.S. California models only).*
☐	☐	☐	☐	☐	42.	Carry out road test (minimum 15 km/10 miles).

Additional Operations

The following additional operations must be carried out at the specified time/mileage interval whichever comes first.

Every 2 years/12,000 miles/20,000 Km

☐ 1. Renew all brake master cylinder, and brake caliper pressure and dust seals.

☐ 2. Renew brake fluid.

☐ 3. Renew coolant. Ensure 50% coolant mixture is maintained.

Every 3 years

☐ 1. Lubricate the swinging arm bearings.

Every 4 years/24,000 miles/40,000Km

☐ 1. Renew all brake hoses.

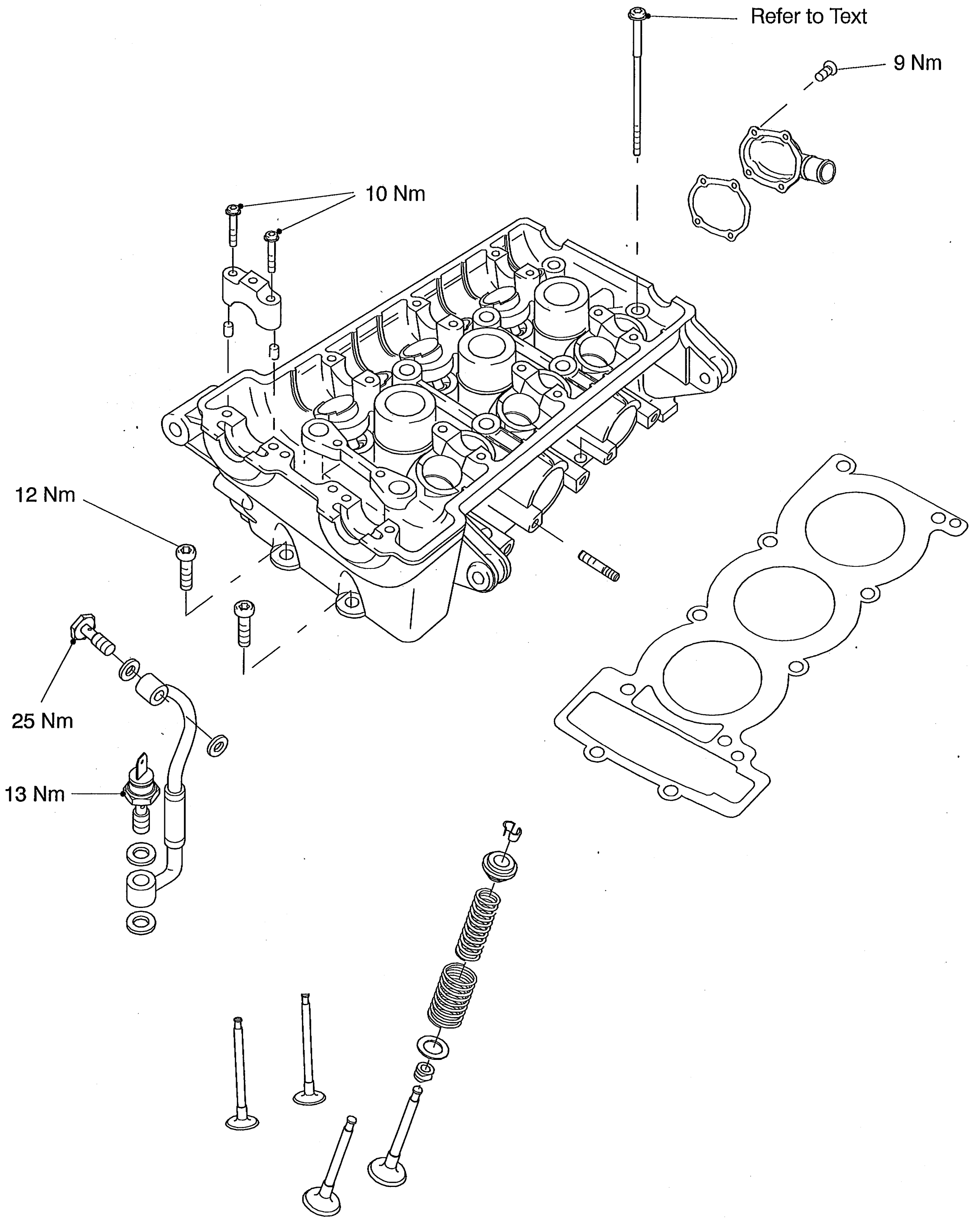
† Adjustments subject to additional charge above basic cost of servicing.
†† Renew drive chain if worn to or above the service limit..

CYLINDER HEAD

CONTENTS

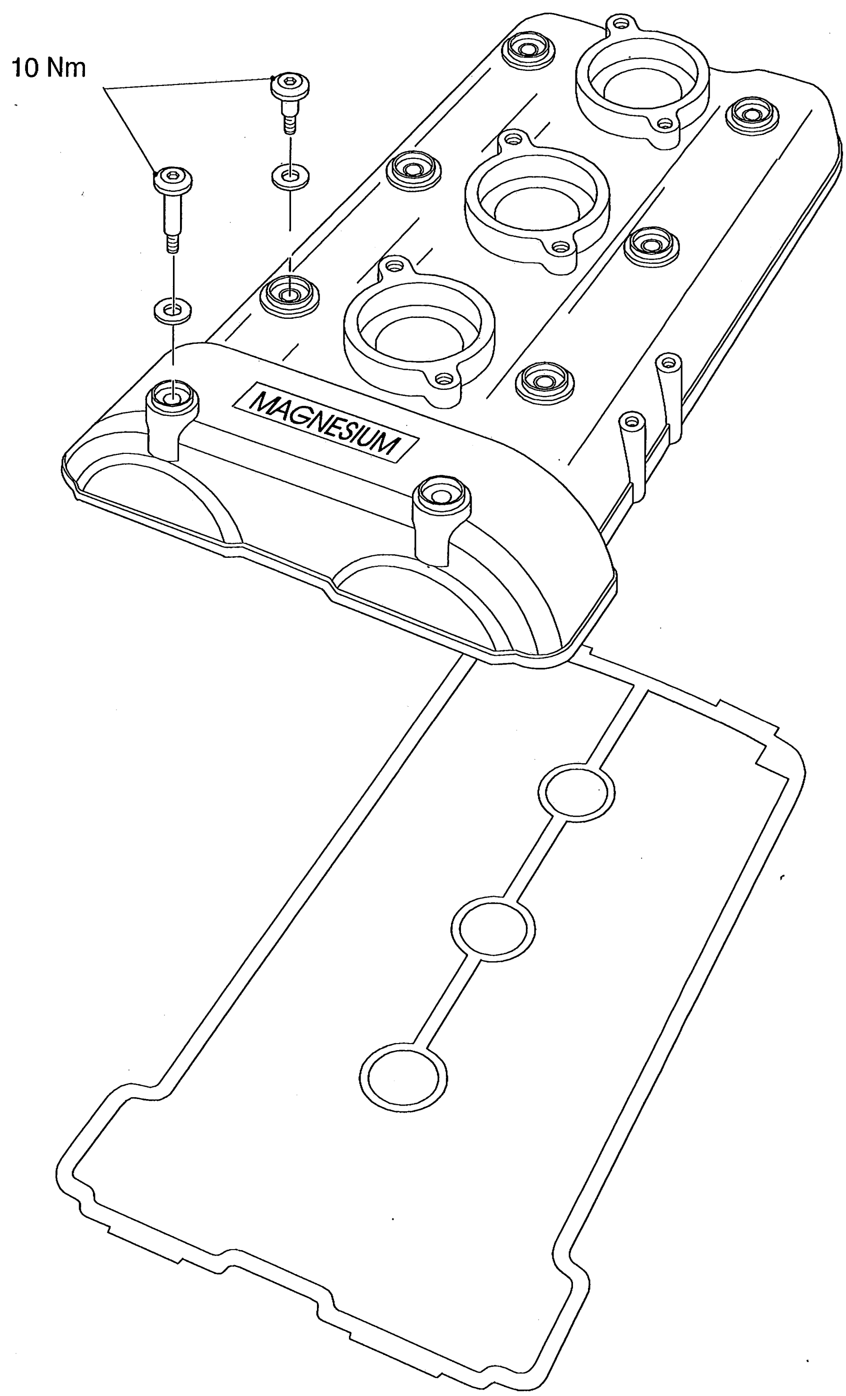
Exploded View

Cylinder Head and Valves



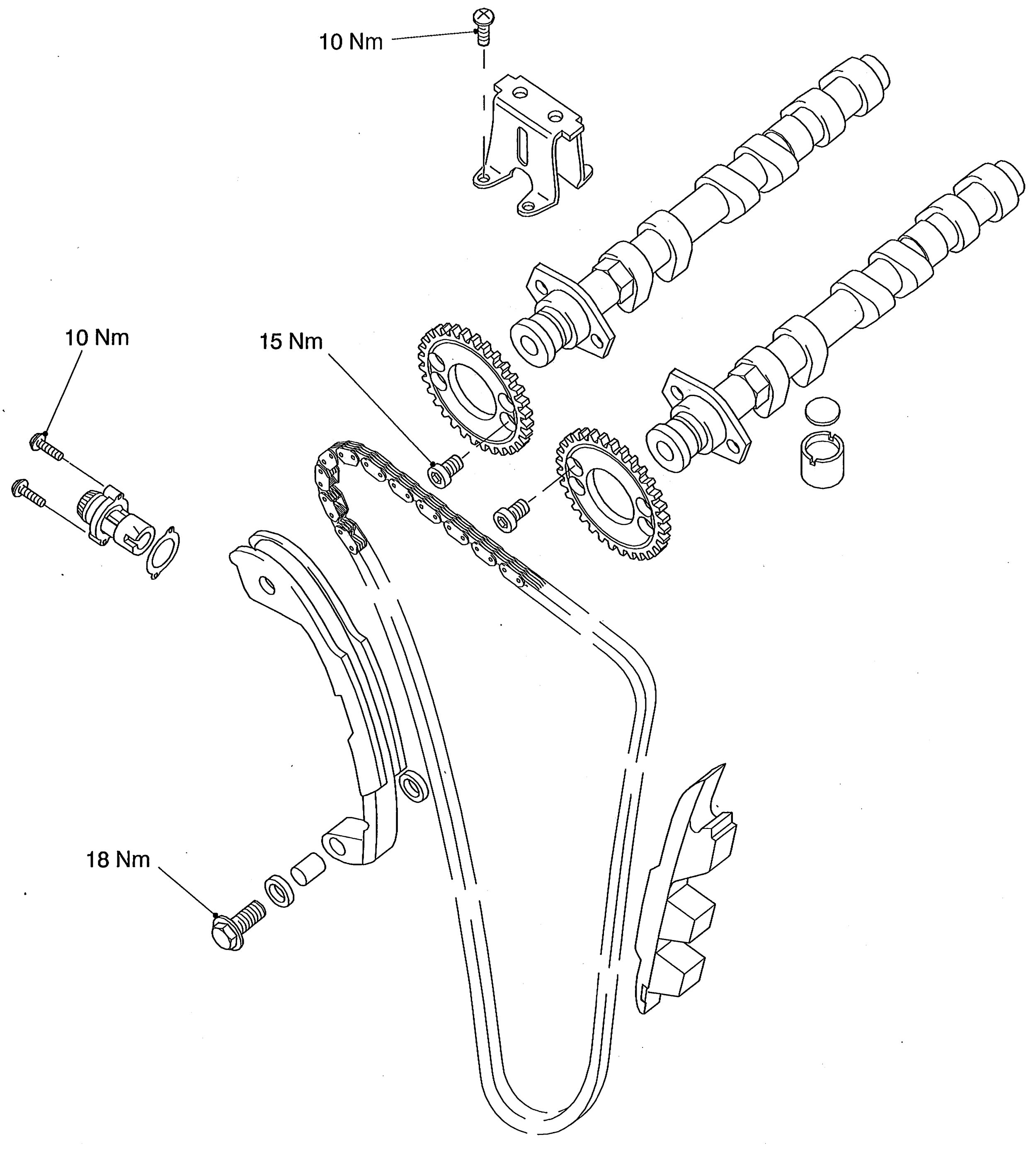
Exploded View

Cam Cover



Exploded View

Camshaft and Camshaft Drive



CYLINDER HEAD DESCRIPTION

The engine is fitted with an aluminium alloy cylinder head which carries the camshaft, valves and spark plugs. The cylinder head is cast as a single entity and various components are permanently added after machining.

The camshafts run directly in the head without additional bearings. Valve clearances are adjusted by changing variable thickness shims which sit between the valve tappet and the camshaft.
The camshafts are driven by a silent-type chain.
The chain is tensioned by a spring loaded device fitted in the upper crankcase, and is guided by two rubber blades.

Oil is supplied to the head by an external feed pipe which is situated at the right hand rear side of the head. Once supplied to the head, the oil is distributed along internal drillings within the head casting and camshaft.

Dual valve springs are used to close the inlet and exhaust valves. These valve springs have close wound coils at one end to assist in the prevention of valve bounce at high engine speed and to give a smooth valve actuation. When assembling the cylinder head it is important that the close wound, colour coded ends of the springs are fitted downwards (towards the piston). Both the tip and seating face of the valves are hardened to give a long service life.

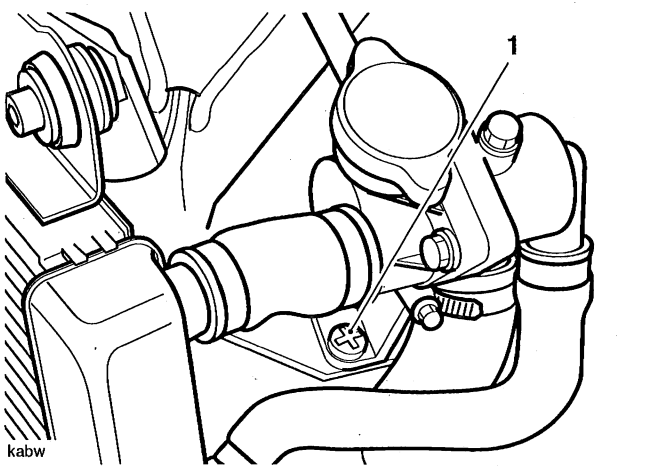
Due to the methods used to assemble the valve seats and valve guides to the head, these parts cannot be replaced.

⚠ CAUTION: In any of the following operations which necessitate the removal or disconnection of the cam chain, NEVER turn the engine without the cam chain and tensioner correctly fitted and adjusted. In the disassembled condition, the pistons will contact the valves if the crankshaft is turned, causing severe engine damage.

CAM COVER

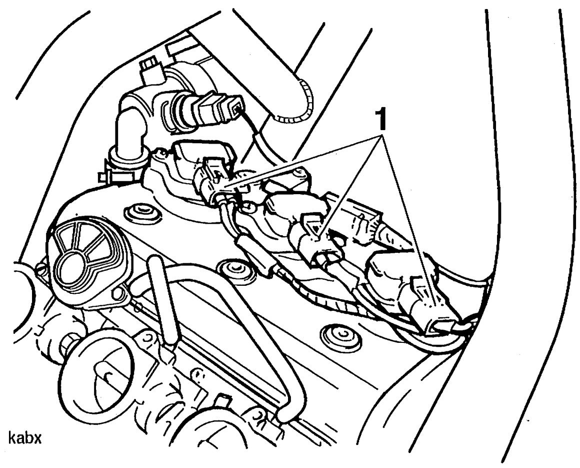
Removal

1. Remove the seats and disconnect the battery, negative (black) lead first.
2. Remove the fuel tank and airbox as detailed in the fuel system section.
3. Release the screw securing the thermostat housing to its support bracket.



1. Thermostat Housing Securing screw

4. Disconnect the electrical connections to the ignition coils, then remove the coils from the cam cover.

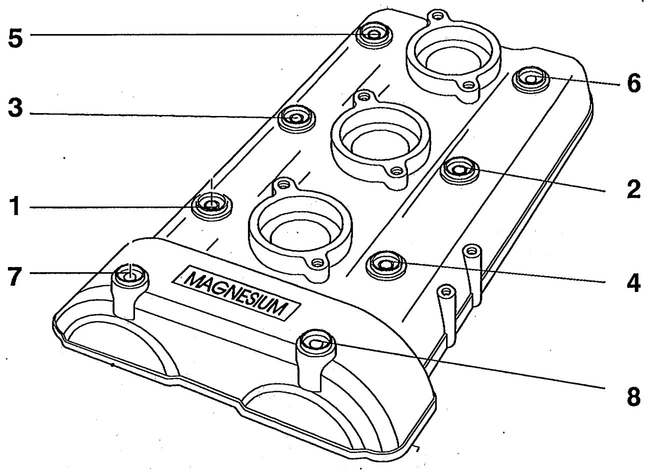


1. Coil Connections

5. Progressively release the cam cover bolts in the sequence shown below.

NOTE:

- **Two longer bolts are fitted at the right hand end adjacent to the cam chain.**



Cam Cover Bolt Release Sequence

6. Remove the cover.

> ⚠ **CAUTION: Never use a lever to remove the camshaft cover from the head.**
>
> **Using a lever will cause damage to the head and cam cover which could lead to an oil leak.**

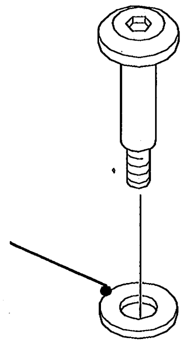
7. Remove the cam cover gasket.

8. Remove any residual oil from the front of the head using a syringe or lint free cloth.

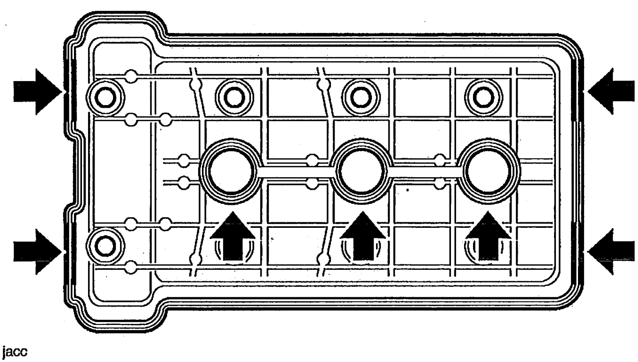
Installation

1. Check the condition of the cam cover seal. Refit/replace as necessary.

2. Check the condition of the cam cover bolt seals. Refit/replace as necessary.



3. Apply silicone sealer to the areas arrowed below.



Silicone Sealer Areas

4. Fit the cam cover, ensuring that the gasket remains in the correct position. Pay particular attention to the spark plug tower areas.

5. Fit the cam cover screws and screw seals, then tighten until finger tight.

6. Finally, tighten the cam cover screws, in same order as for removal, to **10 Nm.**

7. Fit the ignition coils and tighten the coil fixings to **10 Nm.**

8. Reconnect the ignition coils.

9. Refit the thermostat housing.

10. Refit the airbox and fuel tank as described in the fuel system section.

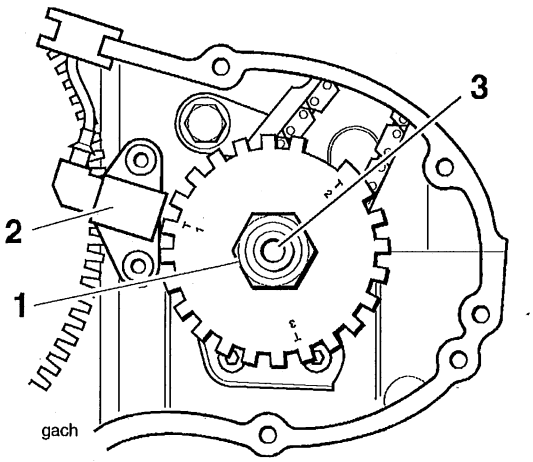
11. Reconnect the battery positive (red) lead first.

12. Refit the seats.

CAM CHAIN TENSIONER

Removal

1. Remove the cam cover as described earlier in this section.
2. Drain the engine oil into a suitable container.
3. Remove the clutch cover to give access to the ignition rotor.

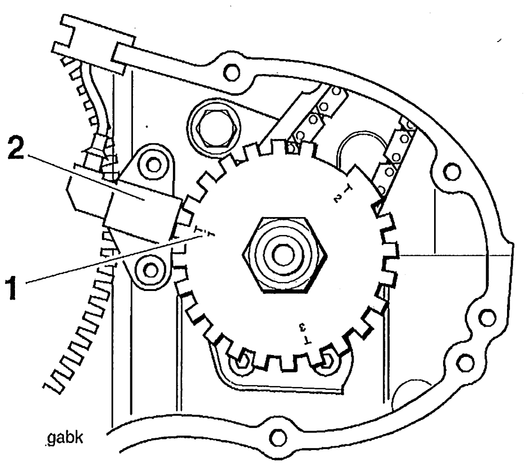


1. Crankshaft Rotor Clamp Nut

2. Crankshaft Position Sensor

3. Centre Bolt

4. Rotate the crankshaft clockwise (the normal direction of rotation), using the nut fitted to the end of the crankshaft. Stop rotation when number 1 cylinder is at top dead centre (TDC), that is when the 'T1' mark on the crankshaft rotor aligns with the crankshaft position sensor.

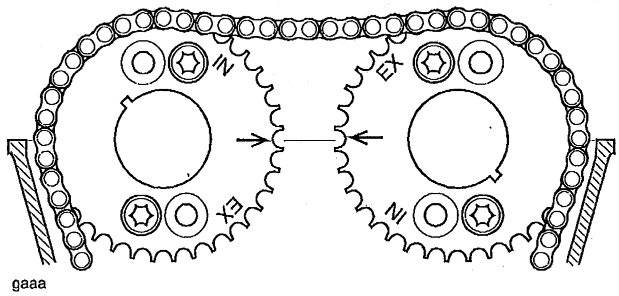


1. 'T1' Mark

2. Crankshaft Position Sensor

NOTE:

- **In addition to the crank sensor/wheel alignment, at TDC, the alignment marks on the camshaft sprockets will point inwards at a point level with the joint face.**



Camshaft to Cylinder Head Alignment Marks

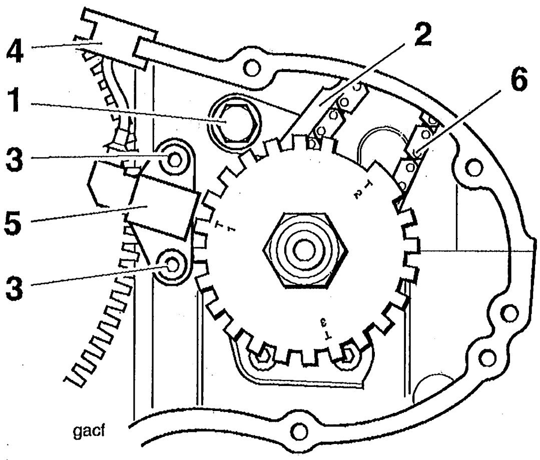
5. Place a suitable wedge between the tensioner blade and crankcase, to hold the cam chain taut during removal of the tensioner.
6. Carefully remove the centre nut from the tensioner and withdraw the tensioner spring.

WARNING: The tensioner centre nut is under spring tension. Always wear hand, eye and face protection when withdrawing the centre nut and take great care in order to minimise the risk of injury and loss of components.

7. Remove the bolts securing the tensioner to the upper crankcase and remove the tensioner and gasket.

Installation

1. Check that number 1 cylinder is still at top dead centre (TDC).
2. Ensure that the wedge fitted earlier is still holding the tensioner blade in contact with the timing chain. Check that the camshaft timing marks point inwards and are level with the line of the head.



1. Tensioner Blade Retaining Bolt

2. Tensioner Blade

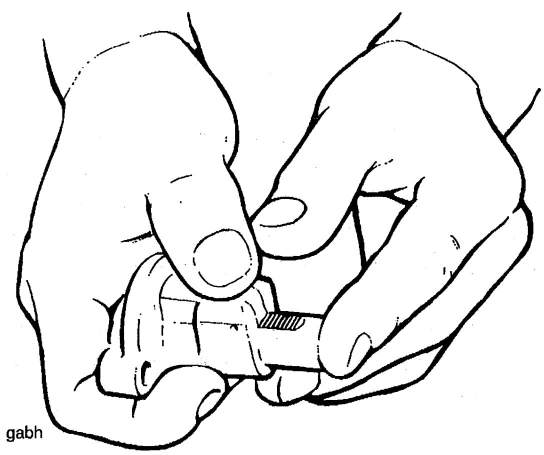
3. Sensor Screws

4. Grommet

5. Crankshaft Position Sensor

6. Cam Chain

3. Set the tensioner plunger onto the first tooth of the ratchet (i.e. minimum extension) by manually lifting the tensioner pawl.



Tensioner Plunger Set-up

4. Fit the tensioner, complete with a new gasket, to the upper crankcase and tighten the retaining bolts to **9 Nm.**

5. Remove the tensioner blade wedge, taking care not to move or damage the tensioner blade.

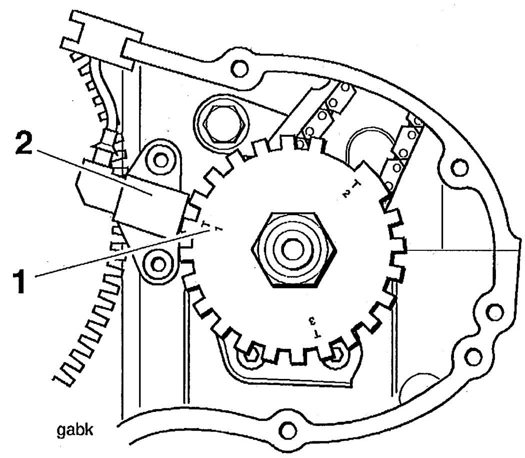
6. Fit a new sealing washer to the centre nut. Using finger pressure only, push the ratchet section of the tensioner into firm contact with the tensioner blade. Refit the spring and centre nut to the tensioner. Tighten the centre nut to **23 Nm.**

7. Check that the tensioner plunger is correctly located in the middle of tensioner blade when viewed from above.

8. Rotate the engine through 4 full revolutions, and reset number 1 cylinder to TDC. Ensure that the 'T1' mark on the crankshaft rotor is aligned with the crankshaft position sensor.

NOTE:

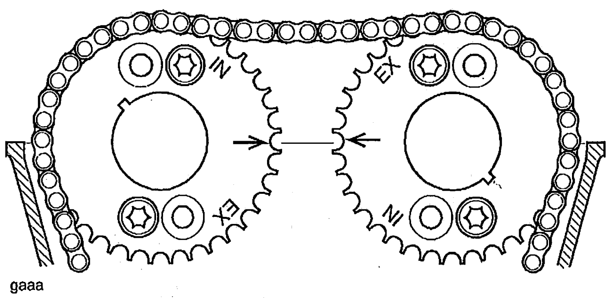
- **Depending on the engine configuration, with the camshaft arrows aligned as shown, the 'T1' mark on the crankshaft may align with the crankshaft position sensor at either the rear, centre or front edge of the gear tooth. Any of those alignment positions can be considered to be correct.**



1. Ignition Rotor

2. Crankshaft Position Sensor

9. Re-check that the camshaft timing marks align as illustrated below.



Camshaft to Cylinder Head Alignment Marks

10. Re-check tensioner plunger location against the tensioner blade.

11. Refit the cam and clutch covers.

12. Refill/adjust the engine oil level.

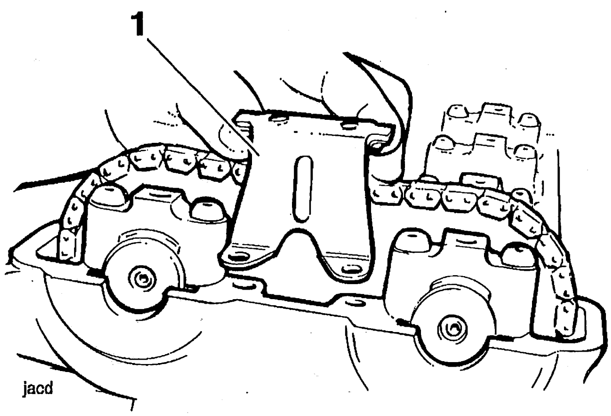
CAMSHAFTS

Removal

NOTE:

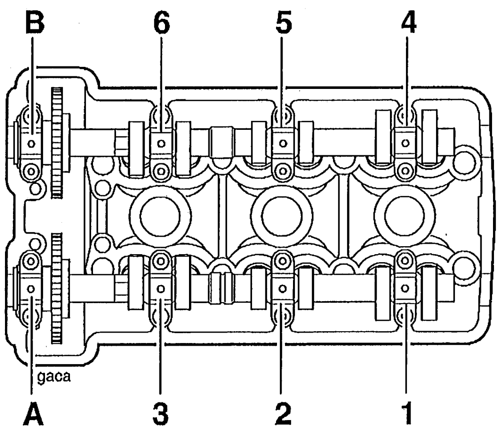
- **The camshafts can be removed from the head without the complete removal of the cam chain. However, the chain must first be detached from the camshafts. The camshafts and sprockets are removed as an assembly.**

1. Remove the cam cover and cam chain tensioner as described earlier in this section.
2. Remove the cam chain top pad from the cam chain side of the cylinder head.



1. Cam Chain Top Pad

3. To ensure that the camshaft caps are refitted in the same positions as prior to removal, mark the position of each camshaft cap in relation to the head. A laundry marker or similar may be used to mark the cap positions.



Camshaft Cap Numbering

NOTE:

- **The caps are numbered sequentially and must not be interchanged for a different position on the head. The camshaft caps on the outside of the timing chain (known as outriggers) are marked 'A' for the exhaust and 'B' for the inlet.**

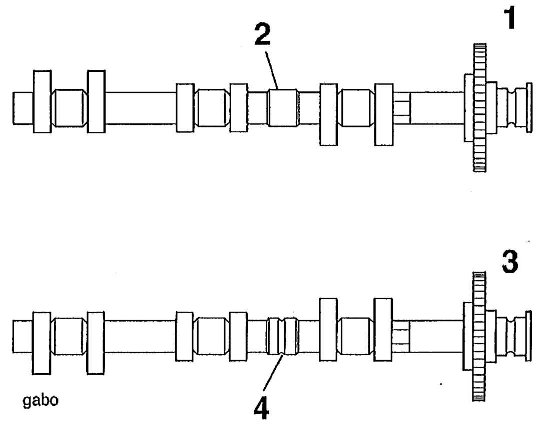
4. Progressively release each of the fasteners securing the camshaft caps of the inlet camshaft to the cylinder head.
5. Release the caps for the exhaust camshaft.

> **CAUTION: Never completely release one camshaft cap in isolation from the others as this may cause the caps to crack.**
>
> **Always progressively release all the camshaft caps of one camshaft before final removal.**

> **CAUTION: Always completely release and remove one camshaft before starting to release the other. If both camshafts are progressively released at the same time, the valves may contact each other and cause damage to the valve head areas and valve stems.**

NOTE:

- **The inlet and exhaust camshafts are different. They can be identified by a plain area in the centre of the exhaust cam and a groove in the same place on the inlet cam.**



1. Exhaust Camshaft

2. Plain Section

3. Inlet Camshaft

4. Grooved section

6. Once the pressure on all the camshaft caps has been released, remove the fasteners and caps complete with dowels.

NOTE:

- **Each cap is located by two dowels which align the cap to the head. If the caps cannot be removed using hand pressure, gently tap each cap with a soft faced tool to release.**

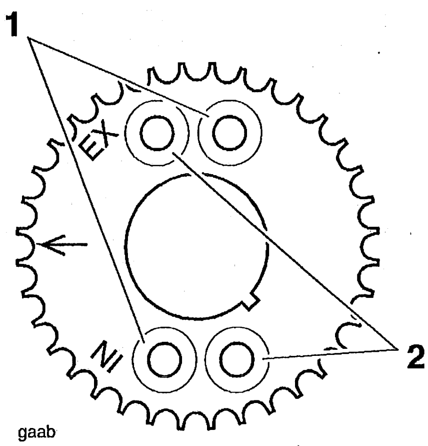
7. Lift the cam chain from the exhaust camshaft sprocket and remove the exhaust camshaft.
8. Repeat the procedure for the inlet camshaft.

Camshaft and Bearing Cap Inspection

1. Inspect the camshaft sprockets for damaged and worn teeth. Replace as necessary.

CAUTION: The same sprocket is used for both inlet and exhaust camshafts. To attach the sprocket to the different camshafts, different bolt holes are used.

Never fit a camshaft sprocket to a camshaft using incorrectly identified bolt holes. Severe engine damage will result from incorrect attachment.



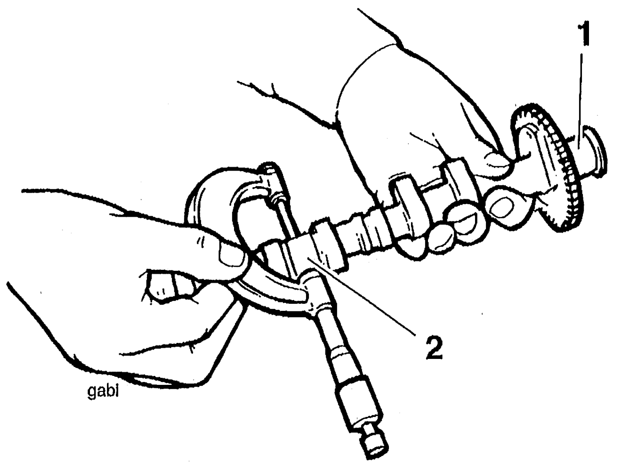
1. Inlet Camshaft Bolt Holes

2. Exhaust Camshaft Bolt Holes

2. Measure the camshaft journals with a micrometer or vernier. If any journal is outside the specified tolerance, replace the camshaft.

Outrigger Journal Diameter
Standard: 22.923 - 22.936 mm

Standard Journal Diameters
Standard: 22.93 mm



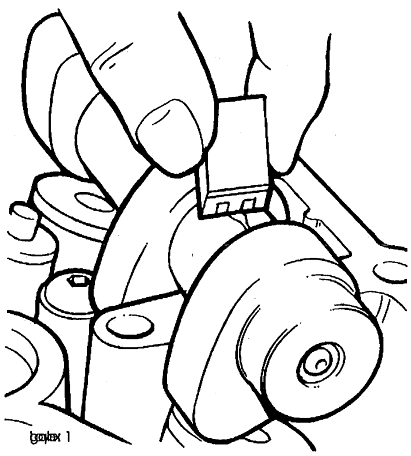
1. Outrigger Journal

2. Standard Journal

3. Examine all camshaft and camshaft bearing caps for excessive wear and damage, paying particular attention to the outrigger caps.
4. Check the journal-to-head clearances, using 'Plastigauge' (Triumph part number 3880150-T0301) as follows:
   - Ensuring that the camshaft sprocket alignment marking is located as for removal, assemble one camshaft to the head and progressively tighten the bearing caps to **10 Nm.**
   - Remove one bearing cap only and wipe the exposed areas of both the camshaft journal and cap.
   - Apply a thin smear of grease to the journal and a small quantity of silicone release agent to the cap.
   - Size a length of the Plastigauge to fit across the camshaft journal. Fit the Plastigauge to the journal using the grease to hold the strip in place.
   - Refit the cap and evenly and progressively tighten all the camshaft cap bolts to **10 Nm.**
   - Release the cap bolts and remove the cap. Using the gauge provided with the Plastigauge kit, measure the width of the now compressed Plastigauge..

NOTE:

- **The camshaft caps are unique to each cylinder head and are, therefore, not available individually. If a camshaft cap is worn or damaged, the complete cylinder head must be replaced.**



Measuring The Compressed Plastigauge.

5. Calculate the journal clearance using the Plastigauge chart supplied with the Plastigauge kit.

6. If the clearance measured is within the specified tolerance, remove the cap and clean off all traces of Plastigauge. Assemble the camshafts as described in this section.

NOTE:

- **If the measured clearance is outside the tolerance, and the camshaft journals are within tolerance, the cylinder head must be replaced.**

CAUTION: Although Plastigauge is oil soluble, all traces of the material must be removed to prevent blockage of the oil drillings and resultant engine damage.

Installation

1. Thoroughly clean the camshafts and journals. Inspect the ends of the camshafts for correct fitment of the sealing plugs. Lubricate the camshafts with clean engine oil before fitting to the head.

2. Locate each camshaft to the head ensuring the camshafts are correctly identified (inlet and exhaust) and also correctly located over their respective valve banks.

3. Working on one camshaft at a time, locate the cam chain over the cam sprocket. Position the camshaft in the same position as for removal **before attempting to fit the caps** (that is, with the timing marks on the camshaft sprockets level and pointing inwards, and with the crankshaft position sensor in line with the 'T1' mark on the crank rotor.

4. Repeat the procedure for the other camshaft.

CAUTION: If the camshafts and caps are fitted without first aligning the timing marks on both the crankshaft and camshaft sprockets, or if both camshafts are fitted at the same time, the inlet and exhaust valves will contact each other causing damage to both the head and the valves.

5. Lubricate the threads of the camshaft cap screws with engine oil and evenly and progressively tighten to **10 Nm**.

6. Before fitting the cam chain tensioner, ensure that each camshaft rotates freely. **Do not rotate either camshaft by more than 5°.**

CAUTION: If any components have been renewed, the valve clearances must be checked and adjusted. Running with incorrectly adjusted valve clearances may cause excess engine noise, rough running and engine damage.

7. Refit the top pad and tighten the fixings to **10 Nm.**

8. Assemble the cam chain tensioner using the instructions given earlier in this section.

9. Check the valve clearances. Adjust as necessary.

10. Refit the engine covers, coils, airbox, fuel tank etc. as described earlier in this section.

VALVE CLEARANCES

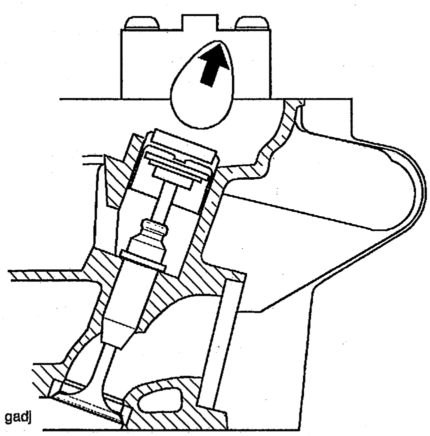
Camshaft, valve, valve shim and valve seat wear affects the valve clearances. The effect of this wear is to change the gap between the camshaft and valve shim, causing engine noise and improper running. If the valve clearances become too small, permanent damage to the valve and valve seat will take place. If the valve clearance becomes too great, the engine will become noisy and will not run correctly.

VALVE CLEARANCE MEASUREMENT

NOTE:

- **Valve clearance measurement must be carried out with the engine cold.**

1. Remove the cam cover as previously described in this section.
2. Remove the spark plugs to reduce compression resistance when turning the engine.
3. Select a high gear and, using the rear wheel, turn the engine until a pair of camshaft lobes are positioned pointing away from the valves.



Cam Lobe Pointing Away From Valve

4. Using feeler gauges, measure and record the clearances **for this pair of valves only.**
5. Repeat the process until the valve clearances for all valves have been checked.

NOTE:

- **If the measurement does not fall within the specified range, adjustment must be made.**

NOTE:

- **The correct valve clearances are in the range given below.**

INLET	0.10 - 0.15 mm
EXHAUST	0.15 - 0.20 mm

CAUTION: If the valve clearances are not checked and corrected, wear could cause the valves to remain partly open, which lowers performance, burns the valves and valve seats and may cause serious engine damage.

6. Record the measured valve clearances on a chart similar to the example shown below.

NOTE:

- **Number 1 valve is situated on the left hand side of the motorcycle.**

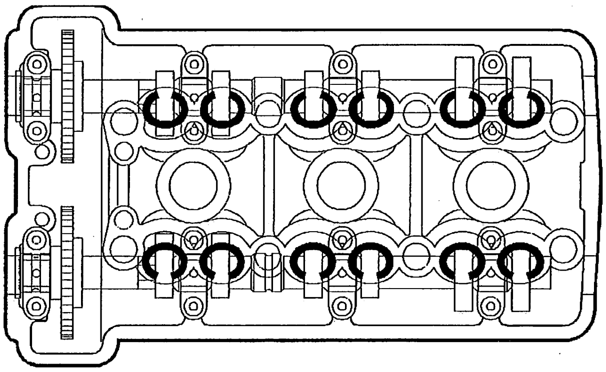
Typical Valve Clearance Chart

Inlet Valve Nº	Gap Measured
1	as measured (mm)
2	as measured (mm)
3	as measured (mm)
4	as measured (mm)
5	as measured (mm)
6	as measured (mm)
Exhaust Valve Nº	Gap Measured
1	as measured (mm)
2	as measured (mm)
3	as measured (mm)
4	as measured (mm)
5	as measured (mm)
6	as measured (mm)

VALVE CLEARANCE ADJUSTMENT

Valves are adjusted, in pairs, using tool T3880012 to hold the valve open during shim removal and replacement.

1. Rotate each tappet bucket until the slots in the buckets are positioned such that they are pointing to the outside of the head.

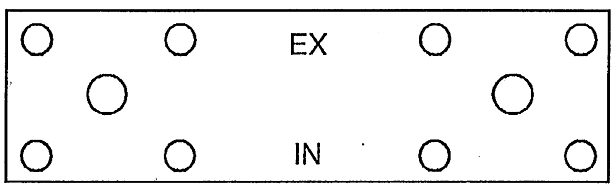


Buckets Positioned to outside of head

2. Remove the spark plugs to reduce compression resistance. Engage a high gear and, with the aid of an assistant, rotate the engine by turning the rear wheel forward until the pair of valves to be adjusted are fully open. Take care to ensure that the tappet buckets do not turn during opening.

NOTE:

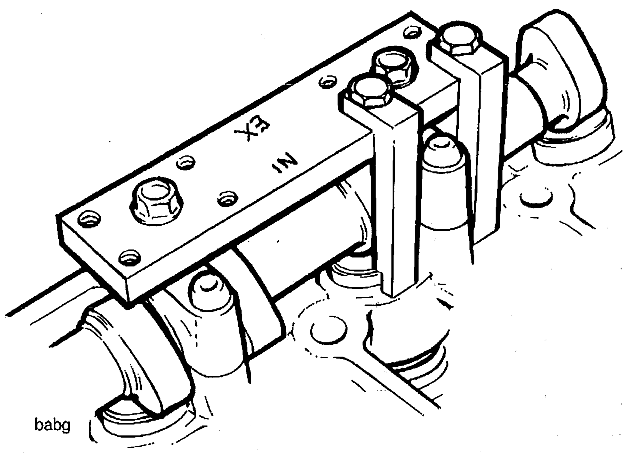
- **The tool mounting plate is marked 'IN' and 'EX' denoting which are the inlet and exhaust sides of the tool. Always ensure that the tool assembly instructions are closely followed to ensure correct tool operation.**



Tool Mounting Plate Markings

3. Loosely assemble the tool legs to the mounting plate ensuring that the legs are assembled to the correct side of the mounting plate for the valve shims being changed. For example, if changing inlet valve shims, the legs must be fitted to the side marked 'IN'.

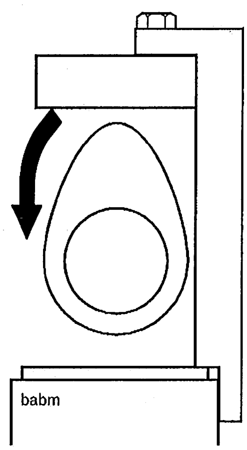
4. Locate the mounting plate to the camshaft caps above the valves to be adjusted. The tool legs must face towards the spark plug tubes. Tighten the mounting plate fixings to **7 Nm.**



Tool in Position on Inlet Camshaft

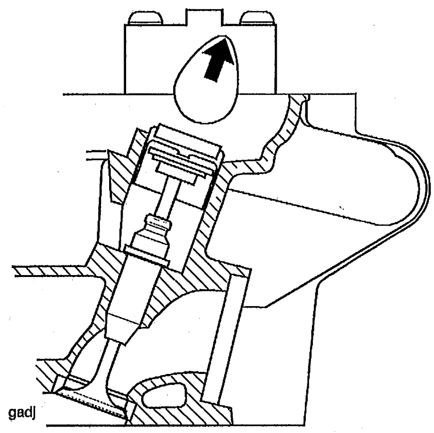
5. Hold the tool legs firmly against the mounting plate and tighten the leg to mounting plate fixings to **7 Nm**.

⚠ CAUTION: With the tool fitted, full 360° rotation of the engine/camshaft is not possible. The engine must be turned such that the camshaft lobes turn within the available free space allowed by the tool. Severe tool and camshaft damage will result from camshaft contact with the tool.



Rotate in direction of arrow, not towards tool.

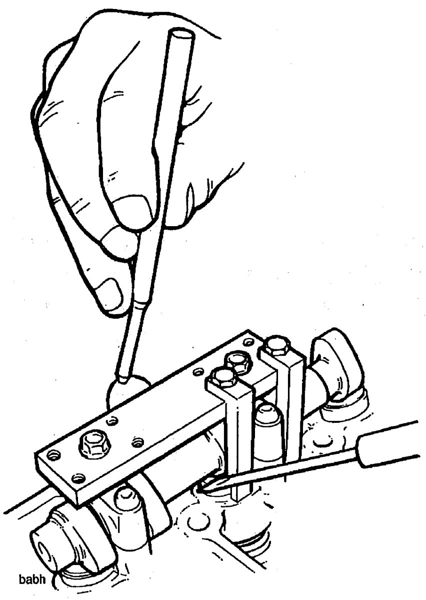
6. Turn the engine over until the camshaft lobes for the valves to be adjusted point directly away from the valves.



Cam Lobe Pointing Away From Valve

7. As the valves begin to close, the tool legs will prevent the valves from rising, allowing the shims to be removed using a soft faced lever and a magnet.

NOTE:
- **The shim is often a tight fit in the tappet. Use a suitable soft faced lever and a magnet to remove the shim from the tappet.**



Removing/Replacing The Shim

8. Select a new shim using the charts shown overpage.

9. Take the selected replacement shim and lubricate with engine oil. Fit the shim to the top of the tappet by reversing the removal procedure.

10. Turn the engine over until the camshaft fully opens the valves being adjusted. Remove the tool when the valve is fully open. Check that the shim has seated correctly and adjust, if necessary, before proceeding.

NOTE:
- **The tool is designed to allow adjustment of 2 pairs of valves without moving the mounting plate. This is achieved by moving the tool legs to a new location once one pair has been adjusted.**

11. Repeat the procedure until all valves have been adjusted.

NOTE:
- **A shim selection chart can be found on the following two pages.**

Exhaust Valve Clearance Adjustment Chart

MEASURED THICKNESS OF FITTED SHIM

MEASURED EXHAUST VALVE CLEARANCE	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20
0.00-0.04				2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05
0.05-0.09			2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10
0.10-0.14		2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15
0.15-0.20	CORRECT CLEARANCE. NO CHANGE OF SHIM REQUIRED																								
0.21-0.25	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20	
0.26-0.30	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20		
0.31-0.35	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20			
0.36-0.40	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20				
0.41-0.45	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20					
0.46-0.50	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20						
0.51-0.55	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20							
0.56-0.60	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20								
0.61-0.65	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20									
0.66-0.70	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20										
0.71-0.75	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20											
0.76-0.80	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20												
0.81-0.85	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20													
0.86-0.90	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20														
0.91-0.95	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20															
0.96-1.00	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20																
1.01-1.05	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20																	
1.06-1.10	2.90	2.95	3.00	3.05	3.10	3.15	3.20																		
1.11-1.15	2.95	3.00	3.05	3.10	3.15	3.20																			
1.16-1.20	3.00	3.05	3.10	3.15	3.20																				
1.21-1.25	3.05	3.10	3.15	3.20																					
1.26-1.30	3.10	3.15	3.20																						
1.31-1.35	3.15	3.20																							
1.36-1.40	3.20																								

SHIM SIZE REQUIRED

EXHAUST VALVE

1. Measure valve clearance (with engine cold).
2. Remove shim and measure thickness with a micrometer.
3. Match measured valve clearance from the left hand vertical column with measured thickness of fitted shim.
4. The shim size specified where the lines intersect will give correct clearance.

NOTE: If there is no clearance fit a shim several sizes smaller and re-measure.

Inlet Valve Clearance Adjustment Chart

MEASURED INLET VALVE CLEARANCE	MEASURED THICKNESS OF FITTED SHIM																								
	2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20
0.00-0.04			2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10
0.05-0.09		2.00	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15
0.10-0.15	CORRECT CLEARANCE. NO CHANGE OF SHIM REQUIRED																								
0.16-0.20	2.05	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20	
0.21-0.25	2.10	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20		
0.26-0.30	2.15	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20			
0.31-0.35	2.20	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20				
0.36-0.40	2.25	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20					
0.41-0.45	2.30	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20						
0.46-0.50	2.35	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20							
0.51-0.55	2.40	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20								
0.56-0.60	2.45	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20									
0.61-0.65	2.50	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20										
0.66-0.70	2.55	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20											
0.71-0.75	2.60	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20												
0.76-0.80	2.65	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20													
0.81-0.85	2.70	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20														
0.86-0.90	2.75	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20															
0.91-0.95	2.80	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20																
0.96-1.00	2.85	2.90	2.95	3.00	3.05	3.10	3.15	3.20																	
1.01-1.05	2.90	2.95	3.00	3.05	3.10	3.15	3.20																		
1.06-1.10	2.95	3.00	3.05	3.10	3.15	3.20																			
1.11-1.15	3.00	3.05	3.10	3.15	3.20																				
1.16-1.20	3.05	3.10	3.15	3.20																					
1.21-1.25	3.10	3.15	3.20																						
1.26-1.30	3.15	3.20																							
1.31-1.35	3.20																								

SHIM SIZE REQUIRED

INLET VALVE

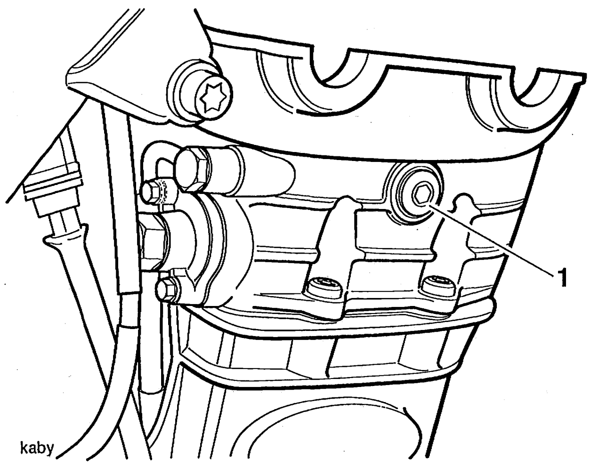
1. Measure valve clearance (with engine cold).
2. Remove shim and measure thickness with a micrometer.
3. Match measured valve clearance from the left hand vertical column with measured thickness of fitted shim.
4. The shim size specified where the lines intersect will give correct clearance.

NOTE: If there is no clearance fit a shim several sizes smaller and re-measure.

CAM CHAIN

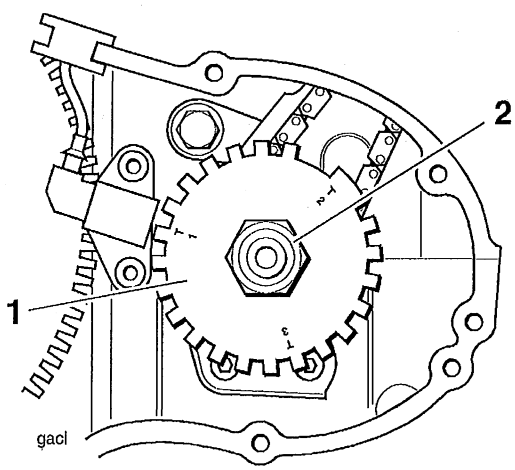
Removal

1. Remove the camshafts as detailed earlier in this section.
2. Release the screws securing the crankshaft position sensor to the crankcase. Slide the sensor grommet out from the crankcase and remove the sensor.
3. Remove the bolt from the centre of the cam chain housing, in the cylinder head.



1. Centre Bolt

4. Remove the crankshaft rotor.



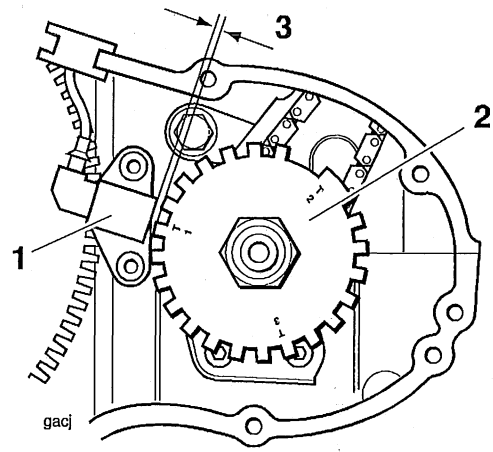
1. Crankshaft Rotor

2. Rotor Retaining Bolt

5. The cam chain is removed from inside the head or through the crankcase, after first detaching the chain from the crankshaft gear.

Installation

1. Refit the cam chain and locate the lower end around the crankshaft gear.
2. Fit the crankshaft position sensor.
3. Refit the crankshaft rotor. Tighten the retaining bolt to **22 Nm**.
4. Adjust the crankshaft position sensor to give an air gap of 1.00 mm $\pm$ 0.20 mm between the crankshaft rotor and the sensor.



1. Crankshaft Position Sensor

2. Crankshaft Rotor

3. 1.00 mm $\pm$ 0.20 mm

5. Apply Triumph silicone grease to the grommet on the crankshaft position sensor and refit the grommet to the crankcase.
6. Refit the camshafts etc. as described earlier in this section.
7. Refit the bolt to the centre of the cam chain housing in the cylinder head, tightening to **10 Nm.**

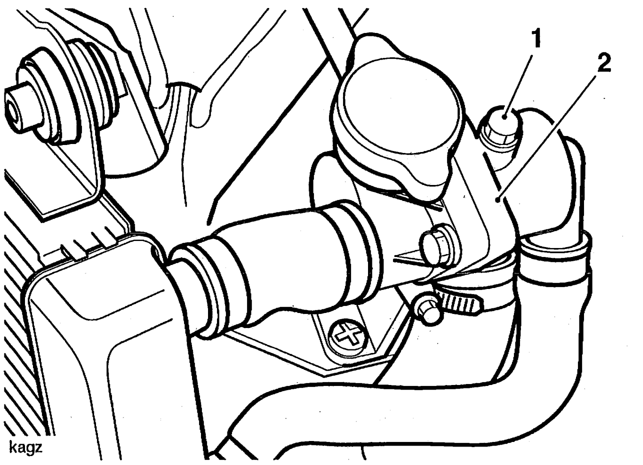
CYLINDER HEAD

Removal

1. Remove the seats and disconnect the battery negative (black) lead first.
2. Remove the body side panels as described in the body section.
3. Remove the fuel tank and airbox assembly as detailed in the fuel system section.

> **WARNING: Do not remove the coolant pressure cap when the engine is hot. When the engine is hot, the coolant inside the radiator is hot and also under pressure. Contact with the pressurised coolant will cause scalds and skin damage.**

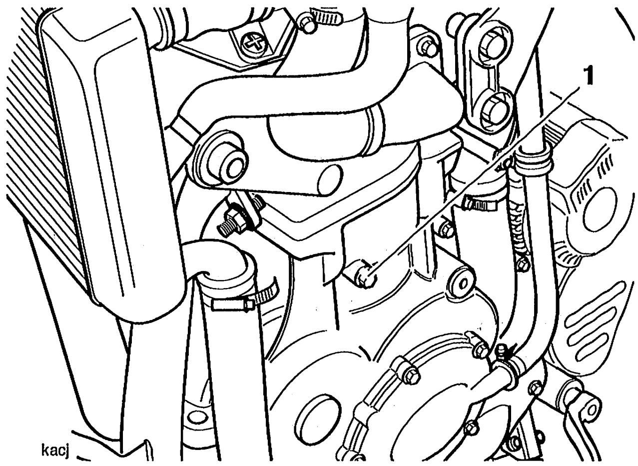
4. Remove the coolant pressure cap on the thermostat housing. Release the bleed screw to help drainage.



1. Bleed Screw

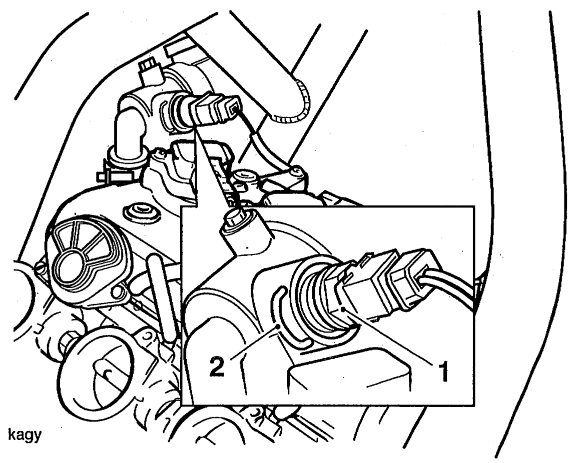
2. Thermostat Housing

5. Position a container to collect the displaced coolant.
6. Remove the crankcase coolant drain plug and allow all the coolant to drain out.



1. Coolant Drain Plug

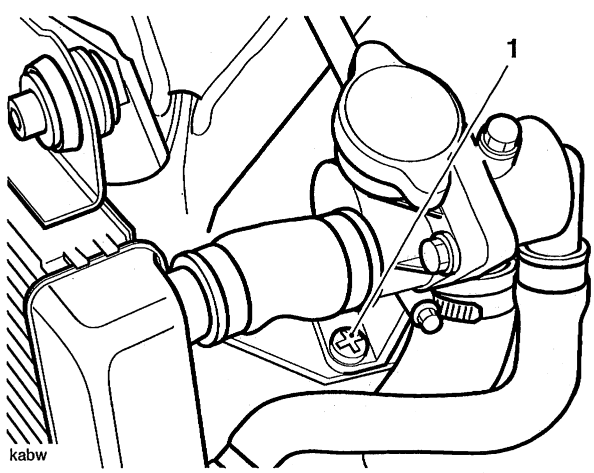
7. Release the clip securing the temperature sensor to the thermostat housing and remove the sensor. **Do not disconnect the electrical connector.**



1. Sensor

2. Sensor Retaining Clip

8. Release the screw securing the thermostat housing to its support bracket.



1. Thermostat Housing Securing screw

9. Remove the radiator as described in the cooling system section.

10. Disconnect the water pump hose and remove the thermostat housing.

11. Remove the exhaust system as described in the fuel system section.

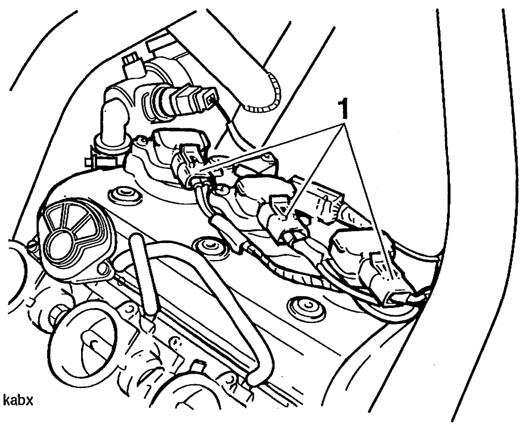
12. Disconnect the electrical connection to the idle air control valve.

13. Release the screws securing the throttle bodies to the head. Place the displaced throttle bodies and idle air control valve on the crankcase. Discard the gasket.

NOTE:

- **It is not necessary to disconnect the throttle cable.**

14. Disconnect the electrical connections to the ignition coils, then remove the coils from the cam cover.

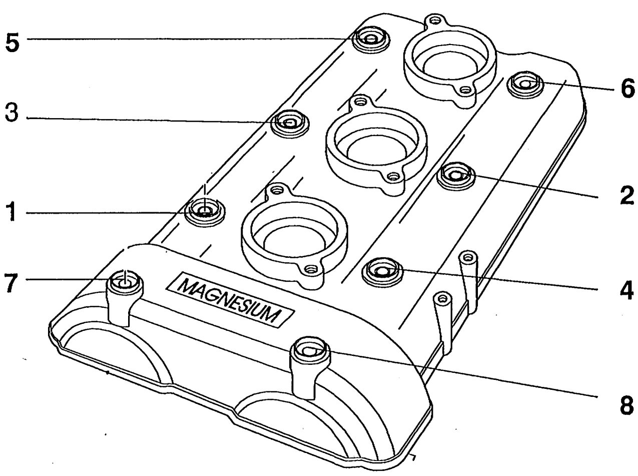


1. Coil Connections

15. Progressively release the cam cover bolts in the sequence shown below.

NOTE:

- **Two longer bolts are fitted at the right hand end adjacent to the cam chain.**



Cam Cover Bolt Release Sequence

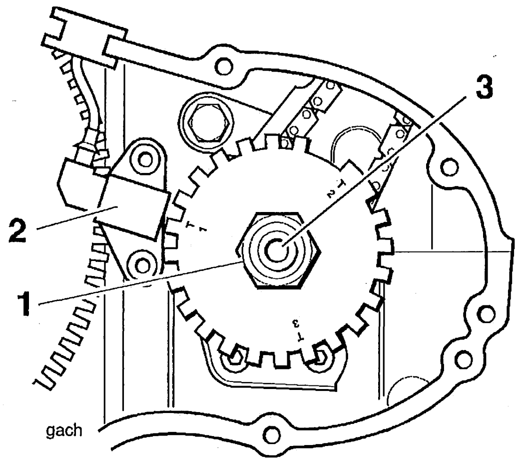
16. Remove the cam cover.

> ⚠ **CAUTION: Never use a lever to remove the camshaft cover from the head.**
>
> **Using a lever will cause damage to the head and cam cover which could lead to an oil leak.**

17. Remove the cam cover gasket.

18. Remove any residual oil from the front of the head using a syringe or lint free cloth.

19. Remove the clutch cover to give access to the crankshaft rotor.

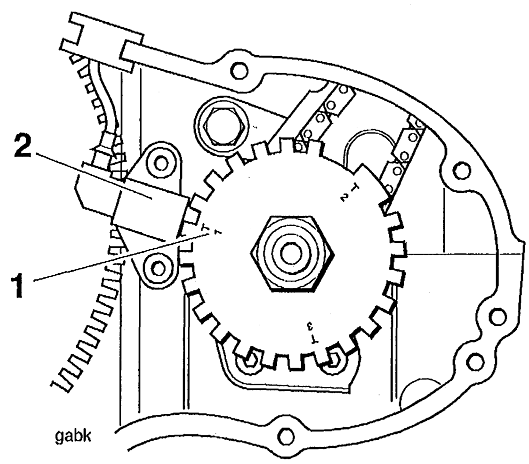


1. Crankshaft Rotor Clamp Nut

2. Crankshaft Position Sensor

3. Centre Bolt

20. Rotate the crankshaft clockwise (the normal direction of rotation), using the nut fitted to the end of the crankshaft. Stop rotation when number 1 cylinder is at top dead centre (TDC), that is when the 'T1' mark on the crankshaft rotor aligns with the crankshaft position sensor.

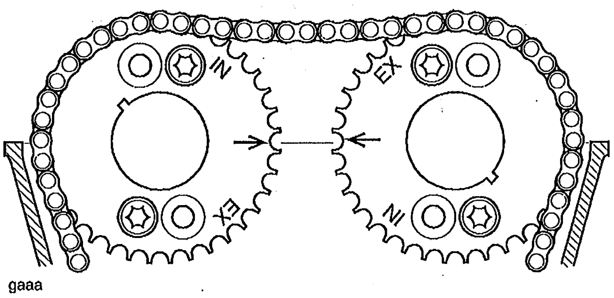


1. 'T1' Mark

2. Crankshaft Position Sensor

NOTE:

- **In addition to the crankshaft alignment described above, at TDC the alignment marks on the camshaft sprockets will point inwards at a point level with the joint face.**



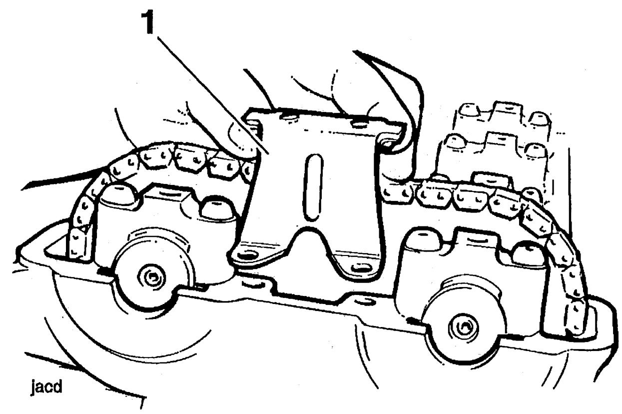
Camshaft to Cylinder Head Alignment Marks

21. Carefully remove the centre nut from the cam chain tensioner and withdraw the tensioner spring.

> **WARNING: The tensioner centre nut is under spring tension. Always wear hand, eye and face protection when withdrawing the centre nut and take great care in order to minimise the risk of injury and the loss of components.**

22. Remove the bolts securing the cam chain tensioner to the upper crankcase and remove the tensioner and gasket.

23. Remove the cam chain top pad from the cam chain side of the cylinder head.



1. Cam Chain Top Pad

24. To ensure that the camshaft caps are refitted in the same positions as prior to removal, mark the position of each camshaft cap in relation to the head. A laundry marker or similar may be used to mark the cap positions.

25. Progressively release each of the fasteners securing the camshaft caps of the inlet camshaft to the cylinder head.

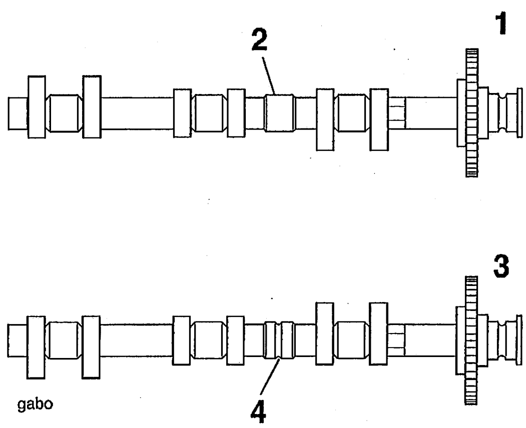
26. Release the caps for the exhaust camshaft.

> **CAUTION: Never release one camshaft cap in isolation from the others as this may cause the caps to crack.**
>
> **Always progressively release all the camshaft caps of one camshaft before final removal.**

> **CAUTION: Always completely release and remove one camshaft before starting to release the other. If both camshafts are progressively released at the same time, the valves may contact each other and cause damage to the valve head areas and valve stems.**

NOTE:

- **The inlet and exhaust camshafts are different. They can be identified by a plain area in the centre of the exhaust cam and a groove in the same place on the inlet cam.**



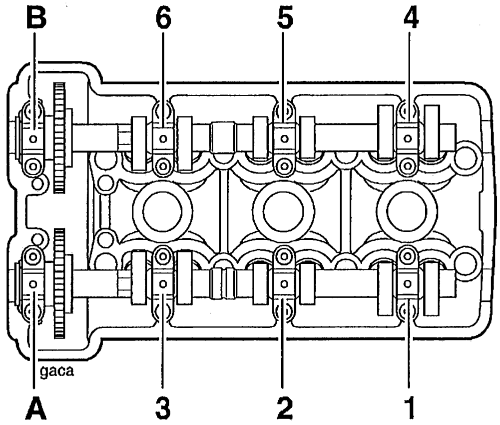
1. Exhaust Camshaft

2. Plain Section

3. Inlet Camshaft

4. Grooved section

27. Once the pressure on all the camshaft caps has been released, remove the fasteners and caps complete with dowels.



Camshaft Cap Numbering

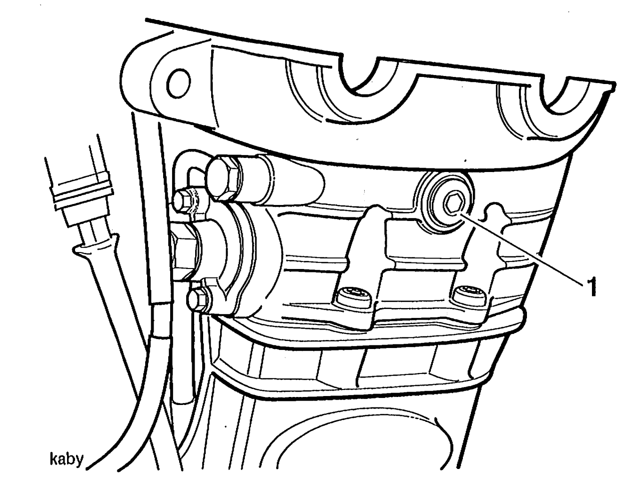
NOTE:

- **The caps are numbered sequentially and must not be interchanged for a different position on the head. The camshaft caps on the outside of the cam chain (known as outriggers) are marked 'A' for the exhaust and 'B' for the inlet.**
- **Each cap is located by two dowels which align the cap to the head. If the caps cannot be removed using hand pressure, gently tap each cap with a soft faced tool to release.**

28. Lift the cam chain from the exhaust camshaft sprocket and remove the exhaust camshaft.

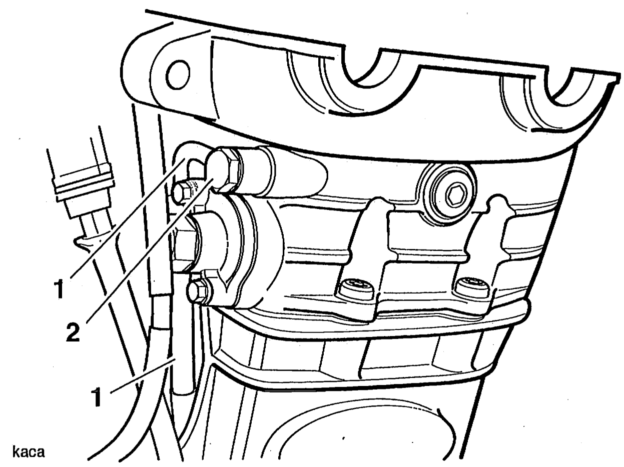
29. Repeat the procedure for the inlet camshaft.

30. Remove the bolt from the centre of the cam chain housing in the cylinder head.



1. Centre Bolt

31. Remove the banjo bolt securing the oil feed pipe to the head. Discard the copper washers.



1. Oil Feed Pipe

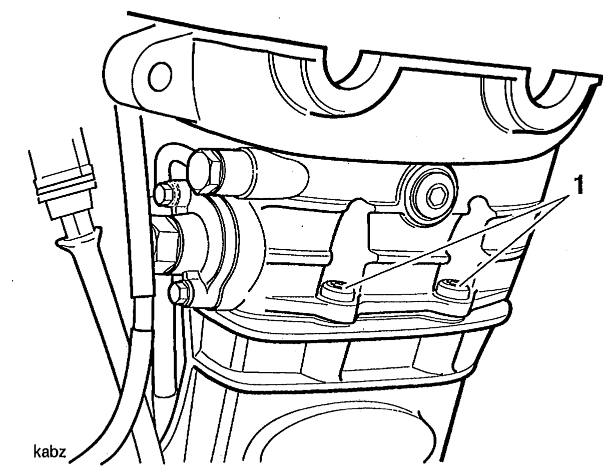
2. Banjo Bolt

32. Note the position of all tappet buckets and shims such that they can be refitted in the same positions. Remove all the buckets and shims.

NOTE:

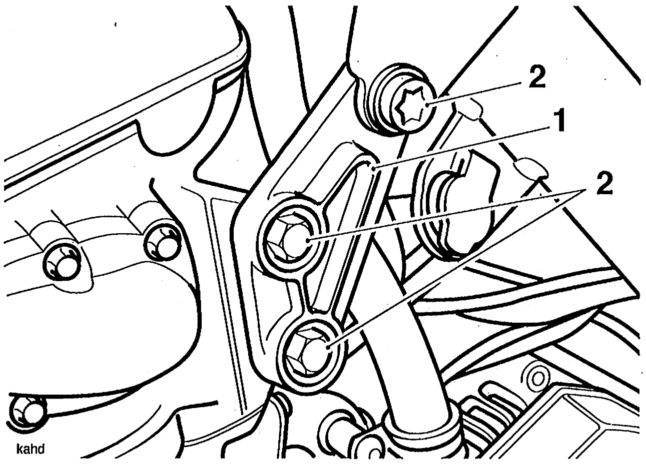
- **To prevent the tappets and shims from becoming mixed, place the shim and tappet together in a marked container. The components must be refitted in their original positions.**

33. Release the screws securing the outside of the cylinder head to the upper crankcase.



1. Cylinder Head to Upper Crankcase Screws

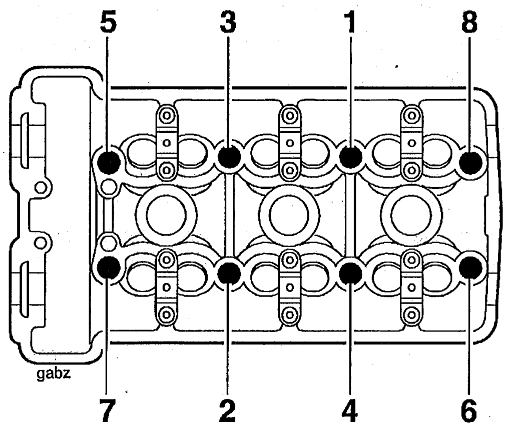
34. Support the engine prior to removing the frame to cylinder head fixings and the engine mounting bracket from the left hand rear side.



1. Engine Mounting Bracket

2. Fixings

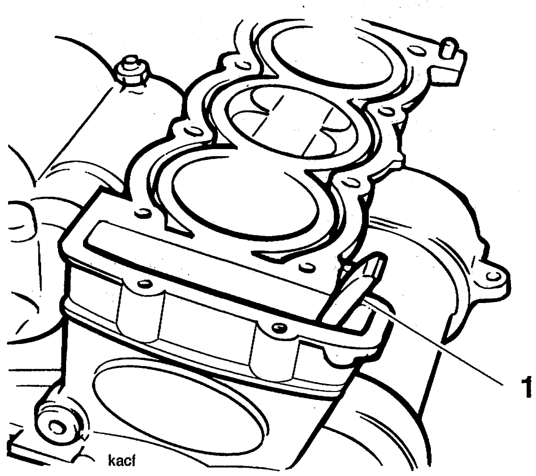
35. Progressively release the cylinder head bolts in the order shown below.



Cylinder Head Bolt Release Sequence

36. Lightly tap the cylinder head with a rubber mallet to break the seal of the gasket. Remove the cylinder head and discard the head gasket.

37. Collect the cam chain rubbing blade from the crankcase.



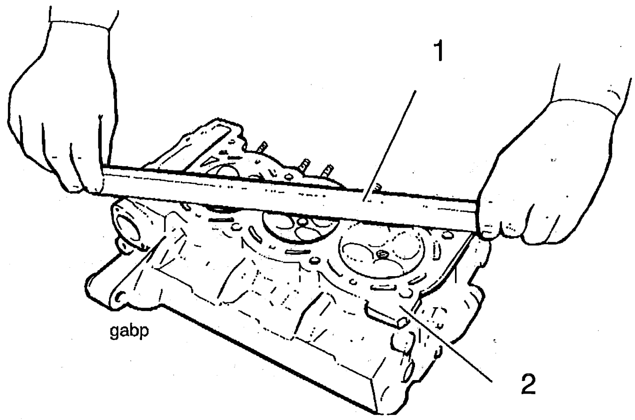
1. Cam Chain Rubbing Blade

38. Remove the cylinder liners as described in section six of this manual.

Inspection

1. Thoroughly clean the surface of the head and check for damage and pitting of the combustion chambers.

2. Using a straight edge, check the cylinder head gasket face for warp which could lead to gasket failure. Replace the head if warped.



1. Straight Edge

2. Cylinder Head Gasket Face

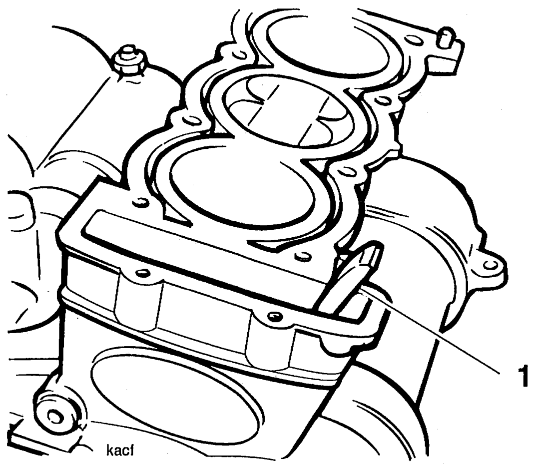
3. Check the cam chain rubbing blade. Renew if worn or damaged.

Installation

NOTE:

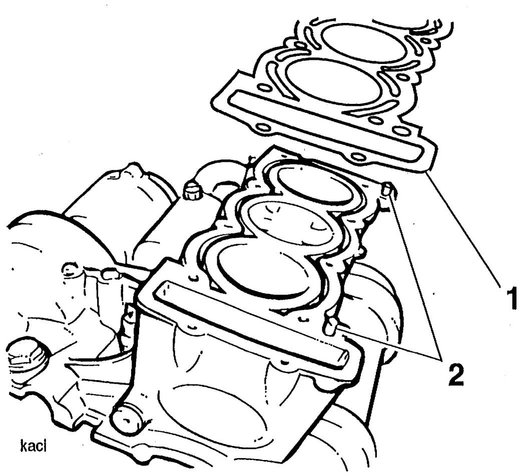
- **On all engines, the cylinder liners must be resealed prior to refiiting the cylinder head. Refer to the crankshaft, pistons and liners section for details.**

1. Position the cam chain rubbing blade to the left hand side of the upper crankcase. When correctly fitted, the blade positively locates at the lower end on a web. The upper section will then fit snugly into the recess in the top of the crankcase.



1. Cam Chain Rubbing Blade

2. Thoroughly clean the upper faces of the crankcase taking care not to damage the mating surfaces. Fit a new cylinder head gasket ('top' marking uppermost) ensuring that the head to crankcase location dowels are correctly in place.



1. Cylinder Head Gasket

2. Dowels

3. Ensure that the cylinder head face is completely clean.

4. Carefully lower the cylinder head over the rubbing blade and locate the head onto the dowels..

CAUTION: Using the correct procedure to fit and tighten the cylinder head bolts will ensure the long term reliability of the cylinder head gasket.

Clean each bolt, paying particular attention to the threads and under-bolt-head areas. If any of the threads or bolt-head areas are damaged, replace the bolt(s).

Lubricate the threads with engine oil, and then wipe clean with a lint-free cloth leaving minimal oil on the threads (that is, almost dry to touch).

Tighten the bolts using the three-stage procedure given below.

Failure to observe these important items may lead to engine damage through a damaged head gasket.

5. Fit the bolts to the head and tighten until finger tight. The head bolts are finally tightened in 3 stages. This is to ensure that the cylinder head gasket seals correctly to the head and crankcase. The 3 stages are as follows:

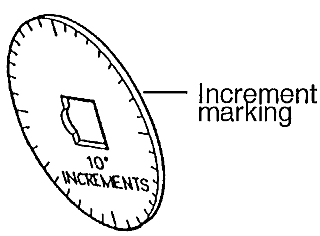
NOTE:

- **For stages A and B of the head bolt tightening operation, a torque wrench of known, accurate calibration must be used.**

A Tighten the head bolts, in the same numerical sequence used to release the bolts, to **20 Nm**.

B Tighten the head bolts in the same numerical sequence used to release the bolts, to **27 Nm**.

C For the final torque operation, which again is carried out in the same numerical sequence used to release the bolts, a 'torque turn' method is used. The bolts must be turned through 90° to reach the final setting. To accurately gauge the 90° turn, use service tool 3880105-T0301 as follows:
Fit the tool between the torx socket and the drive handle and locate the torx drive to the head bolt. Pick an increment point on the torque turn gauge which aligns with a suitable reference point on the head. Tighten the bolts until 9 of the 10° gauge increments have rotated past the chosen point on the head.

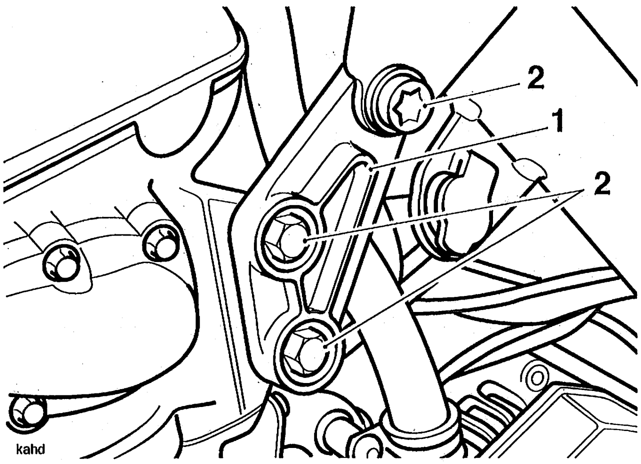


Tool 3880105-T0301

6. Fit the screws securing the side of the cylinder head to the crankcase and tighten to **12 Nm**.

7. Refit the engine mounting bracket to the left hand side of the head. Tighten the fixings to **30 Nm.**

8. Refit the engine mounting bolts and tighten to **95 Nm.**



1. Engine Mounting Bracket

2. Fixings

9. Remove the engine support.

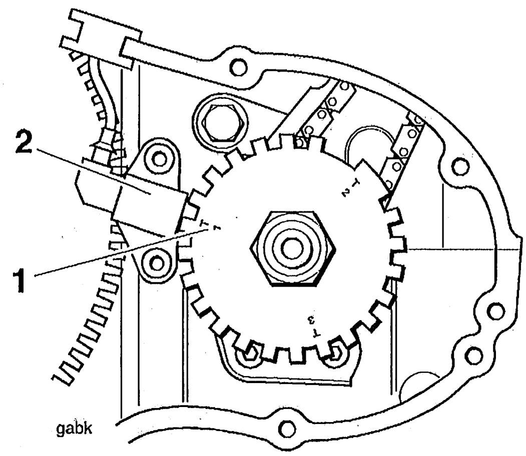
10. Lubricate the tappet buckets with clean engine oil and refit the buckets and shims in the same locations from which they were removed.

11. Thoroughly clean the camshafts and journals. Inspect the ends of the camshafts for correct fitment of the sealing plugs.

12. Lubricate the camshafts with clean engine oil before fitting to the head.

13. Locate each camshaft to the head ensuring the camshafts are correctly identified (inlet and exhaust) and also correctly located over their respective valve banks.

14. Check that the crankshaft sensor remains aligned with the 'T1' mark on the crankshaft rotor.

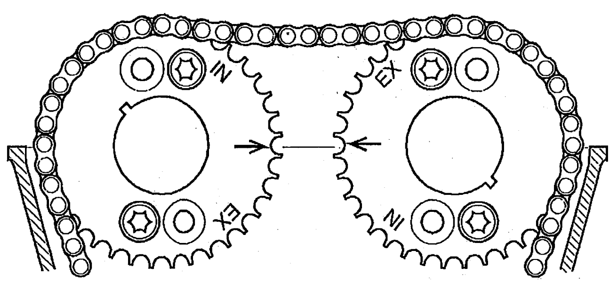


1. 'T1' Mark

2. Crankshaft Position Sensor

15. Locate cam chain over the crankshaft gear and, working on one camshaft at a time, locate the cam chain over the cam sprockets. Position the camshaft in the same position as for removal **before attempting to fit the caps** (that is, with the timing marks on the camshaft sprockets level and pointing inwards, and with the crankshaft position sensor in line with the 'T1' mark on the crank rotor.

16. Repeat the procedure for the other camshaft.



Camshaft to Cylinder Head Alignment Marks

CAUTION: If the camshafts and caps are fitted without first aligning the timing marks on both the crankshaft and camshaft sprockets, or if both camshafts are fitted at the same time, the inlet and exhaust valves will contact each other causing damage to both the head and the valves.

17. Lubricate the threads of the camshaft cap screws and evenly and progressively tighten to **10 Nm**.

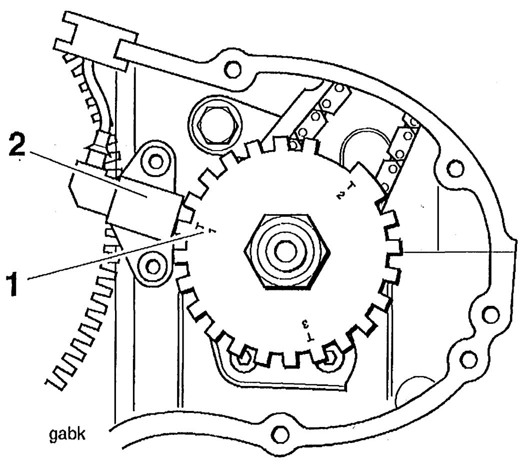
18. Before fitting the cam chain tensioner, ensure that each camshaft rotates freely. Do not rotate either camshaft by more than 5°.

CAUTION: If any components have been renewed, the valve clearances must be checked and adjusted. Running with incorrectly adjusted valve clearances may cause excess engine noise, rough running and engine damage.

19. Recheck that the crankshaft rotor 'T1' mark aligns with the crankshaft position sensor when the timing marks on both camshaft sprockets are level with the cylinder head and point inwards,

20. Assemble the cam chain tensioner following the instructions given earlier in this section.

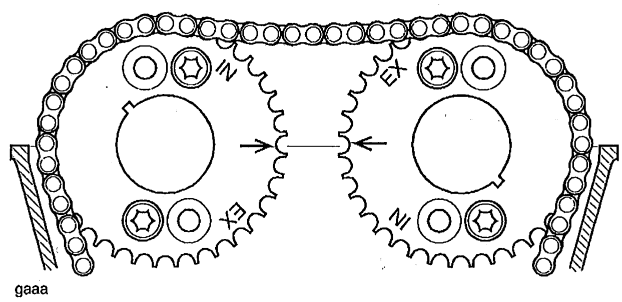
21. Rotate the engine through 4 full revolutions, and reset number 1 cylinder to TDC. Ensure that the 'T1' mark on the crankshaft rotor is aligned with the crankshaft position sensor.



1. Ignition Rotor

2. Crankshaft Position Sensor

22. Re-check that the camshaft timing marks align as illustrated below.



Camshaft to Cylinder Head Alignment Marks

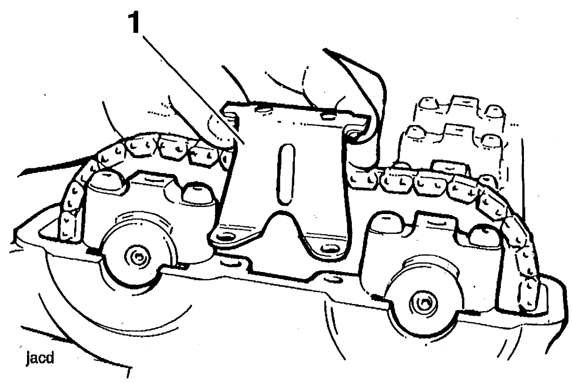
NOTE:

- **Depending on the engine configuration, with the camshaft arrows aligned as shown, the 'T1' mark on the crankshaft may align with the crankshaft position sensor at either the rear, centre or front edge of the gear tooth. Any of those alignment positions can be considered to be correct.**

23. Re-check tensioner plunger location against the tensioner blade.

24. Check the valve clearances. Adjust as necessary.

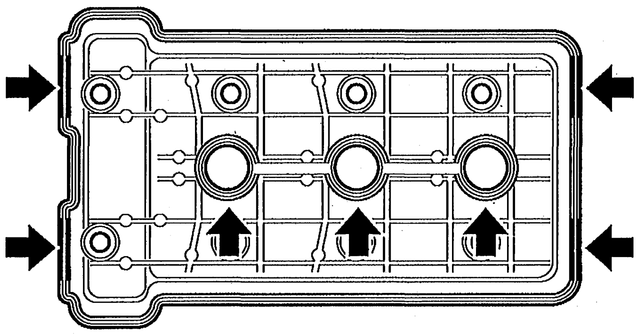
25. Refit the cam chain top pad and tighten the fixings to **10 Nm**.



1. Cam Chain Top Pad

26. Refit the bolt to the centre of the cam chain housing in the cylinder head, tightening to **10 Nm**.

27. Apply silicone sealer to the areas arrowed in the diagram below.



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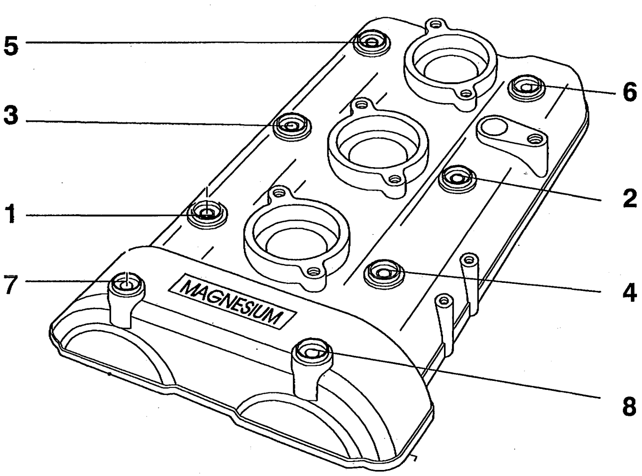
Silicone Sealer Areas

28. Refit the cam cover and gasket and tighten the cam cover fixings to **10 Nm.** Tighten the fixings in the order shown below.



Cam Cover Bolt Tightening Sequence

29. Fit a new gasket over the throttle body locating dowels ensuring that the gasket tab is positioned to the left hand side.

30. Refit the throttle bodies and tighten the fixings to **12 Nm**.

31. Reconnect the idle air control valve electrical connection.

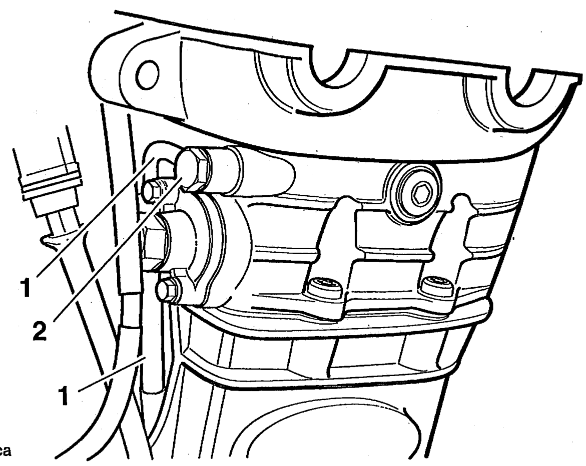
32. Check for correct, unrestricted throttle operation and for cable/throttle binding and sticking.

WARNING: Move the handlebars to left and right full lock while checking that cables and harnesses do not bind. Also check for a sticking throttle. Rectify either condition as necessary.

A cable or harness which binds will restrict the steering and may cause loss of control and an accident.

A sticking throttle will lead to loss of motorcycle control and an accident.

33. Refit the oil feed pipe to the head using new sealing washers to both sides of the banjo bolt. Tighten the banjo bolt to **25 Nm**. Ensure that the oil feed pipe is not distorted during the tightening.



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1. Oil Feed Pipe

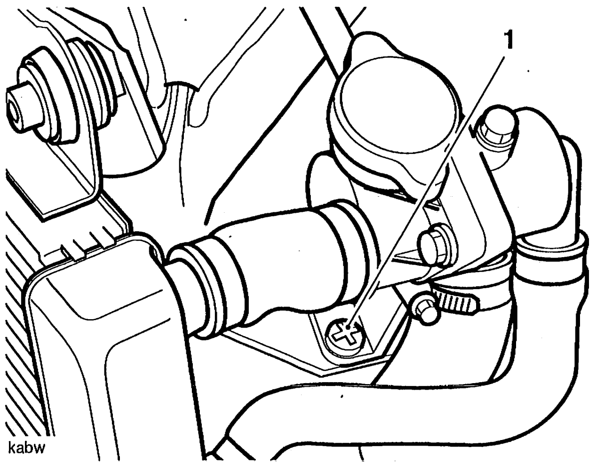
2. Banjo Bolt

34. Refit the exhaust system as described in the fuel system section.

35. Refit the radiator as described in the cooling system section.

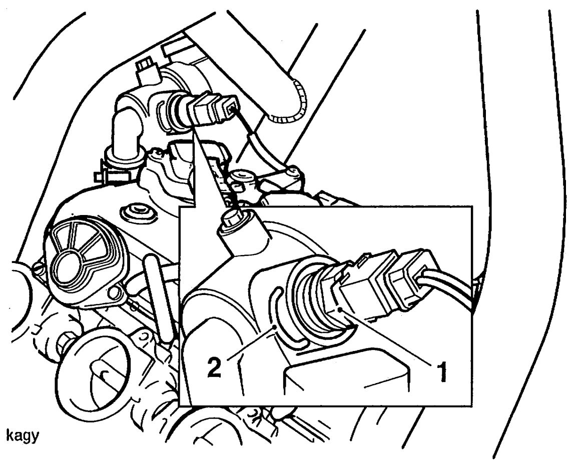
36. Refit the thermostat housing and the water pump hose and tighten the clip.

37. Refit the screw securing the thermostat housing to the support bracket.



1. Thermostat Housing Securing screw

38. Refit the coolant temperature sensor and refit the retaining clip.

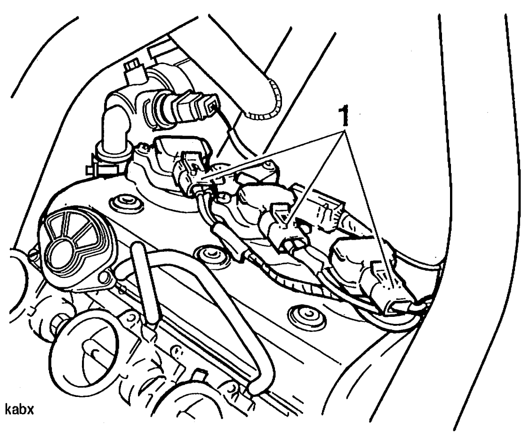


1. Sensor

2. Sensor Retaining Clip

39. Refill the cooling system as described in the cooling system section.

40. Refit and reconnect the coils. Tighten the coil fixings to **10 Nm.**



1. Coil Connections

41. Refit the airbox and fuel tank as described in the fuel system section.

42. Refit the body side panels as described in the body section.

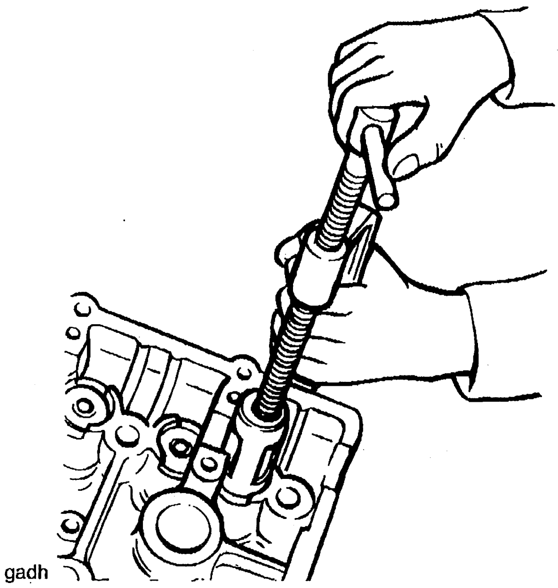
43. Refit and reconnect the battery positive (red) lead first.

44. Refit the seats.

VALVES AND VALVE STEM SEALS

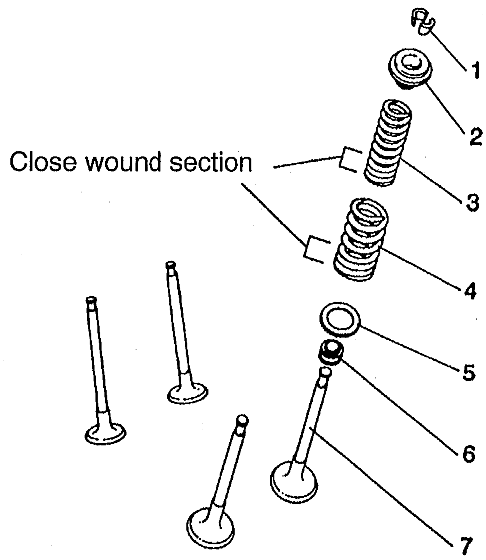
Removal from the cylinder head

1. Remove each valve from the head using a valve spring compressor. The compressor must act on the top cup to allow removal of the valve collets.



1. Valve Removal

2. Once the collets are released, remove the following items:
   - collets
   - valve spring cap
   - valve springs
   - valve stem seal
   - thrust washer
   - valve (de-burr before removal)



1. Collets
2. Valve Spring Cap
3. Inner Valve Spring
4. Outer Valve Spring
5. Thrust Washer
6. Stem Oil Seal
7. Valve

Installation

1. Apply a thin coat of molybdenum disulphide grease to the valve stem.

2. Install the valve into the valve guide and refit the thrust washer to the valve spring recess (if removed).

3. Fit the valve stem seal over the valve stem and, using a suitable tool, press down fully until the seal is correctly seated over the valve guide.

NOTE:

- **During fitment of the valve stem seal, two distinctly different degrees of resistance will be noted when the seal is correctly fitted.**

- **Firstly, press the seal down the valve stem until the lower side of the seal comes into contact with the valve guide. Greater resistance is felt at this contact point and further gentle pressure is then required to locate the seal over the top end of the valve guide.**

- **On application of this pressure, the seal can be felt to positively locate over the top face of the valve guide. Once correctly positioned, the seal cannot be pushed down any further.**

CAUTION: Incorrect fitment of the valve stem oil seals could lead to high oil consumption and blue smoke emissions from the exhaust system. Do not use excessive force in fitting the seal as this may break the seal ring.

4. Install the valve springs over the valve stem ensuring that the close wound coil end faces towards the cylinder head.
5. Compress the valve spring ensuring that the spring is compressed squarely to prevent damage to the valve stem and cylinder head.
6. Fit the valve collets ensuring correct collet location in the spring cap and valve as the spring compressor is released.

CAUTION: Always check for correct location of the valve collets during and after assembly. If not fitted correctly, the collets may become dislodged when the engine is running allowing the valves to contact the pistons. Any such valve to piston contact will cause severe engine damage.

VALVE TO VALVE GUIDE CLEARANCE

If the valve guides are worn beyond the service limit given below, the cylinder head must be replaced.

Valve to valve guide clearance

	Standard	Service Limit
Inlet	**0.01 - 0.04 mm**	**0.07 mm max**
Exhaust	**0.03 - 0.06 mm**	**0.09 mm max**

VALVE GUIDES

If a valve guide is found to be worn beyond the service limit, the complete cylinder head must be renewed.

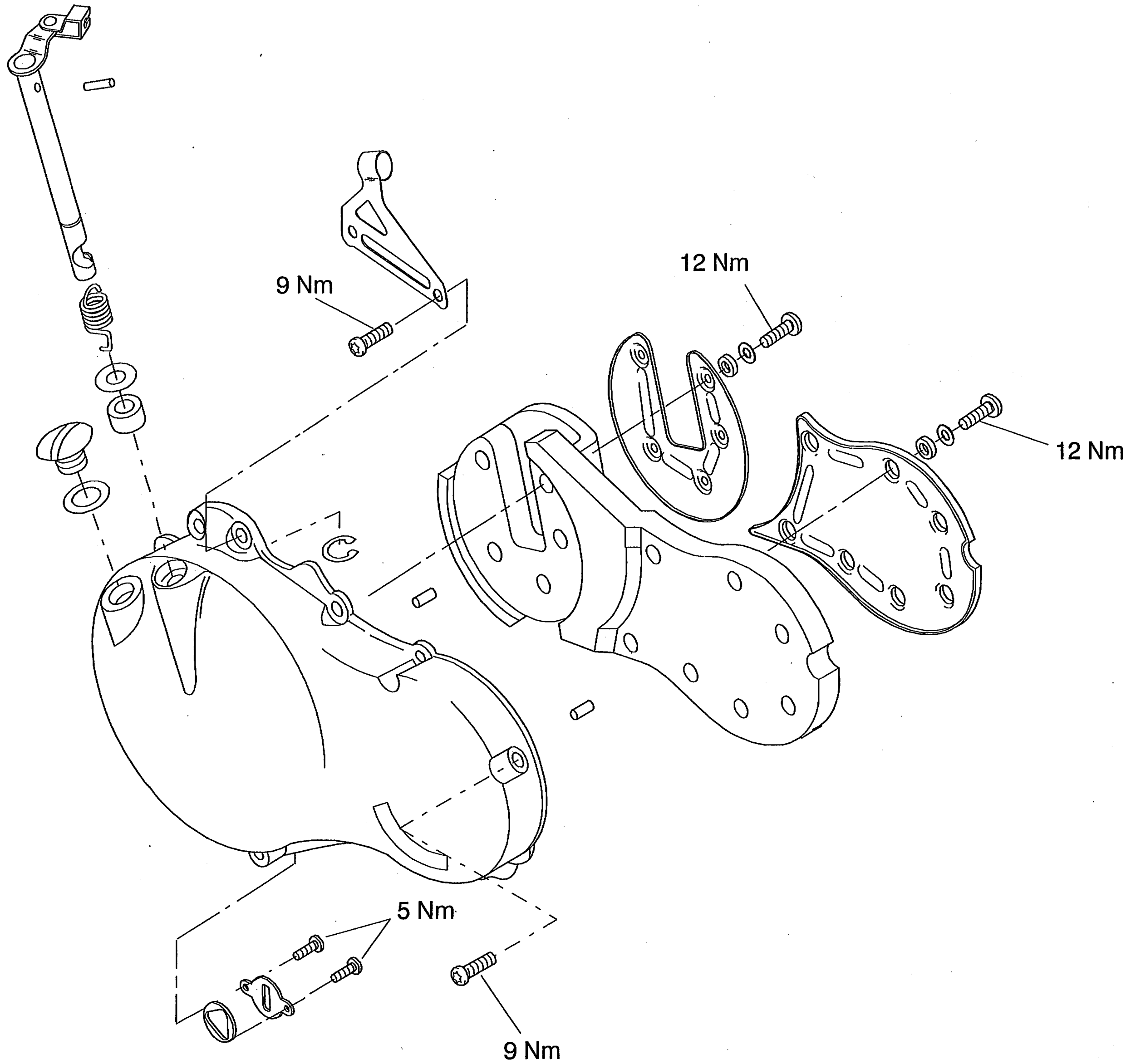
VALVE FACE INSPECTION

1. Remove any carbon build-up from the valve head area. Examine the valve seat face, checking in particular for signs of cracking or pitting.

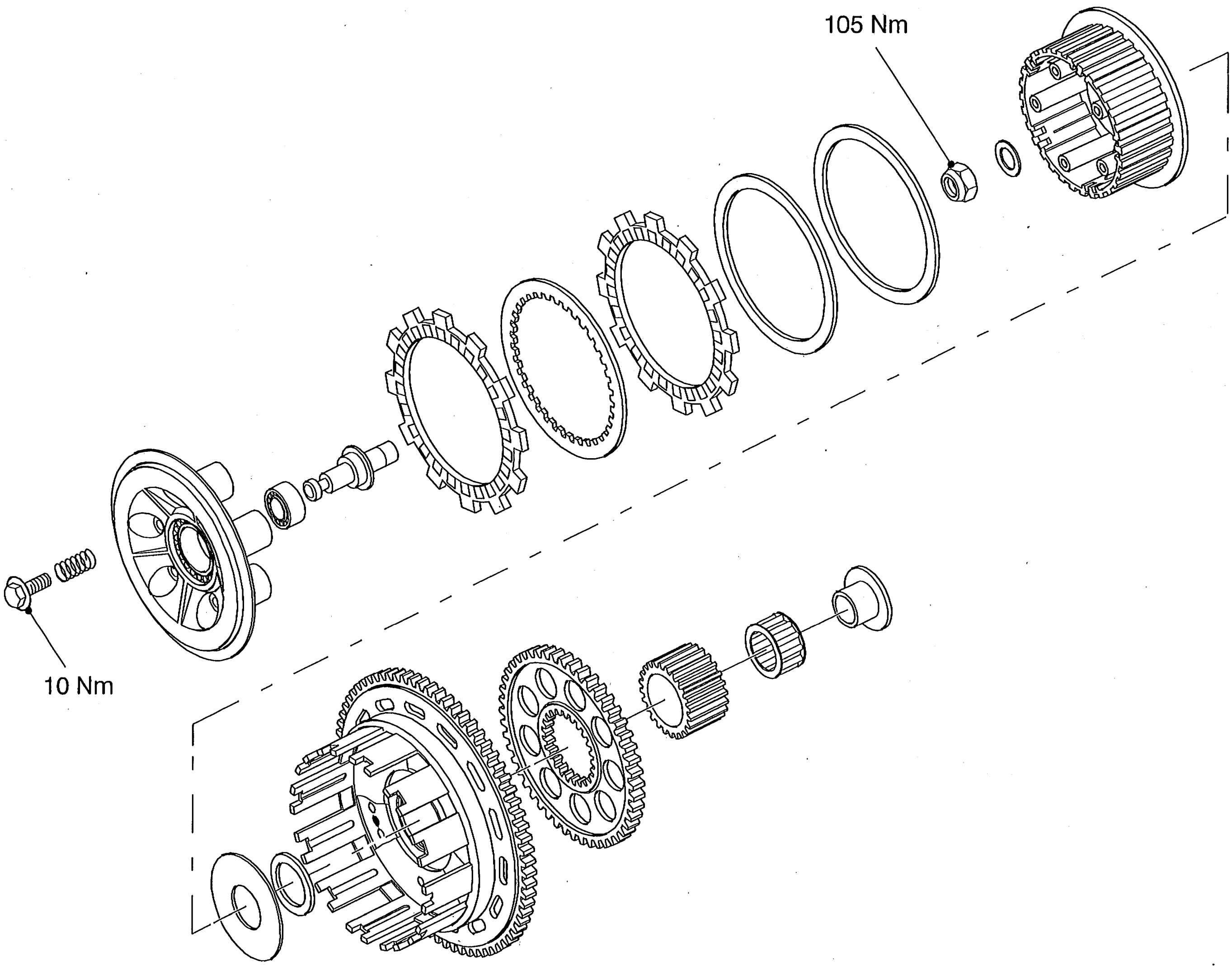
CLUTCH

CONTENTS

Exploded View - Clutch Cover

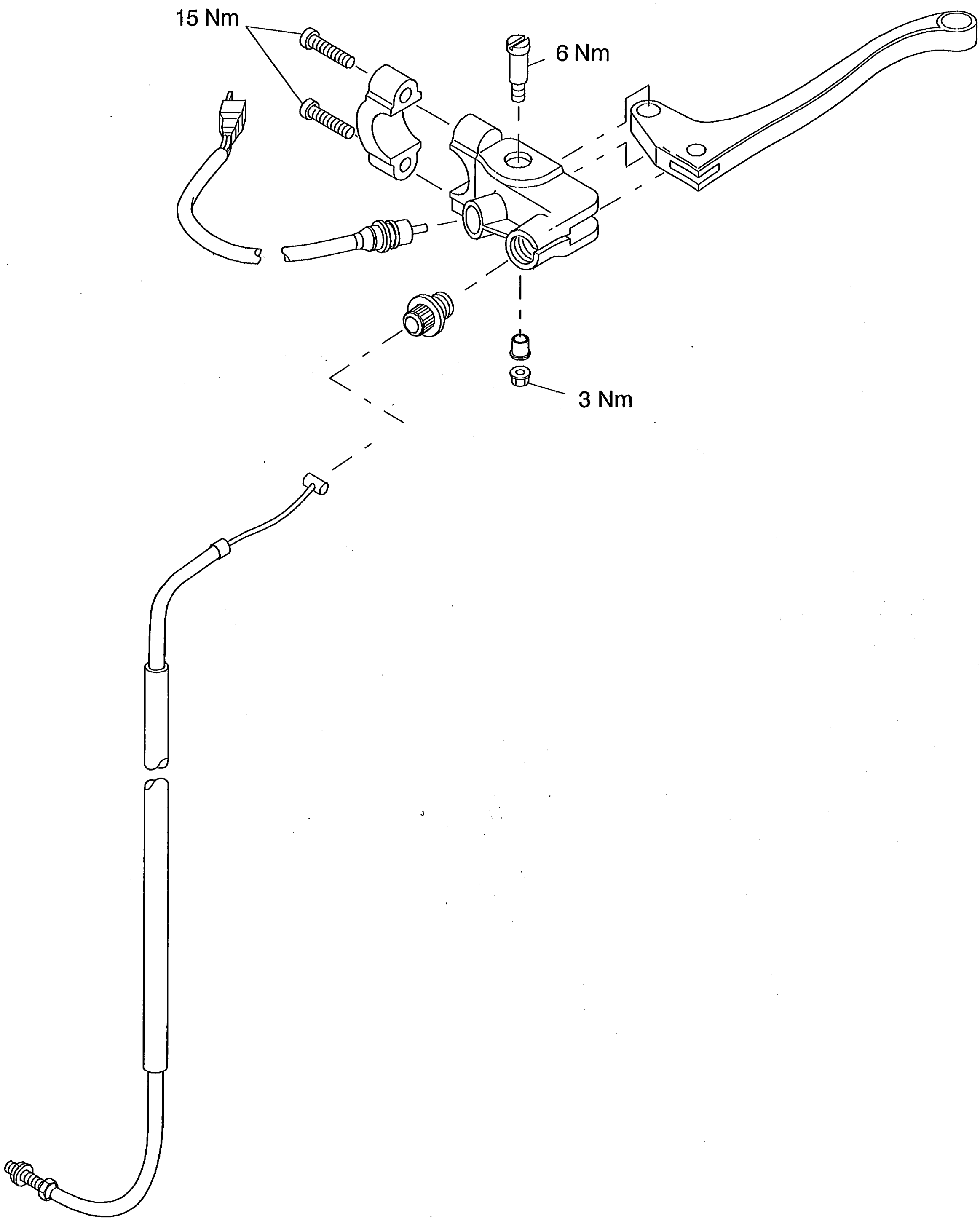


Exploded View - Clutch Assembly



NOTE: The inner and outer clutch plates differ from the remaining plates

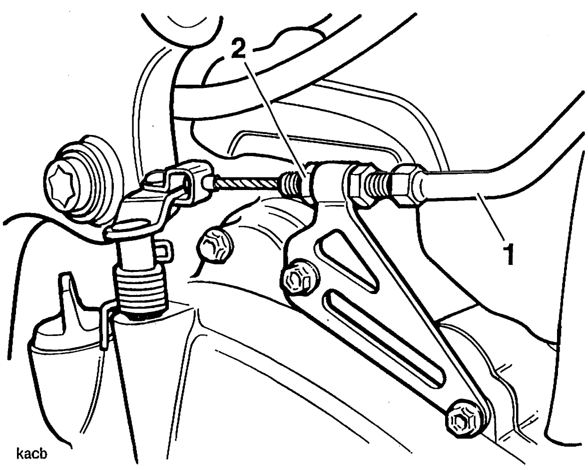
Exploded View - Clutch Controls



CLUTCH CABLE

Removal

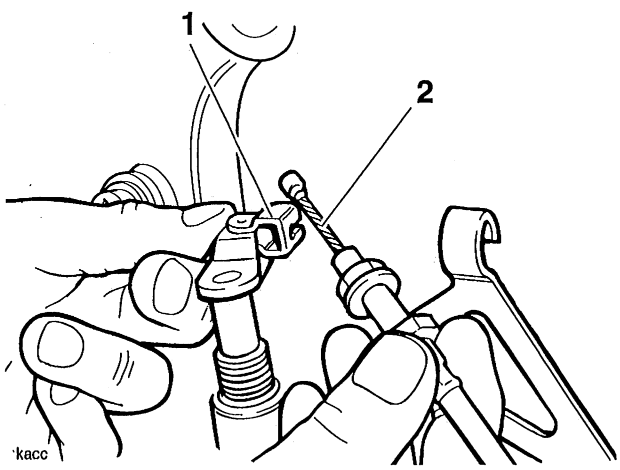
1. Remove the seats and disconnect the battery.
2. Slacken the cable locknut and release the adjuster at the clutch cover end to give maximum play in the cable.



1. Clutch Cable

2. Adjuster

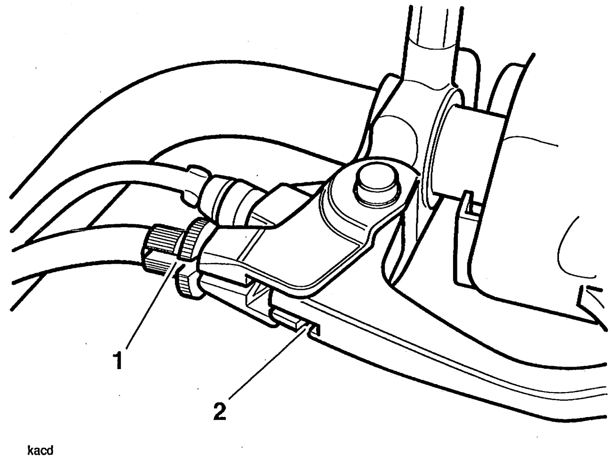
3. Release the clutch cable from the actuating arm by pushing the inner cable nipple through the arm and sliding the cable out of the slot. Detach the cable from the bracket.



1. Actuating Arm

2. Inner Cable

4. Remove the clutch lever pivot bolts and collect the knuckle guard. Temporarily refit the pivot bolt to retain the lever.
5. Align the lever adjuster and locknut slots.
6. Pull in the clutch lever and turn the inner cable, anti-clockwise through the slots in the adjuster and locknut, until the cable can be detached from the lever by pushing downwards.



1. Nut/locknut Slots

2. Cable Release Point

7. Remove the cable from the motorcycle noting the cable routing.

Examination

1. Check the inner cable for free movement through the outer cable.
2. Examine the inner cable for frayed strands.
3. Examine the two inner cable nipples for signs of looseness and damage.

Replace the cable if necessary

Assembly

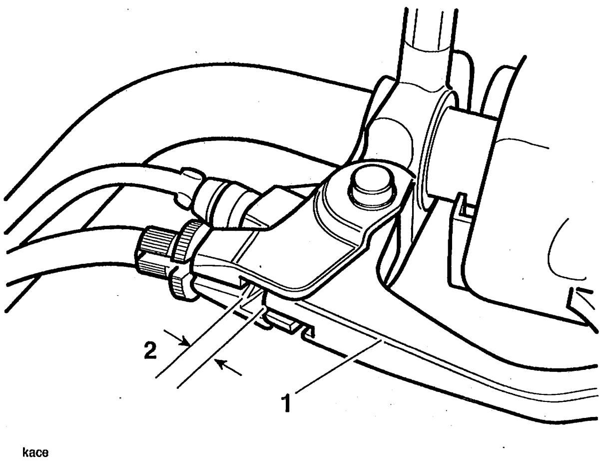
1. Position the cable to the motorcycle using the same routing as noted during removal.
2. Attach the inner cable to the clutch lever and actuating arm using a reversal of the removal process.
3. Refit the outer cable to the adjuster bracket at the clutch end.

NOTE:

- **Ensure that the two adjuster nuts are positioned, one either side of the bracket.**

4. Set the lever adjuster to a point where an equal adjustment is possible in both directions.

5. Set the adjuster at the clutch end to give a preliminary setting of 2-3 mm of free play as measured at the lever.
6. Operate the clutch lever several times and recheck the amount of free-play present.
7. Set the final adjustment of the cable to give 0.4-0.8 mm of free-play at the lever by turning the adjuster nut and locknut at the lever end. Secure the setting with the knurled locknut.



1. Clutch Lever

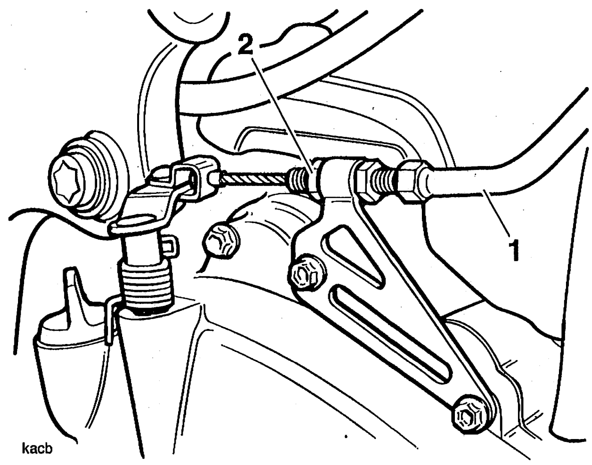
2. Correct Setting, 0.4-0.8 mm

8. Remove the lever pivot bolt (temporarily fitted earlier) and refit the knuckle guard. Tighten the pivot bolt to **6 Nm** and the locknut to **3 Nm.**
9. Reconnect the battery positive (red) lead first.
10. Refit the seats.

CLUTCH

Disassembly

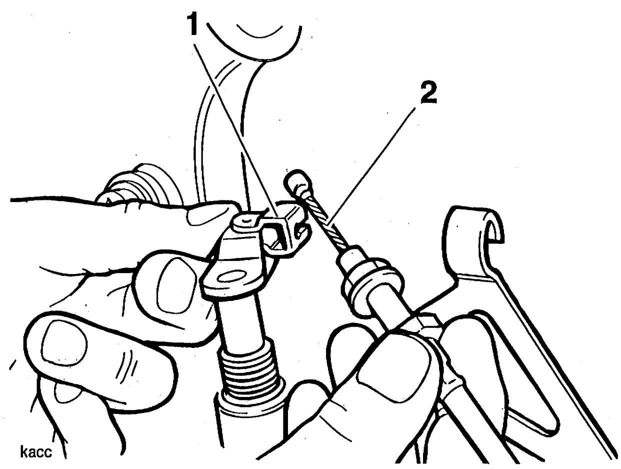
1. Remove the seats and disconnect the battery, negative (black) lead first.
2. Slacken the cable locknut and release the adjuster at the clutch cover end, to give maximum play in the cable.



1. Clutch Cable

2. Adjuster

3. Release the clutch cable from the actuating arm by pushing the inner cable nipple through the arm and sliding the cable out of the slot.



1. Actuating Arm

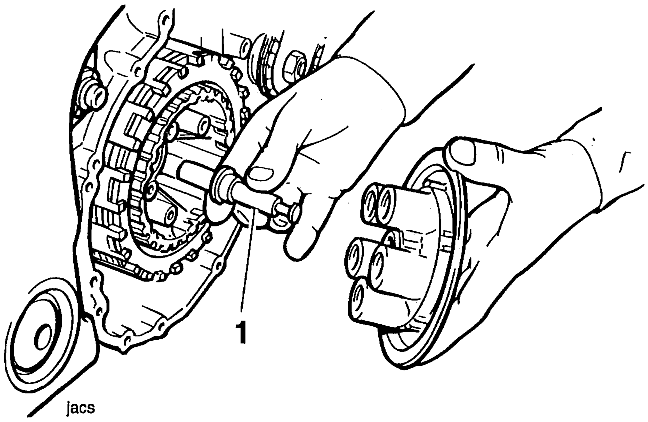
2. Inner Cable

4. Drain the engine oil as described in the lubrication section.

5. Remove the clutch cover.

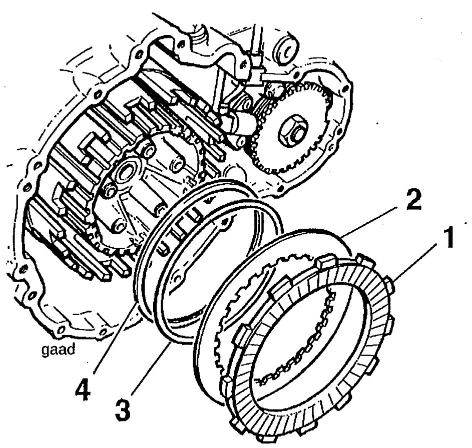
6. Undo the bolts and springs and remove the clutch pressure plate.

7. Remove clutch pull rod.



1. **Clutch pull rod**

8. Remove all the clutch friction plates and steel plates together with the anti-judder spring and anti-judder seat washer. Note the orientation of all components as they are removed.



1. **Friction Plates**
2. **Steel Plate**
3. **Anti-judder Spring**
4. **Anti-judder Seat Washer**

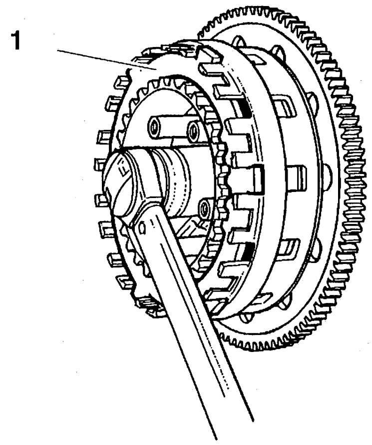
NOTE:

- **The outermost and innermost friction plates differ from all others and must not be fitted in any other positions. They are also darker in colour.**

NOTE:

- **Refer to the final page of this section for details of clutch friction plate checking.**
- **It is not normally necessary to disassemble the clutch further, but if the clutch inner and outer drums are to be removed, proceed as follows:**

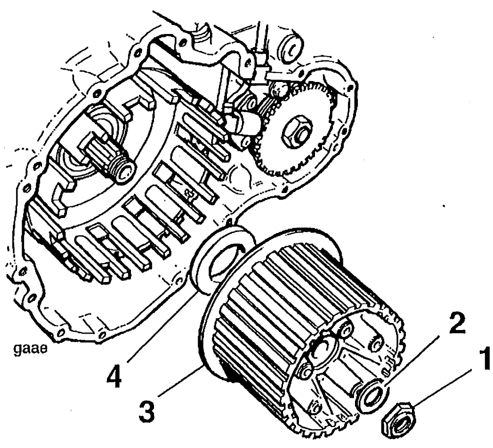
9. Engage second gear and lock the inner and outer clutch drums together using service tool T3880305.



1. **Service Tool T3880305**

10. Depress the rear brake pedal to prevent the engine from turning, then loosen the clutch centre nut.

11. Remove the centre nut, belleville washer, clutch inner drum and spacer.

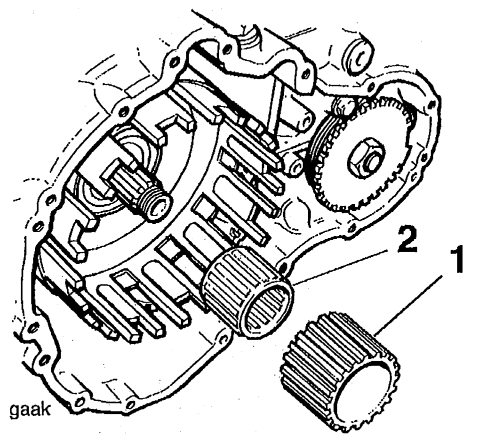


1. **Centre Nut**
2. **Belleville Washer**
3. **Inner Drum**
4. **Spacer**

12. Remove the shim from the input shaft.

13. Remove the crankshaft position sensor.

14. Slide the clutch outer drum gently backwards and forwards to dislodge the splined bearing sleeve. Carefully remove the splined sleeve and needle roller bearing while supporting clutch drum.



1. Splined Sleeve

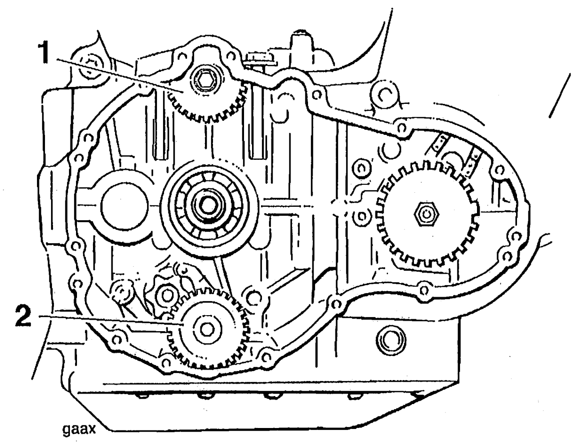
2. Needle Roller Bearing

15. Remove clutch outer drum by easing out of the crankcase, left-hand side first.

16. Remove the auxiliary drive gear and plain sleeve.

Assembly

1. Position the auxiliary gear (with the deeper dish side towards the crankcase) between the oil pump drive gear and alternator drive gear. Ensure full engagement of the auxiliary gear with the alternator gear.

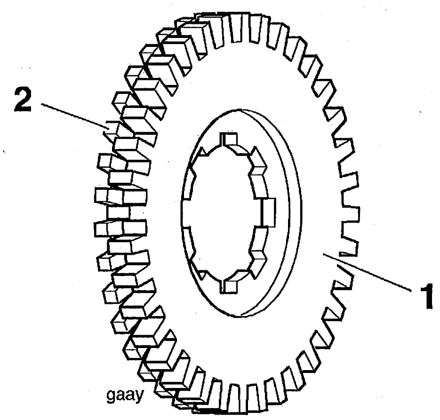


1. Alternator Drive Gear

2. Oil Pump Drive Gear

NOTE:

- **The alternator drive gear is fitted with a backlash eliminator gear. The backlash eliminator is a parallel thinner gear, which follows the main alternator drive gear. To ensure correct engagement of the auxiliary gear with the alternator drive gear, align the teeth of the alternator drive gear and backlash eliminator gears.**



1. Alternator Drive Gear

2. Backlash Eliminator

2. Temporarily fit the plain sleeve, needle roller bearing and splined sleeve to locate the auxiliary gear centrally.

3. Carefully remove the splined sleeve and needle roller bearing while holding the auxiliary gear in place. Leave the plain sleeve in place.

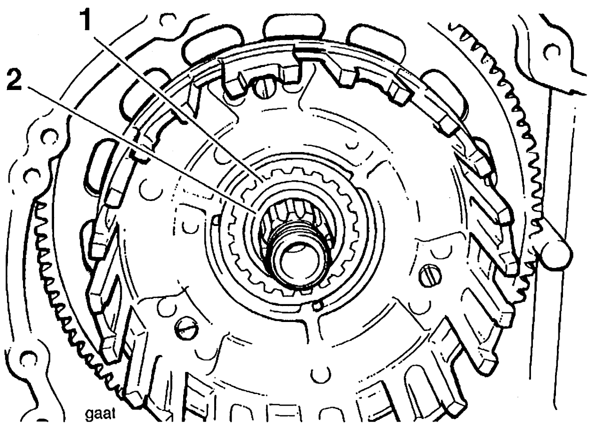
4. Fit the clutch outer drum.

5. Align the splines of the outer drum with the splines on the auxiliary gear (it may be necessary to remove clutch outer drum and rotate by one tooth to align the splines).

6. While holding the clutch outer drum in position, refit the splined sleeve and needle roller bearing.

NOTE:

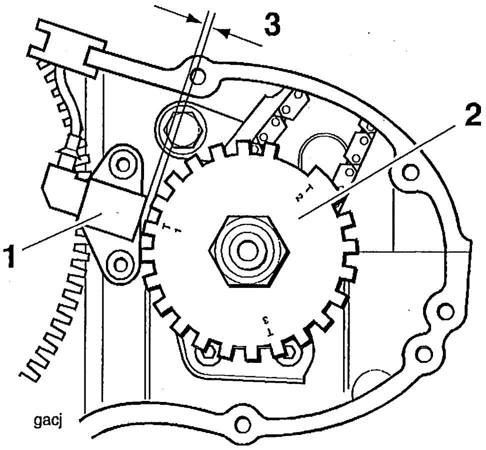
- **When the sleeve is correctly fitted, it will be a flush fit with clutch drum face.**



1. Splined Sleeve

2. Needle Roller Bearing

7. Refit the crankshaft position sensor and adjust the air gap to 1 mm.



1. Crankshaft Position Sensor

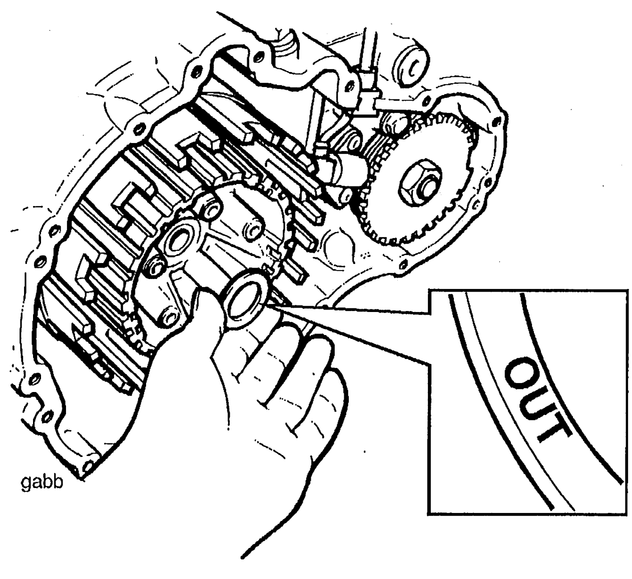
2. Crankshaft Rotor

3. 1.00 mm $\pm$ 0.20 mm

8. Fit the shim and spacer to the shaft.

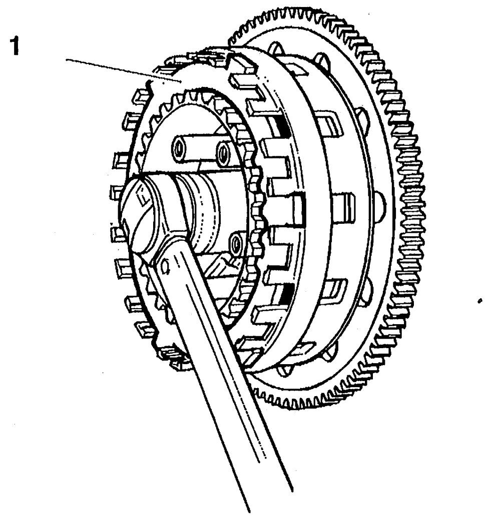
9. Fit the clutch inner drum.

10. Fit a new belleville washer ('out' mark facing outwards), and refit the centre nut.



Belleville Washer 'Out' Mark

11. Lock the inner and outer drums together using service tool T3880305. Depress the rear brake pedal to prevent the engine from turning, and tighten the clutch centre nut to **105 Nm**. Remove the service tool.

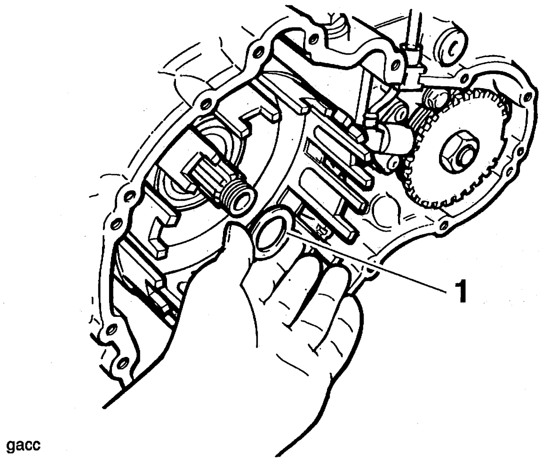


1. Service Tool T3880305

12. Disengage second gear and check for free rotation of the clutch inner drum.

NOTE:

- **If the drum does not rotate freely, or free play is present in the inner drum, the shim which controls the inner drum position must be changed for one of a different thickness. To reduce free play, fit a thinner shim and if the drum is too tight, a thicker shim must be fitted.**



1. Shim

NOTE:

- **The following size shims are available:- 0.10mm, 0.15mm, 0.20mm, 0.25mm, 0.30mm and 0.35mm.**

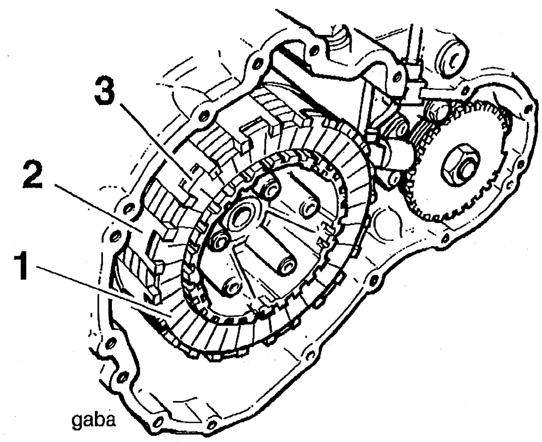
> **CAUTION: Severe engine damage will result from an incorrectly shimmed clutch drum.**

13. Inspect all friction and steel plates for signs of wear, damage or distortion before re-use. Replace any that are not in a serviceable condition.

14. Soak all clutch friction plates in clean engine oil before fitting the friction plates, steel plates, anti-judder spring and anti-judder seat washer to the clutch basket in the same order and orientation as noted during removal.

NOTE:

- **The outermost clutch friction plate is fitted such that the outer tags of the plate are engaged with the corresponding individual tags in the clutch outer drum.**



1. Outer Clutch Friction Plate

2. Outer Drum

3. Individual Tags

15. Refit the clutch pullrod.

16. Refit the clutch pressure plate together with the springs and bolts. Tighten the bolts to **10 Nm.**

17. Clean and refit the clutch cover using a new gasket. Tighten the clutch cover bolts to **9 Nm.**

18. Refit the sump drain plug and tighten to **25 Nm.** Re-fill the engine with the correct grade and type of engine oil.

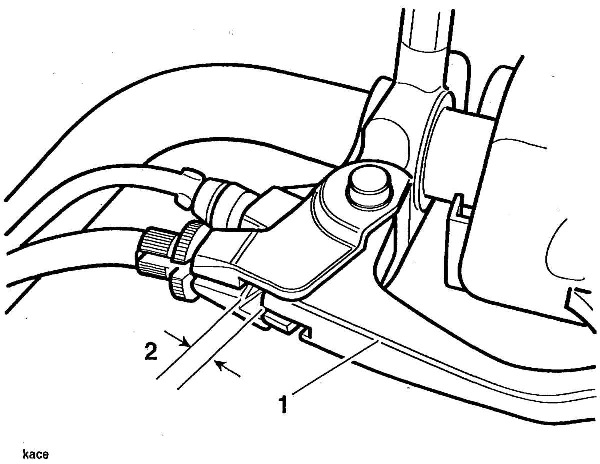
19. Refit the outer cable to the adjuster bracket at the clutch end.

NOTE:

- **Ensure that the two adjuster nuts are positioned, one either side of the bracket.**

20. Remove the clutch lever pivot bolts and collect the knuckle guard. Temporarily refit the pivot bolt to retain the lever.

21. Set the lever adjuster to a point where an equal adjustment is possible in both directions.
22. Set the adjuster at the clutch end to give a preliminary setting of 2-3mm of free-play as measured at the lever.
23. Operate the clutch lever several times and recheck the amount of free-play present at the lever.
24. Set the final adjustment of the cable to give 0.4-0.8 mm of free-play at the lever by turning the adjuster nut and locknut at the lever end.



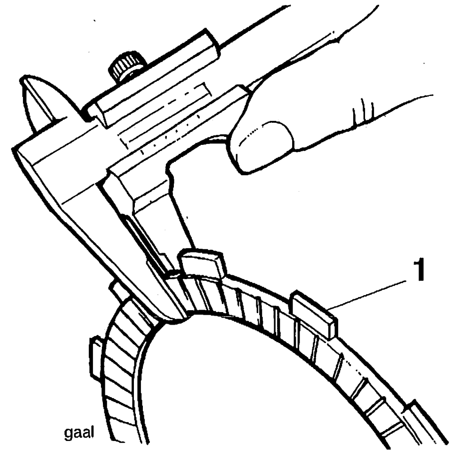
1. Clutch Lever

2. Correct Setting, 0.4-0.8 mm

25. Remove the lever pivot bolt (temporarily fitted earlier) and refit the knuckle guard. Tighten the pivot bolt to **6 Nm** and the locknut to **3 Nm.**
26. Reconnect the battery positive (red) lead first.
27. Refit the seats.

FRICTION PLATE INSPECTION

1. If any friction plate thickness is outside the service limit, replace the friction plates as a set.

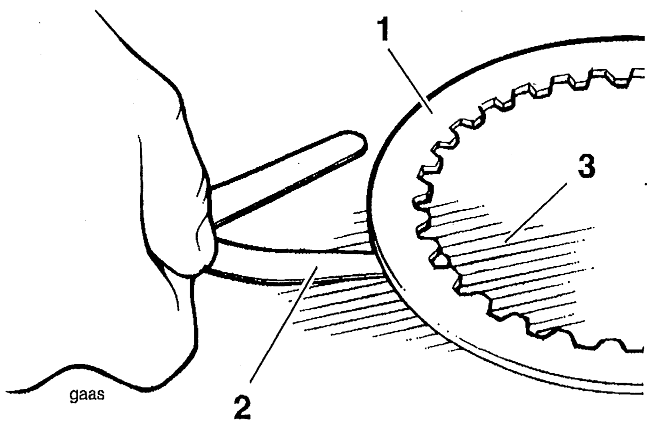


1. Clutch friction Plate

Friction plate thickness

Standard:	**3.80 mm - 0.00 + 0.08 mm**
Service limit:	**3.60 mm**

2. Check all plates for bend and warp as follows: Place the plate being checked on a clean surface plate and attempt to pass a feeler gauge of the maximum specified thickness between the friction plate and surface plate at several points around the plate. If the feeler gauge can be passed beneath the friction plate at any point, renew the plates as a set.



1. Friction Plate
2. Feeler Gauge
3. Surface Plate

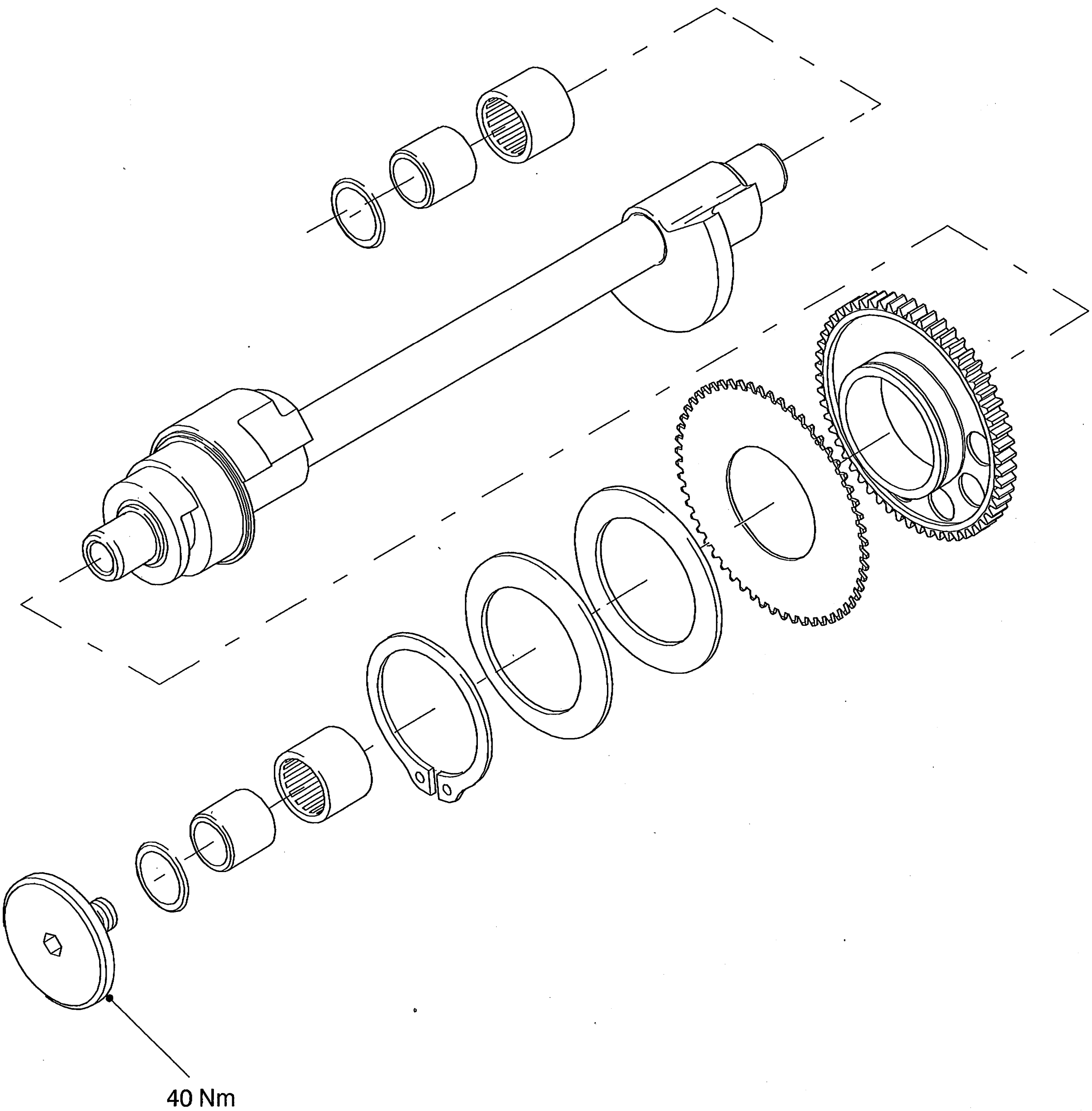
Friction plate bend/warp

Standard:	**0.15 mm**
Service limit:	**0.20 mm**

BALANCER

CONTENTS

Exploded View - Balancer Shaft



BALANCERS

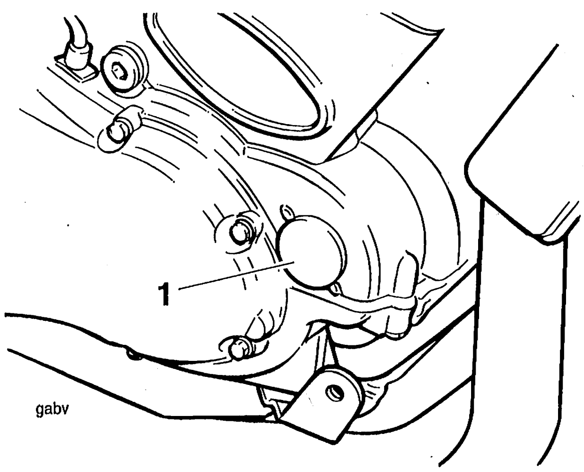
The balancer is fitted to control 'pulsing' within the engine. Without any form of balancer, the engine would 'pulse' each time the crankshaft rotated. This 'pulsing' would be felt as a vibration which would amplify as the engine speed was increased.

The balancer has the effect of a pair of counterbalance weights which create an equal amount of energy in the opposite direction, and at the same time as that produced by the crankshaft, pistons and connecting rods. Because the opposing pulses occur at the same point of crankshaft rotation, and are of an equal magnitude, a state of equilibrium or balance is reached.

Alignment Inspection

If the balancer is not correctly orientated in relation to the crankshaft, severe engine vibration will occur. In circumstances where severe engine vibration is experienced, the relationship of the balancer to the crankshaft must be checked.

1. Disconnect the battery, negative (black) lead first.
2. Drain the engine oil into a clean container.
3. Remove the clutch cover as described in the clutch section.
4. Lever out the plug shown in the illustration below from the right hand side of the crankcase. Take care not to mark or damage the case during removal.

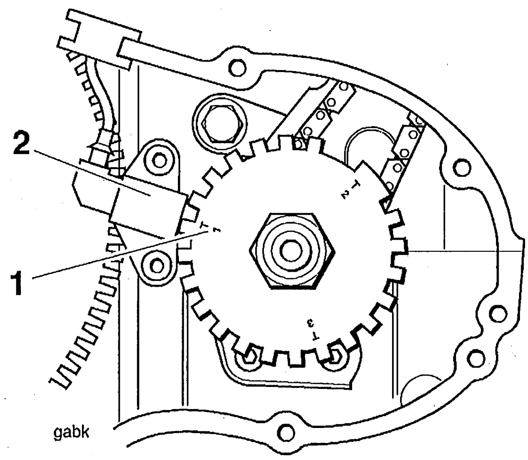


1. Crankcase Plug

NOTE:

- **The plug will be damaged during removal and must be discarded.**

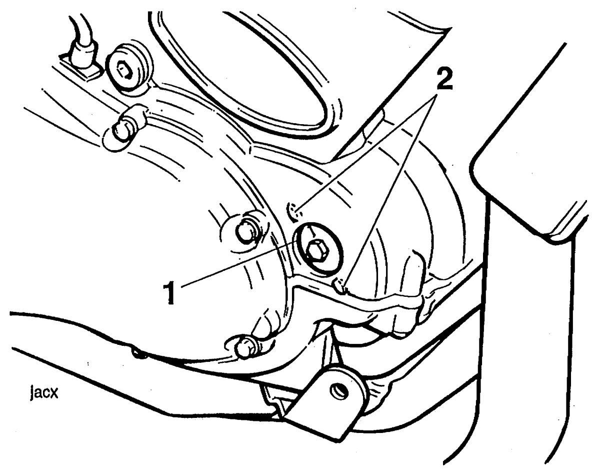
5. Turn the engine over until the 'T1' mark on the crankshaft rotor aligns with the centre of the crankshaft position sensor.



1. 'T1' Mark

2. Crankshaft Position Sensor

6. Examine the marking on the end of the balancer shaft and check that the markings align with the corresponding pointers on the outside of the crankcase. If the markings align as shown below, the balancer is correctly aligned.



1. Balancer Shaft Markings

2. Crankcase Pointers

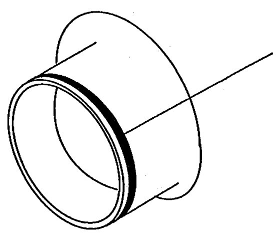
> **CAUTION: If the markings do not align as shown, the balancer must be removed, checked and refitted in the correct alignment position. Continued engine operation with an incorrectly aligned balancer will cause premature engine wear and permanent engine damage.**

7. Fit a new plug to the right hand side of the crankcase as described in 'balancer plug fitting'.
8. Refit the clutch cover as described in the clutch section.

9. Refill the engine with the correct grade engine oil.
10. Reconnect the battery, positive (red) lead first.

Balancer Plug Fitting

1. Thoroughly remove all traces of oil/grease and the previous bonding medium from the plug bores, ensuring that no debris or swarf enter the crankcase.
2. Select new plugs and ensure that they are also free from all traces of oil/grease before proceeding.
3. Using a syringe, apply a bead of Scotchgrip 847 (1236) to the front edge of each plug as shown below. The adhesive is available from Triumph under part number T3450301. The adhesive must cover the complete circumference of the plug.



NOTE:

- **Ensure that the adhesive container is sealed correctly when not in use. This will prevent evaporation solvents which ensure the sealer's bonding efficiency.**

4. Fit the plugs to the crankcase immediately after application of the adhesive. Ensure that the plugs are square to the crankcase and insert by applying a constant pressure with the palm of the hand.
5. Allow the adhesive to cure for at least one hour before starting the engine.

Balancer Shaft Removal

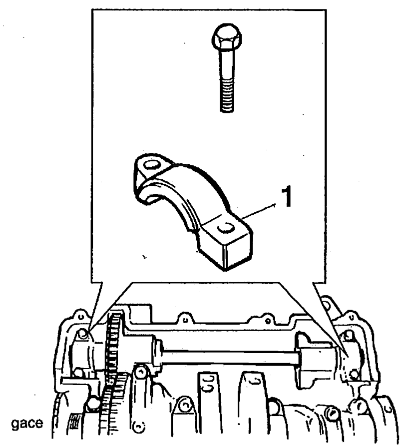
NOTE:

- **To remove the balancer, the engine must be removed from the frame and the two halves of the crankcase separated to allow removal of the crankshaft. For details of engine removal, crankcase separation and crankshaft removal, see the crankcase/crankshaft/piston and connecting rod section.**

1. Invert the upper crankcase ensuring that its weight is adequately supported.
2. Mark the balancer cap positions to ensure that they are refitted in their original orientation and positions in the crankcase.

CAUTION: The crankcase and balancer bearing caps are align bored during manufacture. Refitting the balancer bearing caps incorrectly may cause the shaft to seize or the caps to break resulting in severe engine damage.

3. Remove the balancer cap bolts.



1. Balancer Cap

4. Using hand pressure only, remove the bearing caps.

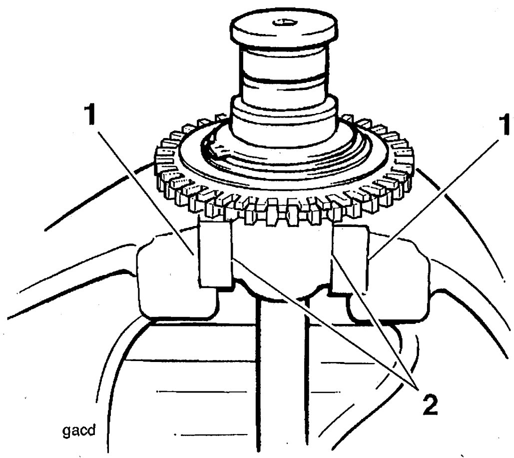
NOTE:

- **Note the position of the balancer cap bolt which has a washer beneath the bolt head. On assembly, ensure that this bolt and washer are returned to the same location.**

5. Withdraw the balancer assembly from the crankcase.
6. Collect the bearing from the left hand end of the balancer shaft.

Disassembly

1. Locate the balancer assembly to a vice fitted with soft jaw-plates.
2. Close the vice such that the vice jaws grip the balancer across the flats on the balancer weight.



1. Vice Jaws

2. Balancer Weight Flats

NOTE:

- **The belleville washer, circlip and backlash eliminator gears are available as spare parts and can, therefore, be replaced. The drive gear and shaft are assembled using liquid oxygen and a press and cannot be replaced. If either of these parts become damaged, the complete shaft assembly must be replaced.**

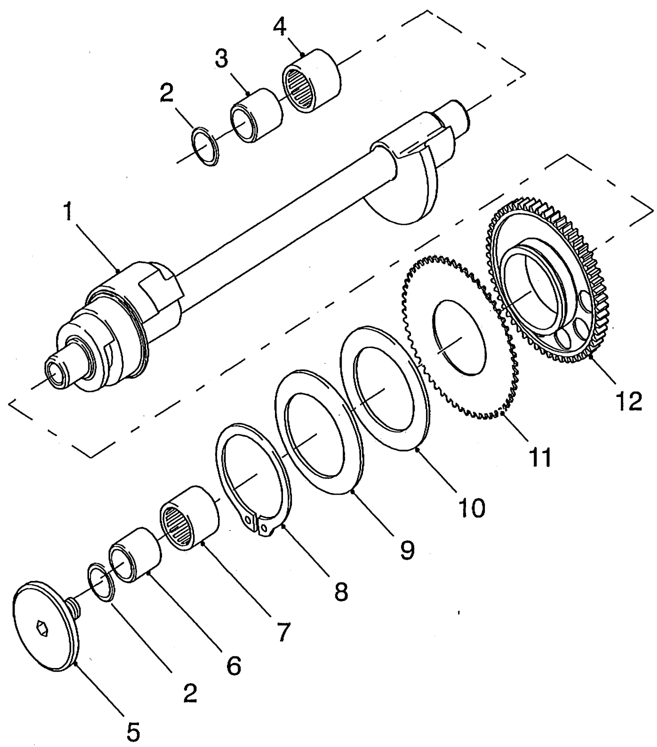
3. Remove the circlip from the right hand (balancer gear) end of the shaft.

> **WARNING: Always wear eye protection when removing the circlip. The belleville washer below the circlip exerts considerable upward pressure and can cause the clip to jump off during release.**
>
> **Eye damage could result from contact with a displaced circlip.**

4. Collect the belleville washer, flat washer and backlash eliminator gear.
5. To remove the right hand bearing, undo the large-head capscrew from the end of the shaft and slide off the bearing and sleeve. Discard the capscrew.
6. If required, remove the circlip from the left hand end of the balancer to release the bearing sleeve.

NOTE:

- **The capscrew must not be re-used as its alignment marks will be incorrectly positioned when assembled.**



1. **Balancer Shaft**
2. **Circlip**
3. **Sleeve, Left Hand**
4. **Bearing, Left Hand**
5. **Large-head Capscrew**
6. **Sleeve, Right Hand**
7. **Bearing, Right Hand**
8. **Circlip**
9. **Belleville Washer**
10. **Washer**
11. **Backlash Eliminator Gear**
12. **Balancer Drive Gear**

Examination

Before assembly, check the following items:

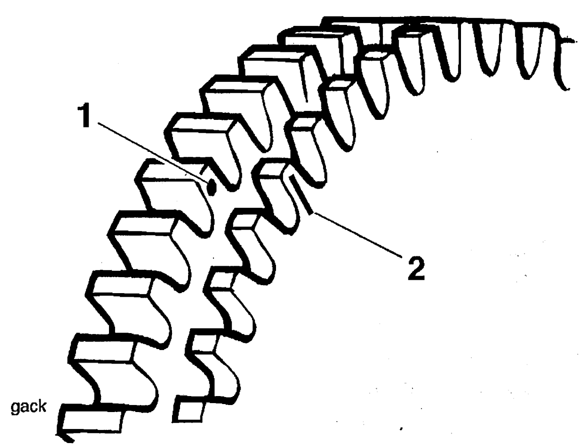
- Shaft bearings for overheating (blue coloured areas), loose or missing rollers etc.
- Shaft bearing areas and sleeves for overheating (blue coloured areas), grooving, scoring etc.
- Drive gear and backlash eliminator gears for tooth damage, overheating etc.
- Belleville washer for distortion.

Assembly

NOTE:

- **Prior to beginning the assembly process, locate the shaft to the vice in the same way as for disassembly.**

1. Locate the right hand bearing and sleeve to the shaft.
2. Apply 'Loctite 270' to the threads of a new large-head capscrew. Fit and tighten the capscrew to **40 Nm.**
3. Identify the balancer drive gear tooth marked with a dot. Fit the backlash eliminator gear such that the line marking on the backlash eliminator gear is in line with the dot marked balancer drive gear tooth.



1. Drive Gear Dot Marking

2. Backlash Eliminator Gear Line Marking

4. Fit the flat washer, belleville washer (dished face outwards) and circlip.

WARNING: Always wear eye protection when fitting the circlip. The belleville washer below the circlip exerts considerable upward pressure and can cause the clip to jump off during assembly.

Eye damage could result from contact with a displaced circlip.

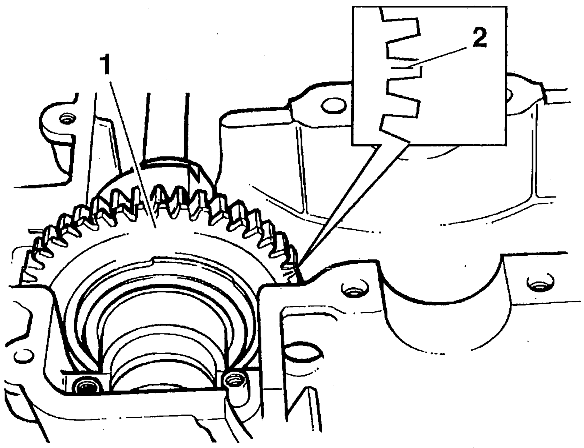
NOTE:

- **An assistant may be required to compress the belleville washer during fitment of the circlip.**

5. If previously removed, fit the left hand bearing sleeve.
6. Retain the bearing sleeve with a new circlip.
7. Lubricate and fit the left hand bearing.
8. Withdraw the shaft from the vice and check that the bearings rotate smoothly etc.

Installation

1. Check that the backlash eliminator gear tooth which is marked with a line is directly in front of the balancer drive gear marked with a dot.



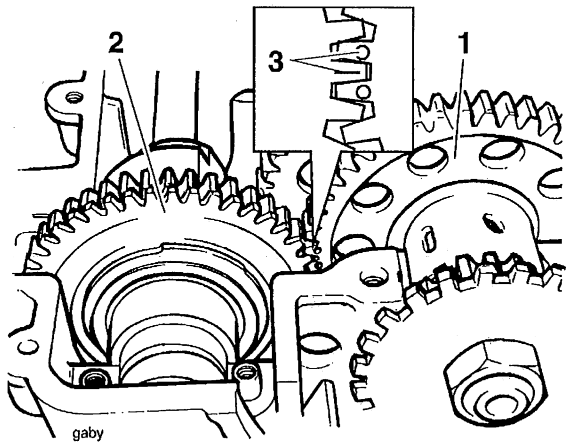
1. Backlash Eliminator Gear

2. Backlash Eliminator Gear Line Marking

NOTE:

- **If the markings on the gears do not align at the same point, the backlash eliminator gear can be rotated by gently moving it against the teeth of the drive gear.**
- **For ease of identification during assembly, apply a small paint spot to the outside face of the dot marked balancer drive gear tooth.**

2. Apply 'Three Bond 1375B' high strength locking fluid (or a direct equivalent) to the balancer bearing locations in the upper crankcase.
3. Locate the retaining circlips to each end of the balancer shaft.
4. Install the balancer assembly into the crankcase ensuring that the oil holes in the balancer bearings face away from the sealer area.
5. Fit the crankshaft to the crankcase aligning the two dot marked teeth on the crankshaft gear with the marked balancer driven gear.

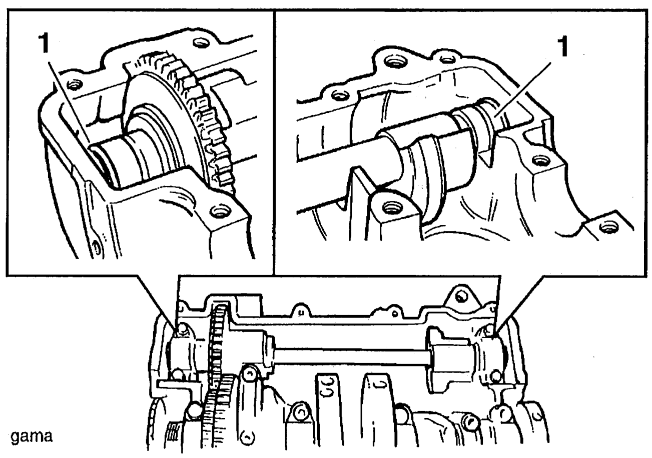


1. Crankshaft Drive Gear

2. Balancer Driven Gear

3. Alignment Marks

6. Align the circlips at either end of the balancer shaft with the corresponding grooves in the crankcase.



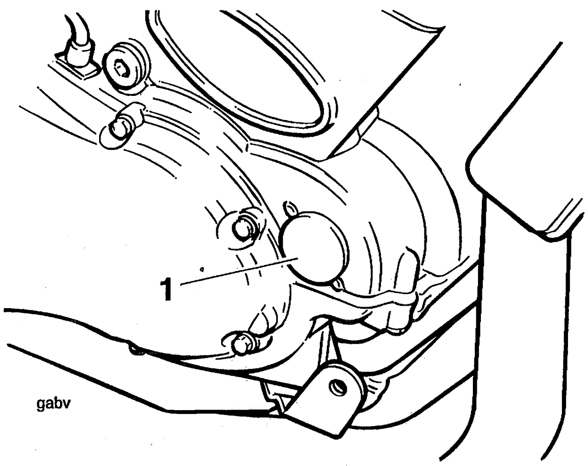
1. Circlip Locations

7. Refit the bearing caps in the position and orientation noted during disassembly **(remembering also, to return the bolt with a washer to the same location as noted during disassembly).**

NOTE:

- **It is not necessary to apply locking fluid to the bearing locations in the caps.**

8. Lubricate the threads of the balancer cap bolts with engine oil and tighten the bolts of both caps as follows;
   - first bolt to **8 Nm.**
   - second bolt to **28 Nm,**
   - retorque first bolt to **28 Nm.**
9. Rebuild the engine to a point where the two halves of the crankcase are assembled together.
10. Lever out the plug, shown in the illustration below, from the right hand side of the crankcase. Take care not to mark or damage the case during removal.

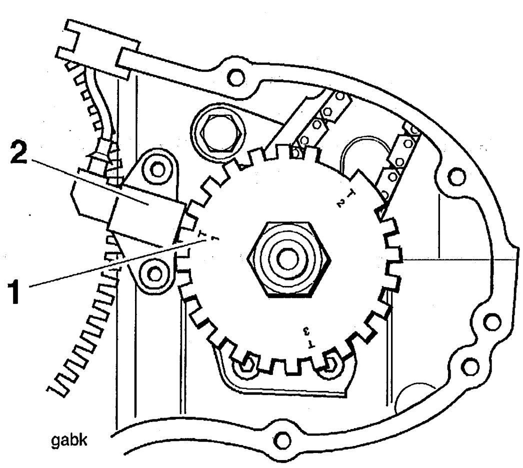


1. Crankcase Plug

NOTE:

- **The plug will be damaged during removal and must be discarded.**

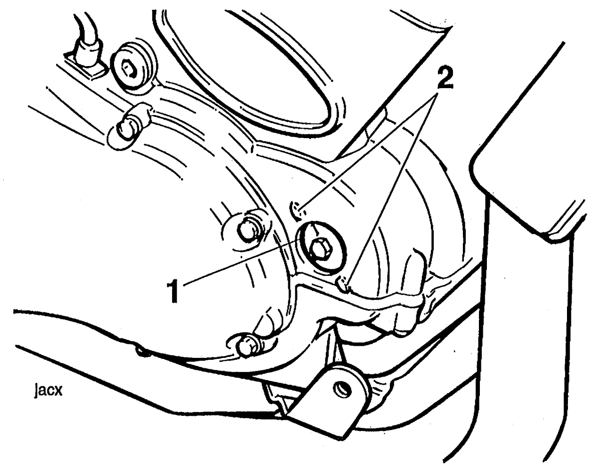
11. Turn the engine over until the 'T1' mark on the crankshaft rotor aligns with the centre of the crankshaft position sensor.



1. 'T1' Mark

2. Crankshaft Position Sensor

12. Make permanent marks on the bolt that accurately align with the two marks on the outside of the crankcase.



1. Balancer Shaft Bolt Marking

2. Crankcase Pointers

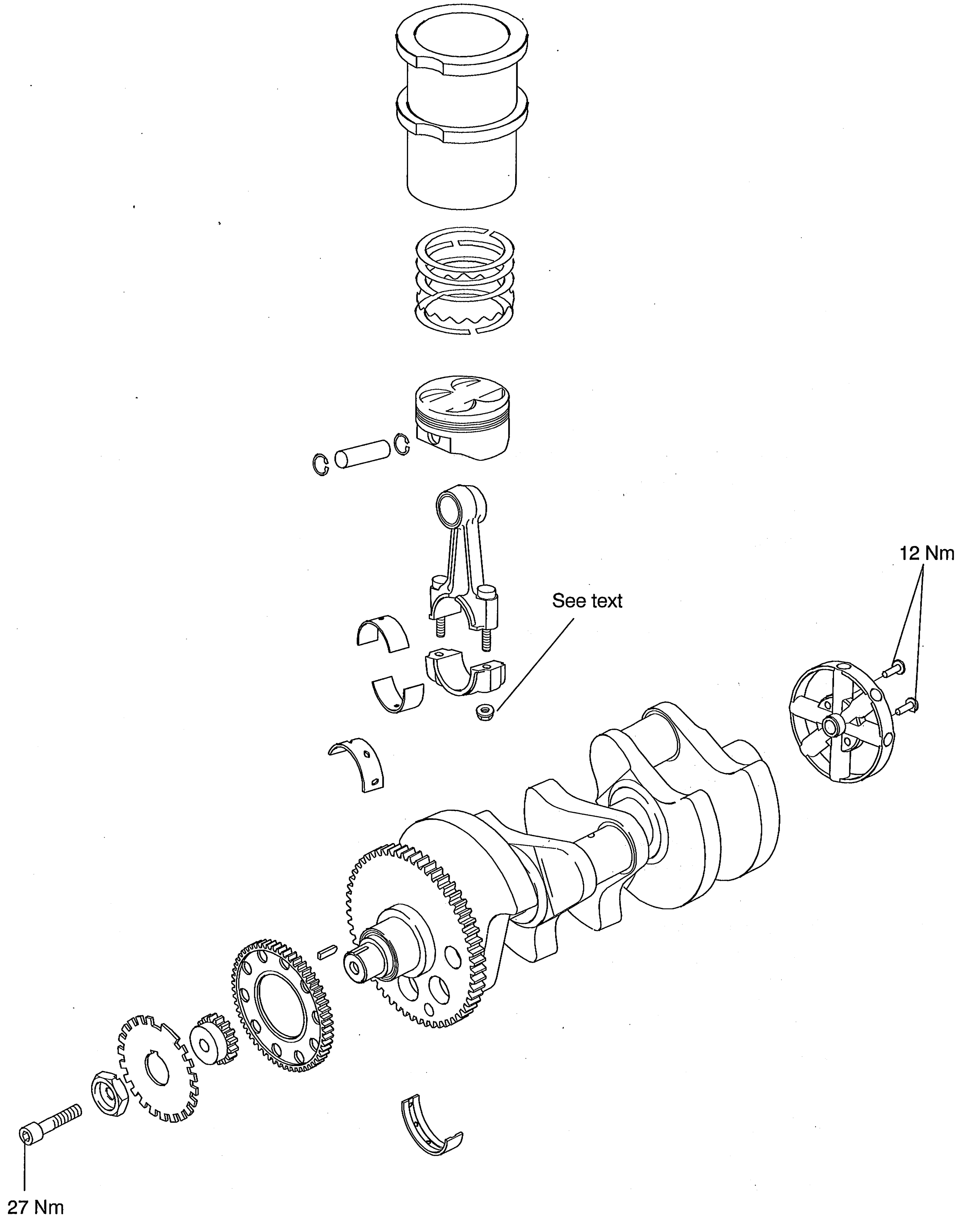
13. Fit a new plug to the right hand side of the crankcase (see 'balancer plug fitting' earlier in this section).
14. Continue to assemble and refit the engine as described in the crankcase/crankshaft/piston and connecting rod section.

CRANKSHAFT, RODS and PISTONS

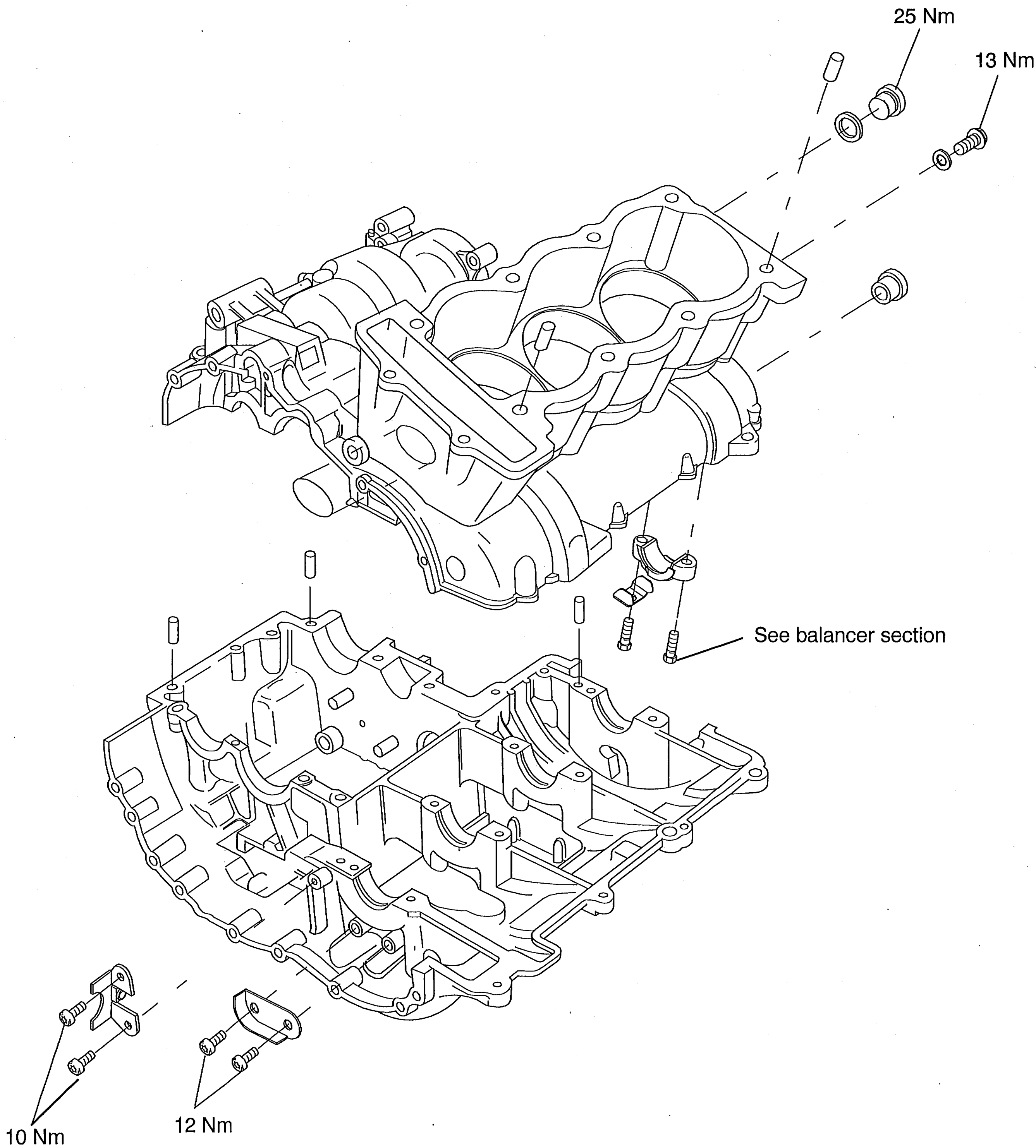
CONTENTS

Exploded View

Crankshaft, Connecting Rod, Piston and Liner



Exploded View - Crankcase



ENGINE REMOVAL/REFIT

Removal

1. Remove the seats and disconnect the battery, negative (black) lead first.
2. Remove the battery.
3. Place the motorcycle on a paddock stand.

> **WARNING: Ensure that the motorcycle is stabilised and adequately supported to prevent the risk of injury from the motorcycle falling.**

4. Remove the body side panels as described in the bodywork section.
5. Remove the fuel tank and airbox as described in the fuel system section.
6. Drain the engine oil into a suitable container. Once all the oil has drained out, fit a new sealing washer to the sump plug and fit and tighten it to **25 Nm.**

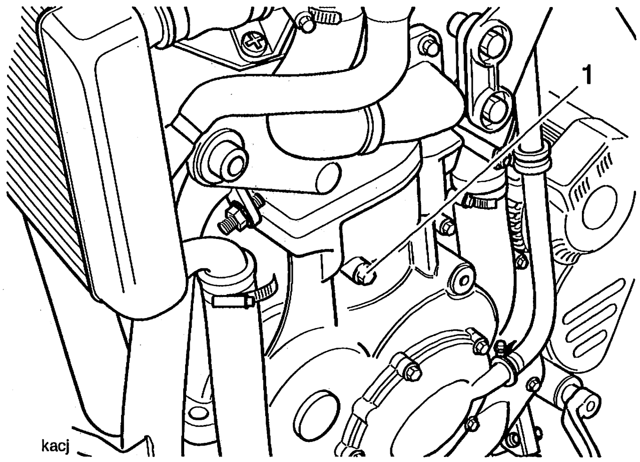
> **WARNING: The oil may be hot to the touch. Contact with hot oil may cause the skin to be scalded or burned.**

> **WARNING: Prolonged or repeated contact with engine oil can lead to skin dryness, irritation and dermatitis. In addition used engine oil contains potentially harmful contaminants which can cause cancer. Wear suitable clothing and avoid skin contact.**

> **CAUTION: Do not pour oil on the ground, down sewers or drains, or into water courses. To prevent pollution of water courses etc., dispose of used oil sensibly. If in doubt contact your local authority.**

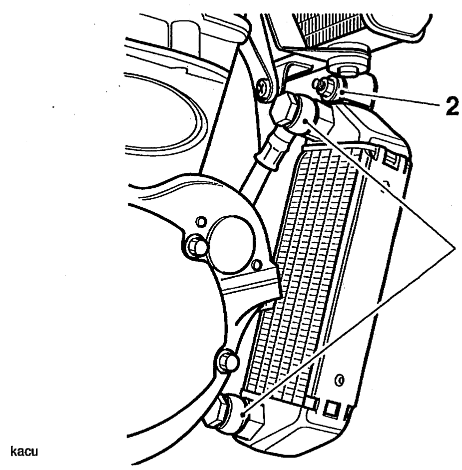
7. Drain the coolant as described in the cooling system section.

> **WARNING: Do not remove the coolant pressure cap when the engine is hot. When the engine is hot, the coolant inside the cooling system is hot and also under pressure. Contact with the pressurised coolant will cause scalds and skin damage.**



1. Coolant Drain Point

8. Once all the coolant has drained out, refit the coolant drain plug and tighten to **13 Nm**. Always use a new sealing washer.
9. Release the oil cooler pipes at their connections with the sump.
10. Remove the oil cooler assembly from its retaining brackets and place the assembly to one side. Do not release the pipe connections to the cooler.

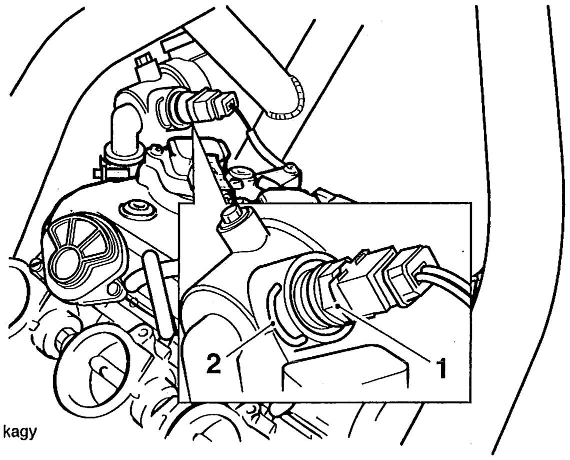


1. Oil Cooler Pipe Connections (Do not remove)

2. Oil Cooler Fixings

11. Remove the screw securing the thermostat housing to its retaining bracket.

12. Leaving the sensor connected, remove the coolant temperature sensor from the thermostat housing.

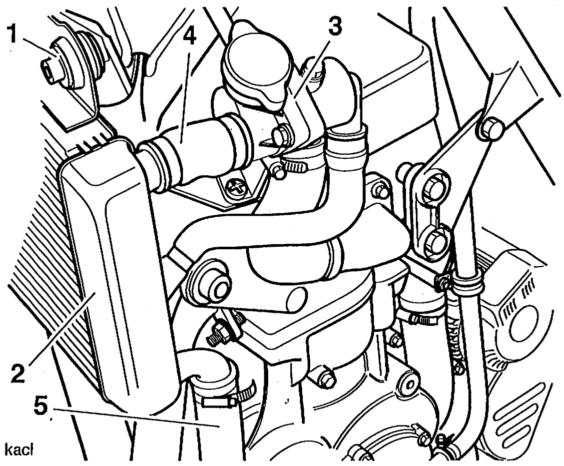


1. Sensor

2. Sensor Retaining Clip

13. Disconnect the bottom radiator hose at the water pump and the top hose at the cylinder head side cover.

14. Remove the radiator assembly complete with the thermostat housing and all water hoses.



1. Radiator Fixings

2. Radiator

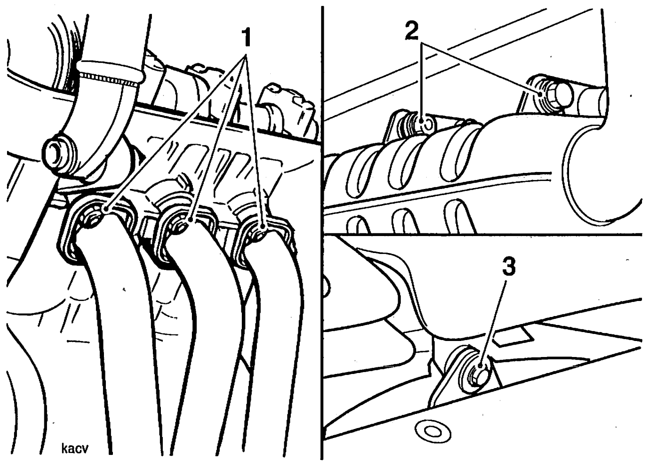
3. Thermostat Housing

4. Top Hose

5. Bottom Hose

15. Disconnect the electrical connection to the cooling fan.

16. Remove the exhaust downpipes, collector box and silencer as detailed in the fuel system section.

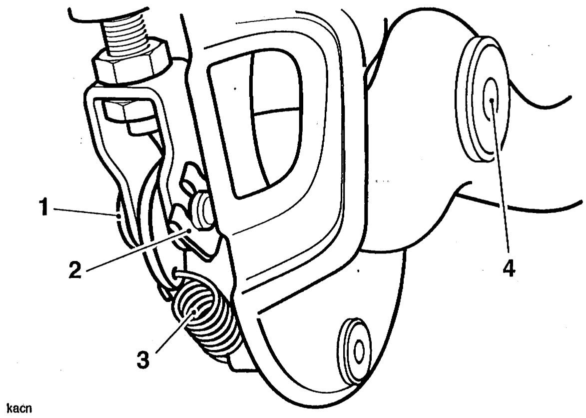


1. Downpipe to Head Fixings

2. Collector Box Mounting

3. Silencer Mounting

17. Detach the rear brake pedal return spring then remove the clevis pin connecting the footbrake pedal to the rear brake master cyclinder.



1. Clevis Pin

2. Clevis Pin Retaining Clip

3. Return Spring

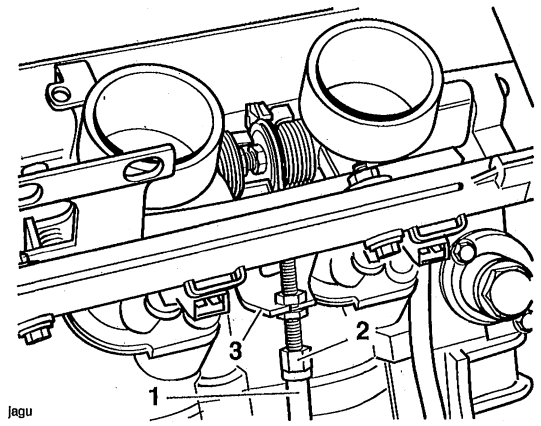
4. Brake Pedal Pivot Bolt

18. Remove the brake pedal.

19. Remove the left hand control plate, and detach the right hand control plate. Secure the right hand control plate/rear brake master cylinder to prevent it from hanging on the brake hose.

20. Disconnect all electrical connections from the main harness to the engine.

21. Disconnect the throttle cable from the throttle bodies.

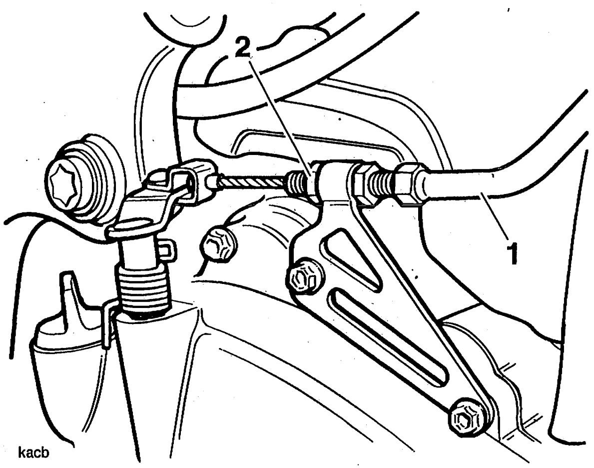


1. Outer Cable

2. Adjuster Locknut

3. Cable Bracket

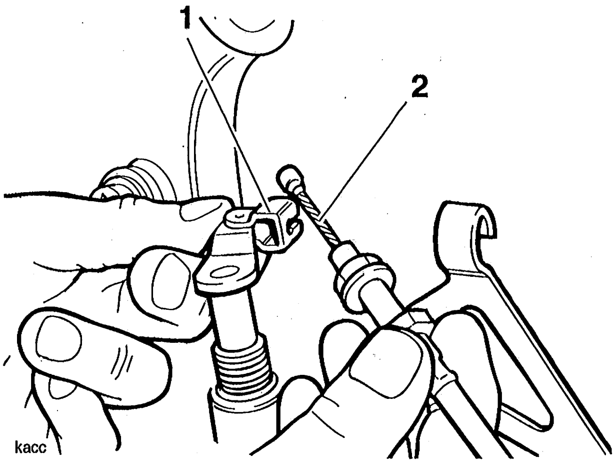
22. Slacken the clutch cable locknut and release the adjuster at the clutch cover end to give maximum play in the cable.



1. Clutch Cable

2. Adjuster

23. Release the clutch cable from the actuating arm by pushing the inner cable nipple through the arm and sliding the cable out of the slot in the arm. Detach the cable from the bracket.



1. Actuating Arm

2. Inner Cable

24. Remove the blanking plugs covering the swinging arm pivot bolts.

25. Slacken, but do not remove, the swinging arm pivot bolts.

26. Remove the sprocket cover.

27. At the swinging arm, slacken the eccentric adjuster clamp bolts.

28. Turn both eccentric adjusters to the position which gives the maximum amount of free play in the chain.

29. Remove the chain guard.

30. Place a jack beneath the engine and ensure that the frame is adequately and securely supported.

31. Note the orientation of the brackets which support the exhaust collector box before removing the rear lower engine mounting bolts.

32. Remove all other engine mounting bolts except those to the front of the cylinder head.

33. Slacken the engine mounting bolts to the front of the cylinder head.

34. Lower the jack allowing the engine to pivot around the front mounting bolts.

> **CAUTION: To prevent damage to components, lower the engine very carefully. Particularly vulnerable items include the throttle position sensor, and accessory socket.**

NOTE:

- **Collect the drive chain rubbing block as the engine is lowered.**
- **Note the position and orientation of the radiator mounting brackets under the front mounting bolts.**

35. With the help of an assistant, remove the remaining engine mounting bolts and lower the engine to allow the drive chain to be detached from the output sprocket.

36. Remove the engine from the frame.

Refit

1. Position the engine beneath the frame.

2. Raise the engine and locate the drive chain to the output sprocket.

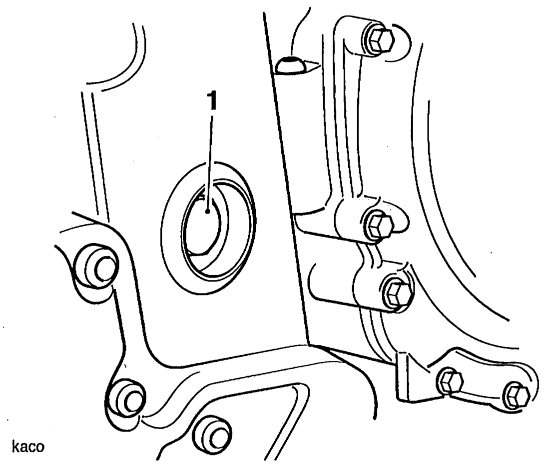
3. Refit the front engine mounting bolts to the cylinder head.

4. Raise the engine, and, remembering to locate the drive chain rubbing block, refit the remaining engine mounting bolts. At the same time, refit the exhaust intermediate box brackets to the lower rear engine mounting bolts in the orientation noted during removal.

5. Tighten all engine mounting bolts to **95 Nm,** in the following sequence:

   - Left hand front upper.
   - Right hand front upper.
   - All remaining left hand bolts working from upper to lower.
   - All remaining right hand bolts working from upper to lower.

6. Tighten the swinging arm pivot bolts to **85 Nm**. Refit plugs to frame.



1. Swinging Arm Pivot Bolt

7. Reconnect the neutral switch wire.

8. Refit the sprocket cover and tighten the bolts to **9 Nm.**

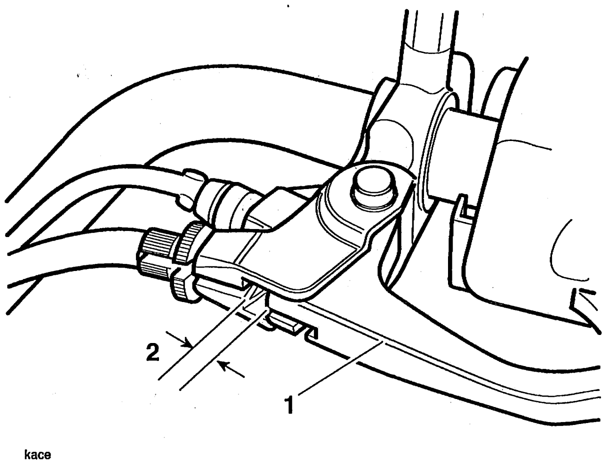
9. Refit the clutch cable and set the adjuster at the clutch end to give a preliminary setting of 2-3 mm of free-play as measured at the lever.

NOTE:

- **To accurately adjust the clutch cable, it is essential that the knuckle guard is first removed from the clutch lever, and the pivot bolt temporarily refitted.**

10. Operate the clutch lever several times and recheck the amount of free-play present.

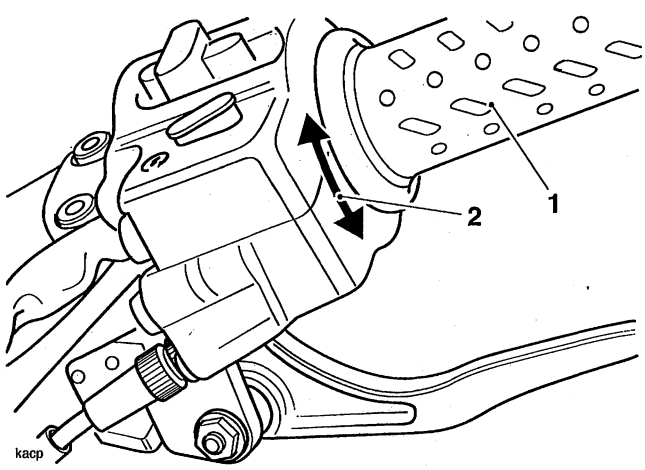
11. Set the final adjustment of the cable to give 0.4-0.8 mm of free-play at the lever by turning the adjuster nut and locknut at the lever end. Tighten the lock ring.



1. Clutch Lever

2. Correct Setting, 0.4-0.8 mm

12. Refit the throttle cable to the throttle bodies. When correctly set, the throttle must have 2-3 mm of free play at the throttle twist grip. If there is more or less than 2-3 mm of free-play present, the throttle cable must be adjusted.

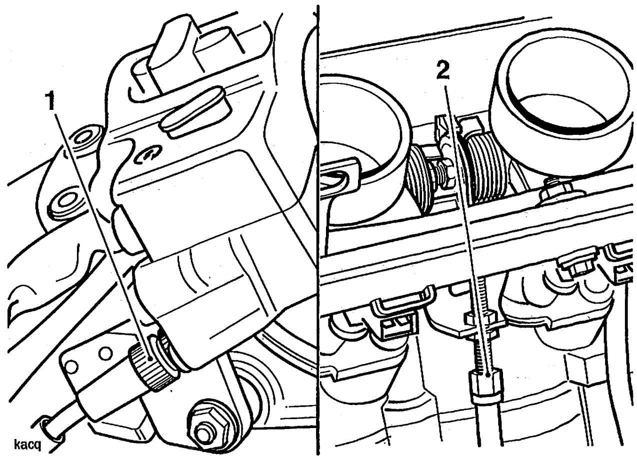


1. Throttle Twist Grip

2. 2-3 mm

WARNING: Operation of the motorcycle with an incorrectly adjusted, incorrectly routed, sticking or damaged throttle cable could interfere with the operation of the brakes, clutch or the throttle itself. Any of these conditions could result in loss of control of the motorcycle and an accident.

WARNING: Move the handlebars to left and right full lock while checking that cables and harnesses do not bind. A cable or harness which binds will restrict the steering and may cause loss of control and an accident.



1. Adjuster - Twist Grip End

2. Adjuster - Throttle Body End

13. Set the cable adjuster at the twist grip end such that it has an equal amount of adjustment in each direction.

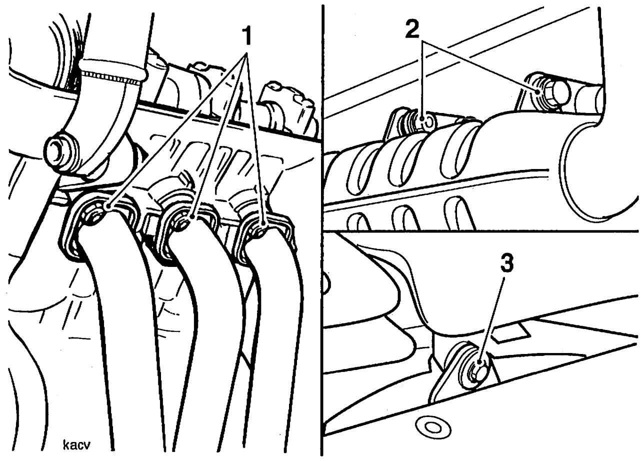
14. Set the adjuster at the throttle body end of the cable to give 2-3mm of play at the throttle twist grip. Tighten the locknut.

15. Make any minor adjustments as necessary to give 2-3 mm of play using the adjuster at the twist grip end of the cable. Tighten the locknut.

WARNING: Ensure that the adjuster locknuts are tightened. A loose throttle cable adjuster could cause the throttle to stick leading to loss of control and an accident.

16. Reconnect all remaining electrical connections to the engine.

17. Locate and secure the oil cooler to the lower mounting bracket. Tighten the fixing to **9 Nm**.
18. Incorporating new sealing washers to both sides of the connections, fit and tighten the oil cooler pipes to the sump. Tighten the connections to **25 Nm**.
19. Using new seals at the cylinder head end, refit the exhaust system as described in the fuel system section.

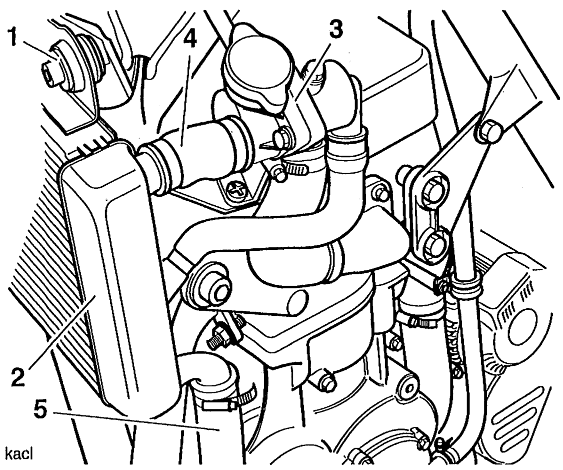


1. Downpipe to Head Fixings

2. Collector Box Mounting

3. Silencer Mounting

20. Position the radiator/thermostat assembly to the lower radiator mounting brackets.



1. Radiator Fixings

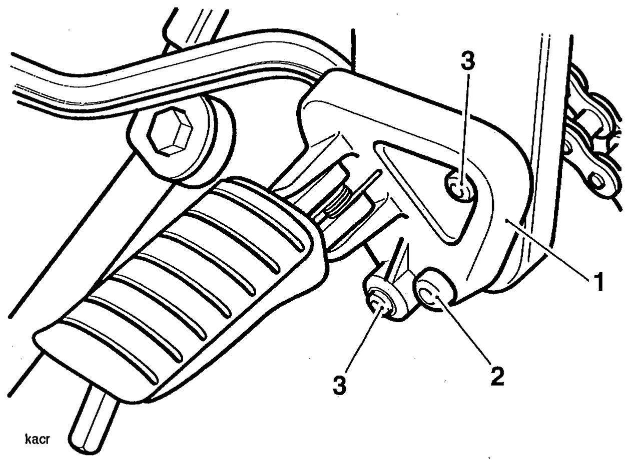
2. Radiator

3. Thermostat Housing

4. Top Hose

5. Bottom Hose

21. Locate the top and bottom hoses and tighten the clips.
22. Tighten the radiator upper mounting bolts to **9 Nm** and the thermostat housing fixing to **5 Nm**.
23. Reconnect the cooling fan.
24. Refit the coolant temperature sensor and retain with the clip.
25. Refit and tighten the upper oil cooler fixing. Tighten the fixing to **9 Nm**.
26. Refit the left hand control plate assembly. Tighten the larger fixings to **27 Nm** and the smaller fixing to **9 Nm**.



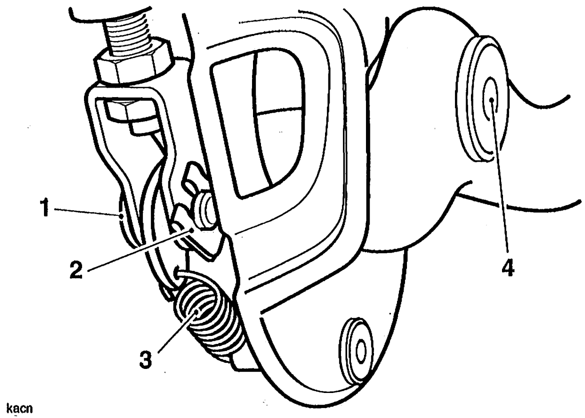
1. Control Plate

2. Larger Fixings

3. Smaller Fixing

27. Refit the right hand control plate assembly ensuring that the rear brake master cylinder and hoses are correctly positioned. Tighten the fixings to **27 Nm**.
28. Refit the brake pedal to the control plate and tighten the pivot bolt to **27 Nm**. Check that the pedal moves freely and rectify any tightness as necessary.

29. Refit the clevis pin the the rear brake pedal/master cylinder push rod and retain with a new clip. Refit the return spring.



1. Clevis Pin

2. Clevis Pin Retaining Clip

3. Return Spring

4. Brake Pedal Pivot Bolt

30. Refill the engine with correct specification oil as detailed in the lubrication section.

31. Refill the cooling system as described in the cooling section.

32. Refit the airbox and fuel tank as described in the fuel system section.

33. Refit all bodywork previously removed.

34. Refit the battery and connect positive (red) lead first.

35. Refit the seats.

36. Support the motorcycle and remove the paddock stand. Park the motorcycle on the side stand.

37. Allow the swinging arm to hang free, and set the chain adjustment as described in the rear suspension/final drive section.

38. Tighten the eccentric adjuster clamp bolts to **35 Nm.**

CRANKCASES

CAUTION: The upper and lower crankcases are machined as a matched set and must never be assembled to non-matching halves. Doing so will cause seizure of the engine.

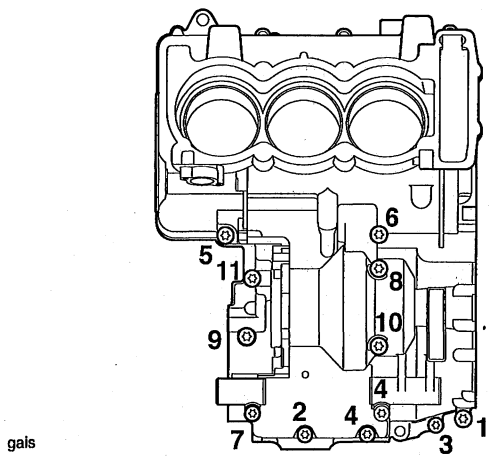
Before the crankcase halves can be separated, the engine must be removed from the frame and the following items must also be removed

1. Sump.
2. Engine covers
3. Alternator.
4. Starter motor.
5. Crankshaft position sensor.

Disassembly

CAUTION: Failure to follow the correct screw release sequence may result in permanent crankcase damage.

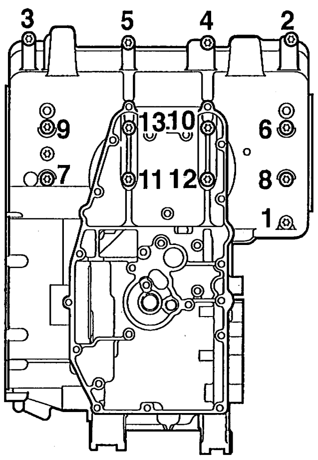
1. Working on the upper crankcase bolts first, release the bolts in the sequence shown below.



Upper Crankcase Bolt Release Sequence

2. Invert the engine to give access to the lower crankcase bolts.

3. Release the lower crankcase bolts in the sequence shown in the diagram below.



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Lower Crankcase Bolt Release Sequence

4. Separate the lower and upper crankcases ensuring that the 3 locating dowels remain in the upper crankcase.

> ⚠ **CAUTION: Do not use levers to separate the upper and lower sections of the crankcase or damage to the crankcases could result.**

NOTE:

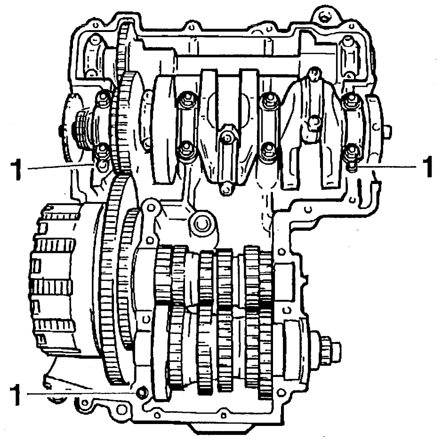
- **At this point the transmission shafts, crankshaft bearings etc. can be removed.**

Assembly

1. Apply Loctite 648 to the outer races of the gearbox bearings. Fit the gearbox shafts (if removed), ensuring the locating ring on the input shaft is in position in the circlip groove on the crankcase. Engage the clutch primary gear with crankshaft gear.

2. Ensure that the transmission is in neutral.

3. Ensure that the 3 locating dowels are in position in the upper crankcase.



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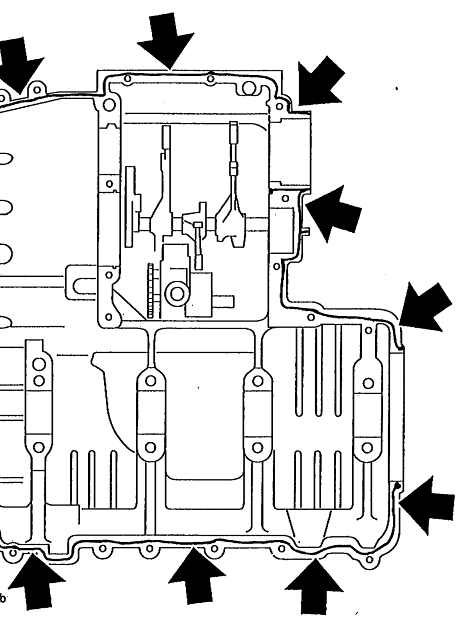
1. Locating dowels

4. Use high flash-point solvent to clean the crankcase mating faces. Wipe the surfaces clean with a lint-free cloth.

5. Apply a thin bead of silicone sealant to the lower crankcase mating faces as shown in the diagram below. (At the factory, Three-bond 1207B is used).



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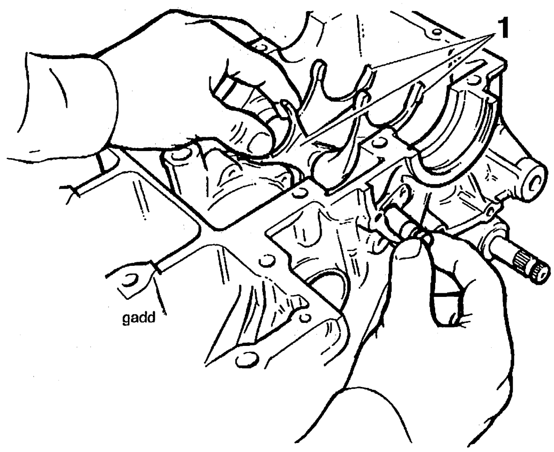
CAUTION: Do not use excessive amounts of sealer. The extra sealer may become dislodged and could block the oil passages in the crankcases causing severe engine damage.

6. Fit a new 'O' ring to the oil pump outlet.
7. Install and lubricate the crankshaft bearing shells with clean engine oil.
8. Lubricate the crankshaft journals with clean engine oil.
9. Position the lower crankcase to the upper, ensuring that all selectors engage correctly. An assistant may be required to support the crankcase during alignment.



Selector Forks

10. Fit the screws into the lower crankcase and hand tighten.
11. Invert the engine.
12. Fit the screws into the upper crankcase and hand tighten.

NOTE:

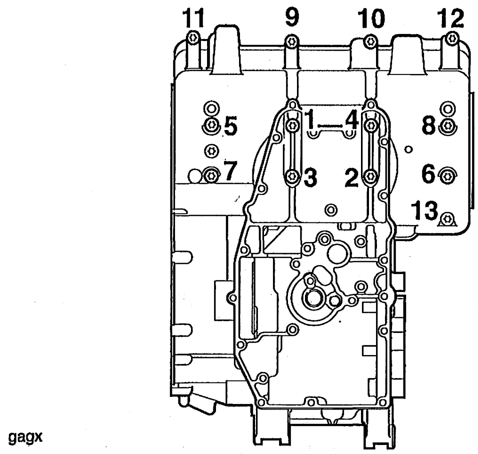
- **The crankcase screws are tightened in stages, in the same sequences used during strip down.**
- **Two different sizes of crankcase screw are used. All screws are tightened through the first two stages of the tightening procedure but only the M8 size screws are tightened at the third stage.**

CAUTION: Failure to follow the correct screw tightening sequence may result in permanent crankcase damage.

Stage 1 - all screws

13. Invert the engine.

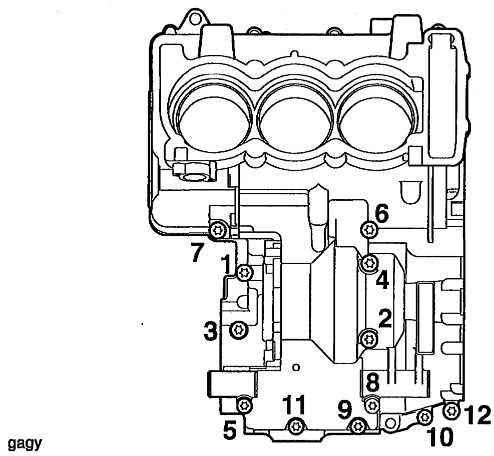
    In the correct sequence, tighten all lower crankcase screws to **10 Nm**.



Lower Crankcase Bolt Tightening Sequence

14. Invert the engine.

    In the correct sequence, tighten all upper crankcase screws to **10 Nm**.



Upper Crankcase Bolt Tightening Sequence

Stage 2 - all screws

15. Invert the engine.

    In the correct sequence, tighten all lower crankcase screws to **12 Nm.**

16. Invert the engine.

    In the correct sequence, tighten all upper crankcase screws to **12 Nm.**

Stage 3 - M8 screws only

17. Invert the engine.

    In the correct sequence, tighten only the **M8** size lower crankcase screws to **28 Nm.**

18. Invert the engine.

    In the correct sequence, tighten only the **M8** size upper crankcase screws to **28 Nm.**

19. Rotate the crankshaft clockwise. Check for tight spots and rectify as necessary.

CRANKSHAFT

NOTE:

- **Before the crankshaft can be removed, the two halves of the crankcase must first be separated.**

Removal

1. Remove the connecting rods as described in this section.
2. Remove the breather disc from the crankshaft.
3. Remove the cam chain as described in the cylinder head section.
4. Release and remove the crankshaft from the upper crankcase.

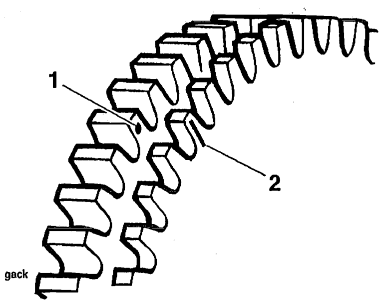
NOTE:

- **Remove all bearings and inspect for damage, wear, overheating (blueing) and any other signs of deterioration. Replace the bearings as a set if necessary.**

Installation

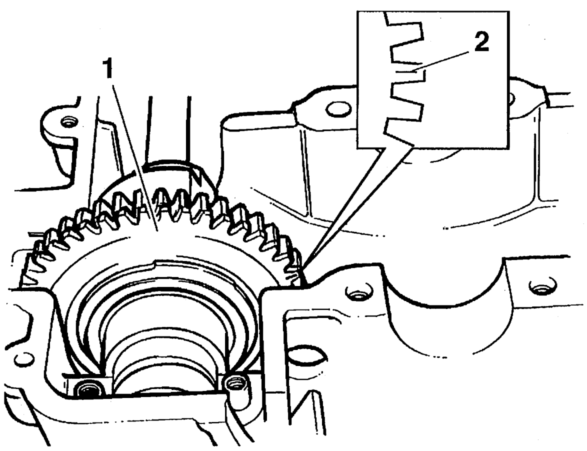
> ⚠ **CAUTION: Always check the bearing journal clearance, as described in the following pages, before final assembly of the crankshaft. Failure to correctly select crankshaft bearings will result in severe engine damage.**

1. Select and fit new main and big end bearings using the selection processes detailed later in this section.
2. Lubricate all bearings with engine oil.
3. Ensure that the crankshaft is clean, and that the oilways within the crank are clean and free from blockages and debris.
4. Before fitting the crankshaft, check that the balancer backlash eliminator gear tooth which is marked with a line is directly in front of the balancer drive gear marked with a dot.



1. Drive Gear Dot Marking

2. Backlash Eliminator Gear Line Marking



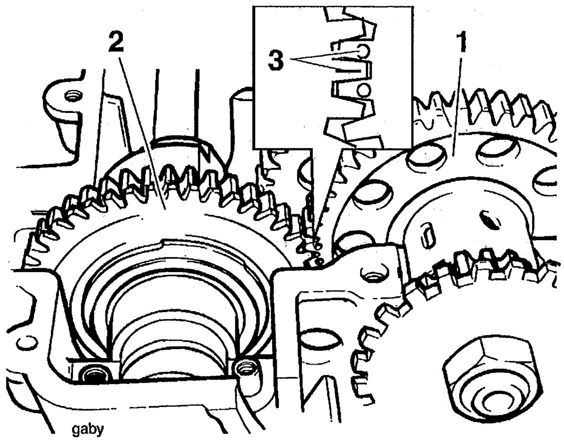
1. Balancer Drive Gear Assembly

2. Backlash Eliminator Gear Marking

NOTE:

- **If the markings on the balancer gears do not align at the same point, the backlash eliminator gear can be rotated independently of the drive gear by gently moving it against the drive gear teeth.**
- **For ease of identification during assembly, apply a small paint spot to the outside face of the dot marked balancer drive gear tooth.**

5. Fit the crankshaft to the crankcase aligning the two dot marked teeth on the crankshaft gear with the marked balancer driven gear.



1. Crankshaft Drive Gear

2. Balancer Driven Gear

3. Alignment Marks

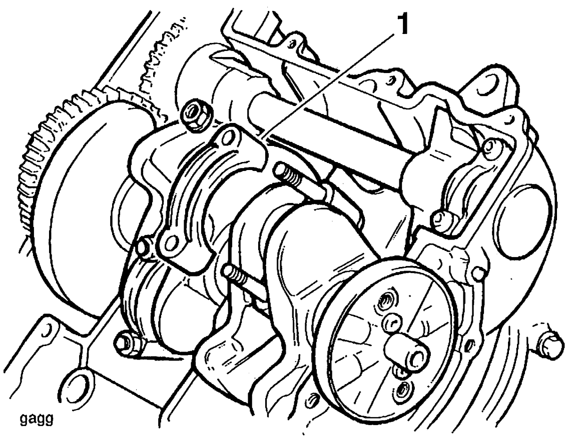
6. Refit the connecting rods as described earlier in this section.
7. Assemble the crankcases as described earlier in this section.

CONNECTING RODS

Removal

Connecting rods may be removed from the engine after first removing it from the frame. The cylinder head must be removed and the crankcase halves separated.

1. Mark each big end cap and connecting rod to identify both items as a matched pair and to identify the correct orientation of the bearing cap to the connecting rod.
2. Release the connecting rod nuts and remove the big end cap. Ensure that the bearing shell remains in place in the cap.



1. Big End Cap

NOTE:

- **It may be necessary to gently tap the big end cap with a rubber mallet to release the cap from the bolts.**

3. Push the connecting rod up through the crankcase and collect the piston and connecting rod from the top.
4. Label the assembly to identify the cylinder from which it was removed.

> **CAUTION: Never re-use connecting rod bolts or nuts. If the connecting rod cap is disturbed, always renew the bolts and nuts. Using the original nuts and bolts may lead to severe engine damage.**

5. Remove the liner using tool T3880315 as described later in this section.

Installation

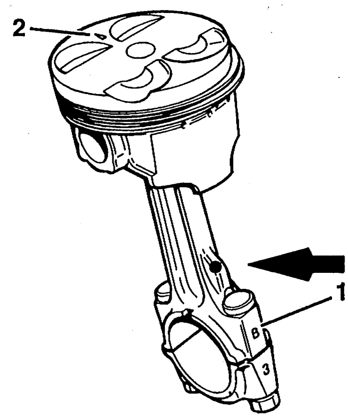
NOTE:

- **Connecting rod bolts and nuts are treated with an anti-rust solution which must not be removed.**
- **Clean the connecting rod with high flash-point solvent.**
- **Remove all bearings and inspect for damage, wear and any signs of deterioration and replace as necessary.**

1. Fit new connecting rod bolts to the big end.

NOTE:

- **Ensure the piston is fitted correctly to the connecting rod, (that is with the oil hole in the connecting rod on the opposite side from the arrow on the piston crown).**



1. Connecting Rod with Oil Hole Arrowed

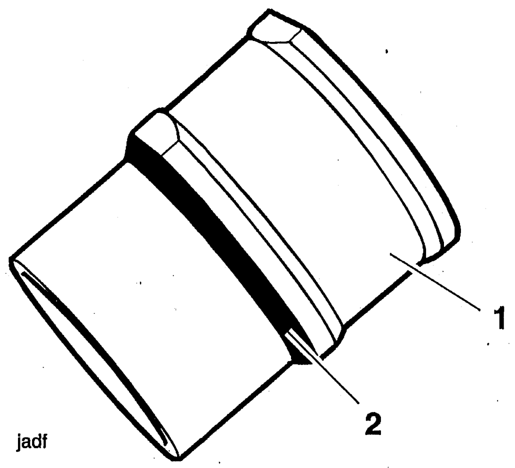
2. Piston Arrow

2. Apply molybdenum disulphide grease to the upper inner surface of the connecting rod big end.

NOTE:

- **Avoid touching any bearing surfaces of the bearing shells with the hand.**

3. Apply silicone sealer to the liner to crankcase mating face.



1. Liner

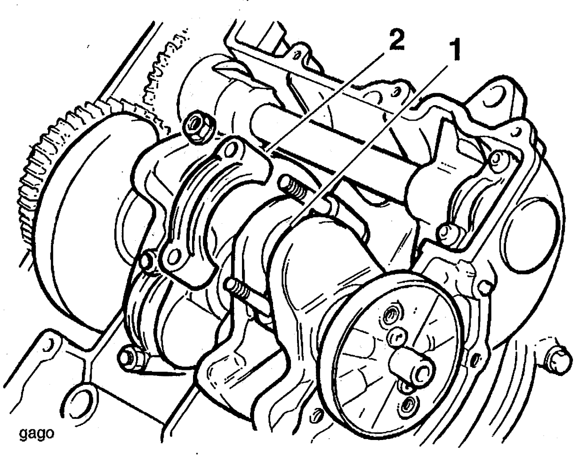
2. Sealer Area

4. Fit the piston and connecting rod assembly into the liner.

5. Fit the liner into the crankcase ensuring that the arrow on the piston faces forward, and the oil hole in the connecting rod faces rearward.

NOTE:

- **Ensure that the piston/liner/connecting rod assembly aligns correctly with the crankpin during assembly into the crankcase.**



1. Crankpin

2. Big End

6. Select big end bearing shells using the selection process described elsewhere in this section.

7. Lubricate both surfaces of the bearing shells with engine oil and fit to the connecting rod and big end cap.

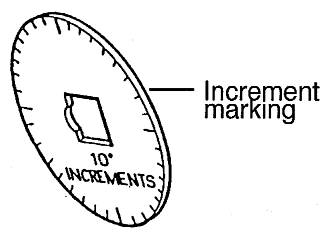
8. Align the connecting rod to the crankshaft and fit the big end cap. Tighten the cap (using new nuts and bolts) as follows:
Lubricate the threads of the bolt and the face of the nut with molybdenum disulphide grease. Tighten the nuts progressively in 2 stages;-

> **CAUTION: The torque characteristics of the connecting rod nuts and bolts are sensitive to the rate at which they are tightened. If all the torque is applied in one action, the bolt may be stretched and the nut may become loose when in service resulting in an expensive engine failure.**

firstly to **14 Nm**

then through 120° of nut rotation as measured using the Triumph torque turn gauge 3880105-T0301.

To accurately gauge the 120° turn, fit the tool between the socket and the drive handle and locate the socket to the big end nut. Pick an increment point on the torque turn gauge which aligns with a suitable reference point. Tighten the bolts until 12 of the 10° gauge increments have rotated past the chosen point.



Service Tool 3880105-T0301

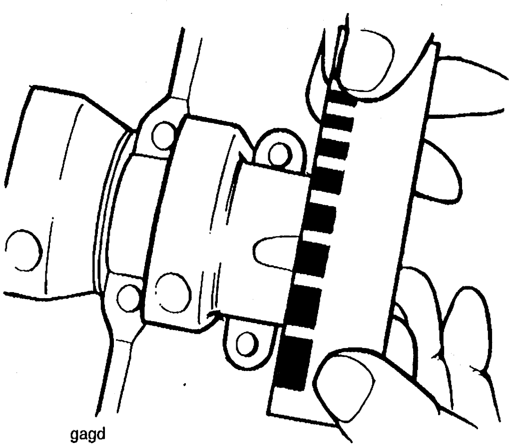
CONNECTING ROD BIG END BEARING SELECTION/CRANKPIN WEAR CHECK

1. Measure the bearing and crankpin clearance as follows.

NOTE:

- **Do not turn the connecting rod and crankshaft during the clearance measurement as this will damage the plastigauge. The crankpin clearances are measured using 'Plastigauge' (Triumph part number 3880150-T0301).**

2. Remove the big end cap from the journal to be checked.
3. Wipe the exposed areas of the crankpin, and the bearing face inside the cap.
4. Apply a thin smear of grease to the journal and a small quantity of silicone release agent to the bearing.
5. Trim a length of the plastigauge to fit across the journal. Fit the strip to the journal using the grease to hold the plastigauge in place.
6. Lubricate the threads of the bolt and the face of the nut with molybdenum disulphide grease. Refit the bearing and cap and tighten the big end nuts as described earlier.
7. Release the nuts and remove the cap being measured. Using the gauge provided with the plastigauge kit, measure the width of the compressed plastigauge.



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Checking the Measured Clearance

Con rod big end bearing/crankpin clearance

- **Standard:** **0.036 - 0.066 mm**
- **Service limit:** **0.1 mm**

NOTE:

- **If the measured clearance exceeds the service limit, measure the crankpin diameter.**

Crankpin diameter

Standard:	**40.946 - 40.960 mm**
Service limit:	**40.932 mm**

NOTE:

- **If any crankpin has worn beyond the service limit, the crankshaft must be replaced. Due to the advanced techniques used during manufacture, the crankshaft cannot be reground and no oversize bearings are available.**

CONNECTING ROD BEARING SELECTION

Minor differences in connecting rod dimensions are compensated for by using selective bearings. For further information on bearing part number to colour cross-references, see the latest parts microfiche.

1. Select the correct big end bearing shell as follows:
   - Measure each crankpin diameter.
   - Check connecting rod for either an A or B mark.
2. Select the correct bearings by matching the information found with the chart below.

Big end bearing selection chart (mm's)

Shell Colour	White	Red	Red	Blue
Rod Marking	A	A	B	B
Crankpin Dia	40.960 40.954	40.953 40.946	40.960 40.954	40.953 40.946
Running Clearance: 0.036 - 0.0666				

For instance:

Con-rod Mark	**A**
Crankpin Diameter	**40.951 mm**
Required Bearing	**Red**

NOTE:

- **Repeat the measurements for all connecting rods and their respective crankpins.**
- **It is normal for the bearings selected to differ from one connecting rod to another.**

3. Install the new bearings in the connecting rod.

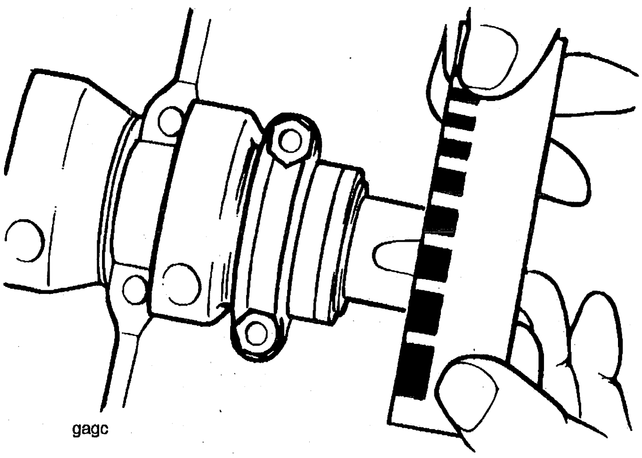
CAUTION: Always confirm, using the plastigauge method, that the running clearance is correct before final assembly. Severe engine damage could result from incorrect clearance.

CRANKSHAFT MAIN BEARING/JOURNAL WEAR

Main Bearing Selection Chart (all dimensions in mm's)						
Shell Colour	White	Red	Red	Blue	Blue	Green
Crankcase Bore	41.126 41.118	41.126 41.118	41.135 41.127	41.135 41.127	41.144 41.136	41.144 41.136
Journal Dia'	37.976 37.969	37.968 37.960	37.976 37.969	37.968 37.960	37.976 37.969	37.968 37.960
Running Clearance	All types 0.044 - 0.020					

Minor differences in crankshaft dimensions are compensated for by using selective bearings. For further information on bearing part number to colour cross-references, see the latest parts microfiche.

1. Measure the bearing to crankshaft main journal clearance using plastigauge (Triumph part number 3880150-T0301). Use the method described in connecting rod clearance measurement.



Checking crankpin clearance using plastigauge

Crankshaft main bearing/journal clearance

Standard: **0.020 - 0.044 mm**

Service limit: **0.08 mm max.**

2. If the clearance exceeds the service limit, measure the diameter of the crankshaft main journal.

Crankshaft main journal diameter

Standard: **37.960 - 37.976 mm**

Service limit: **37.936 mm**

NOTE:

- **If any journal has worn beyond the service limit, the crankshaft must be replaced. Due to the techniques used during manufacture, the crankshaft cannot be reground and no oversize bearings are available.**

Select bearings as follows:

1. Measure and record the diameter of each crankshaft main bearing journal.
2. Measure and record each main bearing bore diameter in the crankcase (bearings removed).

Compare the data found with the chart above to select bearings individually by journal.

For example:

Crankshaft Journal diameter	**37.972 mm**
Crankcase Bore	**41.130 mm**
Bearing Required	**RED**

NOTE:

- **It is normal for the bearings selected to differ from one journal to another.**

CAUTION: Always confirm, using the plastigauge method, that the running clearance is correct before final assembly. Severe engine damage could result from incorrect clearance.

Crankshaft End Float

Standard	**0.05 - 0.20 mm**
Service Limit	**0.4 mm max**

NOTE:

- **Crankshaft end float is controlled by the tolerances in crankshaft and crankcase machining. No thrust washers are used. If crankshaft end float is outside the specified limit, the crankshaft and/or the crankcases must be replaced.**

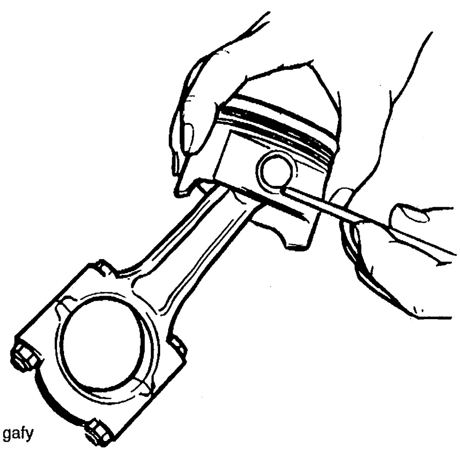
PISTONS

Disassembly

NOTE:

- **The pistons and connecting rods can be separated after removing the cylinder head and liners. It is not necessary to remove the connecting rods from the crankshaft.**

1. Remove the liner, using tool T3880315, as described later in this section.
2. Remove the gudgeon pin circlip from one side of the piston.



Removing the Gudgeon Pin Circlip

3. Remove the gudgeon pin by pushing the pin through the piston and rod toward the side from which the circlip was removed.

> **CAUTION: Never force the gudgeon pin through the piston. This may cause damage to the piston which may also damage the liner when assembled.**

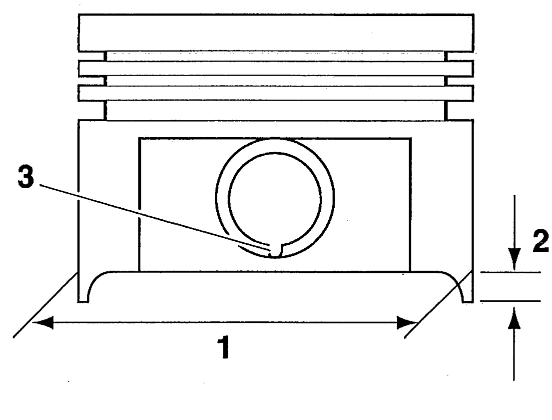
NOTE:

- **If the gudgeon pin is found to be tight in the piston, check the piston for a witness mark caused by the circlip. Carefully remove the mark to allow the pin to be removed.**

4. Piston rings must be removed from the piston using hand pressure only.

Piston Wear Check

1. Measure the piston outside diameter, 5 mm up from the bottom of the piston and at 90° to the direction of the gudgeon pin.



1. Piston Outside Diameter

2. Measurement Point (5mm Up The Piston Skirt)

3. Circlip Removal Groove

Piston outside diameter

Cylinders 1 & 3:	**75.96 - 75.98 mm**
Service limit	**75.92**
Cylinder 2:	**75.97 - 75.96 mm**
Service limit	**75.90**

Replace the piston if the measured diameter falls outside the specified limit.

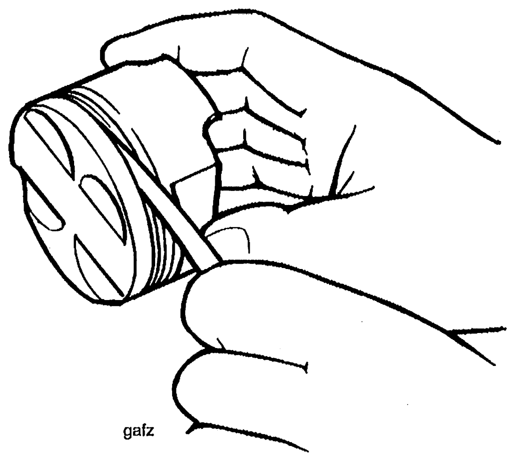
Piston Rings/Ring Grooves

Check the pistons for uneven groove wear by visually inspecting the ring grooves.

If all the rings do not fit parallel to the groove upper and lower surfaces, the piston must be replaced.

Clean the piston ring grooves.

Fit the piston rings to the pistons. Check, using feeler gauges, for the correct clearance between the ring grooves and the rings. Replace the piston and rings if outside the specified limit.



Piston Ring to Ring Groove Clearance Check

Piston ring/Groove Clearance

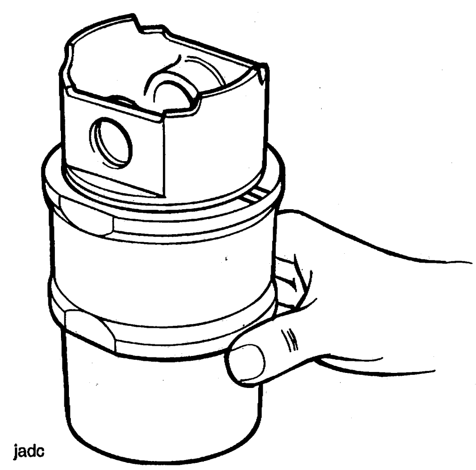
Top	**0.02 - 0.06 mm**
Second	**0.02 - 0.06 mm**

Piston Ring Gap

NOTE:

- **Before final assembly the piston ring gap, when fitted in the liner, must first be checked.**

1. Place the piston ring inside the liner.
2. Push the ring into the top of the cylinder, using the piston to hold the ring square with the inside of the bore. Continue to push the ring into the bore until the third groove of the piston is level with the cylinder top, around full circumference of cylinder.



Aligning Piston Rings using the Piston

3. Remove the piston and measure the gap between the ends of the piston ring using feeler gauges.

Piston Ring End Gap Tolerances

Top	**0.11 - 0.26 mm**
Second	**0.26 - 0.41 mm**
Oil Control	**0.20 - 0.70 mm**

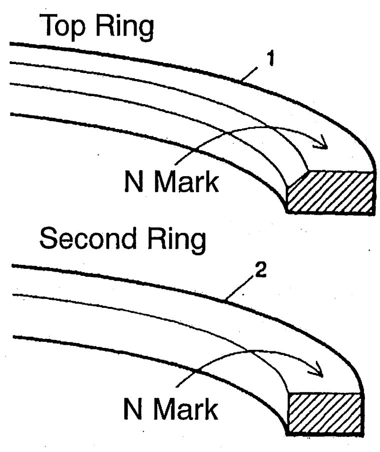
4. If the ring gap is found to be too small, the ring end must be carefully filed until the correct gap is achieved. If the gap is too large, replace the rings with a new set. If the gap remains too large with new rings fitted, both the piston and liner must be replaced.

Piston Assembly

1. Thoroughly clean the piston ring grooves and fit the piston rings to the piston.

NOTE:

- **The top ring upper surface is marked 'N' and can be identified by a chamfer on the inside edge. The top ring has a shiny grey appearance.**
- **The second ring upper surface is also marked 'N' but is plain on the inside edge and has a bronze appearance.**
- **The oil control rings can be fitted with either face upward.**

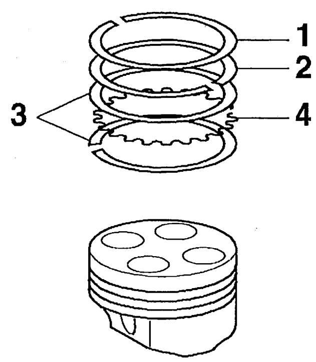


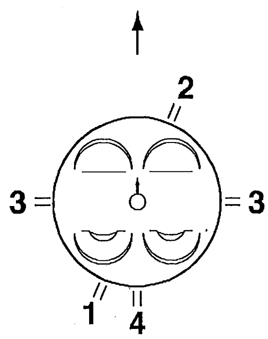
Piston Ring Identification

2. Fit the piston onto the connecting rod with the arrow on the piston crown facing AWAY from the oil hole in the connecting rod.
3. Align the small end in the connecting rod with the gudgeon pin hole in the piston.
4. Lubricate the piston, small end and gudgeon pin with clean engine oil and fit the gudgeon pin.
5. Fit new circlips on both sides of the gudgeon pin ensuring the circlips are correctly fitted in the grooves.

> **WARNING: Failure to use new gudgeon pin circlips could allow the pin to detach from the piston. This could seize the engine and lead to an accident.**

6. The piston ring gaps must be arranged as shown in the diagram below





1. Top Ring

2. Second Ring

3. Steel Oil Control Rings

4. Oil Control Ring Expander

NOTE:

- **The top ring gap should be positioned in the 7 o'clock position, the second ring gap in the 1 o'clock position and the steel oil control ring gaps in the 9 & 3 o'clock positions (one in each position).**

7. Fit the piston into the liner using a gentle rocking motion to engage the rings in the bore.

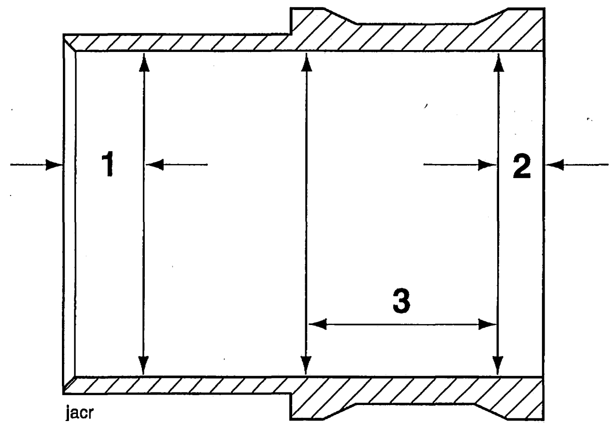
Cylinder Wear

Measure the inside diameter of each cylinder using an internal micrometer or similar accurate measuring equipment.

Cylinder bore diameter

Standard:	**75.985 - 76.003 mm**
Service limit:	**73.053 mm**

1. Check the diameter at points 1, 2 and 3.

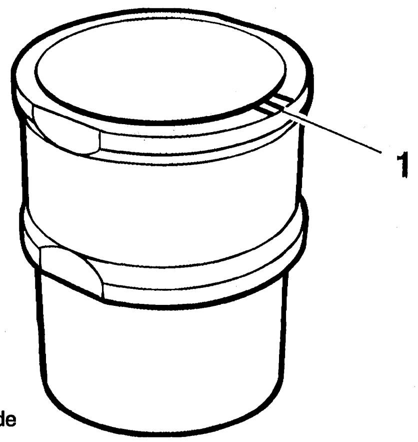


Test Positions For Bore Wear Check (bore shown in section)

2. If any reading is outside the specified limits, replace the liner and piston as an assembly.

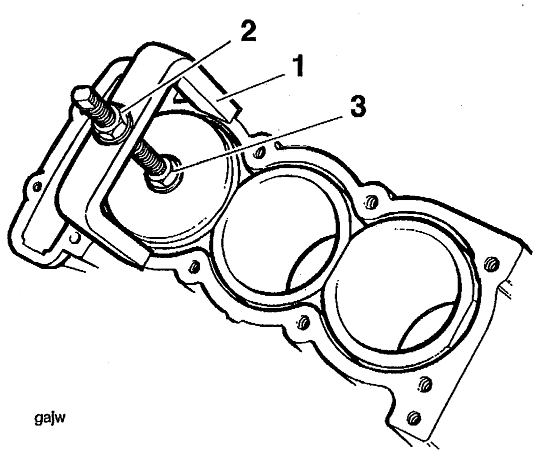
CYLINDER LINERS

Removal



Paint Mark

1. Mark each liner to identify correct orientation and the cylinder number from which it has been removed.
2. Turn the crankshaft until the piston in the liner to be removed is at the bottom of its stroke.



1. **Tool T3880315**
2. **Extraction nut**
3. **Locking nut**

3. Check that the locking nut on tool T3880315 is loose, then fully unscrew the extraction nut.

> ⚠ **CAUTION: The cylinder liners are made of steel alloy and therefore can be easily damaged. Handle with care, ensuring the cylinder bore is not scratched.**

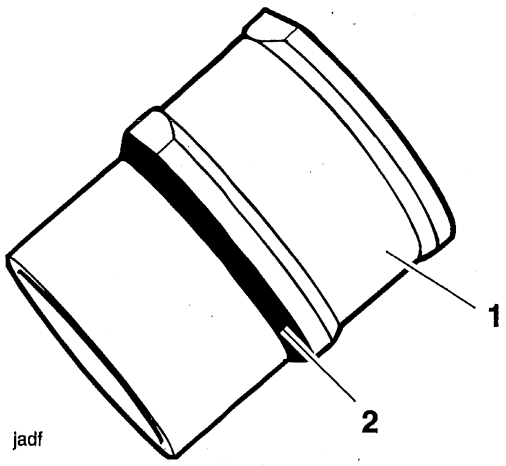
4. Carefully fit the tool fully into the cylinder bore, positioning the tool legs on the crankcase. Turn the locking nut clockwise until the rubber sleeve on the tool **tightly** grips the bore of the liner.
5. Check that the tool legs are positioned to allow withdrawal of the liner, then turn the extraction nut clockwise to extract the liner. Take care to ensure that the piston / connecting rod is not allowed to fall against the inside of the crankcase.
6. Turn the locking nut anticlockwise to release the liner.

NOTE:

- **The tool must only be used to release the seal between the liner and the crankcase. It is not intended that the tool is used to fully extract the liner. Once the seal is released, the tool must be removed and the liner extracted by hand.**

Installation

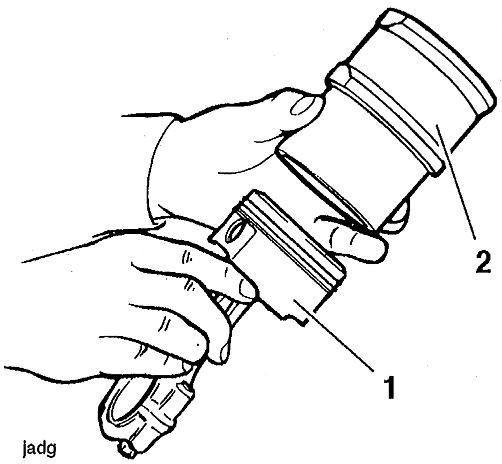
1. Thoroughly clean the liner removing all traces of old silicone sealer.
2. Remove all traces of sealer from the crankcase bores.
3. Apply silicone sealer to the liner to crankcase mating face.



1. Liner

2. Sealer Area

4. Fit each liner over the piston using a gentle rocking motion to allow compression of the piston rings.



1. Piston

2. Liner

NOTE:

- **The liners have a chamfer at the bottom of the bore enabling fitting of the piston without need for a piston ring compressor.**

CAUTION: Fit each liner over whichever piston is at TDC. When turning the engine, do not allow the pistons to contact the inside of the crankcase and also do not allow fitted liners to lift off the crankcase base.

5. Continue fitting each liner in turn until all are fitted and sealed.

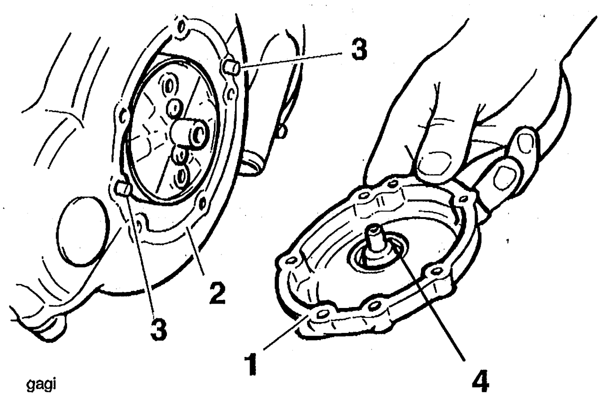
NOTE:

- **When the liners have been fitted, they should not be disturbed. If it is necessary to remove the liner after fitting, the sealer must be re-applied.**

LEFT HAND CRANKSHAFT COVER

The left hand crankshaft cover is fitted, on the inside face, with a lip type seal. The lip seal prevents oil from entering the outlet port for the crankcase gases.

Under normal circumstances it should not be necessary to disturb the cover or the seal. However, should the cover require removal, the following procedure must be used.



1. Left Hand Engine Cover
2. Gasket face
3. Dowels
4. Mandrel

Cover Removal/Refit

1. If the cover and seal are to be replaced without renewing either component, a mandrel **MUST** be inserted into the seal to prevent seal distortion.

NOTE:

- **Always examine the seal for splits, damage and general wear and replace if necessary. The mandrel must remain in the seal from immediately after removal until the point where the cover is to be fitted.**

2. When refitting the cover, remove the mandrel only at the point when the cover assembly is to be refitted and ensure that the seal and breather shaft are clean and dry.

3. Fit the cover assembly taking great care not to damage the seal during fitment and alignment of the cover.

> **CAUTION: If the seal is damaged or is suspected of becoming damaged, it must be replaced.**
> **Failure to replace a damaged seal will result in high engine oil consumption, smoke emissions and possible engine damage.**

> **CAUTION: The engine must not be started or turned over for a minimum of 15 minutes after assembly to allow the seal to fully expand onto the breather shaft.**
> **Failure to allow time for seal expansion will result in high engine oil consumption, smoke emissions and possible engine damage.**

Seal/Cover Replacement

1. Remove the cover and carefully lever the seal from the cover.

NOTE:

- **A new seal is supplied with a mandrel already fitted.**

2. Without removing the mandrel supplied with the seal, press the new seal into the seal recess in the cover to a point where it is just below the face of the recess.

> **CAUTION: The seal must be kept level during and after fitment. A non-level seal will cause high engine oil consumption, smoke emissions and possible engine damage.**

3. When refitting the cover, remove the mandrel only at the point when the cover assembly is to be refitted, and ensure that the seal and breather shaft are clean and dry.

4. Fit the cover assembly taking great care not to damage the seal during fitment and alignment of the cover.

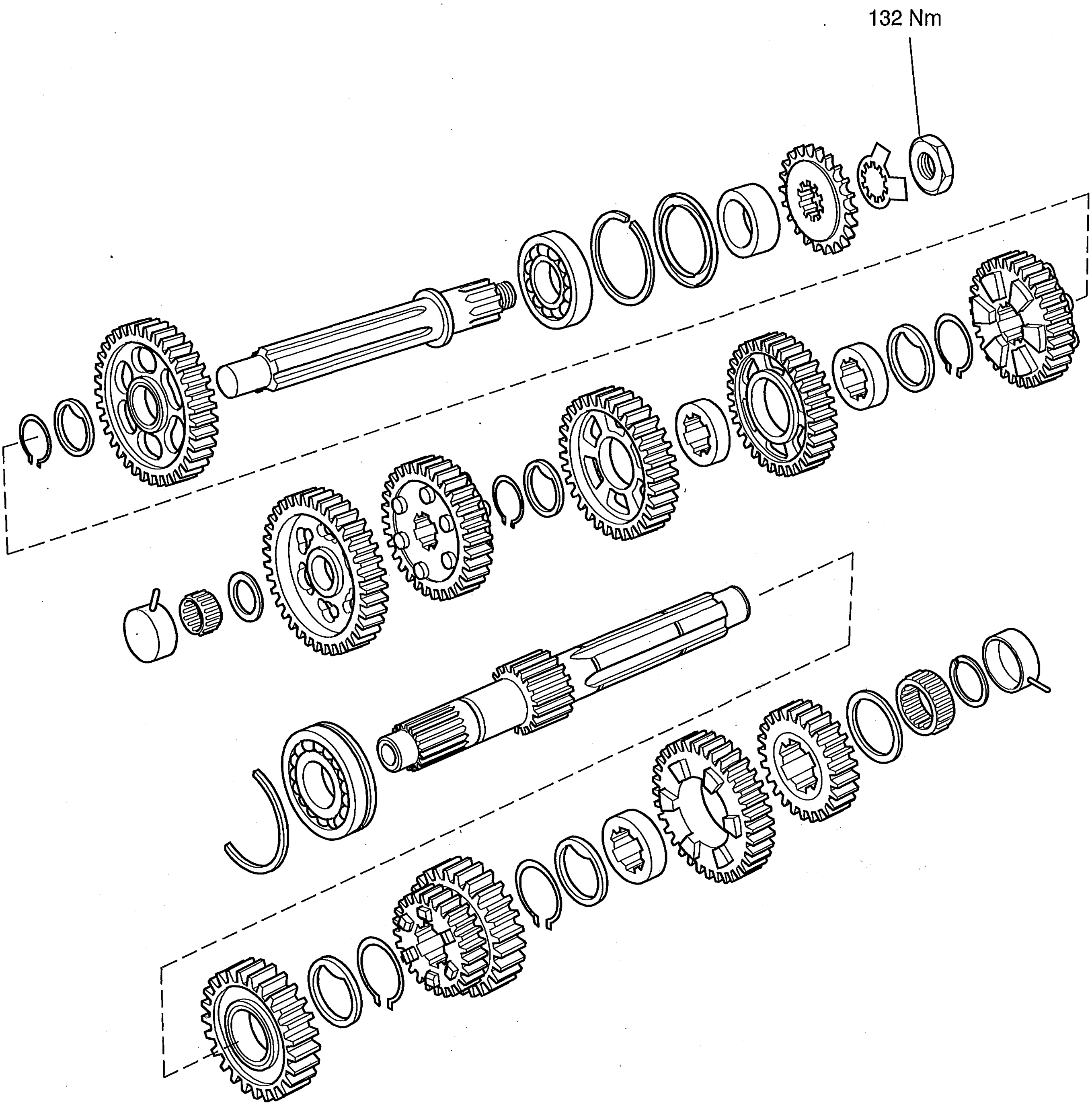
> **CAUTION: If the seal is damaged or is suspected of becoming damaged, it must be replaced.**
> **Failure to replace a damaged seal will result in high engine oil consumption, smoke emissions and possible engine damage.**

> **CAUTION: The engine must not be started or turned over for a minimum of 15 minutes after assembly to allow the seal to fully expand onto the breather shaft.**
> **Failure to allow time for seal expansion will result in high engine oil consumption, smoke emissions and possible engine damage.**

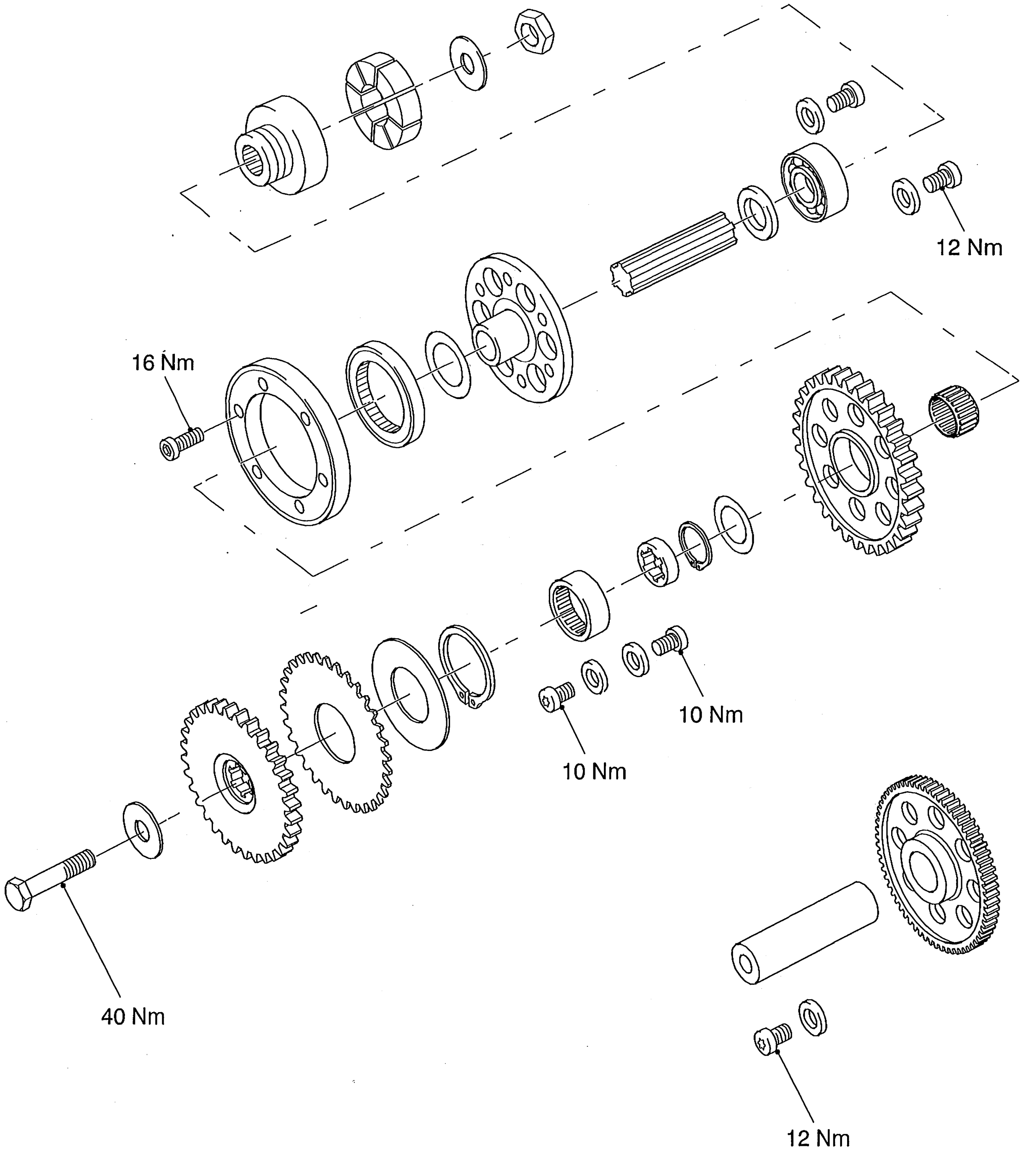
TRANSMISSION

CONTENTS

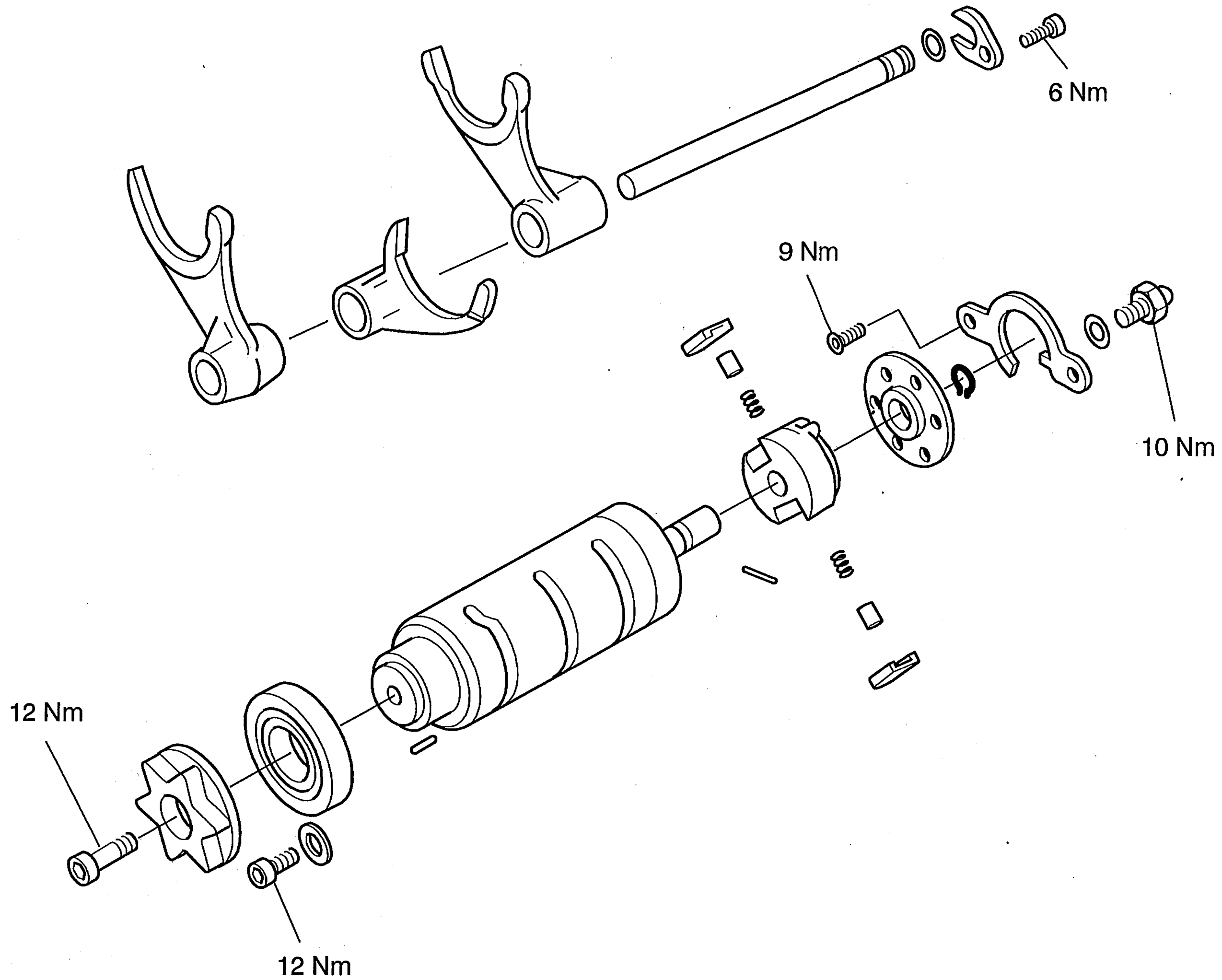
Exploded View, Input and Output Shafts



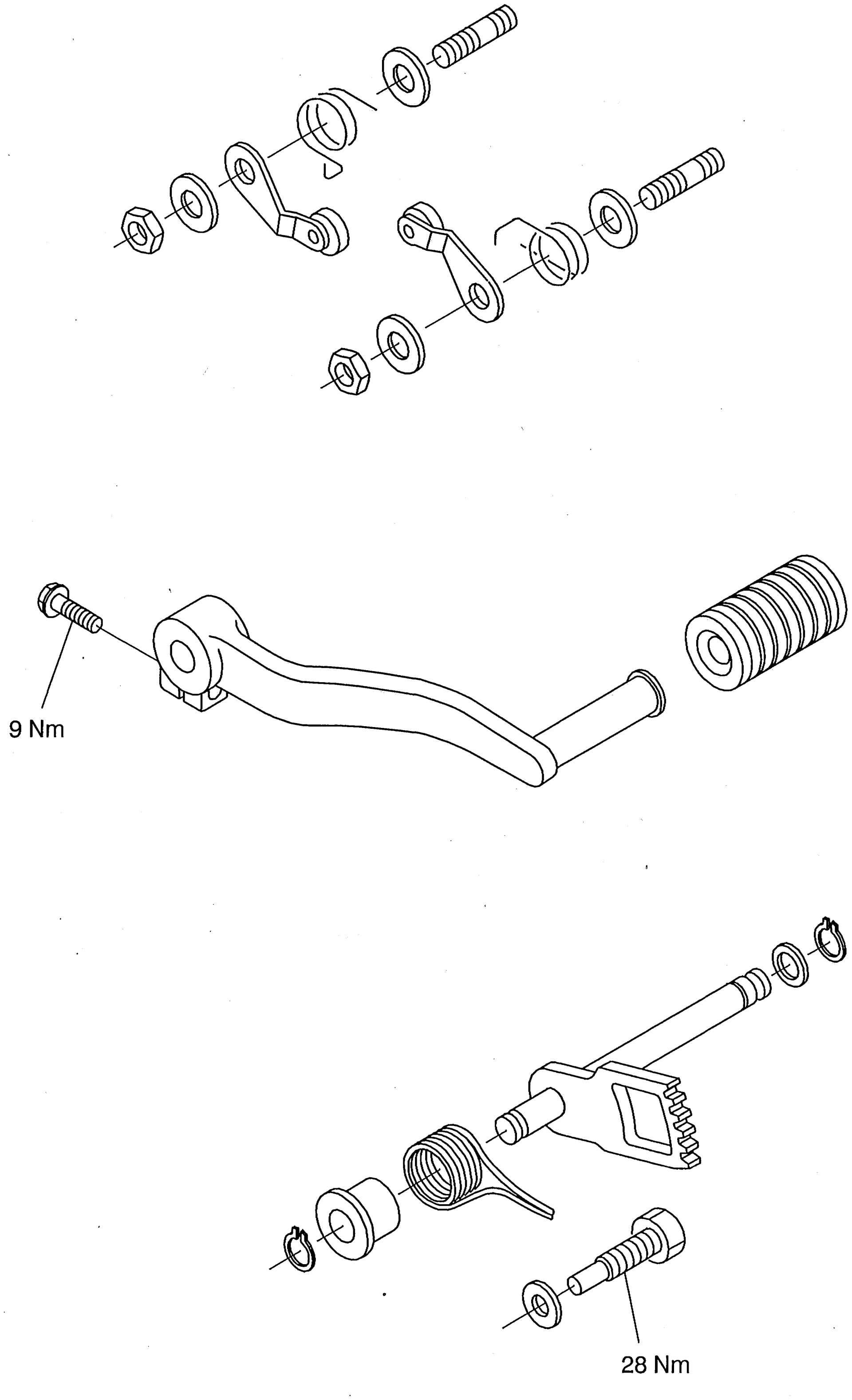
Exploded View, Auxiliary Gears



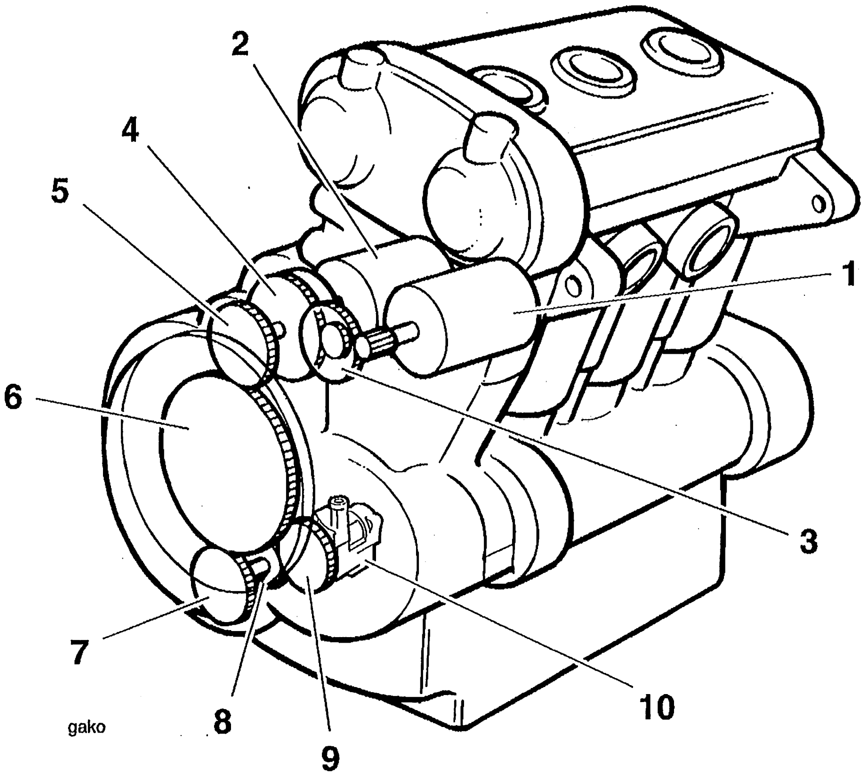
Exploded View, Selector Mechanism



Exploded View, Gear Pedal



AUXILIARY GEARS



1. Starter Motor
2. Alternator
3. Starter Idler Gear
4. Sprag Clutch
5. Alternator Drive Gear
6. Clutch Auxiliary Gear
7. Oil Pump Auxiliary Gear
8. Oil Pump Intermediate Gear
9. Oil Pump Drive Gear
10. Oil Pump

TRANSMISSION DESCRIPTION

This model is fitted with a six speed, constant mesh transmission. All gears are straight cut and no synchromesh system is used. Selection of gears is via a grooved drum which actuates three selector forks within the transmission. The forks remain in constant contact with the gear hubs at all times. The final drive ratio, that is the ratio between the transmission output sprocket and the rear wheel sprocket, is variable. The change in ratio is brought about by selection of front and rear sprockets with different numbers of teeth.
Integral parts of the transmission are the auxiliary gears which drive the following:
- Water pump
- Oil pump
- Alternator
- Starter Motor

Auxiliary Gears - Operation

Engine Cranking

The starter motor, which is fitted in the upper crankcase, drives an idler gear in constant mesh with the sprag clutch. The sprag clutch is mounted on the alternator shaft. When the starter is energised, the sprag clutch action allows the alternator shaft on which it is mounted to be driven by the starter idler gear. The alternator shaft transmits drive to the crankshaft via the alternator drive gear and clutch auxiliary drive gear.

Engine Started

When the engine starts, and the starter button is released, the crankshaft drives the clutch and alternator drive gears causing the alternator shaft to rotate.
Because the alternator shaft and alternator are now being driven, under engine power, by the alternator drive gear (as opposed to being driven by the starter idler gear), the sprag clutch free-wheels and the starter idler gear does not turn.

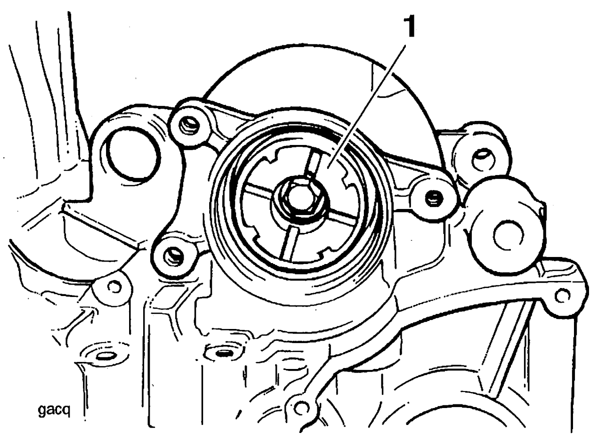
Oil and Water Pump Drives

Drive to both the oil and water pumps is supplied by a gear and shaft in mesh with the clutch auxiliary gear.
The oil pump auxiliary gear is connected to the oil pump by a shaft, to which an intermediate gear is fitted. The intermediate gear drives the oil pump drive gear thus driving the oil pump. At the other side of the oil pump, a slotted shaft extends, from which the water pump is directly driven.

ALTERNATOR SPINDLE

Removal

1. Remove the seats and disconnect the battery, negative (black) lead first.
2. Remove the fuel tank as described in the fuel system section.
3. Remove the starter motor as described in the electrical section.
4. Disconnect and remove the alternator as described in the electrical section.
5. Remove the alternator rubber shock absorbers from the alternator drive housing.

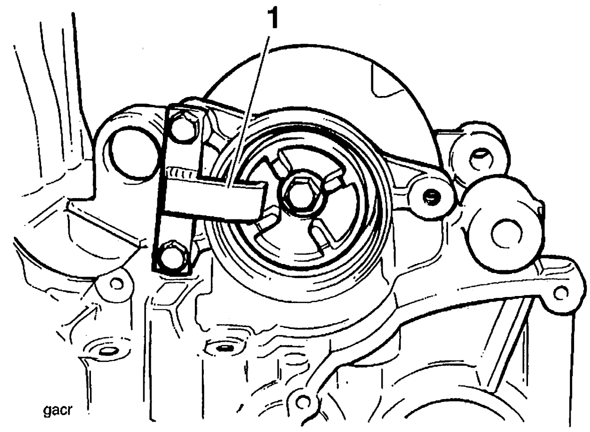


1. Alternator Drive Rubber Shock Absorbers

6. Position a suitable container beneath the clutch cover to collect engine oil. Remove the clutch cover and the complete clutch assembly as described in the clutch section.

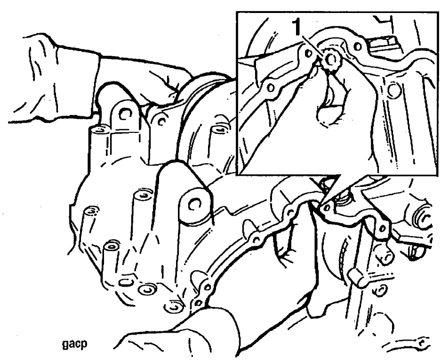
WARNING: The oil may be hot to the touch. Contact with hot oil may cause the skin to be scalded or burned.

WARNING: Prolonged or repeated contact with engine oil can lead to skin dryness, irritation and dermatitis. In addition used engine oil contains potentially harmful contaminants which can cause cancer. Wear suitable clothing and avoid skin contact.



1. Service Tool 3880040-T0301

7. Hold the nut in the alternator drive housing and remove the bolt securing the alternator drive gear (in the clutch housing) to the alternator spindle. Remove the alternator drive gear.
8. Collect the nut from the drive housing end and remove the service tool.
9. Using a new spindle, and keeping the new spindle in constant contact with the original, push the old spindle out of the crankcase in the direction of the alternator side. **Leave the new spindle in place.**



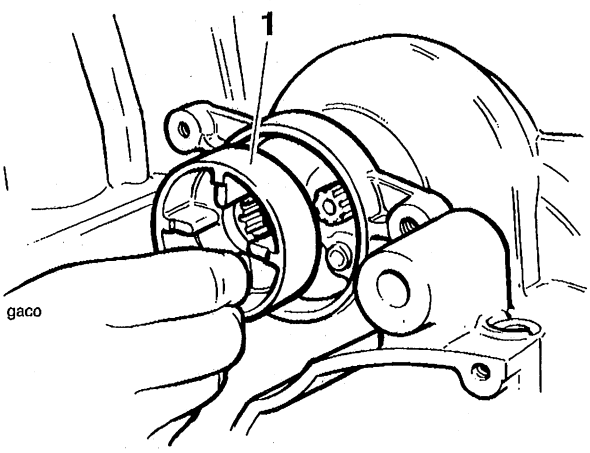
1. New Spindle

CAUTION: Ensure that the new spindle is kept in constant contact with the old item during the removal process. If constant contact is not maintained, internal components may become displaced and it may become necessary to strip the engine to recover them.

10. Remove the alternator drive housing from the old spindle.
11. Prevent the alternator shaft from turning by fitting service tool 3880040-T0301 to the front alternator mounting-bolt holes.

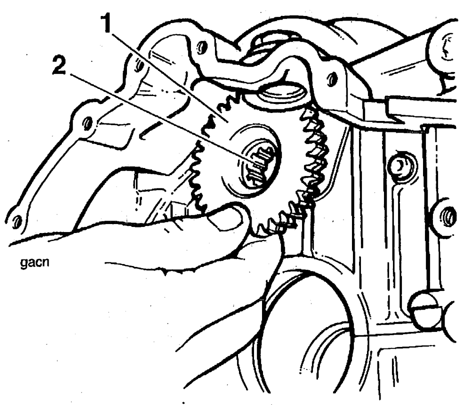
Installation

1. Assemble the alternator drive housing to the alternator end of the new spindle.



1. Alternator Housing

2. Check that the splined spacer is in place on the clutch side and assemble the alternator drive gear to the clutch housing end of the spindle. Fit a new bolt ***from the clutch side***.

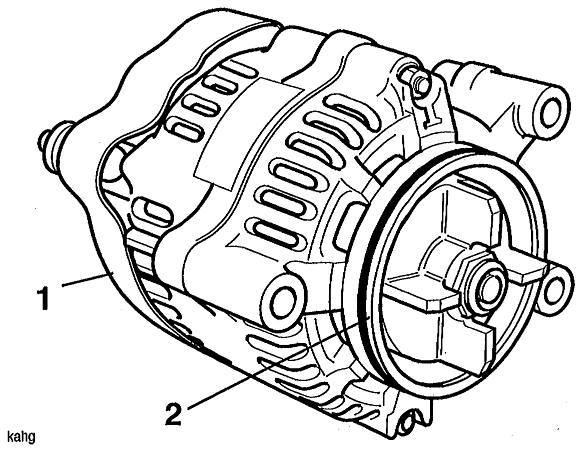


1. Alternator Drive Gear
2. Splined Spacer

NOTE:

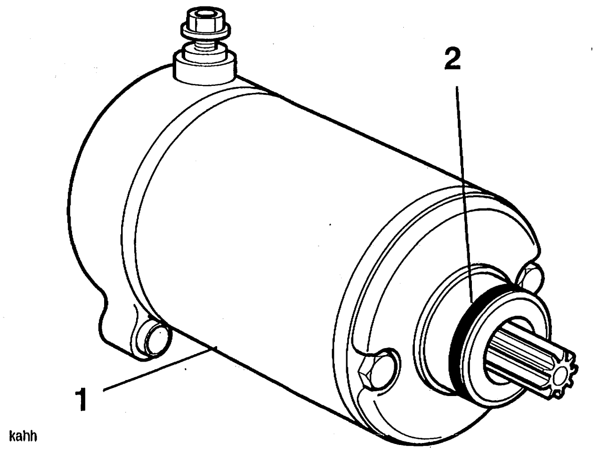
- **The alternator drive gear must be fitted with the backlash eliminator gear facing inwards.**

3. Fit tool 3880040-T0301 to the front alternator mounting-bolt holes.
4. Fit a new nut to the alternator drive housing end where the bolt head extends through. Hold the nut and tighten the bolt to **40 Nm.**
5. Remove tool 3880040-T0301 and refit the rubber shock absorbers to the alternator drive housing.
6. Check the alternator 'O' ring for damage and distortion. Replace as necessary.



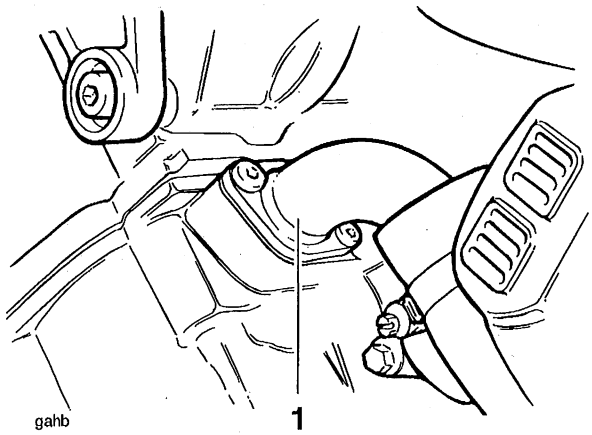
1. Alternator
2. 'O' ring

7. Refit the alternator and ensure that the earth strap is correctly located under the alternator bolt. Tighten the alternator bolts to **20 Nm.**
8. Check the starter motor 'O' ring for damage. Replace as necessary.



1. Starter
2. 'O' ring

9. Refit the starter motor tightening the starter bolts to **10 Nm.**
10. Refit the water elbow to the upper crankcase using a new gasket. Tighten the water elbow bolts to **12 Nm.**



1. Water Elbow

11. Refill the cooling system as described in the cooling section.
12. Refit the clutch and clutch cover as detailed in the clutch section.
13. Top up the engine with the correct grade of engine oil.
14. Reconnect the alternator multi-plug.
15. Refit the fuel tank.
16. Reconnect the battery, positive (red) lead first.
17. Refit the seats.

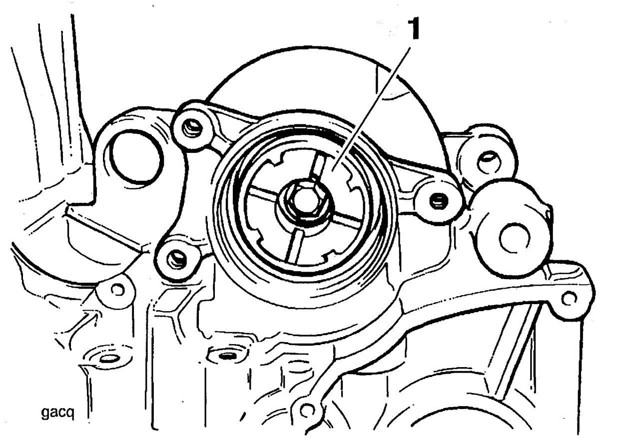
SPRAG CLUTCH

NOTE:

- **In order to remove the sprag clutch, the engine must first be removed from the frame and the two halves of the crankcase separated.**

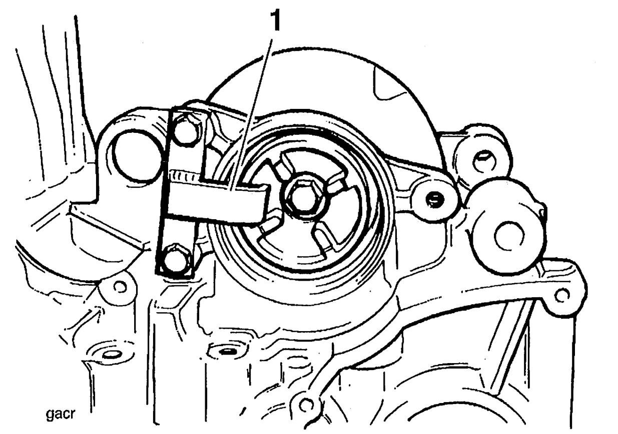
Removal

1. Remove the water elbow from the rear of the upper crankcase.
2. Remove the starter motor.
3. Remove the input and output shafts from the crankcase.
4. Remove the alternator.
5. Remove the alternator rubber shock absorbers from the alternator drive housing.



1. Alternator Drive Rubber Shock Absorbers

6. Prevent the alternator shaft from turning by fitting service tool 3880040-T0301 to the front alternator mounting bolt holes.



1. Service Tool 3880040-T0301

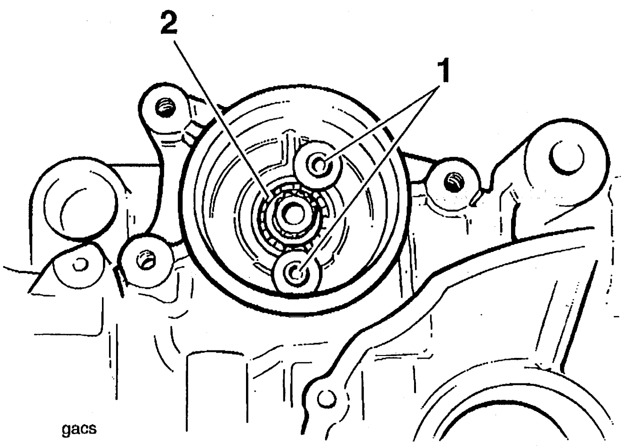
7. Hold the nut at the drive housing end and remove the bolt securing the alternator drive gear (in the clutch housing) to the alternator spindle.

8. Remove the gear.

9. Remove service tool 3880040-T0301.

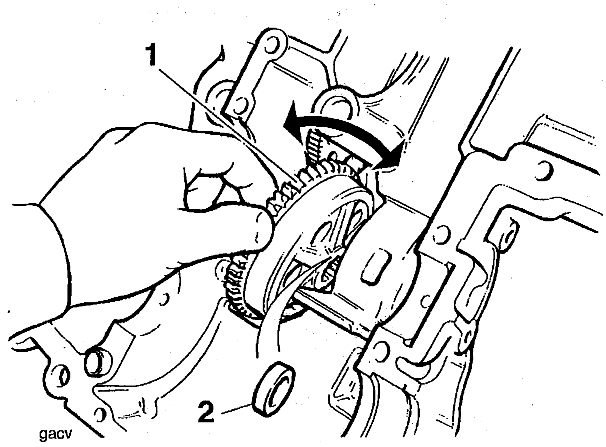
10. Remove the alternator spindle, drive and nut from the alternator side of the crankcase.

11. Working from the alternator side of the crankcase, release the two bolts and washers which secure the alternator shaft bearing to the crankcase.



1. Bearing Retaining Bolts
2. Bearing

12. Gently move the sprag clutch from side to side to displace the alternator shaft bearing. Remove the sprag clutch and collect the spacer from inside the crankcase.

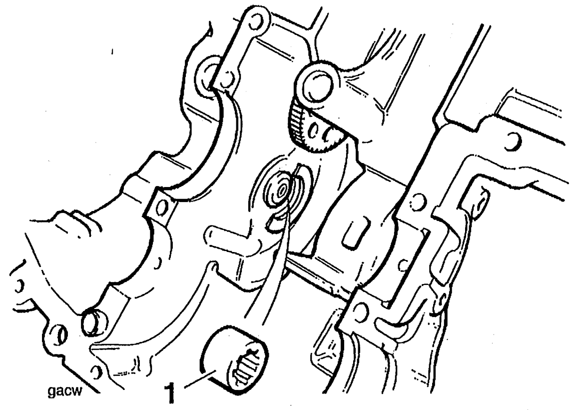


1. Sprag Clutch
2. Spacer

NOTE:

- **The bearing is not an interference fit, no force is required to move the bearing within the crankcase.**

13. Remove the splined spacer from the clutch side of the crankcase.



1. Splined Spacer

Inspection

1. Check all bearings for overheating (blue areas), wear and non-smooth operation. Replace any suspect components.

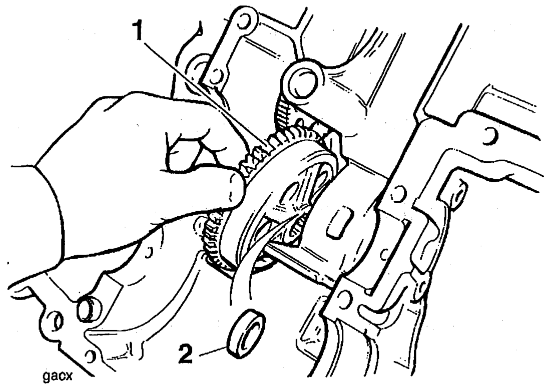
2. Check the sprag clutch for smooth, free movement in one direction only. Check the sprag gear for damaged or broken teeth. Replace if necessary.

3. Check the spindle for damage, pitting etc. Replace if necessary.

Assembly

1. Refit the splined sleeve to the alternator spindle bearing on the clutch side of the crankcase.

2. Refit the spacer (alternator side) and sprag clutch assembly.



1. Sprag Clutch
2. Spacer

3. Refit the bearing to the alternator side of the crankcase and tighten the two retaining screws to **12 Nm.**

4. Refit the alternator spindle and drive taking care to align all components during installation.

5. Fit the alternator drive housing.

6. Fit service tool 3880040-T0301 to the front alternator mounting bolt holes.

7. Fit the alternator drive gear to the clutch side of the alternator spindle. Use a new bolt ***fitted from the clutch side.***

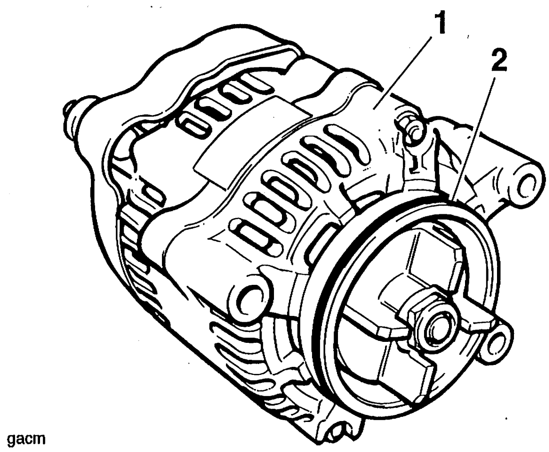
NOTE:

- **The alternator drive gear must be fitted with the backlash eliminator gear facing inwards.**

8. Fit a new nut to the alternator drive housing end where the bolt head extends through. Hold the nut and tighten the bolt to **40 Nm.**

9. Remove tool 3880040-T0301.

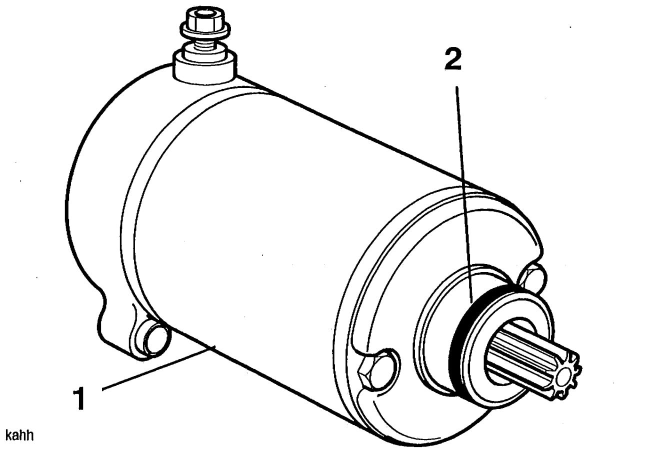
10. Check the alternator 'O' ring for damage and distortion. Replace as necessary.



1. Alternator
2. 'O' ring

11. Refit the alternator and ensure that the earth strap is correctly located under the alternator bolt. Tighten the alternator retaining bolts to **20 Nm.**

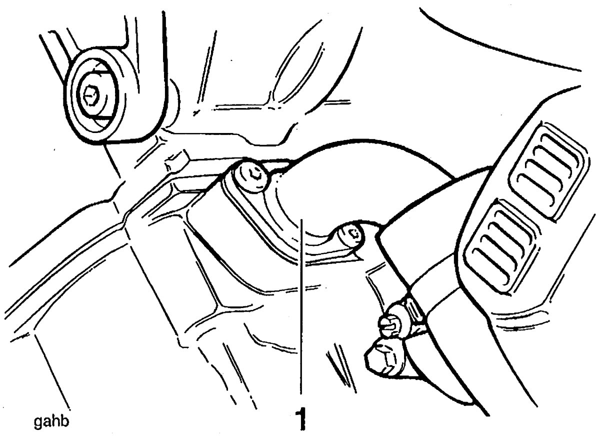
12. Check the starter motor 'O' ring for damage. Replace as necessary.



1. Starter
2. 'O' ring

13. Refit the starter motor tightening the starter bolts to **10 Nm.**

14. Refit the water elbow to the upper crankcase using a new gasket. Tighten the water elbow bolts to **12 Nm.**



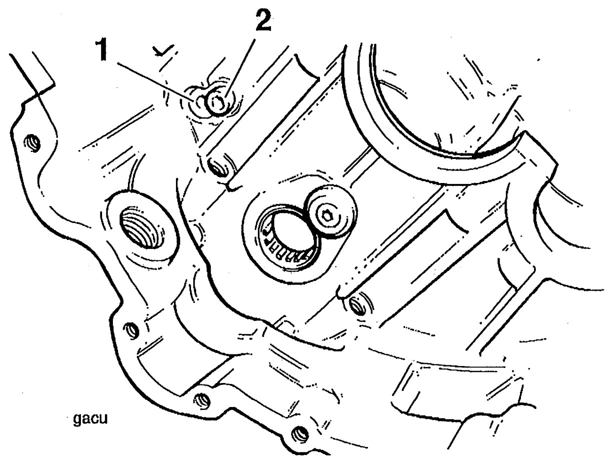
1. Water Elbow

STARTER IDLER GEAR

Removal

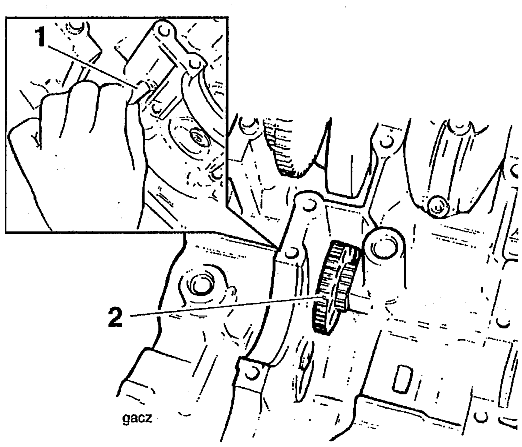
1. Remove the sprag clutch as described earlier in this section.

2. Remove the screw and washer securing the starter idler gear shaft to the crankcase.



1. Idler Gear Shaft
2. Retaining Screw and Washer

3. Slide the shaft from the crankcase and collect the idler gear.



1. Shaft
2. Gear

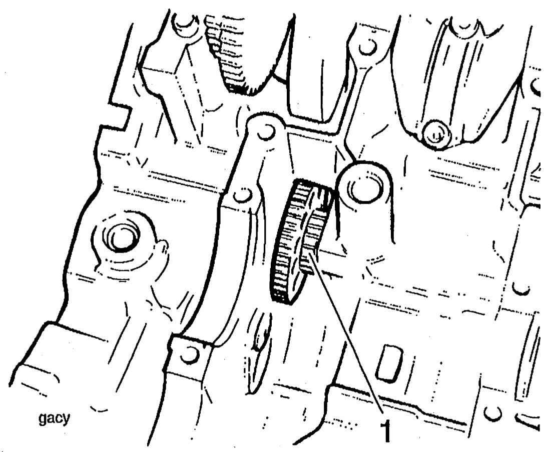
Inspection

1. Check the spindle for damage, pitting etc. Replace if necessary.

2. Check the gear for broken or damaged teeth, overheating (blue areas) etc. Replace if necessary.

Assembly

1. Position the gear into the crankcase with the smaller gear (which meshes with the sprag clutch) facing inwards.



1. Smaller Gear Facing Inwards

2. Support the gear and install the shaft.

3. Fit the shaft retaining bolt and washer. Tighten the bolt to **12 Nm.**

4. Install the sprag clutch as described earlier in this section.

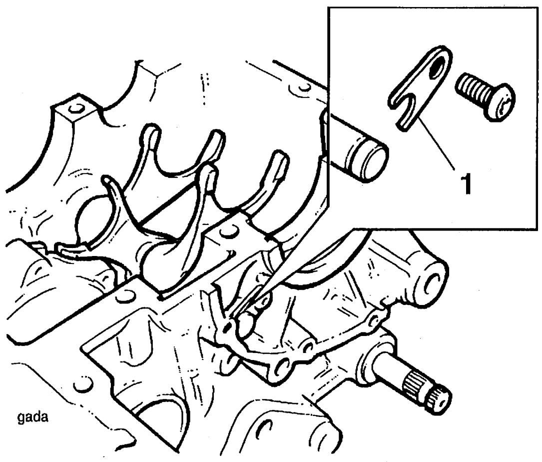
SELECTORS, SELECTOR SHAFT & DRUM

Removal

NOTE:

- **In order to remove the selector mechanism, the engine must first be removed from the frame and the two halves of the crankcase separated.**

1. Remove both the input and output shafts.
2. Remove the capscrew and take out the 'U' shaped keeper plate from the selector shaft.

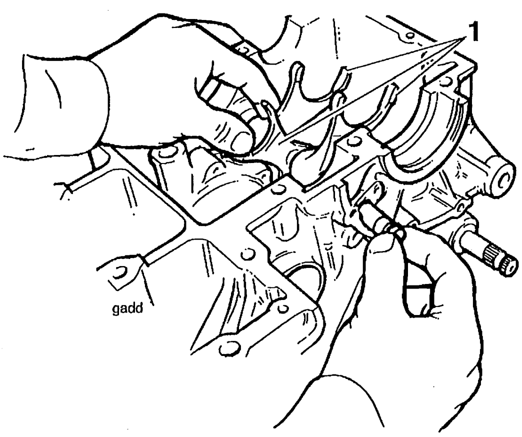


1. Selector Shaft Keeper Plate

NOTE:

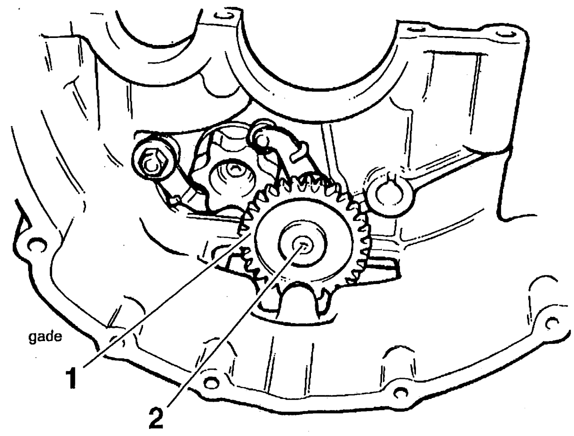
- **To ensure that the selector fork positions are maintained on assembly, mark each fork with felt pen or similar to denote their relative positions.**

3. Using finger pressure, push the selector shaft out of the crankcase in the direction of the keeper plate. Collect each selector fork from the lower crankcase as they are released from the selector shaft.



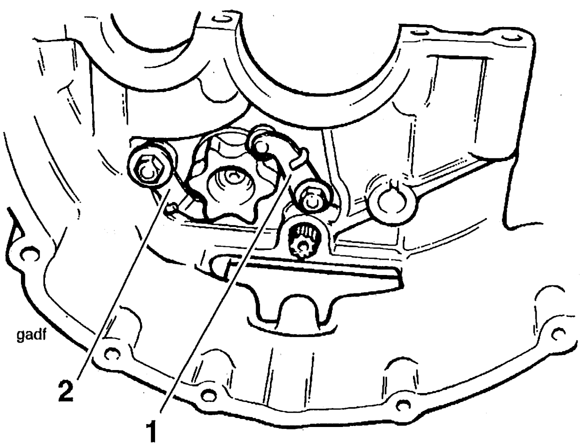
1. Selector Forks

4. Remove the screw securing the oil pump auxiliary gear. Remove the gear from the shaft.



1. Oil Pump Drive Gear
2. Gear Retaining Screw

5. Remove the nuts and washers securing both the neutral and gear detent arms to the lower crankcase.



1. Gear Detent Arm
2. Neutral Detent Arm

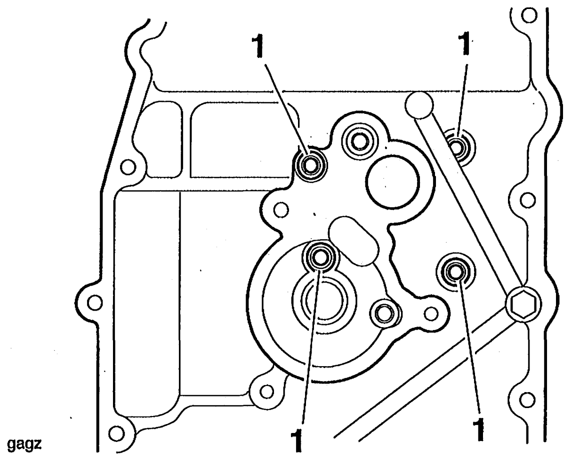
6. Remove the detent arms and springs noting the colour of the detent springs and the position of each component.

NOTE:

- **Detent springs MUST NOT be interchanged. The NEUTRAL spring has a white mark and is fitted rearmost in the crankcase.**

7. Invert the crankcase.

8. Release the screws securing the oil pump to the lower crankcase.



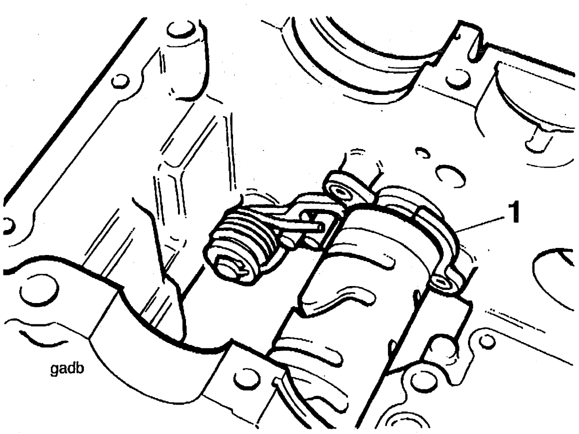
1. Oil Pump Retaining Screws

9. Invert the crankcase.

10. Remove the oil pump from inside the lower crankcase.

11. Remove the oil pressure relief valve.

12. Remove the 2 screws securing the selector drum stop plate to the crankcase. Remove the stop plate.



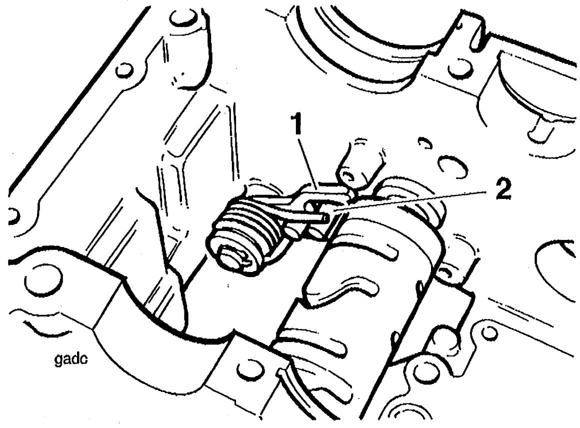
1. Selector Drum Stop Plate

13. Remove the screw securing the detent wheel to the selector drum. Remove the detent wheel.

NOTE:

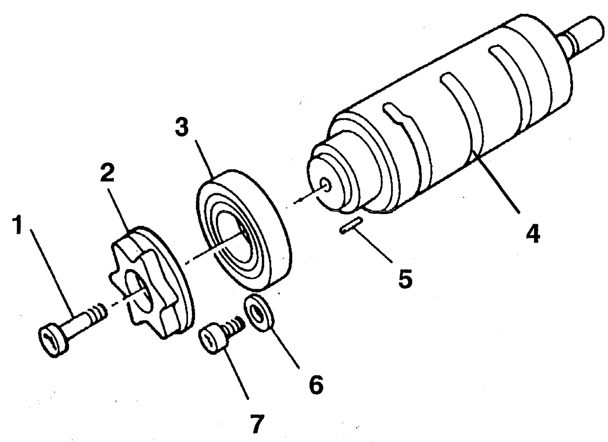
- **The selector drum will not turn through 360° provided the stop plate has been removed.**

14. Remove the spring abutment bolt from the gear quadrant and slide the quadrant out of mesh.



1. Quadrant
2. Abutment Bolt

15. Remove the capscrew from the bearing lock (detent end of the selector drum).



1. Detent Wheel Bolt
2. Detent Wheel
3. Selector Drum Bearing
4. Selector Drum
5. Dowel
6. Bearing Lock
7. Capscrew

16. Remove the selector drum bearing by pushing through from inside the crankcase to outside using hand pressure only.

17. Lift out the selector drum.

Inspection

Examine all components for damage or wear paying particular attention to selector drum and selector forks. Replace any suspect parts.

Gear selector fork thickness:

Standard:	**5.85 mm ± 0.05 mm**
Service Limit:	**5.70 mm ± 0.00 mm**

Gear selector groove width:

Standard:	**6.05 mm ± 0.05 mm**
Service Limit:	**6.25 mm ± 0.00 mm**

Selector fork to groove clearance:

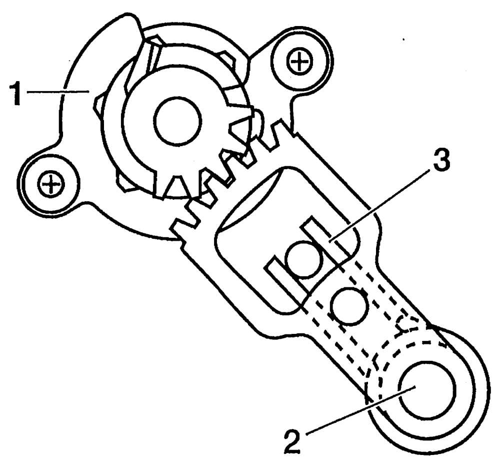
0.55mm max

Installation

1. Locate the selector drum into the crankcase.
2. Lubricate the selector drum bearing with clean engine oil.
3. Support the drum and refit the selector drum bearing. Retain with the bearing lock and capscrew. Tighten the capscrew to **12 Nm.**
4. Align the quadrant with the selector drum.

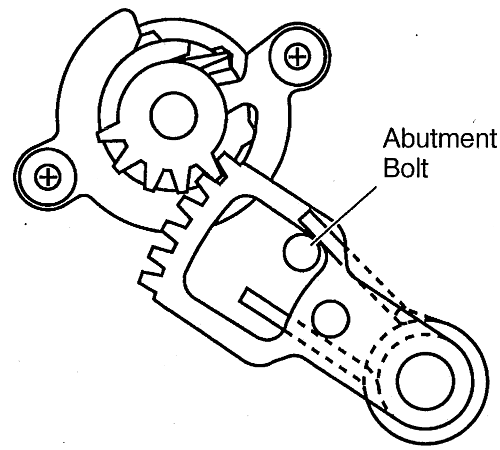
NOTE:

- **Align the gear centre tooth on the selector drum between the centre gear teeth on the gear quadrant.**



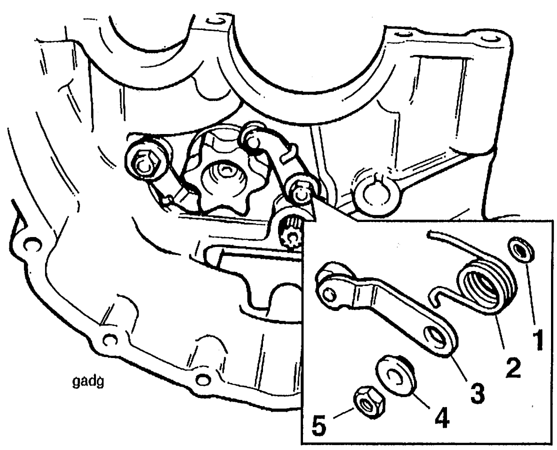
1. Stop Plate
2. Quadrant Shaft
3. Return Spring

5. Fit a new sealing washer to the gearchange abutment bolt and refit it to the lower crankcase. Tighten the bolt to **28 Nm.**
6. Push the mechanism down until the quadrant contacts the abutment bolt (arrowed below). Check that the gear teeth mesh as shown below. Rectify if incorrect by removing and re-engaging the gear quadrant.



Correct Gear Position at Maximum Extension

7. Refit the detent wheel and tighten the centre bolt to **12 Nm.**
8. Apply 'Loctite 242' to the stop plate fixings. Refit the stop plate and tighten the fixings to **9 Nm.**
9. Refit to the studs, the detent arms, springs etc. Ensure that the springs are re-fitted in the same positions as noted during removal. Tighten the nuts to **9 Nm.**

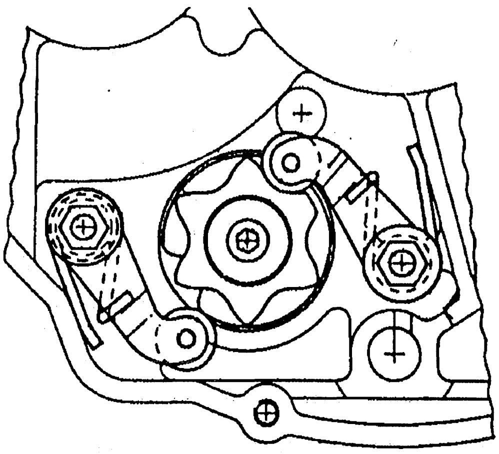


1. Washer
2. Spring
3. Detent Arm
4. Flanged Washer
5. Nut

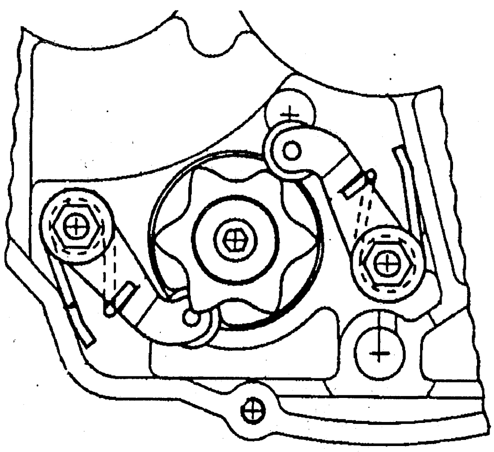
NOTE:

- **Detent springs MUST NOT be interchanged. The NEUTRAL spring has a white mark and is fitted rearmost in the crankcase.**
- **The neutral detent arm is angled in toward the crankcase whereas the gearchange detent arm is angled out towards the detent wheel.**

10. Check that the detent arms correctly align when neutral and all gears are selected. Also check that there is no binding of the arms during operation.

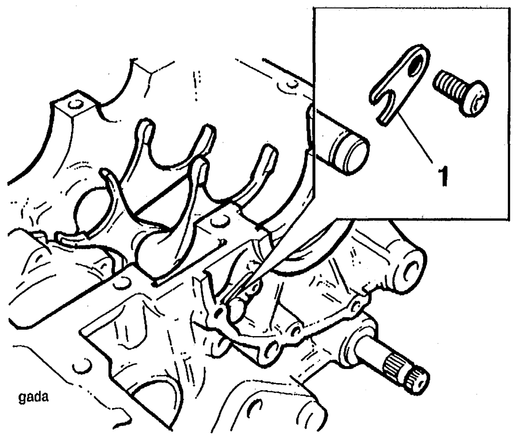


Detent Position 1st. Gear



Detent Position Neutral

11. Apply 'Loctite 270' to the oil pressure relief valve threads and tighten the valve to **15 Nm.**
12. Refit the oil pump and tighten the pump fixings to **12 Nm.**
13. Position the selector forks to the selector drum, in the order noted during removal.
14. Support the selectors and feed the selector shaft through the crankcase and selectors. Fit the shaft keeper plate and tighten the retaining bolt to **6 Nm.**



1. Selector Shaft Keeper Plate

INPUT AND OUTPUT SHAFT ASSEMBLIES

Removal

The input and output shafts can be lifted out of the lower crankcase after the crankcase halves have been separated. For details of crankcase separation, refer to the crankcase section.

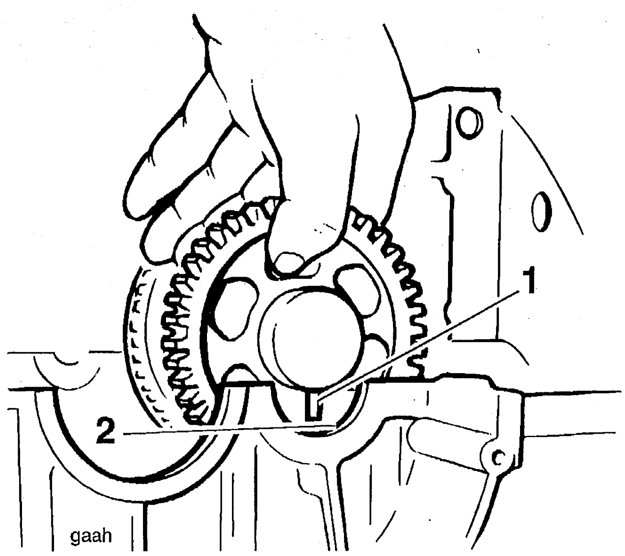
Installation

Ensure the bearing sleeve dowels, oil seal and retaining rings are correctly located when refitting both shafts.

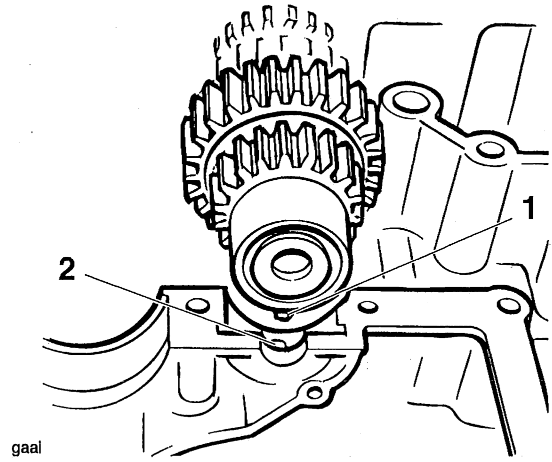
NOTE:

- **Apply a small amount of 'Loctite 648' to the bearing locations in the upper crankcase before fitting the assembled transmission shafts.**

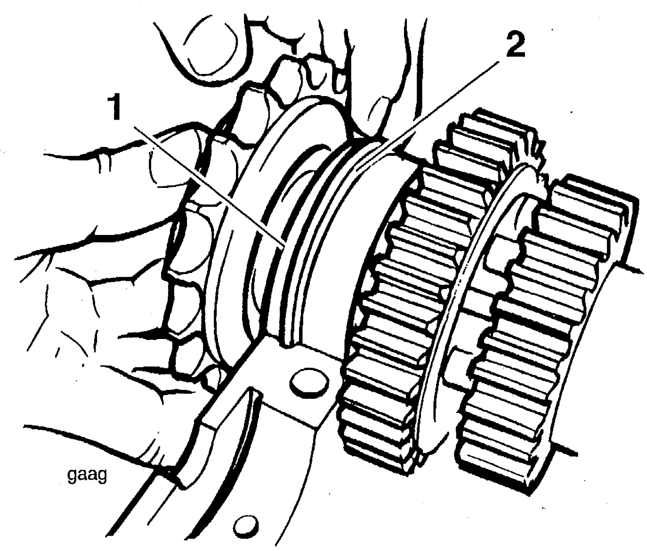
Ensure that all gears are correctly meshed.



1. Output Shaft Dowel (Clutch Side)
2. Crankcase Location



1. Input Shaft Dowel (drive sprocket side)
2. Crankcase Location



1. Oil seal
2. Semi-circular Retaining Ring
(Output Shaft Illustrated)

NOTE:

- **It is recommended that the semi-circular input shaft retaining ring (adjacent to the clutch) is positioned to engage an equal amount in the upper and lower crankcases.**

INPUT SHAFT

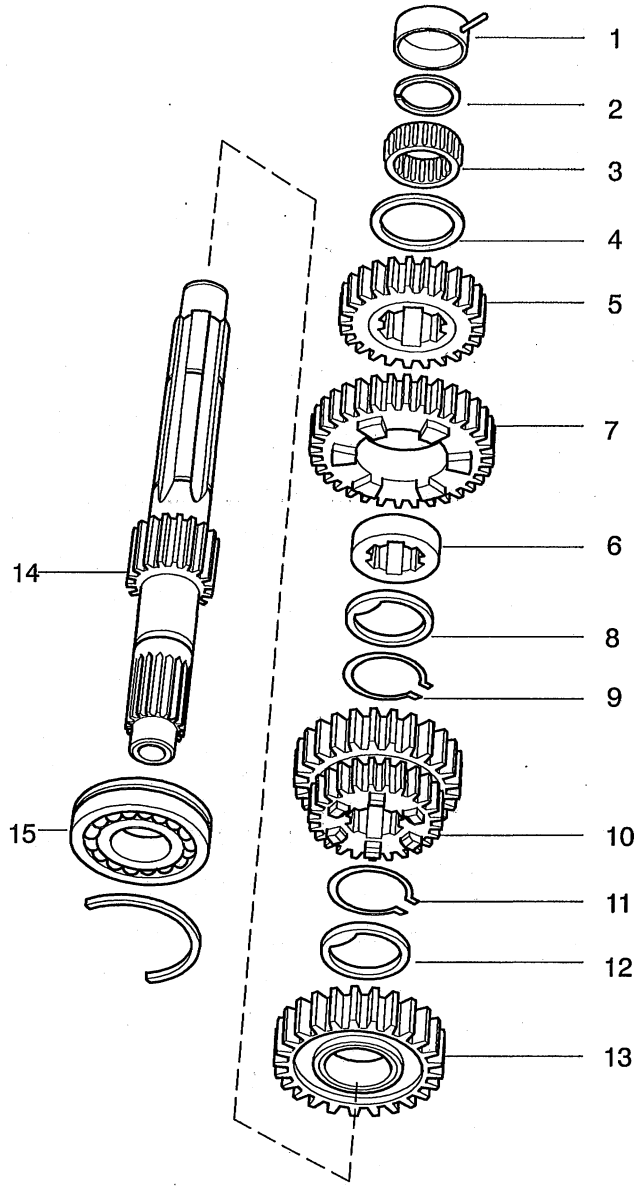
Disassembly

Remove the clutch assembly from the shaft (if not already removed). Working from the opposite end to where the clutch assembly is fitted, dismantle the input shaft as follows:

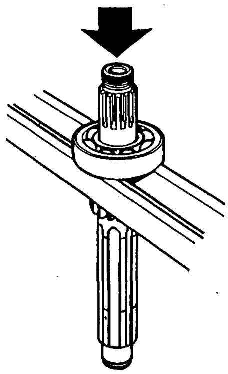
1. Remove the pegged bearing sleeve (1) from the end of the shaft.
2. Detach the circlip (2) from the circlip groove.
3. Slide off the needle bearing (3) and thrust washer (4).
4. Remove second gear (5).
5. Remove sixth gear (7), complete with the splined bush (6) which runs inside the gear.
6. Remove the lipped thrust washer (8) from in front of the circlip between sixth and third/fourth gear.
7. Remove the circlip (9) from the shaft.
8. Slide off the combined third/fourth gear (10).
9. Remove the circlip (11) from in front of fifth gear.
10. Remove the lipped thrust washer (12) adjacent to fifth gear.
11. Remove fifth gear (13).
12. Place the shaft in a press with the input shaft bearing supported on press bars and the clutch end of the shaft facing the press ram. Protect the shaft thread with a thread protector or similar and press the shaft through the bearing.

WARNING: When using a press, always wear overalls, eye, face and hand protection. Objects such as bearings frequently break-up under load and the debris caused during break-up may cause damage and injury to unprotected parts of the body.

Never wear loose clothing which could become trapped in the press and cause crushing injury to the hand, arms or other parts of the anatomy.



1. **Bearing Sleeve**
2. **Circlip**
3. **Needle Roller Bearing**
4. **Thrust Washer**
5. **Second Gear**
6. **Splined Bush**
7. **Sixth Gear**
8. **Thrust Washer**
9. **Circlip**
10. **Third/Fourth Gear**
11. **Circlip**
12. **Thrust Washer**
13. **Fifth Gear**
14. **Input Shaft**
15. **Input Shaft Bearing**



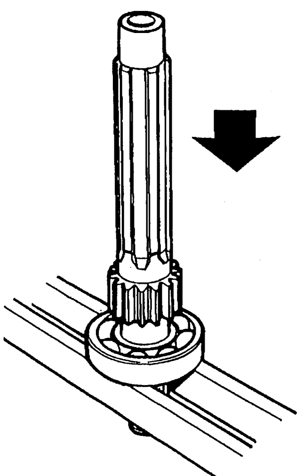
1. Pressing Off The Input Shaft Bearing

Assembly

NOTE:

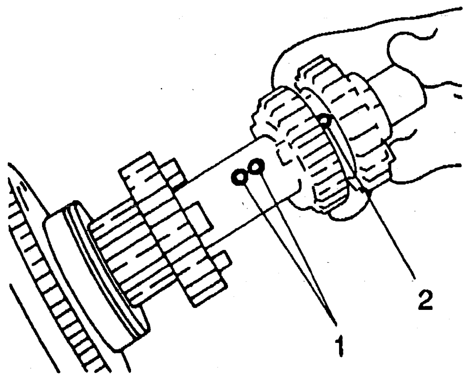
- **Lubricate each gear and bush with clean engine oil during assembly.**
  Examine all gears, bearings and sleeves for damage, chipped teeth and wear beyond the service limits. Replace all suspect components and always use new circlips to assemble the shaft.

1. Place the input shaft bearing on press bars ensuring the **inner** race of the bearing is supported by the bars and the circlip groove is pointing **upwards**. Position the mainshaft to the bearing with the **clutch end pointing downwards** through the bearing. Press the shaft through the bearing until the bearing comes into contact with the fixed gear on the shaft. <u>OBSERVE THE WARNING FOLLOWING PARAGRAPH 12 ON THE PREVIOUS PAGE REGARDING THE DANGERS OF USING A PRESS</u>



Pressing On the Input Shaft Bearing

2. Fit fifth gear (13) to the input shaft with the dog teeth pointing away from the input shaft bearing.
3. Slide on the thrust washer (12).
4. Fit a new circlip (11) to the input shaft ensuring that the clip is correctly located in the circlip groove.
5. Fit the combined third/fourth gear (10) with the smaller gear facing toward fifth gear. Ensure that the double oil hole in the mainshaft aligns with the oil hole in the gear.



1. Input Shaft Double Oil Hole
2. Third/Fourth Gear Oil Hole

6. Fit a new circlip (9) to the input shaft ensuring that the clip is correctly located in the circlip groove.
7. Fit the thrust washer (8) to the input shaft and slide up the shaft until in contact with the circlip.
8. Fit the splined bush (6) from sixth gear ensuring that the oil hole in the input shaft aligns with the oil hole in the bush.
9. Fit sixth gear (7) with the dog teeth facing third/fourth gear.
10. Fit second gear (5) with the stepped side facing away from the clutch end of the input shaft.
11. Fit the thrust washer (4) adjacent to second gear and slide on the needle roller bearing (3). Retain all with a new circlip (2).
12. Finally, fit the bearing sleeve (1) to the needle roller bearing.

OUTPUT SHAFT

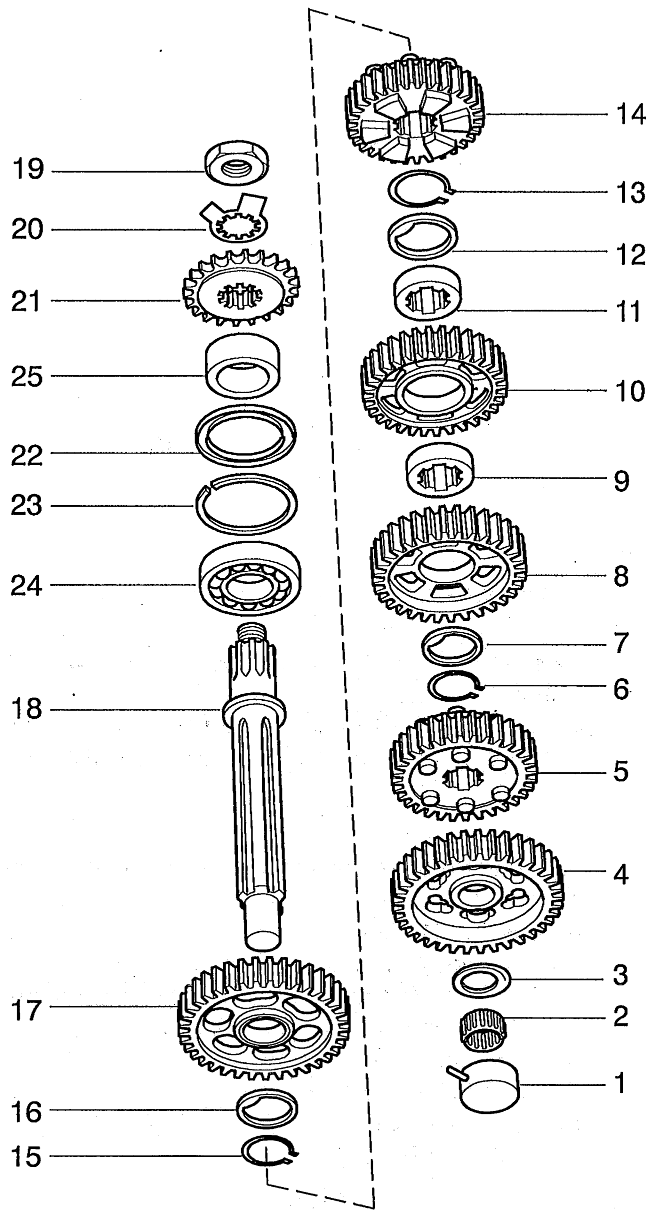
Working from the opposite end to the drive sprocket, dismantle the output shaft as follows.

Disassembly

1. Remove the output bearing sleeve (1), needle roller bearing (2) and hardened thrust washer (3).
2. Mark one side of first gear to denote its correct orientation. Remove first gear (4) from the shaft.
3. Slide fifth gear (5) from the shaft.
4. Remove the circlip (6) from in front of the third gear.
5. Remove the lipped thrust washer (7) from the shaft.
6. Remove the third gear (8) together with the inner splined bush (9).
7. Slide fourth gear (10) off the shaft and also remove the splined bush (11) and thrust washer (12).
8. Remove the circlip (13) from in front of sixth gear.
9. Remove sixth gear (14) from the shaft.
10. Remove the circlip (15) from in front of second gear.
11. Remove thrust washer (16) and slide off second gear (17).
12. Position the output shaft (18) in a vice with soft jaws fitted. Tighten the vice to prevent the shaft from turning and release the lock tab (20) from the output sprocket nut (19), then release the nut.
13. Remove the transmission sprocket nut (19), locktab (20), sprocket (21) and sleeve (25).
14. Collect the oil seal (22) and retaining ring (23).
15. If it is found necessary to replace the large bearing (24) at the end of the shaft, remove the outer race and detach the inner section from the shaft by splitting.

WARNING: When removing the output shaft bearing, always wear overalls, eye, face and hand protection. The bearing races are hardened and are liable to splinter if broken. Debris from broken bearings could cause injury to eyes, face and any unprotected parts of the body.

CAUTION: The bearing cannot be removed intact. If the bearing is removed from the shaft, the complete bearing will be damaged and must be renewed.



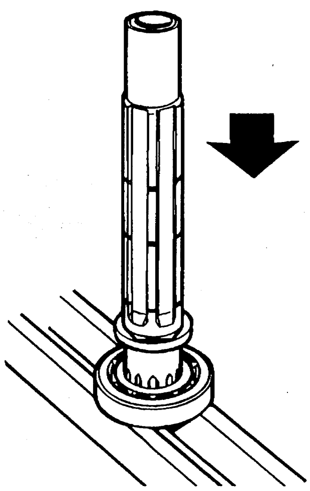
1. Bearing Sleeve
2. Needle Roller Bearing
3. Thrust Washer
4. First Gear
5. Fifth Gear
6. Circlip
7. Thrust Washer
8. Third Gear
9. Third Gear Bush
10. Fourth Gear
11. Fourth Gear Bush
12. Thrust Washer
13. Circlip
14. Sixth Gear
15. Circlip
16. Thrust washer
17. Second Gear
18. Output Shaft
19. Nut
20. Locktab
21. Output Sprocket
22. Oil Seal
23. Retaining Ring
24. Bearing
25. Sleeve

Assembly

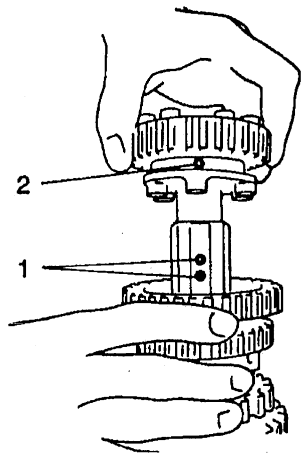
NOTE:

- **Lubricate each gear and bush with clean engine oil during assembly.**
  Examine all gears, bearings and sleeves for damage, chipped teeth and wear beyond the service limits. Replace all suspect components and always use new circlips to assemble the shaft

1. Working from the output sprocket end of the shaft, fit a new bearing (24) to the shaft using a press and press bars.



2. Fit the retaining ring (23) to the shaft. Lubricate and fit a new oil seal (22) and fit the sprocket sleeve (25).
3. Transfer the shaft to the vice and secure between soft jaws. Fit the sprocket (21), locktab (20) and nut (19). Tighten the nut to **132 Nm.** Close the lock tab.
4. Withdraw the shaft from the vice and continue to assemble from the opposite end to the output sprocket.
5. Locate the second gear (17) to the shaft with the large step side facing away from the output sprocket end. Fit the thrust washer (16) and retain with a new circlip (15).
6. Fit sixth gear (14) with the selector fork groove facing away from the output sprocket end. Ensure that the oil hole in the gear aligns with the double oil hole in the output shaft.



1. Double Oil Hole
2. Gear Oil Hole

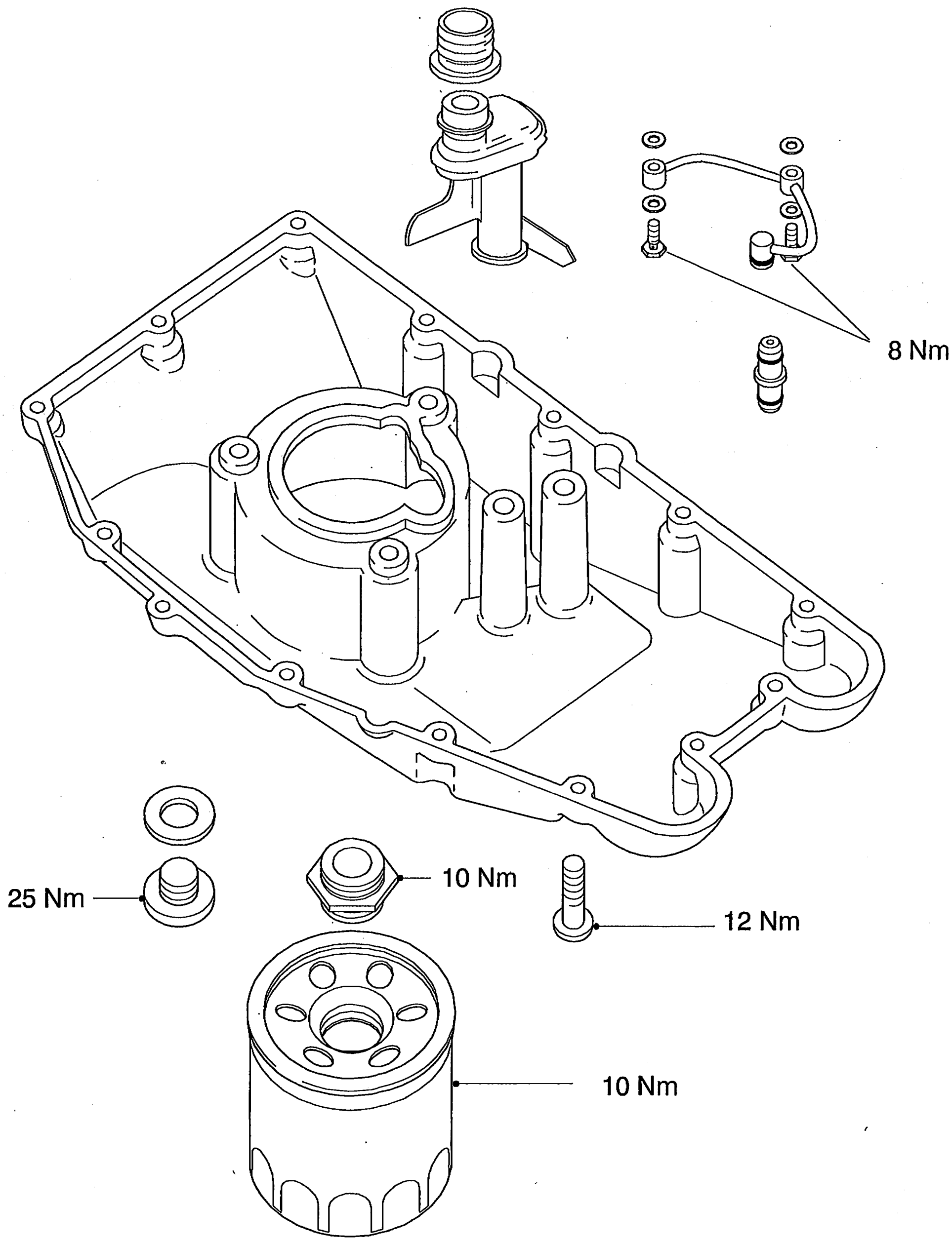
> **CAUTION: Incorrect alignment of the oil holes will result in severe damage to the gears and gear selectors.**

7. Fit a new circlip (13) to retain sixth gear.
8. Fit the thrust washer (12) to the rear of fourth gear and fit the splined sleeve (11) for fourth gear. Ensure correct alignment of the oil hole in the shaft with the oil hole in the sleeve. Fit fourth gear (10) to the shaft with the large step side facing away from the output sprocket.
9. Fit the splined bush (9) for third gear taking care to align the oil hole in the shaft with the corresponding hole in the bush. Fit third gear (8) with the larger step side facing the output sprocket.
10. Fit the thrust washer (7) and retain with a new circlip (6).
11. Fit the fifth gear (5) to the shaft with the circular dog teeth facing away from the output sprocket.
12. Fit first gear (4) to the shaft as marked during disassembly.
13. Finally fit the thrust washer (3), needle roller bearing (2) and bearing cap (1) to the end of the shaft.

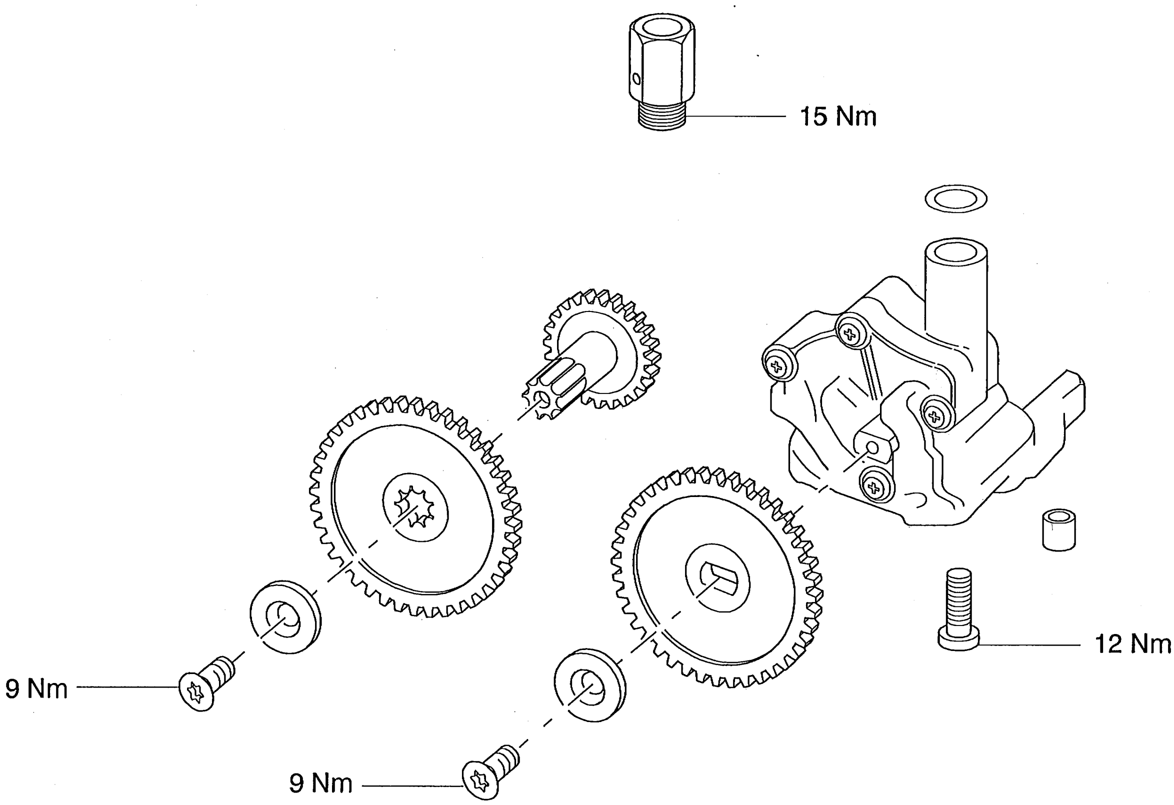
LUBRICATION SYSTEM

CONTENTS

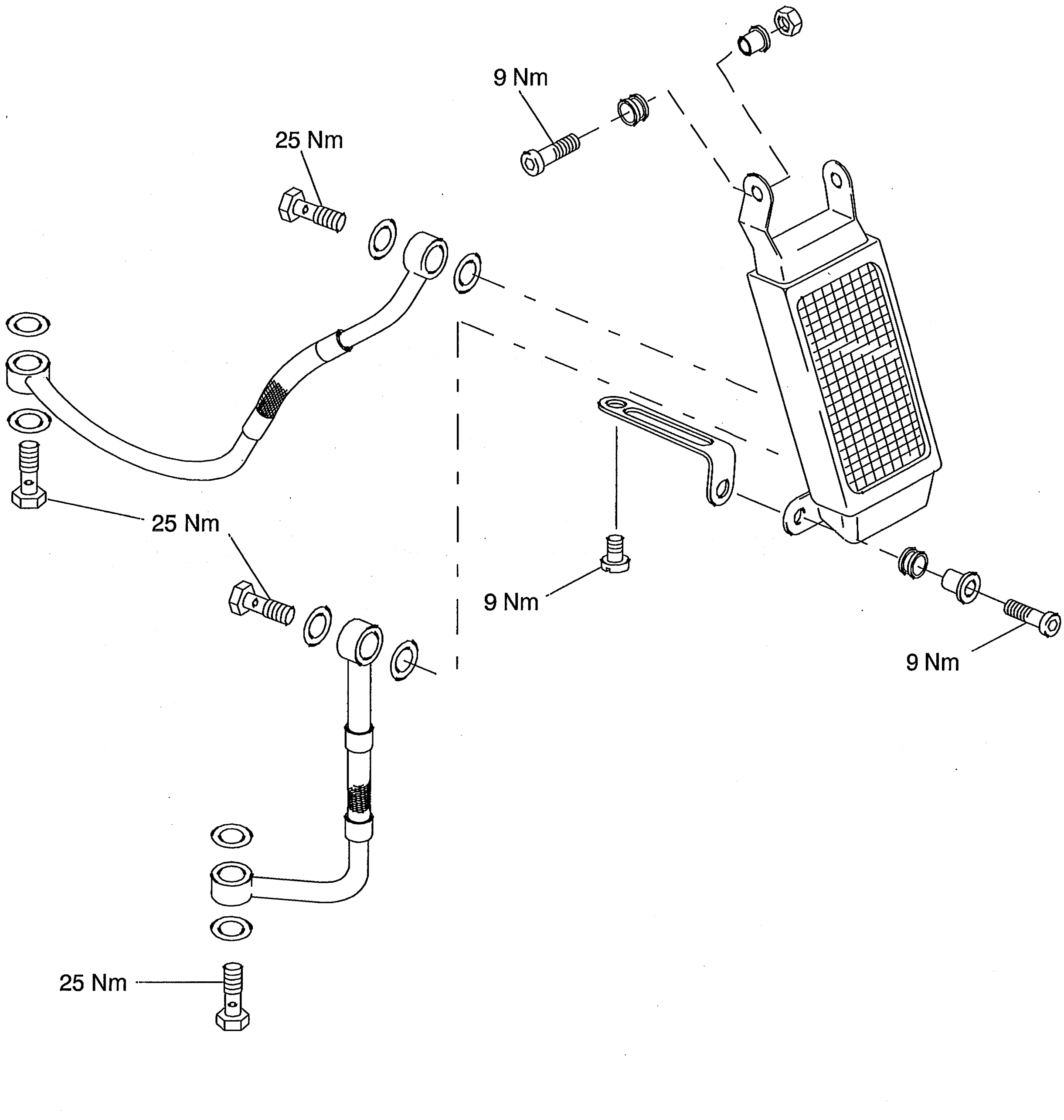
Exploded View - Sump



Exploded View - Oil Pump and Gears



Exploded View - Oil Cooler



ENGINE OIL

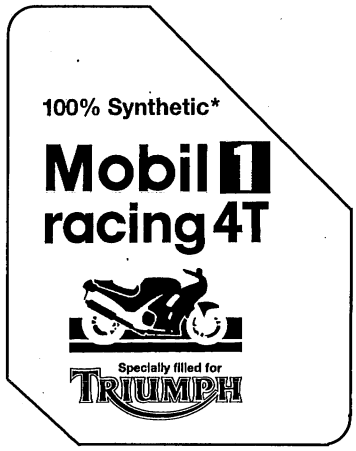
Specification

All Triumph fuel injected engines must be filled with 10W-40, 15W-40 or 15W-50 semi-synthetic motorcycle engine oil which meets API-SG or API-SH specification, or fully-synthetic oil which exceeds these minimum requirements.

Mobil 1 Racing 4T, specially filled for Triumph, is a fully synthetic oil which exceeds these minimum requirements.

> ⚠ **CAUTION: Do not use oils which do not meet API-SG or API-SH specification.**
>
> **Do not use 10W rated oils with a hot viscosity rating greater than 40. For example, DO NOT use an oil with a viscosity rating of 10W-50.**
>
> **Do not use oils with a cold viscosity rating of 0W or 5W.**
>
> **Engine damage may result from using any engine oil which does not meet the required specification or does not fall into the correct viscosity band.**

Triumph Engine Oil

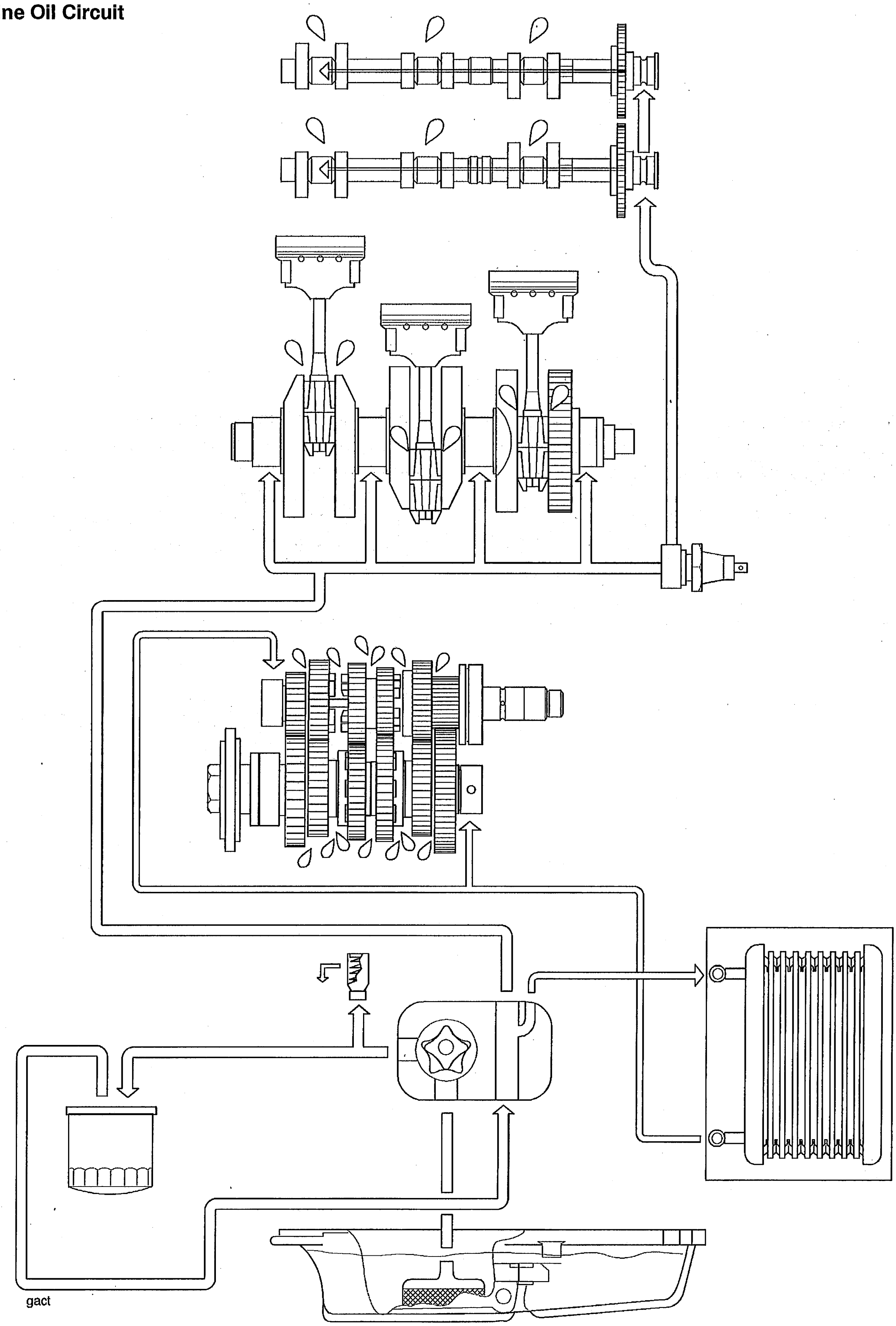


Your Triumph Motorcycle is a quality engineered product which has been carefully built and tested to exacting standards. Triumph Motorcycles are keen to ensure that you enjoy optimum performance from your machine and with this objective in mind have tested many of the engine lubricants currently available to the limits of their performance.

Mobil 1 Racing 4T consistently performed well during our tests and has become our primary recommendation for the lubrication of all current Triumph motorcycle engines.

Mobil 1 Racing 4T, specially filled for Triumph, is available from your authorised Triumph dealer.

Engine Oil Circuit



ENGINE OIL CIRCUIT DESCRIPTION

Oil is collected from the sump and is drawn through a mesh strainer into the oil pump rotor. Pressurised oil is then delivered to the outside of the oil filter where the oil pressure relief valve is fitted. The relief valve is set to open at 75 lb/in^2 and when open, returns high pressure oil direct to the sump.

The oil pump is fitted with a single pumping rotor which supplies pressurised oil to the lubrication circuit and the oil cooler.

Filtered oil is drawn from the centre of the oil filter along the oil filter retaining tube. Part of this filtered oil is supplied, through a non-pumping passage in the oil pump, to a horizontal gallery at the rear of the upper crankcase.

Once received in the upper crankcase gallery, the oil is delivered to the crankshaft main bearings and, via drillings in the crankshaft, to the big end bearings. Oil exits from the big ends through holes in the connecting rods and then splash lubricates the bores and pistons.

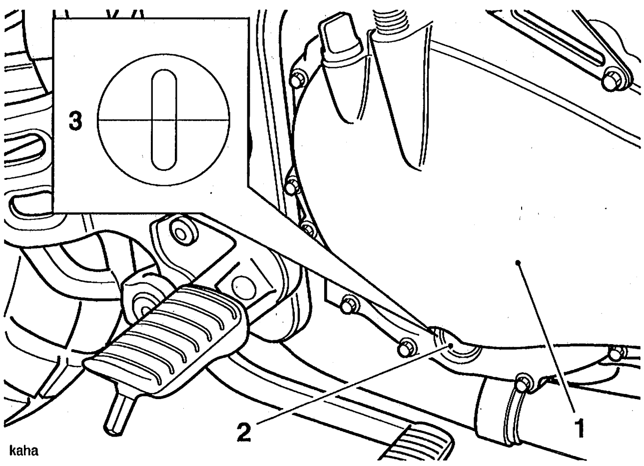
The remainder of the filtered oil is passed through an oil cooler and is supplied to drillings in the lower crankcase by internal, detachable pipes. These lower crankcase drillings deliver oil directly to the end of each gearbox shaft. Oil is circulated along the inside of the gearbox shafts to exit holes which feed directly onto the selectors, bearings and gears.

The same upper crankcase gallery which feeds the crankshaft also feeds the cylinder head and camshafts through an external link pipe. The pipe, located at the rear of the engine, links a drilling in the head to the oil gallery in the upper crankcase. The low oil pressure warning light switch is located at the base of this pipe.

The head drilling supplies oil to the front camshaft bearings which, in turn, deliver oil through the hollow camshafts to the other camshaft bearings, the tappet buckets and the valves.

Oil Level Inspection

1. If the engine has been running, allow it to stand for at least 10 minutes before checking the oil level.
2. Check the oil level visible in the sight glass situated at the lower end of the clutch cover on the right hand side of the motorcycle. When correct, the level of oil should be half way up the sight glass.



1. Clutch Cover

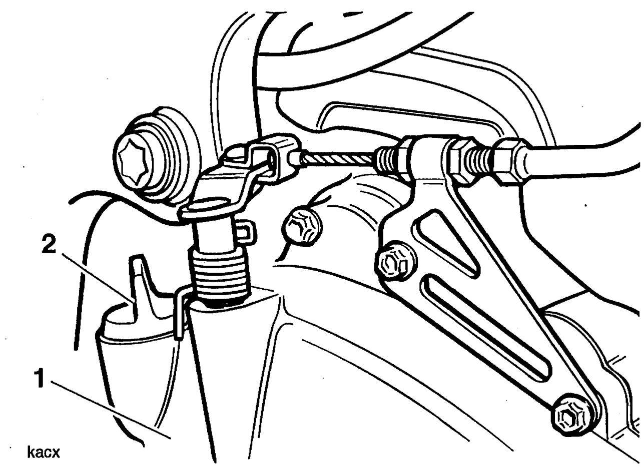
2. Sight Glass

3. Oil Level (correct level shown)

NOTE:

- **Accurate determination of the true oil level is only possible when the motorcycle is level and upright, not when it is on the side stand.**

3. If the oil level requires adjustment, remove the filler plug from the clutch cover and add oil, a little at a time, until the correct level is reached.



1. Clutch Cover

2. Filler Plug

4. Refit the filler plug.

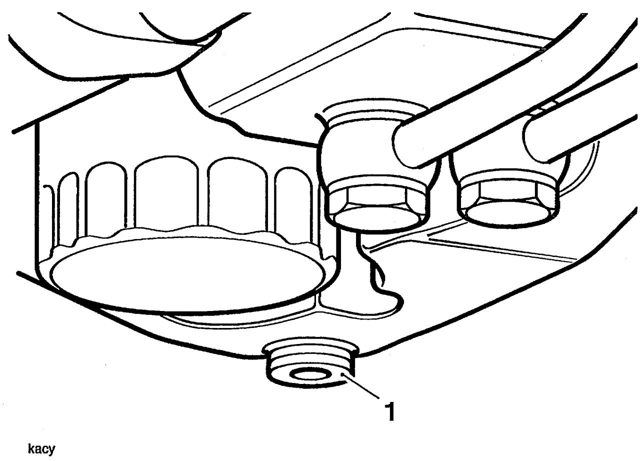
Engine Oil and Filter Change

WARNING: Prolonged or repeated contact with engine oil can lead to skin dryness, irritation and dermatitis. Furthermore, used engine oil contains potentially harmful contaminants which can cause cancer.

When handling used engine oil, always wear protective clothing and avoid any skin contact with the oil.

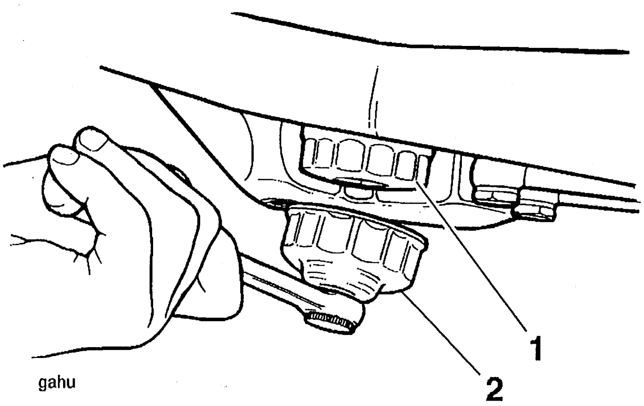
1. Position the motorcycle on level ground and in an upright position.
2. Start the engine and allow it to reach normal operating temperature.
3. Stop the engine and place a container beneath the sump to collect the displaced oil.
4. Remove the sump drain plug and allow the oil to drain out completely.

WARNING: The oil may be hot to the touch. Contact with hot engine oil may cause skin to be scalded or burnt.



1. Sump Drain Plug

5. When the oil has completely drained out, fit a new sealing washer to the sump plug and refit the plug tightening it to **25 Nm.**
6. Move the container to a point below the oil filter.
7. Using tool T3880311 to release the filter cartridge, unscrew and remove the oil filter.



1. Oil Filter

2. Tool T3880311

8. Apply a smear of clean engine oil to the seal of the new filter.

9. Fit the filter and tighten, using tool T3880311, to **10 Nm.**

10. Fill the engine with oil of the correct specification and viscosity.

NOTE:

- **Add oil slowly to avoid overfilling or spillage over the outside of the engine.**

11. Start the engine and allow it to run for a short time at idle. Check that the low oil pressure warning light extinguishes shortly after starting.

> **CAUTION: Stop the engine if the low oil pressure warning light fails to extinguish.**
>
> **Investigate and rectify the cause before restarting the engine. Running the engine with the low oil pressure warning light illuminated will cause engine damage.**

12. While the engine is running, check for oil leaks.

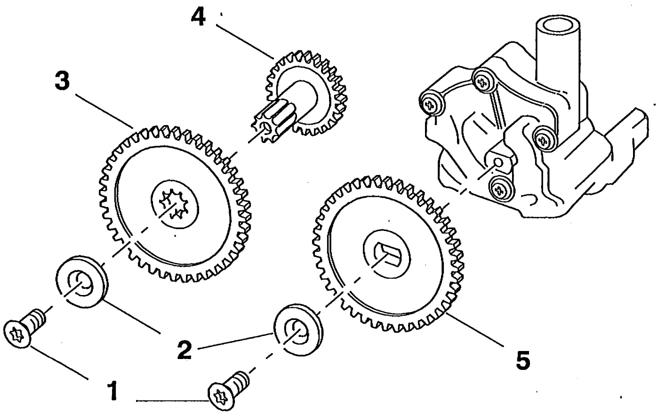
13. Stop the engine and adjust the oil level if necessary.

OIL PUMP AND GEARS

Removal

NOTE:

- **The oil pump is located in the lower crankcase. In order to remove the oil pump, the engine must be removed from the frame and the crankcase halves separated.**



1. Gear Screws

2. Washers

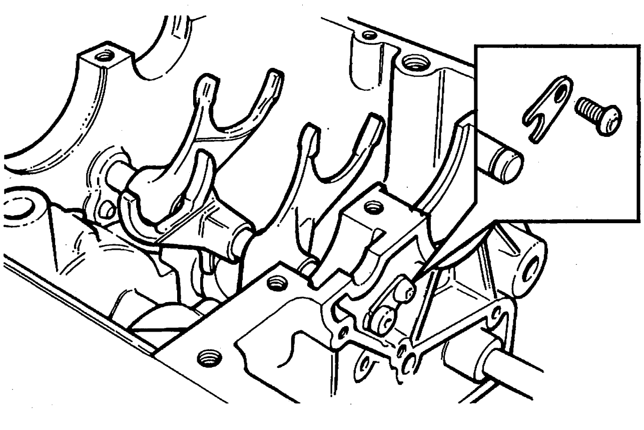
3. Auxiliary Gear

4. Intermediate Gear And Shaft

5. Oil Pump Gear

1. Remove both the input and output shafts.

2. Remove the capscrew and take out the 'U' shaped keeper plate from the selector shaft.

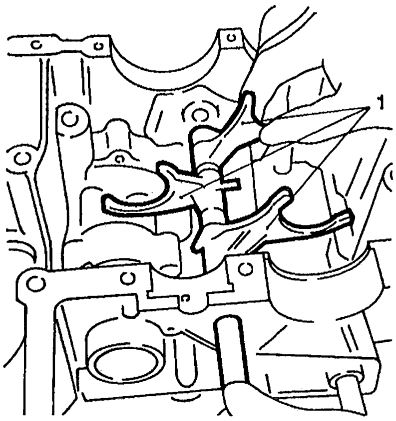


Inset:- Selector Shaft Keeper Plate

NOTE:

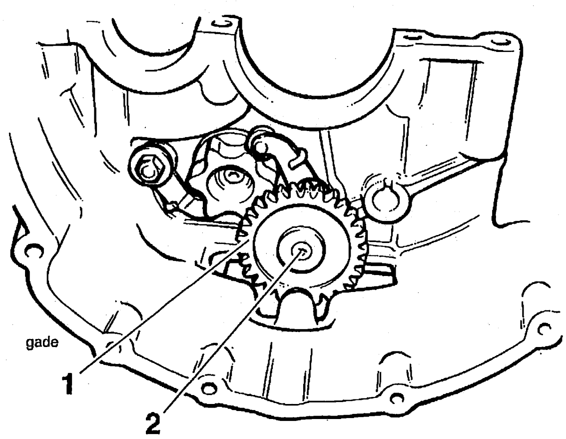
- **To ensure that the selector fork positions are maintained on assembly, mark each fork with felt pen or similar to denote their relative positions.**

3. Using finger pressure, push the selector shaft out of crankcase in the direction of the keeper plate. Collect each selector fork from the lower crankcase as they are released from the selector shaft.



1. Selector Forks

4. Remove the screw securing the oil pump auxiliary gear. Remove the gear from the shaft.



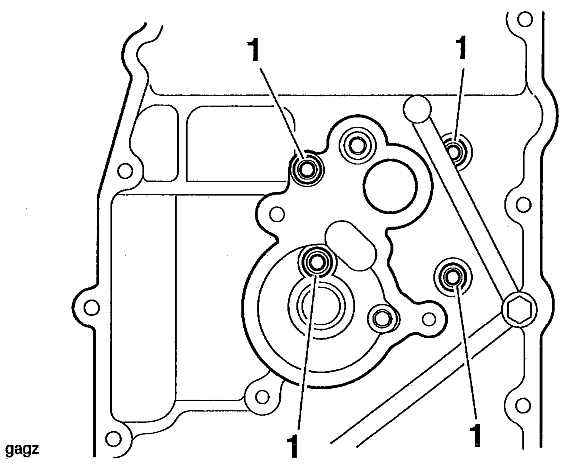
1. Oil Pump Auxiliary Gear

2. Gear Retaining Screw

5. Invert the crankcase.

6. Release the screws securing the oil pump to the lower crankcase.

7. Invert the crankcase.

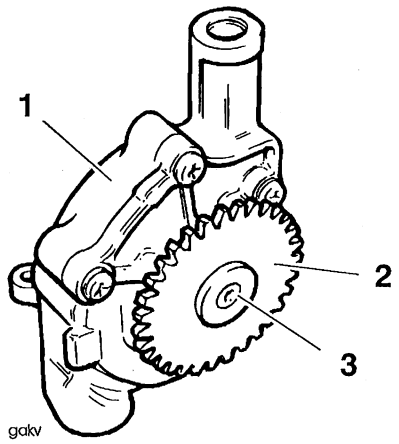


1. Oil Pump Retaining Screws

8. Remove the oil pump from inside the lower crankcase.

9. Withdraw the oil pump intermediate gear by sliding through the crankcase from outside to in.

10. To remove the oil pump gear from the pump, release the securing screw and remove from the shaft.



1. Oil Pump

2. Gear

3. Screw

Inspection

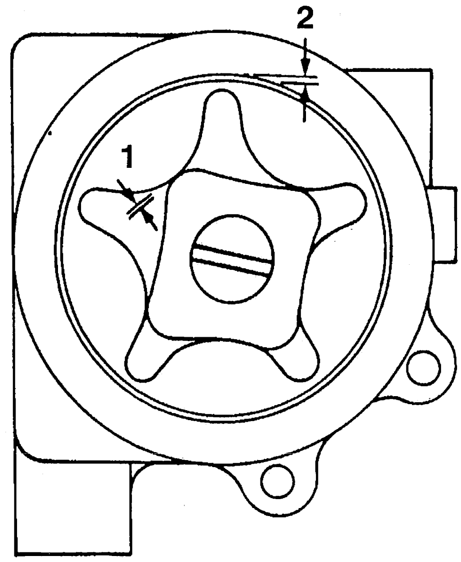
1. Remove the oil pump end cover.

2. Measure the rotor tip clearance using feeler gauges.

Standard:	**0.15 mm**
Service Limit:	**0.20 mm max.**

2. Measure the pump body clearance using feeler gauges.

Standard:	**0.22 - 0.15 mm**
Service Limit:	**0.35 mm max.**



1. Rotor Tip Clearance

2. Pump Body Clearance

CAUTION: If any part of the oil pump is found to be outside the service limit, the complete pump must be renewed. Severe engine damage may result from the continued use of a faulty oil pump.

3. Refit the end cover if all clearances are within the service limits. Renew the complete pump if outside the service limit.

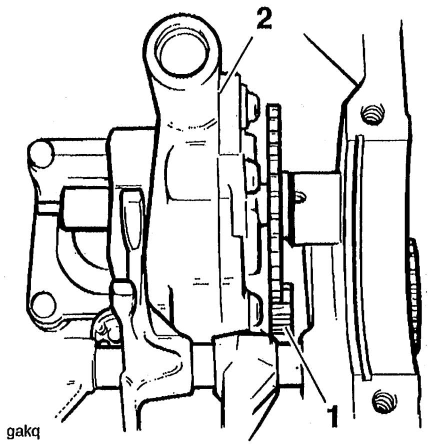
4. Inspect all gears for damage, pitting etc. Renew as necessary.

Installation

1. Locate the oil pump gear to the pump and tighten the retaining screw to **9 Nm**.

2. Fit the oil pump intermediate gear and shaft to the crankcase.

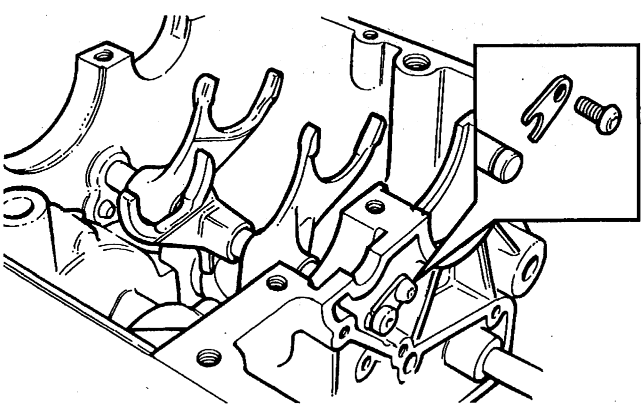
3. Locate the oil pump into the lower crankcase and align it with the shaft.



1. Oil Pump Intermediate Gear

2. Oil Pump

4. Invert the crankcase and support the pump in position.
5. Fit and tighten the oil pump screws to **12 Nm.**
6. Refit the oil pump auxiliary gear and tighten the gear fixing to **9 Nm**.
7. Position the selector forks to the selector drum, in the order noted during removal.
8. Support the selectors and feed the selector shaft through the crankcase and selectors. Fit the shaft keeper plate and tighten the retaining bolt to **6 Nm.**

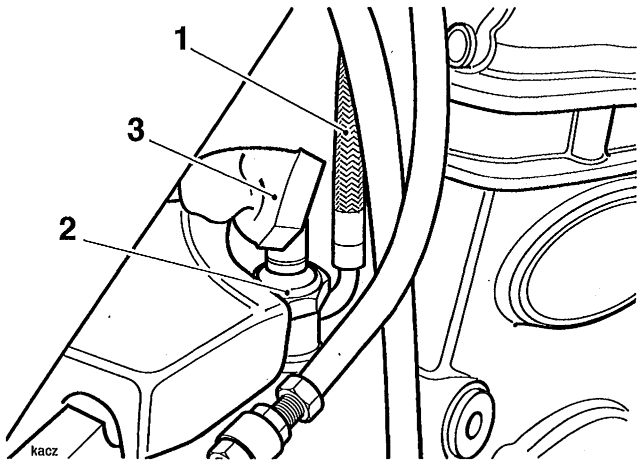


Inset:- Selector Shaft Keeper Plate

9. Refit the input and output shafts.

Low Oil Pressure Warning Light Switch

The low oil pressure warning light switch is located at the lower end of the camshaft oil feed pipe.



1. Oil Feed Pipe

2. Low Oil Pressure Warning Light Switch

3. Electrical Connection/Covering Boot

1. Remove the seats and disconnect the battery negative (black) lead first.
2. Lift the covering boot and disconnect the electrical connection to the switch.
3. Remove the switch and collect the copper washers.

Installation

1. Using new copper washers, fit the switch and tighten to **13 Nm.**
2. Refit the electrical connection.
3. Refit the covering boot.
4. Reconnect the battery, positive (red) lead first.

SUMP

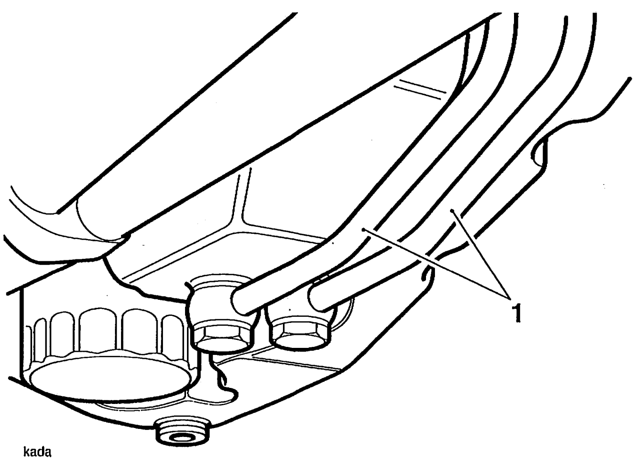
Removal

1. Remove the seats and disconnect the battery negative (black) lead first.
2. Position a container beneath the sump, release the sump plug and drain the engine oil from the sump.

WARNING: The oil may be hot to the touch. Contact with hot oil may cause the skin to be scalded or burned.

WARNING: Prolonged or repeated contact with engine oil can lead to skin dryness, irritation and dermatitis. In addition used engine oil contains potentially harmful contaminants which can cause cancer. Wear suitable clothing and avoid skin contact.

3. Note the position of the oil cooler pipes prior to disconnecting the pipes from the sump.



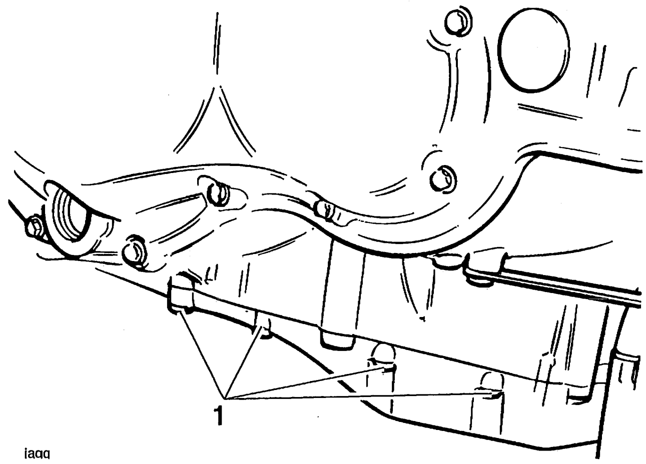
1. Oil Cooler Pipes

4. Remove the exhaust system as described in the fuel system section.

WARNING: The exhaust system will be hot if the engine has recently been running. Always allow sufficient time for the exhaust to cool before working on or near the exhaust system.

Contact with a hot exhaust could result in burn injuries.

5. Remove the oil filter.
6. Release the bolts securing the sump to the lower crankcase.



1. Sump to Lower Crankcase Fixings

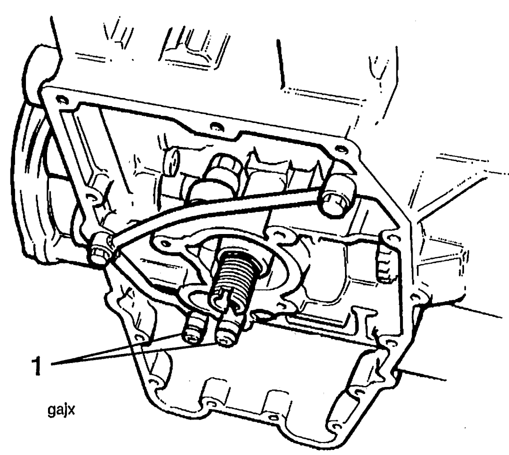
NOTE:

- **Note the position of the hose guide on the right hand side of the sump in order that it can be refitted in the same location.**

7. Detach the sump and collect the oil transfer tubes.

NOTE:

- **The oil transfer tubes may remain in the crankcase or become detached with the sump.**

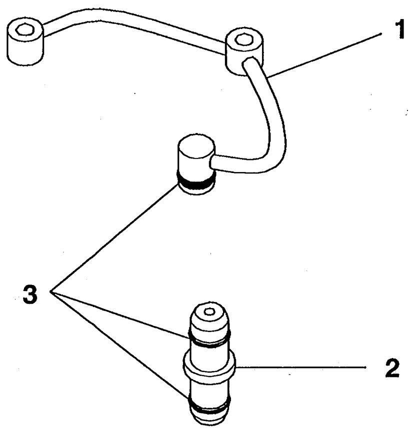


1. Oil Transfer Tubes

8. Remove the sump gasket.

Inspection

1. Inspect the oil transfer tube 'O' rings for damage and swelling. Renew as necessary.
2. Inspect the gearbox oil feed pipe 'O' ring for damage and swelling. Renew as necessary.



1. Gearbox Oil Feed Pipe

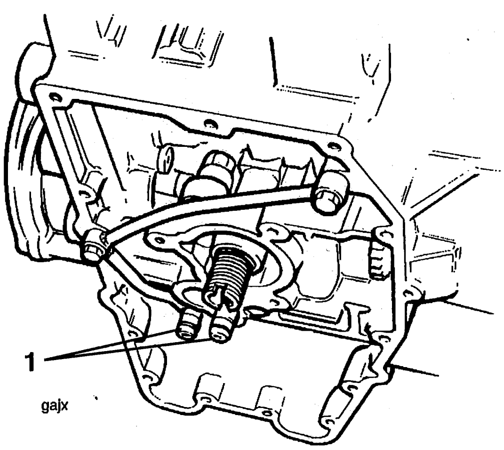
2. Oil Transfer Tube

3. 'O' rings

3. Inspect the oil pick-up for correct fitment in the lower crankcase.

Installation

1. Fit the oil transfer tube to the crankcase.



1. Transfer Tube Location

2. Using a new sump gasket, position the sump to the lower crankcase and locate to the oil transfer tube and gearbox oil transfer pipe.
3. Tighten the sump fixings to **12 Nm**.
4. Using new sealing washers, reconnect the oil cooler pipes. Tighten the cooler pipe banjo bolts to **25 Nm.**
5. Apply a smear of clean engine oil to the seal of a new oil filter.
6. Fit the oil filter and tighten to **10 Nm** using tool T3880011.
7. Refit the exhaust system as described in the fuel system section.

NOTE:

- **Use new exhaust gaskets at the downpipe connections with the cylinder head.**

8. Fill the engine with the correct grade of engine oil
9. Reconnect the battery positive (red) lead first.
10. Start the engine and ensure that the low oil pressure warning light goes out shortly after starting.
11. Stop the engine and adjust the engine oil level.
12. Refit the seats.

OIL COOLER

Removal

1. Remove the seats and disconnect the battery negative (black) lead first.
2. Position a suitable container beneath the oil cooler to catch any oil spillages.
3. Drain the engine oil as described elsewhere in this section.

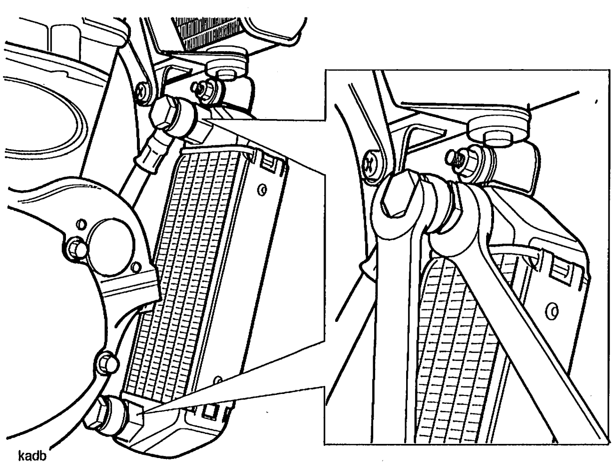
WARNING: The oil may be hot to the touch. Contact with hot engine oil may cause skin to be scalded or burnt.

WARNING: Prolonged or repeated contact with engine oil can lead to skin dryness, irritation and dermatitis. In addition used engine oil contains potentially harmful contaminants which can cause cancer. Wear suitable clothing and avoid skin contact.

4. Using an open-ended spanner, support the oil cooler connection point and disconnect the feed hose.

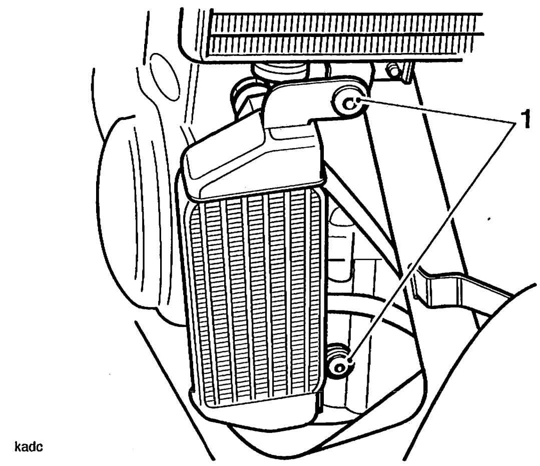
CAUTION: If the cooler connection point is not supported, the oil cooler may become damaged during release of the hose connections. Always follow the above method to avoid oil cooler damage.

5. Using the same method, disconnect the return hose.



Oil Cooler Hose Disconnection

6. Release the oil cooler fixings.



1. Oil Cooler Mountings

7. Detach the oil cooler.

Inspection

1. Inspect the cooler connection points for fractures and signs of oil leakage.
2. Check the cooler fins for damage and leaks.

Installation

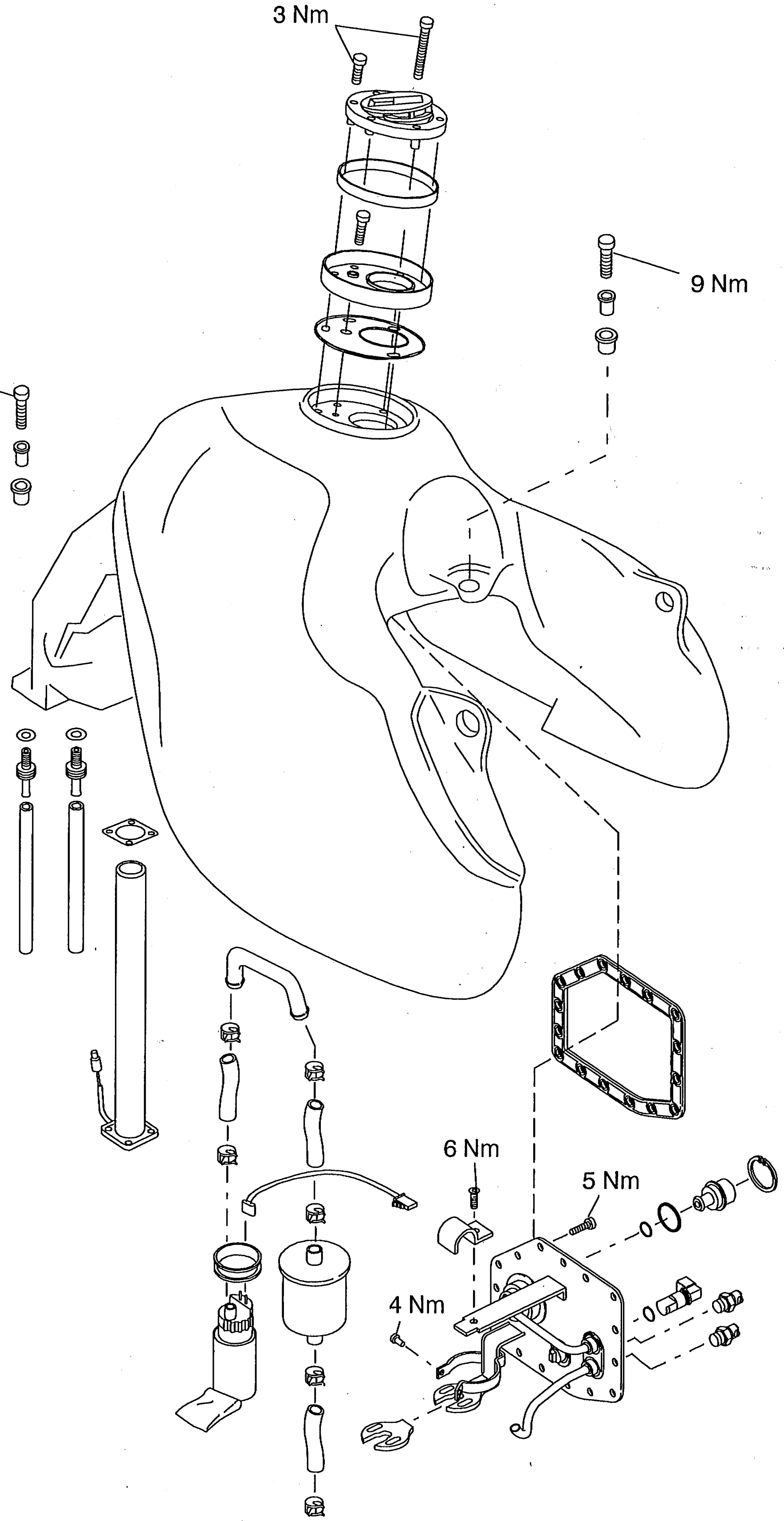
1. Position the oil cooler to the retaining brackets.
2. Refit and tighten the oil cooler fixings to **9 Nm**.
3. Align the oil cooler pipes to the cooler and, using new sealing washers on both sides of the banjo bolts, tighten to **25 Nm**.
4. Refill the engine with oil of the correct grade and viscosity.
5. Start the engine and check for oil leaks. Once a leak check has been made, stop the engine and allow to stand for 10 minutes.
6. Adjust the engine oil level.
7. Reconnect the battery positive (red) lead first.
8. Refit the seats.

FUEL SYSTEM/ENGINE MANAGEMENT

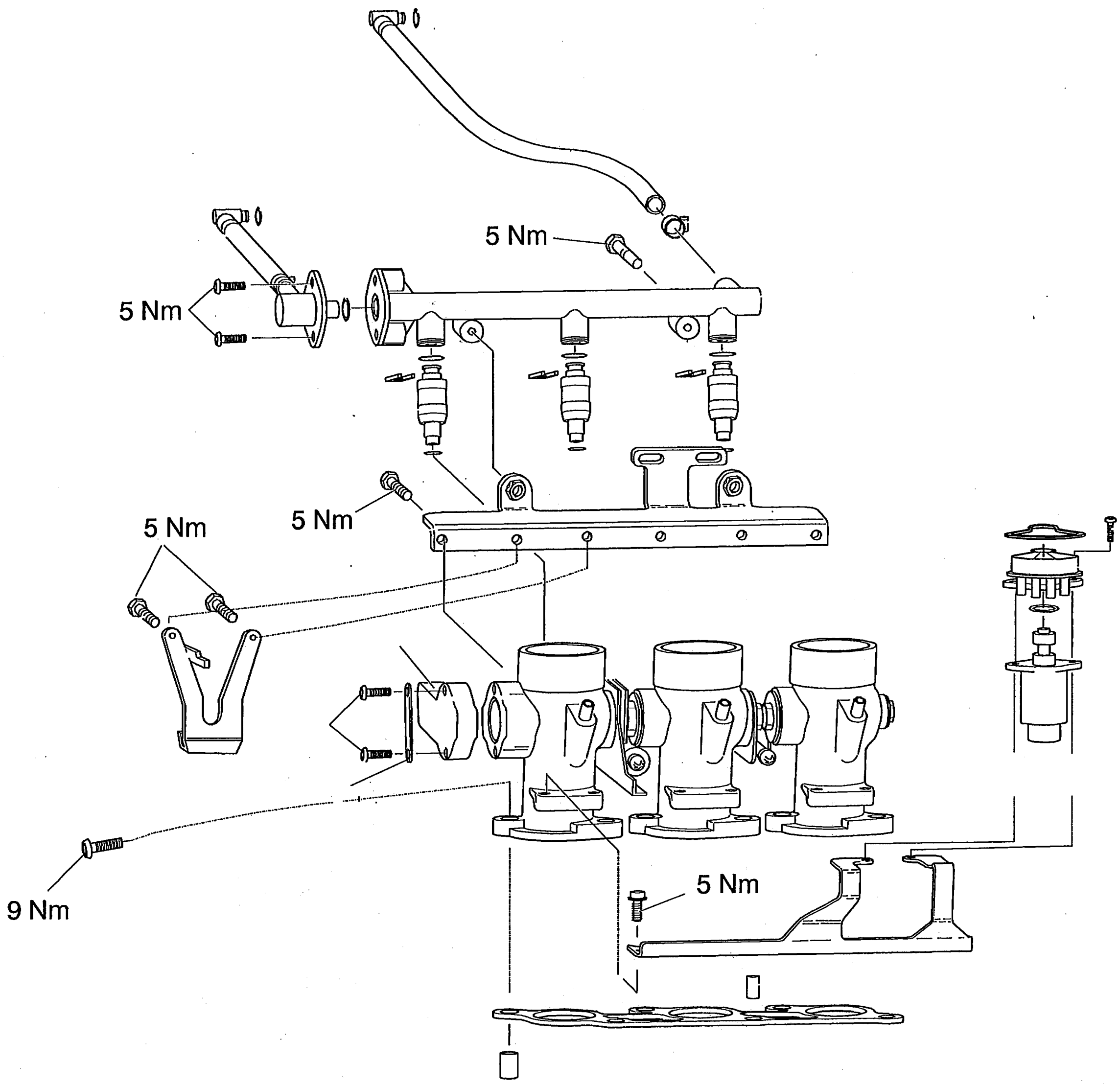
CONTENTS

CONTENTS cont'd

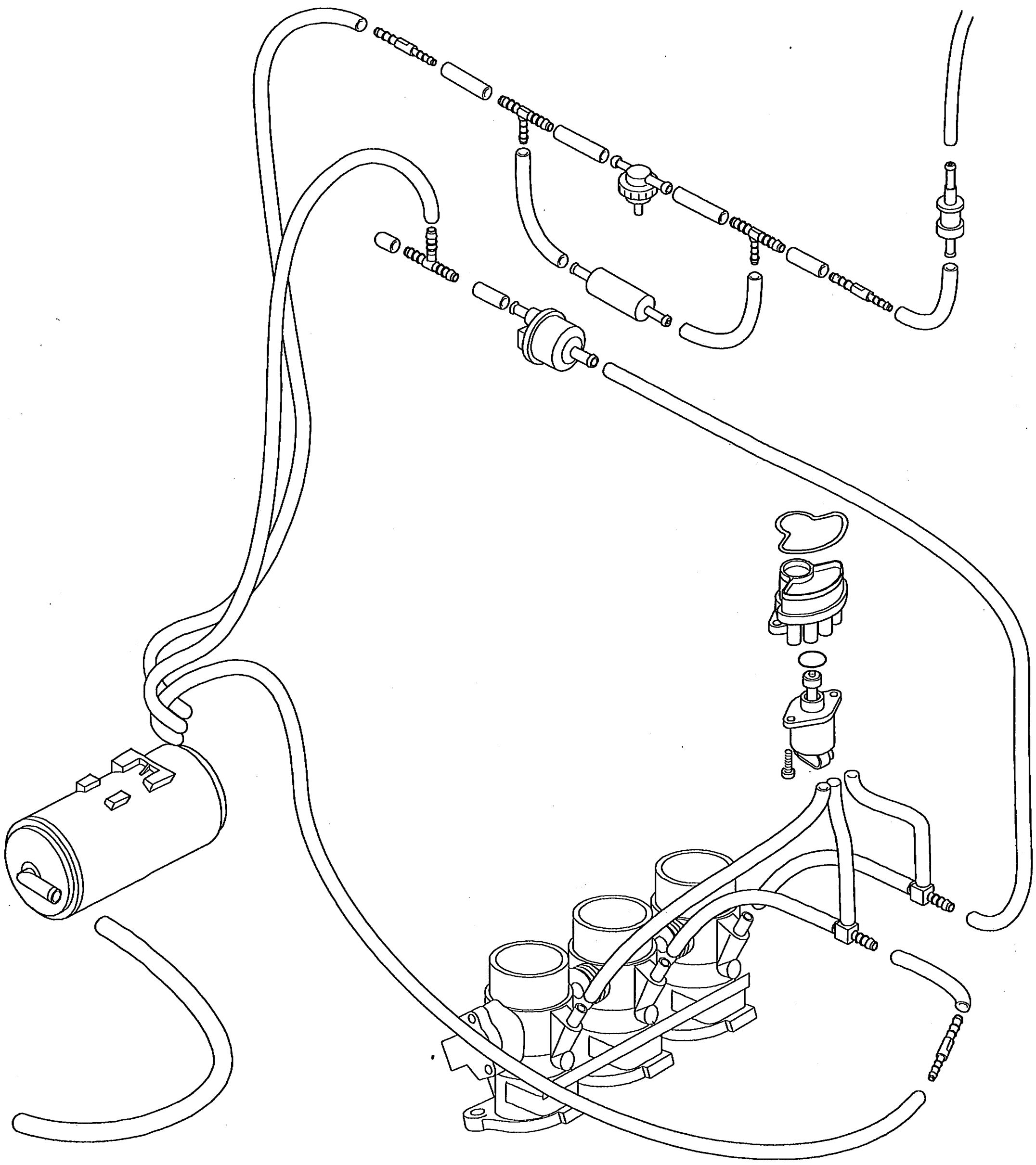
Exploded View - Fuel Tank and Pump



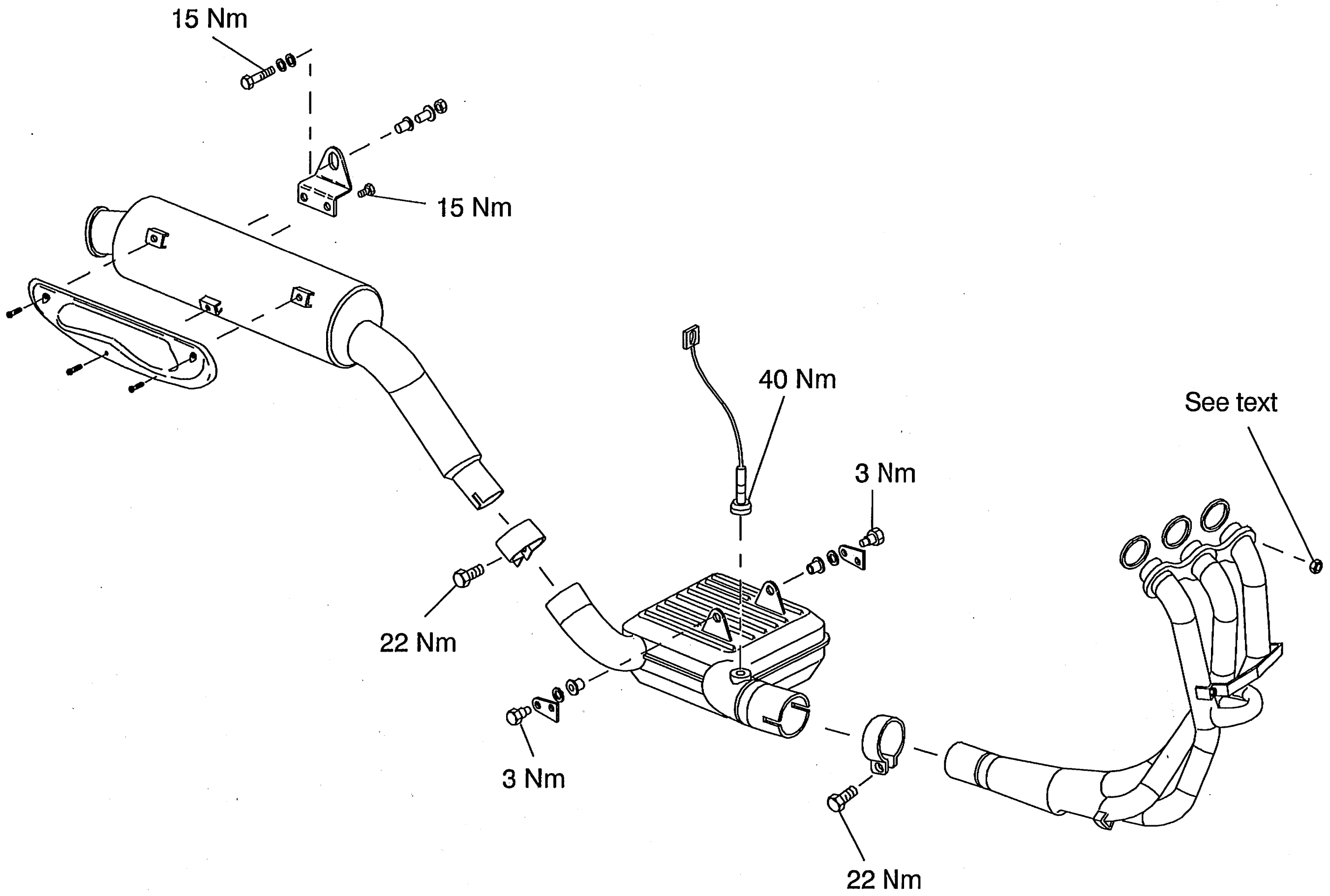
Exploded View - Fuel Rail, Throttles and Injectors



Exploded View - Purge and Idle Air Control



Exploded View - Exhaust System



FUEL REQUIREMENTS

Fuel Requirements - all countries except USA

Outside America, all motorcycles are designed to be run on 95 RON unleaded fuel.

Fuel Requirements - USA

In the United States of America where the octane rating of fuel is measured in a different way, the following information may be applied: Triumph motorcycles are designed to run on unleaded gasoline with a CLC or AKI octane rating (R+M)/2 of 89 or higher.

> ⚠ **CAUTION: The use of leaded gasoline is illegal in some countries, states or territories. Check local regulations before using leaded gasoline.**

Oxygenated Gasoline

To help in meeting clean air standards, some areas of the U.S. use oxygenated gasoline to help reduce harmful emissions. Triumph motorcycles will give best performance when using unleaded gasoline. However, the following should be used as a guide to the use of oxygenated fuels.

> ⚠ **CAUTION: Because of the generally higher volatility of oxygenated fuels, starting, engine response and fuel consumption may be adversely affected by their use. Should any of these difficulties be experienced, run the motorcycle on normal unleaded gasoline.**

Ethanol

Ethanol fuel is a mixture of 10% ethanol and 90% gasoline and is often described under the names 'gasohol', 'ethanol enhanced', or 'contains ethanol'. This fuel may be used in Triumph motorcycles.

Methanol

> ⚠ **CAUTION: Fuels containing methanol should not be used in Triumph motorcycles as damage to components in the fuel system can be caused by contact with methanol.**

MTBE (Methyl Tertiary Butyl Ether)

The use of gasolines containing up to 15% MTBE (Methyl Tertiary Butyl Ether) is permitted in Triumph motorcycles.

GLOSSARY OF TERMS

The following terms and abbreviations will be found in this section. Below is given a brief explanation of what some of the more common terms and abbreviations mean.

Adaptive Stepper Position

The position of the idle air control valve stepper motor after adapting to a particular engine's operational characteristics.

Air temperature

The intake air temperature in the air box.

Air temperature sensor

Measurement in volts at the Electronic Control Module (ECM) of the air temperature in the air box as signalled by the air temperature sensor. Data is read out on the diagnostic tool in degrees Celsius.

ATDC

After Top Dead Centre.

Barometric pressure

Pressure of the air in the air box.

Battery voltage

The voltage at the input to the Electronic Control Module (ECM).

BTDC

Before Top Dead Centre.

Calculated load

The actual volume of air per stroke flowing into the engine, expressed as a percentage of the maximum volume that can enter. Provides an indication of the percent engine capacity that is being used (100% = full throttle).

Catalyst

Device placed in the exhaust system which reduces exhaust emissions.

Closed loop fuelling

Fuel system incorporating a catalyst and oxygen sensor which helps to maintain air fuel ratios within a specific band.

Closed throttle position

Throttle position at idle (i.e. against end stop), measured as a voltage and expressed as percentage.

0% = 0 volts

100% = 5 volts

Coolant temperature

The coolant temperature in the thermostat housing.

Coolant temperature sensor

Measurement in volts at the Electronic Control Module (ECM) of the coolant temperature in the thermostat housing as signalled by the coolant temperature sensor.

Cooling fan status

The 'on' or 'off' condition of the cooling fan.

Corrected Throttle Position

The electronic value of the throttle position corrected according to the closed value of the throttle potentiometer. The reading for corrected throttle position will be different to the actual throttle position.

DTC

Diagnostic Trouble Code.

ECM

Electronic Control Module.

Engine speed

The crankshaft revolutions per minute of the engine.

Freeze frame

A data set captured at the time a Diagnostic Trouble Code (DTC) is set.

IACV

Idle Air Control valve.

Idle air control valve stepper position

The position of the idle air control valve stepper motor;

0 = fully closed.

180 = fully open

Idle fuel trim

The percentage above or below the nominal fuel requirement for the volume of air entering at idle.

Idle fuelling

Adjustment of fuel at idle to suit the actual air inducted.

Idle reference speed

The target idle speed as determined by the Electronic Control Module (ECM). (It should be the same as the actual idle speed if the motorcycle is operating correctly.)

Ignition advance

The timing of ignition at the spark plug relative to top dead centre.

Ignition switch position

The 'on' or 'off' position of either or both the ignition switch and the engine stop switch.

Ignition timing

Same as 'Ignition advance'.

Injector pulse time

The time during which an injector remains open.

Lambda sensor

See oxygen sensor.

Long term fuel trim

Fueling after adapting to the engine's long term fuelling requirements (closed loop only). See also short term fuel trim.

MIL

Malfunction Indicator Lamp.

Illuminates when Diagnostic Trouble Codes (DTC's) are set.

Neutral switch status

The 'neutral' or 'in gear' status of the gearchange.

Off idle fuel trim

The percentage above or below the nominal fuel requirement for the volume of air entering at engine speeds other than idle. This function is not currently used in the Triumph system.

Open circuit

A break in an electrical circuit – current cannot flow.

Open loop

Fuel system without a catalyst fitted or one which is operating in open loop mode due to a catalyst fault.

Over temp'

High temperature within the Electronic Control Module (ECM) caused by an internal or external failure.

Oxygen sensor

Device in the exhaust system which senses the content of the exhaust gases and signals to the ECM to adjust the air-fuel ratio to within a specific parameter.

Purge valve duty cycle

The time the purge valve is open in an open / close cycle, expressed as a percentage of the cycle time.

Sensor reference voltage

Supply voltage to certain sensors (nominally 5 volts).

Short circuit

A 'short cut' in an electrical circuit – current by-passes the intended circuit (usually to earth).

Short term fuel trim

A correction applied to the fuel mixture during closed loop catalyst operation. This, in turn has an effect on the long term fuel trim in that, if an engine constantly requires mixture correction, the long term fuel trim will adapt to this requirement thus reducing the need for constant short term adjustment.

Sidestand status

The 'up' or 'down' position of the side stand.

Target dwell time

The actual time from coil 'on' to coil 'off'.

Throttle position

The position of the throttle butterfly given as a percentage of the movement range. When the data is displayed on the tool, fully open need not be 100% nor fully closed 0%. Generally, fully open will be in the 70% range. (See also corrected throttle position).

Throttle voltage

Voltage at the throttle potentiometer.

Vbatt

Battery voltage.

ENGINE MANAGEMENT SYSTEM

System Description

Each model is fitted with an electronic engine management system which encompasses control of both ignition and fuel delivery. The electronic control module (ECM) draws information from sensors positioned around the engine, cooling and air intake systems and precisely calculates ignition advance and fuelling requirements for all engine speeds and loads. In addition, the system has hardware diagnostic functions similar to the US state of California requirements for on-board diagnostics (OBDII). This function ensures that, should a malfunction occur in the system, the malfunction type and engine data at the time the malfunction occurred are stored in the ECM memory. This stored data can then be recovered by a Triumph dealer using a special service tool which is mandatory for all Triumph dealers. In this way, precise diagnosis of a fault can be made and the fault quickly rectified.

System Sensors

- **Intake air temperature sensor** - situated in the airbox, between the air filter element and the air intakes at the front of the airbox. Because the density of the air (and therefore the amount of oxygen available to ignite the fuel) changes with temperature, an intake air temperature sensor is fitted. Changes in air temperature (and therefore air density) are compensated for by adjusting the amount of fuel injected to a level consistent with clean combustion and low emissions.

- **Barometric pressure sensor** - situated in the airbox, between the air filter element and the throttle butterflies on models fitted with the MC 2000 ECM only. On MC 1000 ECM models, the barometric pressure sensor is incorporated in the ECM itself and is connected to the airbox via a hose

  The barometric pressure sensor measures the air pressure in the airbox. From this measurement the air density is calculated, and when added to other inputs to the ECM, the engine load is calculated. With this information, the amount of fuel per injection is adjusted to suit the prevailing conditions.

- **Crankshaft position sensor** - situated inside the right hand engine cover. The crankshaft position sensor detects movement of a toothed wheel attached to the right hand end of the crankshaft. The wheel has 21 teeth which are evenly spaced, and one triple length tooth next to a triple length gap. The triple length tooth/gap gives a reference point from which the actual crankshaft position is calculated. The crankshaft position sensor information is used by the ECM to determine engine speed and crankshaft position in relation to the point where fuel is injected and ignition of the fuel occurs.

- **Oxygen (Lambda) Sensor** - situated in the exhaust system of closed loop catalyst equipped models. The oxygen sensor continuously senses the content of the exhaust gases and signals to the ECM to adjust the air/fuel ratio to within a specific parameter.

- **Engine coolant temperature sensor** - situated in the thermostat housing. Coolant temperature information, received by the ECM, is used to optimise fuelling at all engine temperatures and to calculate hot and cold start fuelling requirements.

- **Throttle position sensor** - situated at the right hand end of the throttle spindle. The throttle position sensor gives a reading in the fully closed position and all other throttle opening angles are calculated using the fully closed position as a base. Throttle angle is used by the ECM to determine fuelling requirements for all throttle positions.

- **Neutral switch** - situated in the gearbox. The neutral switch indicates when the transmission is in neutral. In addition, the neutral switch provides an interlock facility preventing the rider from riding off with sidestand down. If a gear is selected with the sidestand down, the supply to the ECM is removed causing the engine to cut out.

- **Side stand switch** - situated at the top of the sidestand leg. If the sidestand is in the down position, the engine will not run unless the transmission is in neutral or the clutch lever, which also has a switch, is pulled in to the handlebar.

- **Clutch Switch** - Situated on the clutch lever. The engine will not start unless the clutch lever is pulled to the handlebar.

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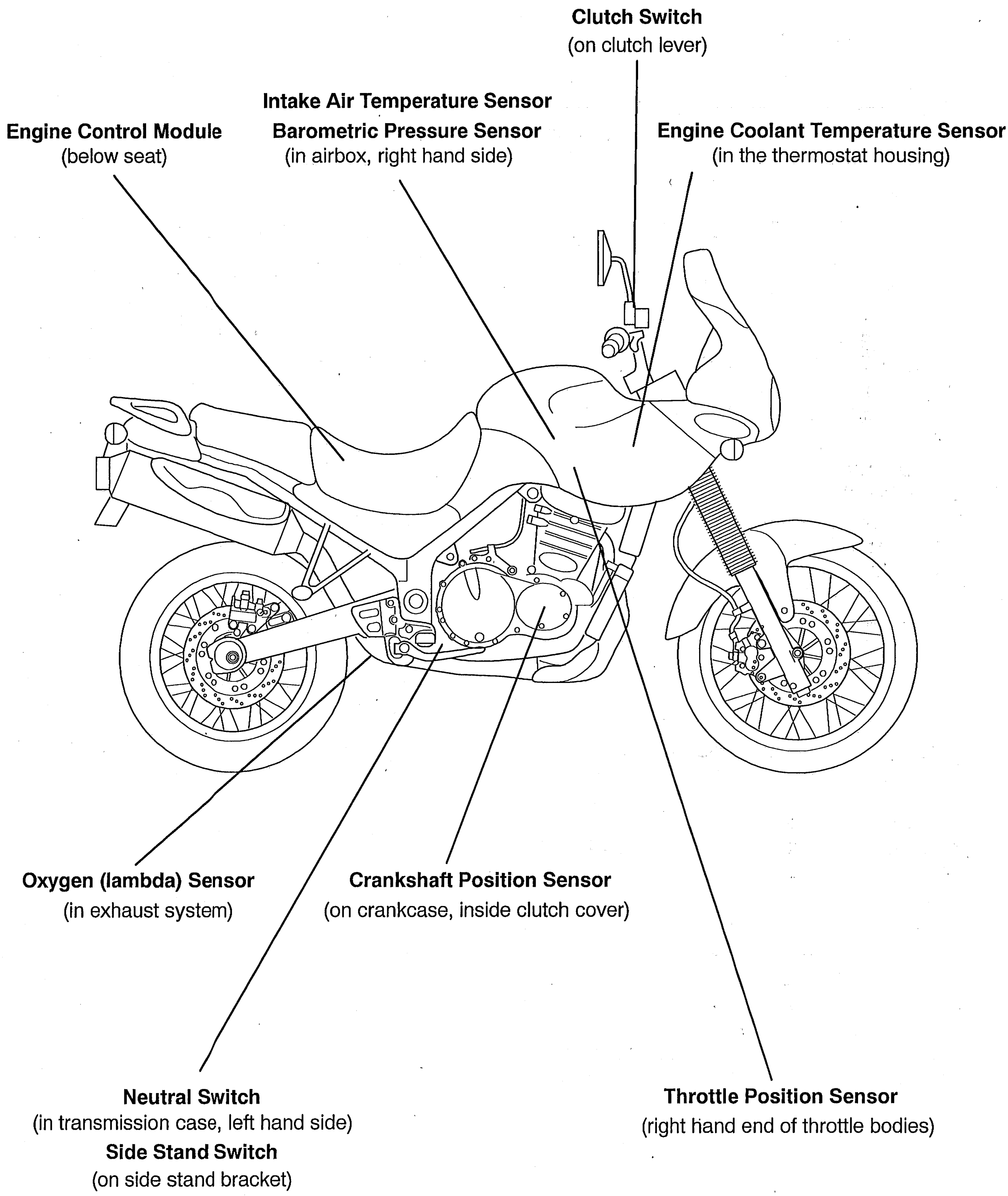
Engine Management System

Sensor Locations



System Actuators

In response to signals received from the sensors, the ECM directs messages to a series of electronic and electro-mechanical actuators. The function and location of the actuators is given below.

- **Idle Air Control System** - located inside the airbox. The system comprises an air control valve fitted with a stepper motor. The system has a controlling influence over the following:
  - Idling.
  - Induction air supply during engine overrun.
  - Air/fuel ratio correction when operating at altitudes above sea level.
  - Cold and hot start air/fuel ratio correction.

  When in operation, the stepper motor opens the air control valve by a variable distance, allowing a controlled supply of air to flow along a series of pipes, into the induction system. The air is fed to a point between the throttle plates and the inlet valves.

  Idling - When the engine is idling, the stepper motor opens the idle air control valve allowing air to be fed to the engine even though the throttles are closed. The distance that the idle air control valve is opened is controlled by the ECM using information received from the coolant temperature sensor, barometric pressure sensor etc. Idle air fuel ratio is adjusted by feeding more or less air to mix with the fuel supplied by the injectors.

  Overrun - During overrun conditions, where air flow into the cylinder is very low, the idle air control system feeds additional air to the induction system allowing normal air/fuel ratios to be maintained. Without the additional air flow, incomplete combustion may take place which could cause unburnt fuel to collect in the exhaust system resulting in backfiring when the throttle is re-opened.

  Altitude correction - If the vehicle is operated at high altitude, the reduced air density will be compensated for by varying the amount of air fed to the engine via the idle air control system. For example, at high altitudes, the idle air control system feeds a greater volume of air to the induction system to compensate for the air's reduced oxygen content.

  Cold and hot start - Except in very cold conditions where a small amount of throttle opening aids cold start performance, the engine is usually started with the throttle in the closed position. The idle air control system regulates the start-up air supply to the induction system.

- **Canister purge valve (California models only)** - situated in the vapour return line between the carbon canister and the throttle. The purge valve controls the return of vapour which has been stored in the carbon canister during the period when the engine is switched off. The valve is 'pulsed' by the ECM to give control over the rate at which the canister is purged. If the valve was not pulsed, all the stored vapour would immediately be drawn into the engine briefly causing a rich mixture and very high emissions.

- **Injectors** - located in the throttle body assembly. The engine is fitted with 3 twin-jet injectors which are targeted as close as possible to the back face of the inlet valves. The spray pattern of the injectors is fixed but the length of time each injector remains open is variable. The duration of each injection is calculated by the ECM using data received from the various sensors in the system.

- **Plug top ignition coils** - mounted directly onto the top of each spark plug. The ECM controls the point at which the coils are switched on and off. In calculating the switch-on time, the ECM allows sufficient time for the coils to charge to a level where a spark can be produced. The coils are switched off at the point of ignition, the timing of which is optimised for good engine performance.

- **Main power relay** - situated adjacent to the ECM, beneath the motorcycle seat. When the ignition is switched on, the main power relay is powered up to provide a stable voltage supply for the ECM.

  When the ignition is switched off, the ECM holds the main power relay on so that it can carry out the power down procedure which includes;

  - writing data to the ECM memory,
  - referencing the position of the idle air control valve stepper motor,
  - running the cooling fan until the engine is sufficiently cool.

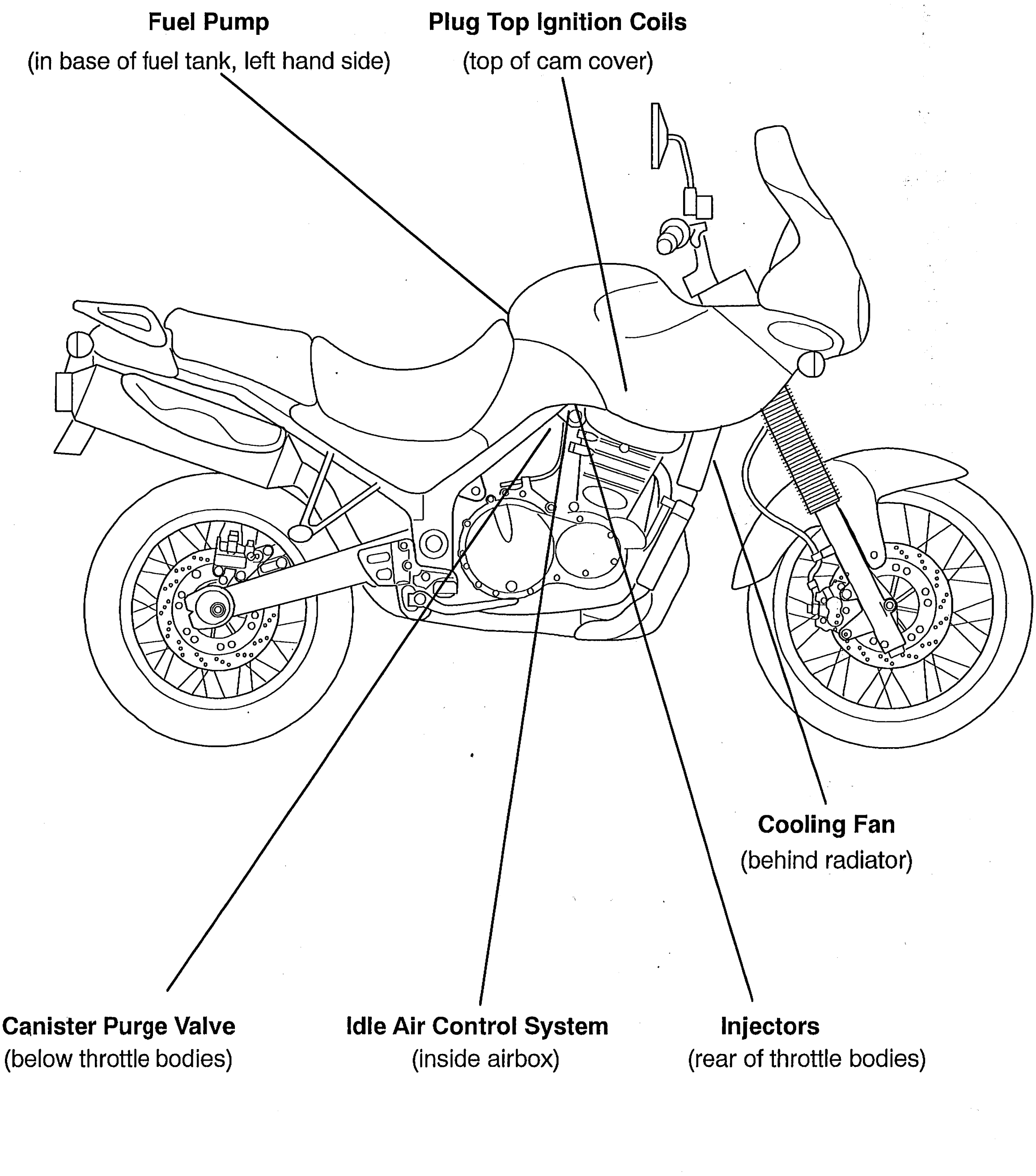
  Once all the power down procedures have been carried out, the main power relay is turned off.

- **Fuel pump -** located inside the fuel tank on the left hand side of the motorcycle. The electric pump delivers fuel into the fuel system, via a pressure regulator, at a constant 3 bar pressure. The pump is run continuously when the engine is rotating and is also run briefly when the ignition is first switched on to ensure that 3 bar is available to the system as soon as the engine is cranked.

- **Cooling fan -** located in front of the radiator. The ECM controls switching on and off of the cooling fan in response to a signal received from the coolant temperature sensor. When the coolant temperature rises to a level where the cooling effect of natural airflow is insufficient, the cooling fan is turned on by the ECM. When the coolant temperature falls sufficiently, the ECM turns the cooling fan off. If the engine is switched off when the fan is running, the fan will continue to run until the temperature has been reduced to a normal level.

Engine Management System

Actuator Locations



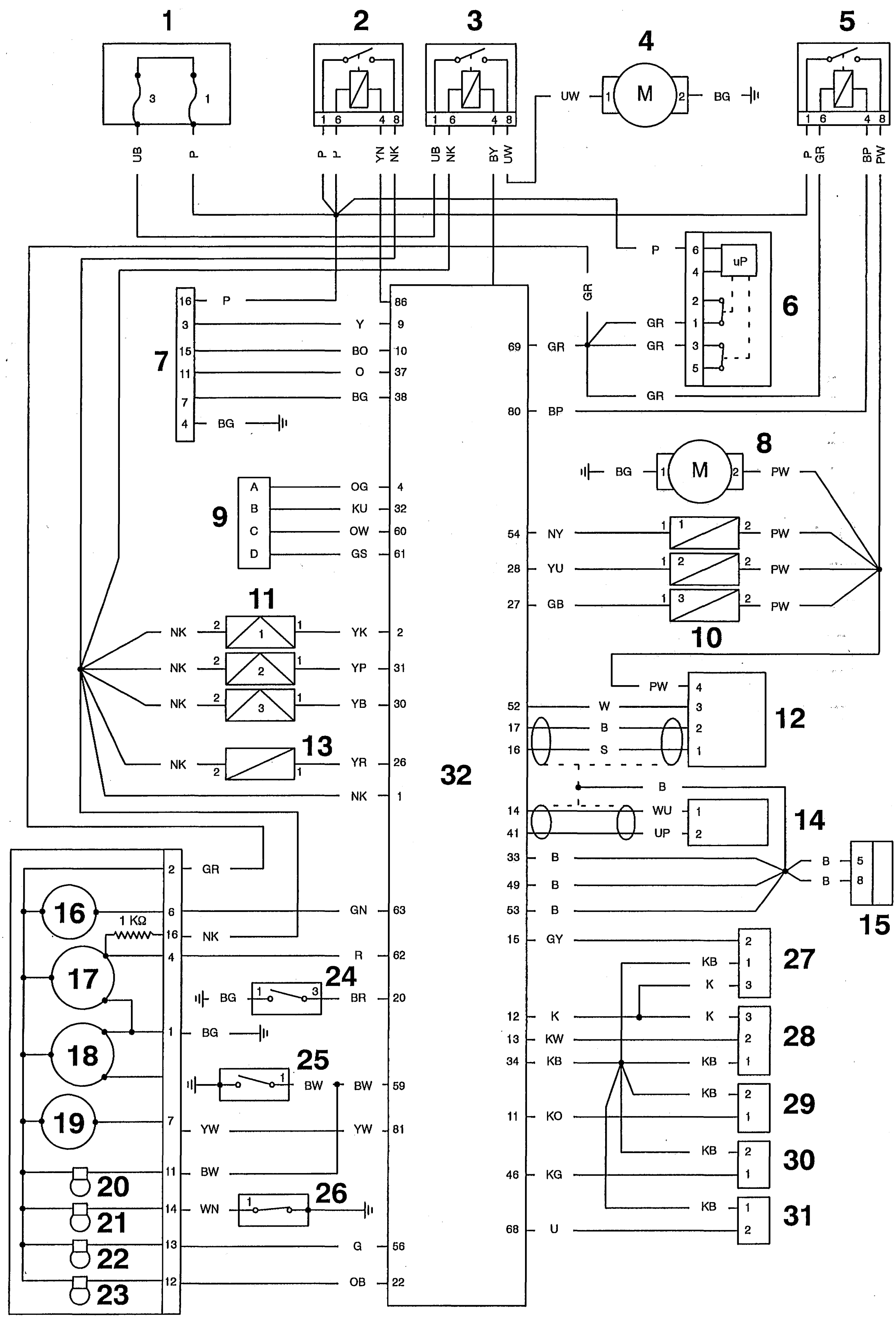
Key To Wiring Circuit Diagram - (to VIN 89736)

Key	Item
1	Fuses 1 & 3
2	ECM main power relay
3	Cooling fan relay
4	Cooling fan
5	Fuel pump relay
6	Alarm control unit (where fitted)
7	Diagnostic connector
8	Fuel pump
9	Idle air control valve stepper motor
10	Ignition coils
11	Fuel injectors
12	Heated oxygen sensor
13	Evaporative purge valve (California models only)
14	Crankshaft position sensor
15	Main connector
16	Fuel gauge
17	Tachometer
18	Speedometer
19	Coolant temperature gauge
20	Neutral warning lamp
21	Oil pressure warning lamp
22	Low fuel level warning lamp
23	Malfunction indicator lamp (MIL)
24	Sidestand switch
25	Neutral switch
26	Oil pressure switch
27	Throttle position sensor
28	Barometric pressure sensor
29	Inlet air temperature sensor
30	Coolant temperature sensor
31	Fuel level sensor
32	Engine control module

Key To Wiring Colour Codes

Code	Wiring Colour
B	Black
U	Blue
N	Brown
G	Green
S	Grey
O	Orange
K	Pink
LG	Light Green
R	Red
P	Purple
W	White
Y	Yellow

Circuit Diagram - Engine Management System (to VIN 89736)



Key To Wiring Circuit Diagram - (from VIN 89737)

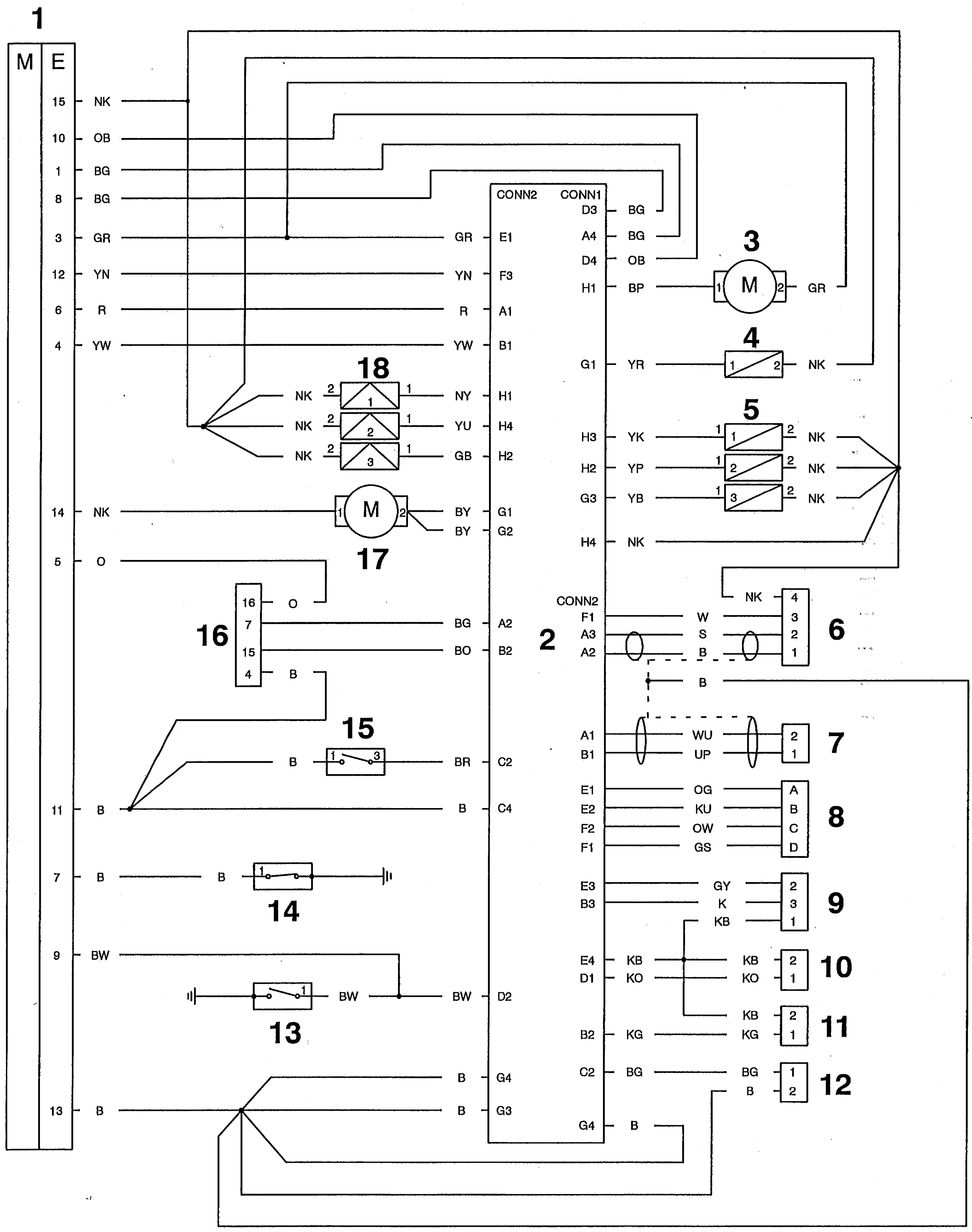
The key found below must be used for identification of components.

Key	Description
1.	Engine connector
2.	Engine control module
3.	Fuel pump
4.	Purge valve (California)
5.	Fuel injectors
6.	Lambda sensor
7.	Crankshaft sensor
8.	Idle speed control stepper motor
9.	Throttle position sensor
10.	Air inlet temperature sensor
11.	Coolant temperature sensor
12.	Fuel level sensor
13.	Neutral switch
14.	Oil pressure switch
15.	Sidestand switch
16.	Diagnostic connector
17.	Cooling fan
18.	Ignition coils

Key To Wiring Colour Codes

Code	Wiring Colour
B	Black
U	Blue
N	Brown
G	Green
S	Grey
O	Orange
K	Pink
LG	Light Green
R	Red
P	Purple
W	White
Y	Yellow

Circuit Diagram - Engine Management System (from VIN 89737)



System Diagnostics

As mentioned earlier, the engine management system has an on-board diagnostics feature which allows service technicians to retrieve stored data from the ECM using a Triumph service tool. **Full details of the tool's operation and how to interpret the results are given elsewhere in this section.**

The tool is connected to the motorcycle using a dedicated diagnostic plug situated beneath the seat. By using a dedicated plug, no electrical connectors associated with the system are disturbed reducing potential connector damage.

The tool allows the user to retrieve data associated with the system sensors and actuators, test various component functions, read build data and make minor adjustments to the set-up of the system. The data and tests available are described on the following pages.

On-board Fault Detection System

The on-board diagnostic system has two stages to fault detection. When a fault is detected, the DSM (Diagnostic Status Manager) raises a flag to indicate that a fault is present and increments a counter. The counter checks the number of instances that the fault is noted. For example, if there is a fault in the camshaft sensor, the counter will increment its count each time the camshaft turns through 360°, provided the fault is still present.

When the count begins, the fault is detected but not confirmed. If the fault continues to be detected and the count reaches a pre-determined threshold, the fault becomes confirmed. If the fault is an emissions related fault or a serious malfunction affecting engine performance, a DTC (Diagnostic Trouble Code) and freeze-frame data will be logged in the ECM's memory and the MIL (Malfunction Indicator Lamp) on the motorcycle instrument panel is illuminated. Once a fault is confirmed, the number of warm-up cycles made by the engine is counted. If the fault clears, the warm-up cycle counter will extinguish the MIL (Malfunction Indicator Lamp) at a pre determined count, and erase the DTC and freeze frame data from the ECM memory at another (higher) count.

A single warm-up cycle is deemed to have taken place when the following criteria have been met:

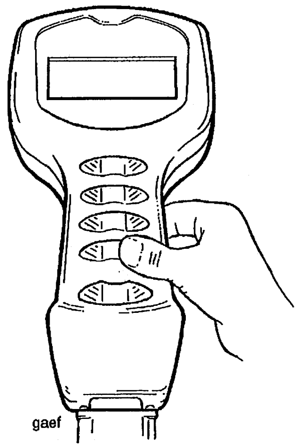
- The coolant temperature must be raised to 72°C or more.
- The coolant temperature must have risen by 23°C or more from its start temperature, when 72°C is reached.
- A controlled power-down sequence must take place.

NOTE:

- **When a fault has been rectified, the MIL will remain illuminated until sufficient non-fault warm-up cycles have taken place to turn it off. The MIL will be immediately extinguished if, after first rectifying the fault, the DTC (diagnostic trouble code) that caused the MIL illumination is erased from the ECM memory using the Triumph diagnostic tool.**

NOTE:

- **In most cases, when a fault is detected, the engine management system will revert to a 'limp-home' mode. In this mode, the engine will still function though the performance and economy may be marginally affected. In some cases, the rider may not notice any appreciable difference from normal operation.**



Triumph Diagnostic Tool

Described on the following pages is the range of information which can be retrieved from the ECM's memory and the adjustments which can be performed using the Triumph service diagnostic tool.

The tables indicate which tests are performed by the on-board system and what information can be retrieved by the Triumph diagnostic tool.

Full details of how to operate the tool and how to interpret the data follow later in this section.

Current Data

By using the Triumph diagnostic tool, live engine data (engine running) can be recovered from the motorcycle. The data available is:-

Function Examined	Result Reported (Scale)
Calculated load	0-100%
Coolant temperature	-40- +215°C
Idle fuel trim	-100 - + 99.2%
Off idle fuel trim	Not Used
Engine speed	0 - 16,383 RPM
Air temperature	-40 - +215°C
Ignition Advance	-64° - +63.5°
Throttle Position	0-100%
Lambda Fuel Trim *	-100 - + 99%
Fuel system status *	Open or closed loop
Oxygen sensor voltage *	0 - 1.25 Volts.

Freeze-frame Data

Freeze frame data is stored at the time a DTC is recorded (confirmed) by the ECM. If multiple DTCs are recorded, the freeze-frame data which is stored will relate to the first recorded DTC only.

By calling up freeze frame data associated with the first recorded DTC, the technician can check the engine condition at the time the fault occurred. The data available is:-

Function Memorised	Result Reported (Scale)
Calculated load	0-100%
Coolant temperature	-40- +215°C
Idle fuel trim	-100 - + 99.2%
Off idle fuel trim	Not Used
Engine speed	0 - 16,383 RPM
Air temperature	-40 - +215°C
Ignition Advance	-64° - +63.5°
Throttle Position	0-100%
Barometric pressure	0 - 983 mm/Hg
Lambda Fuel Trim *	-100 - + 99%
Fuel system status *	Open or closed loop
Oxygen sensor voltage *	0 - 1.25 Volts.

* **These screen messages will not appear unless a closed loop catalyst system is fitted and a closed loop tune resident in the ECM.**

Function Tests

The system allows the diagnostic tool to perform a series of function tests on various actuators in the engine management system. In some cases it is necessary to make a visual observation of a component and in other, if faults are present, DTCs will be logged.

The function tests available are:-

Function Examined	Result Reported
Fuel pump test	None (observation only)
Fuel pump priming	None (observation only)
Cooling fan	None (observation only)
Instrument panel	Observation/DTCs
Purge valve	DTCs
Idle Air Control Valve	Observation/DTCs

Checks/Adjustments

Adjustments

Using the Triumph diagnostic tool, it is possible to adjust the value of two items which affect the idle speed and idle emission settings of the system.

The tool allows adjustment of these items by making small changes to certain parts of the ECM software.

The values that can be adjusted are

Setting Adjusted	Setting Affected
Closed Throttle position	Voltage value of closed throttle threshold
Idle fuelling (not applicable on closed loop catalysts models)	Idle emissions
Adaptive stepper position	IACV start point
Long term fuel trim (applicable on closed loop catalysts models)	Fuel mixture

NOTE:

- **In special circumstances, Triumph will make available a password which can be keyed into the tool which will allow download of a completely new engine tune. This special facility will be made available only when necessary. For example, this may be necessary if a motorcycle is transferred to a country or area where legislation requires a different tune to the original version installed at the factory.**

Diagnostic Trouble Codes

Diagnostic trouble codes (DTCs) are logged in the ECM memory when there is a confirmed fault in the system.

The codes are reported to the Triumph diagnostic tool as a four digit code, as required by California legislation.

As mentioned earlier, when the system detects a fault, it begins to count the number of times the fault occurs before illuminating the MIL and storing a fault code.

Similarly, if a fault clears, the ECM also records this fact and will turn off the MIL when sufficient no-fault warm-up cycles have taken place. Any fault codes will remain in the ECM memory until the required number of no-fault warm-up cycles have taken place. The number of warm-up cycles required to extinguish the MIL will always be less than the number required to remove a DTC from the ECM memory. DTCs can be removed at any time using the Triumph diagnostic tool

The system will log the diagnostic trouble codes listed below/over:-

Diagnostic Trouble Code (DTC)	Fault Description	Number of no-fault cycles before turning off MIL	Number of no-fault cycles before DTC is erased	MIL illuminated when fault is logged
P0335	Crankshaft sensor circuit malfunction	3	40	Yes
P1335	Crankshaft sensor incorrect sequence pattern	3	40	Yes
P0340	Camshaft sensor malfunction	3	40	Yes
P0341	Camshaft sensor circuit fault	3	40	Yes
P1340	Camshaft sensor excessive electrical interference	3	40	Yes
P1341	Camshaft sensor incorrect sequence pattern	3	40	Yes
P0505	Idle air control valve system malfunction	3	40	Yes
P0201	Injector 1 circuit malfunction	3	40	Yes
P0202	Injector 2 circuit malfunction	3	40	Yes
P0203	Injector 3 circuit malfunction	3	40	Yes
P1201	Injector 1 open circuit/short to ground	3	40	Yes
P1202	Injector 2 open circuit/short to ground	3	40	Yes
P1203	Injector 3 open circuit/short to ground	3	40	Yes
P1205	Injector 1 short to battery voltage/over temperature	3	40	Yes
P1206	Injector 2 short to battery voltage/over temperature	3	40	Yes
P1207	Injector 3 short to battery voltage/over temperature	3	40	Yes
P0105	Barometric pressure sensor circuit malfunction	3	40	Yes
P0120	Throttle position sensor circuit malfunction	3	40	Yes
P0122	Throttle position sensor low input	3	40	Yes
P0123	Throttle Position sensor high input	3	40	Yes
P0443	Purge valve system fault circuit malfunction	3	40	Yes
P0444	Purge valve system open circuit/short circuit to ground	3	40	Yes
P0445	Purge valve system short circuit to battery voltage/ over temperature	3	40	Yes
P0351	Ignition coil 1 malfunction	3	40	Yes

Diagnostic Trouble Code (DTC)	Fault Description	Number of no-fault cycles before turning off MIL	Number of no-fault cycles before DTC is erased	MIL illuminated when fault is logged
P0352	Ignition coil 2 malfunction	3	40	Yes
P0353	Ignition coil 3 malfunction	3	40	Yes
P1351	Ignition coil 1 open circuit/short circuit to ground	3	40	Yes
P1352	Ignition coil 2 open circuit/short circuit to ground	3	40	Yes
P1353	Ignition coil 3 open circuit/short circuit to ground	3	40	Yes
P1355	Ignition coil 1 short to battery voltage/over temperature	3	40	Yes
P1356	Ignition coil 2 short to battery voltage/over temperature	3	40	Yes
P1357	Ignition coil 3 short to battery voltage/over temperature	3	40	Yes
P0115	Coolant temperature circuit malfunction	3	40	Yes
P0117	Engine coolant temperature too high	3	40	Yes
P0118	Engine coolant temperature too low	3	40	Yes
P0119	Engine coolant sensor high voltage	3	40	Yes
P0110	Intake air temperature sensor circuit malfunction	3	40	Yes
P0112	Intake air temperature too high	3	40	Yes
P0113	Intake air temperature too low	3	40	Yes
P0230	Fuel pump relay fault	3	40	Yes
P1231	Fuel pump relay open circuit	3	40	Yes
P1232	Fuel pump relay short circuit	3	40	Yes
P0500	Vehicle speed sensor malfunction	3	40	Yes
P1560	Sensor supply voltage circuit fault	3	40	Yes
P0560	System voltage malfunction	3	40	Yes
P0562	System voltage low	3	40	Yes
P0563	System voltage high	3	40	Yes
P1600	MIL system fault	N/A	40	No
P1601	MIL open circuit/short to ground	N/A	40	No
P1602	MIL short to battery voltage	N/A	40	No
P0131	Lambda sensor ground too high	3	40	Yes
P0132	Lambda sensor signal too high	3	40	Yes
P0133	Lambda sensor over voltage	3	40	Yes
P0135	Lambda sensor heater malfunction	3	40	Yes
P0170	Lambda feedback fuel trim malfunction	3	40	Yes
P1172	Lambda feedback maximum enleanment	3	40	Yes
P1171	Lambda feedback maximum enrichment	3	40	Yes

Diagnostic Trouble Code (DTC)	Fault Description	Number of no-fault cycles before turning off MIL	Number of no-fault cycles before DTC is erased	MIL illuminated when fault is logged
P1178	Lambda feedback reached maximum air leakage adaption	3	40	Yes
P1179	Lambda feedback reached minimum air leakage adaption	3	40	Yes
P1551	Cooling fan circuit malfunction	3	40	Yes
P1552	Cooling fan relay short circuit/open circuit	3	40	Yes
P1553	Cooling fan relay short to battery voltage/over temperature	3	40	Yes
P0115	Coolant temperatrure sensor circuit malfunction	N/A	40	No
P1116	Coolant temperature gauge short circuit/open circuit	N/A	40	No
P1117	Coolant temperature gauge short to battery voltage/over temperature	N/A	40	No
P1385	Tachometer circuit malfunction	N/A	40	No
P1386	Tachometer short circuit/open circuit	N/A	40	No
P1387	Tachometer short to battery voltage/over temperature	N/A	40	No
P0462	Fuel sensor circuit low input	N/A	40	No
P0463	Fuel sensor circuit high input	N/A	40	No
P1611	Low fuel level indicator lamp short circuit to ground/open circuit	N/A	40	No
P1612	Low fuel level indicator lamp short to Vbatt	N/A	40	No
P1621	Fuel gauge short circuit to ground/open circuit	N/A	40	No
P1622	Fuel gauge short circuit to Vbatt	N/A	40	No

Checks

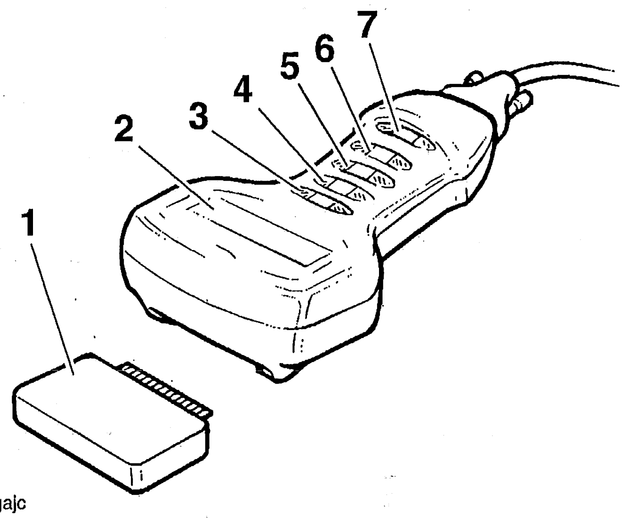
When using this function It is possible to check the status of various sensors and actuators and also check certain items of factory data logged during vehicle assembly.

It is also possible to check when the ECM was last interrogated for stored information and who the dealer was that did it.

The data available is:-

Item Checked	Result Unit
Air temperature sensor	Volts
Air temperature	Degrees Celsius
Coolant temperature sensor	Volts
Coolant temperature	Degrees Celsius
Engine speed	RPM
Idle reference speed	RPM
Battery voltage	Volts
Sensor reference voltage	Volts
Injector pulse time	Milliseconds
Barometric pressure	mm/Hg
Calculated load	Percentage
Target dwell time	Milliseconds
Ignition timing	Degrees BTDC/ATDC
Throttle voltage	Volts
Corrected Throttle position	Percentage
Purge valve duty cycle	Percentage
Idle air control valve stepper position	Incremental steps ranging from 0 to 255
Ignition switch position	On/Off
Cooling fan status	On/Off
Sidestand status	Up/Down
Neutral switch status	Neutral/In gear

Service Diagnostic Tool



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1. **Memory card**
2. **Screen**
3. **Return key**
4. **Up key**
5. **Down key**
6. **Validate key**
7. **Help key**

The memory card (1) contains all the information necessary to allow the technician to follow a number of different paths to:

- Diagnose faults
- Obtain data
- Make checks / adjustments

It is removeable to allow replacement / update cards to be inserted.

The screen (2) comprises 4 horizontal lines and 20 vertical columns forming a series of boxes into which letters and numbers can be displayed to provide the necessary question, message, answer etc.

At the left of the screen, one or more symbols as detailed below may be displayed.

```
            D I A G N O S T I C S
      C U R R E N T   D A T A
▶     R E A D   S T O R E D   D T C S
▼     F U N C T I O N   T E S T S
```

Typical screen showing symbol examples

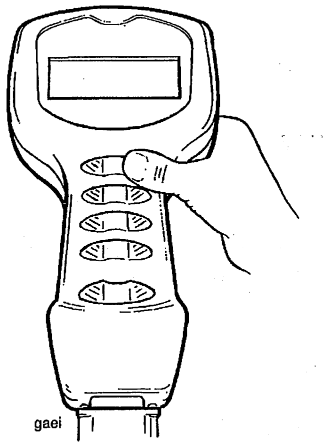
▲▼ Cursors to indicate that further lines of text are available to be seen above and/or below those already in view, by scrolling the text up or down using the 'Up' or 'Down' keys.

▶ Cursor to show which line of text is 'Active'.

? Indicates further help/guidance information available on that line by pressing the help key.

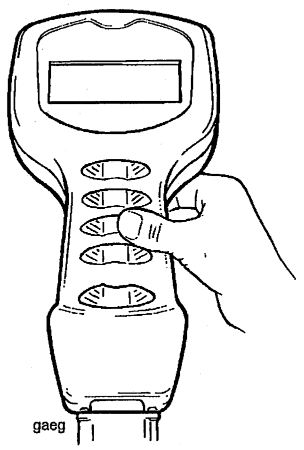
Tool Keys

In most cases, the **Return** key (↲) enables the user to return to the screen last displayed.



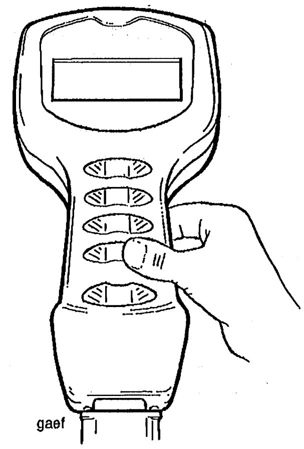
Return key

The **Up** and **Down** keys – press to move the lines of text up or down. They are also used to enter the Dealer number and the date.



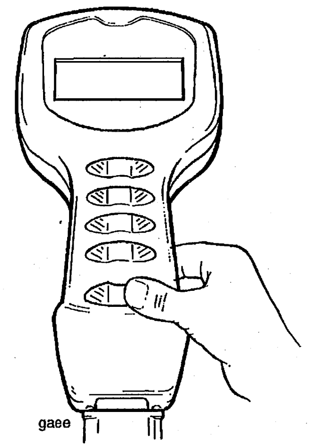
Up/down keys (2 separate keys)

Press the **Validation** key (✳) to move on to the next message.



Validation key

The **Help** key can be used when the '**?**' symbol shows, to get more information about that line of text. To return to the diagnostic screen from the help area, press the help '**?**' button again.



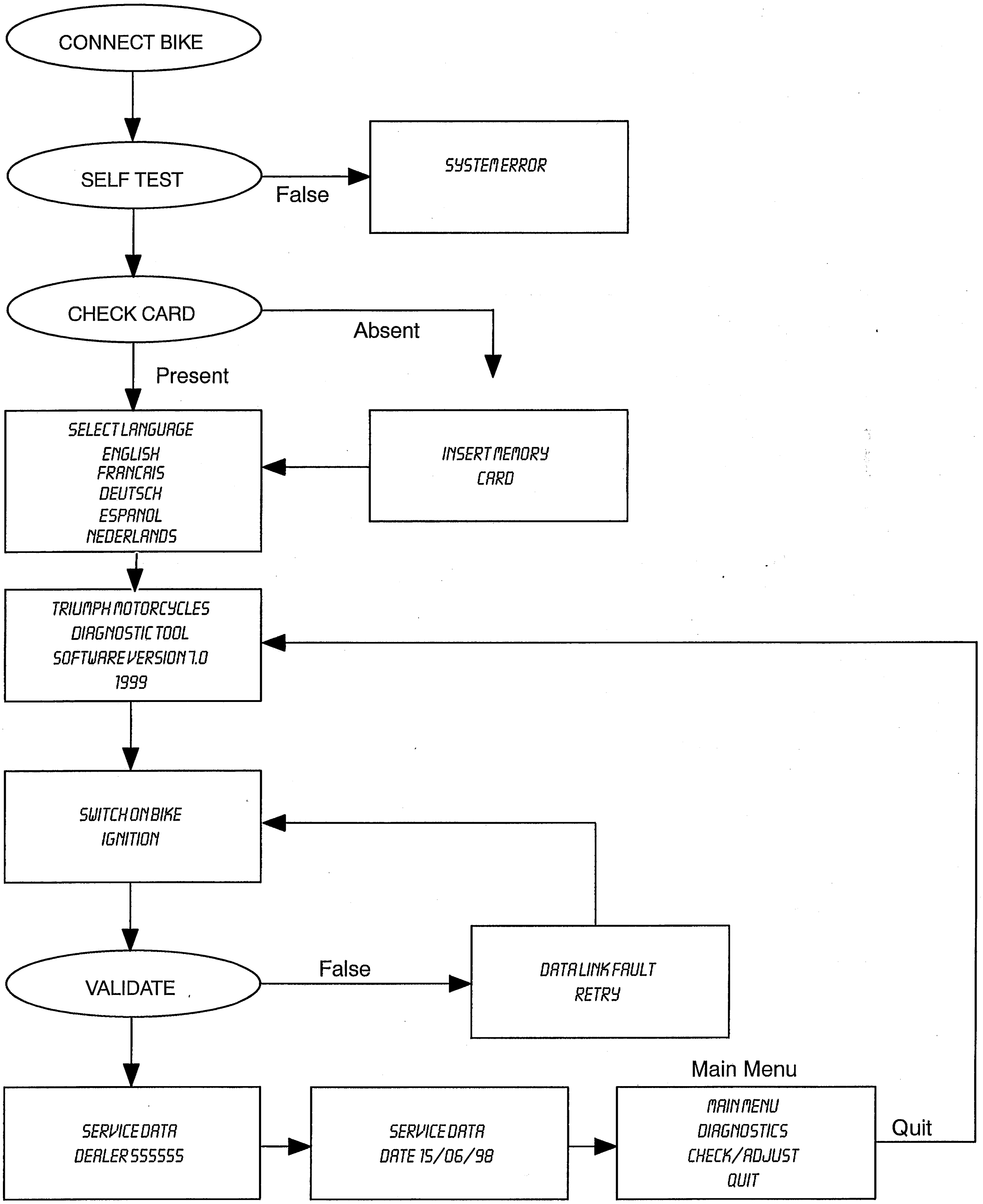
Help key

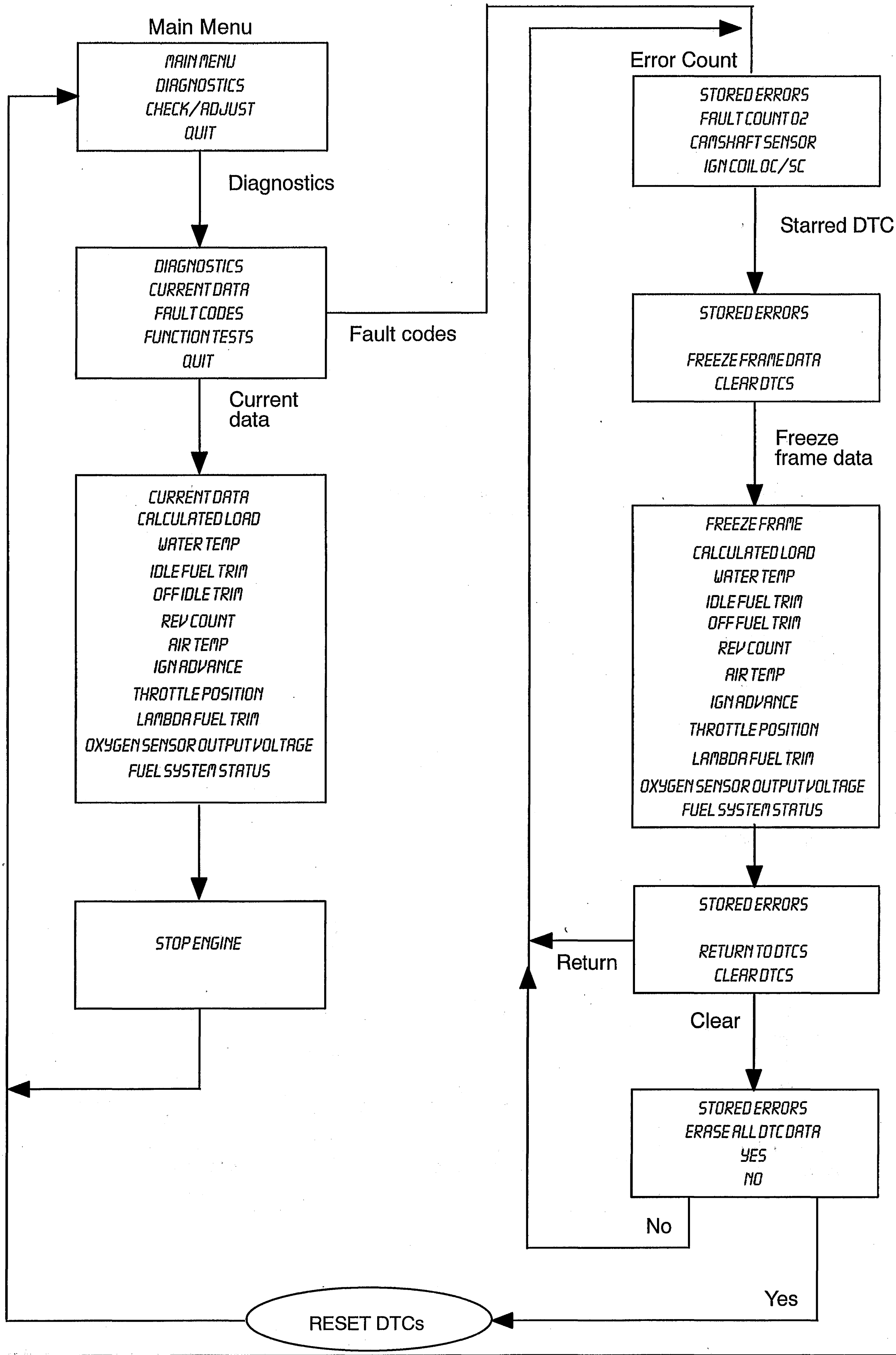
TEST PROCEDURE

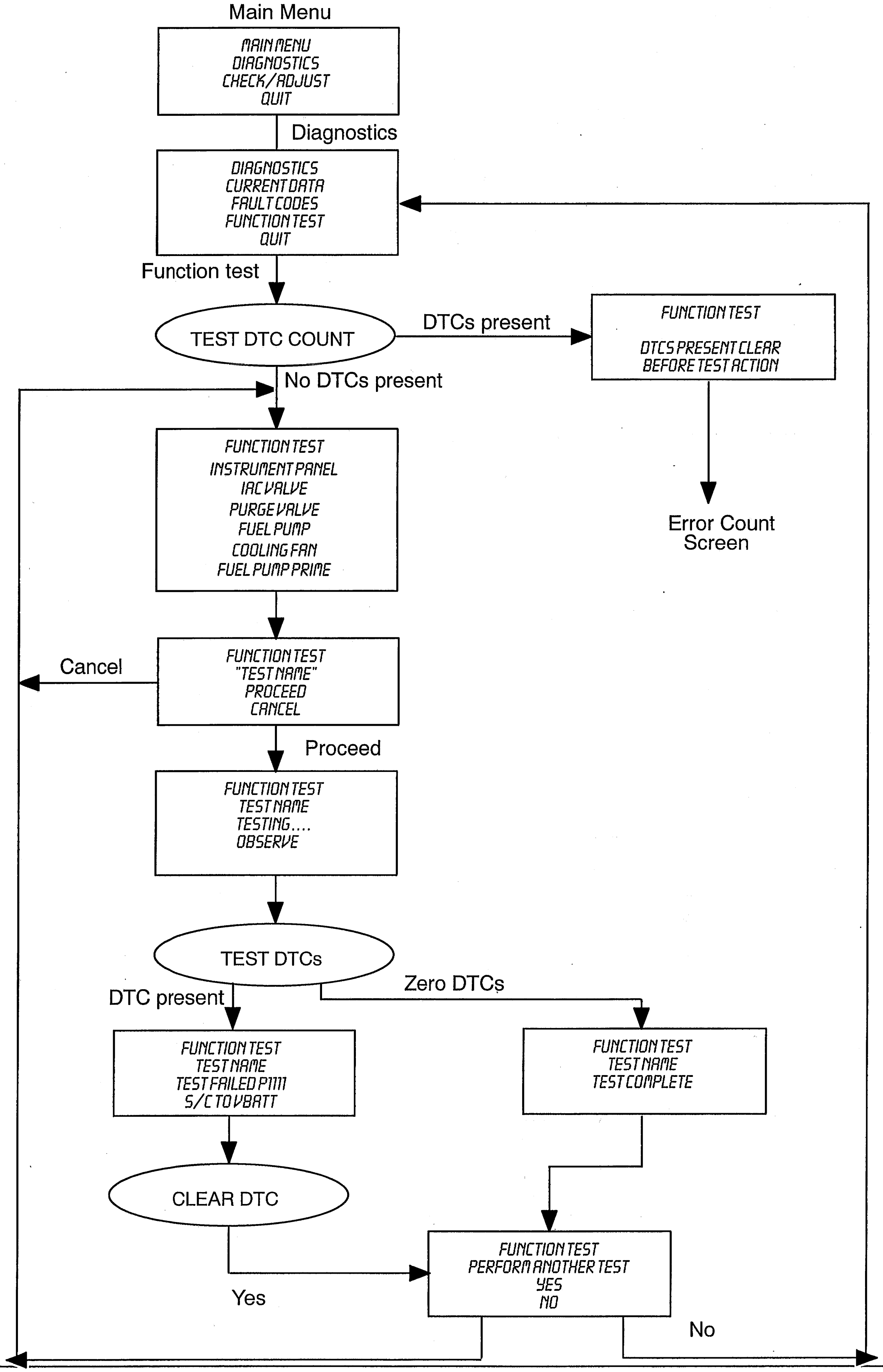
The following describes the procedure to follow when using the service diagnostic tool. It does not cover the further diagnosis that must be carried out once a fault area has been identified. For details of the procedure to follow when a fault area or fault code has been identified, refer to the diagnosis details later in this section.

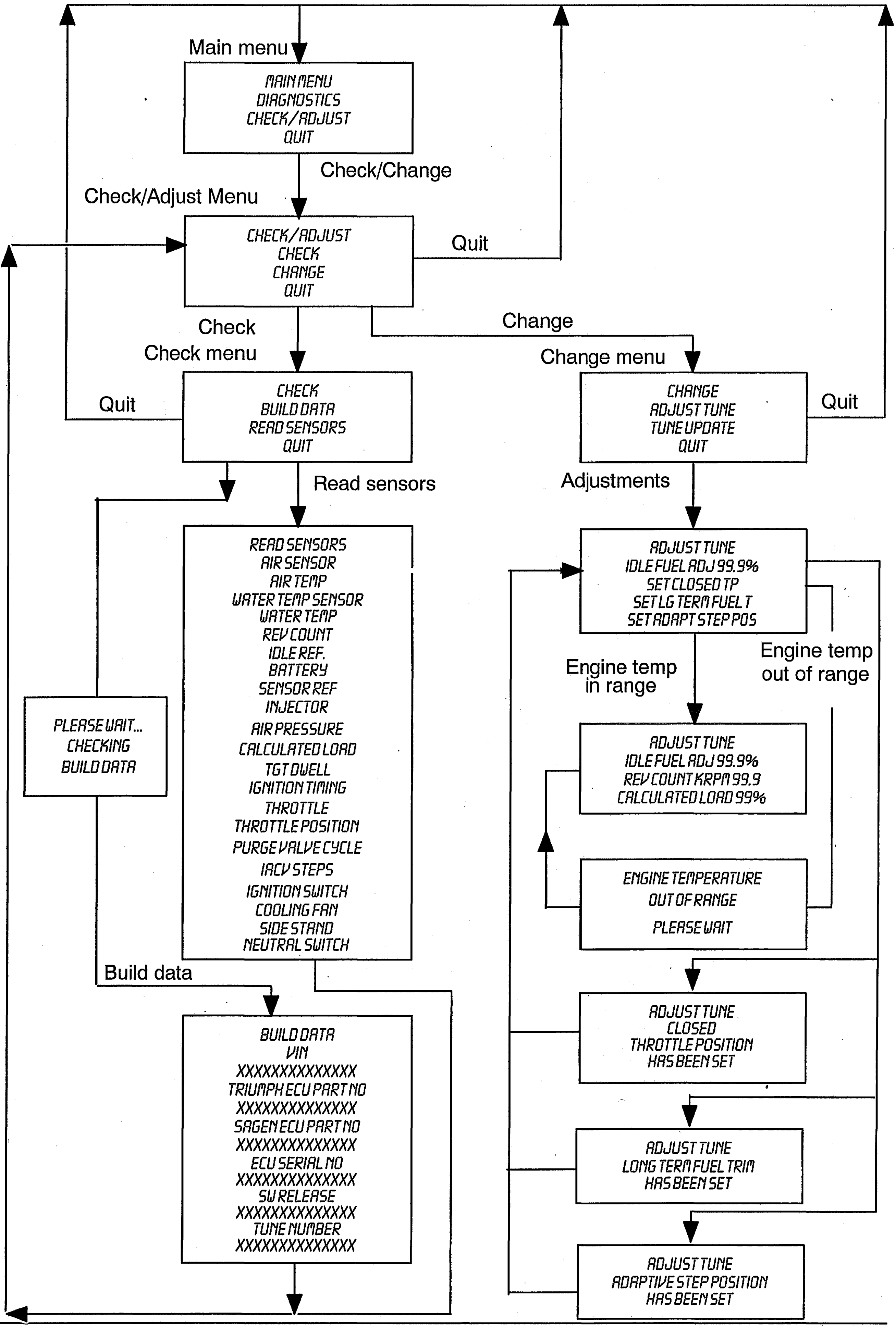
NOTE:

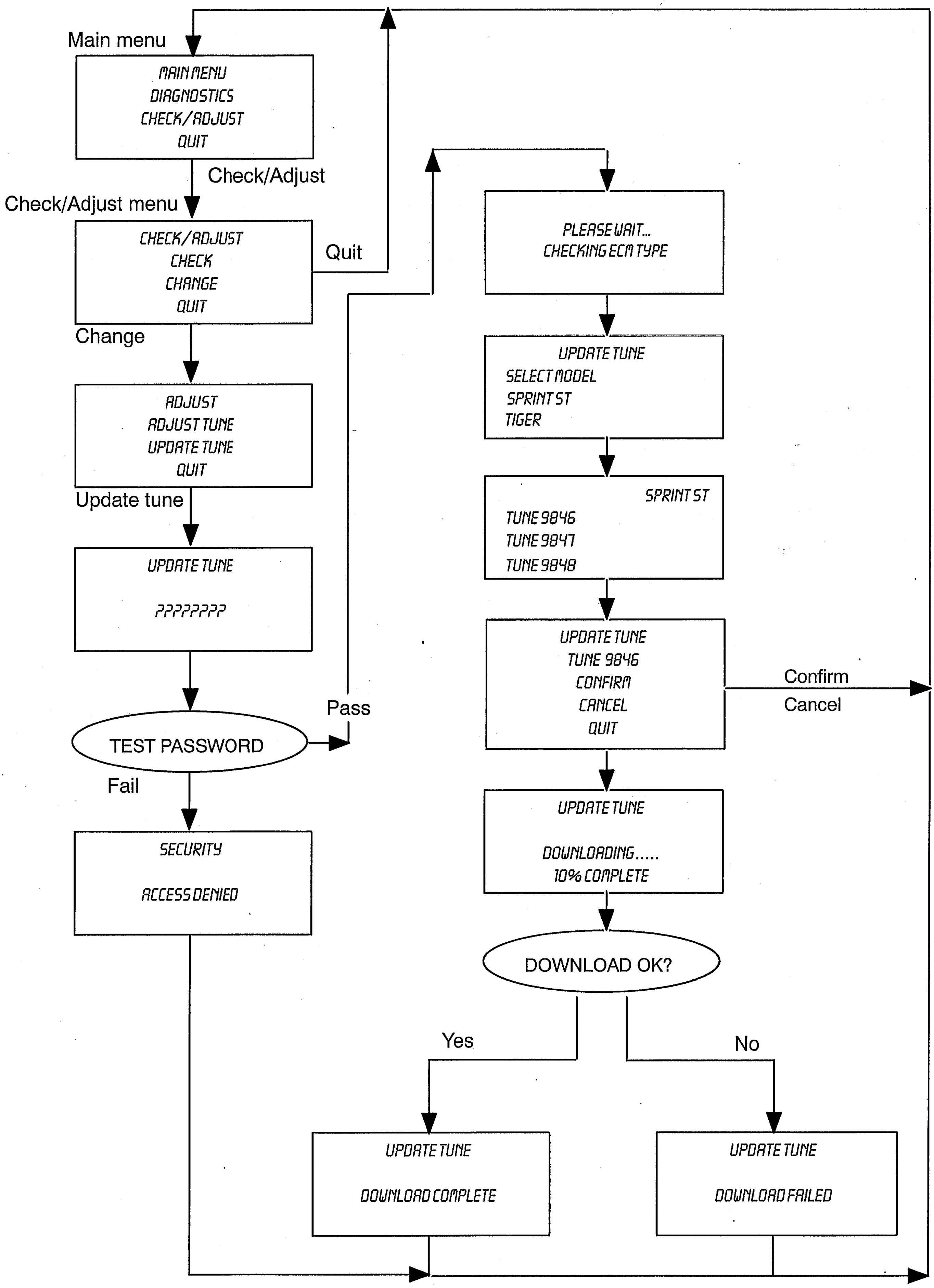
- **The tool does not retain any memory of faults, diagnosis etc. carried out on any particular motorcycle. Any such memory is only retained in the motorcycle's ECM.**
- **The following five pages describe the tool operations in flow chart form.**


CONNECT BIKE
SELF TEST
False
SYSTEM ERROR
CHECK CARD
Absent
Present
SELECT LANGUAGE
ENGLISH
FRANCAIS
DEUTSCH
ESPANOL
NEDERLANDS
INSERT MEMORY
CARD
TRIUMPH MOTORCYCLES
DIAGNOSTIC TOOL
SOFTWARE VERSION 7.0
1999
SWITCH ON BIKE
IGNITION
VALIDATE
False
DATA LINK FAULT
RETRY
SERVICE DATA
DEALER 555555
SERVICE DATA
DATE 15/06/98
Main Menu
MAIN MENU
DIAGNOSTICS
CHECK/ADJUST
QUIT
Quit

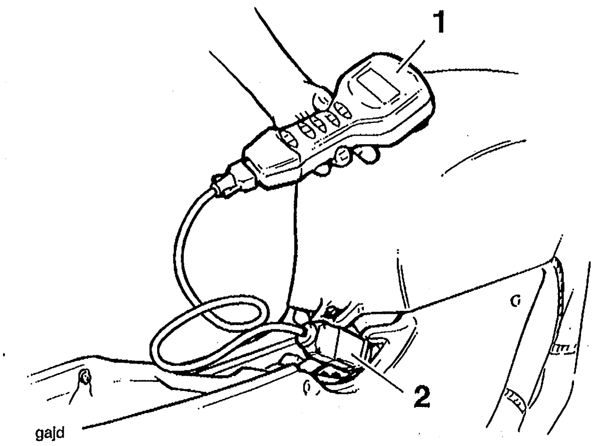

Main Menu
MAIN MENU
DIAGNOSTICS
CHECK/ADJUST
QUIT
Diagnostics
DIAGNOSTICS
CURRENT DATA
FAULT CODES
FUNCTION TESTS
QUIT
Fault codes
Current data
CURRENT DATA
CALCULATED LOAD
WATER TEMP
IDLE FUEL TRIM
OFF IDLE TRIM
REV COUNT
AIR TEMP
IGN ADVANCE
THROTTLE POSITION
LAMBDA FUEL TRIM
OXYGEN SENSOR OUTPUT VOLTAGE
FUEL SYSTEM STATUS
STOP ENGINE
Error Count
STORED ERRORS
FAULT COUNT 02
CAMSHAFT SENSOR
IGN COIL OC/SC
Starred DTC
STORED ERRORS
FREEZE FRAME DATA
CLEAR DTCS
Freeze frame data
FREEZE FRAME
CALCULATED LOAD
WATER TEMP
IDLE FUEL TRIM
OFF FUEL TRIM
REV COUNT
AIR TEMP
IGN ADVANCE
THROTTLE POSITION
LAMBDA FUEL TRIM
OXYGEN SENSOR OUTPUT VOLTAGE
FUEL SYSTEM STATUS
STORED ERRORS
RETURN TO DTCS
CLEAR DTCS
Return
Clear
STORED ERRORS
ERASE ALL DTC DATA
YES
NO
No
Yes
RESET DTCs


Main Menu
MAIN MENU
DIAGNOSTICS
CHECK/ADJUST
QUIT
Diagnostics
DIAGNOSTICS
CURRENT DATA
FAULT CODES
FUNCTION TEST
QUIT
Function test
TEST DTC COUNT
DTCs present
FUNCTION TEST
DTCS PRESENT CLEAR
BEFORE TEST ACTION
Error Count Screen
No DTCs present
FUNCTION TEST
INSTRUMENT PANEL
IAC VALVE
PURGE VALVE
FUEL PUMP
COOLING FAN
FUEL PUMP PRIME
Cancel
FUNCTION TEST
"TEST NAME"
PROCEED
CANCEL
Proceed
FUNCTION TEST
TEST NAME
TESTING....
OBSERVE
TEST DTCs
DTC present
Zero DTCs
FUNCTION TEST
TEST NAME
TEST FAILED P1111
S/C TO VBATT
FUNCTION TEST
TEST NAME
TEST COMPLETE
CLEAR DTC
Yes
FUNCTION TEST
PERFORM ANOTHER TEST
YES
NO
No


Main menu
MAIN MENU
DIAGNOSTICS
CHECK/ADJUST
QUIT
Check/Change
Check/Adjust Menu
CHECK/ADJUST
CHECK
CHANGE
QUIT
Quit
Check
Check menu
Change
Change menu
Quit
CHECK
BUILD DATA
READ SENSORS
QUIT
CHANGE
ADJUST TUNE
TUNE UPDATE
QUIT
Quit
Read sensors
Adjustments
READ SENSORS
AIR SENSOR
AIR TEMP
WATER TEMP SENSOR
WATER TEMP
REV COUNT
IDLE REF.
BATTERY
SENSOR REF
INJECTOR
AIR PRESSURE
CALCULATED LOAD
TGT DWELL
IGNITION TIMING
THROTTLE
THROTTLE POSITION
PURGE VALVE CYCLE
IACV STEPS
IGNITION SWITCH
COOLING FAN
SIDE STAND
NEUTRAL SWITCH
PLEASE WAIT...
CHECKING
BUILD DATA
ADJUST TUNE
IDLE FUEL ADJ 99.9%
SET CLOSED TP
SET LG TERM FUEL T
SET ADAPT STEP POS
Engine temp in range
Engine temp out of range
ADJUST TUNE
IDLE FUEL ADJ 99.9%
REV COUNT KRPM 99.9
CALCULATED LOAD 99%
ENGINE TEMPERATURE
OUT OF RANGE
PLEASE WAIT
Build data
BUILD DATA
VIN
XXXXXXXXXXXXXX
TRIUMPH ECU PART NO
XXXXXXXXXXXXXX
SAGEM ECU PART NO
XXXXXXXXXXXXXX
ECU SERIAL NO
XXXXXXXXXXXXXX
SW RELEASE
XXXXXXXXXXXXXX
TUNE NUMBER
XXXXXXXXXXXXXX
ADJUST TUNE
CLOSED
THROTTLE POSITION
HAS BEEN SET
ADJUST TUNE
LONG TERM FUEL TRIM
HAS BEEN SET
ADJUST TUNE
ADAPTIVE STEP POSITION
HAS BEEN SET


Main menu
MAIN MENU
DIAGNOSTICS
CHECK/ADJUST
QUIT
Check/Adjust
Check/Adjust menu
CHECK/ADJUST
CHECK
CHANGE
QUIT
Quit
Change
ADJUST
ADJUST TUNE
UPDATE TUNE
QUIT
Update tune
UPDATE TUNE
????????
TEST PASSWORD
Pass
Fail
SECURITY
ACCESS DENIED
PLEASE WAIT...
CHECKING ECM TYPE
UPDATE TUNE
SELECT MODEL
SPRINT ST
TIGER
SPRINT ST
TUNE 9846
TUNE 9847
TUNE 9848
UPDATE TUNE
TUNE 9846
CONFIRM
CANCEL
QUIT
Confirm
Cancel
UPDATE TUNE
DOWNLOADING.....
10% COMPLETE
DOWNLOAD OK?
Yes
No
UPDATE TUNE
DOWNLOAD COMPLETE
UPDATE TUNE
DOWNLOAD FAILED

1. CONNECTION AND POWER-UP



1. Tool

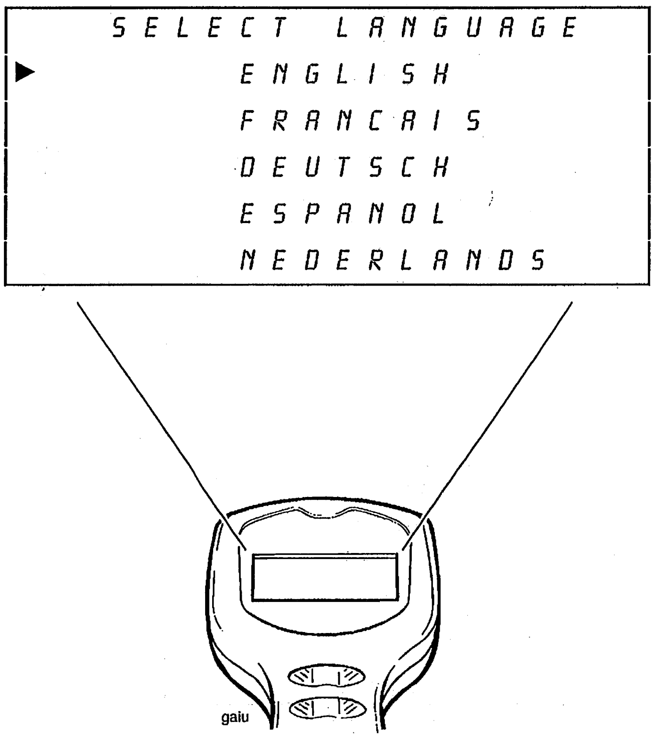
2. Connection to Main Harness

Connect the tool to the dedicated multiplug under the seat.

A message appears on the screen and certain checks are made automatically, e.g. Is the memory card fitted ?

'SELECT LANGUAGE' will then be displayed.

2. SELECT LANGUAGE



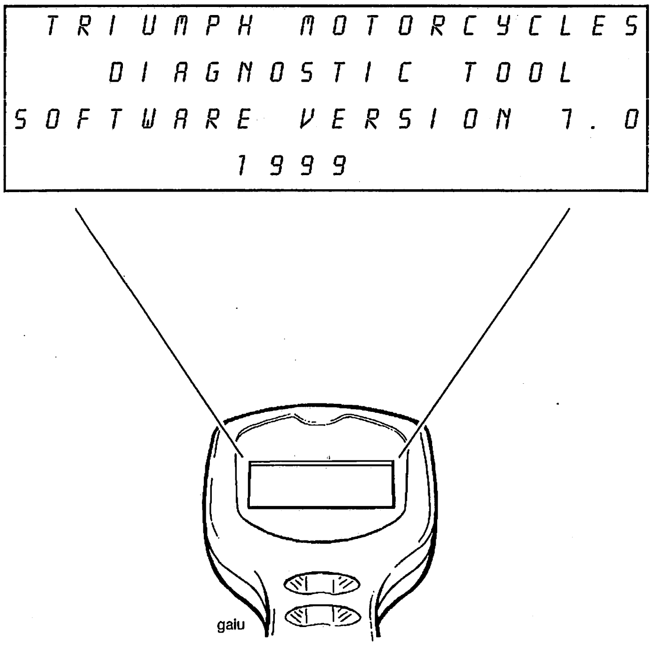
Use the 'Up' and 'Down' keys to move the cursor in column 1 and select the language required.

NOTE:

- **The tool will always select English as the default language, and it is only necessary to use the cursor to select one of the other languages. The entire diagnostic session will then continue in the chosen language.**

Press the validation key '✳' to move on.

3. TRIUMPH MOTORCYCLES

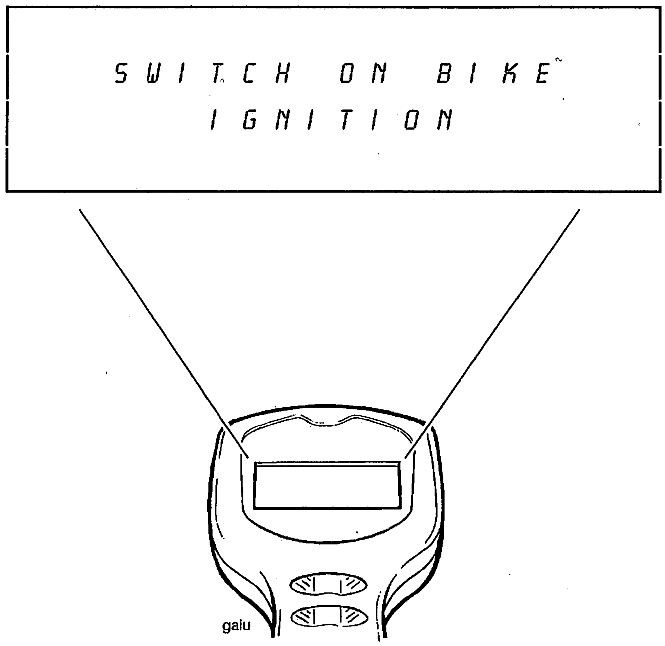


The screen will display the message 'Triumph Motorcycles Diagnostic Tool' and will also give the diagnostic software version and the software release year.

Press the validation key '✳' to move on.

If the Return key (↲) is pressed, the tool will return to the **'SELECT LANGUAGE'** display.

4. SWITCH ON BIKE IGNITION



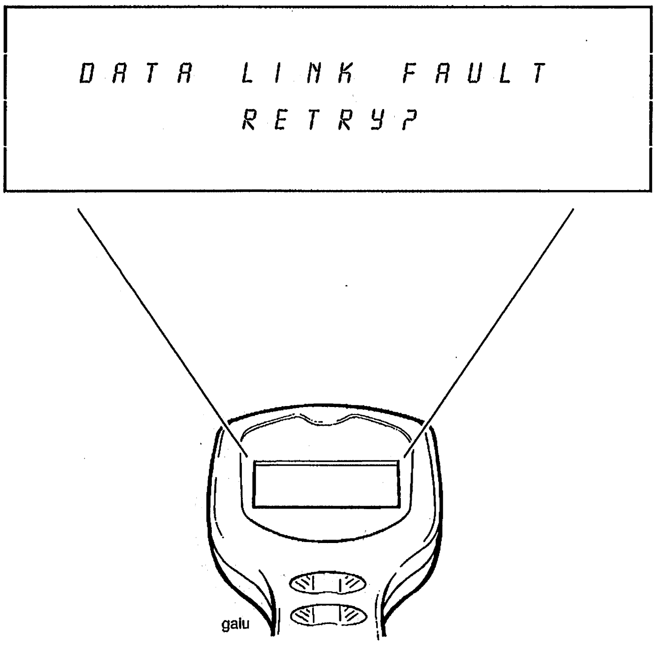
Switch on the ignition. Do NOT start the engine.

Press the validation key '✳'. During a short delay period the tool will carry out certain validation checks.

If it detects a problem which will invalidate the test, **'DATA LINK FAULT RETRY?'** will be displayed.

If all is OK, **'SERVICE DATA'** will appear on the screen.

5. DATA LINK FAULT RETRY?



If the above is displayed, check that the ignition is switched on.

If the ignition is already on, the problem may be caused by bad connections, faulty ignition switch, cable break, faulty ECM, flat battery etc.

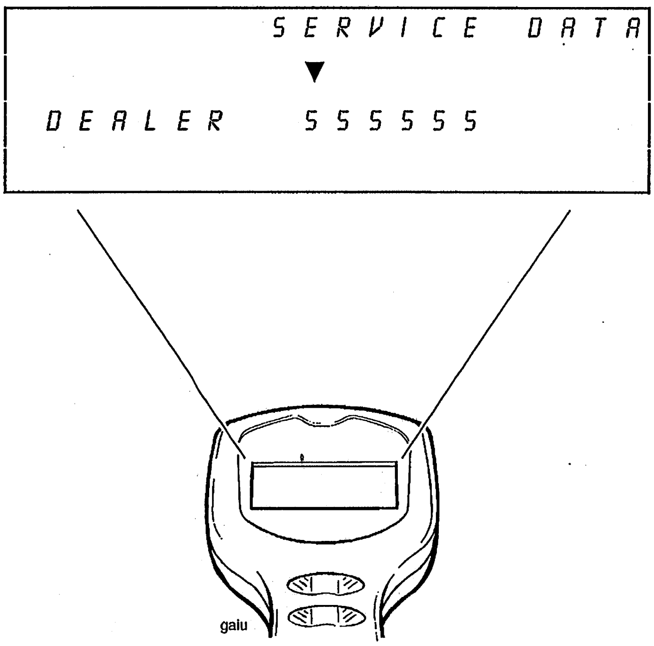
Press the **Help** key **'?'** for advice.

Rectify the problem and press the Validation key '✳' to return to **'SWITCH ON BIKE IGNITION'**.

Press the Validation key '✳' again. If the tool accepts that the problem has been rectified, **'SERVICE DATA'** will be displayed.

This is the first of 2 screens for which the operator has to input information, without which the testing cannot proceed further.

6. SERVICE DATA – DEALER



Enter your Dealer number as follows:

The number **'555555'** is displayed, with the cursor pointing down at the first digit.

Press the 'Up' or 'Down' keys to change this digit to the first digit of your dealer code.

Press the Validation key '✳'.

The cursor will now re-position over the second digit '5'. Enter the 2nd digit of your Dealer number in the same way.

Continue until all 5 digits of your dealer code have been entered.

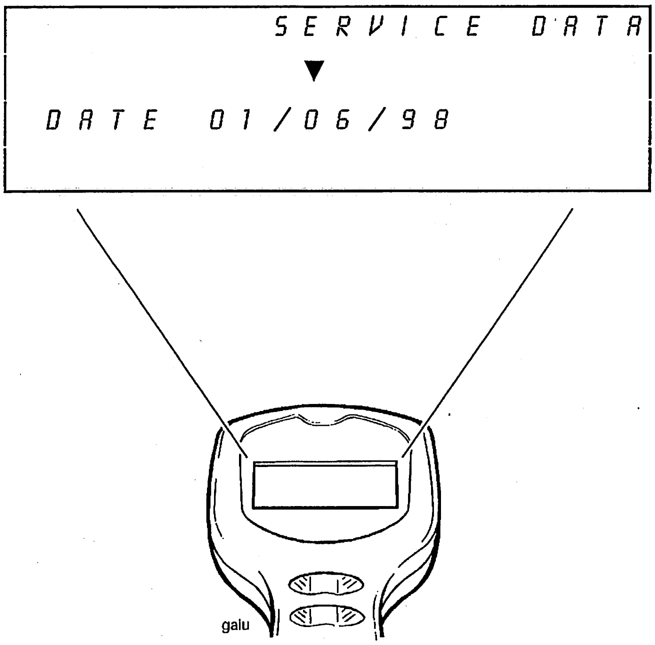
NOTE:

- **If any digit has been entered incorrectly, press the 'Return' key (↵) to start again.**

When all 5 digits have been entered correctly, press the Validation key '✳'.

You must enter a valid Dealer Number to continue. If you do not know your dealer number, contact Triumph or your importer for advice.

7. SERVICE DATA – DATE



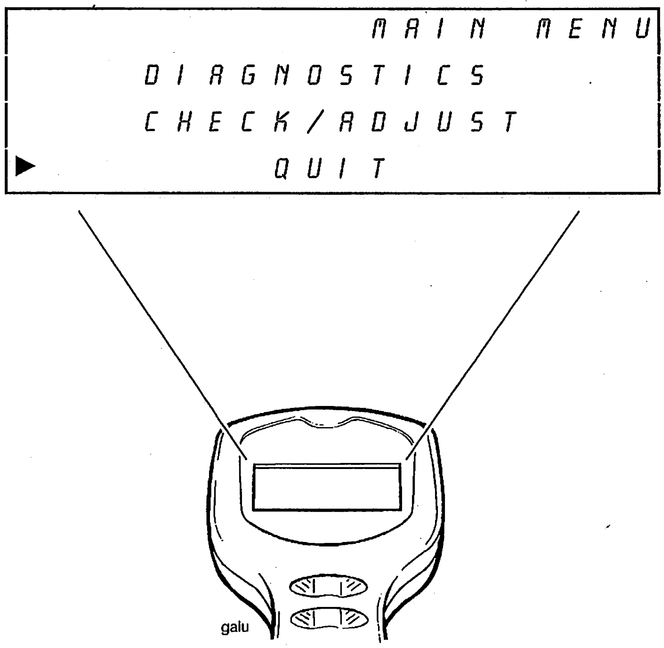
Enter the date using the 'Up' and 'Down' keys in the same way that the Dealer number was entered.

NOTE:

- **6 digits must always be entered, e.g. if it is the 7th month this must be entered as 07.**
- **The date must be entered in the order Day/Month / Year.**

When complete, press the Validation key '*' to display – **'MAIN MENU'.**

8. MAIN MENU



When this screen is displayed, you have to decide whether to proceed along one of two routes:

– **'DIAGNOSTICS'**
– **'CHECK/ADJUST'**

The **'DIAGNOSTICS'** menu provides access to:

Current data e.g. actual engine temperature, engine speed etc.

Diagnostic Trouble Codes (DTC's) i.e. access to codes stored in the motor cycle ECM which indicate a confirmed fault(s) in the system.

Function tests e.g. of tachometer, water temperature gauge, fuel pump etc.

The **'CHECK/ADJUST'** menu provides:

Checks i.e. build information, system data.

Adjustments e.g. adjustment of idle fuel, RPM etc., and entry of software updates.

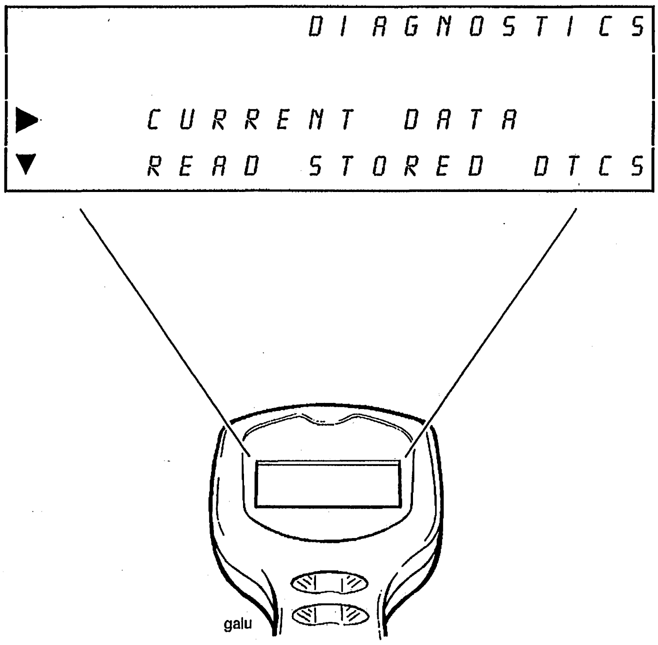
Use the 'Up and Down' keys to position the cursor opposite the desired choice, and press the Validation key '*'.

Either **'DIAGNOSTICS'** (operation 9) or **'CHECK/ADJUST'** (operation 27) will be displayed, dependent on the selection.

NOTE:

- **If 'QUIT' is selected and the validation key '*' pressed, the display will return to 'TRIUMPH MOTORCYCLES'.**

9. DIAGNOSTICS *(If 'DIAGNOSTICS' is selected)*



This display is the **'DIAGNOSTICS'** menu.

Use the 'Up' and 'Down' keys to scroll the text until the horizontal arrowhead is positioned opposite the desired choice, and press the Validation key '✳'.

The choices are:

– **'CURRENT DATA'** (see operation 10)

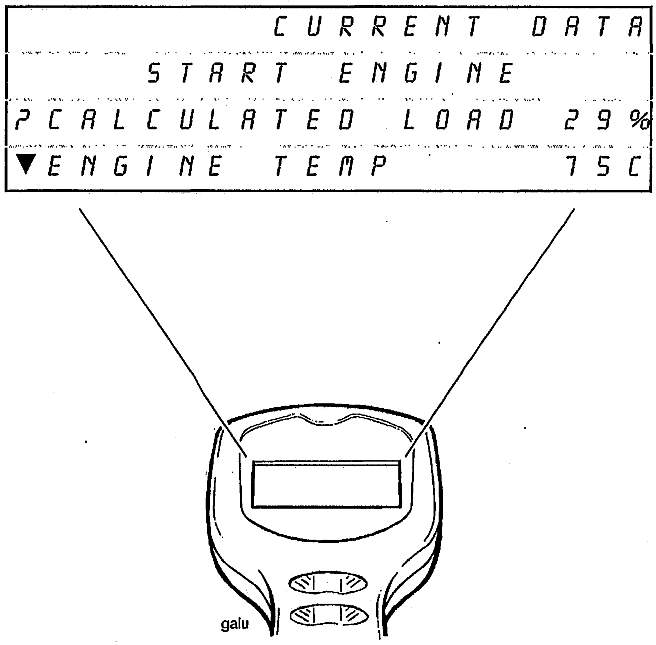
– **'READ STORED DTCS'** (see operation 12)

– **'FUNCTION TESTS'** (see operation 18)

– If **'QUIT'** is selected, the display will return to **'TRIUMPH MOTORCYCLES'**.

*** Closed loop models only.**

10. CURRENT DATA



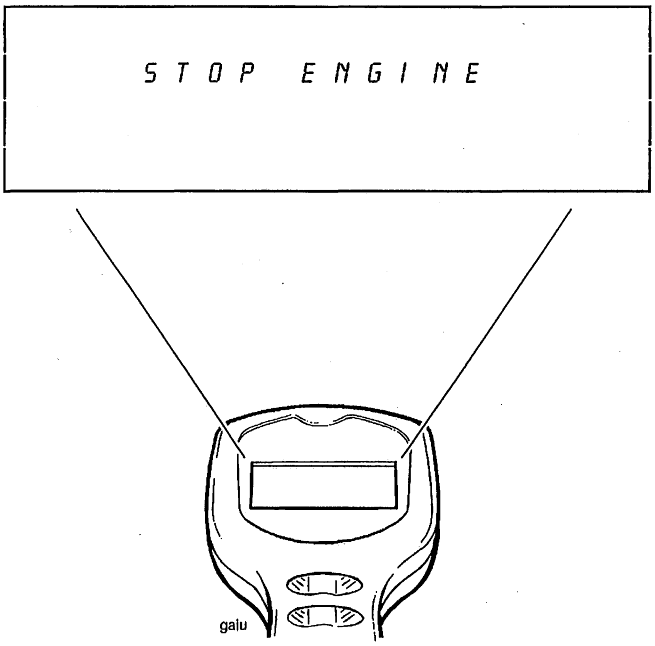
Start the engine. **'CURRENT DATA'** includes the information shown in the table below which can be accessed by scrolling, using the 'Up' and 'Down' keys. At the end of each line of text, the actual reading at that instant is provided to assist diagnosis e.g. **ENGINE TEMP 95C.**

CURRENT DATA AVAILABLE	
Function Examined	**Result Reported (Scale)**
Faults stored (quantity)	1-127
Calculated load	0-100%
Coolant temperature	-40- +215°C
Idle fuel trim	-100 - + 99.2%
Off idle fuel trim	Not used
Engine speed	0 - 16,383 RPM
Air temperature	-40 - +215°C
Ignition Advance	-64° - +63.5°
Throttle Position	0-100%
Lambda fuel trim *	-100 - + 99%
Fuel system status *	Open or closed loop
Oxygen sensor voltage *	0 - 1.25 Volts.

If further clarification of any line of displayed text is required, scroll that line opposite the '**?**' symbol in the left hand column and press the **Help** key (**?**). Limited information on the selected topic will then be displayed.

Press any key to return to the **'CURRENT DATA'** text. When all information has been noted, press either the Validation '✳' or Return (↵) keys.

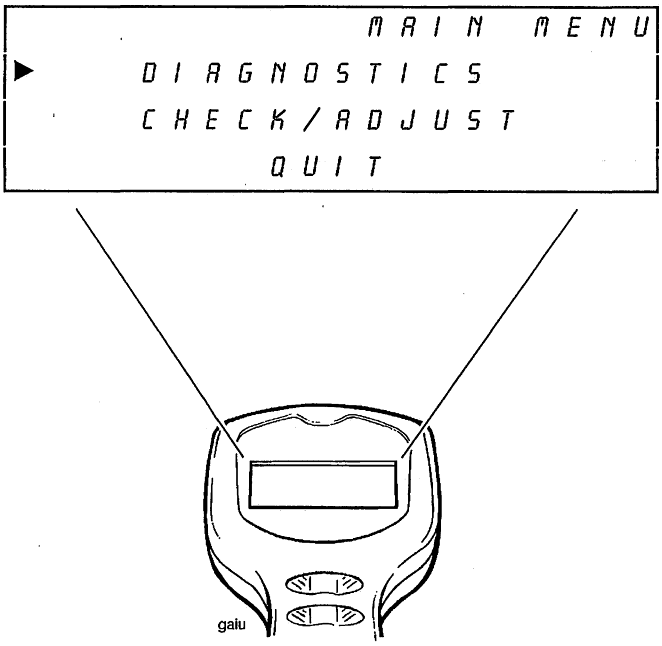
11. STOP ENGINE



Switch off the engine.

As the tool is powered from the motorcycle, this will end the diagnostic session. To continue, return to the power-up section and select tests as required.

12. To select 'READ STORED DTCS' (Diagnostic Trouble Codes) from the MAIN MENU:–



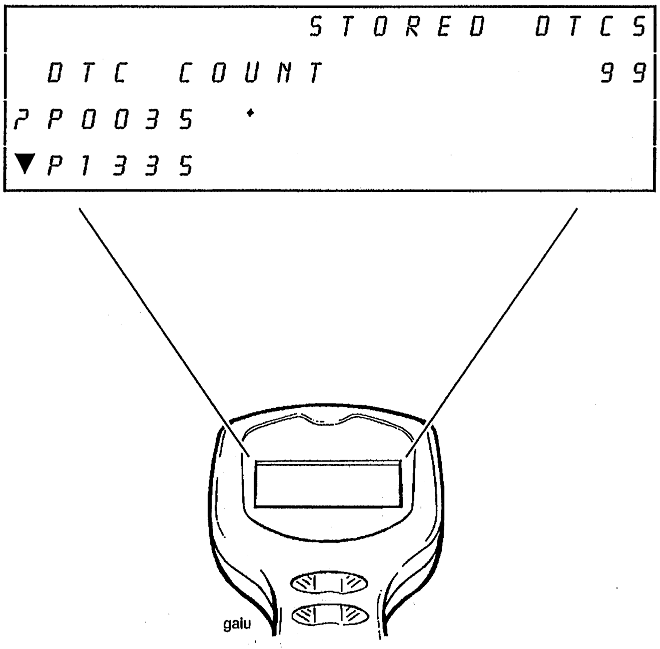
Use the 'Up' and 'Down' keys to position the cursor opposite **DIAGNOSTICS**.

Press the Validation key '✳' to display **'DIAGNOSTICS'** menu.

Select **'READ STORED DTCS'**, and press the Validation key '✳'.

'STORED DTCS' will be displayed.

13. STORED DTCS



The second line – **'DTC COUNT',** shows the number of DTC's stored in the ECM memory.

Lines 3 and 4 display up to two of the DTC'S stored (if any). If additional DTC'S are stored, this will be indicated by a downward pointing arrowhead, and it/they can be accessed using the 'Up' and 'Down' keys.

If there are no DTC's shown, press the Return key (↲) to return to **MAIN MENU**.

(If DTC's are present when the Return key is pressed, display will read **'STORED DTCS, ERASE ALL DTC DATA YES/NO'.**)

Information about each DTC can be obtained by scrolling the text until the appropriate code is opposite the '**?**' in line 3; then press the **Help** key (**?**).

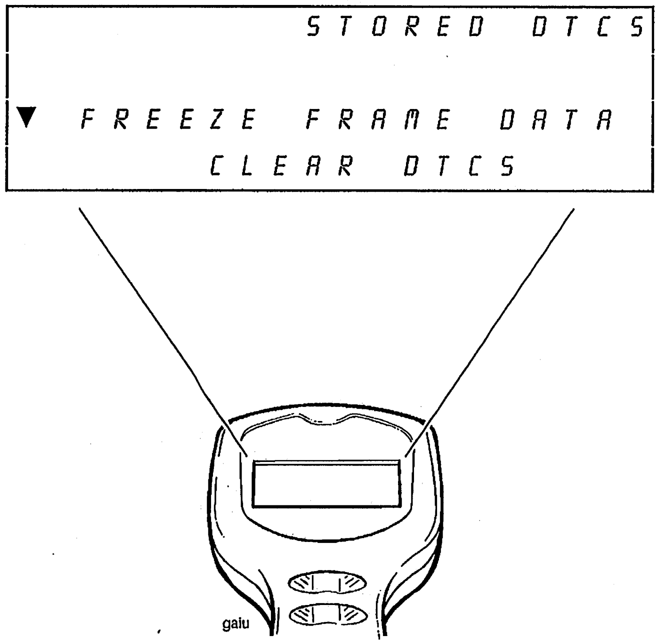
DTC example:	P0035
Help text	CRANKSHAFT SENSOR CIRCUIT MALFUNCTION

Press the Validation key '✳' to continue (operation 14).

IMPORTANT:

If a DTC has an asterisk (*) to its right, this indicates that a snap shot of engine data at the time the DTC was stored is available to aid your fault diagnosis. To access this information, press the Validation key '✳' to go to operation 14 and open **'FREEZE FRAME DATA'**.

14. Three options are now available:–

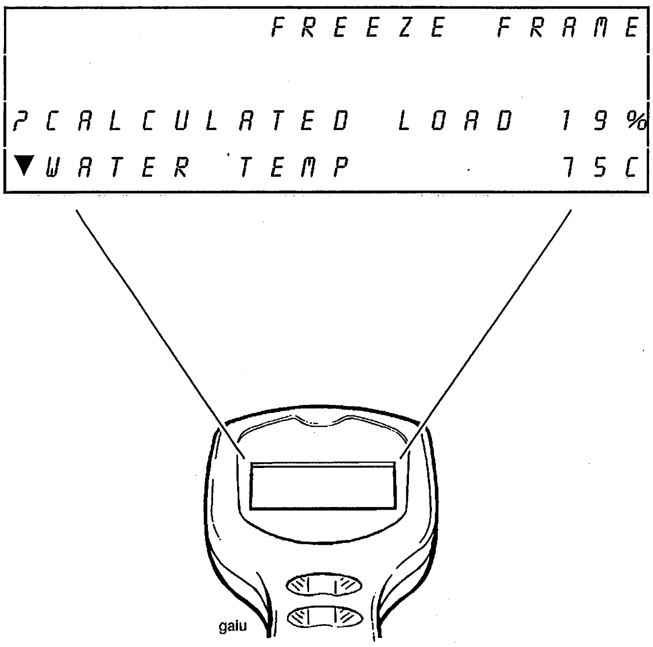


Align **'FREEZE FRAME DATA'** with the cursor, and press the validation key '✳' to display **'FREEZE FRAME'** (see 15).

Align **'CLEAR DTCS'** with the cursor, and press the validation key '✳' to display **'ERASE ALL DTC DATA'** (see 17).

Press the Return key (↲) to go back to **'STORED DTCS'** (operation 13).

15. FREEZE FRAME

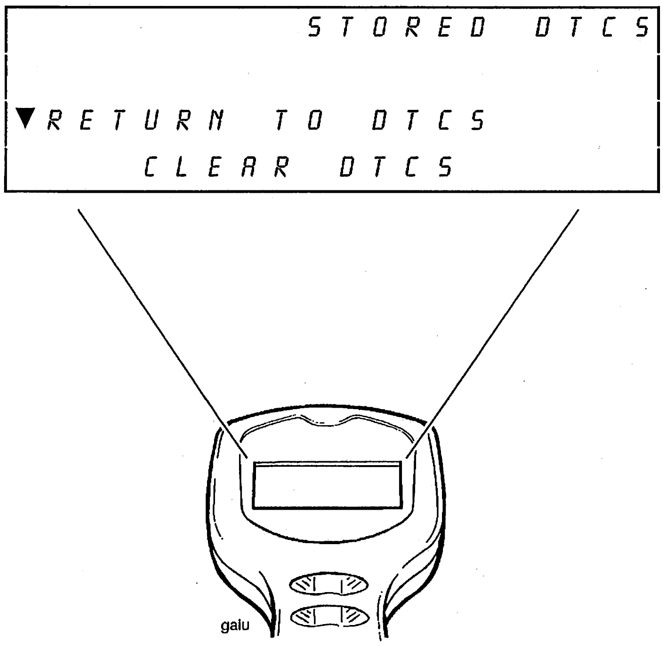


When a fault occurs which causes a DTC to be stored in the memory, the engine condition data at that instant is logged in the ECM. If another, more serious DTC is subsequently set, the original DTC data is automatically erased and new data associated with the latest DTC is logged in its place.

By selecting **'FREEZE FRAME'**, this information becomes available on the screen to aid diagnosis. Scroll the text up or down to view the data. More information can be gained by scrolling the text line in question to line 3 (**?**), then press the **Help** key (**?**) as before. Press the Validation key '✻' to display **'STORED DTCS'** (operation 16).

FREEZE FRAME DATA AVAILABLE	
Function Memorised	**Result Reported (Scale)**
Calculated load	0-100%
Coolant temperature	-40- +215°C
Idle fuel trim	-100 - + 99.2%
Off idle fuel trim	Not used
Engine speed	0 - 16,383 RPM
Air temperature	-40 - +215°C
Ignition Advance	-64° - +63.5°
Throttle Position	0-100%
Barometric pressure	0 - 983 mm/Hg
Lambda fuel trim *	-100 - + 99%
Fuel system status *	Open or closed loop
Oxygen sensor voltage *	0 - 1.25 Volts.

16. STORED DTCS



2 options are now available:

Scroll to **'RETURN TO DTCS'** and press the Validate key '✻' to return to operation 13.

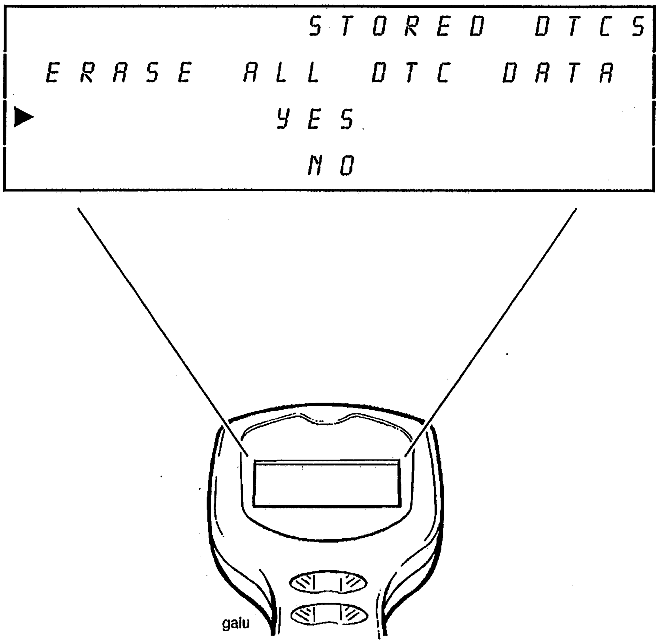
Scroll to **'CLEAR DTCS'** and press the Validation key '✻' to go on to operation 17.

NOTE:

- **A full list of all the possible DTCs can be found earlier in this section.**

*** Closed loop models only.**

17. STORED DTCS, ERASE ALL DTC DATA



Scroll to position either **'YES'** or **'NO'** opposite the cursor.

If **'YES'** is selected, press the Validation key '✳' to erase all DTC data from the memory. **'MAIN MENU'** will then be displayed.

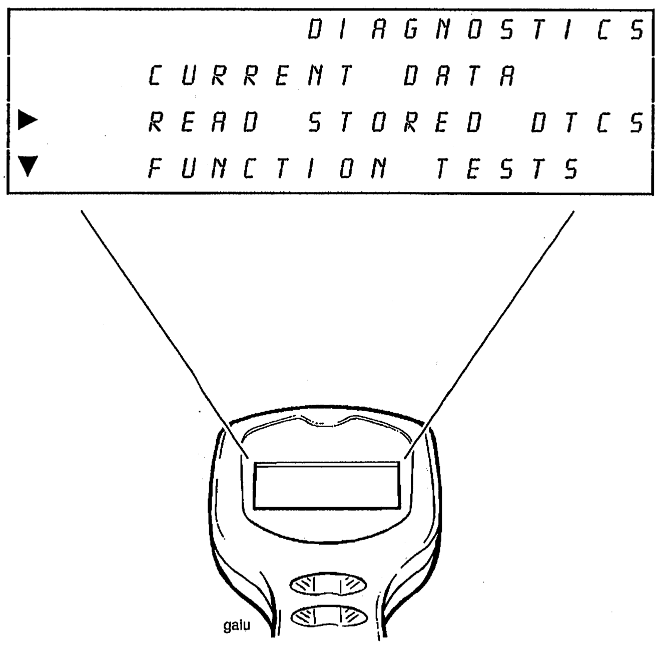
NOTE:

- **If you intend to examine the Function Tests, entry will be inhibited unless the DTC's have been erased.**

If **'NO'** is selected, press the Validation key '✳' to return to operation 13.

That completes the DTC cycle.

18. To select 'FUNCTION TESTS' from the MAIN MENU:



Use 'Up' and 'Down' keys to select **'DIAGNOSTICS'** menu.

The following choices are available.

Press the Validation key '✳'. **'DIAGNOSTICS'** will be displayed.

Select **'FUNCTION TESTS'**, and press the Validation key '✳'.

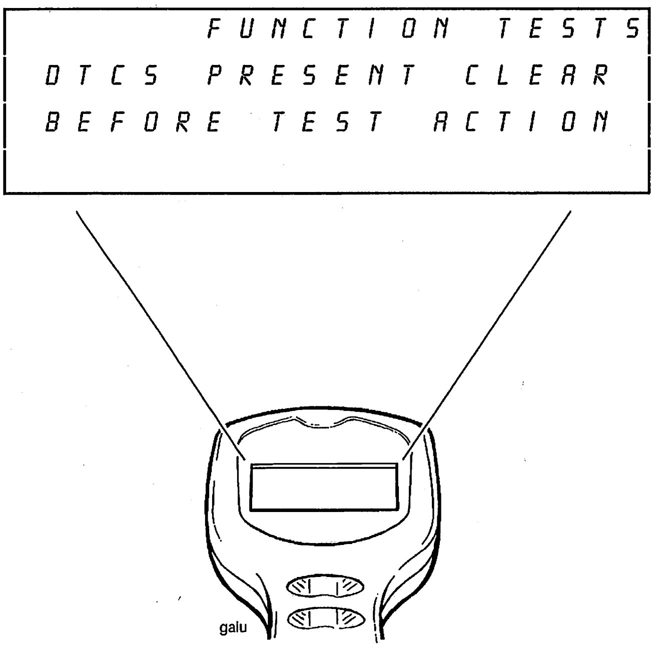
If no DTC'S are stored, **'FUNCTION TEST'** will be displayed (see operation 20).

If one or more DTC'S are stored, the message **'DTCS PRESENT CLEAR BEFORE TEST ACTION'** will be displayed (see operation 19).

NOTE:

- **The diagnostic tool will not allow Function Tests to be accessed until all DTC's in the memory are removed.**

19. FUNCTION TESTS



To clear the DTC's, press the Validation key '✻'. **'STORED DTCS'** will be displayed (see operation 13).

Proceed as before via operations 14 to 17. Scroll to **'YES'** and press the Validation key '✻' to erase all DTC data; the **MAIN MENU** will be displayed again.

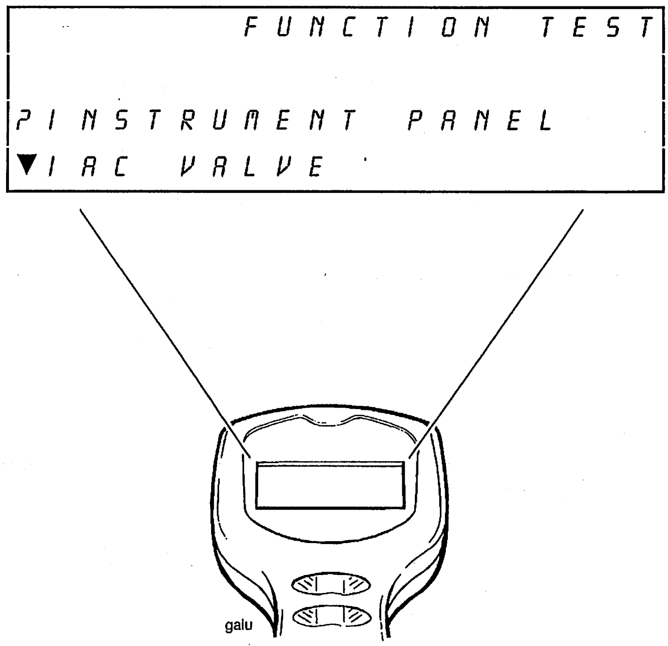
NOTE:

- **The fault(s) which caused the DTC's to be set must be rectified and cleared before continuing the Function Tests.**
- **A full list of all the possible DTCs can be found earlier in this section.**

Select **'DIAGNOSTICS'** menu and **'FUNCTION TESTS'** again pressing the Validation key '✻' each time.

Because the DTC's have now been erased, **'FUNCTION' TEST'** (operation 20) will now be displayed.

20. FUNCTION TEST



The following Function Tests can be made:

1 Instrument Panel
2 Idle air control valve (IACV) test
3 Purge valve test
4 Fuel pump test
5 Cooling fan test
6 Fuel pump priming test

If the fault is electrical, this will then be reported as a DTC.

Instrument Panel test: A signal is sent which should cause the tachometer to read approximately 7,500 RPM for 15 seconds, the water temperature gauge to show 100°C for 15 seconds and the fuel gauge (if fitted) to register 50% full (all simultaneously).

Idle air control valve (IACV) test: A signal is sent which should cause the valve to move through it's full range of step positions and then leave it in the park position. The signal will cause the valve to operate several times. To detect valve movement, use a stethoscope to listen for valve operation.

Fuel pump priming test: The fuel pump is run for a specific time to check for satisfactory priming. A message will then be displayed to that effect.

Fuel pump test: This test provides you with the means to physically check the pump operation.

Cooling fan test: A signal is sent which should cause the fan to operate for a 10 second period.

Purge valve test: (California models only) This test allows you to check operation of the valve. To detect valve movement, use a stethoscope to listen for valve operation.

Use the 'Up' and 'Down' keys to scroll the text lines, and position the function for which you wish to obtain information opposite the **'?'**.

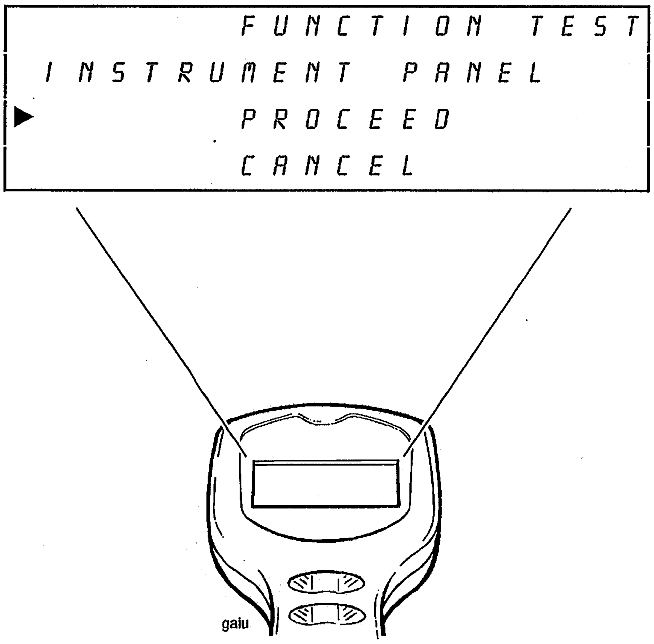
By pressing the Validation key '✳', your selection will be noted and **'FUNCTION TEST'** (operation 21) will be displayed.

Press the **Help** key (**?**) for more information.

NOTE:

- **If the Return key (↵) is pressed, the tool will return to 'DIAGNOSTICS' menu (operation 9).**

21. FUNCTION TEST



The function selected at operation 20 will now show on line 2. To show an example of this, we have chosen the **'INSTRUMENT PANEL'** test.

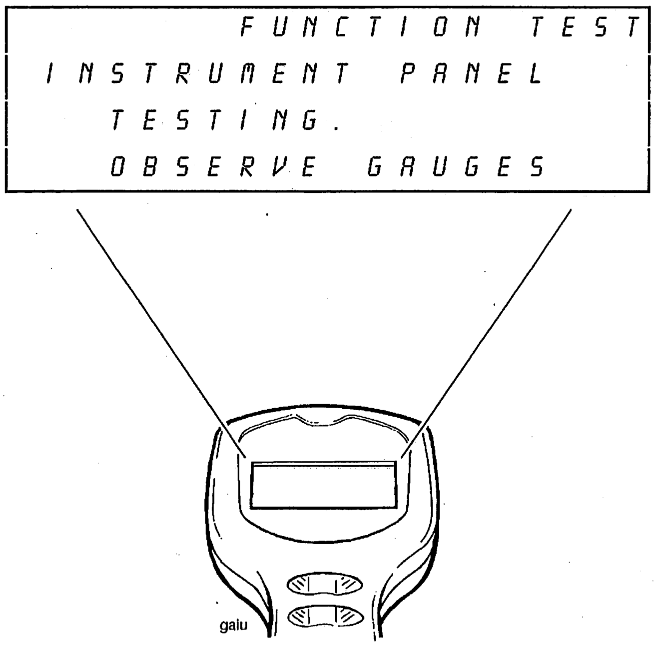
If you press the **Help** key (**?**). help relating to the specific test will be given. In this example, the screen will now read

TACHOMETER - 7500 RPM
TEMP GAUGE - 100 °C
FUEL GAUGE - 50%

If you wish to cancel that selection, scroll to **'CANCEL'** and press the Validation key '✳'. The display will return to operation 20.

If you wish to test the component selected, scroll to **'PROCEED'** and press the Validation key '✳'.

22. FUNCTION TEST

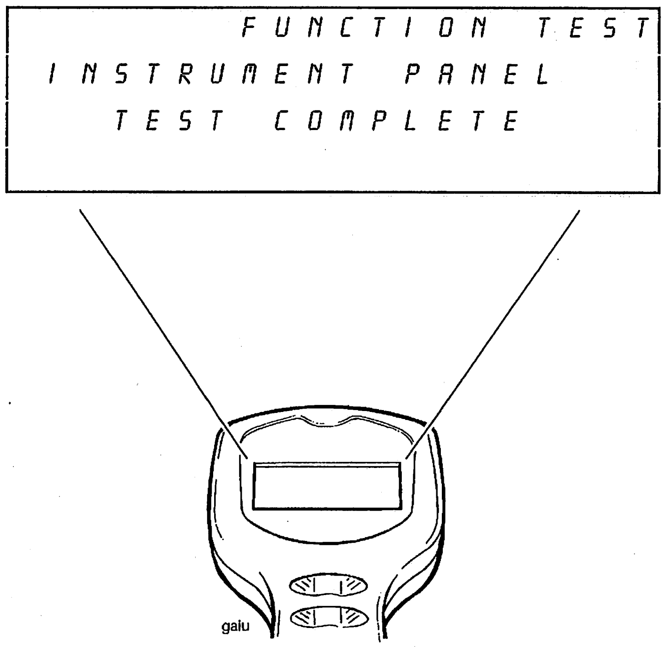


The screen now displayed will be specific to the component being tested:

In the example selected – **'INSTRUMENT PANEL'**, the instruction is to observe the gauges.

After a period of time, the screen will automatically change to either **'TEST COMPLETE'** (see operation 23) which will indicate a satisfactory completion, or to **'TEST FAILED'** (see operation 25) which will indicate failure.

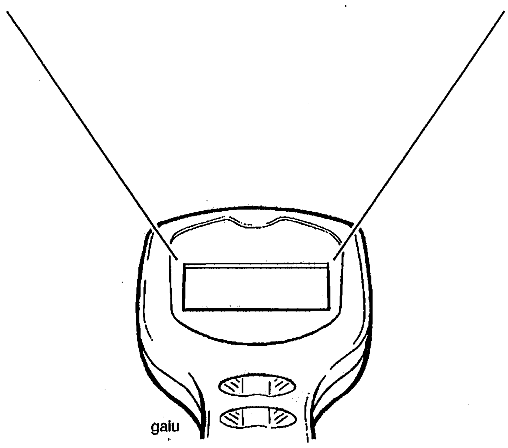
23. FUNCTION TEST



If the test is satisfactory the display will read **'TEST COMPLETE'**. Press the Validation key '✳' to display **'FUNCTION TEST'** (operation 24).

24. FUNCTION TEST

```
            FUNCTION TEST
PERFORM ANOTHER TEST
▶           YES
            NO
```



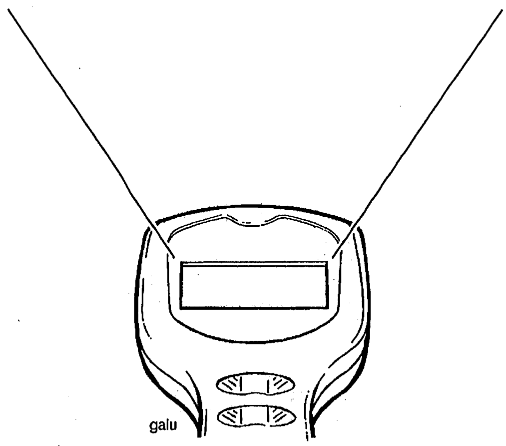
This display allows you to decide whether you wish to test another component.

Either – position the cursor on line 3 **'YES'** and press the Validation key '✱' to return to the **'FUNCTION TEST'** selection menu,

or – position the cursor on line 4 **'NO'** and press the Validation key '✱' to return to **'DIAGNOSTICS'** menu (operation 9).

25. FUNCTION TEST

```
            FUNCTION TEST
 INSTRUMENT PANEL
 TEST FAILED      P1117
```



If the test at operation 22 is unsatisfactory, a DTC will be displayed on line 3 of this display (except fuel pump tests).

Press the Help key **(?)** to access the diagnosis information associated with that code.

Press the Validation key '✱' if you wish to test another component (operation 24).

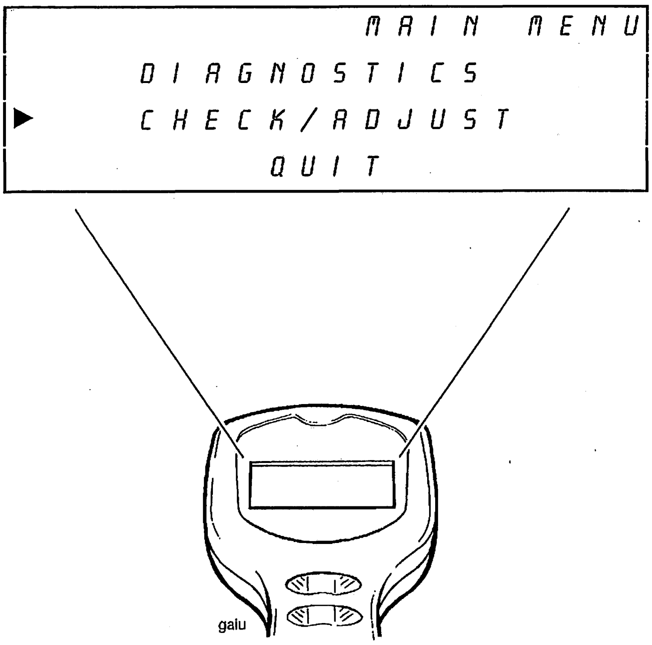
NOTE:

- **Any DTC's logged in the system will be automatically cleared at this point.**

To return to the **'DIAGNOSTICS'** menu, Select **'QUIT'** and press the Validation key '✱' to return to the **'MAIN MENU'** (operation 8).

That completes the **FUNCTION TESTS** cycle.

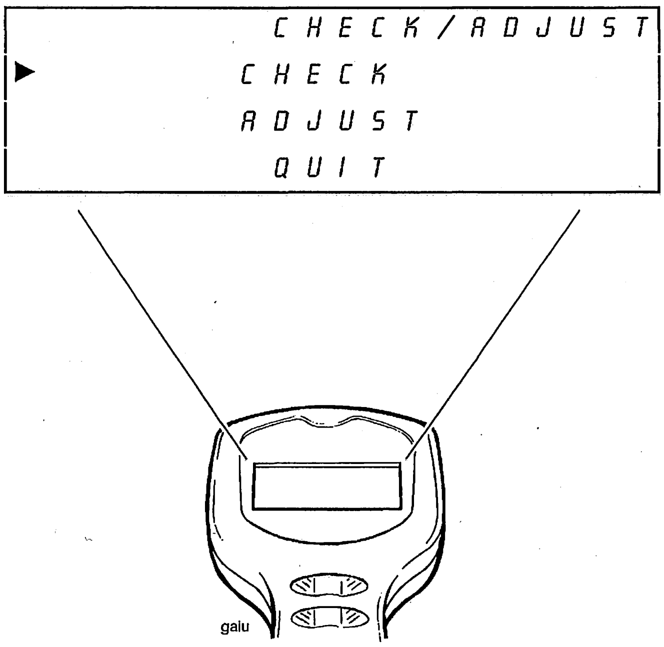
26. To select 'CHECKS/ADJUSTMENTS' from the MAIN MENU (operation 8):–



Use the 'Up' and 'Down' keys to position the cursor opposite **'CHECK/ADJUST'.**

Press the Validation key '⚹'; the **'CHECK/ADJUST'** menu will be displayed.

27. CHECK/ADJUST



This is the Checks and Adjustments menu.

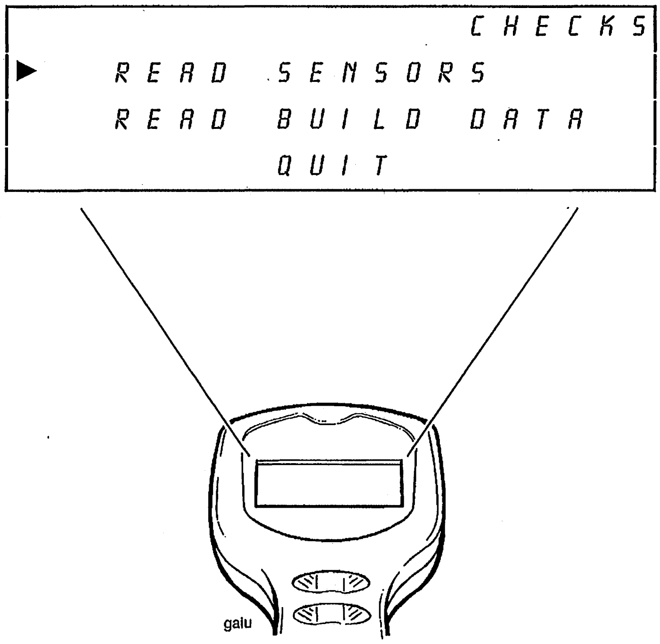
Use the 'Up' and 'Down' keys to position the cursor as follows, and then press the Validation key '⚹':

Opposite **'CHECK'** – **'CHECKS'** will be displayed (operation 28).

Opposite **'ADJUST'** – **'ADJUST'** will be displayed (operation 32).

Opposite **'QUIT'** – to return to **'MAIN MENU'** (operation 8).

28. CHECKS



You now have the option to access the motorcycle **'BUILD DATA'** or the **'SYSTEM DATA'**, or to quit.

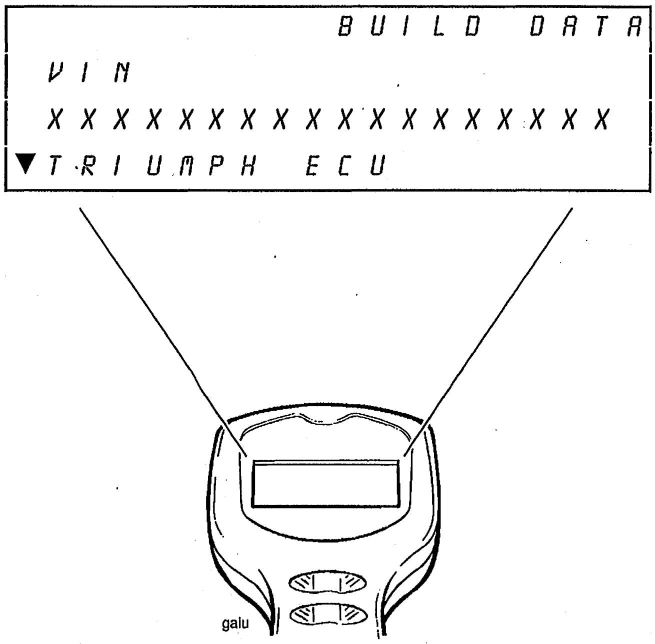
Position the cursor as follows and then press the Validation key '✳':

Opposite **'READ SENSORS'** – **'SENSOR DATA'** (operation 30) will be displayed.

Opposite **'READ BUILD DATA'** – **'BUILD DATA'** (operation 29) will be displayed.

Opposite **'QUIT'** – to return to **'MAIN MENU'** (operation 8).

29. BUILD DATA

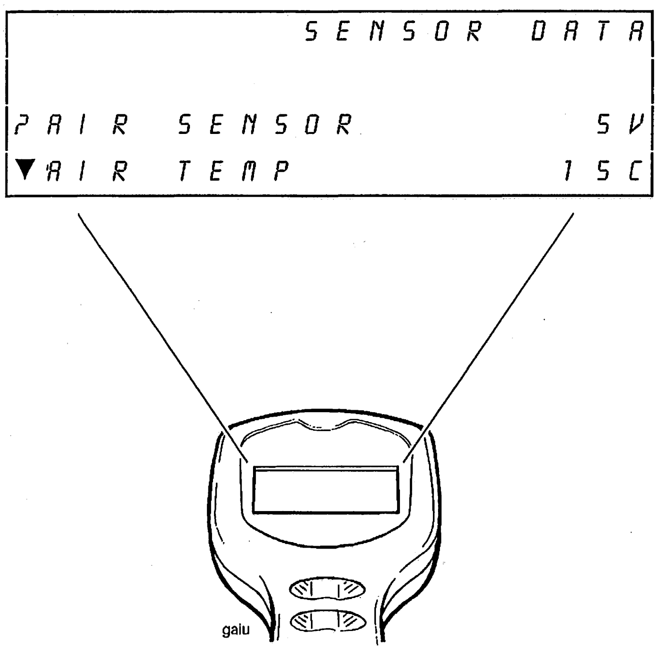


Providing the information was recorded at the time of build, the display will show the following information relating to the motorcycle under test by scrolling up and down: Before displaying the recorded information, the tool will briefly display the message, 'PLEASE WAIT, CHECKING BUILD DATA'.

Vehicle Identification Number (VIN)
Triumph ECM part number
Supplier's ECM part number
ECM Serial number
Tune Number

Press the Validation '✳' keys to return to **'CHECK/ADJUST'** menu (operation 27).

30. SENSOR DATA



The display can be scrolled to show:

The status of the various sensors and actuators

To obtain further data information, scroll the appropriate line to the help key mark (**?**) and press the Help key.

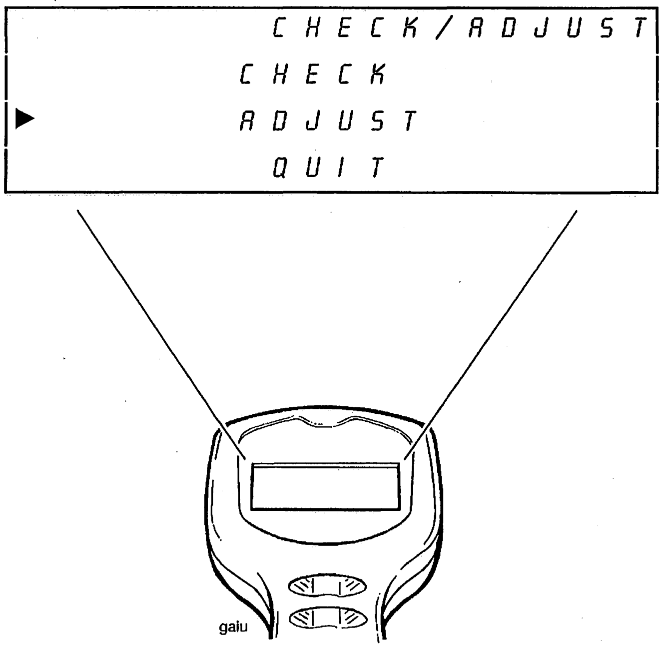
NOTE:

- **The help information shows the likely range of readings for a correctly functioning system at normal operating temperature.**

That completes examination of the Checks.

Press the Validation key '⁎' to return to **'CHECK/ADJUST'** (operation 27).

31. To access the 'ADJUSTMENTS' menu.

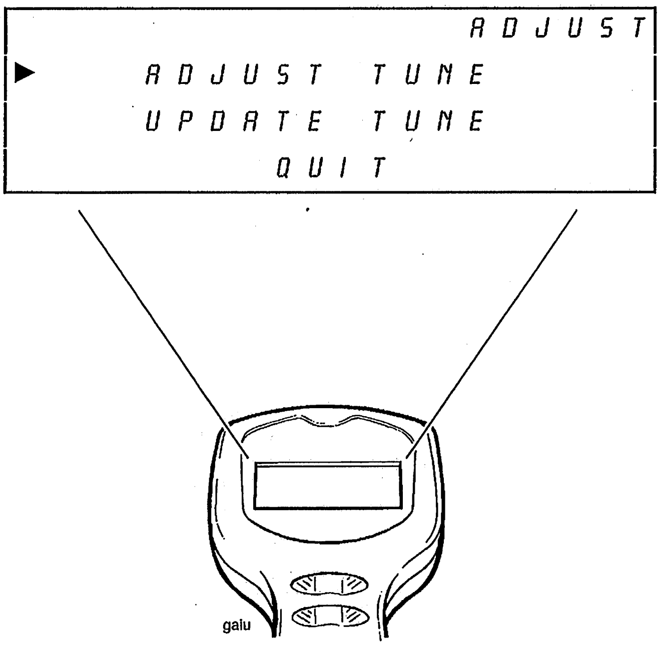


Use the 'Up' and 'Down' keys to position the cursor opposite **'ADJUST'**.

Press the Validation key '⁎'; **'ADJUST'** will be displayed.

Start the engine.

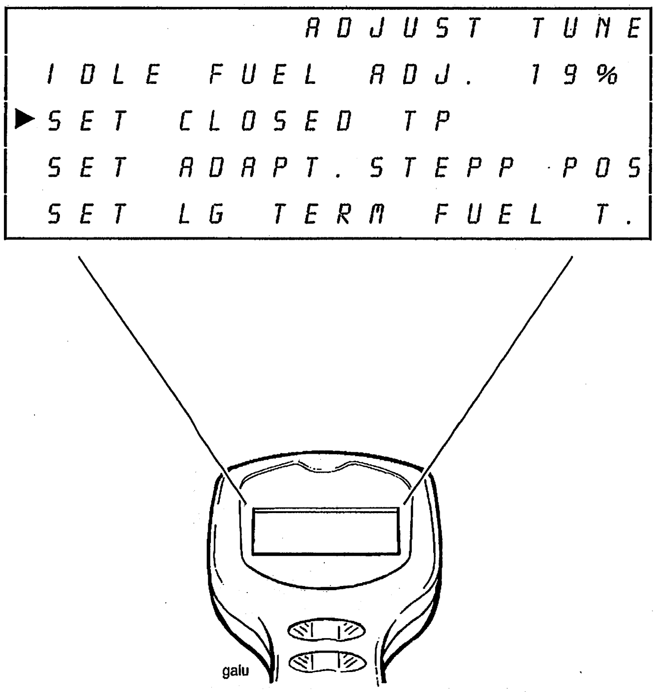
32. ADJUST



Position the cursor on line 2 **'ADJUST TUNE'** if you wish to check and/or adjust the values of certain tune items. Then press the Validation key '✱' to display **ADJUST TUNE** (see operation 33).

In special circumstances, Triumph will request you to introduce a completely new engine tune. Given this situation, select **'UPDATE TUNE'** and press the Validation key '✱' (see operation 36).

33. ADJUST TUNE



The following sequence shows status data and allows adjustments to be made to items which affect the engine operation

IDLE FUEL ADJ. (Idle fuelling) **
– See operation 34

The current setting for idle fuelling is shown in the right hand column.

SET CLOSED TP (Closed throttle position)
– See operation 36

SET ADAPT STEPP POS (adaptive stepper position)
– See operation 37

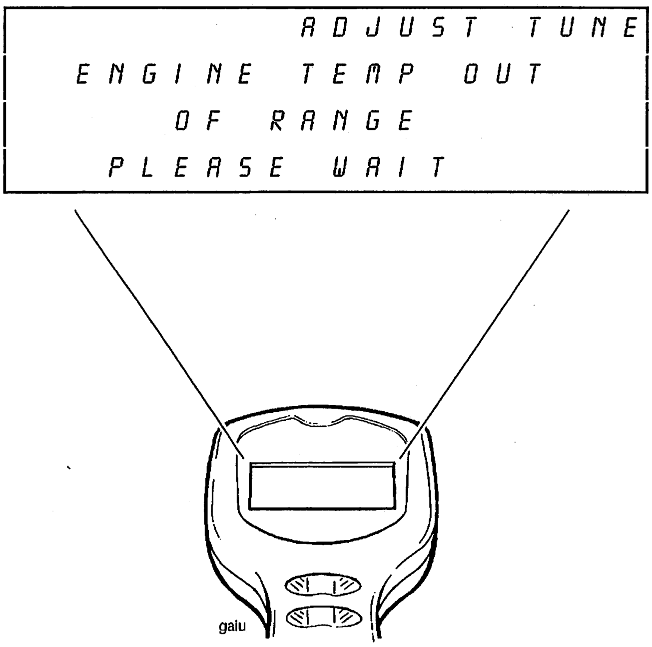
SET LG TERM FUEL T* (set long term fuel trim)
– See operation 38

Position the cursor opposite the setting you wish to adjust and press the Validation key '✱'.

*** Closed loop catalyst models only**

**** Not available on closed loop models**

34. ADJUST TUNE (Idle fuel adjustment)



Because idle fuelling adjustment must be made at normal operating temperature, the above screen may be displayed if the engine is either too cold (thermostat closed) or too hot (cooling fan operating). The current temperature is displayed while the engine warms/cools.

Until the engine warms or cools to the correct temperature range, the tool will not allow access to any other functions. If you wish to escape from this area (and not carry out the adjustment) switch off the ignition and disconnect the tool.

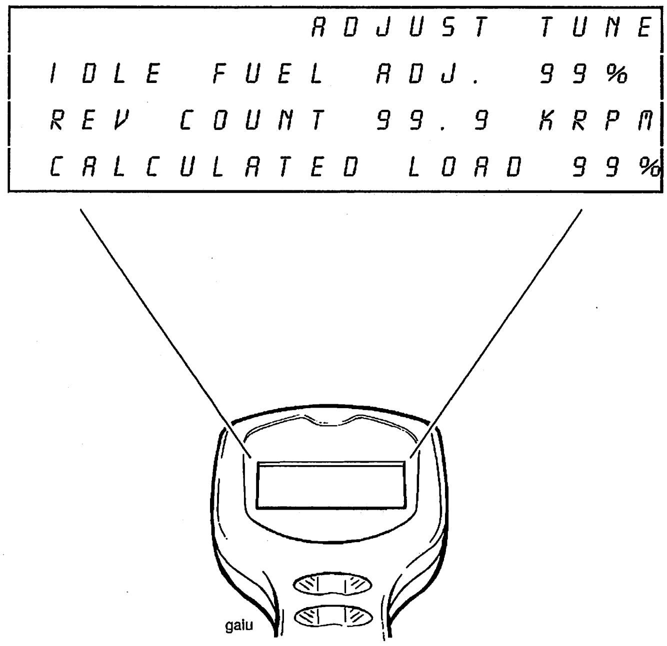
Once the correct temperature range has been reached, the **ADJUST TUNE** screen (operation 35) will automatically be displayed.

The Idle Fuelling (idle Co) can be adjusted when this display is showing, in fuelling increments of 1% by pressing the 'Up' or 'Down' keys as appropriate.

The idle fuel adjustment read out will change accordingly, and the new values of engine speed and calculated load will be displayed.

> **CAUTION: Do not confuse the percentage reading on the tool with the carbon monoxide percentage reading as measured by an exhaust gas analyser. The tool reports idle fuelling as a percentage of the maximum fuelling range <u>NOT AS A PERCENTAGE CO READING.</u>**

35. ADJUST TUNE (Idle fuel adjustment)



Start the engine and allow it to warm up at idle until the tool allows access to the adjustment screen. Ensure that the fuel tank is at least half full.

Once adjustment is enabled by the tool, turn on the headlights, blip the throttle to stabilise combustion and begin sampling the exhaust gases.

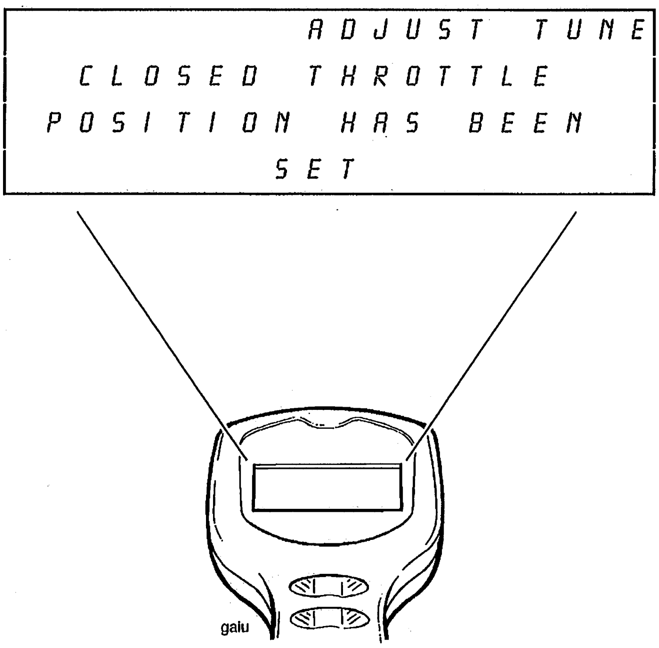
Adjust the idle CO level until the correct reading is shown on the CO meter. Ensure the meter reading is stable before pressing the Validation key '✳' to confirm the new setting and to return to operation 33.

If the desired setting is not reached before the tool locks out further adjustment due to a rise in the coolant temperature, stop the engine and allow it to cool for 30 minutes before repeating the adjustment process. This will allow airbox temperatures to fall and will help ensure an accurate setting is ultimately achieved.

NOTE:

- **Idle fuelling adjustment must always be carried out using an accurate exhaust gas analyser to measure idle carbon monoxide levels.**
- **On California models, an open loop catalyst is fitted. In order to correctly set the idle CO level, the gas analyzer probe must be inserted in the port on the exhaust header, not in the silencer outlet.**
- **Correct idle CO level is 1.5 % +/- 0.3% unless a 'race' silencer is fitted in which case a 2% CO level would be beneficial:**

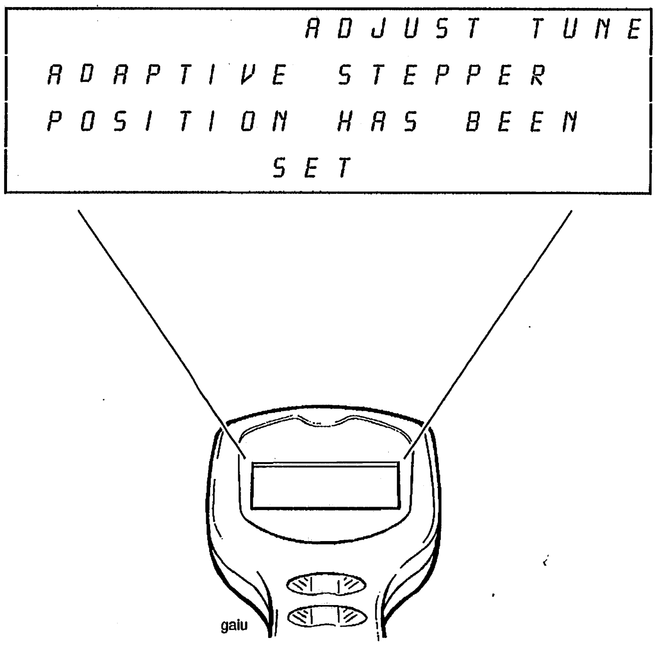
36. ADJUST TUNE (closed throttle position)



The electronic value of the closed throttle position is automatically reset by the tool.

Press either the validate '✱' or return (↵) to return to the main menu.

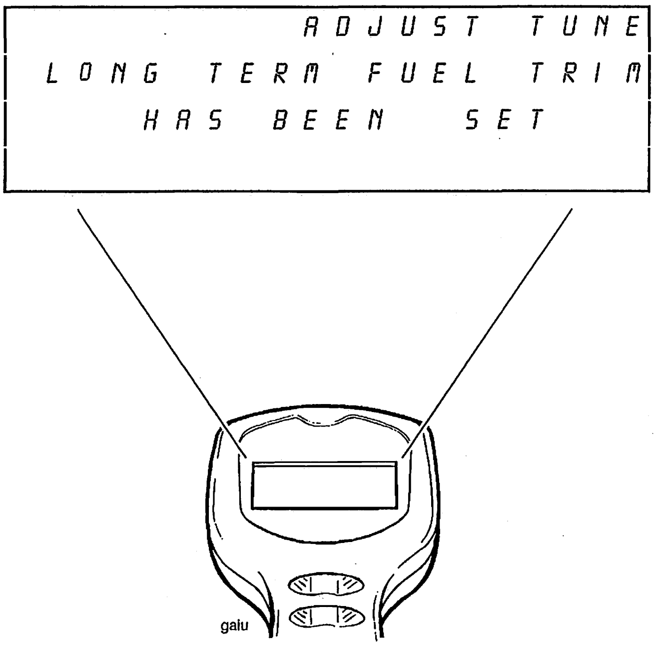
37. ADJUST TUNE (set adaptive stepper position)



The electronic value of the adaptive stepper position is automatically reset by the tool.

Press either the validate '✱' or return (↵) to return to the main menu.

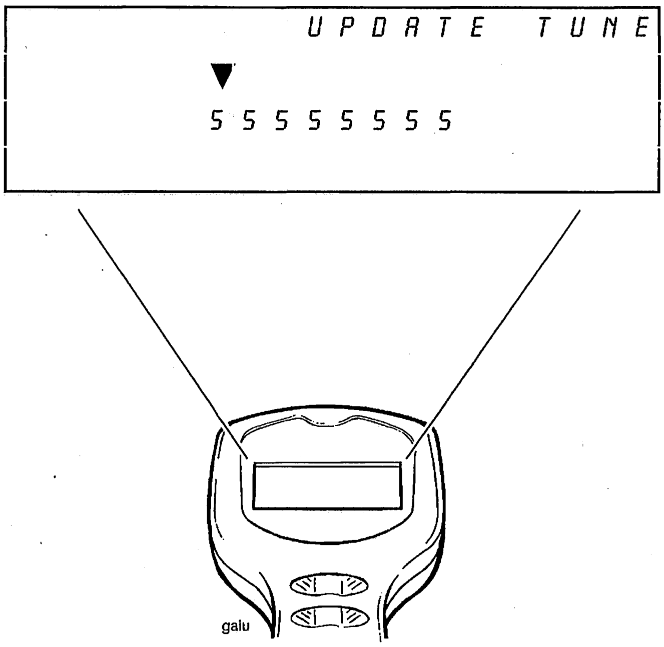
38. ADJUST TUNE (set long term fuel trim)



The electronic value of the long term fuel trim setting is automatically reset to nominal by the tool.

Press either the validate '⁎' or return (↲) to return to the main menu.

39. UPDATE TUNE



(Accessed from operation 32). On receipt of special instructions from Triumph you may be asked to input a completely new engine tune.

To do this, they will give you a Password Number which must be entered using the 'Up' and 'Down' keys in the same way as was done to enter your dealer code number.

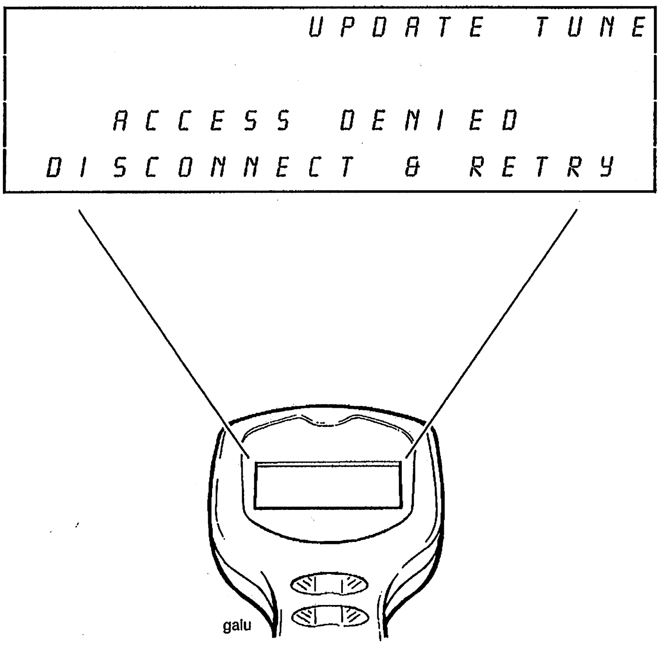
After entering the final digit, press the Validation key '⁎' again.

If the Password number entered is invalid, the screen shown in operation 40 will be displayed.

If the Password number is valid, the tool will briefly display the message, 'PLEASE WAIT, CHECKING ECM TYPE'.

'UPDATE TUNE' (operation 41) will then be displayed.

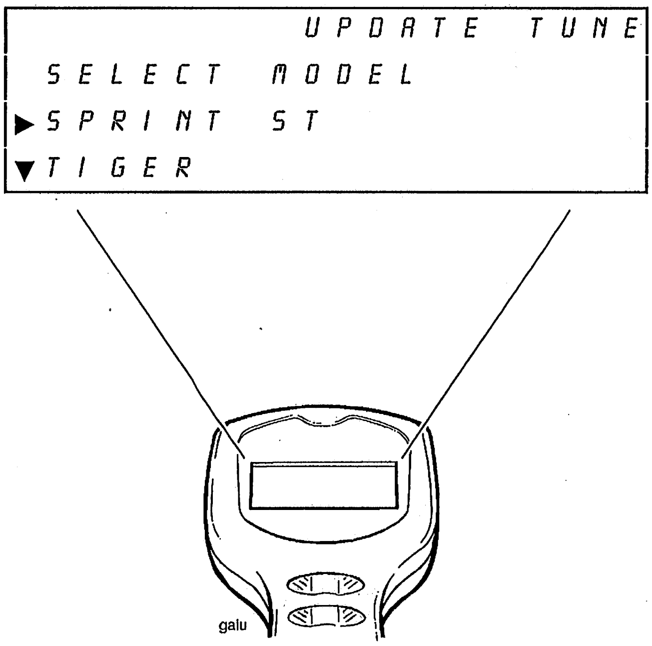
40. UPDATE TUNE



If the Password number has been incorrectly entered, the screen will display **'ACCESS DENIED'**. Press the Validation key '✱' to return to **MAIN MENU** (operation 8) and start again.

If after a second attempt the entry is still invalid, the screen will display **'ACCESS DENIED DISCONNECT AND RETRY'**. The diagnostic tool must be disconnected and the complete procedure re-started.

41. UPDATE TUNE



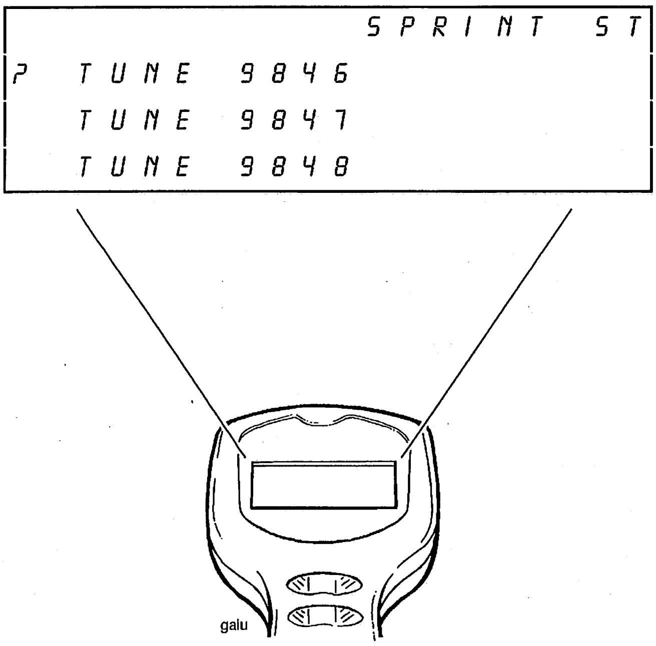
Align the cursor with the model to which a tune is to be downloaded and, when satisfied that the selection is correct, press the validation key '✱'.

The models available at the time of writing are:

- T595 Daytona (all markets except France)
- T595 Daytona (French 108 PS engine)
- Daytona 955i
- 885cc Speed Triple
- 955cc Speed Triple
- Sprint ST
- Tiger

Once a model has been selected and the validation key pressed, screen 42 will be displayed.

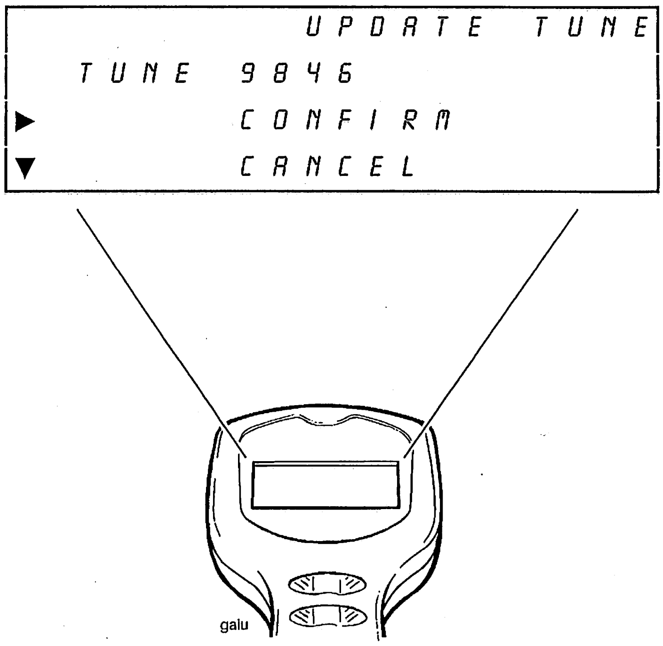
42. UPDATE TUNE



Scroll to the tune required and press the Validation key '✱' to move on to operation 43.

Press the help key for information on the applicability of each tune number.

43. UPDATE TUNE



Scroll to either **'CONFIRM'**, **'CANCEL'** or **'QUIT'** (quit option will not be visible until the text has been scrolled) then press the Validation key '✱'.

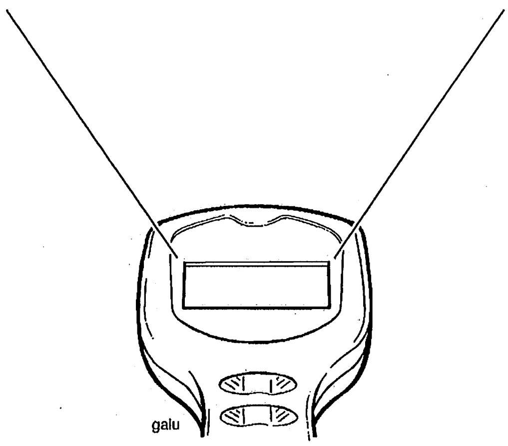
If **'QUIT'** has been selected – this will return to **MAIN MENU** (operation 8)

If **'CANCEL'** has been selected – return to operation 39.

If **'CONFIRM'** has been selected, downloading will begin.

44. UPDATE TUNE (confirm selected)

```
UPDATE TUNE
DOWNLOADING.....
10% COMPLETE
```



The screen will show **'DOWNLOADING'**, and the selected software will be automatically downloaded into the ECM.

When complete, the screen will display **'DOWNLOAD COMPLETE'**.

Press the Validation key '*' to return to the **'MAIN MENU'** (operation 8).

If downloading has been unsuccessful the screen will display **'DOWNLOAD FAILED'**.

Press the Validation key '*' to return to the **'MAIN MENU'** (operation 8).

RESTARTING TUNE DOWNLOAD

> **CAUTION: If, for any reason downloading is interrupted, the ECM will not function and tune download cannot be restarted in the normal way. This is because the tool's operating system has been erased from the ECM's memory and has not yet been fully replaced.**
>
> **Download interruption can occur for a variety of reasons such as, accidental disconnection of the tool, a flat battery, turning the ignition switch to OFF during download etc.**
>
> **In these circumstances, a special-tool key-press-sequence must be followed which is described below**

To restart download, switch the motorcycle ignition to OFF and disconnect the tool. Reconnect the tool, switch the motorcycle ignition to ON, and scroll through to the screen shown below.

```
TRIUMPH MOTORCYCLES
DIAGNOSTIC TOOL
SOFTWARE VERSION 1.0
1999
```

From this screen, use the following button press sequence:

HELP (?) - HELP (?) - RETURN (↵) - HELP (?) VALIDATE (*).

The dealer number screen will then be displayed. From that screen, download can be restarted in the normal way.

NOTE:

- **The software version number is not relevant to this procedure. All versions of the diagnostic software will operate in the way described.**

ELECTRICAL CONNECTORS

Before beginning any diagnosis, the following connector related information should be noted:

NOTE:

- **A major cause of hidden electrical faults can be traced to faulty electrical connectors. For example:**
- **Dirty/corroded terminals**
- **Damp terminals**
- **Broken or bent cable pins within multiplugs**

For example, the Electronic Control Module relies on the supply of accurate information to enable it to plan the correct fuelling and ignition timing. One dirty terminal will cause an excessive voltage drop resulting in an incorrect signal to the ECM.

If, when carrying out fault diagnosis, a fault appears to clear by simply disconnecting and reconnecting an electrical plug, examine each disconnected plug for the following.

BEFORE DISCONNECTION:

- If testing with a voltmeter, the voltage across a connector should be virtually battery volts (unless a resistor is fitted in the circuit). If there is a noticeable change, suspect faulty/dirty connections.

WHEN DISCONNECTING A CONNECTOR

- Check for a security device which must be released before the connector can be separated. E.G. barb, hook and eye etc.

WHEN INSPECTING A CONNECTOR

- Check that the individual pins have not been bent
- Check for dampness/dirt/corrosion.
- Check cables for security.
- Check cable pin joints for damage.

WHEN CONNECTING A CONNECTOR

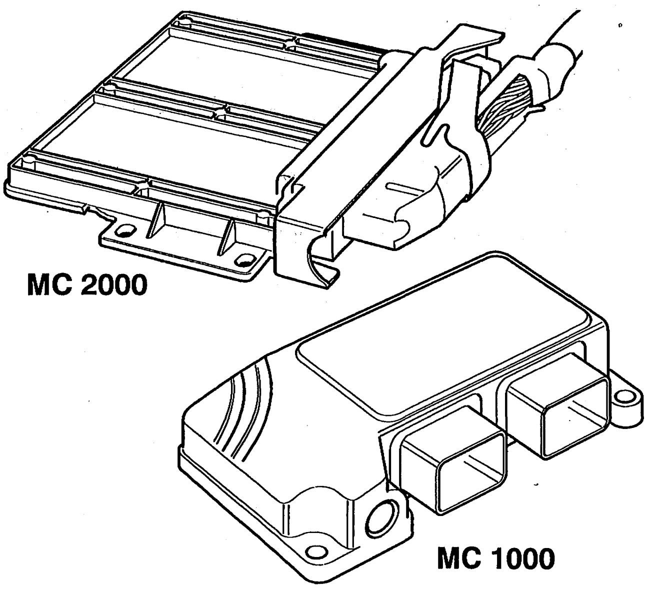
- Ensure there is no dirt around the connector/seal.
- Push together squarely to ensure terminals are not bent or incorrectly located.
- Push the two halves together positively.

Engine Control Module (ECM)

ECM Recognition

Depicted below are the early MC 2000 ECM and the later MC1000 ECM, as fitted from VIN 89737.

The later MC 1000 ECM can be easily recognised as it is physically smaller than its predecessor. In addition, the MC1000 unit has two smaller wiring connectors leading to it whereas the MC 2000 has only one large wiring connector.



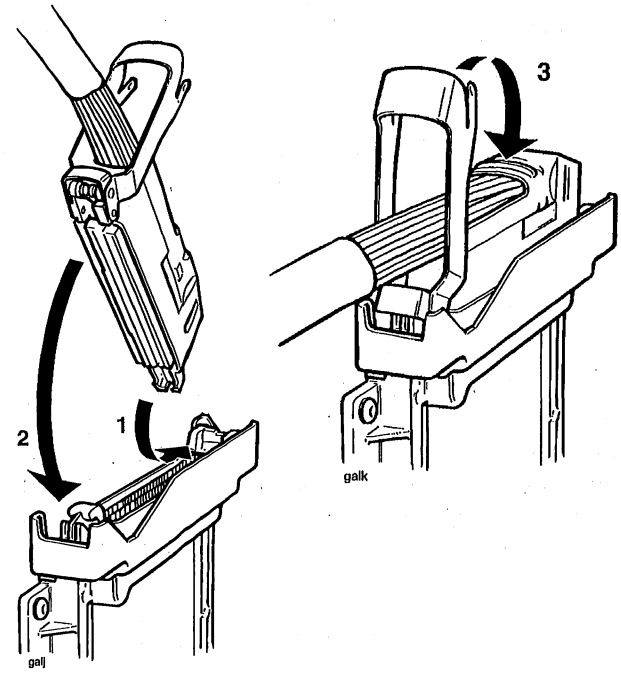
Engine Control Module (ECM) type MC 2000 (up to VIN 89736)

Many of the diagnostic routines described in the following tables call for checking of ECM connections by cable number. The following illustrations describe the method of connection and disconnection of the ECM connector.

NOTE:

- **Not all of the available cable spaces in the connector are used.**

MC 2000 Connector

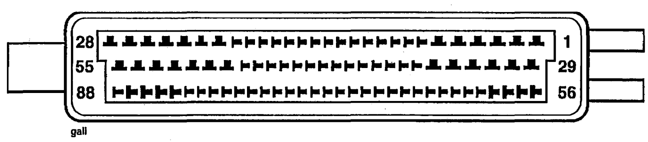


NOTE:

- **The sequence shown in the diagram above must be used when reconnecting the ECM main connector.**
  When disconnecting, reverse the sequence.

ECM Connector Pin Numbering

The diagram below shows the pin sequence of the MC 2000 ECM main connector. These pin numbers correspond directly with the pin numbers given in the diagnostic routines and schematic wiring diagrams used throughout this manual.



ECM Connector Pin Numbering

FURTHER DIAGNOSIS

The tables which follow will, if used correctly, help to pinpoint a fault in the system once a diagnostic trouble code has been stored.

In addition, a further chart which follows the electrical diagnosis section, gives advice on non-electrical fault diagnosis.

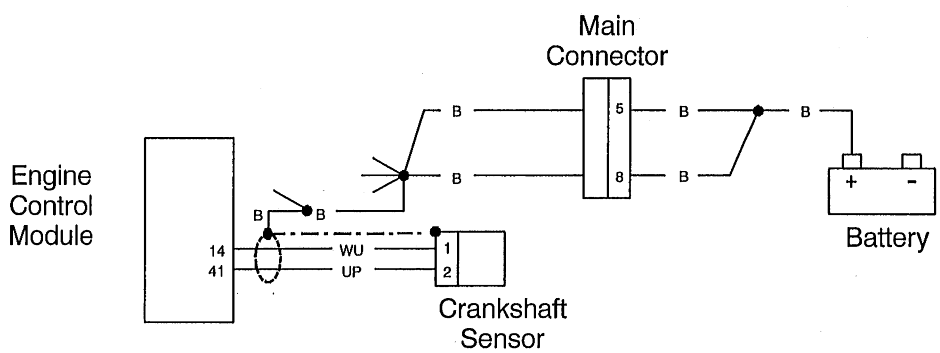
CRANKSHAFT SENSOR - MC 2000 ECM

Fault Code	Possible cause	Action
P0335	Crankshaft sensor system fault	View & note diagnostic tool 'freeze frame' data if available. Ensure sensor is fitted correctly and connector is secure. Check for 1 mm sensor air gap. Check for damaged teeth. Check for contamination by magnetic debris. Disconnect ECM and proceed to pinpoint test 1
P1335	Crank toothed wheel / screen cable fault	proceed to pinpoint test 5

Pinpoint Tests

Test	Result	Action
1 Check terminal and cable integrity: - ECM pin 14 - ECM pin 41	OK	Disconnect sensor and proceed to test 2
	Faulty	Rectify fault, proceed to test 6
2 Check cable for short circuit: - ECM pin 14 to earth - ECM pin 41 to earth	OK	Proceed to test 3
	Short circuit	Locate and rectify wiring fault, proceed to test 6
3 Check cable continuity: - ECM pin 14 to sensor pin 1 - ECM pin 41 to sensor pin 2	OK	Proceed to test 4
	Open circuit	Locate and rectify wiring fault, proceed to test 6
4 Check cable for short circuit: - ECM pin 14 to ECM pin 41	OK	Renew crankshaft sensor, proceed to test 6
	Short circuit	Locate and rectify wiring fault, proceed to test 6
5 Check cable continuity: - Sensor screen cable to earth	OK	Proceed to test 6
	Open circuit	Locate and rectify wiring fault, proceed to test 6
6 Reconnect harness, clear fault code and run engine to verify fault cleared	OK	Action complete - quit test.
	Fault still present	Contact Triumph service.

Circuit Diagram



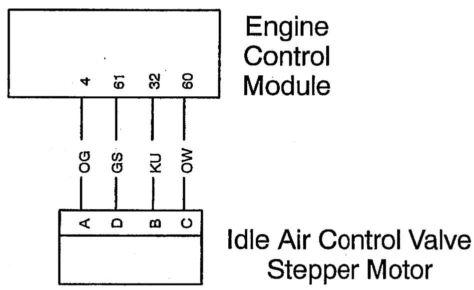
IDLE AIR CONTROL - MC 2000 ECM

Fault Code	Possible cause	Action
P0505	IACV stepper motor / wiring fault	View & note diagnostic tool 'freeze frame' data if available. View & note diagnostic tool 'sensor' data. Ensure sensor connector is secure. Disconnect ECM and proceed to pinpoint test 1

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity:	OK	Proceed to test 2
- ECM pin 4 - ECM pin 32 - ECM pin 60 - ECM pin 61	Faulty	Rectify fault, proceed to test 7
2 Check resistance value: - ECM pin 4 to ECM pin 61	47 to 59Ω	Disconnect stepper motor and proceed to test 3
- ECM pin 32 to ECM pin 60	Open circuit	Proceed to test 4
	Short circuit	Disconnect stepper motor and proceed to test 5
3 Check cable for short circuit:	OK	Proceed to test 7
- ECM pin 4 to earth - ECM pin 32 to earth - ECM pin 60 to earth - ECM pin 61 to earth	Short circuit	Locate and rectify wiring fault, proceed to test 7
4 Check cable continuity:	OK	Proceed to test 6
- ECM pin 4 to stepper motor pin A - ECM pin 32 to stepper motor pin B - ECM pin 60 to stepper motor pin C - ECM pin 61 to stepper motor pin D	Open circuit	Locate and rectify wiring fault, proceed to test 7
5 Check cable for short circuit:	OK	Proceed to test 6
- ECM pin 4 to ECM pin 61 - ECM pin 32 to ECM pin 60	Short circuit	Locate and rectify wiring fault, proceed to test 7
6 Check stepper motor resistance:	47 to 59Ω	Proceed to test 7
- Motor pin A to motor pin D - Motor pin B to motor pin C	Faulty	Renew stepper motor, proceed to test 7
7 Reconnect harness, clear fault code and run diagnostic tool function test to visually verify operation of stepper motor.	OK	Action complete - quit test.
	Fault	Contact Triumph service.

Circuit Diagram



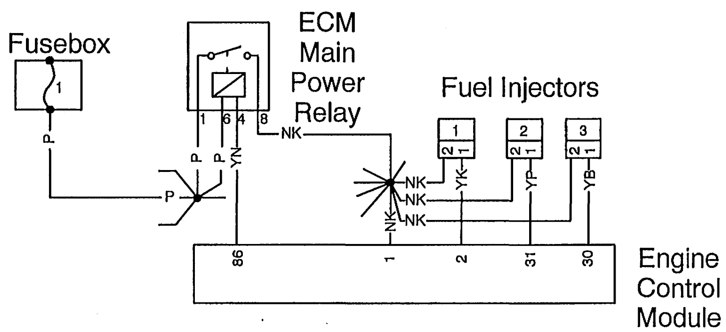
FUEL INJECTORS - MC 2000 ECM

Fault Code	Possible cause	Action
P0201/02/03	Injection system fault - Injector 1/2/3 - Misfire indicates open circuit - Flooding indicates short circuit	View & note diagnostic tool 'freeze frame' data if available. Ensure relevant injector connector is secure. Disconnect ECM and proceed to pinpoint test 1
P1201/02/03	Open or short circuit - Injector 1/2/3	
P1205/06/07	Short circuit to battery+ - Injector 1/2/3	Disconnect relevant injector and proceed to pinpoint test 5

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity:	OK	Proceed to test 2
- ECM pin 2 - ECM pin 30 - ECM pin 31	Faulty	Rectify fault, proceed to test 7
2 Check resistance value: - ECM pin 1 to ECM pin 2 (injector 1)	15.5 to 16.3Ω	Disconnect relevant injector and proceed to test 3
- ECM pin 1 to ECM pin 31 (injector 2) - ECM pin 1 to ECM pin 30 (injector 3)	Open circuit	Proceed to test 4
	Short circuit	Disconnect relevant injector and proceed to test 5
3 Check cable for short circuit:	OK	Proceed to test 7
- ECM pin 2 to earth - ECM pin 31 to earth - ECM pin 30 to earth	Short circuit	Locate and rectify wiring fault, proceed to test 7
4 Check cable continuity:	OK	Proceed to test 6
- ECM pin 1 to relevant injector pin 2 - ECM pin 2 to injector 1 pin 1 - ECM pin 31 to injector 2 pin 1 - ECM pin 30 to injector 3 pin 1	Open circuit	Locate and rectify wiring fault, proceed to test 7
5 Check cable for short circuit:	OK	Proceed to test 6
- ECM pin 1 to ECM pin 2 (injector 1) - ECM pin 1 to ECM pin 31 (injector 2) - ECM pin 1 to ECM pin 30 (injector 3)	Short circuit	Locate and rectify wiring fault, proceed to test 7
6 Check relevant injector resistance:	15.5 to 16.3Ω	Proceed to test 7
- Injector pin 1 to injector pin 2	Faulty	Renew relevant injector, proceed to test 7
7 Reconnect harness, clear fault code and run engine to verify fault cleared.	OK	Action complete - quit test.
	Fault still present	Contact Triumph service.

Circuit Diagram



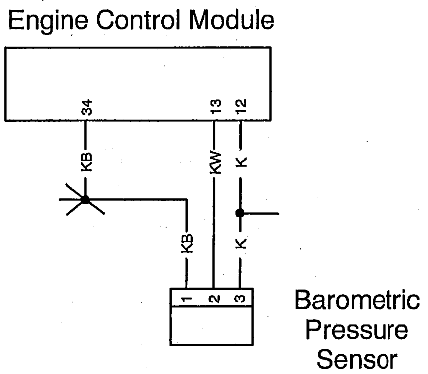
BAROMETRIC PRESSURE SENSOR - MC 2000 ECM

Fault Code	Possible cause	Action
P0105	Barometric pressure sensor / wiring fault	View & note diagnostic tool 'freeze frame' data if available. View & note diagnostic tool 'sensor' data. Ensure sensor connector is secure. Disconnect ECM and proceed to pinpoint test 1

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity: - ECM pin 12	OK	Disconnect sensor and proceed to test 2
- ECM pin 13 - ECM pin 34	Faulty	Rectify fault, proceed to test 5
2 Check cable for short circuit:	OK	Proceed to test 3
- ECM pin 13 to earth	Short circuit	Locate and rectify wiring fault, proceed to test 5
3 Check cable continuity:	OK	Proceed to test 4
- ECM pin 34 to sensor pin 1 - ECM pin 13 to sensor pin 2 - ECM pin 12 to sensor pin 3	Open circuit	Locate and rectify wiring fault, proceed to test 5
4 Check cable for short circuit: - ECM pin 13 to ECM pin 12	OK	Renew barometric pressure sensor, proceed to test 5
- ECM pin 13 to ECM pin 34	Short circuit	Locate and rectify wiring fault, proceed to test 5
5 Reconnect harness, clear fault code and run engine to verify fault cleared.	OK	Action complete - quit test.
	Fault still present	Contact Triumph service.

Circuit Diagram



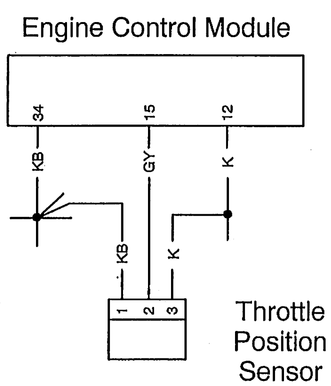
THROTTLE POSITION SENSOR - MC 2000 ECM

Fault Code	Possible cause	Action
P0120 P0122 P0123	Throttle position sensor system fault Sensor low input voltage Sensor high input voltage	View & note diagnostic tool 'freeze frame' data if available. View & note diagnostic tool 'sensor' data. Ensure sensor connector is secure. Disconnect ECM and proceed to pinpoint test 1

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity: - ECM pin 12	OK	Disconnect sensor and proceed to test 2
- ECM pin 15 - ECM pin 34	Faulty	Rectify fault, proceed to test 5
2 Check cable for short circuit:	OK	Proceed to test 3
- ECM pin 15 to earth	Short circuit	Locate and rectify wiring fault, proceed to test 5
3 Check cable continuity:	OK	Proceed to test 4
- ECM pin 34 to sensor pin 1 - ECM pin 15 to sensor pin 2 - ECM pin 12 to sensor pin 3	Open circuit	Locate and rectify wiring fault, proceed to test 5
4 Check cable for short circuit: - ECM pin 15 to ECM pin 12	OK	Renew throttle position sensor, proceed to test 5
- ECM pin 15 to ECM pin 34	Short circuit	Locate and rectify wiring fault, proceed to test 5
5 Reconnect harness, clear fault code and run engine to verify fault cleared.	OK	Action complete - quit test.
	Fault still present	Contact Triumph service.

Circuit Diagram



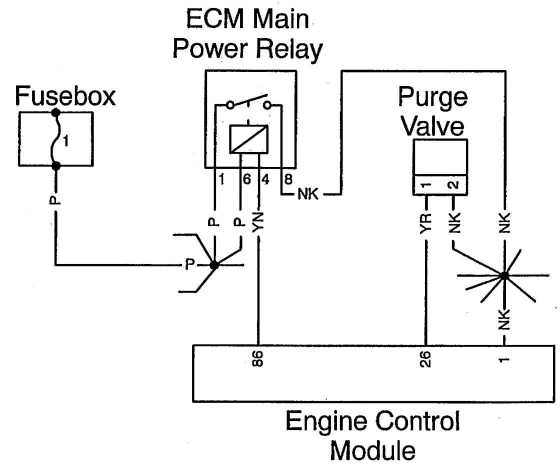
PURGE VALVE - MC 2000 ECM

Fault Code	Possible cause	Action
P0443	Purge valve system fault	View & note diagnostic tool 'sensor' data. Ensure purge valve connector is secure. Disconnect ECM and proceed to pinpoint test 1
P0444	Open circuit or short circuit to earth	
P0445	Short circuit to battery+	disconnect purge valve and proceed to pinpoint test 5

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity:	OK	Proceed to test 2
- ECM pin 26	Faulty	Rectify fault, proceed to test 7
2 Check resistance value: - ECM pin 1 to ECM pin 26	26Ω	Disconnect purge valve and proceed to test 3
	Open circuit	Proceed to test 4
	Short circuit	Disconnect purge valve and proceed to test 5
3 Check cable for short circuit:	OK	Proceed to test 7
- ECM pin 26 to earth	Short circuit	Locate and rectify wiring fault, proceed to test 7
4 Check cable continuity:	OK	Proceed to test 6
- ECM pin 26 to valve pin 1 - ECM pin 1 to valve pin 2	Open circuit	Locate and rectify wiring fault, proceed to test 7
5 Check cable for short circuit:	OK	Proceed to test 6
- ECM pin 1 to ECM pin 26	Short circuit	Locate and rectify wiring fault, proceed to test 7
6 Check purge valve resistance:	26Ω	Proceed to test 7
- Valve pin 1 to valve pin 2	Faulty	Renew purge valve, proceed to test 7
7 Reconnect harness, clear fault code and run diagnostic tool function test to visually verify operation of purge valve.	OK	Action complete - quit test.
	Fault	Contact Triumph service.

Circuit Diagram



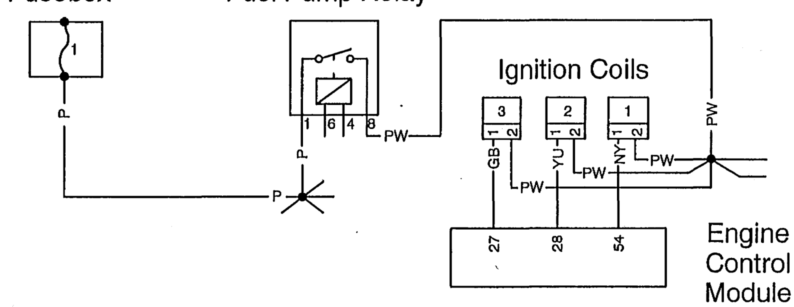
IGNITION COILS - MC 2000 ECM

Fault Code	Possible cause	Action
P0351/52/53	Ignition system fault - Ign coil 1/2/3	View & note diagnostic tool 'freeze frame' data if available. Ensure relevant ign coil connector is secure. Disconnect ECM and proceed to pinpoint test 1:-
P1351/52/53	Open or short circuit - Ign coil 1/2/3	
P1355/56/57	Short circuit to battery+ - Ign coil 1/2/3	disconnect relevant ign coil and proceed to pinpoint test 5

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity:	OK	Proceed to test 2
- ECM pin 27 - ECM pin 28 - ECM pin 54	Faulty	Rectify fault, proceed to test 7
2 Check resistance value: Fuel pump relay pin 8 to	0.8Ω	Disconnect relevant ign coil and proceed to test 3
- ECM pin 54 (ign coil 1) - ECM pin 28 (ign coil 2)	Open circuit	Proceed to test 4
- ECM pin 27 (ign coil 3)	Short circuit	Disconnect relevant ign coil and proceed to test 5
3 Check cable for short circuit:	OK	Proceed to test 7
- ECM pin 27 to earth - ECM pin 28 to earth - ECM pin 54 to earth	Short circuit	Locate and rectify wiring fault, proceed to test 7
4 Check cable continuity:	OK	Proceed to test 6
- Fuel pump relay pin 8 to any ign coil pin 2 - ECM pin 54 to ign coil 1 pin 1 - ECM pin 28 to ign coil 2 pin 1 - ECM pin 27 to ign coil 3 pin 1	Open circuit	Locate and rectify wiring fault, proceed to test 7
5 Check cable for short circuit:	OK	Proceed to test 6
Fuel pump relay pin 8 to - ECM pin 54 (ign coil 1) - ECM pin 28 (ign coil 2) - ECM pin 27 (ign coil 3)	Short circuit	Locate and rectify wiring fault, proceed to test 7
6 Check relevant ign coil resistance:	0.8Ω	Proceed to test 7
- Ign coil pin 1 to ign coil pin 2	Faulty	Renew relevant ign coil, proceed to test 7
7 Reconnect harness, clear fault code and run engine to verify fault cleared.	OK	Action complete - quit test.
	Fault still present	Contact Triumph service.

Circuit Diagram



COOLANT TEMPERATURE SENSOR - MC 2000 ECM

Fault Code	Possible cause	Action
P0115	Coolant temperature system fault	View & note diagnostic tool 'freeze frame' data if available. View & note diagnostic tool 'sensor' data. Ensure sensor connector is secure. Disconnect ECM and proceed to pinpoint test 1:-
P0117	Open circuit, or short circuit to battery+	
P0118	Short circuit to earth	disconnect sensor and proceed to test 6
P0119	Voltage signal too high	proceed to pinpoint test 4

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity:	OK	Proceed to test 2
- ECM pin 34 - ECM pin 46	Faulty	Rectify fault, proceed to test 7
2 Check resistance value: - ECM pin 46 to ECM pin 34	OK	Disconnect temp sensor and proceed to test 6
(Temperature dependent - see data	Open circuit	Disconnect temperature sensor and proceed to test 3
below)	Short circuit	Disconnect temp sensor and proceed to test 4
3 Check cable continuity:	OK	Proceed to test 5
- ECM pin 46 to sensor pin 1 - ECM pin 34 to sensor pin 2	Open circuit	Locate and rectify wiring fault, proceed to test 7
4 Check cable for short circuit:	OK	Proceed to test 5
- ECM pin 46 to ECM pin 34	Short circuit	Locate and rectify wiring fault, proceed to test 7
5 Check sensor resistance:	OK	Proceed to test 7
- Sensor pin 1 to sensor pin 2 (Temperature dependent - see data below)	Faulty	Renew temp sensor, proceed to test 7
6 Check cable for short circuit:	OK	Proceed to test 7
- ECM pin 46 to earth	Short circuit	Locate and rectify wiring fault, proceed to test 7
7 Reconnect harness, clear fault code and run engine to verify fault cleared.	OK	Action complete - quit test.
	Fault	Contact Triumph service.

Resistance data under typical conditions:

Warm engine - 200 to 400Ω.

Cold engine:

20ºC ambient 2.35 to 2.65KΩ.

10ºC ambient 3.60 to 4.00KΩ.

0ºC ambient 5.60 to 6.25KΩ

Circuit Diagram

Refer to page 9.69 for circuit diagram

INLET AIR TEMPERATURE SENSOR - MC 2000 ECM

Fault Code	Possible cause	Action
P0110	Inlet air temperature system fault	View & note diagnostic tool 'freeze frame' data if available. View & note diagnostic tool 'sensor' data. Ensure sensor connector is secure. Disconnect ECM and proceed to pinpoint test 1:-
P0113	Open circuit, or short circuit to battery+	
P0112	Short circuit to earth	disconnect sensor and proceed to pinpoint test 6

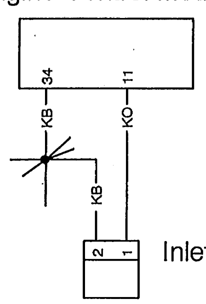
Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity:	OK	Proceed to test 2
- ECM pin 34 - ECM pin 11	Faulty	Rectify fault, proceed to test 7
2 Check resistance value: - ECM pin 11 to ECM pin 34	OK	Disconnect temp sensor and proceed to test 6
(Temperature dependent - see data	Open circuit	Disconnect temp sensor and proceed to test 3
below)	Short circuit	Disconnect temp sensor and proceed to test 4
3 Check cable continuity:	OK	Proceed to test 5
- ECM pin 11 to sensor pin 1 - ECM pin 34 to sensor pin 2	Open circuit	Locate and rectify wiring fault, proceed to test 7
4 Check cable for short circuit:	OK	Proceed to test 5
- ECM pin 11 to ECM pin 34	Short circuit	Locate and rectify wiring fault, proceed to test 7
5 Check sensor resistance:	OK	Proceed to test 7
- Sensor pin 1 to sensor pin 2 (Temperature dependent - see data below)	Faulty	Renew temp sensor, proceed to test 7
6 Check cable for short circuit:	OK	Proceed to test 7
- ECM pin 11 to earth	Short circuit	Locate and rectify wiring fault, proceed to test 7
7 Reconnect harness, clear fault code and run engine to verify fault cleared.	OK	Action complete - quit test.
	Fault	Contact Triumph service.

If engine is warm, remove sensor and allow time to cool to ambient prior to test. Resistance data:

Ambient temp	Resistance value
30ºC	1.6 to 1.8KΩ
25ºC	1.9 to 2.2KΩ
20ºC	2.3 to 2.7KΩ
15ºC	2.9 to 3.3KΩ
10ºC	3.5 to 4.0KΩ
5ºC	4.4 to 4.9KΩ
0ºC	5.5 to 6.1KΩ

Circuit Diagram Engine Control Module



Inlet Air Temperature Sensor

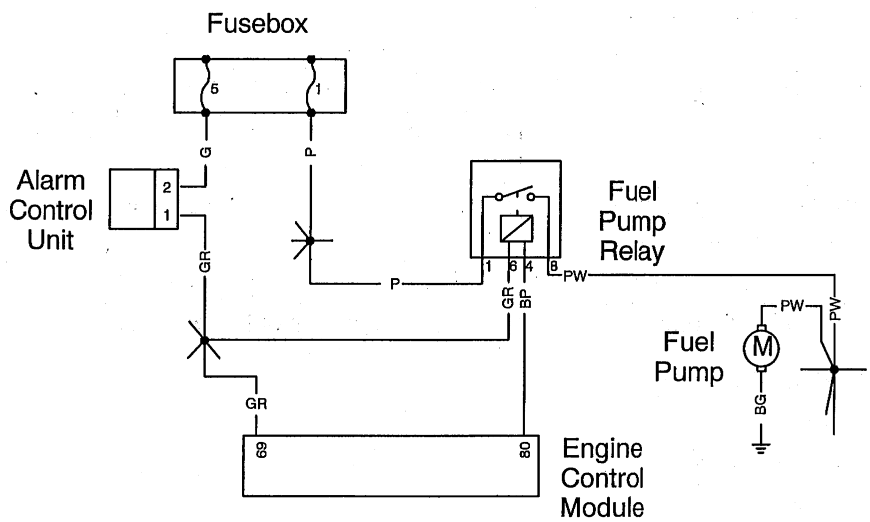
FUEL PUMP RELAY - MC 2000 ECM

Fault Code	Possible cause	Action
P0230	Fuel pump relay system fault	Check if pump runs briefly when ignition is switched on. Ensure relay connector is secure and relay is operational - renew if faulty. Disconnect ECM and proceed to pinpoint test 1:-
P1231	Open circuit, or short circuit to earth	
P1232	Short circuit to battery+	Disconnect relay and proceed to pinpoint test 4

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity: - ECM pin 80	OK	Disconnect relay and proceed to test 2
	Faulty	Rectify fault, proceed to test 5
2 Check cable for short circuit: - ECM pin 80 to earth	OK	Proceed to test 3
	Short circuit	Locate and rectify wiring fault, proceed to test 5
3 Check cable continuity: - ECM pin 80 to relay pin4 - Relay pin 6 to alarm control unit pin1	OK	Proceed to test 4
	Open circuit	Locate and rectify wiring fault, proceed to test 5
4 Check cable for short circuit: - ECM pin 80 to ECM pin 69	OK	Proceed to test 5
	Short circuit	Locate and rectify wiring fault, proceed to test 5
5 Reconnect harness, clear fault code and run diagnostic tool function test to verify fault cleared.	OK	Action complete - quit test.
	Fault still present	Contact Triumph service.

Circuit Diagram



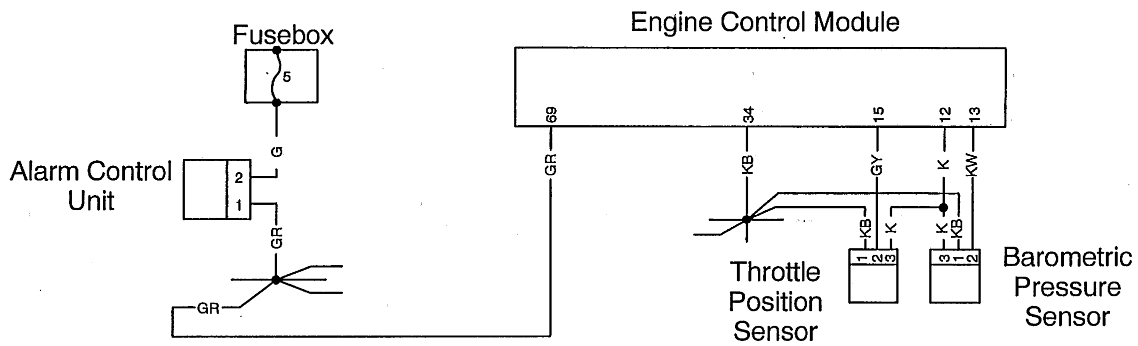
SENSOR SUPPLY VOLTAGE - MC 2000 ECM

Fault Code	Possible cause	Action
P1560	Engine control module / wiring fault	View & note diagnostic tool 'sensor' data. Disconnect ECM and proceed to pinpoint test 1

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity: - ECM pin 12	OK	Disconnect throttle position sensor and air pressure sensor, proceed to test 2
	Faulty	Rectify fault, proceed to test 4
2 Check for short circuit:	OK	Reconnect ECM, proceed to test 3
- ECM pin 12 to ECM pin 34	Short circuit	Locate and rectify wiring fault, proceed to test 4
3 With ignition 'on', check voltage at:	4.5 to 5.5v	Proceed to test 4
- barometric pressure sensor pin 3 or throttle position sensor pin 3.	Faulty	Check for wiring fault between ECM and sensors, if wiring is OK, renew ECM, proceed to test 4
4 Reconnect harness, clear fault code and run engine to verify fault cleared.	OK	Action complete - quit test.
	Fault still present	Contact Triumph service.

Circuit Diagram



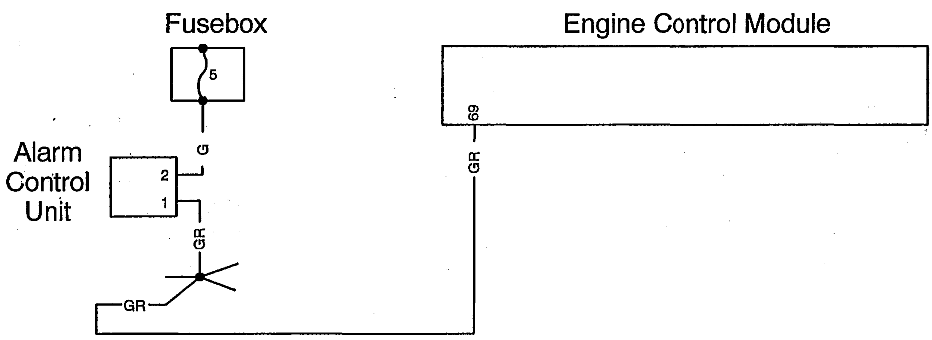
SYSTEM VOLTAGE - MC 2000 ECM

Fault Code	Possible cause	Action
P0560	Bike voltage system fault	View & note diagnostic tool 'sensor' data. Ensure voltage across battery is acceptable, note voltage.
P0562	Wiring / alternator / battery fault - low voltage	Disconnect ECM and proceed to pinpoint test 1
P0563	Alternator fault - high voltage	Ensure alternator output voltage is acceptable, note voltage.

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity:	OK	Proceed to test 2
- ECM pin 69	Faulty	Rectify fault, proceed to test 3
2 With Ignition 'on', check voltage at: - ECM pin 69	Same as 'across battery' voltage	Proceed to test 3
	Less than 'across battery' voltage	Locate and rectify wiring fault, proceed to test 3
3 Reconnect harness, clear fault code and run engine to verify fault cleared.	OK	Action complete - quit test
	Fault still present	Contact Triumph service

Circuit Diagram



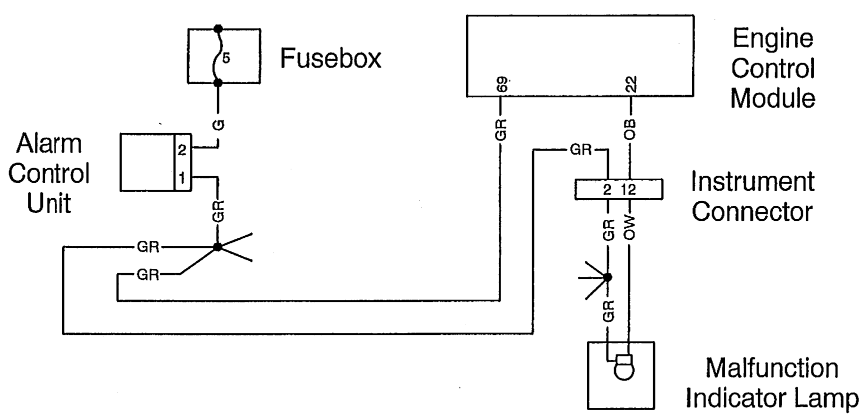
MALFUNCTION INDICATION LAMP - MC 2000 ECM

Fault Code	Possible cause	Action
P1600	MIL system fault	Ensure warning lamp connector is secure and bulb is operational - renew if faulty. Disconnect ECM and proceed to pinpoint test 1:-
P1601	Open circuit, or short circuit to earth	
P1602	Short circuit to battery+	Disconnect instrument connector, remove bulb and proceed to test 4

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity: - ECM pin 22	OK	Disconnect instrument connector and proceed to test 2
	Faulty	Rectify fault, proceed to test 5
2 Check cable for short circuit:	OK	Remove bulb and proceed to test 3
- ECM pin 22 to earth	Short circuit	Locate and rectify wiring fault, proceed to test 5
3 Check cable continuity:	OK	Proceed to test 4
- Instrument plug pin 12 to ECM pin 22 - Instrument plug pin 2 to alarm pin 1 - Instrument plug pin 2 to bulb holder (GR) - Instrument plug pin 12 to bulb holder (OW)	Open circuit	Locate and rectify wiring fault, proceed to test 5
4 Check for short circuit:	OK	Proceed to test 5
- ECM pin 22 to ECM pin 69 - Instrument plug pin 2 to instrument plug pin 12	Short circuit	Locate and rectify wiring fault, proceed to test 5
5 Reconnect harness, refit bulb, clear fault code and switch ignition 'on' to verify fault cleared	OK	Action complete - quit test
	Fault still present	Contact Triumph service

Circuit Diagram



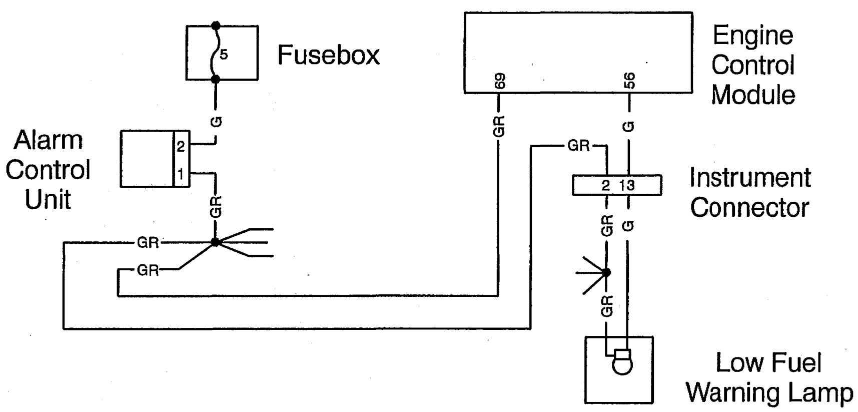
LOW FUEL LEVEL WARNING LAMP - MC 2000 ECM

Fault Code	Possible cause	Action
P1610	Low fuel warning lamp - system fault	Ensure warning lamp connector is secure and bulb is operational - renew if faulty. Disconnect ECM and proceed to pinpoint test 1:-
P1611	Open circuit, or short circuit to earth	
P1612	Short circuit to battery+	Disconnect instrument connector, remove bulb and proceed to test 4

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity: - ECM pin 56	OK	Disconnect instrument connector and proceed to test 2
	Faulty	Rectify fault, proceed to test 5
2 Check cable for short circuit: - ECM pin 56 to earth	OK	Remove bulb and proceed to test 3
	Short circuit	Locate and rectify wiring fault, proceed to test 5
3 Check cable continuity: - Instrument plug pin 13 to ECM pin 56 - Instrument plug pin 2 to alarm pin 1 - instrument plug pin 2 to bulb holder (GR) - instrument plug pin 13 to bulb holder (G)	OK	Proceed to test 4
	Open circuit	Locate and rectify wiring fault, proceed to test 5
4 Check for short circuit: - ECM pin 56 to ECM pin 69 - Instrument plug pin 2 to instrument plug pin 13	OK	Proceed to test 5
	Short circuit	Locate and rectify wiring fault, proceed to test 5
5 Reconnect harness, refit bulb, clear fault code and switch ignition 'on' to verify fault cleared	OK	Action complete - quit test
	Fault still present	Contact Triumph service

Circuit Diagram



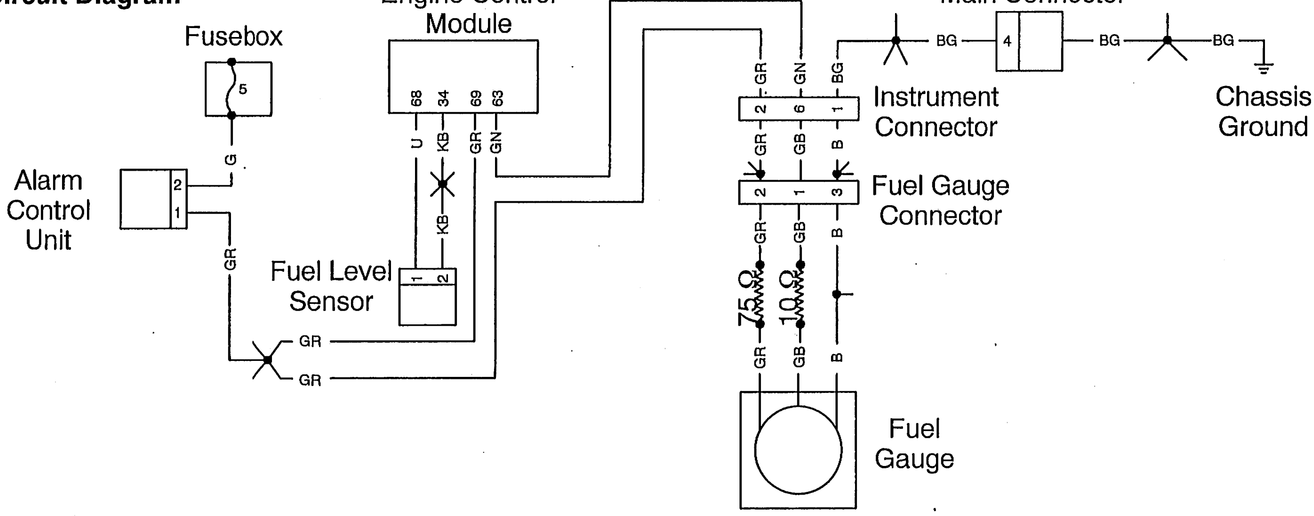
FUEL GAUGE - MC 2000 ECM

Fault Code	Possible cause	Action
P1620	Fuel gauge system fault	View & note 'freeze frame' data if available. View & note 'sensor' data. Ensure fuel gauge connector is secure. Disconnect ECM and proceed to pinpoint test 1:-
P1621	Open circuit, or short circuit to earth	
P1622	Short circuit to battery+	Disconnect fuel gauge and proceed to pinpoint test 4

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity: - ECM pin 63	OK	Disconnect fuel gauge and proceed to test 2
	Faulty	Rectify fault, proceed to test 5
2 Check cable for short circuit: - ECM pin 63 to earth	OK	Proceed to test 3
	Short circuit	Locate and rectify wiring fault, proceed to test 5
3 Check cable continuity: - Fuel gauge pin 1 to ECM pin 63 - Fuel gauge pin 3 to earth - Fuel gauge pin 2 to alarm control unit pin 1	OK	Proceed to test 4
	Open circuit	Locate and rectify wiring fault, proceed to test 5
4 Check cable for short circuit: ECM pin 63 to ECM pin 69	OK	Renew fuel gauge, proceed to test 5
	Short circuit	Locate and rectify wiring fault, proceed to test 5
5 Reconnect harness, clear fault code and run diagnostic tool function test to visually verify operation of fuel gauge	OK	Action complete - quit test
	Fault still present	Contact Triumph service

Circuit Diagram



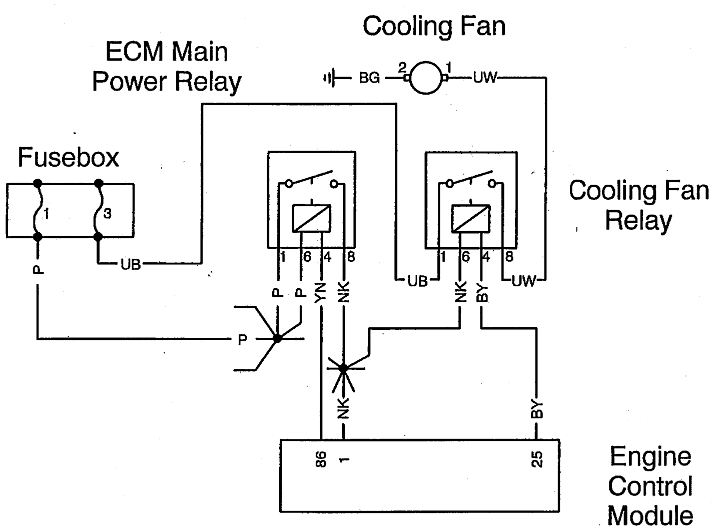
COOLING FAN RELAY - MC 2000 ECM

Fault Code	Possible cause	Action
P1551	Cooling fan relay system fault	View & note diagnostic tool 'sensor' data. Ensure relay connector is secure and relay is operational – renew if faulty. Disconnect ECM and proceed to pinpoint test1:-
P1552	Open circuit, or short circuit to earth	
P1553	Short circuit to battery+	Disconnect relay and proceed to pinpoint test 4

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity:	OK	Disconnect relay and proceed to test 2
- ECM pin 25	Faulty	Rectify fault, proceed to test 5
2 Check cable for short circuit:	OK	Proceed to test 3
- ECM pin 25 to earth	Short circuit	Locate and rectify wiring fault, proceed to test 5
3 Check cable continuity:	OK	Proceed to test 4
- Relay pin 4 to ECM pin 25 - Relay pin 6 to ECM relay pin 8	Open circuit	Locate and rectify wiring fault, proceed to test 5
4 Check cable for short circuit:	OK	Proceed to test5
- ECM pin 25 to ECM pin 1	Short circuit	Locate and rectify wiring fault, proceed to test 5
5 Reconnect harness, clear fault code and run diagnostic tool function test to visually verify operation of cooling fan	OK	Action complete - quit test
	Fault still present	Contact Triumph service

Circuit Diagram



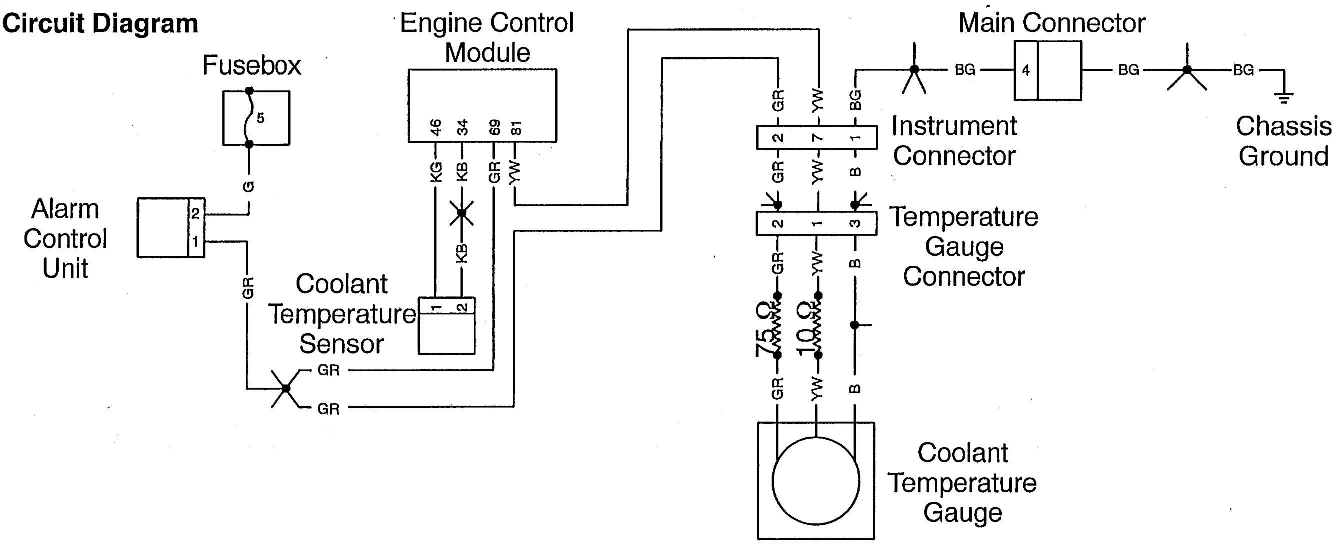
COOLANT TEMPERATURE GAUGE - MC 2000 ECM

Fault Code	Possible cause	Action
P1115	Temperature gauge system fault	View & note 'freeze frame' data if available. View & note 'sensor' data. Ensure temp gauge connector is secure. Disconnect ECM and proceed to pinpoint test 1:-
P1116	Open circuit, or short circuit to earth	
P1117	Short circuit to battery+	Disconnect temp gauge and proceed to pinpoint test 4

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity: - ECM pin 81	OK	Disconnect temp gauge and proceed to test 2
	Faulty	Rectify fault, proceed to test 5
2 Check cable for short circuit: - ECM pin 81 to earth	OK	Proceed to test 3
	Short circuit	Locate and rectify wiring fault, proceed to test 5
3 Check cable continuity: - Temp gauge pin 1 to ECM pin 81 - Temp gauge pin 3 to earth - Temp gauge pin 2 to alarm control unit pin 1	OK	Proceed to test 4
	Open circuit	Locate and rectify wiring fault, proceed to test 5
4 Check cable for short circuit: ECM pin 81 to ECM pin 69	OK	Renew temp gauge, proceed to test 5
	Short circuit	Locate and rectify wiring fault, proceed to test 5
5 Reconnect harness, clear fault code and run diagnostic tool function test to visually verify operation of temp gauge	OK	Action complete - quit test
	Fault still present	Contact Triumph service

Circuit Diagram



LAMBDA SENSOR - MC 2000 ECM

Fault Code	Possible Cause	Action
P0131	Open Circuit or Short Circuit to Battery. Poor electrical contact between exhaust and ECM ground.	View and note freeze frame data. Ensure Lambda sensor connector is secure. Disconnect ECM and proceed to pinpoint test 1.
P0132	Open Circuit or Short Circuit to Battery.	Proceed to pinpoint test 1.
P1133	Faulty Lambda Sensor	Replace Lambda Sensor
P0135	Open Circuit or Short circuit	Proceed to test 6

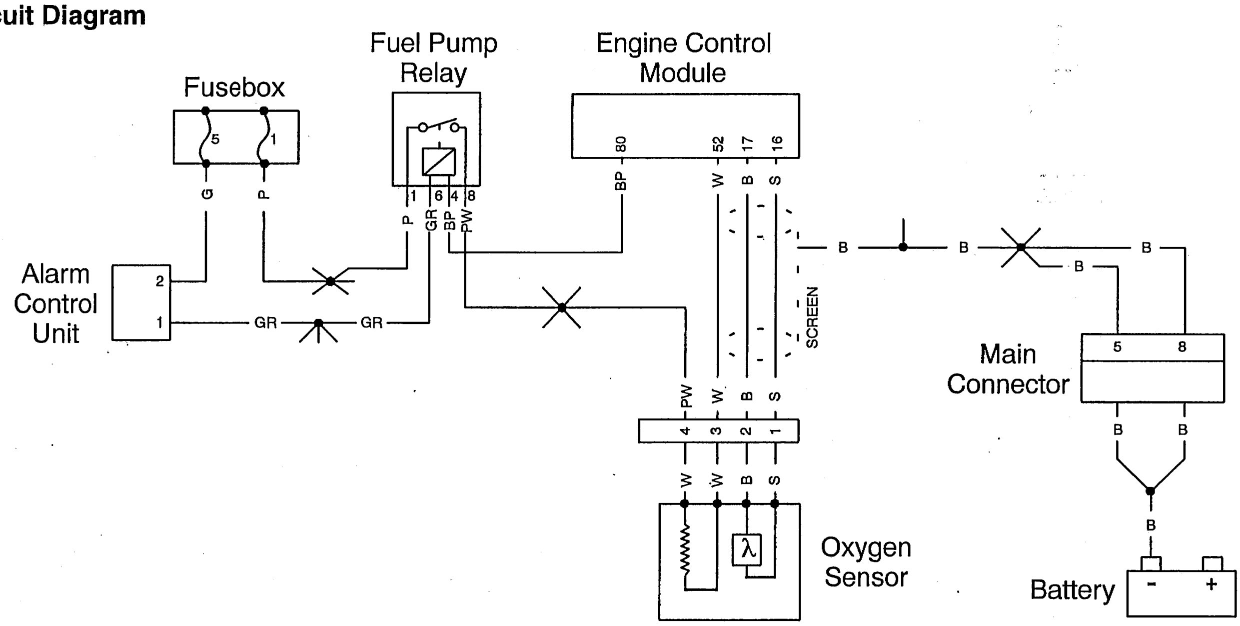
Pinpoint Tests

Test	Result	Action
1. Check cable and terminal integrity. - ECM Pin 16 - ECM Pin 17	OK	Disconnect Sensor and proceed to test 2.
	Faulty	Rectify Fault and proceed to test 11.
2. Check cable continuity - ECM Pin 16 to Sensor Pin 1 - ECM Pin 17 to Sensor Pin 2	OK	Proceed to test 3.
	Faulty	Locate and rectify wiring fault. Proceed to test 11.
3. Check for short circuit to ground. - ECM Pin 16 - ECM Pin 17	OK	Proceed to test 4.
	Faulty	Locate and rectify fault. Proceed to test 11.
4. Check for short circuit to battery. - ECM Pin 16 - ECM Pin 17	OK	Proceed to test 5
	Faulty	Locate and rectify fault. Proceed to test 11.
5. Check continuity between sensor boss and battery negative terminal.	OK	Replace Lambda Sensor and proceed to test 11.
	Faulty	Locate and rectify fault and proceed to test 11.
6. Check cable and terminal integrity. - ECM Pin 52	OK	Disconnect sensor and proceed to test 7.
	Faulty	Rectify and proceed to test 11.
7. Check cable continuity - ECM Pin 52 to Sensor Pin 3 - ECM Relay Pin 8 to Sensor Pin 4	OK	Proceed to test 8.
	Faulty	Rectify wiring fault and proceed to test 11.
8. Check for short circuit to ground - ECM Pin 52	OK	Proceed to test 9.
	Faulty	Rectify wiring fault and proceed to test 11.

Pinpoint Tests(continued)

Test	Result	Action
9. Check for short circuit to battery - ECM Pin 52	OK	Proceed to test 10.
	Faulty	Rectify wiring fault and proceed to test 11.
10. Check resistance of Lambda sensor heater	4Ω to 8Ω	Proceed to test 11.
	Faulty	Replace Lambda Sensor and proceed to test 11.
11. Reconnect harness, clear fault code and switch ignition key 'ON' to verify fault cleared.	OK	Action complete – Quit test.
	Fault still present	Contact Triumph Service

Circuit Diagram



LAMBDA SENSOR (Short Term Feedback) - MC 2000 ECM

Fault Code	Possible Cause	Action
P0170	Fault Code P1171 or P1172 will be present.	View and note freeze frame data. Ensure sensor connector is secure.
P1171	Wiring fault, Air leak, low fuel pressure, faulty purge system, faulty sensor.	Disconnect ECM connector and proceed to test 1.
P1172	Wiring fault, high fuel pressure, faulty purge system, faulty sensor.	Disconnect ECM connector and proceed to test 1.

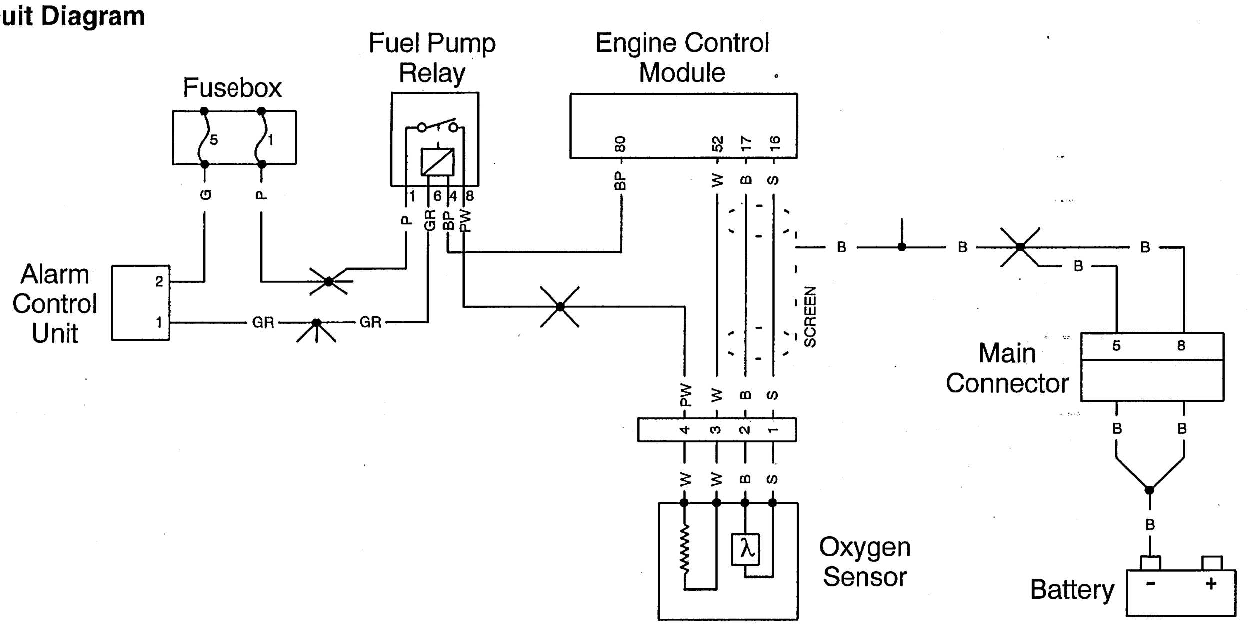
Pinpoint Tests

Test	Result	Action
1. Check cable and terminal integrity. - ECM Pin 16 - ECM Pin 17	OK	Disconnect Sensor and proceed to test 2.
	Faulty	Rectify Fault and proceed to test 10.
2. Check cable continuity - ECM Pin 16 to Sensor Pin 1 - ECM Pin 17 to Sensor Pin 2	OK	Disconnect Sensor and proceed to test 3.
	Faulty	Locate and rectify wiring fault. Proceed to test 10.
3. Check for short circuit to ground. - ECM Pin 16 - ECM Pin 17	OK	Proceed to test 4.
	1.Faulty	Locate and rectify fault. Proceed to test 10.
4. Check for short circuit to battery. - ECM Pin 16 - ECM Pin 17	OK	Proceed to test 5
	Faulty	Locate and rectify fault. Proceed to test 10.
5. Check continuity between sensor boss and battery negative terminal.	OK	Proceed to test 6.
	Faulty	Locate and rectify fault and proceed to test 10.
6. Check for air leaks into the intake system	OK	Proceed to test 7.
	Faulty	Rectify air leak and proceed to test 10.
7. Check fuel rail pressure.	OK	Proceed to test 8.
	Faulty	Rectify and proceed to test 10.
8. Check integrity of purge system pipes, valve and canister.	OK	Proceed to test 9
	Faulty	Rectify and proceed to test 10.

Pinpoint Tests(continued)

Test	Result	Action
9. Check purge valve is not stuck open.	OK	Replace Lambda Sensor and proceed to test 10
	Faulty	Replace purge valve and proceed to test 10
10. Reconnect harness, clear fault code and switch ignition key 'ON' to verify fault cleared.	OK	Action complete – Quit test.
	Fault still present	Contact Triumph Service

Circuit Diagram



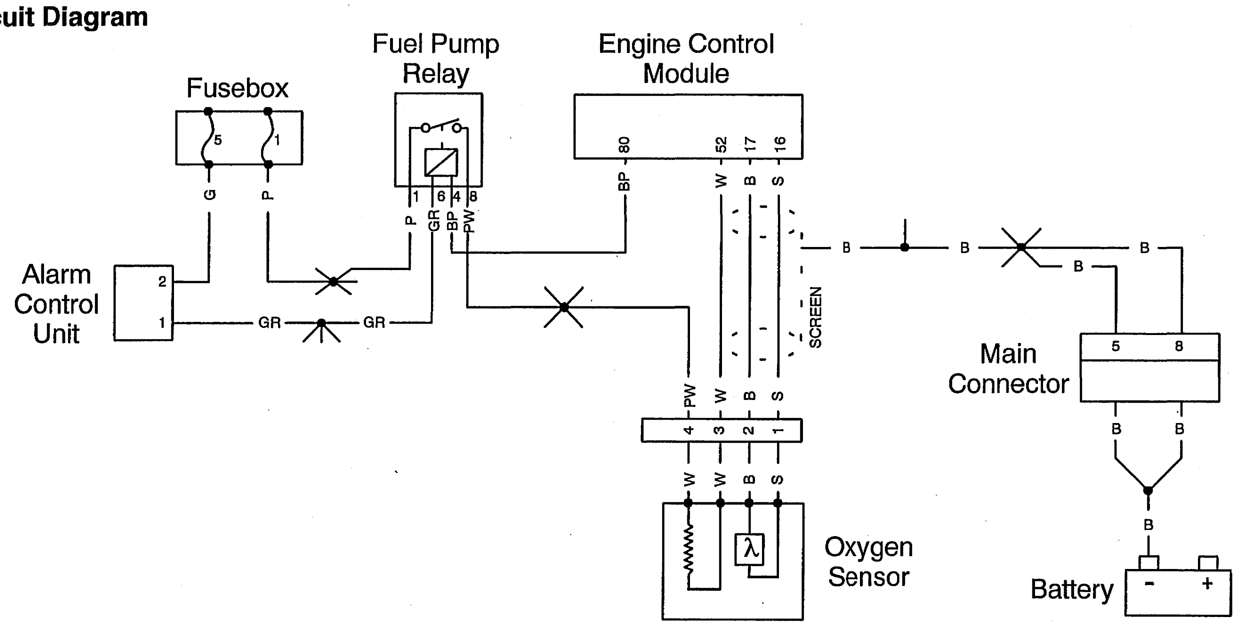
LAMBDA SENSOR (Long Term Feedback) - MC 2000 ECM

Fault Code	Possible Cause	Action
P1178	Air Leak, Low fuel pressure, Faulty purge system, Poor throttle balance.	View and note freeze frame data. Proceed to test 1.
P1179	Blocked idle air control system, High fuel pressure, Faulty purge system	Proceed to test 2

Pinpoint Tests

Test	Result	Action
1. Check throttle balance	OK	Proceed to test 2
	Faulty	Reset and proceed to test 7.
2. Check idle air control system is not blocked.	OK	Proceed to test 3
3. Check for air leaks into the intake system	OK	Proceed to test 4.
	Faulty	Rectify air leak and proceed to test 7.
4. Check fuel rail pressure.	OK	Proceed to test 5.
5. Check integrity of purge system pipes, valve and canister.	OK	Proceed to test 6.
6. Check purge valve is not stuck open.	OK	Proceed to test 7
	Faulty	Replace purge valve and proceed to test 7.
7. Reconnect harness, clear fault code and switch ignition key 'ON' to verify fault cleared.	OK	Action complete – Quit test.
	Fault still present	Contact Triumph Service

Circuit Diagram



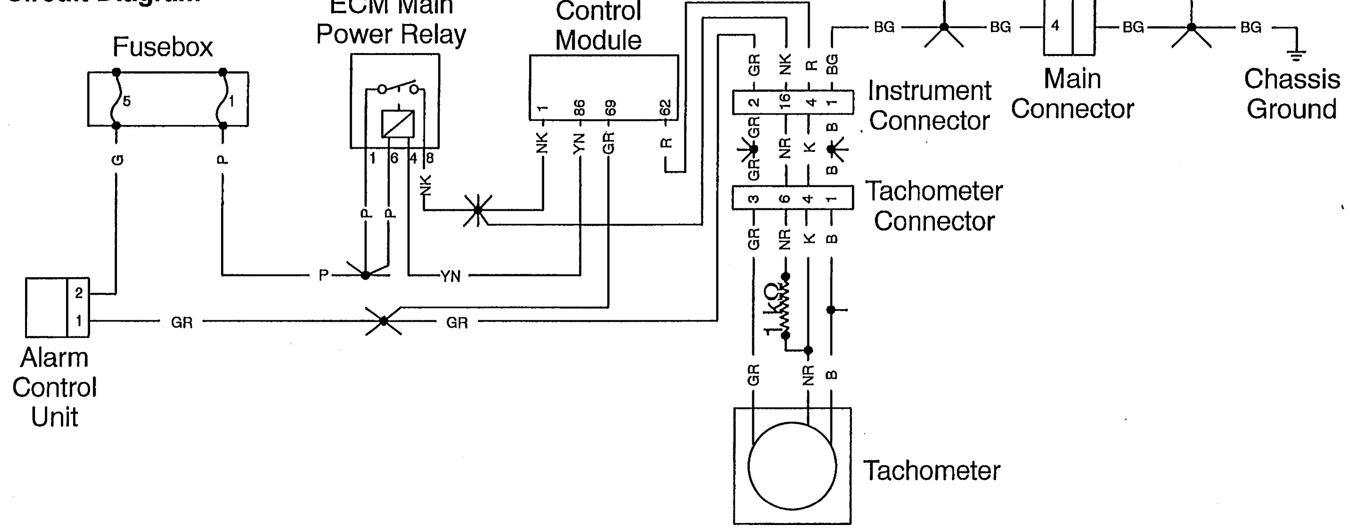
TACHOMETER - MC 2000 ECM

Fault Code	Possible cause	Action
P1385	Tachometer system fault	View & note 'freeze frame' data if available. View & note 'sensor' data. Ensure tachometer connector is secure. Disconnect ECM and proceed to pinpoint test 1:-
P1386	Open circuit, or short circuit to earth	
P1387	Short circuit to battery+	Disconnect tachometer and proceed to pinpoint test 5

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity: - ECM pin 62	OK	Disconnect tachometer and proceed to test 2
	Faulty	Rectify fault, proceed to test 6
2 Check cable for short circuit:	OK	Proceed to test 3
- ECM pin 62 to earth	Short circuit	Locate and rectify wiring fault, proceed to test 6
3 Check cable resistance:	1.1 to 1.3KΩ	Proceed to test 4
- ECM pin 62 to ECM pin 1	Faulty	Renew in-line resistor, proceed to test 6
4 Check cable continuity:	OK	Proceed to test 5
- Tachometer pin 4 to ECM pin 62 - Tachometer pin 1 to earth - Tachometer pin 3 to alarm control unit pin1	Open circuit	Locate and rectify wiring fault, proceed to test 6
5 Check cable for short circuit:	OK	Renew tachometer, proceed to test 6
ECM pin 62 to ECM pin 69	Short circuit	Locate and rectify wiring fault, proceed to test 6
6 Reconnect harness, clear fault code and run diagnostic tool function test to visually verify operation of tachometer	OK	Action complete - quit test
	Fault still present	Contact Triumph service

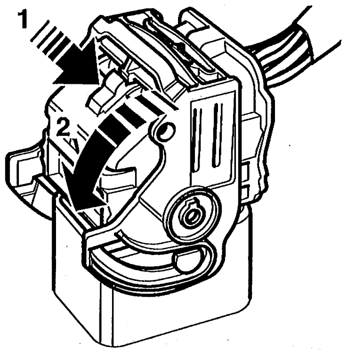
Circuit Diagram



Engine Control Module (ECM) type MC 1000 (from VIN 89736)

Removal of ECM connectors

1. Press the locking tab in and rotate the clamping ring until a definite click is felt.



1. **Locking tab**
2. **Clamping ring**

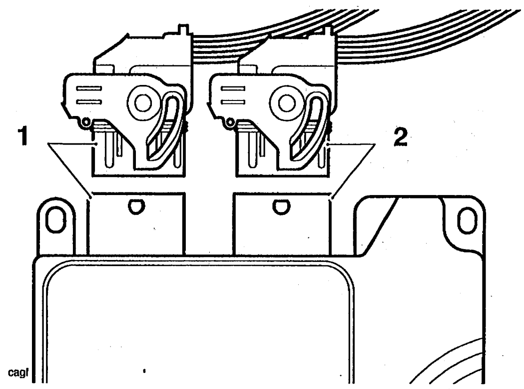
2. Remove the connector from the ECM socket.

Refitting of ECM connectors.

NOTE:

- **The connectors are both colour coded and individually shaped. The grey connector fits into the grey ECM socket and the black connector fits into the black ECM socket.**

CAUTION: Damage to the connector pins may result if an attempt to fit the connectors incorrectly is made.



1. **Grey socket and connector**
2. **Black socket and connector**

1. Fit the connector into its socket and, whilst holding the connector in place, rotate the clamping ring, locking it into place behind the locking tab.
2. Check that both connectors are correctly fitted and their clamping rings are fully rotated and locked.

ECM Connector Pin Numbering - MC 1000

The diagram below shows the pin sequence of the ECM main connectors. These pin numbers correspond directly with the pin numbers given in the diagnostic routines and schematic wiring diagrams used throughout this manual.

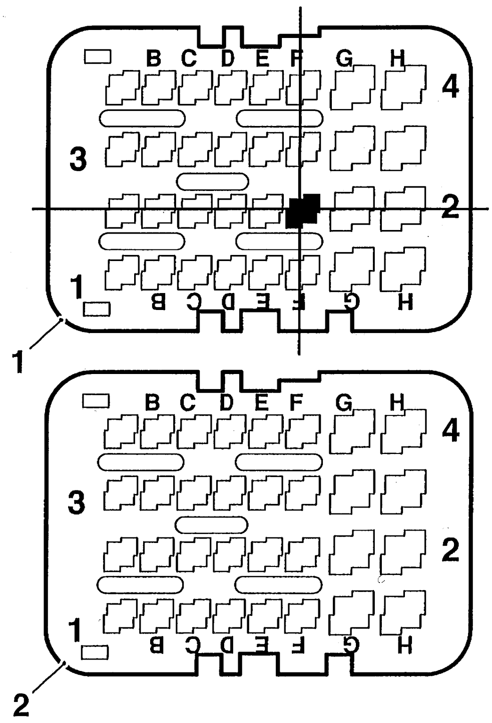
Each connector has 32 pins, arranged in four rows, marked 1, 2, 3 and 4 and eight columns as shown below. The first of these columns is column A and the eighth column is column H.

NOTE:

- **It is important to note that the first column is not marked with a letter A due to space constraints on the face of the connector.**

The diagram below shows the pin numbering as it appears on the connector.

Each ECM connector pin location is described throughout this manual by identifying the connector, 1 (black) or 2 (grey), followed by the row number, and then the column number in which it is situated. In the example below, pin 1/F2 is shown by the intersecting lines.



ECM Connector Pin Numbers

1. Black connector, 1/

2. Grey connector, 2/

FURTHER DIAGNOSIS

The tables which follow will, if used correctly, help to pinpoint a fault in the system once a diagnostic trouble code has been stored.

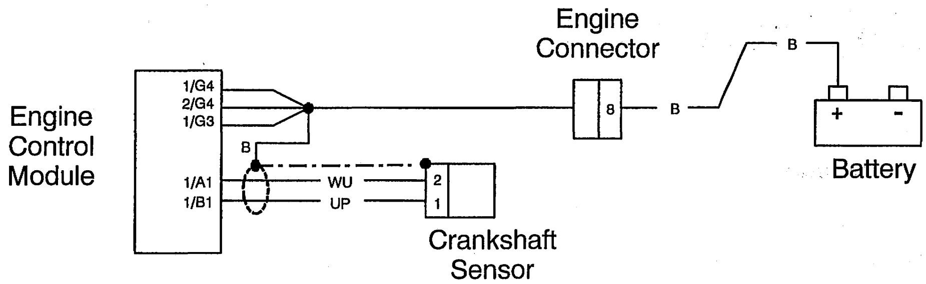
CRANKSHAFT SENSOR - MC 1000 ECM

Fault Code	Possible cause	Action
P0335	Crankshaft sensor system fault	View & note diagnostic tool 'freeze frame' data if available. Ensure sensor is fitted correctly and connector is secure. Check for 1 mm sensor air gap. Check for damaged teeth. Check for contamination by magnetic debris. Disconnect ECM and proceed to pinpoint test 1
P1335	Crank toothed wheel / screen cable fault	proceed to pinpoint test 5

Pinpoint Tests

Test	Result	Action
1 Check terminal and cable integrity: - ECM pin 1/A1 - ECM pin 1/B1	OK	Disconnect sensor and proceed to test 2
	Faulty	Rectify fault, proceed to test 6
2 Check cable for short circuit: - ECM pin 1/A1 to earth - ECM pin 1/B1 to earth	OK	Proceed to test 3
	Short circuit	Locate and rectify wiring fault, proceed to test 6
3 Check cable continuity: - ECM pin 1/B1 to sensor pin 1 - ECM pin 1/A1 to sensor pin 2	OK	Proceed to test 4
	Open circuit	Locate and rectify wiring fault, proceed to test 6
4 Check cable for short circuit: - ECM pin 1/A1 to ECM pin 1/B1	OK	Renew crankshaft sensor, proceed to test 6
	Short circuit	Locate and rectify wiring fault, proceed to test 6
5 Check cable continuity: - Sensor screen cable to earth	OK	Proceed to test 6
	Open circuit	Locate and rectify wiring fault, proceed to test 6
6 Reconnect harness, clear fault code and run engine to verify fault cleared	OK	Action complete - quit test.
	Fault still present	Contact Triumph service.

Circuit Diagram



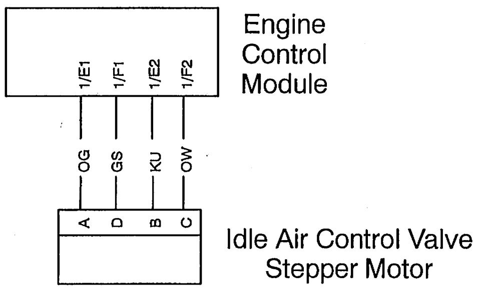
IDLE AIR CONTROL - MC 1000 ECM

Fault Code	Possible cause	Action
P0505	IACV stepper motor / wiring fault	View & note diagnostic tool 'freeze frame' data if available. View & note diagnostic tool 'sensor' data. Ensure sensor connector is secure. Disconnect ECM and proceed to pinpoint test 1

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity:	OK	Proceed to test 2
- ECM pin 1/E1 - ECM pin 1/E2 - ECM pin 1/F1 - ECM pin 1/F2	Faulty	Rectify fault, proceed to test 7
2 Check resistance value:	47 to 59Ω	Disconnect stepper motor and proceed to test 3
- ECM pin 1/E1 to ECM pin 1/F1 - ECM pin 1/E2 to ECM pin 1/F2	Open circuit	Proceed to test 4
	Short circuit	Disconnect stepper motor and proceed to test 5
3 Check cable for short circuit:	OK	Proceed to test 7
- ECM pin 1/E1 to earth - ECM pin 1/E2 to earth - ECM pin 1/F1 to earth - ECM pin 1/F2 to earth	Short circuit	Locate and rectify wiring fault, proceed to test 7
4 Check cable continuity:	OK	Proceed to test 6
- ECM pin 1/E1 to stepper motor pin A - ECM pin 1/E2 to stepper motor pin B - ECM pin 1/F2 to stepper motor pin C - ECM pin 1/F1 to stepper motor pin D	Open circuit	Locate and rectify wiring fault, proceed to test 7
5 Check cable for short circuit:	OK	Proceed to test 6
- ECM pin 1/E1 to ECM pin 1/F1 - ECM pin 1/E2 to ECM pin 1/F2	Short circuit	Locate and rectify wiring fault, proceed to test 7
6 Check stepper motor resistance:	47 to 59 Ω	Proceed to test 7
- Motor pin A to motor pin D - Motor pin B to motor pin C	Faulty	Renew stepper motor, proceed to test 7
7 Reconnect harness, clear fault code and run diagnostic tool function test to visually verify operation of stepper motor.	OK	Action complete - quit test.
	Fault	Contact Triumph service.

Circuit Diagram



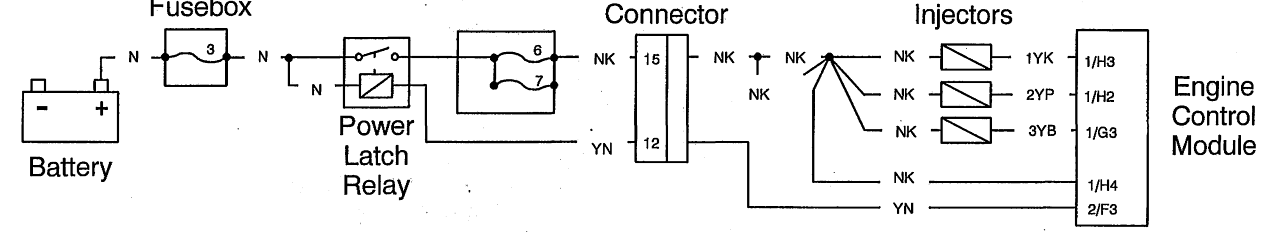
FUEL INJECTORS - MC 1000 ECM

Fault Code	Possible cause	Action
P0201/02/03	Injection system fault - Injector 1/2/3 - Misfire indicates open circuit - Flooding indicates short circuit	View & note diagnostic tool 'freeze frame' data if available. Ensure relevant injector connector is secure. Disconnect ECM and proceed to pinpoint test 1
P1201/02/03	Open or short circuit - Injector 1/2/3	
P1205/06/07	Short circuit to battery+ - Injector 1/2/3	Disconnect relevant injector and proceed to pinpoint test 5

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity:	OK	Proceed to test 2
- ECM pin 1/G3 - ECM pin 1/H3 - ECM pin 1/H2	Faulty	Rectify fault, proceed to test 7
2 Check resistance value:	15.5 to 16.3Ω	Disconnect relevant injector and proceed to test 3
- ECM pin 1/H4 to ECM pin 1/H3 (injector 1) - ECM pin 1/H4 to ECM pin 1/H2 (injector 2) - ECM pin 1/H4 to ECM pin 1/G3 (injector 3)	Open circuit	Proceed to test 4
	Short circuit	Disconnect relevant injector and proceed to test 5
3 Check cable for short circuit:	OK	Proceed to test 7
- ECM pin 1/H3 to earth - ECM pin 1/H2 to earth - ECM pin 1/G3 to earth	Short circuit	Locate and rectify wiring fault, proceed to test 7
4 Check cable continuity:	OK	Proceed to test 6
- ECM pin 1/H4 to relevant injector pin 2 - ECM pin 1/H3 to injector 1 pin 1 - ECM pin 1/H2 to injector 2 pin 1 - ECM pin 1/G3 to injector 3 pin 1	Open circuit	Locate and rectify wiring fault, proceed to test 7
5 Check cable for short circuit:	OK	Proceed to test 6
- ECM pin 1/H4 to ECM pin 1/H3 (injector 1) - ECM pin 1/H4 to ECM pin 1/H2 (injector 2) - ECM pin 1/H4 to ECM pin 1/G3 (injector 3)	Short circuit	Locate and rectify wiring fault, proceed to test 7
6 Check relevant injector resistance:	15.5 to 16.3Ω	Proceed to test 7
- Injector pin 1 to injector pin 2	Faulty	Renew relevant injector, proceed to test 7
7 Reconnect harness, clear fault code and run engine to verify fault cleared.	OK	Action complete - quit test.
	Fault still present	Contact Triumph service.

Circuit Diagram



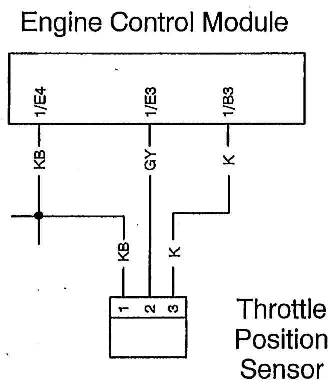
THROTTLE POSITION SENSOR - MC 1000 ECM

Fault Code	Possible cause	Action
P0120 P0122 P0123	Throttle position sensor system fault Sensor low input voltage Sensor high input voltage	View & note diagnostic tool 'freeze frame' data if available. View & note diagnostic tool 'sensor' data. Ensure sensor connector is secure. Disconnect ECM and proceed to pinpoint test 1

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity: - ECM pin 1/B3 - ECM pin 1/E3 - ECM pin 1/E4	OK	Disconnect sensor and proceed to test 2
	Faulty	Rectify fault, proceed to test 5
2 Check cable for short circuit: - ECM pin 1/E3 to earth	OK	Proceed to test 3
	Short circuit	Locate and rectify wiring fault, proceed to test 5
3 Check cable continuity: - ECM pin 1/E4 to sensor pin 1 - ECM pin 1/E3 to sensor pin 2 - ECM pin 1/B3 to sensor pin 3	OK	Proceed to test 4
	Open circuit	Locate and rectify wiring fault, proceed to test 5
4 Check cable for short circuit: - ECM pin 1/E3 to ECM pin 1/B3 - ECM pin 1/E3 to ECM pin 1/E4 - ECM pin 1/E4 to ECM pin 1/B3	OK	Renew throttle position sensor, proceed to test 5
	Short circuit	Locate and rectify wiring fault, proceed to test 5
5 Reconnect harness, clear fault code and run engine to verify fault cleared.	OK	Action complete - quit test.
	Fault still present	Contact Triumph service.

Circuit Diagram



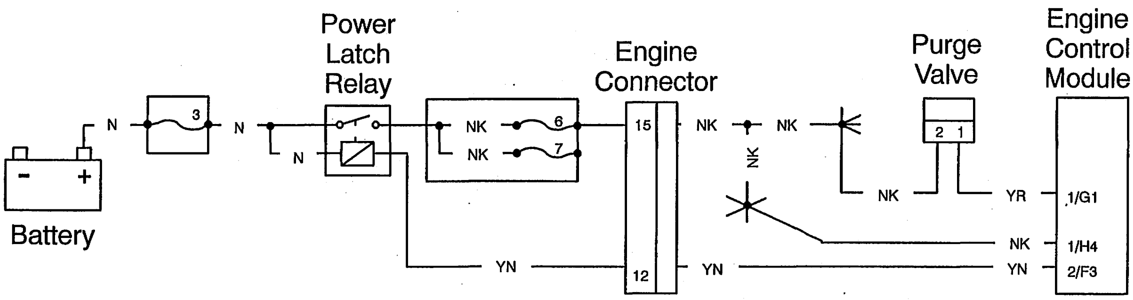
PURGE VALVE - MC 1000 ECM

Fault Code	Possible cause	Action
P0443	Purge valve system fault	View & note diagnostic tool 'sensor' data. Ensure purge valve connector is secure. Disconnect ECM and proceed to pinpoint test 1
P0444	Open circuit or short circuit to earth	
P0445	Short circuit to battery+	disconnect purge valve and proceed to pinpoint test 5

Pinpoint Tests

	Test	Result	Action
1	Check cable and terminal integrity:	OK	Proceed to test 2
	- ECM pin 1/G1	Faulty	Rectify fault, proceed to test 7
2	Check resistance value:	26Ω	Disconnect purge valve and proceed to test 3
	- ECM pin 1/H4 to ECM pin 1/G1	Open circuit	Proceed to test 4
		Short circuit	Disconnect purge valve and proceed to test 5
3	Check cable for short circuit:	OK	Proceed to test 7
	- ECM pin 1/G1 to earth	Short circuit	Locate and rectify wiring fault, proceed to test 7
4	Check cable continuity:	OK	Proceed to test 6
	- ECM pin 1/G1 to valve pin 1 - ECM pin 1/H4 to valve pin 2	Open circuit	Locate and rectify wiring fault, proceed to test 7
5	Check cable for short circuit:	OK	Proceed to test 6
	- ECM pin 1/H4 to ECM pin 1/G1	Short circuit	Locate and rectify wiring fault, proceed to test 7
6	Check purge valve resistance:	26Ω	Proceed to test 7
	- Valve pin 1 to valve pin 2	Faulty	Renew purge valve, proceed to test 7
7	Reconnect harness, clear fault code and run diagnostic tool function test to visually verify operation of purge valve.	OK	Action complete - quit test.
		Fault	Contact Triumph service.

Circuit Diagram



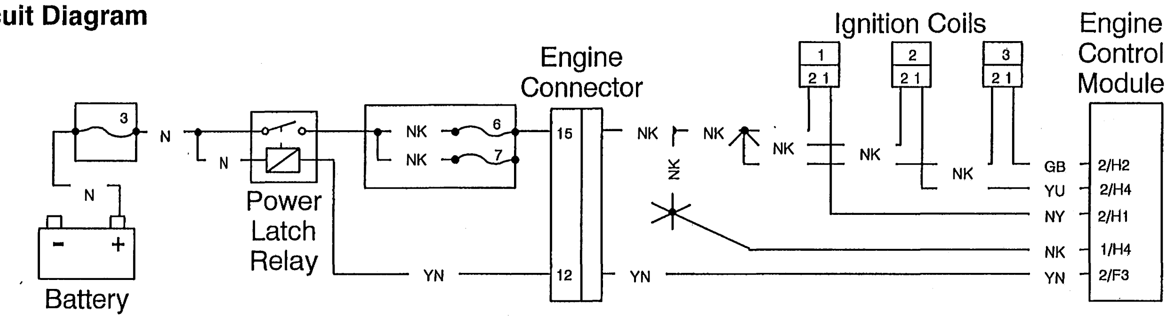
IGNITION COILS - MC 1000 ECM

Fault Code	Possible cause	Action
P0351/52/53	Ignition system fault - Ign coil 1/2/3	View & note diagnostic tool 'freeze frame' data if available. Ensure relevant ign coil connector is secure. Disconnect ECM and proceed to pinpoint test 1:-
P1351/52/53	Open or short circuit - Ign coil 1/2/3	
P1355/56/57	Short circuit to battery+ - Ign coil 1/2/3	disconnect relevant ign coil and proceed to pinpoint test 5

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity:	OK	Proceed to test 2
- ECM pin 2/H1 - ECM pin 2/H2 - ECM pin 2/H4	Faulty	Rectify fault, proceed to test 7
2 Check resistance value: ECM pin 1/H4 to	0.8Ω	Disconnect relevant ign coil and proceed to test 3
- ECM pin 2/H1 (ign coil 1) - ECM pin 2/H4 (ign coil 2)	Open circuit	Proceed to test 4
- ECM pin 2/H2 (ign coil 3)	Short circuit	Disconnect relevant ign coil and proceed to test 5
3 Check cable for short circuit:	OK	Proceed to test 7
- ECM pin 2/H1 to earth - ECM pin 2/H2 to earth - ECM pin 2/H4 to earth	Short circuit	Locate and rectify wiring fault, proceed to test 7
4 Check cable continuity:	OK	Proceed to test 6
- ECM pin 1/H4 to any ign coil pin 2 - ECM pin 2/H1 to ign coil 1 pin 1 - ECM pin 2/H4 to ign coil 2 pin 1 - ECM pin 2/H2 to ign coil 3 pin 1	Open circuit	Locate and rectify wiring fault, proceed to test 7
5 Check cable for short circuit:	OK	Proceed to test 6
- Fuel pump relay pin 8 to - ECM pin 2/H1 (ign coil 1) - ECM pin 2/H4 (ign coil 2) - ECM pin 2/H2 (ign coil 3)	Short circuit	Locate and rectify wiring fault, proceed to test 7
6 Check relevant ign coil resistance:	0.8Ω	Proceed to test 7
- Ign coil pin 1 to ign coil pin 2	Faulty	Renew relevant ign coil, proceed to test 7
7 Reconnect harness, clear fault code and run engine to verify fault cleared.	OK	Action complete - quit test.
	Fault still present	Contact Triumph service.

Circuit Diagram



COOLANT TEMPERATURE SENSOR - MC 1000 ECM

Fault Code	Possible cause	Action
P0115	Coolant temperature system fault	View & note diagnostic tool 'freeze frame' data if available. View & note diagnostic tool 'sensor' data. Ensure sensor connector is secure. Disconnect ECM and proceed to pinpoint test 1:-
P0117	Open circuit, or short circuit to battery+	
P0118	Short circuit to earth	disconnect sensor and proceed to test 6
P0119	Voltage signal too high	proceed to pinpoint test 4

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity:	OK	Proceed to test 2
- ECM pin 1/B2 - ECM pin 1/E4	Faulty	Rectify fault, proceed to test 7
2 Check resistance value:	OK	Disconnect temp sensor and proceed to test 6
- ECM pin 1/E4 to ECM pin 1/B2 (Temperature dependent - see data below)	Open circuit	Disconnect temperature sensor and proceed to test 3
	Short circuit	Disconnect temp sensor and proceed to test 4
3 Check cable continuity:	OK	Proceed to test 5
- ECM pin 1/B2 to sensor pin 1 - ECM pin 1/E4 to sensor pin 2	Open circuit	Locate and rectify wiring fault, proceed to test 7
4 Check cable for short circuit:	OK	Proceed to test 5
- ECM pin 1/B2 to ECM pin 1/E4	Short circuit	Locate and rectify wiring fault, proceed to test 7
5 Check sensor resistance:	OK	Proceed to test 7
- Sensor pin 1 to sensor pin 2 (Temperature dependent - see data below)	Faulty	Renew temp sensor, proceed to test 7
6 Check cable for short circuit:	OK	Proceed to test 7
- ECM pin 1/B2 to earth	Short circuit	Locate and rectify wiring fault, proceed to test 7
7 Reconnect harness, clear fault code and run engine to verify fault cleared.	OK	Action complete - quit test.
	Fault	Contact Triumph service.

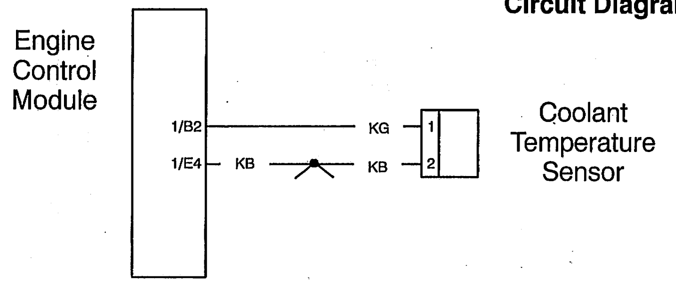
Circuit Diagram

Resistance data under typical conditions:

Warm engine - 200 to 400Ω.

Cold engine:

20ºC ambient	2.35 to 2.65KΩ.
10ºC ambient	3.60 to 4.00KΩ.
0ºC ambient	5.60 to 6.25KΩ



INLET AIR TEMPERATURE SENSOR - MC 1000 ECM

Fault Code	Possible cause	Action
P0110	Inlet air temperature system fault	View & note diagnostic tool 'freeze frame' data if available. View & note diagnostic tool 'sensor' data. Ensure sensor connector is secure. Disconnect ECM and proceed to pinpoint test 1:-
P0113	Open circuit, or short circuit to battery+	
P0112	Short circuit to earth	disconnect sensor and proceed to pinpoint test 6

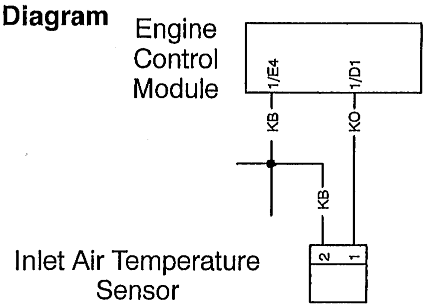
Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity:	OK	Proceed to test 2
- ECM pin 1/E4 - ECM pin 1/D1	Faulty	Rectify fault, proceed to test 7
2 Check resistance value:	OK	Disconnect temp sensor and proceed to test 6
- ECM pin 1/D1 to ECM pin 1/E4 (Temperature dependent - see data below)	Open circuit	Disconnect temp sensor and proceed to test 3
	Short circuit	Disconnect temp sensor and proceed to test 4
3 Check cable continuity:	OK	Proceed to test 5
- ECM pin 1/D1 to sensor pin 1 - ECM pin 1/E4 to sensor pin 2	Open circuit	Locate and rectify wiring fault, proceed to test 7
4 Check cable for short circuit:	OK	Proceed to test 5
- ECM pin 1/D1 to ECM pin 1/E4	Short circuit	Locate and rectify wiring fault, proceed to test 7
5 Check sensor resistance:	OK	Proceed to test 7
- Sensor pin 1 to sensor pin 2 (Temperature dependent - see data below)	Faulty	Renew temp sensor, proceed to test 7
6 Check cable for short circuit:	OK	Proceed to test 7
- ECM pin 1/D1 to earth	Short circuit	Locate and rectify wiring fault, proceed to test 7
7 Reconnect harness, clear fault code and run engine to verify fault cleared.	OK	Action complete - quit test.
	Fault	Contact Triumph service.

If engine is warm, remove sensor and allow time to cool to ambient prior to test. Resistance data:

Ambient temp	Resistance value
30ºC	1.6 to 1.8KΩ
25ºC	1.9 to 2.2KΩ
20ºC	2.3 to 2.7KΩ
15ºC	2.9 to 3.3KΩ
10ºC	3.5 to 4.0KΩ
5ºC	4.4 to 4.9KΩ
0ºC	5.5 to 6.1KΩ

Circuit Diagram



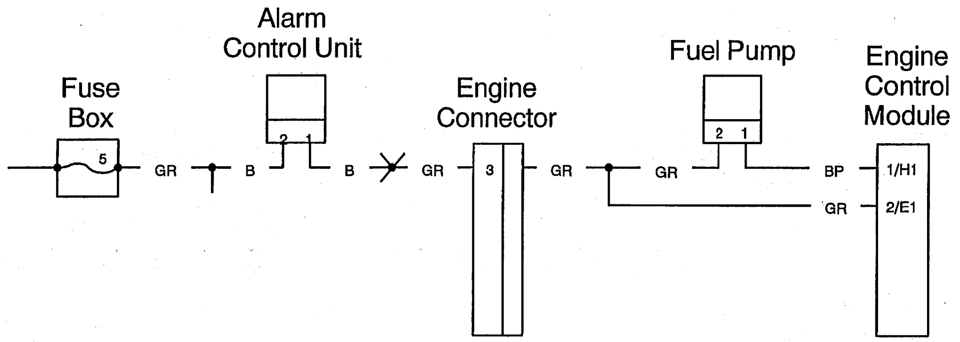
FUEL PUMP RELAY - MC 1000 ECM

Fault Code	Possible cause	Action
P0230	Fuel pump system fault	Check if pump runs briefly when ignition is switched on. Ensure fuel pump connector is secure. Disconnect ECM and proceed to pinpoint test 1:-
P1231	Open circuit, or short circuit to earth	
P1232	Short circuit to battery+	Disconnect fuel pump and proceed to pinpoint test 4

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity: - ECM pin 1/H1	OK	Disconnect fuel pump and proceed to test 2
	Faulty	Rectify fault, proceed to test 5
2 Check cable for short circuit: - ECM pin 1/H1 to earth	OK	Proceed to test 3
	Short circuit	Locate and rectify wiring fault, proceed to test 5
3 Check cable continuity: - ECM pin 1/H1 to fuel pump pin 1 - Fuel pump pin 2 to alarm control unit pin 1	OK	Proceed to test 4
	Open circuit	Locate and rectify wiring fault, proceed to test 5
4 Check cable for short circuit: - ECM pin 1/H1 to ECM pin 2/E1	OK	Proceed to test 5
	Short circuit	Locate and rectify wiring fault, proceed to test 5
5 Reconnect harness, clear fault code and run diagnostic tool function test to verify fault cleared.	OK	Action complete - quit test.
	Fault still present	Contact Triumph service.

Circuit Diagram



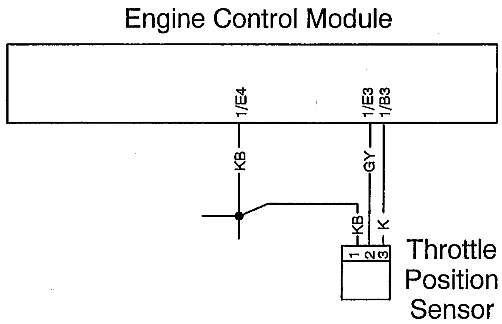
SENSOR SUPPLY VOLTAGE - MC 1000 ECM

Fault Code	Possible cause	Action
P1560	Engine control module / wiring fault	View & note diagnostic tool 'sensor' data. Disconnect ECM and proceed to pinpoint test 1

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity: - ECM pin 1/B3 - ECM pin 1/E4	OK	Disconnect throttle position sensor and , proceed to test 2
	Faulty	Rectify fault, proceed to test 4
2 Check for short circuit: - ECM pin 1/B3 to ECM pin 1/E4	OK	Reconnect ECM, proceed to test 3
	Short circuit	Locate and rectify wiring fault, proceed to test 4
3 With ignition 'on', check voltage at throttle position sensor pin 3.	4.5 to 5.5v	Proceed to test 4
	Faulty	Check for wiring fault between ECM and sensors, if wiring is OK, renew ECM, proceed to test 4
4 Reconnect harness, clear fault code and run engine to verify fault cleared.	OK	Action complete - quit test.
	Fault still present	Contact Triumph service.

Circuit Diagram



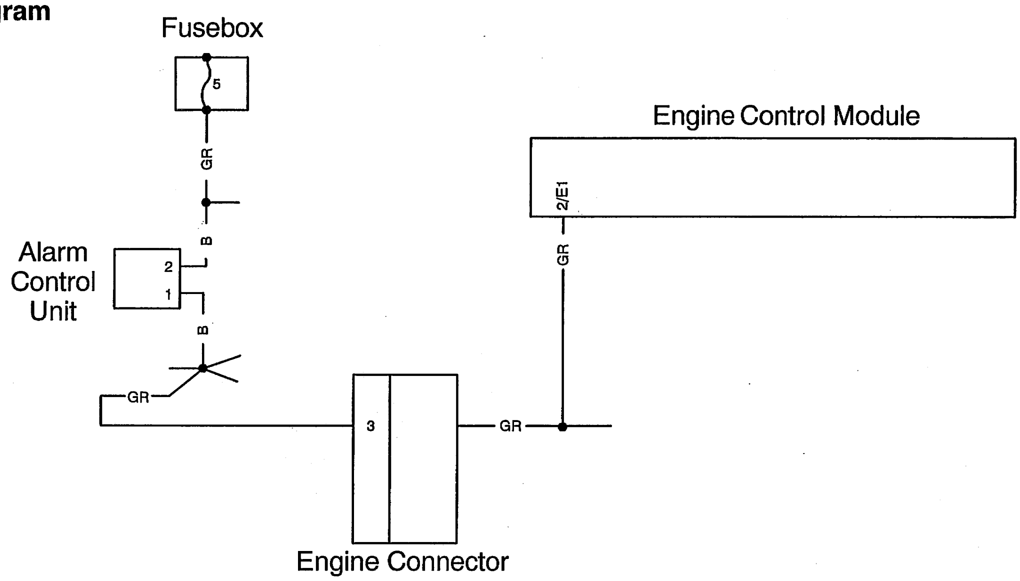
SYSTEM VOLTAGE - MC 1000 ECM

Fault Code	Possible cause	Action
P0560	Bike voltage system fault	View & note diagnostic tool 'sensor' data. Ensure voltage across battery is acceptable, note voltage.
P0562	Wiring / alternator / battery fault - low voltage	Disconnect ECM and proceed to pinpoint test 1
P0563	Alternator fault - high voltage	Ensure alternator output voltage is acceptable, note voltage.

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity: - ECM pin 2/E1	OK	Proceed to test 2
	Faulty	Rectify fault, proceed to test 3
2 With Ignition 'on', check voltage at: - ECM pin 2/E1	Same as 'across battery' voltage	Proceed to test 3
	Less than 'across battery' voltage	Locate and rectify wiring fault, proceed to test 3
3 Reconnect harness, clear fault code and run engine to verify fault cleared.	OK	Action complete - quit test
	Fault still present	Contact Triumph service

Circuit Diagram



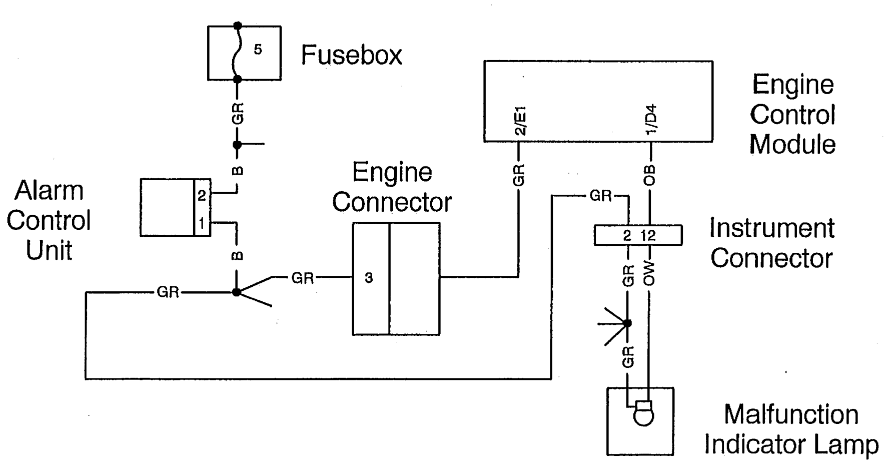
MALFUNCTION INDICATION LAMP - MC 1000 ECM

Fault Code	Possible cause	Action
P1600	MIL system fault	Ensure warning lamp connector is secure and bulb is operational - renew if faulty. Disconnect ECM and proceed to pinpoint test 1:-
P1601	Open circuit, or short circuit to earth	
P1602	Short circuit to battery+	Disconnect instrument connector, remove bulb and proceed to test 4

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity:	OK	Disconnect instrument connector and proceed to test 2
- ECM pin 1/D4	Faulty	Rectify fault, proceed to test 5
2 Check cable for short circuit:	OK	Remove bulb and proceed to test 3
- ECM pin 1/D4 to earth	Short circuit	Locate and rectify wiring fault, proceed to test 5
3 Check cable continuity:	OK	Proceed to test 4
- Instrument plug pin 12 to ECM pin 1/D4 - Instrument plug pin 2 to alarm pin 1 - Instrument plug pin 2 to bulb holder (GR) - Instrument plug pin 12 to bulb holder (OW)	Open circuit	Locate and rectify wiring fault, proceed to test 5
4 Check for short circuit:	OK	Proceed to test 5
- ECM pin 1/D4 to ECM pin 2/E1 - Instrument plug pin 2 to instrument plug pin 12	Short circuit	Locate and rectify wiring fault, proceed to test 5
5 Reconnect harness, refit bulb, clear fault code and switch ignition 'on' to verify fault cleared	OK	Action complete - quit test
	Fault still present	Contact Triumph service

Circuit Diagram



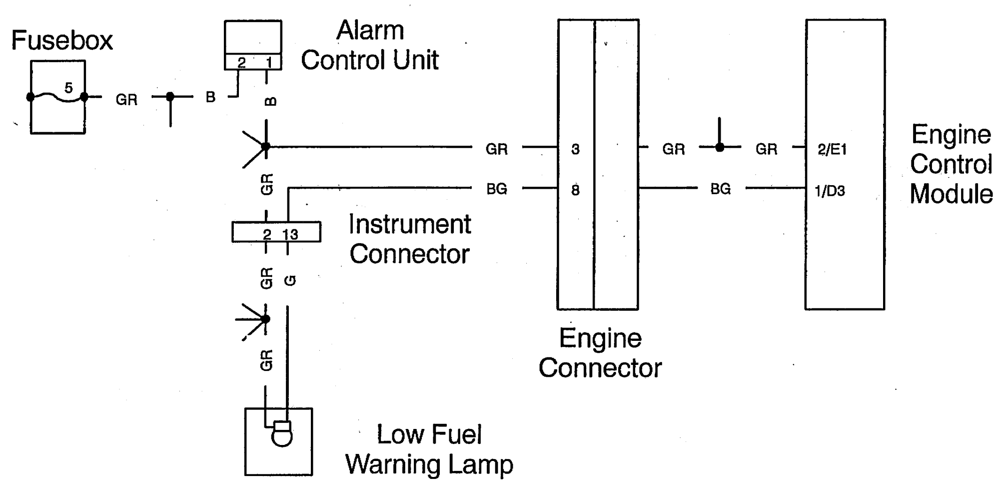
LOW FUEL LEVEL WARNING LAMP - MC 1000 ECM

Fault Code	Possible cause	Action
P1610	Low fuel warning lamp - system fault	Ensure warning lamp connector is secure and bulb is operational - renew if faulty. Disconnect ECM and proceed to pinpoint test 1:-
P1611	Open circuit, or short circuit to earth	
P1612	Short circuit to battery+	Disconnect instrument connector, remove bulb and proceed to test 4

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity:	OK	Disconnect instrument connector and proceed to test 2
- ECM pin 1/D3	Faulty	Rectify fault, proceed to test 5
2 Check cable for short circuit:	OK	Remove bulb and proceed to test 3
- ECM pin 1/D3 to earth	Short circuit	Locate and rectify wiring fault, proceed to test 5
3 Check cable continuity:	OK	Proceed to test 4
- Instrument plug pin 13 to ECM pin 1/D3 - Instrument plug pin 2 to alarm pin 1 - instrument plug pin 2 to bulb holder (GR) - instrument plug pin 13 to bulb holder (G)	Open circuit	Locate and rectify wiring fault, proceed to test 5
4 Check for short circuit:	OK	Proceed to test 5
- ECM pin 1/D3 to ECM pin 2/E1 - Instrument plug pin 2 to instrument plug pin 13	Short circuit	Locate and rectify wiring fault, proceed to test 5
5 Reconnect harness, refit bulb, clear fault code and switch ignition 'on' to verify fault cleared	OK	Action complete - quit test
	Fault still present	Contact Triumph service

Circuit Diagram



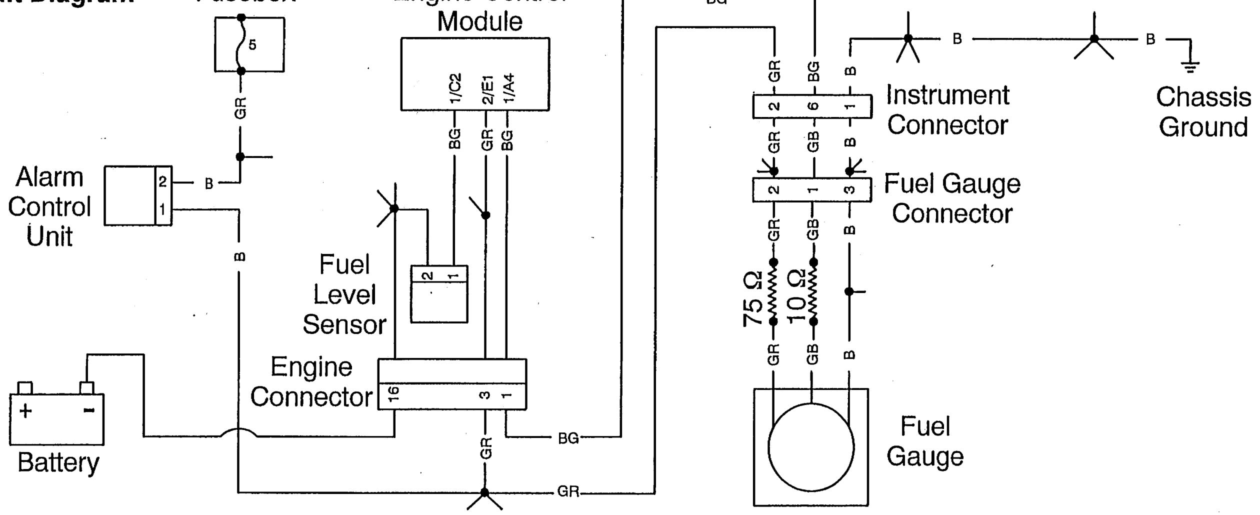
FUEL GAUGE - MC 1000 ECM

Fault Code	Possible cause	Action
P1620	Fuel gauge system fault	View & note 'freeze frame' data if available. View & note 'sensor' data. Ensure fuel gauge connector is secure. Disconnect ECM and proceed to pinpoint test 1:-
P1621	Open circuit, or short circuit to earth	
P1622	Short circuit to battery+	Disconnect fuel gauge and proceed to pinpoint test 4

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity:	OK	Disconnect fuel gauge and proceed to test 2
- ECM pin 1/A4	Faulty	Rectify fault, proceed to test 5
2 Check cable for short circuit:	OK	Proceed to test 3
- ECM pin 1/A4 to earth	Short circuit	Locate and rectify wiring fault, proceed to test 5
3 Check cable continuity:	OK	Proceed to test 4
- Fuel gauge pin 1 to ECM pin 1/A4 - Fuel gauge pin 3 to earth - Fuel gauge pin 2 to alarm control unit pin 1	Open circuit	Locate and rectify wiring fault, proceed to test 5
4 Check cable for short circuit:	OK	Renew fuel gauge, proceed to test 5
- ECM pin 1/A4 to ECM pin 2/E1	Short circuit	Locate and rectify wiring fault, proceed to test 5
5 Reconnect harness, clear fault code and run diagnostic tool function test to visually verify operation of fuel gauge	OK	Action complete - quit test
	Fault still present	Contact Triumph service

Circuit Diagram



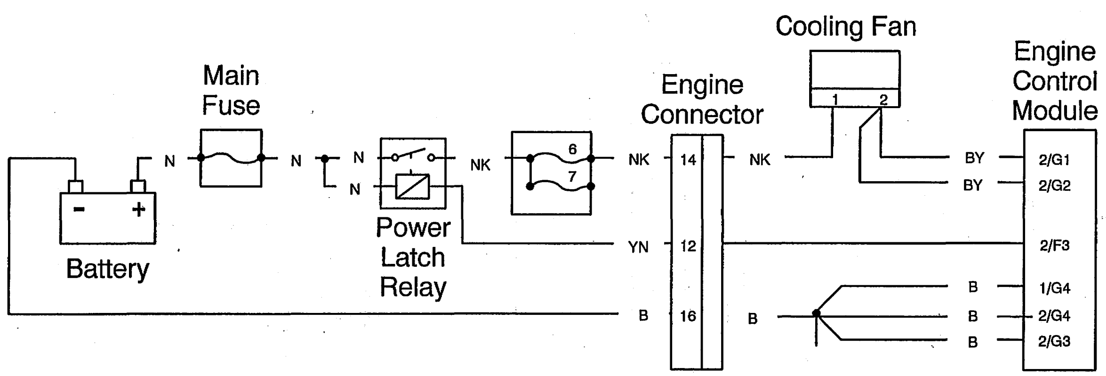
COOLING FAN - MC 1000 ECM

Fault Code	Possible cause	Action
P1551	Cooling fan relay system fault	View & note diagnostic tool 'sensor' data. Ensure fan connector is secure. Disconnect ECM and proceed to pinpoint test1:-
P1552	Open circuit, or short circuit to earth	
P1553	Short circuit to battery+	Disconnect fan and proceed to pinpoint test 4

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity: - ECM pin 2/G1 - ECM pin 2/G2	OK	Disconnect fan and proceed to test 2
	Faulty	Rectify fault, proceed to test 5
2 Check cable for short circuit: - ECM pin 2/G1 to earth - ECM pin 2/G2 to earth	OK	Proceed to test 3
	Short circuit	Locate and rectify wiring fault, proceed to test 5
3 Check cable continuity: - Fan pin 2 to ECM pin 2/G1 and 2/G2 - Fan pin 1 to power latch relay pin 8	OK	Proceed to test 4
	Open circuit	Locate and rectify wiring fault, proceed to test 5
4 Check cable for short circuit: - ECM pin 2/G1 to ECM pin 1/H4 - ECM pin 2/G2 to ECM pin 1/H4	OK	Proceed to test 5
	Short circuit	Locate and rectify wiring fault, proceed to test 5
5 Reconnect harness, clear fault code and run diagnostic tool function test to visually verify operation of cooling fan	OK	Action complete - quit test
	Fault still present	Contact Triumph service

Circuit Diagram



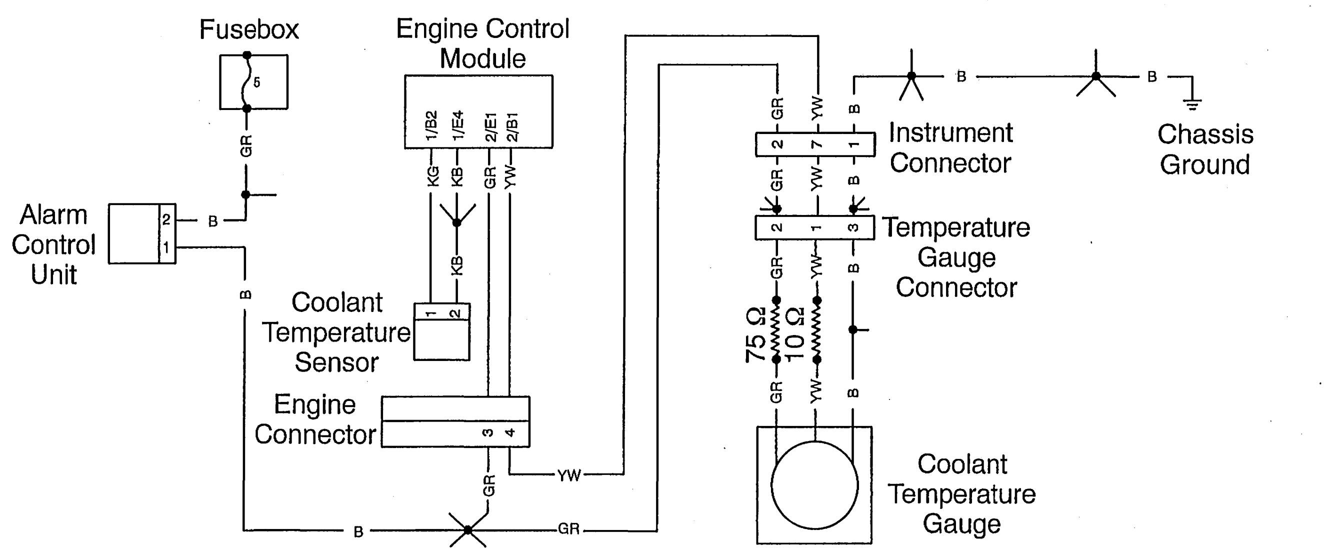
COOLANT TEMPERATURE GAUGE - MC 1000 ECM

Fault Code	Possible cause	Action
P1115	Temperature gauge system fault	View & note 'freeze frame' data if available. View & note 'sensor' data. Ensure temp gauge connector is secure. Disconnect ECM and proceed to pinpoint test 1:-
P1116	Open circuit, or short circuit to earth	
P1117	Short circuit to battery+	Disconnect temp gauge and proceed to pinpoint test 4

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity.	OK	Disconnect temp gauge and proceed to test 2
- ECM pin 2/B1	Faulty	Rectify fault, proceed to test 5
2 Check cable for short circuit:	OK	Proceed to test 3
- ECM pin 2/B1 to earth	Short circuit	Locate and rectify wiring fault, proceed to test 5
3 Check cable continuity:	OK	Proceed to test 4
- Temp gauge pin 1 to ECM pin 2/B1 - Temp gauge pin 3 to earth - Temp gauge pin 2 to alarm control unit pin 1	Open circuit	Locate and rectify wiring fault, proceed to test 5
4 Check cable for short circuit:	OK	Renew temp gauge, proceed to test 5
- ECM pin 2/B1 to ECM pin 2/E1	Short circuit	Locate and rectify wiring fault, proceed to test 5
5 Reconnect harness, clear fault code and run diagnostic tool function test to visually verify operation of temp gauge	OK	Action complete - quit test
	Fault still present	Contact Triumph service

Circuit Diagram



LAMBDA SENSOR - MC 1000 ECM

Fault Code	Possible Cause	Action
P0131	Open Circuit or Short Circuit to Battery. Poor electrical contact between exhaust and ECM ground.	View and note freeze frame data. Ensure Lambda sensor connector is secure. Disconnect ECM and proceed to pinpoint test 1.
P0132	Open Circuit or Short Circuit to Battery.	Proceed to pinpoint test 1.
P1133	Faulty Lambda Sensor	Replace Lambda Sensor
P0135	Open Circuit or Short circuit	Proceed to test 6

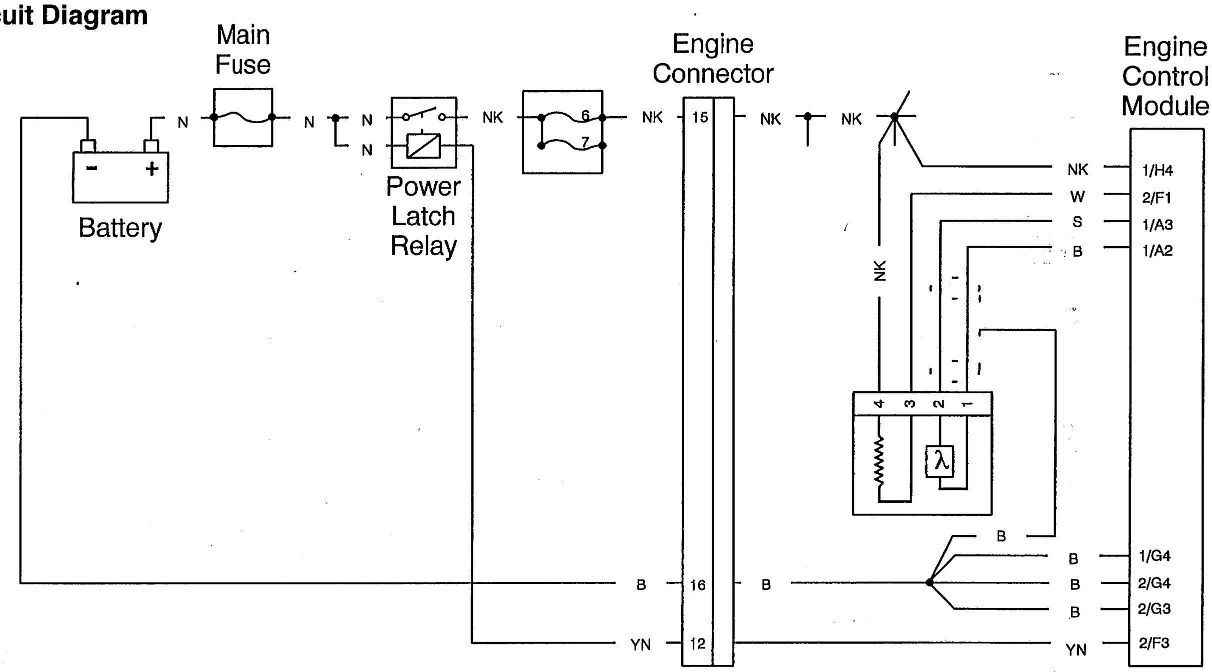
Pinpoint Tests

Test	Result	Action
1. Check cable and terminal integrity.	OK	Disconnect Sensor and proceed to test 2.
- ECM Pin 1/A2- ECM Pin 1/A3	Faulty	Rectify Fault and proceed to test 11.
2. Check cable continuity	OK	Proceed to test 3.
- ECM Pin 1/A2 to Sensor Pin 1 - ECM Pin 1/A3 to Sensor Pin 2	Faulty	Locate and rectify wiring fault. Proceed to test 11.
3. Check for short circuit to ground.	OK	Proceed to test 4.
- ECM Pin 1/A2 - ECM Pin 1/A3	Faulty	Locate and rectify fault. Proceed to test 11.
4. Check for short circuit to battery.	OK	Proceed to test 5
- ECM Pin 1/A2 - ECM Pin 1/A3	Faulty	Locate and rectify fault. Proceed to test 11.
5. Check continuity between sensor boss and battery negative terminal.	OK	Replace Lambda Sensor and proceed to test 11.
	Faulty	Locate and rectify fault and proceed to test 11.
6. Check cable and terminal integrity.	OK	Disconnect sensor and proceed to test 7.
- ECM Pin 2/F1	Faulty	Rectify and proceed to test 11.
7. Check cable continuity	OK	Proceed to test 8.
- ECM Pin 2/F1 to Sensor Pin 3 - Power Latch Relay Pin 8 to Sensor Pin 4	Faulty	Rectify wiring fault and proceed to test 11.
8. Check for short circuit to ground	OK	Proceed to test 9.
- ECM Pin 2/F1	Faulty	Rectify wiring fault and proceed to test 11.

Pinpoint Tests(continued)

Test	Result	Action
9. Check for short circuit to battery - ECM Pin 2/F1	OK	Proceed to test 10.
	Faulty	Rectify wiring fault and proceed to test 11.
10. Check resistance of Lambda sensor heater Sensor pin 3 to sensor pin 4	4Ω to 8Ω	Proceed to test 11.
	Faulty	Replace Lambda Sensor and proceed to test 11.
11. Reconnect harness, clear fault code and switch ignition key 'ON' to verify fault cleared.	OK	Action complete – Quit test.
	Fault still present	Contact Triumph Service

Circuit Diagram



LAMBDA SENSOR (Short Term Feedback) - MC 1000 ECM

Fault Code	Possible Cause	Action
P0170	Fault Code P1171 or P1172 will be present.	View and note freeze frame data. Ensure sensor connector is secure.
P1171	Wiring fault, Air leak, low fuel pressure, faulty purge system, faulty sensor.	Disconnect ECM connector and proceed to test 1.
P1172	Wiring fault, high fuel pressure, faulty purge system, faulty sensor.	Disconnect ECM connector and proceed to test 1.

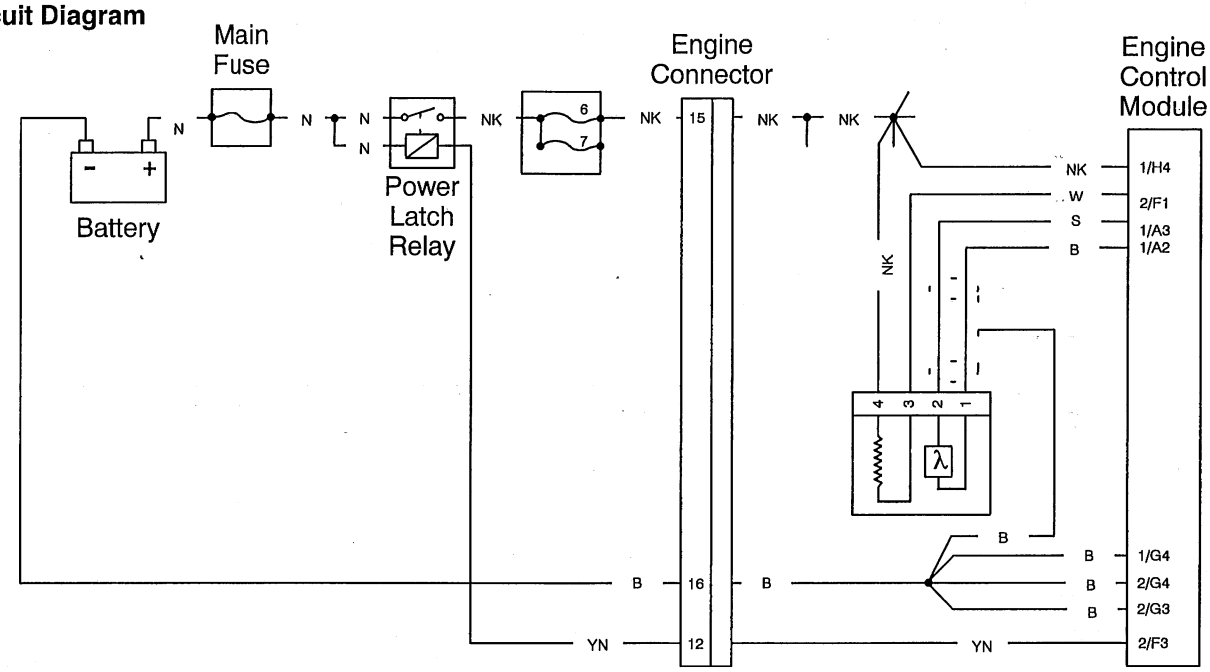
Pinpoint Tests

Test	Result	Action
1. Check cable and terminal integrity. - ECM Pin 1/A2 - ECM Pin 1/A3	OK	Disconnect Sensor and proceed to test 2.
	Faulty	Rectify Fault and proceed to test 10.
2. Check cable continuity - ECM Pin 1/A2 to Sensor Pin 1 - ECM Pin 1/A3 to Sensor Pin 2	OK	Disconnect Sensor and proceed to test 3.
	Faulty	Locate and rectify wiring fault. Proceed to test 10.
3. Check for short circuit to ground. - ECM Pin 1/A2 - ECM Pin 1/A3	OK	Proceed to test 4.
	1.Faulty	Locate and rectify fault. Proceed to test 10.
4. Check for short circuit to battery. - ECM Pin 1/A2 - ECM Pin 1/A3	OK	Proceed to test 5
	Faulty	Locate and rectify fault. Proceed to test 10.
5. Check continuity between sensor boss and battery negative terminal.	OK	Proceed to test 6.
	Faulty	Locate and rectify fault and proceed to test 10.
6. Check for air leaks into the intake system	OK	Proceed to test 7.
	Faulty	Rectify air leak and proceed to test 10.
7. Check fuel rail pressure.	OK	Proceed to test 8.
	Faulty	Rectify and proceed to test 10.
8. Check integrity of purge system pipes, valve and canister.	OK	Proceed to test 9
	Faulty	Rectify and proceed to test 10.

Pinpoint Tests(continued)

Test	Result	Action
9. Check purge valve is not stuck open.	OK	Replace Lambda Sensor and proceed to test 10
	Faulty	Replace purge valve and proceed to test 10
10. Reconnect harness, clear fault code and switch ignition key 'ON' to verify fault cleared.	OK	Action complete – Quit test.
	Fault still present	Contact Triumph Service

Circuit Diagram



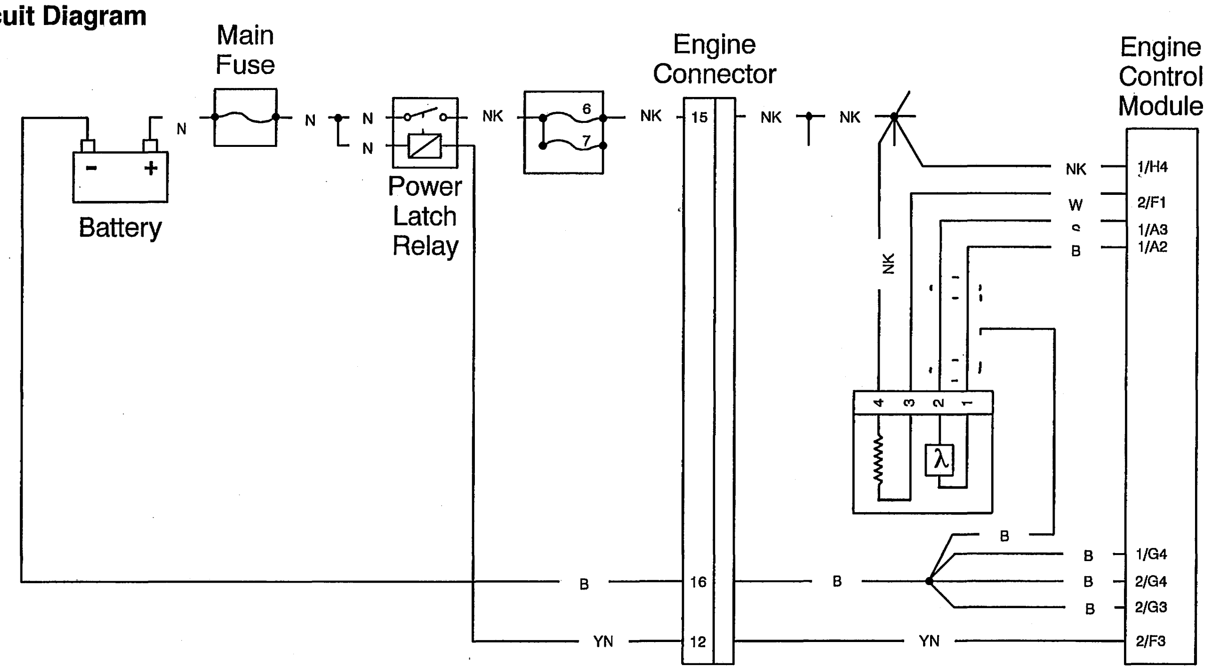
LAMBDA SENSOR (Long Term Feedback) - MC 1000 ECM

Fault Code	Possible Cause	Action
P1178	Air Leak, Low fuel pressure, Faulty purge system, Poor throttle balance.	View and note freeze frame data. Proceed to test 1.
P1179	Blocked idle air control system, High fuel pressure, Faulty purge system	Proceed to test 2

Pinpoint Tests

Test	Result	Action
1. Check throttle balance	OK	Proceed to test 2
	Faulty	Reset and proceed to test 7.
2. Check idle air control system is not blocked.	OK	Proceed to test 3
3. Check for air leaks into the intake system	OK	Proceed to test 4.
	Faulty	Rectify air leak and proceed to test 7.
4. Check fuel rail pressure.	OK	Proceed to test 5.
5. Check integrity of purge system pipes, valve and canister.	OK	Proceed to test 6.
6. Check purge valve is not stuck open.	OK	Proceed to test 7
	Faulty	Replace purge valve and proceed to test 7.
7. Reconnect harness, clear fault code and switch ignition key 'ON' to verify fault cleared.	OK	Action complete – Quit test.
	Fault still present	Contact Triumph Service

Circuit Diagram



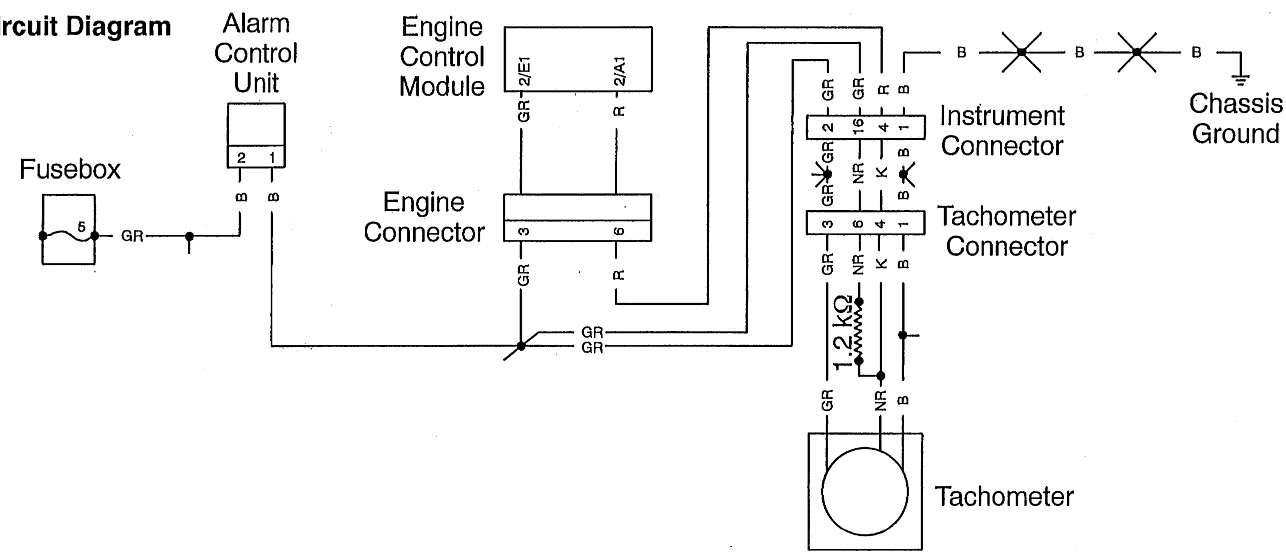
TACHOMETER - MC 1000 ECM

Fault Code	Possible cause	Action
P1385	Tachometer system fault	View & note 'freeze frame' data if available. View & note 'sensor' data. Ensure tachometer connector is secure. Disconnect ECM and proceed to pinpoint test 1:-
P1386	Open circuit, or short circuit to earth	
P1387	Short circuit to battery+	Disconnect tachometer and proceed to pinpoint test 5

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity: - ECM pin 2/A1	OK	Disconnect tachometer and proceed to test 2
	Faulty	Rectify fault, proceed to test 6
2 Check cable for short circuit:	OK	Proceed to test 3
- ECM pin 2/A1 to earth	Short circuit	Locate and rectify wiring fault, proceed to test 6
3 Check cable resistance:	1.1 to 1.3KΩ	Proceed to test 4
- ECM pin 2/A1 to ECM pin 1	Faulty	Renew in-line resistor, proceed to test 6
4 Check cable continuity:	OK	Proceed to test 5
- Tachometer pin 4 to ECM pin 2/A1 - Tachometer pin 1 to earth - Tachometer pin 3 to alarm control unit pin1	Open circuit	Locate and rectify wiring fault, proceed to test 6
5 Check cable for short circuit:	OK	Renew tachometer, proceed to test 6
- ECM pin 2/A1 to ECM pin 2/E1	Short circuit	Locate and rectify wiring fault, proceed to test 6
6 Reconnect harness, clear fault code and run diagnostic tool function test to visually verify operation of tachometer	OK	Action complete - quit test
	Fault still present	Contact Triumph service

Circuit Diagram



Fault Finding - Non Electrical

Symptom	Possible cause(s)
Poor throttle response at low Rpm	Excessively low/high C.O. setting*
	Low fuel pressure caused by filter blockage/leaks
	Low fuel pressure caused by loose fuel pipes to the fuel pump and filter
Cutting out at idle	Throttle bodies out of balance
	IACV (Idle Air Control Valve) inoperative
	Low fuel pressure caused by loose fuel pipes to the fuel pump and filter.
	Excessively low/high C.O. setting*
	Low fuel pressure
Poor response to C.O. adjustment when using the Actia Diagnostic Tool	Weak mixture caused by air leak at the throttle body gasket to cyl. head face
	Low fuel pressure caused by loose fuel pipes to the fuel pump and filter.
Rev limitation cutting in too early	Crankshaft sensor air gap too wide
Idle speed too low/high	IACV (Idle Air Control Valve) sticking
	Incorrect closed throttle position setting
	Mechanical fault with the throttle linkage
Actia tool malfunctions during tune download procedure	Low battery voltage
Throttle hang-up	Incorrect closed throttle position setting
	Low fuel pressure caused by loose fuel pipes to the fuel pump and filter.
	Low fuel pressure due to split fuel filter
Bike will start but cuts out immediately	IACV Stepper Motor stuck
	One way valve inside pipe from throttle bodies to IACV (Idle Air Control Valve) sticking
Abnormally high fuel pressure	Fuel pressure regulator inoperative.
Temperature gauge reads cold	Cooling system air-locked resulting in coolant temperature sensor operating in air instead of coolant.

* Not applicable on closed loop catalyst models.

Fuel Delivery System

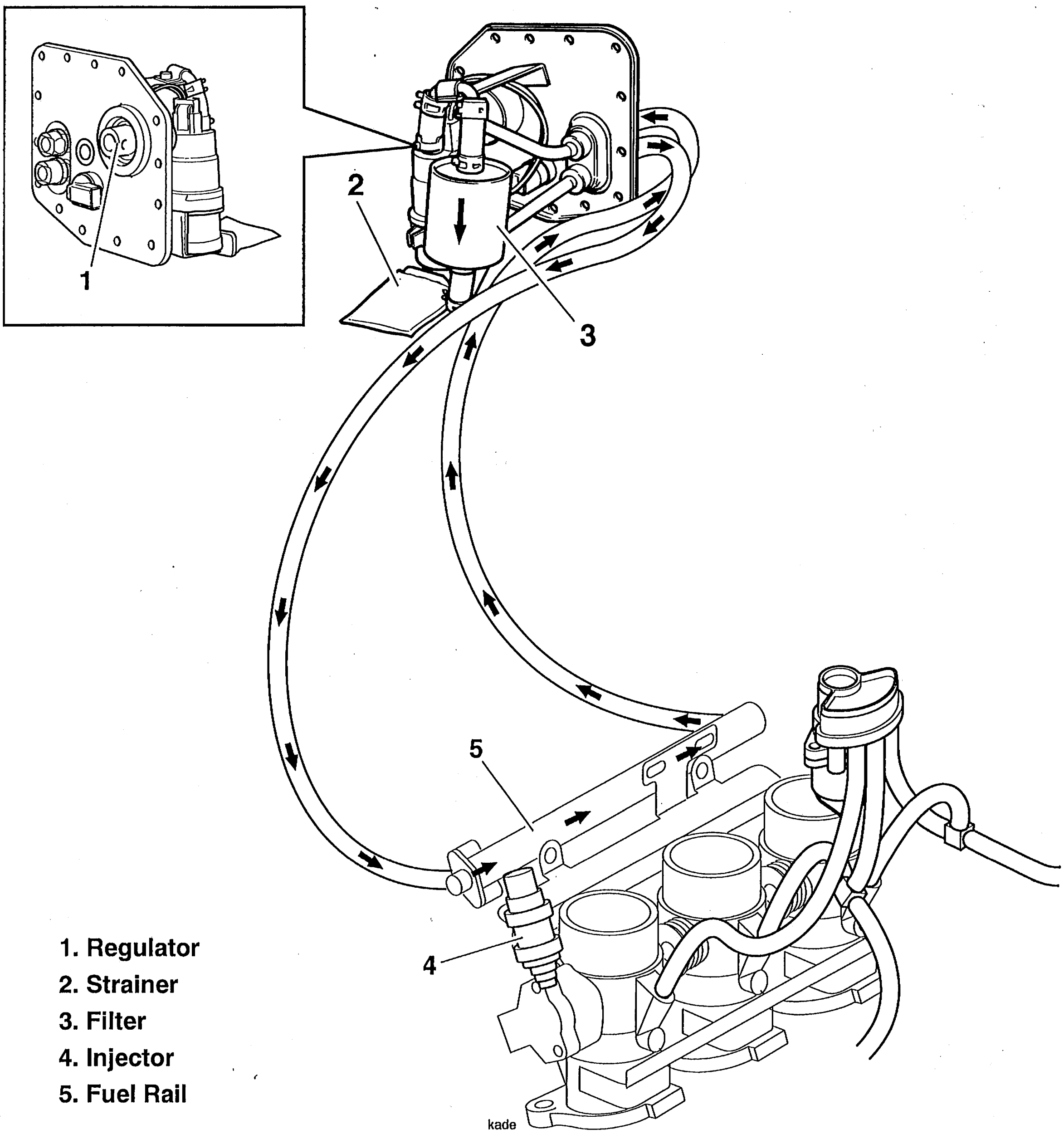
Fuel is delivered to the injectors by a fully submerged pump located inside the fuel tank. Fuel flows in the direction of the arrows shown in the diagram below.

Incorporated in the system is a filter, a pressure regulator and pick-up strainer.

CAUTION: Under no circumstances should the fuel pump be activated (by switching on the ignition) with either, or both, of the fuel hoses disconnected.

Although there is little risk of a fuel leak due to the use of dry-fit connectors, if the fuel pump is activated in this condition, the fuel pressure regulator is bypassed as the system is incomplete.

In this condition, unregulated fuel pressure can be delivered to the fuel filter and hoses which may lead to damage to the filter and detachment of the hoses inside the fuel tank. To ensure this does not happen, always disconnect the battery, negative (black) lead first, when working on the fuel system.



1. **Regulator**
2. **Strainer**
3. **Filter**
4. **Injector**
5. **Fuel Rail**

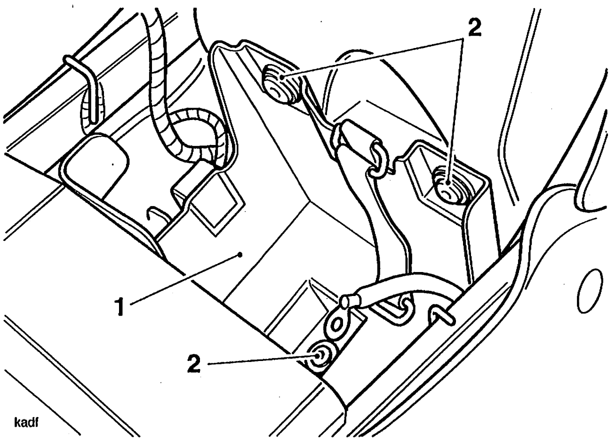
FUEL TANK

Fuel Tank Removal

WARNING: Observe the warning advice given in the general information section on the safe handling of fuel and fuel containers.

A fire, causing personal injury and damage to property, could result from spilled fuel or fuel not handled or stored correctly.

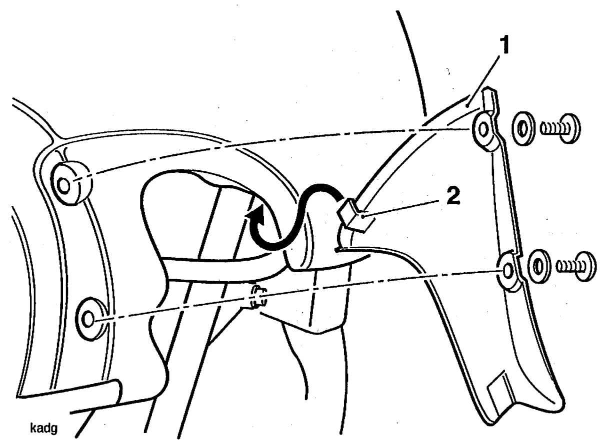
1. Remove the seats and disconnect the battery negative (black) lead first. Remove the battery from the battery case.
2. Remove the battery case.



1. Battery Case

2. Battery Case Fixings

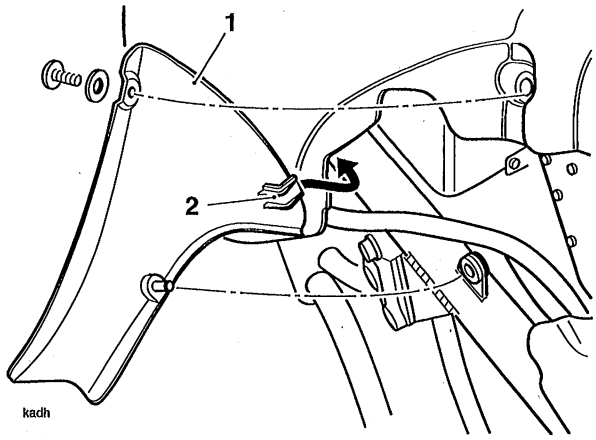
3. Release the fuel tank in-fill panel fixings.
4. On the right hand side, gently lift the rear edge of the panel in order to clear the recess in the fuel tank. Slide the panel down and towards the rear of the motorcycle to release the retaining tag situated at the front of the panel.



1. Right Hand Infill Panel

2. Tag

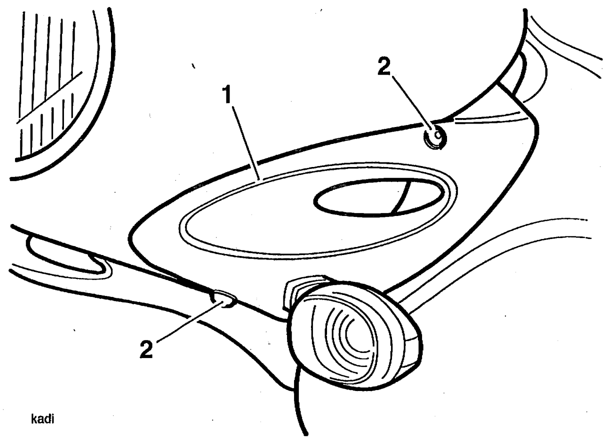
5. On the left hand side, gently lift the rear edge of the panel in order to release the retaining bayonet from the frame. As with the right hand panel, slide the panel down and towards the rear of the motorcycle to release the retaining tag situated at the front of the panel.



1. Left Hand Infill Panel

2. tag

6. Leaving the front indicators attached, detach the cockpit side panels from the fuel tank and cockpit.



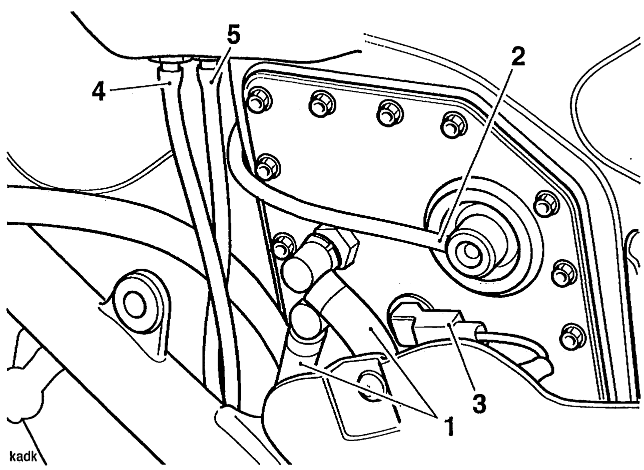
1. Cockpit Side Panel

2. Cockpit Side Panel Fixings

7. From the left hand side of the fuel tank disconnect:-
   - Both fuel hoses.
   - The vacuum hose to the fuel pressure regulator.
   - The electrical connector to the fuel pump.
   - The fuel tank drain hose and the connection to the roll-over valve (where fitted).

NOTE:

- **When disconnected, the fuel hoses are self-sealing.**



1. Fuel Hoses

2. Vacuum Connection

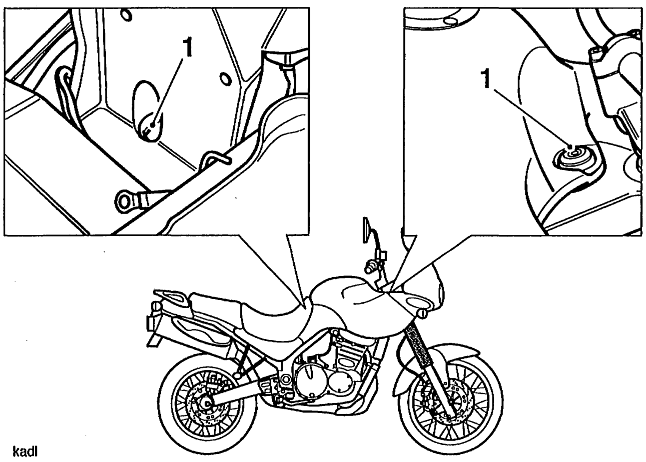
3. Fuel Pump Connection

4. Drain Hose Connection

5. Roll-over Valve Connection (where fitted)

8. On the right hand side of the fuel tank, disconnect the fuel level sender.

9. Release the bolts securing the fuel tank to the frame.



1. Fuel Tank to Frame Bolts

10. Place the handlebars in the straight ahead position.

> ⚠ **CAUTION: During removal of the fuel tank from the frame, the handlebars must be in the straight ahead position. Fuel tank damage WILL occur if the fuel tank is removed with the handlebars in any other position.**

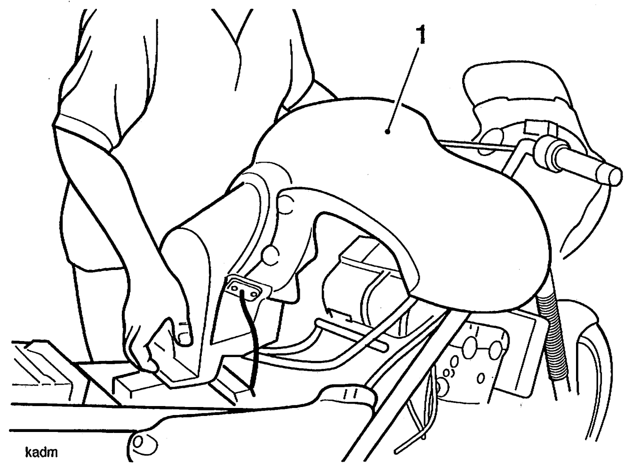
11. To remove the fuel tank, raise the tank, lifting the rear more than the front. When the rear of the tank is clear of the rear suspension unit bridge, move the tank upwards and rearwards to remove completely.

Installation

1. Place the handlebars in the straight ahead position.

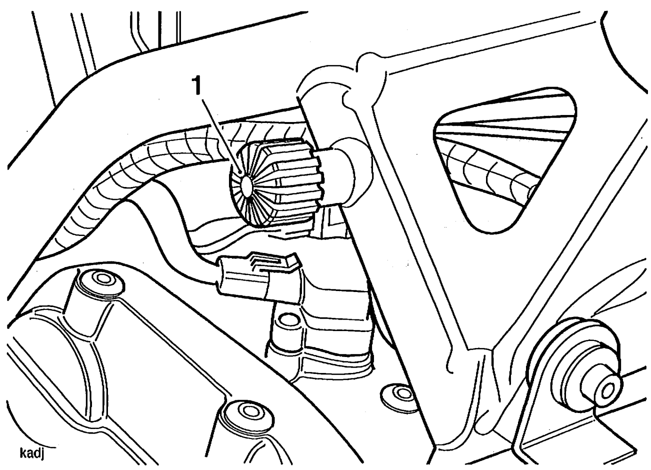
> ⚠ **CAUTION: During installation of the fuel tank, the handlebars must be in the straight ahead position. Fuel tank damage WILL occur if the fuel tank is installed with the handlebars in any other position.**

2. Position the fuel tank to the motorcycle frame as shown below.



1. Fuel Tank

3. Raise the front of the tank and engage the tank to the forward mounting points.



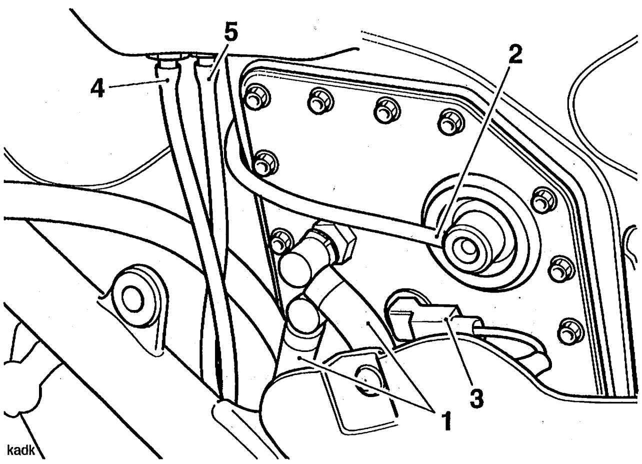
1. Right Hand Forward Mounting Point

> ⚠ **CAUTION: Ensure that the two fuel transfer hoses, situated on the inside face of the tank do not become trapped or kinked during installation.**

4. Align the fuel tank to the mounting points. Tighten the forward fixing to **8 Nm** and the rear fixing to **9 Nm**.

5. On the left hand side of the fuel tank, reconnect:-
   - Both fuel hoses.
   - The vacuum hose to the fuel pressure regulator.
   - The electrical connector to the fuel pump.
   - The fuel tank drain hose and the connection to the roll-over valve (where fitted).

NOTE:
- **When a fuel hose is correctly engaged, an audible 'click' will be heard.**



1. Fuel Hoses

2. Vacuum Connection

3. Fuel Pump Connection

4. Drain Hose Connection

5. Roll-over Valve Connection (where fitted)

6. Reconnect the fuel level sender.
7. Refit the fuel tank infill panels and tighten the panel fixings to **3 Nm**.
8. Refit the cockpit side panels and tighten the fixings to **3 Nm**.
9. Refit the battery box. Tighten the battery box fixings to **9 Nm**.
10. Refit the battery, and connect the battery leads positive (red) lead first.
11. Start the engine and check carefully for fuel leaks. Rectify as necessary.
12. Refit the seats.

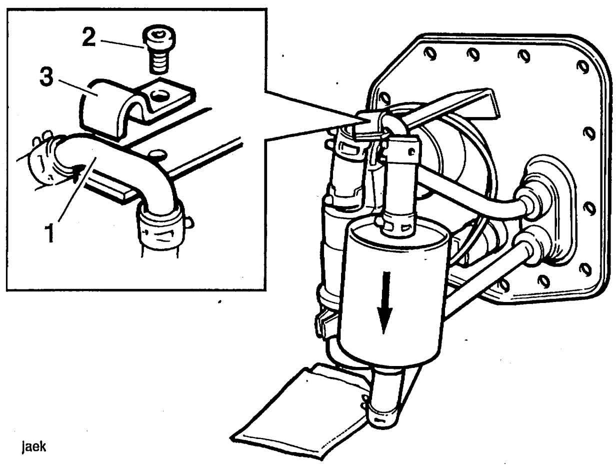
FUEL PUMP

Removal

1. Remove the seats and disconnect the battery negative (black) lead first.
2. Remove the fuel tank as described elsewhere in this section.
3. Drain the fuel tank into a suitable container.

> **WARNING: Observe the warning advice given in the general information section on the safe handling of fuel and fuel containers.**
>
> **A fire, causing personal injury and damage to property, could result from spilled fuel or fuel not handled or stored correctly.**

4. Release the ring of bolts securing the fuel pump mounting plate to the fuel tank.
5. Remove the mounting plate and discard the gasket.
6. Release the clamp bolt securing the fuel hose link pipe to the bracket. Collect the clamp.

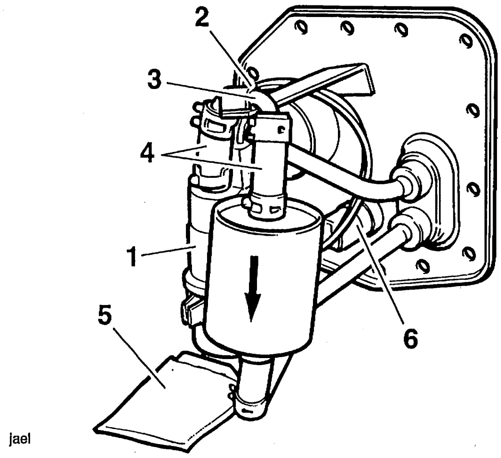


1. Link Pipe

2. Retaining Bolt

3. Clamp

7. Release the clips securing the fuel hoses to the pump and filter. Remove the link pipe and hoses as an assembly.
8. Disconnect the fuel pump electrical connection at the pump.
9. Undo the fuel pump clamp screw and ease the pump from the bracket ensuring the gauze pick-up filter is not damaged during removal.
10. Collect the fuel pump support rubber.



1. Fuel Pump

2. Clamp Screw

3. Link Pipe

4. Fuel Hoses

5. Gauze Pick-up Filter

6. Fuel Pump Connection

Assembly

1. Locate the pump to the mounting bracket ensuring that the rubber support ring is in place at the base of the pump.
2. Tighten the fuel pump clamp screw to **4 Nm.**
3. Refit the fuel hoses and link pipe to the pump and filter and secure with the clips.
4. Refit the link pipe clamp and secure with the clamp bolt.
5. Reconnect the fuel pump cable.
6. Position a new gasket to the fuel tank opening and locate the pump mounting plate to the fuel tank. Tighten the mounting plate fixings to **6 Nm.**

> **CAUTION: Never overtighten the fuel pump mounting plate bolts as this will damage the threaded inserts in the fuel tank.**

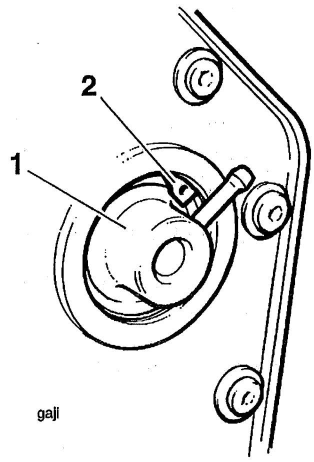
7. Refit the fuel tank as described elsewhere in this section.
8. Refill the fuel tank with the fuel drained earlier.
9. Reconnect the battery, positive (red) lead first.
10. Refit the seats.

FUEL PRESSURE REGULATOR

1. Remove the seats and disconnect the battery negative (black) lead first.
2. Remove the fuel tank as described elsewhere in this section.
3. Drain the fuel tank into a suitable container.

> **WARNING: Observe the warning advice given in the general information section on the safe handling of fuel and fuel containers.**
>
> **A fire, causing personal injury and damage to property, could result from spilled fuel or fuel not handled or stored correctly.**

4. Remove the circlip securing the pressure regulator to the fuel pump mounting plate.



1. Fuel Pressure Regulator

2. Circlip

5. Ease the pressure regulator from the mounting plate.
6. Remove and discard the regulator 'O' rings.

Assembly

1. Fit new 'O' rings to the pressure regulator and lightly lubricate the 'O' rings with petroleum jelly.
2. Fit the pressure regulator and retain with a new circlip.
3. Refit the fuel tank as described elsewhere in this section.
4. Refill the fuel tank with the fuel drained earlier.
5. Reconnect the battery, positive (red) lead first.
6. Refit the seats.

FUEL PRESSURE CHECKING

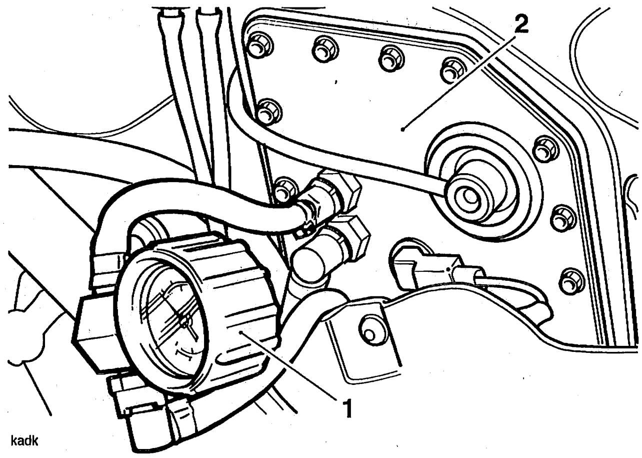
Using Triumph service tool T3880048, allows diagnosis of fuel pump, fuel pressure relief valve and hose related problems without first removing the component concerned.

Test Procedure

1. In order to connect the gauge, turn the ignition to the OFF position and remove the fuel tank trim panel on the left hand side.

> **CAUTION: Never turn the ignition on with either fuel hose disconnected as this will by-pass the fuel pressure regulator and cause excess pressure in the system.**

2. Disconnect either of the fuel hoses and connect the gauge between the detached hose and the fuel pump mounting plate.



1. Gauge (Tool part number T3880048)

2. Mounting Plate

3. Start the engine and check the gauge reading.

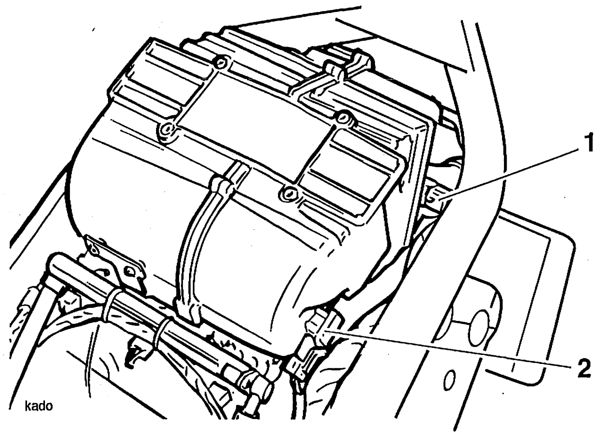
NOTE:

- **If the fuel pressure is being checked because the engine will not start, use the fuel pump test facility on the diagnostic service tool.**
- **If correct, the fuel pressure should be 3.0 Bar +/- 0.25 Bar.**
- **If a higher or lower fuel pressure reading is shown on the gauge, refer to the non-electrical diagnosis table earlier in this section.**

AIRBOX

Removal

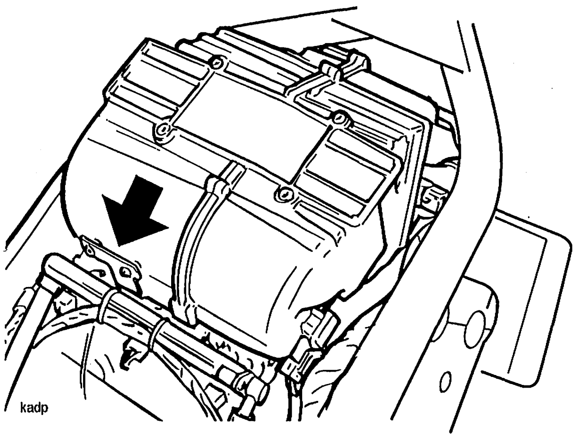
1. Remove the seats and disconnect the battery negative (black) lead first.
2. Remove the fuel tank as described elsewhere in this section.
3. Disconnect the multi-plug connections to the inlet air temperature and barometric pressure sensors.



1. Inlet Air Temperature Connection

2. Barometric Pressure Sensor

4. Disconnect the engine breather hose and fuel pressure regulator hose.
5. Release the bolts securing the airbox to the bracket above the fuel rail.



Arrowed: Airbox Retaining Bolts

6. Raise the rear of the airbox, slide to the rear and remove the airbox from the frame complete with the drain hose.

⚠ CAUTION: To prevent dirt and debris from falling into the throttle openings while the airbox is removed, seal the openings with tape.

If the openings are not protected, debris may fall into the throttles causing damage to the engine and causing the throttles to stick.

Assembly

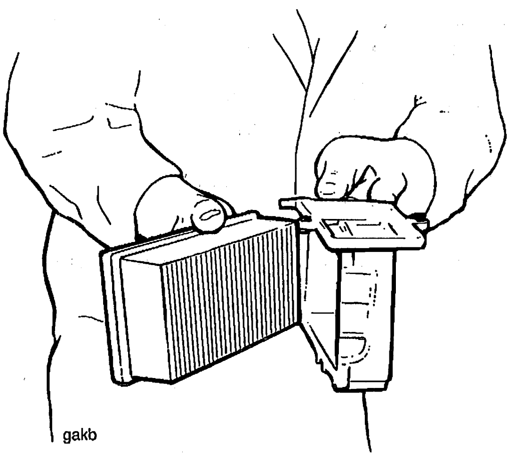
1. Assemble the airbox to the throttle bodies ensuring full engagement of the intakes over the throttles and correct engagement of the front airbox retaining latch.
2. Guide the drain hose into its original location.
3. Tighten the airbox retaining bolts to **5 Nm.**
4. Reconnect the airbox fuel pressure regulator hose and engine breather hose.
5. Reconnect the inlet air temperature sensor and barometric pressure sensor.
6. Refit the fuel tank as described elsewhere in this section.
7. Reconnect the battery, positive (red) lead first.
8. Refit the seats.

Air Filter Element

Removal

1. Remove the seats and disconnect the battery negative (black) lead first.
2. Remove the fuel tank as described elsewhere in this section.
3. Release the screws securing the air filter housing to the airbox and lift up the housing. Retain the gasket for future re-use.
4. Detach the air filter element from the housing.

NOTE:
- **Note the orientation of the element before final detachment. The new item must be assembled in the same orientation.**



Replacing the Air Filter Element

Assembly

1. Clean the air filter housing and locate the new element in the orientation noted during removal.
2. Locate the housing to the airbox ensuring the gasket is correctly positioned. Tighten the screws.
3. Refit the fuel tank as described elsewhere in this section.
4. Reconnect the battery, positive (red) lead first.
5. Refit the seats.

BAROMETRIC PRESSURE SENSOR (To VIN 89736)

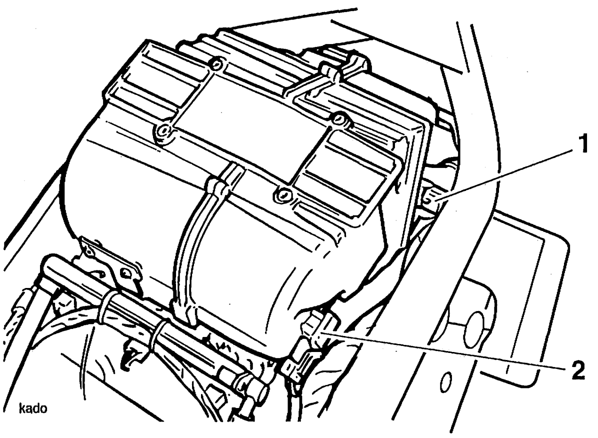
Removal

1. Remove the seats and disconnect the battery negative (black) lead first.
2. Remove the fuel tank as described elsewhere in this section.
3. Disconnect the multiplug connection to the sensor.

NOTE:

- **The barometric pressure sensor is a push fit in the airbox and is retained by a barbed seal.**

4. Remove the sensor by gently pulling in an outward direction.



1. Intake Air Temperature Sensor

2. Barometric Pressure Sensor

Assembly

1. Align the sensor to the airbox and push fully home.
2. Reconnect the multiplug.
3. Refit the fuel tank as described elsewhere in this section
4. Reconnect the battery, positive (red) lead first.
5. Refit the seats.

BAROMETRIC PRESSURE SENSOR (From VIN 89737)

The barometric pressure sensor is an integral part of the ECM.

INTAKE AIR TEMPERATURE SENSOR

Removal

1. Remove the seats and disconnect the battery negative (black) lead first.
2. Remove the fuel tank and airbox as described elsewhere in this section.
3. Disconnect the connection to the sensor after first removing the wire retainer from the multiplug.

NOTE:

- **The intake air temperature sensor has a threaded base which retains it to the airbox.**

4. Unscrew the sensor to remove it from the airbox.

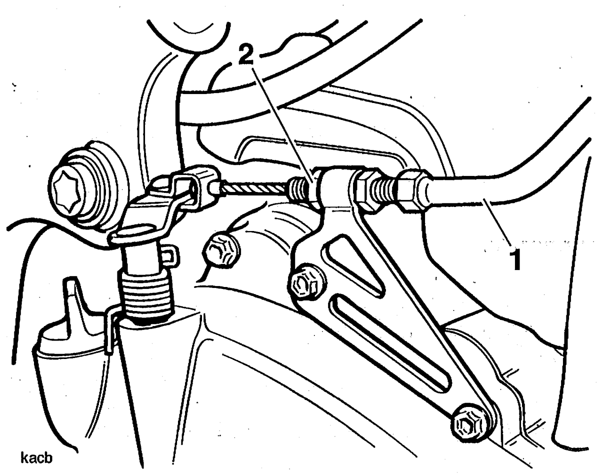
Assembly

1. Fit the temperature sensor to the airbox taking care not to overtighten.
2. Reconnect the multiplug and fit the wire retainer.
3. Refit the airbox and fuel tank as described elsewhere in this section.
4. Reconnect the battery, positive (red) lead first.
5. Refit the seats.

CRANKSHAFT POSITION SENSOR

Removal

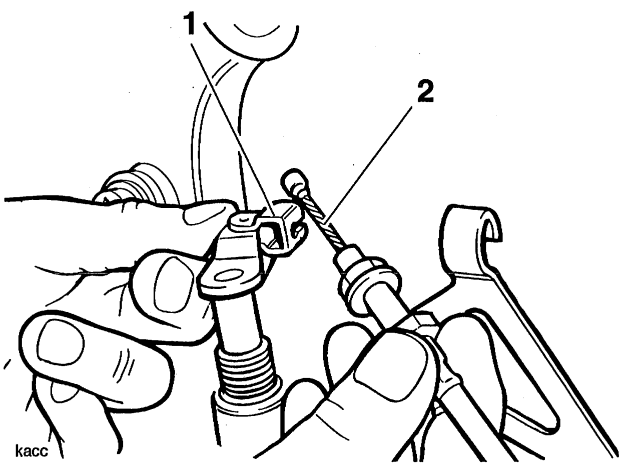
1. Remove the seats and disconnect the battery, negative (black) lead first.
2. Slacken the clutch cable locknut and release the adjuster at the clutch cover end, to give maximum play in the cable.



1. Clutch Cable

2. Adjuster

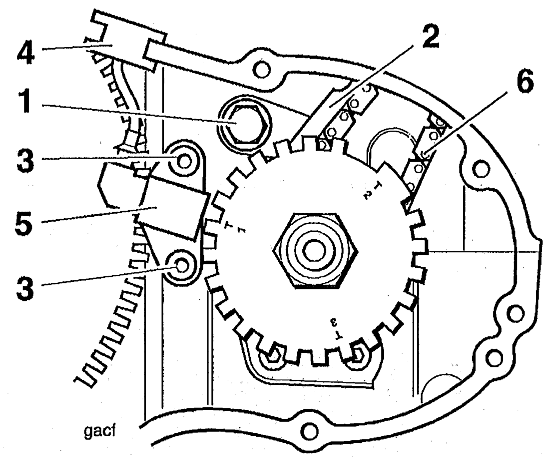
3. Release the clutch cable from the actuating arm by pushing the inner cable nipple through the arm and sliding the cable out of the slot.



1. Actuating Arm

2. Inner Cable

4. Drain the engine oil as described in the lubrication section.
5. Remove the clutch cover.
6. Release the sensor multiplug and detach the sensor grommet from the crankcase.
7. Release the sensor screws and detach the sensor.



1. Camchain Tensioner Blade Retaining Bolt

2. Camchain Tensioner Blade

3. Sensor Screws

4. Rubber Grommet

5. Crankshaft Position Sensor

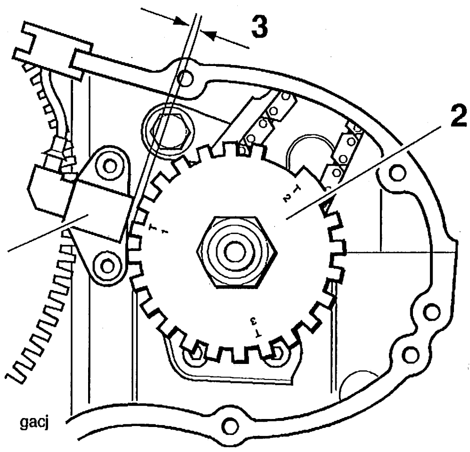
6. Cam Chain

Assembly

1. Assemble the sensor to the crankcase and tighten the screws.
2. Refit the sensor grommet to the crankcase and reconnect the multiplug.
3. Turn the engine over until the 'T1' mark on the crankshaft rotor aligns with the centre of the sensor.
4. Adjust the air gap between the sensor probe and the rotor to 1mm ± 0.20 mm.

NOTE:

- **Always recheck the gap after tightening the screws. Reset the gap if the setting has moved.**



1. Crankshaft Position Sensor

2. Crankshaft Rotor

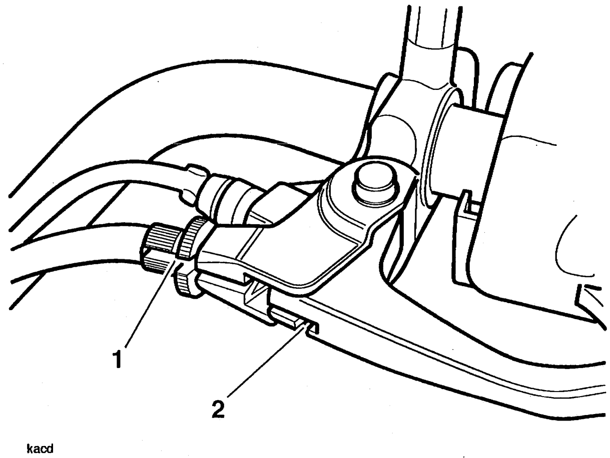
3. 1.00 mm ± 0.20 mm

5. Clean and refit the clutch cover using a new gasket. Tighten the clutch cover bolts to **9 Nm.**
6. Refit the sump drain plug and tighten to **25 Nm.**
7. Re-fill the engine with the correct grade and type of engine oil.
8. Refit the outer cable to the adjuster bracket at the clutch end.

NOTE:

- **Ensure that the two adjuster nuts are positioned, one either side of the bracket.**

9. Set the lever adjuster to a point where an equal adjustment is possible in both directions.
10. Set the adjuster at the clutch end to give a preliminary setting of 2-3mm of free-play as measured at the lever.
11. Operate the clutch lever several times and recheck the amount of free-play present at the lever.



1. Clutch Lever

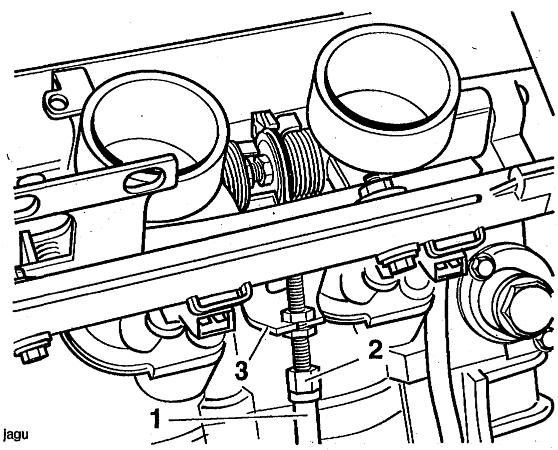
2. 0.4-0.8mm Free Play

12. Set the final adjustment of the cable to give 0.4-0.8 mm of free-play at the lever by turning the adjuster nut and locknut at the lever end.
13. Reconnect the battery positive (red) lead first then the negative (black) lead.
14. Refit the seats.

THROTTLE CABLE

Removal

1. Remove the seats and disconnect the battery negative (black) lead first.
2. Remove the fuel tank and airbox as described in this section.
3. Remove the clip and slacken the adjuster locknut at the throttle body end of the cable such that it will allow the outer cable to be detached from the cable bracket.

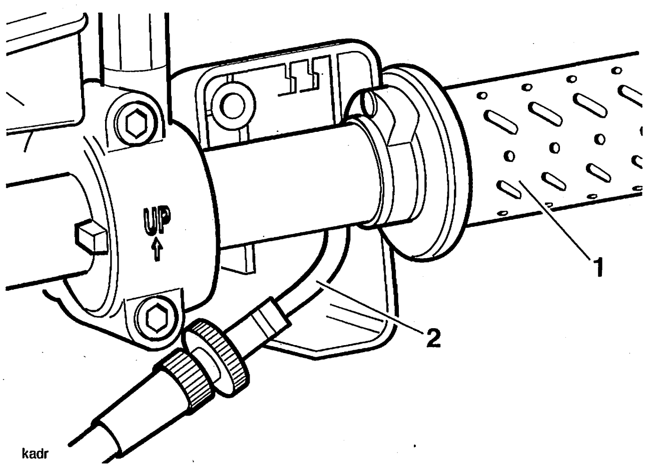


1. Outer Cable

2. Adjuster Locknut

3. Cable Bracket

4. Detach the inner cable from the throttle cam.
5. At the twist grip end, separate the two halves of the right hand switch cube.



1. Twist Grip

2. Twist Grip Guide

6. Release the throttle inner cable from the twist grip.
7. Note the routing of the throttle cable and remove from the frame.

Examination

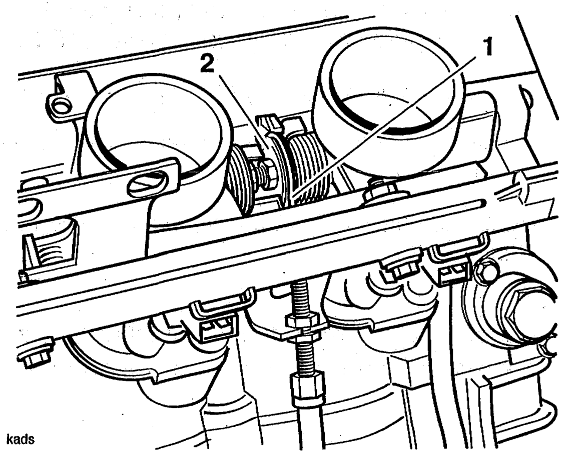
1. Check that the throttle cable operates smoothly, without sticking or binding. Replace the cable if there is any doubt as to its correct operation.

WARNING: Operation of the motorcycle with an incorrectly adjusted, incorrectly routed or damaged throttle cable could interfere with the operation of the brakes, clutch or the throttle itself. Any of these conditions could result in loss of control of the motorcycle and an accident.

WARNING: Move the handlebars to left and right full lock while checking that cables and harnesses do not bind. A cable or harness which binds will restrict the steering and may cause loss of control and an accident.

Installation

1. Locate the cable to the frame following the routing noted during removal.
2. Engage the inner cable nipple to the twist grip.
3. Assemble the two halves of the switch cube ensuring that the cable remains in place on the twist grip.
4. Attach the other end of the inner cable to the throttle cam and locate the outer cable to the cable bracket. Tighten the cable locknut.



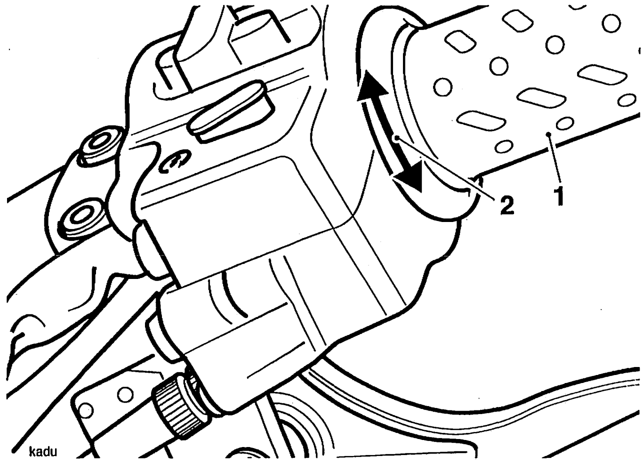
1. Inner Cable

2. Throttle Cam

5. Set the cable adjustment as described below/over.

Adjustment

1. When correctly set, the throttle must have 2-3 mm of free-play at the throttle twist grip. If there is more or less than 2-3 mm of free-play present, the throttle cable must be adjusted.

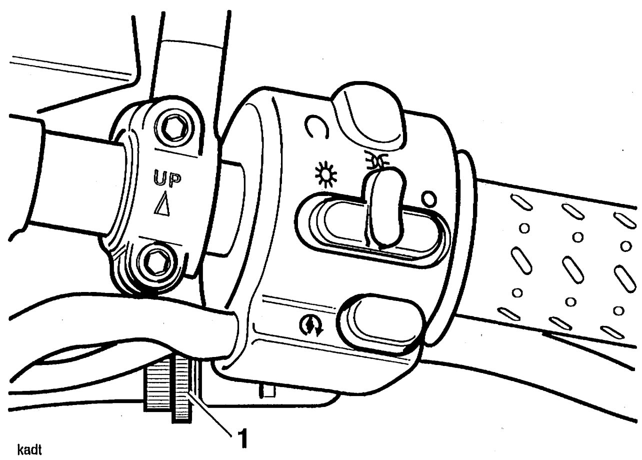


1. Throttle Twist Grip

2. 2-3 mm

NOTE:

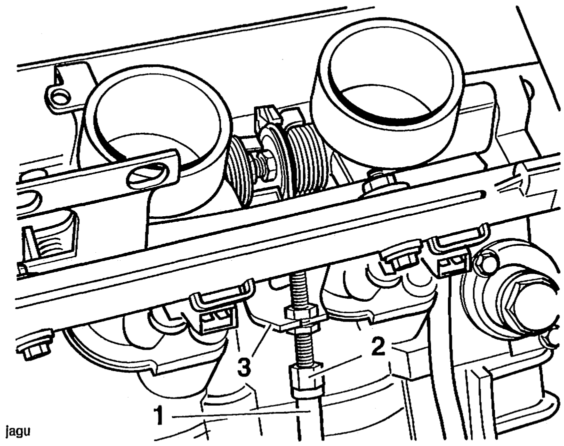
- **Minor adjustments can be made using the adjuster at the twist grip. Where a correct setting cannot be achieved in this way, the adjuster at the throttle body end must be used.**



1. Adjuster - Twist Grip End

2. Set the cable adjuster at the twist grip end such that it has an equal amount of adjustment in each direction.

3. Set the adjuster at the throttle body end of the cable to give 2-3mm of play at the twist grip. Tighten the locknut and refit the clip.



1. Outer Cable

2. Adjuster Locknut

3. Cable Bracket

4. Refit the airbox and fuel tank.

5. Make any minor adjustments as necessary to give 2-3 mm of play using the adjuster at the twist grip end of the cable. Tighten the locknut.

WARNING: Ensure that the adjuster locknuts are tightened. A loose throttle cable adjuster could cause the throttle to stick leading to loss of control and an accident.

WARNING: Operation of the motorcycle with an incorrectly adjusted, incorrectly routed or damaged throttle cable could interfere with the operation of the brakes, clutch or the throttle itself. Any of these conditions could result in loss of control of the motorcycle and an accident.

WARNING: Move the handlebars to left and right full lock while checking that cables and harnesses do not bind. A cable or harness which binds will restrict the steering and may cause loss of control and an accident.

6. Reconnect the battery, positive (red) lead first.

7. Refit the seats.

THROTTLE BODIES

Removal

NOTE:

- **If the fuel rail is to be removed, select neutral, disconnect the wiring connection to the fuel pump and crank the engine briefly to reduce fuel pressure in the fuel rail.**

WARNING: Because fuel stored in the fuel rail will be at 3 bar pressure, it is essential that the fuel pressure is reduced before any dismantling of the throttle bodies takes place.

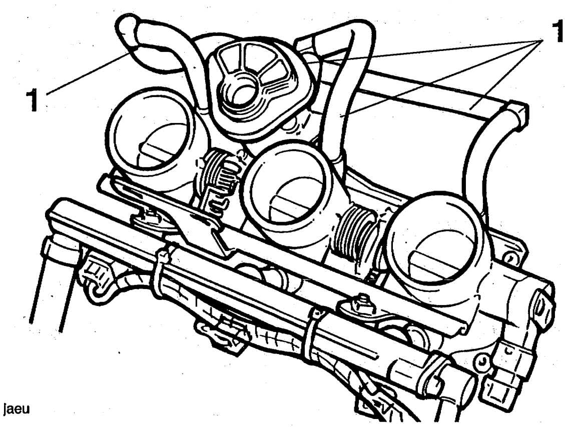
If the throttle bodies are dismantled without first reducing fuel pressure, pressurised fuel may escape causing clothing and components to be coated with fuel.

This would represent a serious fire hazard which could lead to burn injuries and damage to property.

1. Remove the seats and disconnect the battery negative (black) lead first.
2. Remove the fuel tank and airbox as described elsewhere in this section.

NOTE:

- **It is not necessary to disconnect the air bypass hoses when removing the throttle bodies.**

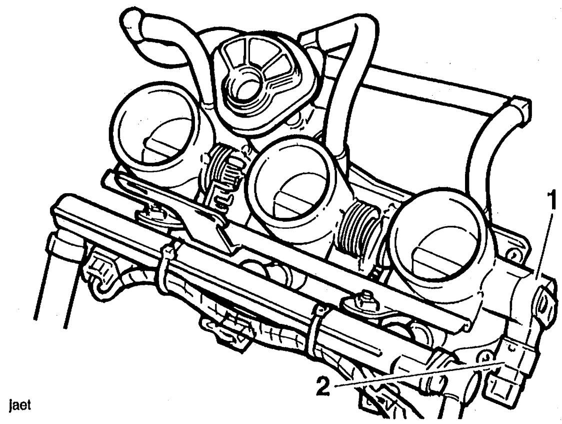


1. Air Bypass System

3. Disconnect the multi-plug leading to the throttle position sensor.

NOTE:

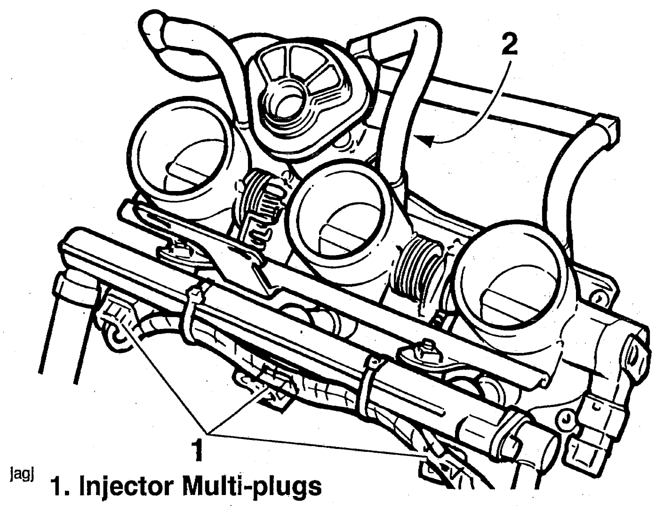
- **Make a note of the location of any cable ties and ensure that, on assembly, the ties are replaced in the same positions.**



1. Throttle Position Sensor

2. Multi-plug

4. Release the throttle cable adjusters and disconnect the throttle cable.
5. Release any cable ties securing the injector cables to the fuel rail.
6. Disconnect the multi-plugs to each injector.
7. Disconnect the multiplug to the idle air control valve.



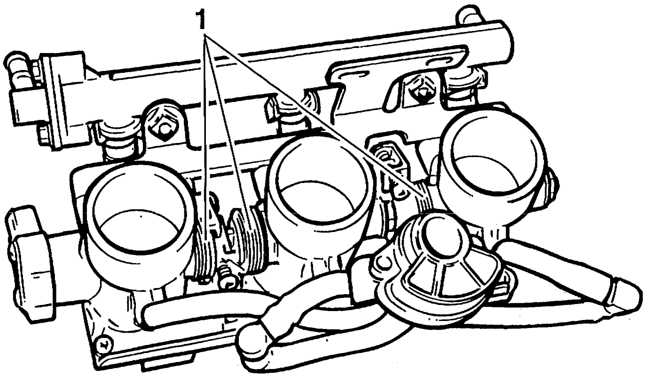
1. Injector Multi-plugs

2. Idle Control Valve Multiplug

8. Release the screws securing the throttle body assembly to the cylinder head.
9. Remove the throttle body assembly and collect the gasket.

Inspection

1. Check that the throttles open and close smoothly and do not stick in any position.
2. Examine all throttle springs for damage, looseness and breakages.



1. Throttle Springs

3. Check for signs of fuel leaks at the injector connections with the fuel rail.

Assembly

1. Thoroughly clean the throttle body to cylinder head mating surfaces.

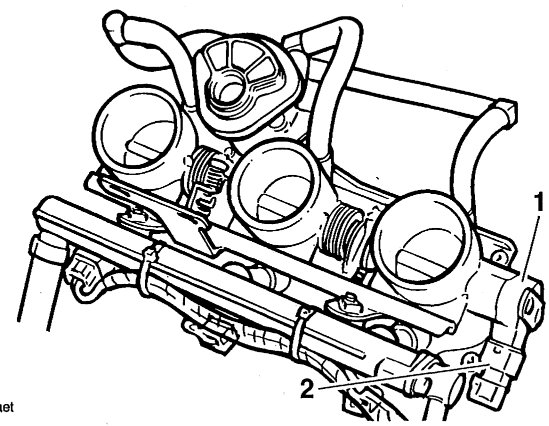
> **CAUTION: Ensure that no debris is allowed to fall into the engine or throttles. Engine damage will result from ingress of debris to the cylinder head or throttles.**

2. Check that the two locating dowels are correctly seatsed in the cylinder head.
3. Fit a new gasket over the locating dowels ensuring that the gasket tab is positioned to the left hand side.
4. Locate the throttle body assembly to the cylinder head.
5. Tighten the throttle body to cylinder head screws to **12 Nm.**
6. Refit the throttle cable and adjust to give 2-3 mm of free-play at the twist grip (the adjustment procedure is detailed elsewhere in this section). Check for smooth throttle operation. Rectify as necessary.

> **WARNING: Operation of the motorcycle with an incorrectly adjusted, incorrectly routed or damaged throttle cable could interfere with the operation of the brakes, clutch or the throttle itself. Any of these conditions could result in loss of control of the motorcycle and an accident.**

> **WARNING: Move the handlebars to left and right full lock while checking that cables and harnesses do not bind. A cable or harness which binds will restrict the steering and may cause loss of control and an accident.**

7. Reconnect the injector multi-plugs and secure using new cable ties.
8. Reconnect the throttle position sensor.
9. Reconnect the multiplug to the idle air control valve.



1. Throttle Position Sensor

2. Multi-plug

10. Refit the airbox and fuel tank as described elsewhere in this section.
11. Reconnect the battery, positive (red) lead first.
12. Refit the seats.

THROTTLE BODY BALANCING

NOTE:

- **In order to accurately balance the throttle bodies, Triumph recommend the use of the *Sagem-Souriau Indiana* digital inlet vacuum analyser or another similar device. Although mercury columns or analogue gauges will allow balancing of the throttle bodies, use of a digital meter will allow a more accurate balance to be achieved.**

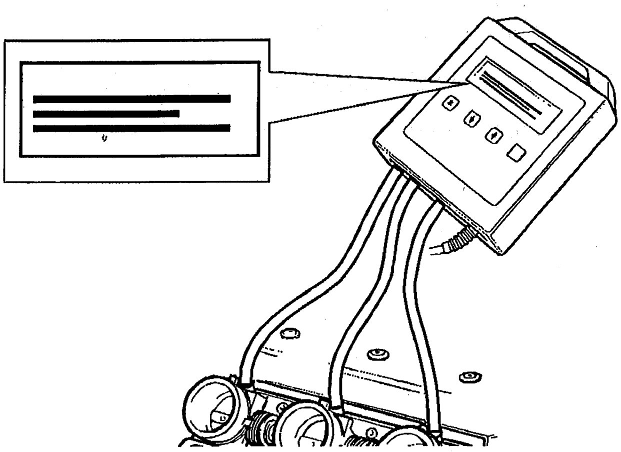
1. Remove the fuel tank and airbox as described elsewhere in this section.
2. Disconnect the idle air control hoses from the throttle bodies.
3. Disconnect and remove the idle air control valve.

CAUTION: The idle control valve may be damaged if it is not disconnected and removed while the throttles are balanced.

4. Position the analyser in a position that it can be easily read and attach the hoses to the idle air control ports on the throttle bodies.
5. Remove the sealer (if any) from the adjustment screws.

WARNING: If the engine has recently been running, the components beneath the fuel tank cover may be hot to the touch.

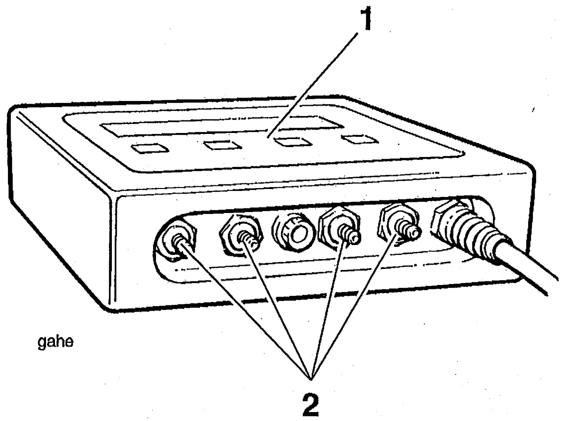
Contact with the hot components may cause damage to exposed skin. To avoid skin damage, always allow the hot parts to cool before hose disconnection/connection.



Typical Analyser Display

NOTE:

- **The hose connections on the tool are marked 1, 2, 3 etc. denoting which cylinder they should be connected to. When connecting the hoses to the throttles, ensure that hose 1 is connected to cylinder number one etc. Cylinder 1 is on the left hand side of the motorcycle.**



1. Analyser marking

2. Throttle body connections

6. Temporarily refit the fuel tank and reconnect the fuel hoses and fuel pump connection.

NOTE:

- **A kit of parts (part number T3880127) is available from Triumph to allow the tank to be remotely located yet still run the engine.**

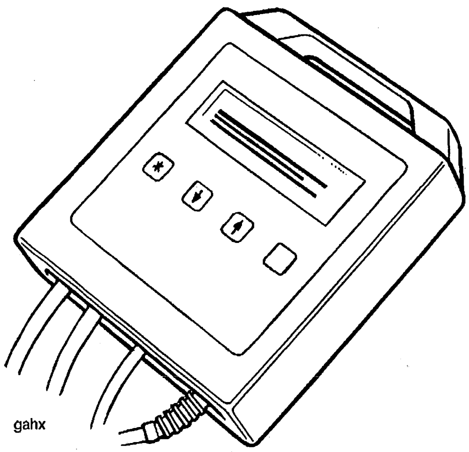
7. Attach an exhaust extraction hose to the silencer.
8. Start the engine.

NOTE:

- **Throughout the balancing procedure, it will be necessary to open the throttle slightly to prevent the engine from stalling. This is because the idle air control system has been disconnected to allow attachment of the analyser hoses.**

9. Using the throttle twist grip, hold the engine speed at approximately 1200 RPM.

10. Select the bar chart display on the analyser and assess which cylinders require adjustment.



Typical display of imbalanced throttles.

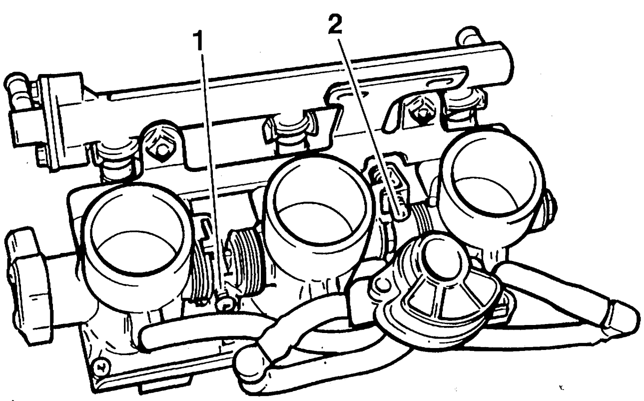
NOTE:

- **The left hand (number 1) cylinder is non-adjustable. All other cylinders are adjusted to match the setting of number 1 cylinder, though it should be noted that adjustment of any cylinder will marginally affect the setting of the other two.**

11. Keeping the engine speed at around 1200 rpm, set both adjusters such that all three throttle bodies have an equal vacuum reading.

NOTE:

- **The adjusters can be reached by working in the space where the fuel tank cover would normally fit.**



1. Adjuster - number 2 cylinder

2. Adjuster - number 3 cylinder

12. Stop the engine.
13. Disconnect the fuel tank.
14. Refit and connect the idle air control valve.
15. Reconnect the idle air control hoses.
16. Refit the air box and fuel tank as described earlier in this section.
17. Start the engine and check that the idle speed is in the range 1200 $\pm$ 50 rpm.
18. Re-apply sealer to the adjustment screws.

NOTE:

- **If the idle speed now falls outside the above range, adjust the closed throttle position using the Triumph service diagnostic tool. Refer to the tool's operating instructions for details.**

INJECTORS

Removal

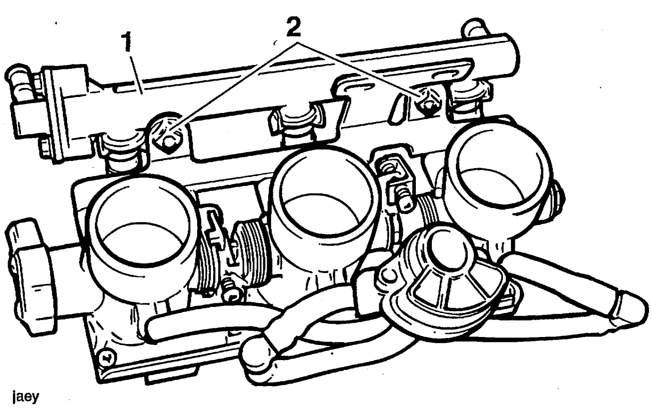
1. Remove the seats and disconnect the battery negative (black) lead first.
2. Remove the fuel tank and airbox as described elsewhere in this section.
3. Move the gearchange to neutral and crank the engine briefly to reduce fuel pressure in the fuel rail.

> **WARNING: Because fuel stored in the fuel rail will be at 3 bar pressure, it is essential that the fuel pressure is reduced before any dismantling of the throttle bodies takes place.**
>
> **If the throttle bodies are dismantled without first reducing fuel pressure, pressurised fuel may escape causing clothing and components to be coated with fuel.**
>
> **This would represent a serious fire hazard which could lead to burn injuries and damage to property.**

4. Release any cable ties securing the injector cables to the fuel rail.
5. Disconnect the multi-plugs to each injector.

NOTE:
- **Make a note of the location of any cable ties and ensure that, on assembly, the ties are replaced in the same positions.**

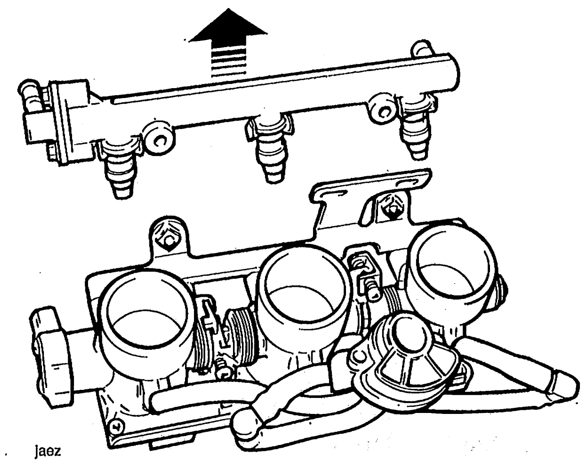
6. Release the two screws securing the fuel rail to its support bracket.



1. Fuel Rail

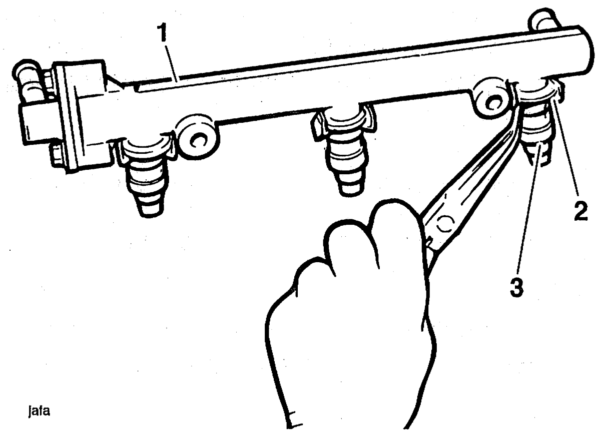
2. Fuel Rail Screws

7. Leaving the injectors attached to the fuel rail, ease the injectors upwards and remove from the throttle body assembly.



Removing the Injectors/Fuel Rail

8. Remove the clips from the top of each injector.



1. Fuel Rail

2. Circlip

3. Injector

9. Ease the injectors from the fuel rail to remove each injector.

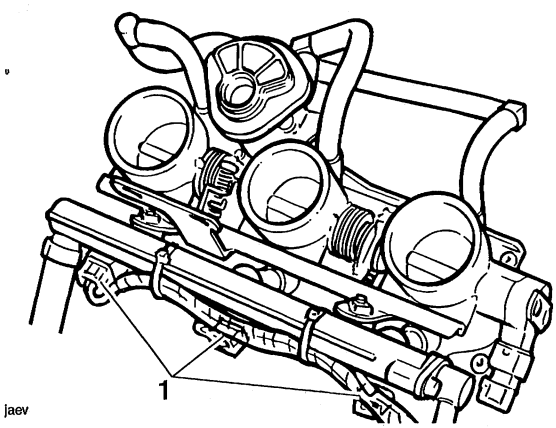
Inspection

1. Check the injector 'O' rings for damage, splits etc. Renew as necessary.

NOTE:
- **The injectors cannot be pressure tested.**

Assembly

1. Fit new injector 'O' rings.
2. Locate the injectors to the fuel rail and rotate the injectors such that the electrical connections will face down and to the rear of the motorcycle when fitted.
3. Refit the injector retaining clips.
4. Locate the injectors to the throttle bodies and engage to a depth that allows the fuel rail to bracket screws to be refitted.
5. Refit the fuel rail to bracket screws and tighten to **5 Nm.**
6. Reassemble the injector multiplugs to each injector and secure with cable ties as noted during strip down.



1. Injector Multiplugs

7. Refit the airbox as described elsewhere in this section.
8. Refit the fuel tank as described elsewhere in this section.
9. Reconnect the battery positive (red) lead first.
10. Refit the seats.

THROTTLE POSITION SENSOR

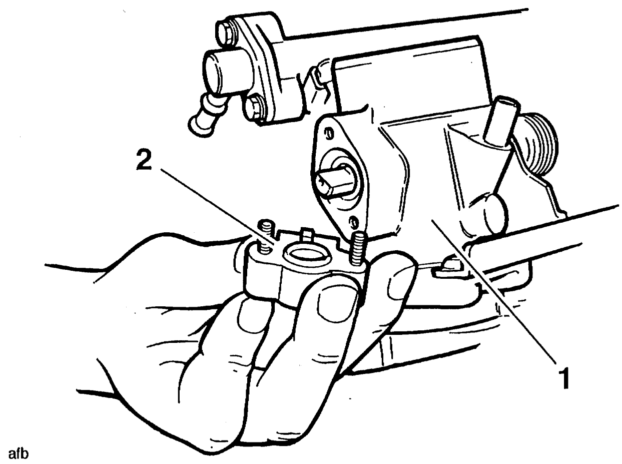
CAUTION: If the throttle position sensor is replaced, the electronic value of the closed throttle position must be adjusted using the Triumph service diagnostic tool.

If the closed throttle position value is not reset, fuel consumption, idle speed and engine performance will be adversely affected.

For details of how to reset the closed throttle position value, refer to the 'adjustment' instructions elsewhere in this section.

Removal

1. Remove the seats and disconnect the battery, negative (black) lead first.
2. Remove the throttle bodies as described elsewhere in this section.
3. Release the screws securing the sensor to the right hand throttle body. Remove the sensor.



1. Right Hand Throttle Body

2. Throttle Position Sensor

Inspection

1. Check the electrical connectors for pin damage and corrosion. Renew as necessary.
2. Check the sensor body for damage, splits, cracks etc. Renew as necessary.

Assembly

1. Locate the sensor to the throttle body ensuring that the 'D' shaped extension of the throttle spindle engages in the mating recess in the sensor.
2. Tighten the sensor fixings to **2 Nm**.
3. Refit the throttle bodies as described elsewhere in this section.
4. Reconnect the battery, positive (red) lead first.
5. Adjust the closed throttle position electronic value using the Triumph service diagnostic tool.

NOTE:

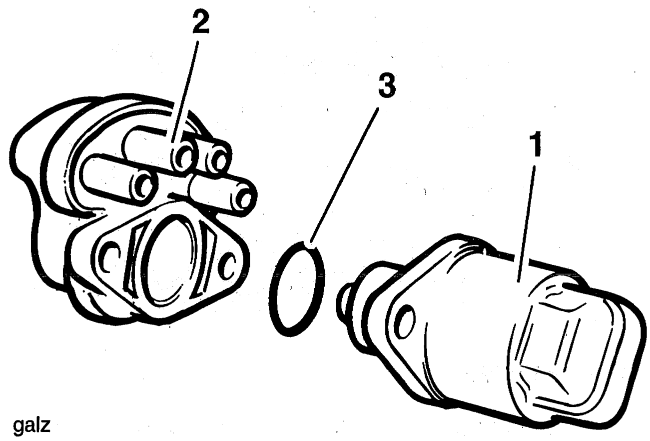
- **For details of how to reset the closed throttle position value, refer to the diagnostic tool instructions elsewhere in this section.**

6. Refit the seats.

IDLE AIR CONTROL VALVE

Removal

1. Remove the seats and disconnect the battery, negative (black) lead first.
2. Remove the fuel tank as detailed elsewhere in this section.
3. Remove the airbox.
4. To ensure that they are returned to the same positions on assembly, note the position of each hose leading from the idle air control valve to the throttle bodies. Disconnect the hoses at the valve.
5. Release the two screws securing the valve to the upper side of the throttle body and remove the valve assembly.
6. Release the screws securing the stepper motor to the valve body.



galz

1. Stepper Motor

2. Valve Body

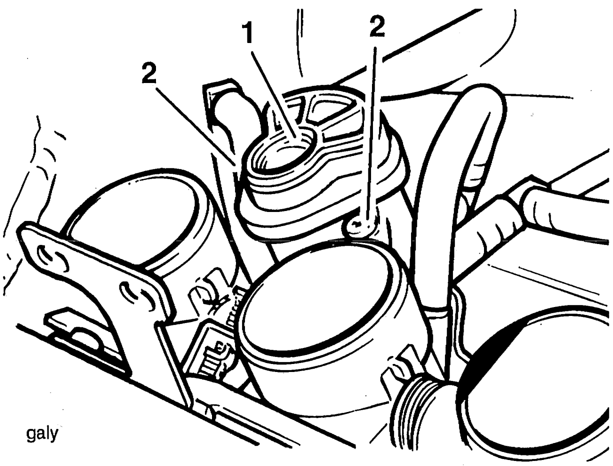
3. 'O' ring

Inspection/test

1. The valve is checked for correct operation using the Triumph service diagnostic tool. No other tests are possible.
2. Check the valve body for cracks, damage and deterioration. Replace as necessary.

Assembly

1. Assemble the stepper motor to the valve body and secure using the original fixings.
2. Position the valve bracket to the throttle body and tighten the fixing to **12 Nm.**



1. Idle Air Control Valve

2. Retaining Screws

3. Reconnect the hoses as noted during the removal process.
4. Refit the airbox as described elsewhere in this section.
5. Refit the fuel tank as described elsewhere in this section.
6. Reconnect the battery, positive (red) lead first.
7. Reset the adaptive step position using the service diagnostic tool.
8. Refit the seats.

EXHAUST SYSTEM

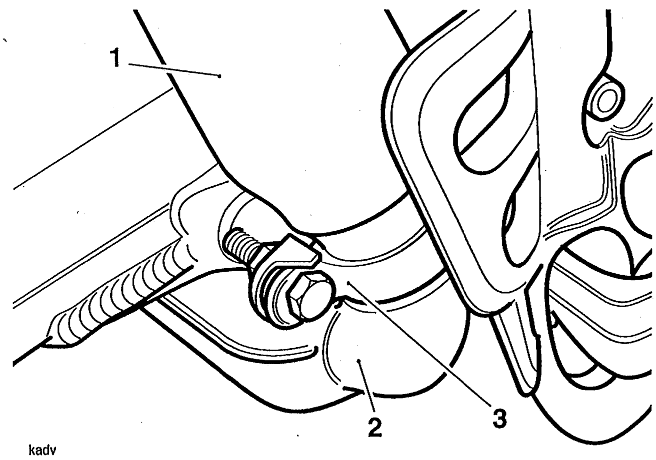
Removal

NOTE:

- **The exhaust system can. if required, be removed as a complete assembly. The method detailed here separates each component from each other as each component can be replaced separately.**

> **WARNING: If the engine has recently been running, the exhaust components may be hot to the touch.**
>
> **Contact with the hot components may cause damage to exposed skin. To avoid skin damage, always allow the hot parts to cool before working on the exhaust system.**

1. Remove the seats.
2. Disconnect the battery, negative (black) lead first.
3. Release the silencer to collector box clamp.

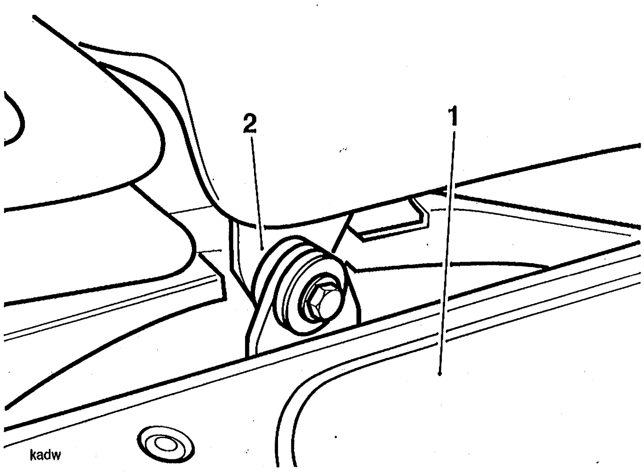


1. Silencer

2. Collector Box

3. Clamp

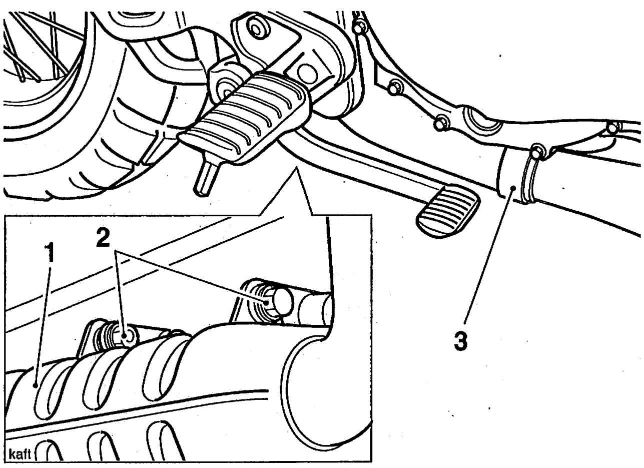
4. Support the silencer and release the bolt securing the silencer mounting bracket to the frame.



1. Silencer

2. Mounting Bracket

5. Remove the silencer.
6. If fitted, disconnect the lambda (oxygen) sensor.
7. Release the collector box mounting bolts.

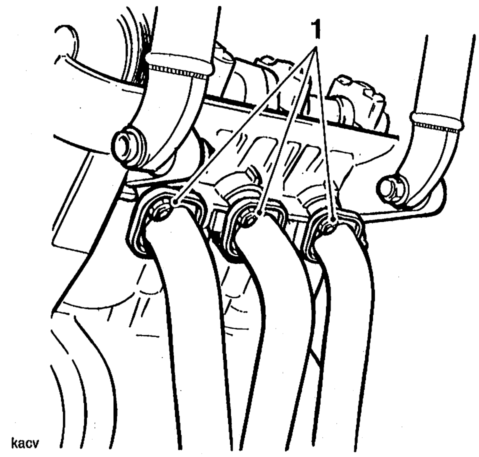


1. Collector Box

2. Collector Box Mounting Bolts

3. Clamp

8. Release the collector box to downpipe clamp and remove the collector box.
9. Release the fixings securing the downpipe joints to the cylinder head.



1. Downpipe to Cylinder Head Fixings

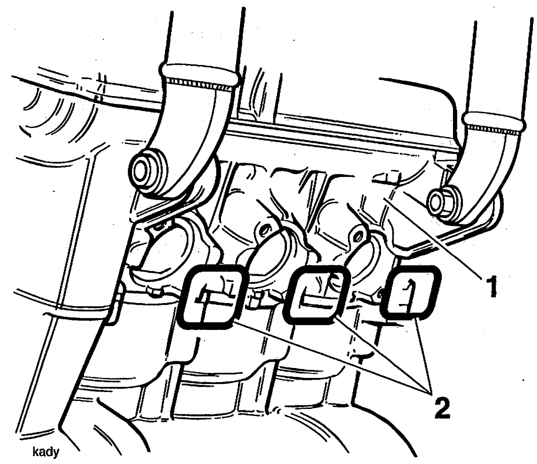
NOTE:

- **It is not necessary to remove the radiator in order to gain access to the downpipe fixings.**

10. Detach the downpipe assembly and collect the seals from the head ports.

Assembly

1. Fit new seals to the cylinder head.



1. Cylinder Head

2. Seals

NOTE:

- **A smear of grease may be used to retain the seals in the cylinder head during assembly.**

2. Locate the downpipes and align the downpipe flanges to the fixings points.
3. Tighten the downpipe flange fixings in stages;

   first tighten all downpipe fixings to **8 Nm**,

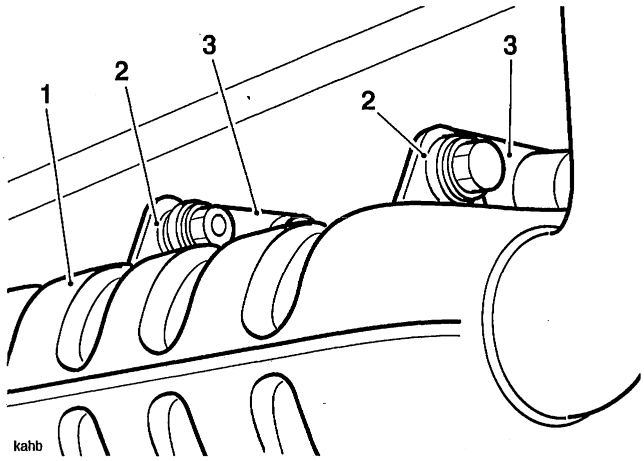
   then tighten all downpipe fixings to **12 Nm.**

4. Place the collector box clamp over the downpipe exit.

5. Position and engage the collector box to the downpipe.

6. Align the collector box mounting points to the corresponding mounting brackets. Locate but do not tighten the mounting bolts.

7. If fitted, reconnect the lambda sensor.



1. Collector Box

2. Mounting Points

3. Mounting Brackets

8. Place the silencer clamp over the collector box exit.

9. Position and engage the silencer to the collector box.

10. Align the silencer mounting bracket to the frame and tighten the fixing to **15 Nm.**

11. Align the silencer and collector box clamps to the joints and tighten the clamp bolts to **22 Nm.**

12. Tighten the collector box mounting bolts to **3 Nm.**

13. Refit the downpipe cover and tighten the fixings to **7 Nm.**

14. Reconnect the battery, positive (red) lead first.

15. Refit the seats.

16. Start the engine and check for exhaust gas leaks etc. Rectify as necessary.

EVAPORATIVE LOSS CONTROL SYSTEM

California Models Only

All California models are fitted with a system to control the evaporation of fuel vapour into the atmosphere.

A carbon cannister absorbs vapour while the engine is not running and, when the engine is started, the vapour is returned to the engine and burnt.

There are two distinct phases to the system's operation, engine off and engine running. These two conditions are explained overleaf.

Component Locations

Carbon Canister - behind the throttle bodies.

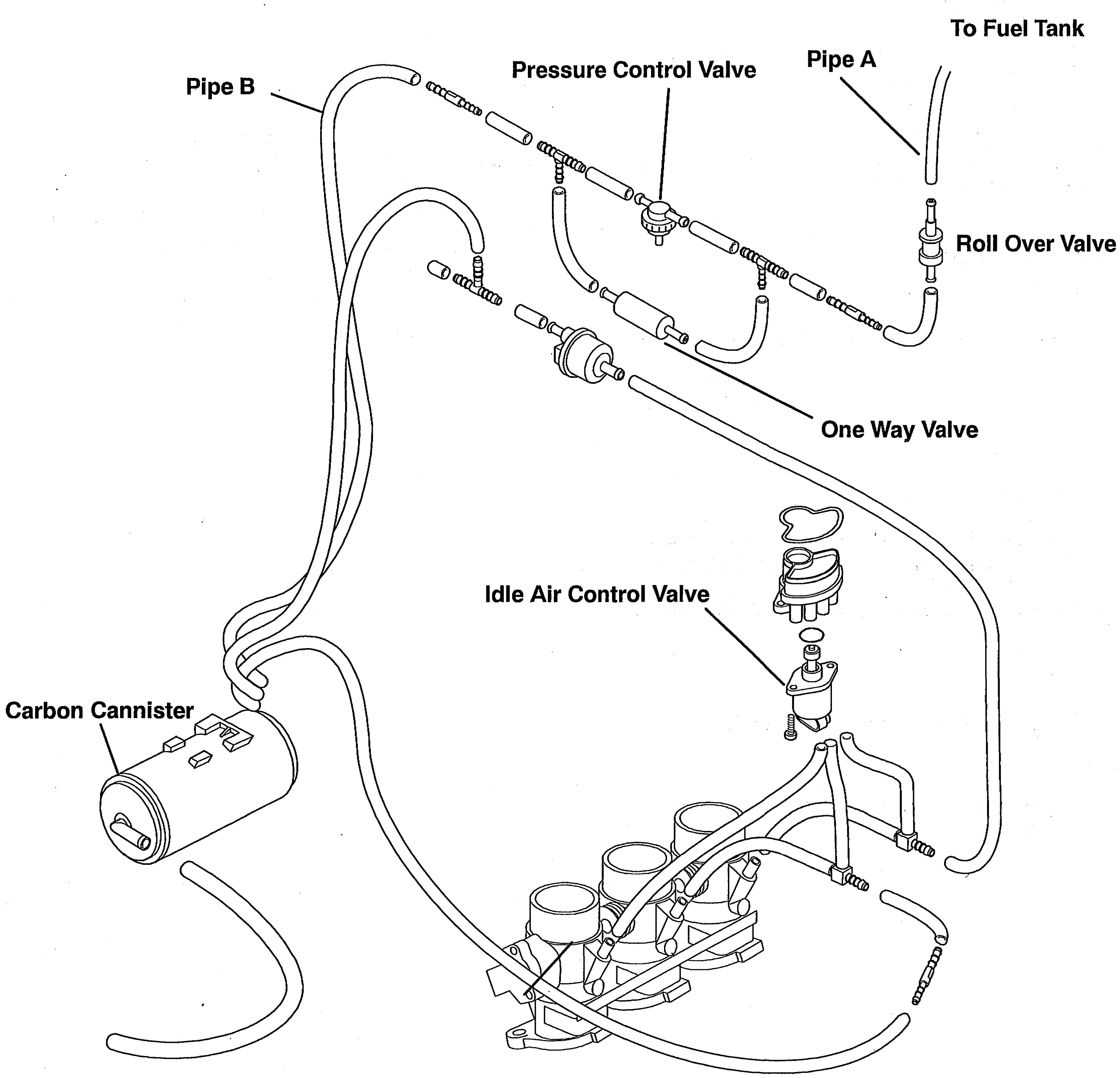
Pressure Control Valve - in the vapour line from the fuel tank.

Purge Control Valve - adjacent to frame, left hand side (electronically controlled by the ECM).

Roll Over Valve - in the vapour line from the fuel tank.

Evaporative Control System - Engine Off.

When the engine is stationary any pressure increase in the fuel tank due to a rise in ambient temperature will cause the fuel vapour to pass down the breather pipe A, through the roll over valve to the pressure control valve. When the pressure is greater than 0.75 lb/in^2 the valve opens allowing vapour to pass through pipe B to the canister. A one-way valve in pipe A will allow vapour to return to the fuel tank if vapour pressures falls and a vacuum is, therefore, created in the fuel tank.

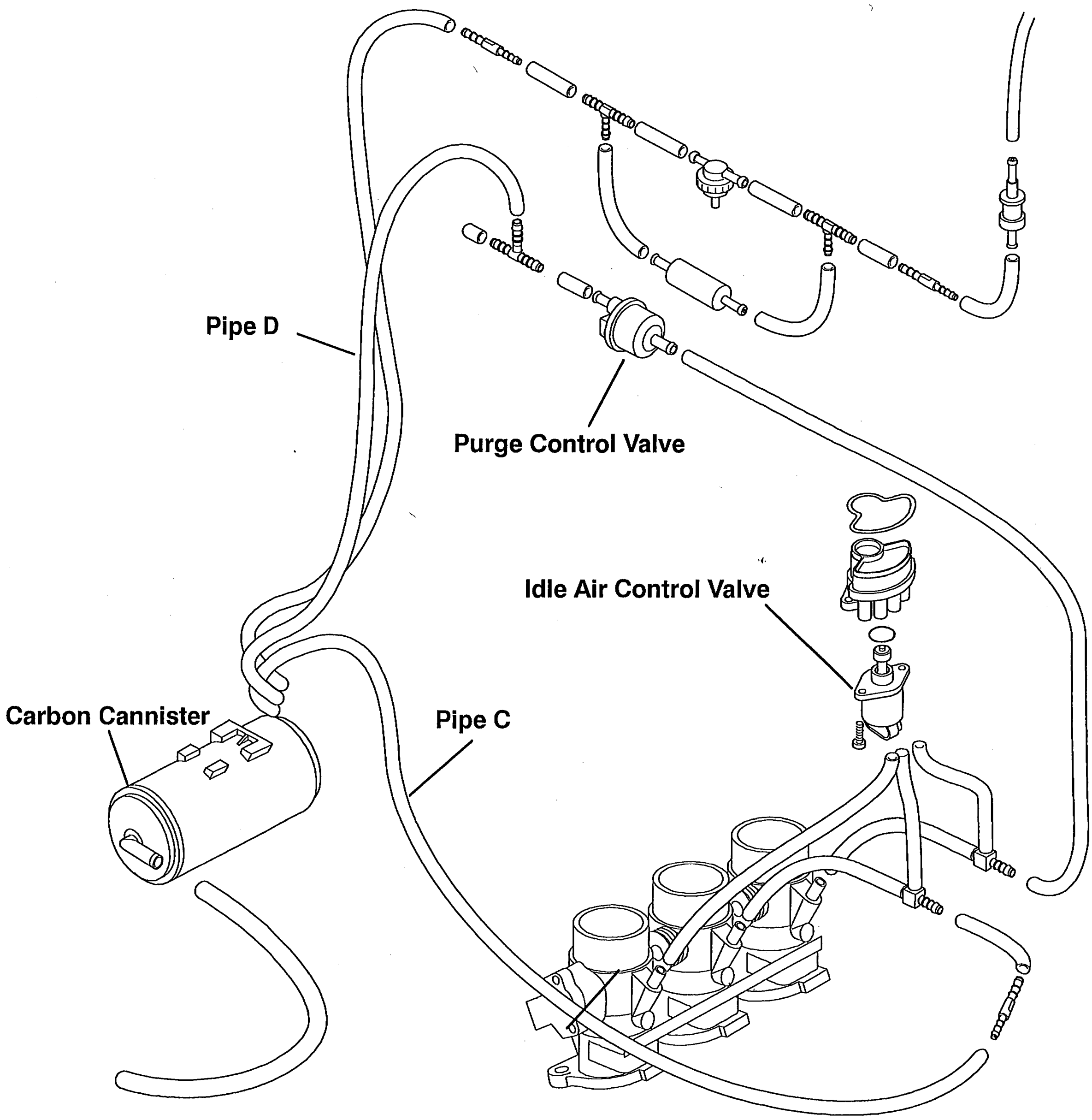


Evaporative Control System - Engine Running

When the engine is started, vacuum is applied via pipe C to the vacuum switch on the canister, causing the canister valve to open.

Direct return of vapour, along pipe D to the throttles, is prevented by the purge control valve which is governed by the engine management system ECM.

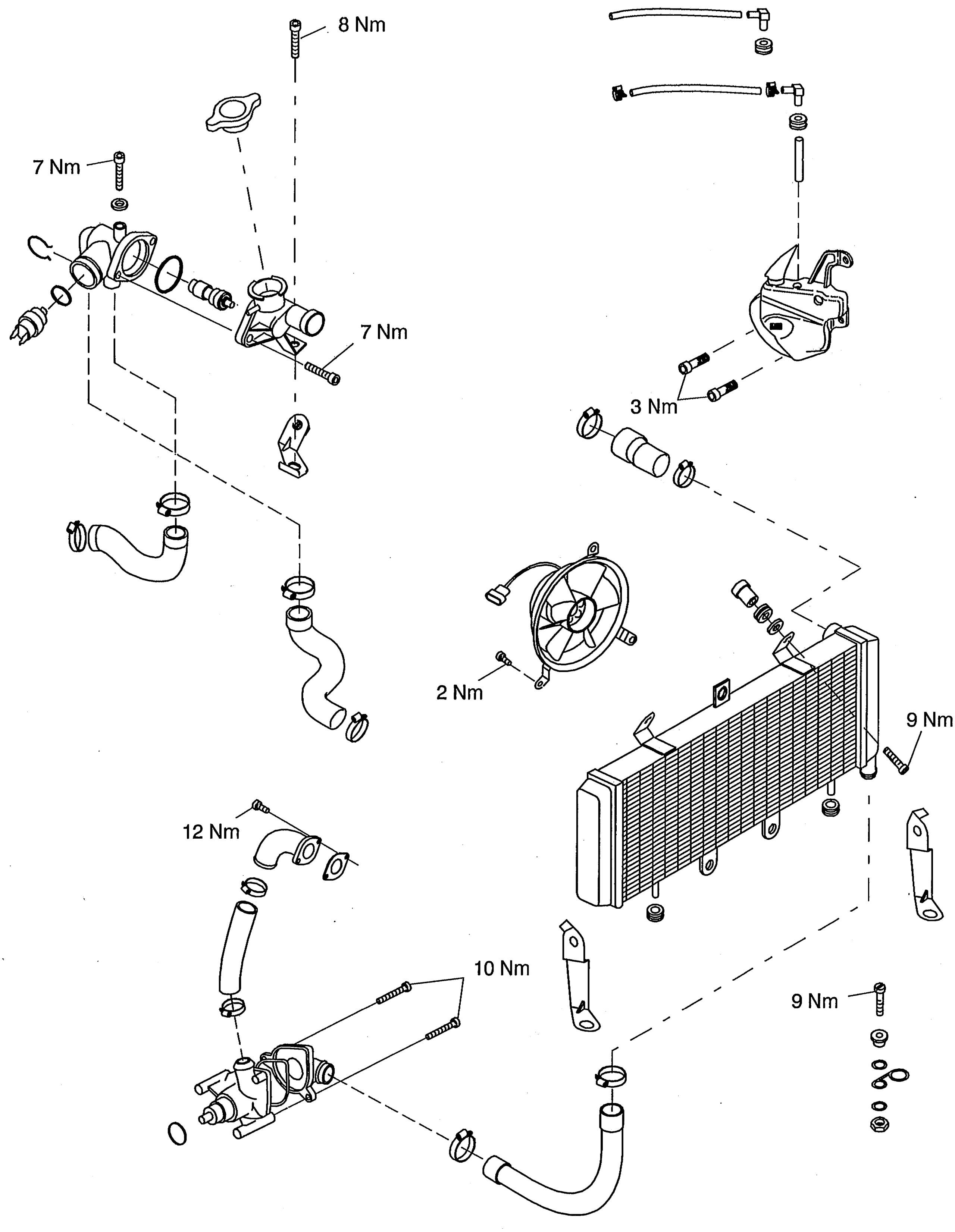
The purge control valve is shuttled between the open and closed position during purging to prevent the transient rich mixture and high emissions that would result from continuous purging.



COOLING SYSTEM

CONTENTS

Exploded View - Cooling System



COOLANT

A permanent type of anti-freeze is installed in the cooling system when the motorcycle leaves the factory. It is coloured blue, contains a 50% solution of ethylene glycol, and has a freezing point of -35°C (-31°F).

Always change the coolant at the intervals specified in the scheduled maintenance chart.

WARNING: Coolant mixture which contains anti-freeze and corrosion inhibitors contains toxic chemicals which are harmful to the human body. Never swallow anti-freeze or any of the motorcycle coolant.

CAUTION: The coolant anti-freeze contains a corrosion inhibitor which helps prevent damage to the metal surfaces inside the cooling system. Without this inhibitor, the coolant would 'attack' the metals and the resulting corrosion would cause blockages in the cooling system leading to engine overheating and damage. Always use the correct anti-freeze as specified in the owner's handbook. Never use a methanol based anti-freeze as this does not contain the required corrosion inhibition properties.

CAUTION: Distilled water must be used with the anti-freeze (see specification for anti-freeze) in the cooling system.

If hard water is used in the system, it causes scale accumulation in the water passages, and considerably reduces the efficiency of the cooling system. Reduced cooling system efficiency may cause the engine to overheat and suffer severe damage.

RADIATOR HOSES

Regularly check all radiator hoses and hose clips for cracks, leaks or deterioration in accordance with the scheduled maintenance chart.

RADIATOR AND COOLING FAN

Check the radiator fins for obstruction by insects, mud, leaves and general debris. Clean off any obstructions by hand or with a stream of low pressure water.

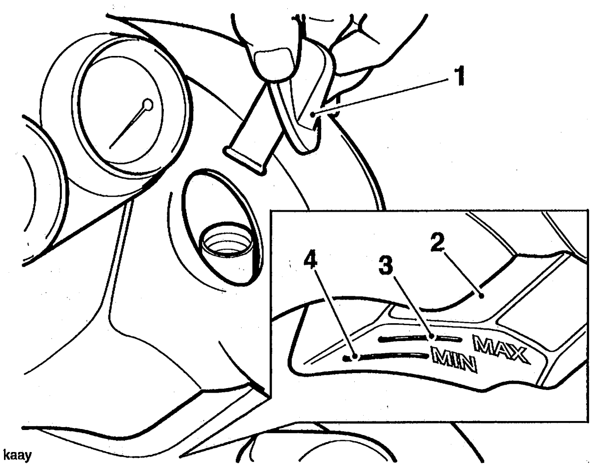
WARNING: The cooling fan operates automatically, even with the ignition switched off. To prevent injury, keep hands and clothing away from the fan blades at all times.

CAUTION: Using high-pressure water, as from a car-wash facility, can damage the radiator fins and impair the radiator's efficiency.

Do not obstruct or deflect airflow through the radiator by installing unauthorized accessories in front of the radiator or behind the cooling fan. Interference with the radiator airflow can lead to overheating and consequent engine damage.

COOLANT LEVEL INSPECTION

> **WARNING: Do not remove the filler cover or the coolant pressure cap when the engine is hot. When the engine is hot, the coolant inside the radiator is hot and also under pressure. Contact with the pressurised coolant will cause scalds and skin damage.**



1. Filler Cover

2. Expansion Tank

3. 'MAX' Mark

4. 'MIN' Mark

1. Position the motorcycle on level ground and in an upright position.
2. Turn the steering to full right lock.
3. The coolant level in the expansion tank can be checked by looking through the gap between the right hand fork and the instrument panel on the right hand side of the motorcycle.
4. Check the coolant level in the expansion tank. The coolant level must be between the 'MAX' (upper line) and 'MIN' (lower line) marks. If the coolant is below the minimum level, the coolant level must be adjusted.

Coolant Level Adjustment

> **WARNING: Do not remove the filler cover or the coolant pressure cap when the engine is hot. When the engine is hot, the coolant inside the radiator is hot and also under pressure. Contact with the pressurised coolant will cause scalds and skin damage.**

1. Allow the engine to cool.
2. Remove the filler cover
3. Add coolant mixture through the filler opening to the 'MAX' mark.
4. Refit the filler cover..

NOTE

- **If the coolant level is being checked because the coolant has overheated, also check the level in the radiator and top-up if necessary.**
- **In an emergency, water alone can be added to the cooling system. However, the coolant must be returned to the correct mixture ratio as soon as possible.**

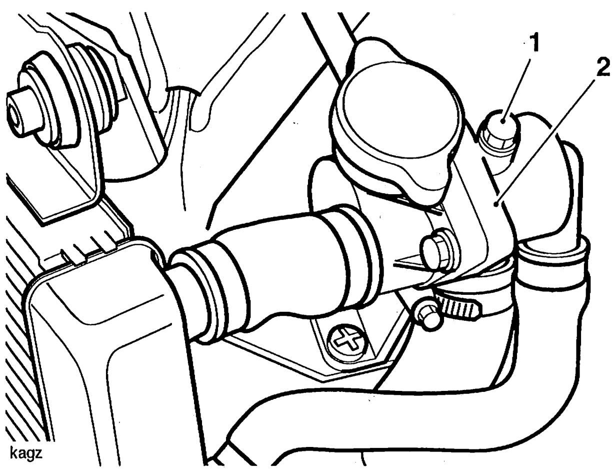
COOLANT REPLACEMENT

Drainage

1. Remove the seats.
2. Disconnect the battery negative (black) lead first.
3. Remove the fuel tank as described in the fuel system section.

> **WARNING: Do not remove the coolant pressure cap when the engine is hot. When the engine is hot, the coolant inside the radiator is hot and also under pressure. Contact with the pressurised coolant will cause scalds and skin damage.**

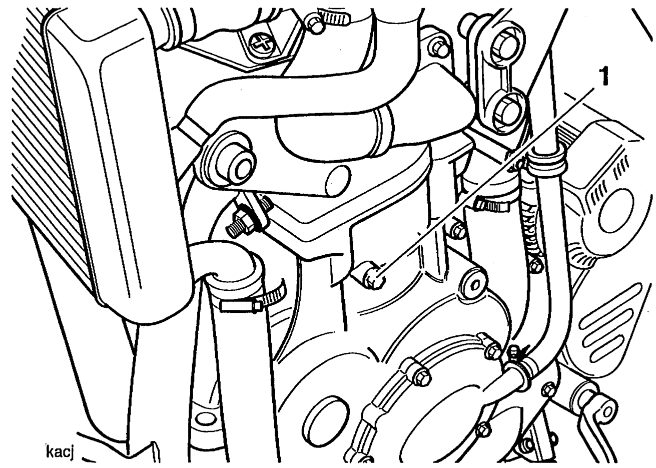
4. Remove the coolant pressure cap on the thermostat housing and slacken the bleed screw to help drainage.



1. Bleed Screw

2. Thermostat housing

5. Position a container to collect the displaced coolant.
6. Remove the coolant drain plug.



1. Coolant Drain Plug

Filling

1. Refit the coolant drain plug and tighten to **13 Nm**.
2. **Slowly** add coolant mixture to the system, through the filler opening, until the system is full. If the system has filled correctly and fully, there should be coolant visible through the bleed screw opening as well as in the filler opening.
3. If there is no coolant visible through the bleed screw opening, but the filler side appears to be full, attach a length of clear tubing to the bleed screw spigot and syphon coolant from the cylinder head etc. into the bleed screw side of the thermostat housing.

NOTE:

- **A hand operated vacuum pump or similar should be used to syphon the coolant through the system. Ensure that the coolant that flows into the bleed screw side of thermostat housing comes from within the cylinder head etc. and is not merely drawn through the thermostat from the filler opening side.**

4. If necessary, top up the system through the filler and refit the pressure cap.
5. Refit the bleed screw and tighten to **7 Nm.**
6. Refit the coolant pressure cap.
7. Temporarily refit the fuel tank.
8. Reconnect the battery positive (red) lead first.
9. Start the motorcycle and allow the engine to idle for a short period of time to allow any air to be expelled from the system.
10. Stop the engine.
11. Disconnect the battery negative (black) lead first.
12. Remove the fuel tank.
13. Top up the coolant level as necessary.

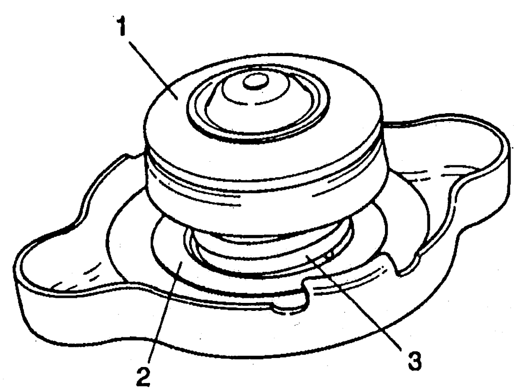
14. Fit the coolant pressure cap.
15. Check the expansion tank level and top up if necessary.
16. Permanently refit the fuel tank as described in the fuel system section.
17. Reconnect the battery positive (red) lead first.
18. Refit the seats.

COOLANT PRESSURE CAP

Inspection

WARNING: Do not remove the coolant pressure cap when the engine is hot. When the engine is hot, the coolant inside the radiator is hot and also under pressure. Contact with the pressurised coolant will cause scalds and skin damage.

1. Check condition of the upper and lower seals of the coolant pressure cap.



1. Lower Seal

2. Upper Seal

3. Spring

NOTE:

- **If there is any sign of damage or deterioration replace the cap.**

2. Pressure test the cap to the blow-off pressure of 1.1 bar. If the cap opens at a lower pressure or fails to open at 1.1 bar, replace the cap.

WATER PUMP

Removal

1. Remove the seats.
2. Disconnect the battery, negative (black) lead first.
3. Drain the coolant as described earlier in this section.

WARNING: Do not remove the coolant pressure cap when the engine is hot. When the engine is hot, the coolant inside the radiator is hot and also under pressure. Contact with the pressurised coolant will cause scalds and skin damage.

4. Disconnect the coolant hoses to the water pump.
5. Release the bolts securing the water pump to the crankcase.
6. Withdraw the water pump.

Inspection

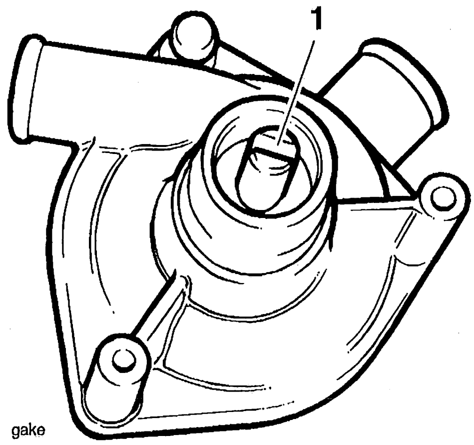
1. Check the water pump shaft and shaft bearings for side and end float. Renew if necessary.
2. Check for corrosion and scale build-up around the impellor and in the pump body. Renew if necessary.

Installation

1. Replace the water pump 'O' ring seal.
2. Align the drive slot in the water pump with the drive slot on the oil pump (inside the crankcase).

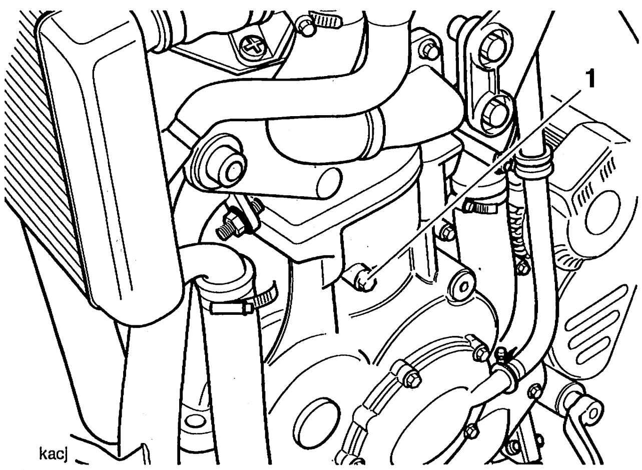
NOTE:

- **The water pump will not engage fully into the crankcase unless the drive slots are engaged.**



1. Water pump slot

3. Fit the pump and tighten the fixings to **10 Nm**.
4. Refit the hoses to the water pump and tighten the clips.
5. Refit the coolant drain plug and tighten to **13 Nm**.



1. Coolant Drain Plug

6. Refill the cooling system as described earlier in this section.

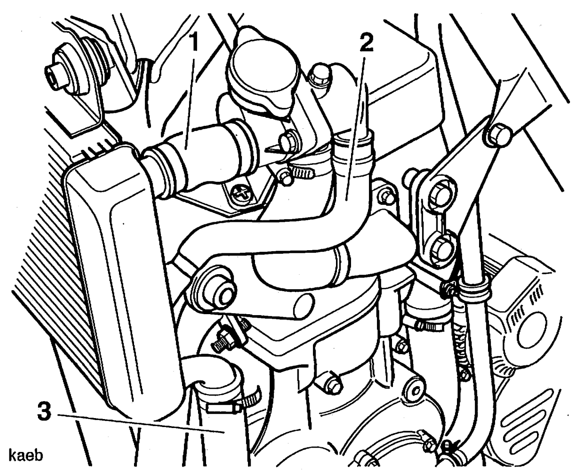
RADIATOR

Removal

1. Remove the seats.
2. Disconnect the battery negative (black) lead first.
3. Drain the coolant as described earlier in this section.

WARNING: Do not remove the coolant pressure cap when the engine is hot. When the engine is hot, the coolant inside the radiator is hot and also under pressure. Contact with the pressurised coolant will cause scalds and skin damage.

4. Remove the fuel tank as described in the fuel system section.
5. Disconnect the top, bypass and bottom hoses at the radiator.

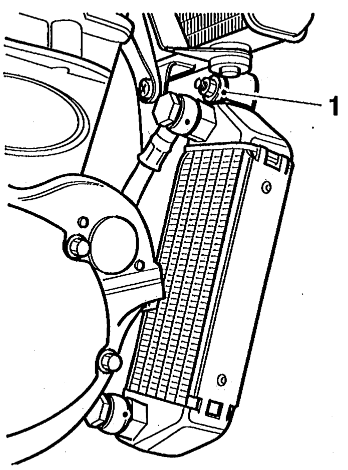


1. Top Hose

2. Bypass Hose

3. Bottom Hose

6. Release the upper oil cooler fixing from near the radiator lower mounting.



1. Oil Cooler Upper Fixing

7. Release the bolts securing the radiator to the frame.

8. Lift the radiator to release it from the lower mounting points and, before removing completely from the motorcycle, disconnect the cooling fan.

Inspection

1. Check the radiator for stone damage.

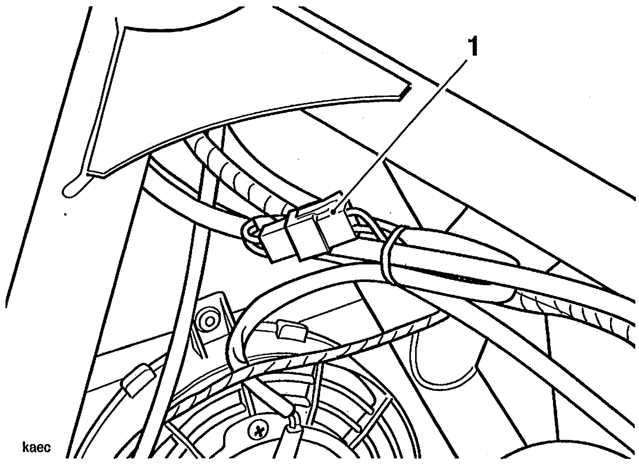
2. Check the radiator core, for damage to fins or obstructions to air flow.

3. Repair any damage and clear all obstructions.

> **CAUTION: To avoid overheating and consequent engine damage, replace the radiator if the cores are blocked or if the fins are badly deformed or broken.**

Installation

1. Position the radiator to the motorcycle and connect the cooling fan.



1. Cooling Fan Connection.

2. Engage the radiator mounting studs into the radiator lower support brackets.

NOTE:

- **Ensure the grommets do not become detached from the lower brackets during assembly.**

3. Align the radiator to the frame and fit the upper mounting bolts. Tighten the bolts to **9 Nm**.

4. Tighten the oil cooler to radiator fixing to **9 Nm.**

5. Reconnect the top, bottom and bypass hoses to the radiator. Tighten the hose clips.

6. Refit the crankcase drain plug and tighten to **13 Nm**.

7. Refill the cooling system as described earlier in this section.

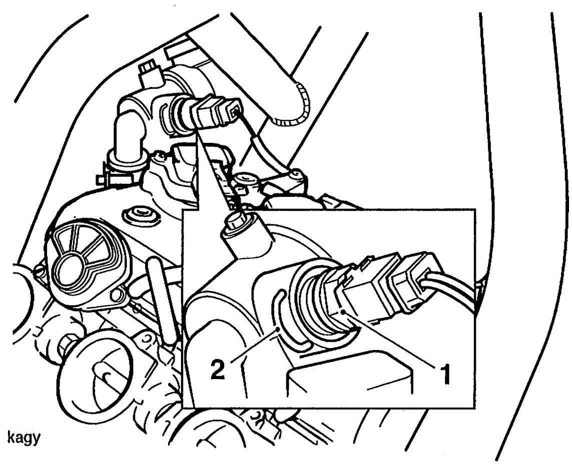
THERMOSTAT

Removal

1. Remove the seats.
2. Remove the fuel tank as described in the fuel system section.
3. Drain the cooling system as described earlier in this section.

> **WARNING: Do not remove the coolant pressure cap when the engine is hot. When the engine is hot, the coolant inside the radiator is hot and also under pressure. Contact with the pressurised coolant will cause scalds and skin damage.**

4. Detach all hoses connected to the thermostat housing.
5. Without removing the electrical connector, remove the coolant temperature sensor from the thermostat housing.



1. Sensor

2. Sensor Retaining Clip

6. Release the fixing securing the thermostat housing to its retaining bracket.
7. Separate the 2 halves of the thermostat housing by releasing the 2 securing screws. Discard the 'O' ring.

> **WARNING: The thermostat is spring loaded. Always wear eye hand and face protection when disassembling the thermostat housing as the spring loaded components could cause injury to unprotected skin and eyes.**

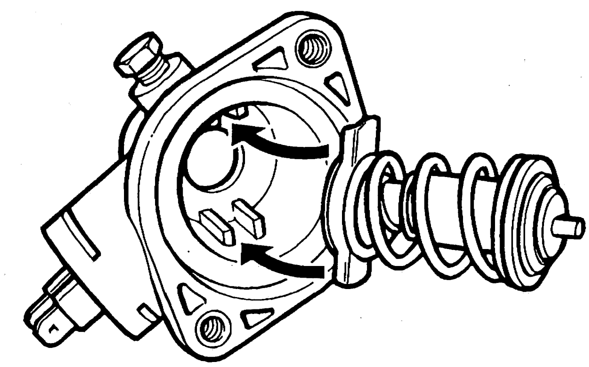
8. Remove the thermostat from the housing.

Inspection

1. Inspect the thermostat at room temperature. If the valve is open, the thermostat must be replaced.
2. To check the valve opening temperature, suspend the thermostat in a container of water and raise the temperature of the water until the thermostat opens.
3. If the temperature at which thermostat opening takes place is incorrect, replace the thermostat.

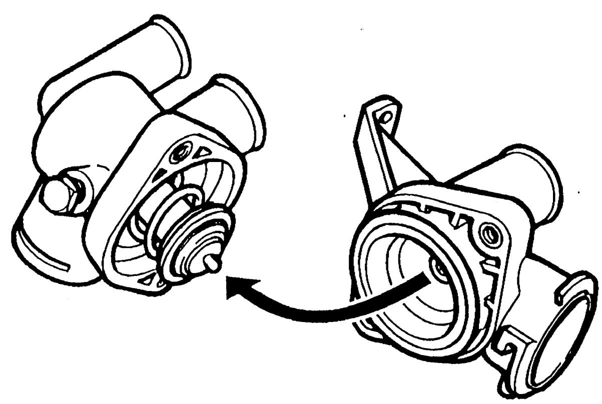
Assembly/Installation

1. Locate the thermostat into the rear half of the housing such that the feet of the thermostat align with the thermostat mounting points in the housing.



Arrowed: Thermostat Mounting Point

2. Fit a new 'O' ring to the front half of the thermostat housing.
3. Align the two halves of the thermostat housing so that the 'nose' of the thermostat aligns with the central lug in the front half of the housing.



Arrowed: Thermostat 'Nose' Mounting Point

4. Evenly close the two halves of the thermostat housing and tighten the retaining screws to **7 Nm.**

CAUTION: Ensure that the thermostat is correctly seated in both sides of the housing before tightening the thermostat housing screws. Damage to the housing and thermostat will result from an incorrectly seated thermostat.

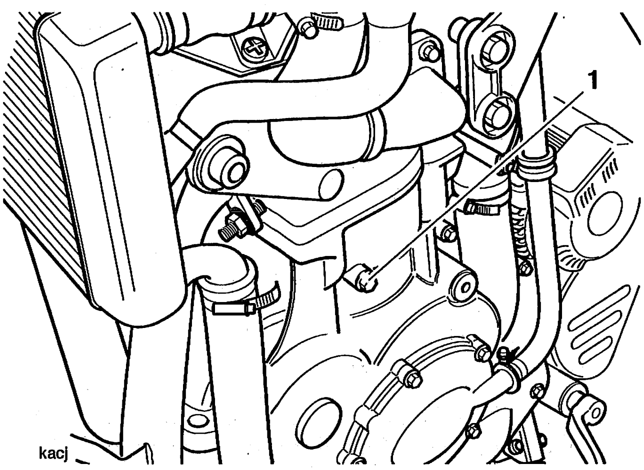
Ensure that the 'O' ring does not become damaged during assembly. A damaged 'O' ring may cause a coolant leak causing overheating and engine damage.

5. Refit the thermostat housing to its bracket. Tighten the fixing to **8 Nm.**

6. Reconnect the coolant hoses and tighten the hose clips.

7. Refit the coolant temperature sensor and secure with the clip.

8. Refit the crankcase drain plug and tighten to **13 Nm.**



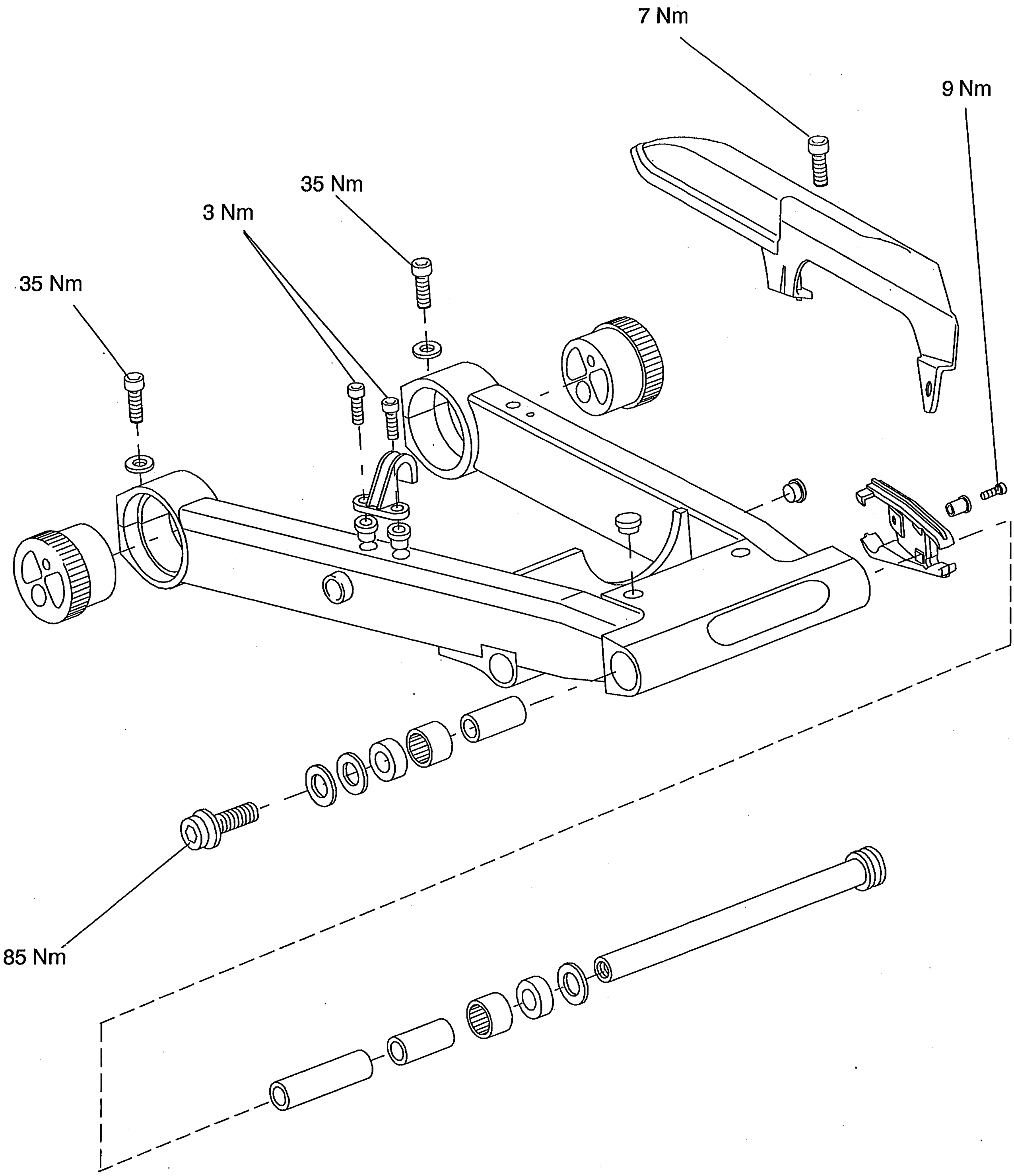
1. Coolant Drain Plug

9. Refill the cooling system as described earlier in this section.

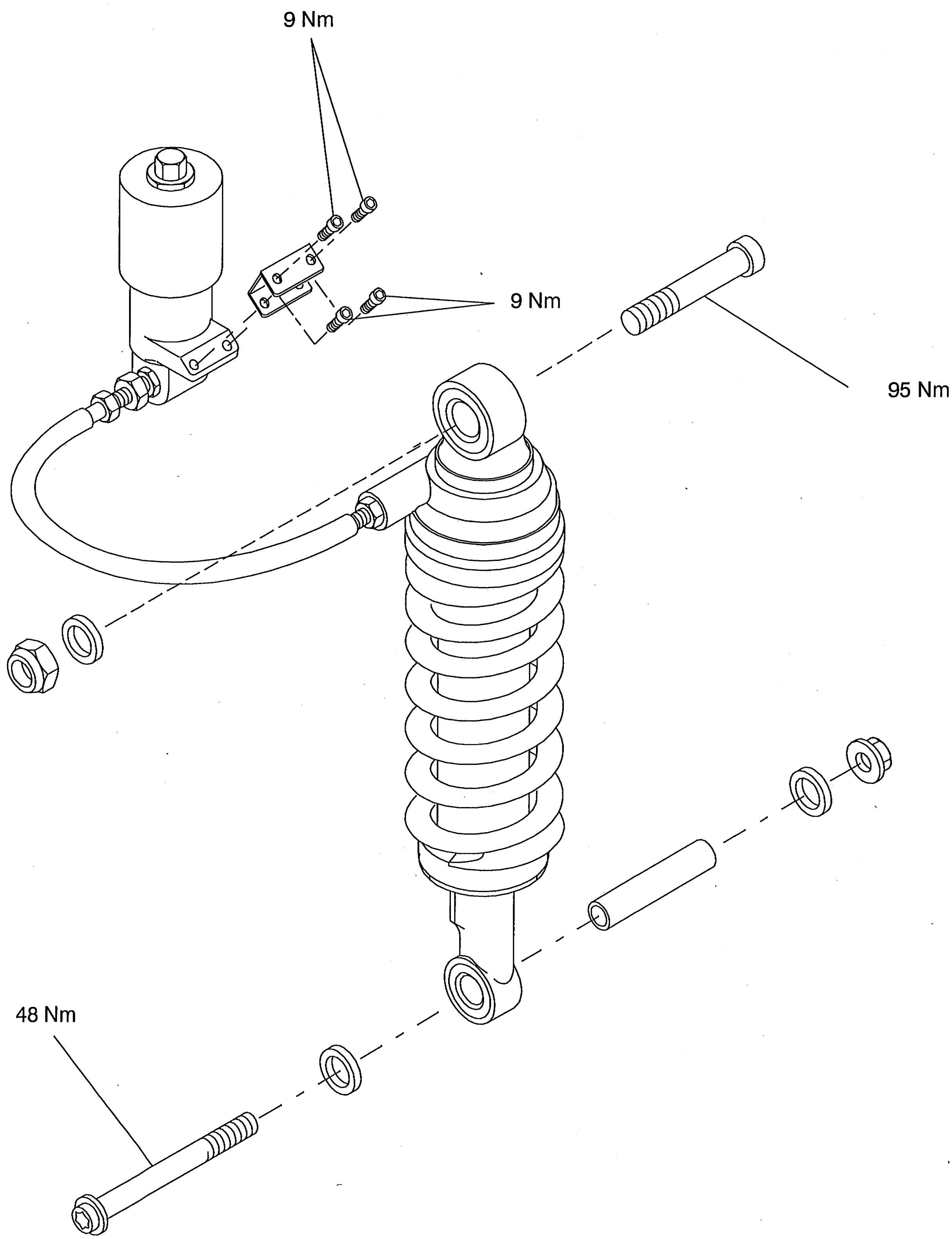
REAR SUSPENSION/FINAL DRIVE

CONTENTS

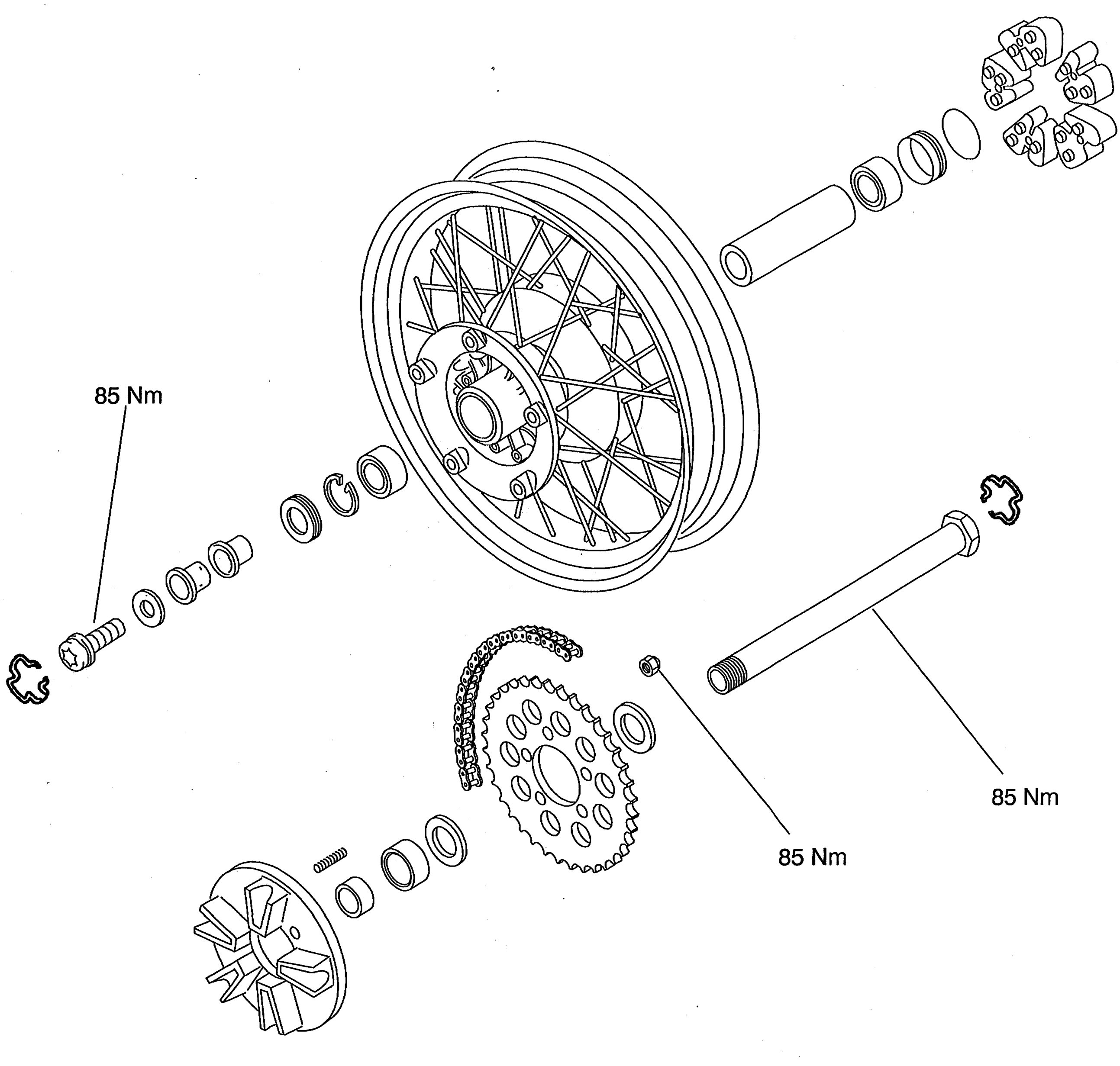
Exploded View - Swinging Arm



Exploded View - Rear Suspension Unit



Exploded View - Final drive



REAR SUSPENSION

The rear suspension consists of a single spring/damper unit, adjustable for pre-load and rebound.

> **WARNING: The remote reservoir, hose and rear suspension unit must never be separated from each other. All parts of the assembly contain gas under pressure which could lead to serious injury if any part of the system is disturbed.**

Inspection/Lubrication

1. Position the motorcycle on level ground in an upright position.
2. Examine all suspension pivots for wear and excess movement.
3. If excess movement is detected in the swinging arm bearings or in the rear suspension unit bushes, investigate the cause and take the necessary remedial action.

REAR SUSPENSION UNIT (RSU)

Removal

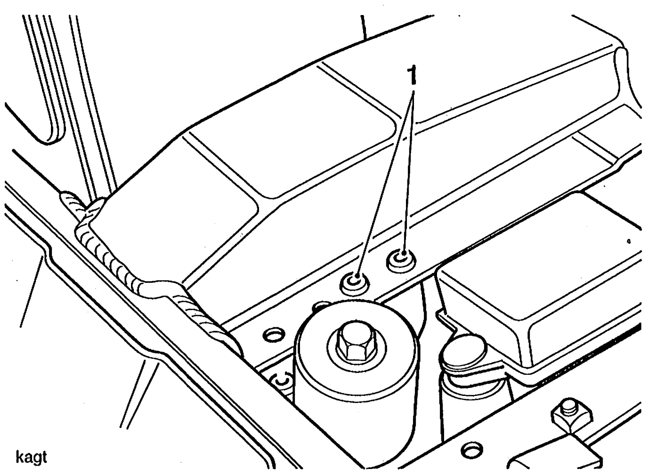
> **WARNING: If the engine has recently been running, the exhaust system will be hot. Before working on or near the exhaust system, allow sufficient time for the exhaust system to cool as touching any part of a hot exhaust system could cause burn injuries.**

1. Remove both seats.
2. Disconnect the battery, negative (black) lead first and remove the battery.
3. Remove the exhaust silencer and collector box as described in the fuel system section.
4. Remove the battery box.
5. Make a note of the suspension adjustment settings.
6. Raise the rear of the motorcycle until the rear wheel is clear of the ground and the rear suspension is hanging. Place a suitable support under the frame or engine taking care not to damage the oil cooler pipes or oil filter.

> **WARNING: Ensure the motorcycle is stabilised and adequately supported, to prevent it falling and causing damage or injury.**

> **WARNING: The remote reservoir, hose and rear suspension unit must never be separated from each other. All parts of the assembly contain gas under pressure which could lead to serious injury if any part of the system is disturbed.**

7. Undo the two fixings securing the remote pre-load adjuster to its mounting bracket, to enable the adjuster to be removed.



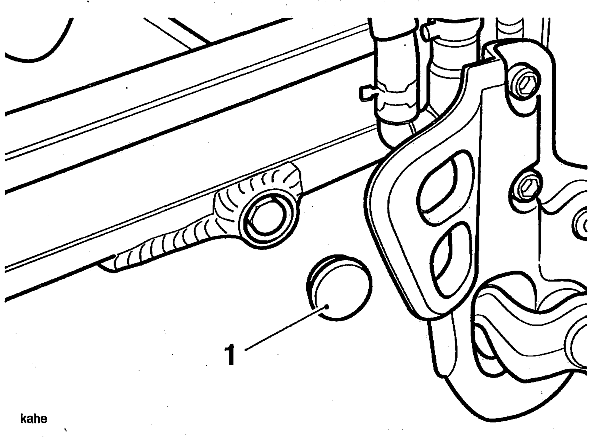
1. Pre-load adjuster bracket fixings

8. Remove side panels as described in section 15.

9. Undo the nut and washer on the upper mounting of the rear suspension unit. Do not remove the bolt at this stage.

10. Remove the blanking plugs from the swinging arm.

11. Undo the nut on the fixing bolt securing the lower suspension unit mounting and withdraw the bolt.



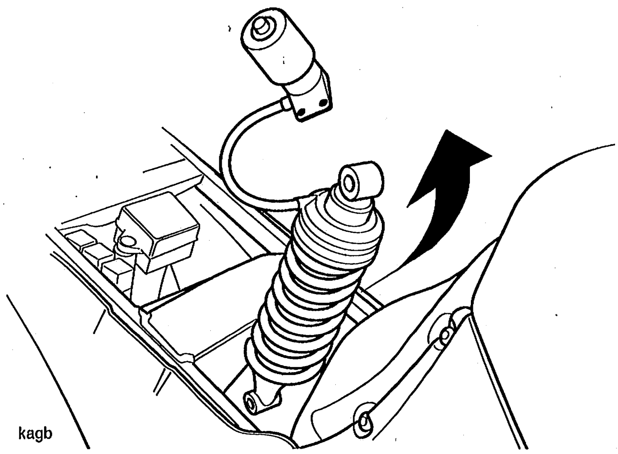
1. Blanking Plug

12. Remove the two washers and using an aluminium drift, drive out the steel sleeve from the swinging arm.

13. Remove the upper mounting bolt and lift out the suspension unit and adjuster assembly through the space where the battery box fits.

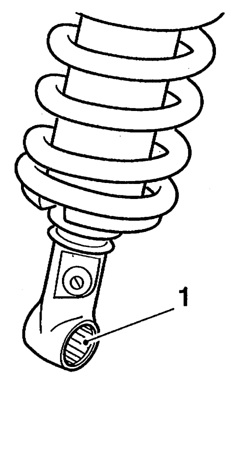
NOTE:

- **Take care not to strain the hydraulic hose between the suspension unit and the remote adjuster.**



Removing the rear suspension unit

14. Ensure all the needle rollers from the lower mounting are accounted for.



1. Needle roller bearings

NOTE:

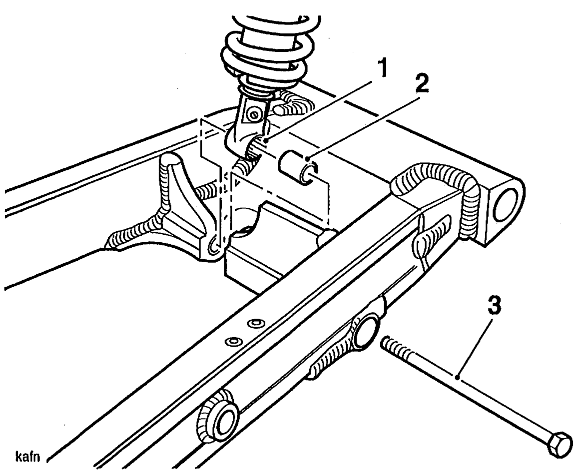
- **The bearing in the bottom mounting of the rear suspension unit is an un-caged roller bearing. The rollers may fall out when the suspension unit is removed.**

Installation

NOTE:

- **Great care must be taken not to dislodge any of the rollers during fitting.**

1. Grease the needle roller bearing in the lower mounting of the rear suspension unit. Ensure all the rollers are in place.
2. With the motorcycle still supported under the frame or engine and working from underneath the motorcycle, place the rear suspension unit and the remote pre-load adjuster into their appropriate positions.
3. Refit the upper rear suspension unit fixing and tighten to **95 Nm**.
4. Grease the lower bearing sleeve.
5. Align the lower mounting holes and refit the bearing sleeve taking care not to dislodge any of the roller bearings.
6. Refit the bottom mounting bolt and washer from the left hand side of the motorcycle. Refit the nut and washer on the other end, tighten to **48 Nm.**



1. Bottom bearing

2. Bearing sleeve

3. Lower mounting bolt

7. Refit the remote pre-load adjuster ensuring the hydraulic hose is correctly routed. Tighten the fixings to **9 Nm**.
8. Check the rear suspension unit still has the previously noted adjustment settings.
9. Refit the blanking plugs to the swinging arm.
10. Replace the battery box.
11. Remove the support and place the motorcycle on its stand.
12. Refit the exhaust silencer and collector box as described in section 9.
13. Refit the battery and reconnect the leads, positive (red) lead first.
14. Refit side panels.
15. Refit the seats.

SWINGING ARM

NOTE:

- **The swinging arm must be removed to fit an endless chain.**

Removal

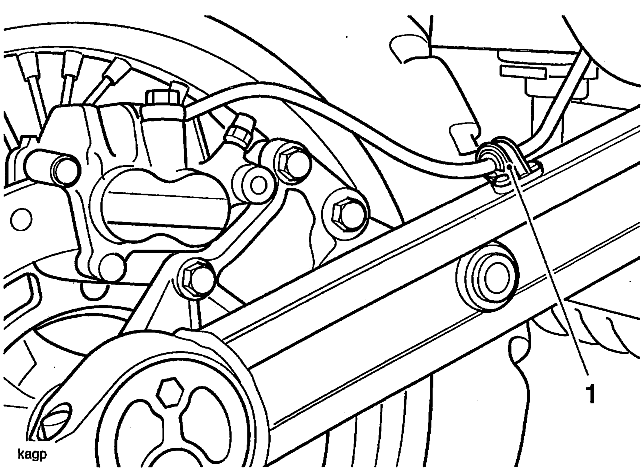
NOTE:

- **If the rear suspension unit is to be removed, follow the instructions earlier in this section.**

1. Remove the seats.
2. Disconnect the battery, negative (black) lead first.

WARNING: If the engine has recently been running, the exhaust system will be hot. Before working on or near the exhaust system, allow sufficient time for the exhaust system to cool as touching any part of a hot exhaust system could cause burn injuries.

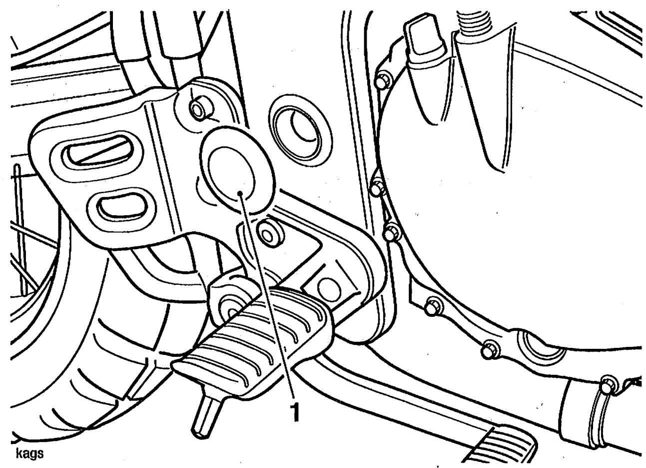
3. Remove the silencer as described in the fuel system section.
4. Undo the brake hose clamp on the swinging arm.



1. Brake hose clamp

WARNING: Ensure the motorcycle is stabilised and adequately supported, to prevent it falling and causing damage or injury.

5. Raise and support the rear of the motorcycle under the frame or engine taking care not to damage the oil pipes.
6. Remove the rear wheel as described in the wheel section with the brake caliper as described in the brake section.
7. Tie the caliper assembly to the rear footrest bracket.
8. Remove only the lower fixing from the rear suspension unit.
9. Push the bush out as described earlier in this section and swing the suspension unit rearwards, clear of the swinging arm.
10. Remove the blanking plugs covering the pivot spindle holes in each side of the frame.



1. Blanking plugs

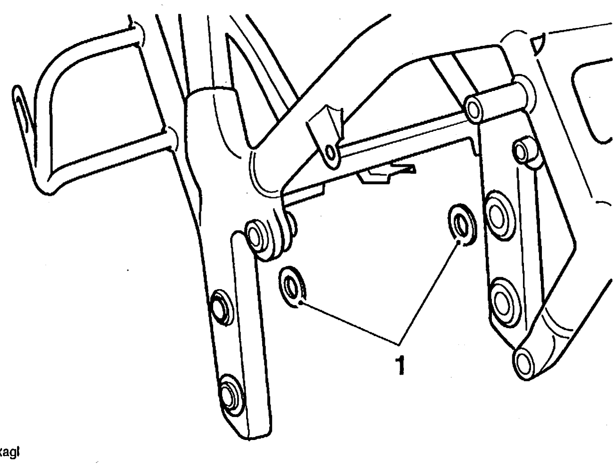
11. Undo the right hand bolt from the end of the pivot spindle. Push the spindle to the left of the motorcycle and withdraw it completely.
12. Remove the swinging arm.
13. Collect the spacers that fit between the swinging arm and the frame.

Inspection

1. Check the swinging arm for damage. Replace as necessary.
2. Check all bearing seals for damage, splits etc. Replace as necessary.
3. Check swinging arm bearings for damage, pitting, and cracks. Replace as necessary.
4. Check the chain for wear, damage etc. Replace as necessary.

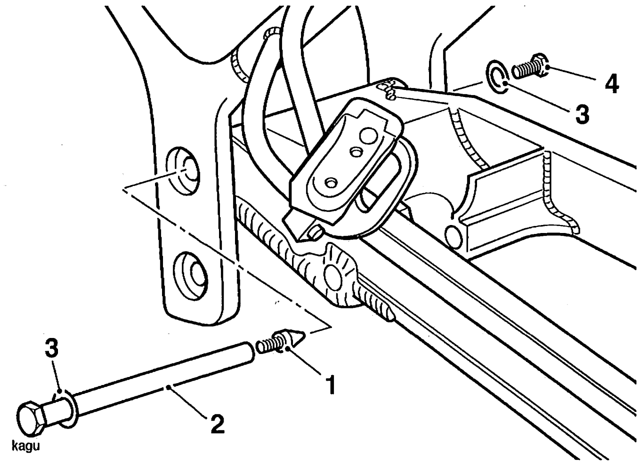
Installation

1. Grease the two bearing sleeves in the swinging arm.
2. Use a small amount of grease on each spacer (1) to hold them in place on the inside faces of the frame.



1. Spacer

3. Refit the washer on the pivot spindle.
4. Screw the alignment tool (part number 3880060) into the open end of the pivot spindle.
5. Position the final drive chain over the swinging arm.
6. Align the swinging arm with the pivot spindle holes in the frame ensuring that the spacers remain in position and slide the pivot spindle through the swinging arm.



1. Alignment Tool
2. Pivot spindle
3. Washer
4. Swinging arm

7. Remove the alignment tool. and refit the washer and pivot spindle bolt, tightening it to **85 Nm.**
8. Refit the blanking plugs into the frame.
9. Refit the rear suspension unit lower mounting into the swinging arm. (See fitting instructions detailed earlier in this section). Tighten to **48 Nm.**
10. Refit the brake caliper and wheel as described in the wheel and brake sections.
11. Remove the support from beneath the engine or frame and position the motorcycle on its side stand.

WARNING: Ensure the rear brake hose is correctly routed and clamped and that it is not chafing against any moving parts. This could cause the hose to leak resulting in total failure of the rear brake. This may lead to loss of control and an accident.

12. Refit the brake hose clamp to the swinging arm.
13. Refit the exhaust silencer and collector box as detailed in the fuel system section.
14. Refit the battery and secure with the fixing strap.
15. Reconnect the battery, positive (red) lead first.

WARNING: Ensure the rear brake operates correctly A faulty rear brake could lead to loss of control and an accident resulting in serious injury or death.

16. Check the operation of the rear brake and correct as required.

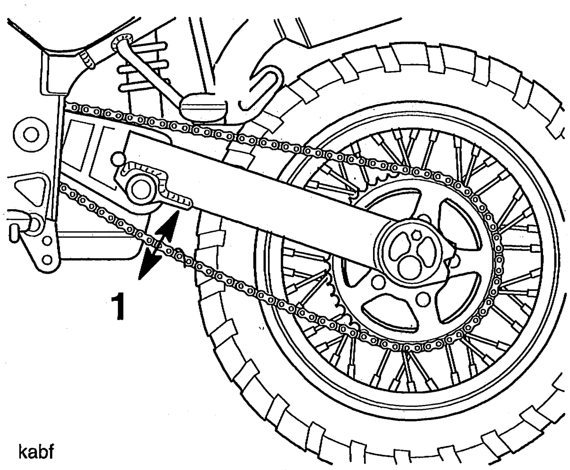
DRIVE CHAIN

The drive chain must be checked, adjusted, and lubricated in accordance with the scheduled maintenance chart. For reasons of safety, and to prevent excessive wear, never neglect any part of the drive chain maintenance. If the chain is badly worn, or incorrectly adjusted - either too loose or too tight - the chain could jump off the sprockets or break. Checking of the adjustment and lubrication should be carried out more frequently where the machine is regularly used in dirty or dusty conditions or where large amounts of road salt are used.

WARNING: A chain that breaks or jumps off the sprockets could snag on the engine drive sprocket or the rear wheel severely damaging the motorcycle and causing an accident. Never neglect chain maintenance.

Chain Slack Inspection

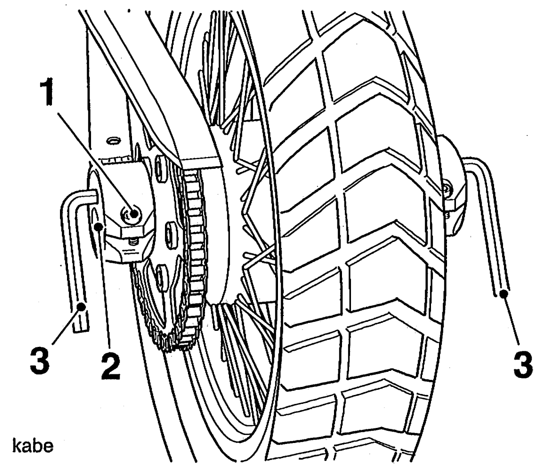
1. Set the motorcycle up on the side stand.
2. Rotate the rear wheel to find the position where the chain has least slack. Measure the chain's vertical movement, mid-way between sprockets.
3. If correct, the vertical movement of the drive chain midway between the sprockets should be 35-40 mm.



1. Vertical Movement 35-40mm

Drive chain adjustment

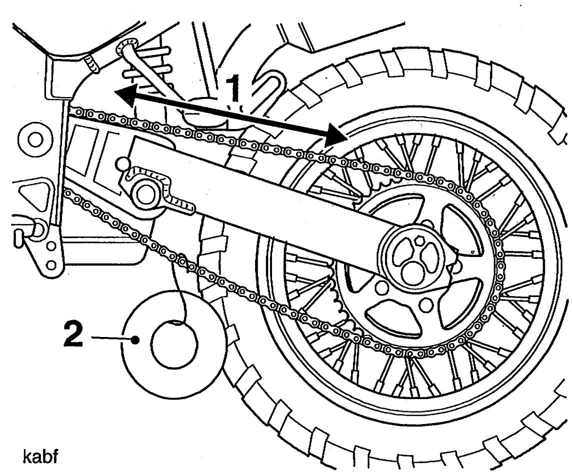
1. Slacken the chain adjuster clamp bolt.
2. Insert Allen wrenches into both hexagonal holes in the eccentric adjusters. Turn the adjusters equally forwards or rearwards until the chain is correctly adjusted (35-40 mm of vertical movement).
3. Tighten the chain adjuster clamp bolts to **35 Nm.**



1. Adjuster clamp bolt
2. Eccentric adjuster
3. Allen Wrenches

Chain Wear Inspection

1. Remove the chainguard from the swinging arm.
2. Stretch the chain taut by hanging a 10-20 kg (20-40 lb) weight on the chain.
3. Measure a length of 20 links on the straight part of the chain from pin centre of the 1st pin to pin centre of the 21st pin. Repeat the test at various sections of the chain to establish an average reading. This is because the chain may wear unevenly.



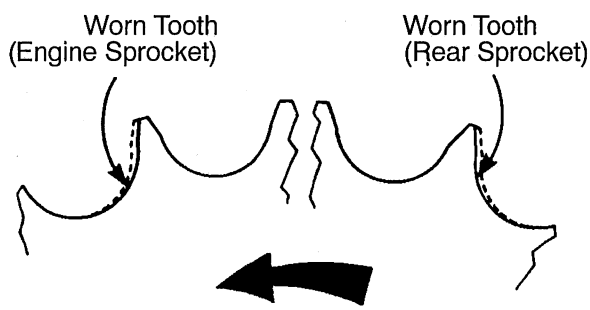
1. Measurement Position
2. 10-20kg Weight

4. If the length exceeds the service limit of 321 mm, the chain must be replaced.

WARNING: Use a genuine Triumph supplied chain as specified in the Triumph Parts Catalogue. The use of non-approved chains may result in a broken chain or may cause the chain to jump off the sprockets. A chain that breaks or jumps off the sprockets could snag on the engine sprocket or lock the rear wheel, severely damaging the motorcycle and causing loss of motorcycle control and an accident.
Never neglect chain maintenance and always have chains installed by an authorised Triumph Dealer.

5. Examine the whole length of the chain. If there are any excessively tight or loose sections, loose pins or damaged rollers, the chain should be replaced.

6. Inspect sprockets for unevenly or excessively worn teeth. Also examine the sprockets for damaged teeth.



(Typical wear profile)

NOTE:
- **Sprocket wear is exaggerated for illustration.**

7. If there is any irregularity found in any of the components, replace the drive chain and/or any other damaged components.

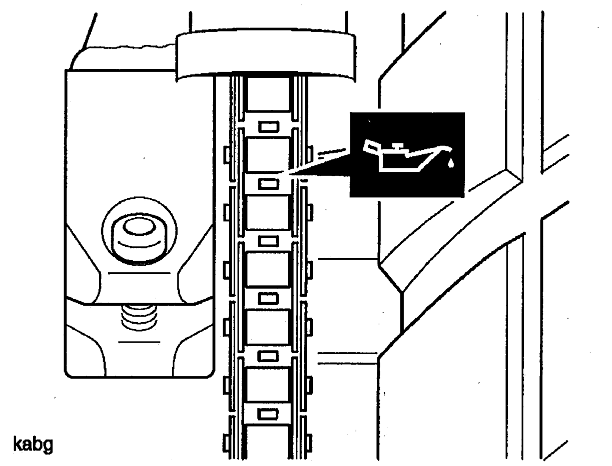
8. Refit the chain/wheel guard.

Chain Lubrication

Chain lubrication is necessary after riding through rain, standing water, on wet roads, or any time that the chain appears dry. Use the chain lubricant recommended in the specification.

CAUTION: Never use a power wash system to clean the chain as this may cause damage to the chain components.

1. Apply chain lubricant to the sides of the chain rollers, and also the 'O'-rings. The lubricant will penetrate the rollers and bushings and also prevent the O-rings from deterioration.



Chain Lubrication Positions

2. Wipe off any excess oil.

3. If the chain is especially dirty, clean using paraffin before applying the lubricant.

DRIVE CHAIN (Split link type)

Removal

NOTE:

- **The following procedure describes the fitment of a replacement chain using a split link. If the replacement chain to be fitted is a 'continuous' type, removal of the swinging arm and sprocket cover is necessary (as described earlier in this section).**

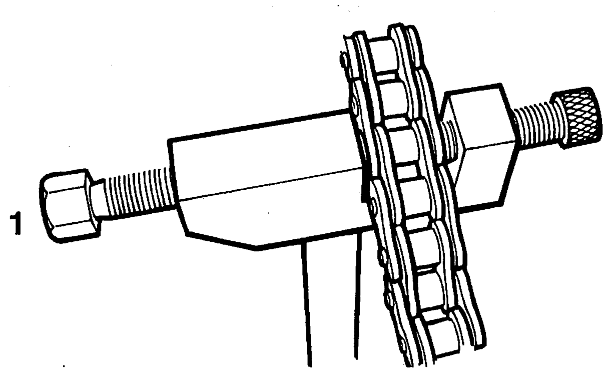
1. Raise the rear of the motorcycle and securely support with the rear wheel clear of the ground.

> **WARNING: Ensure the motorcycle is stabilised and adequately supported, to prevent it falling and causing damage or injury.**

2. Remove any convenient chain link pin using the chain splitter tool as follows:

3. Unscrew the knurled knob to withdraw the arbor as far as possible, and unscrew the pin punch until the link pin extractor is fully withdrawn.

4. Position the tool over the chain link pin to be extracted, and turn the knurled knob clockwise to move the arbor inwards until the chain link is supported. Check that the chain lies squarely in the tool and the extractor aligns with the pin to be removed.



1. Pin punch

2. Arbor

5. Turn the pin punch clockwise, and continue to turn with the aid of a suitably sized spanner until the link pin has been pushed out of its link.

6. Remove the tool and separate the two ends of the chain.

Replacement

NOTE:

- **The replacement chain is supplied in a 'split' condition, complete with a link kit to join the two ends.**

> **CAUTION: The component parts of the new link kit are coated with a special grease which must not be removed. Removal of this special grease will severely reduce the service**

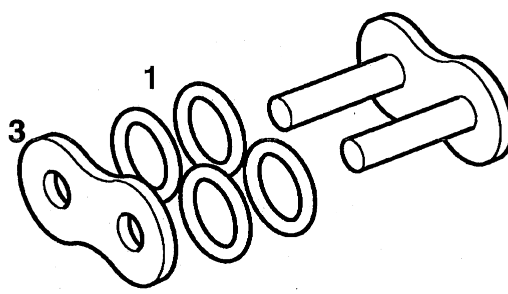
1. Use the old drive chain to pull the new chain into position as follows:

NOTE:

- **Do not use the new connector link as the special grease on it may be removed.**

2. Temporarily attach the end of the new chain to a free end of the old chain using an old connector link. Carefully pull the other end of the old chain to pull the new chain around the sprockets.

3. Disconnect the two chains. Turn the chain and the rear wheel until the ends of the chain are in a convenient working position.



Link kit

1. 'O' rings (4)

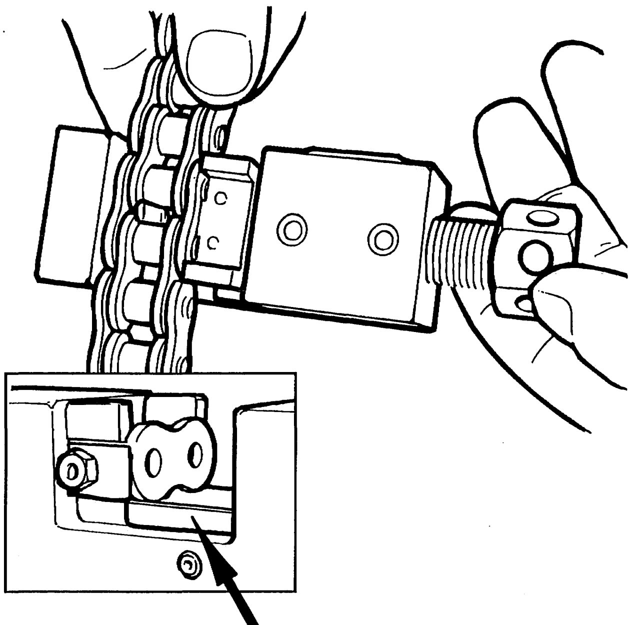
2. Connector link

3. Side plate

> **CAUTION: Always hold the connector link by its plate, NOT by the pins. The special grease on the pins must not be disturbed. Removal of the special grease will severely reduce the service life of the chain.**

4. Fit two of the 'O' rings onto the inboard side of the links to be joined, and fit the connector link from the same side without disturbing the 'O' rings.

5. Fit the other two 'O' rings on the outboard side of the links.



Fitting side plate

6. Retract the threaded arbor of the side plate installer tool as far as it will go and place the arbor plate over the chain location pin. Fit the side plate into the arbor and position the tool over the chain link to be connected.

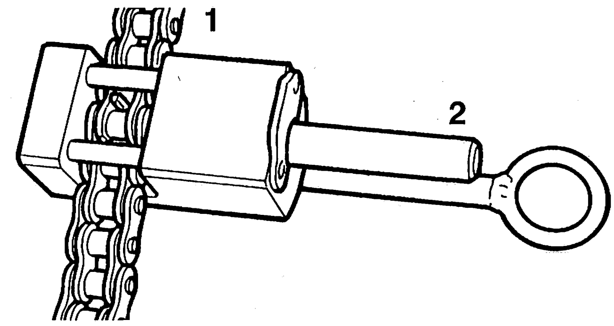
> **CAUTION: Fitting the side plate without the arbor plate present will cause damage to the chain link resulting in premature failure of the chain.**

7. Turn the threaded arbor clockwise to press the side plate onto the connector link pins. The tool will not allow the plate to be fitted too deeply as a stop mechanism is incorporated in the tool to prevent incorrect fitment. Turn the threaded arbor as far as it will go without excessive force.

8. Remove the tool.

9. Use the riveting tool to secure the side plate as follows:

10. Pull back the slide on the riveting tool and position the tool over one of the two pins to be secured. Release the slide.

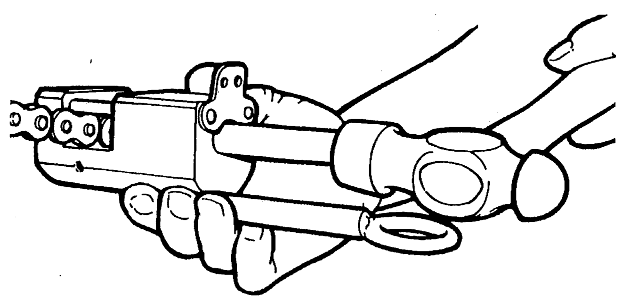


1. Slide

2. Punch

> **WARNING: To prevent risk of injury, do not place fingers or hands inside the slide. The slide is spring loaded and will cause injury to fingers or hands which become trapped inside the slide.**

11. Use a hammer to apply a sharp blow to the tool punch 4 times. Rotate the punch by 45° between each hammer blow.



12. Remove the tool and examine the end of the link pin to check that is has been securely riveted over.

13. Repeat the riveting operation with the second link pin.

14. Check that the links can rotate freely around the pins. If not, the link just fitted must be removed and discarded and a new link fitted.

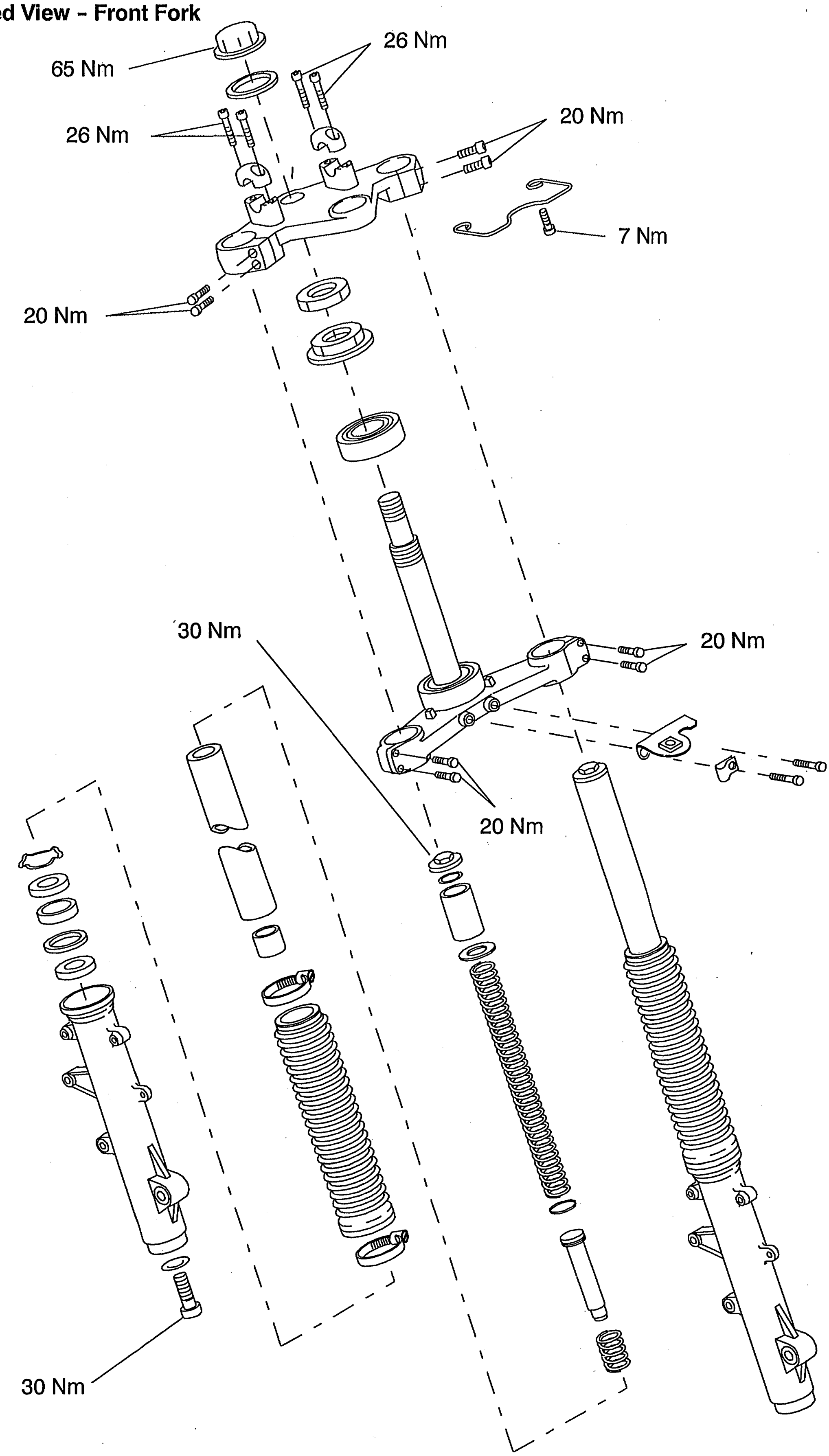
15. Adjust the drive chain tension.

16. Lower the motorcycle to the ground.

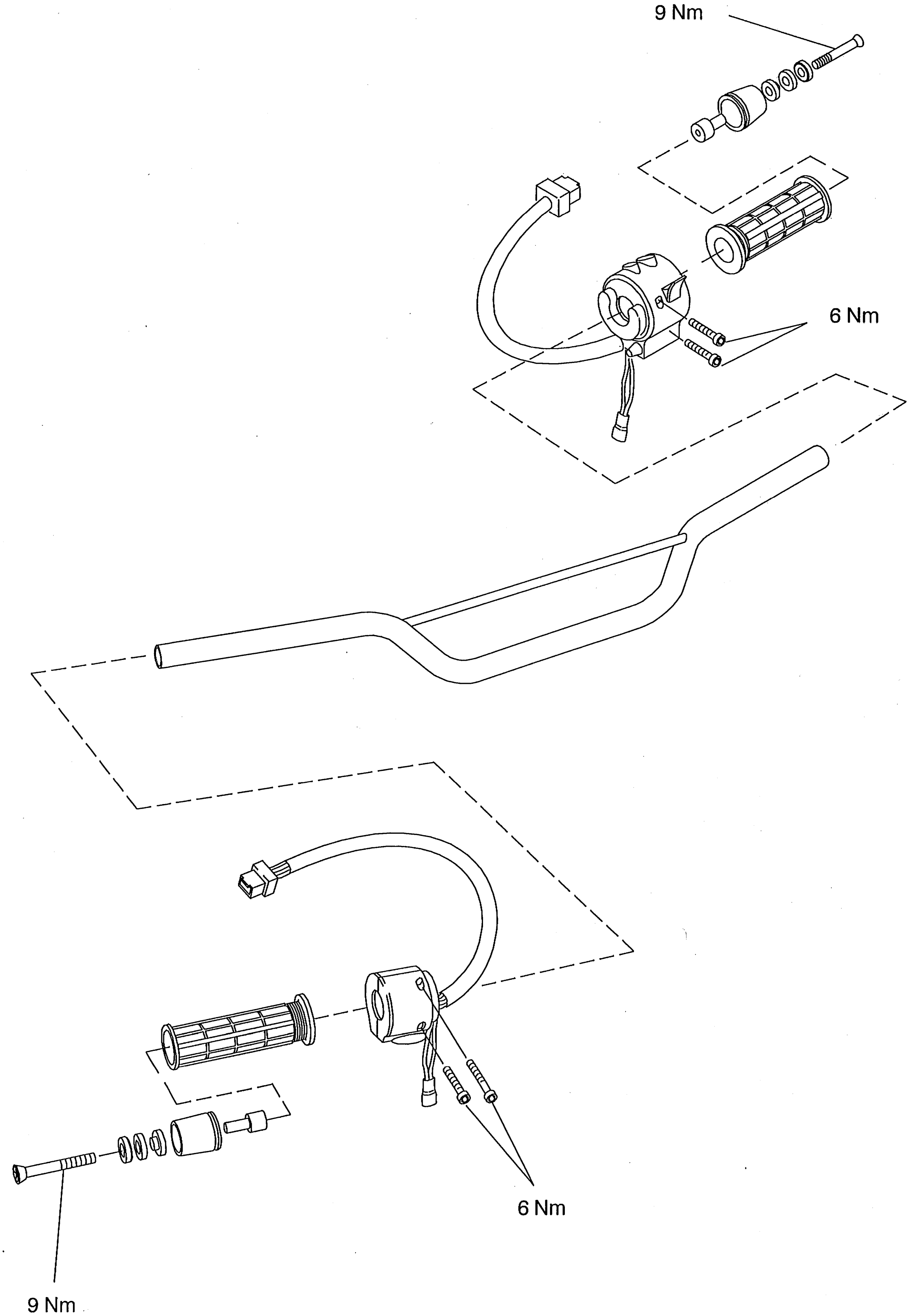
FRONT SUSPENSION/STEERING

CONTENTS

Exploded View - Front Fork



Exploded View - Handlebars



FRONT SUSPENSION

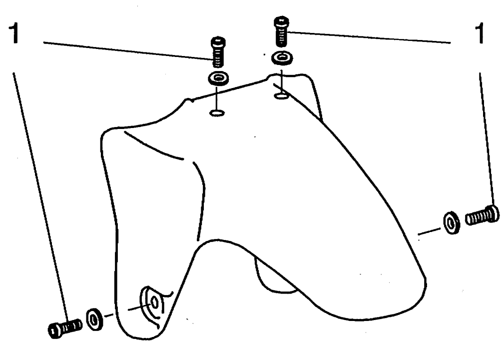
This model is equipped with hydraulic, telescopic front forks fitted with a gaiter to protect the inner fork tube from stone damage. Periodic inspection for damage and fluid leaks is essential for safe riding. Always follow the inspection instructions at the intervals stated in the scheduled maintenance chart.

FORK INSPECTION

1. Check for smooth operation of the forks as follows:
   - Place the motorcycle on level ground.
   - While holding the handlebars and applying the front brake, pump the forks up and down several times.

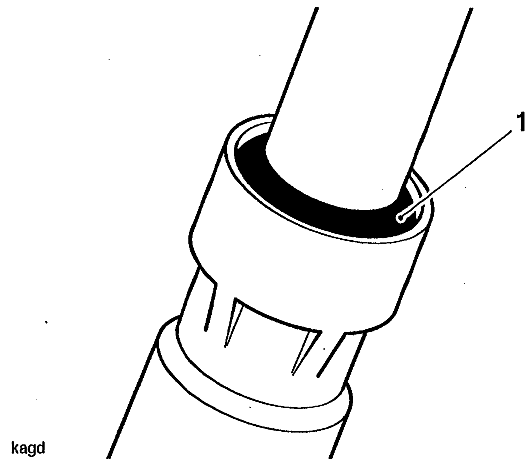
> **WARNING: If roughness or excessive stiffness is detected, investigate the cause and take the necessary remedial action before riding the motorcycle.**
>
> **Riding the motorcycle with defective or damaged suspension can damage the motorcycle, cause loss of control, or an accident.**

2. Remove the front section of the front mudguard.



1. Fixings for the front section of the front mud

3. Loosen the clamp and lift each fork gaiter from the lower end.
4. Visually inspect the fork inner tube for rust and damage. Repair or replace as necessary.
5. Visually inspect the oil seal area for signs of damage or fluid leaks. If oil leaks are found, the fork must be stripped and overhauled or replaced completely.



1. Fork Seal Area

6. Refit the gaiter and tighten the clamps.
7. Refit the front section of the mudguard.

HEADSTOCK BEARING ADJUSTMENT

1. Position the motorcycle on level ground, in an upright position.
2. Place a block under the engine to raise the front wheel off the ground.

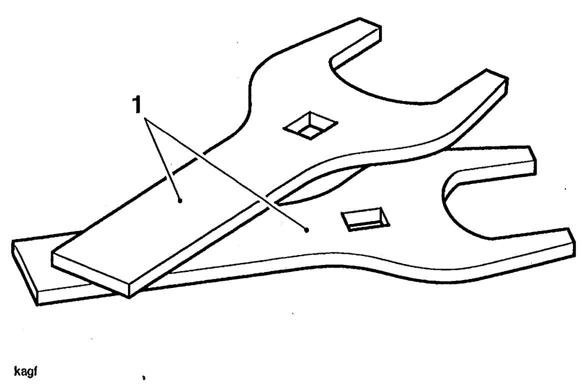
WARNING: Ensure that the motorcycle is stabilised and adequately supported to prevent the risk of injury from the motorcycle falling.

CAUTION: Ensure that the support block is positioned to avoid damaging all oil lines which run beneath the engine and the oil filter element.

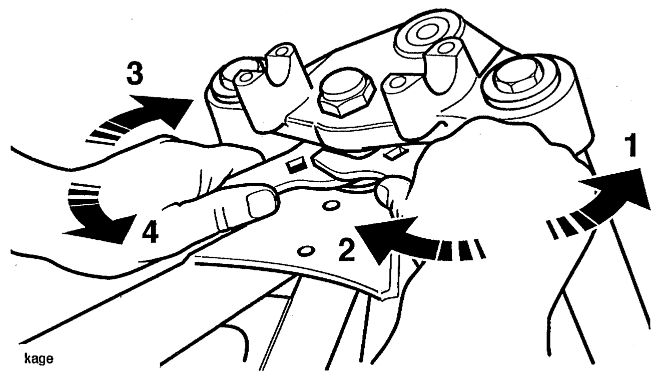
3. Remove the fuel tank as described in the fuel system section.
4. Undo the handlebar clamp fixings and remove the handlebar assembly, resting it on the frame.
5. Release the load on the top yoke by slackening the pinch bolts **on the top yoke only.**

WARNING: If the lower yoke fixings are also slackened, the forks will no longer support the weight of the motorcycle.
Do not slacken the lower yoke fixings as, in this condition, the motorcycle could topple over causing damage and/or risk of injury.

6. Undo the headstock top nut.
7. Release the adjuster locknut using service tool 3880140-T0301. Hold the adjuster nut (the lower nut) to prevent accidental movement.



1. Service tools 3880140-T0301



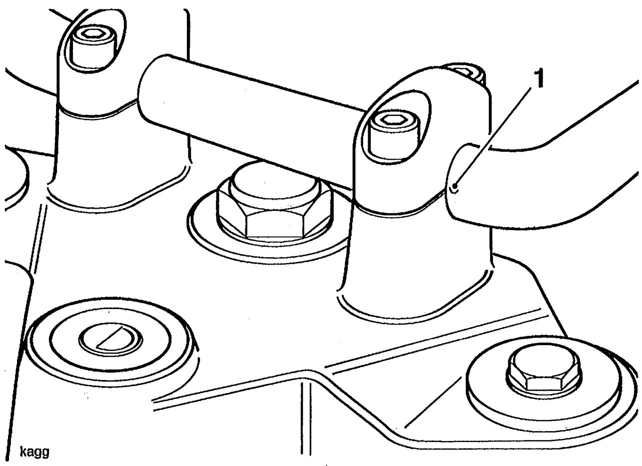
Checking headstock bearing adjustment

1. Unlock
2. Lock
3. Reduce play
4. Increase play

8. Adjust the headstock bearing by moving the adjuster nut, clockwise to take out play/increase pre-load, or anticlockwise to add play/decrease pre-load.

NOTE:
- **Correct adjustment is reached when the bearing play is eliminated without pre-loading the bearings.**

9. When the adjustments have been made, lock the locknut to the adjuster nut to a torque of **40 Nm**.
10. Tighten headstock top nut to **65 Nm.**
11. Tighten the top yoke clamp bolts to **20 Nm**
12. Refit the handlebars, aligning the dot with the centre of the retaining clamp split line. Tighten the clamp fixings to **26 Nm** taking care to keep the clamp splits even.



1. Alignment dot.

13. Check that the steering will fall to either lock from the centre position without undue effort. If excessive effort is required or the steering feels tight or notchy, it is likely that the bearings have been pre-loaded and the adjustment procedure should be repeated until correct. Similarly, if free-play (end float) is still present in the bearings, then the adjustment should be repeated until the correct setting is reached. If all the free-play (end float) cannot be eliminated, the bearings have been worn beyond their service limit and must be replaced.

CAUTION: A true check can only be made when all fixings are correctly torqued.

WARNING: Operation with incorrectly adjusted, worn or damaged steering head bearings may cause impaired handling and instability leading to an accident.
If in doubt, have the motorcycle inspected by an authorised Triumph dealer before riding.

14. Remove all supports and lower the motorcycle to the ground. Support the motorcycle on either the side or centre stand.

FORK OIL

Oil change

1. Remove the fork assembly as described later in this section.

NOTE:

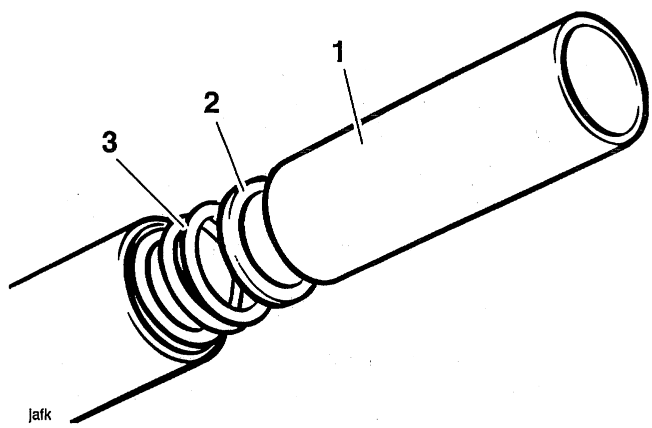
- **To aid removal, slacken but do not remove the top cap before releasing the fork from the yoke.**

2. Unscrew the fork cap from the inner tube. Discard the top cap 'O' ring.

WARNING: The fork cap will spring clear due to spring tension. To prevent injury, always wear eye, face and hand protection when removing spring loaded items.

3. From within the outer tube remove:-

– guide tube
– guide washer
– damping spring.

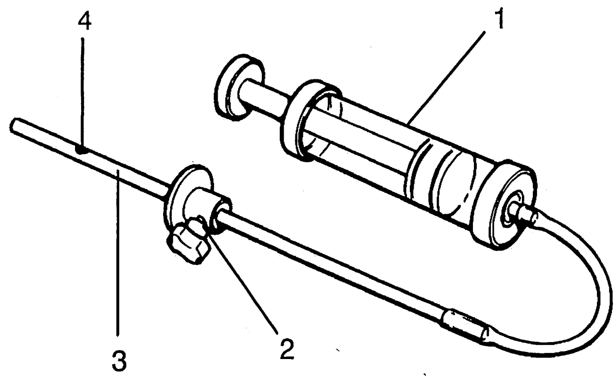


1. Guide Tube
2. Guide Washer
3. Damping spring

4. Invert the fork assembly and allow all the oil to drain into a suitable container. Turn the fork back to an upright position.

5. Fill the fork with the grade of oil specified in the fork oil table, to a level slightly above that which will finally be required.

6. Set the scale on tool 3880160-T0301 to the figure shown in the table.

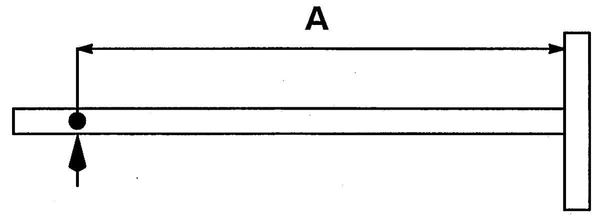


1. Tool 3880160-T0301
2. Adjustment Plate
3. Scale Area
4. Hole (zero position)

NOTE:

- **Zero level on the tool is set at the small exit hole in the side of the scale tube, NOT AT THE END TIP. Do not attempt to block this side hole as this will cause the final fluid level to be incorrect.**

> **WARNING: Incorrect tool adjustment and/or failure to keep the tool level with the fork slider will affect the final fluid level setting.**
>
> **Incorrect fork oil levels could result in an unsafe riding condition leading to loss of control and an accident.**



Zero level measured from the oil hole.
Set dimension 'A' to the required oil level.

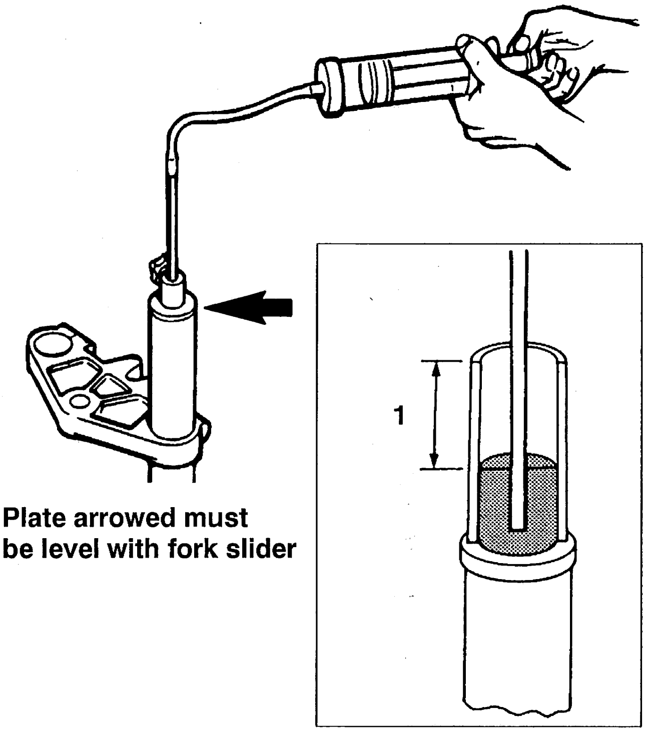


Plate arrowed must be level with fork slider

1. Fork Oil Level Setting (fork fully compressed)

7. Operate the fork several times to expel any trapped air from the valves, then **fully compress the fork.**

8. Insert the scale end of the tool into the fork inner tube.

9. Hold the tool adjuster plate level with the upper surface of the fork inner tube and draw fluid into the syringe until fluid flow ceases (empty the syringe if the body becomes full before fluid flow stops).

10. The fluid level in the fork is now set to the height set on the tool scale. Check the tool scale setting and repeat the process if incorrectly set.

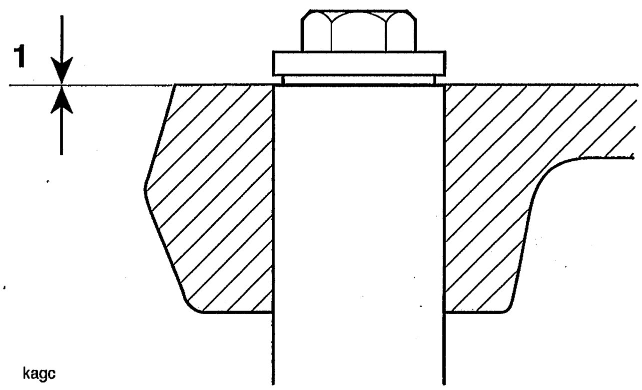
11. When the correct level has been set, assemble the fork components in the reverse order to which they were removed.

12. Refit the fork and tighten the top cap to **30 Nm.**

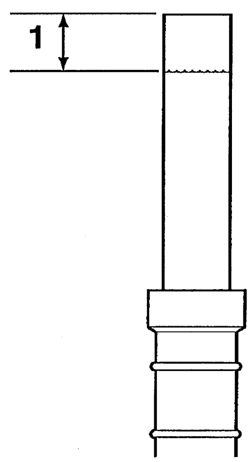
FORK OIL LEVEL CHART

Model	Oil Level	Oil Volume	Oil Grade	Fork Pull Through
Tiger (VIN 71699 on)	119 mm	682 cc	Kayaba G10	Top of the inner tube flush with upper face of top yoke.

WARNING: Any variation in fork oil level from the figures quoted above could result in an unsafe riding condition leading to loss of control and an accident.



1. Fork Pull Through



1. Fork Oil Level

FORKS

Removal

1. Position the motorcycle on level ground, in an upright position.

2. Place a block under the engine to raise the front wheel off the ground.

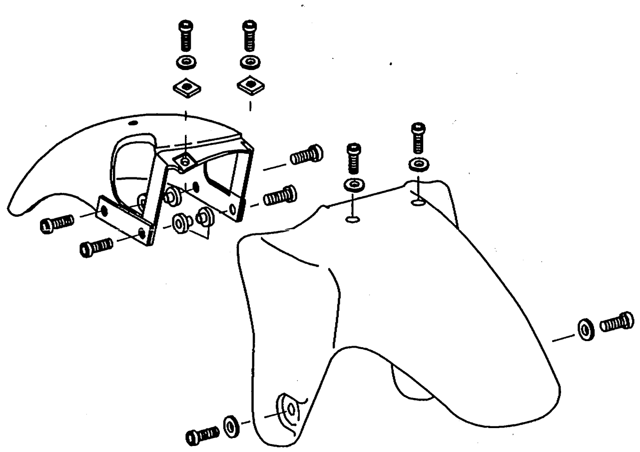
> **WARNING: Ensure that the motorcycle is stabilised and adequately supported to prevent the risk of injury from the motorcycle falling.**

3. Detach the brake calipers without disturbing the brake hydraulics.

> **WARNING: Do not allow the calipers to hang on the brake hoses as this may damage the hoses and could lead to an accident.**

4. Remove front wheel as described in the wheel section.

5. Remove front mudguard taking care not to damage the painted surfaces.



Front mudguards and fixings.

6. Slacken the top and bottom yoke clamp bolts.

7. Using a downward twisting motion withdraw each fork in turn.

Fork Installation

1. Position the forks in the yokes and adjust the fork 'pull through' height in line with the chart.

2.. Tighten the top and bottom yoke pinch bolts to **20 Nm.**

3. Refit the front mudguard.

4. Refit the front wheel as described in the wheel section.

5. Align the brake calipers to the forks and tighten the caliper mounting bolts to **28 Nm.**

6. Remove support block and position the motorcycle on its stand.

7. Check the brakes for correct operation. Rectify as necessary.

FORKS

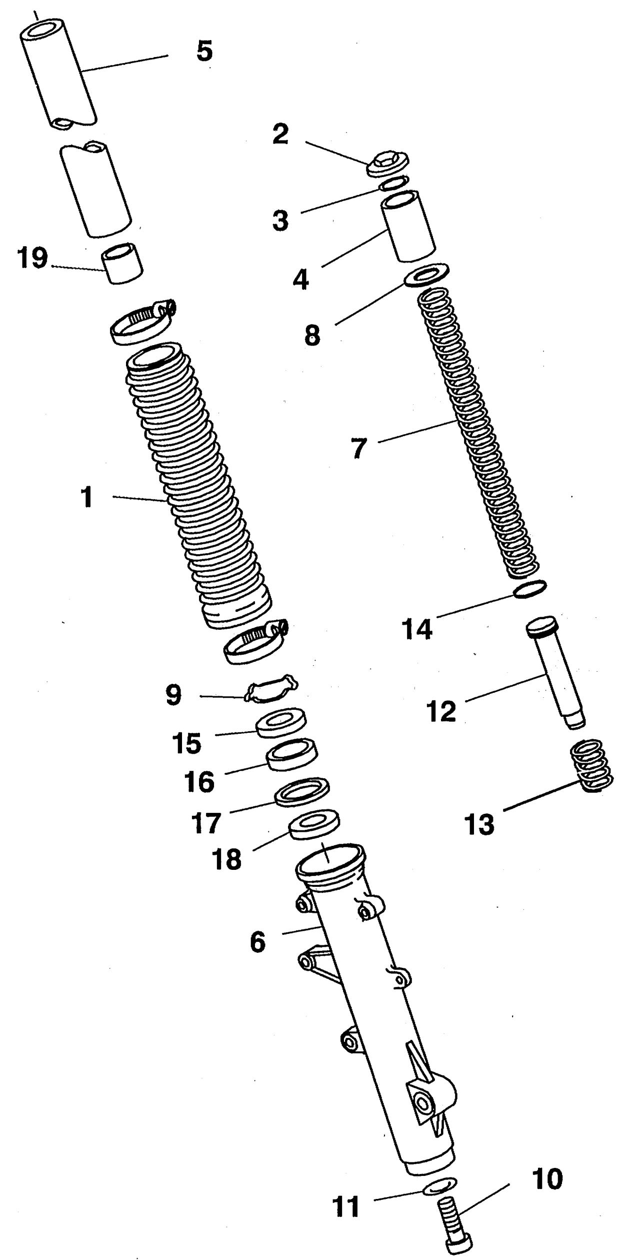
Disassembly

CAUTION: Use the caliper mounting points to secure the outer tube in the vice. Never clamp directly onto the tube itself as this will cause the tube to distort beyond repair.

1. Clamp the outer fork tube in a soft jawed vice, taking care not to mark or damage the caliper mounting bosses.
2. Remove the fork gaiter (1).

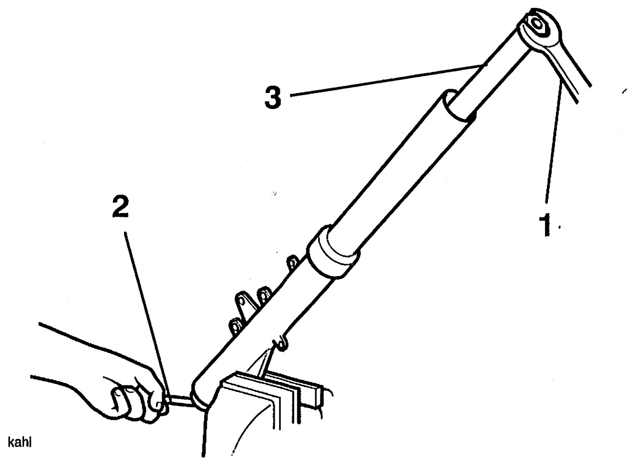
WARNING: The fork cap will spring clear due to spring tension. To prevent injury, always wear eye, face and hand protection when removing spring loaded items.

3. Unscrew the fork cap (2) complete with 'O' ring (3).
4. Remove the spacer tube (4).
5. Remove the assembly from the vice and while keeping the assembly vertical, slide the inner tube (5) down into the outer tube (6).
6. Remove the spring (7) and spring guide (8).
7. Pour the fork oil into a suitable container.
8. Remove the wire circlip (9) from the inside lip of the outer tube.
9. Clamp the assembly in a vice, taking care not to mark or damage the caliper mounting bosses.



1. Gaiter
2. Fork cap
3. 'O' ring
4. Spacer Tube
5. Inner Fork Tube
6. Outer Fork Tube
7. Spring
8. Spring Guide
9. Wire Clip
10. Capscrew
11. Copper Washer
12. Damping Cylinder
13. Rebound Spring
14. Piston Ring
15. Dust Seal
16. Oil Seal
17. Washer
18. Bushes
19. Oil Lock

10. Slide the hexagonal end of service tool 3880090-T0301 down the inner tube and turn until a positive engagement is felt in the cylinder.



1. Spanner
2. Allen Key
3. Tool 3880090-T0301

11. Hold the inner cylinder (5) with the engaged tool and remove the capscrew (10) situated in the outside base of the outer tube.

12. Remove and discard the copper sealing washer (11) from the capscrew (10).

13. Remove the fork from the vice. Remove the service tool, invert the assembly and collect the damping cylinder (12), rebound spring (13) and any excess oil. Remove and discard the piston ring (14).

14. With the inner tube (5) uppermost, pull the inner tube smartly upwards to withdraw it from the outer tube (6), complete with the dust seal (15), oil seal (16), washer (17) and bushes (18).

NOTE:

- **One of the two bushes (18) is permanently fixed to the inner tube (5) and must not be removed.**

15. Invert the outer tube and collect the oil lock (19).

Inspection

1. Examine all components for damage through scoring, scratching splitting etc.

2. Examine the bushes for excessive wear.

3. Always renew the oil seal, piston ring and dust seal.

Assembly

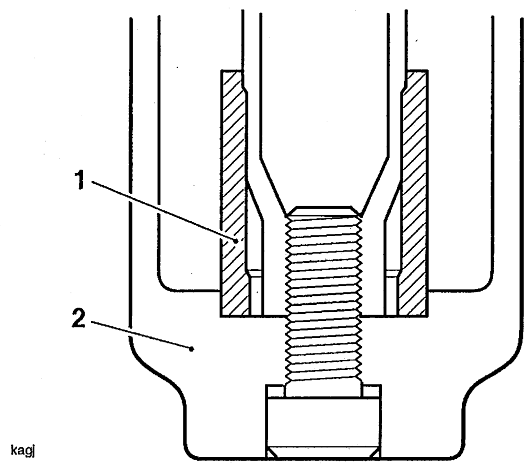
> **WARNING: The front fork consists of many precision machined parts. Rebuilding must take place in a dirt/dust free environment.**
>
> **Dirt ingress may cause damage to the fork parts leading to instability, loss of control or an accident.**

1. Slide the bush (18) then the washer (17) onto the inner tube (5).

NOTE:

- **Use a clean rod to guide the oil lock into place. Do not use force as this will damage the oil lock.**

2. Slide the oil lock (19) into the lower end of the outer fork tube (6) with the thinner wall of the oil lock uppermost, and locate it in the recess at the bottom of the tube.



1. Oil lock
2. Fork outer tube

3. Clamp the outer tube vertically using the top caliper mounting.

4. Locate the inner tube (5) into the outer tube (6) and ensure the oil lock is correctly located.

5. Slide the rebound spring (13) into the inner tube (5).

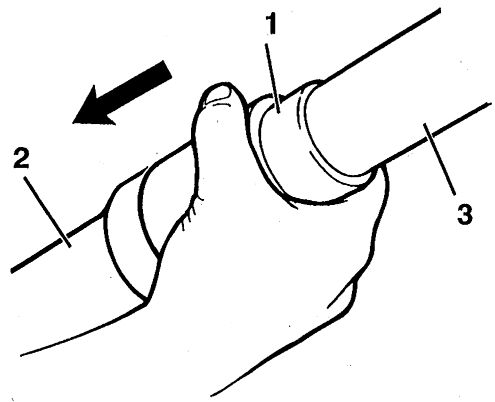
6. Fit a new plastic piston ring (14) into the groove on the damping cylinder (12).

7. Slide the damping cylinder (12) into the inner cylinder, locating into the rebound spring.

8. Fit a new sealing washer (11) to the capscrew (10) and refit special tool 3880090-T0301 to the cylinder. Prevent the cylinder from turning using the inserted tool and tighten the capscrew at the base of the outer tube to **30 Nm.**

9. Remove the special tool 3880090-T0301.

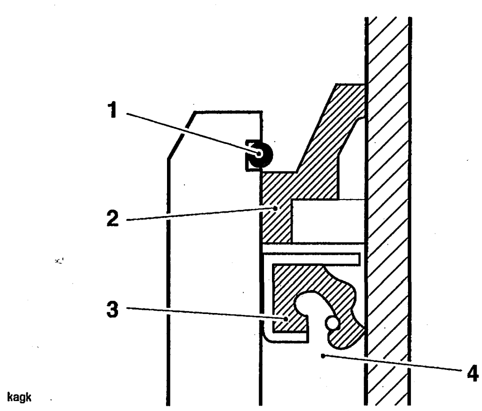
10. Using the larger diameter end of tool 3880080-T0301, drift the bush and washer, fitted earlier, fully home in the outer tube.



1. Tool 3880080-T0301
2. Outer Tube
3. Inner Tube

11. Lubricate a new oil seal (16), open side facing inwards and locate over the inner tube. Using the recessed end of tool 3880080-T0301, drift home the seal.

12. Lubricate a new dust seal (15), open side facing inwards and locate over the inner tube. Using the recessed end of tool 3880080-T0301, drift home the dust seal over the oil seal.



1. Wire clip
2. Dust seal
3. Oil seal
4. Open side

13. Fit a new wire circlip (9).

14. Extend the inner tube, and add oil to the assembly. Operate the inner tube several times to expel any air. Check for smooth operation and rectify as necessary.

15. Add oil to the correct level as described in the fork level checking procedure.

16. Fit a new 'O' ring (3) to the fork cap (2).

17. With the inner tube (5) extended, slide the spring (7), with the close wound coils uppermost, into the inner tube (5). Refit the spring guide (8) and spacer tube (4).

WARNING: Unless fully engaged in the thread, the fork cap will spring clear due to spring tension. To prevent injury, always wear eye, face and hand protection when fitting spring loaded items.

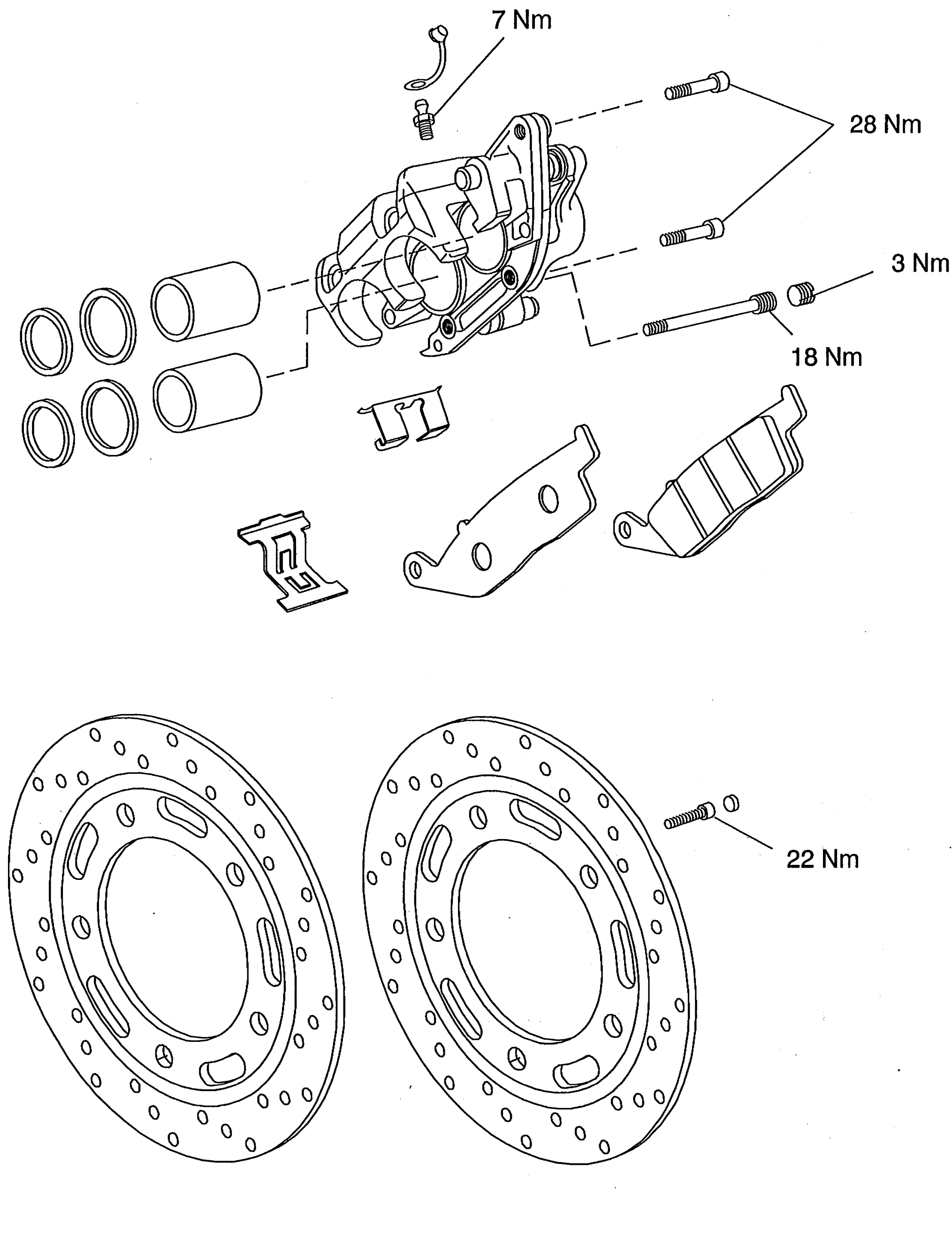
18. Refit the fork cap (2) to the inner tube (5) whilst compressing the spring and tighten the cap to **30 Nm.**

19. Refit the gaiter and tighten the clamp screws.

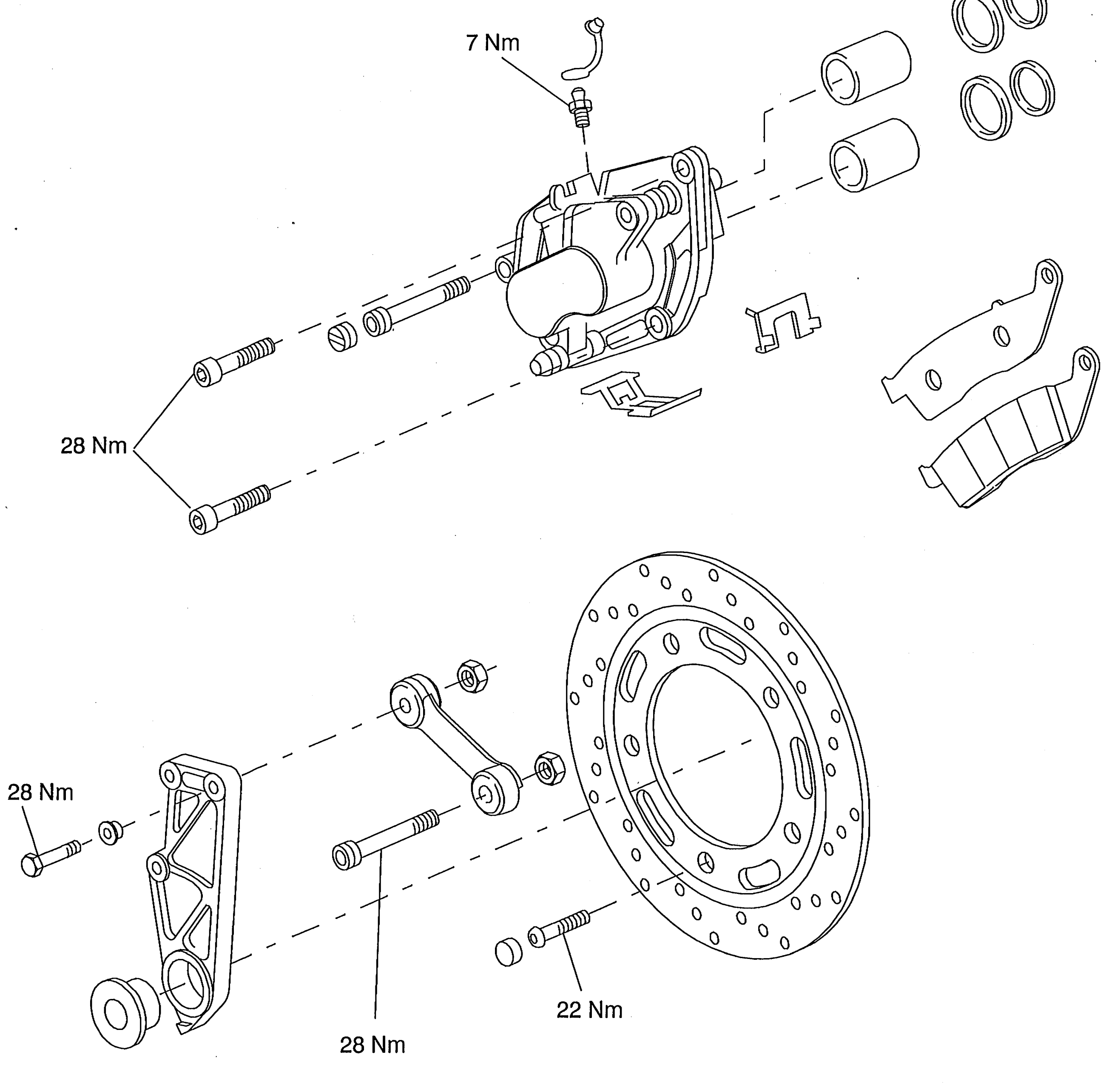
BRAKING SYSTEM

CONTENTS

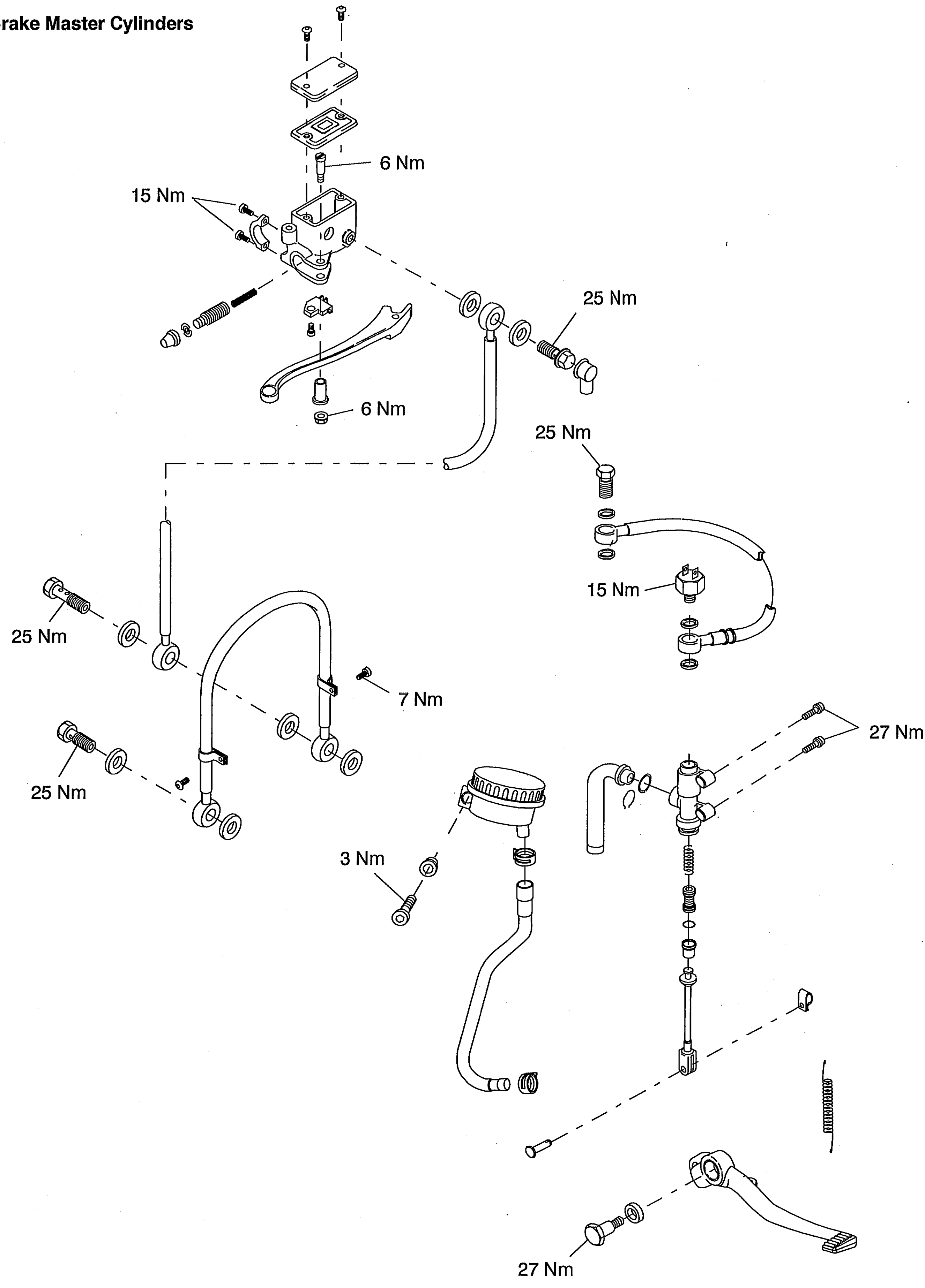
Front Brake Layout



Rear Brakes Layout



Brake Master Cylinders



BRAKING SYSTEM MAINTENANCE SAFETY PRECAUTIONS

WARNING: Brake fluid is hygroscopic which means it will absorb moisture from the air. The absorbed moisture will greatly reduce the boiling point of the brake fluid causing a reduction in braking efficiency.

Replace brake fluid in line with the periodic maintenance chart. A dangerous riding condition could result if this important maintenance item is neglected.

Do not spill brake fluid onto any area of the bodywork as this will damage any painted or plastic surface.

Always use new brake fluid from a sealed container and never use fluid from an unsealed container or from one which has been previously opened.

Do not mix different brands of fluid. Check for fluid leakage around brake fittings, seals and joints.

Check regularly for brake hose damage.

FAILURE TO OBSERVE ANY OF THE ABOVE WARNINGS MAY REDUCE BRAKING EFFICIENCY LEADING TO AN ACCIDENT.

WARNING: If there has been an appreciable drop in the level of the fluid in either brake fluid reservoir, consult your authorised Triumph dealer for advice before riding.

If the brake lever or pedal feels soft when it is applied, or if the lever/pedal travel becomes excessive, there may be air in the brake lines or the brake may be defective.

It is dangerous to operate the motorcycle under such conditions and remedial action must be taken by your authorized Triumph Dealer before riding the motorcycle.

Failure to take remedial action may reduce braking efficiency leading to an accident.

WARNING: Use only D.O.T. 4 specification brake fluid as listed in the general information section of this manual. The use of brake fluids other than those D.O.T. 4 fluids listed in the general information section may reduce the efficiency of the braking system leading to an accident.

Failure to change the brake fluid at the interval specified in the periodic maintenance chart may reduce braking efficiency resulting in an accident.

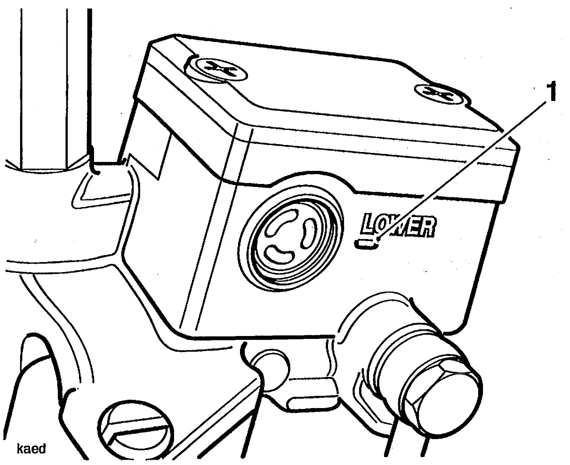
WARNING: Never use mineral based grease in any part of the braking system or in any area where contact with the braking system is possible. Mineral based grease will damage the hydraulic seals in the calipers and master cylinders.

Damage caused by contact with mineral based grease may reduce braking efficiency resulting in an accident.

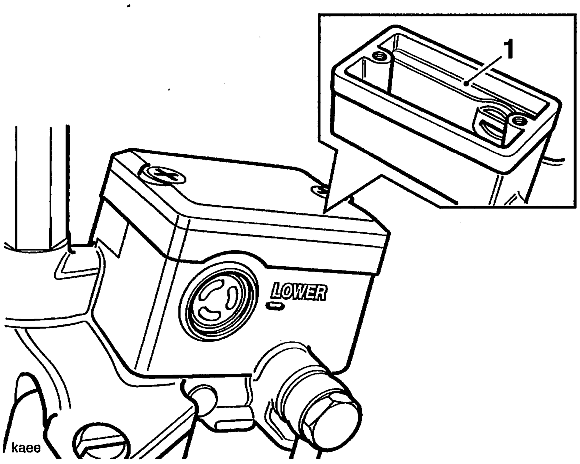
FLUID LEVEL INSPECTION

In accordance with the periodic maintenance chart, inspect the brake fluid level in the front and rear master cylinder reservoirs. In addition, the brake fluid must be regularly replaced, again in accordance with the periodic maintenance chart, to help prevent brake failure.

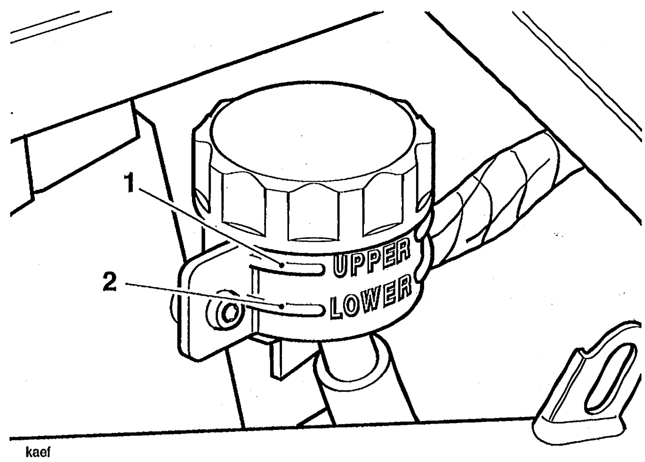
1. Ensure that the brake fluid level in the front and rear brake fluid reservoirs is between the upper and lower level lines (reservoir held horizontal).



1. **Front Reservoir Lower Level**



1. **Front Reservoir Upper Level**



1. Rear Reservoir Upper Level

2. Rear Reservoir Lower Level

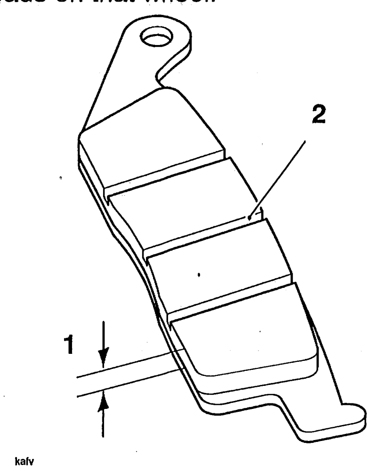
CHANGING BRAKE FLUID, BRAKE HOSES AND HYDRAULIC SEALS

Brake fluid, brake hoses and hydraulic seals in the master cylinders and calipers should be changed in accordance with the periodic maintenance chart.

> **WARNING: Failure to change brake fluid, hoses and hydraulic seals at the specified interval could result in reduced brake efficiency leading to loss of control and an accident.**

BRAKE WEAR INSPECTION

In accordance with the periodic maintenance chart, inspect the brake pads for wear.
The minimum thickness of lining material for any front or rear brake pad is 1.5mm. If any pad has worn to the bottom of the groove in the pad centre, replace all the brake pads on that wheel.



1. Lining material thickness

2. Centre groove

> **WARNING: Do not replace individual brake pads, replace both pads in the brake caliper. If two calipers are mounted on the same wheel, all the pads on the wheel must be replaced together. Replacing individual pads will reduce braking efficiency and may cause an accident.**

BRAKE PADS

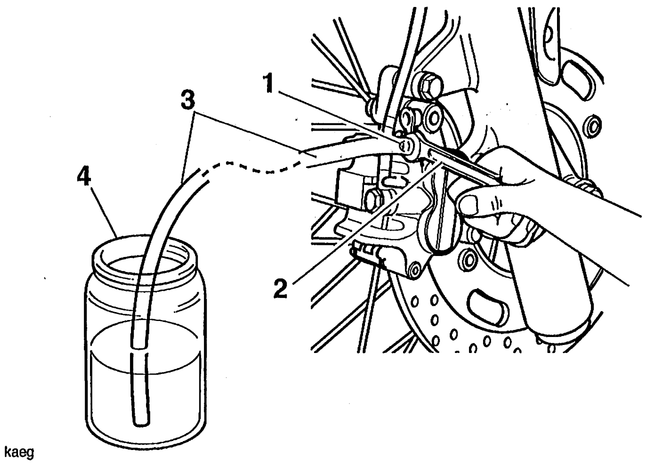
Front and rear brake pad wear is automatically compensated for and has no effect on brake lever or pedal action.

BRAKE LIGHTS

Check the brake lights for correct operation, on both the front and rear brakes, in accordance with the periodic maintenance chart.

BLEEDING THE FRONT BRAKES, RENEWING BRAKE FLUID

19. Remove the rubber cap from the bleed nipple on the right hand caliper.
20. Attach a transparent tube to the bleed nipple.



1. Bleed Nipple

2. Spanner

3. Bleed Tube

4. Container

21. Place the other end of the tube in a suitable receptacle containing new brake fluid.
22. Turn the handlebars to bring the fluid reservoir to a level position.
23. Carefully remove the reservoir cover taking care not to spill any fluid.

WARNING: Ensure absolute cleanliness when adding brake fluid to the brake fluid reservoir. Do not allow moisture or debris to enter the cylinder as this will adversely affect the fluid properties. Always use fluid from a sealed container and do not use fluid from a container which has been previously opened.

Always check for fluid leakage around hydraulic fittings and for damage to hoses. Rectify faults as necessary before riding.

A dangerous riding condition leading to an accident could result if this warning is ignored.

CAUTION: To prevent body damage, do not spill brake fluid onto any area of the bodywork.

24. Check the condition of the sealing diaphragm for the reservoir. Replace if necessary.
25. Release the bleed nipple.

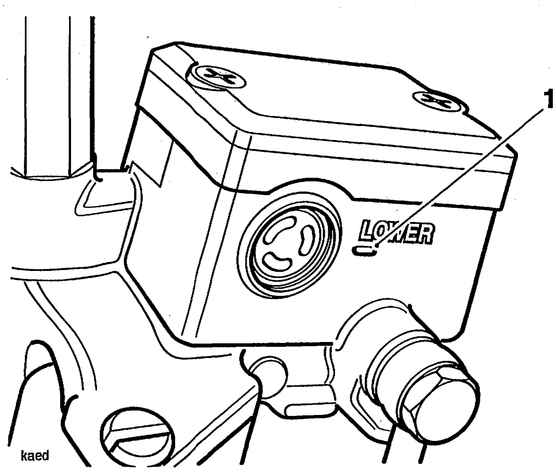
WARNING: Use only D.O.T. 4 specification brake fluid as listed in the general information section of this manual. The use of brake fluids other than those D.O.T. 4 fluids listed in the general information section may reduce the efficiency of the braking system leading to an accident.

Observe the brake fluid handling warnings given earlier in this section of the manual.

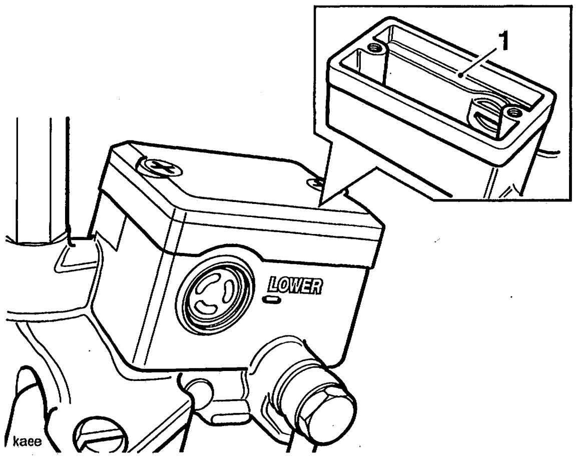
NOTE:

- **During bleeding, do not allow the fluid level to fall below the lower level mark in the reservoir. If the level is allowed to fall below this mark, air may enter the system and the sequence of bleeding must be repeated.**

26. Slowly pull the brake lever to the handlebar and, holding the lever fully in, close the bleed nipple.
27. Repeat the previous two steps until no more air appears in the bleed tube.
28. Maintain the brake fluid level between the upper and lower reservoir levels whilst bleeding is being carried out.



1. **Front Reservoir Lower Level**



1. Front Reservoir Upper Level

29. When all air has been expelled from the system, hold the lever in and close the bleed nipple. Tighten the nipple to **5 Nm**.

30. Fill the reservoir to the upper level with new DOT 4 fluid.

WARNING: Use only D.O.T. 4 specification brake fluid as listed in the general information section of this manual. The use of brake fluids other than those D.O.T. 4 fluids listed in the general information section may reduce the efficiency of the braking system leading to an accident.

Observe the brake fluid handling warnings given earlier in this section of the manual.

31. Remove the transparent bleed tube.

32. Replace the bleed nipple cap.

33. Repeat the procedure for the left-hand caliper.

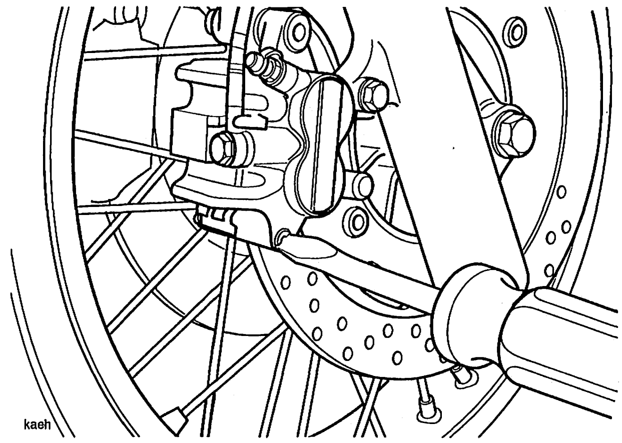
34. Refit the reservoir cover and diaphragm.

35. Check that the brake operates correctly.

FRONT BRAKE PADS

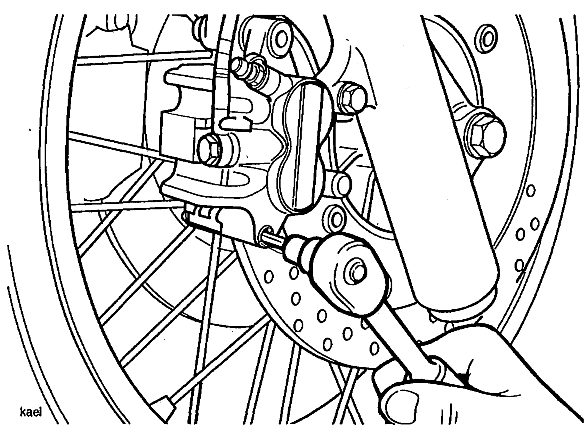
Removal

1. Remove the grub screw from the outer end of the brake pad pin.



Releasing the Grub Screw

2. Release the brake pad pin using an Allen key and withdraw the pin from the caliper.

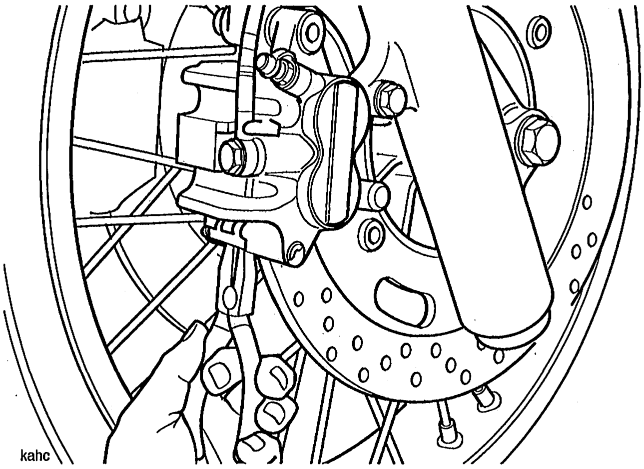


Releasing the Brake Pad Pin

3. Using hand pressure only, retract the caliper pistons by gently pushing the caliper toward the wheel.

CAUTION: Brake fluid will be displaced as the caliper pistons are compressed. To prevent body damage, ensure that the displaced fluid does not come into contact with any part of the bodywork.

4. Remove the brake pads from the lower end of the caliper.



Withdrawing Brake Pads

5. Collect the anti rattle springs from inside the caliper.

Installation

1. Fit the anti-rattle springs into the caliper.
2. Lubricate the pad retaining pin using a minimum amount of proprietary high temperature 'Copperslip' type grease.

> **WARNING: Do not apply more than a minimum coating of grease to the pad retaining pin. Excess grease may contaminate the brake pads, hydraulic seals and disc causing reduced braking efficiency which may lead to loss of control and an accident.**

3. Install the brake pads into the caliper ensuring that the upper end is correctly engaged in the anti-rattle spring.
4. Align the pads and fit the pad retaining pin. Tighten the pin to **18 Nm.**
5. Refit the grub screw to the caliper and tighten to **3 Nm.**
6. Check the brake fluid level and adjust as required with new DOT 4 fluid.

> **WARNING: Use only D.O.T. 4 specification brake fluid as listed in the general information section of this manual. The use of brake fluids other than those D.O.T. 4 fluids listed in the general information section may reduce the efficiency of the braking system leading to an accident.**
>
> **Observe the brake fluid handling warnings given earlier in this section of the manual.**

FRONT BRAKE CALIPER

Removal

1. Disconnect the brake hose at the caliper and place the free end of hose in a suitable container to collect brake fluid.
2. Remove the brake caliper from the fork.
3. Remove the brake pads as described earlier in this section.

Disassembly

1. Cover the caliper opening with a clean, heavy cloth and, using either compressed air or by reconnecting the master cylinder and pumping the brake lever, remove the pistons one at a time.

WARNING: To prevent injury, never place fingers or hands inside the caliper opening when removing the pistons. Always wear eye, hand and face protection when using compressed air. Eye, face and skin damage will result from direct contact with compressed air.

Inspection

1. Check the piston and caliper bore for corrosion, scoring and damage. Renew as necessary.

WARNING: Always renew caliper seals and pistons after removal from the caliper. An effective hydraulic seal can only be made if new components are used.

A dangerous riding condition leading to an accident could result if this warning is ignored.

2. Inspect the brake pads for damage and wear beyond the service limit. Renew as necessary.

Assembly

WARNING: Never use mineral based grease in any part of the braking system or in any area where contact with the braking system is possible. Mineral based grease will damage the hydraulic seals in the calipers and master cylinders.

A dangerous riding condition leading to an accident could result if this warning is ignored.

1. Fit new fluid seals to the caliper. Apply new, clean brake fluid to the outside of the pistons and fluid seals.
2. Push the pistons into the cylinder using hand pressure only.

WARNING: Ensure that the caliper bores do not become scratched during removal and assembly. Ensure that the pistons do not tip during assembly as this could damage the caliper.

A dangerous riding condition leading to an accident could result if this warning is ignored.

3. Refit the brake pads as described earlier in this section.
4. Tighten the pad retaining pin to **18 Nm** and the grub screw to **3 Nm.**

Installation

1. Position the caliper over the brake disc ensuring that the pads are correctly positioned within caliper.
2. Tighten the caliper securing bolts to **28 Nm**.
3. Connect the brake hose to the caliper using new washers on each side of the banjo bolt.
4. Tighten the banjo bolt to **25 Nm**.
5. Fill the master cylinder with new, DOT 4 brake fluid from a sealed container.

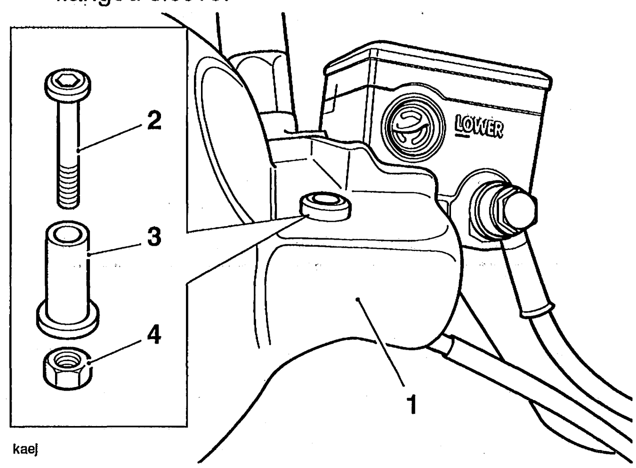
> **WARNING: Use only D.O.T. 4 specification brake fluid as listed in the general information section of this manual. The use of brake fluids other than those D.O.T. 4 fluids listed in the general information section may reduce the efficiency of the braking system leading to an accident.**
>
> **Observe the brake fluid handling warnings given earlier in this section of the manual.**

6. Bleed the brake line as described earlier.

FRONT MASTER CYLINDER

Removal

1. Drain the fluid from the master cylinder by bleeding the system until all fluid has been expelled.
2. Remove the pivot bolt securing the brake lever to the master cylinder. Collect the knuckle guard and flanged sleeve.



1. Knuckle Guard

2. Pivot Bolt

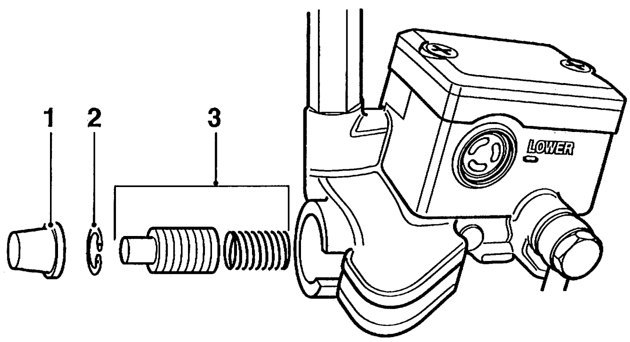
3. Flanged Sleeve

4. Nut

3. Remove the brake lever.
4. Disconnect the brake hose from the master cylinder.
5. Disconnect the brake light switch
6. Release the clamp screws from the handlebars.
7. Remove the master cylinder.

Disassembly

1. Detach the boot from the lever end of the cylinder.
2. Remove the circlip from beneath the boot.
3. Remove the piston set from the master cylinder bore noting the relative position of the seals and piston components.



1. Boot

2. Circlip

3. Piston Set

Inspection

1. Check the following for wear, damage, cracks or deterioration:
   - Cylinder bore
   - Dust cover
   - Spring
   - Piston
   - Pivot Bolt
2. Always renew the piston and seal set if the cylinder is dismantled.
3. Check that the relief and supply ports on the cylinder are not blocked.

Assembly

WARNING: Never use mineral based grease in any part of the braking system or in any area where contact with the braking system is possible. Mineral based grease will damage the hydraulic seals in the calipers and master cylinders.

A dangerous riding condition leading to an accident could result if this warning is ignored.

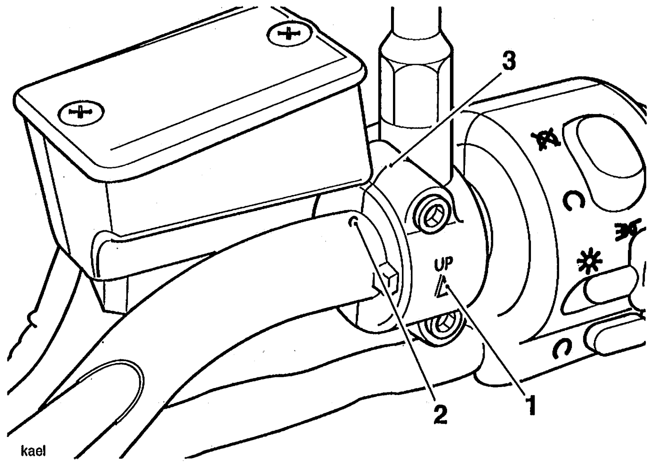
1. Lubricate the piston and cylinder with new, clean brake fluid.
2. Fit the new spring and piston set into the master cylinder and retain with a new circlip.

WARNING: Ensure that the piston and piston seal are fitted facing the same way as noted during removal. A dangerous riding condition leading to an accident could result from incorrect assembly of the master cylinder.

3. Refit the master cylinder boot.

Installation

1. Locate the master cylinder to the handlebars and position the clamp with the 'Up' arrow pointing upwards. Align the master cylinder/clamp split line with the dot mark on the handlebar.



1. Arrow Mark

2. Dot Mark

3. Split Line

2. Tighten the clamp bolts, upper first and then the lower to **15 Nm**.
3. Re-connect the brake light switch.
4. Position the brake lever ensuring that pivot boss is correctly aligned and fitted to the push rod.
5. Fit the knuckle guard and flanged sleeve.
6. Tighten the pivot screw and locknut to **6 Nm.**
7. Using new sealing washers on both sides of the banjo bolt, align and connect the brake hose to the master cylinder. Tighten the banjo bolt to **25 Nm**.
8. Fill and bleed the front brakes as described earlier.

> **WARNING: Use only D.O.T. 4 specification brake fluid as listed in the general information section of this manual. The use of brake fluids other than those D.O.T. 4 fluids listed in the general information section may reduce the efficiency of the braking system leading to an accident.**
>
> **Observe the brake fluid handling warnings given earlier in this section of the manual.**

9. Examine the system for correct operation and fluid leaks. Rectify as necessary.

FRONT BRAKE DISCS

Wear

1. Replace any brake disc if worn beyond the service limit or exceeds the disc run-out limit.

Front Disc Thickness

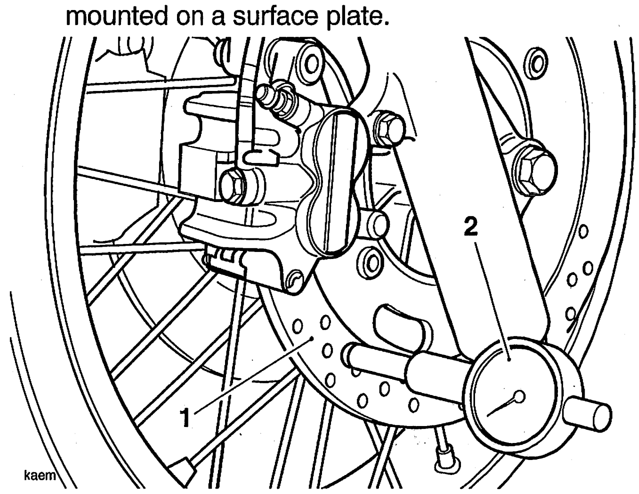
Standard: .... 5.00 mm
Service Limit: .... 4.50 mm

Disc Run-out

Standard: .... 0.15 mm
Service Limit: .... 0.30 mm

> **WARNING: Do not replace front brake discs individually. Discs must always be replaced in pairs even if one of a pair is serviceable.**
>
> **A dangerous riding condition leading to an accident could result if this warning is ignored.**

Measure disc run out using an accurate dial gauge mounted on a surface plate.



1. Disc

2. Dial Gauge

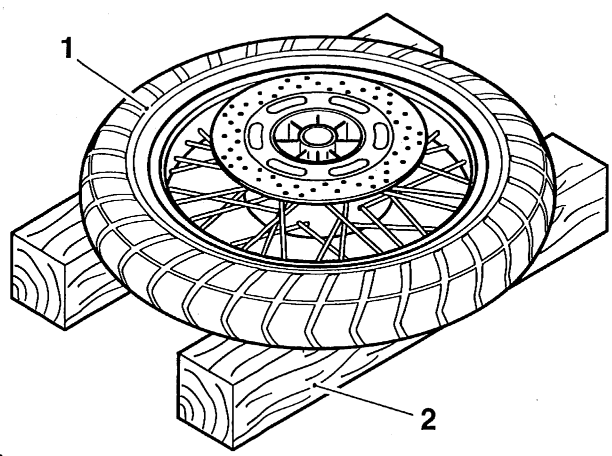
Removal

> **WARNING: Do not renew front brake discs individually. Discs must always be renewed in pairs even if one of a pair is serviceable.**
>
> **A dangerous riding condition leading to an accident could result if this warning is ignored.**

1. Remove the front wheel as described in the wheel section.

> **WARNING: Damage to the wheel centre could cause misalignment of the wheel when refitted. A dangerous riding condition leading to an accident could result if this warning is ignored.**

2. Support the wheel on blocks as illustrated to avoid damage to the wheel centre.



1. Wheel

2. Support block

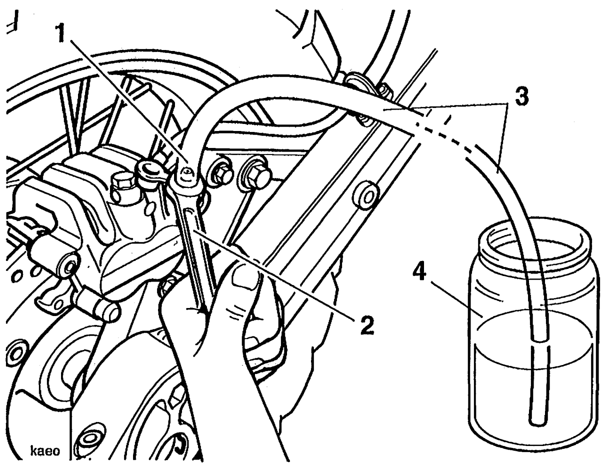
3. Remove and discard the securing bolts to detach the disc.
4. Repeat operations 2 and 3 to remove the disc on the opposite side.

Installation

1. Locate the first disc to the wheel.
2. Fit new securing bolts and tighten to **22 Nm.**
3. Fit the other disc in the same way.
4. Thoroughly clean and degrease the discs.
5. Refit the wheel as described in the wheel section.

BLEEDING THE REAR BRAKES, RENEWING BRAKE FLUID

1. Remove the rubber cap from the bleed nipple on the brake caliper.
2. Attach a transparent tube to the bleed nipple.



1. Bleed Nipple

2. Spanner

3. Bleed Tube

4. Container

3. Place the other end of the tube in a suitable receptacle containing new brake fluid.
4. Remove the right hand rear panel.
5. Carefully remove the reservoir cover taking care not to spill any fluid.

WARNING: Ensure absolute cleanliness when adding brake fluid to the brake fluid reservoir. Do not allow moisture or debris to enter the cylinder as this will adversely affect the fluid properties. Always use fluid from a sealed container and do not use fluid from a container which has been previously opened.

Always check for fluid leakage around hydraulic fittings and for damage to hoses. Rectify faults as necessary before riding.

A dangerous riding condition leading to an accident could result if this warning is ignored.

CAUTION: To prevent body damage, do not spill brake fluid onto any area of the bodywork.

6. Check the condition of the sealing diaphragm for the reservoir. Replace if necessary.
7. Release the bleed nipple.

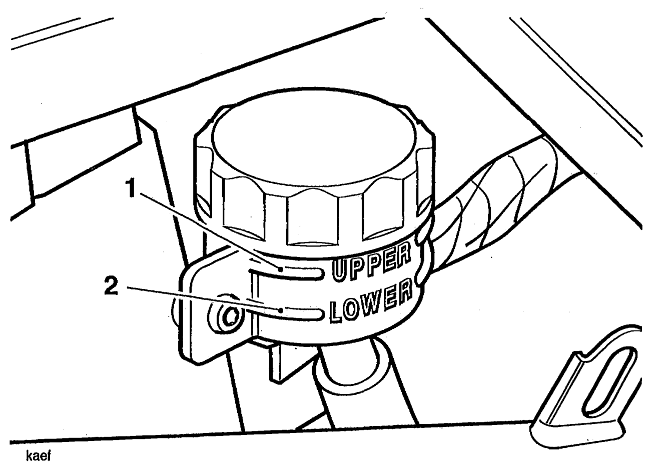
WARNING: Use only D.O.T. 4 specification brake fluid as listed in the general information section of this manual. The use of brake fluids other than those D.O.T. 4 fluids listed in the general information section may reduce the efficiency of the braking system leading to an accident.

Observe the brake fluid handling warnings given earlier in this section of the manual.

NOTE:

- **During bleeding, do not allow the fluid level to fall below the lower level mark in the reservoir. If the level is allowed to fall below this mark, air may enter the system and the sequence of bleeding must be repeated.**

8. Slowly depress the brake pedal and, holding the pedal fully down, close the bleed nipple.
9. Repeat the previous two steps until no more air appears in the bleed tube.
10. Maintain the brake fluid level between the upper and lower reservoir levels whilst bleeding is being carried out.



1. Rear Reservoir Lower Level

2. Rear Reservoir Upper Level

11. When all air has been expelled from the system, hold the pedal down and close the bleed nipple. Tighten the nipple to **5 Nm**.

12. Fill the reservoir to the upper level with new DOT 4 fluid.

WARNING: Use only D.O.T. 4 specification brake fluid as listed in the general information section of this manual. The use of brake fluids other than those D.O.T. 4 fluids listed in the general information section may reduce the efficiency of the braking system leading to an accident.

Observe the brake fluid handling warnings given earlier in this section of the manual.

13. Remove the transparent bleed tube.
14. Replace the bleed nipple cap.
15. Refit the reservoir cover and diaphragm.
16. Check that the brake operates correctly.
17. Refit the right hand rear panel.
18. Reconnect the battery positive (red) lead first.
19. Refit the seats

REAR BRAKE PADS

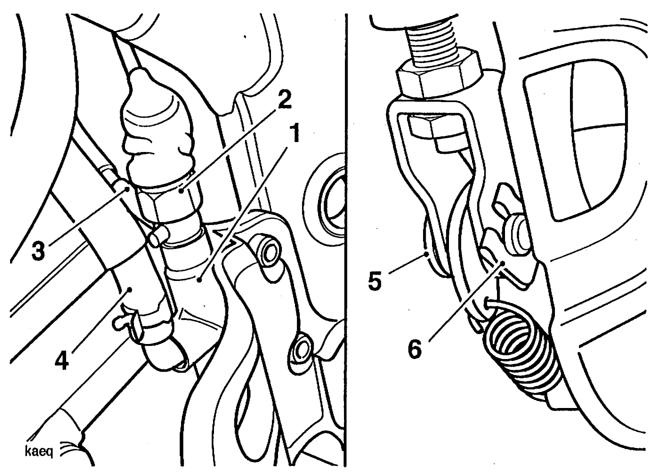
REAR BRAKE CALIPER

The procedure for the replacement of rear brake pads and for the overhaul of the rear brake caliper is the same as for the front brake calipers. Refer to these instructions, located elsewhere in this section for details.

REAR MASTER CYLINDER

Removal

1. Remove the seats and disconnect the battery negative (black) lead first.
2. Remove the right hand body side panel.
3. Drain the fluid from the master cylinder by bleeding the system until all fluid has been expelled.
4. Remove the clip from the clevis pin at the lower end of the brake pushrod.
5. Remove the clevis pin.
6. Remove the reservoir hose from the master cylinder.
7. Disconnect the brake light switch connections.
8. Remove the brake light switch, thus releasing the brake hose.
9. Remove the capscrews and washers retaining the cylinder to the control plate.
10. Remove the master cylinder.



1. Master Cylinder

2. Brake Light Switch

3. Brake Hose

4. Reservoir Hose

5. Clevis Pin

6. Clip

Disassembly

1. Remove the boot from the cylinder and pushrod.
2. Remove the circlip retaining the pushrod to the cylinder.
3. Remove the piston set from the master cylinder bore noting the relative position of the seals and piston components.

Inspection

1. Visually inspect the master cylinder bore for wear, scratches or corrosion. Replace as necessary.
2. Check the piston and cylinder bore for damage, wear or deterioration. Replace as necessary. Always renew the piston seals if the cylinder has been dismantled.
3. Examine the pushrod for bends and damage. Replace as necessary.

Assembly

WARNING: Never use mineral based grease in any part of the braking system or in any area where contact with the braking system is possible. Mineral based grease will damage the hydraulic seals in the calipers and master cylinders.

A dangerous riding condition leading to an accident could result if this warning is ignored.

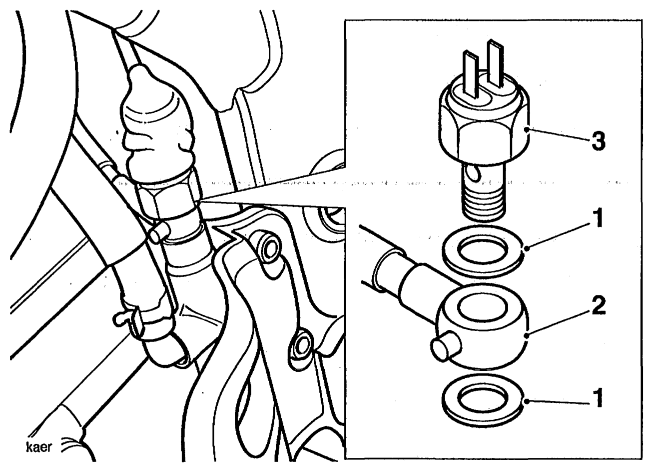
1. Clean the master cylinder bore, piston and seals, with new brake fluid.
2. Ensure all ports are clear of obstruction.
3. Install the spring and piston set together in the orientation noted earlier.

WARNING: Ensure that the piston and piston seal are fitted facing the same way as noted during removal. A dangerous riding condition leading to an accident could result from incorrect assembly of the master cylinder.

4. Apply a small amount of brake grease to the pushrod.
5. Install the pushrod in the master cylinder and retain with a new circlip. Refit the boot.

Installation

1. Fit the reservoir hose to the master cylinder and secure with the clip.
2. Locate the master cylinder to the control plate and tighten the master cylinder capscrews to **27 Nm.**
3. Connect the push rod to the brake pedal with the clevis pin. Retain to the pedal with a new clip.
4. Fit new washers to the brake hose connection and locate to the master cylinder. Fit the brake light switch and tighten to **15 Nm.**



1. Washers

2. Rear Brake Hose

3. Brake Light Switch

5. Reconnect the brake light switch wires.
6. Fill and bleed the rear brake system as described earlier.

WARNING: Use only D.O.T. 4 specification brake fluid as listed in the general information section of this manual. The use of brake fluids other than those D.O.T. 4 fluids listed in the general information section may reduce the efficiency of the braking system leading to an accident.

Observe the brake fluid handling warnings given earlier in this section of the manual.

7. Refit the right hand body side panel.
8. Reconnect the battery positive, (red) lead first

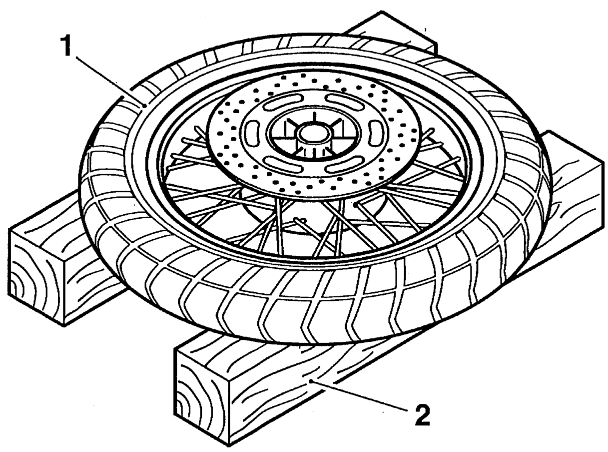
REAR BRAKE DISCS

Removal

1. Remove the rear wheel as described in the wheel section.

> **WARNING: Damage to the wheel centre could cause misalignment of the wheel when refitted. A dangerous riding condition leading to an accident could result if this warning is ignored.**

2. Support the wheel on blocks as illustrated to avoid damage to the wheel centre.



1. Wheel

2. Support block

3. Remove and discard the securing bolts to detach the disc.

Installation

1. Locate the disc to the wheel.
2. Fit new securing bolts and tighten to **22 Nm.**
3. Fit the other disc in the same way.
4. Thoroughly clean and degrease the disc.
5. Refit the wheel as described in the wheel section.

Wear

1. Replace any brake disc if worn beyond the service limit or exceeds the disc run-out limit.

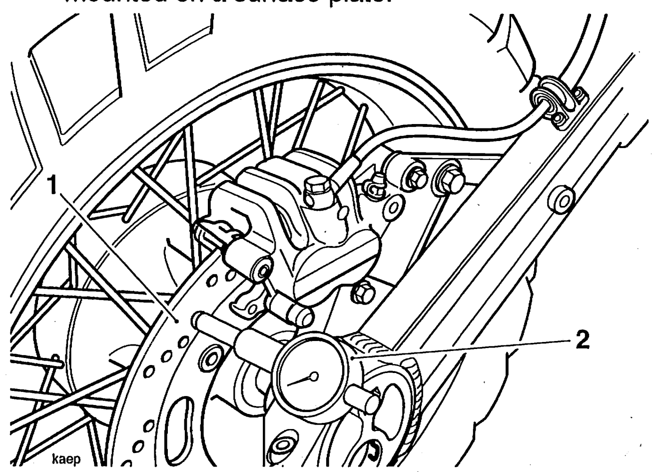
Rear Disc Thickness

Standard: .... 6.0 mm
Service Limit: .... 5.5 mm

Disc Run-out

Standard: .... 0.15 mm
Service Limit: .... 0.30 mm

Measure disc run out using an accurate dial gauge mounted on a surface plate.



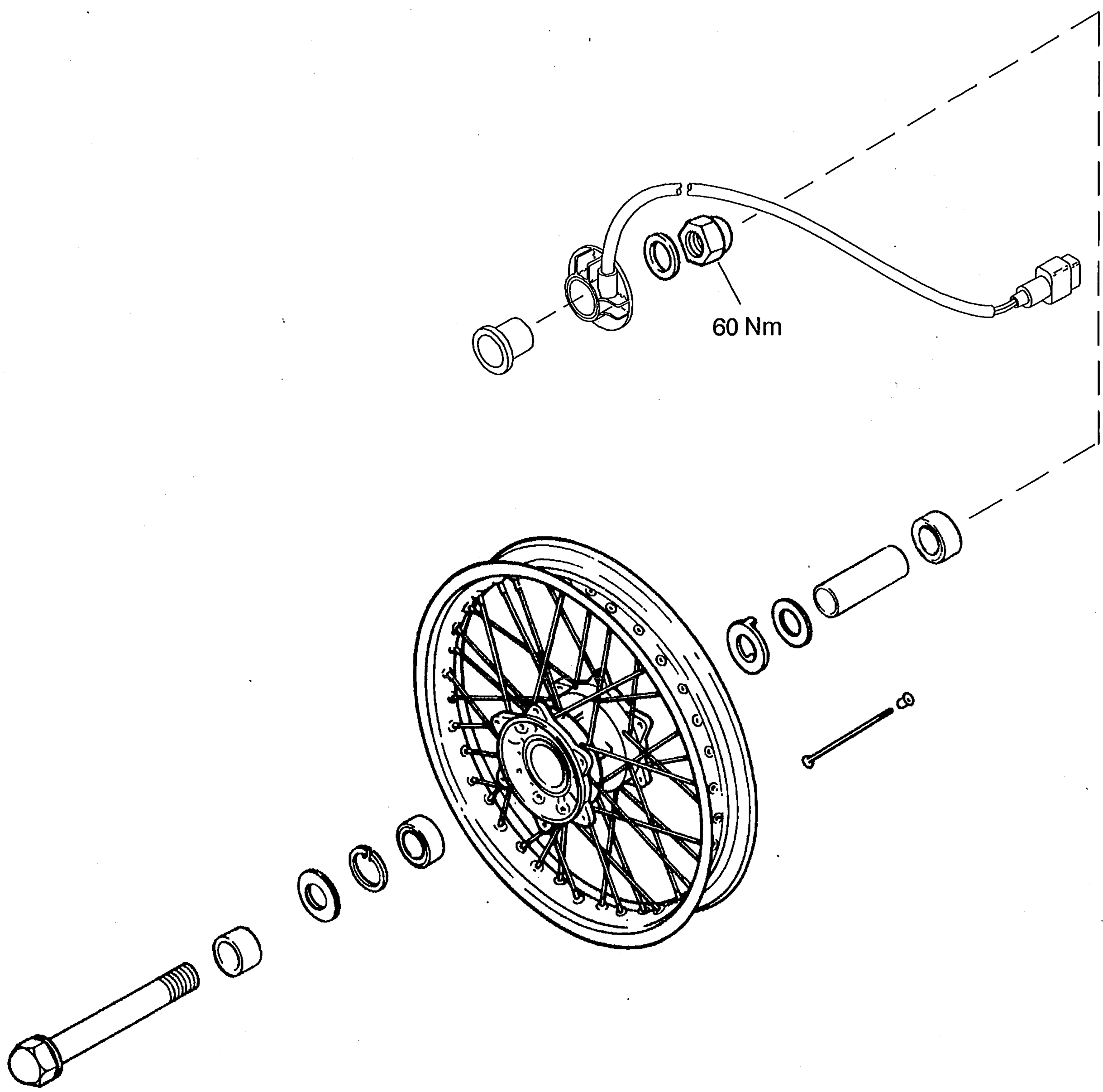
1. Disc

2. Dial Gauge

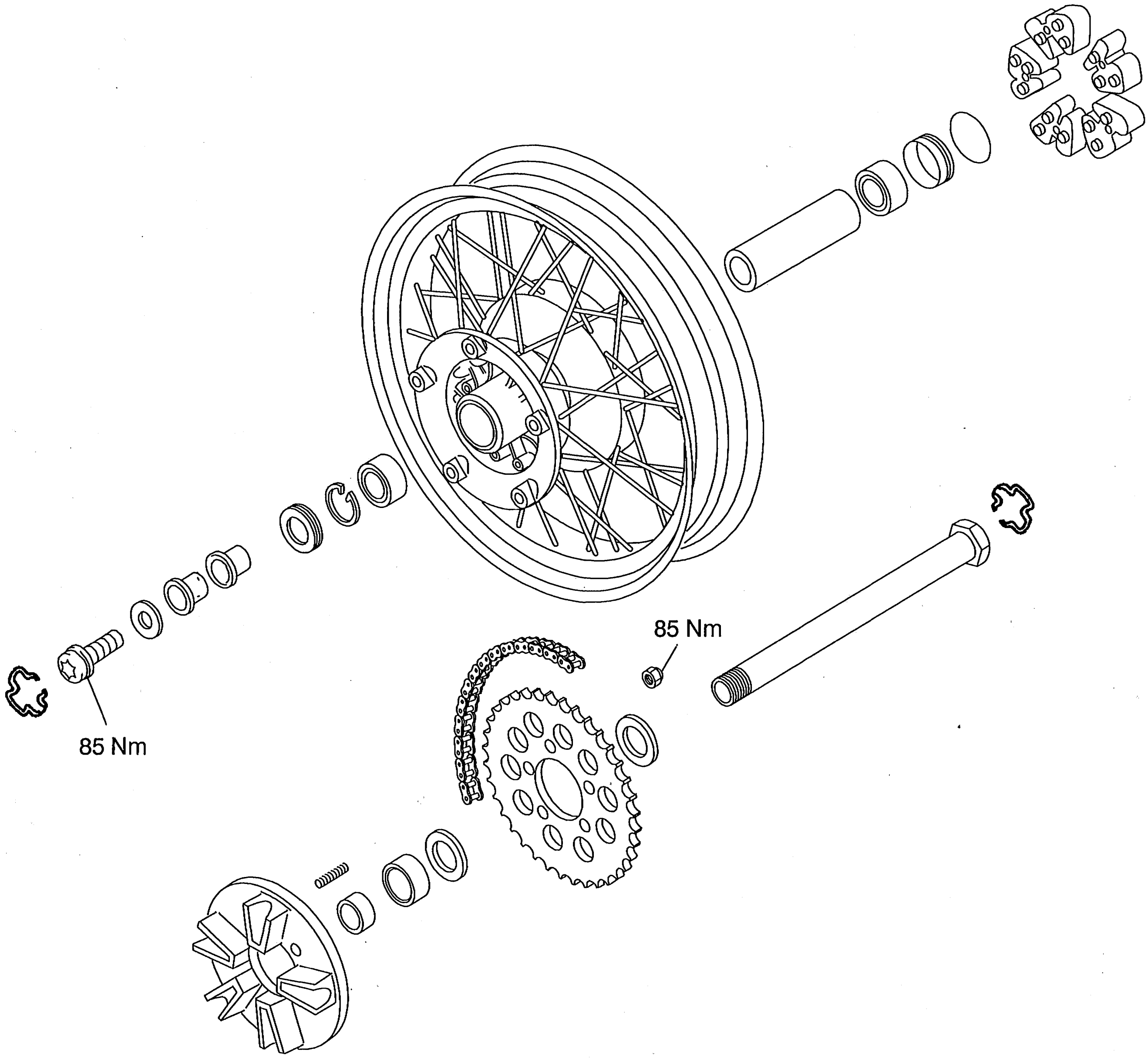
WHEELS

CONTENTS

Exploded view - Front Wheel



Exploded View - Rear Wheel & Cush Drive



Tyres

This model is equipped with spoked wheels which require a tyre suitable for use with an inner tube.

WARNING: Tyres that have been used on a rolling road dynamometer may become damaged. In some cases, the damage may not be visible on the external surface of the tyre.

Tyres must be replaced after such use as continued use of a damaged tyre may lead to instability, loss of control and an accident.

WARNING: Failure to use an inner tube in a spoked wheel will cause deflation of the tyre resulting in loss of control and an accident.

Tyre Pressures

Correct inflation pressure will provide maximum stability, rider comfort and tyre life.

Tyre pressures should be checked frequently and adjusted as necessary. See the owner's handbook for the correct inflation pressures for your model.

WARNING: Incorrect tyre inflation will cause abnormal tread wear and instability problems which may lead to loss of control and an accident.

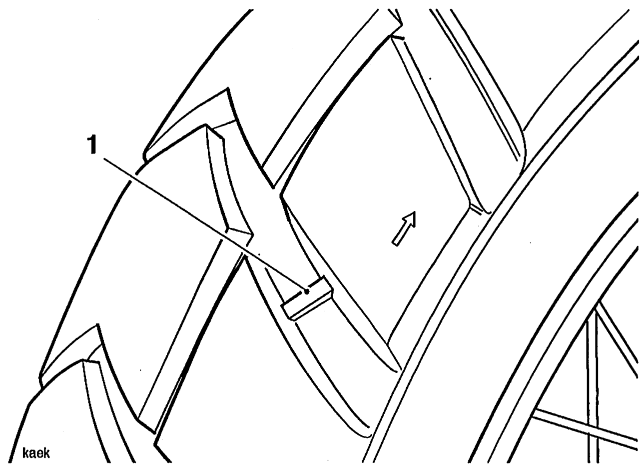
Under-inflation may result in the tyre slipping on, or coming off the rim. Over-inflation will cause instability and accelerated tread wear.

Both conditions are dangerous as they may cause loss of control leading to an accident.

Tyre Wear/Wheel Inspection, All Models

As the tyre tread wears down, the tyre becomes more susceptible to puncture and failure. It is estimated that 90% of all tyre failures occur during the last 10% of tread life (90% worn). It is false economy and unsafe to use tyres until they are worn to their minimum.

All tyres are fitted with tread wear indicators. When the tyre becomes worn down as far as the top of a tread wear indicator, the tyre is worn beyond its service life and must be replaced.



1. Tread Wear Indicator

In accordance with the scheduled maintenance chart, measure the depth of the tread with a depth gauge, and replace any tyre that has worn to, or beyond the minimum allowable tread depth.

Inspect wheels for cracks, splits and kerb damage. Check for loose or damaged spokes. Always replace wheels that are suspected of being damaged.

WARNING: Operation with excessively worn tyres is hazardous and will adversely affect traction, stability and handling which may lead to loss of control or an accident.

Check the tyres for cuts, imbedded nails or other sharp objects.

Check spokes for looseness and damage.

Check the rims for dents or deformation. Operation with damaged or defective wheels or tyres is dangerous and loss of control or an accident could result.

Always consult your Triumph Dealer for tyre replacement, or for a safety inspection of the tyres.

Minimum Recommended Tread Depth

The following chart can be used as a guide to the minimum safe tread depth.

Under 130 km/h (80mph)	2 mm (0.08 in)
Over 130 km/h (80 mph)	Rear 3 mm (0.12 in) Front 2 mm (0.08 in)

WARNING: Triumph motorcycles must not be operated above the legal road speed limit except in authorised closed course conditions.

IMPORTANT TYRE INFORMATION

All Triumph motorcycles are carefully and extensively tested in a range of riding conditions to ensure that the most effective tyre combinations are approved for use on each model. It is essential that approved tyre combinations are used when purchasing replacement tyres as the use of non approved tyres or approved tyres in non approved combinations may lead to motorcycle instability. Always refer to the owner's handbook data section for details of approved tyres and tyre combinations.

WARNING: If a tyre or inner tube sustains a puncture, the tyre and inner tube must be replaced together. Failure to replace a punctured tyre and inner tube together, or operation with a repaired tyre or inner tube can lead to instability, loss of control or an accident.

When replacing a tyre, always inspect the rim tape (rim protection band) to ensure that it is correctly protecting the tube from the spoke threads. A damaged rim tape may lead to rapid tyre deflation causing loss of control and an accident.

WARNING: The use of tyres other than those listed in the specification section of the owner's handbook may adversely affect handling leading to loss of control or an accident.

Use the recommended tyre options only in the combinations given in the owner's handbook.

Do not mix tyres from different manufacturers or tyres from the same manufacturer but from another option..

For example, do not use Tiger option 1 front tyres with Tiger option 2 rear tyres.

WARNING: Always check tyre pressures before riding when the tyres are cold. Operation with incorrectly inflated tyres may affect handling leading to loss of control and an accident.

WARNING: Operation with excessively worn or damaged tyres will impair stability and handling leading to loss of control or an accident.

WARNING: Accurate wheel balance is necessary for safe, stable handling of the motorcycle. Do not remove or change any wheel balance weights. Incorrect wheel balance may cause instability leading to loss of control and an accident.

When wheel balancing is required, such as after tyre replacement, see your authorised Triumph dealer.

Only use self-adhesive weights. Clip on weights will damage the wheel and tyre resulting in tyre deflation, loss of control and and an accident.

WARNING: When replacement tyres are required, consult your authorised Triumph dealer who will arrange for the tyres to be fitted according to the tyre manufacturers instructions.

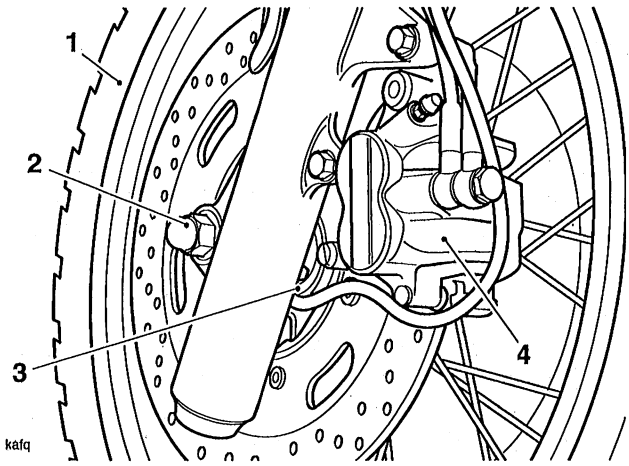
When tyres are replaced, allow time for the tyre to seat itself to the rim (approximately 24 hours). During this seating period, ride cautiously as an incorrectly seated tyre could cause loss of control or an accident. Initially, the new tyre will not produce the same handling characteristics as the worn tyre and the rider must allow adequate riding distance (approximately 100 miles) to become accustomed to the new handling characteristics.

After both 24 hours and 100 miles, the tyre pressures should be checked and adjusted and the tyre examined for correct seating and rectified as necessary.

Use of a motorcycle when not accustomed to its handling characteristics may lead to loss of control and an accident.

FRONT WHEEL

Removal



1. Front wheel

2. Wheel spindle

3. Speedo drive

4. Brake caliper

1. Remove the brake caliper mounting bolts and detach the calipers on each side of the wheel.

NOTE:

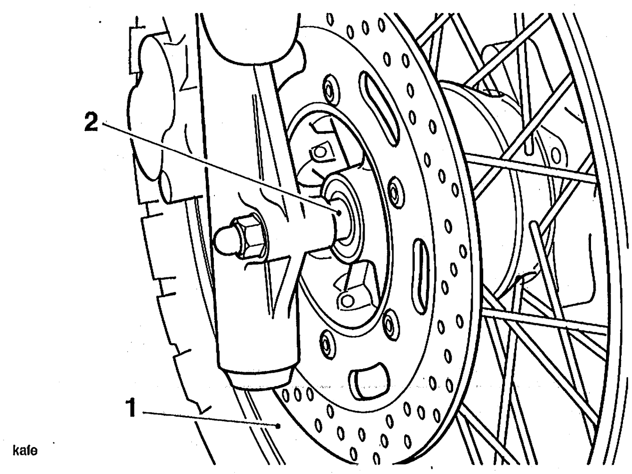
- **It is not necessary to disconnect the brake hoses when removing the caliper. However, to prevent damage to the hoses, always support the brake caliper to prevent it from hanging on the brake hose.**

> **WARNING: Do not allow the calipers to hang on the brake hoses as this may damage the hoses and could lead to an accident.**

2. Raise and support the front of the motorcycle to allow removal of the front wheel.

> **WARNING: Ensure the motorcycle is stabilised and adequately supported, to prevent it falling and causing damage or injury.**

3. Slacken either of the wheel spindle nuts.
4. Support the wheel and remove the wheel spindle.
5. Remove the wheel, recovering the speedometer drive assembly from the left hand side of the wheel, and the sleeve from the right hand side.



1. Wheel

2. Spacer

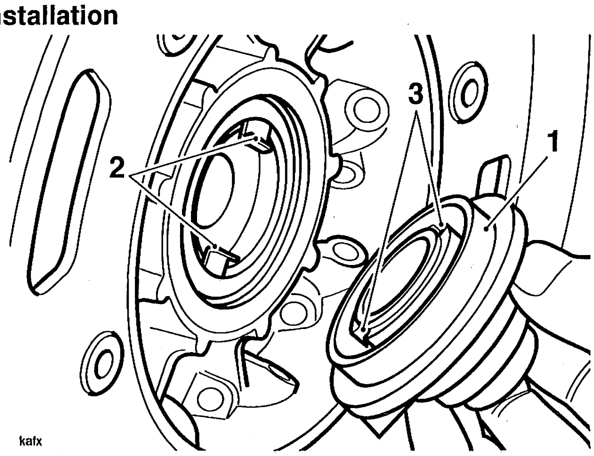
6. Place the wheel on wooden blocks.

> **CAUTION: To prevent wheel and bearing damage, observe absolute cleanliness and ensure there is no dirt ingress to the wheel bearings while the wheel is removed.**
>
> **Never allow the speedometer drive to hang on the cables. Always support the speedometer drive during the period that the wheel is removed.**

> **WARNING: Do not allow the wheel to rest on either brake disc as this may damage the disc and could lead to an accident.**

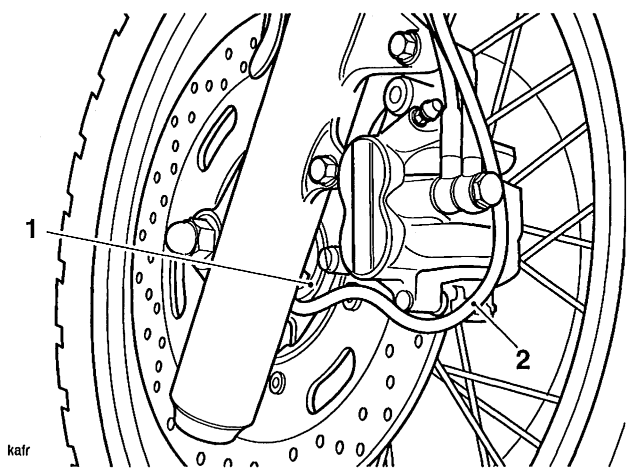
7. Thoroughly clean all components and inspect for wear or damage.

Installation



1. **Speedometer drive**
2. **Drive tongues**
3. **Drive cut-outs**

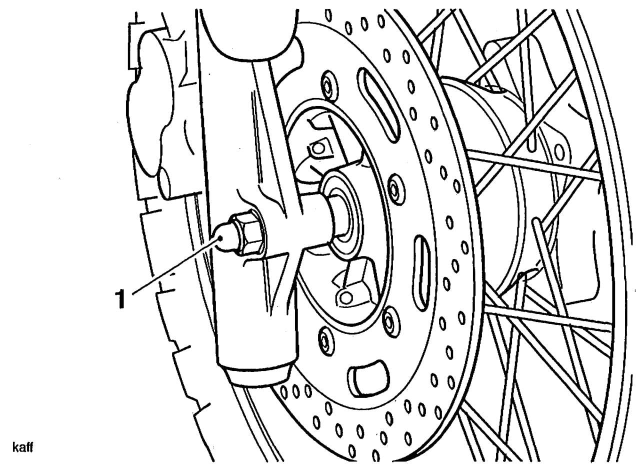
1. Align the wheel to the motorcycle and position the speedometer drive on the wheel hub, ensuring the two drive cut-outs engage with the drive tongues in the wheel.
2. Lightly smear the sleeve surface with grease and locate it in the right hand side of the hub.
3. Position the wheel between the forks and fit the wheel spindle. Turn the speedometer drive such that the cables exit the drive as shown in the diagram below.



1. **Speedometer drive**

2. **Cable exit direction**

4. Refit the wheel spindle nuts and tighten finger tight.
5. Lower the motorcycle to the ground and pump the front suspension to allow the left hand fork to 'float' to its natural position on the wheel spindle.
6. Tighten the wheel spindle nuts to **60 Nm.**



1. **Wheel spindle nuts**

7. Thoroughly clean and degrease the brake discs.
8. Fit the brake calipers, tightening the mounting bolts to **28 Nm**.
9. Check the operation of the front brake by pumping the brake lever several times.

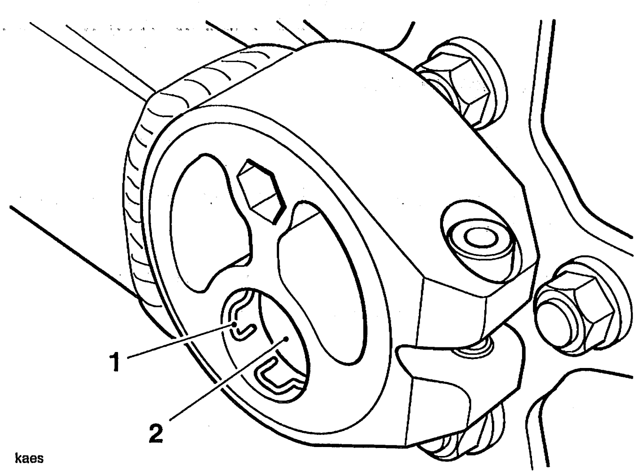
REAR WHEEL

Removal

1. Remove the chain guard.
2. Raise the rear of the motorcycle to allow removal of the rear wheel.

> **WARNING: Ensure that the motorcycle is stabilised and adequately supported to prevent the risk of injury from the motorcycle falling.**

3. Remove the retaining rings from the wheel bolts on both eccentric adjusters.
4. Remove the wheel bolts and wheel spindle.



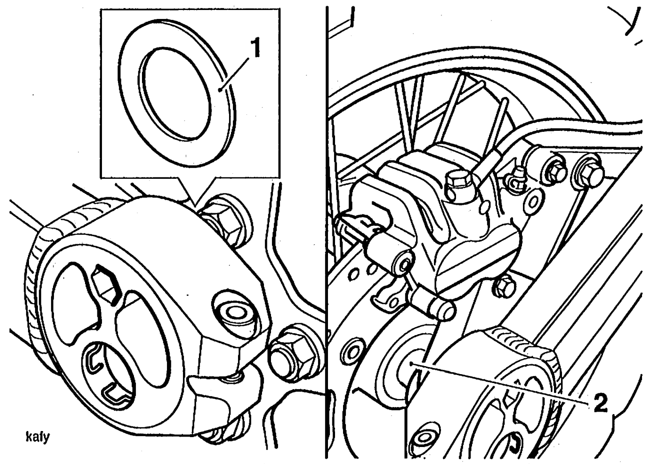
1. Retaining Rings

2. Wheel Bolt

5. Lower the wheel and lift the chain from the rear sprocket.
6. Remove the spacer from the left hand side of the sprocket carrier.
7. Lift the brake caliper carrier and remove the right hand spacer.

NOTE:

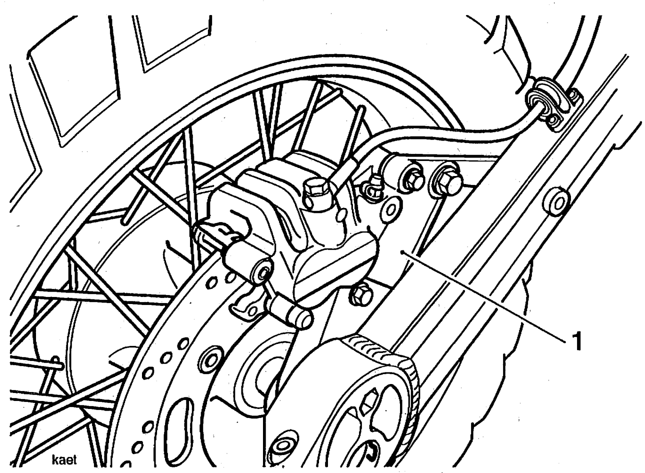
- **Make a note of the orientation of the spacers to ensure correct fitment on assembly.**



1. Left Hand Side Spacer

2. Right Hand Side Spacer

8. Lift the brake caliper carrier and remove the wheel.

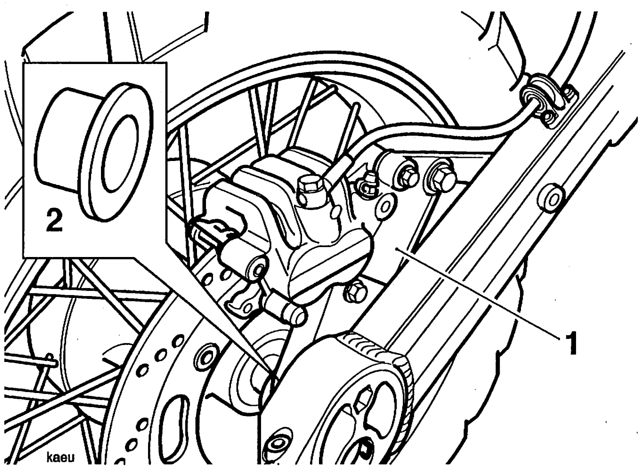


1. Caliper Carrier

Installation

NOTE:

- **Before installing the wheel or wheel spindle, always check that the caliper carrier spacer has not become displaced.**



1. Caliper Carrier

2. Spacer

1. Position the wheel within the swinging arm and align the brake disc to the caliper.
2. Align the chain to the rear sprocket.
3. Clean and lightly lubricate the wheel spindle with oil.
4. While feeding the wheel spindle through the swinging arm and wheel, refit the left and right hand wheel spacers.
5. Refit the wheel bolts and tighten to **85 Nm**.
6. Refit the retaining rings to the wheel bolts.
7. Check the chain adjustment and adjust as necessary.

WHEEL BEARINGS

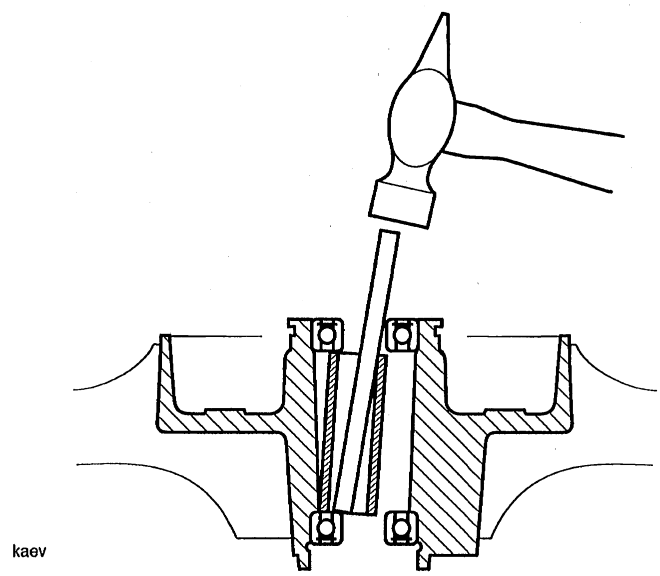
WARNING: Operation with worn or damaged steering head or wheel bearings may cause impaired handling and instability leading to an accident. If in doubt, have the motorcycle inspected by an authorised Triumph dealer before riding.

Removal

1. Remove the wheel as described earlier.
2. Lay the wheel on its side while supporting the wheel on wooden blocks to prevent damage to the brake disc.

CAUTION: Do not allow the wheel to rest on the brake disc as this may damage the disc. Support the wheel on wooden blocks, equally spaced around the rim, such that the brake disc is raised above the ground.

3. Remove the oil seals and bearing circlip. Collect the speedometer drive ring.
4. Using a suitable drift, through the centre of the wheel, drift out each bearing. Collect the centre sleeve.



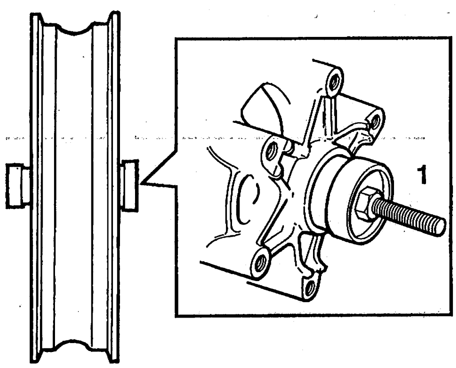
WARNING: To prevent injury, always wear eye, hand and face protection when using a drift.

Installation

1. Refer to the chart below for the correct tool and tool face to use when inserting bearings.

   Bearings are installed by means of a draw bolt acting on the insertion tool. A support tool is located on the opposite side of the hub to the insertion tool and as the draw bolt is tightened, the bearing is drawn into the hub.

   Insert bearings with the marked or shielded side facing outwards and always fit a new bearing circlip.



1. Tool 3880075 in position

Bearing Tool Selection Chart

	FRONT	
	Bearing Insertion Tool	**Support Tool**
Left Bearing	**3880070 Small face to bearing**	**3880075 Large face to hub**
Right Bearing	**3880070 Small face to bearing**	**3880075 Large face to hub**
	REAR	
	Bearing Insertion Tool	**Support Tool**
Left Bearing	**3880070 Small face to bearing**	**3880075 Small face to hub**
Right Bearing	**3880070 Large face to bearing**	**3880075 Small face to hub**
Cush Drive	**3880075 Small face to bearing**	**N/A**

NOTE:

- **Install bearings with the marked or shielded sides face out.**

WARNING: When using bearing service tools always ensure that the selected tool matches the diameter of the bearing being installed. Damage to the wheel and bearing will result from incorrect tool selection which may cause loss of control and an accident.

Ensure that the bearing remains square to the hub during the drawing in procedure. Damage to the bearing and hub will result from forcing a bearing which is not square to the hub which could cause loss of control and an accident. .

Always install bearings with the marked or shielded sides facing outwards.

2. Refit the speedometer drive ring with the drive tags facing outwards.

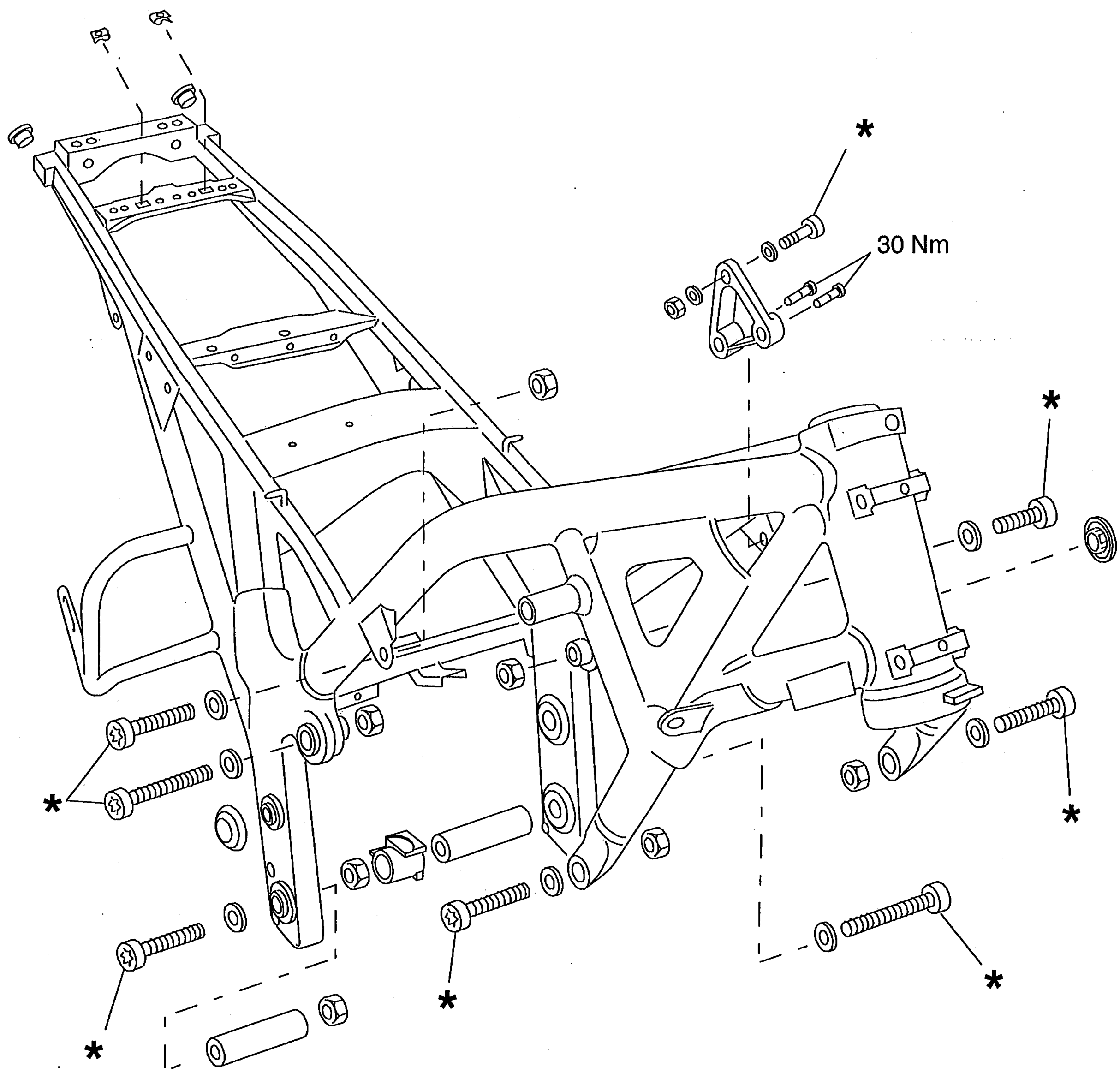
3. Lubricate and fit new seals to the wheel hubs.

4. Refit the wheel as described earlier.

BODYWORK & FRAME

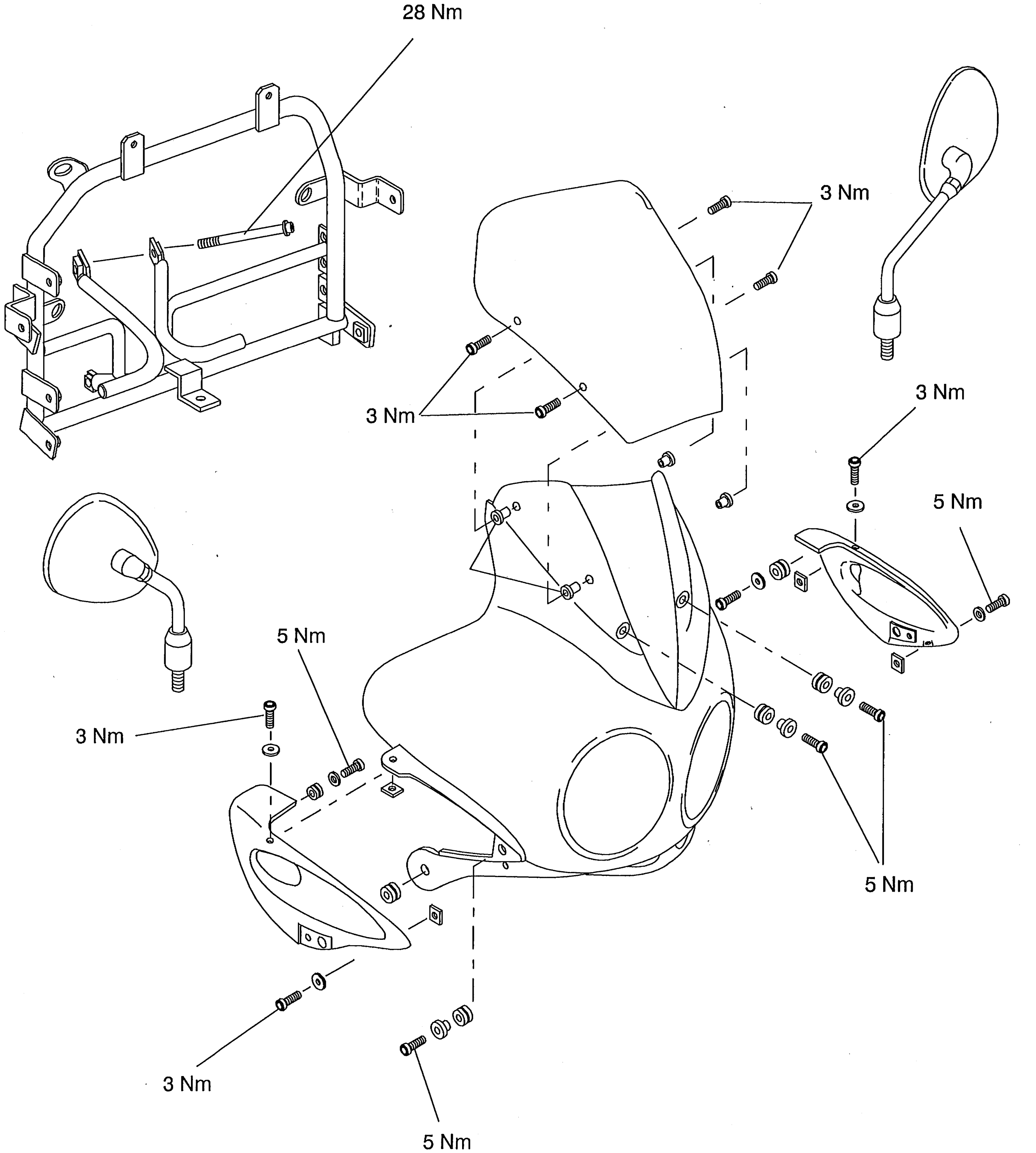
CONTENTS

Exploded View - Frame

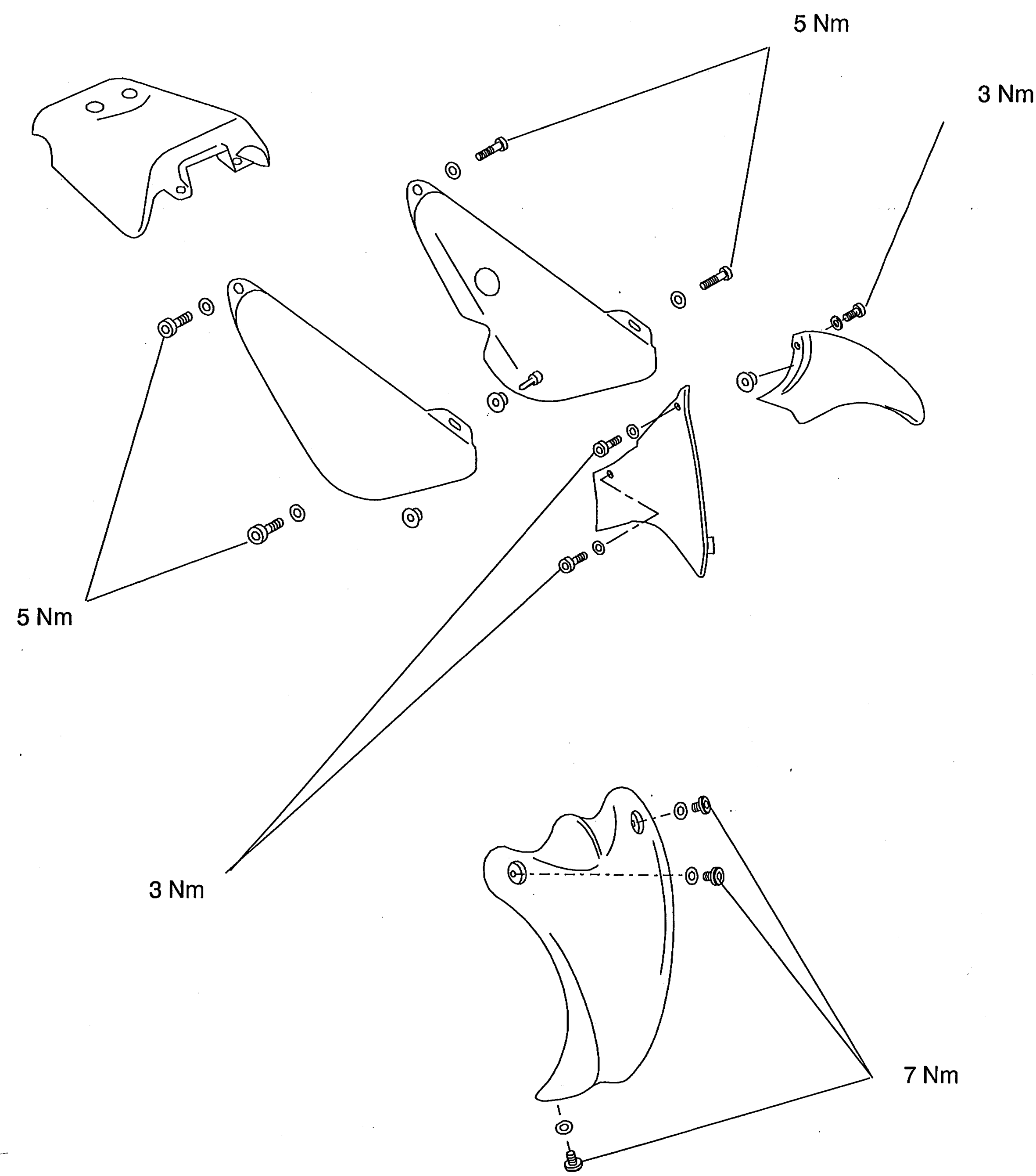


*** Refer to section 6 for all engine mounting details**

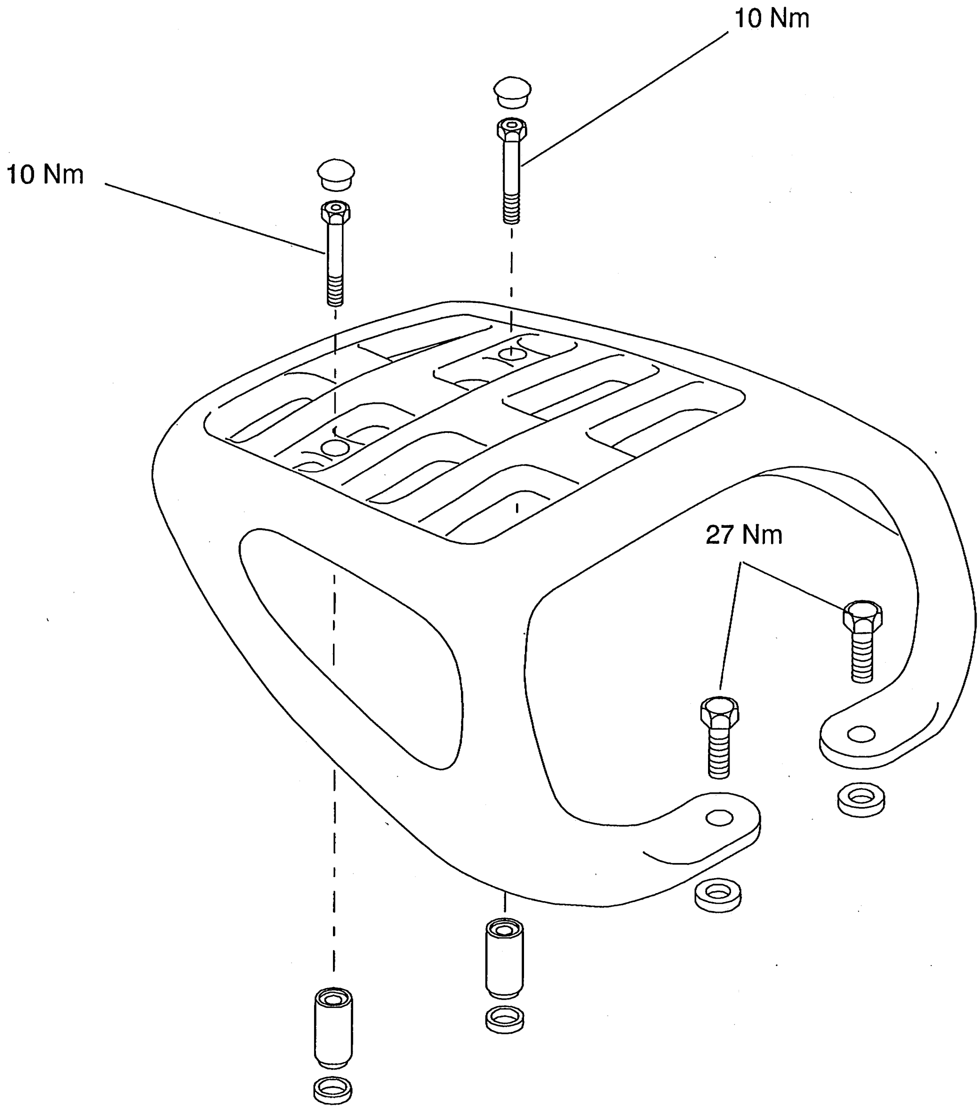
Exploded View - Cockpit and Mountings



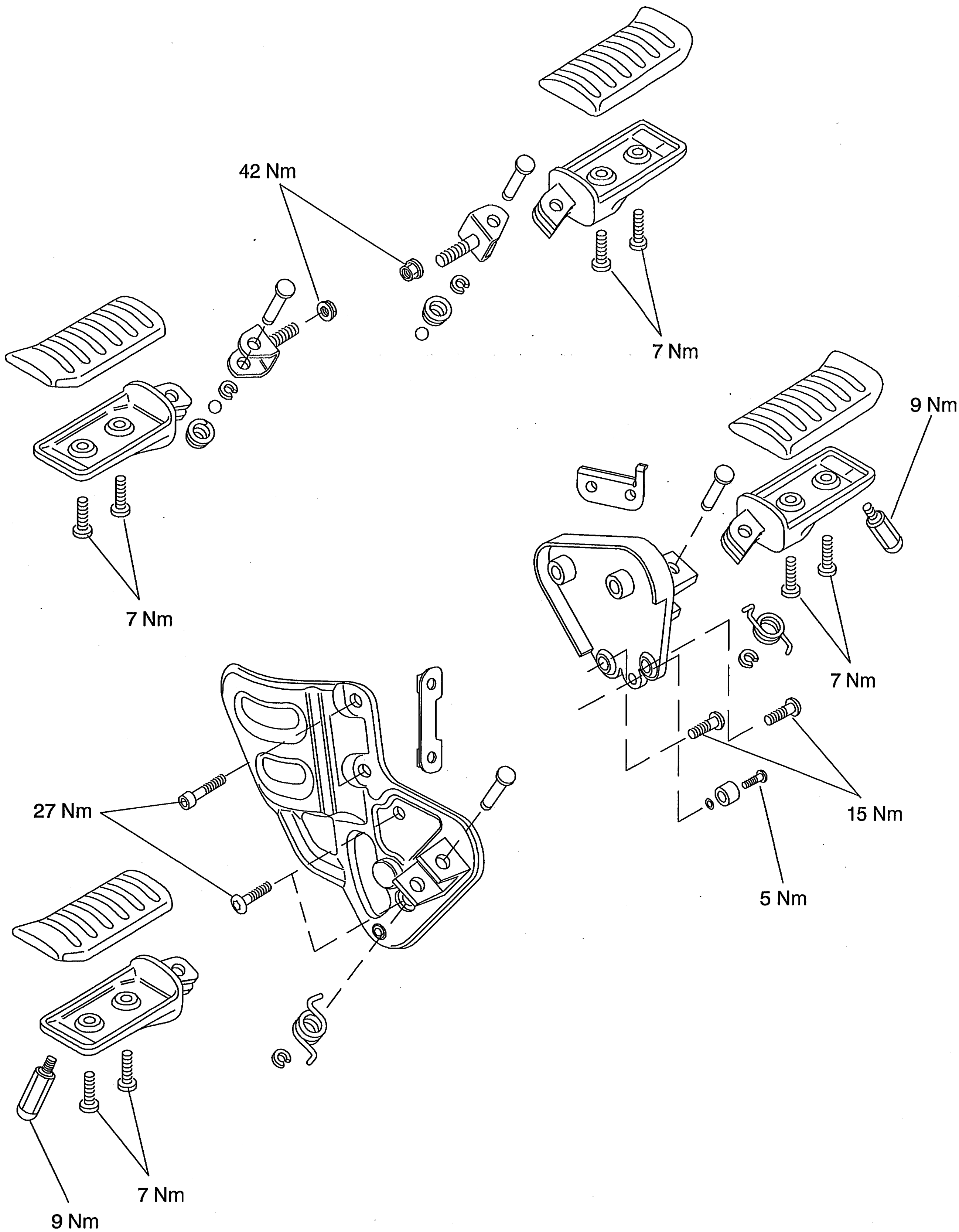
Exploded View - Body Panels



Exploded View - Rear Rack



Exploded View -Footrests and Mountings



SEATS

Rear Seat

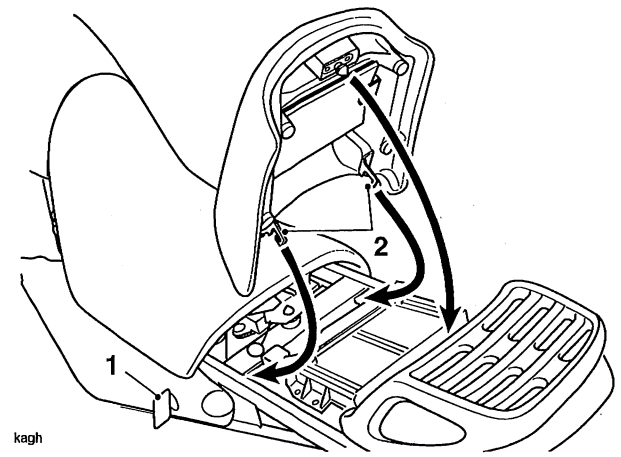
Removal

1. Insert the ignition key into the seat lock and turn the key anti-clockwise while pressing down on the rear part of the seat.

2. Lift the back of the seat and slide it rearwards to remove.

Refit

1. Engage the seat retaining hooks beneath the frame cross-member then press down on the rear of the seat to engage it in the seat lock.



1. Seat Lock

2. Seat Retaining Hooks

Note.

An audible 'click' can be heard when the seat is correctly engaged in the lock.

2. Check again that the seat is correctly fitted.

Front Seat

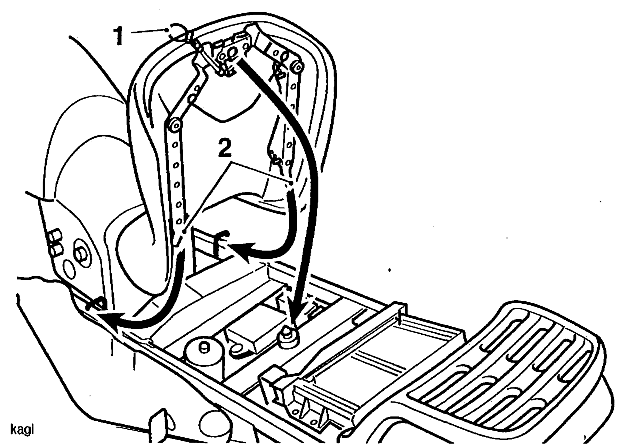
Removal

1. Remove the rear seat.

2. Pull the seat catch ring-pull while pressing down on the rear part of the seat. Lift the rear of the seat slightly, slide it rearwards and remove.

Refit

1. Slide the seat runners under the retaining brackets on either side of the frame. Press down on the rear of the seat to engage in the seat catch.



1. Front Seat Release Ring Pull.

2. Front Seat Runners

Note.

An audible 'click' can be heard when the seat is correctly engaged in the lock.

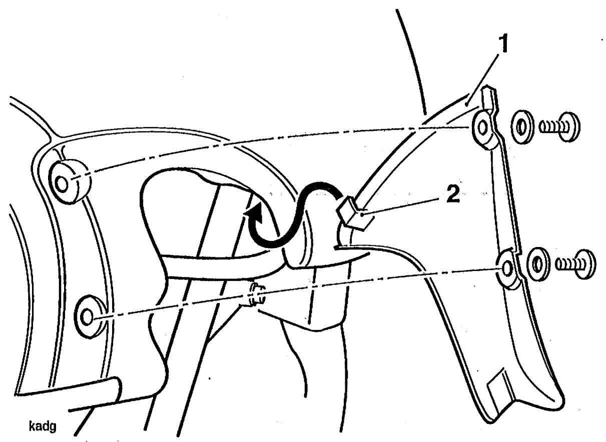
2. Check again that the seat is correctly fitted.

3. Refit the rear seat.

RIGHT HAND IN-FILL PANEL

Removal

1. Remove the seats.
2. Remove the two panel fastening screws.
3. Gently lift the rear edge of the panel in order to clear the recess in the fuel tank. Slide the panel down and towards the rear of the motorcycle to release the retaining tag situated at the front of the panel.



1. Right Hand Infill Panel

2. Locating Tag

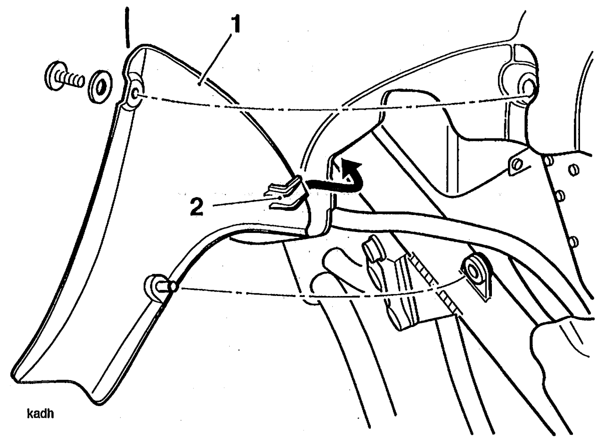
Refit

1. Locate the retaining tag behind the fuel tank moulding.
2. Align the two screw holes and refit the fastening screws, tightening to **3 Nm.**
3. Refit the seat.

LEFT HAND IN-FILL PANEL

Removal

1. Remove the seats.
2. Remove the single fastening screw.
3. Gently lift the bottom edge of the panel in order to release the retaining bayonet from the frame. Slide the panel down and towards the rear of the motorcycle to release the retaining tag situated at the front of the panel.



1. Left Hand Infill Panel

2. Locating Tag

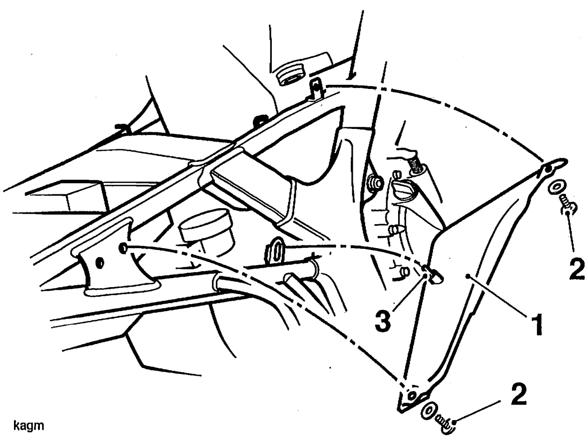
Refit

1. Locate the retaining tag in the narrow section of the fuel tank moulding and ease the retaining bayonet into its grommet in the frame.
2. Align the screw hole and refit the fastening screw, tightening to **3 Nm.**
3. Refit the seat.

RIGHT HAND SIDE PANEL

Removal

1. Remove the seats.
2. Remove the right hand infill panel.
3. Remove the two panel fixings.
4. Gently lift the lower edge of the panel in order to release the retaining bayonet from the frame and remove the panel.



1. Right Hand Side Panel
2. Fixings
3. Bayonet

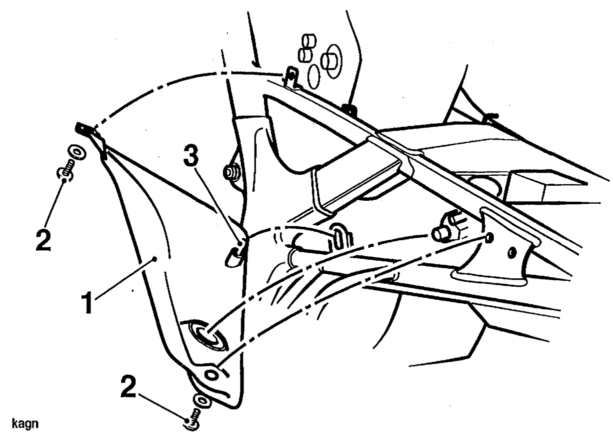
Refit

1. Locate the retaining bayonet into its grommet in the frame.
2. Align the screw holes and refit the fastening screws, tightening to **3 Nm.**
3. Refit the right hand infill panel.
4. Refit the seats.

LEFT HAND SIDE PANEL

Removal

1. Remove the two panel fixings.
2. Remove the seats.
3. Remove the left hand infill panel.
4. Gently lift the lower edge of the panel in order to release the retaining bayonet from the frame whilst easing the seat lock through the rubber grommet.
5. Remove the panel.



1. Left Hand Side Panel
2. Fixings
3. Bayonet

Refit

1. Locate the retaining bayonet into its grommet in the frame whilst easing the seat lock through the rubber grommet in the panel.
2. Align the screw holes and refit the fastening screws, tightening to **3 Nm.**
3. Refit the left hand infill panel.
4. Refit the seats.

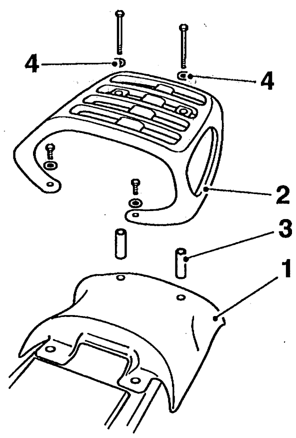
REAR PANEL AND RACK

NOTE

- **The rear panel and rack are secured to the frame by four fixings.**

Removal

1. Carefully, prise out the two blanking plugs in the top of the carrier and undo the fixings, leaving them in place in the rack.
2. Remove the front mounting fixings.
3. Lift off the carrier with the rear panel, taking care with the distance pieces and the four rubber washers.



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1. Rear Panel
2. Rear Rack
3. Distance Pieces
4. Rubber washers

Refit

1. Place the rear panel in position.
2. Place the large rubber washers in position over the front mounting holes in the rear panel.
3. Place the rack in position over the rear panel and loosely fit the front fixings.
4. With the rubber washers in position on the distance pieces, locate them in their correct position and insert the rear fixings. Tighten to **10 Nm**.
5. Tighten the front mounting bolts to **27 Nm**.
6. Refit the blanking plugs

COCKPIT

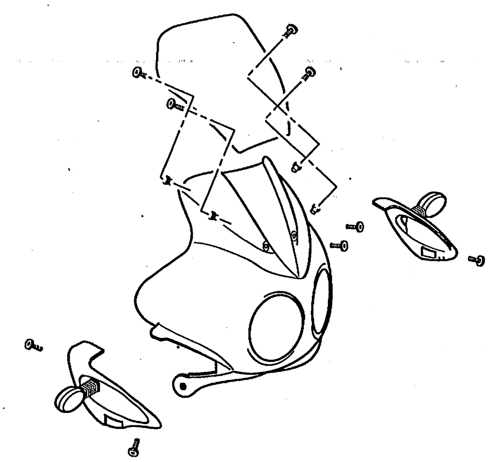
Removal

1. Unscrew the four fixings securing the windscreen to the fairing and remove the windscreen.
2. Remove both cockpit trim panels by unscrewing the two fixings.

Note.

The indicator assembly will come away with the side panel. Take care not to strain the wiring.

3. Unscrew the four fixings holding the cockpit fairing to the cockpit sub-frame (3), and lift the fairing away from the sub-frame.



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Cockpit and Trim Panel Fixings

Refit

1. Place the cockpit in position over the sub frame and refit the four fixings. Tighten to **5 Nm**.
2. Replace the indicator wiring neatly within the cockpit and secure each trim panel by fitting the two fixings finger tight, then tighten to **3 Nm**.
3. Place the windscreen in position and secure with the four fixings. Tighten fixings to **3Nm**.

CAUTION: Do not overtighten the windscreen fixings. Cracking of the windscreen will result from overtightening the fixings.

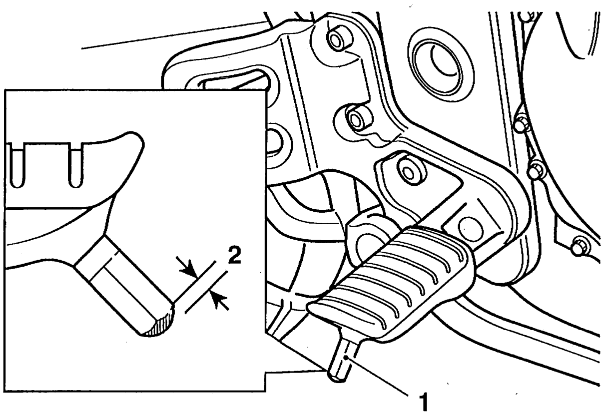
4. Check for the correct operation of both indicators and rectify as necessary.

FRAME, FOOTRESTS AND FIXINGS

Inspection

1. Inspect the frame, footrests and fairings for damage, cracks, chafing and other dangerous conditions. Check panel and frame fixings for security.

2. Inspect the bank angle pegs for wear. If the radiused end is worn away, the bank angle peg must be replaced.



1. Bank Angle Peg
2. Wear limits

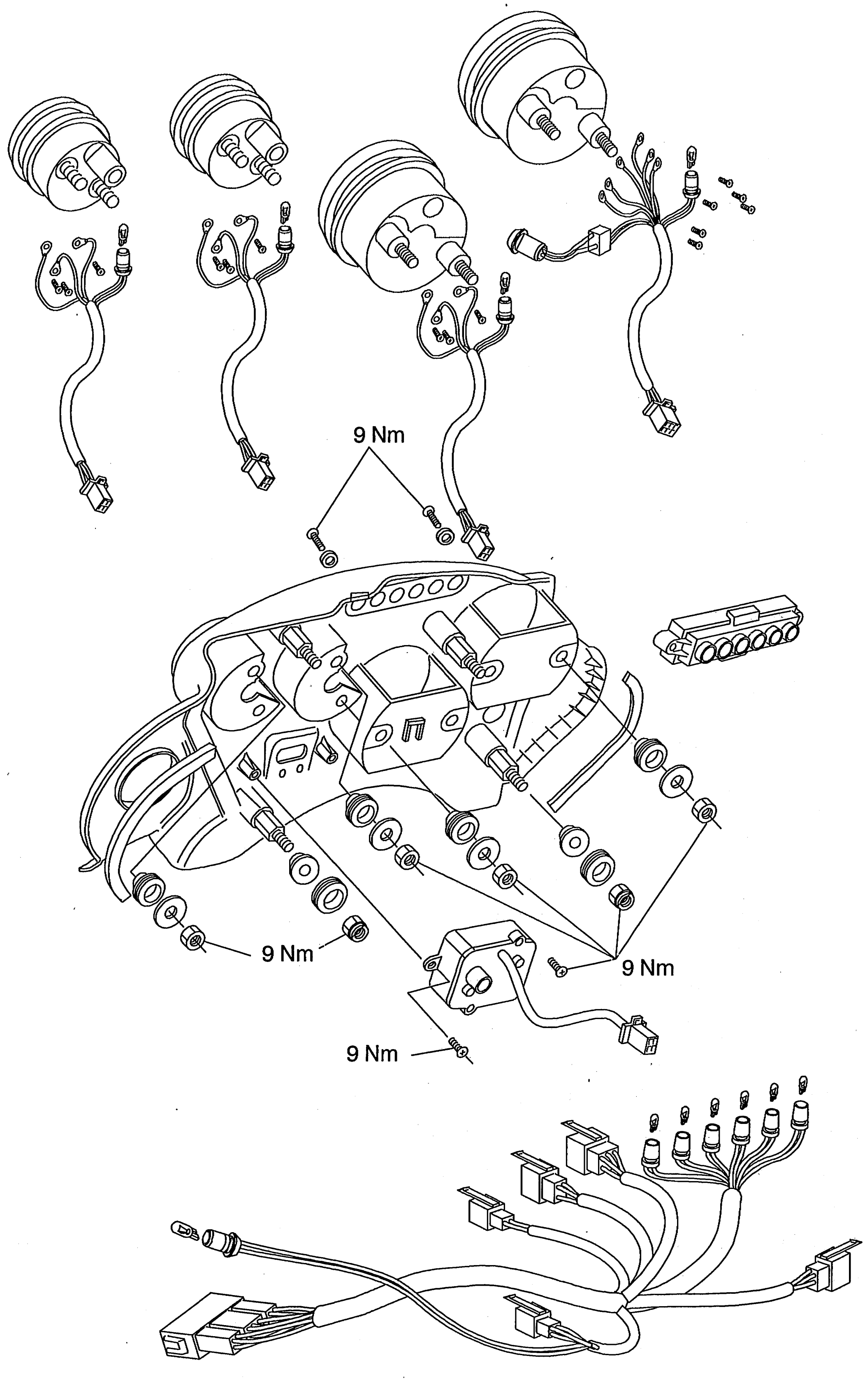
WARNING: Use of a motorcycle with footrests worn beyond the maximum limit will allow the motorcycle to be banked to an unsafe angle. Banking to an unsafe angle may cause instability, loss of control and an accident causing injury or death.

WARNING: The frame must not be modified as any modification to the frame such as welding or drilling may weaken the frame resulting in an accident.

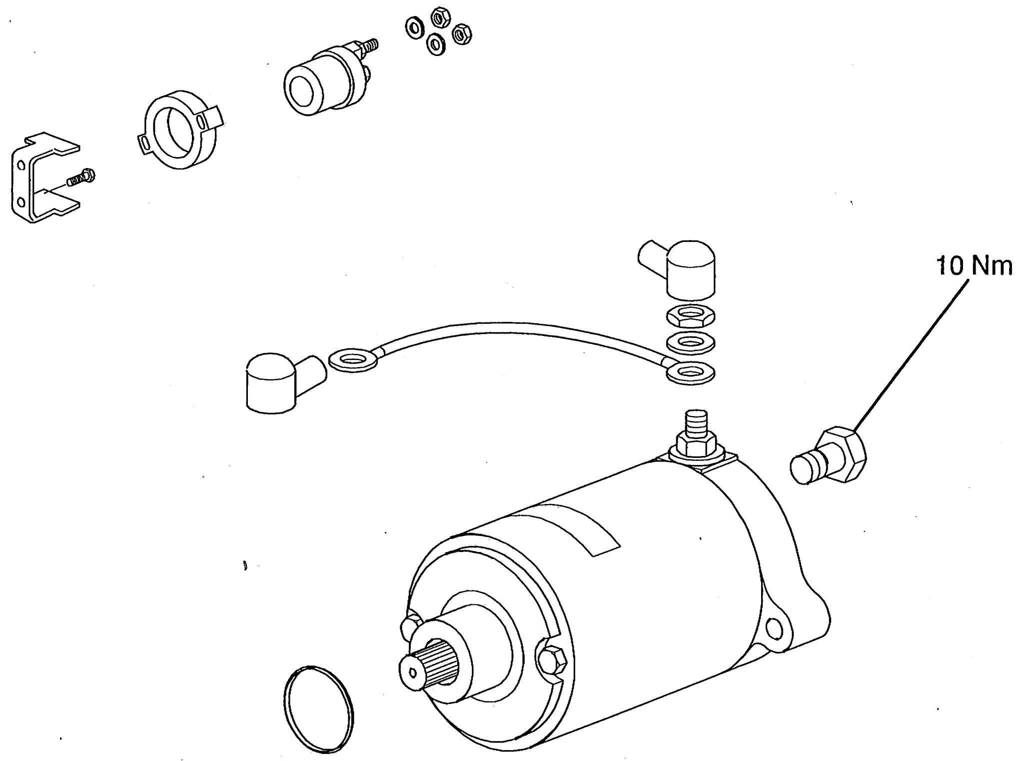
ELECTRICAL SYSTEM

CONTENTS

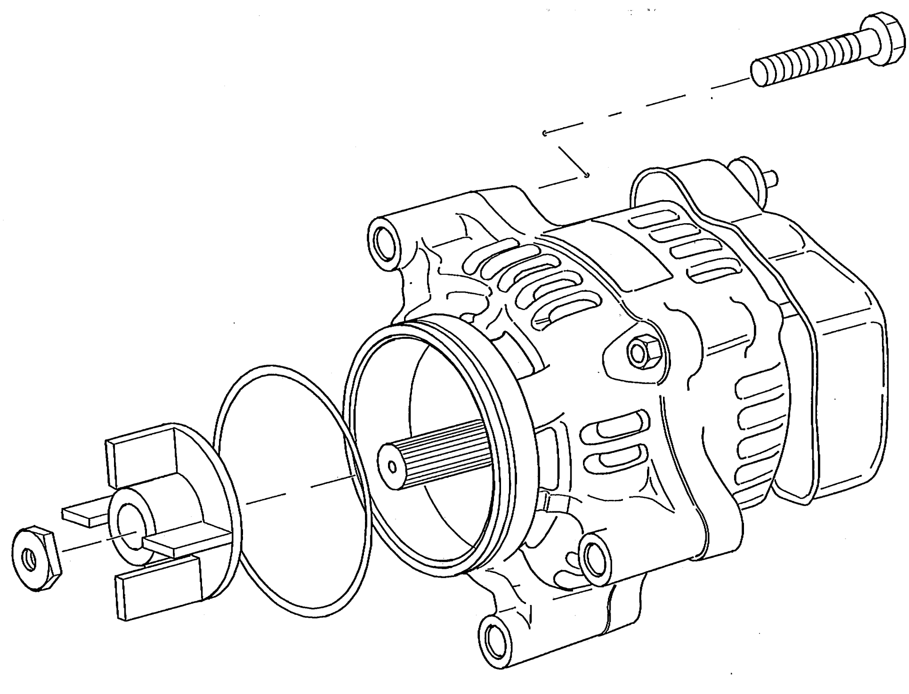
Exploded View - Instruments



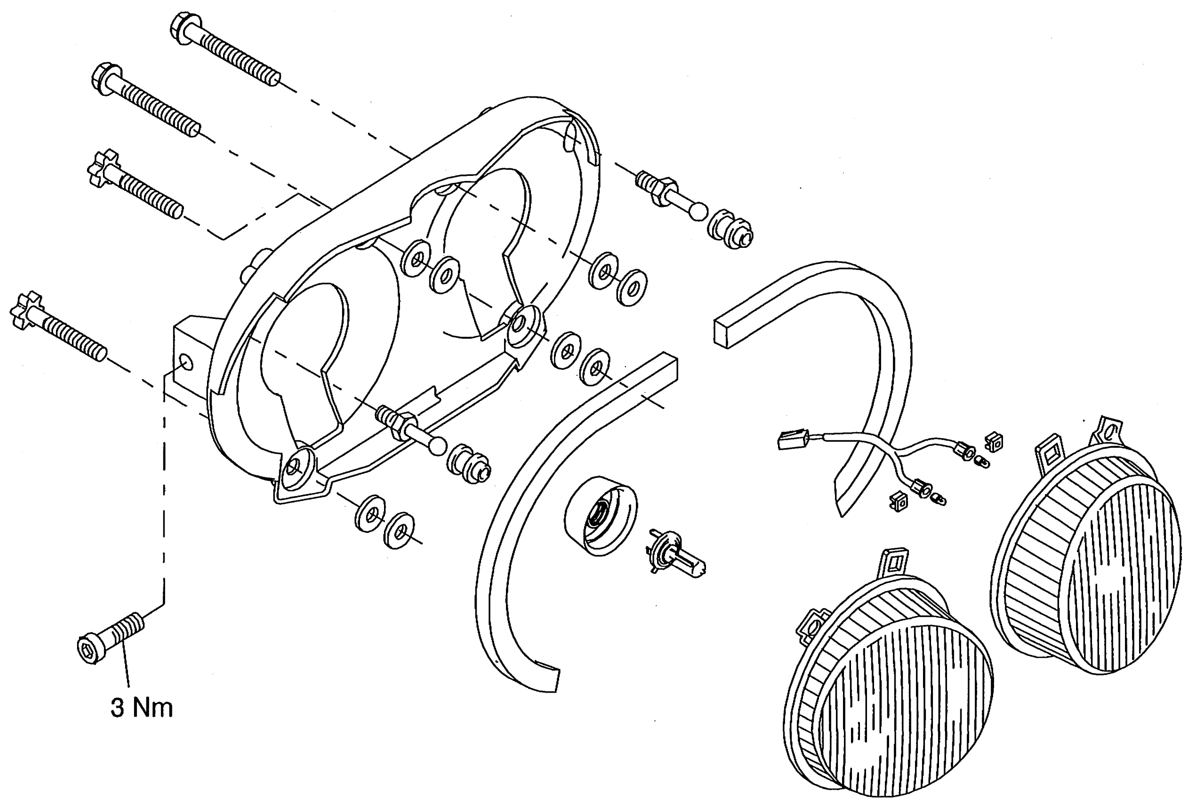
Exploded View - Starter Motor



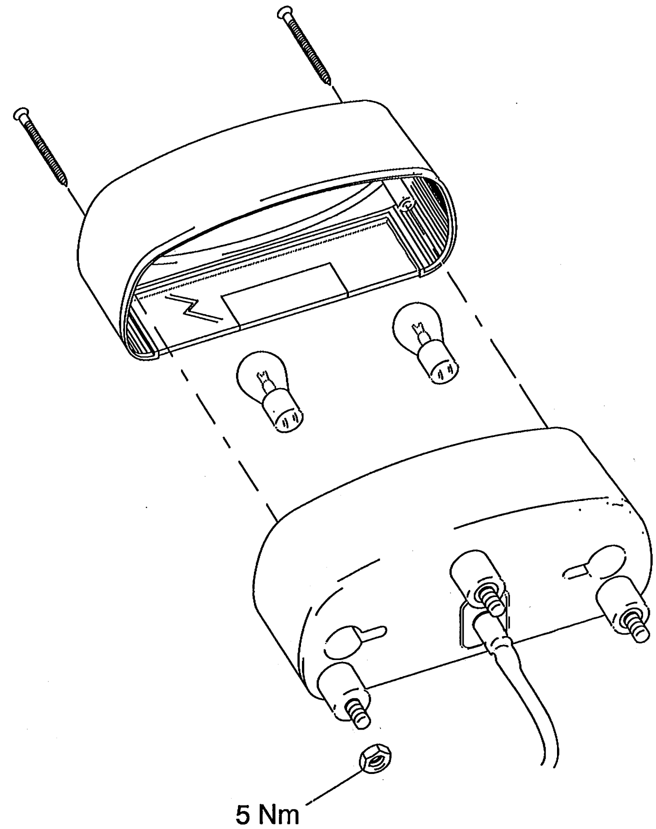
Exploded View - Alternator

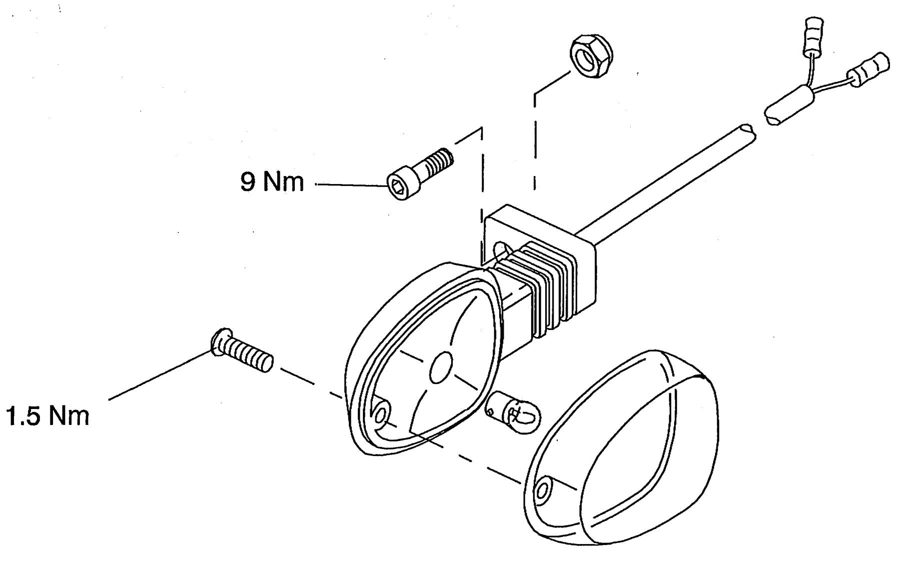


Exploded View - Headlight



Exploded View - Rear Light and Indicators





BATTERY

WARNING: The battery gives off explosive gases; keep sparks, flames and cigarettes away. Provide adequate ventilation when charging or using the battery in an enclosed space.

The battery contains sulphuric acid (electrolyte). Contact with skin or eyes may cause severe burns. Wear protective clothing and a face shield.

- If electrolyte gets on your skin, flush with water immediately.

- If electrolyte gets in your eyes, flush with water for at least 15 minutes and SEEK MEDICAL ATTENTION IMMEDIATELY.

- If electrolyte is swallowed, drink large quantities of water and SEEK MEDICAL ATTENTION IMMEDIATELY.

KEEP ELECTROLYTE OUT OF THE REACH OF CHILDREN.

WARNING: The battery contains harmful materials. Always keep children away from the battery whether or not it is fitted in the motorcycle.
Do not jump start the battery, touch the battery cables together or reverse the polarity of the cables as any of these actions may cause a spark which would ignite battery gasses causing a risk of personal injury.

WARNING: The battery electrolyte is corrosive and poisonous. Never swallow battery electrolyte or allow to come into contact with the skin. Always wear eye and skin protection when adjusting the electrolyte level.

Battery Removal

1. Unlock and remove the seats.
2. Disconnect the battery, negative (black) lead first.
3. Remove the battery strap.
4. Take the battery out of the case.

WARNING: Ensure that the battery terminals do not touch the motorcycle frame as this may cause a short circuit or spark which would ignite battery gases causing a risk of personal injury.

Battery Refit

WARNING: Ensure that the battery terminals do not touch the motorcycle frame as this may cause a short circuit or spark which would ignite battery gases causing a risk of personal injury.

1. Place the battery in the battery case.
2. Reconnect the battery, positive (red) lead first.
3. Apply a light coat of grease to the terminals to prevent corrosion.
4. Cover the terminals with the protective caps.
5. Refit the battery strap.
6. Refit the seats.

BATTERY CHARGING

New Battery

To ensure that a new battery is correctly commissioned and will deliver maximum capacity for starting, the following procedure must be followed.

1. Remove the sealing tape.
2. Using the funnel and electrolyte pack supplied, fill the battery. Use all the electrolyte.
3. Carefully remove the electrolyte pack and funnel.
4. Fit the battery cell covers.
5. Charge the battery continuously at 1.4 Amps maximum for 5 hours

Battery Already in Service

When re-charging a battery in service, the following precautions must be taken to avoid damage to the battery.

1. The charging rate must not exceed 1.4 A except for a boost charge where a maximum charge rate of 6 A (for no longer than 1 hour) is allowed.

Battery Maintenance

The battery is a sealed type and does not require any maintenance other than routine recharging such as during storage.

It is not possible to adjust the electrolyte level in the battery.

HEADLIGHT BEAM ADJUSTMENT

WARNING: Adjust road speed to suit the visibility and weather conditions in which the motorcycle is being operated.

Ensure that the beam is adjusted to illuminate the road surface sufficiently far ahead without dazzling oncoming traffic. An incorrectly adjusted headlight may impair visibility causing an accident.

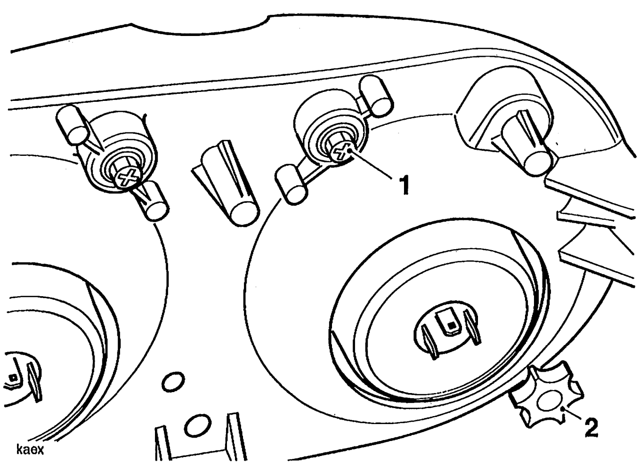
WARNING: Never attempt to adjust the headlight beam when the motorcycle is in motion.

Any attempt to adjust the headlight beam when the motorcycle is in motion may result in loss of control and an accident.

NOTE:

- **In some countries, for legal reasons, it is not possible to switch the headlights off. In these countries, use the ignition switch to turn the headlights on and off.**

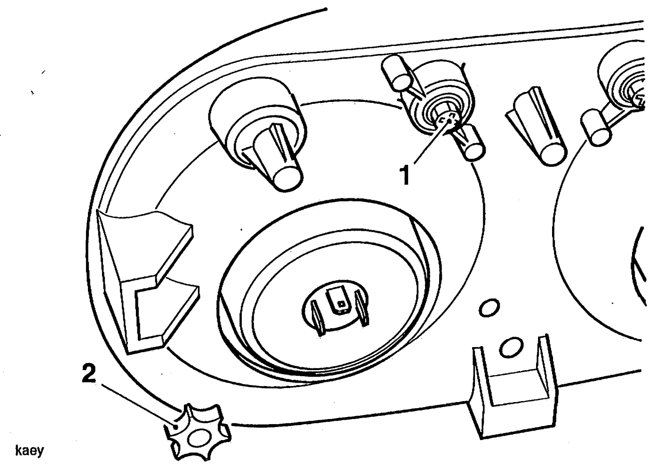
1. Remove the cockpit.
2. Switch the headlight on.
3. Turn the vertical adjustment screw on each headlight clockwise to lower the beam or anti-clockwise to raise the beam.



1. Vertical Adjustment Screw (RH)

2. Horizontal Adjustment Screw (RH)

3. On the RH headlight turn the horizontal adjustment screw clockwise to move the beam to the left or anti-clockwise to move the beam to the right.



1. Vertical Adjustment Screw (LH)

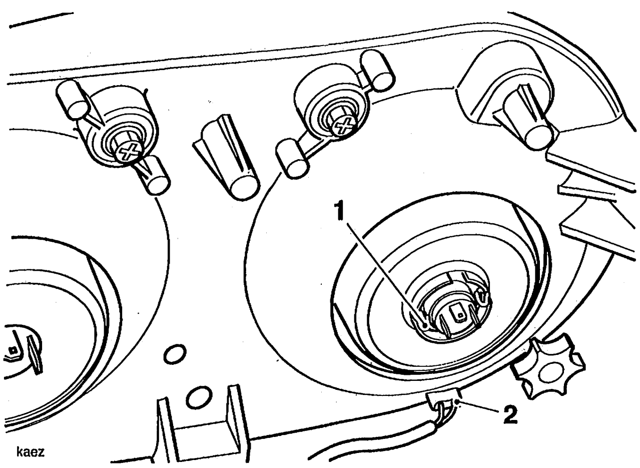
2. Horizontal Adjustment Screw (LH)

3. On the LH headlight turn the horizontal adjustment screw anti-clockwise to move the beam to the left or clockwise to move the beam to the right.
4. Switch the headlights off when the beam settings are satisfactory.

HEADLIGHT BULB REPLACEMENT

POSITION LIGHT BULB REPLACEMENT

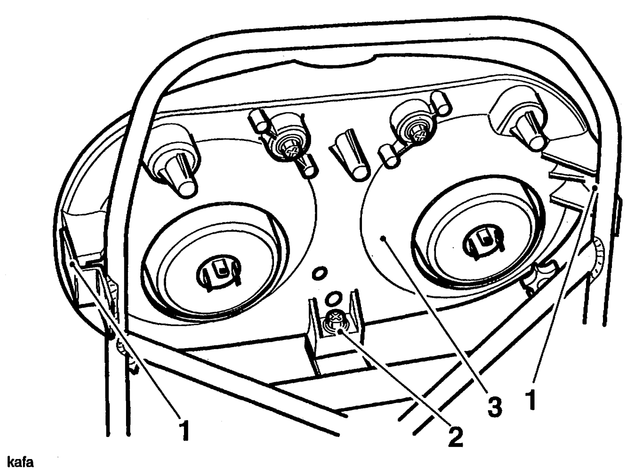
1. Remove the seats.
2. Disconnect the battery, negative (black) lead first.
3. Remove the cockpit as described in the body section.



1. Headlight Bulb Retainer

2. Position Light Bulb Retainer

4. Release the screws securing the headlight unit to the support bracket and release the unit.



1. Side Fixings

2. Centre Fixing

3. Headlight

For the headlight bulb only:

5. Disconnect the multi-pin electrical connector from the headlight bulb to be replaced and remove the rubber cover.
6. Detach the wire bulb retainer from the clip (it is not necessary to undo the screw) then remove the bulb from the light unit.

For the position light bulb only:

7. Without pulling on the wires, ease the bulb holder from the retaining socket in the rear of the light unit.

Installation - Both Bulbs

1. Installation is the reverse of the removal procedure except that when reconnecting the battery, connect the positive (red) lead first.

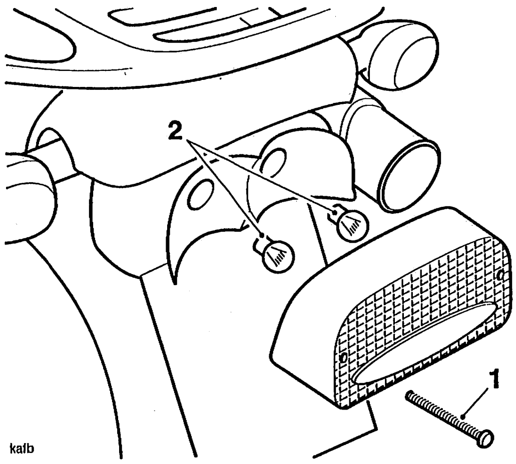
WARNING: Do not reconnect the battery until the assembly process has been completed. Premature battery reconnection, or connecting the negative (black) lead first, could lead to ignition of the battery gases causing an explosion. Always complete all tasks first and connect the battery, positive (red) lead first. An exploding battery can cause severe injury to skin, body and particularly the eyes.

WARNING: The bulbs become hot during use. Always allow sufficient time for the bulb to cool before handling. Avoid touching the glass part of the bulb. If the glass is touched or gets dirty, clean with alcohol before re-use.

REAR LIGHT

Bulb Replacement

1. Remove the screws securing the lens to the light body.



1. Lens Retaining Screws

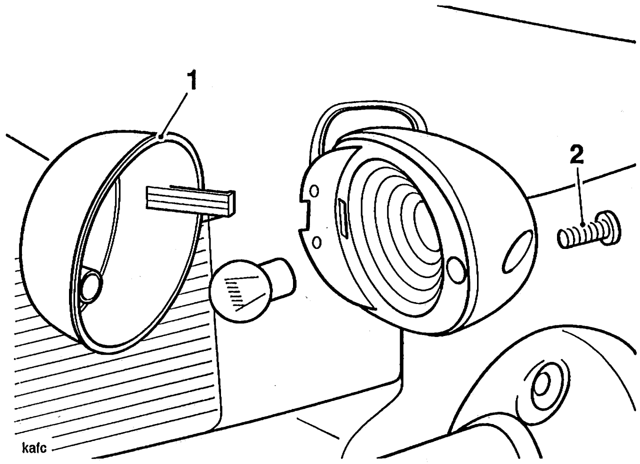
2. Bulb

2. Rotate the bulb anti-clockwise to release.
3. Replace the bulb.
4. Refit the lens taking care not to overtighten the screws.

INDICATOR LIGHT

Bulb Replacement

1. The lens on each indicator light is held in place by a securing screw located in the body of the light.



1. Indicator Lens

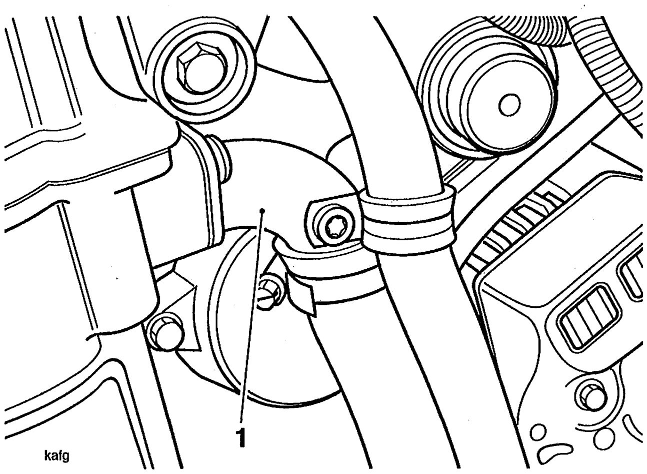
2. Securing Screw

2. Release the screw and remove the amber lens to gain access to the bulb for replacement.

ALTERNATOR

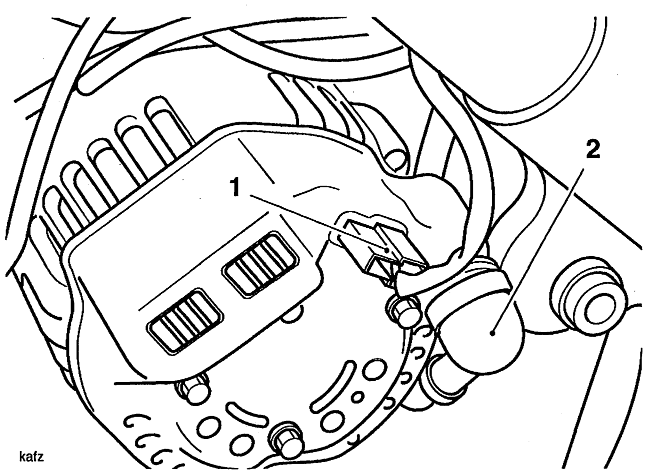
Removal

1. Remove the seat and disconnect the battery, negative (black) lead first.
2. Remove the fuel tank as described in the fuel system section.
3. Drain the coolant from the crankcase as described in the cooling system section.
4. Remove the water pump hose.
5. Remove the coolant elbow from the crankcase. Clean off all traces of gasket from the elbow and crankcase mating faces.



1. Coolant Elbow

6. Remove the starter motor.
7. Disconnect the cable and the multiplug from the alternator.



1. Multiplug

2. Cable

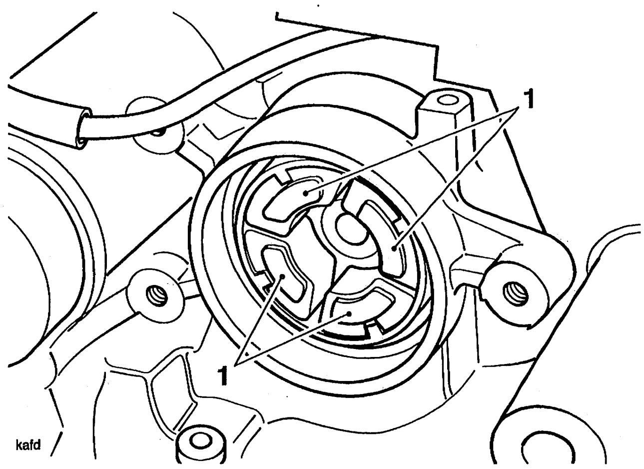
8. Release the alternator by removing the alternator to crankcase securing bolts.
9. Gently ease the alternator from its mounting points and rotate it until the mounting lugs will clear all obstructions.
10. Remove the alternator, capturing the cush drive rubbers from the cush drive.

Inspection

1. Inspect the alternator 'O' ring and renew if damaged / stretched.

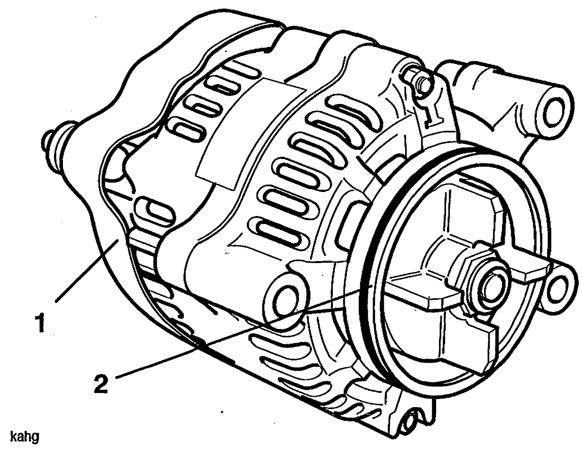
Installation

1. Fit the cush drive rubbers to the alternator drive. If necessary, a small amount of petroleum jelly can be used to hold the rubbers in position.



1. Alternator Drive Rubbers

2. Fit the 'O' ring to the alternator and smear with a small amount of engine oil.



1. Alternator

2. Alternator 'O' ring

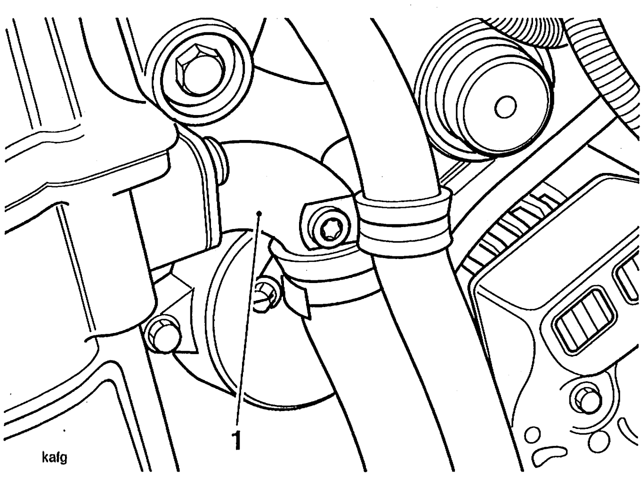
3. Fit the alternator and tighten the bolts to **20 Nm** ensuring that the earth cable is located under one of the bolt heads.
4. Connect the cable and the multiplug to the alternator.

5. Refit the starter motor and tighten the securing bolts to **10 Nm**.
6. Apply sealant to both sides of a new coolant elbow gasket. Fit the elbow and tighten the securing nuts to **12 Nm**.
7. Refit the water pump hose.
8. Fit a new washer to the coolant drain screw and tighten the screw to **13 Nm.**
9. Refill the cooling system as described in the cooling system section.

STARTER MOTOR

Removal

1. Remove the seats and disconnect the battery, negative (black) lead first.
2. Remove the fuel tank as described in the fuel system section.
3. Drain the coolant from the crankcase as described in the cooling system section.
4. Detach the water pump hose at its connection to the coolant elbow at the rear of the crankcase.
5. Remove the coolant elbow from the crankcase. Clean off all traces of gasket from the elbow and crankcase mating faces.

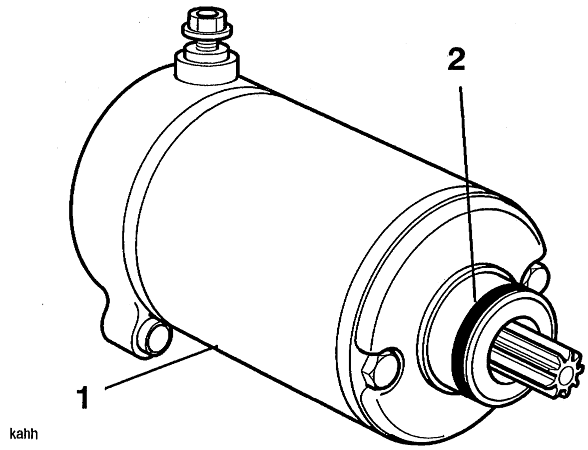


1. Coolant Elbow

6. Disconnect the starter motor cable.
7. Release the starter motor from the crankcase.
8. Remove the starter motor.

Installation

1. Clean the mating faces of the crankcase and starter motor to ensure efficient grounding.
2. Inspect the sealing 'O' ring and renew if damaged / stretched.
3. Fit the 'O' ring to the starter motor and smear with a small amount of engine oil.



1. Starter Motor

2. 'O' ring

4. Fit the starter motor and tighten the securing bolts to **10 Nm**.
5. Connect the starter motor cable.
6. Apply sealant to both sides of a new coolant elbow gasket. Fit the elbow and tighten the securing nuts to **12 Nm**.
7. Fit a new washer to the coolant drain screw and tighten the screw to **13 Nm.**
8. Refit the water pump hose to the coolant elbow.
9. Refill the cooling system as described in the cooling system section.

RELAY PACKS to VIN 89736

Two separate relay packs are fitted to this motorcycle.

An 'engine management' relay pack is situated on the right hand side of the motorcycle beneath the seat.

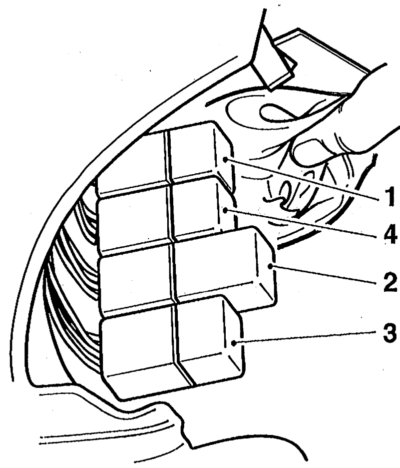
A second relay pack to control lights and indicators is situated below the instrument pack.

NOTE:

- **The physical positions of the relays in non-engine management pack are subject to variation. However, the relay cables are identified by a coloured tag which remains unique to each particular relay. See the illustration (right) for details.**

The relays are attached to their brackets by means of barbed extensions. Never exert extreme force when removing a relay as this may cause damage and never pull on the relay block connector.

Identification of Relays - 'Below Instrument Pack'



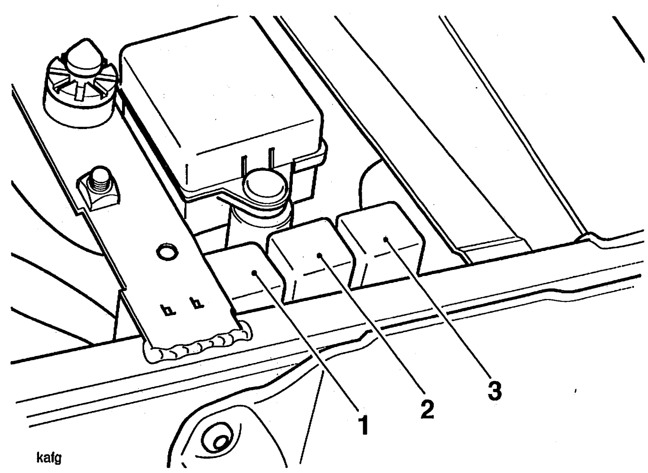
1. Headlamp Dip Beam - white tag

2. Indicator Unit - blue tag

3. Headlamp Main Beam - red tag

4. Headlamp Cut-out - no tag

Identification of Relays - 'Beneath the seat'



1. Cooling Fan

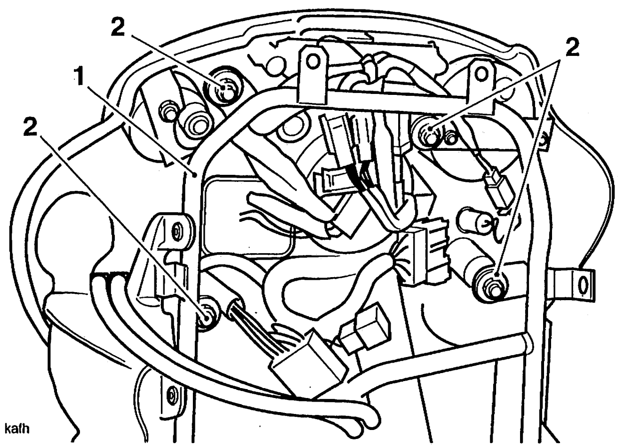
2. Fuel Pump

3. ECM Main Power Relay

INSTRUMENT PACK

Removal

1. Remove the seat.
2. Disconnect the battery negative (black) lead first.
3. Remove the cockpit as described in the bodywork section.
4. Remove the headlight assembly.
5. Release the fixings securing the instrument pack to the cockpit subframe.



1. Cockpit Subframe

2. Instrument Pack Fixings

6. Raise the instrument pack and disconnect the connections to the main harness.
7. The pack can now be removed.

Installation

1. Position the instrument pack to the cockpit subframe.
2. Connect the instruments to the main harness.
3. Place the pack in position.
4. Tighten the pack retaining fixings to **9 Nm.**
5. Refit the cockpit as described in the bodywork section.
6. Refit the headlight assembly and tighten the fixings to **15 Nm.**
7. Reconnect the battery positive (red) lead first.
8. Refit the seat.

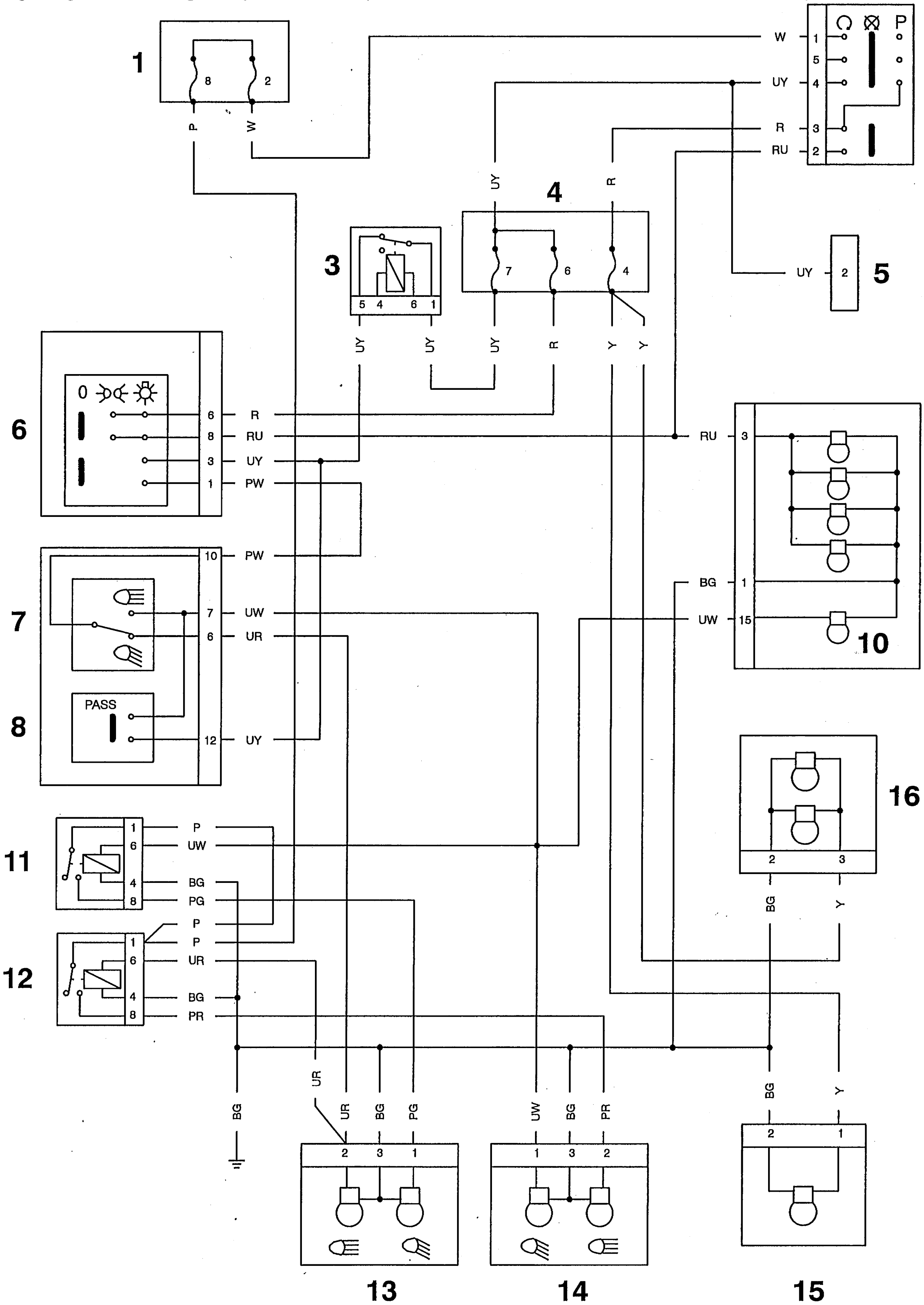
Lighting circuit diagram (to VIN 89736)

Key No:	Item Description
1	Fuses 2 & 8
2	Ignition switch
3	Headlight cut-out relay
4	Fuses 4, 6 & 7
5	Main connector
6	Lighting switch
7	Headlight dip switch
8	Passing button
9	Instrument illumination
10	Main beam warning lamp
11	Headlight main beam relay
12	Headlight dip beam relay
13	Headlight 1
14	Headlight 2
15	Position light
16	Rear light

Key to wiring colour codes

Code	Wiring Colour
B	Black
U	Blue
N	Brown
G	Green
S	Grey
O	Orange
K	Pink
LG	Light Green
R	Red
P	Purple
W	White
Y	Yellow

Lighting Circuit Diagram (to VIN 89736)



Lighting circuit diagram (from VIN 89737)

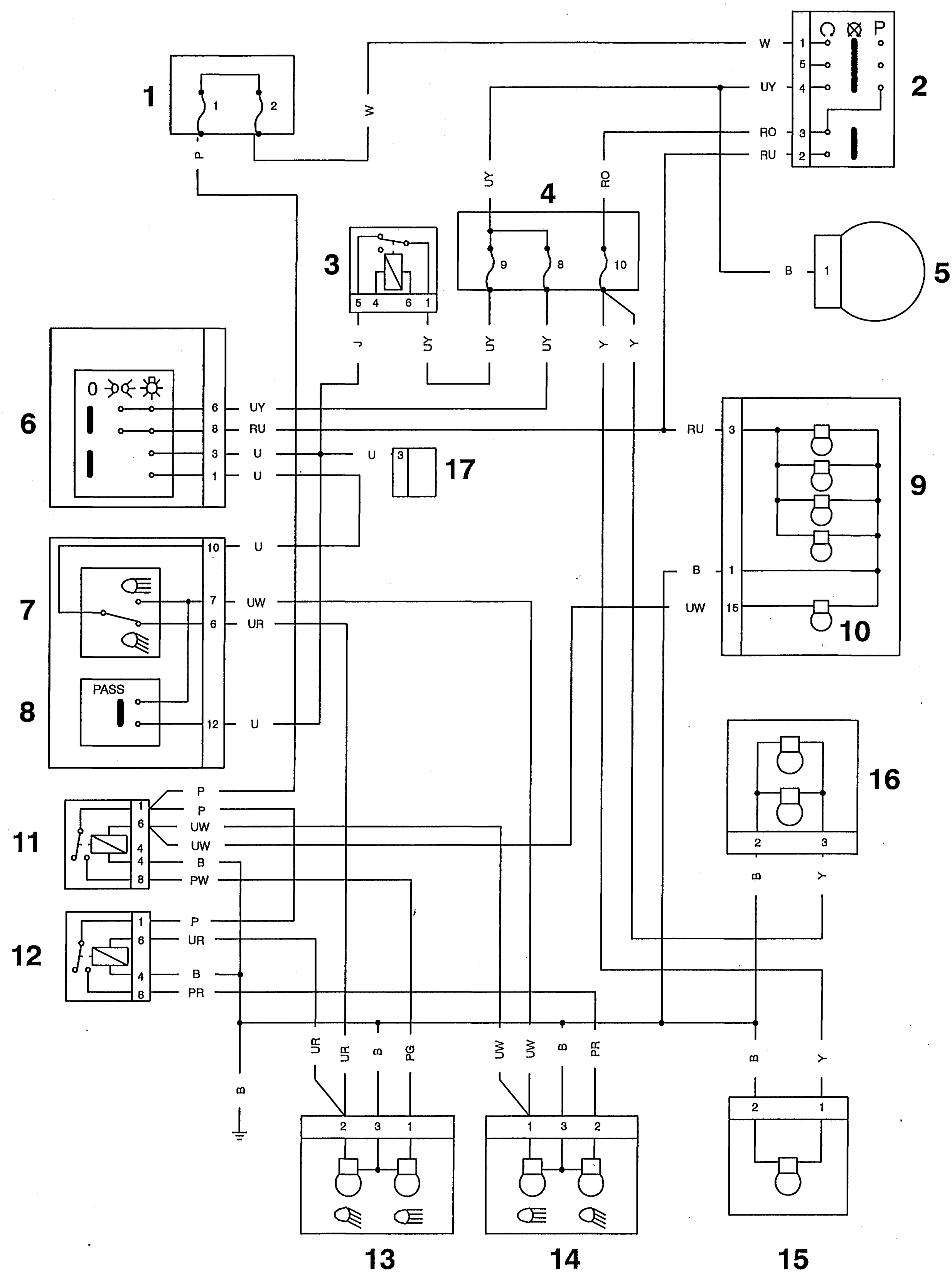
The key found below must be used for identification of components.

Key	Description
1	Fuses 1 & 2
2	Ignition switch
3	Headlamp cut-out relay
4	Fuses 8, 9 and 10
5	Alternator
6	Lighting switch
7	Headlamp dip switch
8	Passing switch
9	Instrument assembly
10	Main beam warning light
11	Main beam relay
12	Dip beam relay
13	Headlight 1
14	Headlight 2
15	Position light
16	Tail light
17	Heated grips connector

Key to wiring colour codes

Code	Wiring Colour
B	Black
U	Blue
N	Brown
G	Green
S	Grey
O	Orange
K	Pink
LG	Light Green
R	Red
P	Purple
W	White
Y	Yellow

Lighting Circuit Diagram (from VIN 89737)



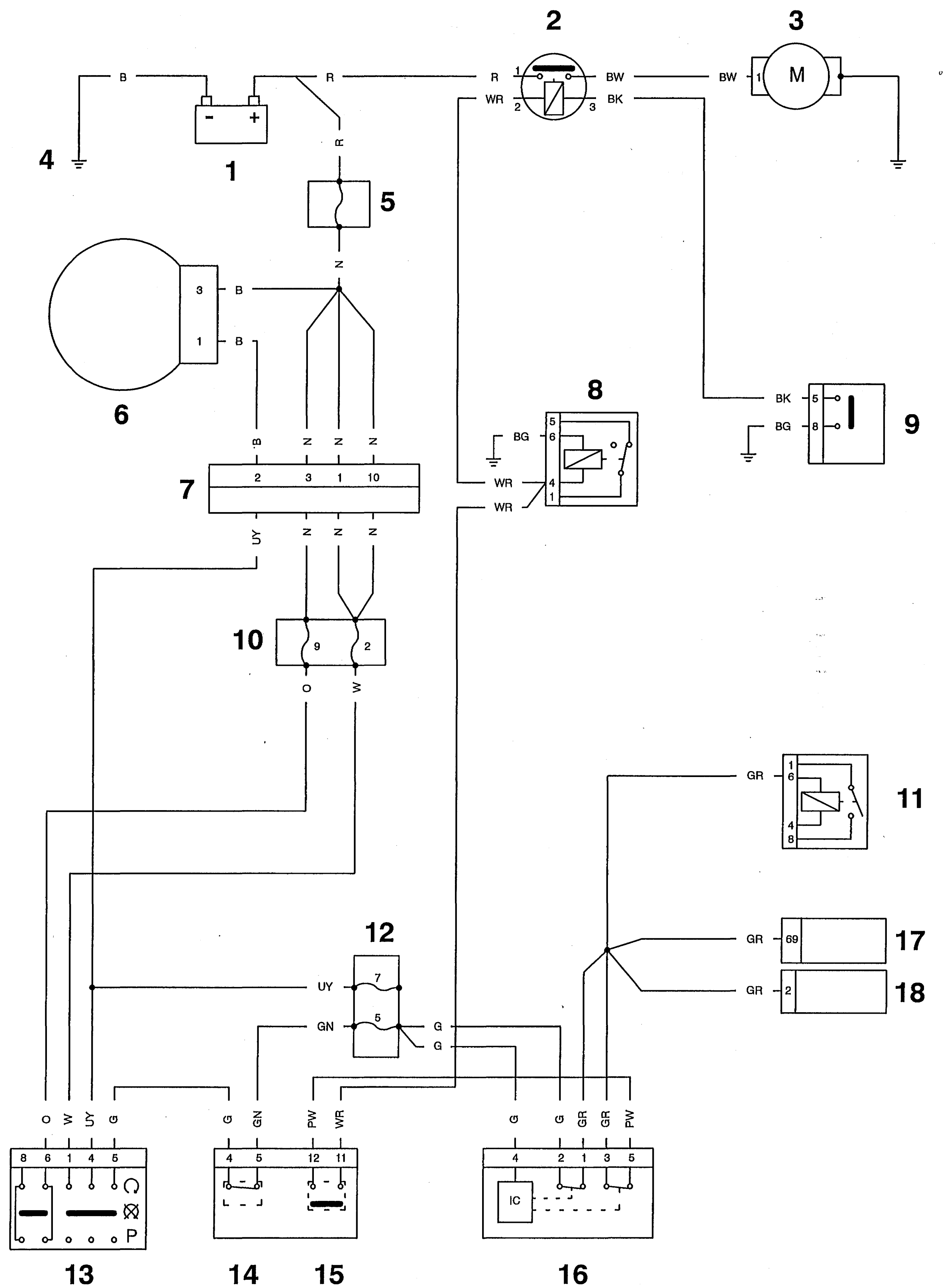
Starting/charging circuit diagram (up to VIN 89736)

Key	Description
1	Battery
2	Starter solenoid
3	Starter motor
4	Engine earth
5	Main fuse (in-line)
6	Alternator
7	Main connector
8	Headlight cut-out relay
9	Clutch lever switch
10	Fuses 2 & 9
11	Fuel pump relay
12	Fuses 5 & 7
13	Ignition switch
14	Engine stop (kill) switch
15	Engine start button
16	Alarm control unit (where fitted)
17	Engine control module
18	Instruments

Key to wiring colour codes

Code	Wiring Colour
B	Black
U	Blue
N	Brown
G	Green
S	Grey
O	Orange
K	Pink
LG	Light Green
R	Red
P	Purple
W	White
Y	Yellow

Starting/Charging Circuit Diagram (up to VIN 89736)



Starting and charging circuit diagram (from VIN 89737)

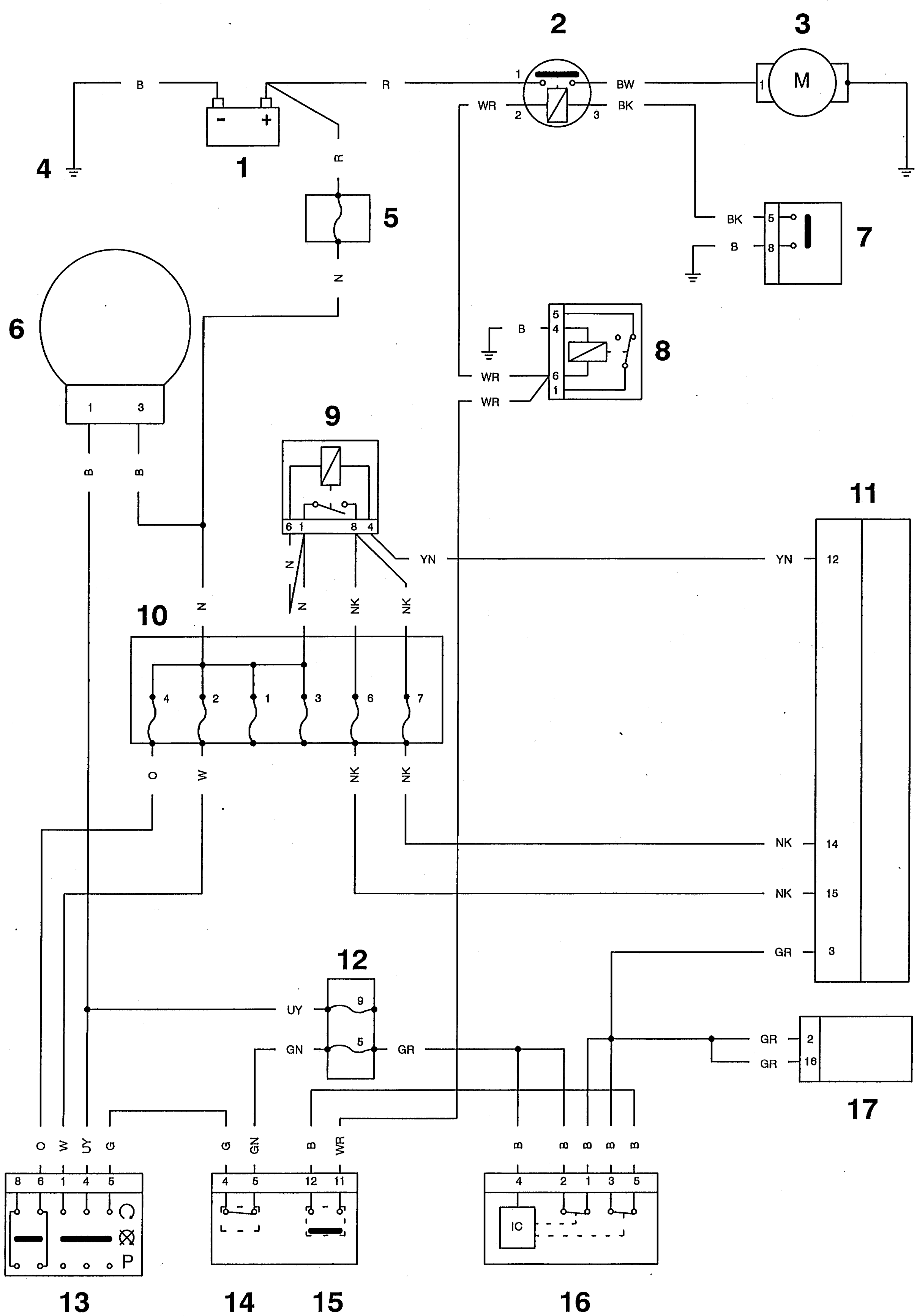
The key found below must be used for identification of components.

Key	Description
1.	Battery
2.	Starter solenoid
3.	Starter motor
4.	Engine earth
5.	Main fuse
6.	Alternator
7.	Clutch switch
8.	Headlight cut-out relay
9.	Power latch relay
10.	Fuses 1, 2, 3, 4, 6 & 7
11.	Engine connector
12.	Fuses 5 & 9
13.	Ignition switch
14.	Engine kill switch
15.	Starter button
16.	Alarm control unit
17.	Instruments

Key to wiring colour codes

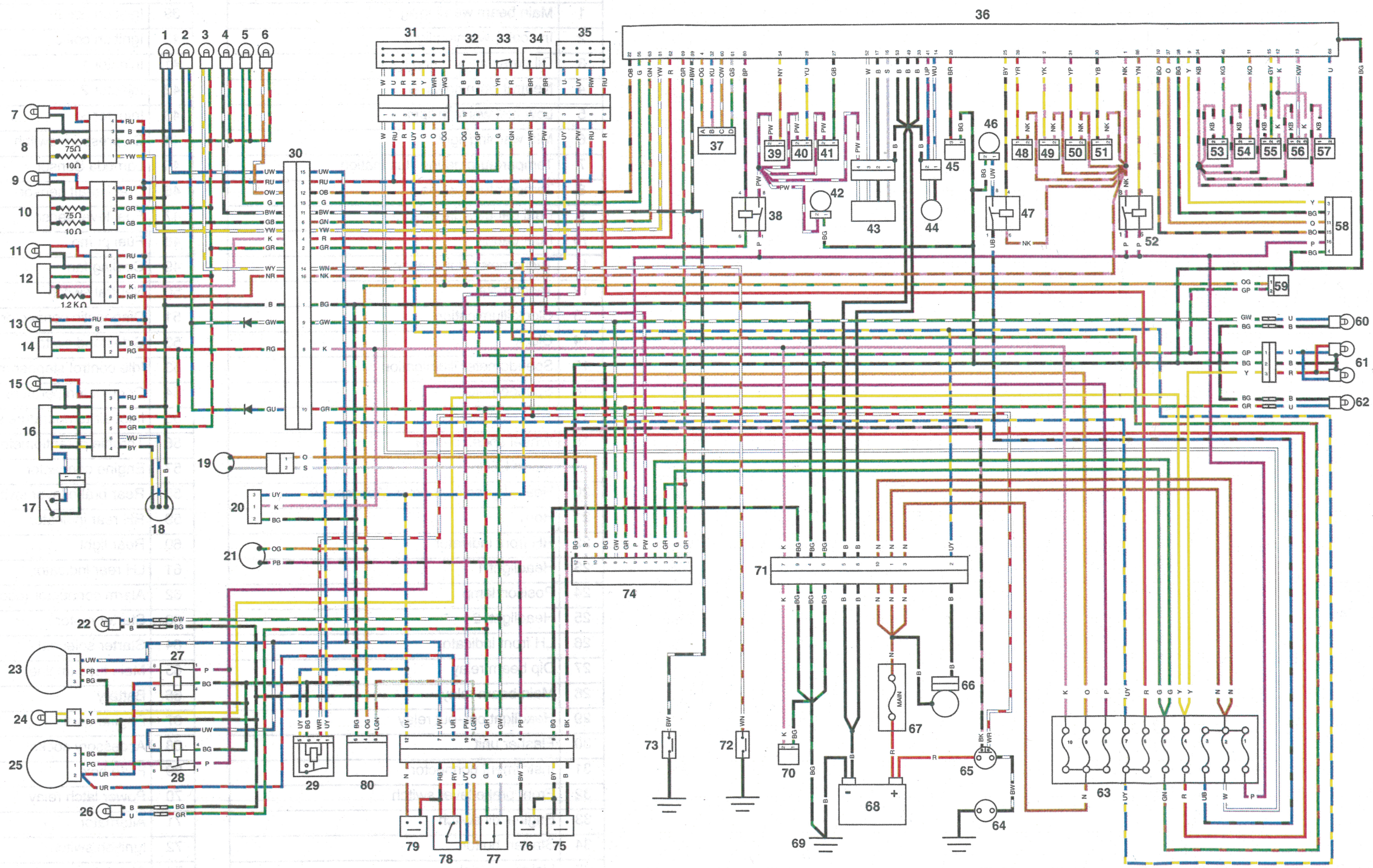
Code	Wiring Colour
B	Black
U	Blue
N	Brown
G	Green
S	Grey
O	Orange
K	Pink
LG	Light Green
R	Red
P	Purple
W	White
Y	Yellow

Starting and charging circuit diagram (from VIN 89737)



Key To Wiring Circuit Diagram (to VIN 89736)

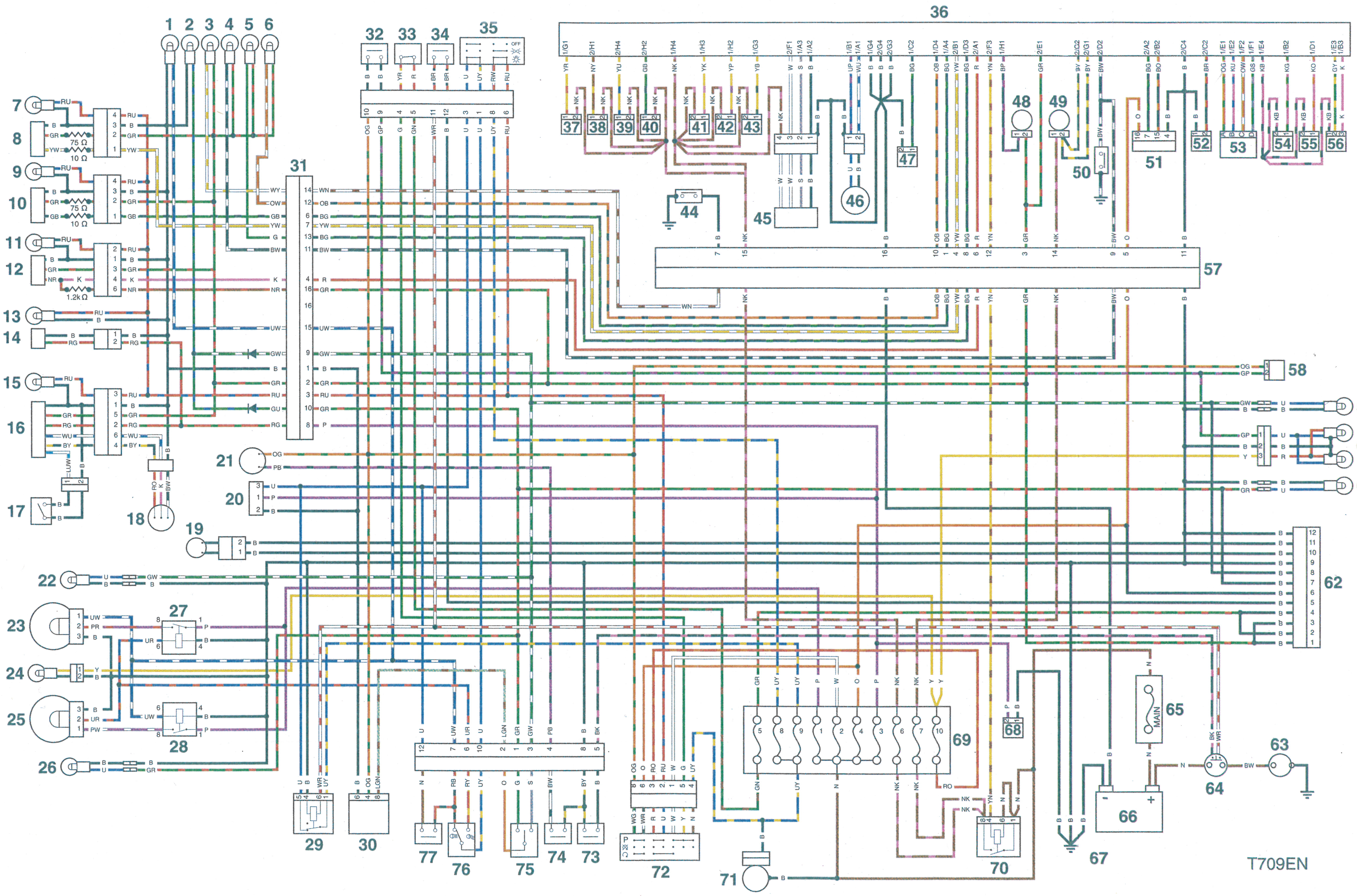
Key	Description	Key	Description
1	Main beam warning light	41	Ignition coil 3
2	Direction indicator warning light	42	Fuel pump
3	Low oil pressure warning light	43	Heated oxygen sensor
4	Neutral warning light	44	Crankshaft position sensor
5	Low fuel level warning light	45	Side stand switch
6	Malfunction indicator light (MIL)	46	Cooling fan
7	Temperature gauge illumination	47	Cooling fan relay
8	Temperature gauge	48	Evaporative purge valve
9	Fuel gauge illumination	49	Fuel injector 1
10	Fuel gauge	50	Fuel injector 2
11	Tachometer illumination	51	Fuel injector 3
12	Tachometer	52	ECM main power relay
13	Clock illumination	53	Coolant temperature sensor
14	Clock	54	Inlet air temperature sensor
15	Speedometer illumination	55	Throttle potentiometer
16	Speedometer	56	Barometric pressure sensor
17	Trip/reset switch	57	Fuel level sensor
18	Speed sensor	58	Diagnostic connector
19	Alarm LED	59	Rear brake light switch
20	Heated handlebar grip connector	60	Rear direction indicator light (RH)
21	Horn	61	Rear light
22	Front direction indicator (RH)	62	Rear direction indicator light (LH)
23	Headlight	63	Fuse box
24	Front position light	64	Starter motor
25	Headlight	65	Starter solenoid
26	Front direction indicator (LH)	66	Alternator
27	Dip beam relay	67	Main fuse (in-line)
28	Main beam relay	68	Battery
29	Headlight cut-out relay	69	Engine earth
30	Instrument connector	70	Accessory socket
31	Ignition switch	71	Main/power harness connector
32	Front brake light switch	72	Low oil pressure switch
33	Engine stop (kill) switch	73	Neutral switch
34	Engine start button	74	Alarm connector
35	Main lighting switch	75	Clutch lever switch
36	Engine control module	76	Horn switch
37	Idle air control valve stepper motor	77	Direction indicator switch
38	Fuel pump relay	78	Headlight dip switch
39	Ignition coil 1	79	Passing button
40	Ignition coil 2	80	Flasher unit


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80
75Ω
10Ω
1.2 KΩ
MAIN

Key to wiring circuit diagram (from VIN 89737)

Key	Description
1	Main beam warning light
2	Indicator warning light
3	Oil pressure warning light
4	Neutral warning lamp
5	Low fuel warning light
6	MIL warning light
7	Temperature gauge illumination
8	Temperature gauge
9	Fuel gauge illuminatiom
10	Fuel gauge
11	Tachometer illumination
12	Tachometer
13	Clock illumination
14	Clock
15	Speedometer illumination
16	Speedometer
17	Trip/reset button
18	Wheel speed sensor
19	Alarm LED
20	Heated grips connector (Accessory)
21	Horn
22	RH front indicator
23	Headlight 1
24	Position lamp
25	Headlight 2
26	LH front indicator
27	Dip beam relay
28	Main beam relay
29	Headlight cut-out relay
30	Flasher unit
31	Instrument connector
32	Front brake lever switch
33	Engine kill switch
34	Starter button
35	Lighting switch
36	Engine control module
37	Purge valve (California)
38	Ignition coil 1

Key	Description
39	Ignition coil 2
40	Ignition coil 3
41	Injector 1
42	Injector 2
43	Injector 3
44	Oil pressure switch
45	Lambda Sensor
46	Crankshaft sensor
47	Fuel level sensor
48	Fuel pump
49	Cooling fan
50	Neutral switch
51	Diagnostic connector
53	Sidestand switch
53	Idle control stepper motor
54	Coolant temperature sensor
55	Inlet air temperature sensor
56	Throttle potentiometer
57	Engine connector
58	Rear brake lever switch
59	RH rear indicator
60	Rear light
61	LH rear indicator
62	Alarm connector (accessory)
63	Starter motor
64	Starter solenoid
65	Main fuse (In line)
66	Battery
67	Engine earth
68	Accessory socket
69	Fuse box
70	Power latch relay
71	Alternator
72	Ignition switch
73	Clutch lever switch
74	Horn button
75	Direction indicator switch
76	Headlight dip switch
77	Passing button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MAIN