TRIUMPH

# TIGER

# TIGER (ABS)

SERVICE MANUAL

INSPEKTIONSHANDBUCH

MANUEL D'ENTRETIEN

MANUALE DI MANUTENZIONE

モーターサイクル整備説明書

# Triumph Tiger
# Triumph Tiger (ABS)
# Motorcycle Service Manual

**Part Number 3857365 Issue 1, 11.2006**

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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, an authorised Triumph dealer must undertake all adjustments, maintenance, and repair work.

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, an authorised Triumph dealer must perform all repairs and scheduled maintenance.

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.

### Warnings, Cautions and Notes

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 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 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 Procedures

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.

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# 1 General Information

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## 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.

## Oils

**Warning**

The engine and bevel box oils 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 your 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 that 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 during lifting or jacking or while repairs and servicing are carried out.

Never rely on a single means of support when working with the motorcycle. Use additional safety supports and straps to prevent toppling.

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 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.

### 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 engine 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

The majority of engine wear occurs while the engine is warming up and before all the rubbing surfaces have an adequate lubrication film. During assembly, oil or grease (whichever is more suitable) should be applied to any rubbing surface, which has lost its lubrication film. Old grease and dirty oil should be cleaned off. This is because used lubricants will have lost some lubrication 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, except in those recommended cases when this forms part of an adjustment.

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 circdip 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 reused 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 appropriate 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 or grease 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 any indoor environment 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, CO2, 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, 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.

## Electrical Testing

For any electrical system to work, electricity must be able to flow in a complete circuit from the power source (the battery) via the components and back to the battery. No circuit means no electrical flow. Once the power has left the positive side of the battery and run through the component it must then return to the battery on its negative side (this is called earth or ground). To save on wiring, connections and space, the negative side of the battery is connected directly to the frame or engine. Around the frame and engine will be various other ground points to which the wiring coming from components will be connected. In the case of the starter motor it bolts directly to the engine, which is bolted to the frame. Therefore the frame and engine also form part of the earth return path.

Ohm's Law

The relationship between voltage, current and resistance is defined by Ohm's Law.

- **The potential of a battery is measured in Volts (V).**
- **The flow of current in a circuit (I) is measured in Amperes.**
- **The power rating of a consumer is measured in Watts (W).**
- **The resistance (R) of a circuit is measured in Ohms (Ω).**

Ohms law, for practical work can be described as -

$$\frac{\text{Voltage}}{\text{Current}} = \text{Resistance}$$

Power is calculated by multiplying Volts x Amps -

$$\text{Watts} = \text{Volts} \times \text{Amps}$$

By transposing either of these formulae, the value of any unit can be calculated if the other two values are known.

For example, if a battery of 12V is connected to a bulb of 60W:

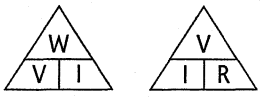
- **the current flowing in the circuit can be calculated by using -**

$$\frac{W}{V} = I \qquad \frac{60}{12} = 5$$

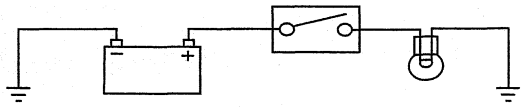
- **the bulb resistance can be calculated by using -**

$$\frac{V}{I} = R \qquad \frac{12}{5} = 2.4$$

To use either of the following triangles, put your finger over the value you want to find. Multiply the remaining values if side-by-side, or divide if one is over the other.




### Basic Electrical Circuits




**Basic Circuit Diagram**

In the above circuit an electrical reservoir (the battery) is connected via a cable to a terminal on the controlling device (the switch) whose contacts are either open or closed. The other terminal on the switch is connected via a cable to the consumer (the bulb), and the other side of the bulb filament is connected to ground (earth) by another cable. The ground point is usually a part of the frame or engine, to which the battery negative terminal is also connected.

When the switch contacts are open (as shown in the diagram), the circuit is broken and no current flows. When the switch contacts are closed the circuit is made and current flows from the battery positive terminal through the switch contacts and bulb filament to ground. The frame completes the circuit to the battery negative terminal and the bulb illuminates.

Although some circuits on the circuit diagram may at first seem more complicated, it will generally be found that they can be broken down into sections which do not differ greatly from the basic circuit above.

## Circuit Diagrams

Circuit diagrams are created to provide a 'picture' of the electrical system and to identify the route taken by each individual wire through the system, in order to identify which components it feeds and which connectors the wire runs through. Circuit diagrams are an essential tool for fault finding, as it is possible to locate start and finish points for a circuit without having to manually trace the wire through the motorcycle itself. Circuits diagrams may look confusing at first but when they are studied closely they soon become logical.

Due to the complex circuits and the number of individual wires, Triumph uses two types of circuit diagram in its service manuals.

- **Within the manual conventional circuit diagrams are used to show the layout of the main circuits of the motorcycle. These are: Engine management/ignition, Lighting, Starting and Charging and Auxiliary and Accessory. In these diagrams no attempt is made to show the components of the system in any particular order or position in relation to the motorcycle.**
- **At the back of the service manual a full colour layout circuit diagram is used to show the main electrical components in a position similar to the actual position on the motorcycle.**

Both of these circuit diagrams use similar symbols to illustrate the various system components and will be accompanied by a key to circuit diagram components and wiring colour codes.

Circuit diagrams also depict the inner workings of a switch cube (I.E. which wire connects to which when a switch is turned from one position to another) so that a test of that switch can be made using the wire terminals in the connector instead of disassembling the switch itself.

## Glossary of Circuit Diagram Symbols

The following is a description of the symbols found in the circuit diagrams used in all Triumph Service Manuals.

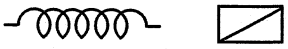
### Connector


This illustration is used to show all multi-plug type electrical connectors on Triumph circuit diagrams. The numbers in the box relate to the terminal numbers of the connector pins. On ECMs with two connectors, the number would be prefixed with the letters 'A' or 'B' to identify each connector. An additional number outside the box will identify the component.

### Diode

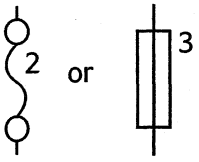
An electrical one-way valve. Diodes allow current to flow in one direction but will not allow it to return. The arrow, which forms part of the diode symbol, indicates the direction of current flow.

### Electromagnetic Winding (solenoid)



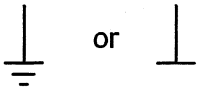
An electromagnetic winding (or solenoid) is used to convert an electrical current into a lateral movement. This can then be used to operate switches (as used in relays) or other components such as fuel injectors or secondary air injection solenoids.

### Fuse



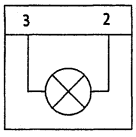

A fuse is a device which protects a circuit in the event of a fault. The fuse will 'blow' should a short circuit occur, protecting that circuit from further damage. The number next to the fuse on the circuit diagram indicates the position of the fuse in the fusebox.

### Ground or Earth Point




This symbol is used to show ground points. This is the negative connection to either the frame or engine, and is a common cause of intermittent faults due to loose or corroded connections.

### Lamp or Bulb

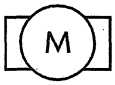



This symbol is used to show all types of light bulbs. The numbers in the box relate to the terminal numbers of the connector pins. An additional number outside the box will identify the component.

**LED (Light Emitting Diode)**

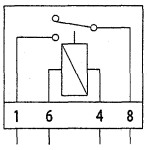
Triumph use LEDs for the alarm warning light, instrument illumination and warning lights, gear change lights and rear light/brake lights on various models.

**Motor**




An electric motor. This could be the starter motor or a motor within an actuator, for example within the ABS modulator.

**Relay**




A relay is effectively an electromagnetic switch. To close the relay contacts and complete the circuit, an electromagnet in the relay is energised which causes the relay contacts to close, making the circuit complete.

Relays are used when the electrical current is too great for a mechanical switch, usually when the switching must be done quickly to prevent arcing across the switch contacts. If a mechanical switch were used, the mechanical switch contacts would quickly burn away.

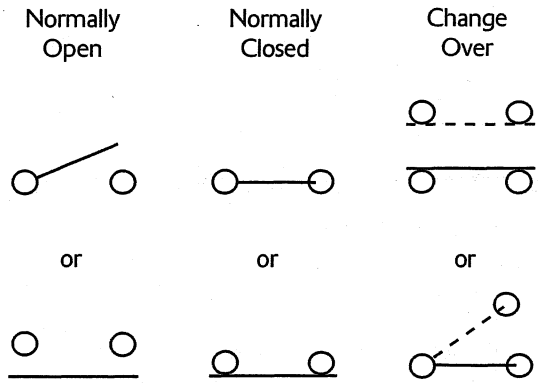
**Resistor**

A device placed in a cable to reduce a voltage or restrict the maximum current a device can draw.

**Splice**

A hard cable joint where two or more cables are joined in the wiring harness. A potential source of both open and short circuits.

**Switches**

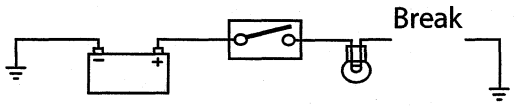



A mechanical device for completing or breaking a circuit. There are three common types of switch: Normally open, normally closed and change-over.

## Tracing Circuits

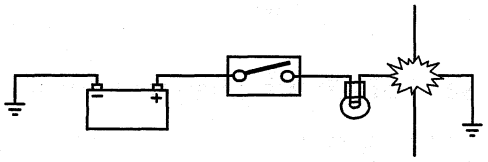
**The following is a description of two types of common electrical failures, and some of the methods which may be used to find them.**

**Open circuit**




A break in an electrical circuit - current cannot flow. Usually caused by a break in a wire or cable or by a loose connection. Open circuits can often by intermittent, making diagnosis difficult.

**Short circuit**



A 'short cut' in an electrical circuit - current by-passes the intended circuit, either to earth or to another, different circuit. Often caused by failure of the cable insulation due to chafing or trapping of the wire. There are two different types of short circuit - short to ground and short to Vbatt.

A short to ground means that the current is going to earth before it reaches the component it is supposed to feed. These are often caused by chafing of the harness to the frame or wires trapped between a bolted component, and will often blow the fuse on that circuit.

A short to Vbatt is a short to battery voltage (12 Volts) and is caused by a live power supply wire contacting an adjacent cable. Note that it is also possible for a 5 Volt sensor reference voltage to short to an adjacent circuit, which can also cause electrical failures and DTCs (Diagnostic Trouble Code) to be stored.

When tracing a wire that is suspect, carefully check the circuit diagram before starting. Remember:

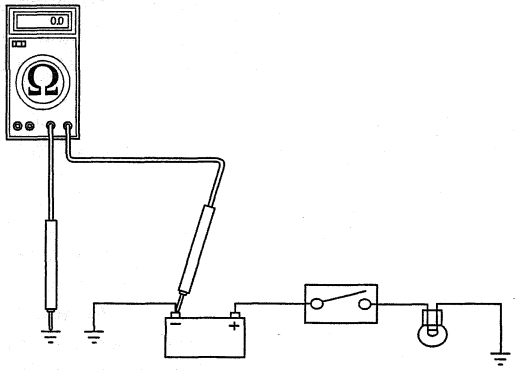
- a wire may diverge at a splice and go off to feed other circuits. If these circuits are working, check for wiring faults from the splice onwards.
- the circuit diagram is not an accurate guide to the actual location of the parts when fitted on the bike. It is a schematic diagram of the circuits.
- particularly where engine management items are concerned, the circuit is only completed by the ECM. If the ECM is not connected, the circuit may register as open.

### To Check Continuity:

**Caution**

Ensure the circuit being tested is switched off before measuring continuity. Damage to the Digital Multi Meter (DMM) may result from testing a 'live' circuit with the meter set to resistance (Ω).

In the example below, the ground circuit continuity is being tested from the battery to the frame.

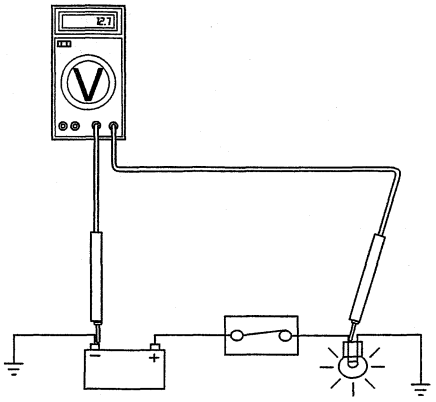


**Continuity (resistance) Check**

- Locate each end of the wire.
- Set the Digital Multi Meter (DMM) to resistance check (Ω).
- Probe each end of the wire.
- If there is continuity, the meter will usually bleep or register the resistance of the cable.
- A high resistance figure could indicate a dirty or corroded connection.
- If there is a break in the wire, the meter will not bleep or register a resistance.
- By probing the wire in various places, the position of a high resistance or break in the wire (open circuit) can be narrowed down until it is found.

### To Measure Voltage:

In the example below, the circuit voltage is being measured at the bulb positive (+) terminal.



**Voltage Check**

- Turn the circuit to be tested 'ON'
- Set the Digital Multi Meter (DMM) to Voltage check (V). Ensure the multi meter is set to dc volts for direct current circuits (most circuits) or ac volts for alternating current circuits (typically alternator output voltage tests).
- Set the range of the DMM to the range best suited to the voltage of the circuit being tested (typically 20 volts for most DMMs). Refer to the DMM manufacturers instructions.
- Connect the black (ground) lead of the DMM to a reliable ground connection (usually the battery or frame ground).
- Locate the positive terminal of the wire or component to be tested.
- connect the red (positive) lead of the DMM to the positive terminal.
- Read the voltage from meter.

### Splices

Splices are probably the most common cause of wiring faults after connectors. Splices are made where two or more wires come together and diverge in different directions, usually to feed a different circuit.

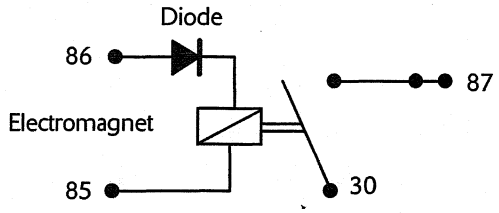
To locate a splice, it is necessary to peel back the insulation and examine the splice for its integrity. The most common fault is where one of the wires at the joint has come adrift usually causing the circuit it feeds or earths to become 'dead'.

### Switches

To check a switch, set the multimeter to resistance/ continuity and probe the two pins that form a closed circuit when the switch is pushed. If the switch is working correctly, the resistance should register or the meter will bleep.

### Relays

All relay cases have a circuit path engraved on them showing the circuit path across the electromagnet and the switch. Before making any checks, first note the pin designations, current paths, and whether or not there is a diode in either circuit path.



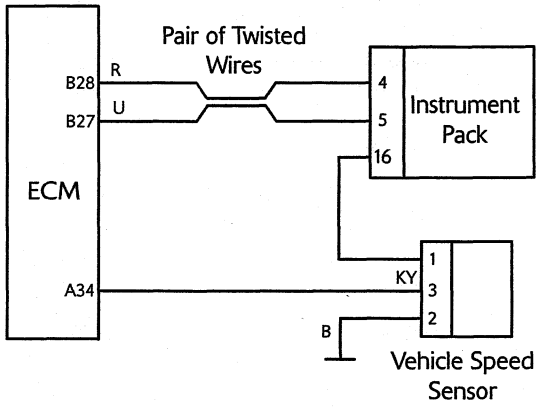

Make continuity checks across the electromagnet first, usually from pin 86 (positive) to pin 85 (negative). If a diode appears in the circuit use the diode check on the multimeter (volts scale) in the direction of current flow. If there is no diode, use the resistance check facility. An open circuit or unusually high resistance value indicates a faulty relay.

To check the switch side, apply a 12 volt supply between pins 86 and 85. With the supply connected the relay should be heard to click and there should be continuity between pins 30 and 87. An open circuit indicates a faulty relay.

## CAN (Controller Area Networking)

CAN (sometimes called CANbus) is a protocol for data communication between Electronic Control Modules (ECMs). Each ECM on the network is connected by a single pair of twisted wires (or bus) which are used for the transmission of vehicle sensor data. By using CAN, the overall number of system sensors, and the amount of cabling required to allow ECMs to communicate with each other is greatly reduced.

This saves cost, weight and space, and makes the system more reliable, as the physical number of wires and connections is reduced.




**Extract from the circuit diagram showing CAN connection between ECMs**

CAN works by each ECM sending out 'packets' of information (such as engine speed or fuel consumption information) on to the network bus (note that the network must be free of data before any ECM is allowed to transmit). This data is given a priority according to its importance (for example 'engine speed' may have a higher priority than 'low fuel level'), so that even if two ECMs send data at the same time, high priority information is always sent first. Lower priority data is then resent after the high priority data has been received by all ECMs on the network.

The receiving ECM confirms the data has been received correctly and that the data is valid, and this information is then used by the ECM as necessary. Specific data not required by an ECM will still be received and acknowledged as correct but then disregarded (for example if an ECM does not require 'clutch switch position' information, this data packet would be ignored).

This allows for a very high speed system of communication, which is also very reliable. Should one ECM fail or transmit corrupted or otherwise incorrect messages, none of the other ECMs on the network will be affected, and after a certain time that ECM will be prevented from transmitting further messages until the fault is rectified. This stops the ECM from clogging the network with incorrect data and preventing other messages from getting through. The fault would then be reported by a DTC (Diagnostic Trouble Code).

Triumph currently use CAN for communication between the engine ECM and the instruments.

## Alternator/Charging System

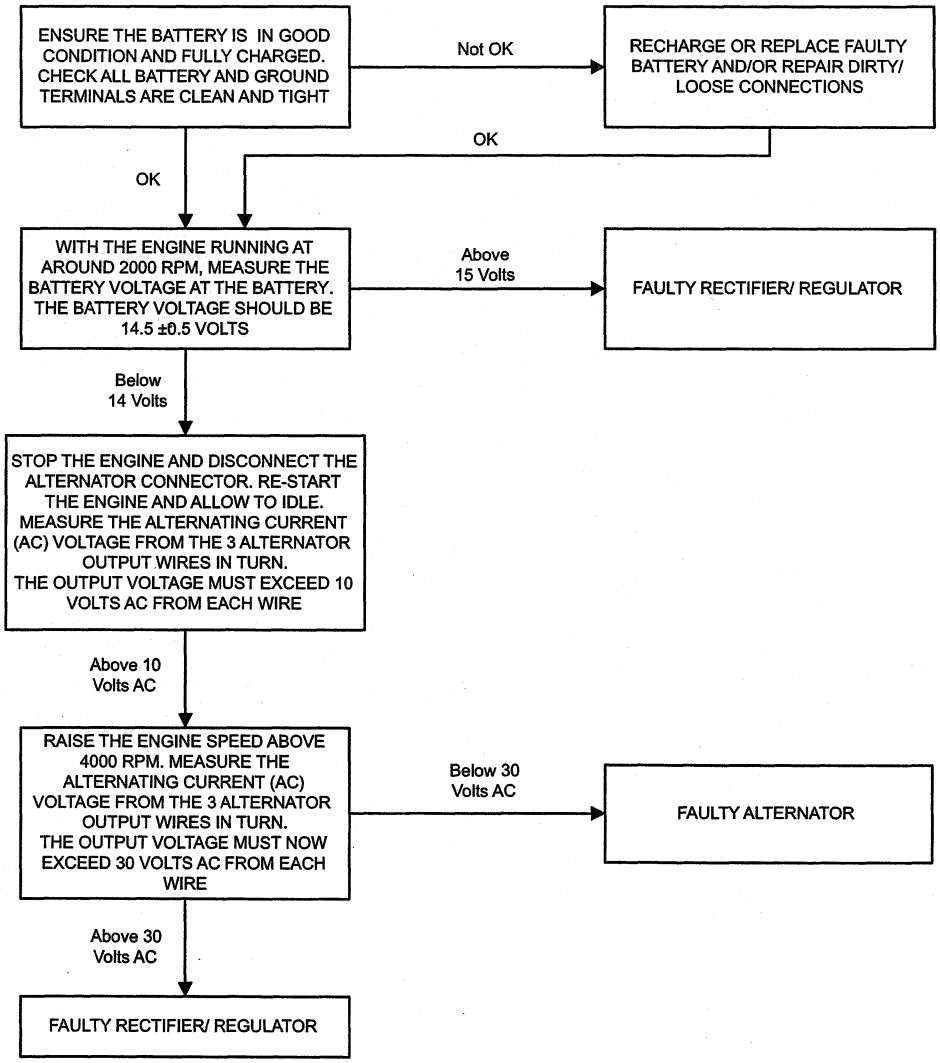
The charging system consists of an alternator and a rectifier/ regulator assembly and the battery. The alternator is made up of two parts, the stator, which is mounted to the crankcase or the engine cover, and the rotor, mounted to the end of the crankshaft. The stator is an assembly of 18 coils, arranged into 3 phases. The rotor is a series of magnets mounted in the engine flywheel, which are arranged so as to be positioned around the outside of the stator coils. As the engine rotates the alternator produces an ac (alternating current) voltage in each of the three phases of the alternator, typically of around 35 to 40 volts ac at 4000-5000 rpm, although this figure varies between models. As the battery requires dc (direct current) voltage for correct charging, this ac voltage must be first rectified to dc current, and then regulated to the correct voltage for the battery of 14.5 ±0.5 volts. This is done by the rectifier/regulator, which uses diodes to convert the alternator output to dc volts and limit the resulting output to the correct figure required for optimal battery charging.

If the charging circuit does not operate correctly, the following basic checks must be carried out before further diagnosis is performed:

- **Check the battery terminals are clean and tight.**
- **Check the frame and engine earth connections are clean, tight and free from corrosion.**
- **Ensure the battery is fully charged and in good condition.**
- **Check that any fuse in the circuit is not blown and is of the correct rating (See page *17-19*).**

Rectify any defects as necessary.

### Diagnosis - Charging Circuit



## Starting Circuit

All Triumph models are equipped with an electric start system. This system consists of a starter relay, starter motor, starter switch, sidestand switch, engine stop switch, clutch switch and the sprag clutch. The starter motor is connected to the starter relay and the battery by heavy duty cables in order to supply the large currents required by the motor to start the engine. When the starter button is pressed the relay is energised, which then allows current to the starter motor. The starter motor will not operate unless the clutch lever is pulled in. Also, the starter will not operate if the sidestand is down, unless the transmission is in neutral. If the starter motor does not operate, the following basic checks must be carried out before further diagnosis is performed:

- **Check the engine stop switch is in the 'RUN' position.**
- **Check the battery terminals are clean and tight.**
- **Check the frame and engine earth connections are clean, tight and free from corrosion.**
- **Ensure the battery is fully charged and in good condition.**
- **Check that any fuse in the circuit is not blown and is of the correct rating.**
- **Using the triumph diagnostic tool, check the operation of the neutral switch or gear position sensor (if fitted), sidestand and clutch switches.**

**Note:**

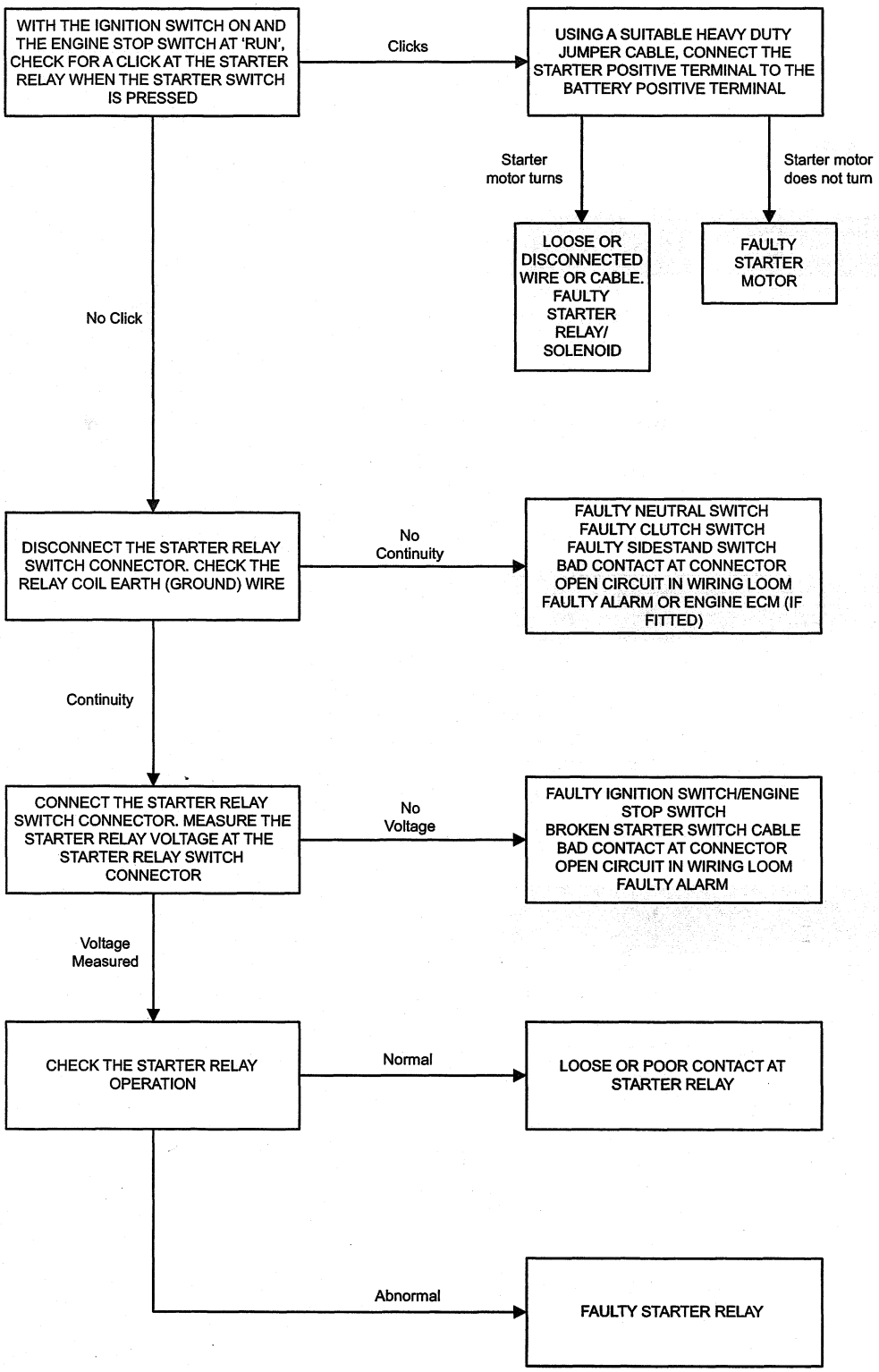
- **On all new models from Daytona 675 onwards, which use a CAN connection between the instruments and the ECM, the engine will not crank if the instruments are disconnected.**

Rectify any defects as necessary.

## General Fault Finding - Starter Motor and Relay

| Symptom | Possible cause(s) |
|---|---|
| Starter relay does not click, starter motor does not turn | Battery discharged or defective |
| | Blown main or starter relay fuse |
| | Defective starter relay wiring or starter switch |
| | Check that the sidestand, transmission and clutch lever are positioned for engine starting I.E. transmission in neutral, clutch lever pulled in and the sidestand down |
| | Defective alarm system - ensure any alarm fitted is working correctly |
| Starter motor turns slowly | Battery discharged or defective |
| | Loose, corroded or dirty battery connections |
| | Loose, corroded or dirty starter motor or starter relay connections |
| | Defective starter motor |
| | Loose, corroded or dirty battery ground connections |
| Starter relay clicks but engine does turn over | Battery discharged or defective |
| | Crankshaft does not turn due to engine defect |
| | Defective starter motor |
| | Starter cable open circuit |
| | Defective starter relay |
| Starter motor turns but engine does not turn over | Defective sprag clutch |
| | Defective idler gear, reduction gear or starter motor |

## Diagnosis - Starter Circuit



### 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 genuine parts should be used to service, repair or convert Triumph motorcycles. To ensure that Triumph genuine 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 genuine 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.

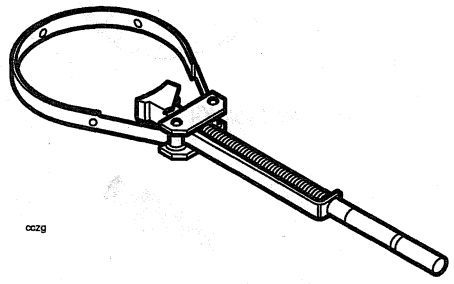
Authorised Triumph Dealers are not agents of Triumph and have no authority to bind the manufacturer by any expressed or implied undertaking or representation.

## Service Tools and Garage Equipment

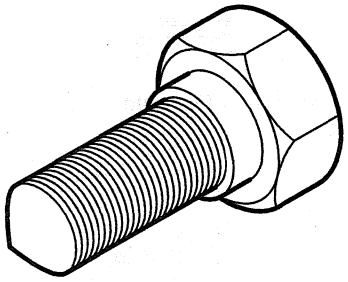
Special service tools have been developed to facilitate removal, dismantling and assembly of certain mechanical components in a practical manner without causing damage. Some operations in this Service Manual cannot be carried out without the aid of the relevant service tools. Where this is the case,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

### Special Service Tools

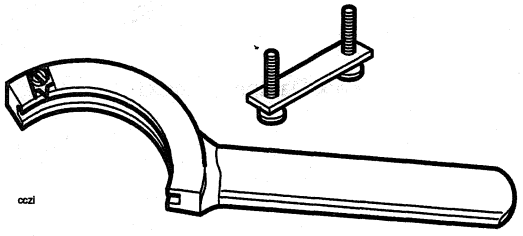
T3880375 – Alternator Rotor Holder



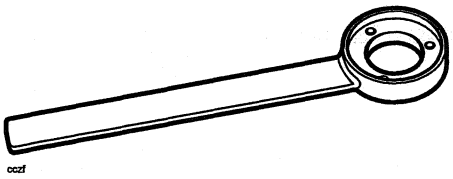

T3880203 – Puller, Alternator Rotor




T3880016 – Holder, Balancer Gear

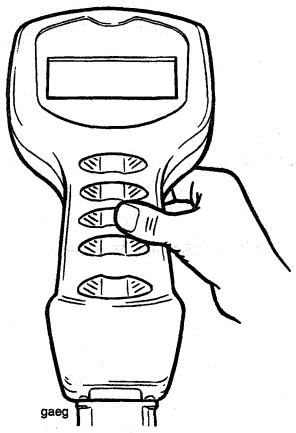



T3880017 – Holder, Sprag Clutch*

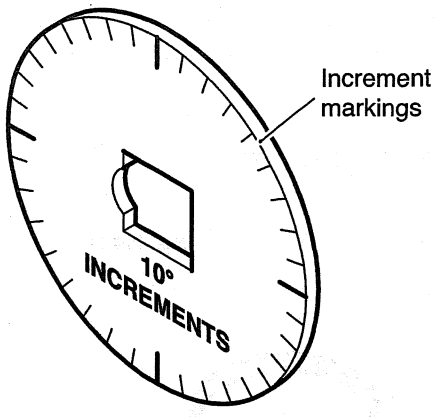



*Older versions of tool T3880017 require modification to function correctly with later models. Refer to Technical News issue 86 (April 2006) for information.

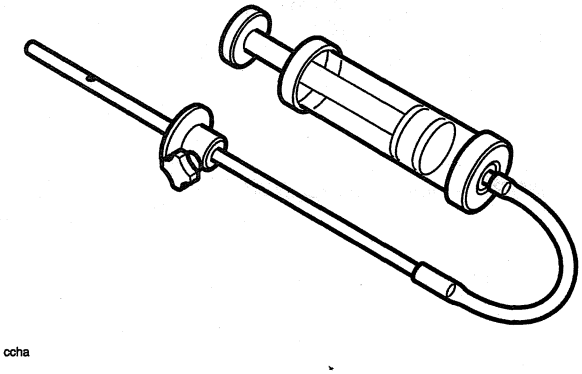
T3880250 – Engine Management/ABS Diagnostics



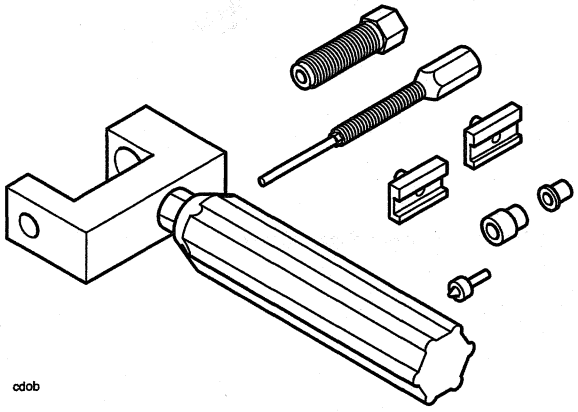

T3880105 – Angular Torque Gauge



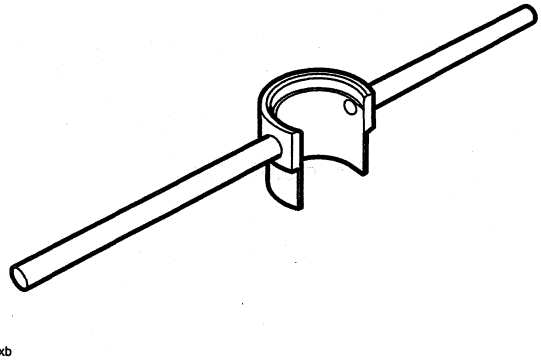

3880160 – Fork Filler / Evacuator



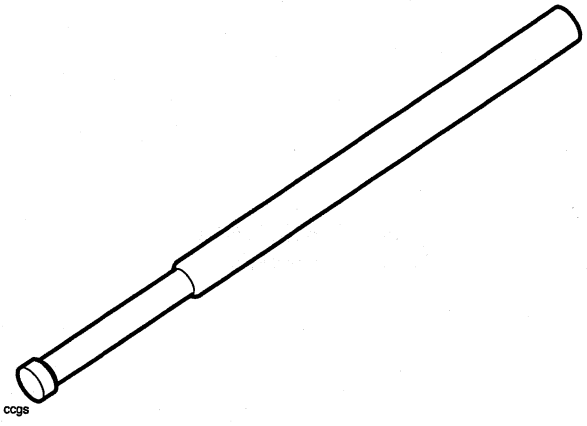

T3880027 - Chain Link Took Kit



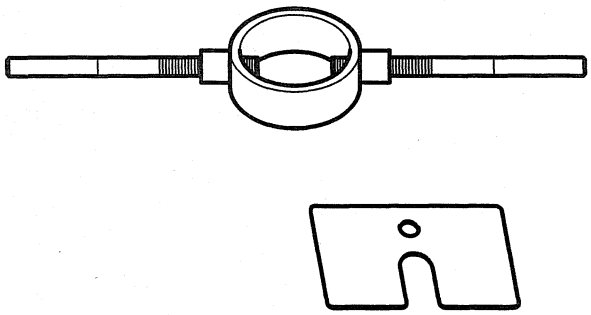

T3880003 –.Fork Seal and Bush Fitment




3880085-T0301 - Fork Damper / Holder

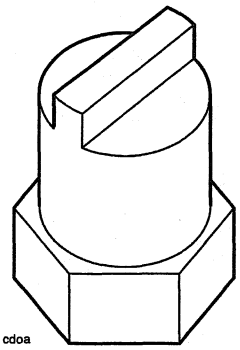


T3880067 - Fork Spring Compressor



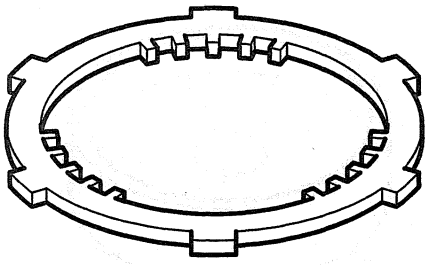
ccgw

T3880104 – Wrench, Swinging Arm Adjuster



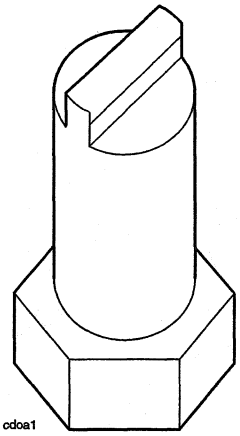
cdoa

T3880305 – Clutch Anti-rotation Tool



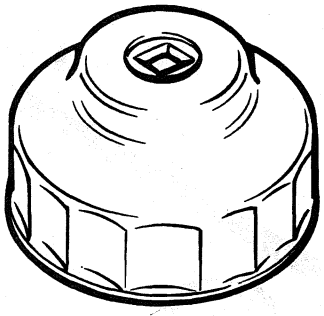
ccml

T3880377 – Wrench, Engine Mounting Adjuster



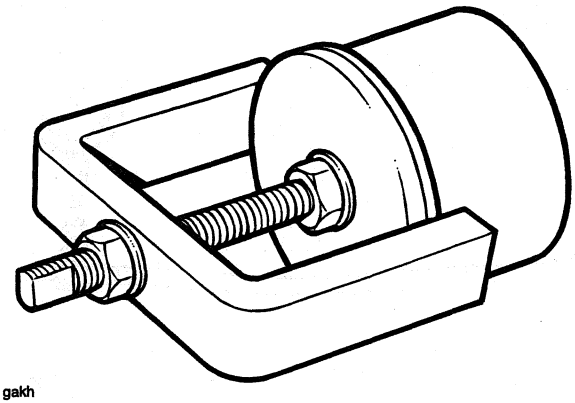
cdoa1

T3880312 – Oil Filter Wrench



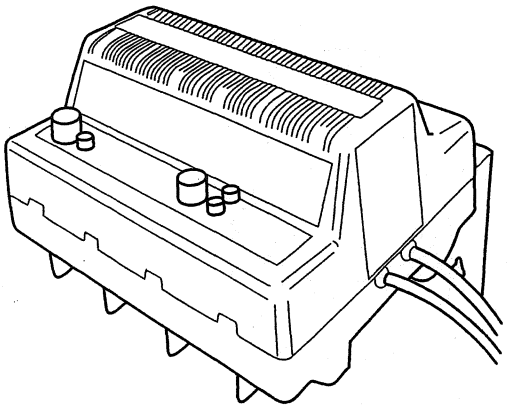
gahc

T3880315 – Extractor, Cylinder Liners



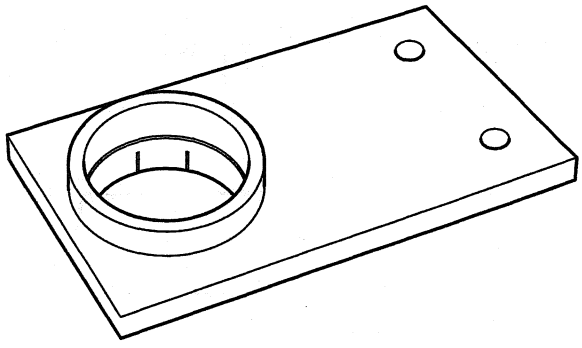
gakh

BatteryMate Battery Charger - See Latest Parts Catalogue for Part Number Information



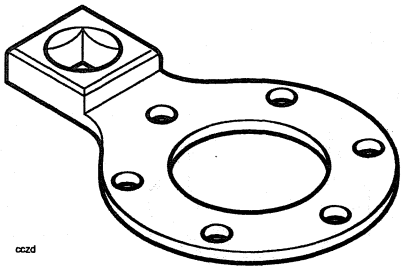
T3880371 – Holder, Oil Pump Drive Gear

T3880002 – Support Plate



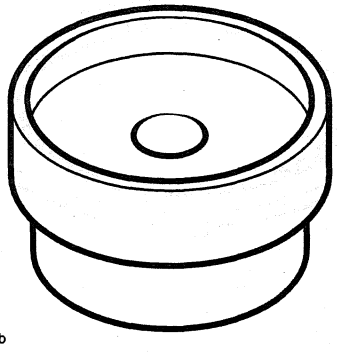
ccxa

3880075 – T0301 – Bearing Installer



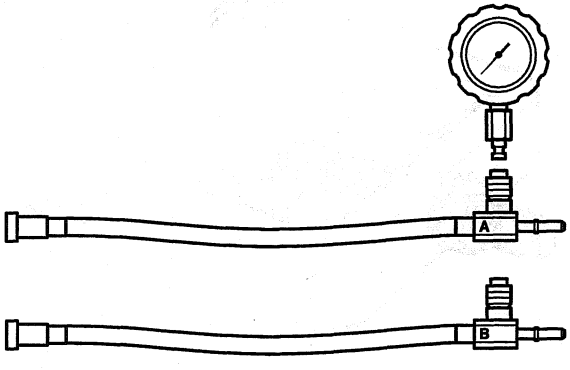
cczd

T3880001 – Fuel Pressure Gauge

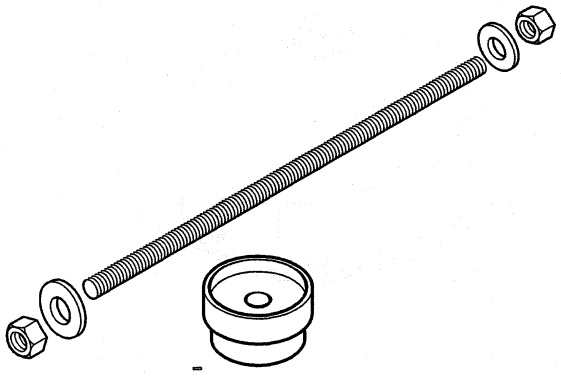


cczb

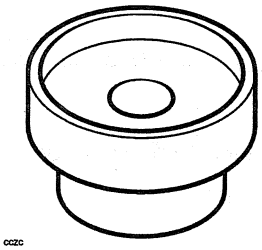
3880053 – Extraction Kit, Wheel bearings




cdgh

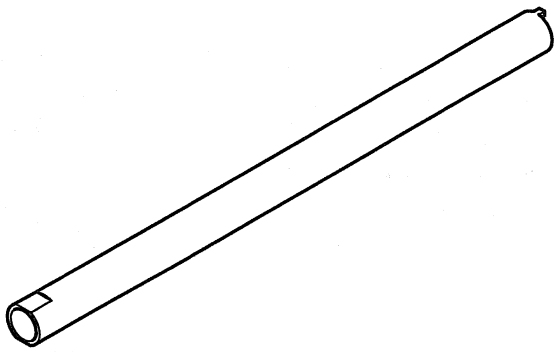


3880070 – T0301 – Bearing Installer



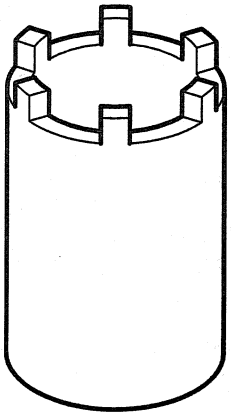
cczc

T3880004 – Holder, Damping Cylinder



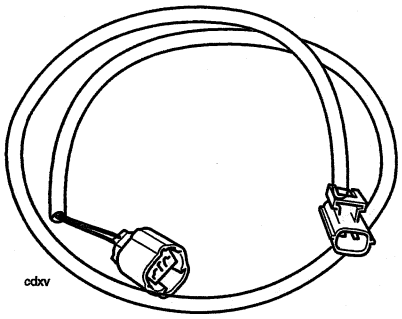
cdet

T3880023 - Headstock Bearing Wrench



cdbp

T3880123 – Extension Cable



cdxv

| Full Specification | | Tiger 1050 cc |
|---|---|---|
| **Engine** | | |
| Engine Configuration | | 3 Cylinder 12 valve DOHC |
| Arrangement | | Transverse in-line |
| Displacement | | 1050 cc |
| Bore x Stroke | | 79 x 71.4 mm |
| Compression Ratio | | 12.0:1 |
| Cylinder Numbering | | Left to Right (no.3 adjacent to cam chain) |
| Cylinder Sequence | | Number 1 at left |
| Firing Order | | 1-2-3 |
| Maximum Power | | 115 PS (114 bhp) at 9,400 rpm |
| Maximum Torque | | 100 Nm (74 ft.lbf)at 6,250 rpm |
| **Cylinder Head Valves** | | |
| Valve Head Diameter | In. | 33.5 mm |
| | Ex | 27.0 mm |
| Valve Lift | In. | 8.75 mm |
| | Ex | 7.45 mm |
| Inlet valve Stem Diameter | | 4.975-4.990 mm |
| Service Limit | | 4.965 mm |
| Exhaust Valve Stem Diameter | | 4.955-4.990 mm |
| Service Limit | | 4.945 mm |
| Inlet Valve Guide Bore Diameter | | 5.000-5.015 mm |
| Service Limit | | 5.043 mm |
| Exhaust Valve Guide Bore Diameter | | 5.000-5.035 mm |
| Service Limit | | 5.063 mm |
| Valve Stem to Guide Clearance | In. | 0.010-0.040 mm |
| | Ex | 0.030-0.060 mm |
| Inlet Valve Seat Width (in head) | | 0.9-1.1 mm |
| Service Limit | | 1.5 mm |
| Exhaust Valve Seat Width (in head) | | 1.1-1.3 mm |
| Service Limit | | 1.7 mm |
| Valve Seat Width (valve) | | 1.5-1.9 mm |
| Valve Seat Angle | | 45° |
| Inlet / Exhaust Valve Spring 'Load at Length' | | 470 N +/-30 at 26.3 mm (inner) |
| Valve Clearance | In. | 0.10-0.20 mm |
| | Ex | 0.20-0.30 mm |
| Valve Bucket Diameter | | 28.476-28.490 mm |
| Service Limit | | 28.549 mm |
| Valve Bucket Bore Diameter | | 28.515-28.535 mm |
| Service Limit | | 28.549 mm |

| Full Specification | Tiger 1050 cc |
|---|---|
| **Camshafts** | |
| Cam Timing Inlet | Open 9.25° BTDC (@ 1.0 mm lift) |
| | Close 39.25° ABDC (@1.0 mm lift) |
| Duration | 228.50° |
| Cam Timing Exhaust | Open 31° BBDC (@ 1.0 mm lift) |
| | Close 1° ATDC (@1.0 mm lift) |
| Duration | 212° |
| Camshaft Journal Diameter | 22.930-22.960 mm |
| | 22.953-22.956 mm (outrigger) |
| Camshaft Journal Clearance Std. | 0.040-0.091 mm |
| Service Limit | 0.13 mm |
| Outrigger | 0.044-0.068 mm |
| Service Limit | 0.13 mm |
| Camshaft Journal Bore Diameter | 23.000-23.021 mm |
| Camshaft End Float | 0.03-0.12 mm |
| Service Limit | 0.20 mm |
| Camshaft Run-out | 0.05 mm max. |
| **Clutch / Primary Drive** | |
| Primary Drive Type | Gear |
| Reduction Ratio | 1.750 (60/105) |
| Clutch Type | Wet multi-plate |
| No. of Friction Plates | 10 |
| Plate Flatness | Within 0.2 mm |
| Friction Plate Thickness (inner and outer) | 3.80 mm |
| Service Limit | 3.60 mm |
| Friction Plate Thickness (all others) | 3.30 mm |
| Service Limit | 3.10 mm |
| Clutch Actuation Method | Cable |
| Cable Free Play (at lever) | 2.0-3.0 mm |
| **Balancer** | |
| End Float | 0.06-0.41 mm |
| **Pistons** | |
| Cylinder Bore Diameter | 79.040-79.060 mm |
| Service Limit | 79.110 mm |
| Piston Diameter (at 90° to gudgeon pin) | 78.970-78.980 mm |
| Service Limit | 78.930 mm |
| Piston Ring to Groove Clearances | |
| Top | 0.02-0.06 mm |

| Full Specification | Tiger 1050 cc |
|---|---|
| Service Limit | 0.075 |
| Second | 0.02-0.06 mm |
| Service Limit | 0.075 |
| Piston Ring End Gaps | |
| Top | 0.28-0.49 mm |
| Service Limit | 0.61 |
| Second | 0.43-0.64 mm |
| Service Limit | 0.76 |
| Oil | 0.33-0.89 mm |
| Service Limit | 1.03 mm |
| Gudgeon Pin Bore Diameter in Piston | 16.993-17.001 mm |
| Service Limit | 17.029 mm |
| Gudgeon Pin Diameter | 16.984-16.989 mm |
| Service Limit | 16.974 mm |
| **Connecting Rods** | |
| Connecting Rod Small End Diameter | 17.005- 17.018mm |
| Service Limit | 17.028 mm |
| Connecting Rod Big End Side Clearance | 0.15-0.30 mm |
| Service Limit | 0.50 mm |
| **Crankshaft** | |
| Crankshaft Big End Journal Diameter | 34.984-35.000 mm |
| Service Limit | 34.960 mm |
| Crankshaft Big End Bearing Clearance | 0.036 mm-0.066 |
| Service Limit | 0.10 mm |
| Crankshaft Main Bearing Journal Diameter | 37.960-37.967 mm |
| Service Limit | 37.936 mm |
| Crankshaft End Float | 0.05-0.20 mm |
| Service Limit | 0.40 mm |
| Crankshaft Run-out | 0.02 mm or less |
| Service Limit | 0.05 mm |
| **Transmission** | |
| Type | 6 Speed, Constant Mesh |
| Gear Ratios 1st | 2.733:1 (15/41) |
| 2nd | 1.947:1 (19/37) |
| 3rd | 1.545:1 (22/34) |
| 4th | 1.292:1 (24/31) |
| 5th | 1.154:1 (26/30) |
| 6th | 1:1 (28/28) |

| Full Specification | Tiger 1050 cc |
|---|---|
| Gear Selector Fork Thickness | 5.8-5.9 mm |
| Service Limit | 5.7 mm |
| Gear Selector Groove Width | 6.0-6.1 mm |
| Service Limit | 6.25 mm |
| Gear Selector Fork to Groove Clearance | 0.55 mm max. |
| **Final Drive** | |
| Final Drive | Chain |
| Final Drive Ratio | 2.444:1 (18/44) |
| Chain Type | RK 530 FXW |
| Number of Links | 114 |
| 20 Link Length | 320 mm |
| Drive Chain Play | 35-40 mm |
| Chain Lubrication | Mobil chain spray |
| **Lubrication** | |
| Type | Pressure Lubrication, Wet Sump |
| Oil Capacity (dry fill) | 3.50 litres |
| Oil Capacity (wet fill including filter) | 3.20 litres |
| Oil Capacity (wet fill excluding filter) | 3.00 litres |
| Oil pressure (in main gallery) | 40.0 lb/in² min. @ 80°C oil temperature @ 5000 RPM |
| Oil Pump Rotor Tip Clearance | 0.15 mm |
| Service Limit | 0.20 mm |
| Oil Pump Body Clearance | 0.15-0.22 mm |
| Service Limit | 0.35 mm |
| Oil Pump Rotor End Float | 0.02-0.07 mm |
| Service Limit | 0.10 mm |
| **Ignition System** | |
| Type | Digital Inductive |
| Electronic Rev Limiter | 9,500 (r/min) |
| Pick-up Coil Resistance | 0.56 KΩ +/-10% @ 20°C |
| Ignition Coil Type | Plug-top |
| Spark Plug Type | NGK CR9EK |
| Spark Plug Gap | 0.7 mm |
| **Fuel System** | |
| Fuel Type | Unleaded, 95 RON (U.S. 89 CLC/AKI |
| Fuel Tank Capacity | 20 litres |
| Low Level Warning Lamp | 3.5 litres remaining |

| Full Specification | Tiger 1050 cc |
|---|---|
| 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 | 1170 RPM |
| Injector Type | Twin jet, solenoid operated plate valve |
| Throttle | Cable/twist grip/electronic throttle potentiometer |
| Control Sensors | Barometric pressure, manifold absolute pressure, throttle position, coolant temperature, crankshaft position sensor, lambda sensor, induction air temperature |

**Emissions Controls***

| | |
|---|---|
| Catalysts | 1, in exhaust header pipe |
| Oxygen sensor | Heated, in exhaust header pipe |
| Secondary Air Injection | Solenoid controlled, reed valve type |
| Evaporative control | Activated carbon canister (California only) |

* Catalysts, Oxygen sensors and Secondary Air Injection fitted in all markets except Australia, New Zealand and South Africa.

**Coolant System**

| | |
|---|---|
| Coolant Mixture | 50/50 Distilled water / anti-freeze |
| Anti-Freeze Type | Mobil anti-freeze |
| Freezing point | -35°C |
| Cooling System Capacity | 2.3 litres |
| Radiator Cap Opening Pressure | 1.1 bar |
| Thermostat Opening Temperature | 85°C (nominal) |
| Cooling Fan Switch On Temperature | 103°C |
| Temperature Gauge Sensor Resistance | 2.9 – 3.3 KΩ @ 15°C |

**Suspension**

| | |
|---|---|
| Front Fork Travel | 150 mm |
| Recommended Fork Oil Grade | Showa SS8 |
| Oil Level (fork fully compressed) | 30 mm (with springs **installed**) |
| Oil Volume (dry fill) | 581 cc |
| Fork Pull Through | (see section 13) |
| Rear Wheel Travel | 150 mm |
| Rear Suspension Bearing Grease | Mobil grease HP 222 |

| Full Specification | Tiger 1050 cc |
|---|---|
| **Brakes** | |
| Front Type | Two hydraulically actuated four piston calipers acting on twin discs |
| Caliper Piston Diameter | 33.96 mm / 30.23 mm |
| Disc Diameter | 320 mm |
| Disc Thickness | 4.5 mm |
| Service Limit | 3.5 mm |
| Disc Run-out Max. | 0.3 mm |
| Master Cylinder Diameter | 15.8 mm |
| Recommended Fluid | Mobil universal brake and clutch fluid DOT4 |
| Rear Type | Hydraulically actuated 2 piston caliper, single disc |
| Caliper Piston Diameter | 27 mm |
| Disc Diameter | 255 mm |
| Disc Thickness | 6.0 mm |
| Service Limit | 5.0 mm |
| Disc Run-out Max. | 0.3 mm |
| Master Cylinder Diameter | 14 mm |
| Recommended Fluid | Mobil universal brake and clutch fluid DOT4 |
| **Wheels and Tyres** | |
| Front Wheel Size | MT 3.5 x 17 |
| Front Tyre Size | 120/70 ZR 17 |
| Front Tyre Pressure | 2.34 Bar (34 PSI) |
| Front Tyre: Option 1 | Michelin Pilot Road S |
| Front Wheel Rim Axial Run-out | 0.5 mm |
| Front Wheel Rim Radial Run-out | 0.5 mm |
| Rear Wheel Size | MT 5.5 x 17 |
| Rear Tyre Size | 180/55 ZR 17 |
| Rear Tyre Pressure | 2.90 Bar (42 PSI) |
| Rear Tyre: Option 1 | Michelin Pilot Road S |
| Rear Wheel Rim Axial Run-out | 0.5 mm |
| Rear Wheel Rim Radial Run-out | 0.5 mm |

| Full Specification | | Tiger 1050 cc |
|---|---|---|
| **Frame** | | |
| Frame Type | | Twin-spar aluminium |
| Overall Length | | 2,110 mm (83.1in) |
| Overall Width | | 840 mm (33.1 in) |
| Overall Height | | 1,320 mm (52.0 in) |
| Wheelbase | | 1510 mm (5 in) |
| Seat Height | | 835 mm (32.8 in) |
| Castor | | 23.2° |
| Trail | | 87.7 mm |
| Dry Weight (non ABS) | | 198 kg |
| Dry Weight (ABS) | | 202 kg |
| Maximum Payload | | 200 kg (rider, passenger, luggage and accessories) |
| **Electrical Equipment** | | |
| Battery Type | | YUASA YTX12-BS |
| Battery Rating | | 12V – 10 Amp. Hour |
| Alternator Rating | | 34A |
| Fuses | #1 | Starter solenoid, dip / main beam headlights |
| | #2 | Ignition switch, tail lights, number plate light, side lights, fuel pump |
| | #3 | Indicators, brake light, horn |
| | #4 | Blank |
| | #5 | Blank |
| | #6 | Accessory socket, heated grips |
| | #7 | Cooling fan |
| | #8 | Engine management system |
| | #9 | Alarm, diagnostic connector, instruments |

## Torque Wrench Settings

### Cylinder Head Area

| Application | Torque (Nm) | Notes |
|---|---|---|
| Cam cover to cylinder head | 10 | Lubricate seals with engine oil |
| Secondary air injection valve covers to cam cover | 9 | |
| Cam chain tensioner to crankcase | 9 | |
| Cam chain tensioner centre bolt | 23 | |
| Camshaft bearing caps and camshaft bearing ladder to head | See section 5 | Lubricate threads |
| Camshaft sprocket to camshaft | 15 | Use new fixings |
| Cam chain tensioner blade to crankcase | 18 | Use new fixings |
| Cam chain top pad to head | 10 | Use new fixings |
| Cylinder head to crankcase (M6 screws) | 10 | |
| Cylinder head to crankcase bolts | See section 3 | |
| Sound suppression bolt in head | 10 | |
| Oil feed pipe | 25 | |
| Spark plug to cylinder head | 12 | |

### Clutch

| Application | Torque (Nm) | Notes |
|---|---|---|
| Clutch cover to crankcase | 9 | |
| Clutch centre nut | 105 | |
| Clutch pressure plate to centre | 10 | |
| Clutch lever to handlebar | 15 | |
| Clutch lever pivot bolt | 1 | |
| Clutch lever pivot nut | 3.5 | |

### Balancer, Crankshaft and Crankcase

| Application | Torque (Nm) | Notes |
|---|---|---|
| Crankcase lower to upper (M8 fixings) | See section 6 | |
| Crankcase upper to lower (M6 fixings) | See section 6 | |
| Connecting rod big end nut | See section 6 | |
| Balancer retaining bolt | 60 | Apply ThreeBond 1305 to the threads |
| Big end bearings | See section 6 | |
| Sprag clutch to crankshaft | 54 | |
| Starter drive cover to crankcase | 9 | |

### Engine Covers

| Application | Torque (Nm) | Notes |
|---|---|---|
| Clutch cover to crankcase | 9 | |
| Clutch cover sound suppression plate to cover | 9 | |
| Sprocket cover to crankcase | 9 | |
| Water outlet cover | 9 | |
| Alternator cover to crankcase | 9 | |
| Crank cover to crankcase | 9 | |
| Starter cover to crank cover | 9 | |
| Plug, crank cover | 18 | |

### Transmission

| Application | Torque (Nm) | Notes |
|---|---|---|
| Output sprocket to output shaft | 132 | Use new tab washers |
| Detent wheel to selector drum | 12 | Use a new fixing |
| Detent arm bolt | 12 | Use a new fixing |
| Selector drum bearing retaining screw | 12 | Use a new fixing |
| Selector shaft retainer | 12 | Use a new fixing |
| Spring abutment bolt | 23 | |
| Neutral switch | 10 | |
| Gear pedal pinch bolt | 9 | |
| Gear change rod locknuts (upper nut is left hand thread) | 6 | |
| Gear pedal pivot bolt | 22 | |

### Lubrication System

| Application | Torque (Nm) | Notes |
|---|---|---|
| Sump to crankcase | 12 | |
| Sump drain plug to sump | 25 | Use a new washer |
| Oil pressure relief valve to crankcase | 15 | Apply ThreeBond 1305 to the threads |
| Low oil pressure warning light switch to crankcase | 13 | Use new washers |
| Oil filter to adapter | 10 | |
| Oil cooler pipe union bolts | 10 | |
| Oil cooler to mounting bracket/radiator | 9 | |
| Oil pump to crankcase | 13.7 | |
| Oil pump drive sprocket to pump shaft | 15 | |
| Oil feed pipe union to head | 25 | |
| Transmission oil feed pipes to crankcase | 8 | |
| Oil cooler bracket to crankcase | 9 | |

### Final Drive

| Application | Torque (Nm) | Notes |
|---|---|---|
| Rear sprocket to sprocket carrier | 55 | |
| Rear sprocket studs to sprocket carrier | 30 | Use new fixings |
| Chain guard bolts | 4.5 | |

### Cooling System

| Application | Torque (Nm) | Notes |
|---|---|---|
| Water pump to crankcase | 10 | |
| Radiator to frame | 9 | |
| Water elbow to head | 12 | |
| Thermostat housing to head | 12 | |
| Fan shroud to radiator | 2.5 | |
| Expansion tank to frame | 4 | |

### Fuel System, Exhaust System and Airbox

| Application | Torque (Nm) | Notes |
|---|---|---|
| Fuel tank to frame (front fixing) | 9 | |
| Fuel tank to frame (rear fixing) | 9 | |
| Fuel tank brackets to frame (rear) | 9 | |
| Fuel cap to fuel tank | 3 | |
| Fuel pump mounting plate to fuel tank | 9 | |
| Throttle body transition piece to cylinder head | 12 | |
| Fuel rail to bracket | 6 | |
| Throttle potentiometer to throttle body | 2 | |
| Throttle restrictor bracket to throttle body | 2 | Apply ThreeBond 1360 to the threads |
| Exhaust downpipe to cylinder head | 19 | See section 10 |
| Airbox to bracket | 5 | |
| Airbox upper to lower section | 3 | |
| Exhaust downpipe to frame | 15 | |
| Exhaust clamp to downpipe | 22 | |
| Silencer mounting bracket to frame | 15 | |
| Catalyst heatshield to downpipe (only if catalyst fitted) | 5 | |
| Exhaust pipe heatshield | 5 | |
| Silencer heatshield | 5 | |

### Rear Suspension

| Application | Torque (Nm) | Notes |
|---|---|---|
| Swinging arm spindle bolt | 110 | |
| Swinging arm end-float adjuster sleeve | 6 | |
| Chain rubbing strip bolts | 4.5 | |
| Chain adjuster locknut | 20 | |
| Chain guard bolts | 4.5 | |
| Rear suspension unit upper mounting bolt | 48 | |
| Rear suspension unit lower mounting bolt /drop to drag link pivot | 48 | |
| Drag link pivot at frame | 48 | |
| Drop links to swinging arm | 48 | |

### Front Suspension

| Application | Torque (Nm) | Notes |
|---|---|---|
| Handlebar clamp bolt | 26 | |
| Handlebar lower clamp to top yoke nut | 35 | |
| Handlebar end weight bolt | 5 | |
| Upper yoke pinch bolt | 20 | |
| Lower yoke pinch bolt | 20 | |
| Fork top cap to inner tube | 35 | |
| Upper yoke centre nut | 90 | |
| Damping cylinder bolt | 19 | |

### Wheels

| Application | Torque (Nm) | Notes |
|---|---|---|
| Front wheel spindle / axle bolt | 110 | |
| Front wheel spindle pinch bolts | 20 | |
| Rear wheel spindle/axle bolt | 110 | |

### Front Brakes

| Application | Torque (Nm) | Notes |
|---|---|---|
| Front brake disc to wheel | 22 | Use new fixings |
| Front brake caliper to fork | 35 | |
| Front brake pad retaining pin | 17 | |
| Front brake caliper bleed screw | 5.5 | |
| Front brake hose to caliper | 25 | Use new sealing washers |
| Front brake master cylinder to handlebar | 15 | |
| Front brake master cylinder reservoir to mounting | 5 | |
| Front brake hose to master cylinder | 25 | Use new sealing washers |
| Front brake lever to master cylinder bolt | 1 | |
| Front brake lever to master cylinder nut | 6 | |

### Rear Brakes

| Application | Torque (Nm) | Notes |
|---|---|---|
| Rear brake disc to wheel | 22 | Use new fixings |
| Rear brake caliper to carrier | 40 | |
| Rear brake pad retaining pin | 17 | |
| Rear brake caliper bleed screw | 5.5 | |
| Rear brake hose to caliper | 25 | Use new sealing washers |
| Rear brake master cylinder to frame | 27 | Use new fixings |
| Rear brake master cylinder reservoir to frame | 9 | |
| Rear brake hose to master cylinder (brake light switch) | 15 | |
| Rear brake pedal pivot bolt | 22 | |

### ABS System

| Application | Torque (Nm) | Notes |
|---|---|---|
| Front wheel speed sensor to fork leg | 9 | |
| Rear wheel speed sensor to caliper carrier | 9 | |
| Front pulser ring to front wheel hub | 5 | |
| Rear pulser ring to rear brake disc | 5 | |
| ABS modulator to mounting bracket | 9 | |
| ABS modulator mounting bracket to frame | 9 | Use new fixings |
| Brake line unions to ABS modulator | 17 | |

### Footrests, Control Plates and Engine Mountings

| Application | Torque (Nm) | Notes |
|---|---|---|
| Upper crankcase to frame | See section 9 | |
| Lower crankcase to frame | See section 9 | |
| Cylinder head to frame | See section 9 | |
| Control plate to frame bolts | 9 | Use new fixings |
| Heel guard to Control plate bolts | 7 | |
| Rear footrest hanger to frame | 27 | |
| Side stand mounting bracket | 40 | |
| Side stand pivot | 20 | |

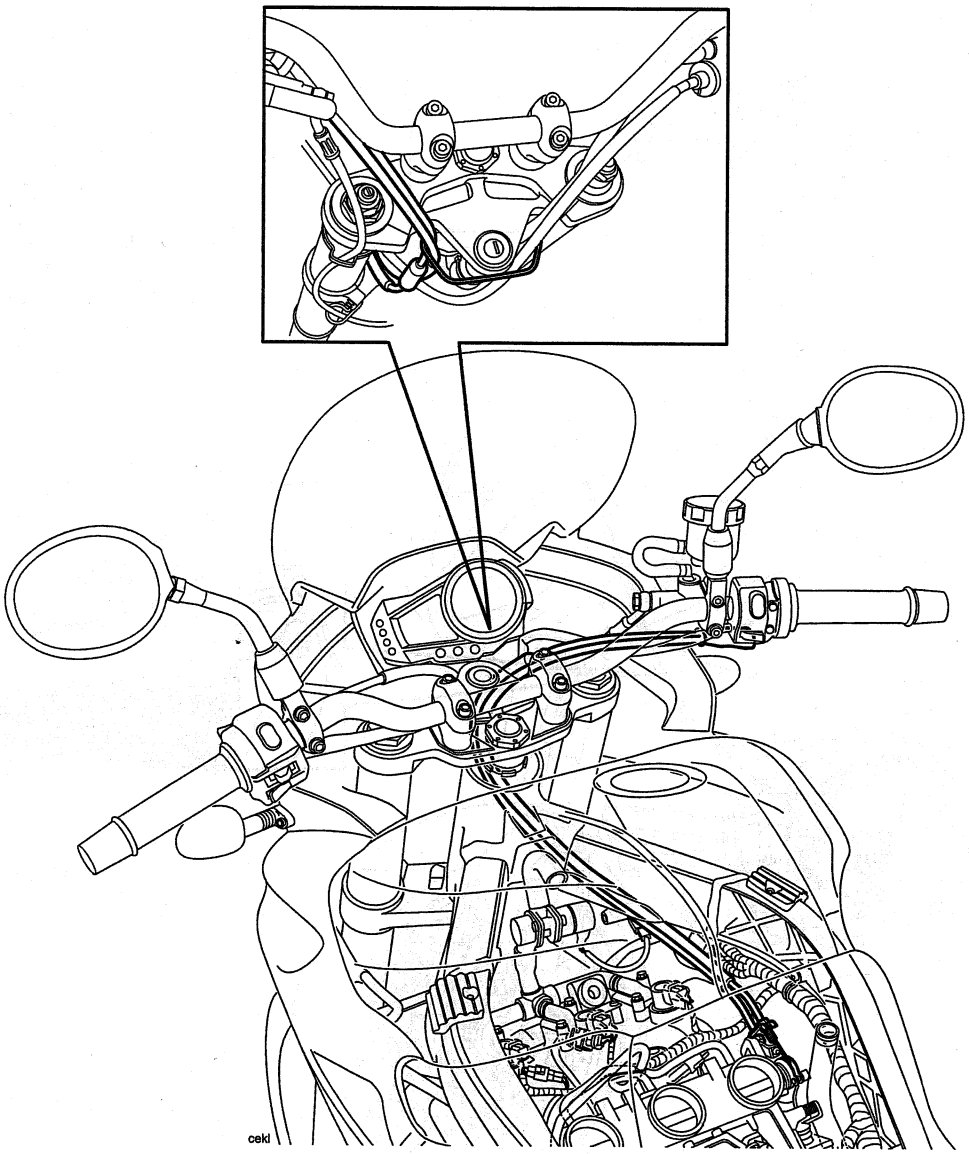
### Electrical

| Application | Torque (Nm) | Notes |
|---|---|---|
| Alternator rotor to crankshaft | 105 | |
| Alternator stator to cover | 12 | |
| Alternator regulator to frame | 7 | |
| Starter motor to crankcase | 10 | |
| Alternator cover to crankcase | 9 | |
| Headlight to cockpit frame | 3.5 | |
| Rear light fixings | 4 | |
| Licence plate lamp fixing | 3 | |
| Horn to lower yoke | 18 | |

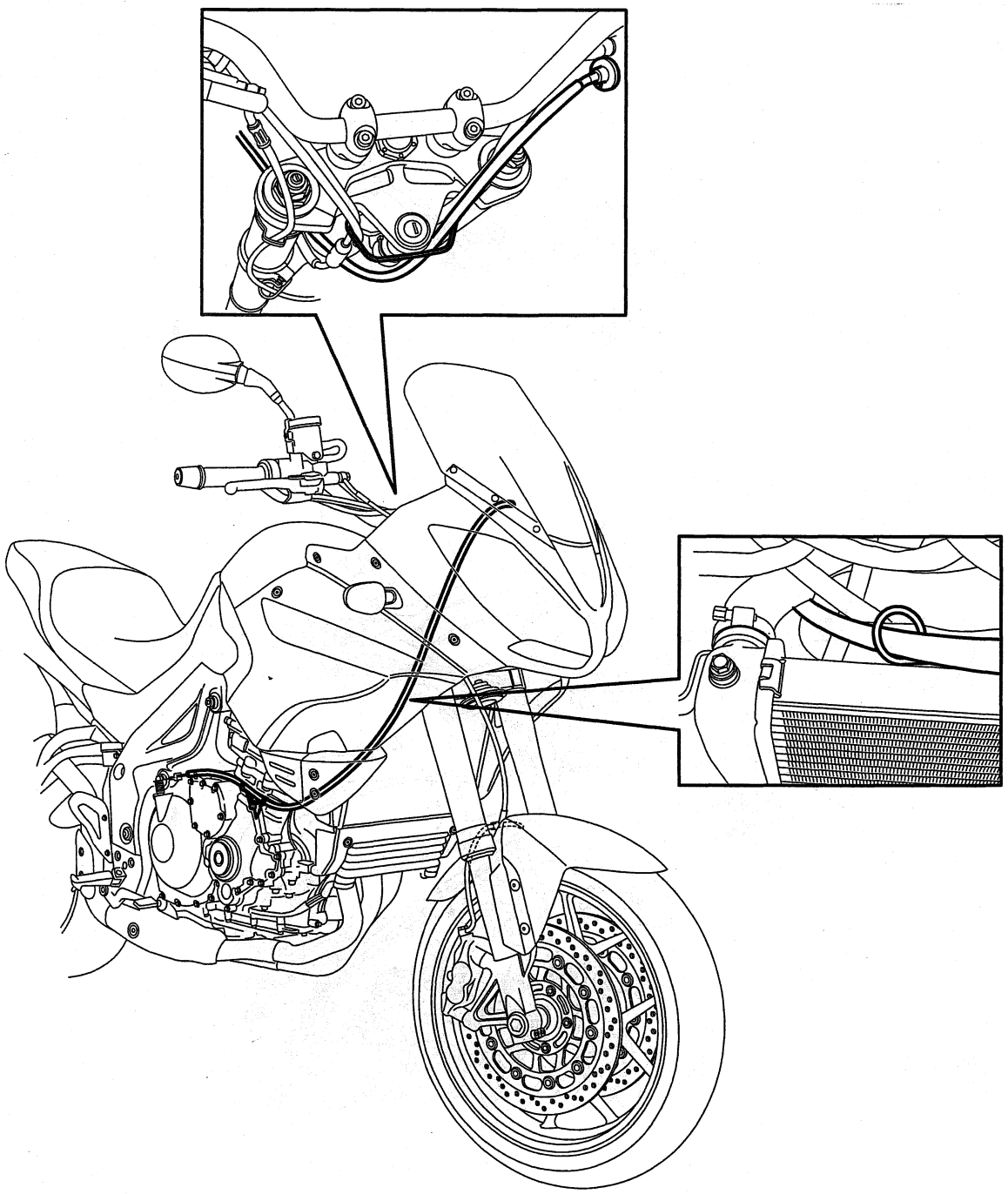
### Bodywork

| Application | Torque (Nm) | Notes |
|---|---|---|
| Front mudguard to fork | 3 | |
| Side panels to brackets/fuel tank | 3 | |
| Cockpit to headlight | 3 | |
| Side fairings to frame/headlight | 3 | |
| Rear panel to subframe | 3 | |
| Infill panels to cockpit | 3 | |
| Mirrors to handlebars | 25 | |
| Windscreen to cockpit subframe | 1.5 | |
| Cockpit subframe to frame | 30 | |
| Rear mudguard to frame | 6 | |
| Rear mudguard end section to bracket | 6 | |
| Rear hugger to swinging arm | 7 | |
| Belly pan to brackets | 3 | |

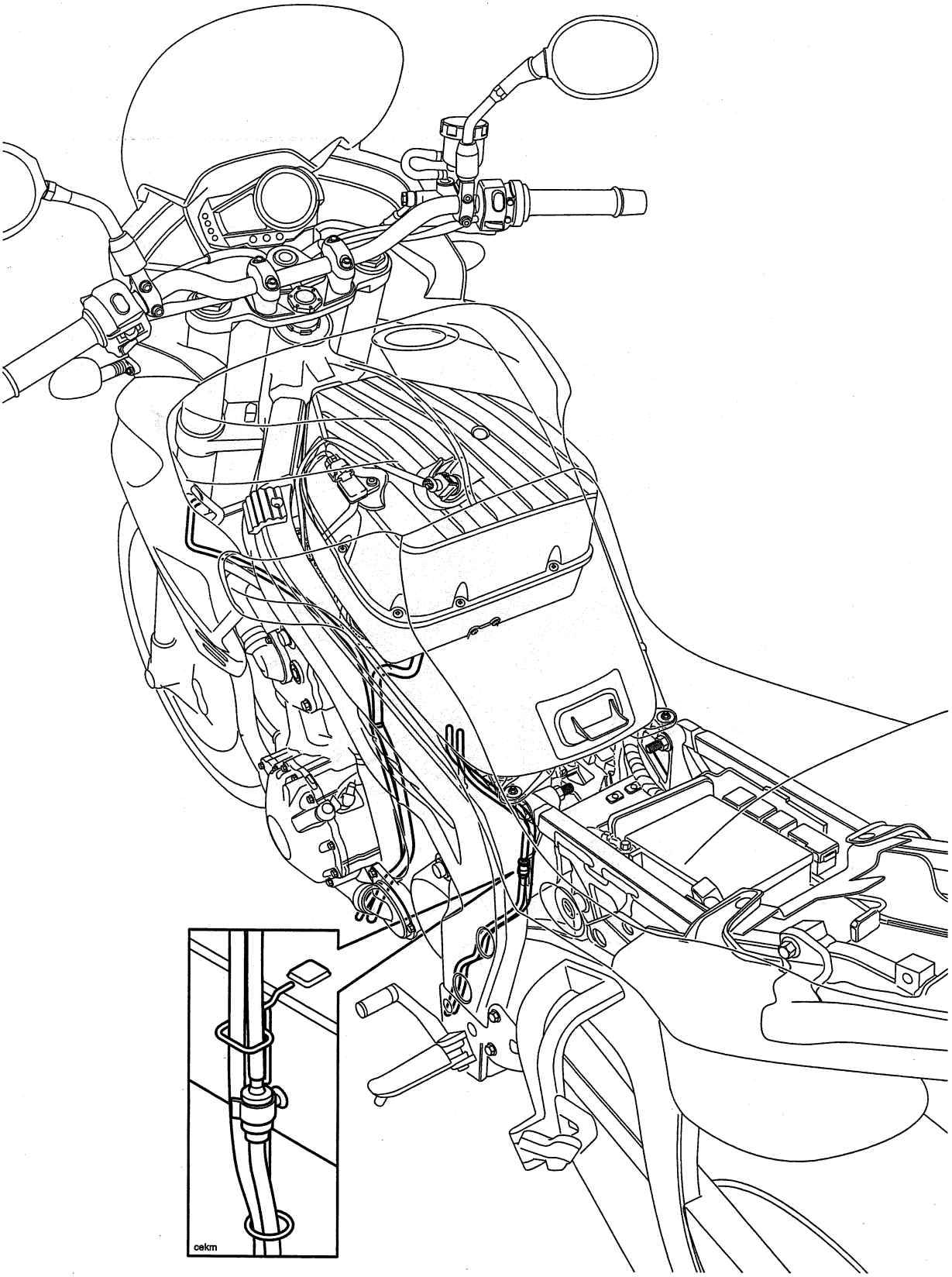
## Throttle Cable Routing



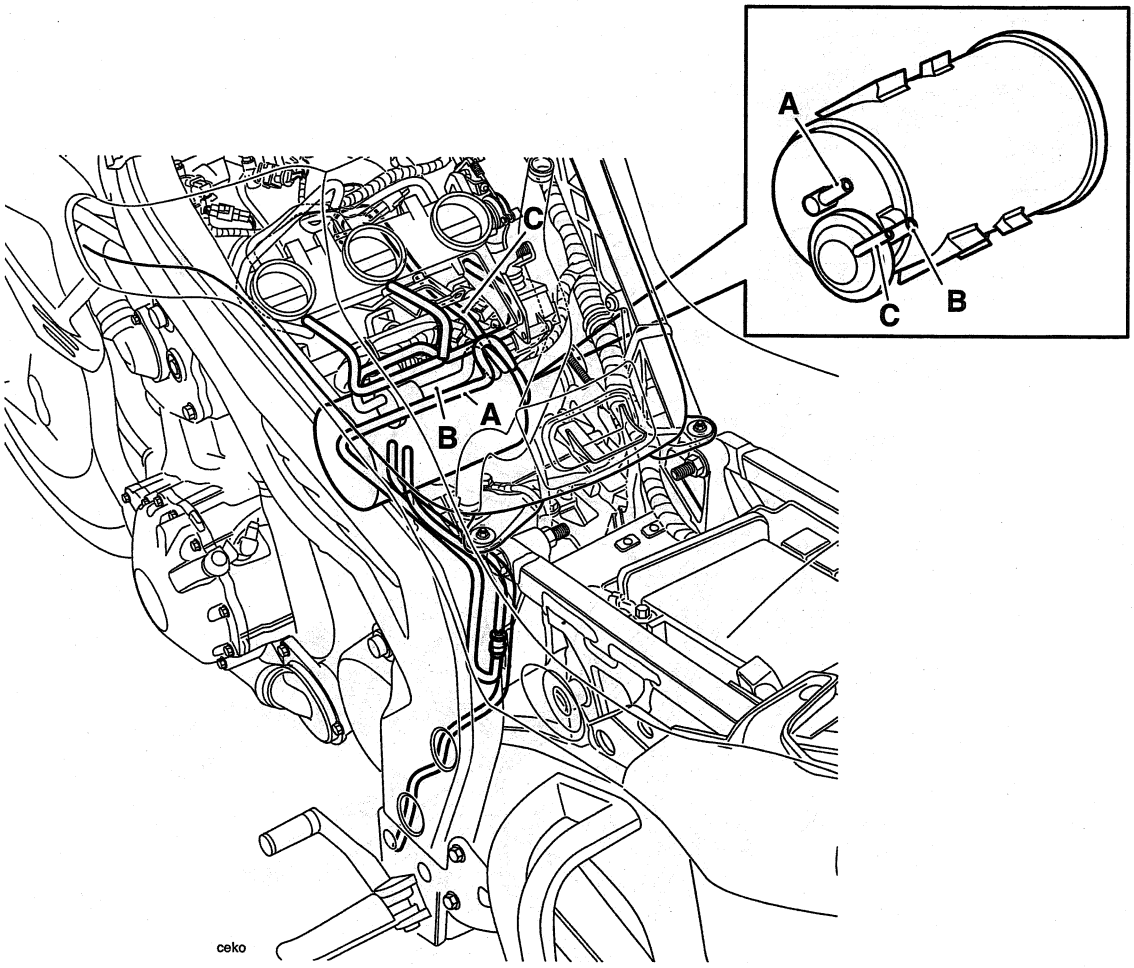
## Clutch Cable Routing



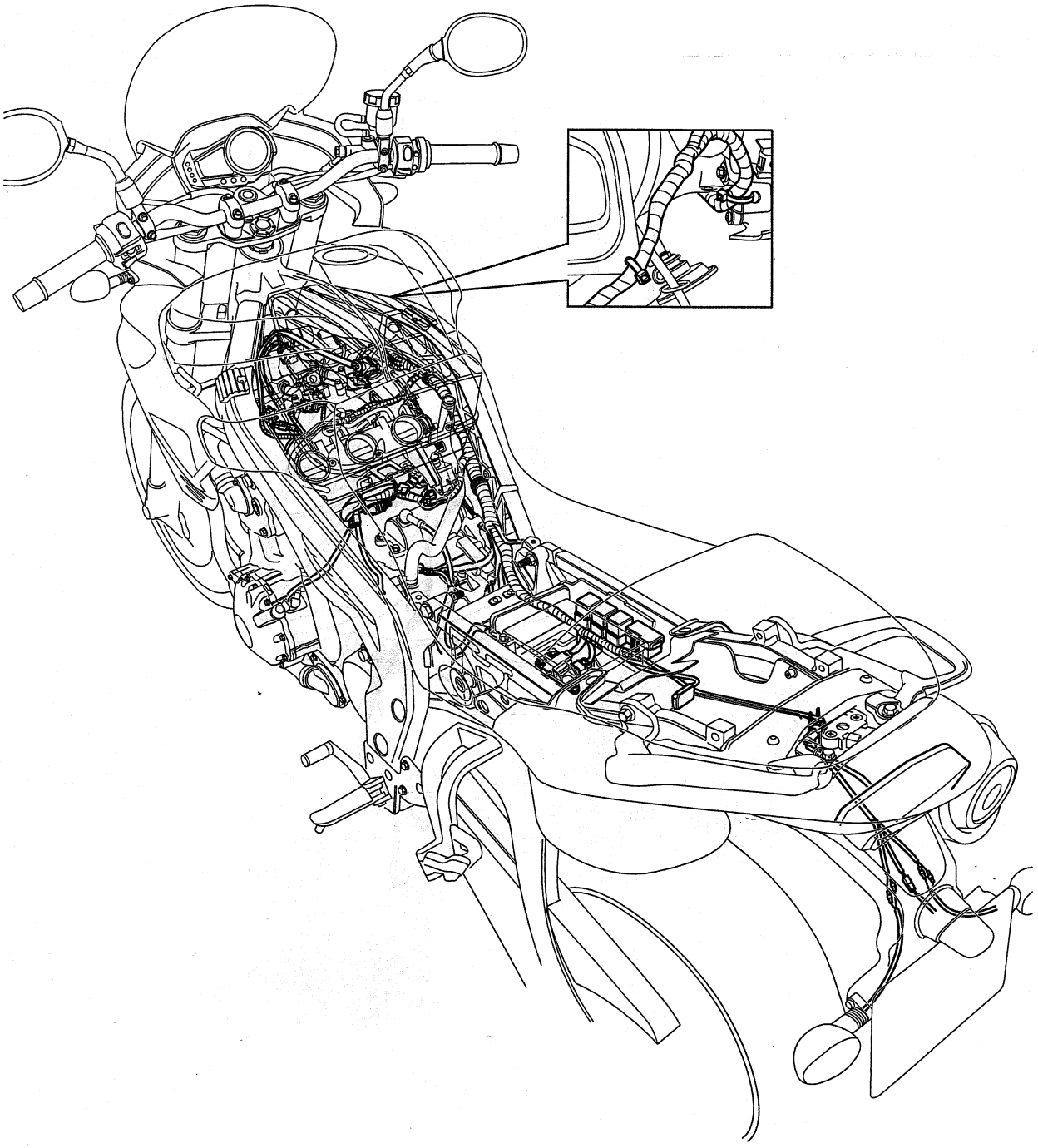
## Fuel Tank Breather Hose Routing - Models without Evaporative Emissions



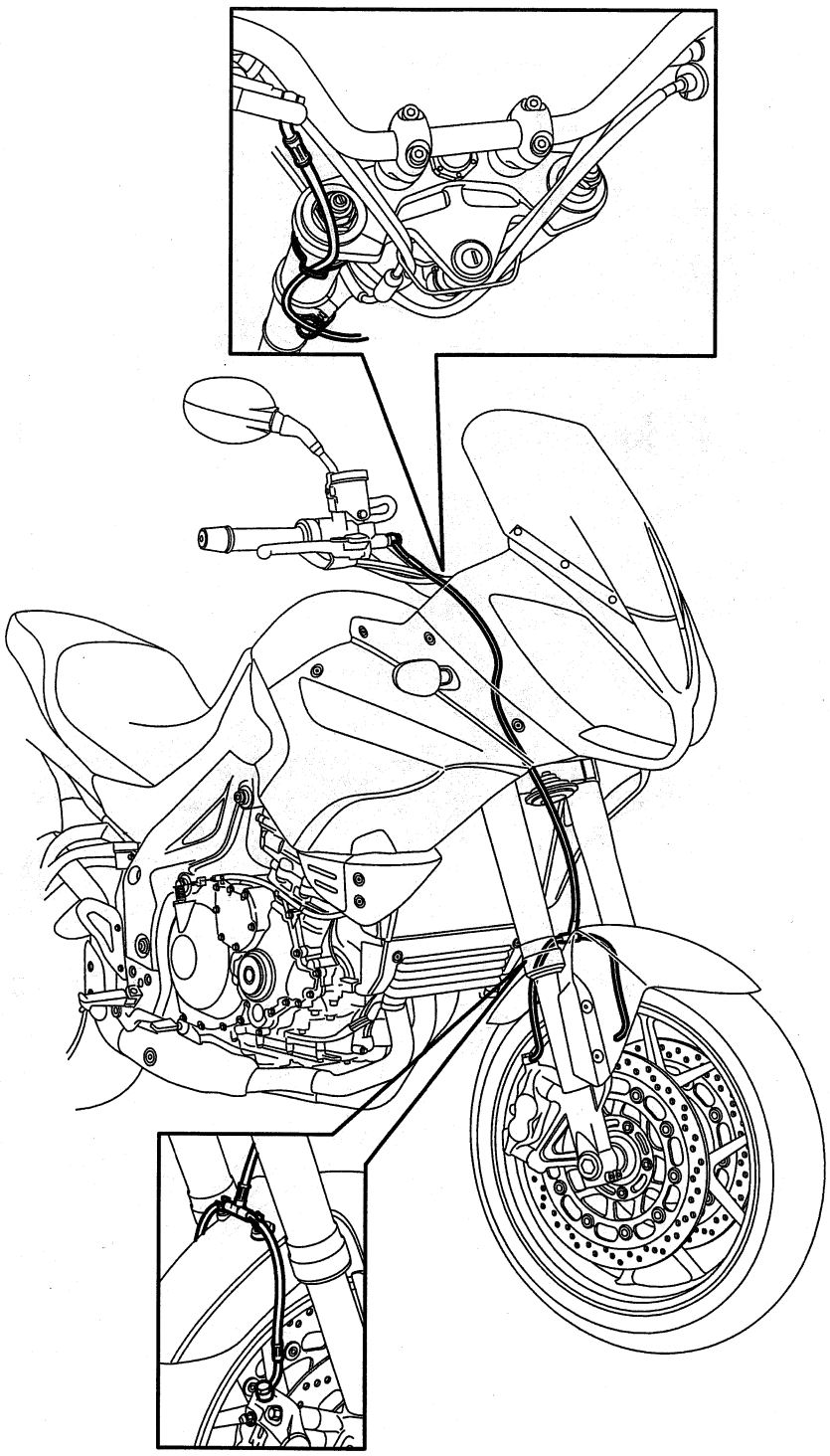
## Fuel Tank Breather Hose Routing - Models with Evaporative Emissions



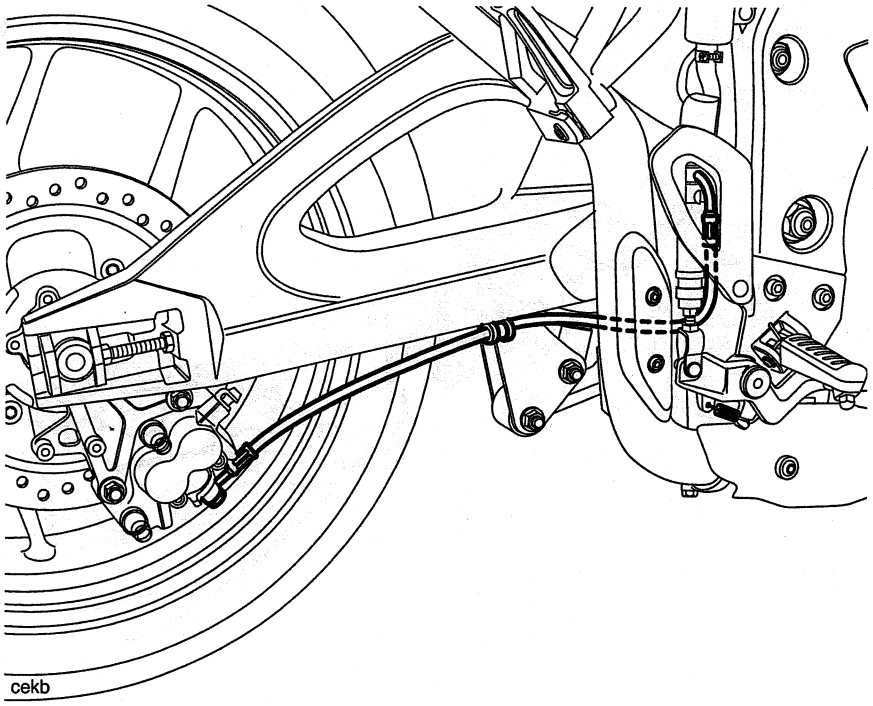
## Main Wiring Harness Routing



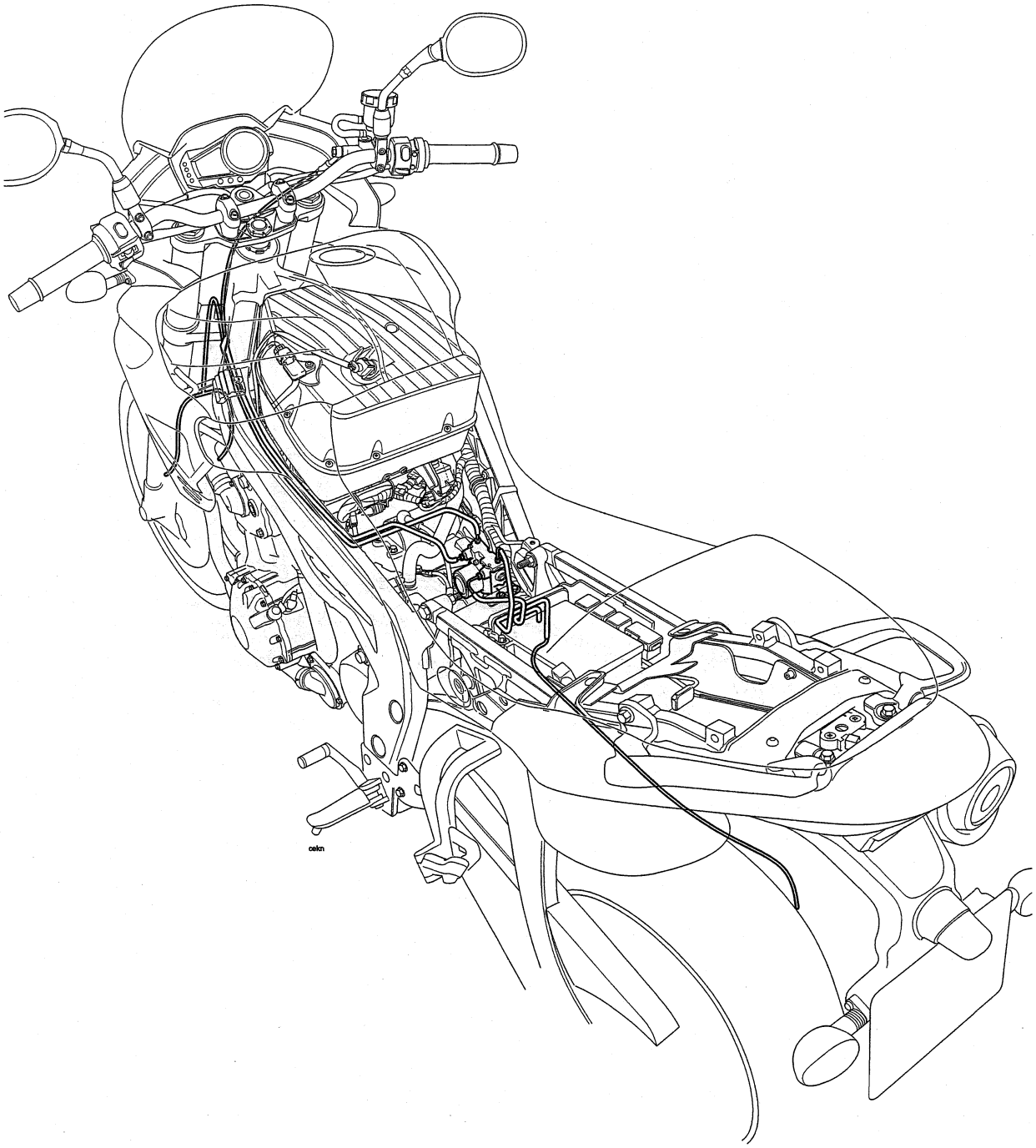
## Front Brake Hose Routing - Models without ABS Brakes



## Rear Brake Hose Routing - Models without ABS Brakes



## Brake Hose Routing - Models with ABS Brakes



# 2 Scheduled Maintenance

## Table of Contents

## Introduction

To maintain the motorcycle in a safe and reliable condition, the maintenance and adjustments outlined in this section must be carried out as specified in the schedule of daily checks, and also in line with the scheduled maintenance chart.

Weather, terrain and geographical location affects maintenance. The maintenance schedule should be adjusted to match the particular environment in which the vehicle is used and the demands of the individual owner. For advice on adjusting the service schedule, consult your authorised Triumph dealer.

**Warning**

In order to correctly carry out the maintenance items listed in the scheduled maintenance chart, special tools and specialist knowledge will be required. As only an authorised Triumph dealer will have this knowledge and equipment, Triumph strongly recommends that your authorised Triumph dealer carries out all scheduled maintenance.

A dangerous riding condition could result from incorrect maintenance leading to loss of motorcycle control and an accident.

**Warning**

All maintenance is vitally important and must not be neglected. Incorrect maintenance or adjustment may cause one or more parts of the motorcycle to malfunction. A malfunctioning motorcycle is dangerous and may lead to an accident.

**Warning**

Triumph Motorcycles cannot accept any responsibility for damage or injury resulting from incorrect maintenance or improper adjustment carried out by the owner.

Since incorrect or neglected maintenance can lead to a dangerous riding condition, always have an authorised Triumph dealer carry out the scheduled maintenance of this motorcycle.

## Scheduled Maintenance Chart

| Operation Description | Odometer Reading in Miles (Kms) or time period, whichever comes first. | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Every | 500 (800) 1 month | 6,000 (10000) 1 year | 12,000 (20000) 2 years | 18,000 (30000) 3 years | 24,000 (40000) 4 years | 30,000 (50000) 5 years | 36,000 (60000) 6 years |
| Engine & oil cooler - check for leaks | Day | • | • | • | • | • | • | • |
| Engine oil - renew | - | • | • | • | • | • | • | • |
| Engine oil filter - renew | - | • | • | • | • | • | • | • |
| Valve clearances - check | - | | | • | | • | | • |
| Air cleaner - renew | - | | | • | | • | | • |
| Engine ECM - check for stored DTCs | - | • | • | • | • | • | • | • |
| Spark plugs - check | - | | • | | • | | • | |
| Spark plugs - renew | - | | | • | | • | | • |
| Throttle bodies - balance | - | | • | • | • | • | • | • |
| Throttle cables - check/adjust | Day | • | • | • | • | • | • | • |
| Cooling system - check for leaks | - | • | • | • | • | • | • | • |
| Coolant level - check/adjust | - | • | • | | • | | • | |
| Coolant - renew | - | | | • | | • | | • |
| Fuel system - check for leaks | Day | • | • | • | • | • | • | • |
| Lights, instruments & electrical systems - check | Day | • | • | • | • | • | • | • |
| Steering - check for free operation | Day | • | • | • | • | • | • | • |
| Headstock bearings - check/adjust | - | • | • | • | • | • | • | • |
| Headstock bearings - lubricate | - | | | • | | • | | • |
| Forks - check for leaks/smooth operation | Day | • | • | • | • | • | • | • |
| Fork oil - renew | - | | | | | • | | |
| Brake fluid levels - check | Day | • | • | • | • | • | • | • |
| Brake fluid - renew | Every 2 years | | | | | | | |
| Brake pad wear - check | Day | • | • | • | • | • | • | • |
| Brake master cylinders - check for leaks | - | • | • | • | • | • | • | • |
| Brake calipers - check for leaks and seized pistons | - | • | • | • | • | • | • | • |
| Drive chain - lubricate | Every 200 miles (300 kms) | | | | | | | |
| Drive chain - wear check | Every 500 miles (800 kms) | | | | | | | |
| Drive chain slack - check/adjust | Day | • | • | • | • | • | • | • |
| Drive chain rubbing strip - check | - | | • | • | • | • | • | • |
| Fasteners - inspect visually for security | Day | • | • | • | • | • | • | • |
| Wheels - inspect for damage | Day | • | • | • | • | • | • | • |
| Tyre wear/tyre damage - check | Day | • | • | • | • | • | • | • |
| Tyre pressures - check/adjust | Day | • | • | • | • | • | • | • |
| Clutch cable - check/adjust | Day | • | • | • | • | • | • | • |
| Stand – check operation | Day | • | • | • | • | • | • | • |
| Secondary exhaust clamp bolt - check/adjust | - | • | • | • | • | • | • | • |

| Operation Description | Odometer Reading in Miles (Kms) or time period, whichever comes first. | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Every | 500 (800) 1 month | 6,000 (10000) 1 year | 12,000 (20000) 2 years | 18,000 (30000) 3 years | 24,000 (40000) 4 years | 30,000 (50000) 5 years | 36,000 (60000) 6 years |
| Secondary air injection system - check | - | | | • | | • | | • |
| Fuel and evaporative loss* hoses - renew | - | | | | | • | | |

*Evaporative system fitted to California models only

# 3 Cylinder Head

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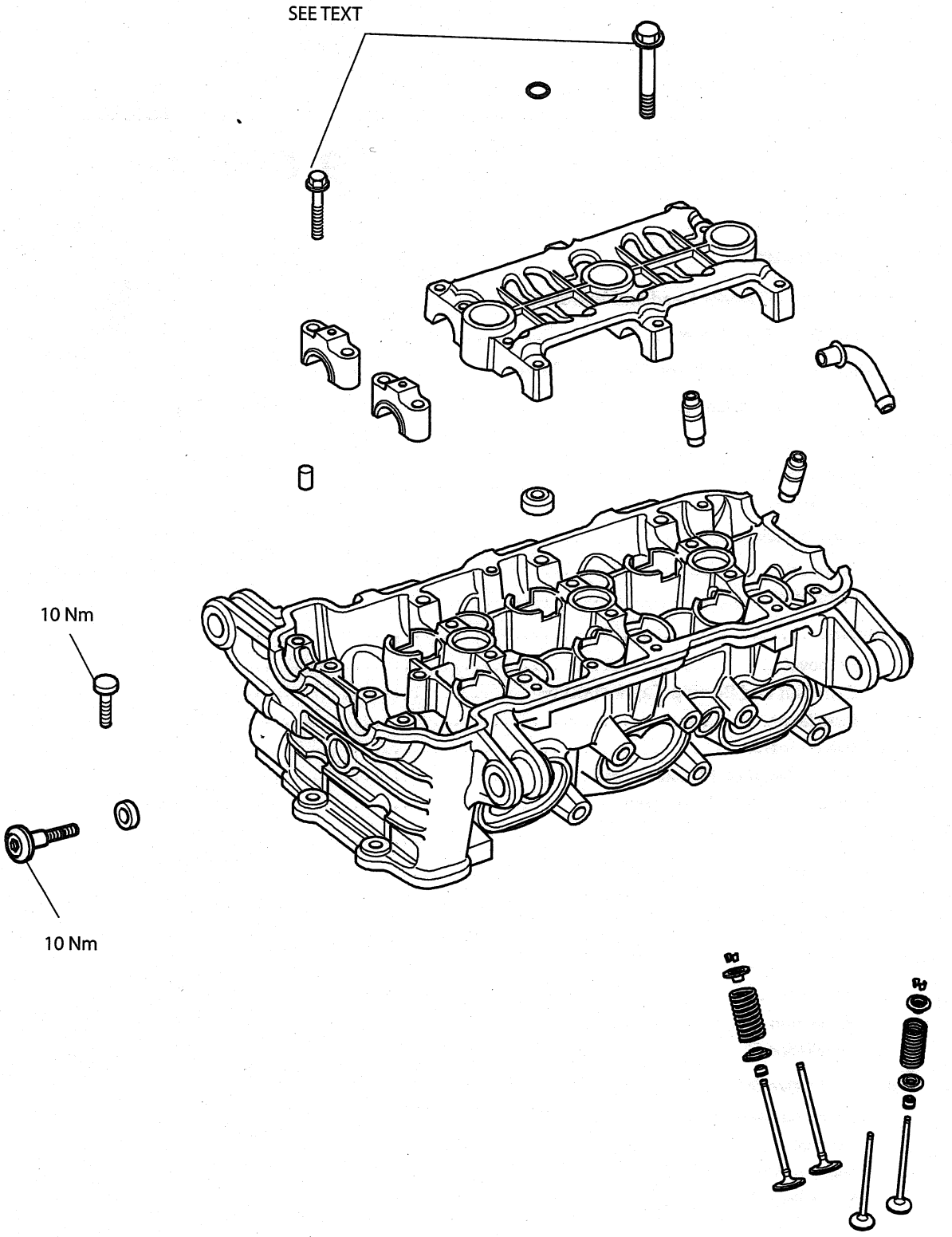
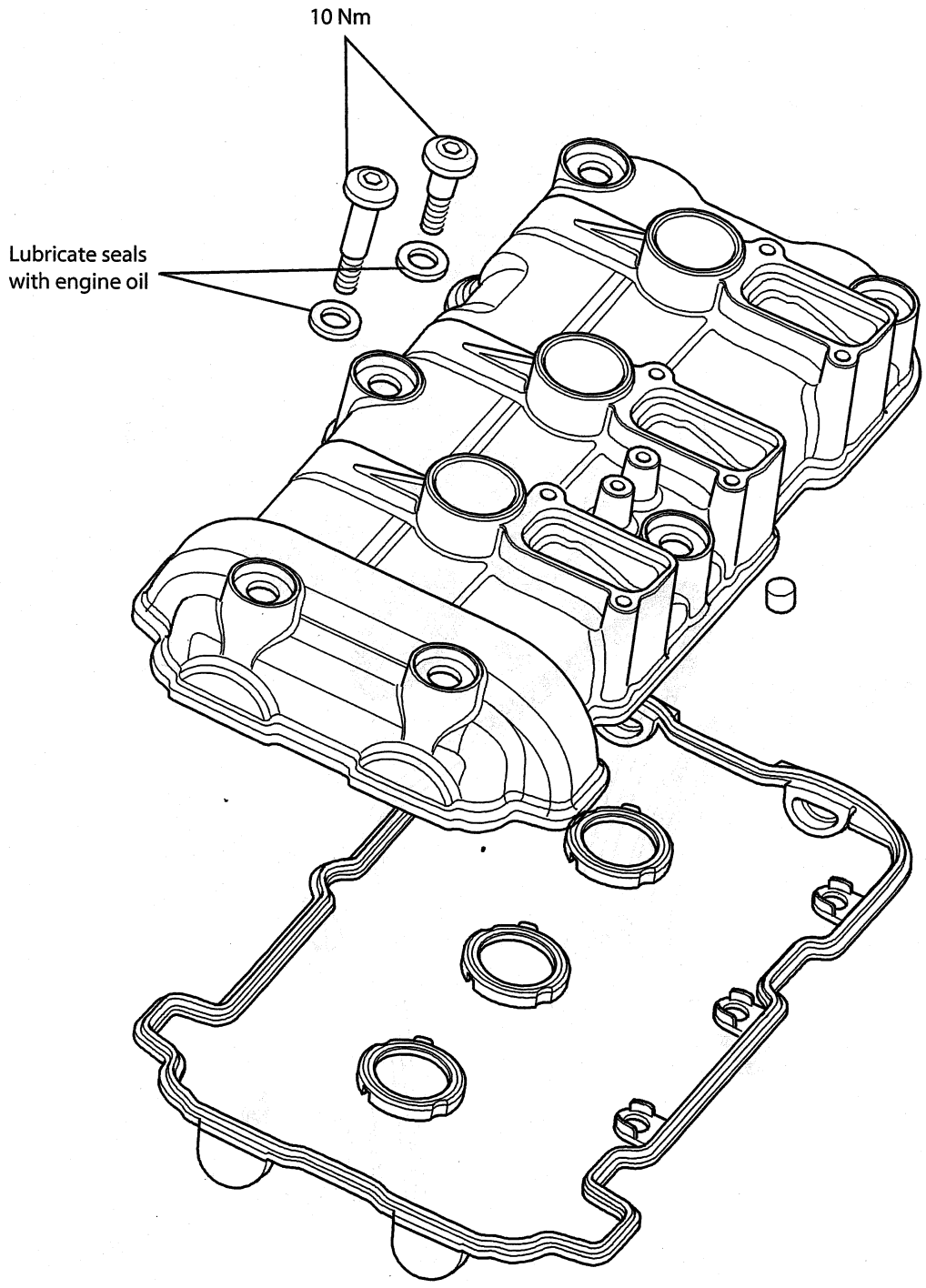
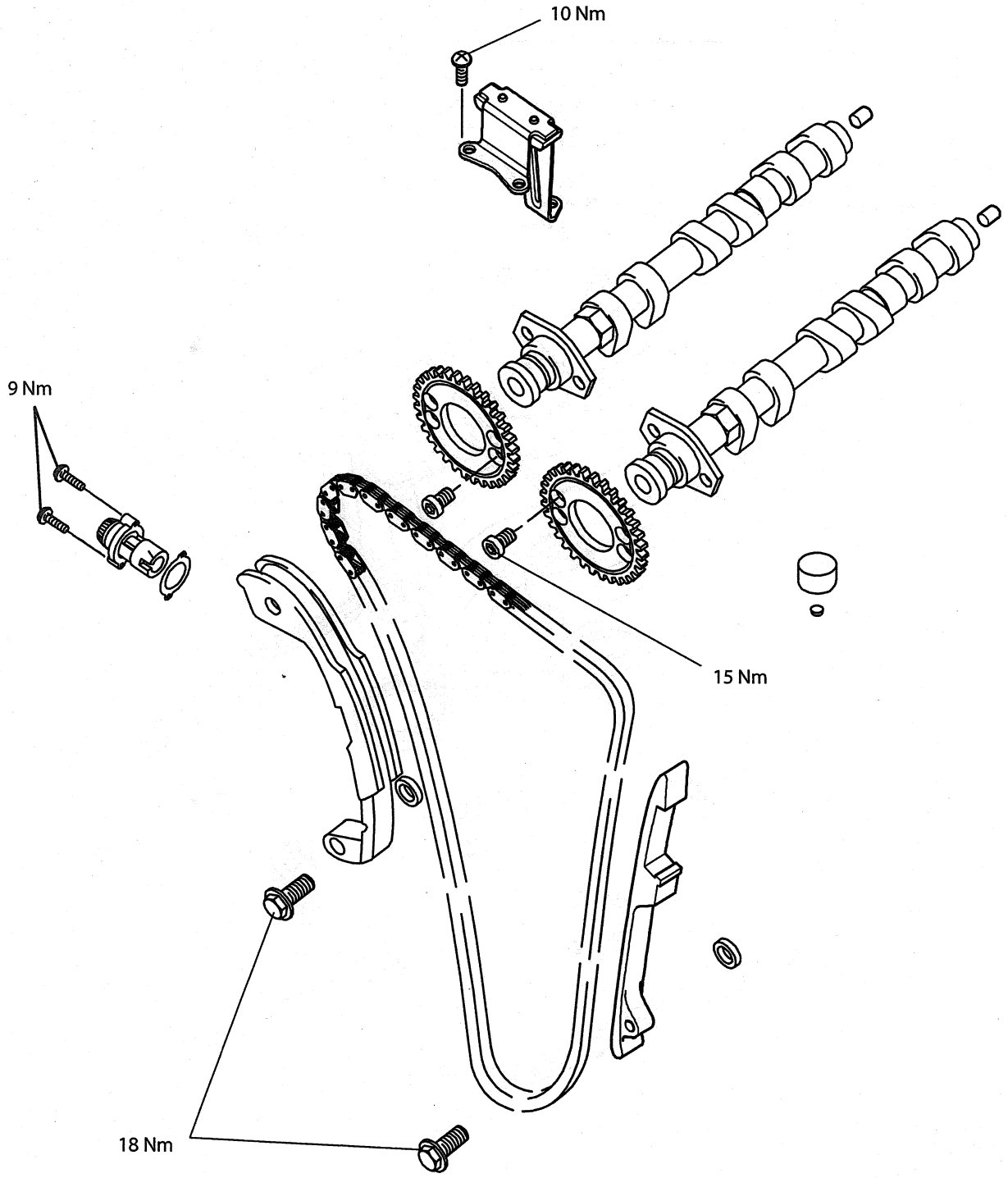
## Exploded View - Cylinder Head and Valves



## 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 camshafts, 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 separate bearings. Valve clearances are adjusted by changing variable thickness shims which sit between the valve tappet bucket and the valves.

The camshafts are driven by a silent-type chain. The cam chain is tensioned by a spring loaded device fitted in the cylinder head, 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.

Single valve springs are used to close the inlet valves and single springs to close the 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 seat and valve guides to the head, these parts cannot be replaced.

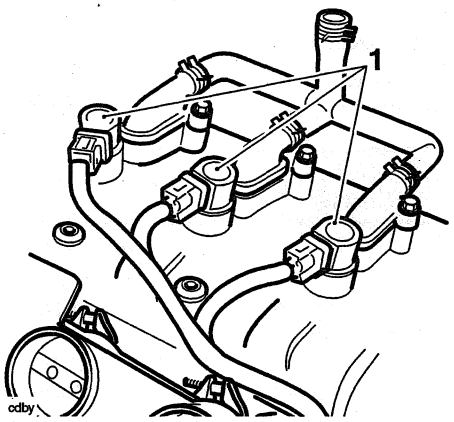
**⚠ Caution**

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

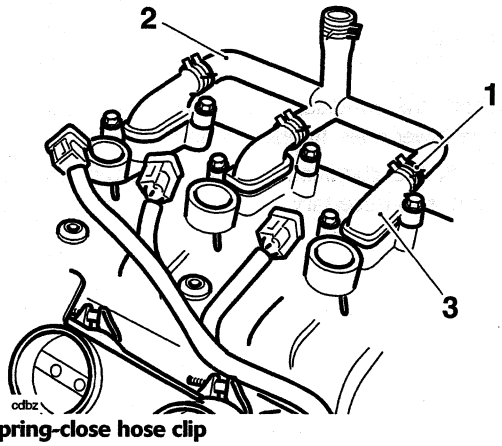
### Removal

1. Remove the seat (see page *16-9.*).
2. Disconnect the battery, negative (black) lead first.
3. Remove the side panels (see page *16-10*).
4. Remove both side fairings (see page *16-13*).
5. Remove the fuel tank (see page *10-99*).
6. Remove the airbox (see page *10-104*).
7. Remove the secondary air injection solenoid valve (see page *10-123*).
8. Remove the ignition coils from the head by pulling them upwards.




**1. Coils**

9. Detach the secondary air injection hose from the reed valves on top of the cam cover (see page *10-123*).

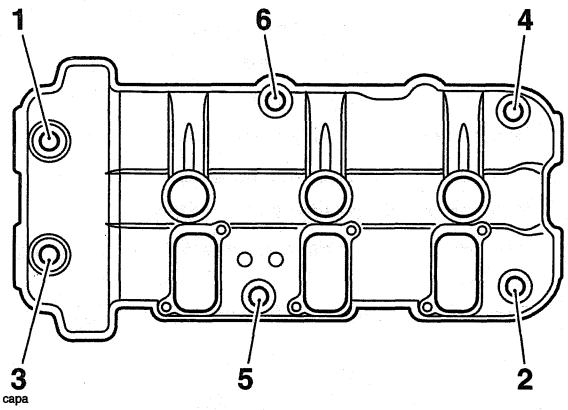



**1. Spring-close hose clip**
**2. Secondary air injection hose**
**3. Reed valve assembly**

10. Release the throttle cables at the throttle bodies (see page *10-111*).
11. Progressively release the cam cover bolts in the sequence shown below.

**Note:**

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



capa

**Cam cover bolt release sequence**

12. Ease the water hoses to allow the cover to be removed from the left hand side of the motorcycle.

**Caution**

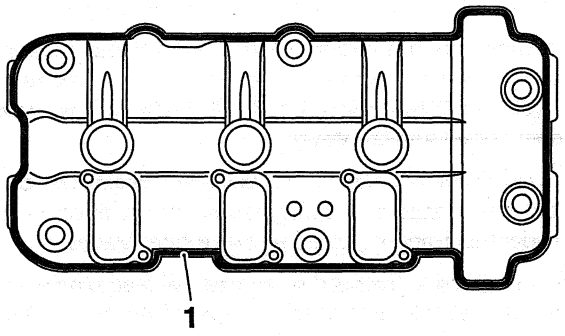
Never use a lever to remove the camshaft cover from the head.

Using a lever will cause damage to the head and cam cover which could lead to an oil leak.

13. Remove the cam cover gasket and plug tower seals. If necessary, recover the dowels from the secondary air injection holes in the head (these may come away in the cover or gasket).
14. Remove any residual oil from the front of the head using a syringe or lint free cloth.

## Installation

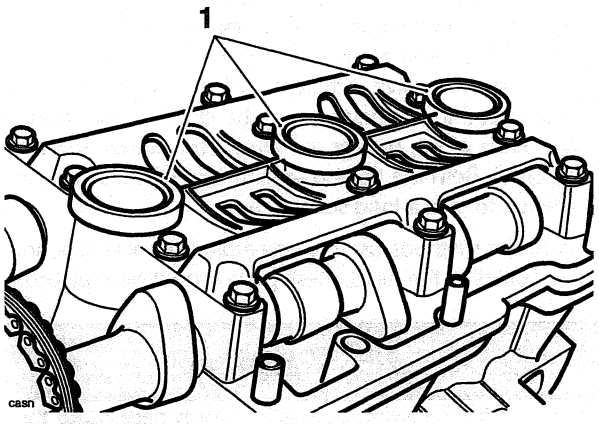
1. Check the condition of the cam cover gasket and plug tower seals. Replace as necessary.
2. Check the condition of the cam cover bolt seals. Replace as necessary.
3. Fit the cam cover seal to the groove in the cam cover.



capb

**1. Cam cover seal groove**

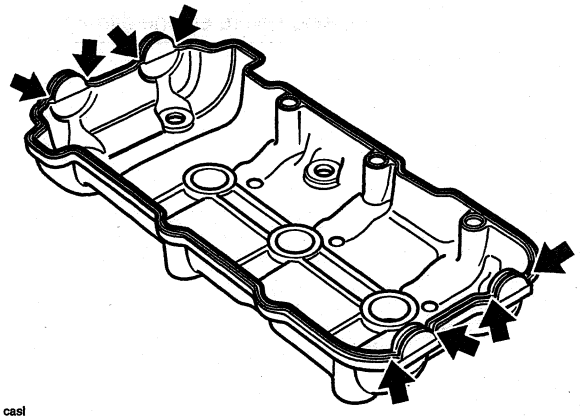
4. Fit the plug tower seals to the cam cap ladder.



casn

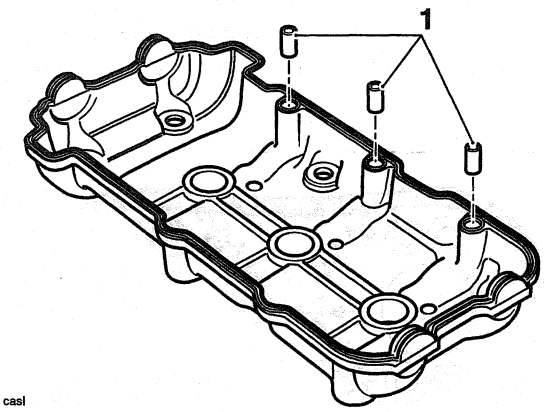
**1. Plug tower seals**

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


casl

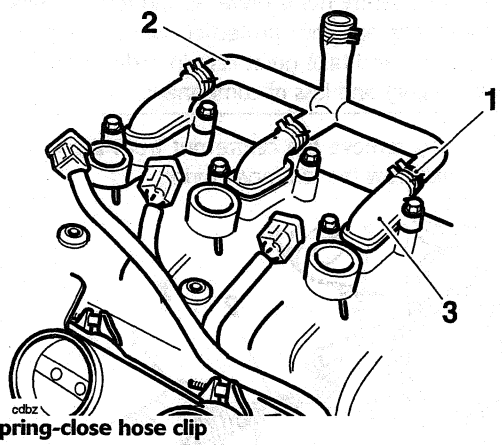
6. Fit the cam cover, ensuring that the gasket and seals remain in the correct positions.

7. Refit the dowels to the cam cover before locating it to the head.



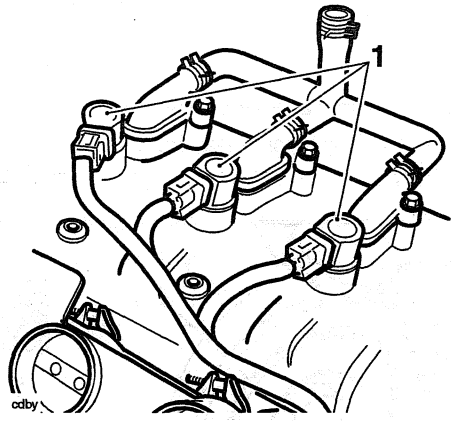

**1. Dowels**

8. Lubricate the screw seals with clean engine oil prior to installation.
9. Fit the cam cover screws and screw seals, then tighten until finger tight.
10. Finally, tighten the cam cover screws, in the same order as for removal, to **10 Nm.**
11. Refit the throttle cables and adjust (see page *10-112*).
12. Refit the secondary air injection hose to the reed valves (see page *10-124*).




**1. Spring-close hose clip**
**2. Secondary air injection hose**
**3. Reed valve assembly**

13. Fit the ignition coils and reconnect.



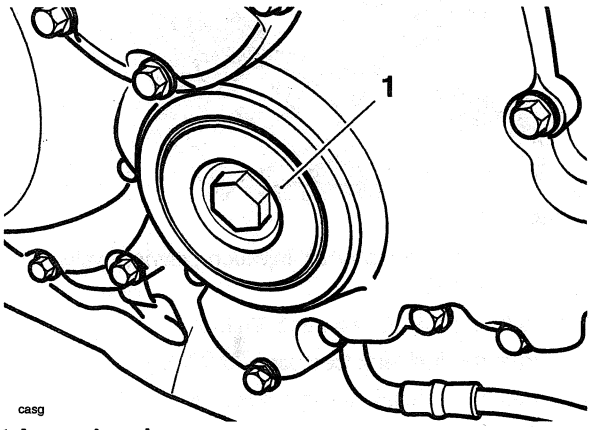

**1. Coils**

14. Refit the secondary air injection solenoid valve (see page *10-123*).
15. Refit the airbox (see page *10-106*).
16. Refit the fuel tank (see page *10-100*).
17. Refit the side fairings (see page *16-13*).
18. Refit the side panels (see page *16-10*).
19. Reconnect the battery, positive (red) lead first.
20. Refit the seat (see page *16-9*).

## Cam Chain Tensioner

### Removal

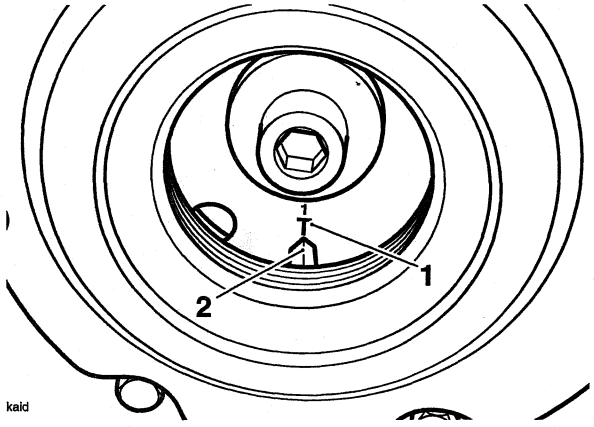
1. Remove the cam cover (see page *3-5*).
2. Remove the inspection plate from the right hand crank cover.




casg

**1. Inspection plate**

3. Rotate the crankshaft clockwise (the normal direction of rotation), using the bolt 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 sprag clutch aligns with the line at the bottom of the cover.

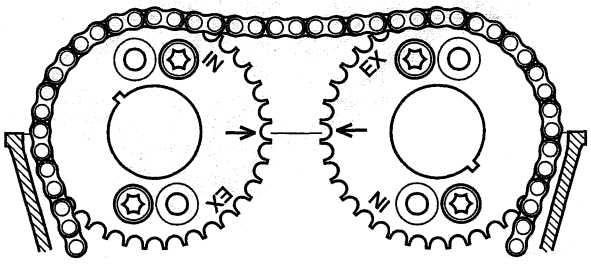



kaid

**1. 'T1' Mark**
**2. Marker line**

**Note:**

- **In addition to the 'T1' mark alignment, at TDC, the alignment marks on the camshaft sprockets will point inwards at a point level with the joint face.**



gaaa

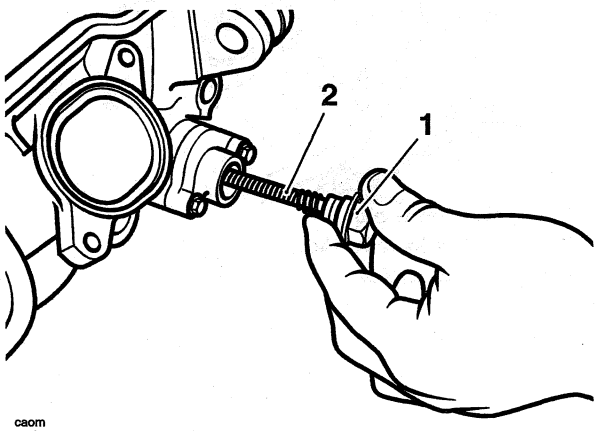
**Camshaft to Cylinder Head Alignment Marks**

4. Place a suitable wedge between the tensioner blade and crankcase, to hold the cam chain taut during removal of the tensioner.

**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.

5. Carefully remove the centre nut from the tensioner and withdraw the tensioner spring.



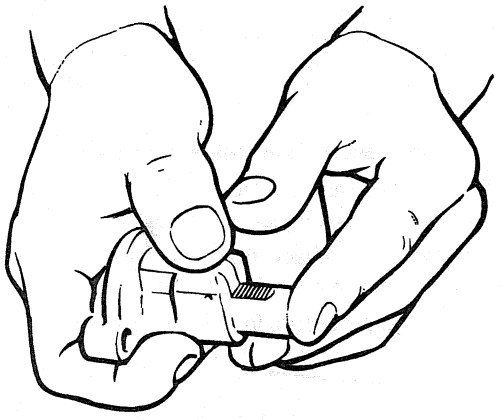

caom

**1. Centre nut**
**2. Spring**

6. Remove the bolts securing the tensioner to the cylinder head. 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 cam chain. Check that the camshaft timing marks point inwards and are level with the joint face of the head.
3. Set the tensioner plunger onto the first tooth of the ratchet (i.e. minimum extension) by manually lifting the tensioner pawl.



gabh

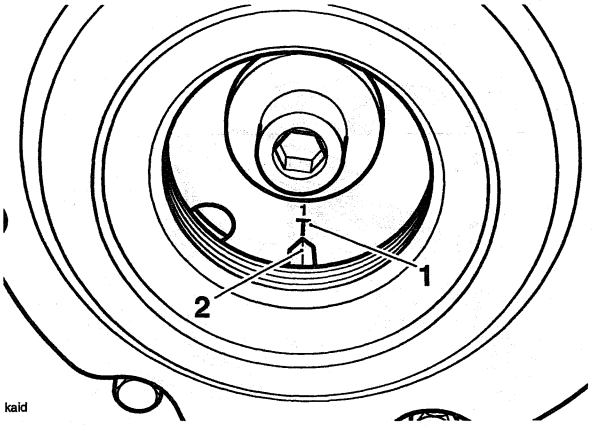
**Tensioner Plunger Set-up**

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

**Note:**

- **If fitting a new tensioner, observe the following:**
- **Remove the new tensioner assembly from the packaging. On examination, it can be seen that the tensioner nut will not be tightened fully into the tensioner body and that the tensioner 'nose' (i.e., the part which actually contacts the chain rubbing strip) is fully retracted into the housing.**
- **Prior to assembly into the engine it is necessary to disassemble the tensioner nut, washer and spring. To do this without damaging the internal components, turn the tensioner nut at least a half turn clockwise (i.e. tighten it further into the housing) until the plunger springs outwards. The tensioner nut can then be withdrawn safely without causing internal damage to tensioner components.**

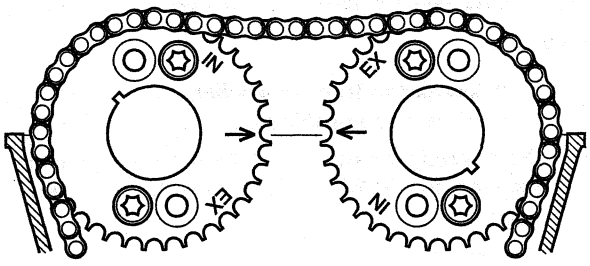
5. Remove the tensioner blade wedge, taking care not to move or damage the tensioner blade.
6. Fit a new sealing washer to the centre nut. Using finger pressure only, push the ratchet section of the tensioner into firm contact with the tensioner blade. Refit the spring and centre nut to the tensioner. Tighten the centre nut to **23 Nm.**
7. Check that the tensioner plunger is correctly located in the middle of the 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 sprag clutch aligns with the line at the bottom of the cover.




kaid

**1. 'T1' Mark**
**2. Marker line**

9. Check that the camshaft timing marks align as illustrated below.




gaaa

**Camshaft to Cylinder Head Alignment Marks**

10. Re-check the tensioner plunger location against the tensioner blade.
11. Refit the cam cover (see page *3-6*).
12. Check the O-ring in the crank cover inspection plate. Renew as necessary.
13. Refit the crank cover inspection plate, tightening it to **18 Nm.**

## Camshafts

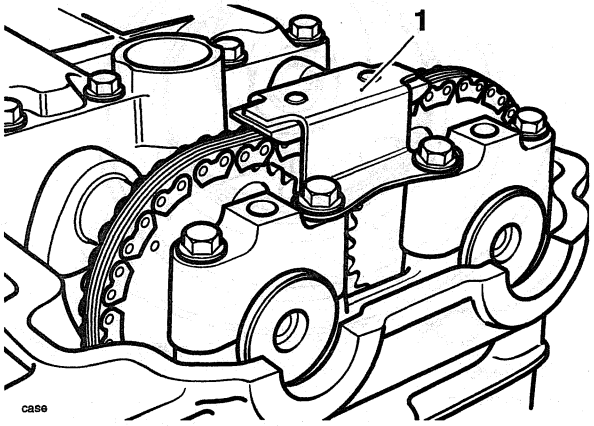
## Removal

1. Remove the cam chain tensioner (see page *3-8*).

**Note:**

- **It is not necessary to remove the cam chain completely.**
- **Each camshaft and sprocket is removed as an assembly.**
- **Before commencing work, ensure the crankshaft T1 mark is in alignment with the line in the crank cover inspection plate.**

2. Remove the cam chain top pad from the cam caps and cylinder head.



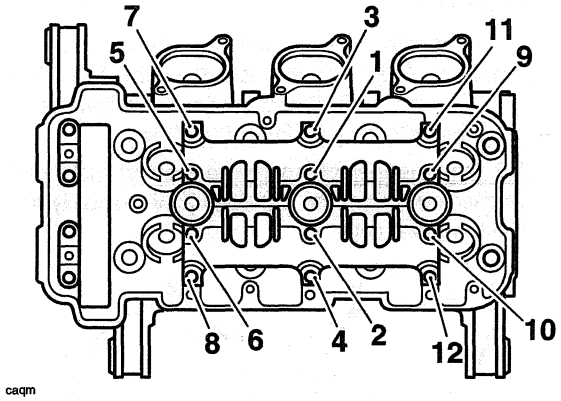

**1. Cam chain top pad**
**2. Cam caps**

3. To ensure that all components are refitted in the same positions as prior to removal, mark the position of each cam cap and the orientation of the cam bearing ladder in relation to the head.

**Note:**

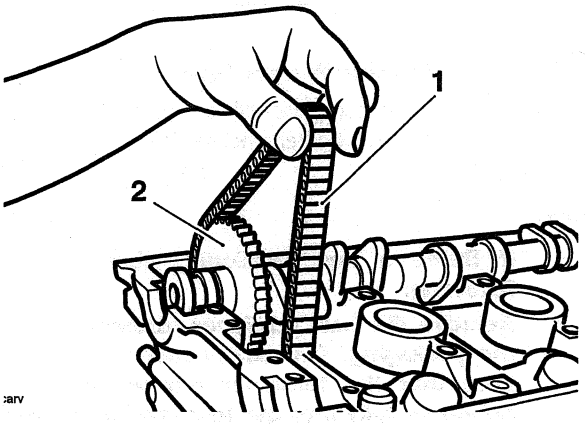
- **A laundry marker or similar may be used to mark the cap positions.**

4. Progressively release each of the remaining fasteners securing the individual cam caps to the cylinder head.
5. Remove the caps.
6. Progressively release the bolts securing the cam cap ladder to the head in the sequence shown below.




**Cam Ladder Bolt Release Sequence**

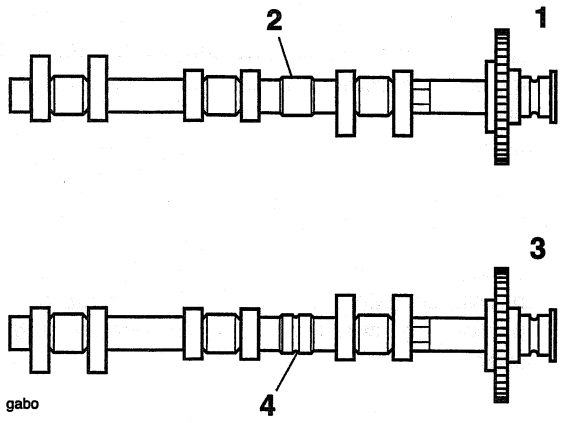
7. Remove the cam cap ladder and collect the dowels (if loose) and spark plug tower O-rings.
8. Lift the cam chain from the exhaust camshaft sprocket and remove the exhaust camshaft.
9. Repeat the procedure for the inlet camshaft.




**1. Cam chain**
**2. Inlet camshaft**

**Note:**

- **The inlet and exhaust camshafts are different. They can be identified by a plain section 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**

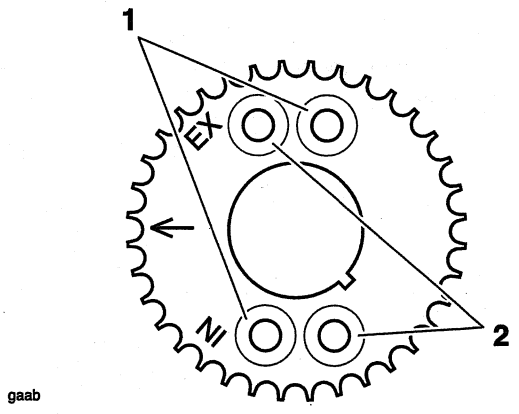
## Camshaft and Bearing Cap Inspection

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**

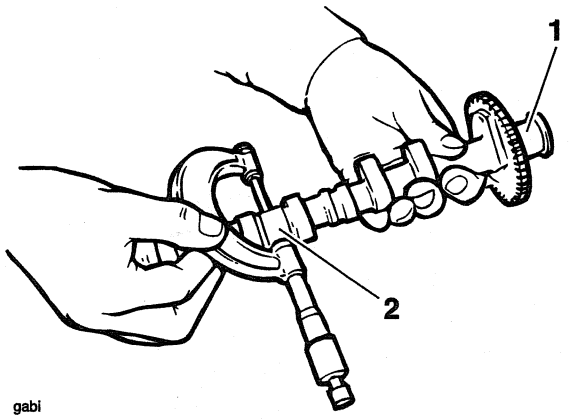
2. Measure the camshaft journals with a micrometer. If any journal is outside the specified tolerance, replace the camshaft.

**Outrigger Journal Diameter**

| | |
|---|---|
| Standard: | 22.953 - 22.956 mm |

**Standard Journal Diameters**

| | |
|---|---|
| Standard: | 22.93 - 22.96 mm |



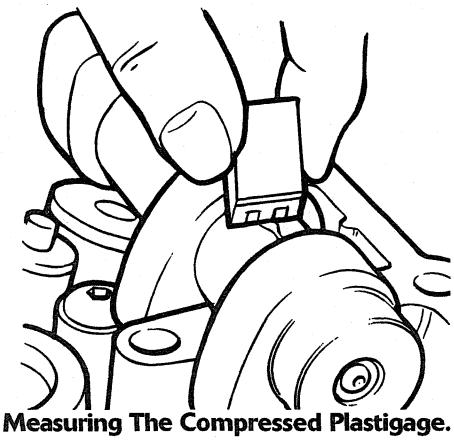

**1. Outrigger journal**
**2. Standard journal**

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 'Plastigage' (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 and cam cap ladder to 10 Nm.**
   - **Remove the cam cap and cam cap ladder using the bolt release sequence given earlier. Wipe the exposed areas of both the camshaft journal and a single cap or cap area of the ladder.**
   - **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 Plastigage to fit across the camshaft journal. Fit the Plastigage to the camshaft journal using the grease to hold the strip in place.**
   - **Refit the cap and cam cap ladder then evenly and progressively tighten all the camshaft cap and ladder bolts to 10 Nm in the correct sequence (see camshaft installation).**

- Release the cap bolts and remove the cap/ladder. Using the gauge provided with the Plastigage kit, measure the width of the now compressed Plastigage.

**Note:**

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



**Measuring The Compressed Plastigage.**

- Calculate the journal clearance using the Plastigage chart supplied with the Plastigage kit.

**Camshaft journal clearance, Standard**

| | |
|---|---|
| Standard: | 0.040 - 0.091 mm |
| Service limit: | 0.13 mm |

**Camshaft journal clearance, Outrigger**

| | |
|---|---|
| Standard: | 0.044 - 0.068 mm |
| Service limit: | 0.13 mm |

- If the clearance measured is within the specified tolerance, remove the cap/ladder and clean off all traces of Plastigage. Assemble the camshafts.

**Note:**

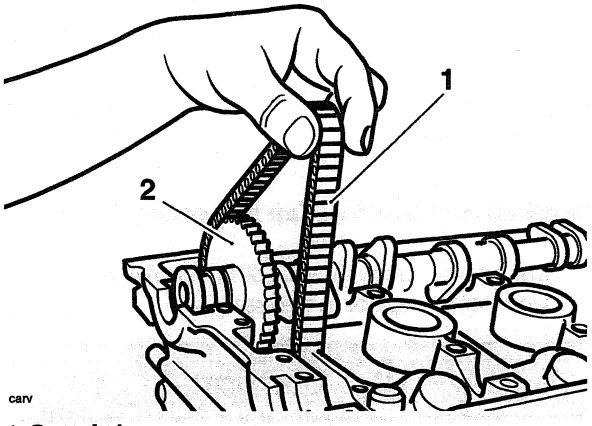
- **If the measured clearance is outside the tolerance, and the camshaft journals are within tolerance, the cylinder head must be replaced.**

**⚠ Caution**

Although Plastigage 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 are 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 and ladder (that is, with the timing marks on the camshaft sprockets level and pointing inwards, and with the 'T1' mark on the sprag clutch in alignment with the line at the bottom of the cover).




carv

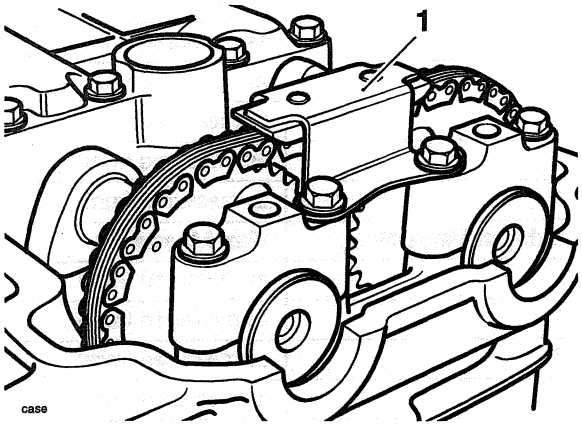
**1. Cam chain**
**2. Inlet camshaft**

4. Repeat the procedure for the other camshaft.

**⚠ Caution**

If the camshafts and caps/ladder are fitted without first aligning the timing marks on both the crankshaft and camshaft sprockets, the inlet and exhaust valves will contact each other causing damage to both the head and the valves.

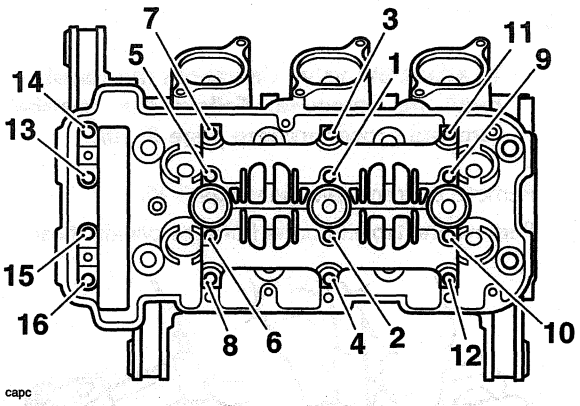
5. Assemble the cam caps, dowels, cam ladder and top pad in the same location and orientation as prior to removal.




case

**1. Cam chain top pad**

6. Fit and evenly tighten the cam cap screws to **10 Nm**, in the sequence shown below.




capc

**Cam-cap and Ladder Bolt Tightening Sequence**

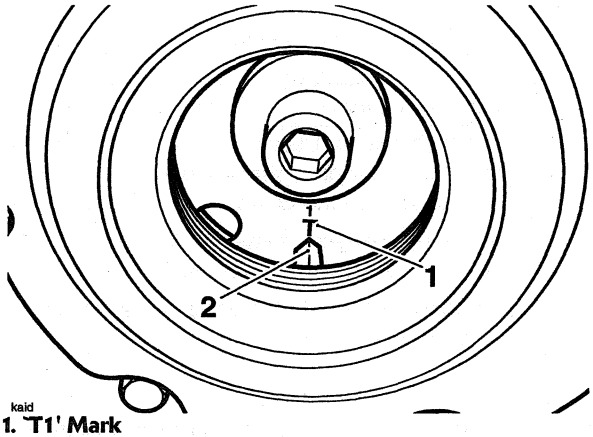
7. Before fitting the cam chain tensioner, ensure that each camshaft rotates freely. Do not rotate either camshaft by more than 5°.

**⚠ 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.

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

9. Rotate the engine through 4 full revolutions, and reset number 1 cylinder to TDC. Ensure that the 'T1' mark on the sprag clutch aligns with the line at the bottom of the cover.

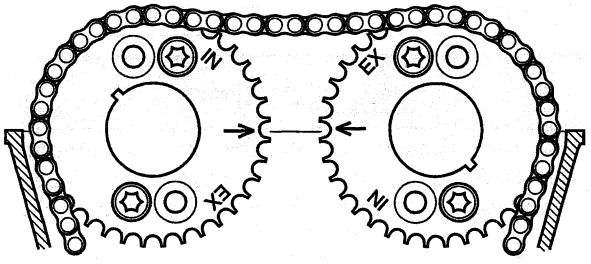



kaid

**1. 'T1' Mark**

**2. Marker line**

10. Check that the camshaft timing marks align as illustrated below. Rectify any misalignment before proceeding.



gaaa

**Camshaft to Cylinder Head Alignment Marks**

11. Check the valve clearances. Adjust as necessary (see page *3-14*).

12. Refit the cam chain tensioner (see page *3-9*).

## 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 tappet bucket, 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 (see page *3-5*).
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.
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.**

| | |
|---|---|
| Inlet: | 0.10 - 0.20 mm |
| Exhaust: | 0.20 - 0.30 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 seat and may cause serious engine damage.

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

**Typical Valve Clearance Chart**

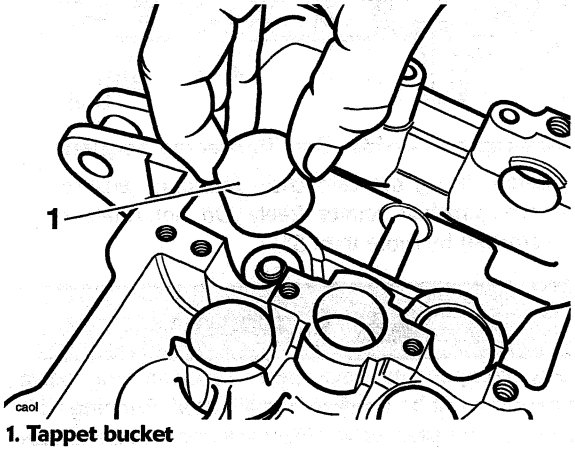
| Inlet Valve No. | Gap Measured |
|---|---|
| 1 | as measured (mm) |
| 2 | as measured (mm) |
| 3 | as measured (mm) |
| 4 | as measured (mm) |
| 5 | as measured (mm) |
| 6 | as measured (mm) |
| **Exhaust Valve No.** | **Gap Measured** |
| 1 | as measured (mm) |
| 2 | as measured (mm) |
| 3 | as measured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

## Valve Clearance Adjustment

**Note:**

- **To adjust the valve clearances the camshafts must be removed. Follow the camshaft removal procedure (see page *3-10*).**

1. Remove the camshafts (see page *3-10*).
2. Remove the tappet bucket from the cylinder head.

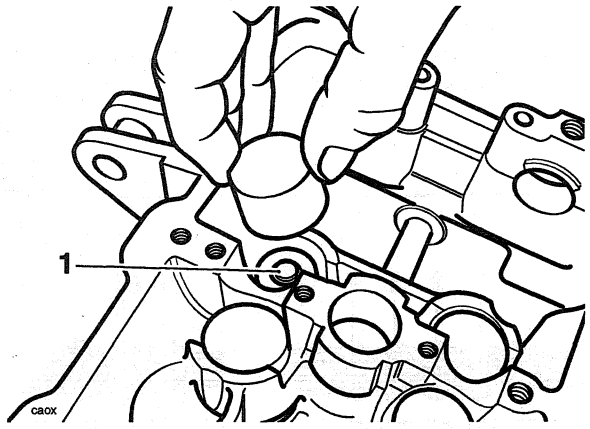



**1. Tappet bucket**

**Note:**

- **The shim may withdraw with the tappet bucket.**

3. Remove the shim from the valve head.




**1. Shim**

4. Measure the original shim, using a micrometer and select the appropriate new shim as required.

Clearance too small:

- **Fit a thinner shim.**

Clearance too large:

- **Fit a thicker shim.**

**Note:**

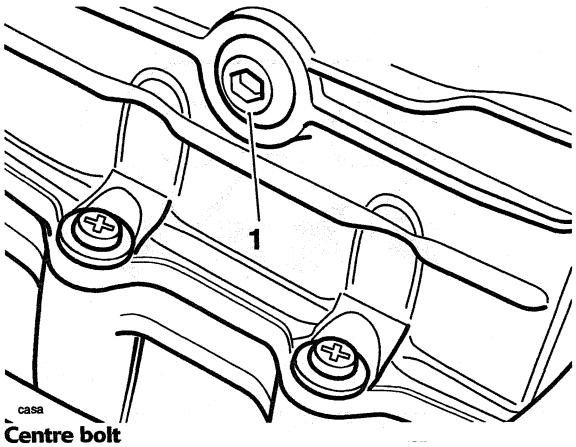
- **Shims are available ranging from 1.70 mm to 3.00 mm in increments of 0.025 mm.**

5. Fit the new shim to the valve head.
6. Lubricate the tappet bucket(s) with a 50/50 solution of engine oil and molybdenum disulphide grease.
7. Refit the tappet bucket.
8. Refit the camshafts (see page *3-12*).
9. Re-check all valve clearances.
10. Repeat the procedure if the valves require further adjustment.

## Cam Chain

### Removal

1. Remove the camshafts (see page *3-10*).
2. Remove the starter gear cover (see page *7-20*).
3. Remove the right hand crank cover (see page *7-20*).
4. Remove the sprag clutch and drive gear (see page *7-20*).
5. Remove the bolt from the centre of the cam chain housing in the cylinder head.



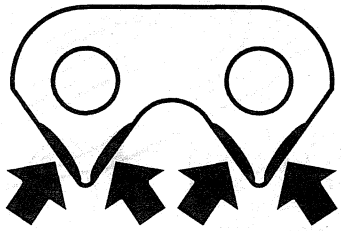

**1. Centre bolt**

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

### Inspection

Visual in-situ checks can also be made as follows:

1. Check for significant blue discolouration of the chain plates indicating excessive heat build-up.
2. Examine all pins for signs of rotation.
3. Check for cracking or deep scratching of the chain plates.
4. Check for severe wear of the inner plates as indicated in the diagram below.



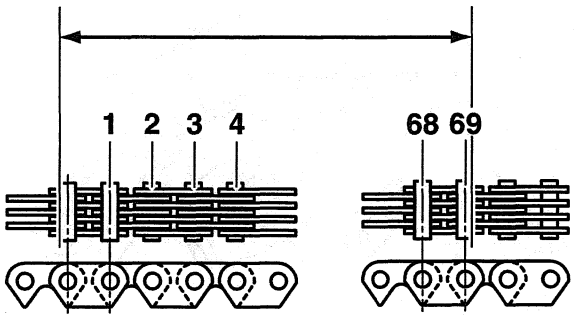
ccrv

For a more thorough check, proceed as follows:

1. Remove the chain from the engine.
2. Suspend the chain from a pin or hook with a 13kg weight attached at the lower end.

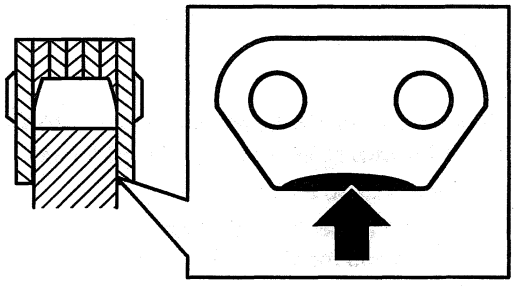
cajs

3. Measure across 23 links as shown in the diagram below. If the chain is within limits, the measurement should be no longer than 150.14 mm. Measurements beyond 150.14 mm indicate that the chain must be replaced.

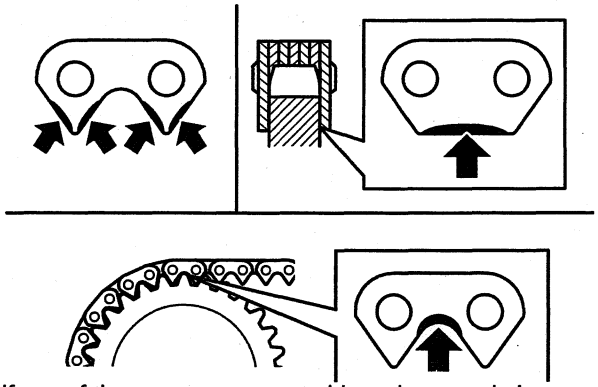



cajt

4. Check for severe wear of the inner surface of the outer plates at the side-contact points with the sprocket teeth.



5. Check for signs of stiffness or kinking.
6. Check for severe wear of the plates in the area shown below.



If any of these symptoms are evident, the cam chain must be replaced.

### Installation

1. Fit the cam chain and locate the lower end around the crankshaft gear.
2. Refit the bolt to the centre of the cam chain housing in the cylinder head, tightening to **10 Nm**.
3. Refit the camshafts (see page *3-12*).

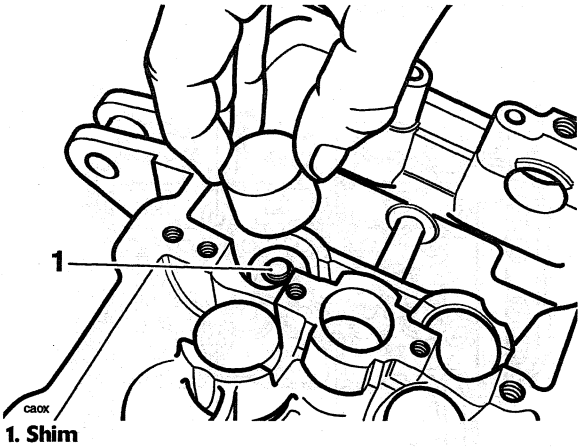
## Cylinder Head

### Removal

**Note:**

- **The rubbing blades for the cam chain protrude from the crankcase such that removal of the head while in the frame is made extremely difficult and may lead to damage to the head, rubbing blades and frame.**

1. Remove the engine from the frame (see page *9-2*).
2. Remove the camshafts (see page *3-10*).
3. Note the position of all tappet buckets and shims such that they can be refitted in the same positions. Remove all the tappet buckets and shims.

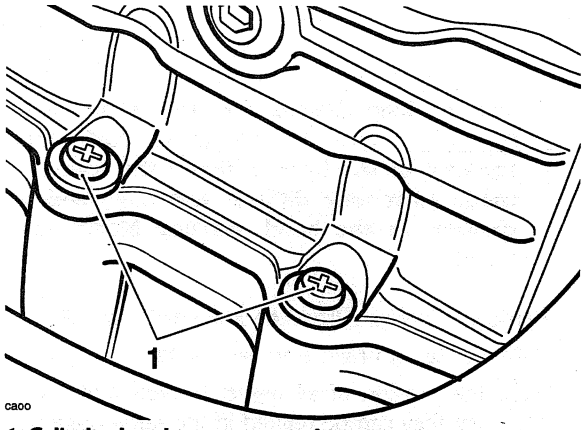



**1. Shim**

**Note:**

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

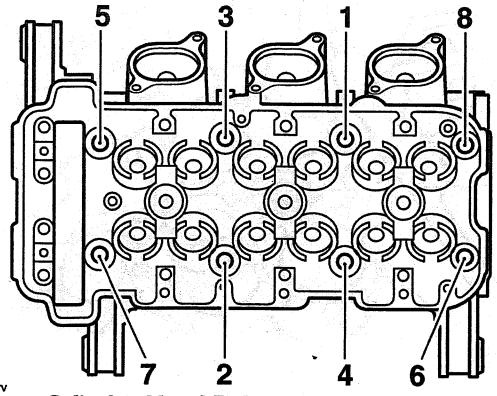
4. Release the screws securing the outside of the cylinder head to the upper crankcase.




caoo

**1. Cylinder head to upper crankcase screws**

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



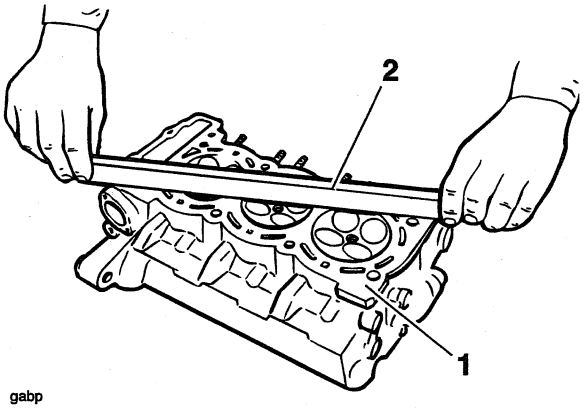

carv

**Cylinder Head Bolt Release Sequence**

6. Lightly tap the cylinder head with a rubber mallet to break the seal of the gasket.
7. Lift the head directly upwards until clear of the cam chain rubbing blades

## 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.



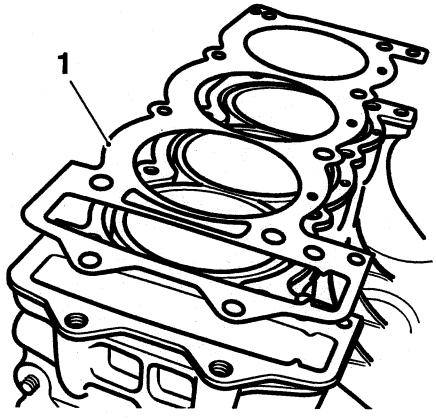

gabp

**1. Straight edge**
**2. Cylinder head gasket face**

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

## Installation

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




cart

**1. Cylinder head gasket**

3. Ensure that the cylinder head face is completely clean.
4. If removed, install the cam chain rubbing strips.
5. Carefully lower the cylinder head over the cam chain and rubbing strips and locate the head onto the dowels.

**Caution**

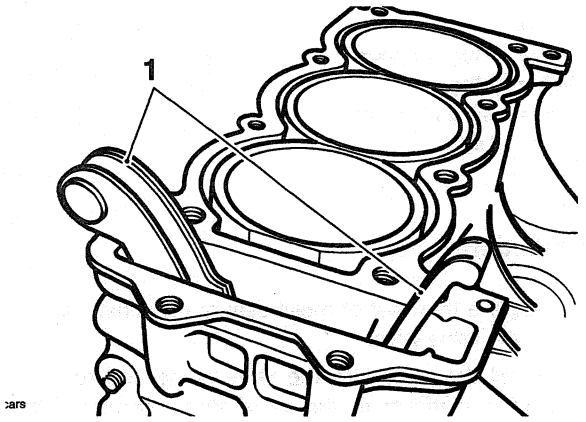
Using the correct procedure to fit and tighten the cylinder head bolts will ensure the long term reliability of the cylinder head gasket.

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.

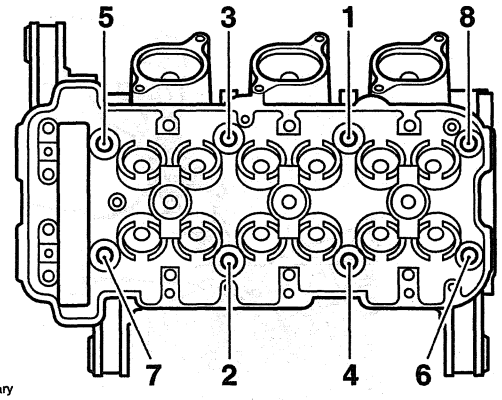



**1. Rubbing strips**

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

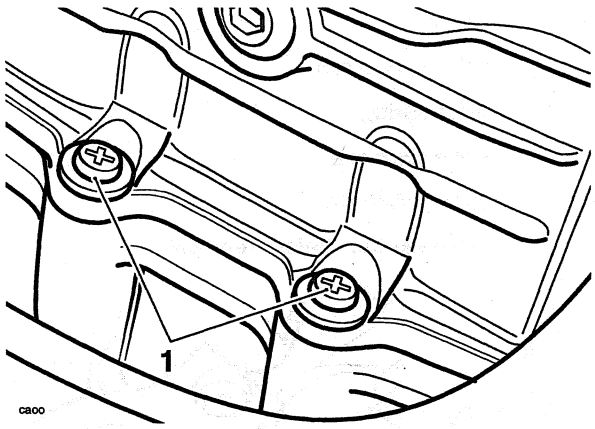
**Note:**

- **For stages A and B of the head bolt tightening operation, a torque wrench of known, accurate calibration must be used.**
- **Tighten the head bolts, in the same numerical sequence used to release the bolts, to 20 Nm.**
- **Tighten the head bolts in the same numerical sequence used to release the bolts, to 35 Nm.**
- **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.**




**Cylinder Head Bolt Tightening Sequence**

7. Fit the screws securing the side of the cylinder head to the crankcase and tighten to **10 Nm**.



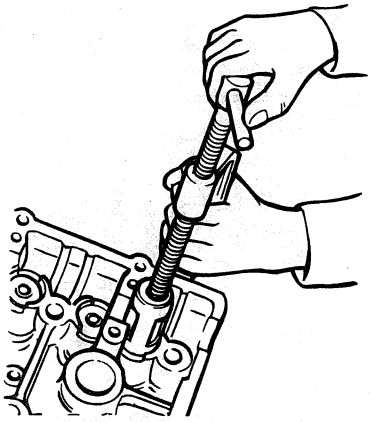

**1. Cylinder head to upper crankcase screws**

8. Clean and lubricate the tappet buckets with clean engine oil and refit the buckets and shims in the same locations from which they were removed.
9. Refit the cam shafts (see page *3-12*).
10. Install the engine to the frame (see page *9-6*).

## Valves and Valve Stem Seals

### Removal from the Cylinder Head

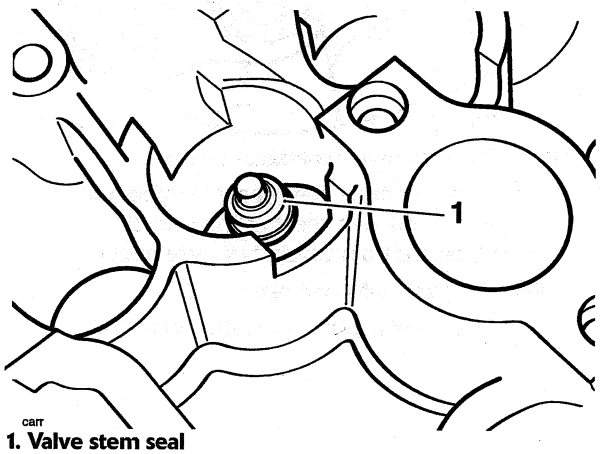
1. Remove each valve from the head using a valve spring compressor. The compressor must act on the top cup to allow removal of the valve collets.



gadh

**Valve Removal**

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

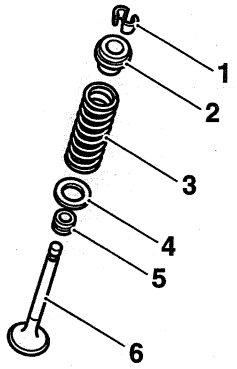



carr

**1. Valve stem seal**

**Note:**

- **Ensure inlet and exhaust valve components do not become mixed.**




ccrx

**1. Collets**
**2. Valve spring retainer**
**3. Valve spring**
**4. Valve spring platform**
**5. Stem oil seal**
**6. 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 spring platform to the valve spring recess in the head.
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 spring over the valve stem.
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 Stem to Guide Clearance

| | |
|---|---|
| Inlet: | 0.010 - 0.040 mm |
| Exhaust: | 0.030 - 0.060 mm |

#### 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.

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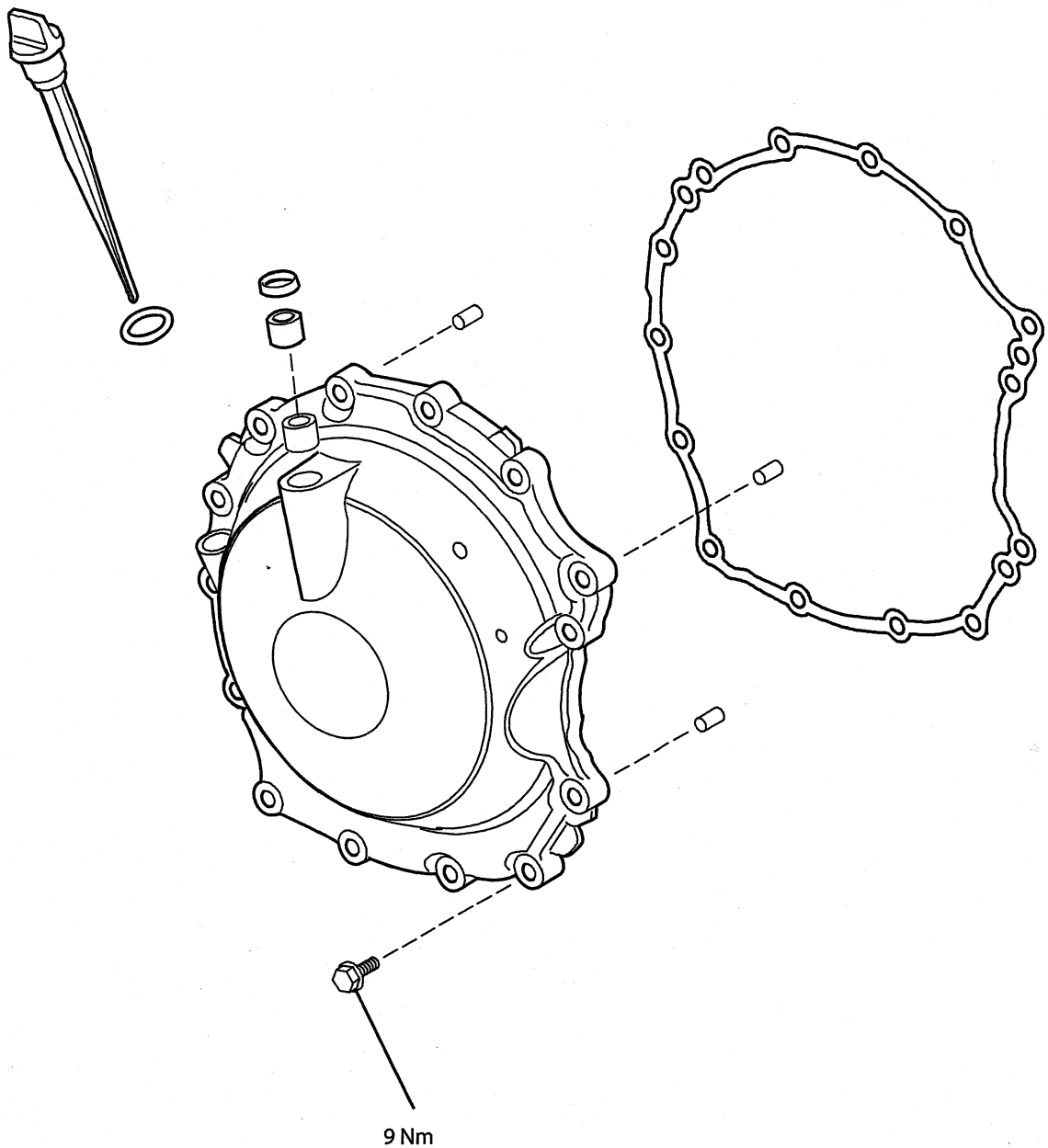
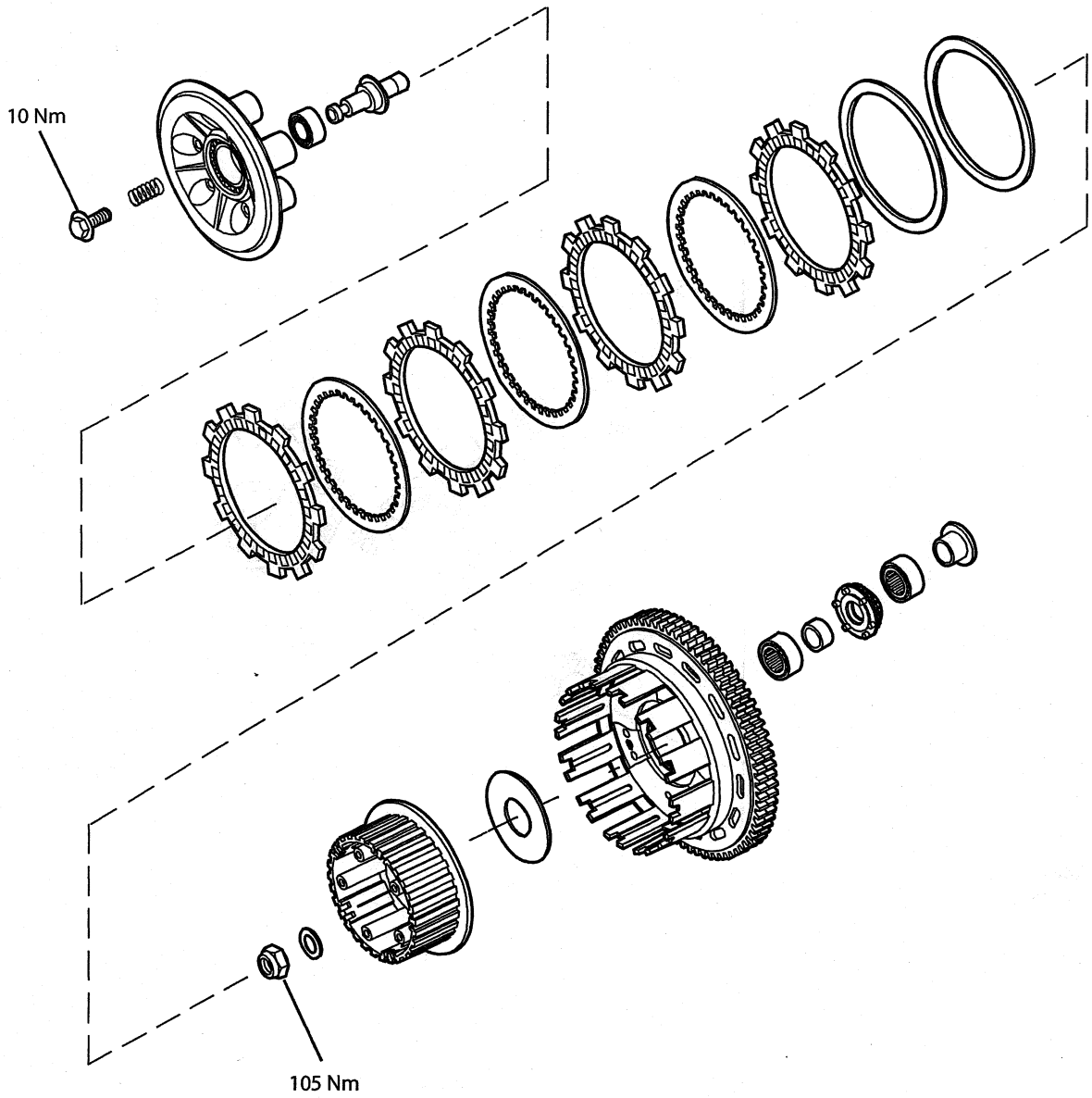
# 4 Clutch

## Table of Contents

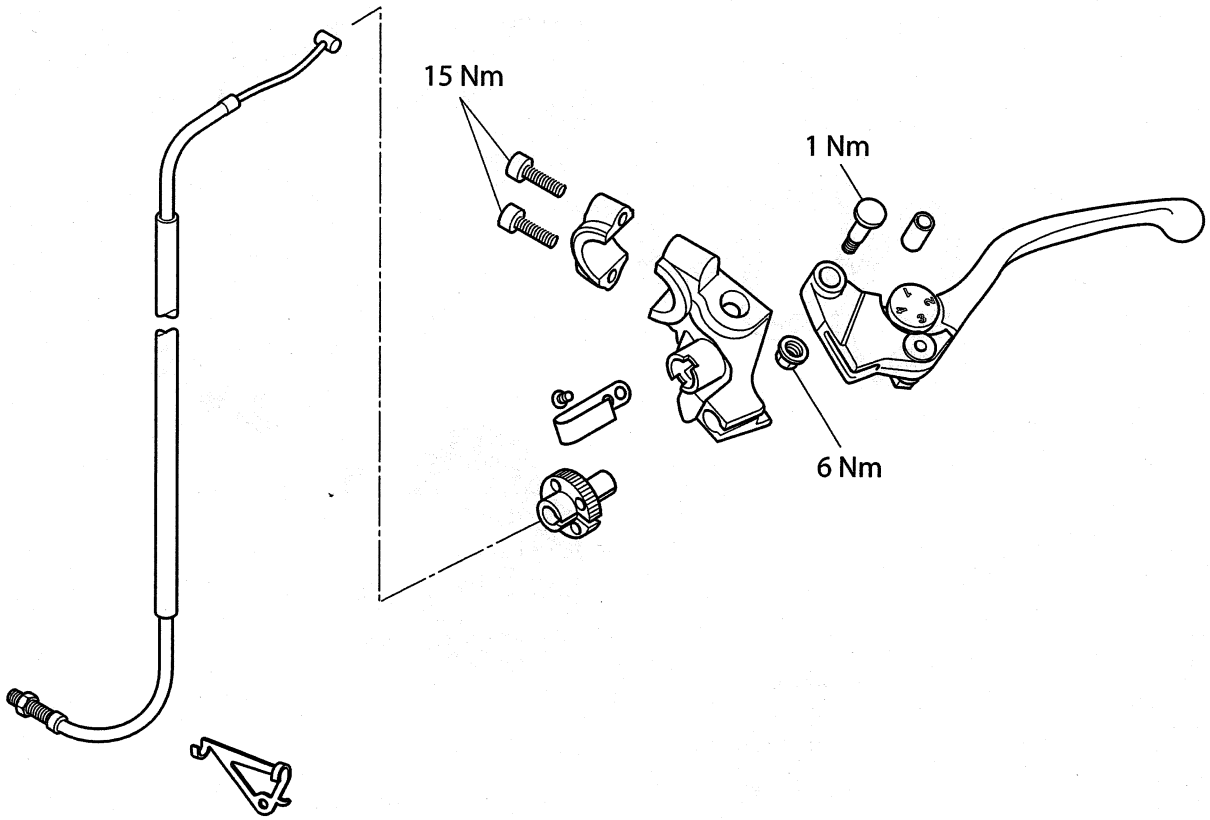
## Exploded View - Clutch Cover



## Exploded View - Clutch Assembly



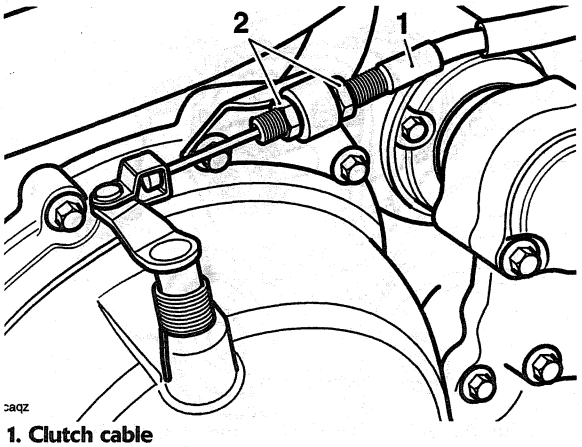
## Exploded View - Clutch Controls



## Clutch Cable

### Removal

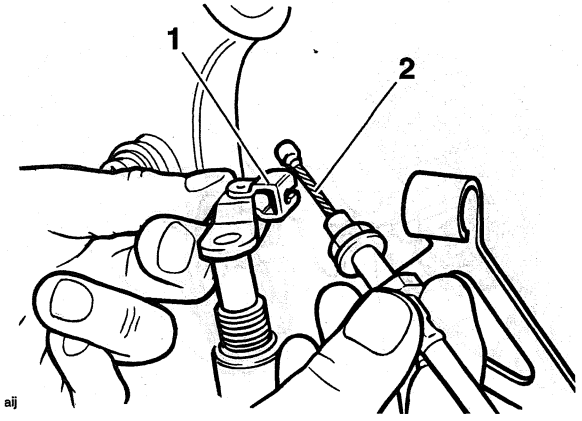
1. Remove the seat (see page *16-9*).
2. Disconnect the battery (see page *17-7*).
3. Slacken the cable locknut and release the adjuster at the clutch cover end to give maximum play in the cable.




caqz

**1. Clutch cable**
**2. Adjuster**

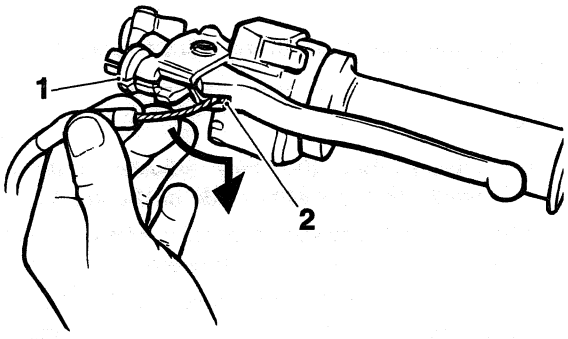
4. Release the clutch cable from the actuating arm by pushing the inner cable nipple through the arm and sliding the cable out of the slot. Detach the cable from the bracket.




aij

**1. Actuating arm**
**2. Inner cable**

5. Align the lever adjuster and lever bracket slots.
6. Pull in the clutch lever and turn the inner cable, anti-clockwise through the slots in the adjuster and lever bracket, until the cable can be detached from the lever by pushing downwards.




gaau

**1. Adjuster slot**
**2. Cable release point**

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

### Inspection

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.

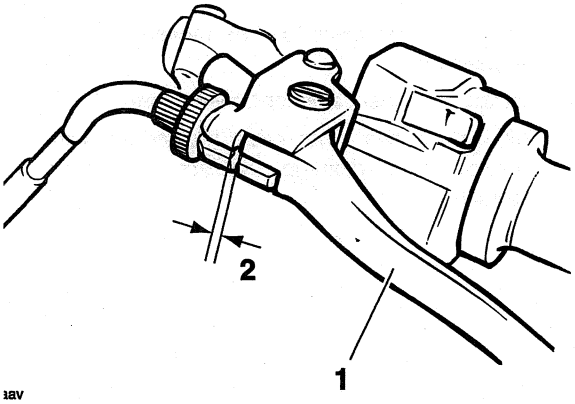
### Assembly

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. Tighten the locknut.
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 2-3 mm of free-play at the lever by turning the adjuster nut at the lever end.




iav

**1. Clutch lever**

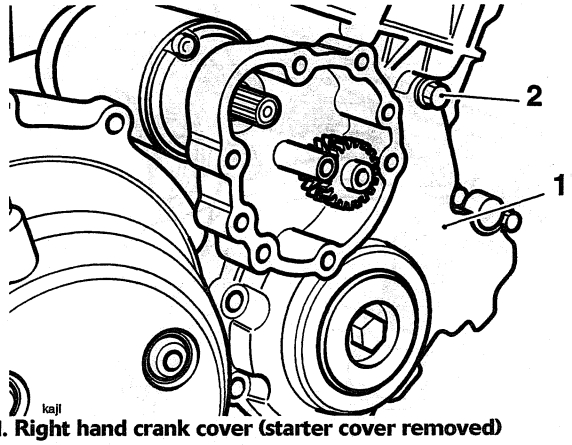
**2. Correct setting, 2-3 mm**

8. Reconnect the battery positive (red) lead first.
9. Refit the seat (see page *16-9*).

## Clutch

### Disassembly

1. Release the clutch cable from the actuating arm (see page *4-5*).
2. Remove the starter cover, right hand crank cover and associated starter gears to gain access to the clutch cover bolt at the centre-right hand side.

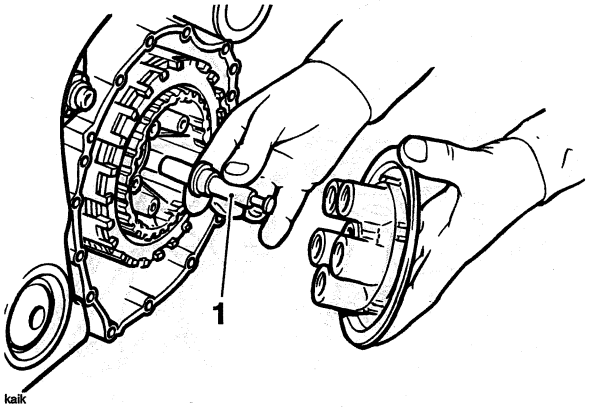



kajl

**1. Right hand crank cover (starter cover removed)**

**2. Aluminium washer position**

3. Remove the clutch cover.
4. Undo the bolts and springs and remove the clutch pressure plate.
5. Remove the clutch pull rod.



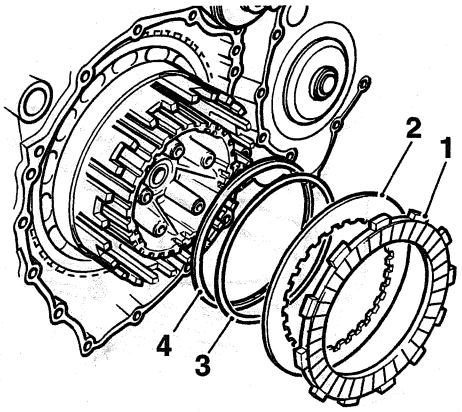

kaik

**1. Clutch pull rod**

6. Remove all the clutch friction plates and steel plates together with the anti-judder spring and anti-judder seat washer.

**Note:**

- **Record the orientation of all components as they are removed. The plates must be assembled in the same order.**



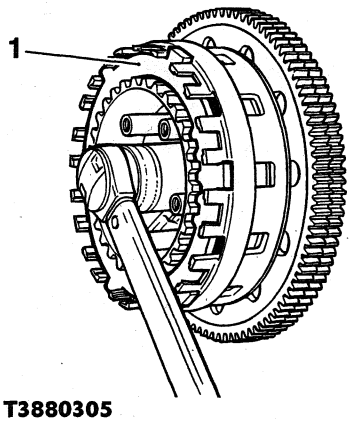

kain

**1. Friction plate**
**2. Steel plate**
**3. Anti-judder spring**
**4. Anti-judder seat washer**

**Note:**

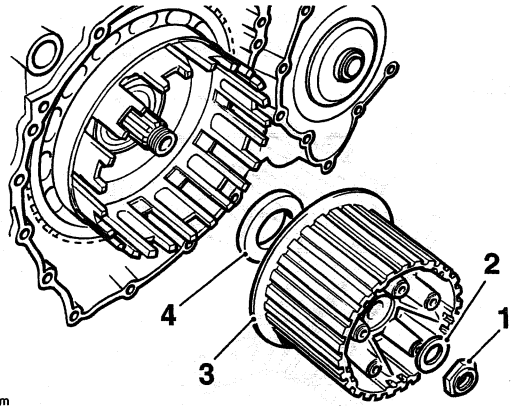
- **The outermost and innermost friction plates differ from all others and must not be fitted in any other positions. They are thicker and are also darker in colour.**
- **Refer to the following page of this section for details of clutch friction plate checking.**
- **It is not normally necessary to disassemble the clutch further, but if the clutch inner and outer drums are to be removed, proceed as follows:**

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




**1. Service tool T3880305**

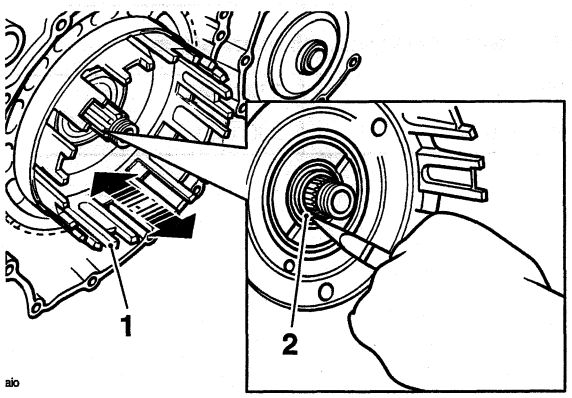
8. Depress the rear brake pedal to prevent the engine from turning, then release the clutch centre nut.
9. Remove the centre nut, belleville washer, clutch inner drum and thrust washer.




kaim

**1. Centre nut**
**2. Belleville washer**
**3. Inner drum**
**4. Thrust washer**

10. Slide the clutch outer drum assembly gently backwards and forwards to dislodge the inner bearing sleeve. Carefully remove the bearing sleeve while supporting the clutch drum.




aio

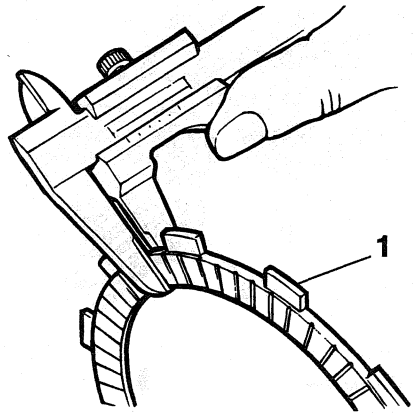
**1. Outer drum**
**2. Bearing sleeve**

11. Remove clutch outer drum leaving the oil pump drive sprocket, bearing and sleeve in place on the input shaft.

## Friction Plate Inspection

### Thickness

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




gaal

**1. Clutch friction plate**

**Friction plate thickness - inner and outermost plates**

| | |
|---|---|
| Standard | 3.80 mm |
| Service limit | 3.60 mm |

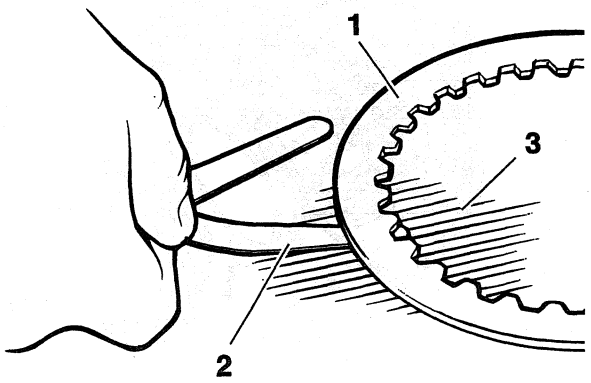
**Friction plate thickness - all other plates**

| | |
|---|---|
| Standard | 3.30 mm |
| Service limit | 3.10 mm |

### Bend/warp

Check all plates for bend and warp as follows:

1. 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.




gaas

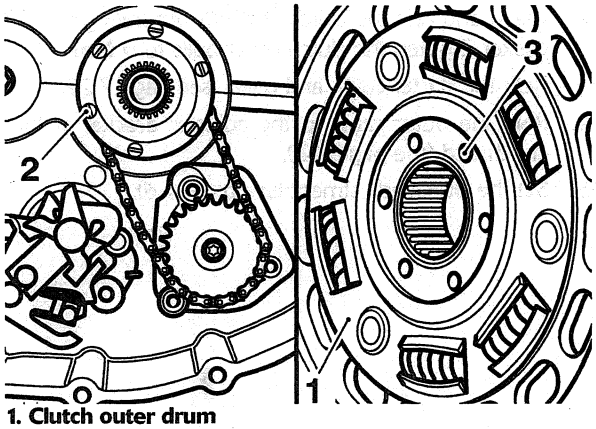
**1. Friction plate**
**2. Feeler gauge**
**3. Surface plate**

**Friction plate bend/warp**

| | |
|---|---|
| Standard | up to 0.15 mm |
| Service limit | 0.20 mm |

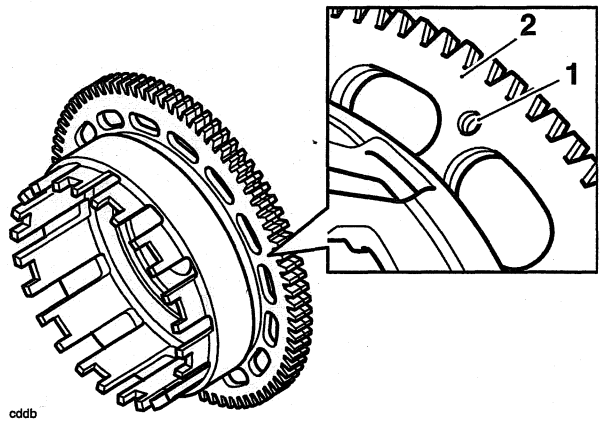
## Assembly

1. Position the clutch outer drum assembly to the input shaft and align the oil pump drive pegs with the corresponding holes in the rear of the clutch outer drum.




**1. Clutch outer drum**
**2. Oil pump sprocket drive pegs**
**3. Oil pump drive holes**

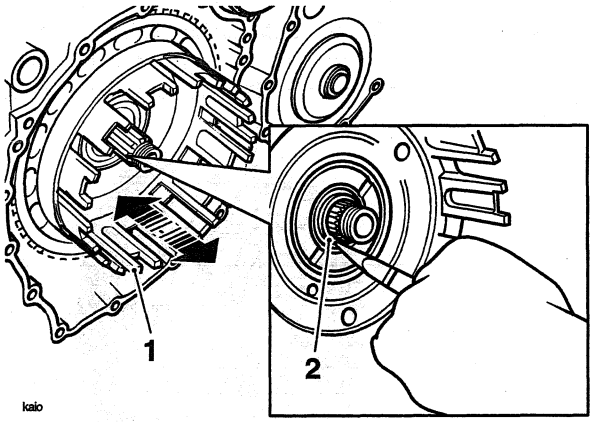
2. To fully engage the outer drum, insert a suitable tool to preload and align the primary gear and backlash eliminator gear through the hole shown in the illustration below.




cddb

**1. Alignment hole**
**2. Outer drum**

3. While holding the clutch outer drum in position and ensuring correct engagement with the oil pump drive, refit the bearing sleeve.



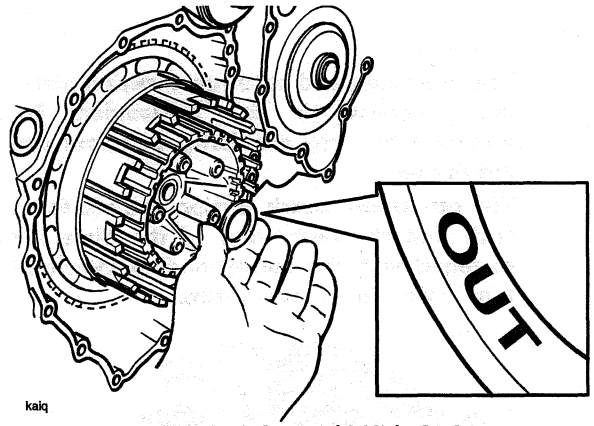

kaio

**1. Outer drum**
**2. Bearing sleeve**

**Note:**

- **When the bearing sleeve is correctly fitted, it will be a flush fit with the clutch drum face. In addition, a groove around the input shaft will be visible.**

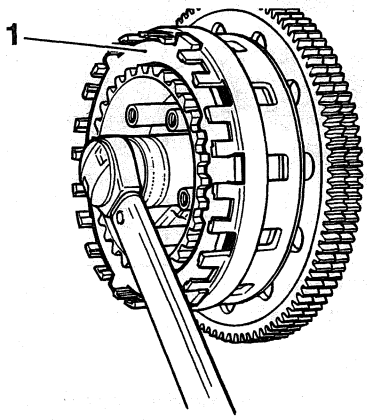
4. Fit the thrust washer to the shaft.
5. Fit the clutch inner drum.
6. Fit a new belleville washer ('OUT' mark facing outwards), and refit the centre nut.




kaiq

**Belleville Washer 'OUT' Mark**

7. 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.



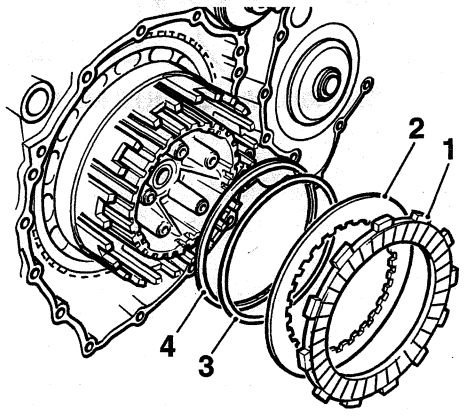

gaaz

**1. Service tool T3880305**

8. Disengage second gear and check for free rotation of the clutch inner drum.
9. Coat 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 innermost and outermost friction plates are different to the remainder. For identification, they are darker in colour and are thicker.**
- **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.**




kain

**1. Outer clutch friction plate**
**2. Outer drum**
**3. Individual tags**

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

**Note:**

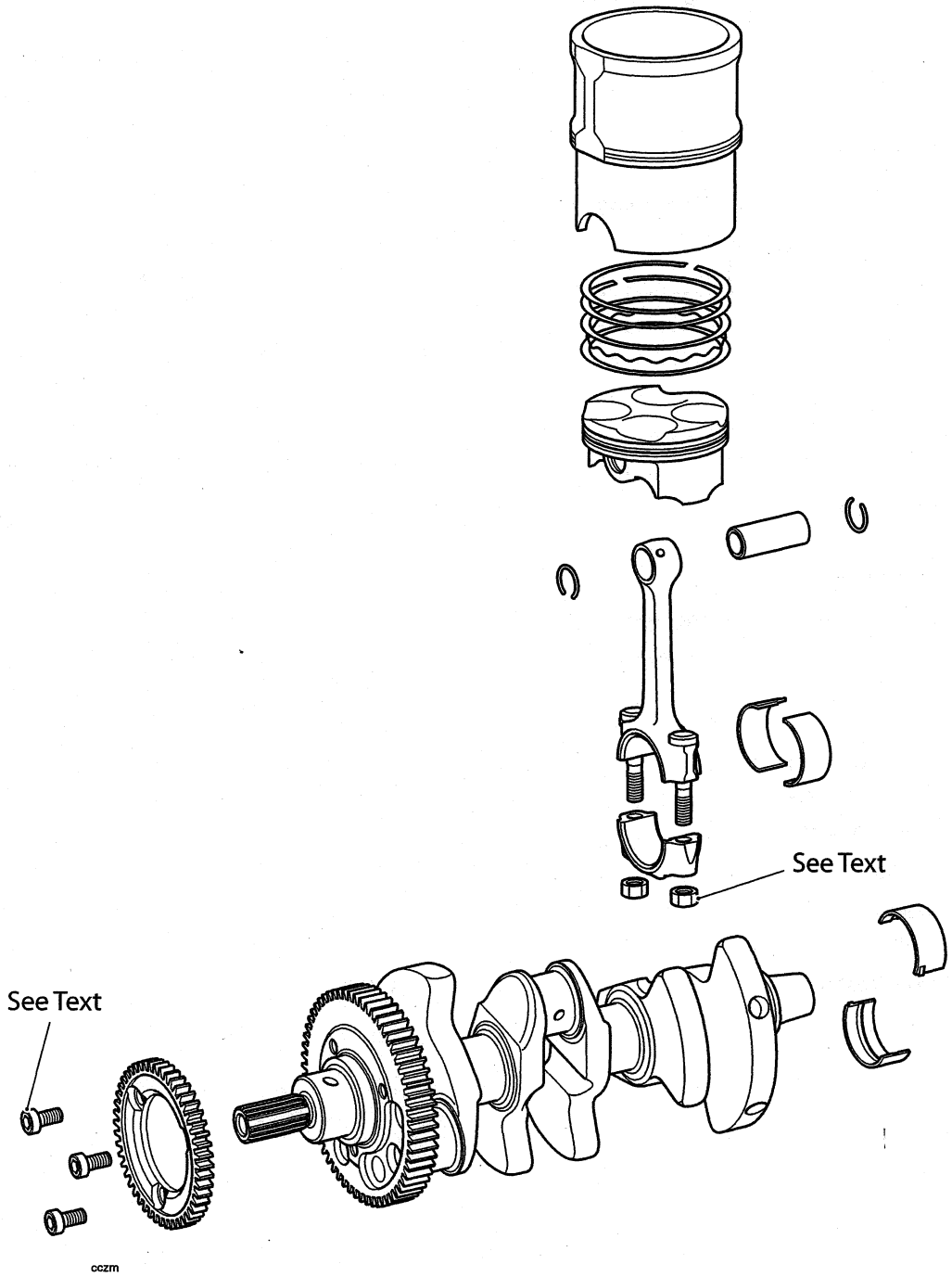
- **The pull rod should be free to move in and out and also it should be free to turn.**

12. Clean and refit the clutch cover incorporating a new gasket. Tighten the clutch cover bolts to **9 Nm.**
13. Refit the starter cover and gears (see page *7-22*).
14. Refit the outer cable to the adjuster bracket at the clutch end (see page *4-6*).
15. Set the clutch adjustment (see page *4-6*).

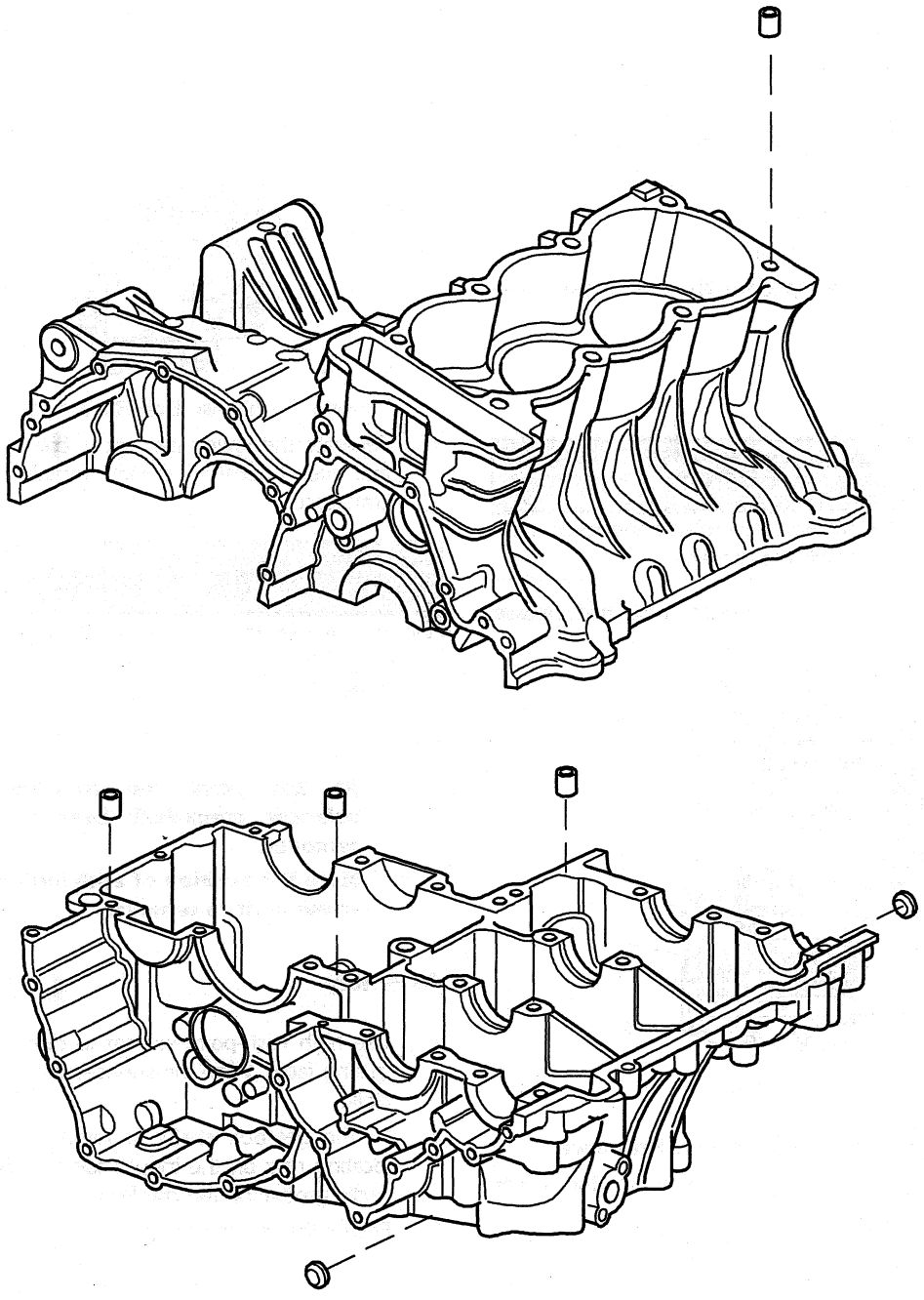
# 5 Crankshaft, Connecting Rods and Pistons

## Table of Contents

## Exploded View - Crankshaft, Connecting Rod, Piston and Liner



## Exploded View - Crankcase



## Crankcases

**Caution**

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

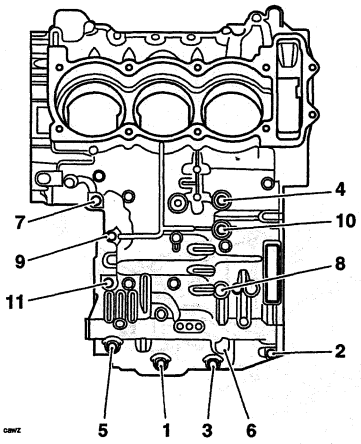
1. Remove the engine from the frame (see page *9-5*).
2. Remove the sump (see page *8-12*).
3. Remove the engine covers.
4. Remove the clutch (see page *4-6*).
5. Remove the oil pump drive chain and gears (see page *8-9*).

### Disassembly

**Caution**

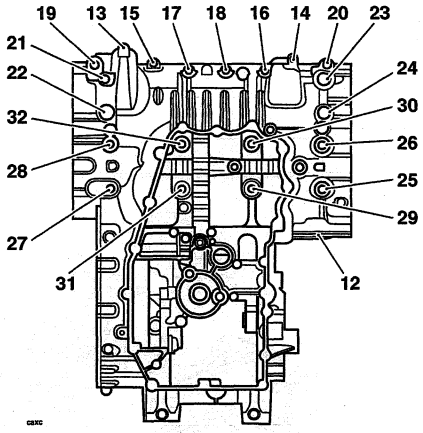
Failure to follow the correct screw release sequence may result in permanent crankcase damage.

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.




**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.

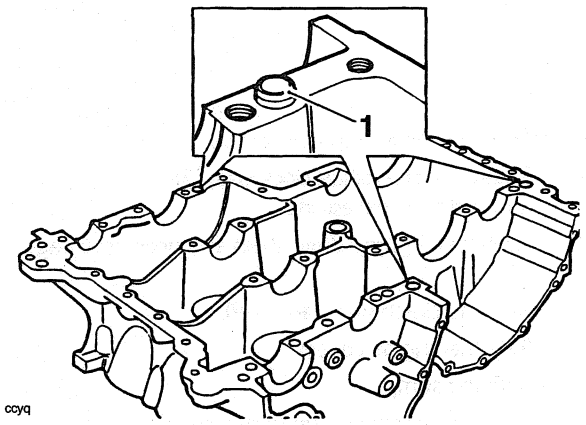
**Note:**

- **At this point the transmission shafts, balancer, crankshaft, bearings etc. can be removed.**
- **Note the position of each individual bearing screw prior to removal.**

### Assembly

1. Use high flash-point solvent to clean the crankcase mating faces. Wipe the surfaces clean with a lint-free cloth.
2. Fit the gearbox shafts (if removed), ensuring the locating ring on the input shaft is in position in the circlip groove on the crankcase.
3. Ensure that the transmission is in neutral.

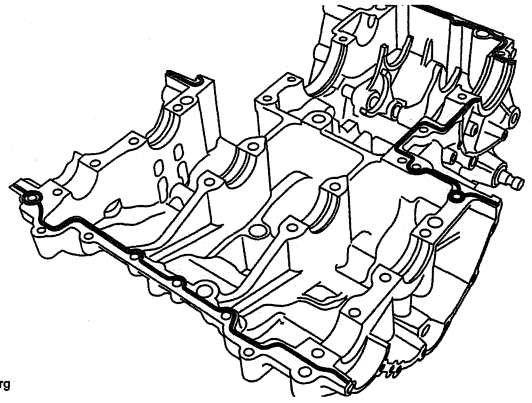
4. Ensure that the 3 locating dowels are in position in the upper crankcase.




ccyq

**1. Locating dowels**

5. Apply a thin bead of silicone sealant to the lower crankcase mating faces. (At the factory, Three Bond 12155 is used).



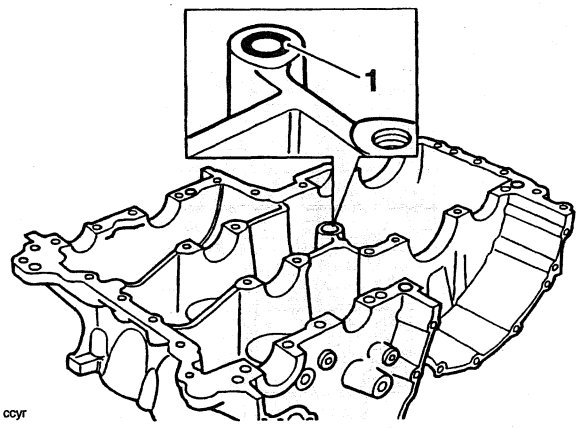
carg

**1. Sealer areas**

**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. Install and lubricate the crankshaft bearing shells with clean engine oil (see bearing selection before proceeding).
7. Lubricate the crankshaft journals with clean engine oil.
8. Locate a new oil gallery O-ring to the upper crankcase.




ccyr

**1. O-ring**

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.
10. Fit the screws into the lower crankcase and hand tighten until the bolt heads are near contact with the crankcase.
11. Invert the engine.
12. Fit the screws into the upper crankcase and hand tighten until the bolt heads are near contact with the crankcase.

**Note:**

- **The crankcase screws are tightened in stages.**
- **Two different sizes of crankcase screw are used. All screws are tightened through the first stage of the tightening procedure but only the M8 size screws are tightened at the second stage.**

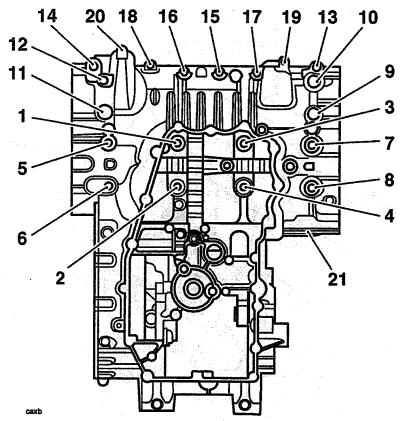
**Caution**

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

**Stage 1 - all screws**

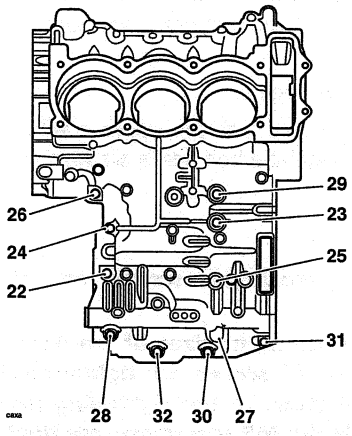
1. Invert the engine.

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




**Lower Crankcase Bolt Tightening Sequence**

3. Invert the engine.
4. In the correct sequence, tighten all upper crankcase screws to **12 Nm.**




**Upper Crankcase Bolt Tightening Sequence**

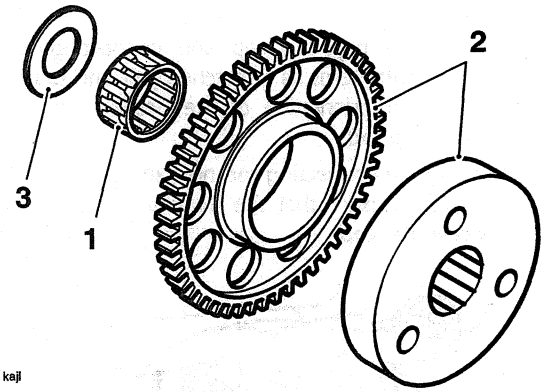
**Stage 2 - M8 screws only**

1. In the correct sequence, tighten only the M8 size upper crankcase screws (numbers 22 to 29) to **28 Nm.**
2. Invert the engine.
3. In the correct sequence, tighten only the M8 size lower crankcase screws (number 1 to 14) to **28 Nm.**
4. Rotate the crankshaft clockwise. Check for tight spots and rectify as necessary.
5. Refit the oil pump drive chain and gears (see page *8-10*).
6. Refit the clutch (see page *4-9*).
7. Refit the engine covers.
8. Refit the sump.
9. Install the engine in the frame (see page *9-6*).

## Crankshaft

### Removal

1. Remove the sprag clutch (see page *7-20*).




kajl

**1. Needle roller bearing**
**2. Gear/sprag clutch assembly**
**3. Plain washer**

2. Remove the alternator rotor from the crankshaft (see page *17-16*).
3. Separate the two halves of the crankcase (see page *5-4*).
4. Remove the connecting rods (see page *5-8*).
5. Remove the cam chain (see page *3-15*).
6. Release and remove the crankshaft from the upper crankcase.

**Note:**

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

7. Remove the balancer (see page *6-3*).
8. Collect the piston cooling jets from the crankcase oilways beneath the crankshaft bearings.

**Note:**

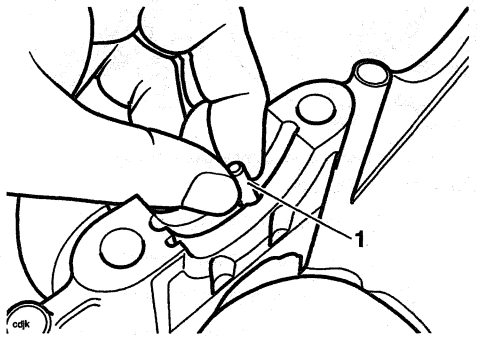
- **This engine is fitted with a balancer drive gear that is bolted on to the crankshaft. Under no circumstances should the bolts be disturbed as the crank and gear are not individually serviceable.**

### Installation

**⚠ Caution**

Always check the bearing journal clearance (see page *5-12*), before final assembly of the crankshaft. Failure to correctly select crankshaft bearings will result in severe engine damage.

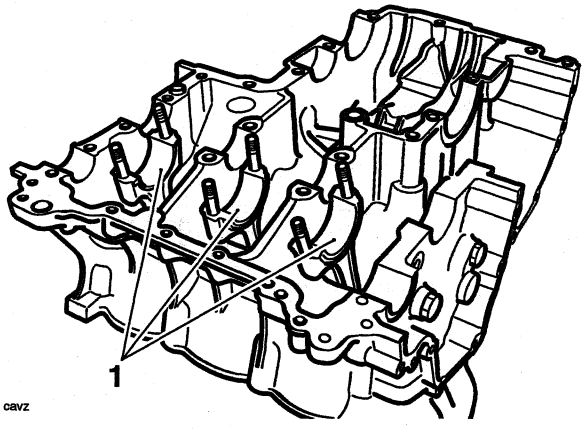
1. If removed, insert the three piston cooling jets into the main bearing housings in the upper crankcase.




cdjk

**1. Piston Cooling Jet**

2. Select and fit new main and big end shell bearings using the selection processes detailed later in this section.

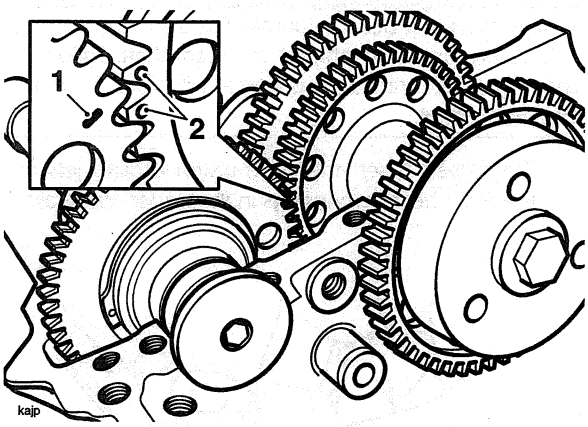



cavz

**1. Big end shells**

3. Lubricate all bearings with engine oil.
4. Ensure that the crankshaft is clean, and that the oilways within the crank are clean and free from blockages and debris.
5. Refit the balancer (see page *6-4*).

6. Install the crankshaft ensuring that the crank pins align with the big ends and that the crankshaft and balancer gear markings align as shown in the next illustration.




**1. Balancer backlash and drive gear markings**
**2. Crankshaft markings**

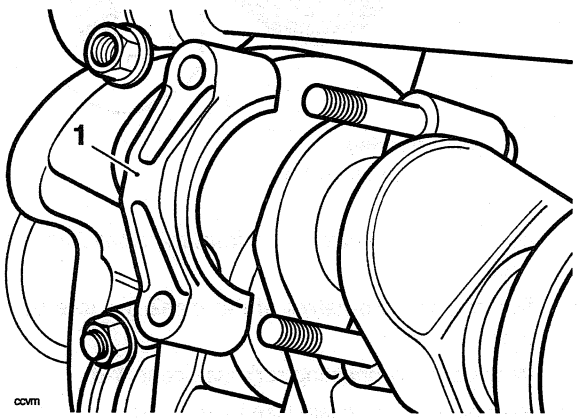
7. Refit the connecting rods (see page *5-9*).
8. If removed, refit the transmission shafts.
9. Assemble the crankcases (see page *5-4*).
10. Assemble the alternator rotor (see page *17-17*).
11. Assemble the sprag clutch (see page *7-22*).
12. Assemble the cam chain (see page *3-17*).

## 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 (see page *5-16*).
6. Detach the piston from the connecting rod (see page *5-13*).

## 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.**

**Warning**

Connecting rod bolts and nuts MUST only be used once. If the bolts or nuts are removed or undone for any reason, new bolts and nuts MUST always be used.

Re-using bolts can cause connecting rods and their caps to detach from the crankshaft causing severe engine damage, loss of motorcycle control and an accident.

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

**Note:**

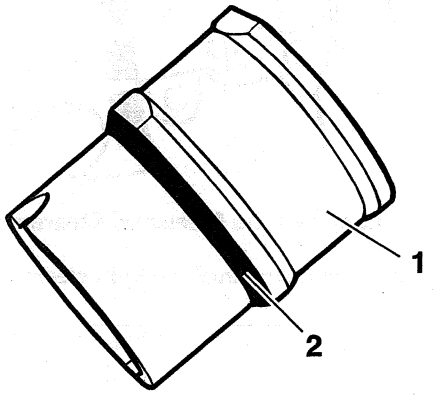
- **Ensure the piston is fitted correctly to the connecting rod.**
- **If a previously run engine is being rebuilt, always ensure that the piston and con-rod are assembled in the same orientation as prior to strip-down.**

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.



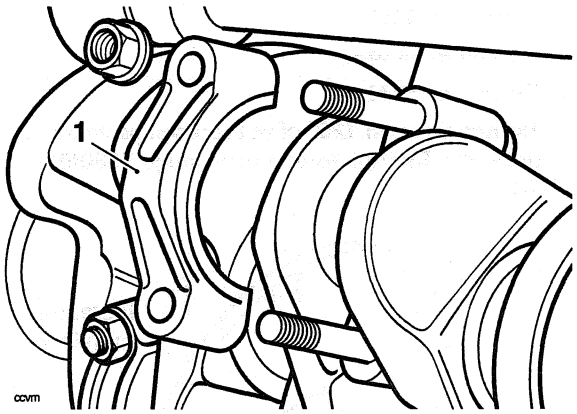

ccvk

**1. Liner**
**2. Sealer area**

4. Fit the piston and connecting rod assembly into the liner from the bottom.
5. Fit the liner into the crankcase ensuring that the arrow/dot on the piston faces forward.

**Note:**

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




ccvm

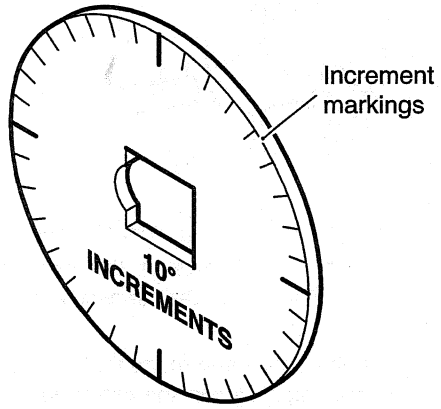
**1. Big end**

6. Select big end bearing shells (see page *5-10*).
7. Lubricate both halves 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:
9. Lubricate the threads of the bolt and the face of the nut with molybdenum disulphide grease. Tighten the nuts progressively in five stages as follows:

**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.

a) Tighten to **22 Nm.**
b) Release by **140°.**
c) Tighten to **10 Nm.**
d) Tighten to **14 Nm.**
e) Tighten through **120°** of nut rotation as measured using the Triumph torque turn gauge 3880105-T0301.




cbxt

**Service Tool 3880105-T0301**

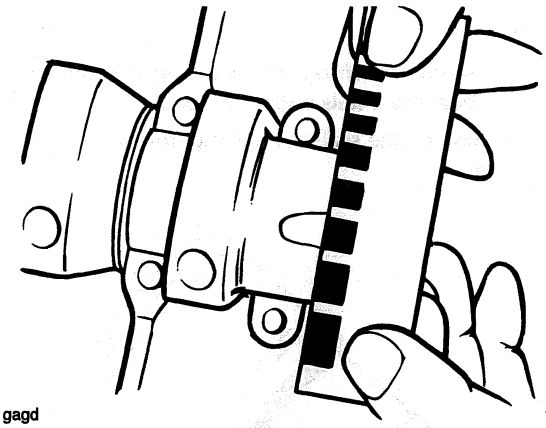
## Connecting Rod Big End Bearing Selection/Crankpin Wear Check

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 'Plastigage'. The crankpin clearances are measured using 'Plastigage' (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 Plastigage to fit across the journal. Fit the strip to the journal using the grease to hold the Plastigage in place.
6. Release the nuts and remove the cap being measured. Using the gauge provided with the Plastigage kit, measure the width of the compressed Plastigage.
7. 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 (see page *5-9*).



gagd

**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: | 34.984 - 35.000 mm |
| Service limit: | 34.960 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 re-ground 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 information.

1. Select the correct big end bearing shell as follows:
   - Measure each crankpin diameter.
   - Note the connecting rod marking.
2. Select the correct bearings by matching the information found with the chart below.

**Big end bearing selection chart**

| **Shell Colour** | **White** | **Red** | **Red** | **Blue** |
|---|---|---|---|---|
| Rod Marking | 5 | 5 | 4 | 4 |
| Con-rod Big End Bore Dia. | 38.008<br>38.000 | 38.008<br>38.000 | 38.018<br>38.009 | 38.018<br>38.009 |
| Crankpin Dia. | 35.000<br>34.992 | 34.991<br>34.984 | 35.000<br>34.992 | 34.991<br>34.984 |
| Running Clearance | 0.066<br>0.036 | | | |

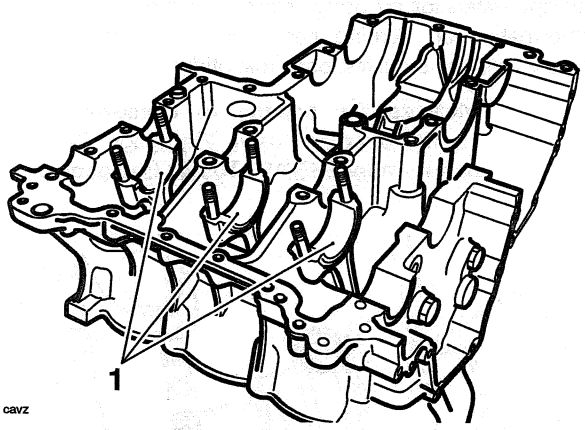
For instance:

| | |
|---|---|
| Con-rod Mark | 5 |
| Con-rod Big End Diameter | 38.002 |
| Crankpin Diameter | 34.987 |
| 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.




**1. Big end bearings**

**Caution**

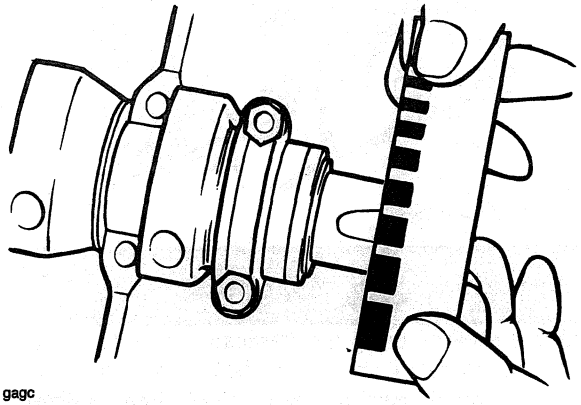
Always confirm, using the Plastigage method, that the running clearance is correct before final assembly. Severe engine damage could result from incorrect clearance.

### Crankshaft main bearing/journal wear

| Main Bearing Selection Chart (all dimensions in mm's) | | | | | | |
|---|---|---|---|---|---|---|
| Shell Colour | White | Red | Red | Blue | Blue | Green |
| Crankcase Bore | 41.121<br>41.113 | 41.121<br>41.113 | 41.130<br>41.122 | 41.130<br>41.122 | 41.139<br>41.131 | 41.139<br>41.131 |
| Journal Dia. | 37.976<br>37.969 | 37.968<br>37.960 | 37.976<br>37.969 | 37.968<br>37.960 | 37.976<br>37.969 | 37.968<br>37.960 |
| Running Clearance | 0.043<br>0.020 | 0.044<br>0.020 | 0.044<br>0.021 | 0.043<br>0.019 | 0.043<br>0.020 | 0.044<br>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.

- **Measure the bearing to crankshaft main journal clearance using Plastigage (Triumph part number 3880150-T0301) (see page *5-9*)**



gagc

**Checking Crankpin Clearance Using Plastigage**

### Crankshaft main bearing/journal clearance

| | |
|---|---|
| Standard: | 0.019 - 0.044 mm |
| Service limit: | 0.07 mm |

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 re-ground 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 | 41.135 mm |
| Bearing Required | Blue |

**Note:**

- **It is normal for the bearings selected to differ from one journal to another.**
- **It is also normal for there to be two options of bearing shell colour. In such cases, pick the shell size which gives the greater running clearance.**

**⚠ Caution**

Always confirm, using the Plastigage 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 | 0.40 mm |

**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.**

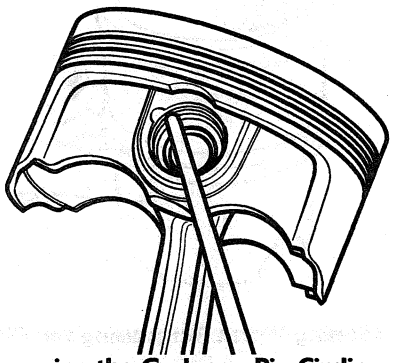
## Pistons

### Disassembly

**Note:**

- **It is not necessary to remove the connecting rods from the crankshaft.**

1. Remove the cylinder head (see page *3-17*).
2. Remove the liner, using tool T3880315 (see page *5-16*).
3. Remove the gudgeon pin circlip from one side of the piston.



**Removing the Gudgeon Pin Circlip**

4. 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.

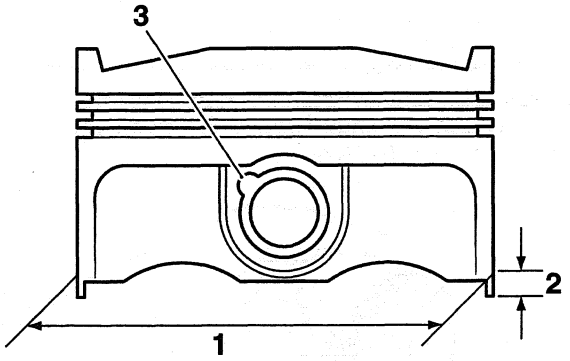
**Note:**

- **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.**

5. 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.




capf

**1. Piston outside diameter**
**2. Measurement point**
**3. Circlip removal groove**

| | |
|---|---|
| All Cylinders | 78.980 – 78.970 mm |
| Service limit | 78.930 mm |

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

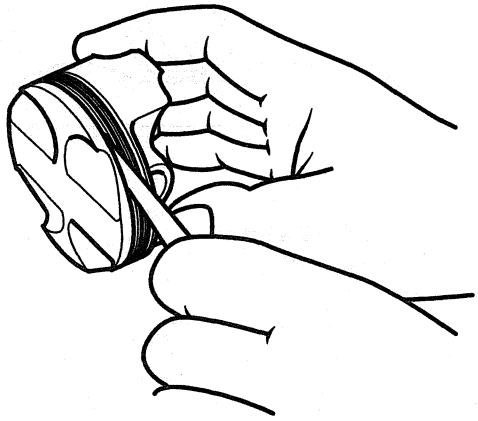
### Piston Rings/Ring Grooves

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.



capg

**Piston Ring to Ring Groove Clearance Check**

### Piston ring/Groove Clearance

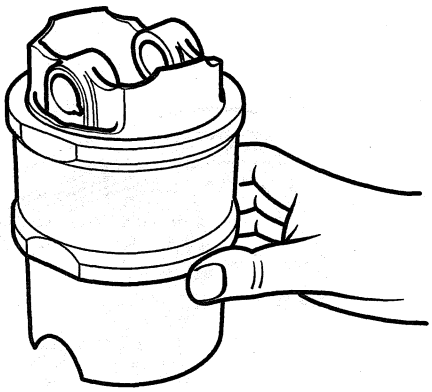
| | |
|---|---|
| Top ring<br>Service limit | 0.02 - 0.06 mm<br>0.075 mm |
| Second<br>Service limit | 0.02 - 0.06 mm<br>0.0.75 mm |

### 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.



ccvj

**Aligning Piston Rings using the Piston**

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

### Piston Ring End Gap Tolerances

| | |
|---|---|
| Top<br>Service limit | 0.28 - 0.49 mm<br>0.61 mm |
| Second<br>Service limit | 0.43 - 0.64 mm<br>0.76 mm |
| Oil Control<br>Service limit | 0.33 - 0.89 mm<br>1.03 mm |

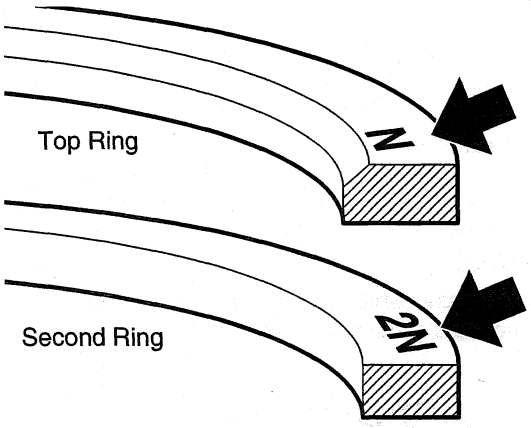
2. If the ring gap is found to be too small, the ring end must be carefully filed until the correct gap is achieved. If the gap is too large, replace the rings with a new set. If the gap remains too large with new rings fitted, both the piston and liner must be replaced.

### Piston Assembly

1. 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 second ring upper surface is marked '2N' 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**

1. Fit the piston onto the connecting rod.

**Note:**

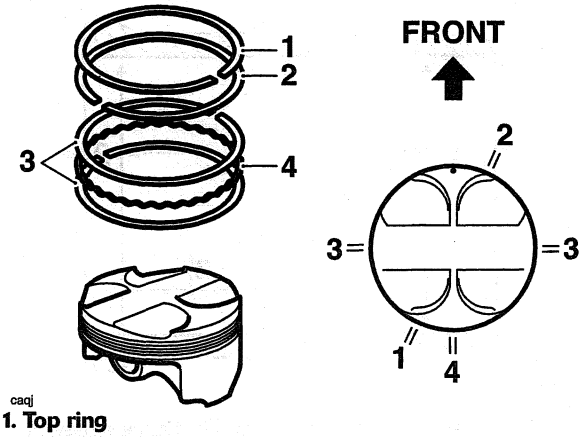
- **Connecting rods may be fitted either way around. However, ensure all three are fitted the same way.**

2. Align the small end in the connecting rod with the gudgeon pin hole in the piston.
3. Lubricate the piston, small end and gudgeon pin with clean engine oil and fit the gudgeon pin.
4. 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.

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




caqj

**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).**

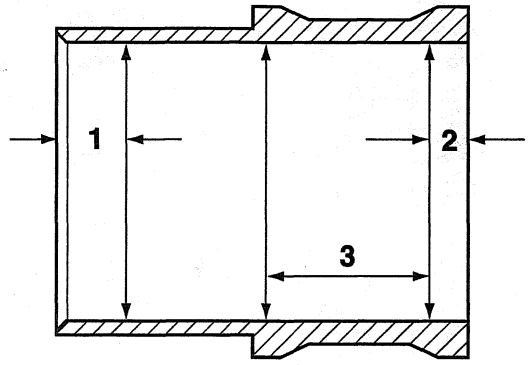
6. Fit the piston into the liner using a gentle rocking motion to engage the rings in the bore.

### Cylinder Wear

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

**Cylinder bore diameter**

| | |
|---|---|
| Standard: | 79.040 – 79.060 mm |
| Service limit: | 79.110 mm |



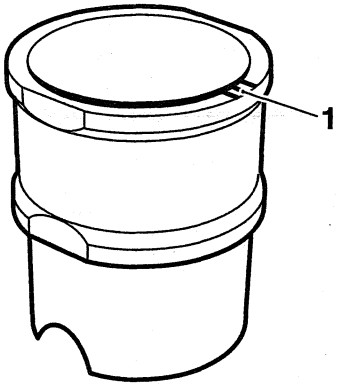

gaep

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

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

## Cylinder Liners

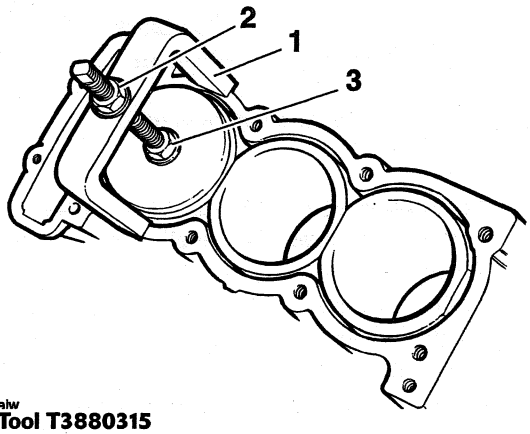
### Removal




vi

**1. 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.




qalw

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

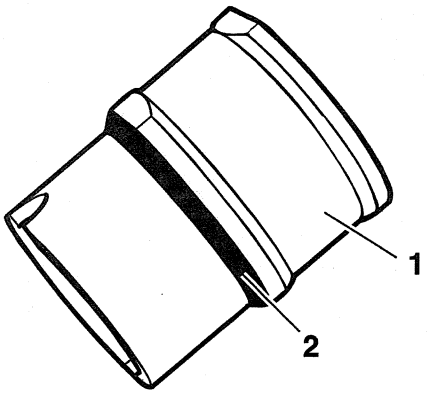
3. Check that the locking nut on tool T3880315 is loose, then fully unscrew the extraction nut.
4. Carefully fit the tool fully into the cylinder bore, positioning the tool legs on the crankcase. Turn the locking nut clockwise until the rubber sleeve on the tool tightly grips the bore of the liner.
5. 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 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.

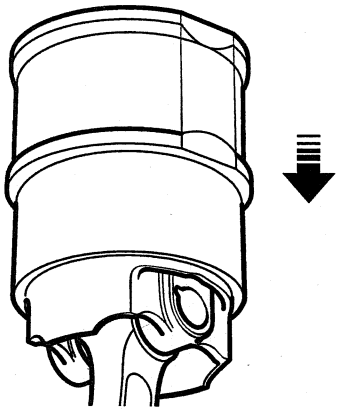



ccvk

**1. Liner**

**2. Sealer area**

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



ccvl

**Arrowed: Liner-piston Fitment**

**Note:**

- **The liners have a large 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.

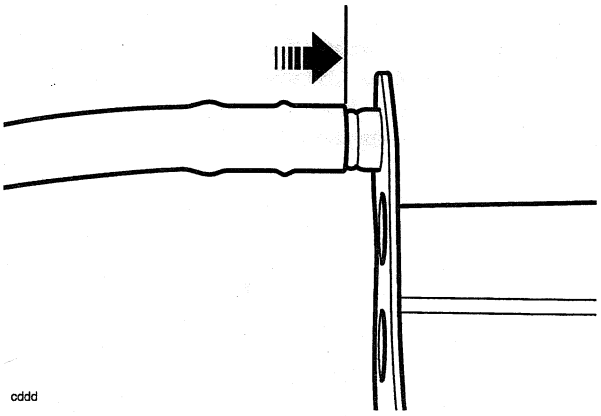
**Note:**

- **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.**

## Crankcase Breather

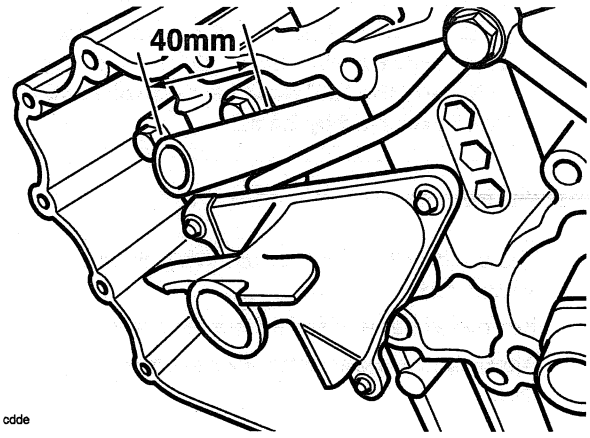
The upper crankcase is fitted with a labyrinth type breather system, which requires no maintenance. However, when assembling the crankcases, ensure that the breather hose is not damaged and is securely fitted to the breather as follows:

1. The hose should be pushed fully on to the breather outlet.



cddd

2. The hose is retained by means of a spring-clip and protrudes into the sump as shown below.




cdde

# 6 Balancer

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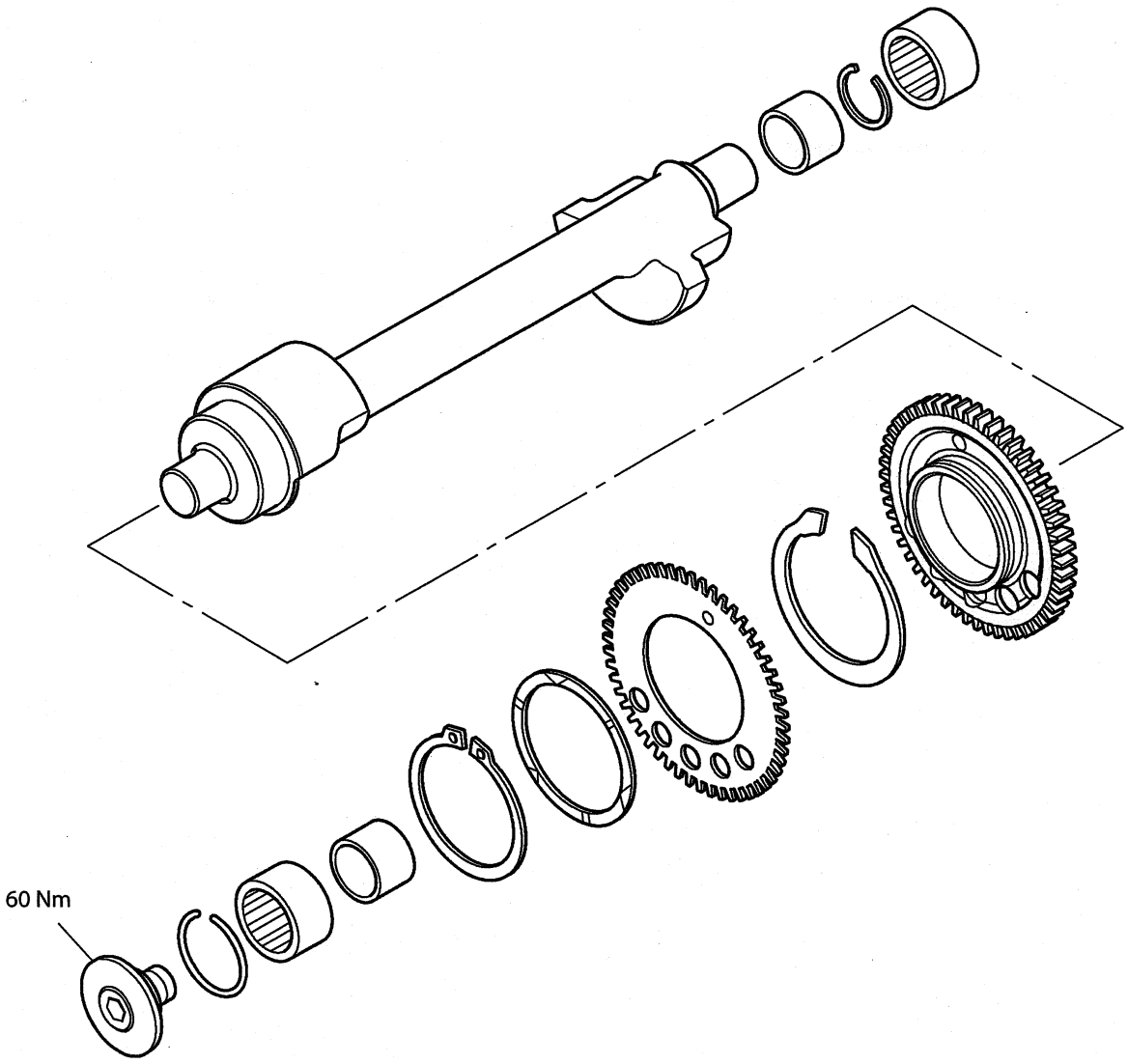
## Exploded View - Balancer Shaft



## Balancer

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.

### Removal

1. Separate the crankcase halves (see page *5-4*).
2. With the crankcase halves separated, lift out the balancer shaft complete with the shaft bearings/ circlips.

**Note:**

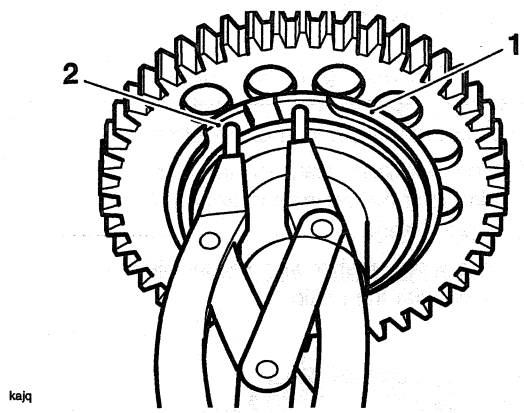
- **As the shaft is released from the crankcase, the backlash eliminator gear will spring out of alignment with the crankshaft.**

3. To remove the left hand bearing, slide the bearing, circlip and bearing sleeve from the balancer shaft.
4. To remove the right hand bearing, remove the bolt and slide the circlip, bearing race and inner ring from the shaft.

**⚠ Caution**

When removing the circlip, always ensure that the area where the breather seal runs does not become scratched or damaged. A damaged seal track will cause oil to be ejected from the engine.

5. To strip the backlash eliminator from the drive gear, release the circlip and remove the wave-washer, backlash gear and spring.




**1. Wave washer**
**2. Circlip**

### Inspection

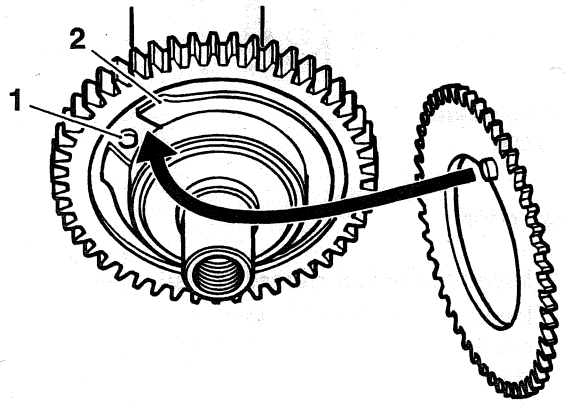
1. Inspect all gears for chipped or missing teeth.
2. Inspect all bearings for signs of overheating (blue discolouration), seized or damaged rollers, and any other damage.
3. Ensure the breather tube in the centre of the shaft is not blocked by oil, debris etc.
4. Inspect the backlash spring for deformities, damage etc.
5. Inspect the gear teeth for overheating (blue discolouration).

**Note:**

- **Signs of blue discolouration on the gear centre are due to the manufacturing process and must be disregarded.**

### Assembly/Installation

1. If the backlash gear was disassembled, fit the backlash spring to the balancer drive gear, positioning the spring ends on either side of the peg.
2. Fit the backlash gear, ensuring its peg is located clockwise of the balancer gear peg and also between the spring ends.
3. Fit the wave washer and secure all components in position with the circlip.



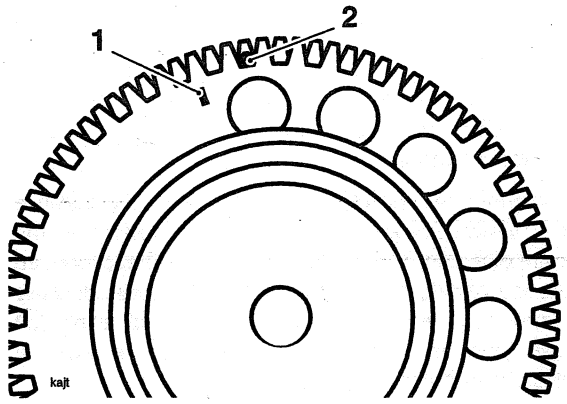

kalb

**1. Wave washer**
**2. Circlip**

4. Lubricate and fit the right hand bearing and circlip to the shaft.
5. Apply Threebond TB1305 locking compound to the threads of the balancer bearing bolt.
6. Fit the bolt and tighten to **60 Nm.**
7. Lubricate and fit the left hand bearing and circlip.

**Note:**

- **Prior to installation in the crankcase, it is essential that the markings on the backlash eliminator and drive gears are brought into alignment against the tension of the spring. This will facilitate correct positioning of the balancer in relation to the crankshaft when both are installed in the crankcase.**




kajt

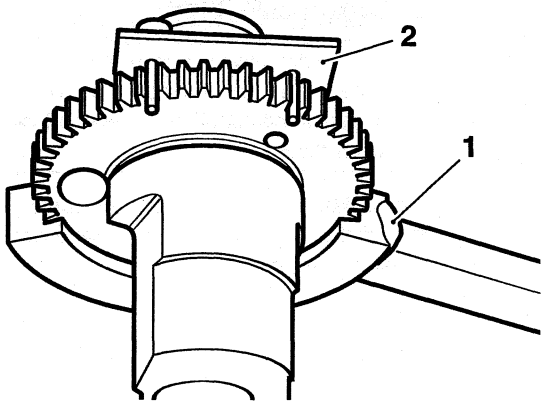
**1. Backlash gear line**
**2. Drive gear dot**

8. Using tool T3880016, bring the backlash and drive gear marks into alignment against the backlash spring.

**Note:**

- **When in alignment, the line on the backlash gear must be located directly above the drive gear tooth marked with a dot.**
- **Since the drive gear dot cannot be seen when the backlash gear is in alignment, always mark the dot-marked gear tooth with chalk in order that it can be identified.**

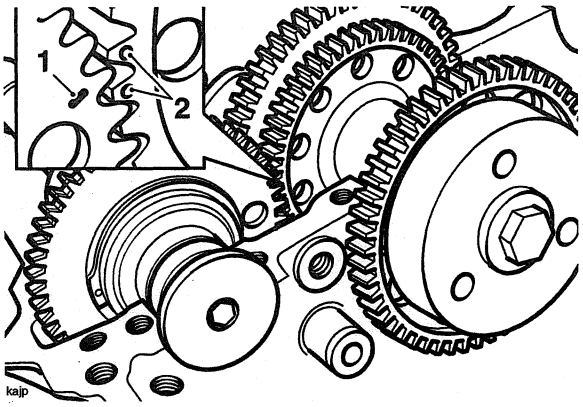
9. Secure the backlash gear in position with the fixture supplied with the tool by placing the fixture pegs across two gear teeth (ensure that the fixture will not be in the way when assembling the balancer to the crank).




ajs

**1. Tool T3880016**
**2. Securing fixture**

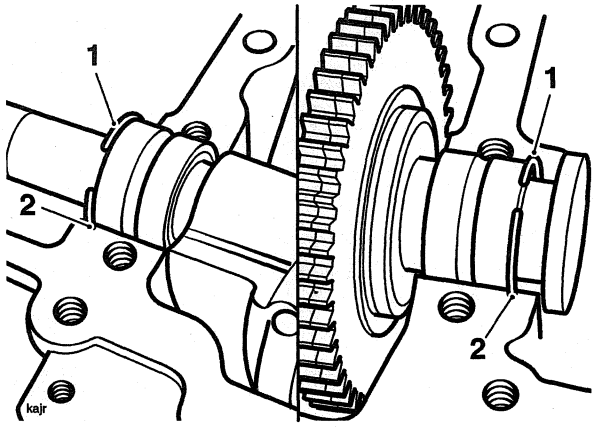
10. With the drive and backlash eliminator gears still correctly aligned, locate the balancer to the crankcase aligning the balancer gears and crankshaft as shown in the illustration below while ensuring that the bearing circlips locate correctly in their corresponding grooves in the crankcase.




**1. Balancer backlash and drive gear markings**
**2. Crankshaft markings**

**Caution**

If the balancer and crankshaft are not correctly aligned, severe engine vibration will occur leading to damage to components.




**1. Circlips**
**2. Crankcase circlip grooves**

11. Remove the securing fixture.
12. Check that the balancer and crankshaft are correctly aligned before continuing to assemble the crankcase halves.

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# 7 Transmission

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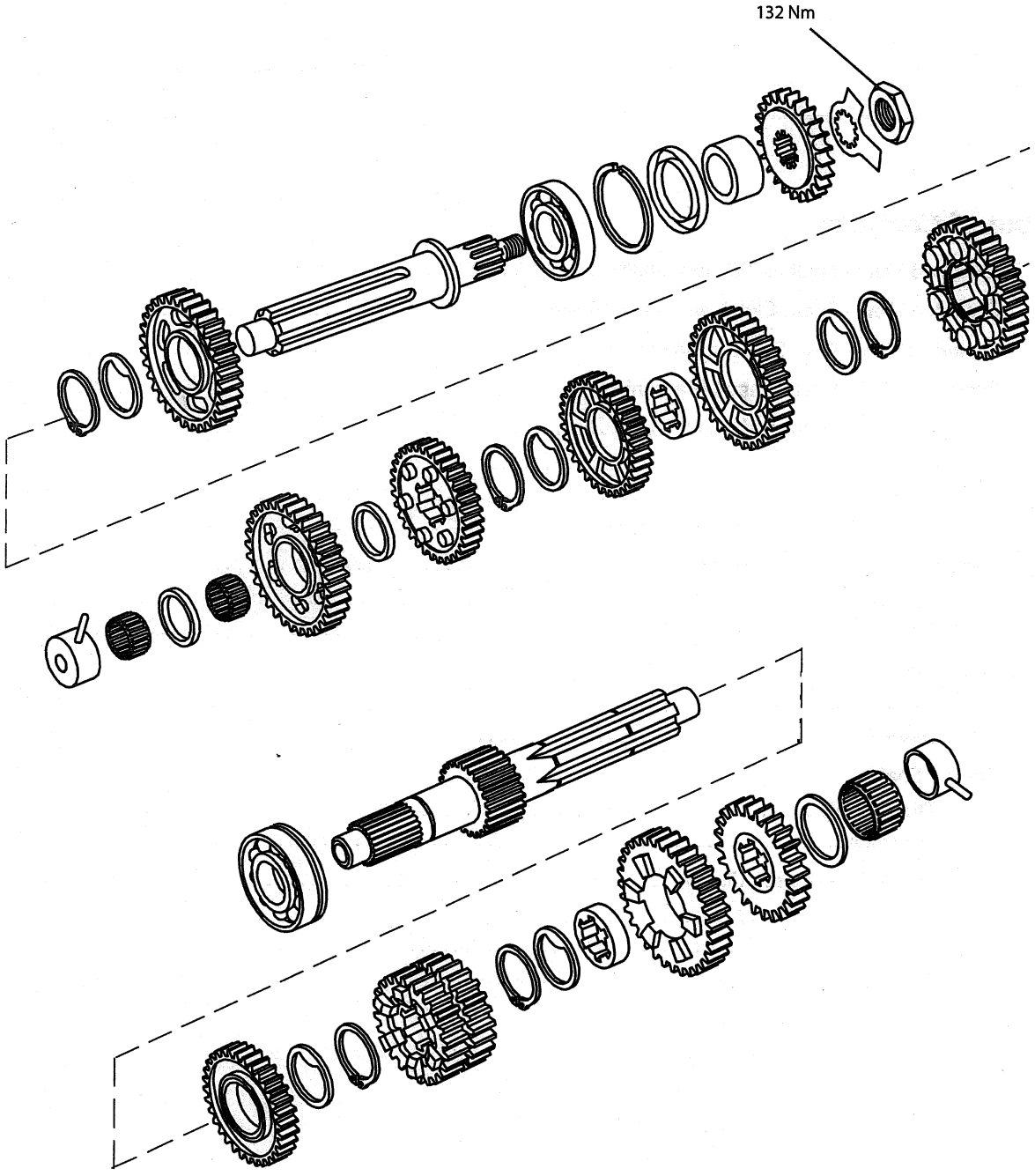
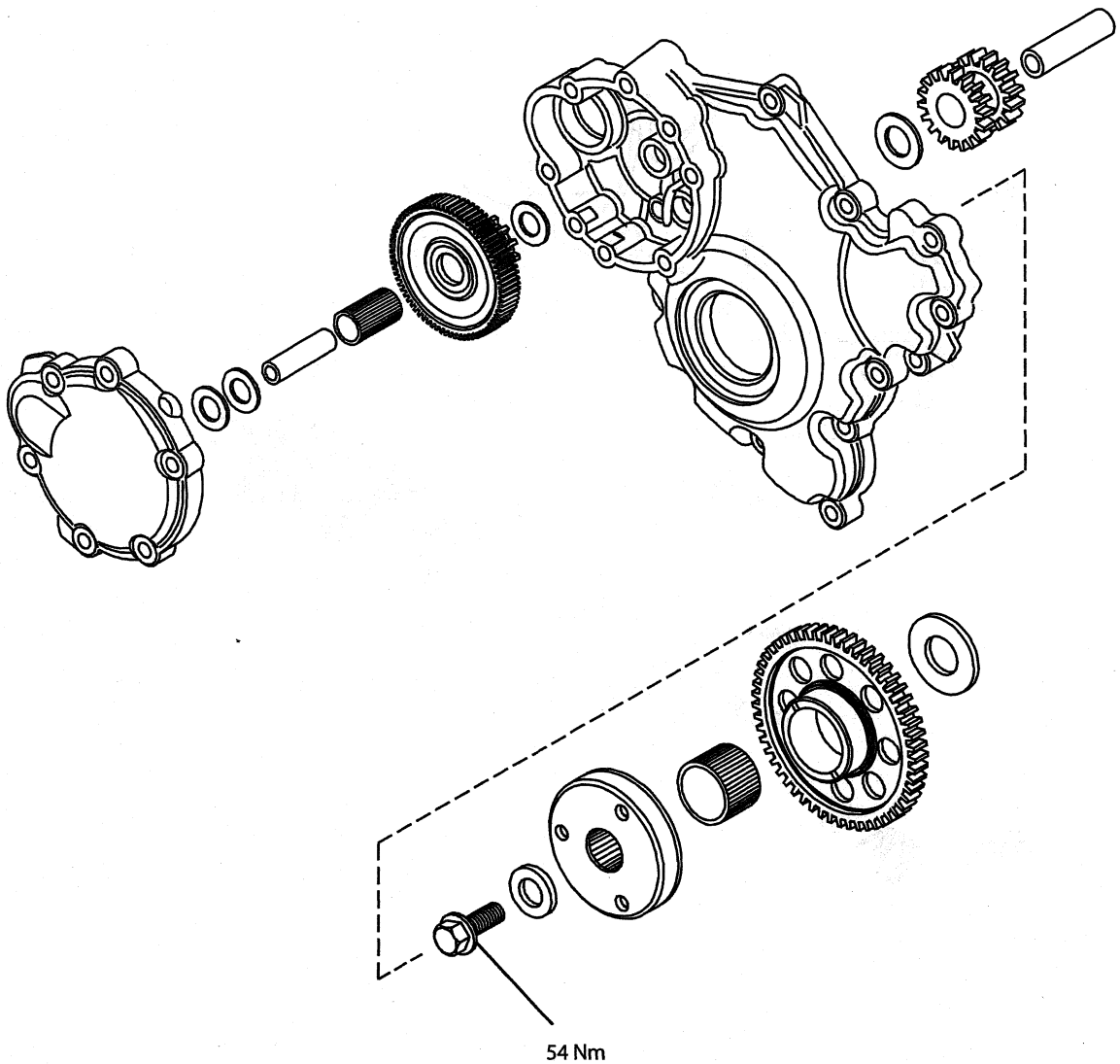
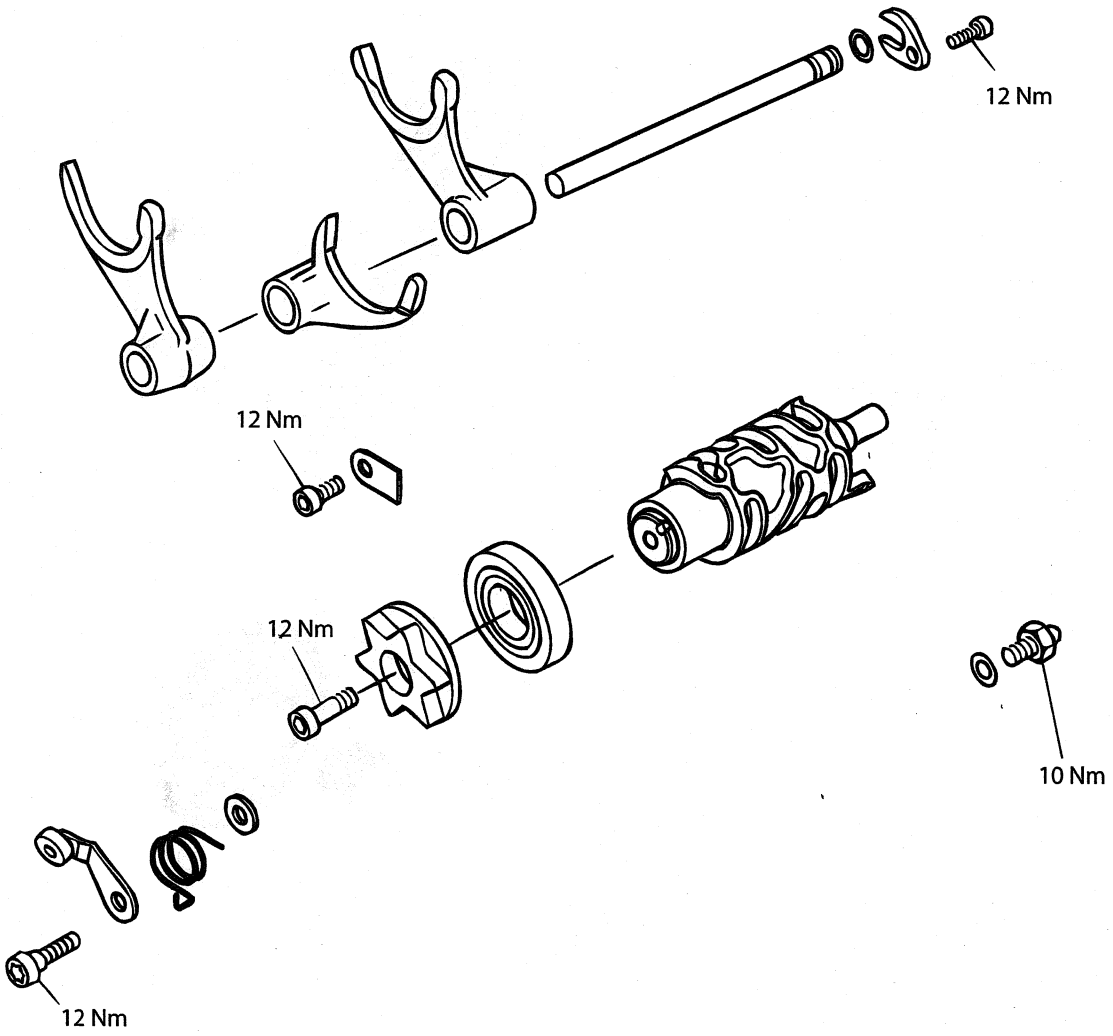
## Exploded View - Input and Output Shafts



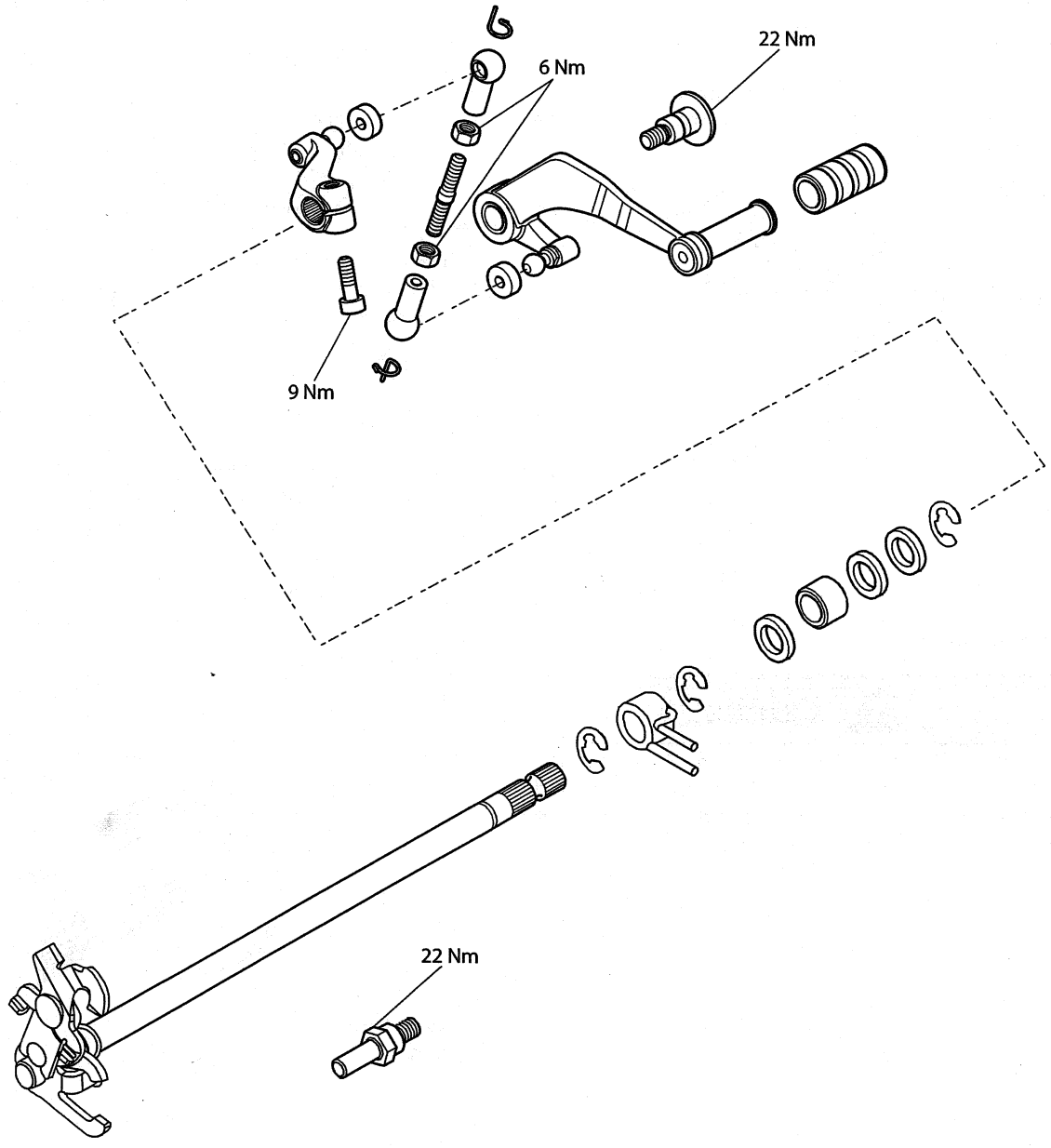
## Exploded View - Sprag Clutch and Starter Gears



## Exploded View - Gear Selectors and Drum



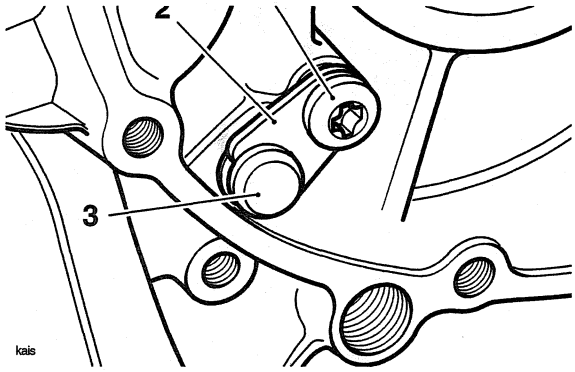
## Exploded View - Gear Change Mechanism



## Selector Shaft, Selector Forks and Drum

### Removal

1. Remove the engine from the frame (see page *9-2*).
2. Separate the two halves of the crankcase (see page *5-4*).
3. Remove the input and output shafts from the crankcase (see page *7-11*).
4. Remove the fixing and take out the 'U' shaped keeper plate from the selector shaft. Discard the fixing.



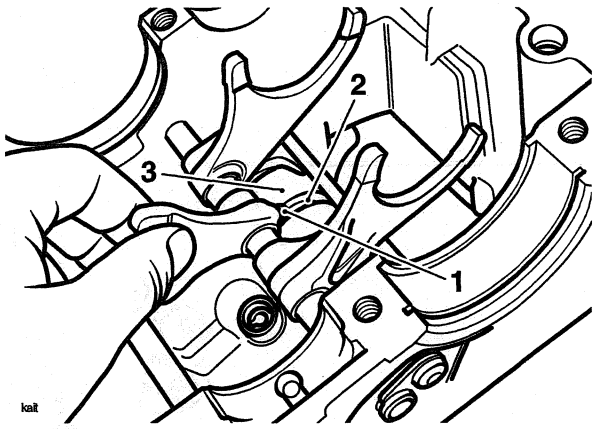

**1. Fixing**
**2. Keeper plate**
**3. Selector shaft**

**Caution**

The selector forks can be fitted incorrectly. Ensure the position and orientation of the selector forks are marked prior to removal. Incorrect fitting of the selector forks will cause gearbox damage.

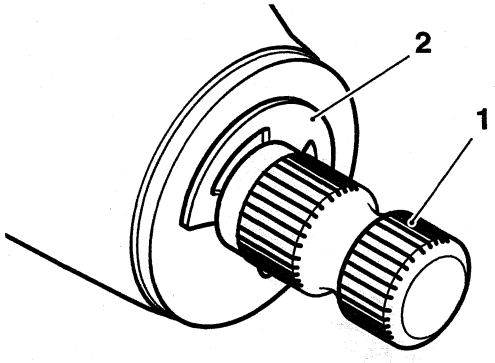
**Note:**

- **The centre selector fork locates in the selector drum as shown below:**



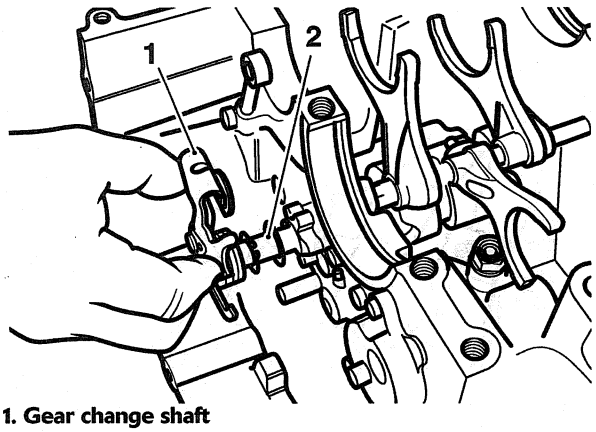

**1. Selector fork stop**
**2. Selector fork guide**
**3. Selector drum**

5. Using a suitable tool, push the selector shaft out from the crankcase in the direction of the keeper plate. Collect each selector fork as they are released by the selector shaft.
6. If not already removed, note the position and orientation of the gear pedal crank in relation to the shaft, then remove the pedal.
7. Remove the e-clip and washer from the gear pedal end of the gear change shaft.




**1. Gear change shaft**
**2. E-clip**

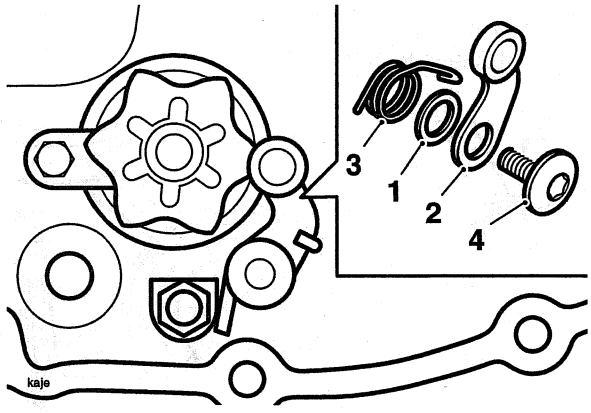
8. Withdraw the gear change shaft from the clutch end of the crankcase and collect the washer from inside the crankcase.




**1. Gear change shaft**
**2. Washer**

**Note:**

- **The detent arm is held in position under spring pressure. Prior to removal, note the orientation of the detent arm, fixing, spring and washer. The same orientation must be retained on assembly.**



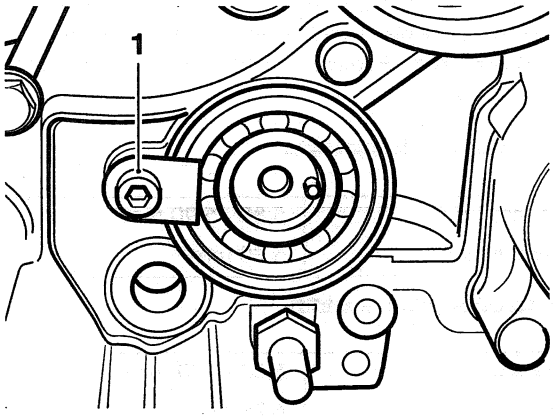

**1. Washer**
**2. Detent arm**
**3. Spring**
**4. Fixing**

9. Release and remove the fixing securing the detent arm.
10. Withdraw the detent arm complete with its spring and washer. Discard the fixing.
11. Remove the fixing from the centre of the detent wheel (discard the fixing) and withdraw the wheel.

**Note:**

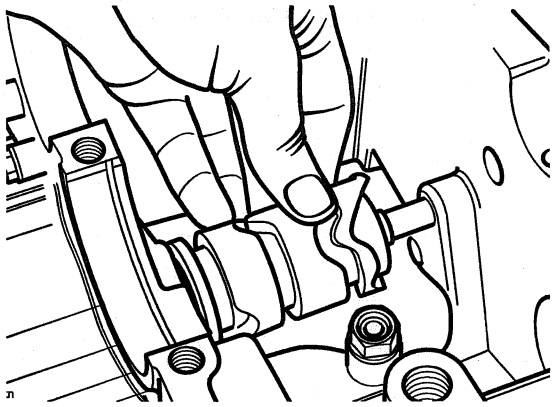
- **To prevent drum rotation, use a stout rod through one of the through-holes in the drum. Care must be taken not to damage the oil pressure relief valve.**

12. Release and remove the bolt securing the selector drum bearing to the crankcase. Discard the bolt.




**1. Bolt**

13. Ease the selector drum backwards and forwards to push the drum bearing out of the crankcase.
14. Withdraw the drum from within the crankcase.



**Selector Drum Removal**

### Inspection

1. Examine all components for damage and/or wear, paying particular attention to the selector forks and selector drum. Replace any parts that are damaged and/or worn.

**Gear selector fork thickness**

| | |
|---|---|
| Standard | 5.80 - 5.90 mm |
| Service limit | 5.70 mm |

**Gear selector groove width**

| | |
|---|---|
| Standard | 6.00 - 6.10 mm |
| Service limit | 6.25 mm |

**Selector fork to groove clearance**

| |
|---|
| 0.55 mm max. |

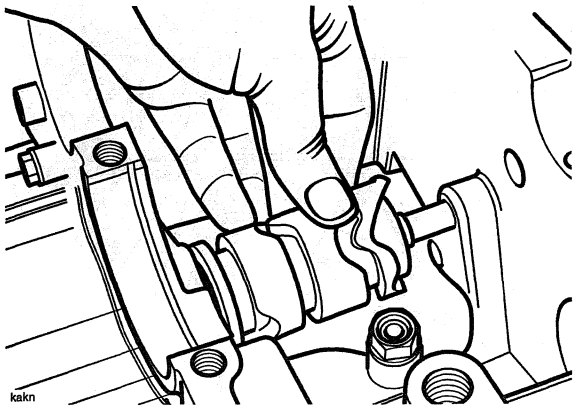
2. Examine the gear change shaft seal for damage and/or wear. Replace the seal if damaged and/or worn.

### Installation

**Note:**

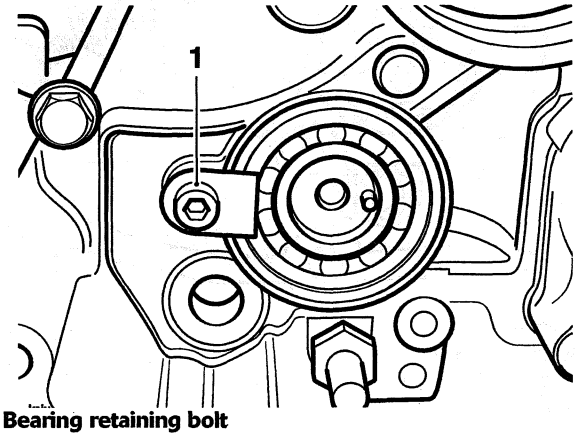
- **The detent wheel is keyed to the selector drum**

1. Position the selector drum into the crankcase.




**Locating the Selector Drum**

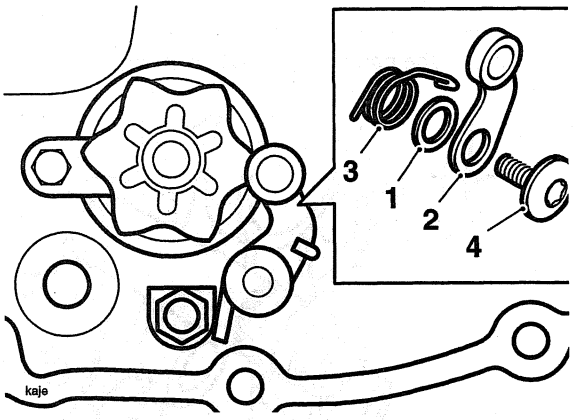
2. Using clean engine oil, lubricate the selector drum bearing.
3. Position the bearing into the crankcase recess and engage with the selector drum.
4. Refit the bearing retainer. Secure with a new bolt and tighten to **12 Nm.**




**1. Bearing retaining bolt**

5. Fit the detent wheel engaging the wheel with the locator pin in the selector drum. Tighten a new fixing to **12 Nm.**

6. Assemble the detent arm as noted on removal and place up to the crankcase.



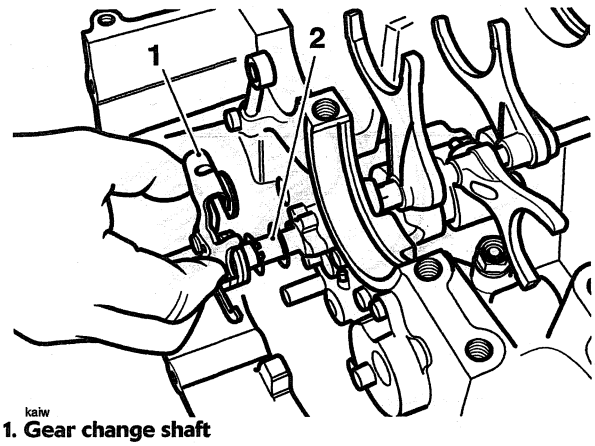

**1. Washer**
**2. Detent arm**
**3. Spring**
**4. Fixing**

7. Hold the detent arm assembly in position and fit a new fixing. Start the thread and push the detent arm, using finger pressure, to locate on the detent wheel. Ensure the detent arm remains correctly located on the detent wheel. Tighten the capscrew to **12 Nm**.
8. Rotate the selector drum and ensure a smooth movement. Rectify as necessary.
9. Using clean engine oil, lubricate the lip of the seal on the gear change shaft.
10. Lubricate, with a 50/50 solution of engine oil and molybdenum disulphide grease, both sides of the fingers of the selector mechanism on the gear change shaft.

**⚠ Caution**

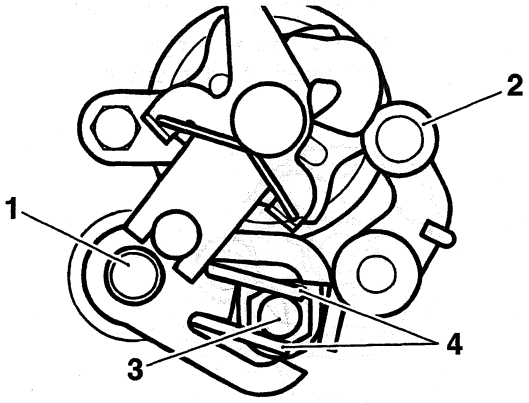
Take care to avoid damaging the lip of the seal when inserting the gear change shaft into the crankcase. A damaged seal will lead to oil loss and could result in engine damage.

11. Feed the washer onto the shaft and insert the gear change shaft into the crankcase. Gently push the gear pedal end of the shaft through the bearing and seal located, at the gear pedal end, in the crankcase.



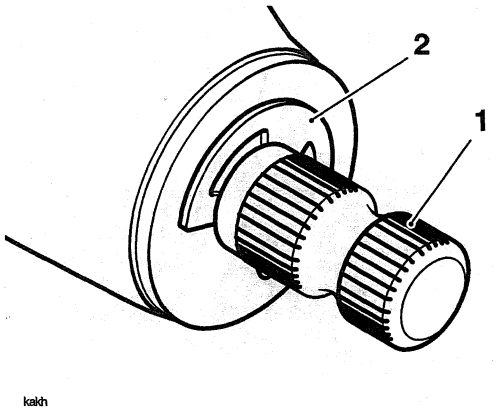

**1. Gear change shaft**
**2. Washer**

12. Ensure that the gear change shaft locates in the detent wheel/arm and that the spring fits over the abutment bolt.




**1. Gear change shaft**
**2. Detent arm**
**3. Abutment bolt**
**4. Spring**

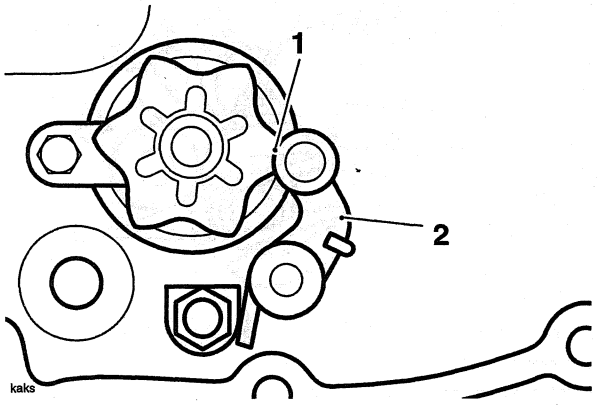
13. Fit the large washer and e-clip to the gear pedal end of the gear change shaft.




kakh

**1. Gear change shaft**
**2. E-clip**
**3. Washer**

14. Fit the gear pedal crank to the shaft in the same orientation as noted prior to removal. Tighten the fixing to **9 Nm**.
15. Position the selector drum in the neutral position.
16. Check that the detent arm locates in the raised profile in the detent wheel (neutral position).



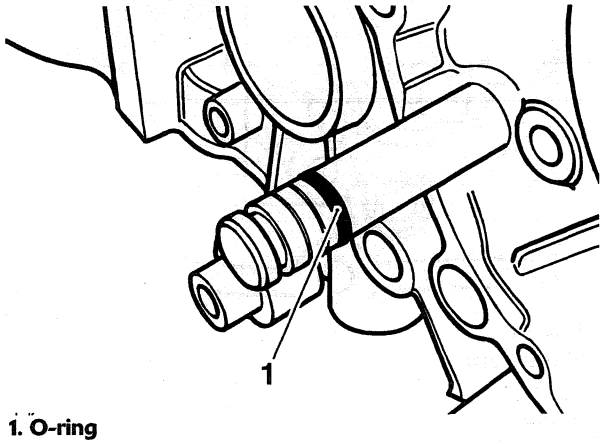

kaks

**1. Raised profile**
**2. Detent arm**

**Caution**

The selector forks can be fitted incorrectly. Ensure the position and orientation of the selector forks are the same as noted during removal. Incorrect fitting of the selector forks will cause gearbox damage when changing gear.

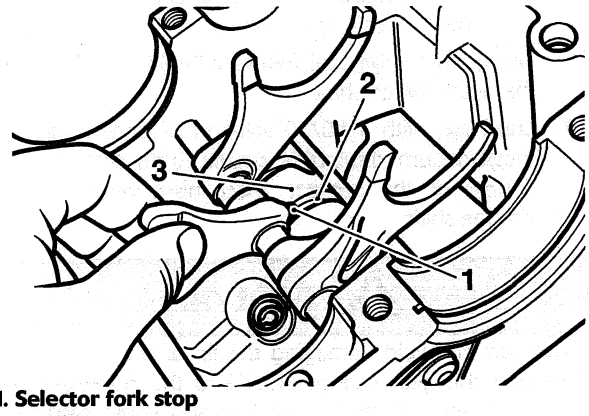
17. Push the selector shaft into the crankcase from the keeper plate end. As the shaft is inserted locate the selector forks and also fit a new O-ring (O-ring located at the keeper plate end). Ensure the forks are fitted in the positions noted during removal.




**1. O-ring**

**Note:**

- **The centre selector fork locates in the selector drum as shown below:**




**1. Selector fork stop**
**2. Selector fork guide**
**3. Selector drum**

18. Fit the 'U' shaped keeper plate.
19. Fit a new capscrew, and tighten to **12 Nm**.
20. Fit the input and output shafts (see page *7-11*).

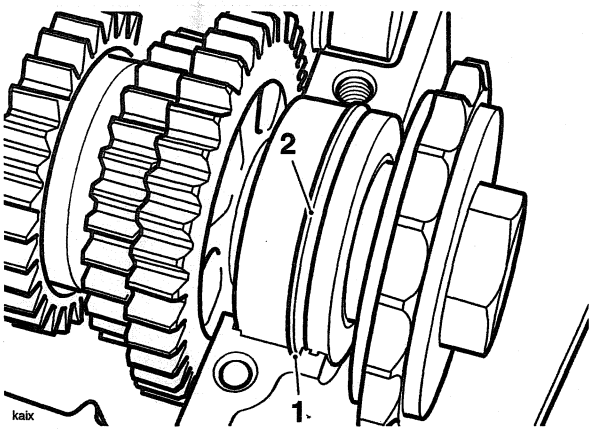
## Input and Output Shafts Assemblies

### Removal

1. Remove the engine from the frame (see page *9-2*).
2. Separate the two halves of the crank case (see page *5-4*).
3. Lift the input and output shaft assemblies out of the upper crankcase.

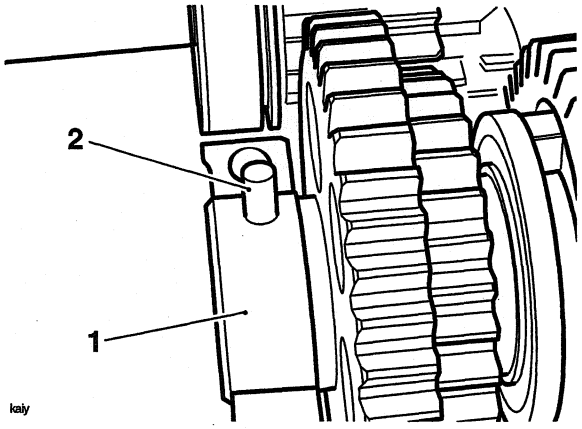
### Installation

1. Place the output shaft in position in the crankcase.
2. Ensure the retaining ring on the bearing locates in the groove provided in the crankcase.
3. Ensure the output shaft seal aligns with its recess in the crankcase.




**1. Groove in crankcase**
**2. Retaining ring**
**3. Seal**

4. Ensure the dowel in the output shaft needle roller bearing is positioned to locate in the hole provided in the upper crankcase.




**1. Roller bearing**
**2. Dowel**

5. Ensure the output shaft seal aligns with its recess in the crankcase.
6. Repeat steps 1 to 3 for the input shaft and ensure that both sets of gear mesh correctly and that the half-circlip is correctly located and is not accidentally omitted.

## Input Shaft

### Disassembly

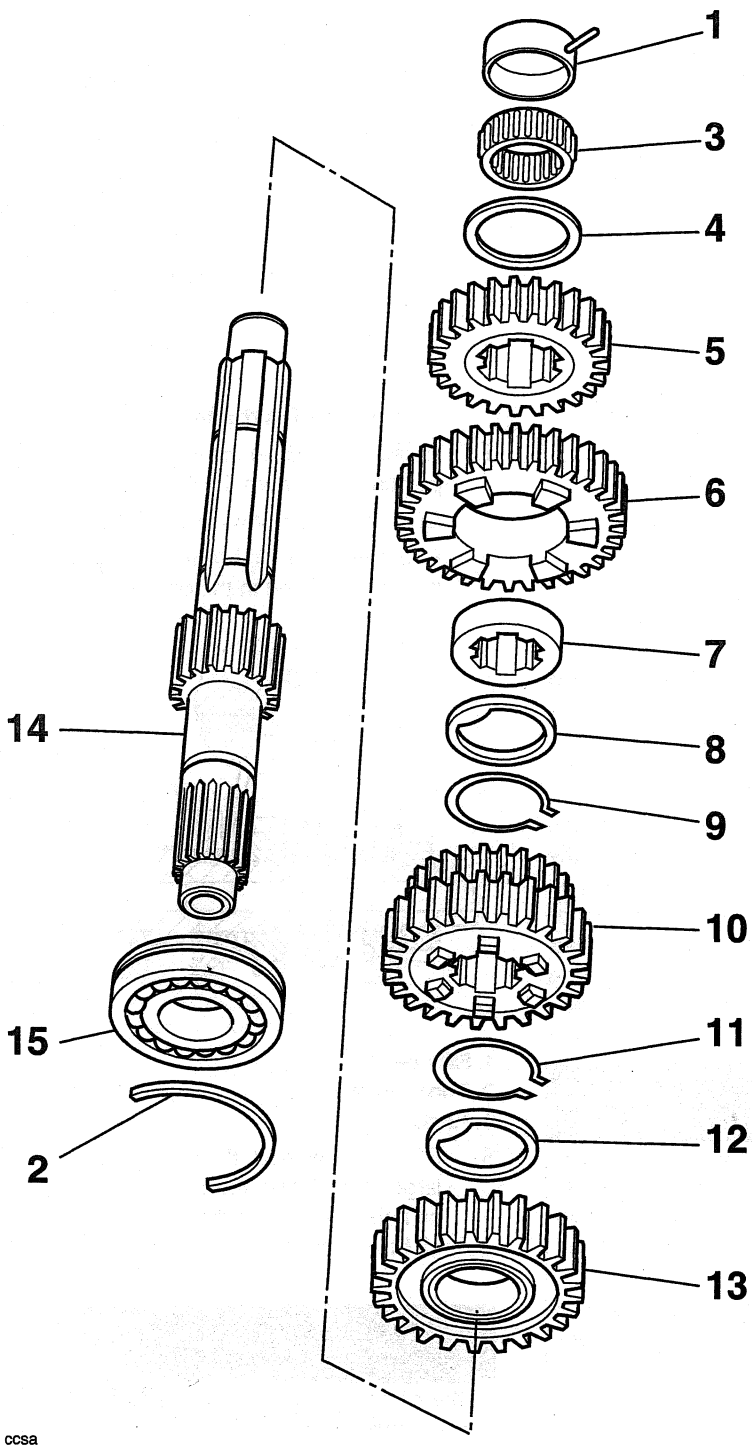
Working from the opposite end to where the clutch assembly is fitted, dismantle the input shaft as follows:

1. Remove the pegged bearing sleeve (1) from the end of the shaft.
2. Slide off the needle bearing (3) and thrust washer (4).
3. Remove second gear (5).
4. Remove sixth gear (6), complete with the splined bush (7) which runs inside the gear.
5. Remove the thrust washer (8) from in front of the circlip between sixth and third/fourth gear.
6. Remove the circlip (9) from the shaft.
7. Slide off the combined third/fourth gear (10).
8. Remove the circlip (11) from in front of fifth gear.
9. Remove the thrust washer (12) adjacent to fifth gear.
10. Remove fifth gear (13).
11. 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**

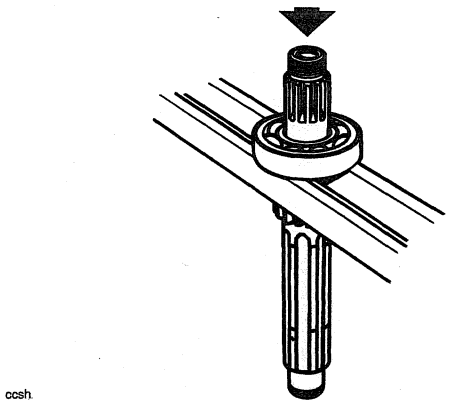
When using a press, always wear overalls, eye, face and hand protection. Objects such as bearings frequently break-up under load and the debris caused during break-up may cause damage and injury to unprotected parts of the body.

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.



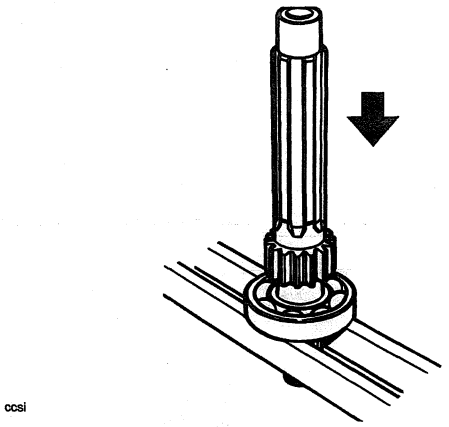

ccsa

1. Bearing Sleeve
2. Half Circlip
3. Needle Roller Bearing
4. Thrust Washer
5. Second Gear
6. Sixth Gear
7. Splined Bush
8. Thrust Washer
9. Circlip
10. Third/Fourth Gear
11. Circlip
12. Thrust Washer
13. Fifth Gear
14. Input Shaft
15. Input Shaft Bearing



ccsh

**Pressing Off The Input Shaft Bearing**



ccsi

**Pressing On 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.**

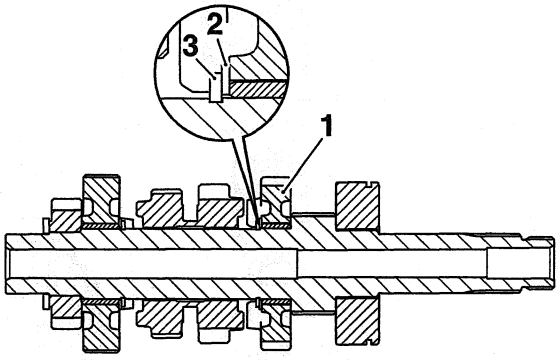
1. Place the input shaft bearing on press bars ensuring the inner race of the bearing is supported by the bars and the circlip groove is pointing upwards. Position the mainshaft to the bearing with the clutch end pointing downwards through the bearing. Press the shaft through the bearing until the bearing comes into contact with the fixed gear on the shaft.

**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.

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 located in the circlip groove.




cwb

**1. Fifth gear**
**2. Thrust washer**
**3. Circlip**

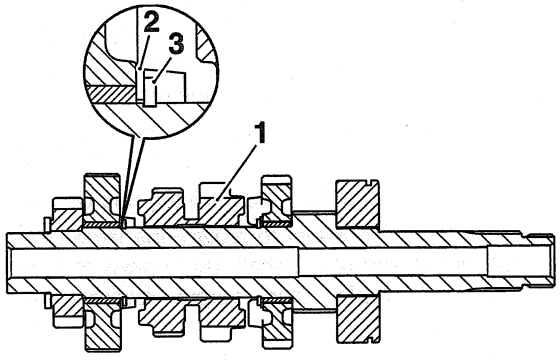
5. Fit the combined third/fourth gear (10) with the larger gear facing toward fifth gear. Ensure that the oil hole in the input shaft DOES NOT align with the oil hole in the gear.

**Warning**

If the oil hole in the third/fourth gear is aligned with the corresponding hole in the input shaft, engine oil pressure and gear lubrication will be reduced.

Reduced oil pressure and gear lubrication will cause engine damage and could also lead to engine seizure resulting in loss of motorcycle control and an accident.

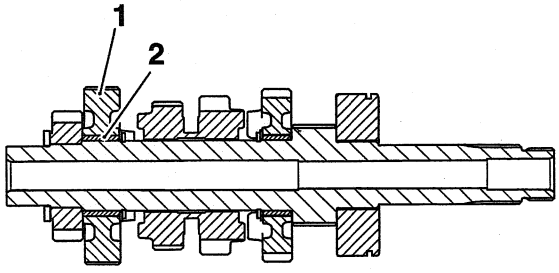
6. Fit a new circlip (9) to the input shaft ensuring that the circlip is located in the circlip groove.




ccwa

**1. Third/forth gear**
**2. Thrust washer**
**3. Circlip**

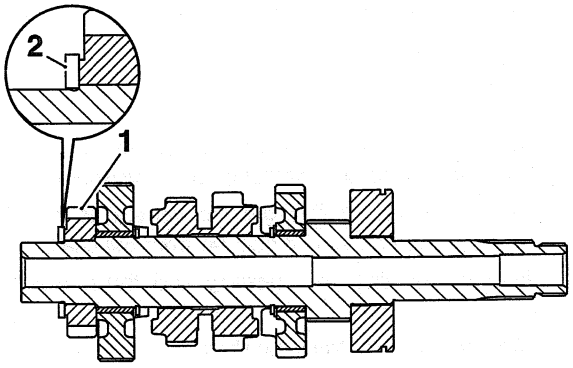
7. Fit the thrust washer (8) to the input shaft and slide up the shaft until in contact with the circlip.
8. Fit the splined bush (7) from sixth gear taking care that the oil hole in the shaft aligns with the hole in the bush.
9. Fit sixth gear (6) with the dog teeth facing third/ fourth gear.




cvz

**1. Sixth gear**
**2. Splined bush**

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).




ccvq

**1. Second gear**
**2. Thrust washer**

12. Finally, fit the bearing sleeve (1) to the needle roller bearing.

## Output Shaft

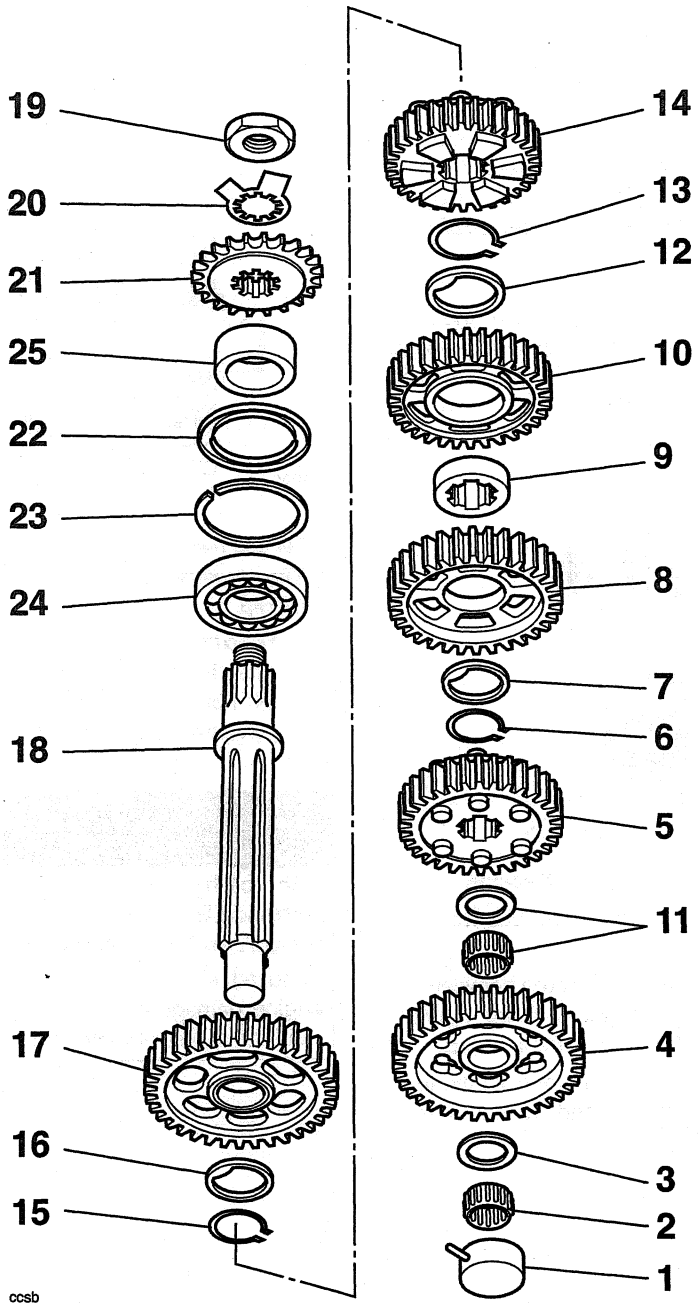
Working from the opposite end to the drive sprocket, dismantle the output shaft as follows.

### Disassembly

1. Remove the output shaft 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. Remove the first gear bearing and thrust washer (11).
4. Slide fifth gear (5) from the shaft.
5. Remove the circlip (6) from in front of the third gear.
6. Remove the splined thrust washer (7) from the shaft.
7. Remove the third gear (8).
8. Slide fourth gear (10) off the shaft and also remove the splined bush (9) and thrust washer (12).
9. Remove the circlip (13) from in front of sixth gear.
10. Remove sixth gear (14) from the shaft.
11. Remove the circlip (15) from in front of second gear.
12. Remove thrust washer (16) and slide off second gear (17).
13. 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.
14. Remove the transmission sprocket nut (19), locktab (20) and sprocket (21).
15. Collect the oil seal (22) and retaining ring (23).
16. If it is found necessary to replace the large bearing (24) at the end of the shaft, use a press to remove both the bearing and output sprocket sleeve together.

**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.



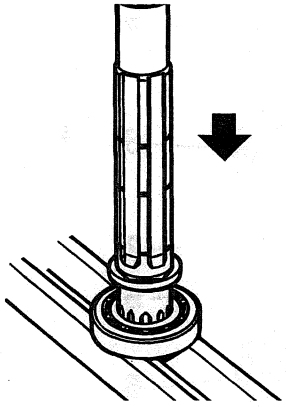

1. Bearing sleeve
2. Needle roller bearing
3. Thrust washer
4. First gear
5. Fifth gear
6. Circlip
7. Thrust washer
8. Third gear
9. Third gear bush
10. Fourth gear
11. First gear bearing & washer
12. Thrust washer
13. Circlip
14. Sixth gear
15. Circlip
16. Thrust washer
17. Second gear
18. Output shaft
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**

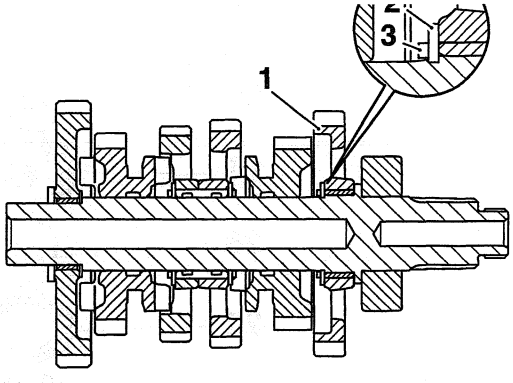
1. Working from the output sprocket end of the shaft, fit a new bearing (24) and new sleeve (25) to the shaft using a press and press bars. Fit the sleeve with the large chamfer facing outwards.



ccsj

**Pressing On the Output Shaft Bearing**

2. Fit the retaining ring (23) to the shaft. Lubricate and fit a new oil seal (22).
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).




ccww

**1. Second gear**
**2. Thrust washer**
**3. Circlip**

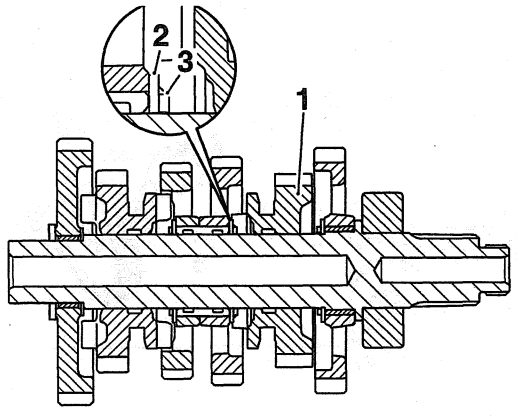
6. Fit sixth gear (14) with the selector fork groove facing away from the output sprocket end. Ensure that the oil holes in the gear DO NOT align with the corresponding oil hole in the output shaft.

**Warning**

If the oil holes in the sixth gear are aligned with the corresponding hole in the output shaft, engine oil pressure and gear lubrication will be reduced.

Reduced oil pressure and gear lubrication will cause engine damage and could also lead to engine seizure resulting in loss of motorcycle control and an accident.

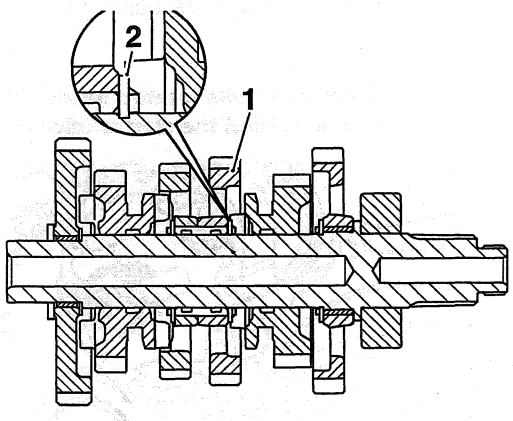
7. Fit a new circlip (13) to retain sixth gear.




ccvp

**1. Sixth gear**
**2. Thrust washer**
**3. Circlip**

8. Fit the thrust washer (12) to the rear of fourth gear. Fit the splined sleeve (9) for fourth gear, taking care to align the oil hole in the shaft with the corresponding hole in the bush. Fit fourth gear (10) to the shaft with the large step side facing towards the output sprocket.

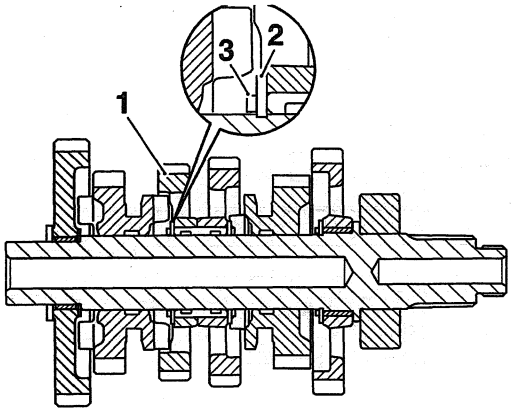



ccwd

**1. Fourth gear**
**2. Thrust washer**

9. Fit third gear (8) with the larger step side facing away from the output sprocket.

10. Fit the thrust washer (7) and retain with a new circlip (6).




ccwe

**1. Third gear**
**2. Thrust washer**
**3. Circlip**

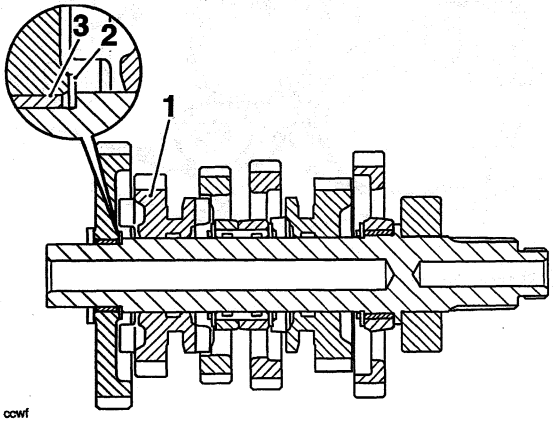
11. Fit the fifth gear (5) to the shaft with the groove facing towards the output sprocket. Ensure that the oil holes in the gear DO NOT align with the corresponding oil hole in the output shaft.

**Warning**

If the oil holes in the fifth gear are aligned with the corresponding hole in the input shaft, engine oil pressure and gear lubrication will be reduced.

Reduced oil pressure and gear lubrication will cause engine damage and could also lead to engine seizure resulting in loss of motorcycle control and an accident.

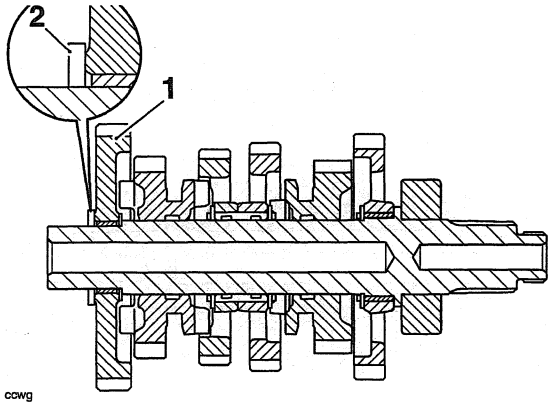
12. Fit the first gear thrust washer and bearing (11).




ccwf

**1. Fifth gear**
**2. Thrust washer**
**3. Bearing**

13. Fit first gear (4) to the shaft as marked during disassembly.



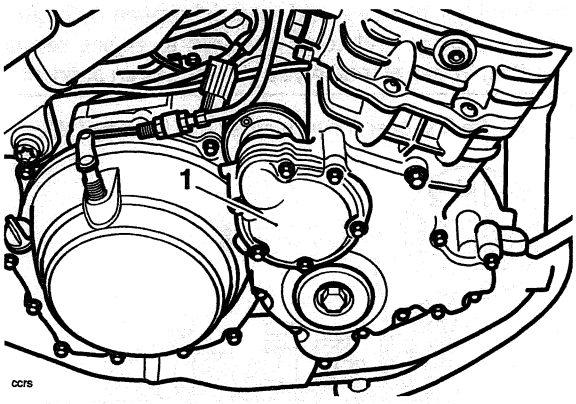

**1. First gear**
**2. Thrust washer**

14. Finally fit the thrust washer (3), needle roller bearing (2) and bearing cap (1) to the end of the shaft.

## Starter Drive Gears/Sprag Clutch

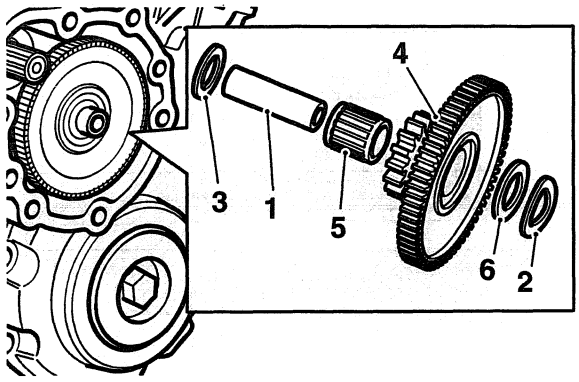
### Removal

1. Disconnect the battery, negative (black) lead first (see page *17-7*).
2. Remove the starter cover.




**1. Starter cover**

3. Withdraw the large starter idler gear noting the fitted position of all components.

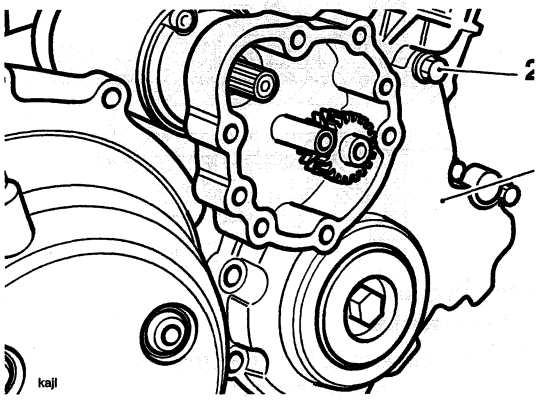



**1. Idler shaft**
**2. Wave washer**
**3. Flat washer**
**4. Idler gear**
**5. Bearing**
**6. Flat washer**

4. Remove the bolts securing the right hand crank cover noting the position of the aluminium washer under the head of one of the upper bolts.

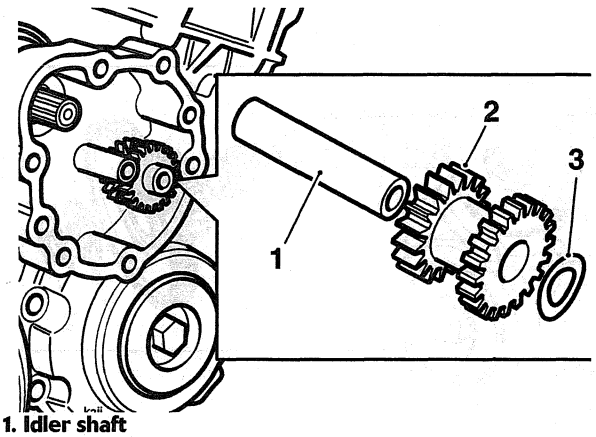
**Note:**

- **There are two bolts located inside the cover in the area behind the starter idler gear.**



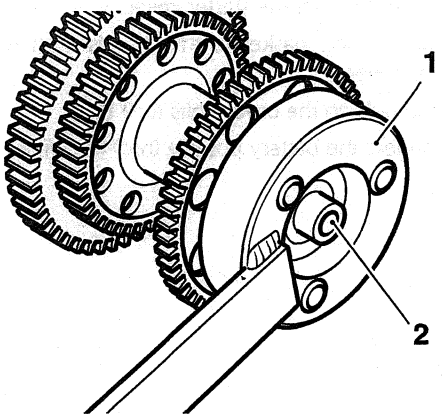

**1. Right hand crank cover**
**2. Aluminium washer position**

5. Ease the cover from the crankcase and collect the small starter idler gear again noting the position of all components.




**1. Idler shaft**
**2. Gear**
**3. Wave washer**

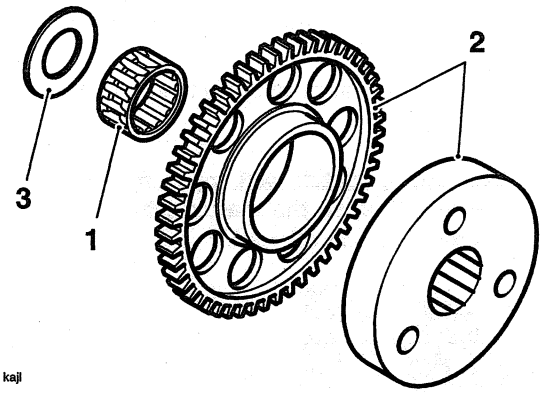
6. Using tool T3880017, prevent the sprag from turning and remove the sprag fixing and washer from the end of the crankshaft.




**1. Tool T3880017**
**2. Sprag fixing**

7. Slide the sprag clutch and gear from the crankshaft.

8. Separate the sprag clutch, bearing and gear from each other.




**1. Needle roller bearing**
**2. Sprag clutch and gear**
**3. Plain washer**

9. Recover the washer from the end of the crankshaft.

## Inspection

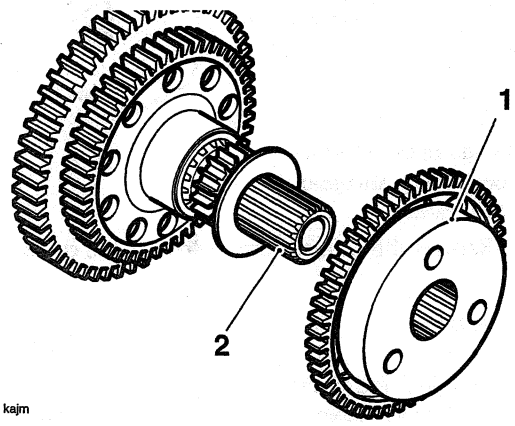
1. Examine the sprag clutch for signs of slipping, overheating (going blue) and for any other damage.
2. Examine all gears for chipped teeth, overheating (going blue) and for any other damage.
3. Examine all bearings for chipped, broken or seized rollers, overheating (going blue) and for any other damage.
4. Examine the end of the crankshaft for damage.

## Installation

1. Fit the sprag's washer to the crankshaft.
2. Assemble the needle roller bearing and sprag gear to the sprag clutch.
3. Locate the sprag clutch assembly to the crankshaft.

**Note:**

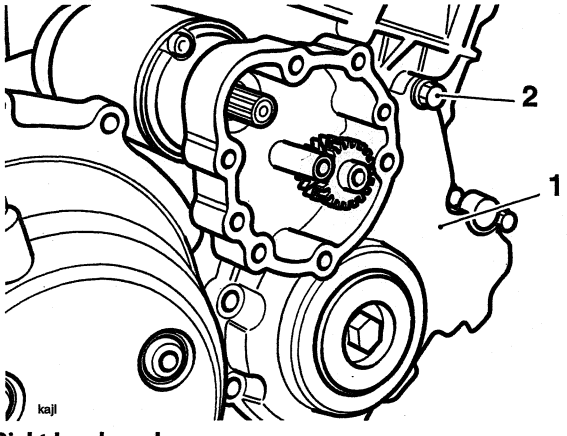
- **The sprag clutch will only fit with the crankshaft when the master splines on both components are aligned.**




kajm

**1. Sprag clutch**
**2. Crankshaft end**

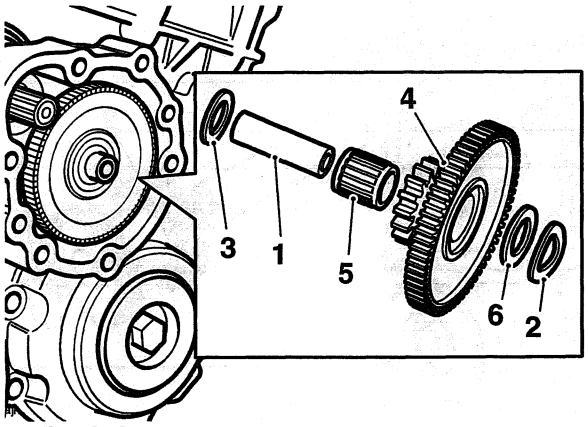
4. Prevent the sprag from turning using tool T3880017 then fit and tighten a new sprag fixing and washer to **54 Nm**.
5. Lubricate the idler gear shaft.
6. Fit the small idler gear, shaft and wave-washer (washer to the outside of the gear) to the crankcase.
7. Thoroughly clean the right hand crank cover.
8. Position a new gasket to the crankcase dowels then refit the right hand crank cover.
9. Ensure the bolt with the aluminium washer is correctly located then tighten the cover bolts to **9 Nm**.




kajl

**1. Right hand crank cover**
**2. Aluminium washer position**

10. Lubricate then refit the large starter idler gear ensuring that all components are located in the positions noted on removal.



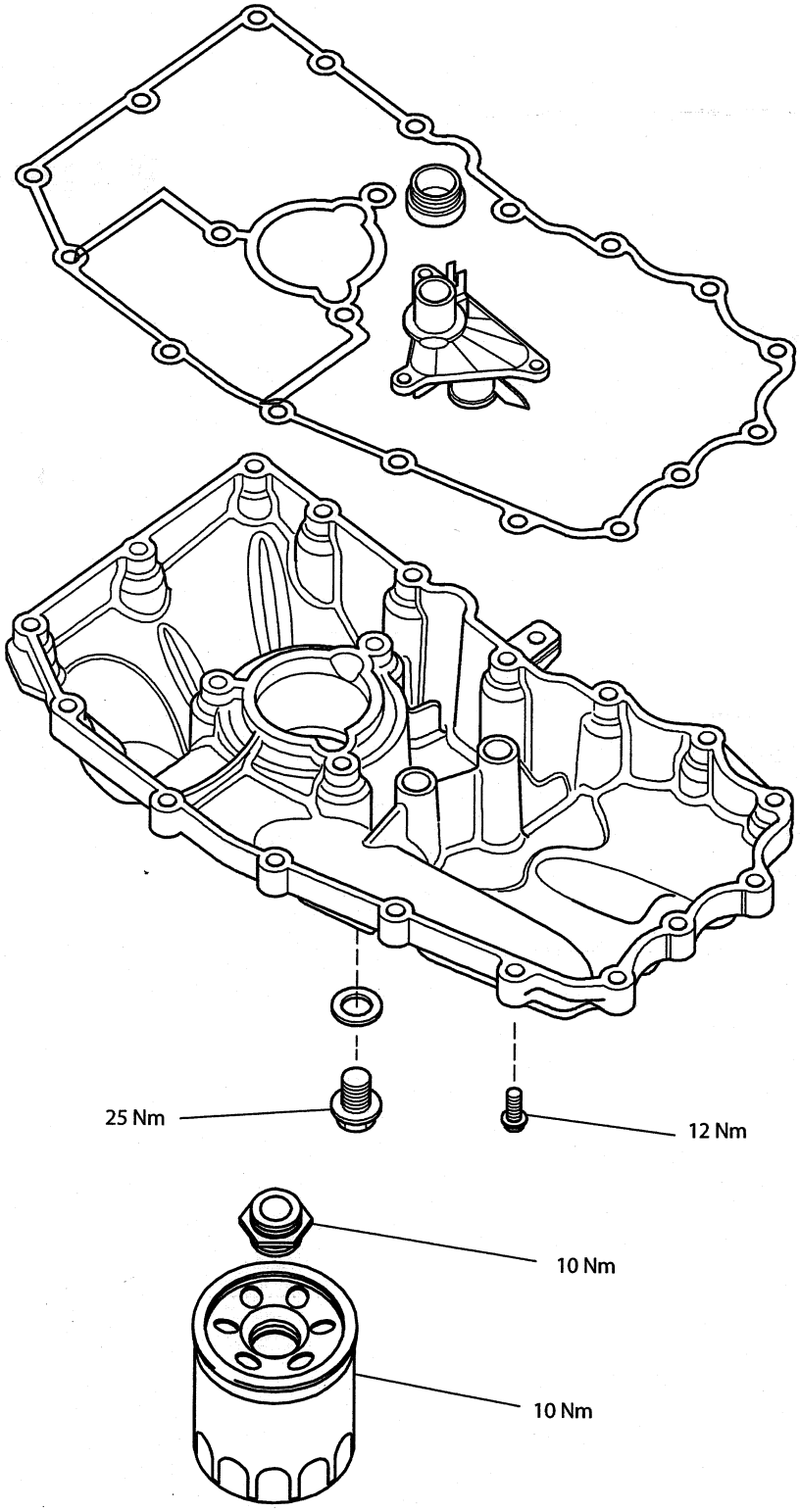

**1. Idler shaft**
**2. Wave washer**
**3. Flat washer**
**4. Gear**
**5. Bearing**
**6. Flat washer**

11. Thoroughly clean the starter cover.
12. Position a new gasket to the dowels then refit the starter cover.
13. Fit and tighten the cover bolts to **9 Nm**.
14. Reconnect the battery positive (red) lead first.

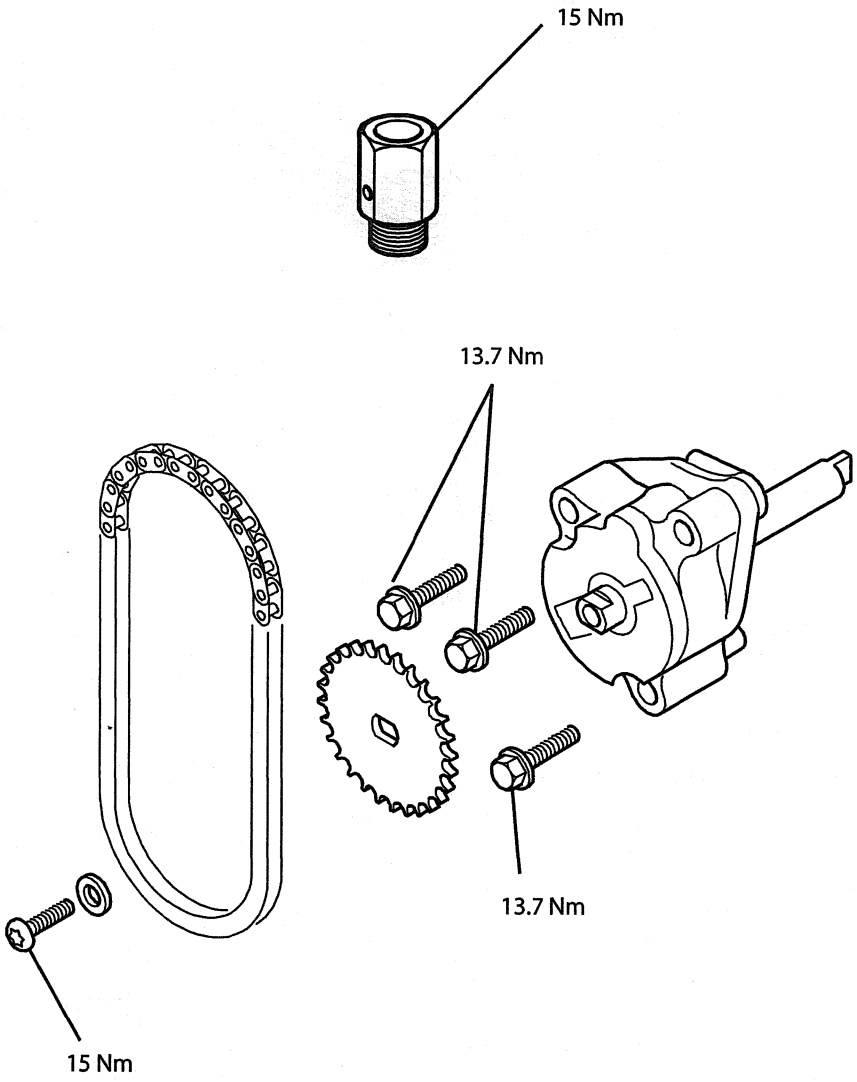
# 8 Lubrication

## Table of Contents

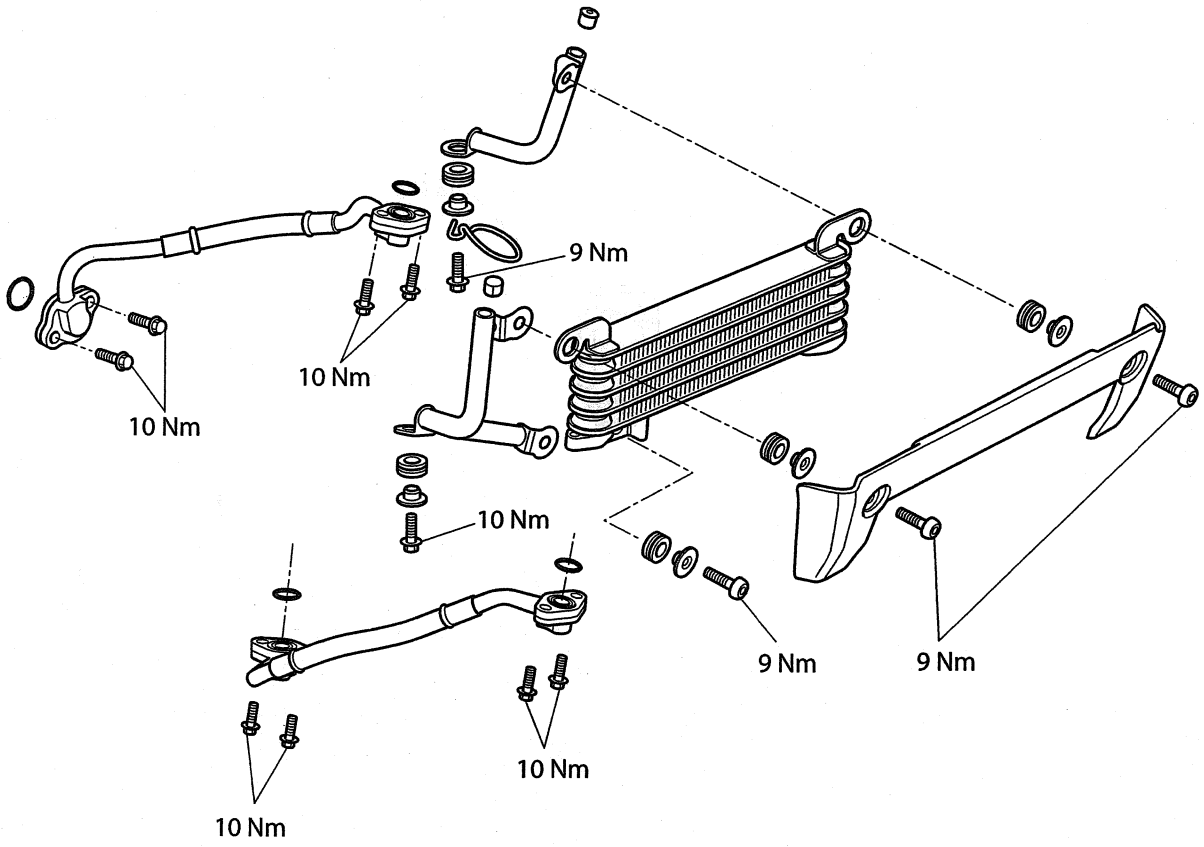
## Exploded View - Sump



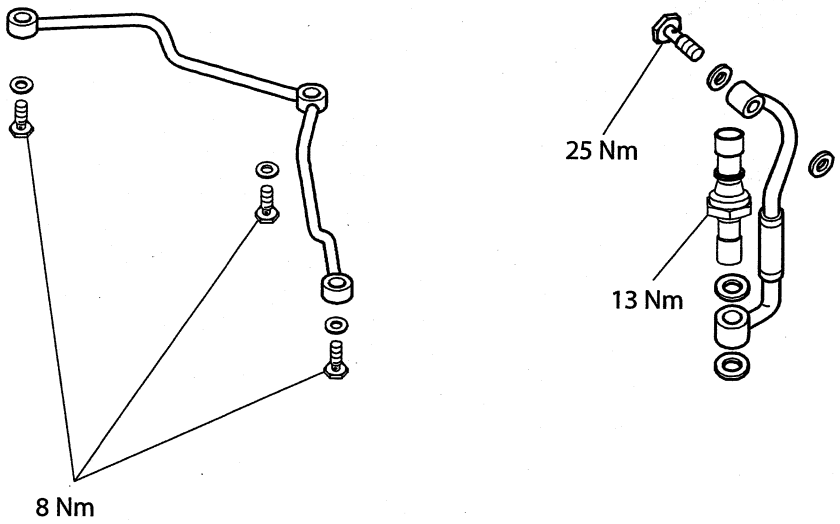
## Exploded View - Oil Pump and Gears



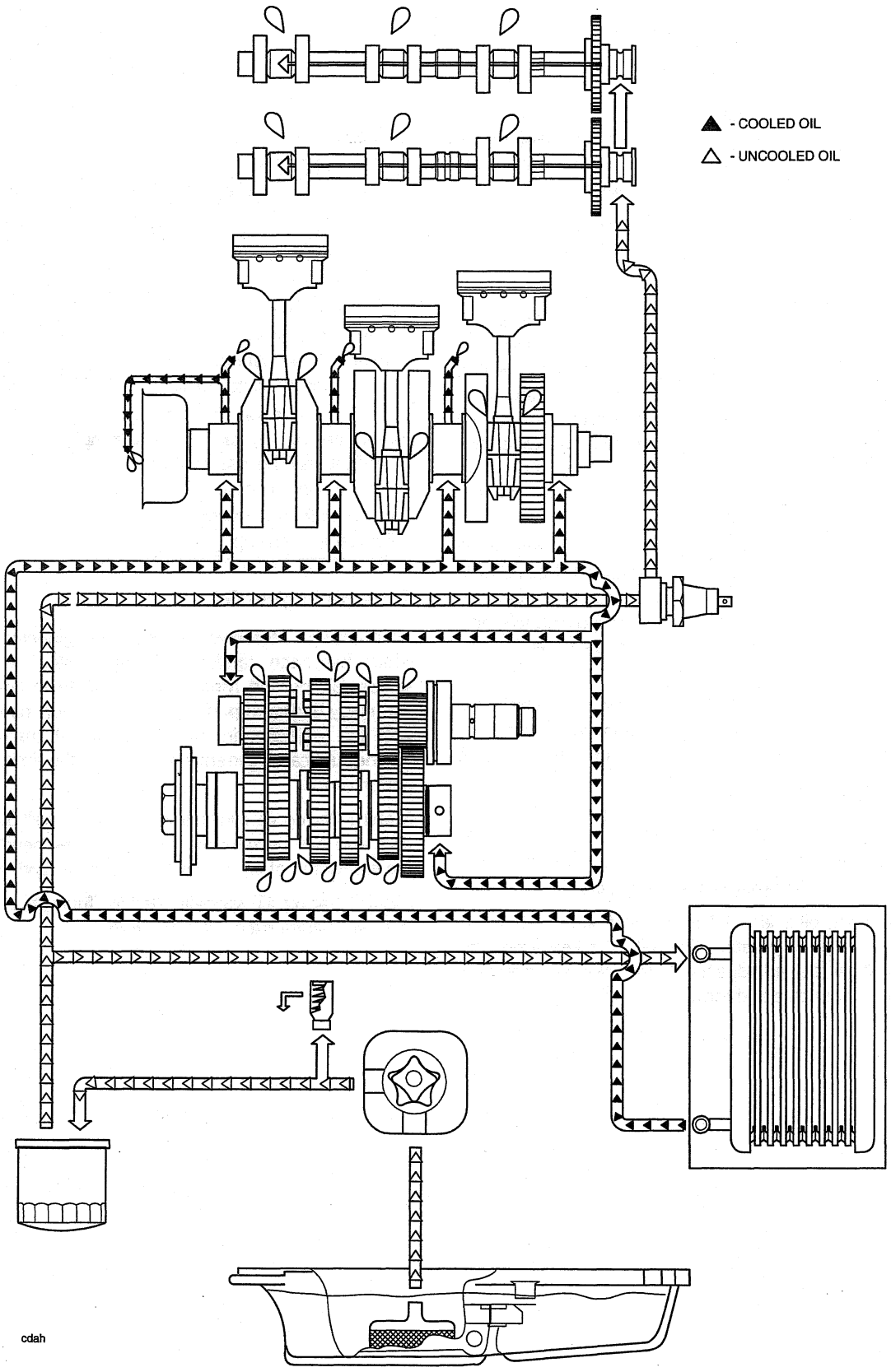
## Exploded View - Oil Cooler




## Exploded View - Oil Pipes



## 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. The oil pump is fitted with a single pumping rotor which supplies pressurised oil to the lubrication circuit and the oil cooler.

Pressurised oil is delivered to the outside rim of the oil filter near to where the oil pressure relief valve is fitted. The relief valve is set to open at 75 lb/in² and when open, returns high pressure oil direct to the sump.

Filtered oil is then fed into the lower crankcase gallery and from here is distributed around the engine:

1. Some oil is sent directly to the cylinder head via a drilling in the upper crankcase and an external link pipe. A low oil pressure warning light switch is located at the crankcase end of the link pipe. Oil that arrives at the cylinder head is fed to both cams via a gallery in the cylinder head casting that delivers oil directly to the sprocket end cam bearings. Oil is then fed through the hollow camshafts to the other camshaft bearings, the tappet buckets and the valves.
2. The remaining oil is sent directly to the remote oil cooler (mounted beneath the radiator). Cooled oil is returned to the main gallery located under the crankshaft. Here it is delivered to the crankshaft main bearings and, via drillings in the crankshaft, to the big end bearings.

Spray jets located in the upper crankcase, behind the main bearing shells, lubricate the pistons and connecting rod small ends. These jets are fed oil from the crankshaft oil feed.

Oil is fed to the gearbox via internal oil pipes and drillings that supply oil directly to the end of each shaft. Oil is circulated along the gearbox shafts to exit holes that feed directly to the bearings, gears and selectors.

On the Tiger, oil is also fed to the alternator cover to aid cooling of the alternator. The oil is taken from the crankshaft oil feed and directed to the cover via drillings in the upper crankcase and through a small hole in the cover gasket.

## Engine Oil

### Specification

Use semi or fully synthetic 10W/40 or 15W/50 motorcycle engine oil which meets specification API SH (or higher) and JASO MA, such as Mobil 1 Racing 4T.

**⚠ Caution**

Triumph high performance fuel injected engines are designed to use semi or fully synthetic motorcycle engine oil which meets specification API SH (or higher) AND JASO MA.

Do not add any chemical additives to the engine oil. The engine oil also lubricates the clutch and any additives could cause the clutch to slip.

Do not use mineral, vegetable, non-detergent oil, castor based oils or any oil not conforming to the required specification. The use of these oils may cause instant, severe engine damage.

Ensure no foreign matter enters the crankcase during an oil change or top-up.

### 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.

## Oil Level Inspection

In order for the engine, transmission, and clutch to function correctly, maintain the engine oil at the correct level, and change the oil and oil filter in accordance with scheduled maintenance requirements.

**Warning**

Motorcycle operation with insufficient, deteriorated, or contaminated engine oil will cause accelerated engine wear and may result in engine or transmission seizure. Seizure of the engine or transmission may lead to loss of motorcycle control and an accident.

**Warning**

Never start the engine or run the engine in a confined area. Exhaust fumes are poisonous and can cause loss of consciousness and death within a short period of time. Always operate your motorcycle in the open-air or in an area with adequate ventilation.

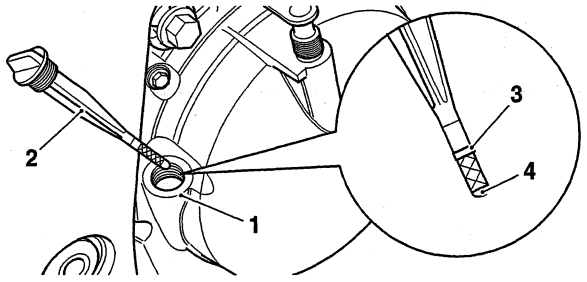
**Caution**

Running the engine with insufficient oil will cause engine damage. If the low oil pressure indicator light remains on, stop the engine immediately and investigate the cause.

**Note:**

- **An accurate indication of the level of oil in the engine is only shown when the engine oil is at normal operating temperature, the motorcycle is upright (not on the side stand) and the filler plug/dipstick has been fully screwed home.**

1. Start the engine and run at idle for approximately five minutes.
2. Stop the engine and wait for three minutes to allow the oil to settle.
3. With the motorcycle upright, remove the filler plug/dipstick, wipe the blade clean and screw it fully home.




**1. Filler**
**2. Filler plug/dipstick**
**3. Upper marking**
**4. Lower marking**

4. Remove the filler plug/dipstick.
5. The oil level is indicated by lines on the filler plug/dipstick. When full, the indicated oil level must be level with the upper marking on the dipstick.
6. If the oil level is too low, add oil a little at a time until the correct level is reached.
7. Once the correct level is reached, re-fit the filler plug/dipstick.

## Oil and Oil Filter Change

**Warning**

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

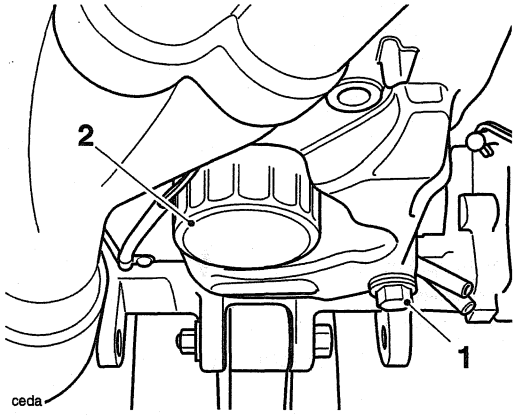
The engine oil and filter must be replaced in accordance with scheduled maintenance requirements.

1. Warm up the engine thoroughly, and then stop the engine and secure the motorcycle in an upright position on level ground.
2. Place an oil pan beneath the engine.

**Warning**

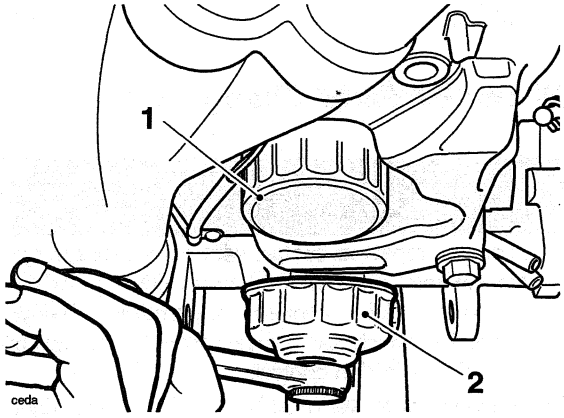
The oil may be hot to the touch. Avoid contact with the hot oil by wearing suitable protective clothing, gloves, eye protection, etc. Contact with hot oil may cause the skin to be scalded or burned.

3. Remove the oil drain plug. Discard the sealing washer.




**1. Oil drain plug**
**2. Oil filter**

4. Unscrew and remove the oil filter using Triumph service tool T3880312.




**1. Oil filter**
**2. Tool T3880312**

5. Dispose of the old filter in an environmentally friendly way.
6. Pre-fill a new oil filter with clean engine oil.
7. Apply a smear of clean engine oil to the sealing ring of the new oil filter.
8. Fit the oil filter and tighten to **10 Nm.**
9. After the oil has completely drained out, fit a new sealing washer to the drain plug. Fit and tighten the plug to **25 Nm.**
10. Fill the engine with new oil of the type and grade listed previously and in the specification section.
11. Start the engine and allow to idle.

**Caution**

Racing the engine before the oil reaches every part can cause engine damage or seizure.

12. Ensure that the oil pressure warning light extinguishes shortly after starting.

**Caution**

If the engine oil pressure is too low, the low oil pressure warning light will illuminate. If this light stays on when the engine is running, stop the engine immediately and investigate the cause. Running the engine with low oil pressure will cause engine damage.

13. Stop the engine and check the oil level. Adjust if necessary.

### Disposal of Used Engine Oil

To protect the environment, do not pour oil on the ground, down sewers or drains, or into water courses. Dispose of used oil sensibly. If in doubt contact your local authority.

## Oil Pump

**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.

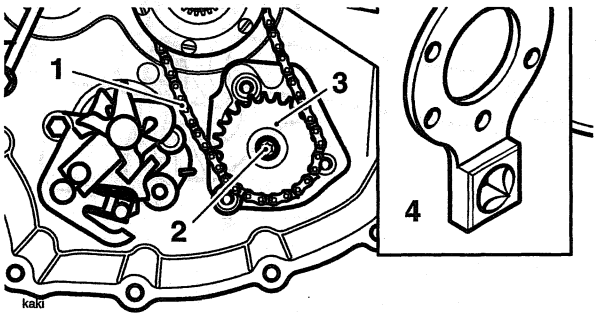
When handling used engine oil, always wear protective clothing and avoid any skin contact with the oil.

**Caution**

Do not pour engine 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.

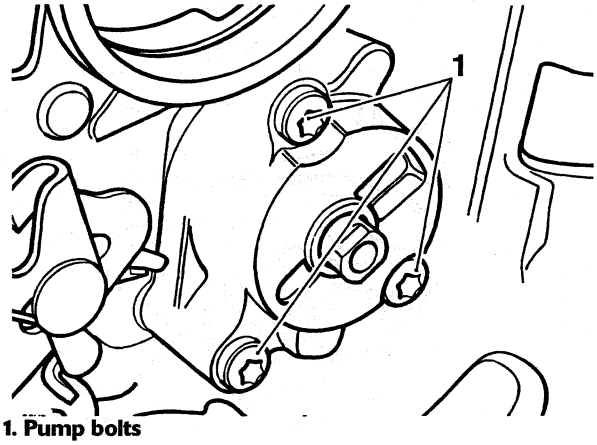
### Removal

1. Remove the seat (see page *16-9*).
2. Disconnect the battery, negative (black) lead first.
3. Remove the clutch (see page *4-5*).
4. Fit tool T3880371 to the drive dogs on the upper oil pump drive sprocket. Hold the tool to prevent rotation and release the bolt securing the oil pump drive sprocket to the oil pump.




**1. Oil pump drive chain**
**2. Pump drive sprocket fixing**
**3. Pump drive sprocket**
**4. Tool T3880371**

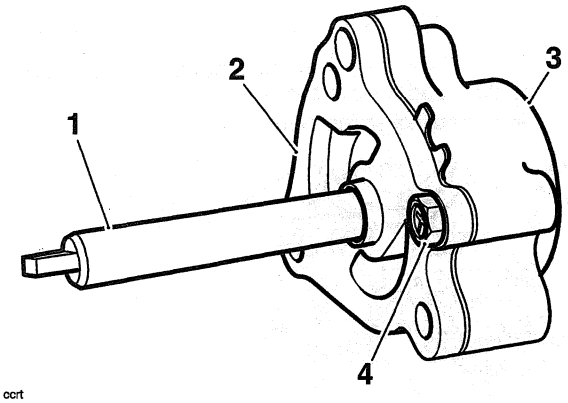
5. Remove the tool, upper and lower sprockets, upper sprocket bearing and the drive chain by sliding all components off the shaft together.
6. Release the bolts securing the oil pump to the crankcase and withdraw the oil pump.




**1. Pump bolts**

### Inspection

1. Release the screw and withdraw the oil pump plate from the pump body.




ccrt

**1. Oil pump drive shaft**
**2. Oil pump plate**
**3. Oil pump body**
**4. Screw**

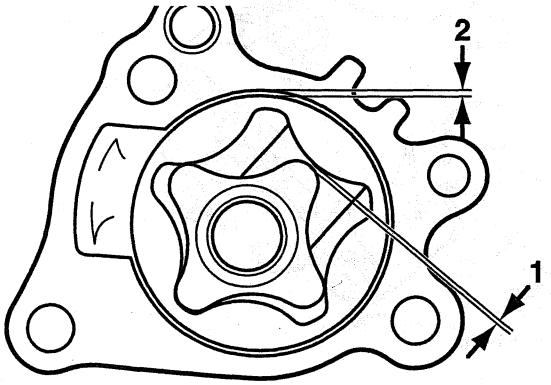
**Caution**

If any part of the oil pump is found to be outside the service limit, the complete pump must be replaced. Severe engine damage may result from the continued use of a faulty oil pump.

2. Measure the rotor tip clearance using feeler gauges.

**Rotor Tip Clearance**

| | |
|---|---|
| Standard: | 0.15 mm |
| Service limit: | 0.20 mm |




**1. Rotor tip clearance**
**2. Pump body clearance**

3. Measure the pump body clearance using feeler gauges.

**Body Clearance**

| | |
|---|---|
| Standard: | 0.15 - 0.22 mm |
| Service limit: | 0.35 mm |

4. Measure the pump end clearance.

**Pump End Clearance**

| | |
|---|---|
| Standard: | 0.02 - 0.07 mm |
| Service limit: | 0.10 mm |

5. (a) If all clearances are within service limits, liberally apply clean engine oil to all internal components and refit the oil pump plate to the oil pump body.

   **(b) If any clearance measured is outside the service limits, renew the complete pump.**

6. Inspect the sprocket and chain for wear and/or damage. Replace the sprocket and chain if wear and/or damage is found.

### Installation

**Caution**

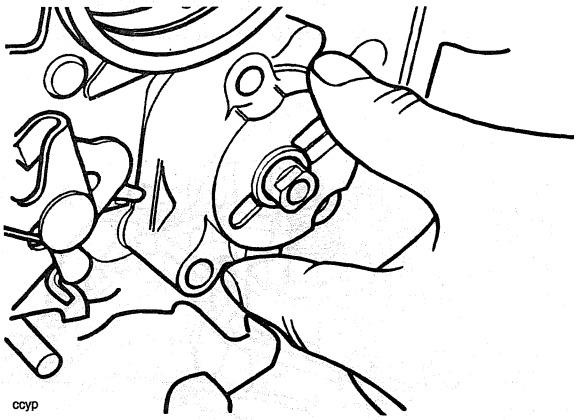
Before fitting the oil pump to the crankcase ensure the pump internal surfaces have been 'wetted' with clean engine oil. The pump may fail to pick-up oil from the sump if the surfaces have not been 'wetted'. This will cause the engine to run without engine oil pressure and will lead to severe engine damage.

1. Fill the oil pump with new engine oil, turning the pump rotor as the oil is poured in to ensure all surfaces are coated with oil.
2. Position the oil pump to the crankcase and insert into the opening provided.

**Note:**

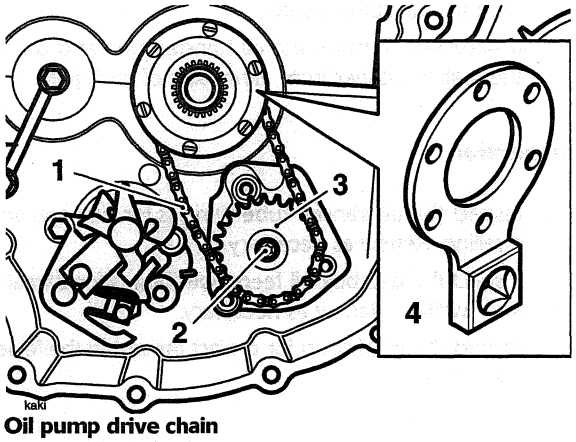
- **Use the sprocket end of the oil pump shaft to turn the drive peg into alignment with the drive on the water pump.**

3. Fit the oil pump to the crankcase, ensure the water pump drive peg locates into the drive on the water pump shaft. Tighten the bolts to **13.7 Nm.**




**Pump Insertion**

4. As an assembly, slide the upper drive sprocket bearing, upper drive sprocket, drive chain and pump sprocket onto the input shaft and oil pump.

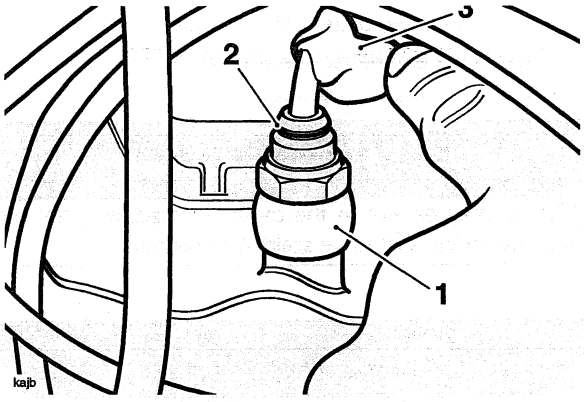



**1. Oil pump drive chain**
**2. Pump drive sprocket fixing**
**3. Pump drive sprocket**
**4. Tool T3880371**

5. Locate the pump drive sprocket onto the pump ensuring that the drive engages correctly.
6. Refit tool T3880371 to the upper drive sprocket and tighten a new oil pump drive sprocket centre bolt to **15 Nm.** Remove the tool.
7. Assemble the clutch (see page *4-9*).
8. Reconnect the battery, positive (red lead) first.
9. Refill the engine with oil (see page *8-7*).

## 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 seat (see page *16-9*).
2. Disconnect the battery negative (black) lead first.
3. Lift the covering boot and disconnect the electrical connection to the switch.
4. Remove the switch and collect the copper washers.

### Installation

1. Using new copper washers on both sides of the oil pipe union, 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 seat (see page *16-9*).
2. Disconnect the battery negative (black) lead first.
3. Drain the engine oil (see page *8-7*).

**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.

4. Remove the belly pan (see page *16-17*).
5. Remove the exhaust system (see page *10-119*).

**Warning**

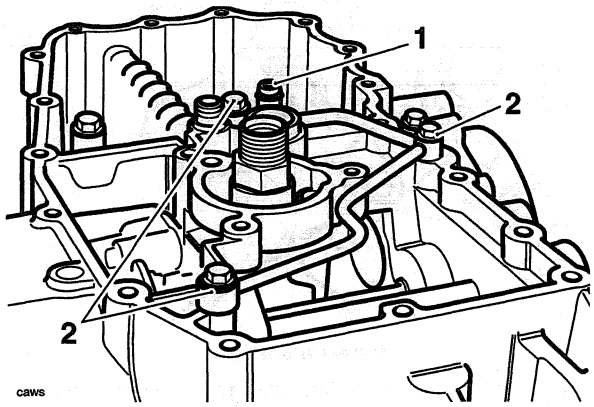
The exhaust system will be hot if the engine has recently been running. Always allow sufficient time for the exhaust to cool before working on or near the exhaust system.

Contact with a hot exhaust could result in burn injuries.

6. Remove the oil filter (see page *8-7*).
7. Release the bolts securing the sump to the lower crankcase.
8. Detach the sump and collect the oil transfer tube.

**Note:**

- **The oil transfer tube may remain in the crankcase or become detached with the sump.**




**1. Oil transfer tube**
**2. Transmission oil feed pipe fixings**

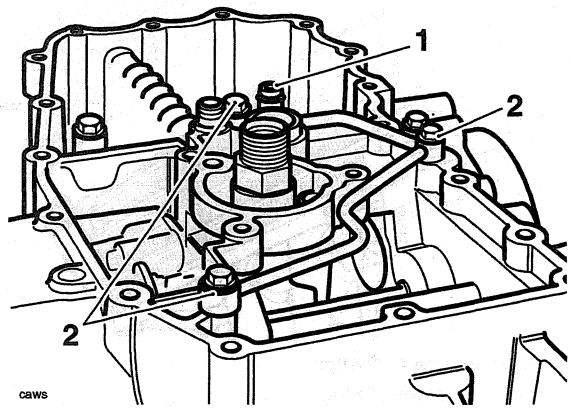
9. Remove the sump gasket.
10. If necessary, remove the oil transfer pipe and collect the sealing washer from either side of each joint.

### 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.
3. Inspect the oil pick-up for correct fitment in the lower crankcase.

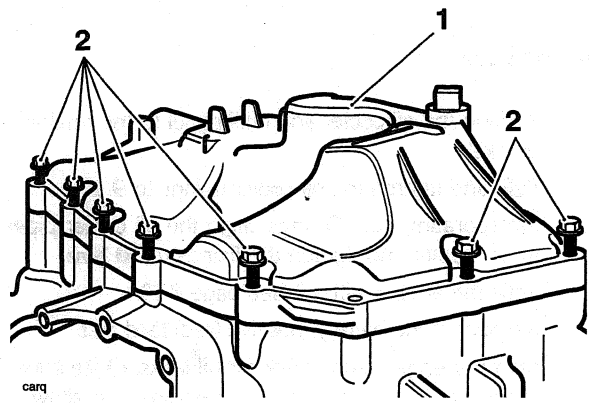
## Installation

1. Fit the oil transfer tube to the crankcase.




**1. Oil transfer tube**
**2. Transmission oil feed pipe fixings**

2. If removed, fit the oil transfer pipe incorporating new washers. Tighten the fixings to **8 Nm.**
3. Incorporating a new sump gasket, position the sump to the lower crankcase.
4. Tighten the sump fixings to **12 Nm.**




**1. Sump**
**2. Fixings**

5. Pre-fill a new oil filter with clean engine oil.
6. Apply a smear of clean engine oil to the seal of the new oil filter.
7. Fit the oil filter and tighten to **12 Nm** using tool T3880012.
8. Refit the exhaust system (see page *10-120*).

**Note:**

- **Use new exhaust gaskets at the downpipe connections with the cylinder head.**

9. Fill the engine with the correct grade of engine oil
10. Reconnect the battery positive (red) lead first.
11. Start the engine and ensure that the low oil pressure warning light goes out shortly after starting.
12. Stop the engine and adjust the engine oil level.
13. Refit the belly pan (see page *16-17*).
14. Refit the seat (see page *16-9*).

## Oil Cooler

### Removal

1. Remove the seat (see page *16-9*).
2. Disconnect the battery, negative (black) lead first.
3. Drain the engine oil (see page *8-7*).

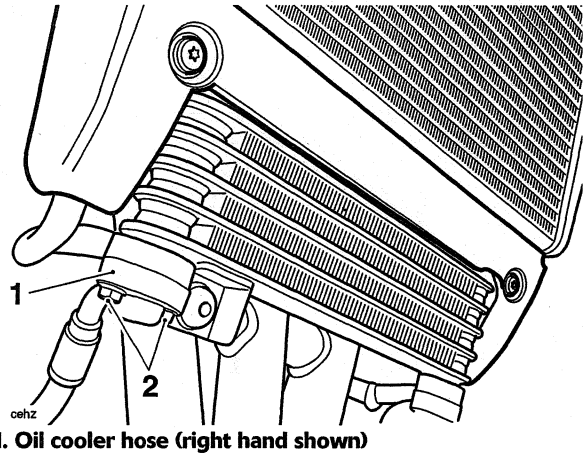
**Warning**

The oil may be hot to the touch. Contact with hot engine oil may cause skin to be scalded or burnt.

**Warning**

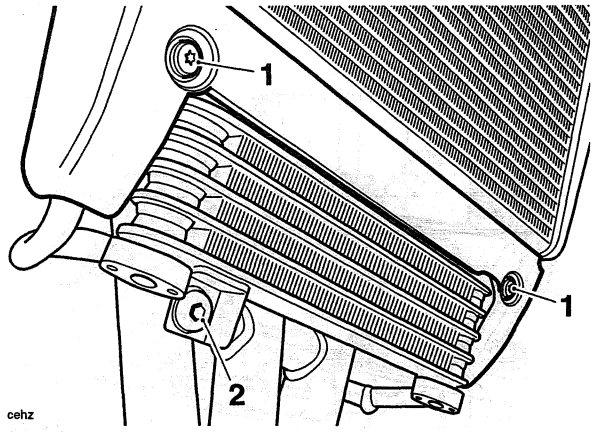
Prolonged or repeated contact with engine oil can lead to skin dryness, irritation and dermatitis. In addition used engine oil contains potentially harmful contaminants which can cause cancer. Wear suitable clothing and avoid skin contact.

4. Disconnect the oil cooler feed and return hoses.




**1. Oil cooler hose (right hand shown)**
**2. Fixings**

5. Release the oil cooler fixings.




**1. Upper oil cooler fixings**
**2. Lower oil cooler fixing**

6. Detach the oil cooler, collecting the oil cooler infill panel as it is released.

### Inspection

1. Inspect the oil cooler connection points for fractures and signs of oil leakage.
2. Check the oil cooler fins for damage and leaks.

### Installation

1. Position the oil cooler and infill panel to the retaining brackets.
2. Refit and tighten the oil cooler fixings to **9 Nm.**
3. Incorporating new O-rings, align the oil cooler pipes to the cooler and tighten the fixings to **10 Nm.**
4. Refill the engine with oil (see page *8-7*).
5. Reconnect the battery, positive (red) lead first.
6. 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.
7. Adjust the engine oil level (see page *8-7*).
8. Refit the seat (see page *16-9*).

# 9 Engine Removal/Refit

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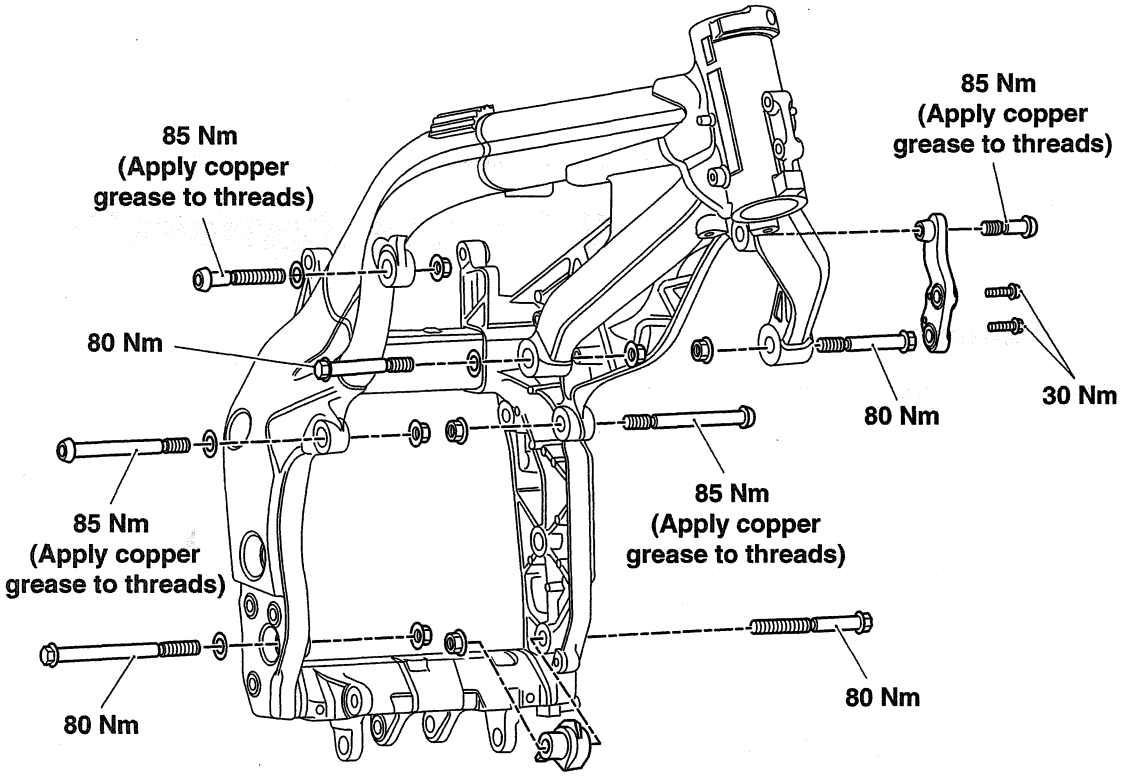
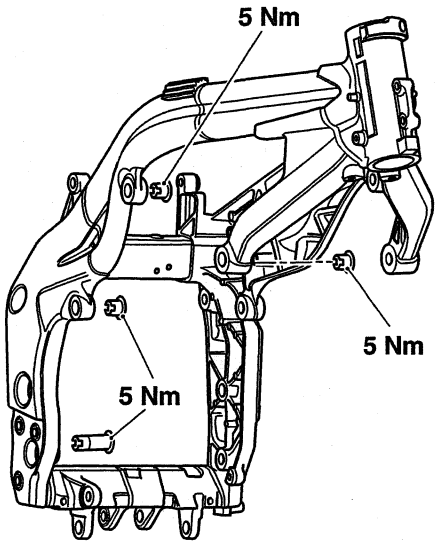
## Exploded View - Engine Mountings




Refer to text for bolt tightening sequence

## Exploded View - Frame Adjuster Sleeves




Refer to text for frame adjuster tightening sequence

## Engine Removal/Refit

**Warning**

Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

1. Place the motorcycle on a paddock stand.
2. Remove the seat (see page *16-9*).
3. Remove the battery (see page *17-7*).
4. Remove the body rear panel and side fairings (see page *16-10*).
5. Remove the fuel tank (see page *10-99*).
6. Remove the airbox (see page *10-104*).
7. Drain the engine oil (see page *8-7*).
8. Remove the oil cooler (see page *8-14*).
9. Remove the radiator (see page *11-8*).

**Note:**

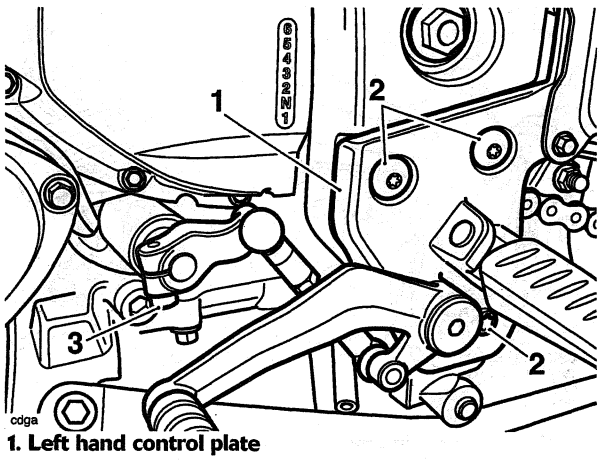
- **Secure the hoses to prevent damage as the engine is removed.**

10. Remove the exhaust system (see page *10-119*).
11. Set the drive chain adjustment to allow maximum free play in the chain (see page *12-12*).

**Caution**

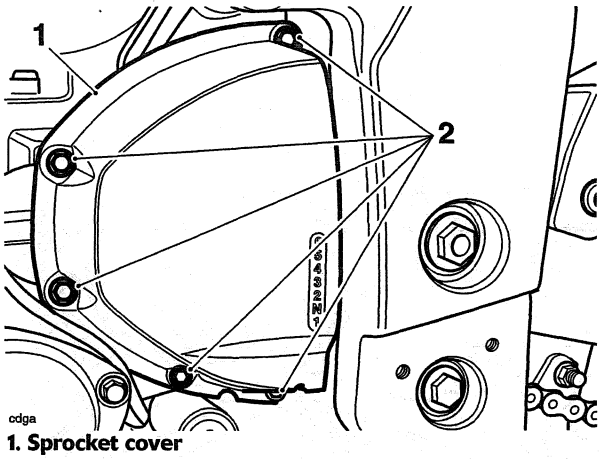
To prevent chain damage, do not allow the chain to come into contact with dirt, road grit etc.

12. Remove the bolt and, noting its position, detach the gear change lever from the transmission shaft.
13. Remove the three fixings and remove the left hand control plate, heel guard, gear lever and linkage as an assembly.



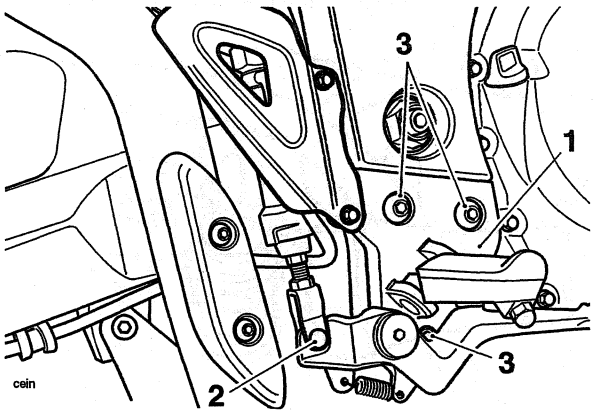

**1. Left hand control plate**
**2. Control plate fixings**
**3. Gearchange lever fixing**

14. Remove the sprocket cover.



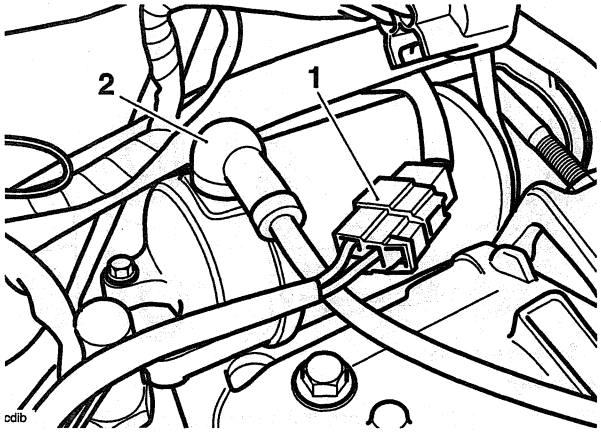

**1. Sprocket cover**
**2. Fixings**

15. Remove the clip from the clevis pin at the lower end of the brake pushrod. Remove the clevis pin.
16. Remove the three fixings and remove the right hand control plate and brake pedal as an assembly.



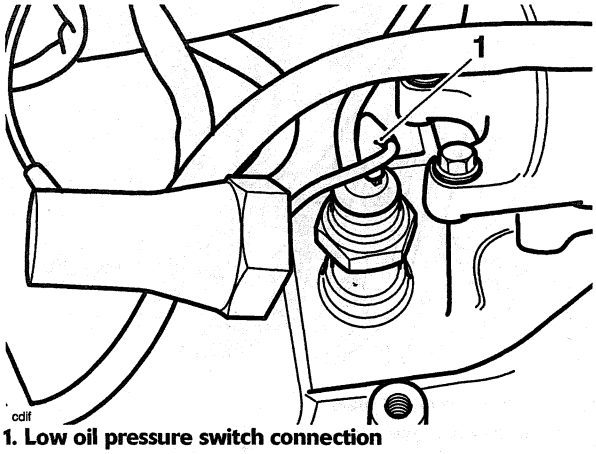

**1. Right hand control plate**
**2. Brake pedal clevis pin**
**3. Control plate fixings**

17. Ease the boot from the starter lead and release the lead nut. Detach the lead.
18. Disconnect the alternator multiplug.




**1. Alternator multiplug**
**2. Starter motor connection**

19. Ease the boot from the low oil pressure warning light switch and disconnect the electrical connector.




**1. Low oil pressure switch connection**

20. Disconnect the vehicle speed sensor multiplug.
21. Disconnect the side stand switch multiplug.
22. Disconnect the engine ground connections.
23. Disconnect the crankshaft position sensor multiplug.
24. Disconnect the neutral position indicator switch electrical connector.
25. Remove the throttle bodies, injectors and fuel rail from the cylinder head (see page *10-113*).

**Note:**

- **It is not necessary to disconnect the throttle cables. position the throttle bodies aside.**

26. Disconnect the clutch cable (see page *4-5*).

**Caution**

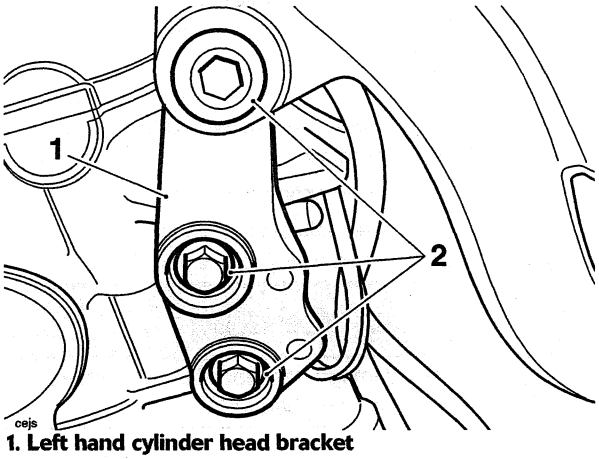
Failure to ensure adequate support for either the engine or motorcycle could cause both components to fall or move unexpectedly. A fall or sudden movement could lead to injury.

27. Place a support beneath the engine and ensure that the frame is still adequately and securely supported.

**Caution**

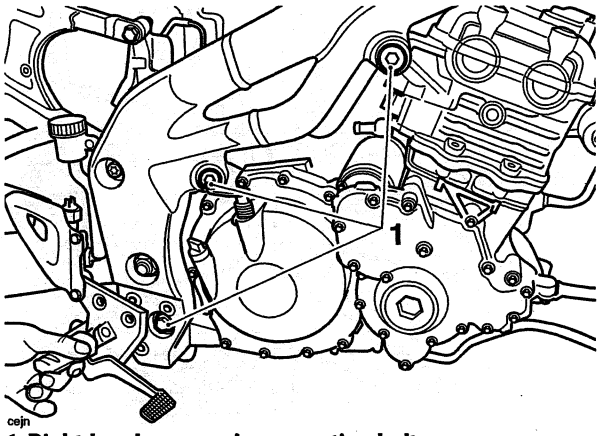
To prevent damage to components, lower the engine very carefully. Particularly vulnerable items include the throttle position sensor and the throttle body assembly.

28. Release the three bolts and remove the left hand cylinder head bracket.



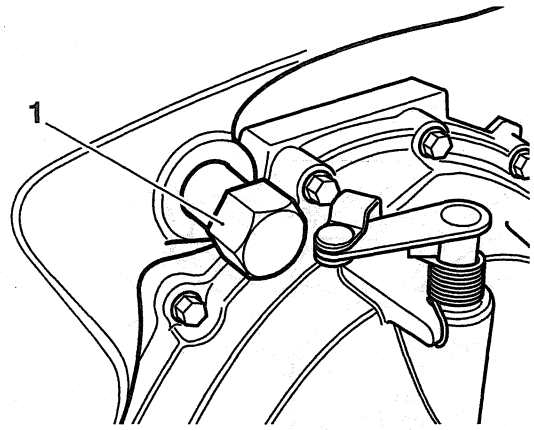

**1. Left hand cylinder head bracket**
**2. Fixings**

29. Remove and discard the nuts securing the three right hand rear engine mounting bolts (two on the crankcase and one at the rear of the cylinder head) and remove the bolts.

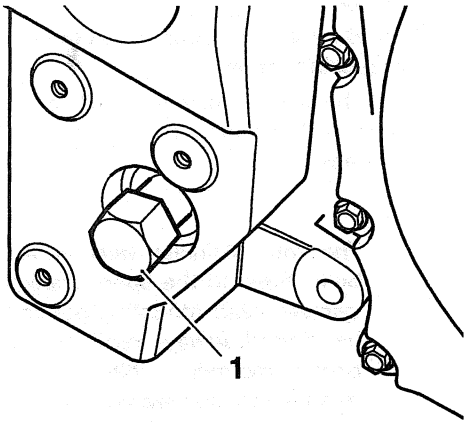



**1. Right hand rear engine mounting bolts**

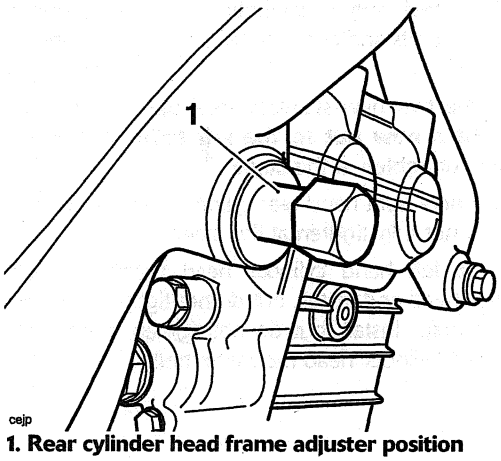
30. Slacken the three frame adjuster sleeves using tool T3880377 as shown below.




**1. Upper crankcase frame adjuster position**



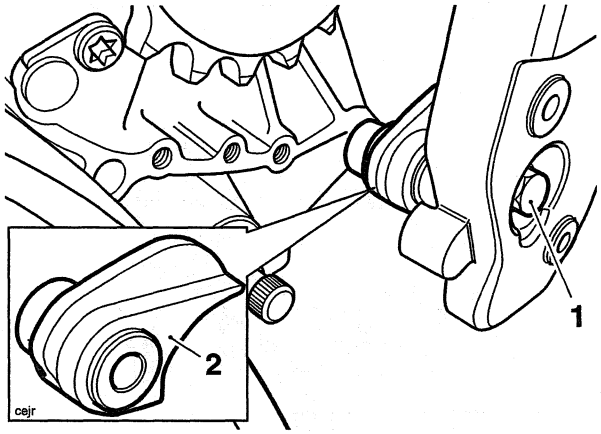

**1. Lower crankcase frame adjuster position**




**1. Rear cylinder head frame adjuster position**

31. Remove and discard the nuts securing the two left hand crankcase mounting bolts.

32. Remove the two bolts, collecting the chain rubbing spacer from between the frame and the engine as the lower crankcase bolt is removed.



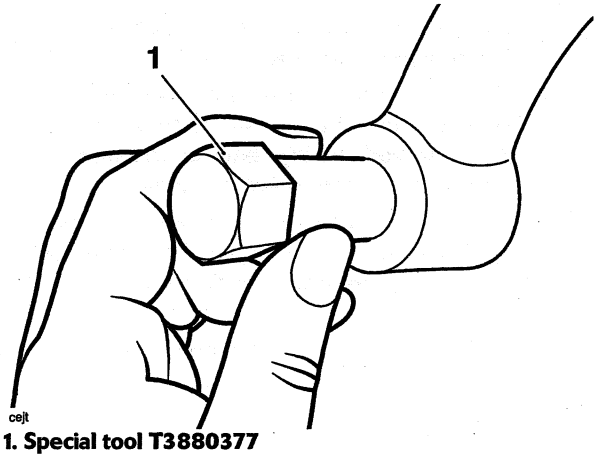

**1. Left hand crankcase mounting bolts (lower shown)**
**2. Chain rubbing spacer**

33. Slacken the two remaining engine mounting bolts at the front of the cylinder head.
34. Lower the engine sufficiently to allow the drive chain to be detached from the output sprocket, pivoting the engine on the two front cylinder head bolts.
35. With assistance, remove the two front cylinder head bolts and lower the engine from the frame.

**Note:**

- **The four stainless steel engine mounting bolts (fitted to the upper crankcase and rear cylinder head mounting positions) must not be re-used.**
- **Discard the stainless steel engine mounting bolts.**

36. Slacken the front frame adjuster sleeve, on the right hand side of the frame, using tool T3880377 as shown below.

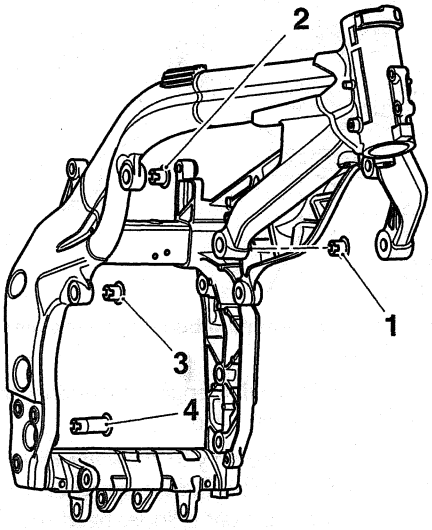



**1. Special tool T3880377**

## Engine Installation

**Note:**

- **The frame is fitted with four frame adjuster sleeves, located on the right hand side of the frame, as shown below.**




**1. Front cylinder head frame adjuster**
**2. Rear cylinder head frame adjuster**
**3. Rear upper crankcase frame adjuster**
**4. Rear lower crankcase frame adjuster**

1. Position the engine beneath the frame.

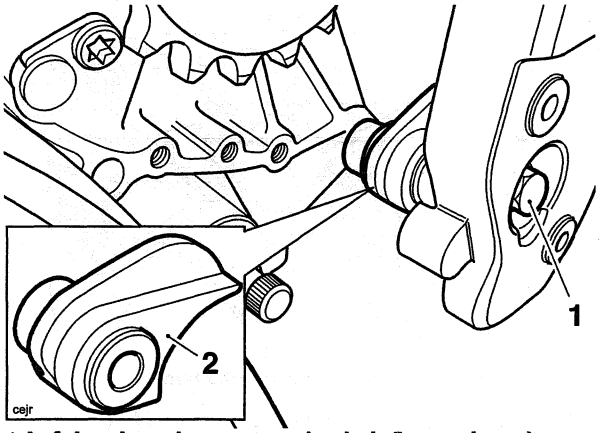
**Caution**

Unless the following engine mounting bolt tightening sequence is precisely followed, severe frame damage will occur.

**Note:**

- **Do not fit the left hand cylinder head bracket until instructed to do so.**
- **Do not fit nuts to the right hand side bolts until instructed to do so, as these bolts will be removed during engine installation to tighten the frame adjuster sleeves.**

2. Raise the engine and insert the two front cylinder head bolts to support the engine. **Fit a new nut to the left hand side only**, but do not tighten at this stage.
3. Raise the engine and loop the drive chain over the output sprocket.
4. Align the engine to the frame and fit the chain rubbing spacer to the left hand lower crankcase mounting and refit the bolt to retain it. Fit a new nut but do not tighten at this stage.




**1. Left hand crankcase mounting bolt (lower shown)**
**2. Chain rubbing spacer**

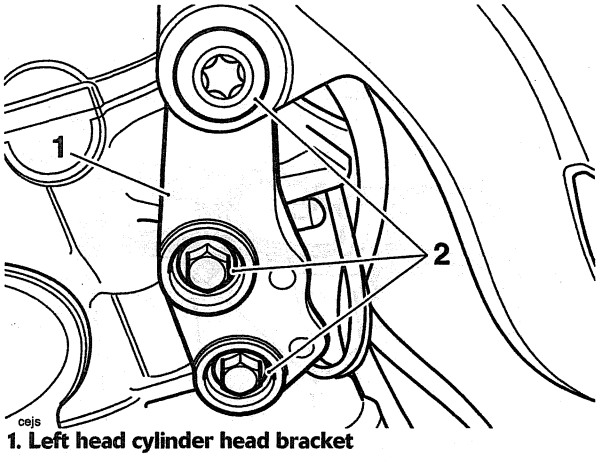
5. Refit the engine mounting bolt to the right hand lower crankcase mounting. **Do not** fit a new nut at this stage.

**Note:**

- **The four stainless steel engine mounting bolts (fitted to the upper crankcase and rear cylinder head mounting positions) must not be re-used. Always install new stainless steel engine mounting bolts if they have been removed for any reason.**

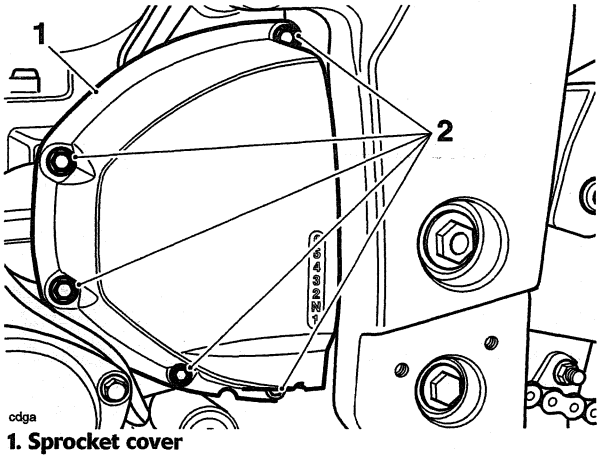
6. Apply copper grease to the threads of the four **new** stainless steel engine mounting bolts (two upper crankcase bolts and two rear cylinder head mounting bolts).
7. Install the two new stainless steel upper crankcase bolts. **Fit a new nut to the left hand side only**, but do not tighten at this stage.
8. Install a new right hand rear cylinder head mounting bolt. Do not fully tighten at this stage.
9. Refit the left hand cylinder head bracket to the cylinder head and install, but do not tighten, the two smaller bolts. Install, but do not tighten, a new left hand rear cylinder head mounting bolt.

10. Tighten the two smaller cylinder head bracket bolts to **30 Nm.**



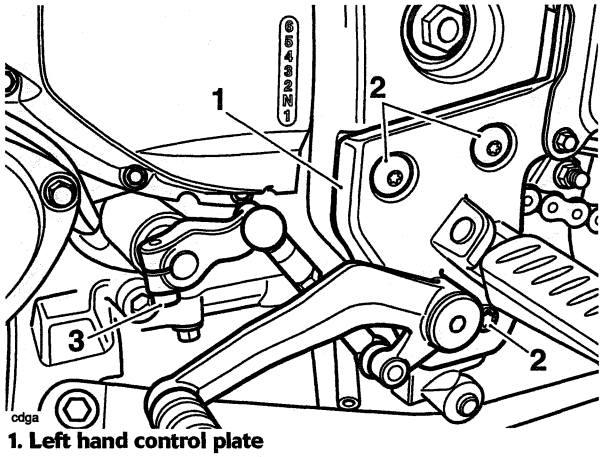

**1. Left head cylinder head bracket**
**2. Fixings**

11. Tighten the left hand engine mounting bolts to **20 Nm,** in the following sequence:
    a) Upper crankcase mounting
    b) Front cylinder head mounting
    c) Lower crankcase mounting
    d) Rear cylinder head bracket to frame mount
12. Remove each right hand engine mounting bolt, one at a time, and tighten the frame adjuster sleeves until the adjuster contacts the engine, **and then a further half turn (180°)**, using tool T3880377. Re-insert each bolt immediately after tightening the sleeve and fit, but do not tighten, a new nut.
13. Fully tighten the left hand engine mounting bolts in the following sequence, to the torque shown below:
    a) Upper crankcase mounting - **85 Nm**
    b) Front cylinder head mounting - **80 Nm**
    c) Lower crankcase mounting - **80 Nm**
    d) Rear cylinder head bracket to frame mount - **85 Nm**
14. Remove the support from beneath the engine.
15. Fully tighten the right hand engine mounting bolts in the following sequence, to the torque shown below:
    a) Upper crankcase mounting - **85 Nm**
    b) Front cylinder head mounting - **80 Nm**
    c) Lower crankcase mounting - **80 Nm**
    d) Rear cylinder head mounting - **85 Nm**
16. Refit the sprocket cover and tighten the bolts to **9 Nm.**




**1. Sprocket cover**
**2. Fixings**

17. Reposition the left hand control plate and gear change linkage to the frame. Tighten the fixings to **9 Nm.**
18. Refit the gear change lever to the transmission shaft in the position noted during removal and refit the bolt. Tighten to **9 Nm.**




**1. Left hand control plate**
**2. Control plate fixings**
**3. Gearchange lever fixing**

19. Refit the clutch cable (see page *4-6*).
20. Check the injector O-rings for splits and other damage. Replace as necessary.
21. Refit the throttle bodies, injectors and fuel rail to the cylinder head (see page *10-112*).

**Warning**

Operation of the motorcycle with incorrectly adjusted, incorrectly routed or damaged throttle cables 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.

22. Adjust the throttle cables as necessary (see page *10-110*).

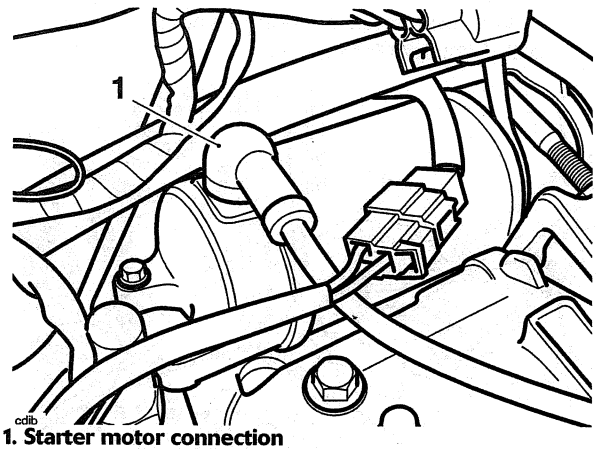
**Warning**

Move the handlebars to left and right full lock while checking that cables and harnesses do not bind. Cables or harness that bind will restrict the steering and may cause loss of motorcycle control and an accident.

**Warning**

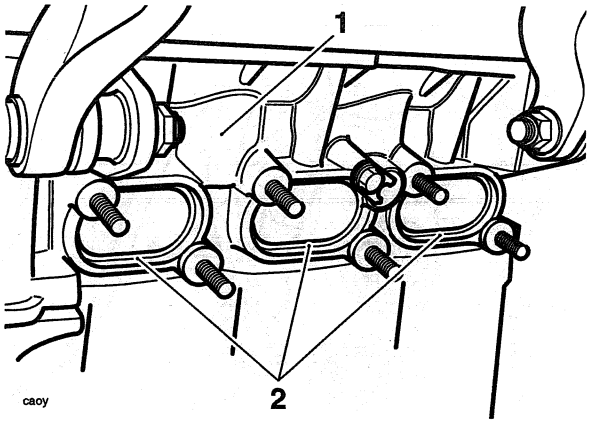
Ensure that the adjuster locknuts are tightened. A loose throttle cable adjuster could cause the throttle to stick leading to loss of motorcycle control and an accident.

23. Reconnect all electrical connections to the engine.
24. Reconnect the starter lead to the starter motor and tighten the nut to **10 Nm.** Refit the boot.




**1. Starter motor connection**

25. Using new seals at the cylinder head end, refit the exhaust system (see page *10-120*).

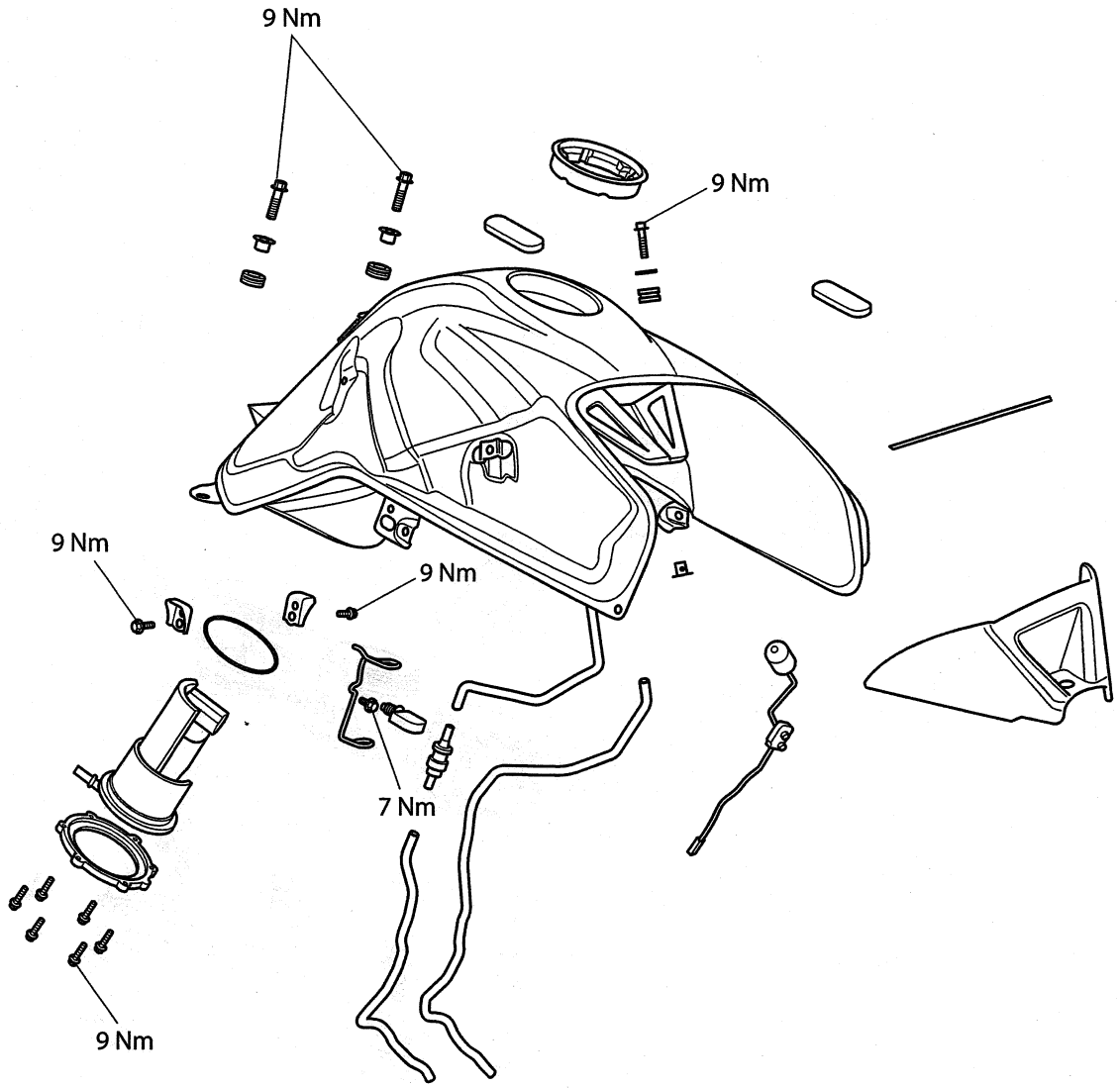



**1. Cylinder head**
**2. Seals**

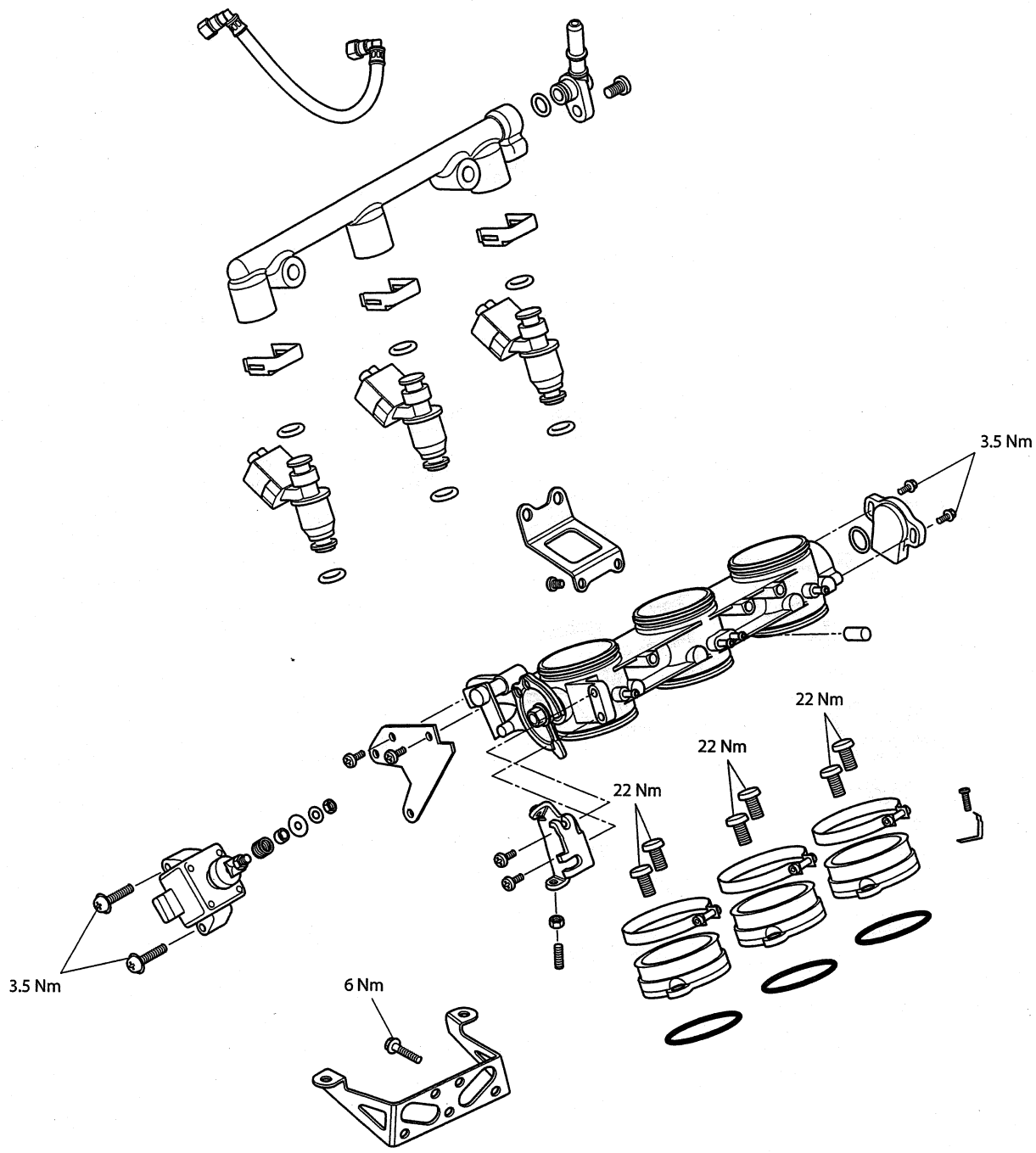
26. Refit the radiator (see page *11-9*).
27. Refill the cooling system (see page *11-5*).
28. Refit the oil cooler (see page *8-14*).
29. Fill the engine with oil of the correct grade and viscosity (see page *8-7*).
30. Refit the airbox (see page *10-104*).
31. Refit the fuel tank (see page *10-100*).
32. Refit the bodywork (see page *16-10* and *16-10*).
33. Refit the battery (see page *17-7*).
34. Remove the motorcycle from the paddock stand and place on the side stand.
35. Set the drive chain adjustment (see page *12-12*).
36. Refit the seat (see page *16-9*).

# 10 Fuel System/Engine Management

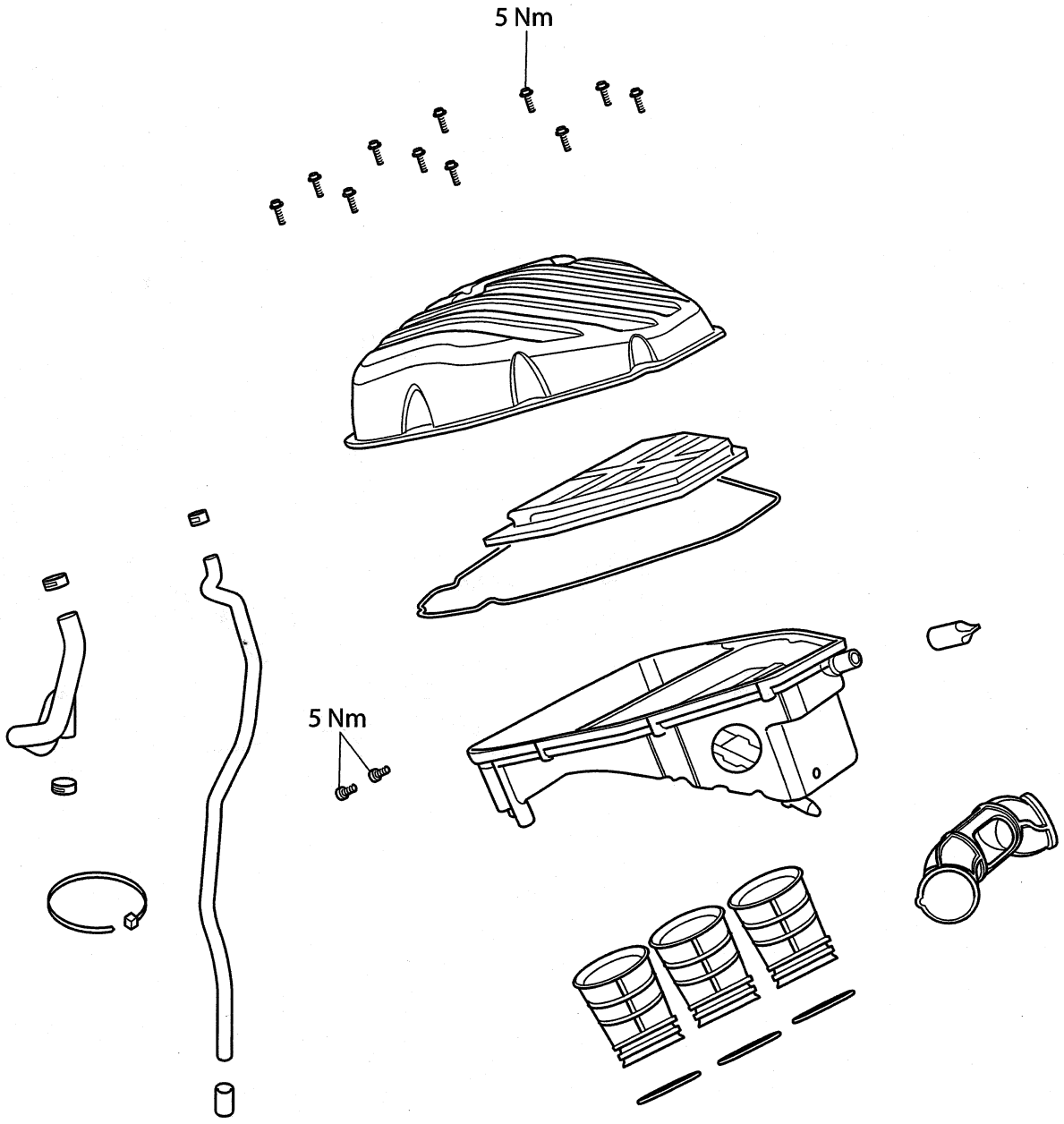
## Exploded View - Fuel Tank



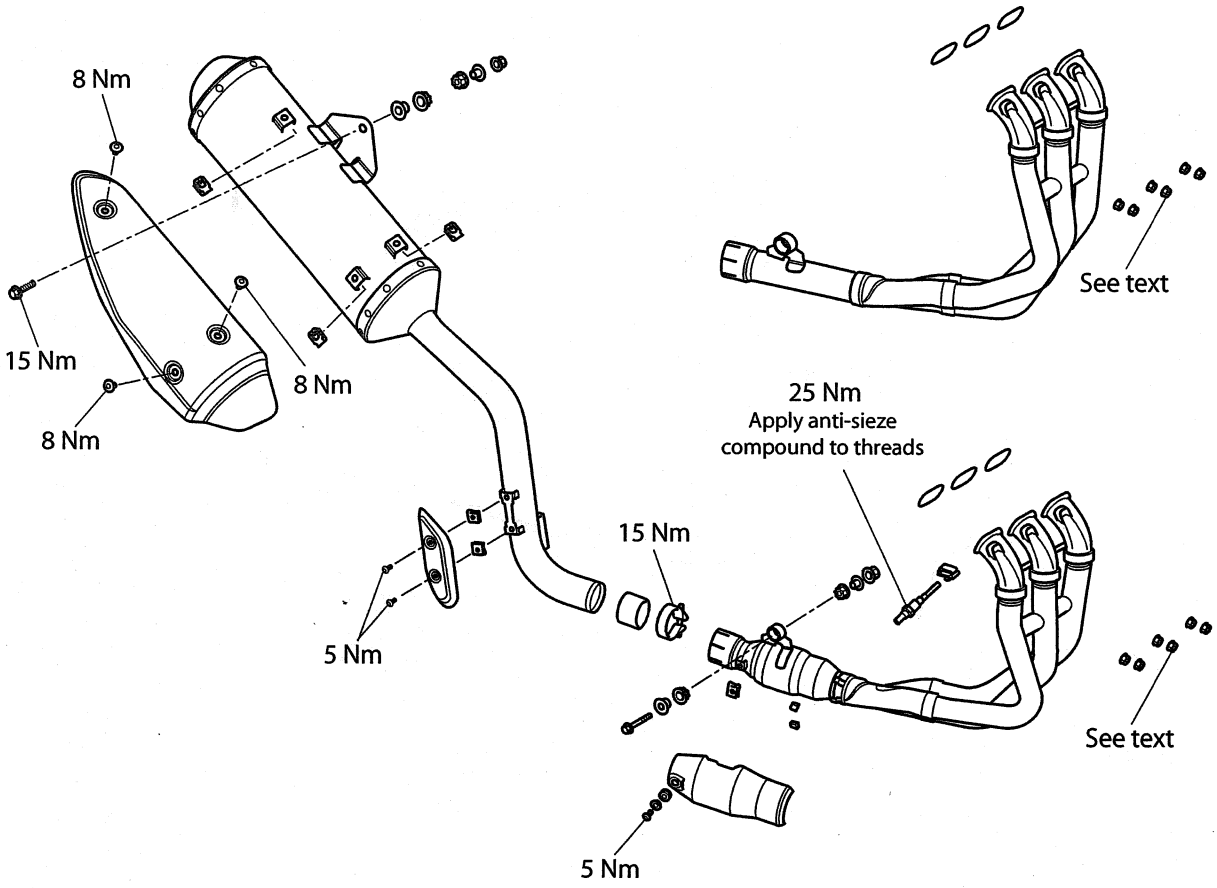
## Exploded View - Fuel Rail, Throttles and Injectors



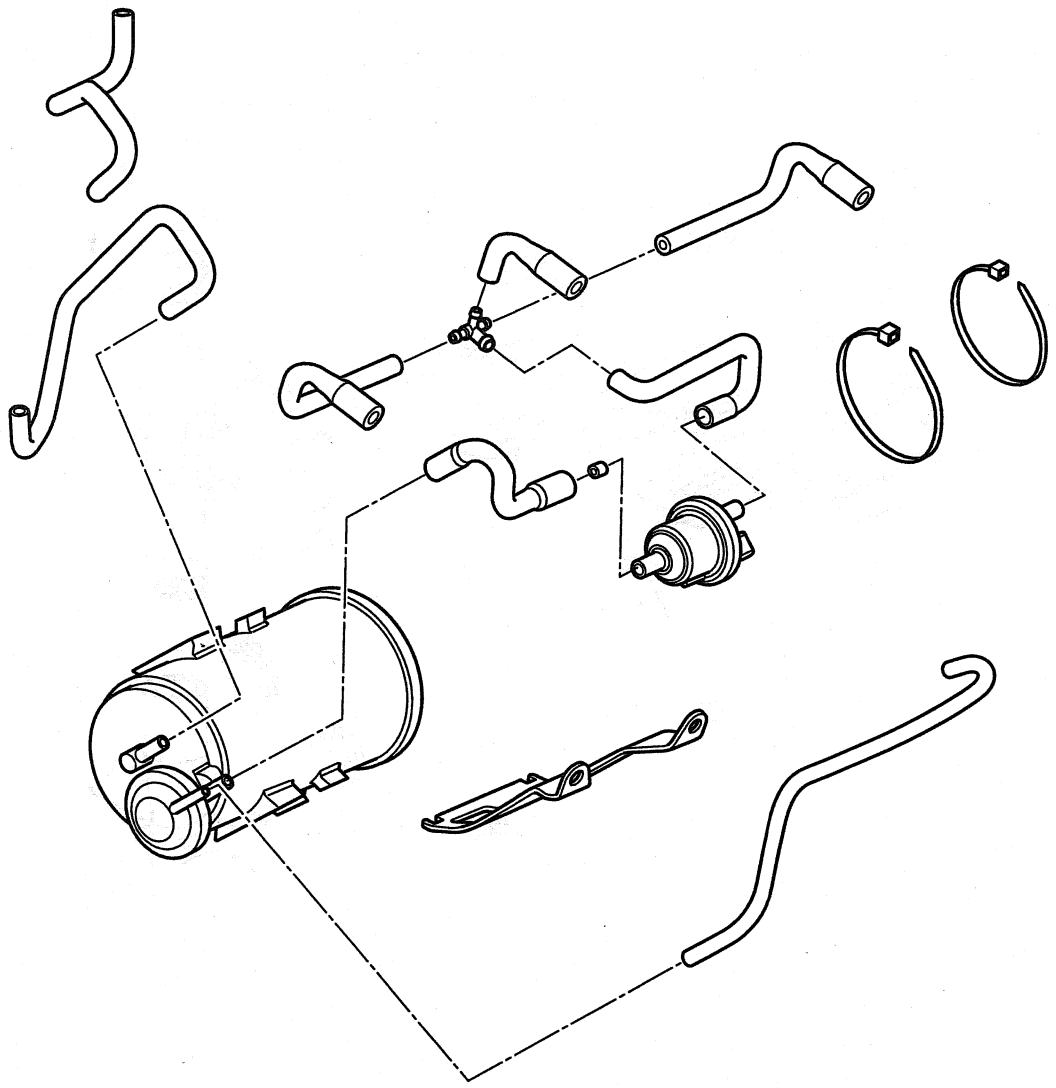
## Exploded View - Airbox



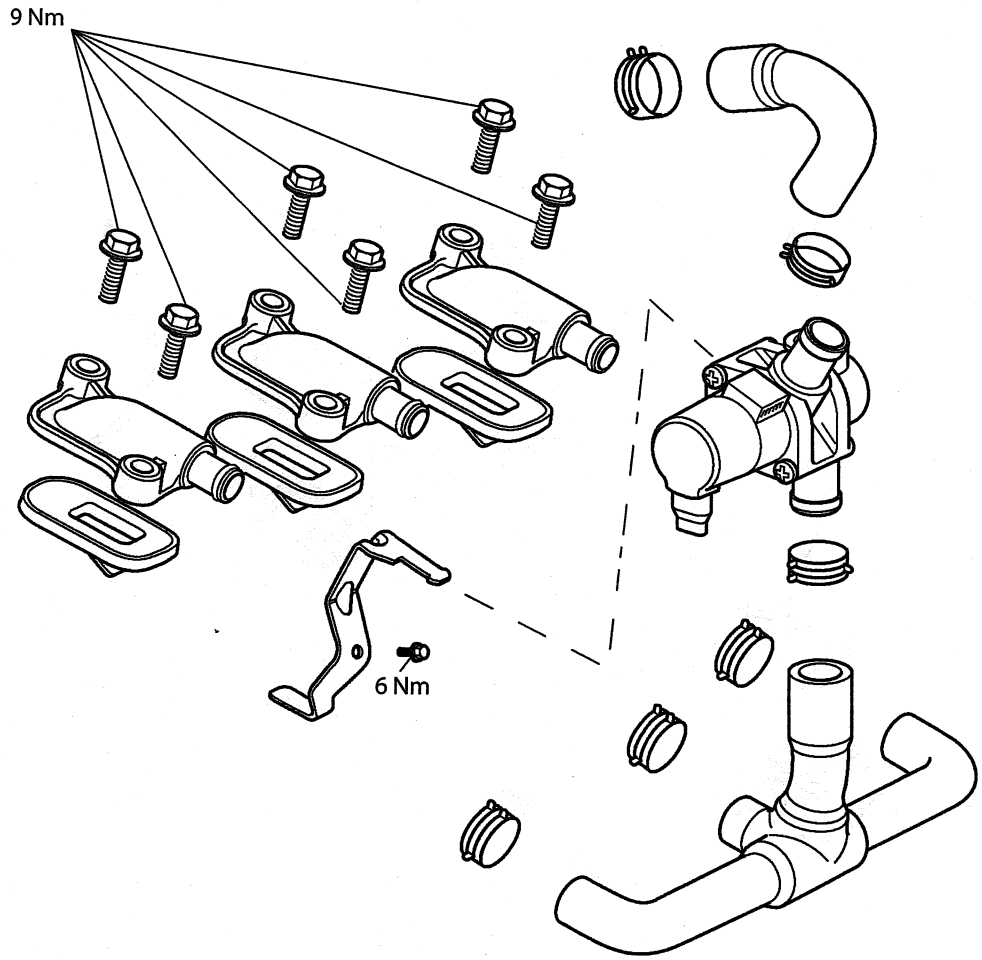
## Exploded View - Exhaust System



## Exploded View - Evaporative System



## Exploded View - Secondary Air Injection



## Fuel Requirements

### Fuel Requirements - all countries except USA

Outside America, this model must 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: This model is designed to run on unleaded gasoline with a CLC or AKI octane rating (R+M)/2 of 89 or higher.

**Note:**

- **If 'knocking' or 'pinking' occurs at a steady engine speed under normal load, use a different brand of gasoline or a higher octane rating.**

**Caution**

The use of leaded gasoline is illegal in some countries, states or territories and will invalidate the vehicle and emissions control warranties. Additionally, leaded gasoline will cause damage to emissions control components.

### Oxygenated Gasoline

To help in meeting clean air standards, some areas of the U.S. use oxygenated gasoline to help reduce harmful emissions. This model 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.

**Air temperature**

The air temperature in the air box and intake system.

**Air temperature sensor**

Sensor located in the airbox to detect the temperature of the incoming air.

**ATDC**

After Top Dead Centre (TDC).

**Barometric pressure**

Pressure of the air in the airbox.

**Battery voltage**

The voltage at the input to the Electronic Control Module (ECM).

**BTDC**

Before Top Dead Centre (TDC).

**Catalyst**

Device placed in the exhaust system which reduces exhaust emissions by stimulating secondary combustion of the exhaust gases.

**Closed throttle position**

Throttle position at idle (i.e. against end stop), measured as a voltage and expressed as percentage.

**Coolant temperature**

The coolant temperature in the cylinder head.

**Coolant temperature sensor**

Sensor which detects coolant temperature.

**Cooling fan status**

The 'on' or 'off' condition of the cooling fan.

**DTC**

Diagnostic Trouble Code.

**ECM**

Engine Control Module.

**Engine speed**

The crankshaft revolutions per minute.

**Freeze frame**

A data set captured at the time a Diagnostic Trouble Code (DTC) is set.

**Idle fuel trim**

The percentage above or below the nominal fuel requirement for the volume of air entering at idle.

**Idle fueling**

Adjustment of fueling 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 (i.e. delivering fuel).

**Long term fuel trim**

Fueling after adapting to the engine's long term fueling requirements (closed loop only). See also short term fuel trim.

**MAP sensor**

Manifold absolute pressure (the air pressure in the intake system).

**MIL**

Malfunction Indicator Lamp.

Illuminates when most Diagnostic Trouble Codes (DTCs) are set.

**Neutral switch status**

The 'neutral' or 'in gear' status of the gear change.

**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.

**Over temp**

High temperature within the Electronic Control Module (ECM) caused by an internal or external failure.

**Primary Throttle Position Sensor**

Sensor for the primary (lower) throttle position.

**Primary Throttle Stepper Motor**

Stepper motor used to vary throttle opening at idle and when the engine is cold.

**Purge valve duty cycle**

The time the purge valve is open in an open / close cycle, expressed as a percentage of the cycle time.

**Road Speed Sensor**

Gearbox mounted sensor which delivers information to the ECM that is converted to the road speed value that is displayed on the speedometer.

**Sensor reference voltage**

Supply voltage to the system 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%.

**Throttle voltage**

Voltage at the throttle potentiometer.

**Vbatt**

Battery voltage.

## Engine Management System

### System Description

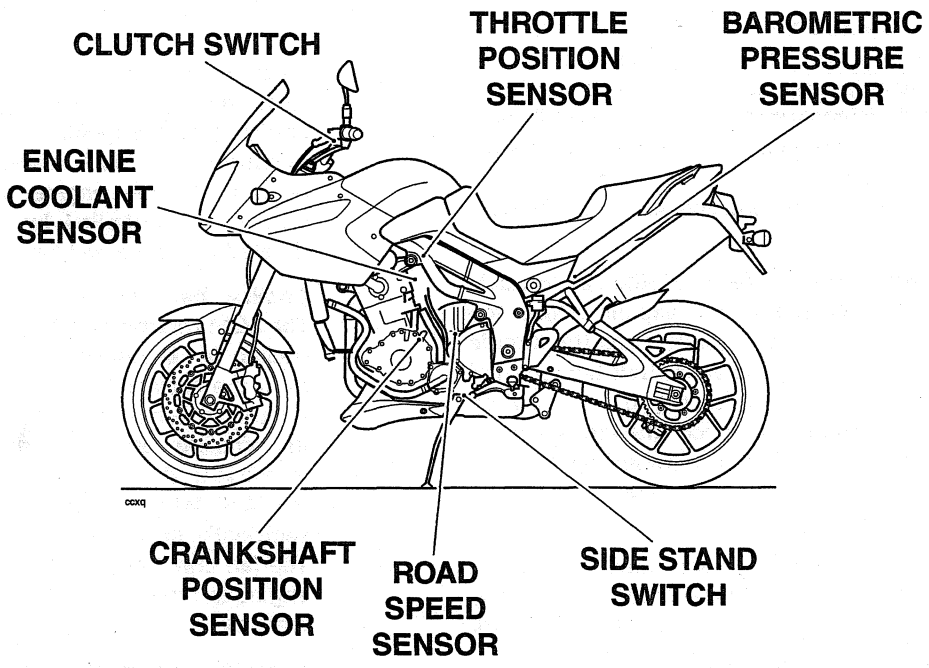
The Tiger is fitted with an electronic engine management system which encompasses control of both ignition and fuel delivery. The electronic control module (ECM) draws information from sensors positioned around the engine, cooling and air intake systems and precisely calculates ignition advance and fueling requirements for all engine speeds and loads.

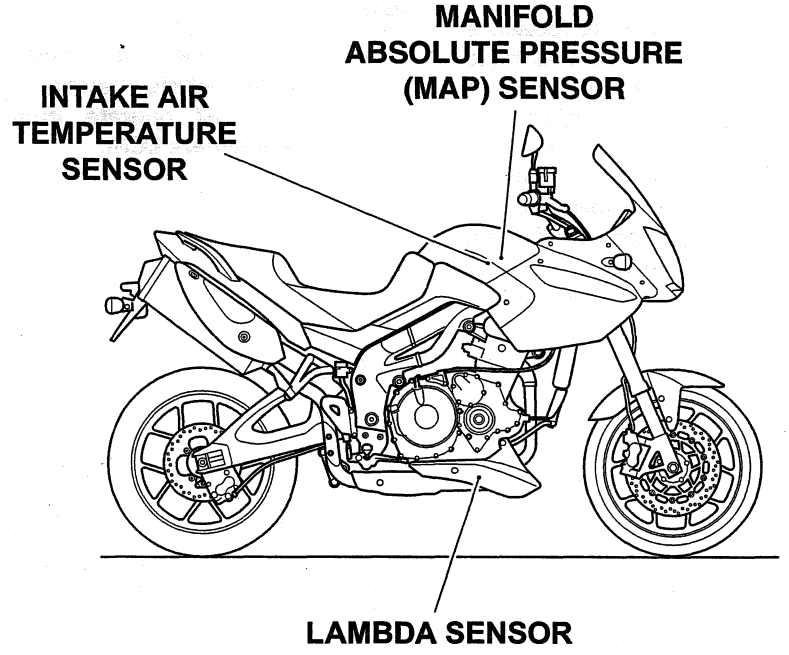
In addition, the system has an on-board diagnostic function. This ensures that, should a malfunction occur in the engine management system, the malfunction type, and engine data at the time the malfunction occurred, are stored in the ECM memory. This stored data can then be recovered using a special 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 top of the airbox. As 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 beneath the battery. The barometric pressure sensor measures atmospheric air pressure. With this information, the amount of fuel per injection is adjusted to suit the prevailing conditions.
- **Manifold Absolute Pressure (MAP) sensor** - situated at the left side of the airbox, connected to each of the three throttle bodies by equal length tubes. The MAP sensor provides information to the ECM which is used at shallow throttle angles (very small throttle openings) to provide accurate engine load indications to the ECM. This degree of engine load accuracy allows the ECM to make very small adjustments to fuel and ignition which would otherwise not be possible from throttle angle data alone.
- **Clutch switch** - situated on the clutch lever. The clutch must be pulled in for the starter motor to operate.
- **Crankshaft position sensor** - situated in the crankcase, near the alternator cover. The crankshaft position sensor detects movement of a toothed wheel attached to the alternator rotor.
  The toothed wheel 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.
- **Engine coolant temperature sensor** - situated at the rear of the cylinder head, on the left hand side. Coolant temperature information, received by the ECM, is used to optimise fueling at all engine temperatures and to calculate hot and cold start fueling requirements.
- **Throttle position sensor** - situated at the left end of the throttle body. Used to relay throttle position information to the ECM. Throttle opening angle is used by the ECM to determine fueling and ignition requirements for all throttle positions.
- **Road speed sensor** - situated in the upper crankcase, on the left hand side, above the sprocket cover. The road speed sensor provides the ECM with data from which road speed is calculated and displayed on the speedometer.
- **Lambda sensor** - situated in the exhaust header system upstream of the catalyst. The lambda sensor constantly feeds information to the ECM on the content of the exhaust gases. Based on this information, adjustments to air/fuel ratio are made.
- **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.
- **Fall detection switch** - situated beneath the battery. The fall detection switch will detect if the motorcycle is on its side and will cut power to the ECM immediately. This prevents the engine from running and the fuel pump from delivering fuel. In the event of a fall, the switch is reset by returning the bike to an upright position and switching the ignition off then back on again.

## Sensor Locations



### System Actuators

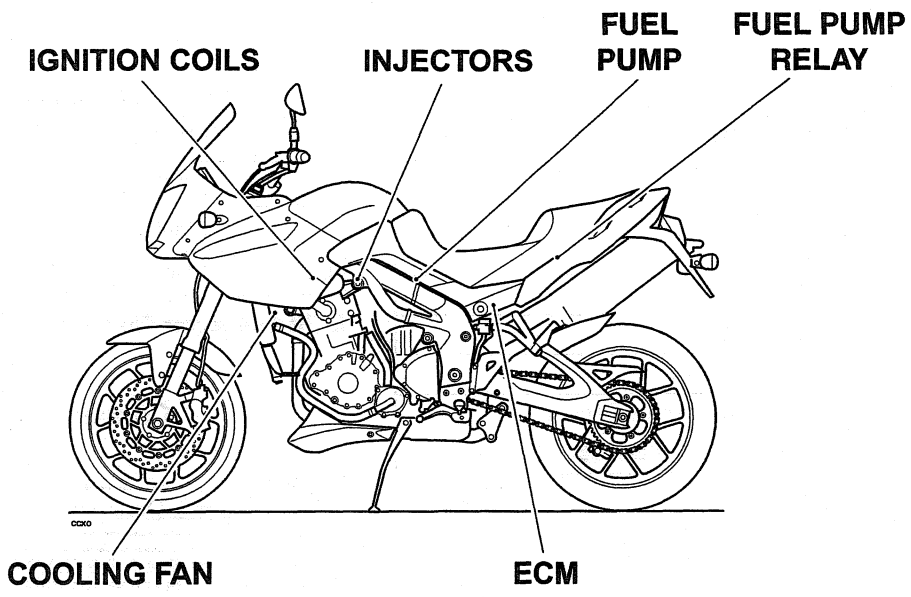
In response to signals received from the sensors, the ECM controls and directs messages to a series of electronic and electro-mechanical actuators. The function and location of the actuators is given below.

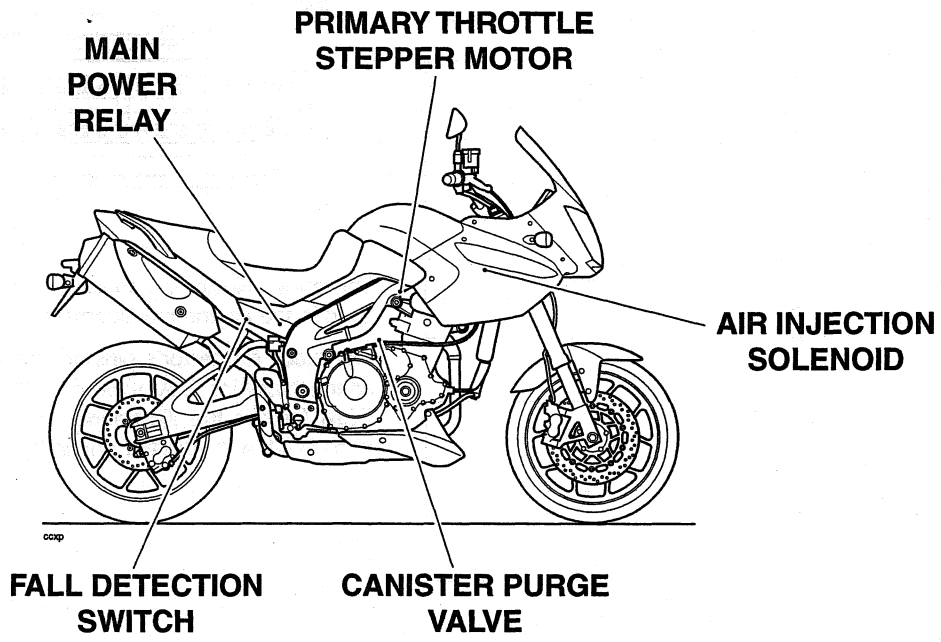
- **Primary throttle stepper motor** - situated at the right end of the throttle bodies. The primary throttle stepper actuates a cam/lever which causes variations in the closed throttle position. Although used primarily to ensure target idle speed is maintained, it also increases throttle opening when the engine is cold.
- **Canister purge valve (California models only)** - situated in the vapour return line between the carbon canister and the throttle bodies. 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.
- **Injectors** - located in the cylinder head. The engine is fitted with three injectors. The spray pattern of the injectors is fixed but the length of time each injector can remain open is variable according to operating conditions. The duration of each injection is calculated by the ECM using data received from the various sensors in the system.
- **Ignition coils** - plug-top coils are located in the cam cover. There are three coils fitted, one for 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 under the seat. When the ignition is switched on, the main power relay is powered up to provide a stable voltage supply for the ECM.
- **Fuel pump** - located inside the fuel tank. 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 operating 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. Fuel pressure is controlled by a regulator also situated inside the fuel tank.
- **Cooling fan** - located behind 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. The fan only becomes operational when the engine is running. It will not operate at any other time.
- **Secondary air injection solenoid** - located in front of the airbox. The secondary air injection solenoid controls airflow through the secondary air injection system.

**Note:**

- **In this system, the starter lockout system (clutch switch, neutral switch, sidestand switch) all operate through the engine management ECM.**

## Actuator Locations



## Engine Management Circuit Diagram - Tiger - without ABS

### Key To Wiring Circuit Diagram

| Key | Item Description |
|---|---|
| 1 | Engine Control Module |
| 2 | Diagnostic Connector |
| 3 | Vehicle Speed Sensor |
| 4 | Instrument Assembly |
| 5 | Clutch Switch |
| 6 | Starter Relay |
| 7 | Sidestand Switch |
| 8 | Fuel level Sender |
| 9 | Fall Detection Switch |
| 10 | Ambient Air Temperature Sensor |
| 11 | Intake Air Temperature Sensor |
| 12 | MAP Sensor |
| 13 | Coolant Temperature Sensor |
| 14 | Lambda Sensor |
| 15 | Throttle Position Sensor |
| 16 | Fuel Pump |
| 17 | Fuse Box (fuse 5) |
| 18 | Cooling Fan |
| 19 | Cooling Fan Relay |
| 20 | Idle Speed Control Stepper Motor |
| 21 | Ignition Coils |
| 22 | Exhaust Air Injection Solenoid |
| 23 | Fuel Injectors |
| 24 | Purge Valve |
| 25 | 330 ohm Resistor |
| 26 | Neutral Switch |
| 27 | Crankshaft Sensor |
| 28 | Engine Management System Relay |
| 29 | Fuel Pump Relay |

### Key To Wiring Colour Codes

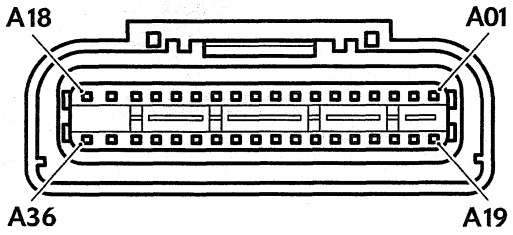
| Code | Wiring Colour |
|---|---|
| B | Black |
| U | Blue |
| N | Brown |
| G | Green |
| S | Slate/Grey |
| O | Orange |
| K | Pink |

### Key To Wiring Colour Codes (continued)

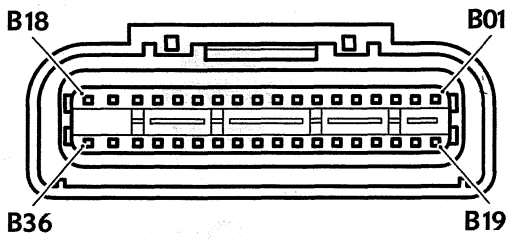
| Code | Wiring Colour |
|---|---|
| R | Red |
| P | Purple |
| W | White |
| Y | Yellow |
| LG | Light Green |
| LU | Light Blue |

### ECM Connector Pin Numbering

Connector A (Black)



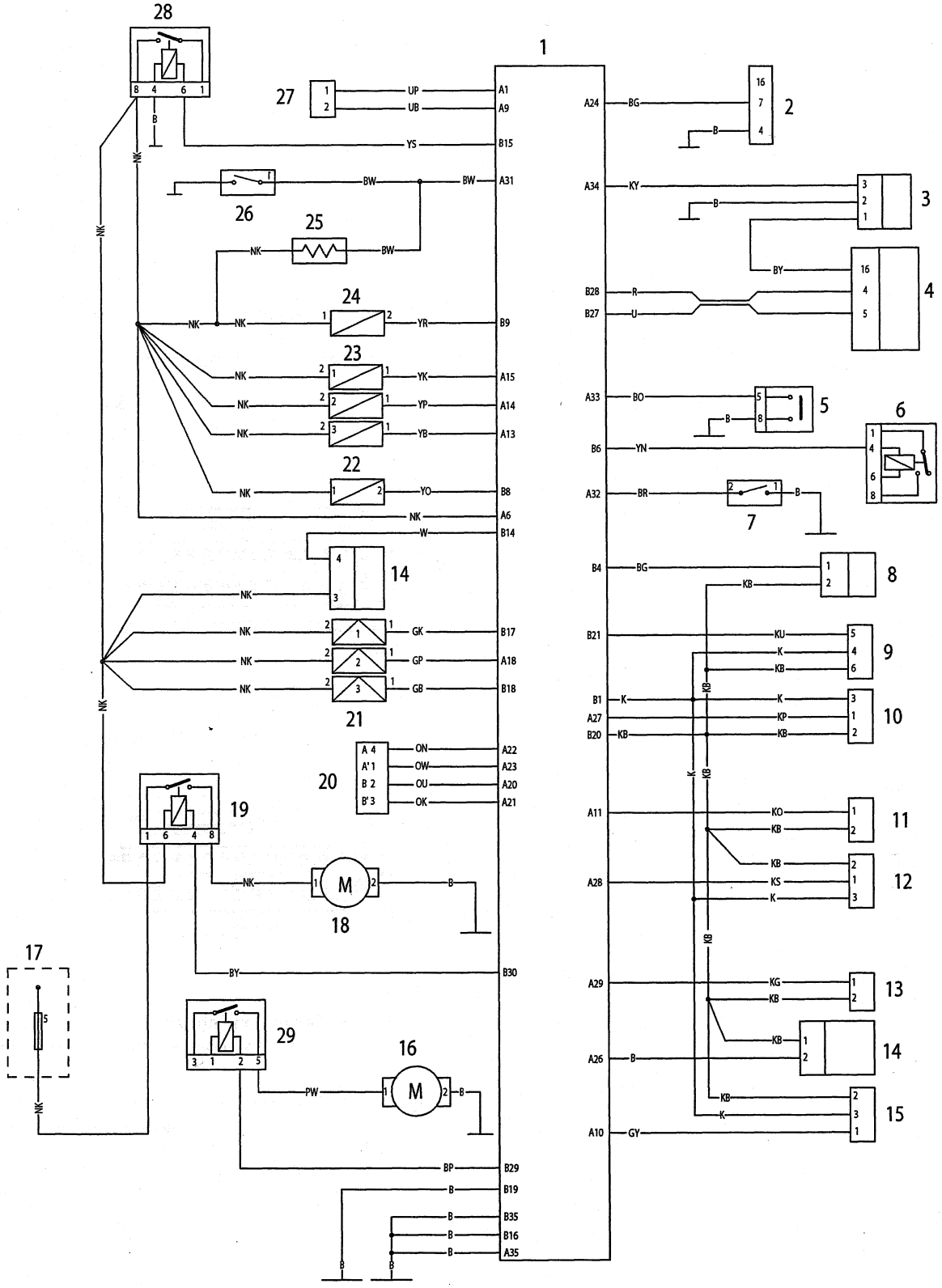

Connector B (Grey)




The above illustration shows the pin numbering system used in the engine management circuit diagram.

The black connector's pins are prefixed A and the grey connector's pins B. As viewed on the mating face with the ECM (as per the illustration), pins are numbered from right to left with number one in the top right corner.

## Circuit Diagram - Engine Management System - Tiger - without ABS



## Engine Management Circuit Diagram - Tiger - with ABS

### Key To Wiring Circuit Diagram

| Key | Item Description |
|---|---|
| 1 | Engine Control Module |
| 2 | Diagnostic Connector |
| 3 | Vehicle Speed Sensor |
| 4 | Instrument Assembly |
| 5 | Clutch Switch |
| 6 | Starter Relay |
| 7 | Sidestand Switch |
| 8 | Fuel level Sender |
| 9 | Fall Detection Switch |
| 10 | Ambient Air Temperature Sensor |
| 11 | Intake Air Temperature Sensor |
| 12 | MAP Sensor |
| 13 | Coolant Temperature Sensor |
| 14 | Lambda Sensor |
| 15 | Throttle Position Sensor |
| 16 | Fuel Pump |
| 17 | Fuse Box (fuse 5) |
| 18 | Cooling Fan |
| 19 | Cooling Fan Relay |
| 20 | Idle Speed Control Stepper Motor |
| 21 | Ignition Coils |
| 22 | Exhaust Air Injection Solenoid |
| 23 | Fuel Injectors |
| 24 | Purge Valve |
| 25 | 330 ohm Resistor |
| 26 | Neutral Switch |
| 27 | Crankshaft Sensor |
| 28 | Engine Management System Relay |
| 29 | Fuel Pump Relay |
| 30 | ABS Control Module |

### Key To Wiring Colour Codes

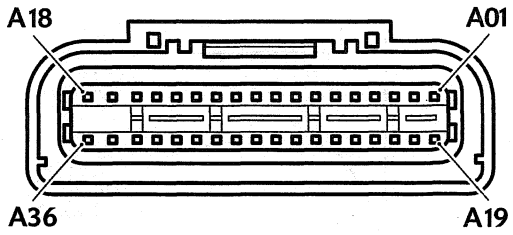
| Code | Wiring Colour |
|---|---|
| B | Black |
| U | Blue |
| N | Brown |
| G | Green |
| S | Slate/Grey |

### Key To Wiring Colour Codes (continued)

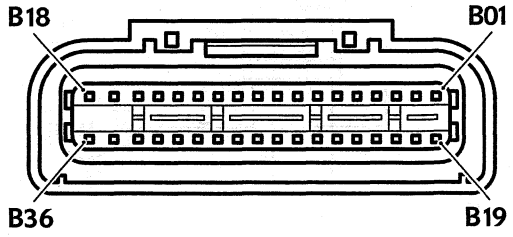
| Code | Wiring Colour |
|---|---|
| O | Orange |
| K | Pink |
| R | Red |
| P | Purple |
| W | White |
| Y | Yellow |
| LG | Light Green |
| LU | Light Blue |

### ECM Connector Pin Numbering

Connector A (Black)



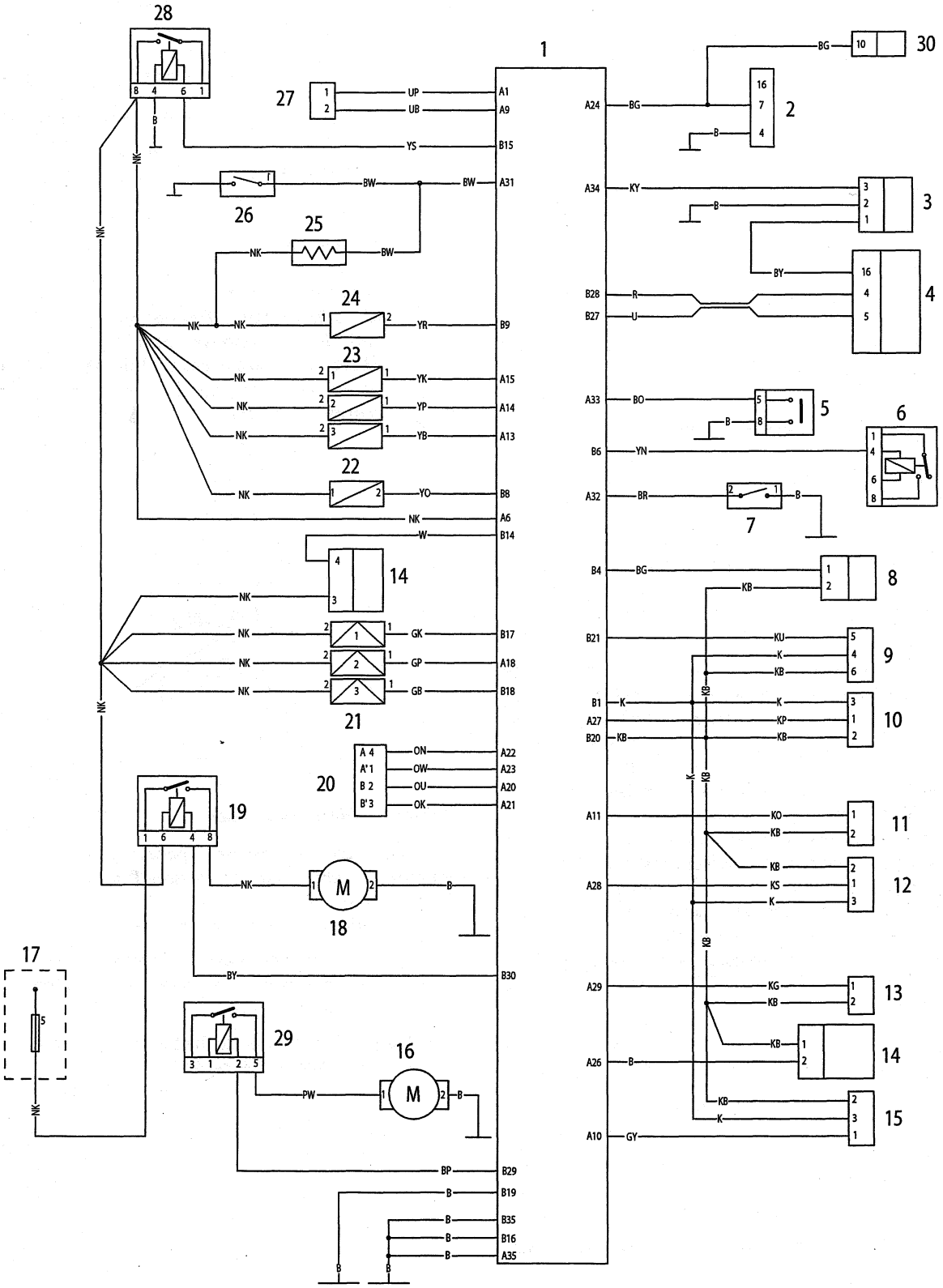

Connector B (Grey)




The above illustration shows the pin numbering system used in the engine management circuit diagram.

The black connector's pins are prefixed A and the grey connector's pins B. As viewed from the mating face with the ECM (as per the illustration), pins are numbered from right to left with number one in the top right corner.

## Circuit Diagram - Engine Management System - Tiger - with ABS



## System Diagnostics

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 crankshaft position sensor, the counter will increment its count each time the crankshaft 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:

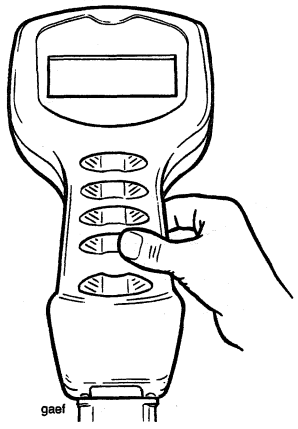
- **The coolant temperature must be raised to 72°C or more.**
- **The coolant temperature must have risen by 23°C or more from its start temperature, when 72°C is reached.**
- **A controlled power-down sequence must take place.**

**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 fuel 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) |
|---|---|
| Engine speed | RPM |
| Calculated load | % |
| Coolant temperature | °C |
| Short term fuel trim | % |
| Throttle position | % |
| Intake air temperature | °C |
| Vehicle speed | km/h |
| Ignition advance | degrees |
| Heated oxygen sensor output voltage | volts |
| Intake manifold absolute pressure | mm/hg |
| Fuel system status | open or closed loop operation |

### Freeze-frame Data

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 calling up freeze frame data associated with the recorded DTC, the technician can check the engine condition at the time the fault occurred. The data available is:

| Function Examined | Result Reported (Scale) |
|---|---|
| Engine speed | RPM |
| Calculated load | % |
| Coolant temperature | °C |
| Short term fuel trim | % |
| Throttle position | % |
| Intake air temperature | °C |
| Vehicle speed | km/h |
| Ignition advance | degrees |
| Heated oxygen sensor output voltage | volts |
| Intake manifold absolute pressure | mm/hg |
| Fuel system status | open or closed loop operation |

### 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 | Report Method |
|---|---|
| Instrument panel | Visual inspection of instruments |
| Idle speed control stepper motor | Stored fault code* |
| Purge control valve | Stored fault code* |
| Fuel pump relay | Stored fault code* |
| Fuel pump operation | Stored fault code*/Fuel pressure test |
| Cooling fan | Stored fault code*/fan operation |

* If a fault is detected.

## Checks/Adjustments

### Adjustments

Using the Triumph diagnostic tool, it is possible to reset the ECU to the factory default settings and to balance the throttle bodies.

Further facilities are provided to allow correct replacement/adjustment of the primary throttle position sensor and the primary throttle stepper motor. These facilities are needed as, after replacement of the parts concerned, adjustments have to be made to specific voltage settings, all with the throttles in a specific position.

Full details of these procedures are provided later in this section.

### Adaption status

Because the fuel system is adaptive, it is able to automatically adjust to new working conditions. This screen displays information as to the adaption status of the vehicle which will show if it has adapted or not.

| Function Examined | Report Method |
|---|---|
| Closed throttle position reference status | adapted/not adapted |
| Idle speed control adaption status | % |
| Oxygen sensor adaption status (off idle) | % |
| Oxygen sensor adaption range (off idle) | % |
| Oxygen sensor adaption status (idle) | % |
| Oxygen sensor adaption range (idle) | % |

### Build data

The following items of build data can also be read.

| Function Examined |
|---|
| Vehicle Identification Number (VIN) |
| Triumph ECM part number |
| ECM manufacturer's part number |
| ECM serial number |
| Software version number (tune number) |

### 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.

The data sets are divided into three groups, voltages/ pressures, throttles/coils/injectors and other data.

The data available under voltages is:

| Item Checked | Result Unit |
|---|---|
| Throttle position sensor voltage | Volts |
| Throttle position | % open |
| Manifold absolute pressure sensor voltage | Volts |
| Manifold absolute pressure (one reading per cylinder) | mmHg |
| Atmospheric pressure sensor voltage | Volts |
| Atmospheric pressure | mmHg |
| Battery voltage | Volts |
| Battery voltage scaling | Volts |
| Coolant temperature sensor voltage | Volts |
| Air temperature sensor voltage | Volts |
| Oxygen sensor voltage | Volts |
| Oxygen sensor reading | Volts |
| Gear position sensor voltage | Volts |
| Fuel level sensor voltage | Volts |
| Fall detection switch voltage | Volts |
| Fuel sensor voltage | Volts |

The data available under throttles/coils/injectors is:

| Item Checked | Result Unit |
|---|---|
| Injector 1 pulse time | milliseconds |
| Injector 2 pulse time | milliseconds |
| Injector 3 pulse time | milliseconds |
| Ignition timing cyl 1 | degrees BTDC |
| Ignition timing cyl 2 | degrees BTDC |
| Ignition timing cyl 3 | degrees BTDC |
| Coil 1 dwell time | milliseconds |
| Coil 2 dwell time | milliseconds |
| Coil 3 dwell time | milliseconds |

The data available under 'other' is:

| Item Checked | Result Unit |
|---|---|
| Malfunction indicator light status | MIL off/on |
| Fan relay status | fan off/on |
| Starter relay status | starter on/off |
| Fall detection status | normal/over |
| Oxygen sensor heater status | heater on/off |
| Secondary air injection status | SAI on/off |
| Engine rpm | RPM |
| Vehicle speed | km/h |
| Short term fuel trim | +/-100% |
| Calculated load | % |
| Idle reference speed | RPM |
| Idle speed control target steps | numeric |
| Purge valve duty cycle | % |
| Gear position | numeric value |
| Neutral switch | gear/neutral |
| Clutch switch | grip/release |
| Low fuel alarm status | on/off |

## 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 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.

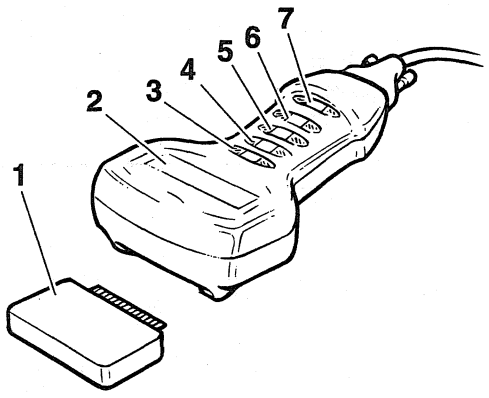
Similarly, if a fault clears, the ECM also records this fact and will turn off the MIL when sufficient no-fault warm-up cycles have taken place. Any fault codes will remain in the ECM memory until the required number of no-fault warm-up cycles have taken place. The number of warm-up cycles required to 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 |
|---|---|---|---|---|
| P0201 | Injector 1 circuit malfunction | 3 | 40 | Yes |
| P0202 | Injector 2 circuit malfunction | 3 | 40 | Yes |
| P0203 | Injector 3 circuit malfunction | 3 | 40 | Yes |
| P0335 | Crankshaft sensor circuit malfunction | 3 | 40 | Yes |
| P0032 | Oxygen sensor heater short circuit to battery | 3 | 40 | Yes |
| P0031 | Oxygen sensor heater open circuit/short to ground | 3 | 40 | Yes |
| P0030 | Oxygen sensor heater circuit malfunction | 3 | 40 | Yes |
| P0122 | Throttle position sensor low input | 3 | 40 | Yes |
| P0123 | Throttle Position sensor high input | 3 | 40 | Yes |
| P0351 | Ignition coil 1 circuit malfunction | 3 | 40 | Yes |
| P0352 | Ignition coil 2 circuit malfunction | 3 | 40 | Yes |
| P0353 | Ignition coil 3 circuit malfunction | 3 | 40 | Yes |
| P0107 | Manifold absolute pressure sensor low voltage | 3 | 40 | Yes |
| P0108 | Manifold absolute pressure sensor high voltage | 3 | 40 | Yes |
| P1105 | Manifold absolute pressure sensor pipe malfunction | 3 | 40 | Yes |
| P1107 | Ambient air pressure sensor circuit low voltage | 3 | 40 | Yes |
| P1108 | Ambient air pressure sensor circuit high voltage | 3 | 40 | Yes |
| P0112 | Intake air temperature too high | 3 | 40 | Yes |
| P0113 | Intake air temperature too low | 3 | 40 | Yes |
| P0117 | Engine coolant temperature too high | 3 | 40 | Yes |
| P0118 | Engine coolant temperature too low | 3 | 40 | Yes |
| P0500 | Vehicle speed sensor 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 |
|---|---|---|---|---|
| P1552 | Cooling fan short circuit/open circuit | 3 | 40 | Yes |
| P1553 | Cooling fan short to battery voltage/over temperature | 3 | 40 | Yes |
| P1231 | Fuel pump short circuit to ground or open circuit | 3 | 40 | Yes |
| P1232 | Fuel pump relay short circuit to battery | 3 | 40 | Yes |
| P0444 | Purge valve system short circuit to ground or open circuit | 3 | 40 | Yes |
| P0445 | Purge valve system short circuit to battery | 3 | 40 | Yes |
| P0414 | Secondary air injection system short circuit to battery | 3 | 40 | Yes |
| P0413 | Secondary air injection system short circuit to ground or open circuit | 3 | 40 | Yes |
| P0505 | Idle speed control system malfunction | 3 | 40 | Yes |
| P1631 | Fall detection sensor circuit low voltage | 3 | 40 | Yes |
| P1632 | Fall detection sensor circuit high voltage | 3 | 40 | Yes |
| P0560 | System voltage - battery circuit malfunction | 3 | 40 | Yes |
| P0460 | Fuel level sensor circuit malfunction | 0 | 40 | No |
| P0603 | EEPROM fault | 0 | 40 | No |
| P1690 | CAN communication fault | 0 | 40 | No |
| P1696 | Voltage control circuit short to ground | 3 | 40 | Yes |
| P1697 | Voltage control circuit short to Vbatt | 3 | 40 | Yes |
| P1698 | Voltage control circuit malfunction | 3 | 40 | Yes |
| P1602 | Tunelock | Only if Tunelock is unlocked | | Flashing |
| P1614 | ECM or tune ID Incorrect | Only if Instrument ID Matching | | Flashing |

## Service Diagnostic Tool




gajc

**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 removable to allow replacement / update cards to be inserted.

The screen comprises four horizontal lines and twenty 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 |

**Typical Screen Showing Symbol Examples**

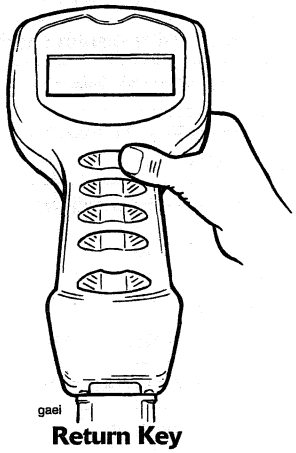
▲▼ Cursors to indicate that further lines of text are available to be seen above and/or below those already in view, by scrolling the text up or down using the 'Up' or 'Down' keys.

▶ 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

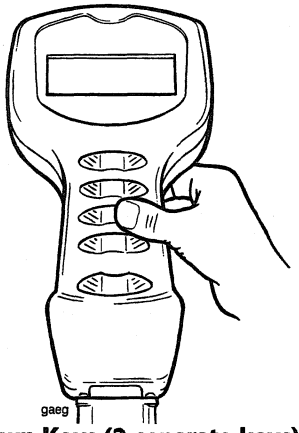
In most cases, the **Return** key (↵) enables the user to return to the screen last displayed.



gaei

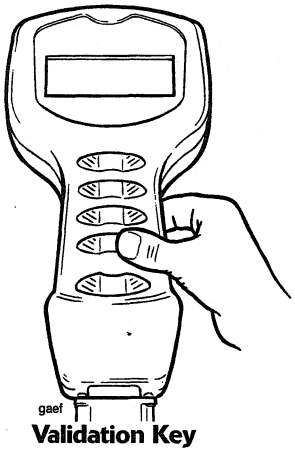
**Return Key**

The Up and Down keys - press to move the lines of text up or down. They are also used to enter the update tune password and ECU unlock code.



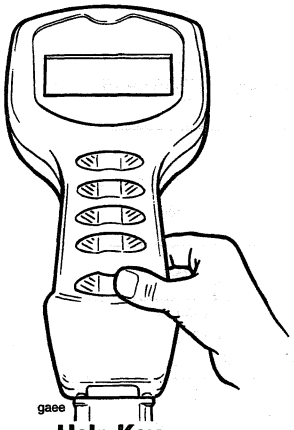

**Up/down Keys (2 separate keys)**

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**

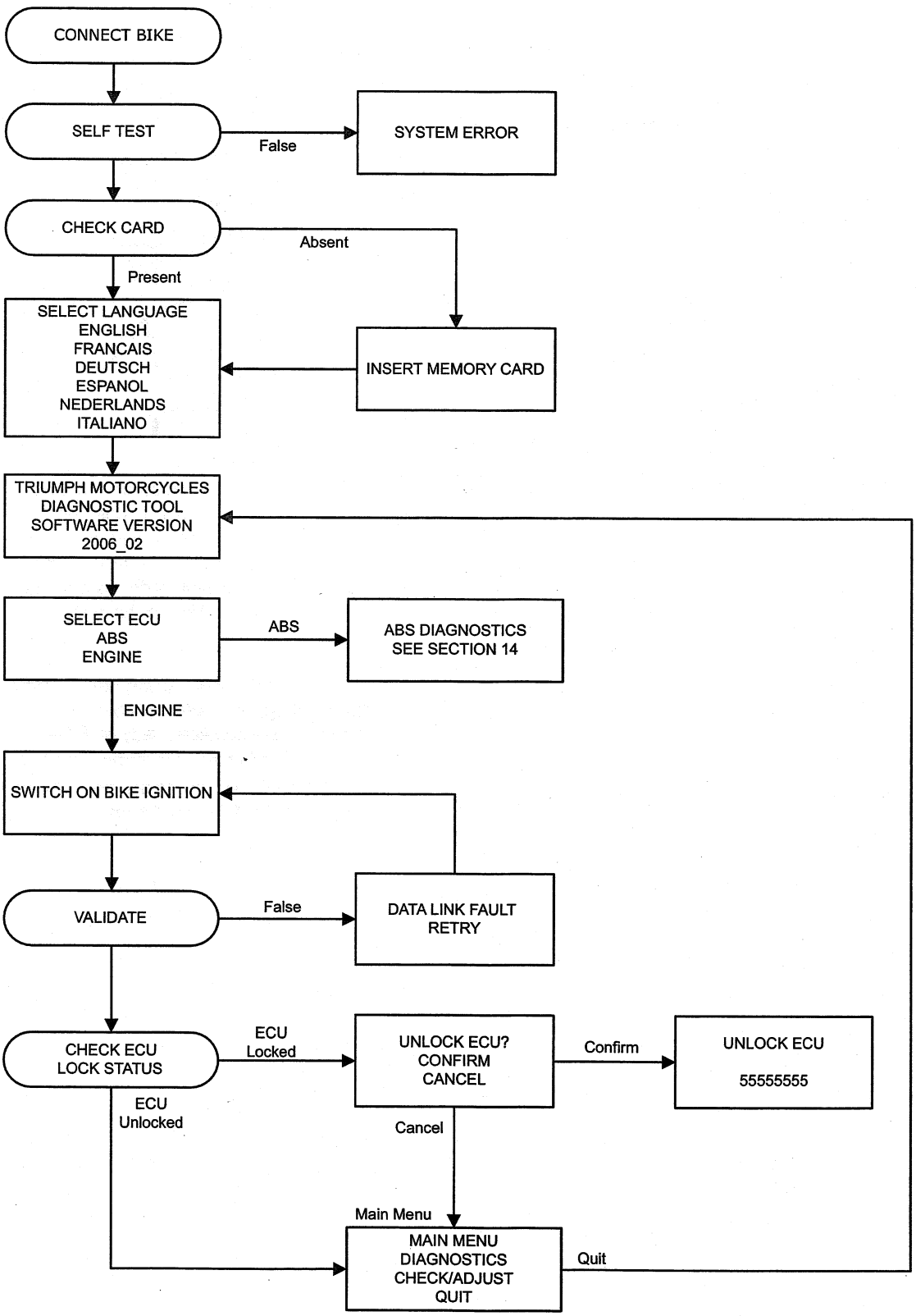
**Test Procedure**

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.

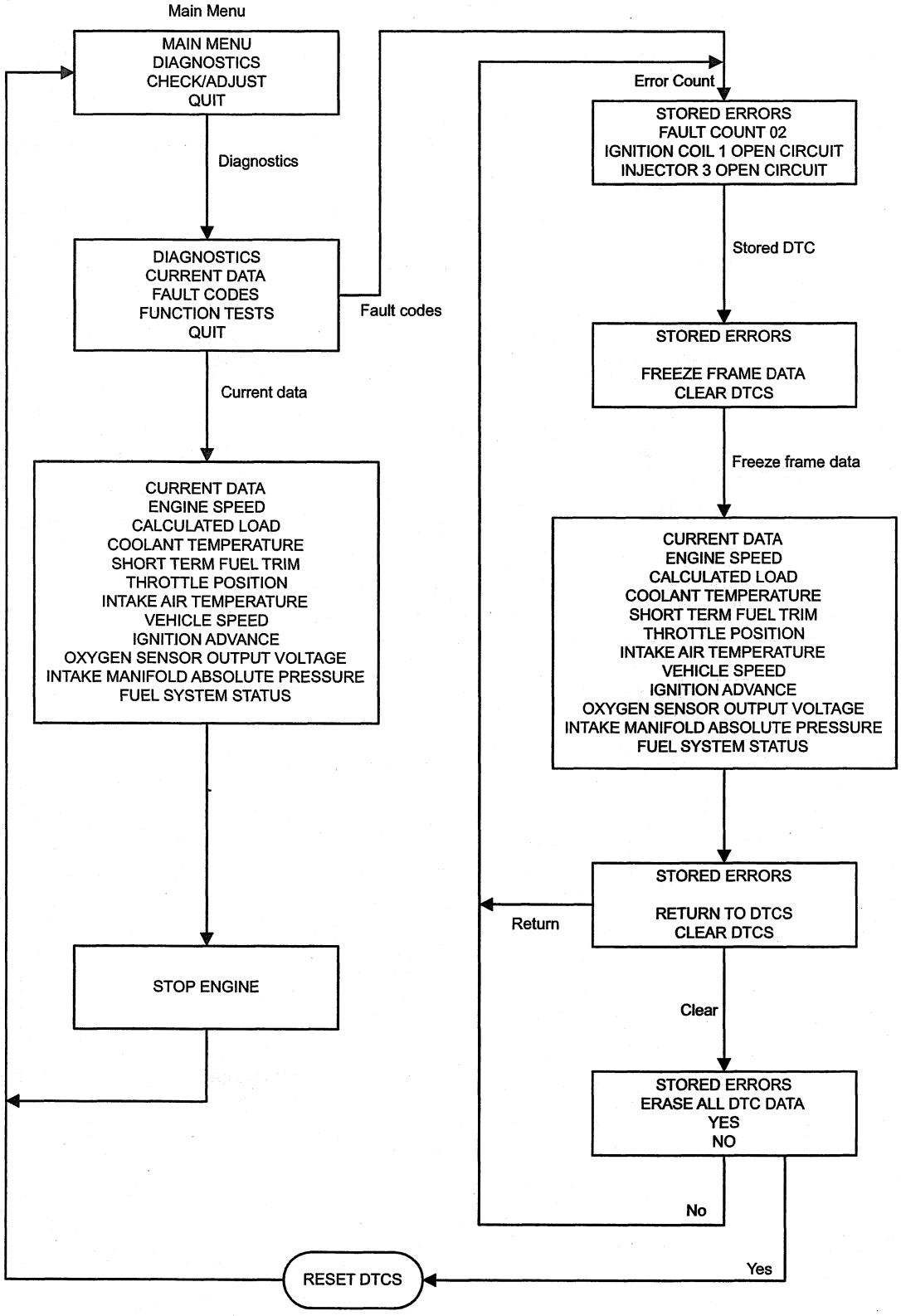
**Note:**

- **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 seven pages describe the tool operations in flow chart form.**

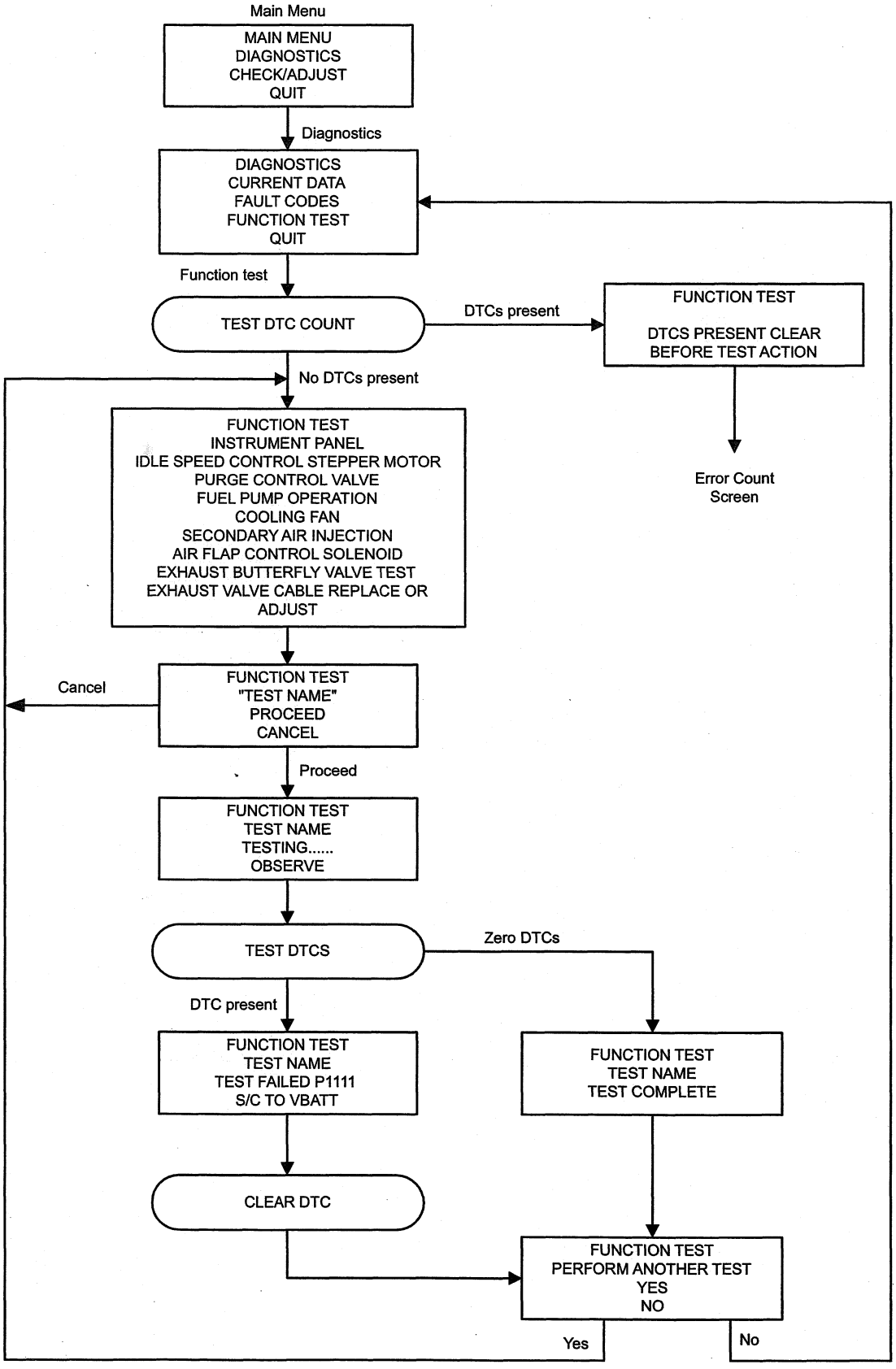
## Initialisation



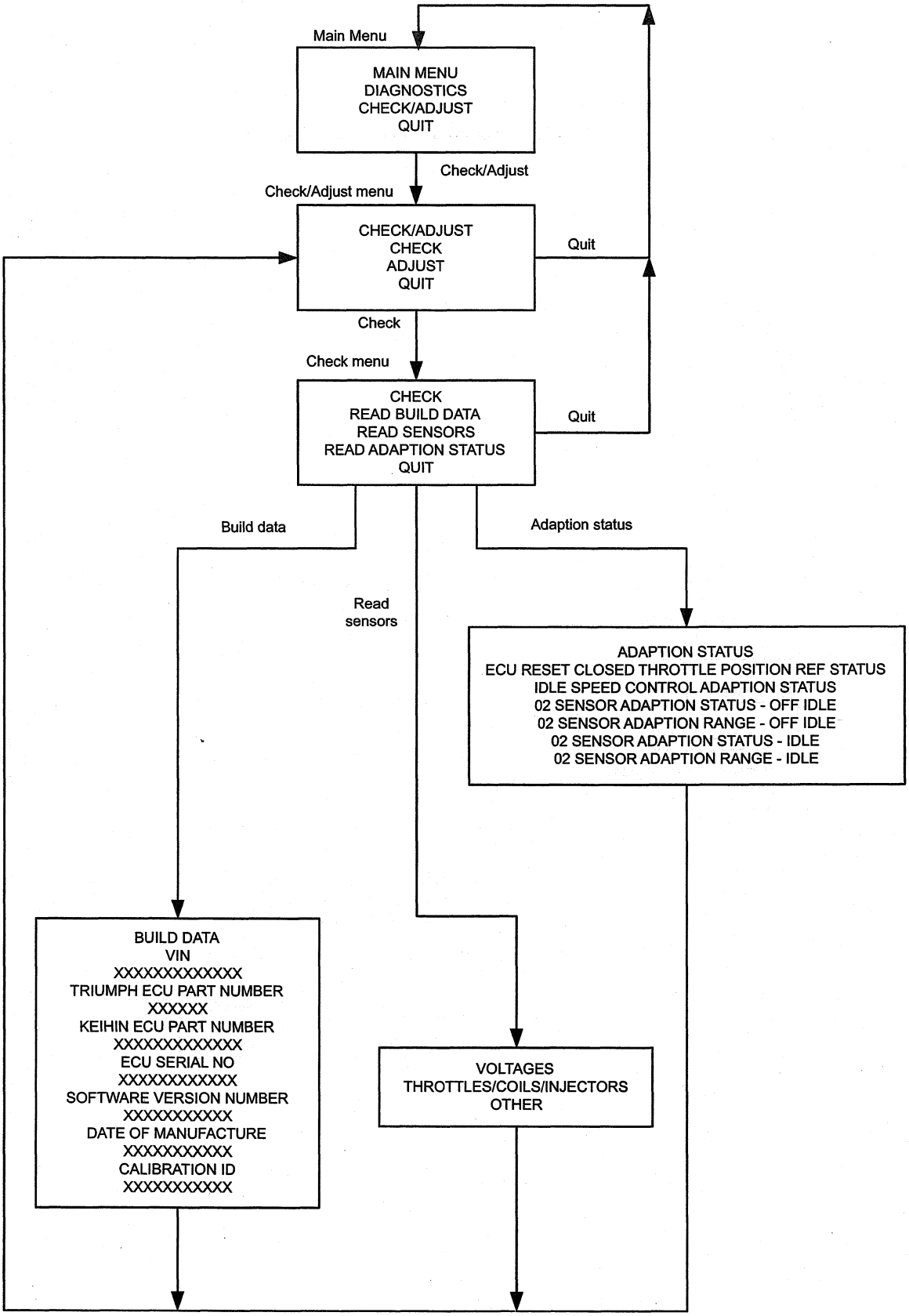
## Diagnostics



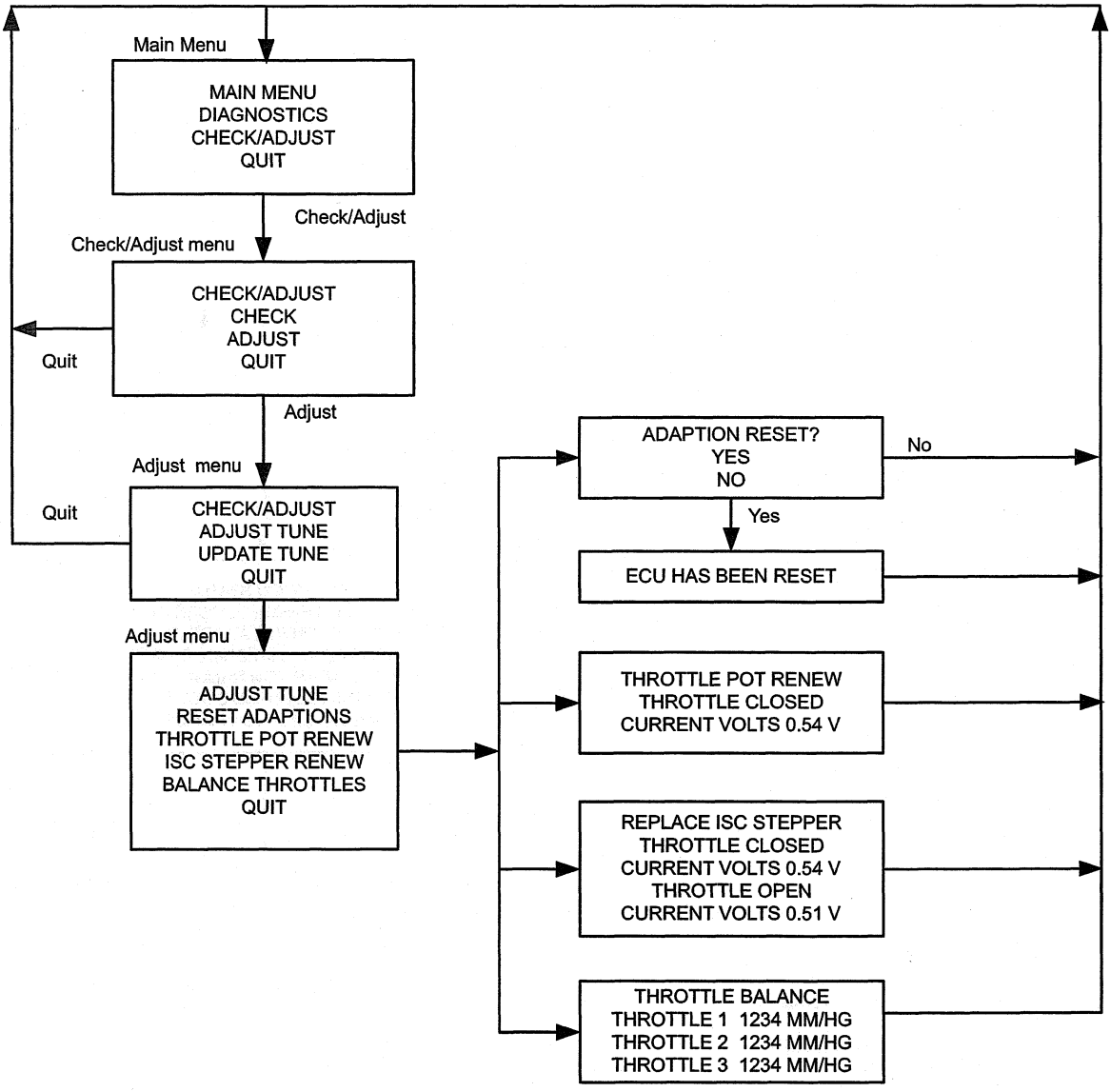
## Function Tests



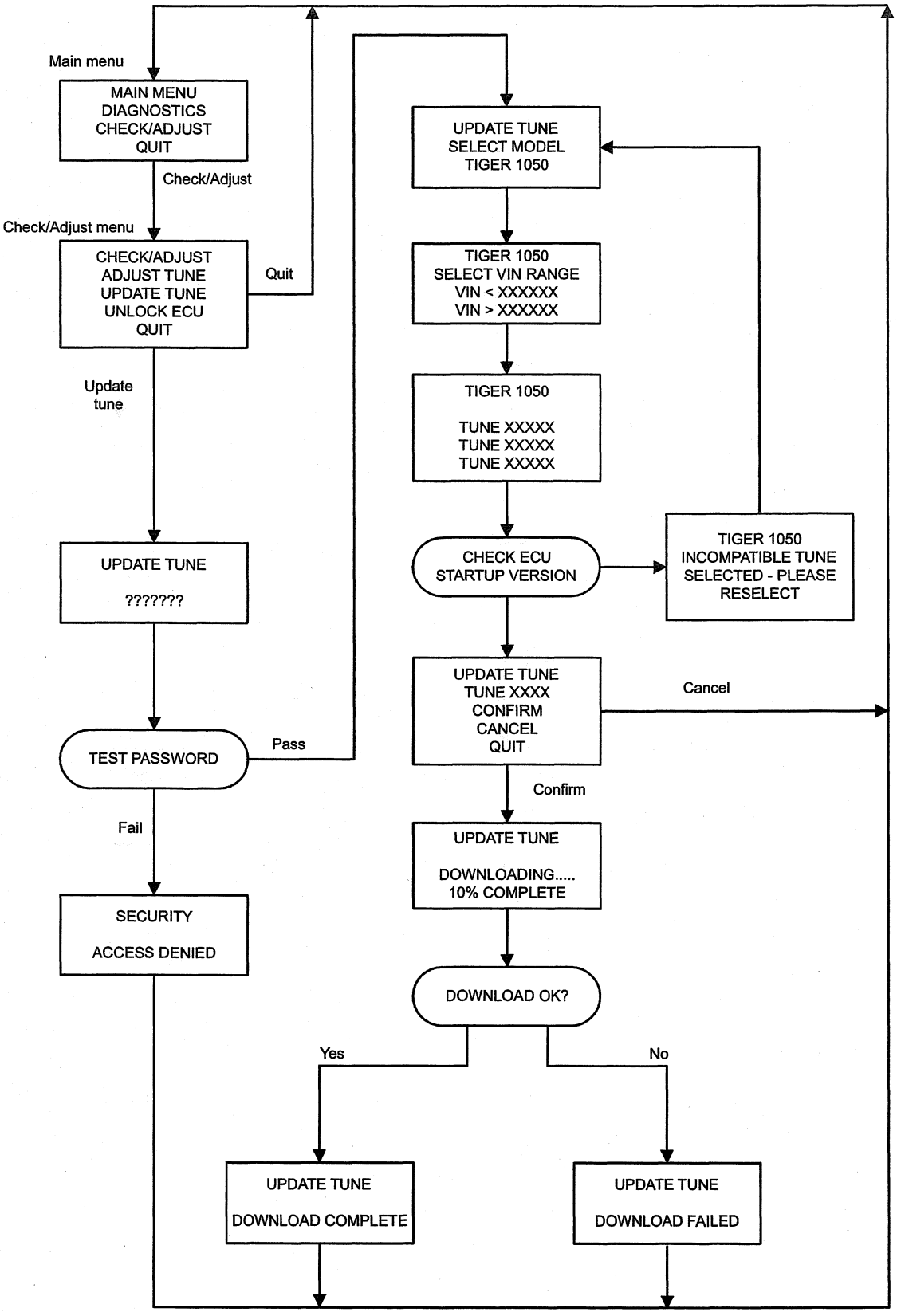
## Checks


Main Menu
MAIN MENU
DIAGNOSTICS
CHECK/ADJUST
QUIT
Check/Adjust
Check/Adjust menu
CHECK/ADJUST
CHECK
ADJUST
QUIT
Quit
Check
Check menu
CHECK
READ BUILD DATA
READ SENSORS
READ ADAPTION STATUS
QUIT
Quit
Build data
Adaption status
Read sensors
ADAPTION STATUS
ECU RESET CLOSED THROTTLE POSITION REF STATUS
IDLE SPEED CONTROL ADAPTION STATUS
02 SENSOR ADAPTION STATUS - OFF IDLE
02 SENSOR ADAPTION RANGE - OFF IDLE
02 SENSOR ADAPTION STATUS - IDLE
02 SENSOR ADAPTION RANGE - IDLE
BUILD DATA
VIN
XXXXXXXXXXXXX
TRIUMPH ECU PART NUMBER
XXXXXX
KEIHIN ECU PART NUMBER
XXXXXXXXXXXXX
ECU SERIAL NO
XXXXXXXXXXX
SOFTWARE VERSION NUMBER
XXXXXXXXXX
DATE OF MANUFACTURE
XXXXXXXXXX
CALIBRATION ID
XXXXXXXXXX
VOLTAGES
THROTTLES/COILS/INJECTORS
OTHER

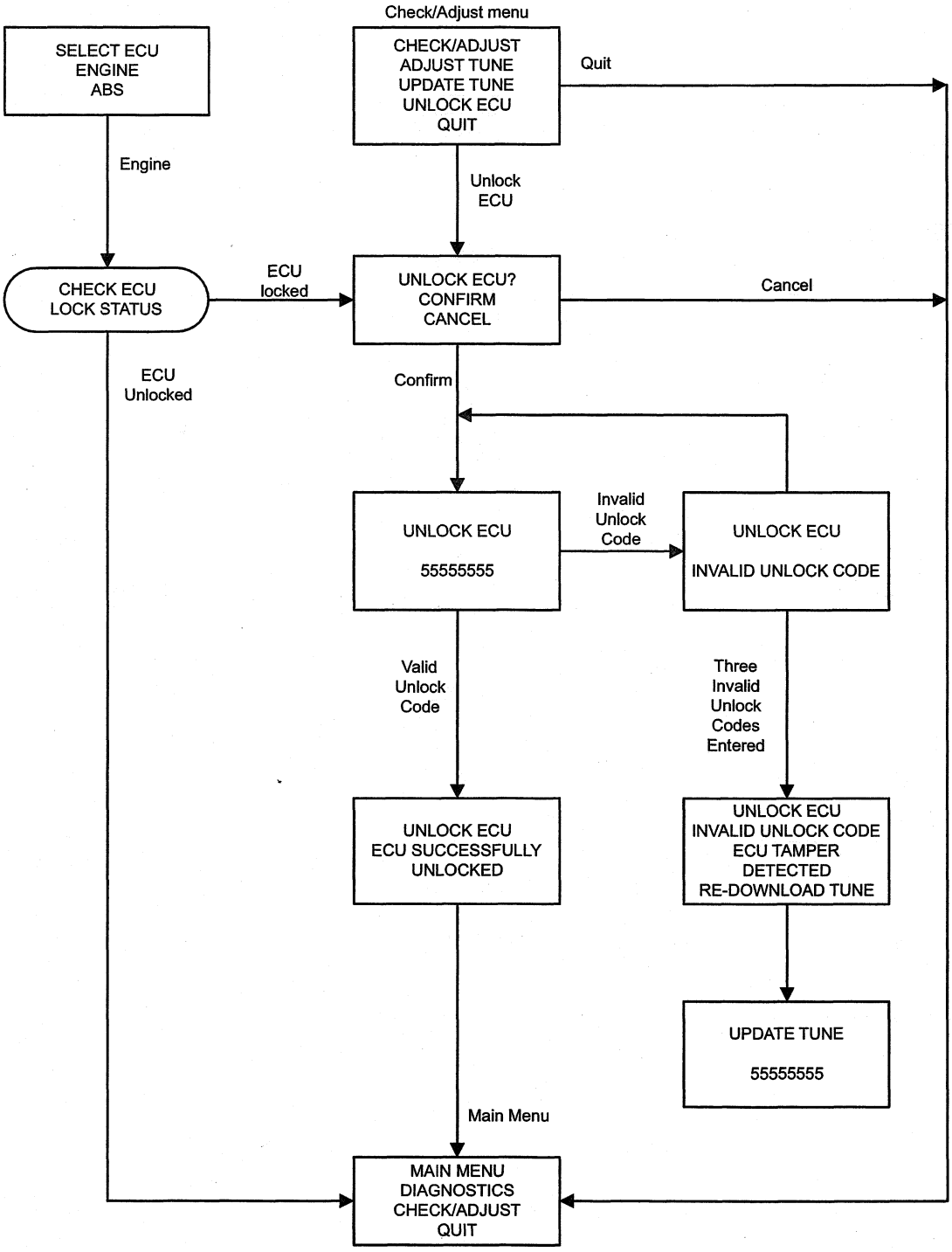
## Adjust Tune


Main Menu
MAIN MENU
DIAGNOSTICS
CHECK/ADJUST
QUIT
Check/Adjust
Check/Adjust menu
CHECK/ADJUST
CHECK
ADJUST
QUIT
Quit
Adjust
Adjust menu
CHECK/ADJUST
ADJUST TUNE
UPDATE TUNE
QUIT
Quit
Adjust menu
ADJUST TUNE
RESET ADAPTIONS
THROTTLE POT RENEW
ISC STEPPER RENEW
BALANCE THROTTLES
QUIT
ADAPTION RESET?
YES
NO
No
Yes
ECU HAS BEEN RESET
THROTTLE POT RENEW
THROTTLE CLOSED
CURRENT VOLTS 0.54 V
REPLACE ISC STEPPER
THROTTLE CLOSED
CURRENT VOLTS 0.54 V
THROTTLE OPEN
CURRENT VOLTS 0.51 V
THROTTLE BALANCE
THROTTLE 1 1234 MM/HG
THROTTLE 2 1234 MM/HG
THROTTLE 3 1234 MM/HG

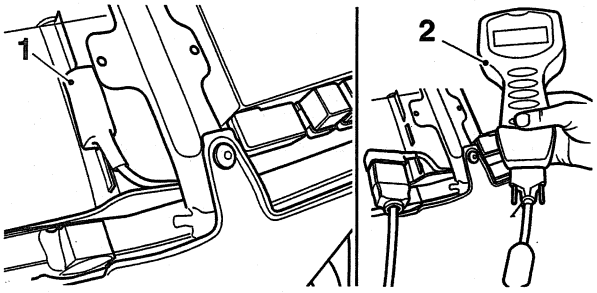
## Update Tune


Main menu
MAIN MENU
DIAGNOSTICS
CHECK/ADJUST
QUIT
Check/Adjust
Check/Adjust menu
CHECK/ADJUST
ADJUST TUNE
UPDATE TUNE
UNLOCK ECU
QUIT
Quit
Update tune
UPDATE TUNE
???????
TEST PASSWORD
Pass
Fail
SECURITY
ACCESS DENIED
UPDATE TUNE
SELECT MODEL
TIGER 1050
TIGER 1050
SELECT VIN RANGE
VIN < XXXXXX
VIN > XXXXXX
TIGER 1050
TUNE XXXXX
TUNE XXXXX
TUNE XXXXX
CHECK ECU
STARTUP VERSION
TIGER 1050
INCOMPATIBLE TUNE
SELECTED - PLEASE
RESELECT
UPDATE TUNE
TUNE XXXX
CONFIRM
CANCEL
QUIT
Cancel
Confirm
UPDATE TUNE
DOWNLOADING.....
10% COMPLETE
DOWNLOAD OK?
Yes
No
UPDATE TUNE
DOWNLOAD COMPLETE
UPDATE TUNE
DOWNLOAD FAILED

## Unlock ECU


Check/Adjust menu
SELECT ECU
ENGINE
ABS
CHECK/ADJUST
ADJUST TUNE
UPDATE TUNE
UNLOCK ECU
QUIT
Quit
Engine
Unlock
ECU
CHECK ECU
LOCK STATUS
ECU
locked
UNLOCK ECU?
CONFIRM
CANCEL
Cancel
ECU
Unlocked
Confirm
UNLOCK ECU
55555555
Invalid
Unlock
Code
UNLOCK ECU
INVALID UNLOCK CODE
Valid
Unlock
Code
Three
Invalid
Unlock
Codes
Entered
UNLOCK ECU
ECU SUCCESSFULLY
UNLOCKED
UNLOCK ECU
INVALID UNLOCK CODE
ECU TAMPER
DETECTED
RE-DOWNLOAD TUNE
UPDATE TUNE
55555555
Main Menu
MAIN MENU
DIAGNOSTICS
CHECK/ADJUST
QUIT

## 1. CONNECTION AND POWER-UP




**1. Connection to main harness**
**2. Triumph service diagnostic tool**

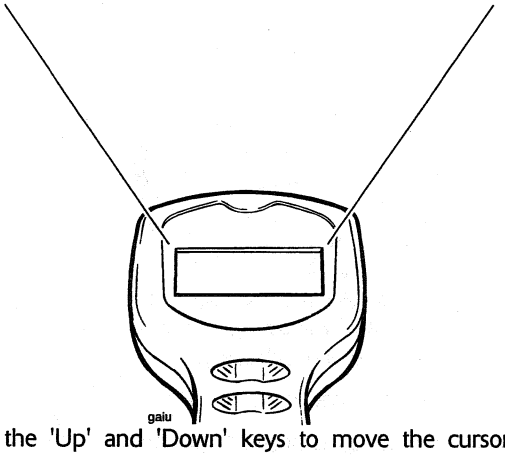
Connect the tool to the dedicated multiplug, located in the storage compartment beneath the seat.

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

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | S | E | L | E | C | T | | L | A | N | G | U | A | G | E | |
| ▶ | | | | | | | E | N | G | L | I | S | H | | | | | |
| | | | | | | | F | R | A | N | C | A | I | S | | | | |
| | | | | | | | D | E | U | T | S | C | H | | | | | |
| | | | | | | | E | S | P | A | N | O | L | | | | | |
| | | | | | | | I | T | A | L | I | A | N | O | | | | |
| | | | | | | | N | E | D | E | R | L | A | N | D | S | | |




Use the 'Up' and 'Down' keys to move the cursor in column 1 and select the language required.

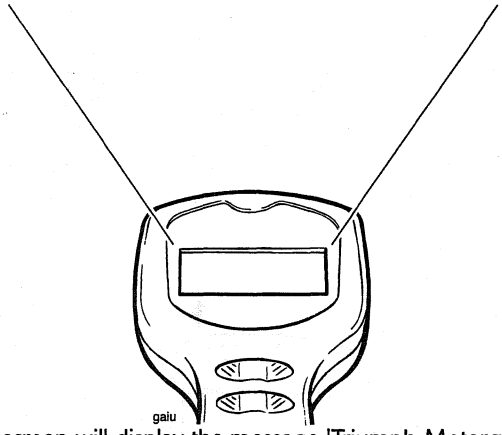
**Note:**

- **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

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | T | R | I | U | M | P | H | | M | O | T | O | R | C | Y | C | L | E | S |
| | | | D | I | A | G | N | O | S | T | I | C | | T | O | O | L | | |
| S | O | F | T | W | A | R | E | | V | E | R | S | I | O | N | | | | |
| | | | | | 2 | 0 | 0 | 6 | - | 0 | 3 | | | | | | | | |



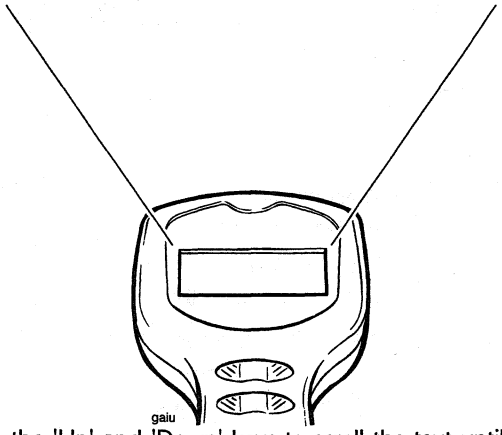

The screen will display the message 'Triumph Motorcycles Diagnostic Tool' and will also give the diagnostic software version and the software release year.

Press the validation key '*' to move on.

If the Return key (↵) is pressed, the tool will return to the 'SELECT LANGUAGE' display.

## 4 SELECT ECU

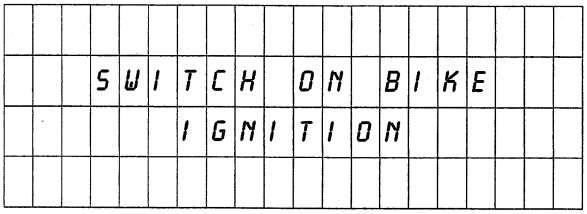
| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | S | E | L | E | C | T | | E | C | U |
| ► | E | N | G | I | N | E | | | | | | | | | | | | | |
| | A | B | S | | | | | | | | | | | | | | | | |

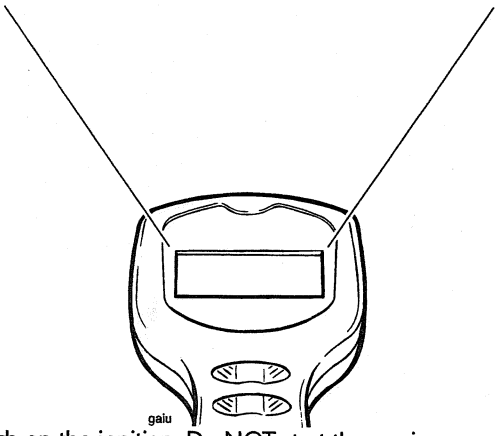



Use the 'Up' and 'Down' keys to scroll the text until the horizontal arrowhead is positioned opposite the 'ENGINE', and press the Validation key '*'.

'SWITCH ON BIKE IGNITION' will appear on the screen (see operation 5).

## 5 SWITCH ON BIKE IGNITION



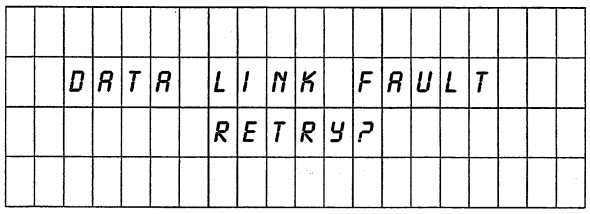

Switch on the ignition. Do NOT start the engine.

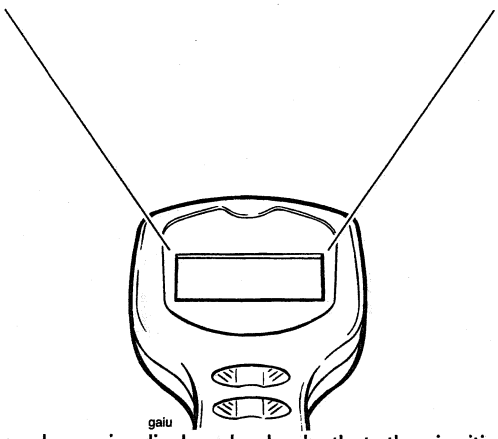
Press the validation key '*'. During a short delay period the tool will carry out certain validation checks.

If it detects a problem which will invalidate the test, 'DATA LINK FAULT RETRY?' will be displayed.

If all is OK, the tool will now automatically check for a locked ECM. Either 'UNLOCK ECU' (operation *7*) will be displayed if the ECM is locked, or the 'MAIN MENU' (operation *10*) will be displayed if the ECM has previously been unlocked.

## 6 DATA LINK FAULT RETRY?




If the above is displayed, check that the ignition is switched on.

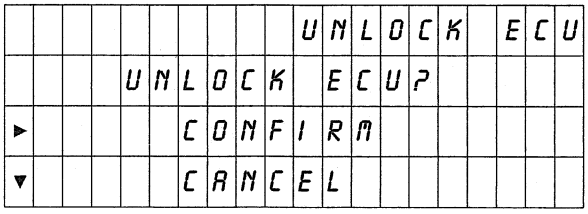
If the ignition is already on, the problem may be caused by bad connections, faulty ignition switch, cable break, faulty ECM, flat battery etc.

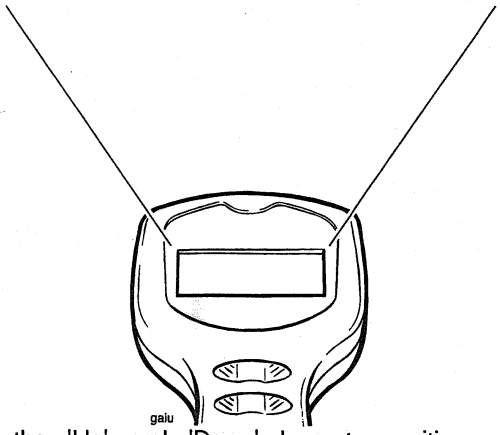
Press the Help key '?' for advice.

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, the tool will now automatically check for a locked ECM. Either 'UNLOCK ECU' (operation *7*) will be displayed if the ECM is locked, or the 'MAIN MENU' (operation *10*) will be displayed if the ECM has previously been unlocked.

## 7 UNLOCK ECM



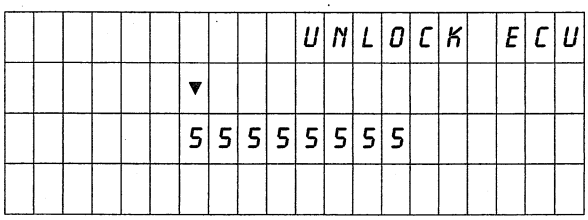



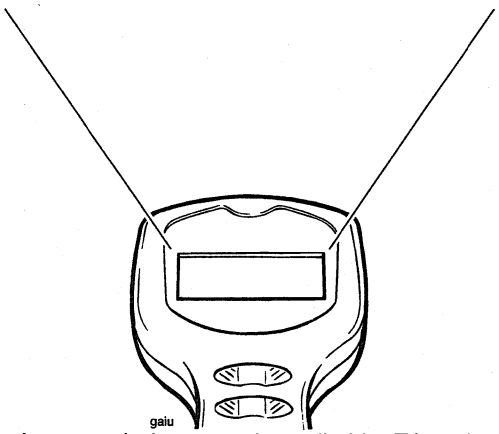

Use the 'Up' and 'Down' keys to position either 'CONFIRM' or 'CANCEL' opposite the cursor.

If 'CONFIRM' is selected, press the Validation key '*' to unlock the ECM. Operation *8* will be displayed.

If 'CANCEL' is selected, the 'MAIN MENU' (operation *10*) will be displayed. Note that if cancel is selected, the ECM will remain locked until the ECM unlock sequence is carried out, but all other diagnostic data will be available.

## 8 UNLOCK ECM




Enter the numerical password supplied by Triumph using the 'Up' and 'Down' keys as described below.

The number '55555555' 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 the numerical password.

Press the Validation key '*'.

The cursor will now re-position over the second digit '5'. Enter the 2nd digit of the number in the same way.

Continue until all 8 digits of the number have been entered.

**Note:**

- **If any digit has been entered incorrectly, press the 'Return' key (↵) to start again.**

When all 8 digits have been entered correctly, press the Validation key '*'.

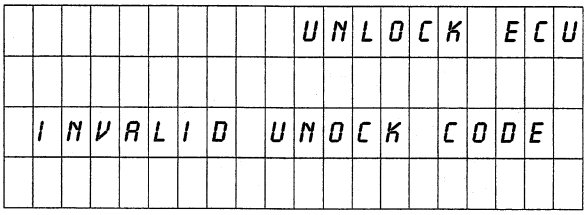
If the numerical password entered is invalid, the screen shown in operation *9* will be displayed.

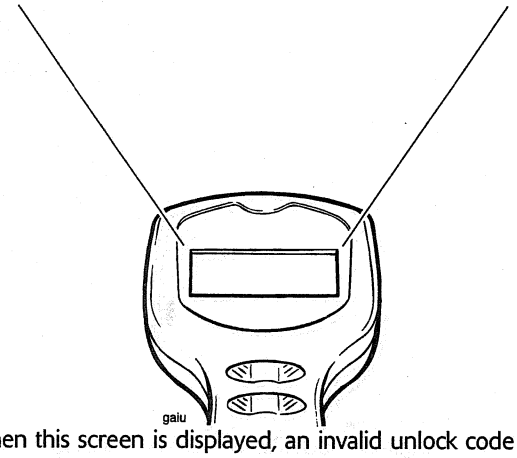
If the numerical password entered is valid, the screen will display 'ECU SUCCESSFULLY UNLOCKED'. The ECM is now unlocked, and the engine can be started.

**Note:**

- **Each new Triumph model will have a unique pass code (i.e. all 2007 model year onwards Tiger motorcycles will have the same pass code). The pass code will be released via 'Triumph On Line' on a pre-arranged date. The specific date when this code will be released will vary from model to model.**

## 9 UNLOCK ECM



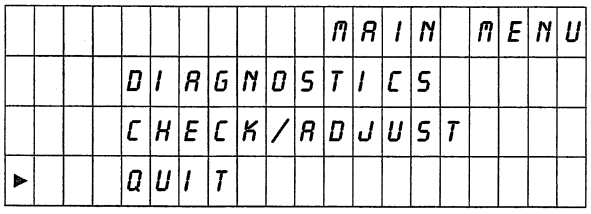



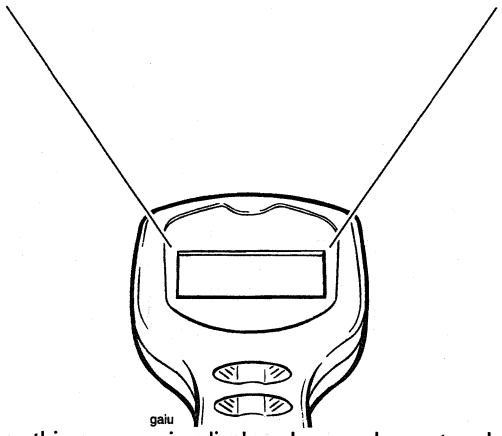

When this screen is displayed, an invalid unlock code has been entered.

Press the Validation key '*' key to return to the previous screen. Enter the correct lock code to unlock the ECM.

If an incorrect unlock code is entered three times, the screen will display 'INVALID UNLOCK CODE ECU TAMPER DETECTED RE-DOWNLOAD TUNE'. No further attempts to enter the unlock code will be allowed. The correct tune must then be re-downloaded in order to allow further attempts to unlock the ECM.

## 10 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 (DTCs) 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 throttle balance 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 '*'.

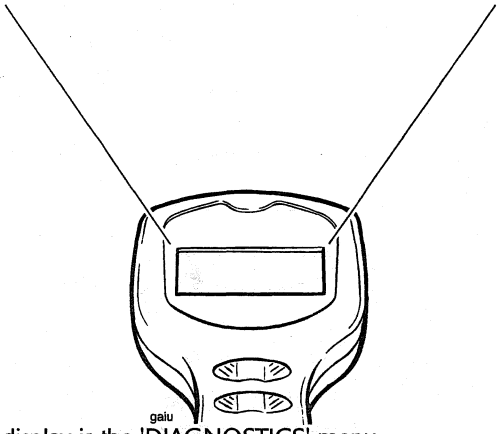
Either 'DIAGNOSTICS' (operation *11*) or 'CHECK/ADJUST' (operation *29*) will be displayed, dependent on the selection.

**Note:**

- **If 'QUIT' is selected and the validation key '*' pressed, the display will return to 'TRIUMPH MOTORCYCLES'.**

## 11 DIAGNOSTICS *(If 'DIAGNOSTICS' is selected)*

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 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 |




This display is the 'DIAGNOSTICS' menu.

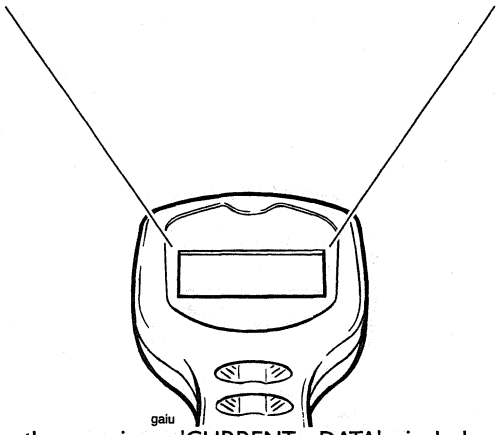
Use the 'Up' and 'Down' keys to scroll the text until the horizontal arrowhead is positioned opposite the desired choice, and press the Validation key '*'.

The choices are:

- **'CURRENT DATA'** (see operation *12*)
- **'READ STORED DTCS'** (see operation *14*)
- **'CLEAR DTCS'** (see operation *19*)
- **'FUNCTION TESTS'** (see operation *20*)
- If **'QUIT'** is selected, the display will return to **'TRIUMPH MOTORCYCLES'.**

## 12 CURRENT DATA

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | C | U | R | R | E | N | T | | D | A | T | A |
| | | | | S | T | A | R | T | | E | N | G | I | N | E | | | |
| ? | C | A | L | C | U | L | A | T | E | D | | L | O | A | D | | 2 | 9% |
| ▼ | E | N | G | I | N | E | | T | E | M | P | | | | | | 7 | 5 | C |



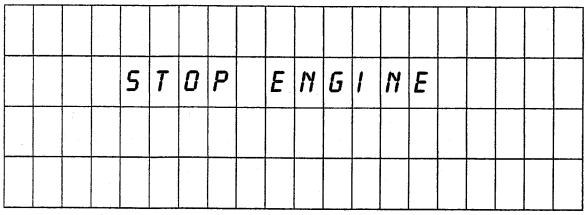

Start the engine. 'CURRENT DATA' includes the information shown in the table below which can be accessed by scrolling, using the 'Up' and 'Down' keys. At the end of each line of text, the actual reading at that instant is provided to assist diagnosis e.g. ENGINE TEMP - 75C.

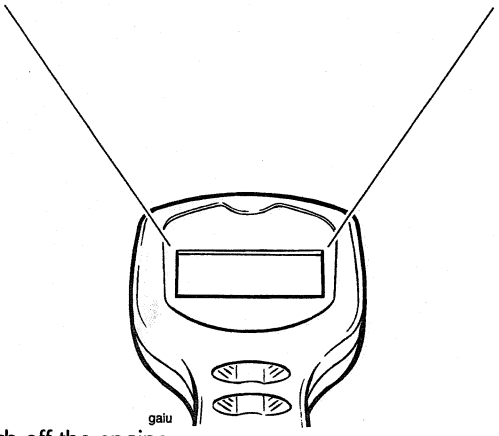
For a complete list of the items reported, see the table titled 'CURRENT DATA' earlier in this section.

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.

## 13 STOP ENGINE

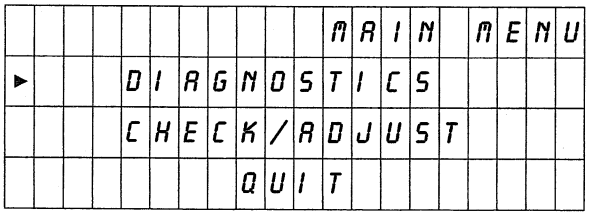


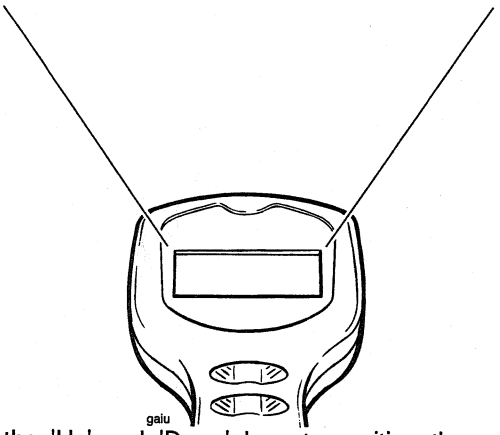




Switch off the engine.

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.

## 14 To select 'READ STORED DTCS' (Diagnostic Trouble Codes) from the MAIN MENU:



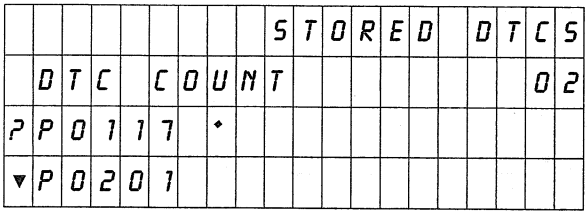

Use the 'Up' and 'Down' keys to position the cursor opposite 'DIAGNOSTICS'.

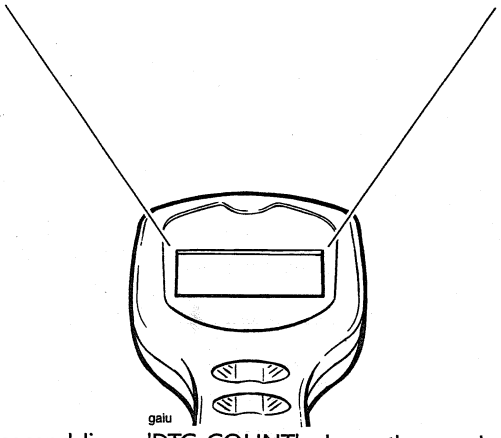
Press the Validation key '*' to display 'DIAGNOSTICS' menu.

Select 'READ STORED DTCS', and press the Validation key '*'.

'STORED DTCS' will be displayed.

## 15 STORED DTCS




The second line - 'DTC COUNT', shows the number of DTCs stored in the ECM memory.

Lines 3 and 4 display up to two of the DTCs stored (if any). If additional DTCs 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 DTCs shown, press the Return key (↵) to return to MAIN MENU.

(If DTCs 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: *P0117*

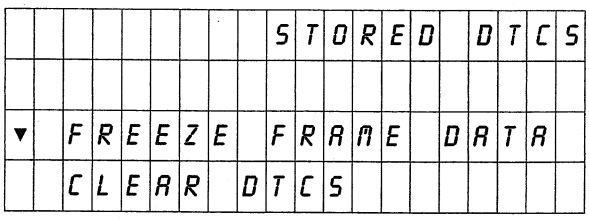
Help text *MAP SENSOR LOW VOLTAGE*

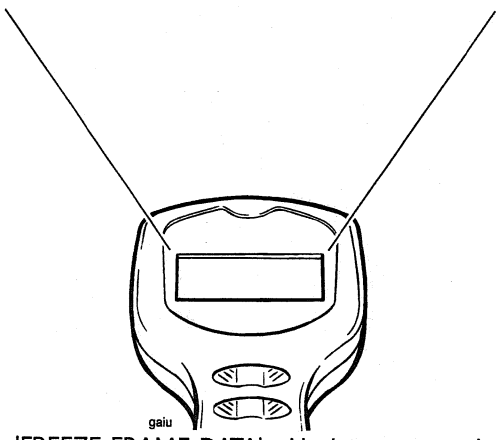
Press the Validation key '*' to continue (operation *16*).

**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 *16* and open 'FREEZE FRAME DATA'.

## 16 Three options are now available:



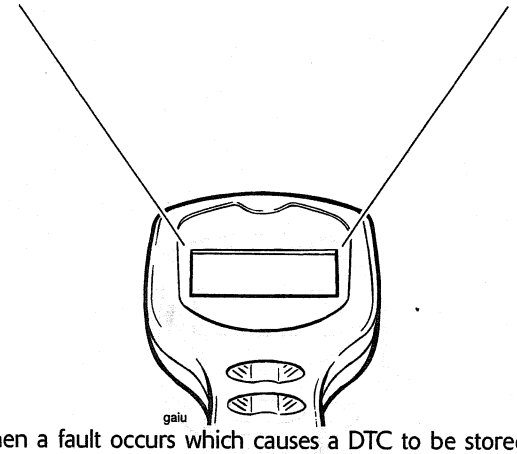

Align 'FREEZE FRAME DATA' with the cursor, and press the validation key '*' to display 'FREEZE FRAME' (operation *17*).

Align 'CLEAR DTCS' with the cursor, and press the validation key '*' to display 'ERASE ALL DTC DATA' (operation *19*).

Press the Return key (↵) to go back to 'STORED DTCS' (operation *15*).

## 17 FREEZE FRAME

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | F | R | E | E | Z | E | | F | R | A | M | E |
| | | | | | | | | | | | | | | | | | | |
| ? | C | A | L | C | U | L | A | T | E | D | | L | O | A | D | | 1 | 9% |
| ▼ | W | A | T | E | R | | T | E | M | P | | | | | | | 7 | 5C |



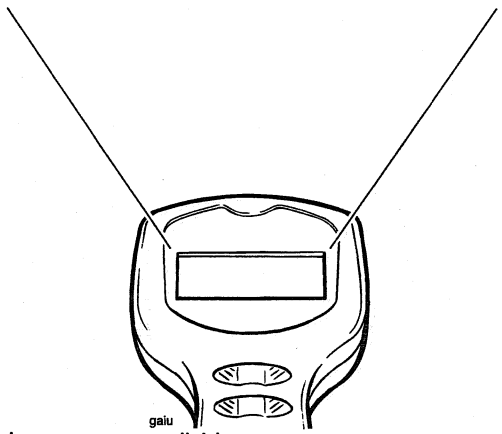

When a fault occurs which causes a DTC to be stored in the memory, the engine condition data at that instant is logged in the ECM. If another, more serious DTC is subsequently set, the original DTC data is automatically erased and new data associated with the latest DTC is logged in its place.

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 *18*).

For a complete list of the items reported, see the table titled 'FREEZE FRAME DATA' earlier in this section.

## 18 STORED DTCS

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | S | T | O | R | E | D | | D | T | C | S |
| | | | | | | | | | | | | | | | | | | |
| ▼ | R | E | T | U | R | N | | T | O | | D | T | C | S | | | | |
| | C | L | E | A | R | | D | T | C | S | | | | | | | | |




2 options are now available:

Scroll to 'RETURN TO DTCS' and press the Validate key '*' to return to operation *15*

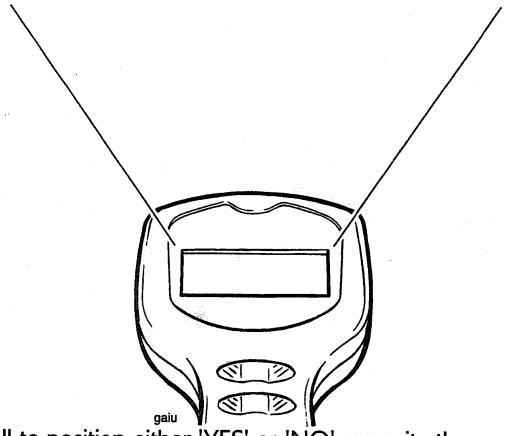
Scroll to 'CLEAR DTCS' and press the Validation key '*' to go on to operation *19*

**Note:**

- **A full list of all the possible DTCs can be found earlier in this section.**

## 19 STORED DTCS, ERASE ALL DTC DATA

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | S | T | O | R | E | D | | D | T | C | S |
| | E | R | A | S | E | | A | L | L | | D | T | C | | D | A | T | A | |
| ► | Y | E | S | | | | | | | | | | | | | | | | |
| | N | O | | | | | | | | | | | | | | | | | |




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:**

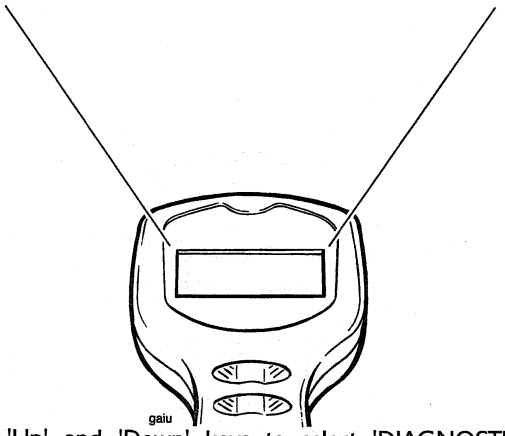
- **If you intend to examine the Function Tests, entry will be inhibited unless the DTCs have been erased.**

If 'NO' is selected, press the Validation key '*' to return to operation *15*.

That completes the DTC cycle.

## 20 To select 'FUNCTION TESTS' from the MAIN MENU:

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 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 |
| ▼ | | | C | L | E | A | R | | D | T | C | S | | | | | | | |




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 DTCs are stored, 'FUNCTION TEST' will be displayed (operation *22*).

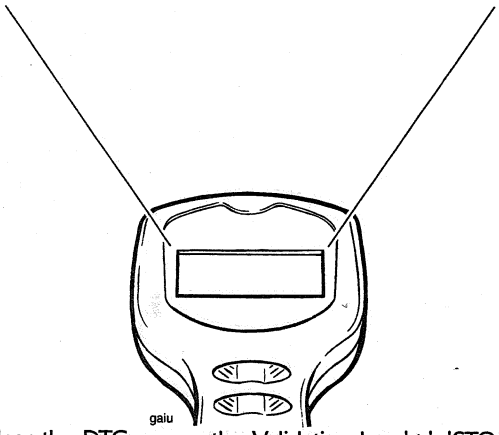
If one or more DTCs are stored, the message 'DTCS PRESENT CLEAR BEFORE TEST ACTION' will be displayed (operation *21*).

**Note:**

- **The diagnostic tool will not allow Function Tests to be accessed until all DTCs in the memory are removed.**

## 21 FUNCTION TESTS

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | F | U | N | C | T | I | O | N | | T | E | S | T | S |
| | D | T | C | S | | P | R | E | S | E | N | T | | C | L | E | A | R | |
| | B | E | F | O | R | E | | T | E | S | T | | A | C | T | I | O | N | |
| | | | | | | | | | | | | | | | | | | | |




To clear the DTCs, press the Validation key '*'. 'STORED DTCS' will be displayed (see operation *15*).

Proceed as before via operations *16* to *19*. Scroll to 'YES' and press the Validation key '*' to erase all DTC data; the MAIN MENU will be displayed again.

**Note:**

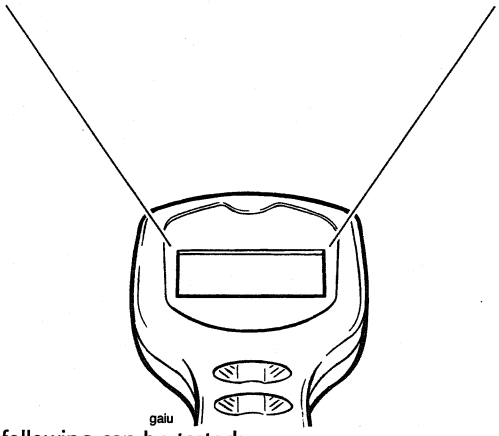
- **The fault(s) which caused the DTCs to be set must be rectified and cleared before continuing the Function Tests.**
- **A full list of all the possible DTCs can be found earlier in this section.**

Select 'DIAGNOSTICS' menu and 'FUNCTION TESTS' again pressing the Validation key '*' each time.

Because the DTCs have now been erased, 'FUNCTION' TEST' (operation *22*) will now be displayed.

## 22 FUNCTION TEST

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | F | U | N | C | T | I | O | N | | T | E | S | T |
| | | | | | | | | | | | | | | | | | | |
| P | I | N | S | T | R | U | M | E | N | T | | P | A | N | E | L | | |
| ▼ | I | S | C | | S | T | E | P | P | E | R | | | | | | | |




The following can be tested:

a) **Instrument panel.**
b) **Idle speed control stepper.**
c) **Purge valve.**
d) **Fuel pump prime.**
e) **Cooling fan operation.**
f) **Fuel pump operation.**

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, the water temperature gauge to show 100°C* and the speedometer 100 km/h*, all for 10 seconds.

* Or the imperial equivalents.

Idle speed control stepper: A signal is sent which should cause the stepper to be driven to the fully closed position, then to the fully open position, pausing briefly in each position. DTCs are set if a malfunction is found.

Purge valve (California models only): This test allows you to check operation of the valve. To detect valve operation, use a stethoscope to listen for valve operation. DTCs are set if a malfunction is found.

Fuel pump prime: This test provides you with the means to physically check the pump and relay operation. DTCs are set if a malfunction is found.

Cooling fan test: A signal is sent which should cause the fan to operate for a 10 second period. DTCs are set if a malfunction is found.

Fuel pump operation: This test provides you with the means to physically check the pump operation. DTCs are

set if a malfunction is found. The pump is energised when the test is confirmed and ended when the Validation key '*' is pressed for a second time.

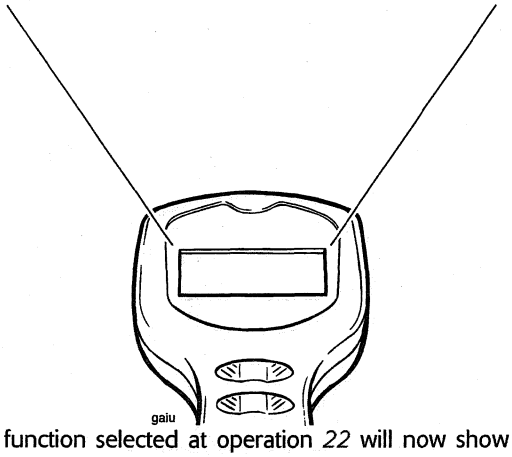
Press the Help key (?) for more information.

**Note:**

- **If the Return key (↵) is pressed, the tool will return to 'DIAGNOSTICS' menu (operation *11*).**

## 23 FUNCTION TEST

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | F | U | N | C | T | I | O | N | | T | E | S | T |
| | I | N | S | T | R | U | M | E | N | T | | P | A | N | E | L | | | |
| ► | P | R | O | C | E | E | D | | | | | | | | | | | | |
| | C | A | N | C | E | L | | | | | | | | | | | | | |




The function selected at operation *22* 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 - The temperature gauge shows from empty to full then flashes twice.**
- **SPEEDOMETER - 100 km/h*.**

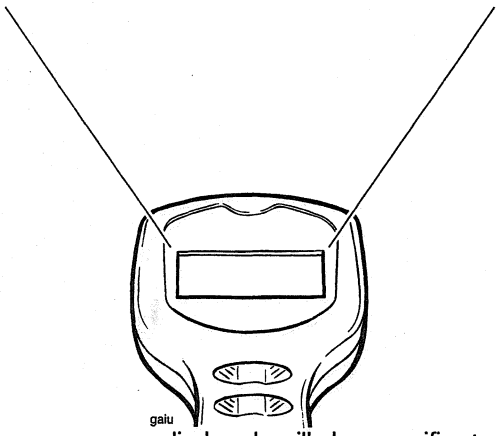
* Or the imperial equivalents.

If you wish to cancel that selection, scroll to 'CANCEL' and press the Validation key '*'. The display will return to operation *22*.

If you wish to test the component selected, scroll to 'PROCEED' and press the Validation key '*'.

## 24 FUNCTION TEST

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | F | U | N | C | T | I | O | N | | T | E | S | T |
| | I | N | S | T | R | U | M | E | N | T | | P | A | N | E | L | | | |
| | | | | T | E | S | T | I | N | G | . | . | . | | | | | | |
| | | | | O | B | S | E | R | V | E | | G | A | U | G | E | S | | |



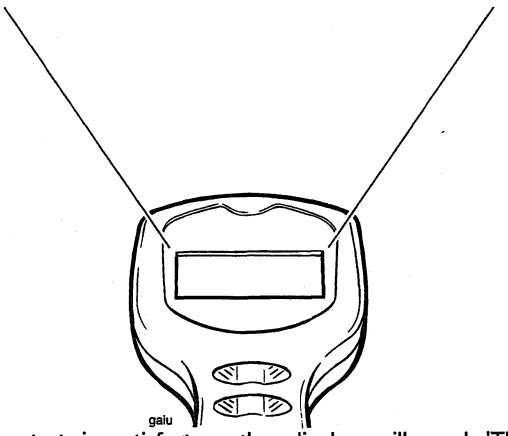

The screen now displayed will be specific to the component being tested:

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' (operation *25*) which will indicate a satisfactory completion, or to 'TEST FAILED' (operation *27*) which will indicate failure.

## 25 FUNCTION TEST

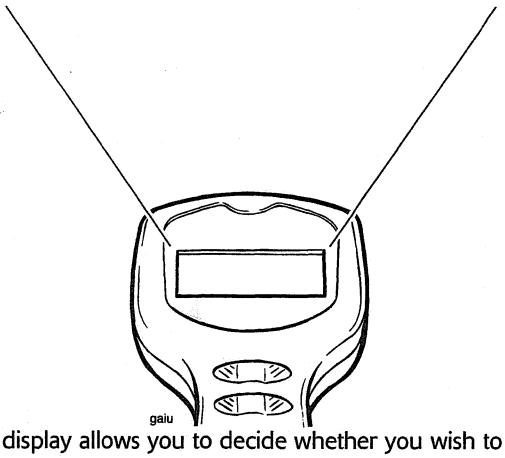
| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | F | U | N | C | T | I | O | N | | T | E | S | T |
| | I | N | S | T | R | U | M | E | N | T | | P | A | N | E | L | | | |
| | | | | T | E | S | T | | C | O | M | P | L | E | T | E | | | |
| | | | | | | | | | | | | | | | | | | | |




If the test is satisfactory the display will read 'TEST COMPLETE'. Press the Validation key '*' to display 'FUNCTION TEST' (operation *26*).

## 26 FUNCTION TEST

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | F | U | N | C | T | I | O | N | | T | E | S | T |
| P | E | R | F | O | R | M | | A | N | O | T | H | E | R | | T | E | S | T |
| ▶ | Y | E | S | | | | | | | | | | | | | | | | |
| | N | O | | | | | | | | | | | | | | | | | |



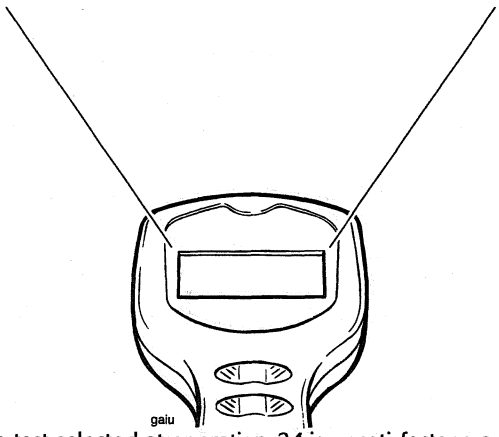

This display allows you to decide whether you wish to test another component.

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 *11*).

## 27 FUNCTION TEST

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | F | U | N | C | T | I | O | N | | T | E | S | T | |
| | I | N | S | T | R | U | M | E | N | T | | P | A | N | E | L | | | |
| | T | E | S | T | | F | A | I | L | E | D | | | P | 1 | 1 | 1 | 7 | |
| | | | | | | | | | | | | | | | | | | | |




If the test selected at operation *24* is unsatisfactory, a DTC will be displayed on line 3 of this display.

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 *26*).

**Note:**

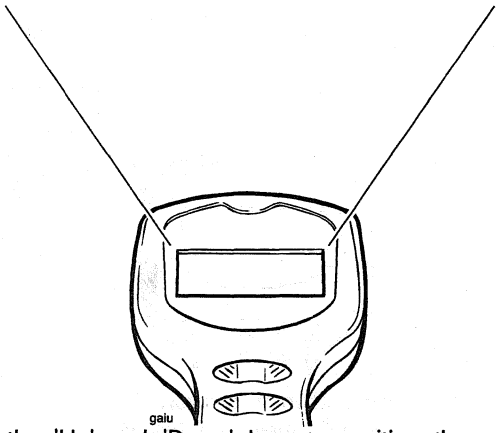
- **Any DTCs logged in the system will be automatically cleared at this point.**

To return to the 'DIAGNOSTICS' menu, Select 'QUIT' and press the Validation key '⁎' to return to the 'MAIN MENU' (operation *10*).

That completes the 'FUNCTION TESTS' cycle.

## 28 To select 'CHECKS/ADJUSTMENTS' from the MAIN MENU (operation *10*):

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | M | A | I | N | | M | E | N | U |
| | | | D | I | A | G | N | O | S | T | I | C | S | | | | | |
| ▶ | | | C | H | E | C | K | / | A | D | J | U | S | T | | | | |
| | | | | | | | Q | U | I | T | | | | | | | | |

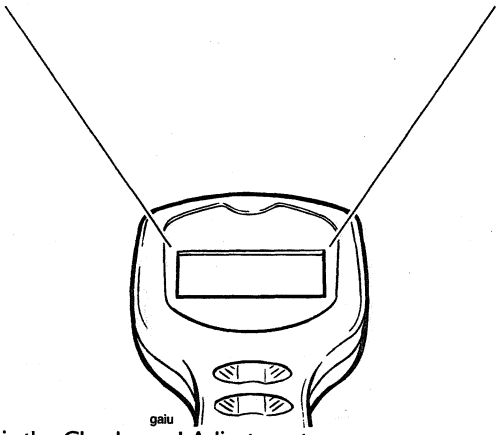



Use the 'Up' and 'Down' keys to position the cursor opposite 'CHECK/ADJUST'.

Press the Validation key '*'; the 'CHECK/ADJUST' menu will be displayed.

## 29 CHECK/ADJUST

| | | | | | | | | C | H | E | C | K | / | A | D | J | U | S | T |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ▶ | | | | | | | | C | H | E | C | K | | | | | | | |
| | | | | | | | | A | D | J | U | S | T | | | | | | |
| | | | | | | | | | Q | U | I | T | | | | | | | |




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 '*':

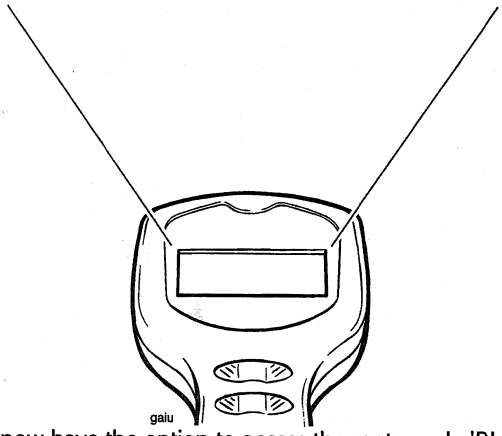
Opposite 'CHECK' - 'CHECKS' will be displayed (operation *30*).

Opposite 'ADJUST' - 'ADJUSTS' will be displayed (operation *34*).

Opposite 'QUIT' - to return to 'MAIN MENU' (operation *10*).

## 30 CHECKS

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | C | H | E | C | K | S |
| ► | | R | E | A | D | | S | E | N | S | O | R | S | | | | | |
| | | R | E | A | D | | B | U | I | L | D | | D | A | T | A | | |
| | | A | D | A | P | T | I | O | N | | S | T | A | T | U | S | | |




You now have the option to access the motorcycle 'BUILD DATA', 'ADAPTION STATUS' or the 'SENSOR DATA', or to quit.

Position the cursor as follows and then press the Validation key '*':

Opposite 'READ SENSORS' - 'SENSOR DATA' (operation *32*) will be displayed.

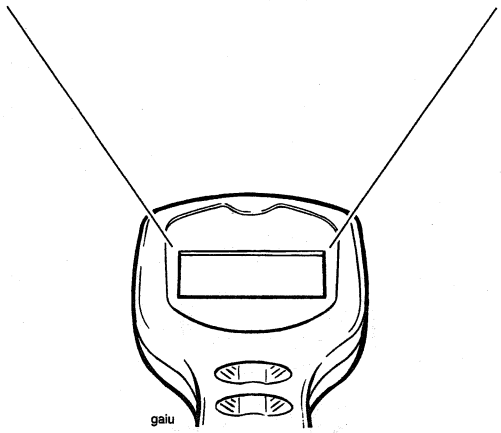
Opposite 'READ BUILD DATA' - 'BUILD DATA' (operation *31*) will be displayed.

Opposite 'ADAPTION STATUS' - 'ADAPTION DATA' (operation *33*) will be displayed if the coolant temperature is higher than 90°C. If not, a holding screen will be displayed indicating the current temperature.

Opposite 'QUIT' - to return to 'MAIN MENU' (operation *10*).

## 31 BUILD DATA

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | B | U | I | L | D | | D | A | T | A |
| | V | I | N | | | | | | | | | | | | | | | |
| | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| ▼ | T | R | I | U | M | P | H | | E | C | U | | | | | | | |



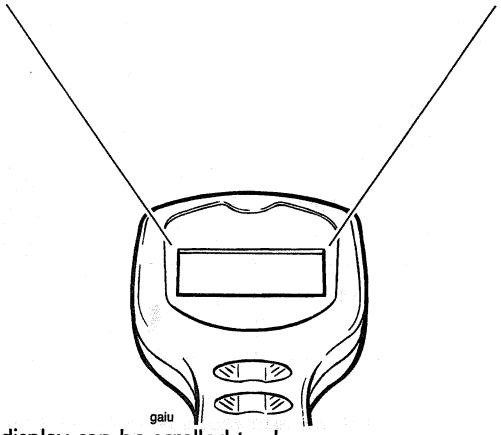

Providing the information was recorded at the time of build, the display will show the following information relating to the motorcycle under test by scrolling up and down. Before displaying the recorded information, the tool will briefly display the message, 'PLEASE WAIT, CHECKING BUILD DATA'.

- **Vehicle Identification Number (VIN)**
- **Triumph ECM part number**
- **Manufacturer's ECM part number**
- **ECM Serial number**
- **Tune Number**

Press the Validation '*' key to return to 'CHECK/ADJUST' menu (operation *29*).

## 32 SENSOR DATA

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | S | E | N | S | O | R | | D | A | T | A |
| | | | | | | | | | | | | | | | | | | |
| P | A | I | R | | S | E | N | S | O | R | | | | | | | 5 | V |
| ▼ | A | I | R | | T | E | M | P | | | | | | | | 1 | 5 | C |




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:**

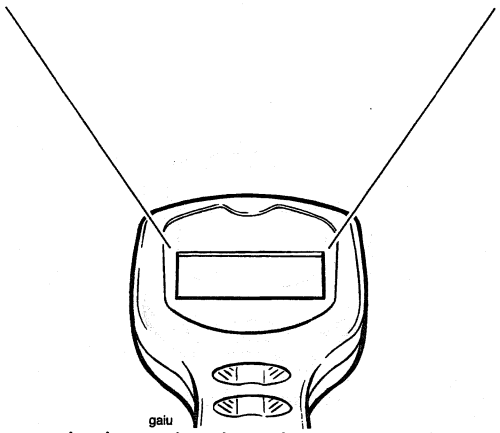
- **The help information shows the likely range of readings for a correctly functioning system at normal operating temperature.**

That completes examination of the Checks.

Press the Validation key '*' to return to 'CHECK/ADJUST' (operation *29*).

## 33 ADAPTION STATUS

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | A | D | A | P | T | I | O | N | | S | T | A | T | U | S |
| | | E | N | G | I | N | E | | T | E | M | P | | O | U | T | | | |
| | | | | | O | F | | R | A | N | G | E | | | | | | | |
| | | | P | L | E | A | S | E | | W | A | I | T | | | | | | |

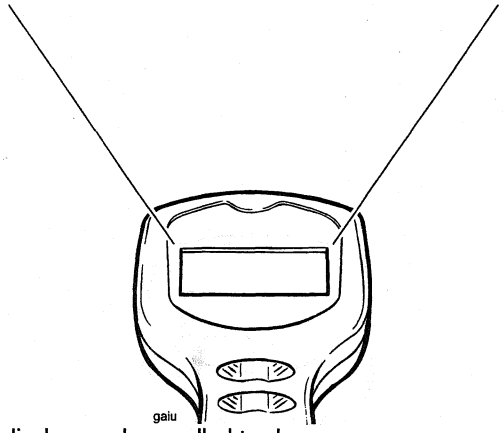



Because adaption only takes place at normal operating temperature, the above screen will be displayed until the engine reaches normal operating temperature.

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 'ADAPTION STATUS' screen (operation *34*) will automatically be displayed.

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | A | D | A | P | T | I | O | N | | D | A | T | A |
| C | L | O | S | E | D | | T | H | R | O | T | T | L | E | | | | N | O |
| I | S | C | | A | D | A | P | T | I | O | N | | | | | | 7 | 6 | % |
| O | 2 | | S | E | N | S | O | R | | A | D | A | P | | | | 5 | 1 | % |




The display can be scrolled to show:

The adaption status of the various sensors and actuators involved in the adaption process will give an indication as to whether or not the vehicle is correctly adapted. If the readings show an incorrect adaption status, refer to the table of contents for the location of further information and the actions necessary to force correct adaption.

See page *10-24* for additional information on forcing adaption.

The data displayed under this option are:

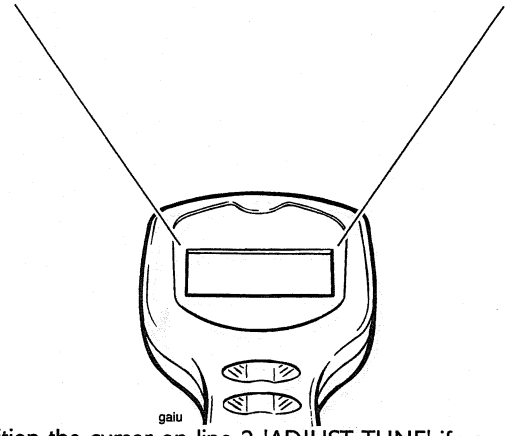
| Function Examined | Report Method |
|---|---|
| Closed throttle position reference status | adapted/not adapted |
| Idle speed control adaption status | % |
| Oxygen sensor adaption status (off idle) | % |
| Oxygen sensor adaption range (off idle) | % |
| Oxygen sensor adaption status (idle) | % |
| Oxygen sensor adaption range (idle) | % |

**Note:**

- **Several forced adaptions may be needed to fully adapt an individual motorcycle.**

## 34 ADJUST

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | A | D | J | U | S | T |
| ► | | | A | D | J | U | S | T | | T | U | N | E | | | | | |
| | | | U | P | D | A | T | E | | T | U | N | E | | | | | |
| | | | | | | | | Q | U | I | T | | | | | | | |

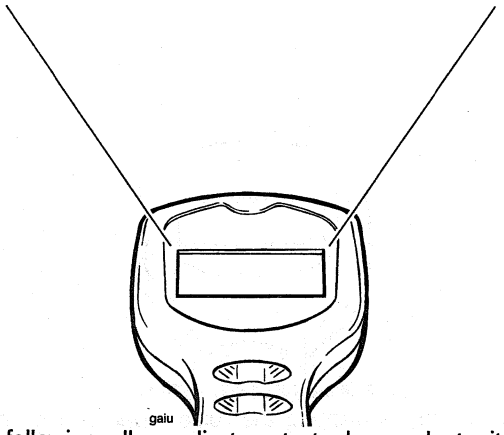



Position the cursor on line 2 'ADJUST TUNE' if you wish to check and/or adjust the values of certain tune items. Then press the Validation key '⁎' to display ADJUST TUNE (operation *35*).

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 '⁎' (operation *38*).

## 35 ADJUST TUNE

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | A | D | J | U | S | T | | T | U | N | E |
| | R | E | S | E | T | | A | D | A | P | T | I | O | N | S | | | | |
| | B | A | L | A | N | C | E | | T | H | R | O | T | T | L | E | S | | |
| ► | T | H | R | O | T | T | L | E | | P | O | T | | R | E | N | E | W | |
| | I | S | C | | S | T | E | P | P | E | R | | R | E | N | E | W | | |




The following allow adjustments to be made to items which affect the engine operation

Position the cursor opposite the setting you wish to adjust and press the Validation key '⁎'.

'RESET ADAPTIONS' - See operation *36*.

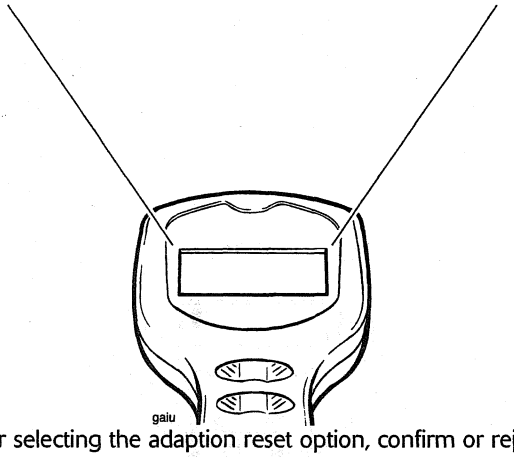
BALANCE THROTTLES' - See operation *37*.

THROTTLE POT RENEW' - See page *10-115* for details on when and how to use this function.

'IDLE SPEED CONTROL STEPPER RENEW' - See page *10-116* for details on when and how to use this function.

## 36 ADJUST TUNE (adaption reset)

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | A | D | A | P | T | I | O | N | | R | E | S | E | T |
| | | | C | O | N | F | I | R | M | | | | | | | | | |
| ► | | | Y | E | S | | | | | | | | | | | | | |
| | | | N | O | | | | | | | | | | | | | | |




After selecting the adaption reset option, confirm or reject the option by positioning the cursor opposite the option chosen and press the Validation key '*'.

If YES is chosen, a screen will confirm that adaptions have been reset.

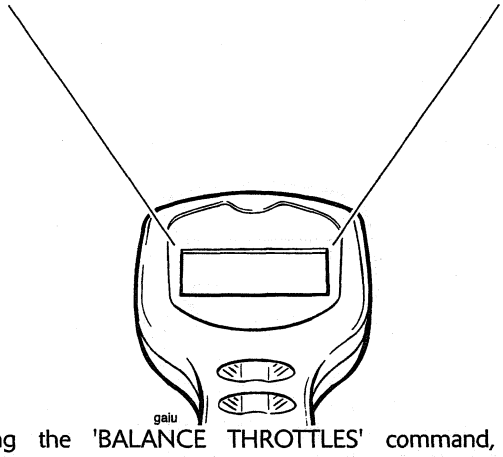
If NO is chosen, you will be returned to the adjust tune menu.

**Note:**

- **Resetting the adaption values does not adapt the motorcycle. This can only be done by the method explained later in this section. Adaption reset only returns adaption values to their 'start' point.**

## 37 BALANCE THROTTLES

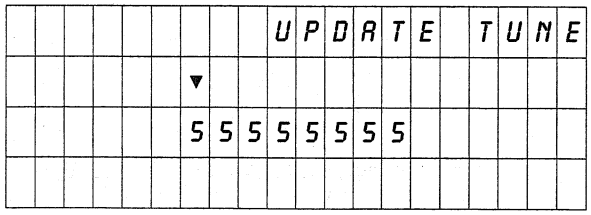
| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T | H | R | O | T | T | L | E | S | | B | A | L | A | N | C | E | D | |
| T | H | R | O | T | T | L | E | | 1 | | 1 | 2 | 3 | 4 | M | M | / | H | G |
| T | H | R | O | T | T | L | E | | 2 | | 1 | 2 | 3 | 4 | M | M | / | H | G |
| T | H | R | O | T | T | L | E | | 3 | | 1 | 2 | 3 | 4 | M | M | / | H | G |

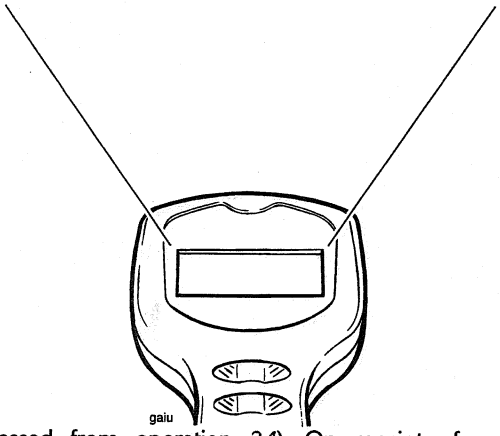



Using the 'BALANCE THROTTLES' command, the throttles may be balanced without the need to connect an external device to measure the vacuum levels in each throttle body. The diagnostic tool displays data taken from the manifold absolute pressure sensor reading for each throttle.

Once throttle imbalance has been reduced to a pre-determined level, the top line of information will display the word *BALANCED*. Under any other conditions where imbalance is detected, nothing will be displayed indicating that the throttles require balancing.

### 38 UPDATE TUNE




(Accessed from operation *34*). On receipt of special instructions from Triumph you may be asked to input a completely new engine tune.

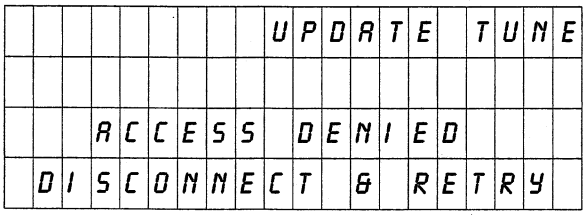
To do this, they will give you a password number which must be entered using the 'Up' and 'Down' keys in the same way as was done to unlock the ECM.

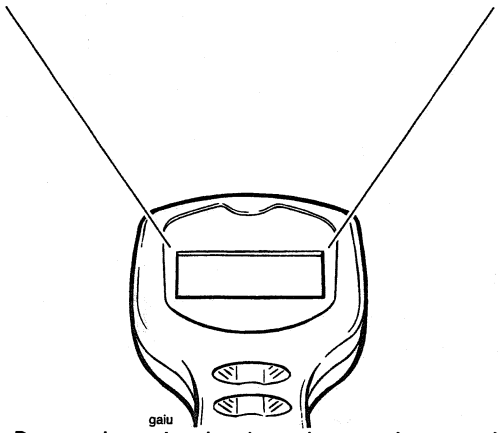
After entering the final digit, press the Validation key '*' again.

If the password number entered is invalid, the screen shown in operation *38* will be displayed.

If the password number is valid, the tool will briefly display the message, 'PLEASE WAIT, CHECKING ECM TYPE' then, 'UPDATE TUNE' (operation *39*) will be displayed.

### 39 UPDATE TUNE



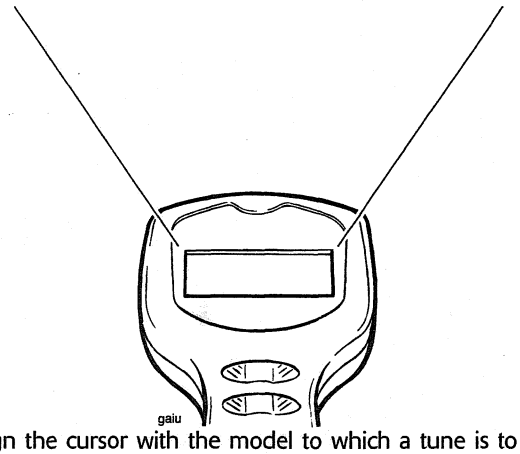




If the Password number has been incorrectly entered, the screen will display 'ACCESS DENIED'. Press the Validation key '*' to return to MAIN MENU (operation *10*) and start again.

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.

## 40 UPDATE TUNE

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | U | P | D | A | T | E | | T | U | N | E |
| | S | E | L | E | C | T | | M | O | D | E | L | | | | | | |
| ▶ | T | I | G | E | R | | I | 0 | 5 | 0 | | | | | | | | |
| | | | | | | | | | | | | | | | | | | |

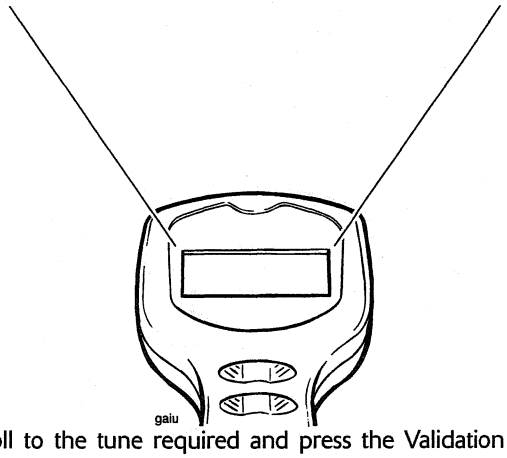



Align the cursor with the model to which a tune is to be downloaded and, when satisfied that the selection is correct, press the validation key '*'.

Once a model has been selected and the validation key pressed, screen *40* will be displayed.

## 41 UPDATE TUNE

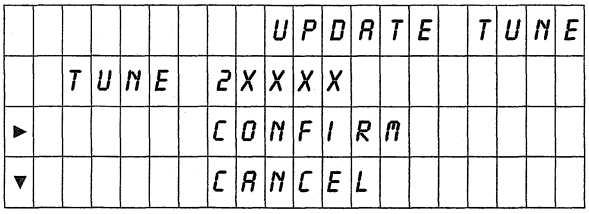
| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | T | I | G | E | R | | I | 0 | 5 | 0 |
| | | T | U | N | E | | 2 | X | X | X | X | | | | | | | |
| | | T | U | N | E | | 2 | X | X | X | X | | | | | | | |
| | | T | U | N | E | | 2 | X | X | X | X | | | | | | | |

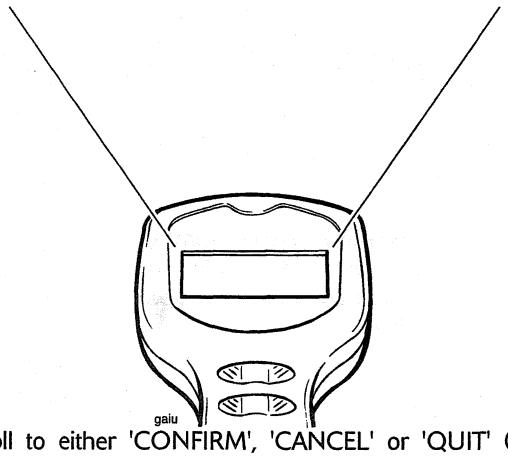



Scroll to the tune required and press the Validation key '*' to move on to operation *41*.

Press the help key for information on the applicability of each tune number.

## 42 UPDATE TUNE



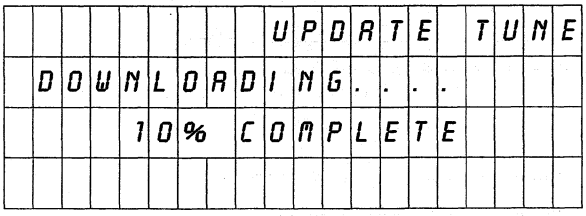

Scroll to either 'CONFIRM', 'CANCEL' or 'QUIT' (quit option will not be visible until the text has been scrolled) then press the Validation key '*'.

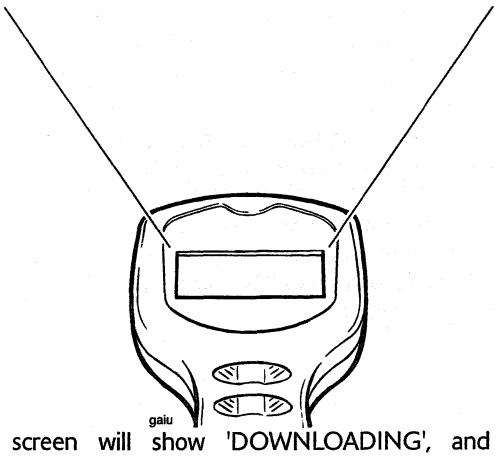
If 'QUIT' has been selected - this will return to MAIN MENU (operation *10*).

If 'CANCEL' has been selected - return to operation *40*.

If 'CONFIRM' has been selected, downloading will begin.

## 43 UPDATE TUNE (confirm selected)




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 *10*).

If downloading has been unsuccessful the screen will display 'DOWNLOAD FAILED'. Should this message appear, refer to *44*, restarting tune download.

Press the Validation key '*' to return to the 'MAIN MENU' (operation *10*).

## 44 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.

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | T | R | I | U | M | P | H | | M | O | T | O | R | C | Y | C | L | E | S |
| | | | D | I | A | G | N | O | S | T | I | C | | T | O | O | L | | |
| S | O | F | T | W | A | R | E | | V | E | R | S | I | O | N | | | | |
| | | | | | 2 | 0 | 0 | 6 | - | 0 | 3 | | | | | | | | |

From this screen, use the following button press sequence:

HELP (?) - HELP (?) - RETURN (↵) - HELP (?) VALIDATE (*).

The dealer log-in 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 multi-plugs.**

For example, the electronic control module (ECM) 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 that 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.**

### Disconnection of ECM Connectors

**Note:**

- **Two different shaped connectors are used in the ECM, which ensures correct connection is always made.**

**Caution**

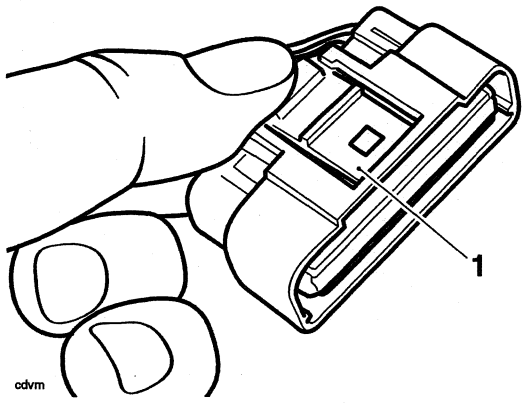
When disconnecting a connector, never pull directly on the wires as this may result in cable and connector damage.

**Caution**

Never disconnect an ECM when the ignition switch is in the 'ON' position as this may cause multiple fault codes to be logged in the ECM memory.

Always disconnect an ECM after disconnecting the battery negative (black) lead first.

1. Turn the ignition to the 'OFF' position and wait at least 1 minute for the ECM to complete its power down sequence.
2. Press down on the locking device and gently pull back on the connector to release it from the ECM.




**1. Locking device**

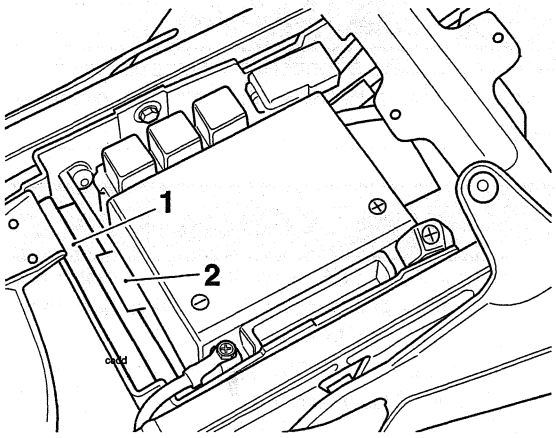
**Note:**

- **The ECM is located under the seat, forward of the battery.**

### Reconnection of ECM connectors

**Caution**

Damage to the connector pins may result if an attempt to fit the connectors incorrectly is made.




**1. ECM**
**2. ECM retaining tang**

3. Fit the connector into its socket and, whilst holding the connector in place, insert it fully into the ECM until the locking device retains it.

## Further Diagnosis

The tables that follow will, if used correctly, help to pinpoint a fault in the system once a diagnostic trouble code has been stored.

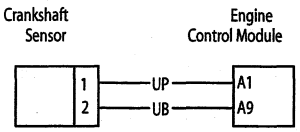
## Crankshaft Sensor

| Fault Code | Possible cause | Action |
|---|---|---|
| P0335 | Crankshaft sensor system fault | View & note diagnostic tool 'freeze frame' data if available.<br>Ensure sensor is fitted correctly and connector is secure.<br>Disconnect ECM and proceed to pinpoint test 1: |

### Pinpoint Tests

| | Test | Result | Action |
|---|---|---|---|
| 1 | Check terminal and cable integrity:<br>- ECM pin A9<br>- ECM pin A1 | OK | Disconnect sensor and proceed to test 2 |
| | | Faulty | Rectify fault, proceed to test 6 |
| 2 | Check cable for short circuit:<br>- ECM pin A9 to earth<br>- ECM pin A1 to earth | OK | Proceed to test 3 |
| | | Short circuit | Locate and rectify wiring fault, proceed to test 6 |
| 3 | Check cable continuity:<br>- ECM pin A1 to sensor pin 1<br>- ECM pin A9 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:<br>- ECM pin A9 to ECM pin A1 | OK | Renew crankshaft sensor, proceed to test 6 |
| | | Short circuit | Locate and rectify wiring fault, proceed to test 6 |
| 5 | Check crank toothed wheel:<br>- Damage to teeth - magnetic debris contamination | OK | Proceed to test 6 |
| | | Faulty | Clean/renew toothed wheel, 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



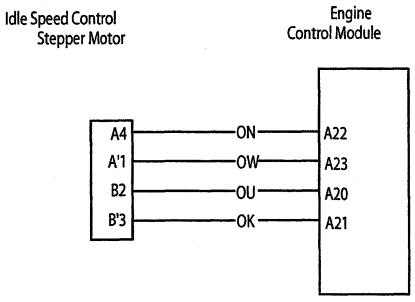
## Idle Speed Control

| Fault Code | Possible cause | Action |
|---|---|---|
| P0505 | ISC stepper motor / wiring fault | View & note diagnostic tool 'freeze frame' data if available.<br>View & note diagnostic tool 'sensor' data.<br>Ensure sensor connector is secure.<br>Disconnect ECM and proceed to pinpoint test 1: |

### Pinpoint Tests

| | Test | Result | Action |
|---|---|---|---|
| 1 | Check cable and terminal integrity:<br>- ECM pin A22<br>- ECM pin A23<br>- ECM pin A20<br>- ECM pin A21 | OK | Proceed to test 2 |
| | | Faulty | Rectify fault, proceed to test 7 |
| 2 | Check resistance value:<br>- ECM pin A22 to ECM pin A23<br>- ECM pin A20 to ECM pin A21 | 4Ω to 12Ω | Disconnect stepper motor and proceed to test 3 |
| | | Open circuit | Proceed to test 4 |
| | | Short circuit | Disconnect stepper motor and proceed to test 5 |
| 3 | Check cable for short circuit:<br>- ECM pin A22 to earth<br>- ECM pin A23 to earth<br>- ECM pin A20 to earth<br>- ECM pin A21 to earth | OK | Proceed to test 7 |
| | | Short circuit | Locate and rectify wiring fault, proceed to test 7 |
| 4 | Check cable continuity:<br>- ECM pin A22 to stepper motor pin A<br>- ECM pin A23 to stepper motor pin A1<br>- ECM pin A20 to stepper motor pin B<br>- ECM pin A21 to stepper motor pin B1 | OK | Proceed to test 6 |
| | | Open circuit | Locate and rectify wiring fault, proceed to test 7 |
| 5 | Check cable for short circuit:<br>- ECM pin A22 to ECM pin A23<br>- ECM pin A20 to ECM pin A21 | OK | Proceed to test 6 |
| | | Short circuit | Locate and rectify wiring fault, proceed to test 7 |
| 6 | Check stepper motor resistance:<br>- Motor pin A to motor pin A1<br>- Motor pin B to motor pin B1 | 4Ω to 12Ω | Proceed to test 7 |
| | | 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 still present | Contact Triumph service |

## Circuit Diagram



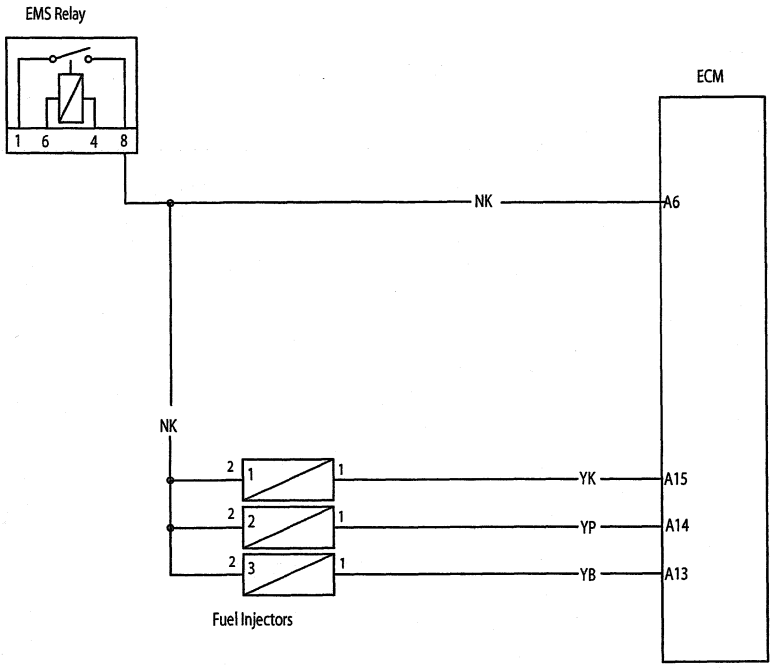
## Fuel Injectors

| Fault Code | Possible cause | Action |
|---|---|---|
| P0201/02/03 | Injection system fault - Injector 1/2/3<br>- Misfire indicates open circuit<br>- Flooding indicates short circuit | View & note diagnostic tool 'freeze frame' data if available.<br>Ensure relevant injector connector is secure. Disconnect ECM and proceed to pinpoint test 1: |

### Pinpoint Tests

| | Test | Result | Action |
|---|---|---|---|
| 1 | Check cable and terminal integrity:<br>- ECM pin A15<br>- ECM pin A14<br>- ECM pin A13 | OK | Proceed to test 2 |
| | | Faulty | Rectify fault, proceed to test 7 |
| 2 | Check resistance value:<br>- ECM pin A6 to ECM pin A15 (injector 1)<br>- ECM pin A6 to ECM pin A14 (injector 2)<br>- ECM pin A6 to ECM pin A13 (injector 3) | 12.5Ω to 14.0Ω | Proceed to test 3 |
| | | Open circuit | Disconnect relevant injector and proceed to test 4 |
| | | Short circuit | Disconnect relevant injector and proceed to test 5 |
| 3 | Check cable for short circuit to ground:<br>- ECM pin A15 to earth<br>- ECM pin A14 to earth<br>- ECM pin A13 to earth | OK | Proceed to test 7 |
| | | Short circuit | Locate and rectify wiring fault, proceed to test 7 |
| 4 | Check cable continuity:<br>- ECM pin A6 to relevant injector pin 2<br>- ECM pin A15 to injector 1 pin 1<br>- ECM pin A14 to injector 2 pin 1<br>- ECM pin A13 to injector 3 pin 1 | OK | Proceed to test 6 |
| | | Open circuit | Locate and rectify wiring fault, proceed to test 7 |
| 5 | Check cable for short circuit to supply box:<br>- ECM pin A6 to ECM pin A15 (inj 1)<br>- ECM pin A6 to ECM pin A14 (inj 2)<br>- ECM pin A6 to ECM pin A13 (inj 3) | OK | Proceed to test 6 |
| | | Short circuit | Locate and rectify wiring fault, proceed to test 7 |
| 6 | Check relevant injector resistance:<br>- Injector pin 1 to injector pin 2 | 12.5Ω to 14.0Ω | Proceed to test 7 |
| | | 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



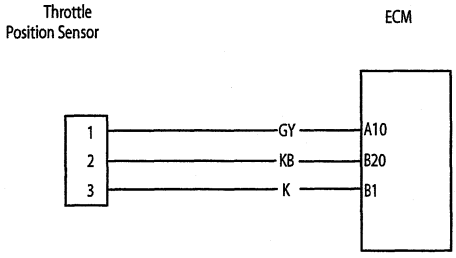
## Throttle Position Sensor

| Fault Code | Possible cause | Action |
|---|---|---|
| P0122<br>P0123 | Throttle position sensor low input voltage (short to ground or open circuit)<br>Throttle position sensor high input voltage (short circuit to sensor supply) | View & note diagnostic tool 'freeze frame' data if available.<br>View & note diagnostic tool 'sensor' data.<br>Ensure sensor connector is secure. Disconnect ECM and proceed to pinpoint test 1: |

### Pinpoint Tests

| | Test | Result | Action |
|---|---|---|---|
| 1 | Check cable and terminal integrity:<br>- ECM pin B1<br>- ECM pin B20<br>- ECM pin A10 | OK | Disconnect sensor and proceed to test 2 |
| | | Faulty | Rectify fault, proceed to test 5 |
| 2 | Check cable for short circuit:<br>- ECM pin A10 to ground | OK | Proceed to test 3 |
| | | Short circuit | Locate and rectify wiring fault, proceed to test 5 |
| 3 | Check cable continuity:<br>- ECM pin A10 to sensor pin 1<br>- ECM pin B20 to sensor pin 2<br>- ECM pin B1 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:<br>- ECM pin A10 to ECM pin B1<br>- ECM pin A10 to ECM pin B20 | 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



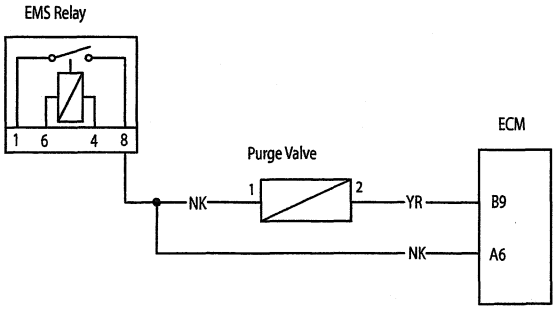
## Purge Valve

| Fault Code | Possible cause | Action |
|---|---|---|
| P0444 | Open circuit or short circuit to earth | View & note diagnostic tool 'sensor' data.<br>Ensure purge valve connector is secure.<br>Disconnect ECM and proceed to pinpoint test 1: |
| 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:<br>- ECM pin B9 | OK | Proceed to test 2 |
| | | Faulty | Rectify fault, proceed to test 7 |
| 2 | Check resistance value:<br>- ECM pin A6 to ECM pin B9 | 24Ω to 28Ω | 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:<br>- ECM pin B9 to earth | OK | Proceed to test 7 |
| | | Short circuit | Locate and rectify wiring fault, proceed to test 7 |
| 4 | Check cable continuity:<br>- ECM pin B9 to valve pin 2<br>- ECM pin A6 to valve pin 1 | OK | Proceed to test 6 |
| | | Open circuit | Locate and rectify wiring fault, proceed to test 7 |
| 5 | Check cable for short circuit:<br>- ECM pin A6 to ECM pin B9 | OK | Proceed to test 6 |
| | | Short circuit | Locate and rectify wiring fault, proceed to test 7 |
| 6 | Check purge valve resistance:<br>- Valve pin 1 to valve pin 2 | 24Ω to 28Ω | Proceed to test 7 |
| | | 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 still present | Contact Triumph service |

## Circuit Diagram



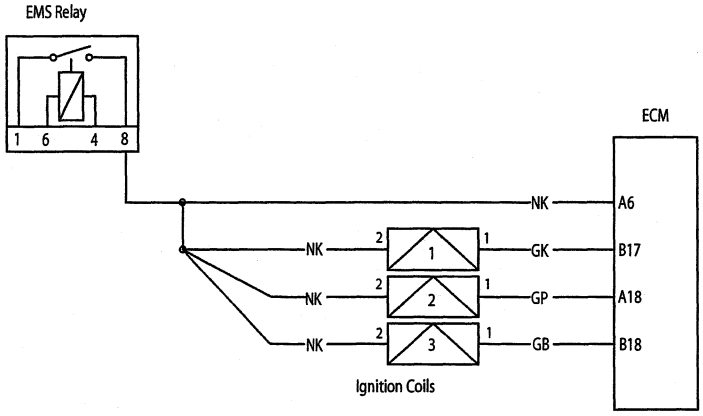
## Ignition Coils

| 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.<br>Ensure relevant ign coil connector is secure. Disconnect ECM and proceed to pinpoint test 1: |

### Pinpoint Tests

| | Test | Result | Action |
|---|---|---|---|
| 1 | Check cable and terminal integrity:<br>- ECM pin B17<br>- ECM pin A18<br>- ECM pin B18 | OK | Proceed to test 2 |
| | | Faulty | Rectify fault, proceed to test 7 |
| 2 | Check resistance value:<br>ECM pin A6 to<br>- ECM pin (ign coil 1) B17<br>- ECM pin (ign coil 2) B18<br>- ECM pin (ign coil 3) B18 | 0.8Ω to 1.2Ω | Proceed to test 3 |
| | | Open circuit | Disconnect relevant ignition coil and proceed to test 4 |
| | | Short circuit | Disconnect relevant ignition coil and proceed to test 5 |
| 3 | Check cable for short circuit:<br>- ECM pin to earth B17<br>- ECM pin to earth A18<br>- ECM pin to earth B18 | OK | Proceed to test 7 |
| | | Short circuit | Locate and rectify wiring fault, proceed to test 7 |
| 4 | Check cable continuity:<br>Power latch relay pin 8 to any ign coil pin 2<br>- ECM pin B17 to ign coil 1 pin 1<br>- ECM pin B18 to ign coil 2 pin 1<br>- ECM pin B18 to ign coil 3 pin 1 | OK | Proceed to test 6 |
| | | Open circuit | Locate and rectify wiring fault, proceed to test 7 |
| 5 | Check cable for short circuit:<br>ECM pin A6 to<br>- ECM pin (ign coil 1) B17<br>- ECM pin (ign coil 2) A18<br>- ECM pin (ign coil 3) B18 | OK | Proceed to test 6 |
| | | Short circuit | Locate and rectify wiring fault, proceed to test 7 |
| 6 | Check relevant ign coil resistance:<br>- Ign coil pin 1 to ign coil pin 2 | 0.8Ω to 1.2Ω | Proceed to test 7 |
| | | Faulty | Renew relevant ignition 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

| Fault Code | Possible cause | Action |
|---|---|---|
| P0118 | Open circuit, or short circuit to battery+ | View & note diagnostic tool 'freeze frame' data if available.<br>View & note diagnostic tool 'sensor' data.<br>Ensure sensor connector is secure. Disconnect ECM and proceed to pinpoint test 1: |
| P0117 | Short circuit to ground | Disconnect sensor and proceed to test 6: |

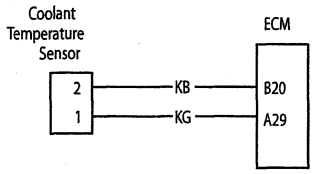
### Pinpoint Tests

| | Test | Result | Action |
|---|---|---|---|
| 1 | Check cable and terminal integrity:<br>- ECM pin A29<br>- ECM pin B20 | OK | Proceed to test 2 |
| | | Faulty | Rectify fault, proceed to test 7 |
| 2 | Check resistance value:<br>- ECM pin A29 to ECM pin B20 (Temperature dependent,–see below) | OK | Disconnect temp sensor and proceed to test 6 |
| | | Open circuit | Disconnect sensor and proceed to test 3 |
| | | Short circuit | Disconnect temp sensor and proceed to test 4 |
| 3 | Check cable continuity:<br>- ECM pin A29 to sensor pin 1<br>- ECM pin B20 to sensor pin 2 | OK | Proceed to test 5 |
| | | Open circuit | Locate and rectify wiring fault, proceed to test 7 |
| 4 | Check cable for short circuit:<br>- ECM pin A29 to ECM pin B20 | OK | Proceed to test 5 |
| | | Short circuit | Locate and rectify wiring fault, proceed to test 7 |
| 5 | Check sensor resistance:<br>- Sensor pin 1 to sensor pin 2 (Temperature dependent - see below) | OK | Proceed to test 7 |
| | | Faulty | Renew temp sensor, proceed to test 7 |
| 6 | Check cable for short circuit:<br>- ECM pin A29 to ground | OK | Proceed to test 7 |
| | | 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 still present | Contact Triumph service |

Resistance data under typical conditions:

| | |
|---|---|
| Warm engine: | 200 to 400Ω |
| Cold engine: | |
| 20°C ambient | 2.35 to 2.65KΩ |
| -10°C ambient | 8.50 to 10.25KΩ |

## Circuit Diagram



## Inlet Air Temperature Sensor

| Fault Code | Possible cause | Action |
|---|---|---|
| P0113 | Open circuit, or short circuit to battery+ | View & note diagnostic tool 'freeze frame' data if available.<br>View & note diagnostic tool 'sensor' data.<br>Ensure sensor connector is secure. Disconnect ECM and proceed to pinpoint test 1: |
| P0112 | Short circuit to ground | Disconnect sensor and proceed to pinpoint test 6: |

### Pinpoint Tests

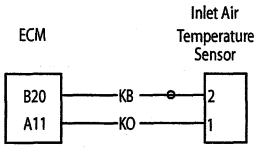
| | Test | Result | Action |
|---|---|---|---|
| 1 | Check cable and terminal integrity:<br>- ECM pin A11<br>- ECM pin B20 | OK | Proceed to test 2 |
| | | Faulty | Rectify fault, proceed to test 7 |
| 2 | Check resistance value:<br>- ECM pin A11 to ECM pin B20<br>(Temperature dependent–see below) | OK | Disconnect temp sensor and proceed to test 6 |
| | | Open circuit | Disconnect temp sensor and proceed to test 3 |
| | | Short circuit | Disconnect temp sensor and proceed to test 4 |
| 3 | Check cable continuity:<br>- ECM pin A11 to sensor pin 1<br>- ECM pin B20 to sensor pin 2 | OK | Proceed to test 5 |
| | | Open circuit | Locate and rectify wiring fault, proceed to test 7 |
| 4 | Check cable for short circuit:<br>- ECM pin A11 to ECM pin B20 | OK | Proceed to test 5 |
| | | Short circuit | Locate and rectify wiring fault, proceed to test 7 |
| 5 | Check sensor resistance:<br>- Sensor pin 1 to sensor pin 2<br>(Temperature dependent–see below) | OK | Proceed to test 7 |
| | | Faulty | Renew temp sensor, proceed to test 7 |
| 6 | Check cable for short circuit:<br>- ECM pin A11 to ground | OK | Proceed to test 7 |
| | | 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 still present | 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 |
|---|---|
| 80°C | 200 to 400Ω |
| 20°C | 2.35 to 2.65KΩ |
| -10°C | 8.50 to 10.25KΩ |

## Circuit Diagram



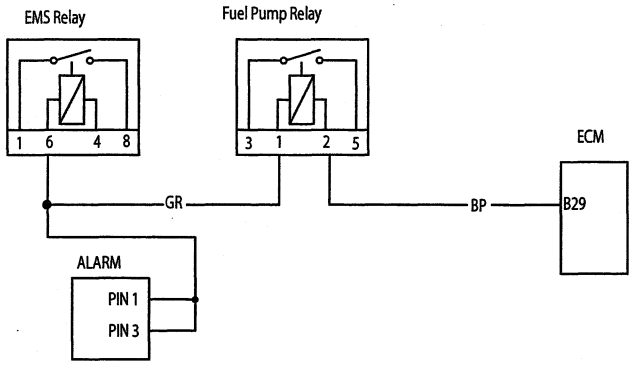
## Fuel Pump Relay

| Fault Code | Possible cause | Action |
|---|---|---|
| P1231 | Fuel pump relay open circuit, or short circuit to ground | Check if pump runs briefly when ignition is switched on.<br>Ensure fuel pump relay connector is secure.<br>Disconnect ECM and proceed to pinpoint test 1: |
| P1232 | Short circuit to battery+ | Disconnect fuel pump relay and proceed to pinpoint test 4: |

### Pinpoint Tests

| | Test | Result | Action |
|---|---|---|---|
| 1 | Check cable and terminal integrity:<br>- ECM pin B29 | OK | Disconnect fuel pump relay and proceed to test 2 |
| | | Faulty | Rectify fault, proceed to test 5 |
| 2 | Check cable for short circuit:<br>- ECM pin B29 to earth | OK | Proceed to test 3 |
| | | Short circuit | Locate and rectify wiring fault, proceed to test 5 |
| 3 | Check cable continuity:<br>- ECM pin B29 to fuel pump relay pin 2<br>- Fuel pump relay pin 1 to EMS relay pin 6 | OK | Proceed to test 4 |
| | | Open circuit | Locate and rectify wiring fault, proceed to test 5 |
| 4 | Check cable for short circuit:<br>- ECM pin B29 to ALARM pin 1 or 3 | 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



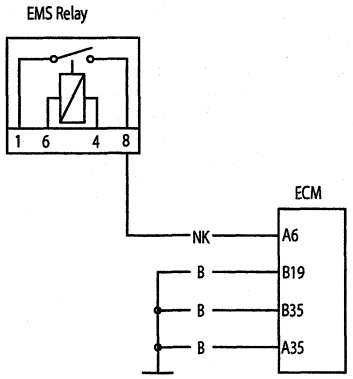
## System Voltage

| Fault Code | Possible cause | Action |
|---|---|---|
| P0560 | Bike voltage system fault | View & note diagnostic tool 'sensor' data.<br>Ensure voltage across battery is acceptable, note voltage.<br>Disconnect ECM and proceed to pinpoint test 1: |

### Pinpoint Tests

| | Test | Result | Action |
|---|---|---|---|
| 1 | Check cable and terminal integrity:<br>- ECM pin A6 | OK | Proceed to test 2 |
| | | Faulty | Rectify fault, proceed to test 3 |
| 2 | With Ignition 'ON', check voltage at:<br>- ECM pin A6 | 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



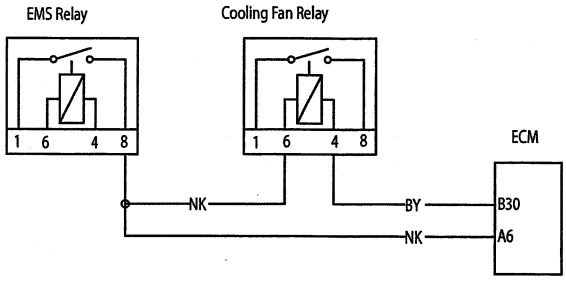
## Cooling Fan Relay

| Fault Code | Possible cause | Action |
|---|---|---|
| P1552 | Fan relay open circuit, or short circuit to ground | View & note diagnostic tool 'sensor' data.<br>Ensure fan relay connector is secure.<br>Disconnect ECM and proceed to pinpoint test1: |
| P1553 | Short circuit to battery+ | Disconnect fan relay and proceed to pinpoint test 4: |

### Pinpoint Tests

| | Test | Result | Action |
|---|---|---|---|
| 1 | Check cable and terminal integrity:<br>- ECM pin B30 | OK | Disconnect fan relay and proceed to test 2 |
| | | Faulty | Rectify fault, proceed to test 5 |
| 2 | Check cable for short circuit:<br>- ECM pin B30 to ground | OK | Proceed to test 3 |
| | | Short circuit | Locate and rectify wiring fault, proceed to test 5 |
| 3 | Check cable continuity:<br>- Fan relay pin 4 to ECM pin B30<br>- Fan relay pin 6 to EMS 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:<br>- ECM pin B30 to ECM pin A6 | 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



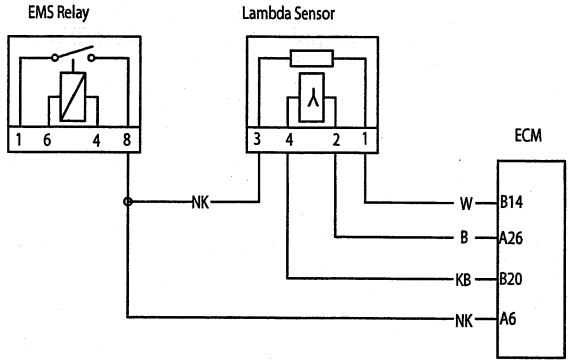
## Lambda Sensor

| Fault Code | Possible cause | Action |
|---|---|---|
| P0130 | Lambda sensor circuit fault | View & note 'freeze frame' data if available.<br>View & note 'sensor' data.<br>Ensure sensor connector is secure.<br>Disconnect ECM and proceed to pinpoint test 1: |

### Pinpoint Tests

| | Test | Result | Action |
|---|---|---|---|
| 1 | Check cable and terminal integrity:<br>- ECM pin A26<br>- ECM pin B20 | OK | Disconnect lambda sensor and proceed to test 2 |
| | | Faulty | Rectify fault, proceed to test 4 |
| 2 | Check cable for short circuit:<br>- ECM pin A26 to ECM pin B20<br>- ECM pin A26 to ECM pin A6 | OK | Proceed to test 3 |
| | | Short circuit | Locate and rectify wiring fault, proceed to test 4 |
| 3 | Check cable continuity:<br>- ECM pin A26 to sensor pin 2<br>- ECM pin A26 to sensor pin 4 | OK | Proceed to test 4 |
| | | Open circuit | Locate and rectify wiring fault, proceed to test 4 |
| 4 | Reconnect harness, clear fault code and run engine. Check adaptation status. | OK | Action complete - quit test |
| | | Fault still present | Contact Triumph service |

### Circuit Diagram



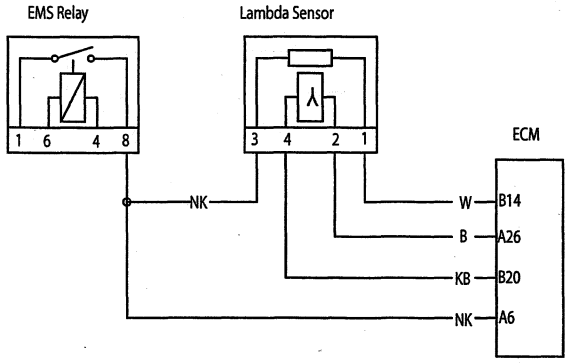
## Lambda Sensor Heater

| Fault Code | Possible cause | Action |
|---|---|---|
| P0031 | Lambda sensor heater circuit short circuit to ground or open circuit | View & note 'freeze frame' data if available.<br>View & note 'sensor' data.<br>Ensure sensor connector is secure.<br>Disconnect ECM and proceed to pinpoint test 1: |
| P0032 | Lambda sensor heater circuit, short circuit to battery | Disconnect lambda sensor and proceed to pinpoint test 4: |

### Pinpoint Tests

| | Test | Result | Action |
|---|---|---|---|
| 1 | Check cable and terminal integrity:<br>- ECM pin B14 | OK | Disconnect lambda sensor and proceed to test 2 |
| | | Faulty | Rectify fault, proceed to test 5 |
| 2 | Check cable for short circuit:<br>- ECM pin B14 to ground | OK | Proceed to test 3 |
| | | Short circuit | Locate and rectify wiring fault, proceed to test 5 |
| 3 | Check cable continuity:<br>- ECM pin B14 to sensor pin 1<br>- ECM pin A6 to sensor pin 3 | OK | Proceed to test 5 |
| | | Open circuit | Locate and rectify wiring fault, proceed to test 5 |
| 4 | Check cable for short circuit:<br>- ECM pin B14 to ECM pin A6 | OK | Renew lambda sensor and proceed to test 5 |
| | | Short circuit | Locate and rectify wiring fault, proceed to test 5 |
| 5 | Reconnect harness, clear fault code and run engine. Check adaption status. | OK | Action complete, quit test |
| | | Fault still present | Contact Triumph service |

### Circuit Diagram



## EEPROM Error

| Fault Code | Possible cause | Action |
|---|---|---|
| P0603 | EEPROM error | View & note 'freeze frame' data if available.<br>No tests available - contact Triumph service. |

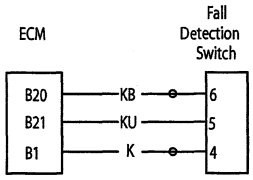
## Fall Detection Switch

| Fault Code | Possible cause | Action |
|---|---|---|
| P1631<br>P1632 | Fall detection switch low input voltage<br>Fall detection switch high input voltage or open circuit | View & note 'freeze frame' data if available.<br>View & note 'sensor' data<br>Ensure switch connector is secure.<br>Disconnect ECM and proceed to pinpoint test1: |

### Pinpoint Tests

| | Test | Result | Action |
|---|---|---|---|
| 1 | Check cable and terminal integrity:<br>- ECM pin B21 | OK | Disconnect sensor and proceed to test 2 |
| | | Faulty | Rectify fault, proceed to test 6 |
| 2 | Check cable for short circuit:<br>- ECM pin B21 to ground<br>- ECM pin B21 to ECM pin A6 | OK | Proceed to test 3 |
| | | Short circuit | Locate and rectify wiring fault, proceed to test 6 |
| 3 | Check cable continuity:<br>- ECM pin B1 to sensor pin 4<br>- ECM pin B21 to sensor pin 5<br>- ECM pin B20 to sensor pin 6 | OK | Proceed to test 4 |
| | | Open circuit | Locate and rectify wiring fault, proceed to test 6 |
| 4 | Check cable for short circuit:<br>- Sensor pin 4 to sensor pin 5<br>- Sensor pin 4 to sensor pin 6 | OK | Proceed to test 5 |
| | | Short circuit | Locate and rectify wiring fault, proceed to test 6 |
| 5 | Check voltage (with ignition on):<br>- Sensor pin 4 | 5V | Renew fall detection switch and proceed to test 6 |
| | | Less than 4.8V | Locate and rectify wiring fault, proceed to test 6 |
| 6 | Reconnect harness, clear fault code. | OK | Action complete, quit test |
| | | Fault still present | Contact Triumph service |

### Circuit Diagram



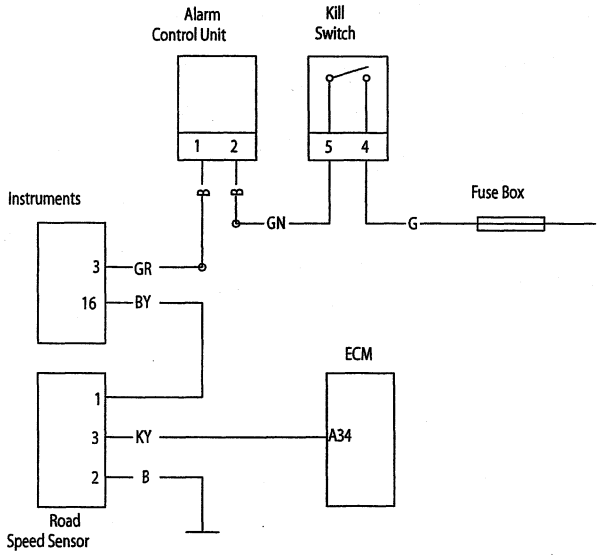
## Vehicle Speed Sensor

| Fault Code | Possible cause | Action |
|---|---|---|
| P0500 | Vehicle speed sensor circuit fault | View & note 'freeze frame' data if available.<br>View & note 'sensor' data.<br>Ensure sensor connector is secure.<br>Disconnect ECM and proceed to pinpoint test1: |

### Pinpoint Tests

| | Test | Result | Action |
|---|---|---|---|
| 1 | Check cable and terminal integrity:<br><br>- ECM pin A34<br>- Instrument pin 16 | OK | Disconnect ambient pressure sensor and proceed to test 2 |
| | | Faulty | Rectify fault, proceed to test 4 |
| 2 | Check cable for short circuit:<br><br>- ECM pin A34 to ground<br>- ECM pin A34 to ECM pin B1<br>- ECM pin A34 to battery | OK | Proceed to test 3 |
| | | Faulty | Locate and rectify wiring fault, proceed to test 4 |
| 3 | Check cable for continuity:<br><br>- ECM pin A34 to sensor pin 3<br>- Sensor pin 2 to ground<br>- Instruments pin 16 to sensor pin 1 | OK | Renew vehicle speed sensor and proceed to test 4 |
| | | Open circuit | Locate and rectify wiring fault, proceed to test 4 |
| 4 | Reconnect harness, clear fault code and run engine. | OK | Action complete, quit test |
| | | Fault still present | Contact Triumph service |

### Circuit Diagram



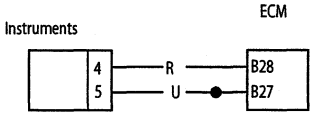
## Instrument Communication (CAN)

| Fault Code | Possible cause | Action |
|---|---|---|
| P1690 | Fault in CAN communication between ECM and Instrument pack | View & note 'freeze frame' data if available.<br>View & note 'sensor' data.<br>Ensure Instrument connector is secure.<br>Disconnect ECM and proceed to pinpoint test 1: |

### Pinpoint Tests

| | Test | Result | Action |
|---|---|---|---|
| 1 | Check cable and terminal integrity:<br>- ECM pin B28<br>- ECM pin B27<br>- Instrument pin 4<br>- Instrument pin 5 | OK | Disconnect instruments and proceed to test 2 |
| | | Faulty | Rectify fault, proceed to test 4 |
| 2 | Check cable for short circuit:<br>- ECM pin B28 to ground<br>- ECM pin B27 to ground | OK | Proceed to test 3 |
| | | Faulty | Locate and rectify wiring fault, proceed to test 4 |
| 3 | Check cable continuity:<br>- ECM pin B28 to Instrument pin 4<br>- ECM pin B27 to Instrument pin 5 | OK | Contact Triumph service |
| | | Open circuit | Locate and rectify wiring fault, proceed to test 4 |
| 5 | Reconnect harness, clear fault code and run engine | OK | Action complete, quit test |
| | | Fault still present | Contact Triumph service |

### Circuit Diagram



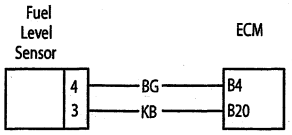
## Fuel Level Sensor

| Fault Code | Possible cause | Action |
|---|---|---|
| P0460 | Fuel level sensor circuit fault | View & note 'freeze frame' data if available.<br>View & note 'sensor' data.<br>Ensure sensor connector is secure.<br>Disconnect ECM and proceed to pinpoint test1: |

### Pinpoint Tests

| | Test | Result | Action |
|---|---|---|---|
| 1 | Check cable and terminal integrity:<br>- ECM pin B4<br>- ECM pin B20 | OK | Disconnect sensor and proceed to test 2 |
| | | Faulty | Rectify fault, proceed to test 5 |
| 2 | Check cable for short circuit:<br>- ECM pin B4 to ground | OK | Proceed to test 3 |
| | | Short circuit | Locate and rectify wiring fault, proceed to test 5 |
| 3 | Check cable continuity:<br>- ECM pin B4 to sensor pin 4<br>- ECM pin B20 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:<br>- Sensor pin 3 to sensor pin 4 | OK | Renew fuel level sensor and proceed to test 5 |
| | | Short circuit | Locate and rectify wiring fault, proceed to test 5 |
| 5 | Reconnect harness, clear fault code | OK | Action complete, quit test |
| | | Fault still present | Contact Triumph service |

### Circuit Diagram



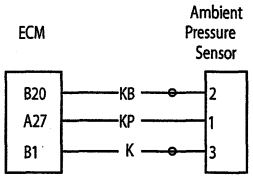
## Ambient Pressure Sensor

| Fault Code | Possible cause | Action |
|---|---|---|
| P1107 | Ambient pressure sensor circuit short circuit to ground | View & note 'freeze frame' data if available.<br>View & note 'sensor' data.<br>Ensure sensor connector is secure.<br>Disconnect ECM and proceed to pinpoint test1: |
| P1108 | Ambient pressure sensor circuit, short circuit to supply or open circuit | Disconnect ambient pressure sensor and proceed to pinpoint test 4: |

### Pinpoint Tests

| | Test | Result | Action |
|---|---|---|---|
| 1 | Check cable and terminal integrity:<br>- ECM pin A27<br>- ECM pin B20<br>- ECM pin B1 | OK | Disconnect ambient pressure sensor and proceed to test 2 |
| | | Faulty | Rectify fault, proceed to test 5 |
| 2 | Check cable for short circuit:<br>- ECM pin A27 to ECM B20 | OK | Proceed to test 3 |
| | | Short circuit | Locate and rectify wiring fault, proceed to test 5 |
| 3 | Check cable for continuity:<br>- ECM pin A27 to sensor pin 1<br>- ECM pin B20 to sensor pin 2<br>- ECM pin B1 to sensor pin 3. | OK | Renew ambient pressure sensor and proceed to test 5 |
| | | Open circuit | Locate and rectify wiring fault, proceed to test 5 |
| 4 | Check cable for short circuit:<br>- ECM pin A27 to ECM pin B1 | OK | Renew ambient pressure sensor and proceed to test 5 |
| | | Short circuit | Locate and rectify wiring fault, proceed to test 5 |
| 5 | Reconnect harness, clear fault code and run engine | OK | Action complete, quit test |
| | | Fault still present | Contact Triumph service |

### Circuit Diagram



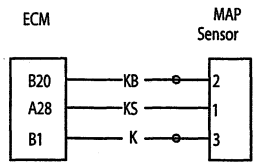
## Manifold Absolute Pressure (Map) Sensor

| Fault Code | Possible cause | Action |
|---|---|---|
| P0107 | MAP sensor circuit short circuit to ground | View & note 'freeze frame' data if available.<br>View & note 'sensor' data.<br>Ensure sensor connector is secure.<br>Disconnect ECM and proceed to pinpoint test1: |
| P0108 | MAP sensor circuit, short circuit to supply or open circuit | Disconnect MAP sensor and proceed to test 4: |
| P1105 | MAP sensor pipe fault | Check connection/condition of pipe from MAP sensor to throttle body |

### Pinpoint Tests

| | Test | Result | Action |
|---|---|---|---|
| 1 | Check cable and terminal integrity:<br>- ECM pin A28<br>- ECM pin B20<br>- ECM pin B1 | OK | Disconnect MAP sensor and proceed to test 2 |
| | | Faulty | Rectify fault, proceed to test 5 |
| 2 | Check cable for short circuit:<br>- ECM pin A28 to ECM B20 | OK | Proceed to test 3 |
| | | Short circuit | Locate and rectify wiring fault, proceed to test 5 |
| 3 | Check cable for continuity:<br>- ECM pin A28 to sensor pin 1<br>- ECM pin B20 to sensor pin 2<br>- ECM pin B1 to sensor pin 3 | OK | Renew MAP sensor and proceed to test 5 |
| | | Open circuit | Locate and rectify wiring fault, proceed to test 5 |
| 4 | Check cable for short circuit:<br>- ECM pin A28 to ECM pin B1 | OK | Renew MAP sensor and proceed to test 5 |
| | | Short circuit | Locate and rectify wiring fault, proceed to test 5 |
| 5 | Reconnect harness, clear fault code and run engine | OK | Action complete, quit test |
| | | Fault still present | Contact Triumph service |

### Circuit Diagram



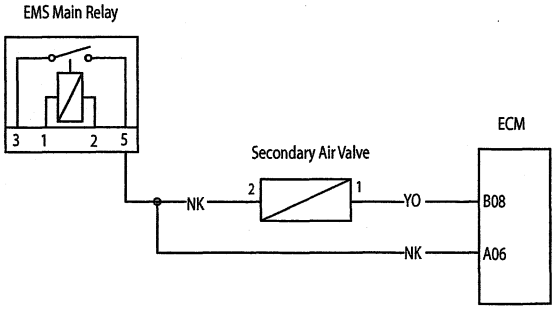
## Secondary Air Injection Valve

| Fault Code | Possible cause | Action |
|---|---|---|
| P00413 | Open circuit or short circuit to earth | View & note diagnostic tool 'sensor' data. Ensure SAI valve connector is secure. Disconnect ECM and proceed to pinpoint test 1: |
| P0414 | Short circuit to battery positive | Disconnect SAI valve and proceed to pinpoint test 5: |

### Pinpoint Tests

| | Test | Result | Action |
|---|---|---|---|
| 1 | Check cable and terminal integrity:<br>- ECM pin B08 | OK | Proceed to test 2 |
| | | Faulty | Rectify fault, proceed to test 7 |
| 2 | Check resistance value:<br>- ECM pin B08 to ECM pin A06 | 20Ω to 25Ω | Disconnect SAI valve and proceed to test 3 |
| | | Open circuit | Proceed to test 4 |
| | | Short circuit | Disconnect SAI valve and proceed to test 5 |
| 3 | Check cable for short circuit:<br>- ECM pin B08 to ground | OK | Proceed to test 6 |
| | | Short circuit | Locate and rectify wiring fault, proceed to test 7 |
| 4 | Check cable continuity:<br>- ECM pin B08 to valve pin 1<br>- ECM pin A06 to valve pin 2 | OK | Proceed to test 6 |
| | | Open Circuit | Locate and rectify wiring fault, proceed to test 7 |
| 5 | Check cable for short circuit:<br>- ECM pin B08 to ECM pin A06 | OK | Proceed to test 6 |
| | | Short circuit | Locate and rectify wiring fault, proceed to test 7 |
| 6 | Check SAI valve resistance:<br>- Valve pin 1 to Valve pin 2 | 20Ω to 25Ω | Proceed to test 7 |
| | | Faulty | Renew SAI valve, proceed to test 7 |
| 7 | Reconnect harness, clear fault code and run diagnostic tool function test to visually verify operation of SAI valve | OK | Action complete - quit test |
| | | Fault still present | Contact Triumph service |

## Circuit Diagram



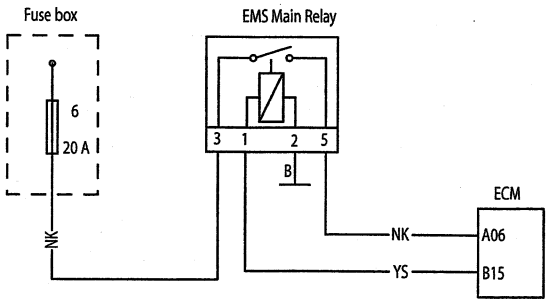
## EMS Main Relay Circuit

| Fault Code | Possible cause | Action |
|---|---|---|
| P1685 | EMS Main Relay circuit fault | Note that the Starter Motor cannot be powered if a Main Relay fault exists. Ensure the EMS Main Relay connector is secure. Proceed to pinpoint test 1: |

### Pinpoint Tests

| | Test | Result | Action |
|---|---|---|---|
| 1 | Ensure ignition has been switched off for greater than one minute. Identify EMS Main Relay on the harness.<br>Check that relay operates when the ignition is switched ON. | OK | Proceed to test 2 |
| | | Faulty | Disconnect ECM and proceed to test 4 |
| 2 | Check fuse box Fuse 6 integrity | OK | Disconnect ECM and proceed to test 4 |
| | | Faulty | Disconnect ECM and proceed to test 3 |
| 3 | Check cable for short circuit:<br>- ECM pin A06 to ground<br>- EMS Main relay pin 3 to ground | OK | Replace Fuse 6 and proceed to test 4 |
| | | Short circuit | Locate and rectify wiring fault, replace Fuse 6 and proceed to test 7 |
| 4 | Check cable and terminal integrity:<br>- ECM pin A06<br>- ECM pin B15<br>- EMS Main Relay pin 1<br>- EMS Main Relay pin 2<br>- EMS Main Relay pin 3<br>- EMS Main Relay pin 5 | OK | Disconnect Main Relay and proceed to test 5 |
| | | Faulty | Rectify fault, proceed to test 7 |
| 5 | Check cable for short circuit:<br>- ECM pin B15 to ground | OK | Proceed to test 6 |
| | | Short circuit | Locate and rectify wiring fault, proceed to test 7 |
| 6 | Check cable continuity:<br>- ECM pin A06 to EMS Relay pin 5<br>- ECM pin B15 to Relay pin 1<br>- EMS Main Relay pin 2 to ground<br>- EMS Main Relay pin 3 to Fuse box Fuse 6 | OK | Replace EMS Main Relay and proceed to test 7 |
| | | Open circuit | Locate and rectify wiring fault, proceed to test 7 |
| 7 | Reconnect harness, clear fault code. Switch ignition off for longer than one minute. Switch ignition on and check that the EMS main relay operates. Start engine as final check | OK | Action complete - quit test |
| | | Fault still present | Contact Triumph service |

## Circuit Diagram



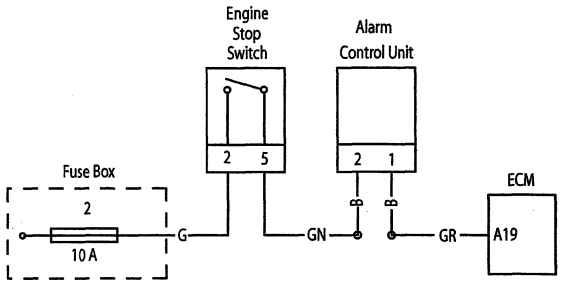
## EMS Ignition Voltage Input Circuit

| Fault Code | Possible cause | Action |
|---|---|---|
| P1659 | EMS Ignition Voltage input circuit fault | Disconnect ECM and proceed to pinpoint test 1: |

### Pinpoint Tests

| | Test | Result | Action |
|---|---|---|---|
| 1 | Check Fuse box Fuse 2 integrity | OK | Proceed to test 3 |
| | | Faulty | Proceed to test 2 |
| 2 | Check cable for short circuit:<br>- ECM pin A19 to ground | OK | Replace Fuse 2 and proceed to test 3 |
| | | Short circuit | Locate and rectify wiring fault, replace Fuse 2 and proceed to test 5 |
| 3 | Check cable and terminal integrity:<br>- ECM pin A19<br>- Alarm Connector pin 1<br>- Alarm Connector pin 2<br>- Right hand switchcube pin 2<br>- Right hand switchcube pin 5 | OK | Proceed to test 4 |
| | | Faulty | Rectify fault, proceed to test 5 |
| 4 | Check cable continuity:<br>- ECM pin A19 to fuse box Fuse 2, note that the engine stop switch must be in the 'RUN' position and any Alarm fitted must be disarmed | OK | Proceed to test 5 |
| | | Open circuit | Locate and rectify wiring, immobiliser or engine stop switch 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



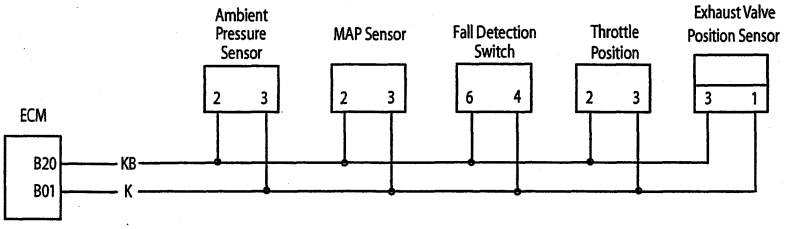
## 5 Volt Sensor Supply Circuit

| Fault Code | Possible cause | Action |
|---|---|---|
| P1696/P1697/P1698 | Sensor supply circuit shorted Sensor supply circuit shorted to ground<br>Sensor supply circuit shorted to battery positive | View & note 'sensor' data. Note ECM sensors requiring a power supply will not be active. Disconnect ECM and proceed to pinpoint test 1: |

### Pinpoint Tests

| | Test | Result | Action |
|---|---|---|---|
| 1 | Check cable and terminal integrity:<br>- ECM pin B01<br>- ECM pin B20 | OK | Proceed to test 2 |
| | | Faulty | Rectify fault, proceed to test 5 |
| 2 | Check cable for short circuit<br>- ECM pin B01 to ECM pin B20 | OK | Proceed to test 4 |
| | | Faulty | Proceed to test 3 |
| 3 | Disconnect the following sensors in turn:<br>- MAP sensor<br>- Ambient pressure sensor<br>- Throttle position switch<br>- Exhaust control valve actuator<br>-Fall detection sensor and retest for short circuit<br>- ECM pin B01 to ECM pin B20 | OK | Replace sensor last removed and proceed to test 5 |
| | | Faulty | Proceed to test 4 |
| 4 | Check cable for short circuit:<br>- ECM pin B01 to ground<br>- ECM pin B20 to ground<br>- ECM pin B01 to A06<br>- ECM pin B20 to A06<br>- ECM pin B01 to battery positive<br>- ECM pin B20 to battery positive | OK | Proceed to test 5 |
| | | Short circuit | Locate and rectify wiring fault, proceed to test 5 |
| 7 | Reconnect harness, clear fault code and use service tool to check for correct sensor outputs and 5V sensor supply voltage level | OK | Action complete - quit test |
| | | Fault still present | Contact Triumph service |

### Circuit Diagram



## Tune Lock

| Fault Code | Possible cause | Action |
|---|---|---|
| P1602 | ECM is locked to prevent the motorcycle from being operated | This is also identified by a fast flashing MIL indication, and a disabled engine management system. Unlock the ECM using the service tool and supplied unlock code from Triumph service |

## ECM or Tune ID Incorrect

| Fault Code | Possible cause | Action |
|---|---|---|
| P1614 | ECM or Tune is incorrect, causing the ECM to be disabled to prevent the motorcycle from being operated. | This is also identified by a fast flashing MIL indication, and a disabled engine management system. |

### Pinpoint Tests

| | Test | Result | Action |
|---|---|---|---|
| 1 | Check ECM part number is correct for the motorcycle | OK | Proceed to test 2 |
| | | Incorrect | Replace ECM with correct part and proceed to test 3 |
| 2 | Check that the tune is correct for the motorcycle, using the diagnostic tool | OK | Proceed to test 3 |
| | | Incorrect | Update tune using service tool, proceed to test 3 |
| 3 | Clear fault code, check for normal operation | OK | Action complete - quit test |
| | | Fault still present | Contact Triumph service |

## Fault Finding - Non Electrical

| Symptom | Possible cause(s) |
|---|---|
| Poor throttle response at low RPM | Low fuel pressure caused by filter blockage/leaks |
| Cutting out at idle | Throttle bodies out of balance |
| | ISC (Idle Speed Control) actuator inoperative |
| | Low fuel pressure |
| | Weak mixture caused by air leak at the throttle body/ transition piece to cylinder head face |
| Idle speed too low/high | ISC (Idle Speed Control) actuator sticking |
| | Incorrect closed throttle position setting |
| | Mechanical fault with the throttle linkage |
| Diagnostic tool malfunctions during tune download procedure | Low battery voltage |
| Throttle hang-up | Incorrect closed throttle position setting |
| Bike will start but cuts out immediately | ISC motor stuck |
| | Low fuel pressure caused by filter blockage/leaks |
| Abnormally high fuel pressure | Fuel pressure regulator inoperative |
| Temperature gauge reads cooler than normal | Cooling system air–locked resulting in coolant temperature sensor operating in air instead of coolant |

## Fuel Tank

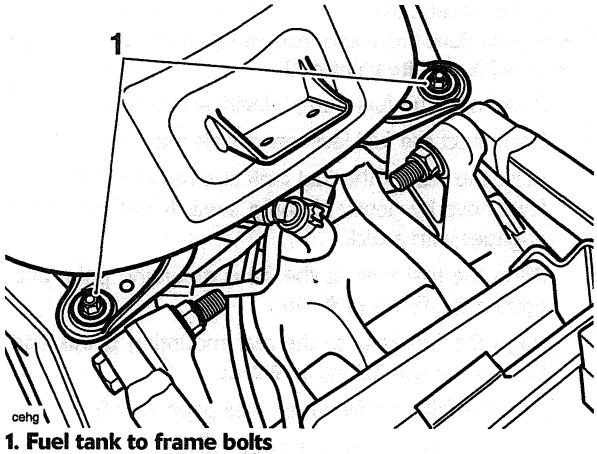
### Removal

**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 seat (see page *16-9*).
2. Disconnect the battery, negative (black) lead first.
3. Remove the side fairings (see page *16-13*).
4. Remove the side panels (see page *16-10*).
5. Remove the fairing infill panels (see page *16-11*).
6. Release and remove the two bolts securing the rear of the fuel tank to the frame.

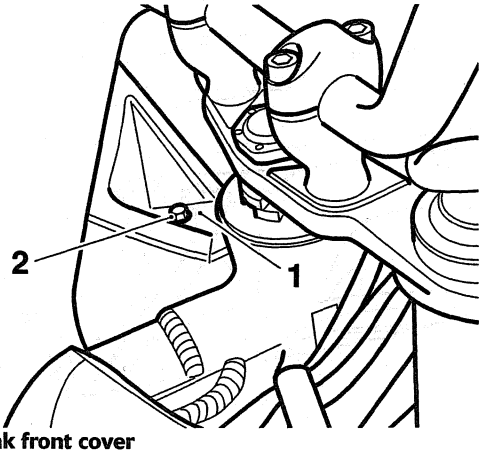



**1. Fuel tank to frame bolts**

7. Release and remove the bolt securing the front of the fuel tank to the frame.

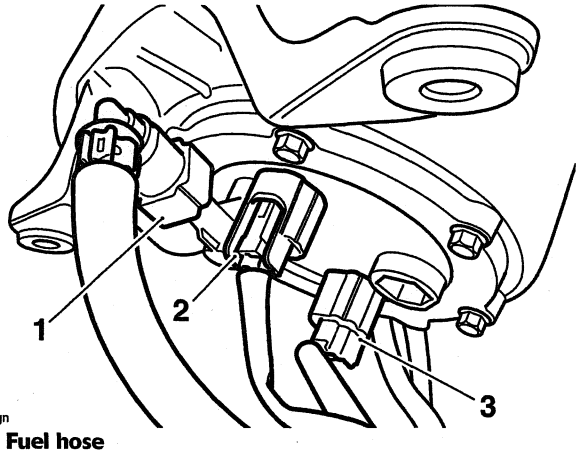
**Note:**

- **The fuel tank front cover can only be removed after the tank has been removed.**




**1. Fuel tank front cover**
**2. Fixing**

8. Raise the rear of the tank and disconnect the fuel hose by squeezing the sides of the connector and pulling the hose free from the spigot.
9. Disconnect the electrical connections to the fuel level sender and the fuel pump.




**1. Fuel hose**
**2. Fuel pump electrical connection**
**3. Fuel level sender electrical connection**

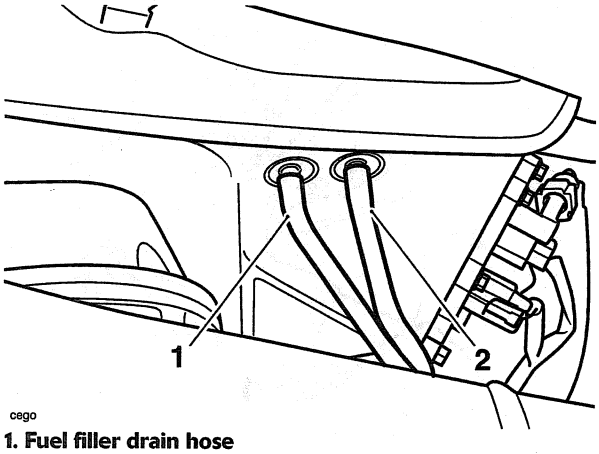
**Note:**

- **When the hose is disconnected, the fuel tank is self-sealing although some fuel may dribble from the hose.**

**Note:**

- **Before disconnection, note the position of the two breather hoses so that they can be returned to the same locations when refitting the tank.**

10. Disconnect the two breather hoses.




cego

**1. Fuel filler drain hose**

**2. Fuel tank vent hose (connects to roll-over valve & marked with a white paint dot)**

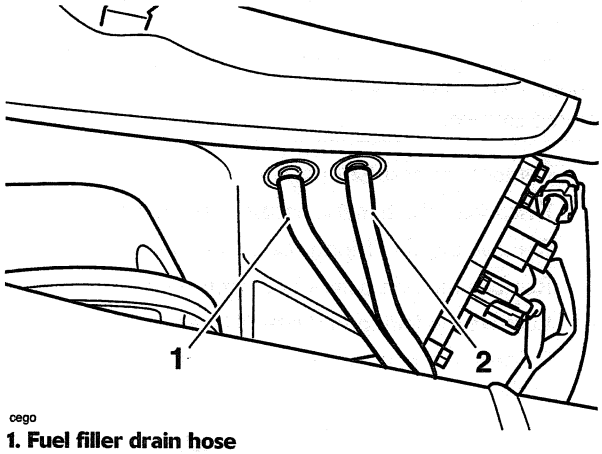
11. Remove the fuel tank.

## Installation

**Note:**

- **If removed, ensure the fuel tank front cover is installed prior to fuel tank installation.**

1. Position the fuel tank to the mounting points.
2. Connect the two breather hoses as noted prior to removal.




cego

**1. Fuel filler drain hose**

**2. Fuel tank vent hose (connects to roll-over valve & marked with a white paint dot)**

3. Reconnect the fuel pump electrical connection.
4. Reconnect the fuel level sender electrical connection.
5. Raise the rear of the fuel tank and reconnect the fuel feed hose by gently pushing inwards until the hose engages with a click.
6. Align the fuel tank to the front mounting point and tighten the fixing to **9 Nm.**
7. Align the fuel tank to the rear mounting points and tighten the two fixings to **9 Nm.**
8. Refit the fairing infill panels (see page *16-11*).
9. Refit the side panels (see page *16-10*).
10. Refit the side fairings (see page *16-13*).
11. Reconnect the battery, positive (red) lead first.
12. Start the engine and check carefully for fuel leaks. Rectify as necessary.
13. Refit the seat (see page *16-9*).

## Fuel Pump and Filter Assembly

### Removal

**Note:**

- **The fuel pump and filter assembly is a sealed for life unit and must be replaced as a complete assembly.**

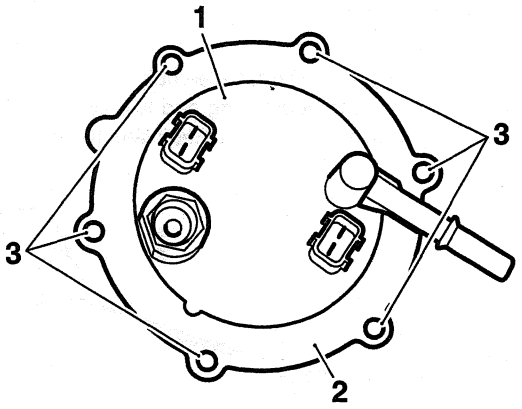
1. Remove the seat (see page *16-9*).
2. Disconnect the battery, negative (black) lead first.
3. Remove the fuel tank (see page *10-99*).
4. Drain the fuel tank into a suitable container.

**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.

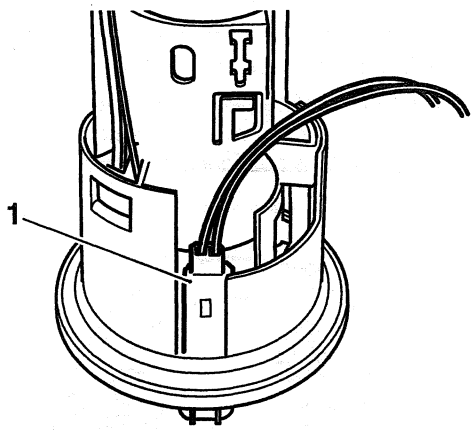
5. Invert the fuel tank and place on a protective surface to prevent paint damage.
6. Remove the fixings securing the fuel pump mounting plate to the tank. Remove the plate.




ceha

**1. Fuel pump**
**2. Mounting plate**
**3. Mounting plate fixings**

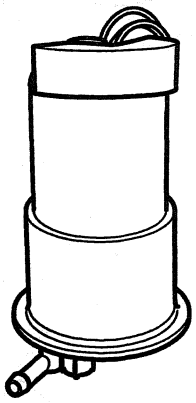
7. Lift the fuel pump and filter assembly and manoeuvre it from the fuel tank aperture.
8. Disconnect the fuel level sensor electrical connector and remove the fuel pump and filter assembly.




egz

**1. Fuel level sensor electrical connector**

9. Noting its orientation, remove and discard the sealing ring from the fuel pump assembly.

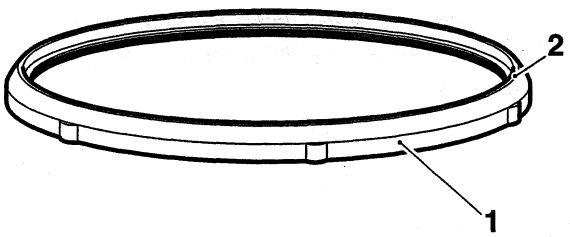


ccxh

**Fuel Pump and Filter Assembly**

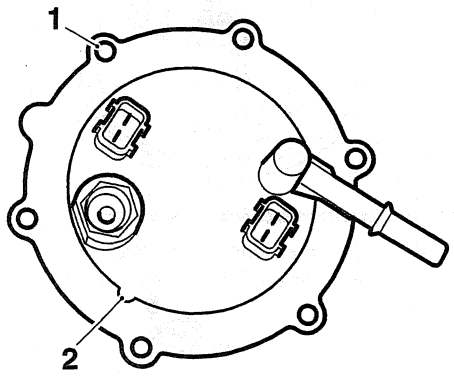
### Assembly

1. Install a new sealing ring into the fuel pump assembly, with the seal lip facing uppermost, and ensure that it is correctly seated.



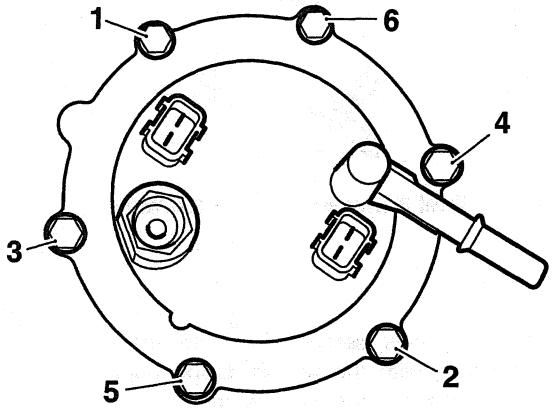

**1. Sealing ring**
**2. Seal lip**

2. Taking care to ensure the sealing ring is not damaged or dislodged, manoeuvre the fuel pump assembly into the tank aperture.
3. Reconnect the fuel level sensor electrical connector and locate the fuel pump and filter assembly.
4. Ensure the locating peg on the fuel pump assembly is located in the cut out on the mounting plate and the offset hole is positioned as shown below.




**1. Offset hole position**
**2. Locating peg**

5. Tighten the fixings in the sequence shown below to **9 Nm.**



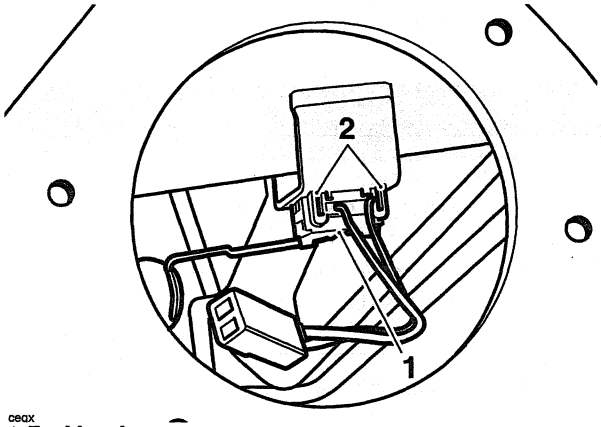

**Pump Mounting Plate Torque Sequence**

6. Refit the fuel tank (see page *10-100*).
7. Refill the fuel tank with the fuel drained earlier.
8. Reconnect the battery, positive (red) lead first.
9. Start the engine and check carefully for fuel leaks. Rectify as necessary.
10. Refit the seat (see page *16-9*).

## Fuel Level Sender Assembly

### Removal

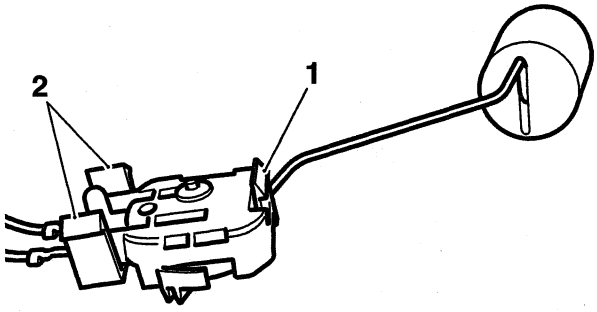
1. Remove the seat (see page *16-9*).
2. Disconnect the battery, negative (black) lead first.
3. Remove the fuel pump and filter assembly (see page *10-101*).
4. Release the two side tangs securing the fuel level sender to the bracket inside the fuel tank and carefully withdraw the fuel level sender.




**1. Fuel level sensor**
**2. Tangs**

### Assembly

1. Refit the fuel level sender assembly to the fuel tank ensuring that the upper tang and two side tangs are correctly attached to the bracket inside the fuel tank.




**1. Upper tang**
**2. Side tangs**

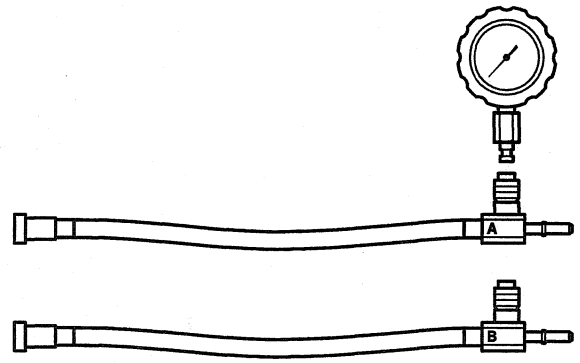
2. Refit the fuel pump and filter assembly (see page *10-101*).
3. Refill the fuel tank with the fuel drained earlier.
4. Reconnect the battery, positive (red) lead first.
5. Start the engine and check carefully for fuel leaks. Rectify as necessary.
6. Refit the seat (see page *16-9*).

## Fuel Pressure Checking

**Warning**

Observe the fuel handling precautions given in the general information section.

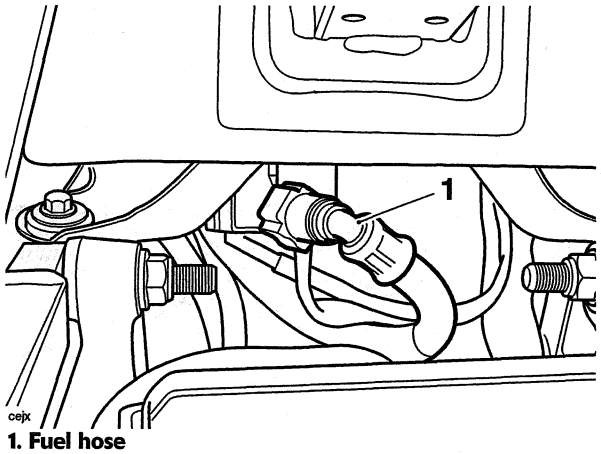
Fuel pressure is checked using service tool T3880001.




cdgh

**Tool T3880001**

1. Remove the seat (see page *16-9*).
2. Disconnect the fuel hose from the fuel pump plate by squeezing the sides of the connector and pulling the hose free from the spigot.




cejx

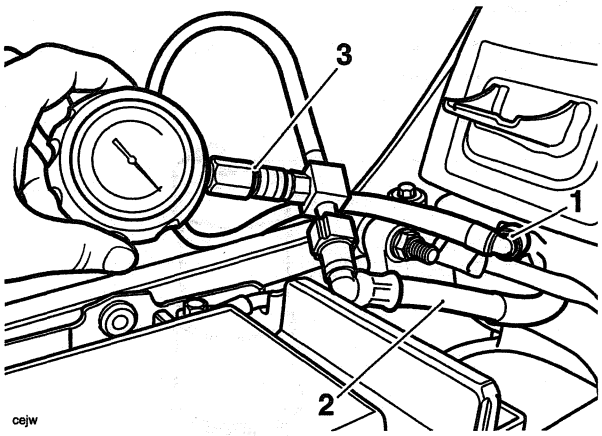
**1. Fuel hose**

3. Select the fuel pressure gauge adapter marked 'B' from service tool T3880001.

**Warning**

Always use the correct fuel pressure gauge adapter **(adapter 'B' for 2007-onwards Tiger)**. Use of an incorrect adapter will result in a fuel leak. A fuel leak can result in a fire causing damage to property and injury to persons.

4. Connect the adapter between the fuel pump plate outlet and fuel hose as shown in the illustration below. Insert the gauge to the adapter also as shown in the illustration.




cejw

**1. Fuel pump plate outlet connection**
**2. Fuel hose**
**3. Tool T3880001**

**Note:**

- **To release the fuel pressure gauge from the adapter, slide the outer ferrule downwards. This will allow the gauge to spring upwards from the adapter.**
- **To insert the gauge to the adapter, push the gauge spigot into the adapter until a click can be heard.**

5. Ensuring the gauge is visible to the side of the motorcycle.
6. Start the engine and observe the fuel pressure reading on the gauge.

**Note:**

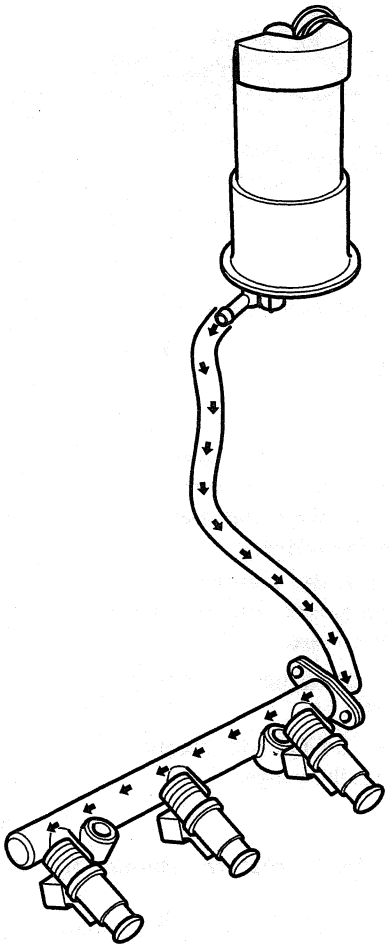
- **The fuel pressure should be 3.0 bar nominally.**

7. When fuel pressure checking is complete, disconnect the fuel pressure gauge adapter.
8. Reconnect the fuel hose and refit the seat (see page *16-9*).

## Fuel Delivery System

Fuel is delivered to injectors by a pump located inside the fuel tank. Fuel flows in the direction of the arrows shown in the diagram below.

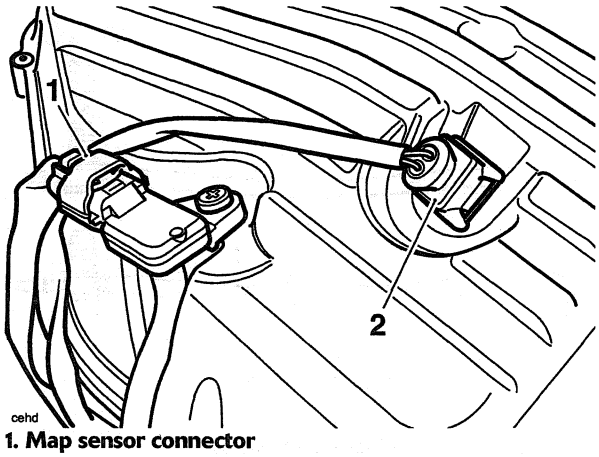
Incorporated in the system is a filter, a pressure regulator and a pick-up strainer.



## Airbox

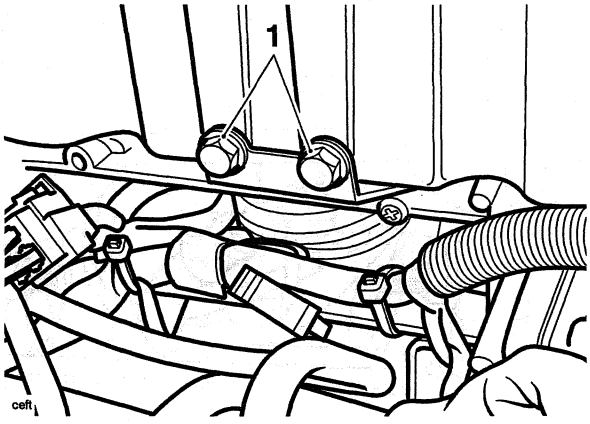
### Removal

1. Remove the seat (see page *16-9*).
2. Disconnect the battery, negative (black) lead first.
3. Remove the fuel tank (see page *10-99*).
4. Disconnect the air temperature and map sensor connectors.



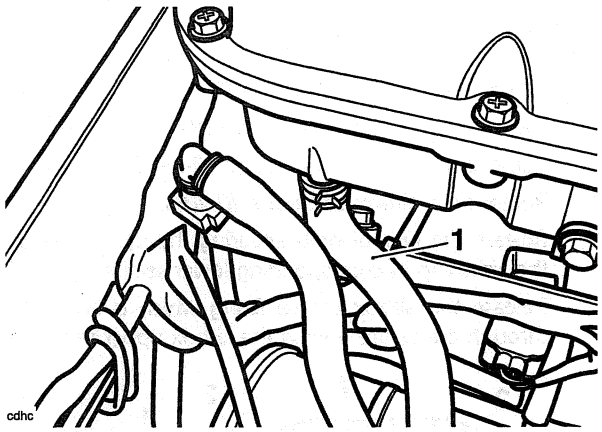

**1. Map sensor connector**
**2. Intake air temperature connector**

5. Disconnect the map sensor hose.
6. Release the fixings securing the airbox to its bracket.



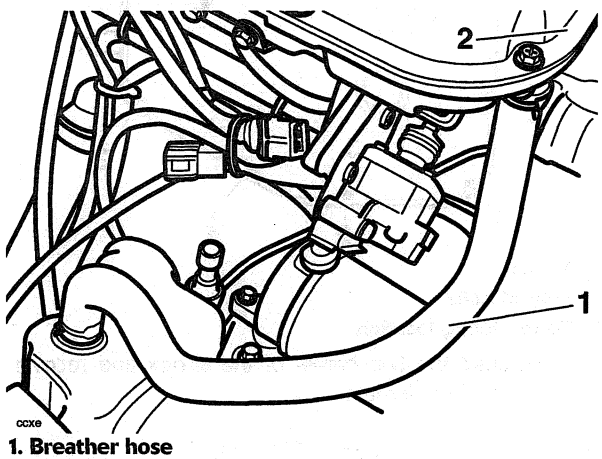

**1. Airbox fixings**

7. Disconnect the drain tube from the rear of the airbox.




**1. Drain tube**

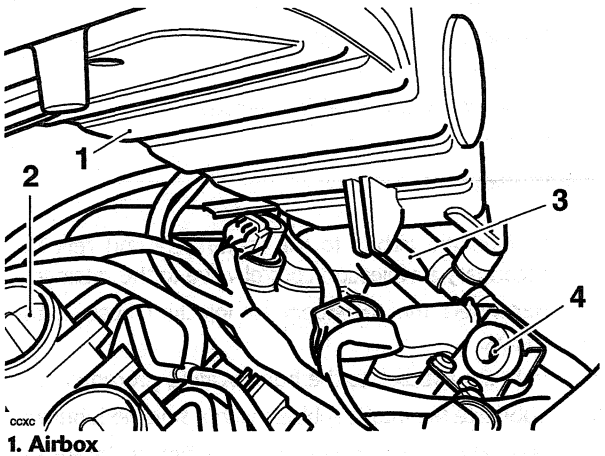
8. Disconnect the breather hose from the rear of the airbox.




**1. Breather hose**
**2. Airbox**

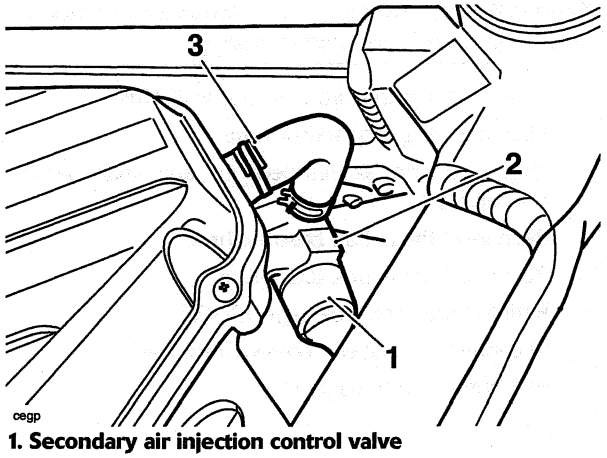
9. Gently lift the rear of the airbox to release it from the throttle bodies.

10. Once the airbox has cleared the throttle bodies, slide it rearwards to release it from the front locating grommet.




**1. Airbox**
**2. Throttle bodies**
**3. Forward locating peg**
**4. Locating grommet**

11. Disconnect the secondary air injection hose at the airbox.




**1. Secondary air injection control valve**
**2. Valve retainer**
**3. Hose**

12. Release the secondary air injection control valve from the retainer on the airbox and remove the airbox.

### Inspection

1. Inspect the intake rubbers for splits, damage and distortion.
2. Inspect the intake rubber retaining rings for loss of elasticity.
3. Check the airbox itself for damage.

### Installation

1. Position the airbox to the motorcycle and refit the secondary air injection control valve to the retainer.
2. Reconnect the secondary air injection hose at the airbox.
3. Refit the airbox into the front locating grommet.
4. Lubricate the intake rubbers with a suitable lubricant.
5. Press down on the rear of the airbox to locate the intake rubbers to the throttle bodies.

**Caution**

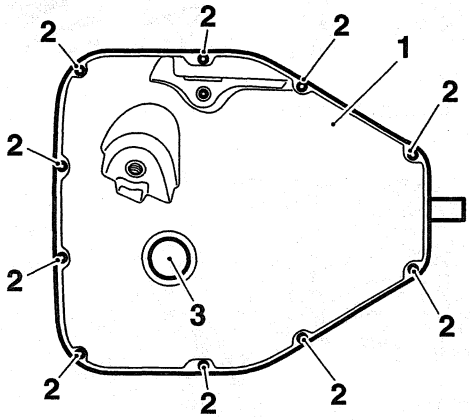
Always ensure that all 3 intake rubbers seal to the throttles through 360° as poor performance and lack of power can result from incorrect sealing.

6. Fit and tighten the airbox fixings to **5 Nm**.
7. Reconnect the map sensor hose.
8. Reconnect the air temperature and map sensor connectors.
9. Reconnect the airbox breather hose.
10. Reconnect the airbox drain tube.
11. Refit the fuel tank (see page *10-100*).
12. Reconnect the battery, positive (red) lead first.
13. Refit the seat (see page *16-9*).

## Air Filter Element

### Removal

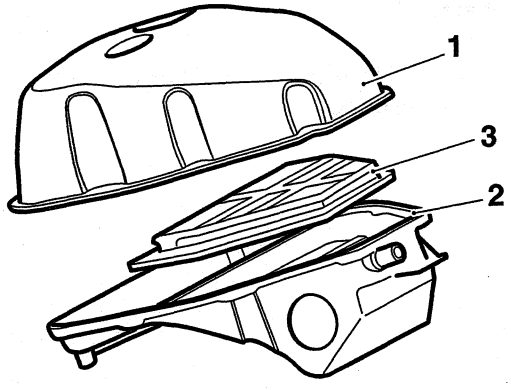
1. Remove the seat (see page *16-9*).
2. Disconnect the battery, negative (black) lead first.
3. Remove the fuel tank (see page *10-99*).
4. Remove the airbox (see page *10-104*).
5. Release the ring of bolts securing the upper half of the airbox to its corresponding lower section.
6. Release the airbox centre fixing which is accessed through the centre hole in the airbox upper section.




cdar

**1. Airbox**
**2. Ring of bolts**
**3. Centre fixing location**

7. Separate the two halves of the airbox and recover the air filter element.




cdau

**1. Airbox upper section**
**2. Airbox lower section**
**3. Air filter element**

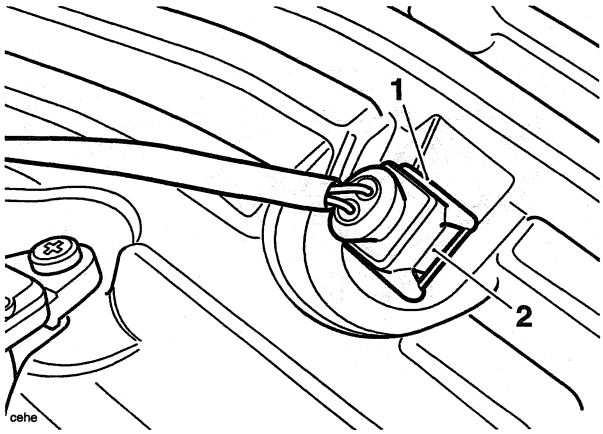
### Installation

1. Thoroughly clean the inside and outside of the airbox.
2. Seat the air filter element in the lower section.
3. Locate the upper section to the lower and secure with the fixings. Tighten to **4 Nm.**
4. Refit the airbox (see page *10-106*).
5. Refit the fuel tank (see page *10-100*).
6. Reconnect the battery, positive (red) lead first
7. Refit the seat (see page *16-9*).

## Intake Air Temperature Sensor

### Removal

1. Remove the seat (see page *16-9*).
2. Disconnect the battery, negative (black) lead first.
3. Remove the fuel tank (see page *10-99*).
4. Disconnect the multiplug from the air temperature sensor.




**1. Intake air temperature connector**
**2. Intake air temperature sensor**

**Note:**

- **The intake air temperature sensor has a threaded base.**

5. Unscrew the sensor to remove it from the airbox.

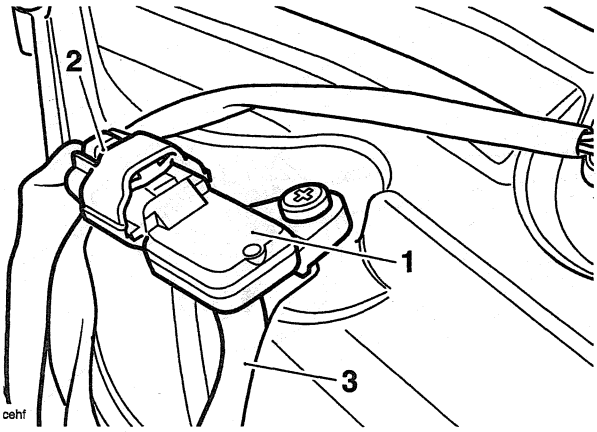
### Assembly

1. Fit the air temperature sensor to the airbox. Tighten to **4 Nm.**
2. Reconnect the air temperature sensor.
3. Refit the fuel tank (see page *10-100*).
4. Reconnect the battery, positive (red) lead first.
5. Refit the seat (see page *16-9*).

## Map Sensor

### Removal

1. Remove the seat (see page *16-9*).
2. Disconnect the battery, negative (black) lead first.
3. Remove the fuel tank (see page *10-99*).
4. Disconnect the multiplug from the map sensor.



ceht

**1. Map sensor**
**2. Multi-plug**
**3. Air hose**

5. Disconnect the air hose from the sensor.
6. Release the fixing screw securing the sensor to the airbox.
7. Raise the sensor to remove it from the airbox and collect the O-ring.

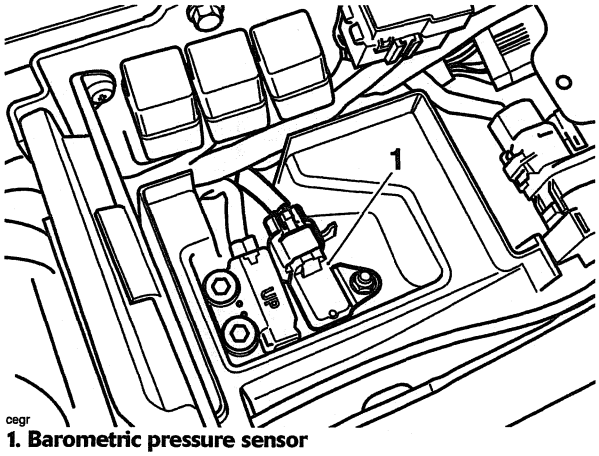
### Installation

1. Take a new O-ring and lubricate it with a smear of petroleum jelly. Fit the O-ring to the sensor, then fit the sensor to the airbox, tightening the screw to **3 Nm.**
2. Refit the air hose.
3. Reconnect the multi-plug.
4. Refit the fuel tank (see page *10-100*).
5. Reconnect the battery, positive (red) lead first.
6. Refit the seat (see page *16-9*).

## Barometric Pressure Sensor

### Removal

1. Remove the seat (see page *16-9*).
2. Disconnect the battery, negative (black) lead first.
3. Remove the battery (see page *17-7*).
4. Disconnect the barometric pressure sensor multiplug.
5. Release the fixing screw securing the sensor to the mounting bracket and remove the barometric pressure sensor. Collect the mounting screw from below the battery tray.



cegr

**1. Barometric pressure sensor**

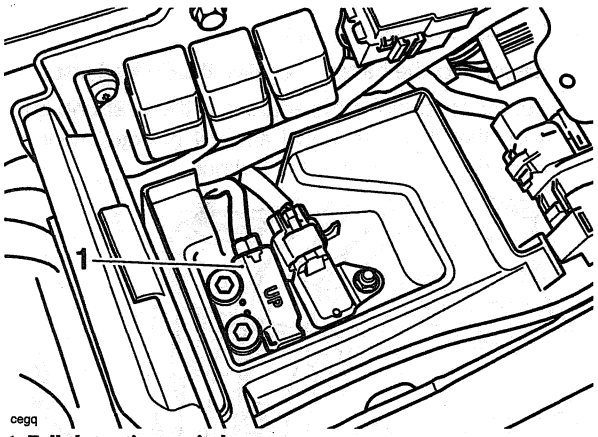
### Installation

1. Fit the mounting screw to the battery from below.
2. Fit the barometric pressure sensor to the mounting screw, fit the nut and tighten to **3 Nm.**
3. Connect the barometric pressure sensor multiplug.
4. Refit the battery (see page *17-7*).
5. Reconnect the battery, positive (red) lead first.
6. Refit the seat (see page *16-9*).

## Fall Detection Switch

### Removal

1. Remove the seat (see page *16-9*).
2. Disconnect the battery, negative (black) lead first.
3. Remove the battery (see page *17-7*).
4. Disconnect the fall detection switch multiplug.
5. Release and discard the fixing screws securing the switch to the mounting bracket and remove the switch.




cegq

**1. Fall detection switch**

### Installation

1. Fit the fall detection switch to the mounting bracket, fit new fixing screws and tighten to **4 Nm.**
2. Connect the fall detection switch multiplug.
3. Refit the battery (see page *17-7*).
4. Reconnect the battery, positive (red) lead first.
5. Refit the seat (see page *16-9*).

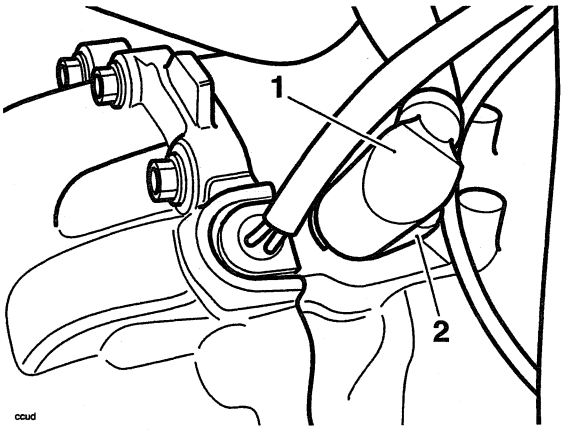
## Crankshaft position sensor

**Note:**

- **The air gap for the crankshaft position sensor is not adjustable.**

### Removal

1. Remove the seat (see page *16-9*).
2. Disconnect the battery, negative (black) lead first.
3. Remove the fixing securing the sensor bracket to the crankcase. Ease the sensor from the crankcase.



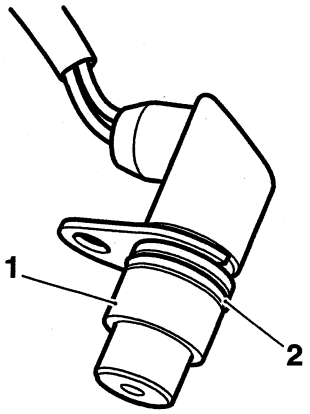

ccud

**1. Sensor**
**2. Sensor bracket**

4. Disconnect the sensor multi-plug.

### Installation

1. Check the sensor O-ring for damage or deterioration. Renew as necessary.




ccwy

**1. Sensor**
**2. O-ring**

1. Apply a smear of oil to the sensor O-ring to aid assembly.
2. Refit the sensor taking care not to damage the O-ring.
3. Refit the sensor bracket. Fit and tighten the fixing to **10 Nm.**
4. Reconnect the sensor multi-plug.
5. Reconnect the battery, positive (red) lead first.
6. Refit the seat (see page *16-9*).

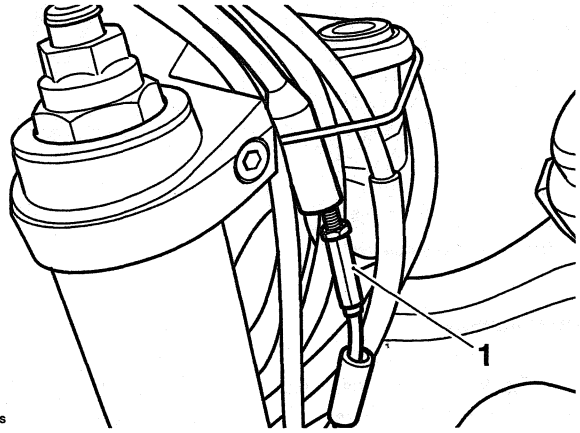
## Throttle Cable

### Adjustment

**Note:**

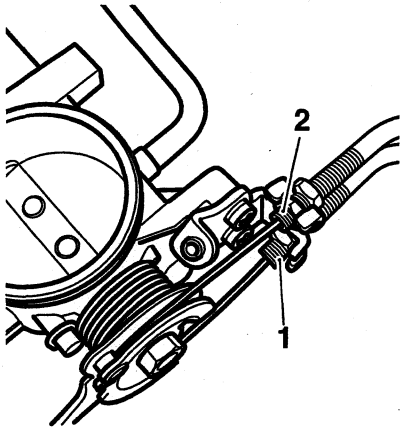
- **Minor adjustments to the opening cable can be made using the adjuster near the twist grip end of the throttle. Where a correct setting cannot be achieved this way, the adjusters at the throttle end of both cables must be used. The opening cable must be set first followed by the closing cable.**

1. Remove the seat (see page *16-9*).
2. Disconnect the battery, negative (black) lead first.
3. Set the 'opening' cable adjuster at the twist grip end such that it has an equal amount of adjustment in each direction. Tighten the locknut.




**1. 'Opening' cable adjuster (twist grip end)**

4. Remove the fuel tank (see page *10-99*).
5. Remove the airbox (see page *10-104*).
6. Set the 'opening' cable adjuster at the throttle end to give 2-3 mm of play at the twist grip. Tighten the locknut.




**1. 'Opening' cable adjuster (throttle end)**
**2. 'Closing' cable adjuster (throttle end)**

7. With the throttle fully closed, ensure that there is 2-3mm of free play in the 'closing' cable. Adjust if necessary ensuring that the locknut is secure afterwards.

**Warning**

Operation of the motorcycle with incorrectly adjusted, incorrectly routed or damaged throttle cables 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. Cables or harness that bind will restrict the steering and may cause loss of control and an accident.

**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.

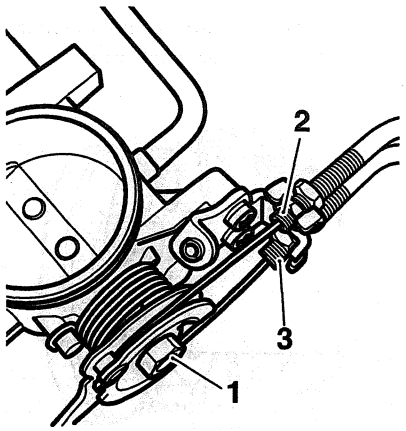
8. Refit the airbox (see page *10-106*).
9. Refit the fuel tank (see page *10-100*).
10. Reconnect the battery, positive (red) lead first.
11. Refit the seat (see page *16-9*).

## Removal

**Note:**

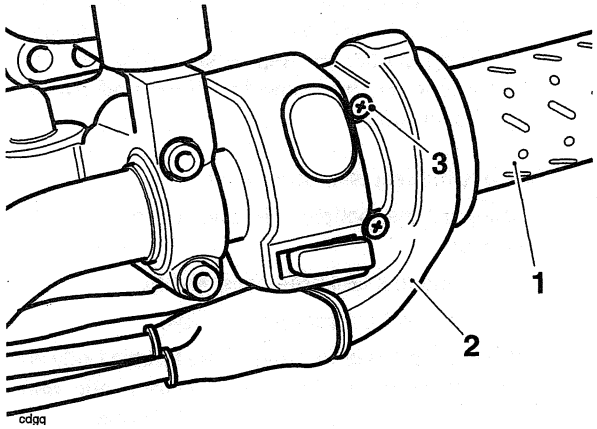
- **Before beginning to remove the throttle cables, note the exact routing and location of both cables to help ensure that they are returned to the same locations and routing on assembly.**

1. Remove the seat (see page *16-9*).
2. Disconnect the battery, negative (black) lead first. (see page *17-7*).
3. Remove the fuel tank (see page *10-99*).
4. Remove the airbox (see page *10-104*).
5. Slacken the adjuster locknuts at the throttle body end of the cables such that they will allow the outer cables to be detached from the cable bracket.
6. Detach the inner portion of the cables from the throttle cam.



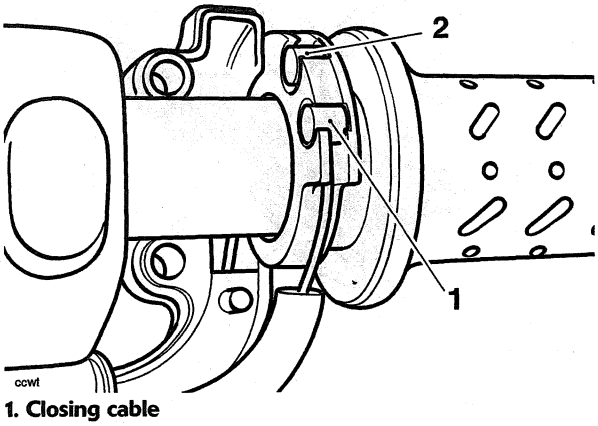

**1. Throttle cam**
**2. Closing cable**
**3. Opening cable**

7. At the twist grip end, slide off the rubber boot and release the screws which secure the two halves of the twist grip guide to each other.




**1. Twist grip**
**2. Twist grip guide**
**3. Screws**

8. Separate the two halves of the guide then release the inner cables from the twist grip.




**1. Closing cable**
**2. Opening cable**

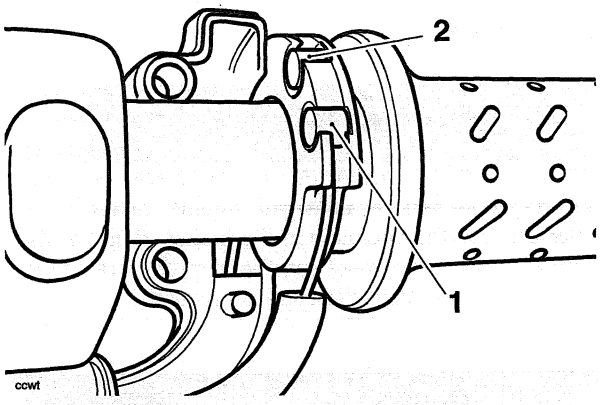
9. Detach the cables from the motorcycle.

## Examination

1. Check that both the throttle cables operate smoothly, without sticking or binding. Replace the cables if there is any doubt as to their correct operation.

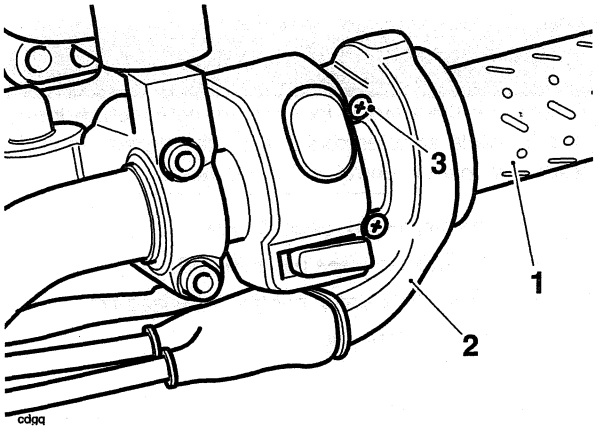
## Installation

1. Locate the cables to the frame following the routing noted during removal.
2. Engage the inner cable nipples to the twist grip.




**1. Closing cable**
**2. Opening cable**

3. Assemble the two halves of the cable guide ensuring that the outer cables are correctly located in the guide and the guide is positioned on the handlebars as prior to removal.




**1. Twist grip**
**2. Twist grip guide**
**3. Screws**

4. Refit the boot.
5. Attach the other end of the inner cables to the throttle cam ensuring the opening cable is fitted to the bottom of the throttle cam and the closing cable to the top.
6. Locate the outer cables to the bracket and secure with the adjuster and locknuts.
7. Set the cable adjustment (see page *10-110*).
8. Refit the airbox (see page *10-106*).
9. Refit the fuel tank (see page *10-100*).
10. Reconnect the battery, positive (red) lead first
11. Refit the seat (see page *16-9*).

## Throttle Bodies/Injectors

### Removal

**Note:**

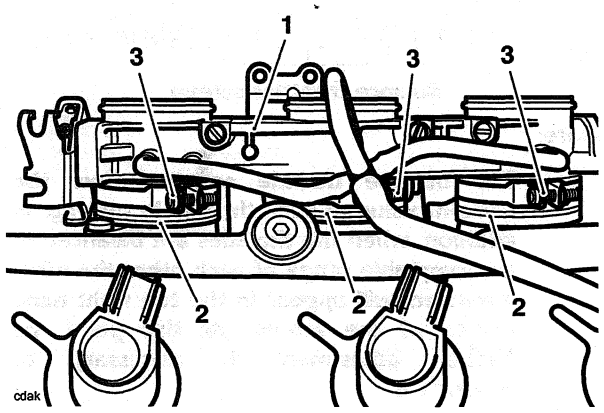
- **Because fuel stored in the fuel rail will be at 3 bar pressure, it is essential that the fuel pressure is reduced before any dismantling of the fuel rail takes place. To reduce pressure, briefly crank the engine with the fuel pump disconnected.**

**Warning**

If the fuel rail is dismantled without first reducing pressure fuel may escape causing clothing and components to be coated with fuel.

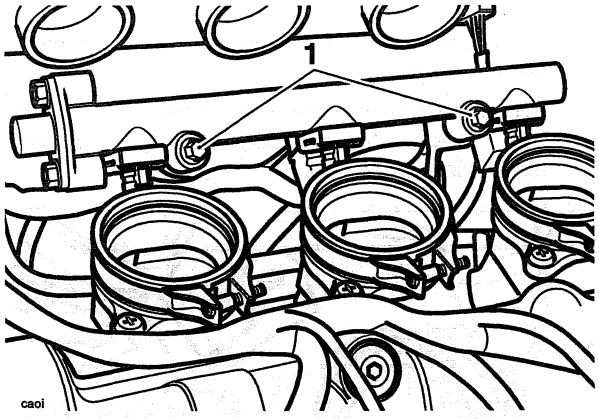
This would represent a serious fire hazard which could lead to burn injuries and damage to property.

1. Remove the seat (see page *16-9*).
2. Disconnect the battery, negative (black) lead first.
3. Remove the side panels (see page *16-10*).
4. Remove the fuel tank (see page *10-99*).
5. Remove the airbox (see page *10-104*).
6. Disconnect the throttle position sensor.
7. Release both throttle cables from the throttle cam (see page *10-110*).
8. Release the clips securing the throttle bodies to the transition pieces.



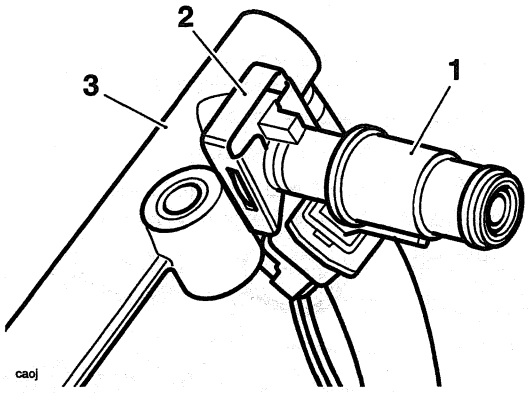

**1. Throttle body**
**2. Transition piece (one per cylinder)**
**3. Clip (one per cylinder)**

9. Ease the throttle bodies from the transition pieces and lay the assembly on the crankcase.
10. Release the bolts securing the fuel rail to its bracket.




**1. Fuel rail bolts**

11. Ease the fuel rail and injectors from the cylinder head.
12. To detach the injectors from the fuel rail, release the clip at the fuel rail end of each injector and ease the injector from the rail.




**1. Injector**
**2. Clip**
**3. Fuel rail**

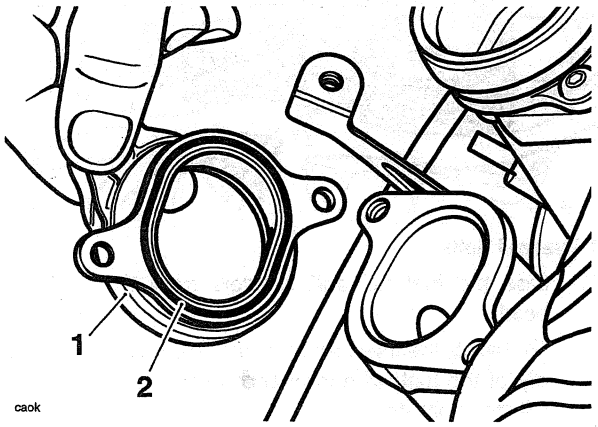
13. To detach the transition pieces from the head, release the screws, raise the transition pieces and collect the O-rings.

### Inspection

1. Check all joints and seals for splits, cuts and damage.
2. Check the throttles for sticking, loose or damaged throttle plates.
3. Check the O-rings for damage.

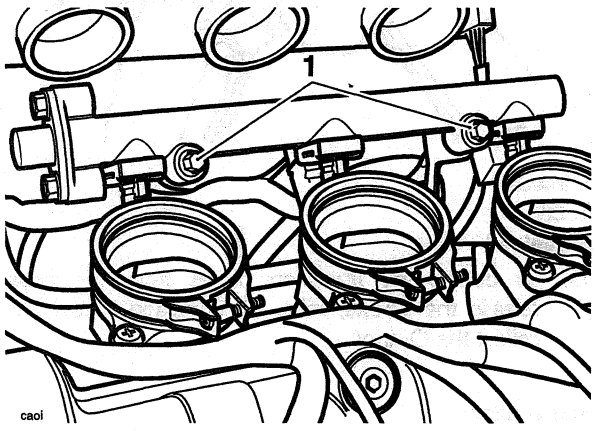
### Installation

1. Thoroughly clean the transition piece to cylinder head mating faces.
2. Refit the transition pieces to the head incorporating new O-rings to the joint face. Tighten the transition piece fixings to **12 Nm.**




**1. Transition piece**
**2. O-ring**

3. If the injectors have been removed from the fuel rail, refit them to the rail and secure with the clips.
4. Check the injector O-rings for splits and other damage. Replace as necessary.
5. Refit the injectors and fuel rail to the cylinder head. Tighten the fuel rail fixings to **6 Nm.**




**1. Fuel rail bolts**

6. Refit the throttle bodies to the transition pieces and secure with clips.
7. Re-attach and adjust the throttle cables (see page *10-110*).
8. Refit the airbox (see page *10-106*).
9. Refit the fuel tank (see page *10-100*).
10. Refit all bodywork.
11. Reconnect the battery, positive (red) lead first.
12. Refit the seat (see page *16-9*).

## Throttle Body Balancing

**Note:**

- **The throttles cannot be balanced using equipment to measure vacuum in each throttle. Instead, the Triumph diagnostic tool must be used.**

1. Remove the fuel tank (see page *10-99*).
2. Remove the airbox (see page *10-104*).

**Warning**

If the engine has recently been running, the components beneath the fuel tank may be hot to the touch.

3. Connect the diagnostic tool.
4. Temporarily refit the fuel tank and reconnect the hoses and fuel pump connection.
5. Attach exhaust extraction hoses to the silencers.
6. Start the engine.
7. On the diagnostic tool navigate to 'ADJUSTMENTS' (see page *10-24*).
8. Select 'balance throttles'.

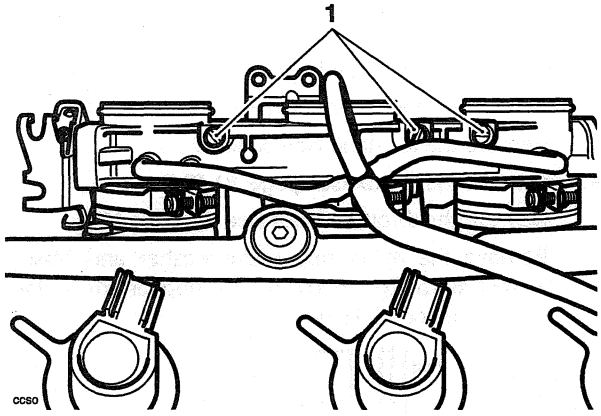
| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T | H | R | O | T | T | L | E | S | | B | A | L | A | N | C | E | D | | |
| T | H | R | O | T | T | L | E | | 1 | | 1 | 2 | 3 | 4 | M | M | / | H | G |
| T | H | R | O | T | T | L | E | | 2 | | 1 | 2 | 3 | 4 | M | M | / | H | G |
| T | H | R | O | T | T | L | E | | 3 | | 1 | 2 | 3 | 4 | M | M | / | H | G |

**Balance throttles screen**

**Note:**

- **The balance throttle screens show the vacuum value of each throttle in mm/hg. In addition, when the throttles are balanced to an acceptable range of each other the word 'balanced' will appear in the top right hand corner of the screen. At this point, no further adjustment is necessary or productive.**

9. Using the throttle adjusters, make adjustments until the word 'BALANCED' appears



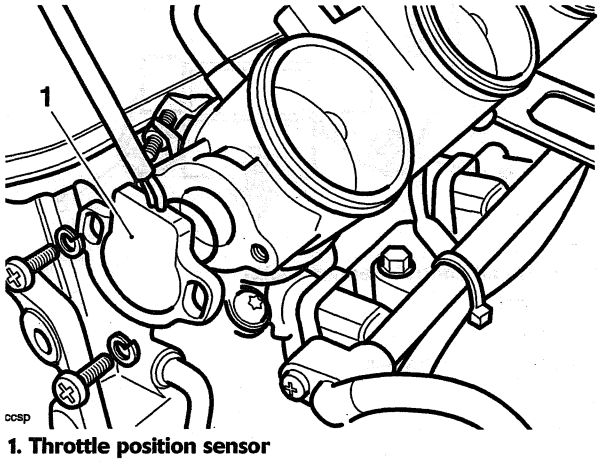

**1. Adjusters**

10. When balanced, stop the engine and disconnect the diagnostic tool.
11. Refit the airbox (see page *10-106*).
12. Refit the fuel tank (see page *10-100*).
13. Refit the seat (see page *16-9*).

## Throttle Position Sensor

### Removal

1. Remove the seat (see page *16-9*).
2. Disconnect the battery, negative (black) lead first.
3. Remove the fuel tank (see page *10-99*).
4. Remove the airbox (see page *10-104*).
5. Remove the throttle body assembly (see page *10-113*).
6. Remove the throttle position sensor from the left hand end of the throttle body. Collect the O-ring on disassembly.




**1. Throttle position sensor**

### Installation

1. Fit the replacement throttle position sensor ensuring the O-ring is positioned correctly between the sensor and throttle body.
2. Engage the new screws and washers supplied and part tighten such that the sensor can still be rotated.
3. Position the throttle body assembly near to its fitted position and reconnect the sensor.
4. Reconnect the battery, positive (red) lead first.
5. Attach the Triumph service diagnostic tool to the dedicated plug.
6. Turn the ignition to the 'ON' position.
7. Connect the diagnostic tool and scroll through to, and select the 'ADJUST TUNE' option.
8. At the next screen, align the cursor with 'THROTTLE POT RENEW' (see below) then press the validation key which is marked '*'.

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | A | D | J | U | S | T | | T | U | N | E |
| | R | E | S | E | T | | A | D | A | P | T | I | O | N | S | | | |
| | B | A | L | A | N | C | E | | T | H | R | O | T | T | L | E | S | |
| ► | T | H | R | O | T | T | L | E | | P | O | T | | R | E | N | E | W |
| | I | S | C | | S | T | E | P | P | E | R | | R | E | N | E | W | |

9. On pressing the validation key, the diagnostic tool will send a command, which drives the primary throttle to the fully closed position. The tool will also display the voltage reading coming from the throttle position sensor.

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | R | E | P | L | A | C | E | | P | R | I | M | A | R | Y | | T | P | S |
| | | | | | T | H | R | O | T | T | L | E | | C | L | O | S | E | D |
| C | U | R | R | E | N | T | | V | O | L | T | S | | O | . | 5 | 6 | V | |
| | | | | | | | | | | | | | | | | | | | |

10. Gently rotate the new throttle position sensor until the voltage reading on the tool shows 0.6 volts +/- 0.02 volts.

**Note:**

- **This is a setting voltage only. Because of the adaptive nature of the engine management system, in-service voltage may vary from this setting figure.**

11. Tighten the sensor retaining screw to **3.5 Nm** and recheck the voltage reading shown on the tool. Repeat the adjustment if the reading is outside the specified range.

12. Press the validation key marked '*' to return the throttle to normal control and return the diagnostic tool to the 'ADJUST TUNE' menu.
13. Disconnect the diagnostic tool.
14. Disconnect the battery negative (black) lead first.
15. Check that the throttle opens and closes without obstruction/sticking and has a smooth action throughout the full range of its movement. Rectify as necessary.

**Warning**

Operation of the motorcycle with an incorrectly adjusted throttle position sensor, or a throttle position sensor that causes the throttle to stick could result in loss of throttle control. Loss of throttle control could result in loss of control of the motorcycle and an accident.

**Warning**

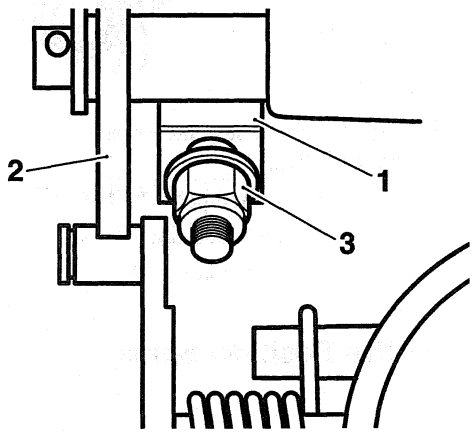
Operation of the motorcycle with an incorrectly adjusted, incorrectly routed or damaged throttle cable could interfere with the operation of the brakes, clutch or the throttle itself. Any of these conditions could result in loss of control of the motorcycle and an accident.

16. Refit the throttle body assembly (see page *10-114*).
17. Refit the airbox (see page *10-106*).
18. Refit the fuel tank (see page *10-100*).
19. Reconnect the battery, positive (red) lead first.
20. Check and clear any stored faults using the same tool.
21. Refit the seat (see page *16-9*).

## Idle Speed Control Stepper Motor

### Removal

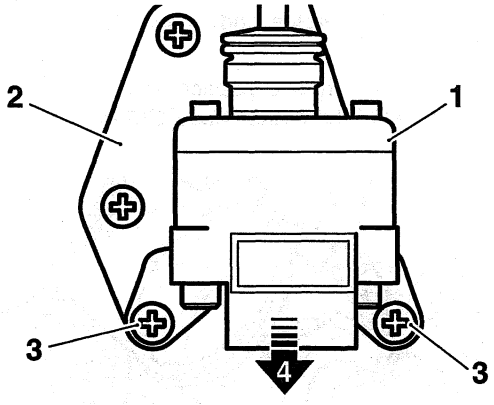
1. Remove the seat (see page *16-9*).
2. Disconnect the battery, negative (black) lead first.
3. Remove the fuel tank (see page *10-99*).
4. Remove the airbox (see page *10-104*).
5. Remove the throttle bodies (see page *10-113*).
6. Remove the nylon nut, metal washer and plastic washer attaching the idle control stepper arm to the idle speed control lever




cdav

**1. Idle control stepper arm**
**2. Idle speed control lever**
**3. Nut etc.**

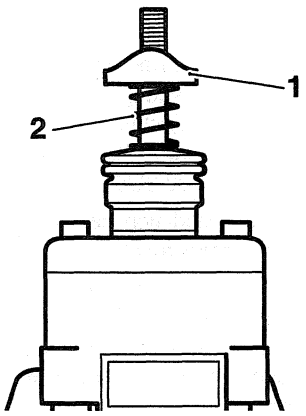
7. Remove the two screws securing the idle speed control stepper motor to its bracket, then remove the stepper motor in the direction shown.




cdaw

**1. Idle speed control stepper motor**
**2. Bracket**
**3. Fixings**
**4. Direction of removal**

8. Collect the plastic collar and spring from the control stepper arm.

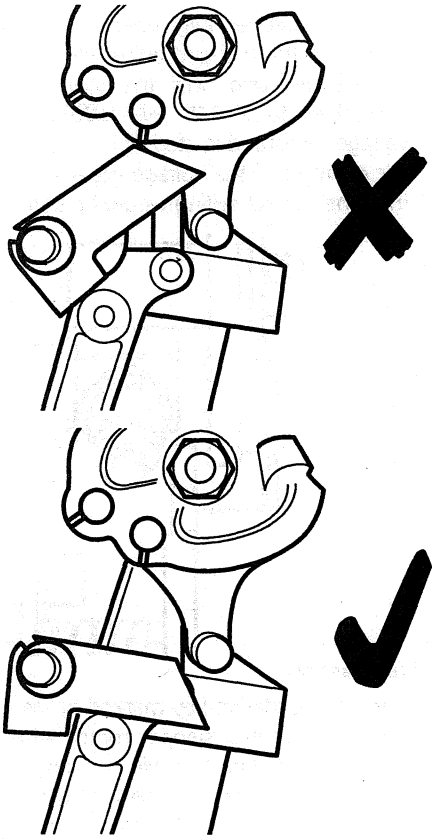



cdax

**1. Collar**
**2. Spring**

## Installation

1. Ensure the Idle speed control lever is correctly positioned in relation to the throttle cam as shown below.

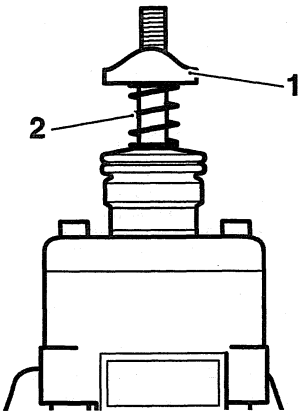


cdgr



cdgs

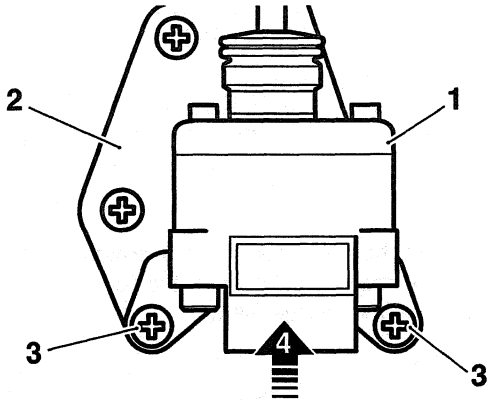
2. Loosley fit the spring and collar on the stepper arm.




cdax

**1. Collar**
**2. Spring**

3. Locate the stepper motor to its bracket and tighten the fixings to **3.5 Nm.**




cday

**1. Idle speed control stepper motor**
**2. Bracket**
**3. Fixings**
**4. Direction of fitting**

4. Fit the plastic washer through the lever then fit the metal washer and nut.
5. Mount the throttle body onto the engine.
6. Temporarily reconnect the battery, positive (red) lead first.
7. Turn the ignition to the 'ON' position.
8. Connect the service diagnostic tool and scroll through to, and select the 'ADJUST TUNE' option.

9. At the next screen, align the cursor with 'ISC* STEPPER RENEW' then press the validation key which is marked '*'.

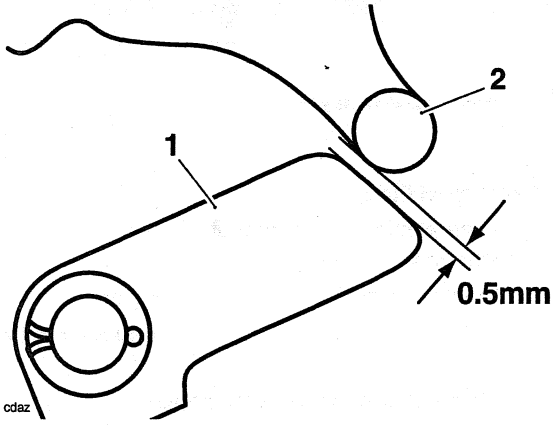
   *ISC = Idle Speed Control

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | A | D | J | U | S | T | | T | U | N | E |
| | R | E | S | E | T | | A | D | A | P | T | I | O | N | S | | | |
| | T | H | R | O | T | T | L | E | | P | O | T | | R | E | N | E | W |
| ▶ | I | S | C | | S | T | E | P | P | E | R | | R | E | N | E | W | |

10. On pressing the validation key, the diagnostic tool will send a command that drives the throttle to the fully closed position. The tool will also display the voltage reading coming from the throttle position sensor which will be needed for a check/adjustment made later in the process.

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | R | E | P | L | A | C | E | | I | S | C | | S | T | E | P | P | E | R |
| | | | | | T | H | R | O | T | T | L | E | | C | L | O | S | E | D |
| C | U | R | R | E | N | T | | V | O | L | T | S | | | O | . | 5 | 8 | V |
| | | | | | | | | | | | | | | | | | | | |

11. Tighten the stepper arm until a clearance of 0.5 mm can be measured between the idle speed control cam and the throttle roller.

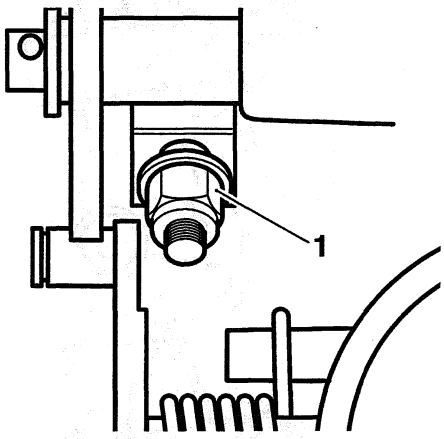



**1. Idle speed control lever**
**2. Throttle roller**

12. Check the voltage reading on the tool. If the reading is 0.6 volts +/- 0.02 volts, MAKE A NOTE OF THE EXACT VOLTAGE READING then proceed to step 16. If the reading is not within this tolerance band, adjustment must be made as described in paragraphs 13 to 15.
13. Slacken the screws on the throttle position sensor.
14. Gently turn the throttle position sensor until the voltage reading on the tool shows 0.6 volts +/- 0.02 volts. MAKE A NOTE OF THE EXACT VOLTAGE READING.
15. Tighten the sensor retaining screw to **3.5 Nm** and recheck the voltage reading shown on the tool. Repeat the adjustment if the reading is outside the specified range, NOTING THE FINAL VOLTAGE READING IF ADJUSTMENT IS MADE.
16. Press the validation key marked '*' to progress to the next adjustment.
17. On pressing the validation key, the diagnostic tool will send a command that drives the throttle to the fully open position. The tool will also display the voltage reading coming from the throttle position sensor.

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | R | E | P | L | A | C | E | | I | S | C | | S | T | E | P | P | E | R |
| | | | | | T | H | R | O | T | T | L | E | | O | P | E | N | | |
| C | U | R | R | E | N | T | | V | O | L | T | S | | | O | . | 7 | 2 | V |
| | | | | | | | | | | | | | | | | | | | |

18. With the stepper fully opened, check the voltage shown on the tool and adjust the nut on the top of the stepper arm until the tool shows a voltage equivalent to X+0.15 (+/- 0.05V) where X= the voltage measured in step 12 (or 14 if re-adjusted). For example, if the voltage measured was 0.6 volts, then the correct setting would be 0.70-0.80 volts.




**1. Adjustment nut**

19. Press the validation key marked '*' to fully close the idle speed control stepper motor. After a minimum of 15 seconds (the tool will not allow further actions to take place during this period), press the validation key again to return the ECM to normal control.

**Caution**

Do not operate the throttle while the stepper motor is being adjusted, otherwise the incorrect value will be adapted and the engine will not start.

20. Turn the ignition to the 'OFF' position.
21. Disconnect the battery, negative (black) lead first.
22. Check and adjust the throttle cable settings (see page *10-110*).

**Warning**

Move the handlebars to left and right full lock while checking that the 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.

23. Refit the airbox (see page *10-106*).
24. Refit the fuel tank (see page *10-100*).
25. Reconnect the battery, positive (red) lead first.
26. Refit the seat (see page *16-9*).

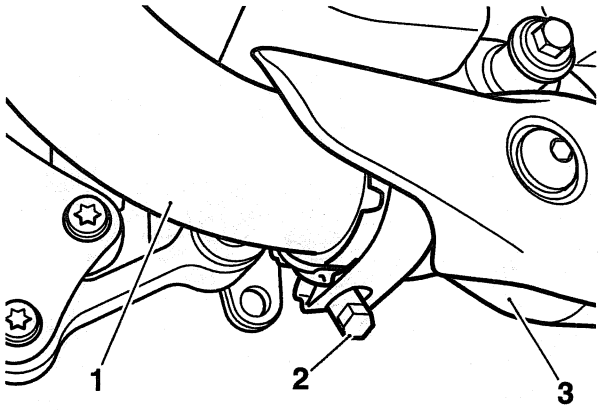
## Exhaust System

### 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.

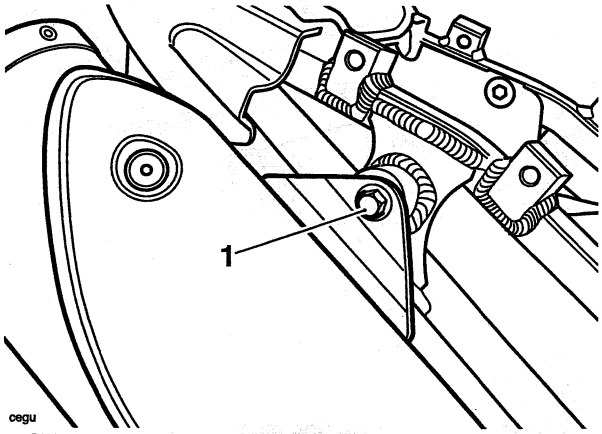
1. Remove the seat (see page *16-9*).
2. Disconnect the battery, negative (black) lead first.
3. Remove the rear bodywork (see page *16-10*).
4. Release the clamp securing the silencer to the exhaust pipe.




cegv

**1. Silencer**
**2. Clamp**
**3. Exhaust pipe**

5. Support the silencer and release the bolt and nut securing the silencer mounting bracket to the rear subframe. Discard the nut.

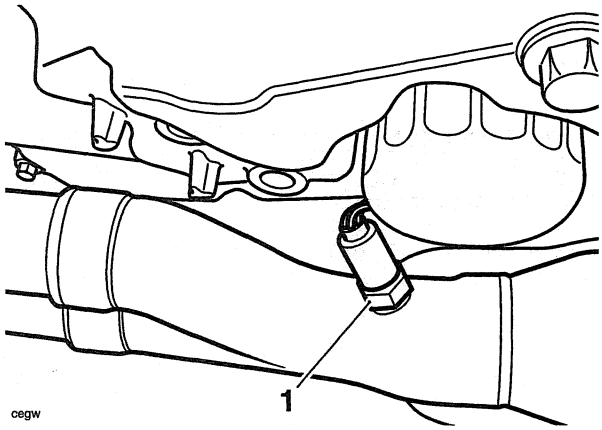



cegu

**1. Silencer mounting bracket/fixing**

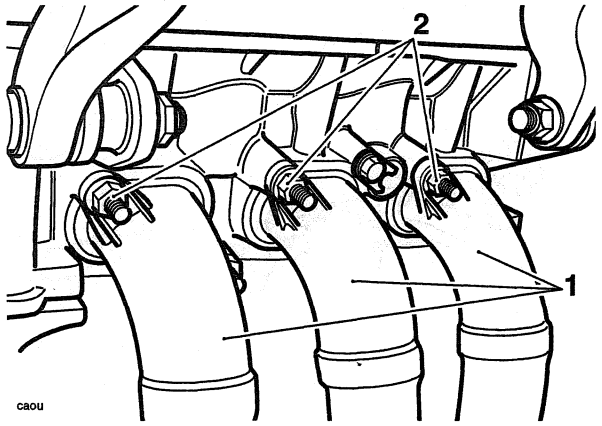
6. Move the silencer rearwards to disengage it from the header pipes and remove.

7. Disconnect the oxygen sensor.



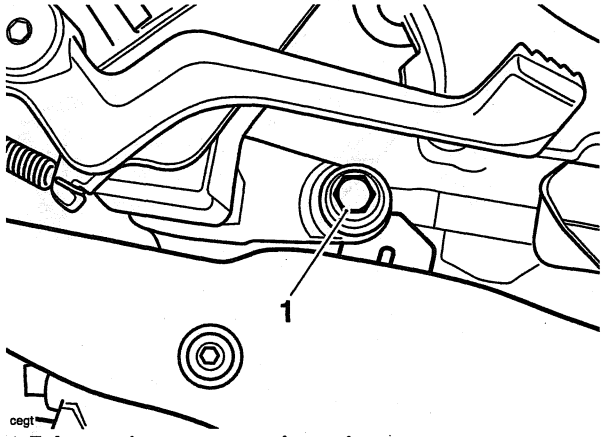

**1. Oxygen sensor**

8. Remove the oil cooler (see page *8-14*).
9. Remove the radiator (see page *11-8*).
10. Release the fixings securing the exhaust pipe joints to the cylinder head.




**1. Down pipes**
**2. Fixings (upper fixings shown)**

11. Remove the bolt from the exhaust pipe rear mounting point.




**1. Exhaust pipe rear mounting point**

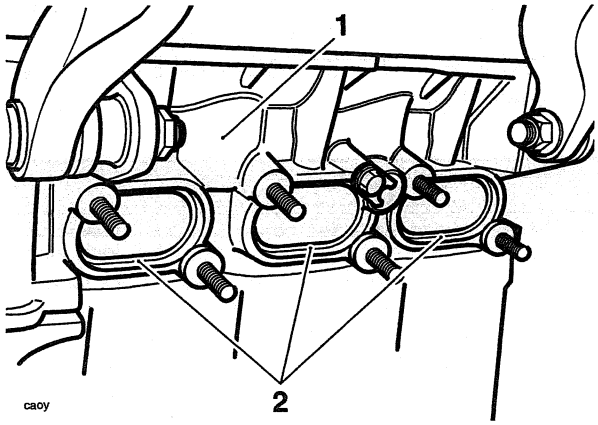
12. Detach the exhaust pipe assembly and collect the seals from the head ports.

## Assembly

1. Fit new seals to the cylinder head.

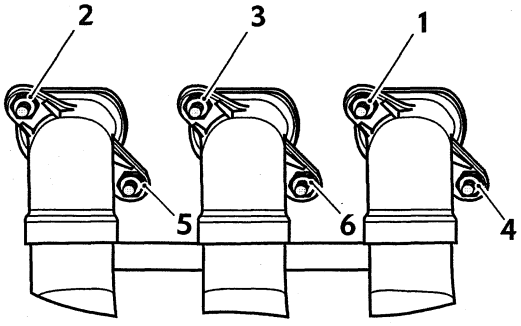
**Note:**

- **A smear of grease may be used to retain the seals in the cylinder head during assembly.**




**1. Cylinder head**
**2. Seals**

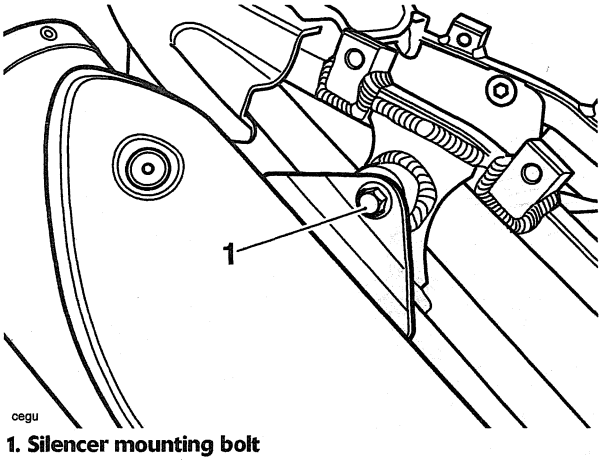
2. Locate the exhaust pipes and align the exhaust pipe flanges to the fixing points.
3. Assemble the rear mounting point fixings but do not tighten at this stage.
4. Tighten the exhaust pipe to cylinder head fixings in the following sequence:
   - Tighten the nuts numbered 1 to 6 to **23 Nm** in the sequence shown below, then tighten the nuts numbered 1 to 3 again to **23 Nm.**




**Exhaust Pipe Fixings Tightening Sequence**

5. Tighten the rear mounting point fixing to **15 Nm.**
6. Refit the radiator and refill the cooling system (see page *11-9*).
7. Refit the oil cooler (see page *8-14*).
8. Fit a new gasket to the exhaust header pipe.
9. Position and engage the silencer to the exhaust pipe.

10. Align the silencer mounting bracket to the frame and refit the bolt and a new nut. Tighten to **15Nm.**




cegu

**1. Silencer mounting bolt**

11. Align the clamp to the silencer to exhaust pipe joint and tighten to **15 Nm.**
12. Reconnect the battery, positive (red) lead first.
13. Refit the rear bodywork (see page *16-10*).
14. Refit the seat (see page *16-9*).

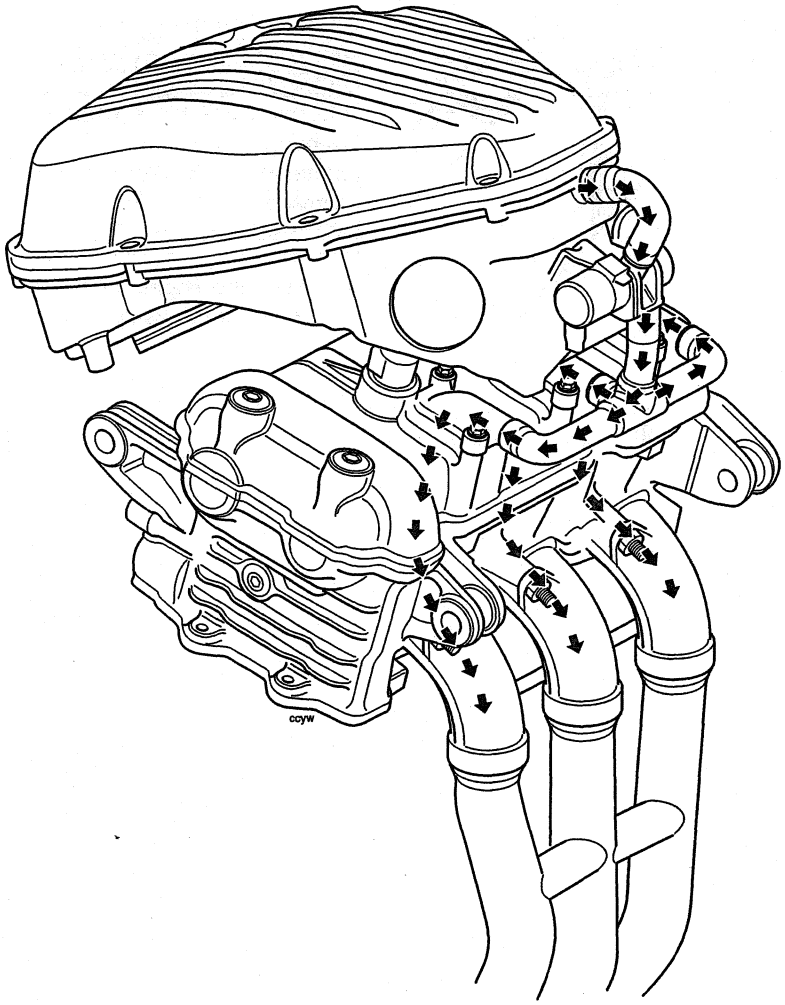
**⚠ Caution**

Do not install the exhaust system or run the engine without the exhaust heatshields fitted. Components protected by the exhaust heatshields may suffer severe damage or a fire if the motorcycle is operated without the heatshields being fitted.

15. Start the engine and check for exhaust gas leaks. Rectify if necessary.

## Secondary Air Injection

### System Purpose and Operation




The secondary air injection system is an aid to reducing levels of pollutants in the exhaust gases. It does this by introducing a small amount of air into each exhaust port as the exhaust valve opens. The introduced air helps promote further combustion of the fuel mixture in the exhaust system after it has left the combustion chamber.

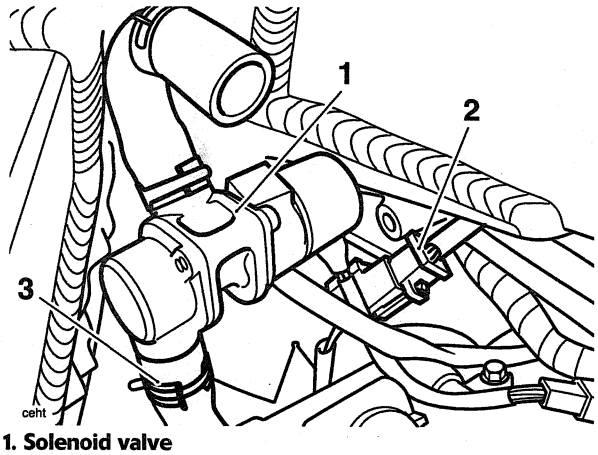
At certain specific engine speeds above idle (determined by the factory programming of the engine management system), the secondary air injection control valve is opened by the ECM and allows an air feed into the secondary air system where, each time a pair of exhaust valves open, the exhaust gases in the exhaust port create a depression which causes reed valves in the secondary air injection system to open. When open, the depression in the exhaust port draws air from the control valve, through the open reed valves, into the exhaust port. This air promotes secondary combustion of the exhaust gases in the ports and the header system.

At other engine speeds, the system is disabled by closing the control valve in the system. This allows an oxygen sensor to control air to fuel ratios. If air was fed to the exhaust system when the oxygen sensor was operational, the incoming air would cause inaccuracies in the readings sensed by the oxygen sensor (which requires access to 'raw' combustion gases) which would lead to rough running.

## Secondary Air Injection Solenoid Valve

### Removal

1. Remove the seat (see page *16-9*).
2. Disconnect the battery, negative (black) lead first.
3. Remove the fuel tank (see page *10-99*).
4. Remove the airbox (see page *10-104*).
5. Release the valve from the hose.
6. Disconnect the electrical connector and remove the valve.




**1. Solenoid valve**
**2. Electrical connector**
**3. Secondary air injection hose clip**

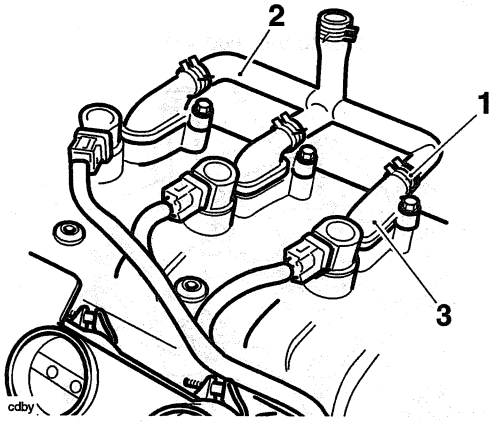
### Installation

1. Refit the valve to the hose.
2. Reconnect the electrical connector.
3. Refit the airbox (see page *10-106*
4. Refit the fuel tank (see page *10-100*).
5. Reconnect the battery, positive (red) lead first.
6. Refit the seat (see page *16-9*).

## Secondary Air Injection Reed Valves

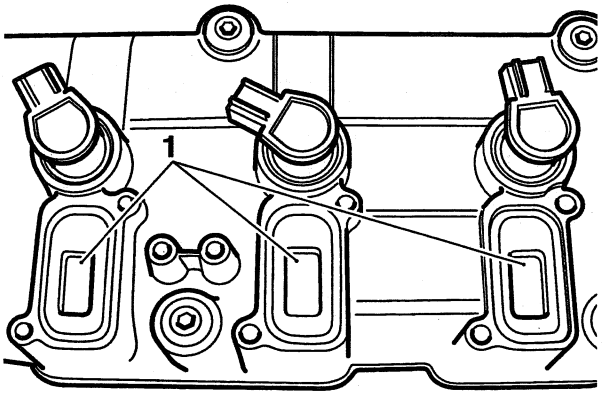
### Removal

1. Remove the seat (see page *16-9*).
2. Disconnect the battery, negative (black) lead first.
3. Remove the fuel tank (see page *10-99*).
4. Remove the airbox (see page *10-104*).
5. Remove the secondary air injection solenoid valve (see page *10-123*).
6. Detach the secondary air injection feed hoses from the reed valves on the cam cover.




**1. Spring-close clip**
**2. Secondary air injection hose**
**3. Reed valve assembly**

7. Release the bolts securing the valve covers to the cam cover.
8. Ease the valve covers from the valves.
9. Detach the valves from the cam cover.



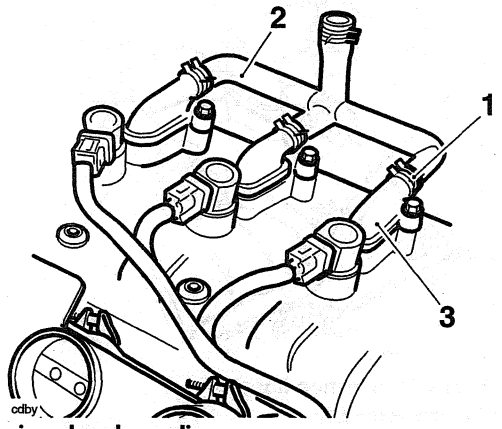

**1. Valves**

## Inspection

1. Check for cracks, bending or other damage to the valve flaps. Replace as necessary.
2. Check for damage to the seal areas. Replace as necessary.
3. Check the valve body to cylinder head seal for damage.

## Installation

1. Fit the reed valves to the cam cover.
2. Refit the valve covers and tighten the fixings to **9 Nm.**
3. Refit the air hoses to the reed valves.




**1. Spring-close hose clip**
**2. Secondary air injection hose**
**3. Reed valve assembly**

4. Refit the secondary air injection solenoid valve (see page *10-123*).
5. Refit the airbox (see page *10-106*).
6. Refit the fuel tank (see page *10-100*).
7. Reconnect the battery, positive (red) lead first
8. Refit the seat (see page *16-9*).

## Evaporative Emissions Control System

### California Models Only

All California models are fitted with a system to control the evaporation of fuel vapour to the atmosphere.

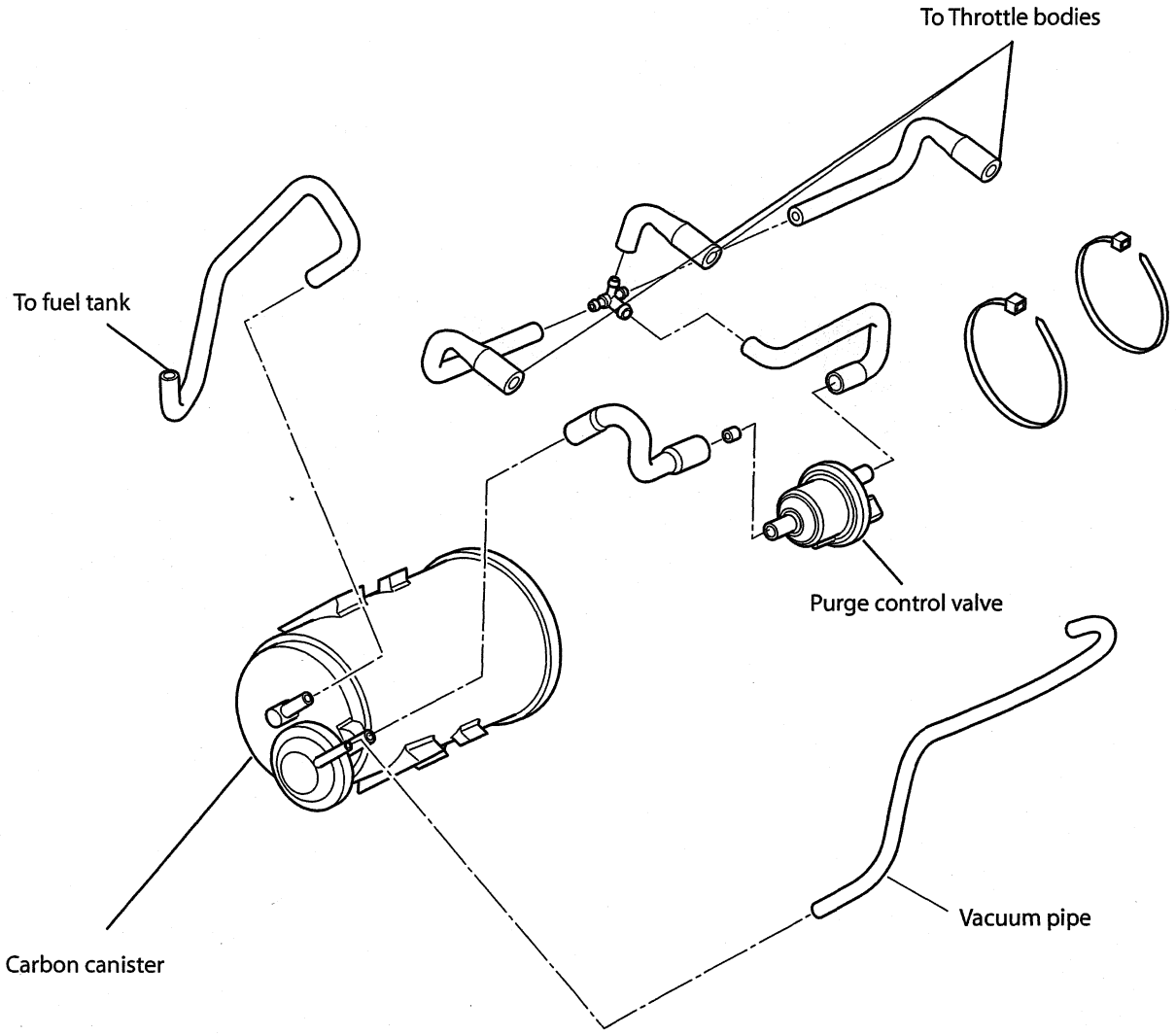
A carbon canister absorbs vapour while the engine is not running. When the engine is started, the vapour is returned to the engine and burnt.

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

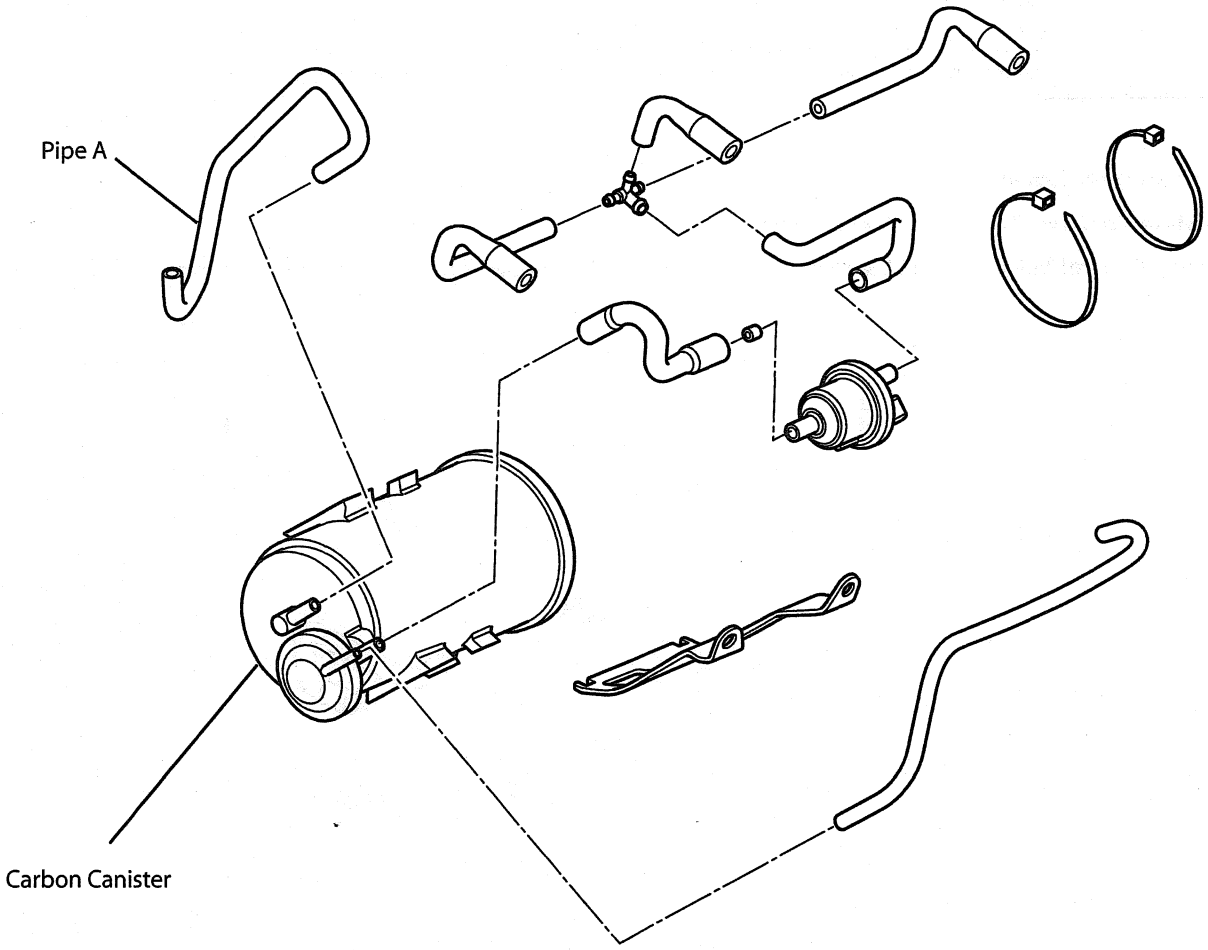
**Purge Control Valve** - Behind the carbon canister, mounted to the same bracket (electronically controlled by the ECM)



### 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 to a carbon filled canister which stores the vapour.

Once in the canister, vapour cannot return to the fuel tank because of a one-way valve in the canister.

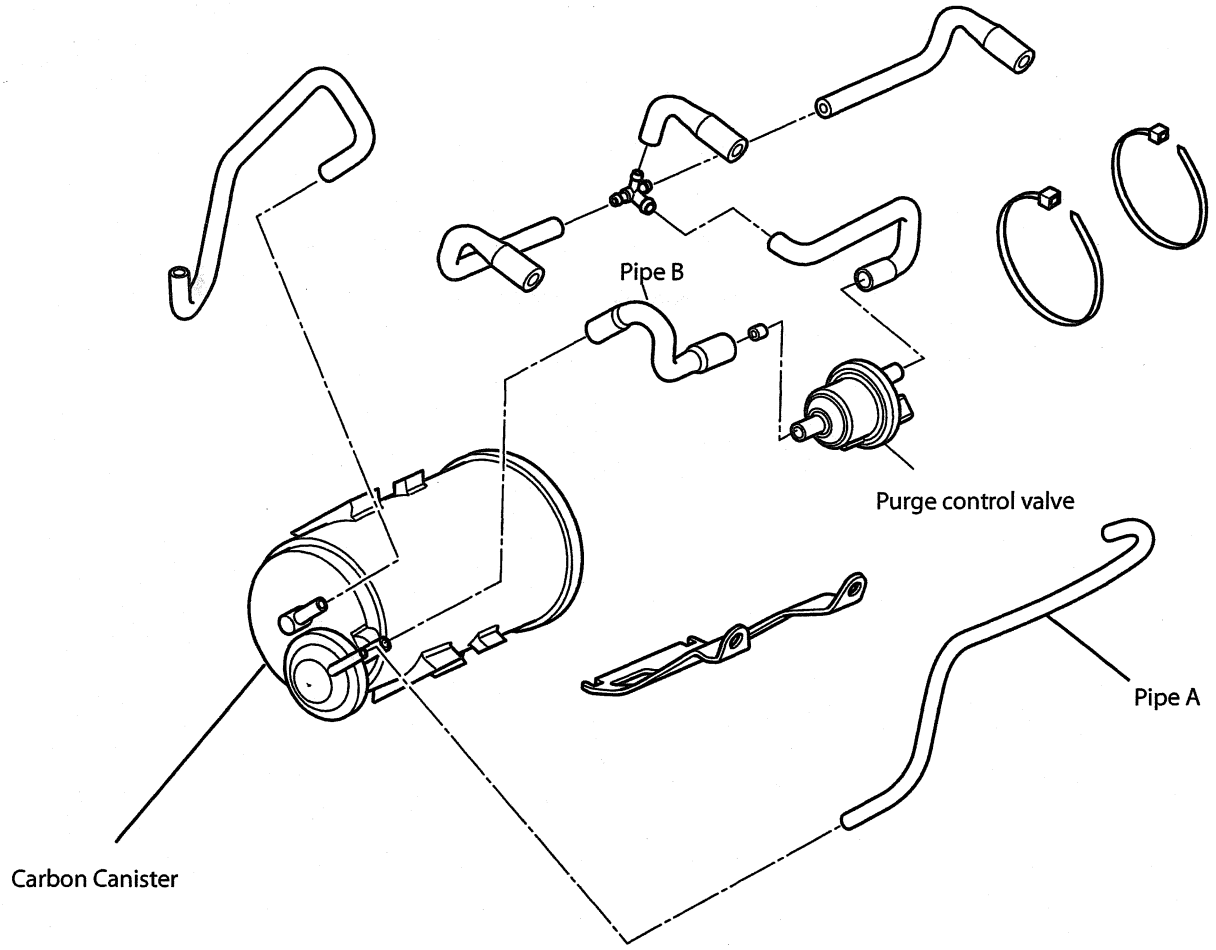


### Evaporative Control System - Engine Running

When the engine is started, a vacuum is applied via pipe A to a vent valve on the canister, causing it to open. Simultaneously, vacuum is applied along pipe B, via the purge control valve to the canister vent port.

Because the vent valve has been opened, the vacuum applied at point B begins to draw stored vapour from the carbon filled area of the canister via the vent port and returns it to the throttle bodies for burning in the engine.

In order to control the speed at which vapour is purged from the canister, the engine management system regularly shuttles the purge control valve between open and closed positions.



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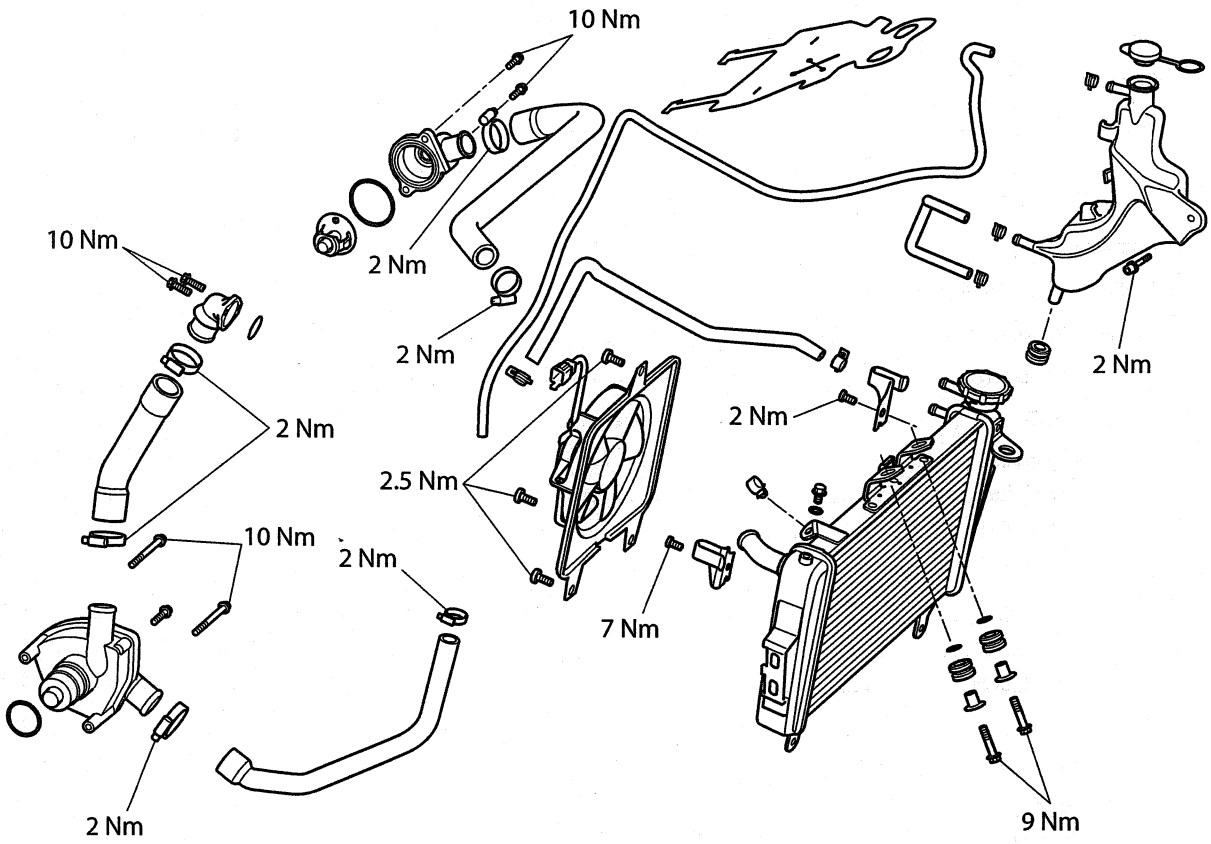
# 11 Cooling

## Table of 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.

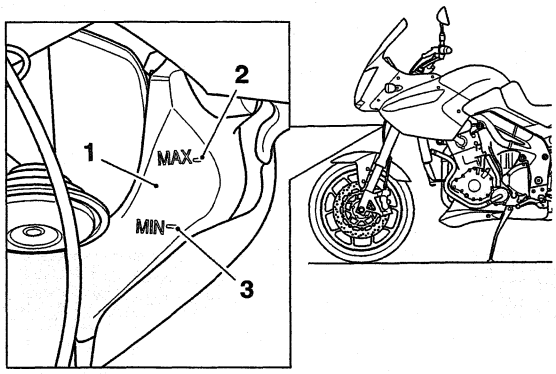
If hard water is used in the system, it causes scale accumulation in the water passages, and considerably reduces the efficiency of the cooling system. Reduced cooling system efficiency may cause the engine to overheat and suffer severe damage.

## Coolant Level 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. Position the motorcycle on level ground and in an upright position.
2. Check the coolant level in the expansion tank by looking up, through the centre opening of the front fairing. The coolant level should be between the 'MAX and 'MIN.' marks.

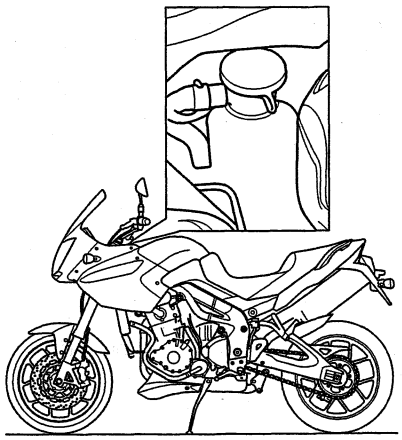



**1. Expansion tank**
**2. 'Max' mark**
**3. 'Min' mark**

3. If the level of coolant is low, coolant must be added as follows:

**Note:**

- **It is not necessary to remove the left hand cockpit infill panel in order to remove the coolant expansion tank cap.**



cecv

**Coolant Expansion Tank Cap**

4. Remove the cap from the expansion tank, located below the left hand cockpit infill panel, and add coolant mixture through the filler opening until the level reaches the 'MAX' mark.

**Caution**

If the coolant level is found to be low, or if coolant has to be added regularly, inspect the cooling system for coolant leaks. If necessary, pressure test the system to locate the source of the leak and rectify as necessary. Loss of coolant may cause the engine to overheat and suffer severe damage.

5. Refit the cap.

## Coolant Replacement

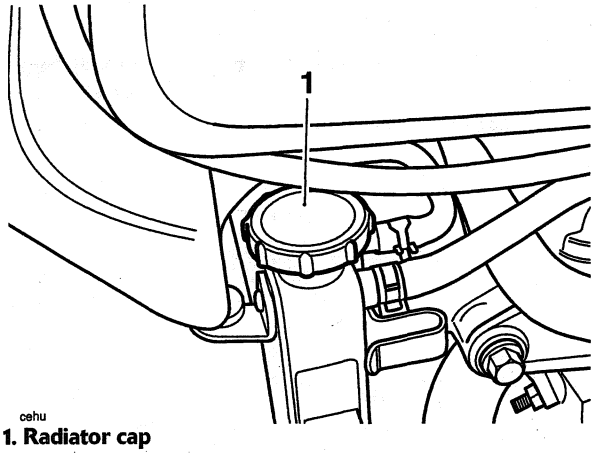
### Drainage

1. Remove the seat (see page *16-9*).
2. Disconnect the battery, negative (black) lead first.
3. Remove side fairings (see page *16-13*).

**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.

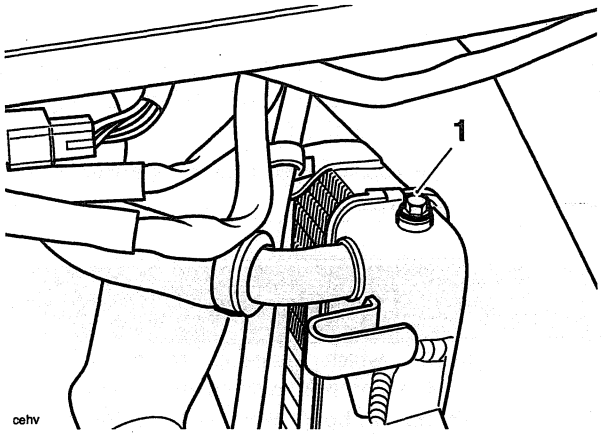
4. Remove the coolant pressure cap on the radiator.




cehu

**1. Radiator cap**

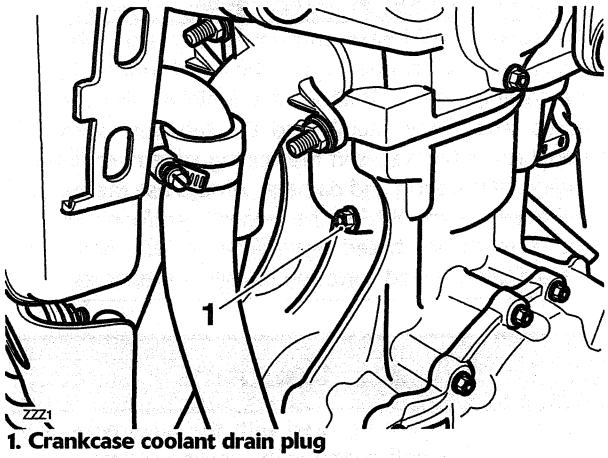
5. Position a container to collect the displaced coolant.
6. Release the bleed screw on the right hand side of the radiator.




cehv

**1. Bleed screw**

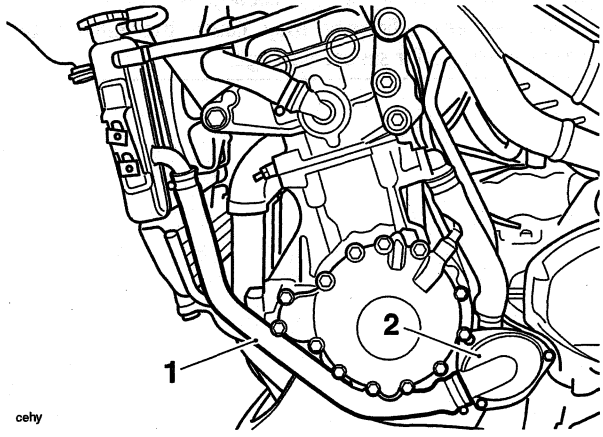
7. Release the crankcase coolant drain plug, located behind the exhaust header for number 1 cylinder.




ZZZ1

**1. Crankcase coolant drain plug**

8. To ensure full drain-out of the system, release the bottom hose from the water pump.




cehy

**1. Bottom hose**
**2. Water pump**

### Filling

1. Reconnect the bottom hose and tighten the clip.
2. Incorporating a new sealing washer, refit the crankcase coolant drain plug and tighten to **13 Nm.**
3. Slowly add coolant mixture to the system, through the filler opening in the radiator, 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.
4. 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 into the bleed screw side of the radiator.

**Note:**

- **A hand operated vacuum pump or similar should be used to syphon the coolant through the system.**

5. If necessary, top up the system through the filler and refit the coolant pressure cap.
6. Reconnect the battery, positive (red) lead first.
7. 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.

**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.

8. Stop the engine and top up the coolant level in the radiator as necessary.
9. Fit the coolant pressure cap.
10. Check the expansion tank level and top up if necessary.
11. Refit the seat (see page *16-9*).
12. Refit both side fairings (see page *16-13*).

## 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. To prevent injury, keep hands and clothing away from the fan blades at all times.

**Caution**

Using high-pressure water, such 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.

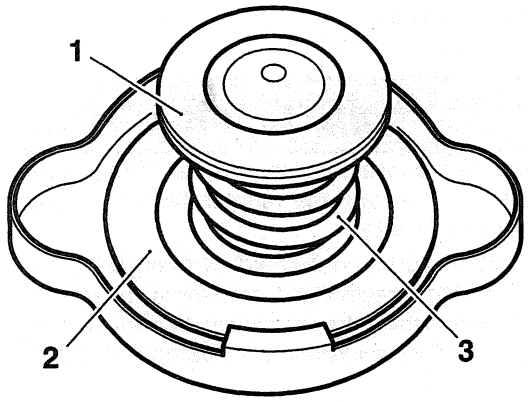
## Coolant Pressure Cap

### 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

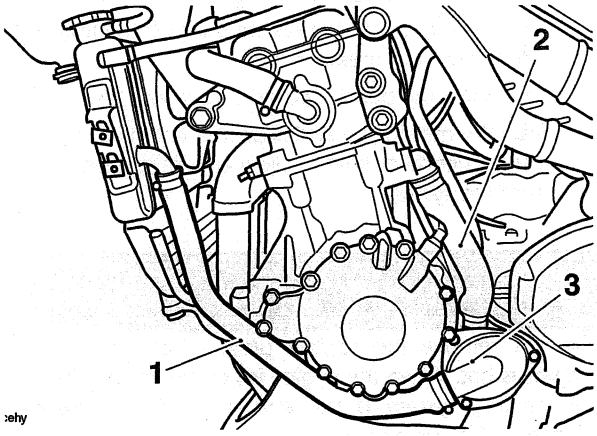
### Removal

1. Remove the seat.
2. Disconnect the battery, negative (black) lead first.
3. Drain the coolant (see page *11-4*).

**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.




**1. Bottom hose**
**2. Bypass hose**
**3. Water pump**

5. Release the bolts securing the water pump to the crankcase.
6. Withdraw the water pump.

### Inspection

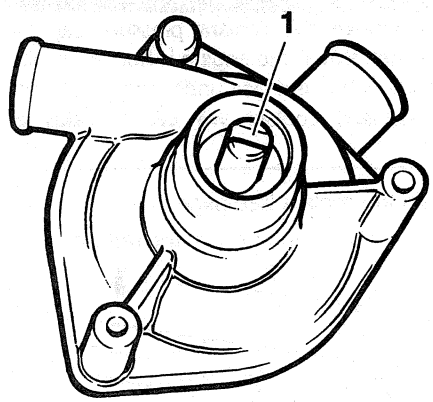
1. Check the water pump shaft and shaft bearings for side and end float. Renew if necessary
2. Check for corrosion and scale build-up around the impeller and in the pump body. Renew if necessary.

### 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.**




gake

**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. Refill the cooling system (see page *11-5*).

## Thermostat

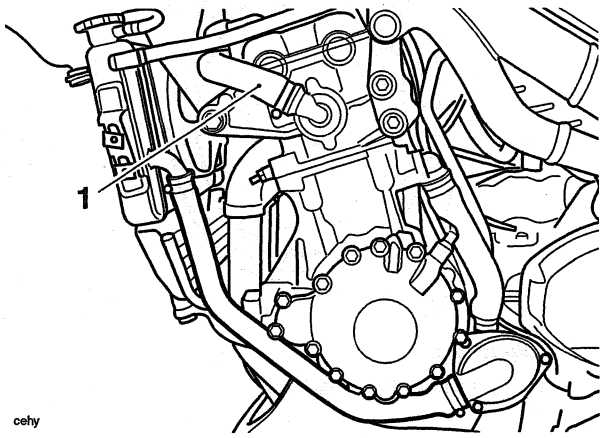
### Removal

1. Remove the seat (see page *16-9*).
2. Disconnect the battery, negative (black) lead first.
3. Drain the coolant (see page *11-4*).

**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 the top hose from the thermostat elbow.




cehy

**1. Top hose**

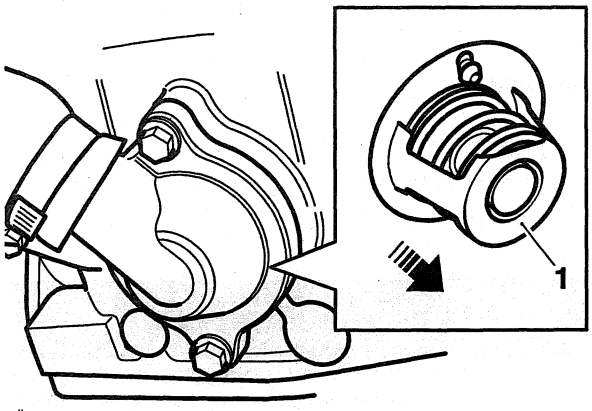
5. Release the fixings securing the thermostat elbow to the cylinder head.
6. Remove the thermostat housing. Discard the O-ring.
7. Remove the thermostat from the cylinder head.

### 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. The thermostat should start to open at 88°C +/- 5°C.
3. If the temperature at which thermostat opening takes place is incorrect, replace the thermostat.

### Installation

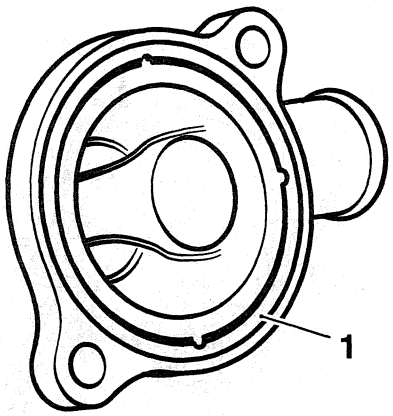
1. Locate the thermostat into the cylinder head.




cdbv

**1. Thermostat (face shown to be inserted into the head)**

2. Fit a new O-ring to the thermostat elbow.




**1. O-ring/groove**

3. Tighten the bolts to **12 Nm.**
4. Reconnect the top hose clips.
5. Reconnect the battery, positive (red) lead first.
6. Remove the seat (see page *16-9*).
7. Refill the cooling system (see page *11-5*).

## Radiator

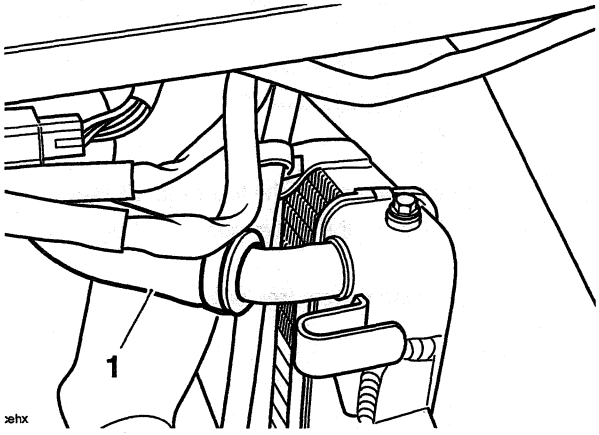
### Removal

1. Remove the seat (see page *16-9*).
2. Disconnect the battery, negative (black) lead first.

**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.

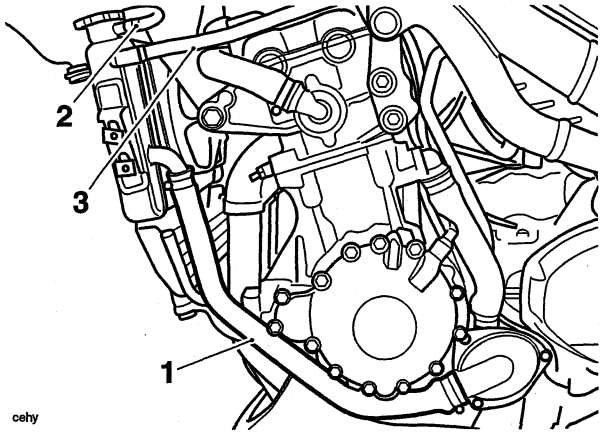
3. Drain the coolant (see page *11-4*).
4. Disconnect the top hose at the radiator.




cehx

**1. Top hose**

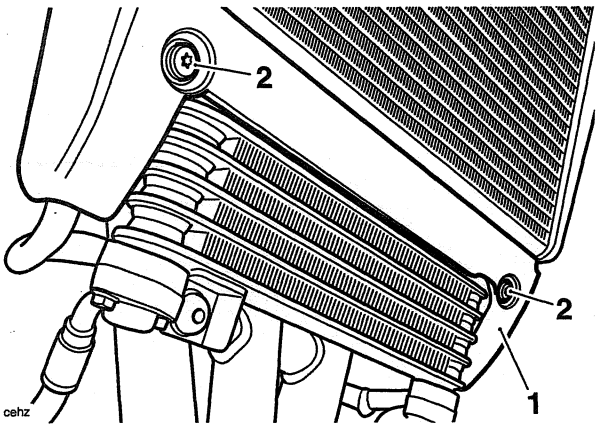
5. Disconnect the bottom hose, expansion tank and bypass hose from the radiator.




cehy

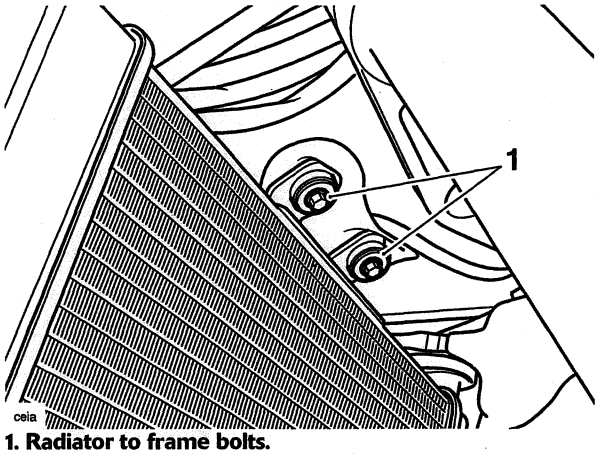
**1. Bottom hose**
**2. Expansion tank hose**
**3. Bypass hose**

6. Release the oil cooler fixings from the radiator lower mounting. Collect the oil cooler infill panel.




**1. Radiator lower fixings**
**2. Oil cooler infill panel**

7. Disconnect the cooling fan multiplug located above the cam cover, which is accessible without removing the fuel tank, from the right hand side of the motorcycle.
8. Release the bolts securing the radiator to the frame.




**1. Radiator to frame bolts.**

9. Remove the radiator.

## 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.

4. Check that the fan spins freely and without tight spots.
5. Check the fan blades for signs of heat distortion.

## Installation

1. Align the radiator to the frame and fit the upper mounting bolts. Tighten the bolts to **9 Nm.**
2. Reconnect the cooling fan.
3. Align the oil cooler and infill panel to the radiator. Fit the lower mounting bolts and tighten to **9 Nm.**
4. Reconnect the top, bypass, expansion tank and bottom hoses to the radiator. Tighten the hose clips.
5. Refill the cooling system (see page *11-5*).
6. Reconnect the battery, positive (red) lead first.
7. Remove the seat (see page *16-9*).
8. Fill the cooling system (see page *11-5*).

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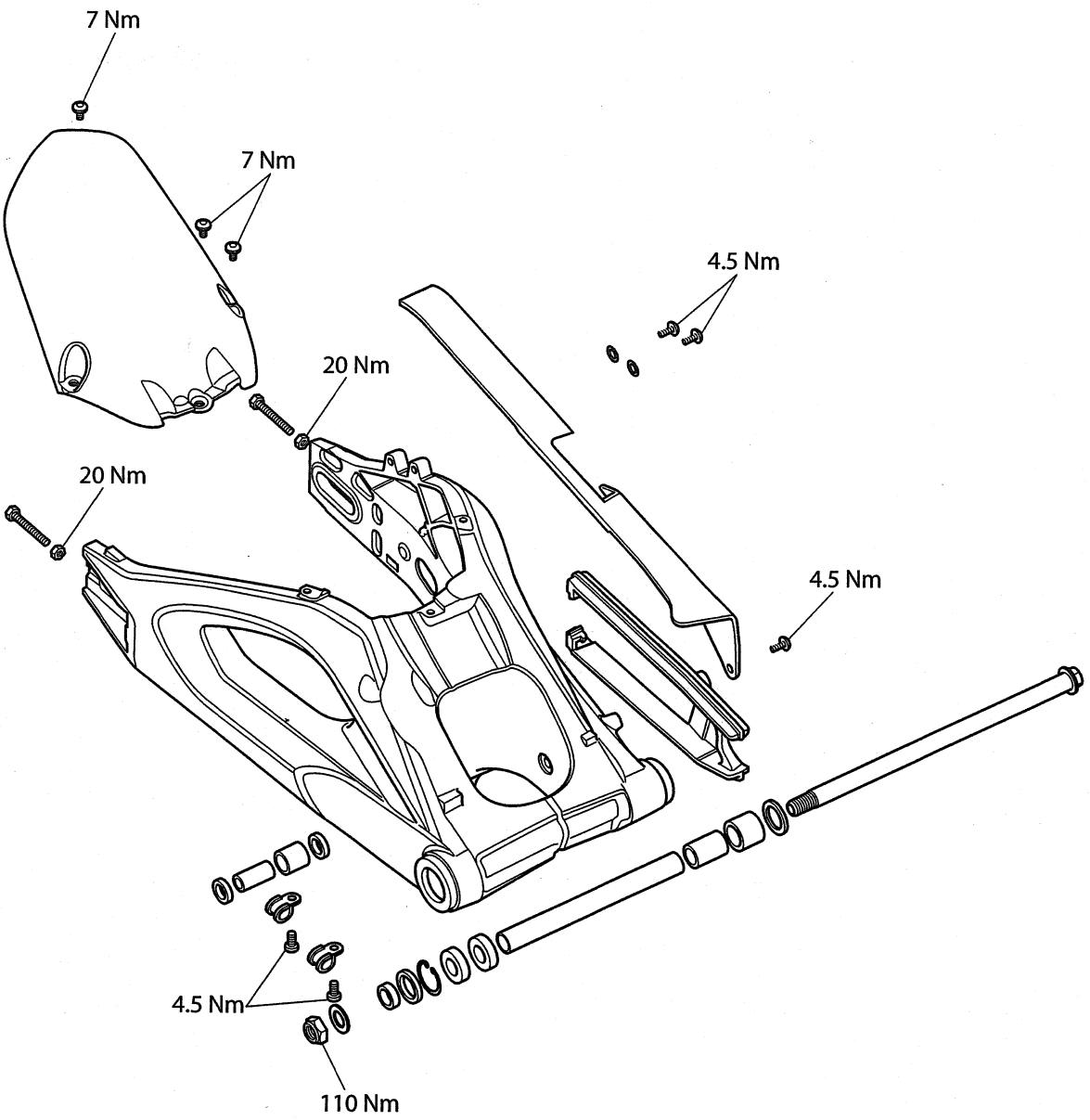
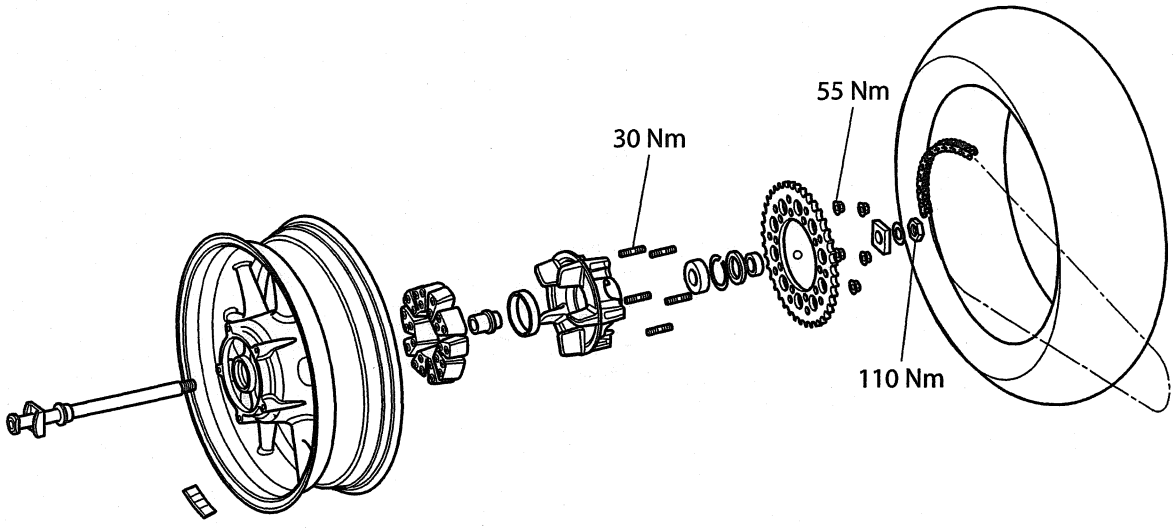
# 12 Rear Suspension

## Table of Contents

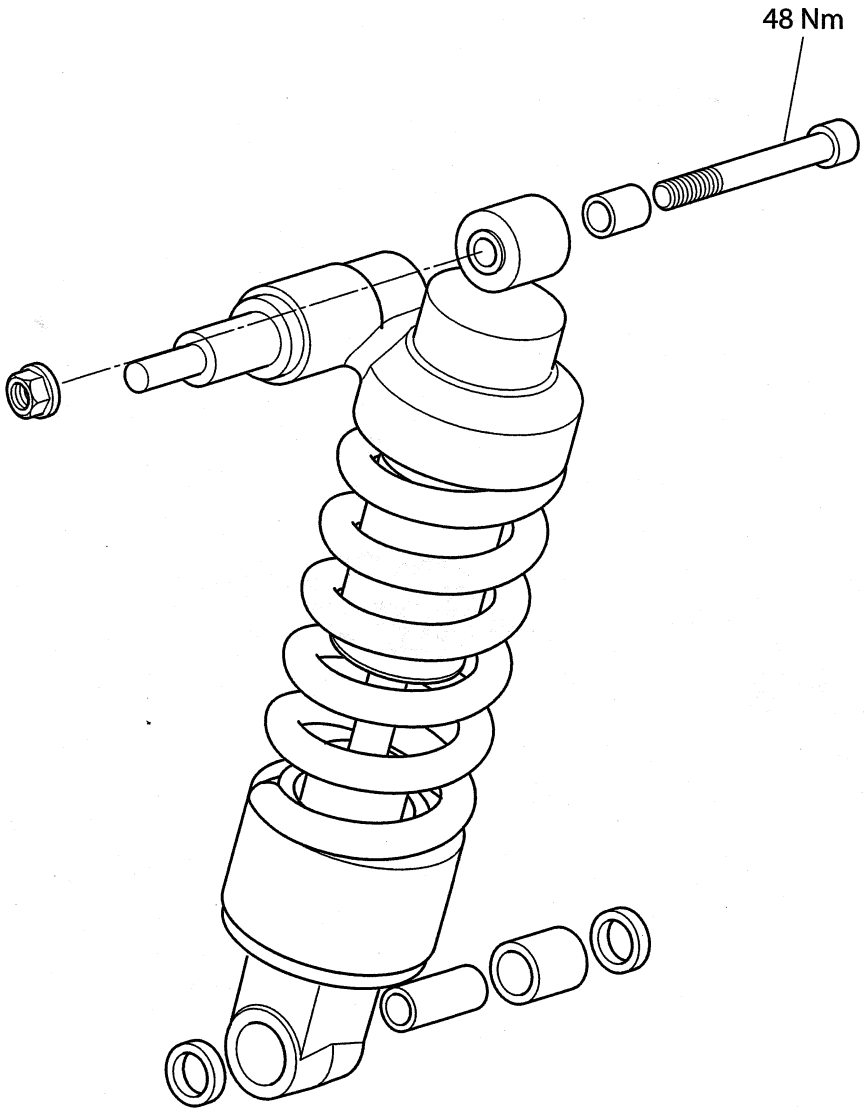
## Exploded View - Swinging Arm



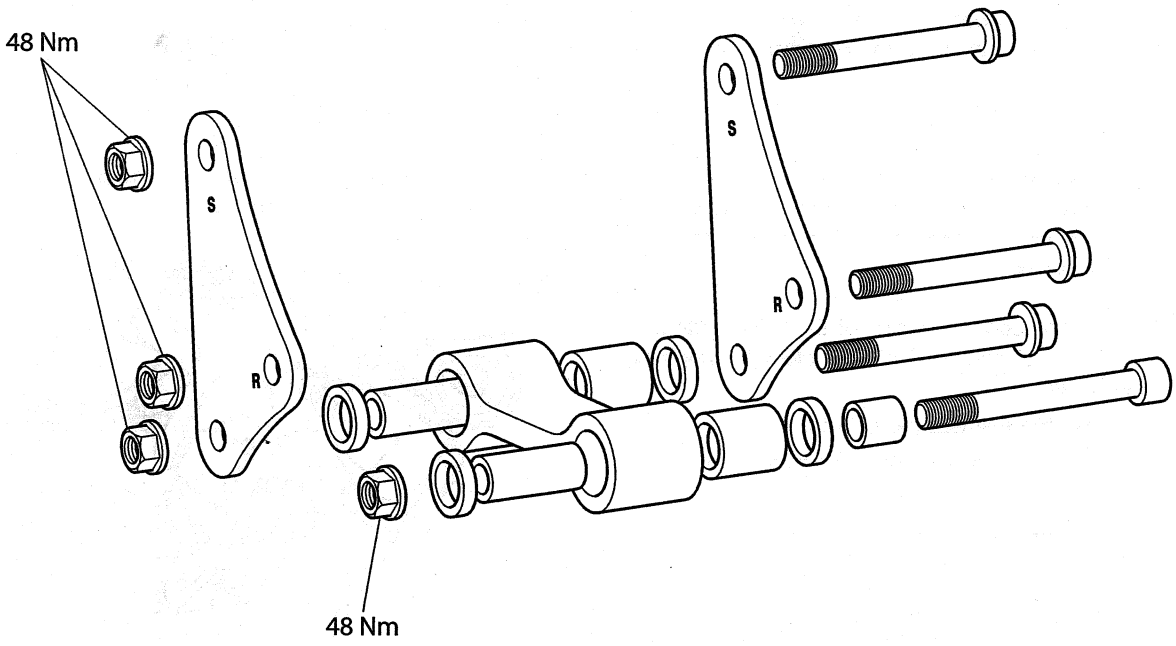
## Exploded View - Rear Hub and Wheel



## Exploded View - Rear Suspension Unit



## Exploded View - Drop/Drag Link



## Rear Suspension Unit

### 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.

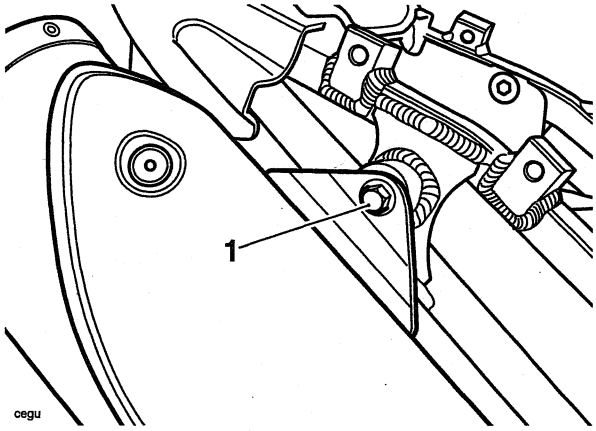
**Warning**

Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

**Note:**

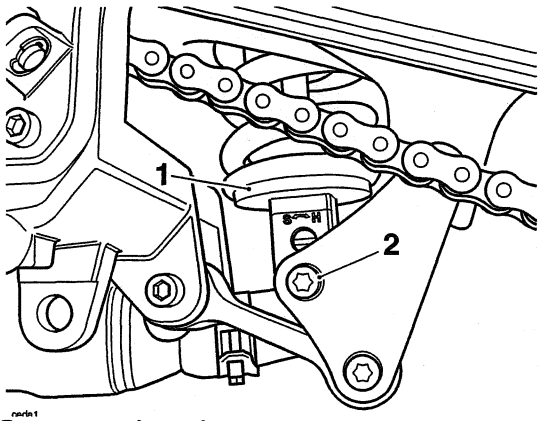
- **A stand that supports the rear wheel or swinging arm will not support the motorcycle when the suspension linkage is removed.**

1. Raise and support the rear of the motorcycle under the frame or engine. Position a block to support the rear wheel.
2. Remove the seat (see page *16-9*).
3. Disconnect the battery, negative (black) lead first.
4. Remove the battery (see page *17-7*).
5. Remove the rear panel (see page *16-10*).
6. Support the silencer and release the bolt and nut securing the silencer mounting bracket to the rear subframe. Discard the nut. It is **NOT** necessary to remove the silencer completely.



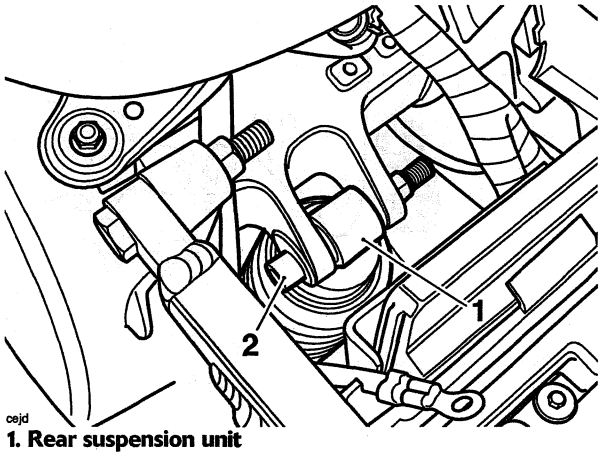

**1. Silencer mounting bracket/fixing**

7. Detach the starter solenoid from its two retaining blades on the rear mudguard. It is not necessary to remove the solenoid completely or to disconnect the starter cables.
8. Remove the nut and bolt securing the rear suspension unit lower mounting to the drop link. Discard the nut.




**1. Rear suspension unit**
**2. Rear suspension unit lower bolt**

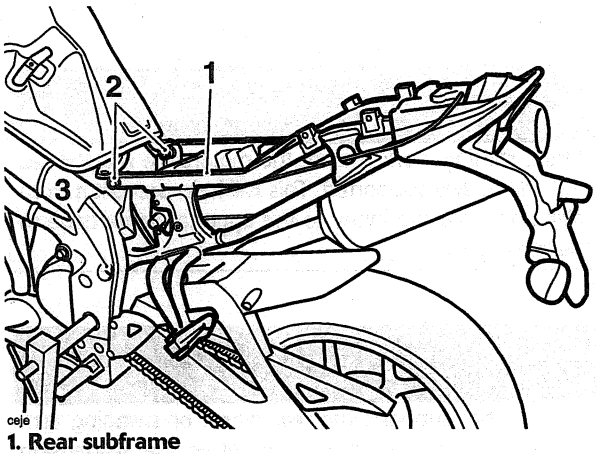
9. Remove the rear suspension unit upper mounting nut and bolt. Discard the nut.




**1. Rear suspension unit**
**2. Rear suspension unit upper bolt**

10. Slacken the two lower rear subframe bolts.

11. Remove the two upper rear subframe bolts and allow the rear subframe to pivot downwards on the lower bolts.




ceje

**1. Rear subframe**
**2. Upper fixings**
**3. Lower fixings (left hand shown)**

12. Withdraw the rear suspension unit upwards between the frame and the rear subframe.

## Inspection

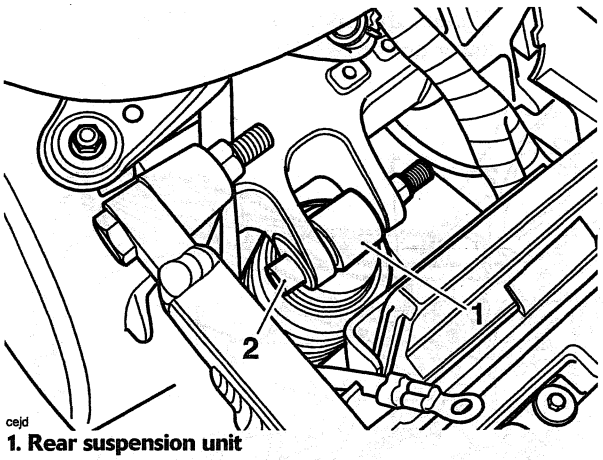
1. Clean all components and inspect for damage and wear to:
   - **rear suspension unit upper and lower mountings,**
   - **lower mounting sleeve.**
2. Renew parts as necessary.

## Installation

1. Locate the rear suspension unit and loosely fit the upper mounting bolt (from the left) and a new nut.

**Note:**

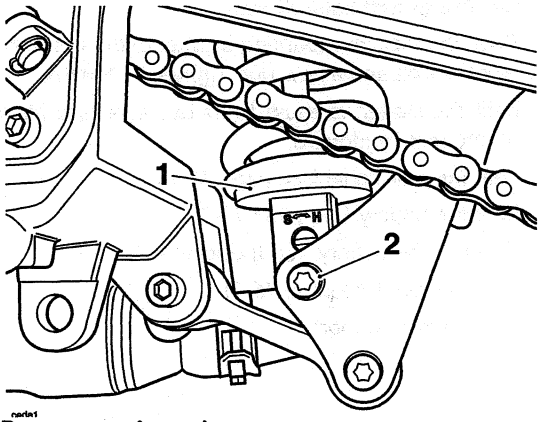
- **The unit must be fitted such that the preload adjuster faces to the right hand side of the motorcycle.**




cejd

**1. Rear suspension unit**
**2. Rear suspension unit lower bolt**

2. Align the rear suspension unit to the drop link. Loosely fit the bolt (from the left) and a new nut.

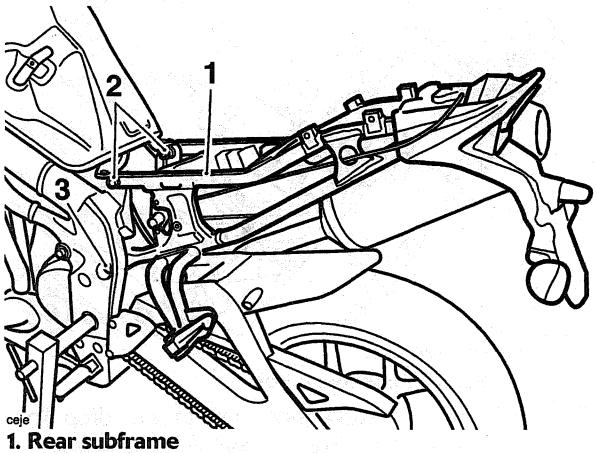



cedd1

**1. Rear suspension unit**
**2. Rear suspension unit lower bolt**

3. Tighten the rear suspension unit upper mounting to **48 Nm.**

4. Tighten the rear suspension unit lower mounting to **48 Nm.**
5. Refit the rear subframe as follows:
   - **Align the subframe to the main frame and refit the upper bolts.**
   - **Remove and discard the nuts from the lower bolts and fit new nuts to both the upper and lower bolts.**
   - **Tighten the upper bolts to 60 Nm, and the lower bolts to 40 Nm.**




**1. Rear subframe**
**2. Upper fixings**
**3. Lower fixings (left hand shown)**

6. Align the silencer mounting bracket to the frame and refit the bolt and a new nut. Tighten to **15Nm.**
7. Refit the starter solenoid to its two retaining blades on the rear mudguard.
8. Refit the rear panel (see page *16-10*).
9. Refit the battery (see page *17-7*).
10. Connect the battery, red (positive) lead first.
11. Refit the seat (see page *16-9*).
12. Remove the support.

## Drag Link

### Removal

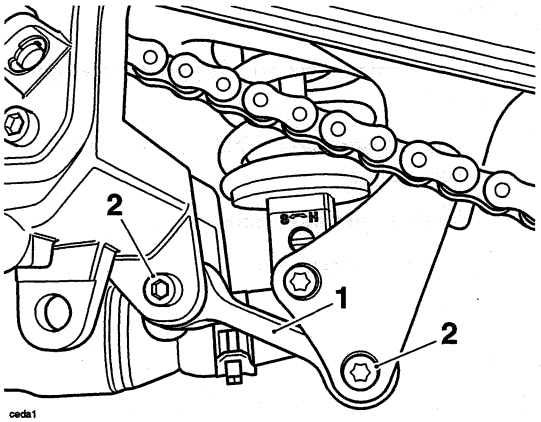
**Warning**

Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

**Warning**

A stand that supports the rear wheel or swinging arm will not support the motorcycle when the suspension linkage is removed.

1. Raise and support the rear of the motorcycle under the frame or engine. Position a block to support the rear wheel.

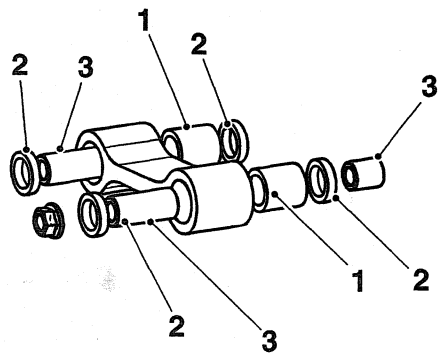



**1. Drag link**
**2. Drag link bolts**

2. Remove the nut (discard the nut) and bolt securing the drag link to the drop link.
3. Remove the bolt and nut (discard the nut) securing the drag link to the frame.
4. Detach the drag link from the frame and drop link.

### Inspection

1. Clean all components and inspect for damage / wear to:
   - drag link bearings, sleeve and seals
   - fixing bolts
2. Renew as necessary.




**1. Drag link bearing**
**2. Drag link seals**
**3. Drag link sleeve**

### Installation

1. Pack the drag link bearings with grease to NLGI 2 specification (we recommend Mobil HP222).
2. Fit the drag link sleeves and seals.
3. Position the drag link to the frame and drop link and refit the bolts. Fit new nuts and tighten both bolts to **48 Nm**.
4. Remove the support block from the rear wheel and lower the motorcycle to the ground.

## Drop Link Plates

### Removal

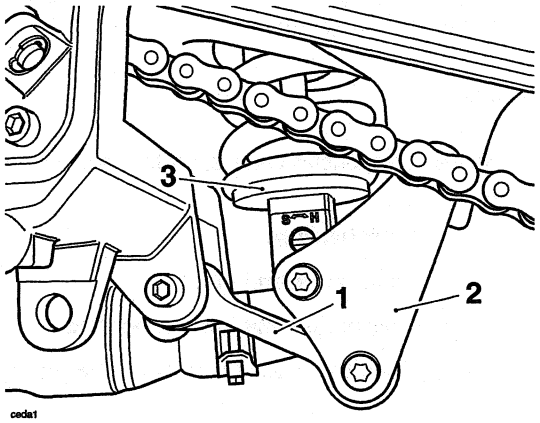
**Warning**

Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

**Warning**

A stand that supports the rear wheel or swinging arm will not support the motorcycle when the suspension linkage is removed.

1. Raise and support the rear of the motorcycle beneath the frame or engine. Position a block to support the rear wheel.

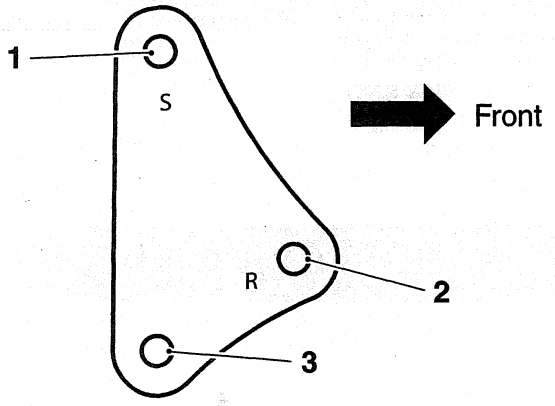



**1. Drag link**
**2. Drop link plate (left hand shown)**
**3. Rear suspension unit**

2. Remove the nut and bolt securing the drag link to the drop link plates. Discard the nut.
3. Detach the drag link from the drop link plates.
4. Remove the nut and bolt securing the rear suspension unit to the drop link. Discard the nut.
5. Ease the suspension unit and spacer forward to clear the drop link plates.
6. Remove the nut and bolt securing the drop link plates to the swinging arm. Discard the nut.

**Note:**

- **Both drop link plates are marked as shown below. Both plates are identical, and must be fitted with the bolt hole markings facing the right hand side of the motorcycle.**




**1. Swinging arm bolt position**
**2. Rear suspension bolt position**
**3. Drag link bolt position**

7. Noting their orientation, remove the drop link plates from the swinging arm.

## Inspection

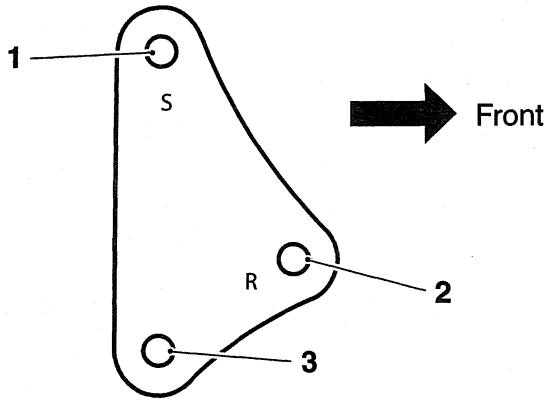
1. Clean all components and inspect for damage / wear to:
   - drag link bearings,
   - drag link sleeve and bolt,
   - rear suspension unit lower mounting,
   - drop link bearings and seals (in the swinging arm).
2. Renew as necessary.
3. Check the drop link upper bearings for wear.

## Installation

1. Remove the drag link sleeve and pack the bearing with fresh grease. Refit the sleeve.
2. Remove the rear suspension lower sleeve and pack the bearing with fresh grease. Refit the sleeve.
3. Remove the swinging arm drop link sleeve and pack the bearing with fresh grease. Refit the sleeve.

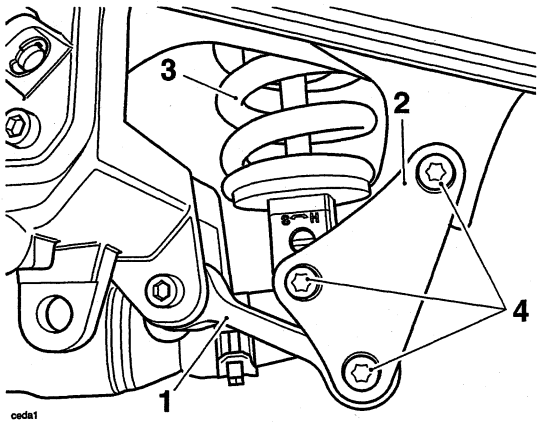
**Note:**

- **The drop link plates are marked as shown below. Both plates are identical, and must be fitted with the bolt hole markings facing the right hand side of the motorcycle.**




**1. Swinging arm bolt position (marked 'S')**
**2. Rear suspension bolt position (marked 'R')**
**3. Drag link bolt position**

4. Locate the drop link plates and, from the left hand side, loosely fit the bolts and new nuts.




**1. Drag link (drive chain not shown for clarity)**
**2. Drop link plate**
**3. Rear suspension unit**
**4. Fixings**

5. Tighten the three drop link fixings to **48 Nm**.
6. Remove the support block from the rear wheel and lower the motorcycle to the ground.

## Drive Chain

For safety and to prevent excessive wear, the drive chain must be checked, adjusted and lubricated in accordance with scheduled maintenance requirements. Checking, adjustment and lubrication must be carried out more frequently for extreme conditions such as salty or heavily gritted roads.

If the chain is badly worn or incorrectly adjusted (either too loose or too tight) the chain could jump off the sprockets or break.

**Warning**

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 an accident. Never neglect chain maintenance.

**Note:**

- **Lubrication of the drive chain should ideally be carried out with the motorcycle set up so that the rear suspension hangs free.**
- **The chain must be adjusted with the motorcycle in an upright position, resting on its wheels, and with no additional weight it.**

### Chain Lubrication

Lubrication is necessary every 200 miles (300 km) and also after riding in wet weather, on wet roads, or any time that the chain appears dry.

Use the special chain lubricant as recommended in the specification section.

Correct application is critical for chain lubrication. Apply the lubricant for one full chain revolution only, then leave for eight hours before riding. This allows the lubricant's solvent (used to thin the oil) to evaporate and the oil to 'soak' into all parts of the chain. If the lubricant is applied and the motorcycle is ridden shortly afterwards, the lubricant is unlikely to reach all parts and the majority will be flung off and wasted. Applying excessive amounts is not helpful under any circumstances.

It should be noted that the lubricant is applied to the chain to lubricate its action across the sprockets. In an O-ring chain, external lubrication does not penetrate to the bushes and rollers as the O-ring seals prevents this from happening.

**Caution**

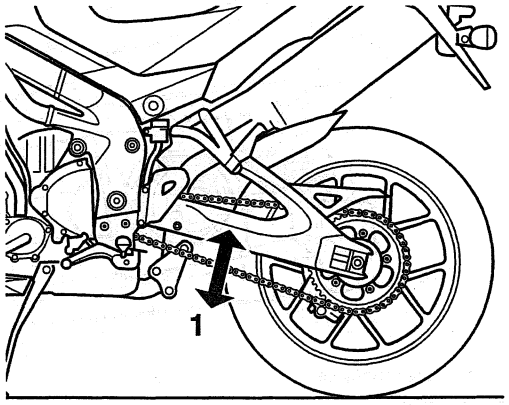
Do not use a power 'jet' wash to clean the chain as this may cause damage to the chain components.

## Chain Adjustment

**Note:**

- **The correct adjustment setting is 35-40 mm.**

### Chain Free-movement Inspection




cecw

**1. Maximum movement position**

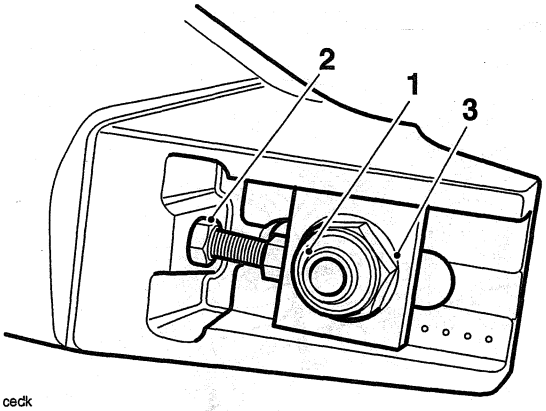
**Warning**

Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

1. Place the motorcycle on a level surface and hold it in an upright position with no weight on it.
2. Rotate the rear wheel by pushing the motorcycle to find the position where the chain has least slack. Measure the chains 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.

### Chain Free-movement adjustment

1. Loosen the wheel spindle nut.
2. Release the locknuts on both the left hand and right hand chain adjuster bolts.




ceck

**1. Adjuster bolt locknut**
**2. Adjuster bolt**
**3. Rear wheel spindle nut**

3. Ensure the wheel is in firm contact with the adjusters.
4. Moving both adjusters by an equal amount, turn the adjuster bolts clockwise (viewed from the rear of the motorcycle) to increase chain free movement and counter clockwise to reduce chain free movement.

**Note:**

- **Check for equal adjustment on both sides using the graduation marks on the swinging arm.**

5. Counter-hold the adjuster bolts and tighten both adjuster locknuts to **20 Nm,** and the rear wheel spindle nut to **110 Nm.**
6. Repeat the chain adjustment check. Re-adjust if necessary.

**Warning**

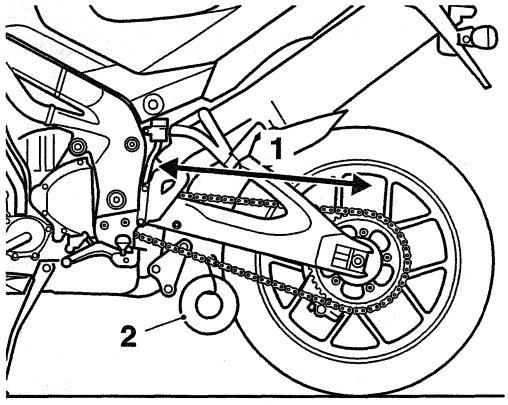
Operation of the motorcycle with insecure adjuster locknuts or a loose wheel spindle may result in impaired stability and handling of the motorcycle. This impaired stability and handling may lead to loss of motorcycle control and an accident.

7. Check the rear brake effectiveness. Rectify if necessary.

**Warning**

It is dangerous to operate the motorcycle with defective brakes; you must have your authorised Triumph dealer take remedial action before you attempt to ride the motorcycle again. Failure to take remedial action may reduce braking efficiency leading to loss of motorcycle control and an accident.

### Chain Wear Inspection




cecx

**1. Measurement across 20 links**
**2. 10-20kg Weight**

**Warning**

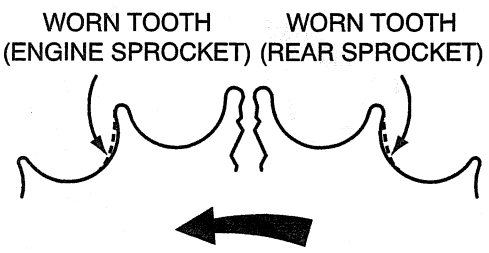
Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

1. Remove the chain guard 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.
4. If the length exceeds the service limit of 320 mm (12.59 in), the chain must be replaced.

**Warning**

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 control and an accident.

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.




ccol

**Note:**

- **Sprocket wear is exaggerated for illustration purposes.**

**Warning**

The use of non-approved chains may result in a broken chain or may cause the chain to jump off the sprockets.

Use a genuine Triumph supplied chain as specified in the Triumph Parts Catalogue.

Never neglect chain maintenance and always have chains installed by an authorised Triumph dealer.

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 guard, tightening the fixings to **4.5 Nm**.

## Swinging Arm/Drive Chain

### Removal

**Warning**

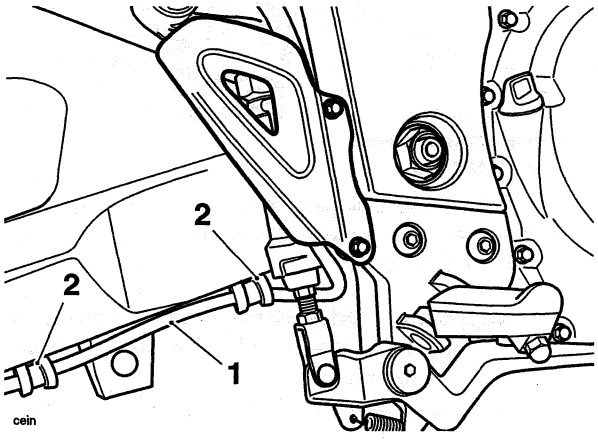
Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

1. Remove the seat (see page *16-9*).
2. Disconnect the battery, negative (black) lead first.
3. Remove the side panels (see page *16-10*).
4. Remove the exhaust silencer (see page *10-119*).
5. Remove the rear wheel (see page *15-9*).
6. Support the swinging arm and remove the rear suspension unit (see page *12-6*).
7. Remove the output sprocket cover.
8. Detach the chain from the output sprocket.

**Warning**

Do not allow the caliper to hang on the brake hose as this may damage the hose and could lead to an accident.

9. Release the brake hose clips from the swinging arm and tie the rear brake caliper to one side.

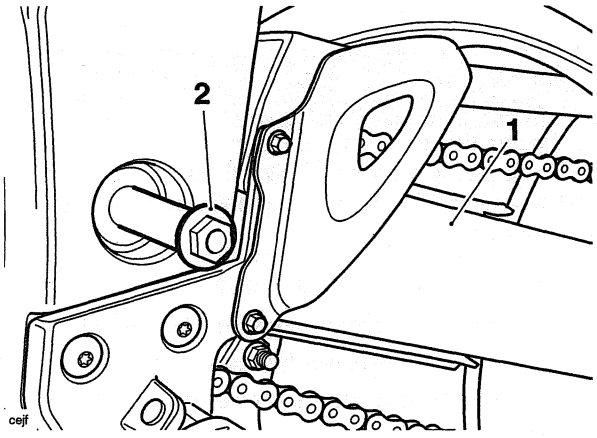



cein

**1. Rear brake hose**
**2. Rear brake hose clips**

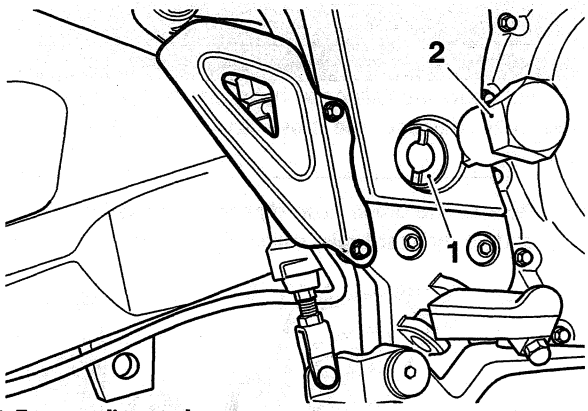
10. Remove and discard the swinging arm spindle nut.

11. Partially withdraw the swinging arm spindle from the left hand side, to allow access to the frame adjuster sleeve located on the right hand side of the frame.




**1. Swinging arm**
**2. Spindle**

12. Engage tool T3880295 in the slots of the frame adjuster sleeve and rotate anti-clockwise to slacken the sleeve fully.

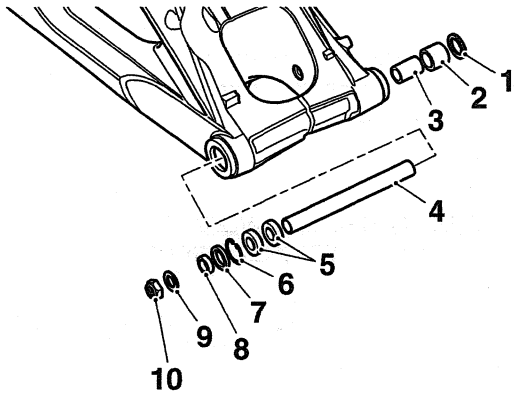



**1. Frame adjuster sleeve**
**2. Tool T3880104**

13. Withdraw the swinging arm spindle from the left hand side and remove the swinging arm, together with the drive chain.

- **Support the drive chain while the swinging arm is being removed to protect it from contamination.**
- **If the swinging arm is to be replaced remove the drive chain (see page *12-16*).**

14. Remove the bearing sleeves from both sides.
15. Remove the right hand bearing by drifting through from the left.
16. Collect the spacer tube.




**1. Seal**
**2. Sleeve**
**3. Needle roller bearing**
**4. Spacer tube**
**5. Ball Bearing**
**6. Circlip**
**7. Seal**
**8. Spacer**
**9. Washer**
**10. Nut**

**Note:**

- **The needle roller bearing in the left hand side of the arm cannot be removed undamaged.**

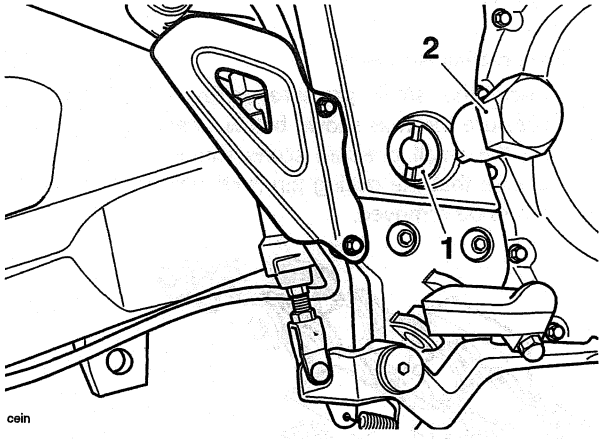
17. If required, remove the fixings securing the chain guard and drive chain rubbing strip and remove both items.
18. If required, remove the fixings securing the hugger and remove the hugger.

## Inspection

1. Check all swinging arm bearings for damage, pitting, and cracks. Replace as necessary.
2. Check the swinging arm for damage. Replace as necessary.
3. Check the wheel bearings for damage, pitting, and cracks. Replace as necessary.
4. Check all bearing seals for damage, splits etc. Replace as necessary.
5. Check the chain for wear, damage etc. Replace as necessary.
6. Check both sprockets for wear, damage etc. Replace as necessary.
7. Check the drive chain rubbing strip for wear and damage. Replace as necessary.

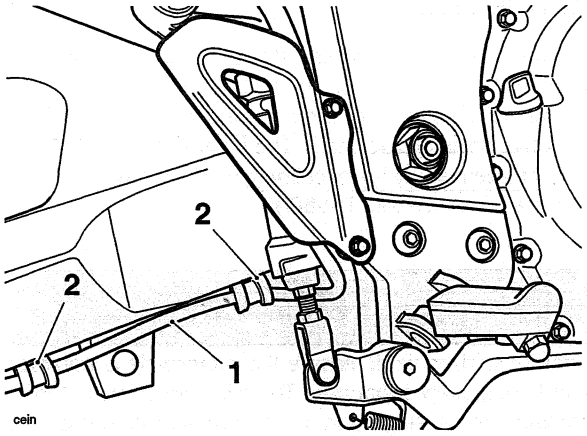
## Assembly

1. Install the bearings (marked faces outwards), sleeves etc. into the swinging arm in the order shown on the previous page. Use new seals throughout.
2. Position the hugger to the swinging arm and secure with the fixings. Tighten to **7 Nm.**
3. Fit the drive chain rubbing strip and chainguard. Tighten the fixings to **4.5 Nm**.
4. Fit the drive chain to the swinging arm (see page *12-16*).
5. Position the swinging arm to the frame ensuring the drive chain is in position on the rubbing strip.
6. Refit the swinging arm spindle from the left hand side such that it will support the swinging arm, but not pass all the way through the frame adjuster sleeve. This will allow tool T3880104 to engage in the slot in the frame adjuster sleeve.
7. Using tool T3880104, tighten the frame adjuster sleeve to **6 Nm**.




**1. Frame adjuster**
**2. Tool T3880104**

8. Fully insert the swinging arm spindle.
9. Fit a new swinging arm spindle nut and tighten to **110 Nm**.
10. Fit the drive chain to the output sprocket.
11. Refit the sprocket cover and tighten the bolts to **9 Nm**.
12. Release the caliper and refit the rear brake hose clips to the swinging arm. Tighten the fixings to **4.5 Nm**.




**1. Rear brake hose clips**

13. Refit the rear suspension unit (see page *12-7*).
14. Refit the rear wheel (see page *15-10*).
15. Refit the exhaust system (see page *10-120*).
16. Connect the battery, red (positive) lead first.
17. Fit the seat (see page *16-9*).
18. Pump the rear brake pedal several times to position the brake pads in the caliper. Rectify as necessary if correct brake operation is not restored (see page *14-25*).

**Warning**

It is dangerous to operate the motorcycle with defective brakes; you must have your authorised Triumph dealer take remedial action before you ride the motorcycle again. Failure to take remedial action may result in reduced braking efficiency leading to loss of motorcycle control and an accident.

## Drive Chain Replacement

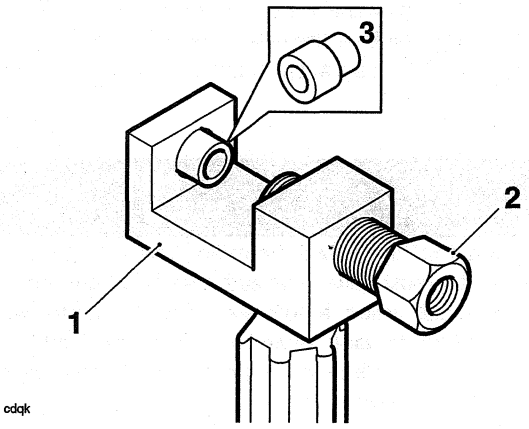
### Rivet link type

As the drive chain passes through the swinging arm casting, the chain must be split for removal from the motorcycle. Removal of the swinging arm is not required for drive chain replacement. The following instructions for the replacement of RK rivet link type drive chains requires the use of service tool T3880027.

**Warning**

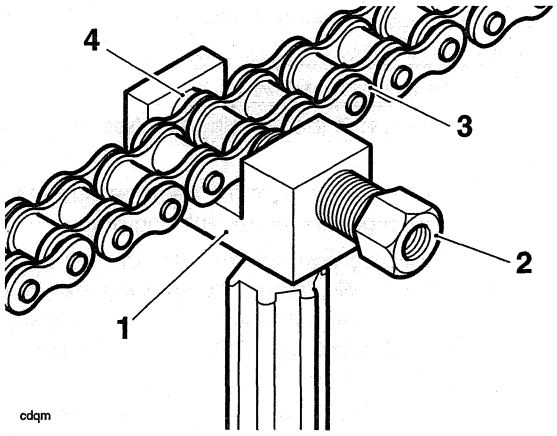
Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

1. Support the motorcycle on a stand so the rear wheel is clear of the ground.
2. Insert the hollow chain cutting tail piece into the tool body so its larger diameter end is facing towards the large pressure screw as shown.



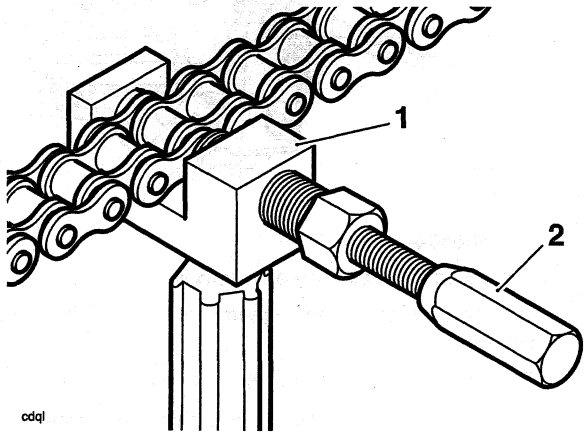

**1. Tool T3880027**
**2. Large pressure screw**
**3. Chain cutting tail piece**

3. Position the chain to the tool ensuring that the chain link pin which is to be removed is aligned with the holes in the chain cutting tail piece and the large pressure screw. Tighten the large pressure screw by hand to grip the chain.




**1. Tool T3880027**
**2. Large pressure screw**
**3. Chain**
**4. Chain cutting tail piece**

4. Insert the small pressure screw into the larger pressure screw as shown below, until the cutting pin on the small pressure screw contacts the link pin. Ensure that the cutting pin is centralised on the link pin to be removed.




**1. Tool T3880027**
**2. Small pressure screw**

5. Retain the tool body then tighten the small pressure screw until the link pin is pressed out from the chain.
6. Repeat steps 3 to 5 on the remaining chain link pin.
7. Remove the tool and separate the two ends of the chain.
8. Remove the chain cutting tail piece from the body.

**Note:**

- **The replacement chain is supplied in a split condition, complete with a link kit to join the two ends.**

**Caution**

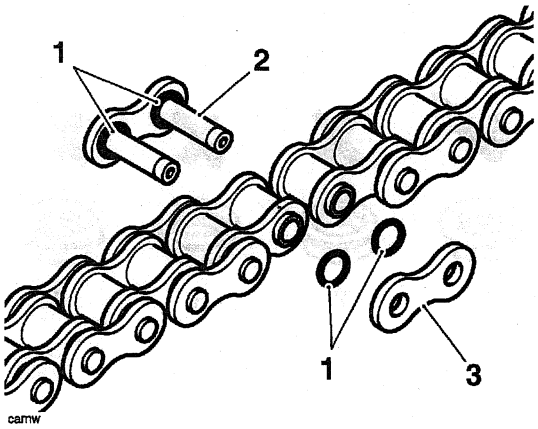
The component parts of the new link kit are coated with a special grease which must not be removed. Removal of this special grease will severely reduce the service life of the chain.

9. Use the old drive chain to pull the new chain into position as follows: Temporarily attach the end of the new chain to a free end of the old chain using the old connector link. Carefully pull the other end of the old chain to pull the new chain around the sprockets.

**Note:**

- **Do not use the new connector link as the special grease on it may be removed.**

10. Using the new link supplied with the chain kit, join the two ends of the chain. Ensure that the O-rings are positioned as shown below and the link plate is fitted with its markings facing outwards.



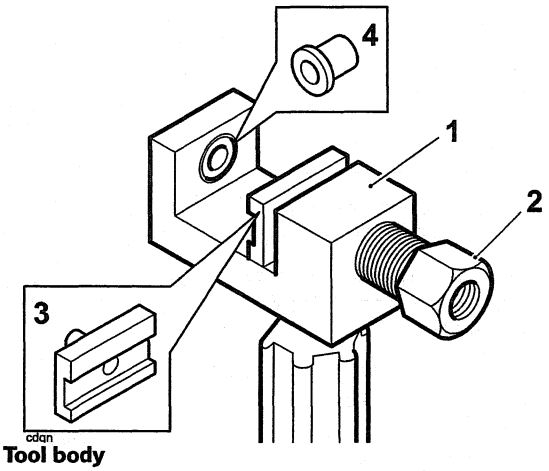

**1. O-rings**
**2. Link**
**3. Link plate**

11. Insert the riveting tail piece into the tool body so its larger diameter end is facing towards the large pressure screw as shown.

**Note:**

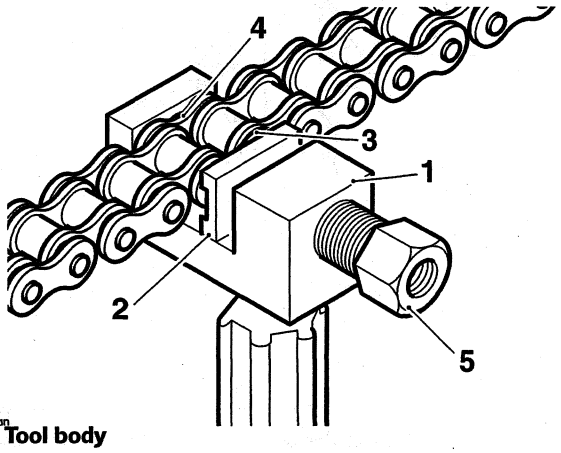
- **Tool T3880027 includes two link plate holders, one is for riveted link plates (marked PH5060R), the other is for link plates retained by a spring clip (marked PH4060C). The holder for riveted link plates has a shallow groove to allow for chain link clearance, the holder for clipped link plates has a deep groove to allow for chain link clearance.**

12. Insert the link plate holder (marked PH5060R) into the large pressure screw.



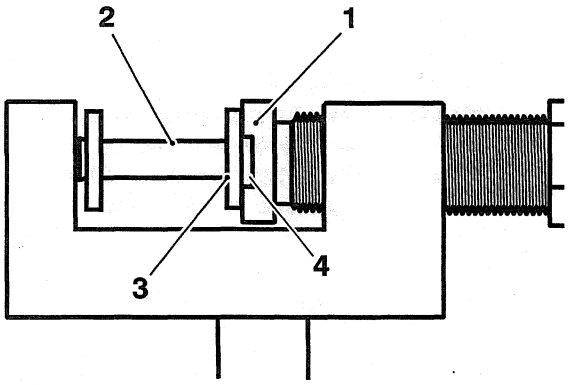

**1. Tool body**
**2. Large pressure screw**
**3. Link plate holder (marked PH5060R)**
**4. Riveting tail piece**

13. Position the tool to the chain. Ensure the link plate holder is correctly located in the large pressure screw.



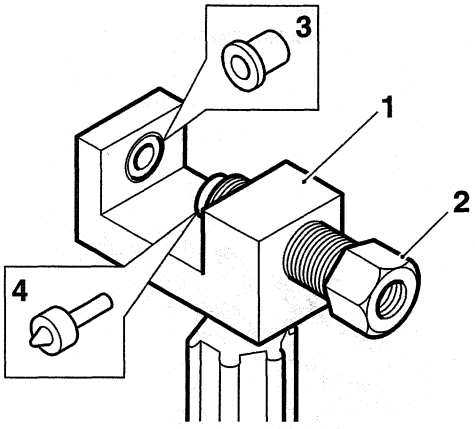

**1. Tool body**
**2. Link plate holder (marked PH5060R)**
**3. Link plate**
**4. Link**
**5. Large pressure screw**

14. Locate the split link pins such that the pins will enter the groove in the link plate holder when the link plate is pressed on to the link.



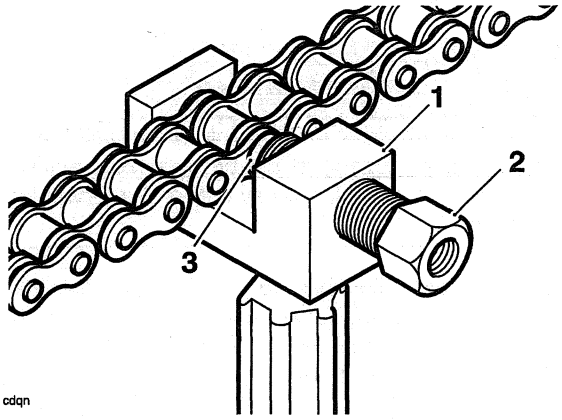

**1. Link plate holder**
**2. Chain link**
**3. Link plate**
**4. Link plate holder groove**

15. Retain the tool body and tighten the large pressure screw until the link plate is pressed fully onto the link.
16. Back off the pressure screw, slide the tool assembly to one side and check that the split link is correctly assembled.
17. Remove the link plate holder from the tool. Do not remove the riveting tail piece from the tool
18. Insert the flare pin into the large pressure screw.



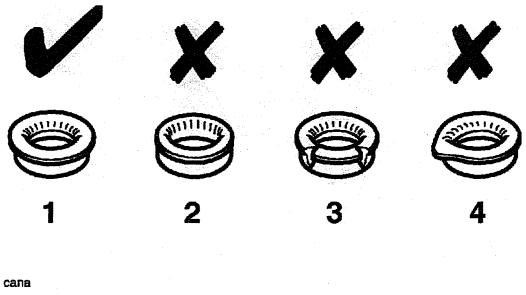

**1. Tool body**
**2. Large pressure screw**
**3. Riveting tail piece**
**4. Flare pin**

19. Locate one of the split link pins into the riveting tail piece and screw the large pressure screw in until the flare pin contacts the split link end. Ensure the split link pin is centrally located on the flare pin.
20. Retain the tool body and tighten the large pressure screw until the split link end is riveted-over.




**1. Tool body**
**2. Large pressure screw**
**3. Flare pin**

21. Back off the large pressure screw and rivet the remaining split link pin as described above.
22. Remove the tool from the chain and check that both the split link pins are correctly riveted as shown below.




**1. Correct riveting**
**2. Insufficient riveting**
**3. Excessive riveting**
**4. Riveting off-centre**

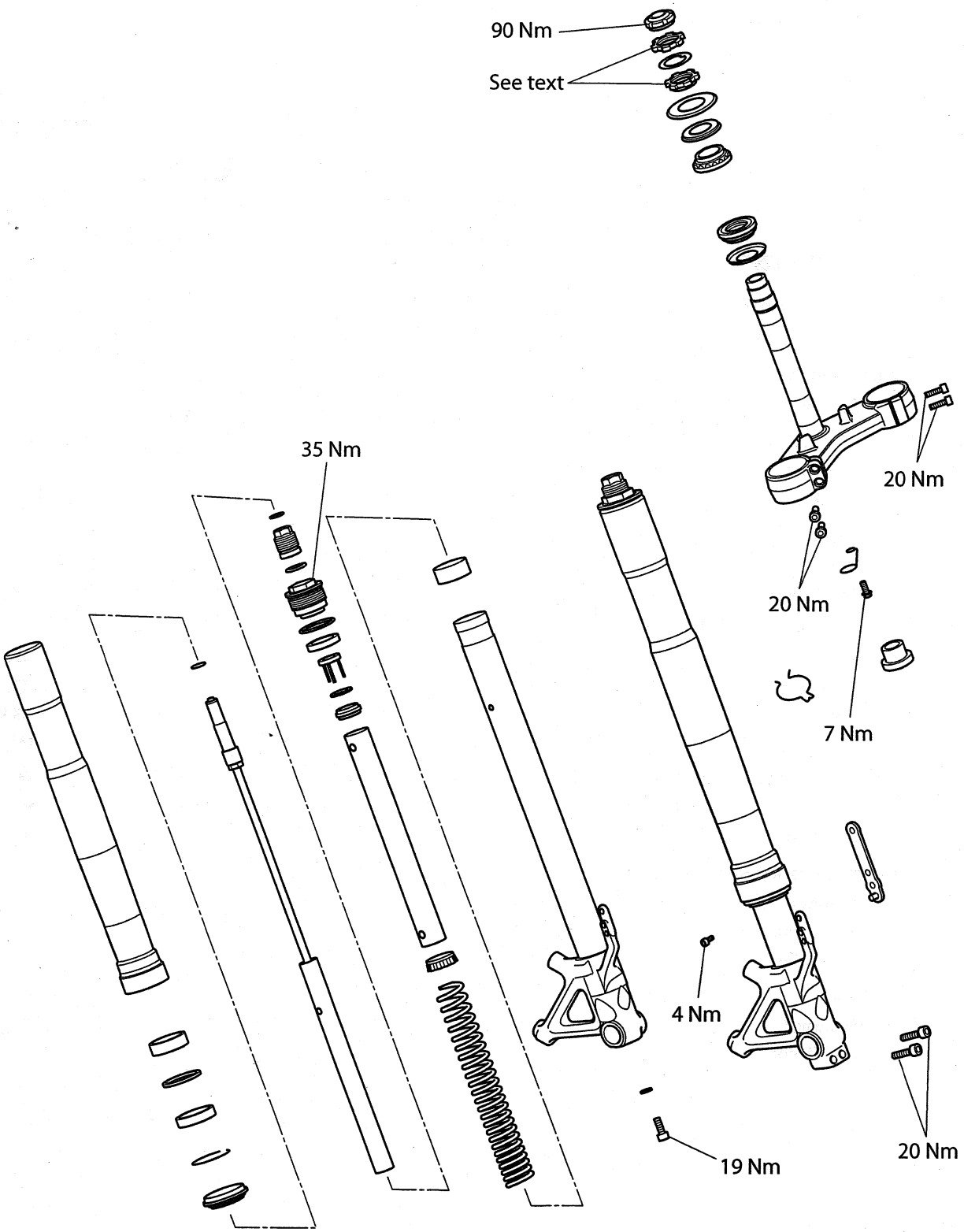
**Warning**

If either split link pin is not correctly riveted, the split link must be removed and replaced with a new link. Never operate the motorcycle with an incorrectly riveted split link as the link could fail resulting in an unsafe riding condition leading to loss of control and an accident.

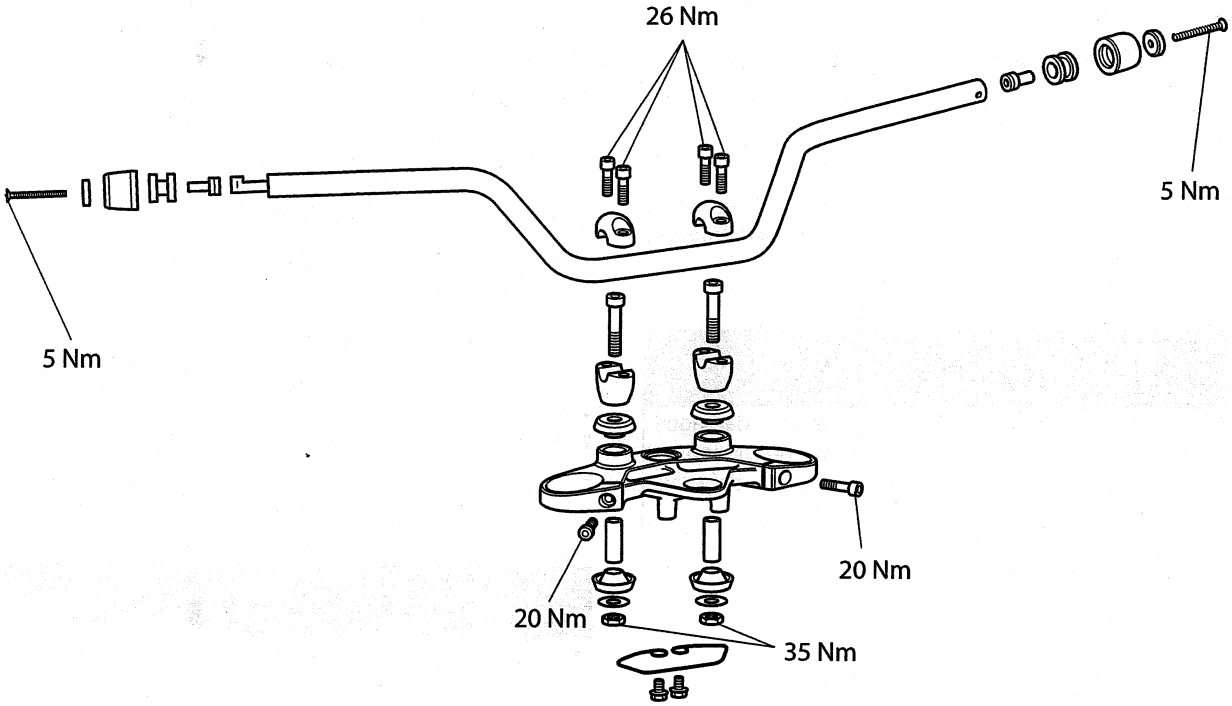
# 13 Front Suspension

## Table of Contents

## Exploded View - Front Fork



## Exploded View - Handlebars



## Front Suspension

The Tiger 1050 is equipped with hydraulic, adjustable, telescopic front forks. Both forks are adjustable for spring pre-load; the right hand fork is adjustable for compression damping and the left hand fork for rebound damping.

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

Examine each fork for any sign of damage or scratching of the slider surface or for oil leaks.

If any damage or oil leakage is found, strip and repair as described in this section or consult an authorised Triumph dealer.

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.**

If roughness or excessive stiffness is detected, repair as described in this section or consult an authorised Triumph dealer.

**Warning**

Riding the motorcycle with defective or damaged suspension can cause loss of motorcycle control and an accident. Never ride with damaged or defective suspension.

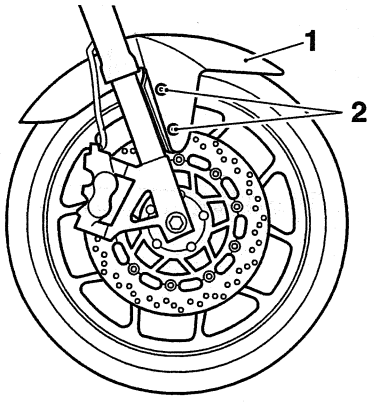
## Front Fork

### Removal

**Warning**

Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

1. Raise and support the front of the motorcycle.
2. Remove the front wheel (see page *15-6*).
3. Remove the front mudguard (see page *16-16*).

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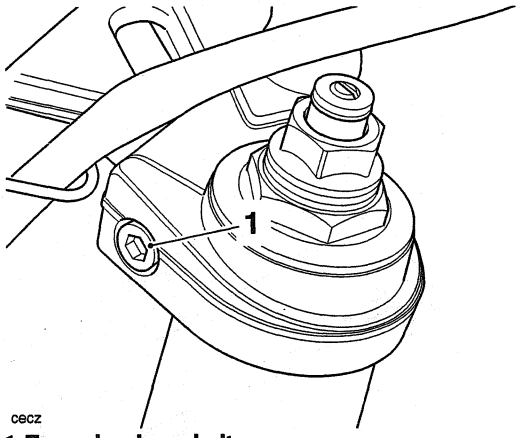
**1. Mudguard**
**2. Fixings**

4. Detach and the support the front brake calipers (see page *14-16*).

**Warning**

Never allow the brake calipers to hang on the brake hoses as this may damage the hoses. A damaged brake hose can cause a reduction in braking efficiency leading to loss of motorcycle control and an accident.

5. Slacken the top yoke clamp bolt.




cecz

**1. Top yoke clamp bolt**

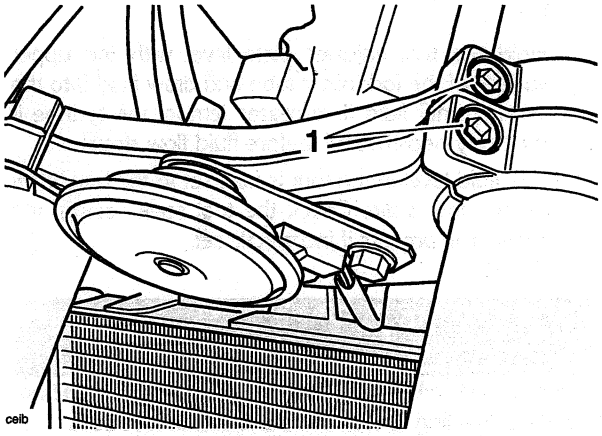
**Note:**

- **If the forks are to be disassembled, slacken the top cap a little before loosening the lower yoke clamp bolts, to allow easier removal during strip-down.**

**⚠ Caution**

Care must be taken when removing the forks, to ensure that the outer surfaces do not become scratched.

6. Slacken the bottom yoke clamp bolts.



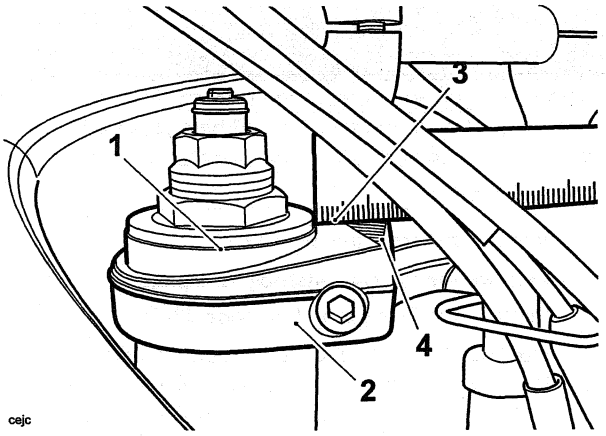

ceib

**1. Bottom yoke clamp bolts**

7. Using a downward, twisting action, withdraw the forks from between the yokes.

**Installation**

1. Position the fork within the yokes so that the lip of the outer tube, not the top cap, is flush with the flat upper surface of the top yoke as shown below.




cejc

**1. Outer tube**
**2. Top yoke**
**3. Straight edge**
**4. Flat area**

2. Tighten the bottom yoke clamp bolts to **20 Nm.**
3. Tighten the top yoke clamp bolts to **20 Nm**.
4. Refit the front mudguard (see page *16-16*).
5. Install the front wheel (see page *15-7*).
6. Refit the front brake calipers (see page *14-18*).
7. Lower the motorcycle to the ground and park it on the side stand.

## Fork Oil Change

### Draining

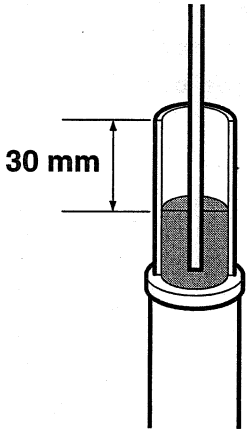
**Warning**

Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

1. Remove the fork (see page *13-4*).
2. Remove the top cap assembly (see page *13-7*).
3. Remove the fork spring (see page *13-7*).
4. Holding the inner and outer tubes together, invert the fork and pour out the fork oil into a suitable container. Pump the damper rod to remove all the oil.

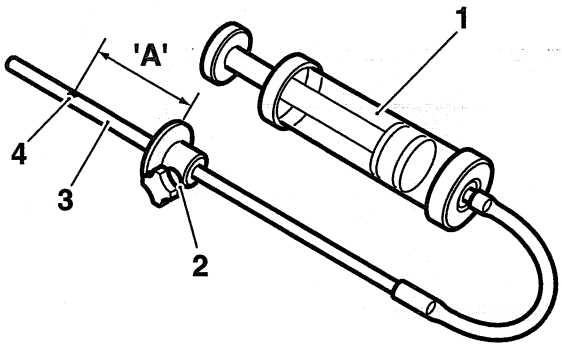
### Oil Refilling

The oil level is measured from the upper surface of the fork outer tube, with the fork fully compressed and the spring **installed**.




**Fork Oil Level (fork fully compressed and spring installed)**

1. Refit the fork spring, close wound end uppermost.
2. Fill the fork with the grade of oil specified in the fork oil table opposite, to a level above that which will finally be required.
3. Pump the fork assembly and damper several times to expel any trapped air then fully compress the fork and support it in an upright position. Leave the fork for a few minutes to allow the oil to stabilise.
4. Set the scale on tool 3880160 to the level specified for the model being worked on (see the fork oil table opposite for the correct level setting).




cbyg

**1. Tool 3880160**
**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.**

5. Insert the scale end of the tool into the fork outer tube.
6. Hold the tool adjuster plate level with the upper surface of the fork outer tube and draw fluid into the syringe until fluid flow ceases (empty the syringe if the body becomes full before fluid flow stops).
7. 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.

**Warning**

Incorrect fork oil levels could result in an unsafe riding condition leading to loss of control and an accident.

8. Assemble the fork (see page *13-10*).
9. Refit the fork (see page *13-5*).

### Fork Oil Level Chart

| Oil Level | Oil Volume | Oil Grade | Fork Pull Through |
|---|---|---|---|
| 30 mm, measured with the spring **installed** | 581cc | Showa SS8 | Top of the outer tube flush with the flat upper face of the top yoke |

## Front Fork

### Disassembly

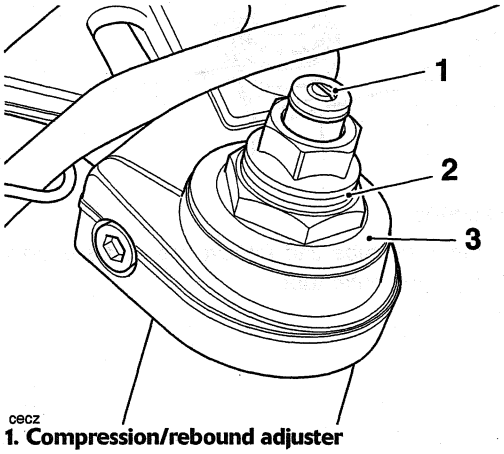
**Warning**

Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

**Note:**

- **Before removing the forks, slacken the top yoke clamp bolt to release pressure on the top cap threads, then slacken top cap a little to allow easier removal during strip-down.**

1. Remove the forks (see page *13-4*).
2. Note the position of the preload adjuster relative to the fork cap to ensure the setting is retained on re-assembly.




cecz

**1. Compression/rebound adjuster**
**2. Preload adjuster marks**
**3. Fork top cap**

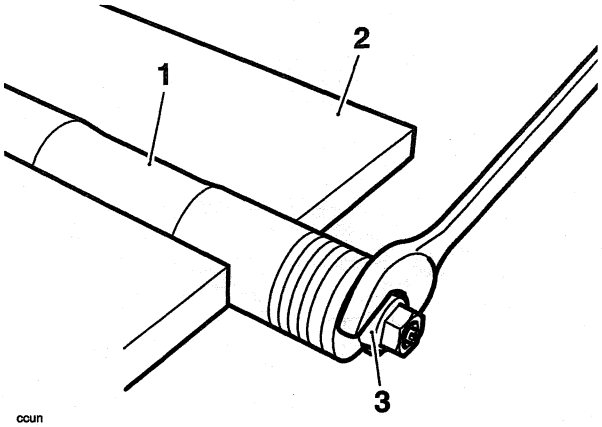
**Warning**

Do not change the fork adjustment settings. If they are changed, this will change the handling of the motorcycle from those which the rider is used to. Riding with unfamiliar fork settings may cause unexpected handling characteristics leading to loss of control and an accident.

**Note:**

- **The fork seals can be renewed without removal of the damping cylinder. Unless removal of the damping cylinder is necessary, omit items 15 and 16 of this procedure.**

3. **Very gently** clamp the fork in the soft jawed vice to prevent it from turning, hold the outer tube, then unscrew the top cap from the outer tube.




ccun

**1. Fork**
**2. Soft jaws**
**3. Top cap**

**Caution**

Never tightly clamp the outer tube as this will cause the tube to permanently distort. A distorted tube is not serviceable and must be replaced.

**Note:**

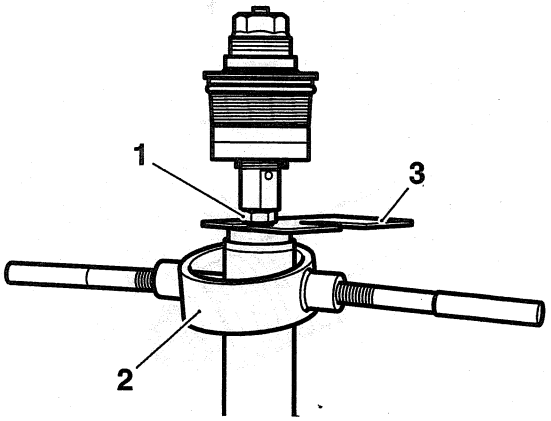
- **The top cap is not under spring tension and will not spring upwards when the threads disengage.**

4. Holding the inner and outer tubes together, invert the fork and pour out the fork oil into a suitable container. Pump the damper rod to remove all the oil.
5. Return the fork to the soft jawed vice.
6. Allow the outer tube to slide down into the inner.

**Warning**

While compressing the fork spring and while the spring holder is in place always wear protective equipment for the face and eyes and never stand directly above or look directly down on the fork. If the spring compressor or holder should dislodge or detach, the resulting release of spring tension could cause parts to fly off resulting in injury to the user.

7. Fit tool T3880067 over the top cap. Position the two adjustable arms to the holes in the spring spacer. Screw in the arms until they positively engage in the spring spacer holes.
8. Using tool T3880067, manually compress the fork spring and insert the spring holder as shown, below the damper locknut.



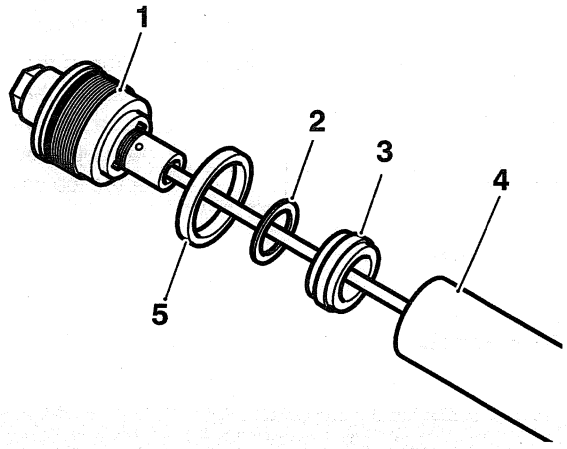

**1. Damper locknut**
**2. Tool T3880067**
**3. Spring holder (part of T3880067)**

9. Slacken the locknut, unscrew and remove the top cap and damper rod. If necessary, remove the O-ring seal from the top cap assembly. The top cap assembly cannot be dismantled.
10. Recompress the fork spring to remove the holder.

**Warning**

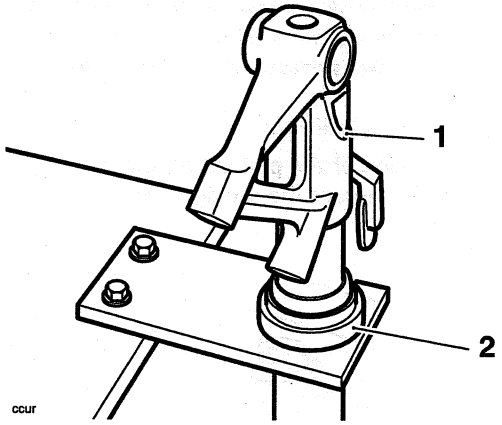
While compressing the fork spring and while the spring holder is in place always wear protective equipment for the face and eyes and never stand directly above or look directly down on the fork. If the spring compressor or holder should dislodge or detach, the resulting release of spring tension could cause parts to fly off resulting in injury to the user.

11. Remove the washer, nylon spacer, spring cap and spring. It is not necessary to remove the bump rubber if still attached to the top cap.




**1. Top cap**
**2. Washer**
**3. Nylon spacer**
**4. Spring cap**
**5. Bump rubber**

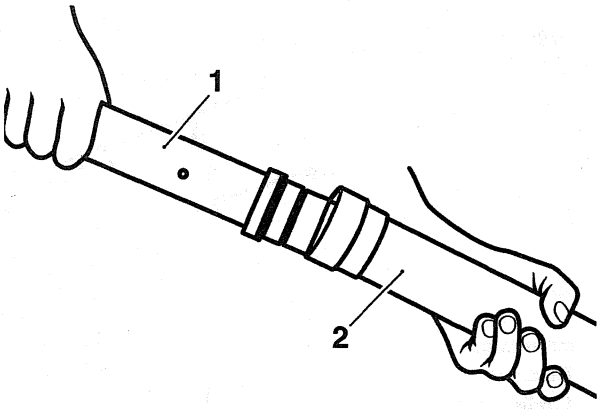
12. Invert and mount the fork assembly to tool T3880002.




**1. Fork**
**2. Tool T3880002**

13. Raise the inner tube and remove the dust seal and circlip from the outer tube.

14. Remove the fork from the tool and, using a slide hammer action to release the oil seal and bushes from the outer tube, separate the inner and outer tubes leaving the seals and bushes in place on the inner tube. Note the relative positions of all bushes and seals before removal.



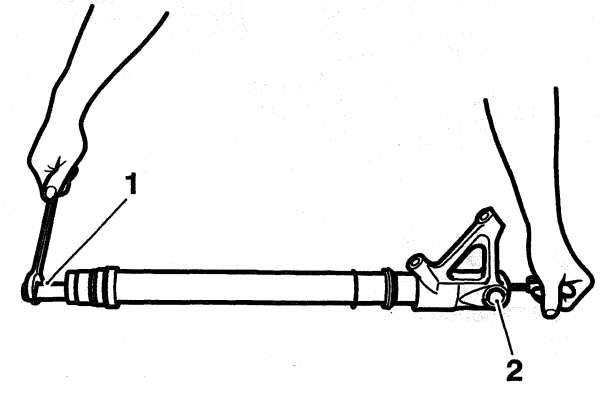

ccuw

**1. Inner tube**
**2. Outer tube**

15. Insert the slotted end of tool T3880004 over the damper rod and locknut, engage the slots in the tool to the corresponding slots in the damping cylinder inside the fork. Hold the flats of the tool to prevent the cylinder from turning while removing the damper bolt from the bottom of the fork.

**Note:**

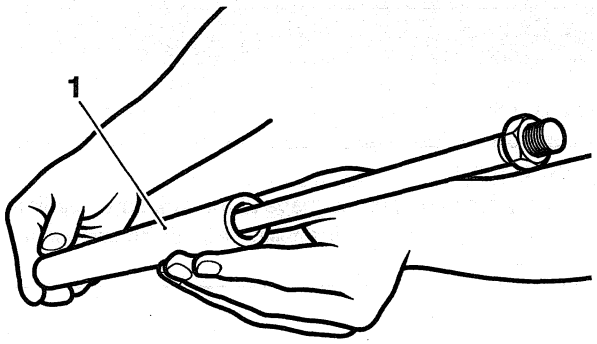
- **Tool T3880004 is designed to fit over the top of the damper rod locknut.**




ccux

**1. Tool T3880004**
**2. Damping cylinder bolt location**

16. Remove the tool, then the damping cylinder from the inner tube.




ccuy

**1. Damping cylinder**

## Inspection

1. Inspect the inner tube for stone chips, scoring, scratches, excessive wear and any other damage. Renew as necessary.

**Note:**

- **Small inclusions in the inner tube may be removed using a fine grade stone or similar.**

2. Inspect the spring for damage, cracks and deformation. Renew the spring if necessary.
3. Inspect all the bushes and seals for damage. Renew any damaged items if necessary.

## Assembly

**Warning**

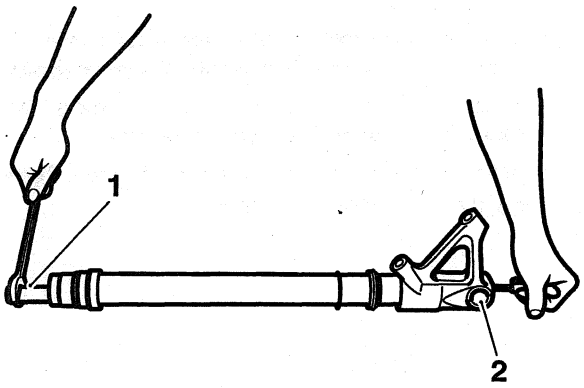
The front forks comprise many precision machined parts. Total cleanliness must be observed at all times and assembly must take place in a dirt/dust-free environment.

Dirt ingress may cause damage to the fork parts, leading to incorrect operation, instability, loss of control or an accident.

**Note:**

- **If the damper has not been removed, omit operations 1 and 2.**

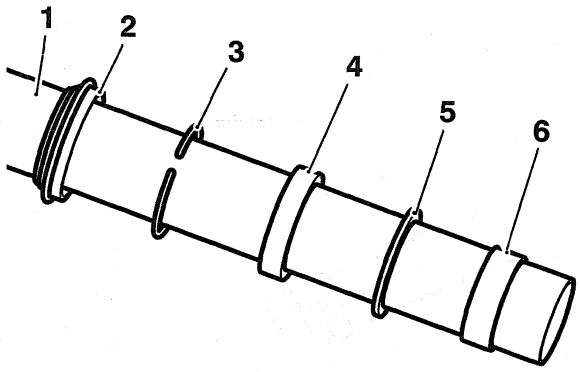
1. Fit the damping cylinder to the inner tube and engage tool T3880004 as during removal.
2. Clean the threads of the damping cylinder bolt and fit a new sealing washer. Apply a drop of ThreeBond 1342 to the threads then install the bolt. Prevent the cylinder from turning by holding the flats at the end of tool T3880004 while tightening the damping cylinder securing bolt to **19 Nm**.




ccux

**1. Tool T3880004**
**2. Damping cylinder bolt location**

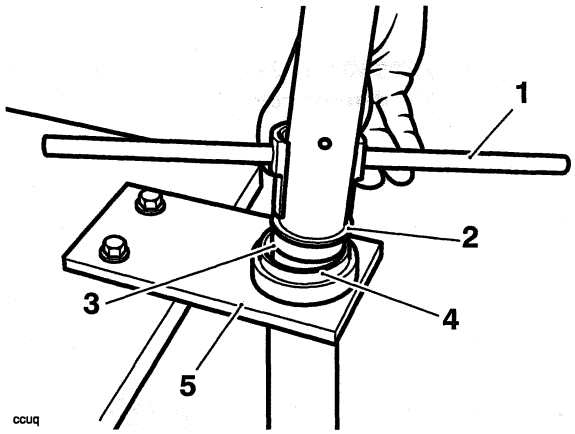
3. Invert and position the fork tube outer to tool T3880002.
4. Apply a smear of fork oil to the bushes and seals.
5. Position the seals and bushes to the inner tube as noted prior to removal.




ccup

**1. Inner tube**
**2. Dust seal**
**3. Circlip**
**4. Seal**
**5. Washer**
**6. Bush**

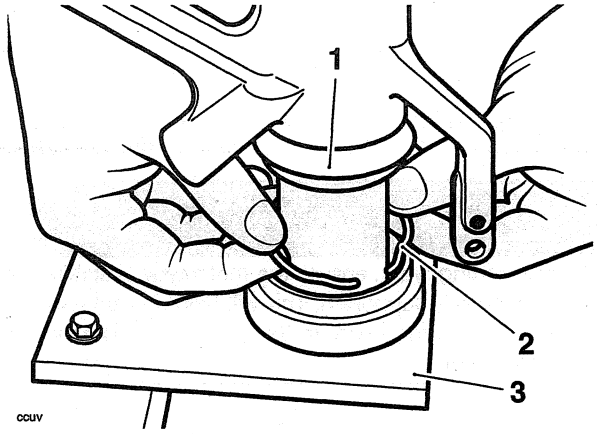
6. Position the inner tube assembly to the outer, ensuring that the oil and dust seal lips do not become damaged.
7. Using the narrow end of tool T3880003, push/tap the bush, washer and seal into place.




ccuq

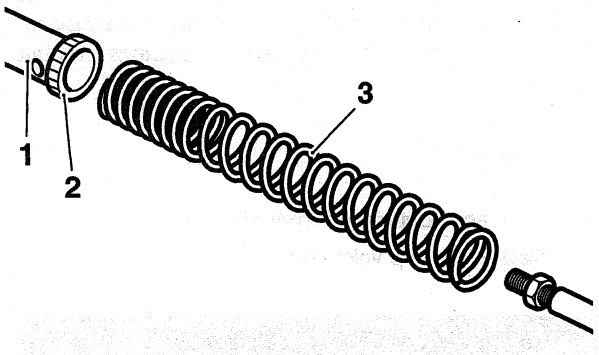
**1. Tool T3880003I**
**2. Seal**
**3. Washer**
**4. Bush**
**5. Tool T3880002**

8. Retain the bush, washer and seal with a new circlip.




**1. Dust seal**
**2. Circlip**
**3. Tool T3880002**

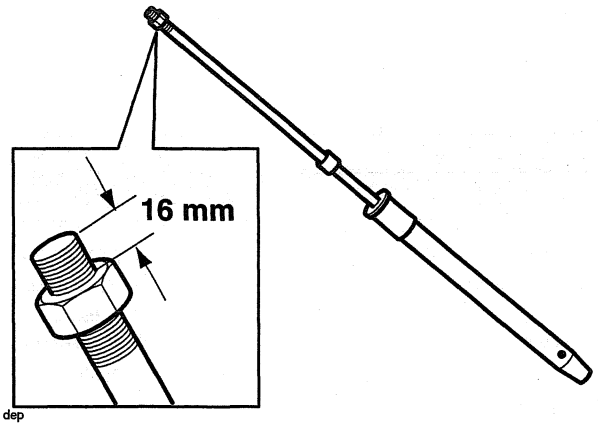
9. Position the dust seal to the outer tube.
10. Invert tool T3880003 and, using hand pressure only, push the dust seal squarely into the outer tube.
11. Fill the fork with oil (see page *13-7*).
12. Position the fork assembly as for compression of the fork spring during strip down.
13. Refit the fork spring, close wound end uppermost, spring cap, nylon spacer and washer.




**1. Spring cap**
**2. Nylon spacer (lower)**
**3. Spring**

14. Attach tool 3880085-T0301 to the threads of the damper rod and pull the damper upwards.

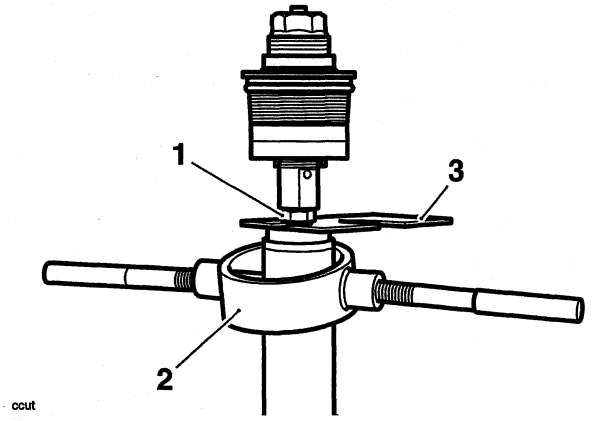
15. Rethread the damping rod locknut leaving 16 mm of thread exposed above the nut.




**Warning**

While re-compressing the fork spring and while the spring holder is in place always wear protective equipment for the face and eyes and never stand directly above or look directly down on the fork. If the spring compressor or holder should dislodge or detach, the resulting release of spring tension could cause parts to fly off resulting in injury to the user.

16. Refit tool T3880067 as previously described, compress the fork spring and refit the spring holder.




**1. Damper locknut**
**2. Tool T3880067**
**3. Spring holder (part of T3880067)**

**Caution**

If removed, the damping rod locknut must be fitted with the flat face facing to the top of the fork. The slightly tapered face must face the fork spring. Incorrect orientation may lead to a loosening of the locknut.

17. If removed, fit a new O-ring to the top cap.
18. Refit the top cap and the damper rod, turning the damping rod down to the pre-load adjuster mark noted prior to dismantling.
19. Hold the top cap while tightening the damper rod locknut to **22 Nm**.

**Warning**

While compressing the fork spring and while the spring holder is in place always wear protective equipment for the face and eyes and never stand directly above or look directly down on the fork. If the spring compressor or holder should dislodge or detach, the resulting release of spring tension could cause parts to fly off resulting in injury to the user.

20. Recompress the spring to remove the spring holder.
21. Lubricate the O-ring on the top cap with a smear of fork oil then screw the top cap fully into the inner tube.
22. Tighten the top cap to **35 Nm**.

**Note:**

- **It is much easier to tighten the top cap when the fork has been refitted.**

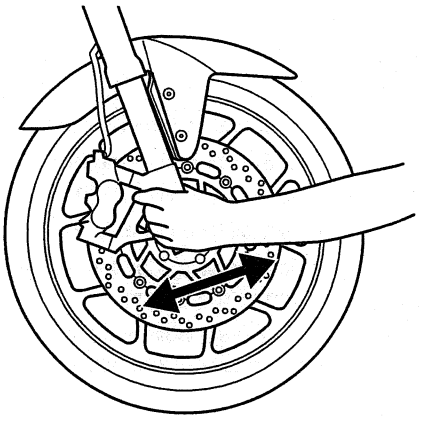
## Headstock Bearing Check/ Adjustment

### Check

1. Raise and support the front of the motorcycle.

**Warning**

Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.



cecy

**Checking Headstock Bearing Adjustment**

2. Hold the lower end of the front forks as illustrated and 'rock' with a front-to-rear motion. If free play can be detected, the headstock bearings require adjustment.

### Adjustment

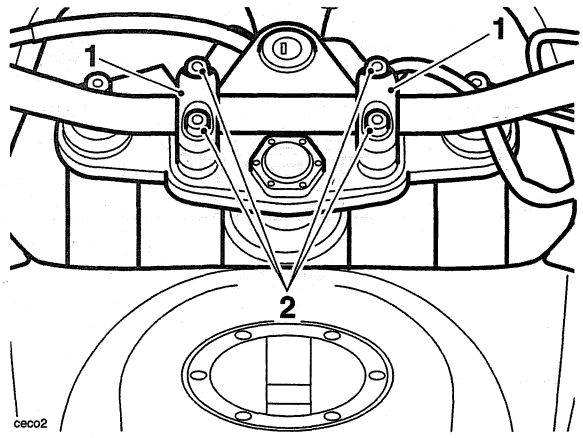
1. Raise and support the front of the motorcycle.
2. Slacken the top yoke clamp bolts.

**Warning**

If the lower yoke fixings are also slackened, the forks will no longer support the weight of the motorcycle.

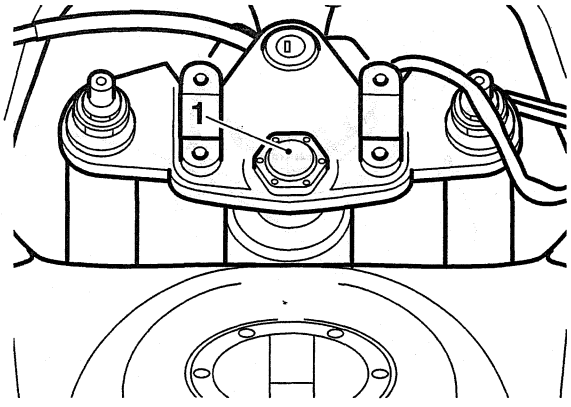
Do not slacken the lower yoke fixings as, in this condition, the motorcycle could topple over causing damage and/or risk of injury.

3. Release the fixings securing the handlebar clamps to the risers, detach the clamps and carefully position the handlebars clear of the headstock top nut.




**1. Upper clamp**
**2. Fixings**

4. Slacken the headstock top nut.

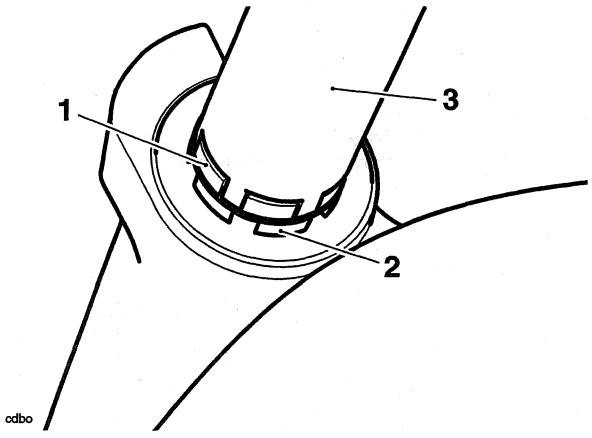



**1. Headstock top nut**

5. Ease the top yoke from the forks.
6. Adjust the bearing free-play as follows, all using tool T3880024:-
   - Remove the locknut and tab washer.
   - Slacken the adjuster nut then tighten to **40 Nm.**
   - Slacken the adjuster nut, then retighten to **15 Nm.**
   - Fit the tab washer and adjuster nut.
   - Tighten the locknut to **40 Nm.**

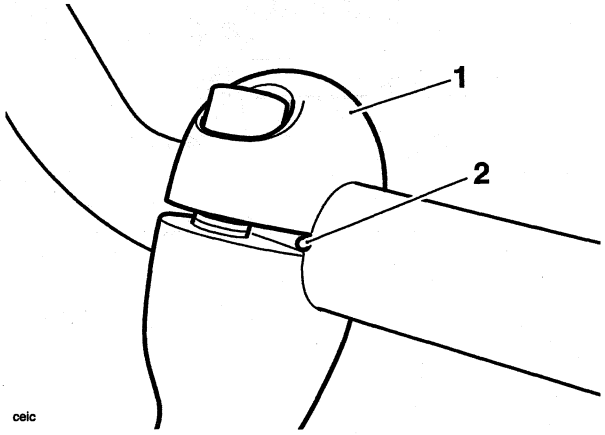
**Warning**

It is essential that the adjuster nut is not over-tightened. If the adjuster is over-tightened it will cause a pre-load on the headstock bearings. This will introduce tight steering, which could cause loss of control and an accident.




**1. Adjuster nut**
**2. Locknut**
**3. Tool T3880024**

7. Refit the top yoke assembly to the forks.
8. Tighten the top nut to **90 Nm.**
9. Tighten the top yoke clamp bolts to **20 Nm.**
10. Locate the handlebar in the lower halves of the clamps. Fit the upper clamps and fixings.
11. Align the handlebar punch mark with the front right hand split line of the clamp/riser, then tighten the clamp bolts, front first, to **26 Nm.**




**1. Right hand front clamp split line**
**2. Handlebar punch mark**

12. Recheck the bearing adjustment (see page *13-12*).

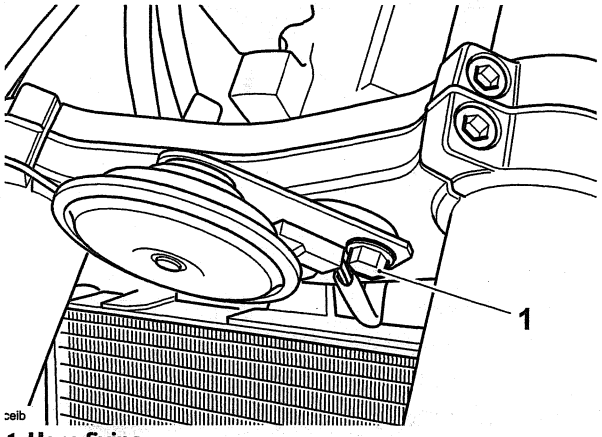
## Headstock Bearing Renewal

**Warning**

Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help to prevent it falling and causing injury to the operator or damage to the motorcycle.

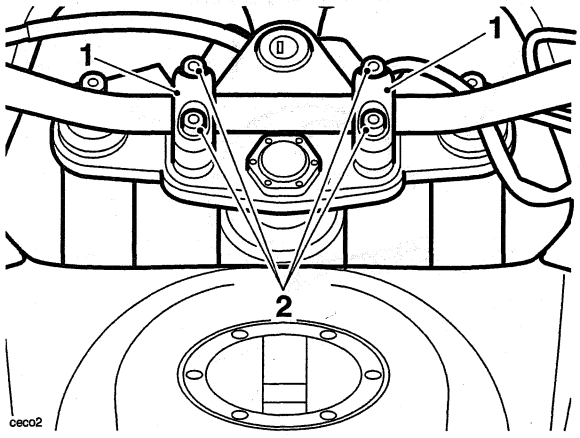
### Removal

1. Remove both forks (see page *13-4*).
2. Release the fixing and detach the horn from the lower yoke. Without disconnecting any wiring, lay the horn aside.



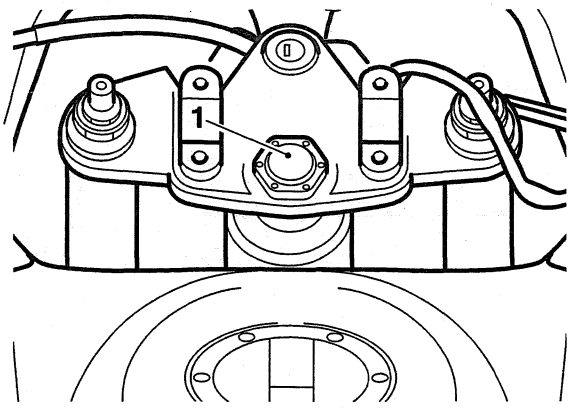

**1. Horn fixing**

3. Release the fixings securing the handlebar clamps to the risers, detach the clamps and carefully position the handlebars clear of the headstock top nut.



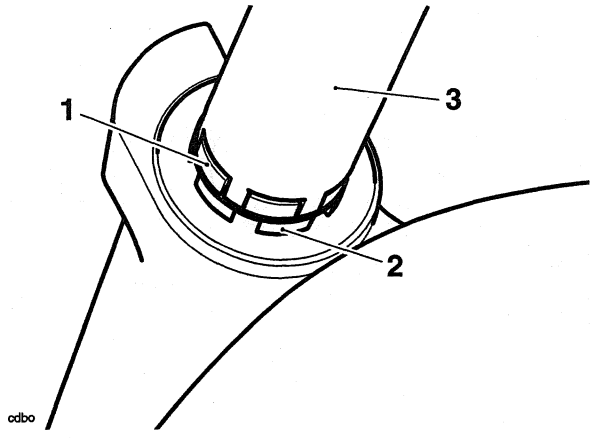

**1. Upper clamp**
**2. Fixings**

4. Slacken the headstock top nut.




**1. Headstock top nut**

5. Ease the top yoke from the forks.
6. Using tool T3880024, remove the locknut and tab washer. Discard the tab washer.




**1. Locknut**
**2. Adjuster nut**
**3. Tool T3880024**

7. Using the same tool, remove the adjuster nut.
8. Remove the bottom yoke from below the frame headstock.

**Warning**

Always wear eye, hand and face protection when using a hammer and drift. Use of a hammer and drift can cause bearings to fragment. Pieces of fragmented bearing could cause eye and soft tissue injuries if suitable protective apparel is not worn.

9. Using a suitable drift, evenly and progressively drive the bearing races from the frame headstock.
10. Remove the inner race and dust seal from the bottom yoke using a press or puller.

## Inspection

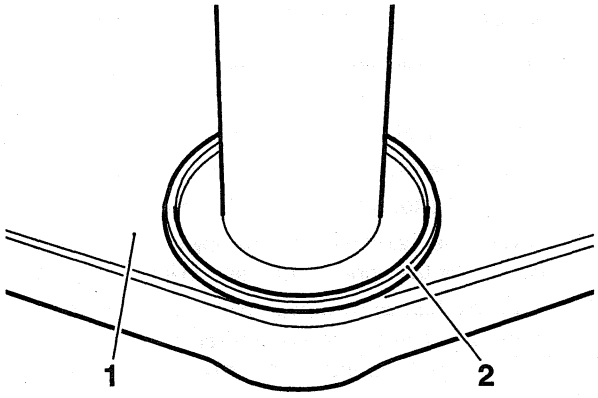
**Warning**

Only remove raised witness marks from within the frame. Removal of material below any raised areas will reduce the level of interference between the frame and the bearings. Loss of interference could cause the bearing to become loose in the wheel leading to loss of motorcycle control and an accident.

1. Examine the frame for any raised witness marks caused by the removal process. Remove any such marks with fine emery paper or a gentle file.

## Installation

1. Fit a new dust seal to the steering stem on the bottom yoke. Lubricate the seal's knife-edge with grease to NLGI 2 specification (we recommend Mobil HP222).



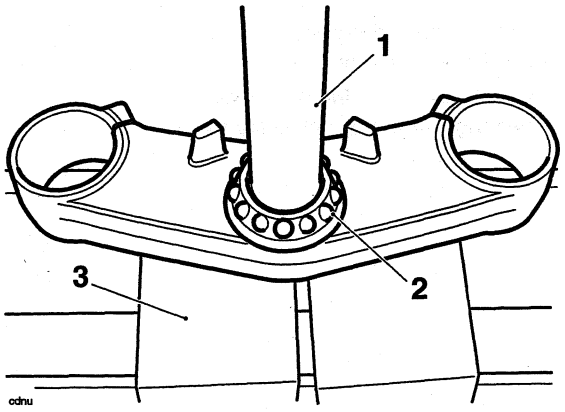

cdgo

**1. Bottom yoke**
**2. Dust seal**

**Caution**

Protect the threads of the bottom yoke when using a press or puller as damaged threads may mean replacing the yoke completely.

2. Press a new lower bearing inner race onto the steering stem of the bottom yoke. Fit the bearing to the inner race.

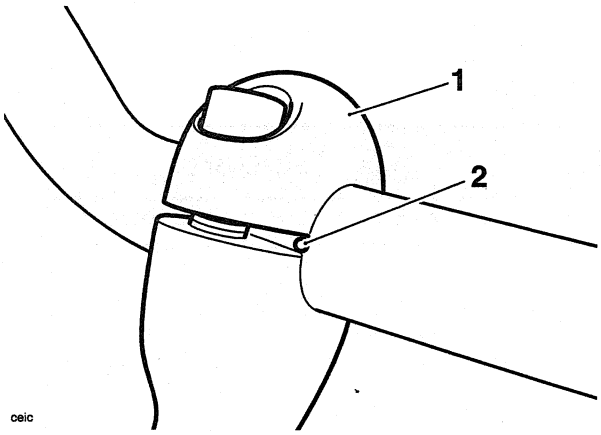



cdnu

**1. Steering stem**
**2. Bearing**
**3. Press bed**

3. Evenly and progressively drive a new upper bearing outer race into the frame headstock.
4. Evenly and progressively drive a new lower bearing outer race into the frame headstock.

5. Lubricate the lower and upper bearings with grease to NLGI 2 specification (we recommend Mobil HP222).
6. Insert the lower yoke to the frame, fit the upper bearing and inner race, and retain with the adjuster nut.
7. Adjust the headstock bearings (see page *13-12*).
8. Locate the upper yoke to the steering stem. Install but do not fully tighten the headstock top nut at this stage.
9. Fit the forks (see page *13-5*).
10. Tighten the headstock top nut to **90 Nm.**
11. Tighten the top yoke clamp bolts to **20 Nm.**
12. Locate the handlebar in the lower halves of the clamps. Fit the upper clamps and fixings.
13. Align the handlebar punch mark with the front right hand split line of the clamp/riser, then tighten the clamp bolts, front first, to **26 Nm.**




**1. Right hand front clamp split line**
**2. Handlebar punch mark**

14. Check that no freeplay exists in the headstock bearings. Adjust as necessary (see page *13-12*).

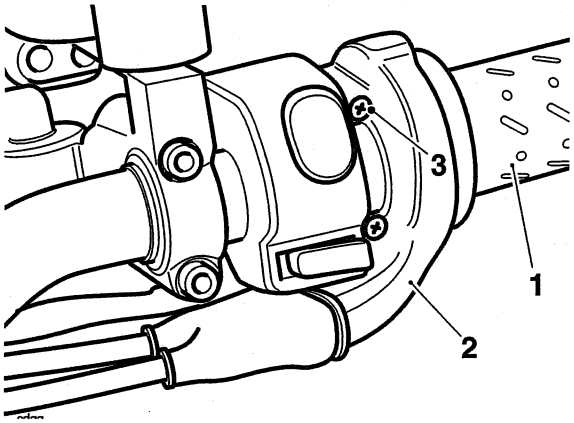
## Handlebars

### Removal

**Warning**

Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help to prevent it falling and causing injury to the operator or damage to the motorcycle.

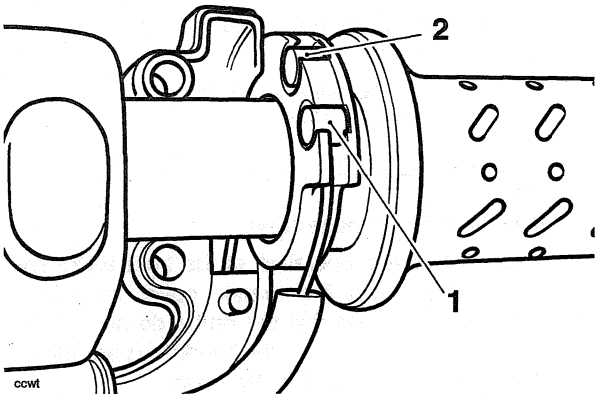
1. Remove the seat (see page *16-9*).
2. Disconnect the battery, negative (black) lead first. (see page *17-7*).
3. Undo the fixing screws and remove the end weights from the handlebars.
4. Undo the screws and free the left hand switchgear assembly from the handlebar. Without disconnecting any wiring, lay the switch aside.
5. Unscrew the bolts and remove the clamp from the clutch lever assembly. Without disconnecting the clutch cable, lay the lever aside.
6. Slide off the rubber boot and release the screws which secure the two halves of the twist grip guide to each other.




**1. Twist grip**
**2. Twist grip guide**
**3. Screws**

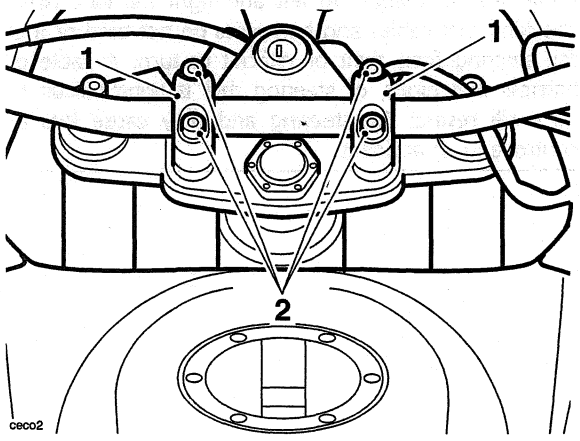
7. Note the position of the guide relative to the handlebar then separate the two halves of the twist grip guide.
8. Note and mark the position of each cable relative to the twist grip in order to correctly identify their location during reassembly.

9. Release the inner cables from the twist grip.




**1. Closing inner cable**
**2. Opening inner cable**

10. Slide the twist grip off the handlebar.
11. Undo the screws and free the right hand switchgear assembly from the handlebar. Without disconnecting any wiring, lay the switch aside.
12. Unscrew the bolts and remove the clamp from the front brake master cylinder. Taking care to not invert the brake fluid reservoir, lay the assembly aside.
13. Release the fixings securing the handlebar clamps to the risers, detach the clamps and collect the handlebar.

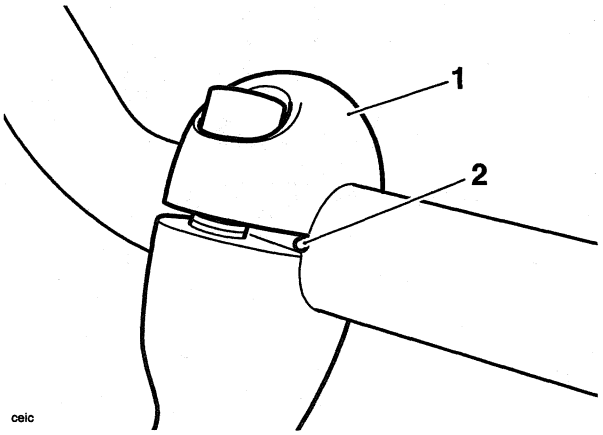



**1. Upper clamp**
**2. Fixings**

14. Remove the left hand handlebar grip.

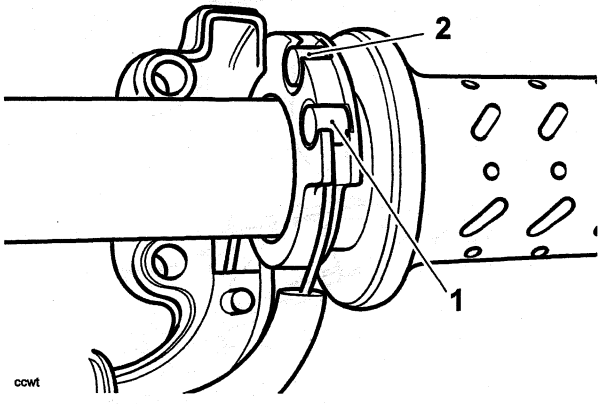
## Installation

1. Locate the handlebar in the lower halves of the clamps. Fit the upper clamps and fixings.
2. Align the handlebar punch mark with the front right hand split line of the clamp/riser, then tighten the clamp bolts, front first, to **26 Nm.**



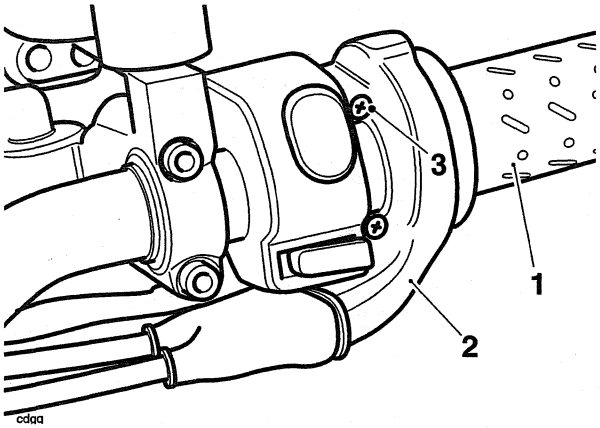

**1. Right hand front clamp split line**
**2. Handlebar punch mark**

3. Slide the twist grip onto the right hand side of the handlebar.
4. Reconnect the inner throttle cables as noted during removal. Ensure that the positions of the opening and closing cables are not transposed.



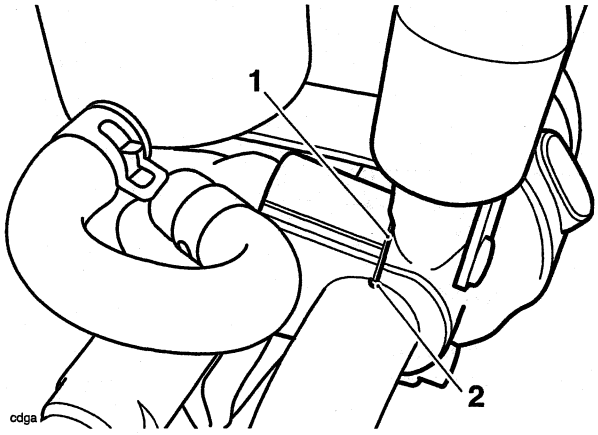

**1. Closing inner cable**
**2. Opening inner cable**

5. Assemble the two halves of the cable guide ensuring that the outer cables are correctly located in the guide and the guide is positioned on the handlebars as prior to removal.




**1. Twist grip**
**2. Twist grip guide**
**3. Screws**

6. Tighten the cable guide fixings to **6 Nm.**
7. Position the right hand switch cube to the handlebar and tighten the fixings to **4 Nm.**
8. Position the front brake master cylinder assembly to the handlebar. Fit the clamp (Up arrow pointing upwards) and clamp fixings.
9. Align the split line of the master cylinder clamp to the punch mark on the upper surface of the handlebar and tighten the clamp fixings, upper first, to **15 Nm.**




**1. Punch mark**
**2. Clamp split Line**

10. Fit the left hand handlebar grip.
11. Position the clutch lever to the handlebar. Fit the clamp (UP arrow pointing upwards) and clamp bolts.
12. Align the split line of the clutch lever with the punch mark on the upper surface of the handlebar, then tighten the clamp bolts, upper first, to **15 Nm.**
13. Align the left hand switch cube to the handlebar and secure with the screws. Tighten the screws to **4 Nm.**
14. Fit the handlebar end weights, tightening the fixings to **5 Nm.**
15. Check the throttle cable free play setting. Adjust as necessary (see page *10-110*).
16. Reconnect the battery, positive (red) lead first (see page *17-7*).
17. Refit the seat (see page *16-9*).
18. Check for correct operation of the front brake and clutch. Check that the throttle opens and closes without sticking and that the cables do not bind or restrict the steering when the handlebars are turned from lock-to-lock. Rectify as necessary.

**Warning**

Operation of the motorcycle with incorrectly adjusted, incorrectly routed or damaged throttle cables 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.

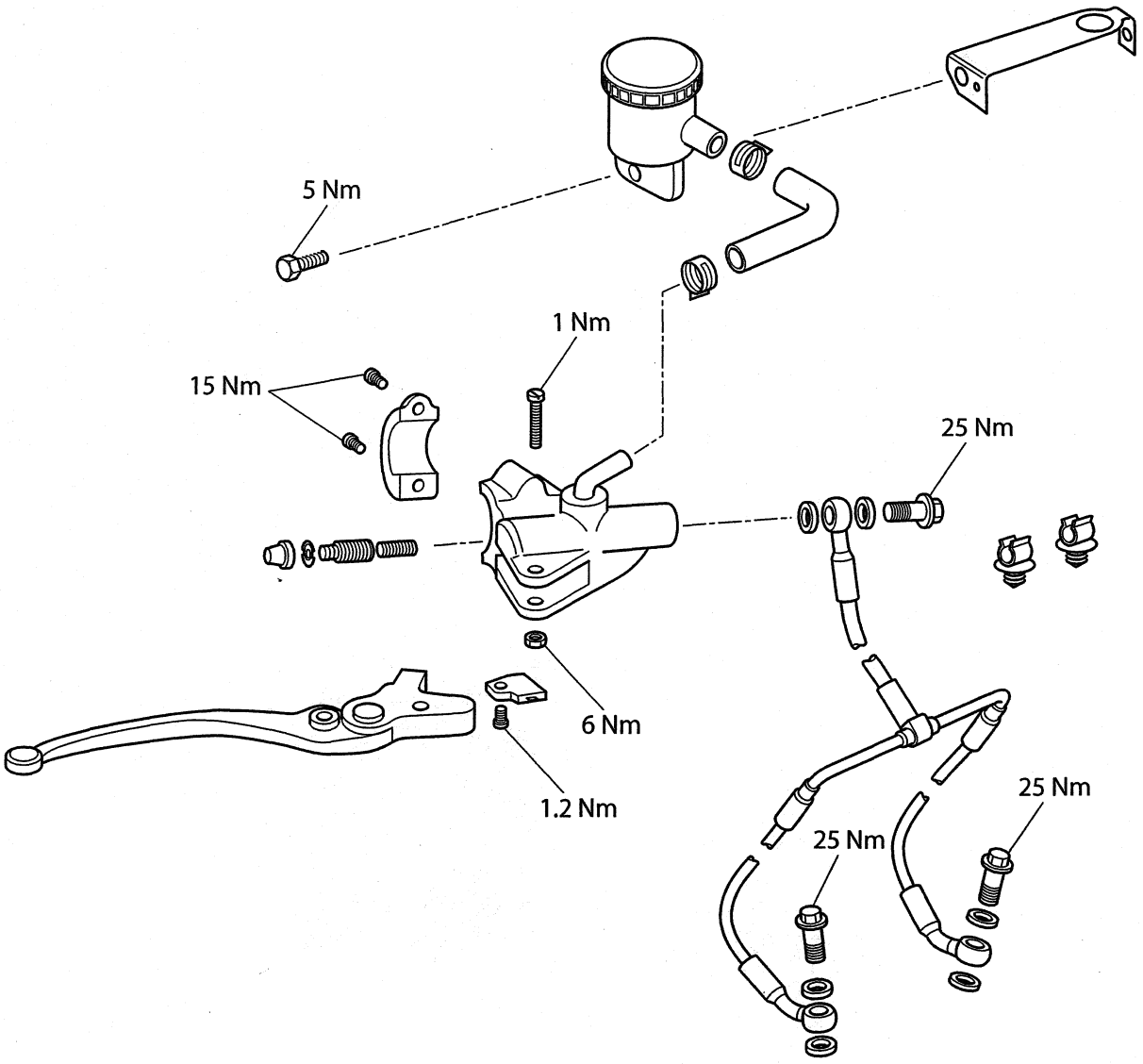
**Warning**

Move the handlebars to left and right full lock while checking that cables and harnesses do not bind or that the steering feels tight or difficult to turn. A cable or harness that binds, or steering that is tight/difficult to turn will restrict the steering and may cause loss of control and an accident.

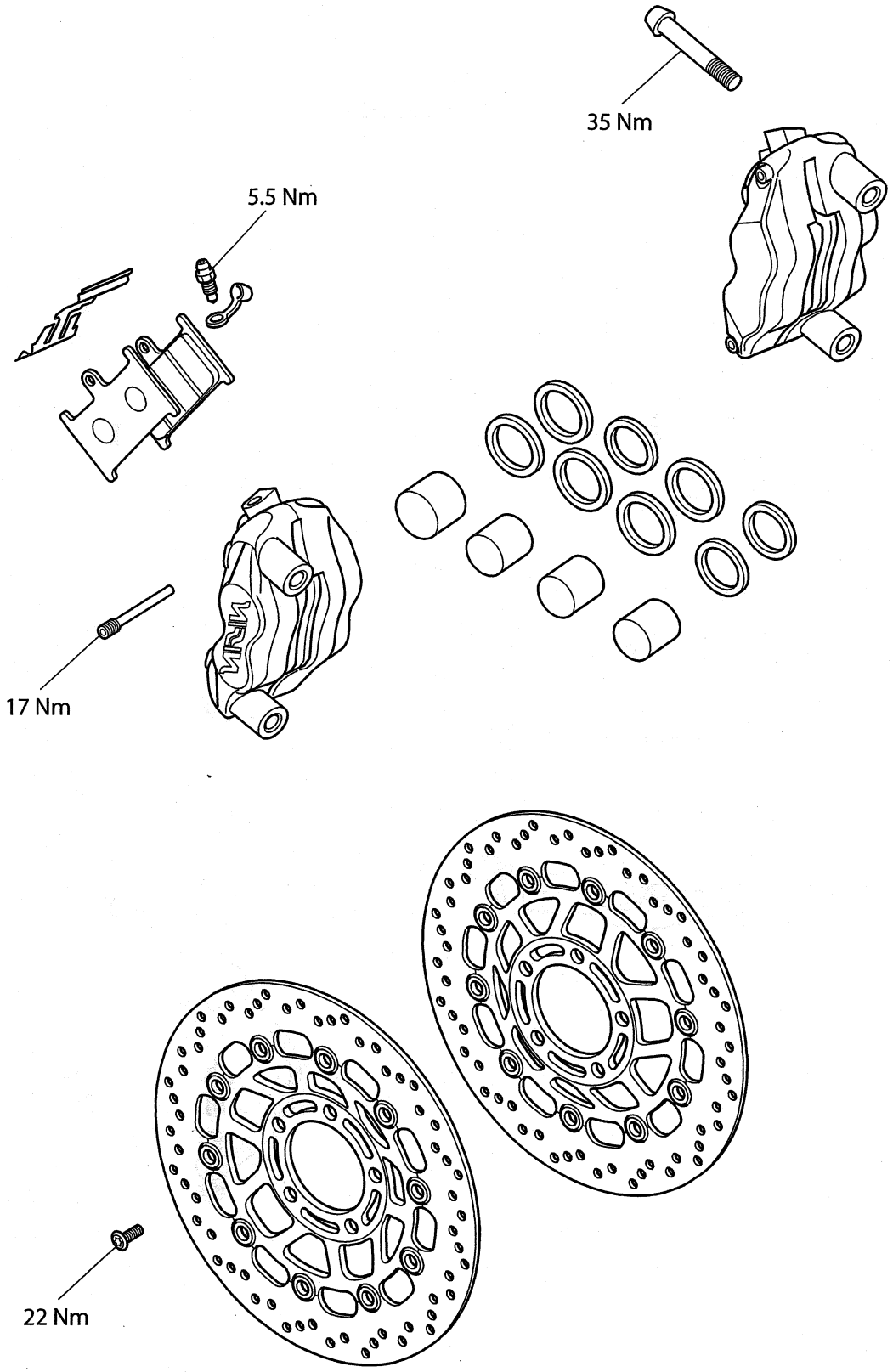
# 14 Brakes

## Table of Contents

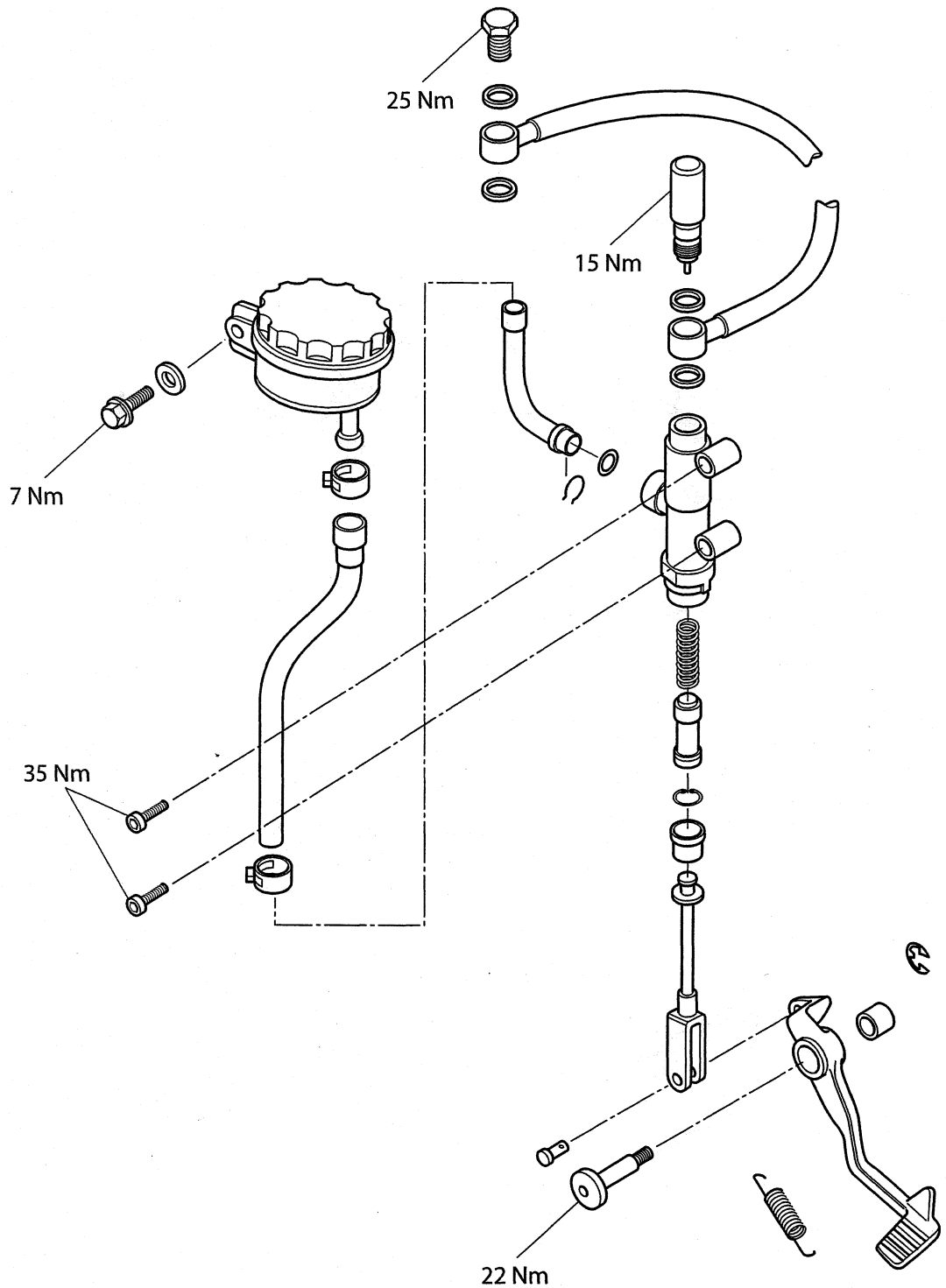
## Exploded View - Front Brake Master Cylinder



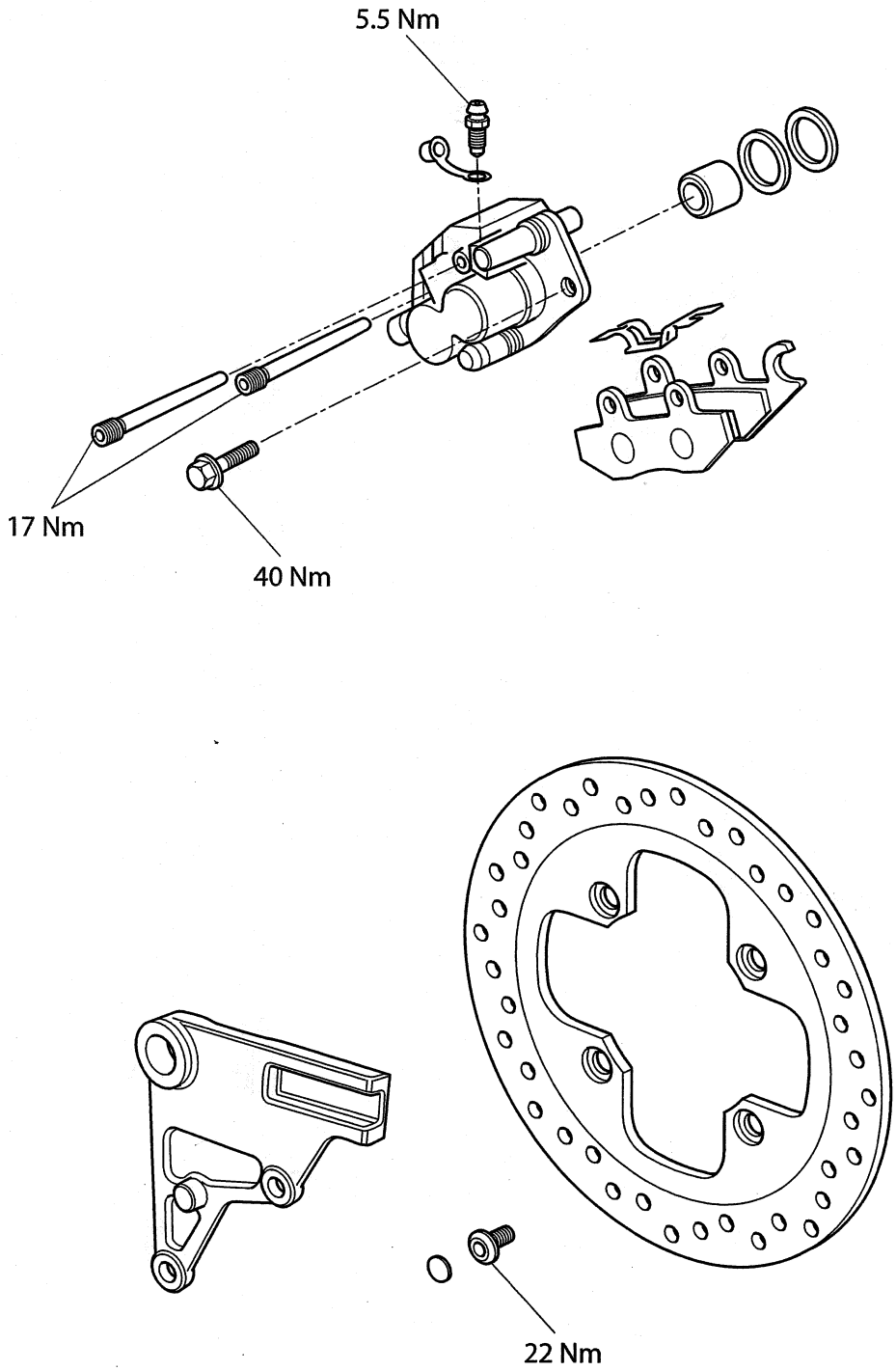
## Exploded View - Front Brake Calipers and Discs



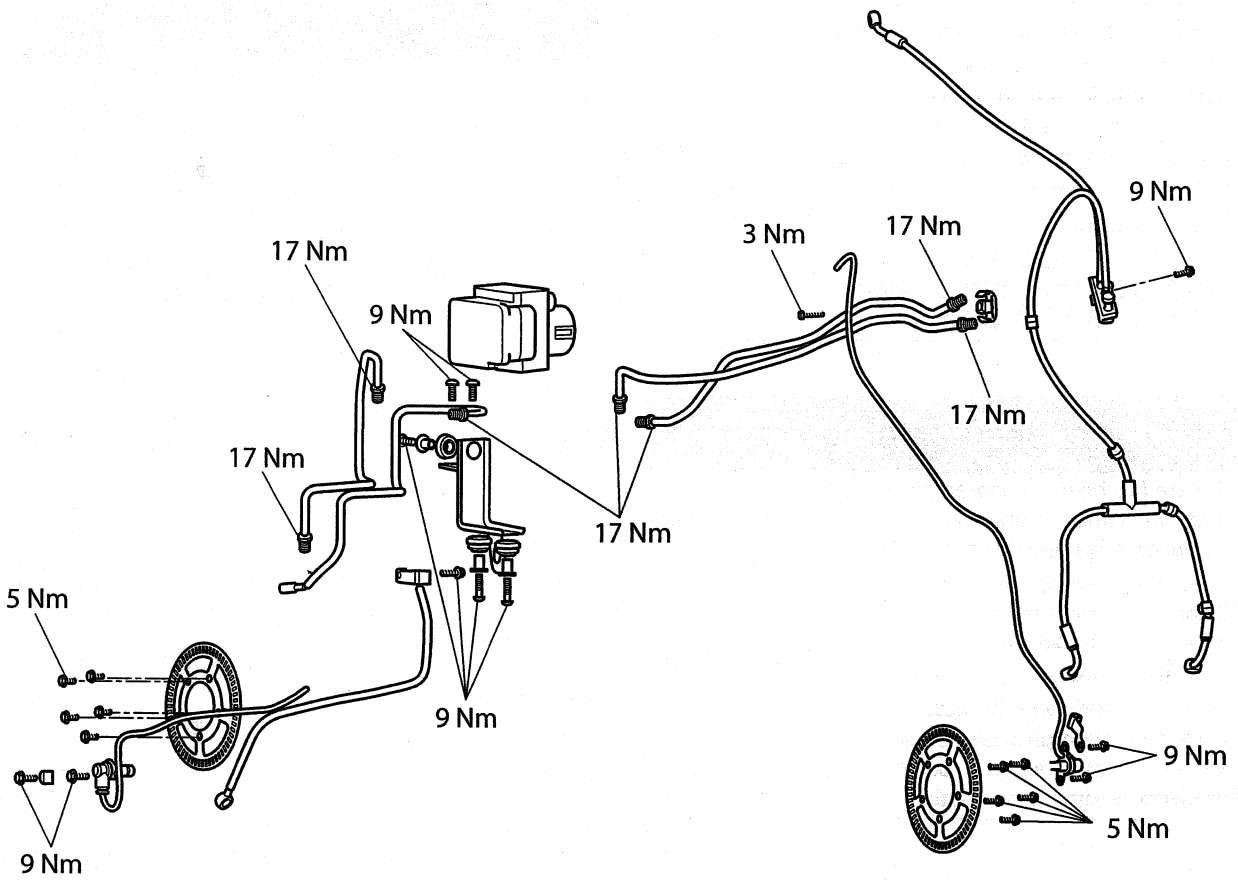
## Exploded View - Rear Brake Master Cylinder



## Exploded View - Rear Brake Caliper and Disc



## Exploded View - ABS System - see also page *14-78*



## 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 scheduled 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 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 scheduled 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.

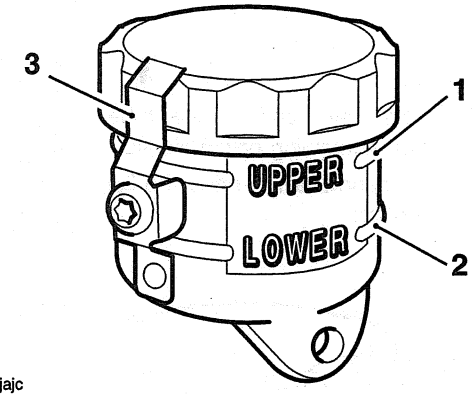
## Fluid Level Inspection

**Warning**

Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

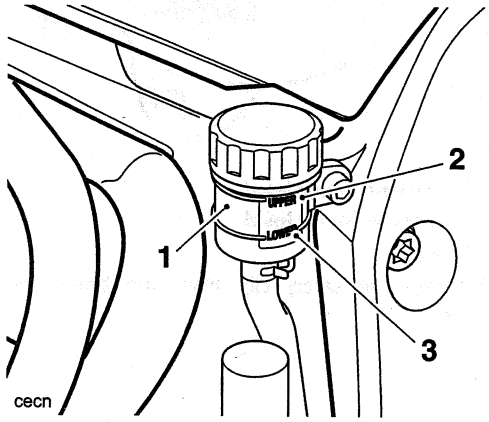
In accordance with the scheduled maintenance chart, inspect the brake fluid level in the front and rear master cylinder reservoirs.

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).




jajc

**1. Front reservoir upper level**
**2. Front reservoir lower level**
**3. Safety clip**




cecn

**1. Rear reservoir**
**2. Rear reservoir upper level**
**3. Rear reservoir lower level**

## Changing Brake Fluid

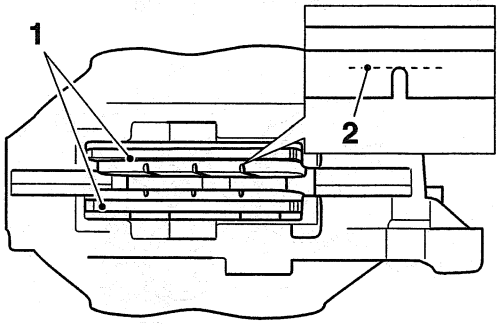
Brake fluid should be changed at the interval specified in the scheduled maintenance chart.

## Brake Pads

Front and rear pad wear is automatically compensated for and has no effect on brake lever or pedal action.

## Brake Wear Inspection

In accordance with the scheduled 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.




cbmz

**1. Lining material thickness**
**2. Centre groove**

**Warning**

Do not replace individual brake pads, replace both pads in the brake caliper. On the front where two calipers are mounted on the same wheel, all the pads in both calipers must be replaced together. Replacing individual pads will reduce braking efficiency and may cause an accident.

## Bleeding the Front Brakes, Renewing Brake Fluid

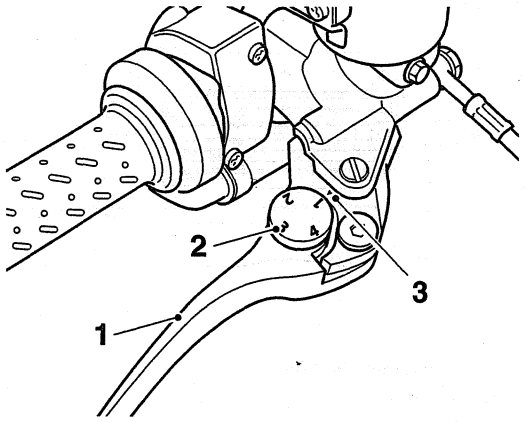
**Note:**

- **Models with ABS brakes: Refer to bleeding ABS brakes later in this section (see page *14-32*).**

**Warning**

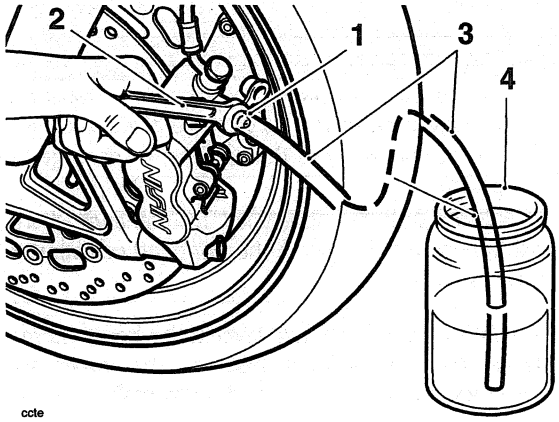
Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

1. Note the original setting of the brake lever adjuster in order that it can be returned to the same position when the bleeding operation is complete. Set the brake lever adjuster to position No.1.




**1. Brake lever**
**2. Adjuster**
**3. Indicator mark**

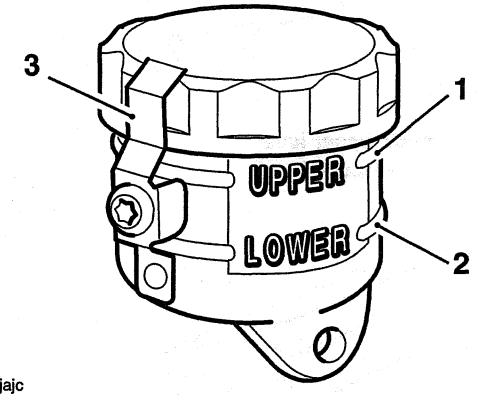
2. Remove the rubber cap from the bleed nipple on the right hand caliper.
3. Attach a transparent tube to the bleed nipple.




ccte

**1. Bleed nipple**
**2. Spanner**
**3. Bleed tube**
**4. Container**

4. Place the other end of the tube in a suitable receptacle containing new brake fluid.
5. Turn the handlebars to bring the fluid reservoir to a level position.




jajc

**1. Front reservoir upper level**
**2. Front reservoir lower level**
**3. Safety clip**

6. Remove the safety clip from the brake reservoir cover.

**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 opened for any period of time. Always check for fluid leakage around hydraulic fittings and for damage to hoses.

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.

7. Carefully remove the reservoir cover taking care not to spill any fluid.
8. Check the condition of the sealing diaphragm for the reservoir. Replace if necessary.
9. 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.**

10. Slowly pull the brake lever to the handlebar and, holding the lever fully in, close the bleed nipple.
11. Repeat steps 9 and 10 until no more air appears in the bleed tube.
12. When all air has been expelled from the system, hold the lever in and close the bleed nipple. Tighten the nipple to **5.5 Nm.**
13. 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.

14. Remove the transparent bleed tube.

**Note:**

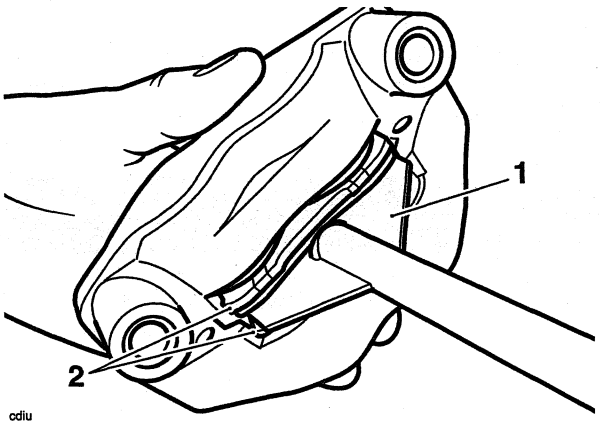
- **To fully remove any air from the braking system, carry out the additional bleeding procedure to each caliper as listed below:**

15. Undo and remove the bolts securing the front brake caliper to the fork and manoeuvre the caliper clear of the brake disc. **Do not remove the brake hose(s) connected to the caliper.**

**Warning**

Do not allow the brake caliper to hang on the brake hose as this may damage the hose and could lead to an accident.

16. Obtain a suitable, wide, flat metal plate which is approximately 2 mm thick and place it between the brake pads. Pump the front brake lever a few times until the metal plate is held in place by the brake pads.

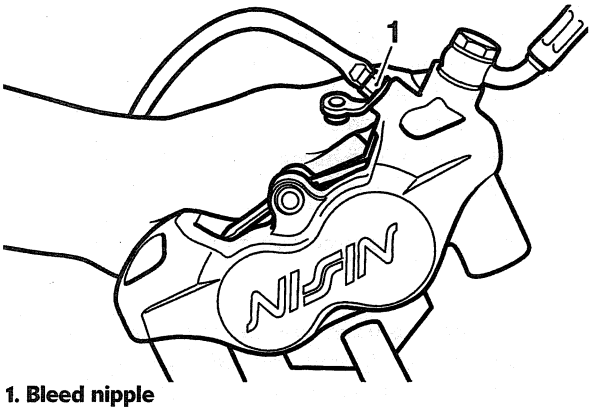



odiu

**1. Plate**
**2. Brake pads**

17. Whilst supporting the caliper, attach a transparent tube to the bleed nipple and place the other end of the tube in a suitable receptacle containing new brake fluid. Keep the tube end below the level of fluid.

18. Support the caliper so that the bleed nipple is uppermost.




**1. Bleed nipple**

19. Release the bleed nipple.

**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.**

20. Get an assistant to slowly pull the brake lever to the handlebar.
21. With the lever held fully against the handlebar, close the bleed nipple. Once the bleed nipple is closed, release the brake lever.
22. Repeat steps **19** to **21** until no more air appears in the bleed tube.
23. When all the air has been expelled from the system, hold the lever fully against the handlebar and close the bleed nipple.
24. Remove the transparent bleed tube.
25. Using the flat metal plate, gently push the brake pads apart to allow clearance for the brake disc when the caliper is refitted.

**Warning**

Brake fluid may be displaced as the caliper pistons are compressed. To prevent bodywork damage, ensure that the displaced fluid does not come into contact with any part of the bodywork or wheel.

26. Secure the caliper to the front fork using the original fixings. Tighten the fixings to **35 Nm.**
27. Refit the transparent bleed tube and repeat steps **19** and **21** until no more air appears in the bleed tube.

**Note:**

- **Maintain the brake fluid level between the upper and lower reservoir levels whilst bleeding is carried out.**

28. Tighten the bleed nipple to **5.5 Nm.**
29. Repeat the bleeding procedure for the left-hand caliper.
30. Fill the reservoir to the upper level with new DOT 4 fluid.

**Warning**

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

Observe the brake fluid handling warnings given in elsewhere in this section.

31. Refit the reservoir cover and diaphragm. Refit the safety clip and screw.

**Warning**

Always return the lever adjuster to the original setting. Operating the motorcycle with lever settings which are unfamiliar may lead to loss of control or an accident.

32. Reset the brake lever adjuster to the original setting.
33. Check that the brake operates correctly. Rectify as necessary.

**Warning**

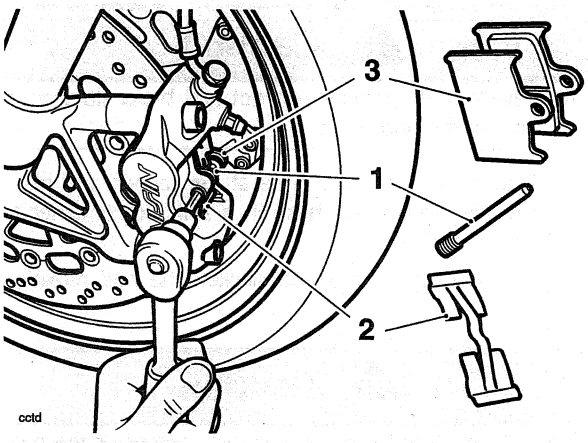
It is dangerous to operate the motorcycle with defective brakes; you must have your authorised Triumph dealer take remedial action before you ride the motorcycle again. Failure to take remedial action may result in reduced braking efficiency leading to loss of motorcycle control and an accident.

## Front Brake Pads

### Removal

**Warning**

Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.




**1. Retaining pin**
**2. Anti-rattle spring**
**3. Brake pads**

1. Remove the brake pad retaining pin after removing the 'R' clip from its inner end. Inspect the pad retaining pin for damage.
2. Remove the anti-rattle spring and inspect the spring for damage.

**Caution**

Never lever directly against the disc, caliper or the pad lining material as this will damage these components. Always use a levering tool made from a soft material which will not cause damage to the load bearing surfaces.

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.

3. Ease the brake pads apart to force the caliper pistons back and allow withdrawal of the pads.
4. Remove both brake pads and inspect for damage and wear beyond the service limit.

**Note:**

- **Complete the assembly of the brake pads to one caliper (see assembly for details) before removing the pads from the other caliper.**

### Installation

**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.

1. Fit new brake pads as an axle set or, if all the pads are in a serviceable condition, clean the pad grooves before refitting all pads in their original positions.

**Warning**

Do not apply more than a minimum coating of grease to the pad retaining pins. Excess grease may contaminate the brake pads, hydraulic seals and discs causing reduced braking efficiency and an accident.

2. Lubricate the pad retaining pins using a minimum amount of proprietary high temperature 'Copperslip' type grease.
3. Fit the anti-rattle spring over the pads and push down in the centre to allow the pad retaining pin to slide across the top of the spring.
4. Tighten the pad retaining pins to **17 Nm,** and secure with the 'R' clip.
5. Pump the brake lever to correctly position the caliper pistons.

**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. Check the front brake fluid level and top up as required with new DOT 4 fluid.
7. Check for correct brake operation. Rectify as necessary.

**Warning**

It is dangerous to operate the motorcycle with defective brakes; you must have your authorised Triumph dealer take remedial action before you ride the motorcycle again. Failure to take remedial action may result in reduced braking efficiency leading to loss of motorcycle control and an accident.

## Front Brake Caliper

### Removal

**Warning**

Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

**Caution**

To prevent body damage, do not spill brake fluid onto any area of the bodywork.

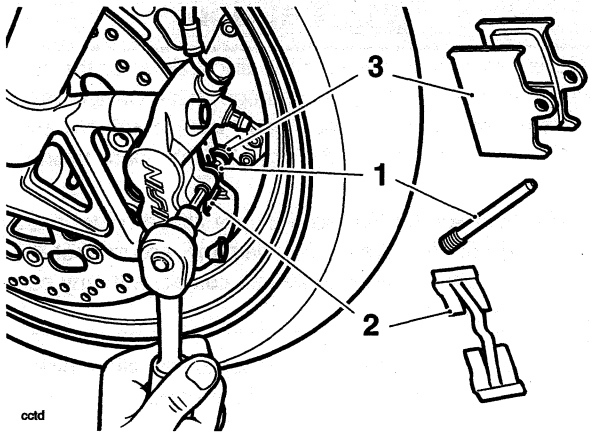
1. Disconnect the brake hose at the caliper, and place the free end of the hose in a suitable container to collect brake fluid.
2. Remove the 'R' clip and slacken the pad retaining pin.

**Caution**

Never lever directly against the disc, caliper or the pad lining material. Always use a levering tool made from a soft material that will not cause damage to the load bearing surfaces.

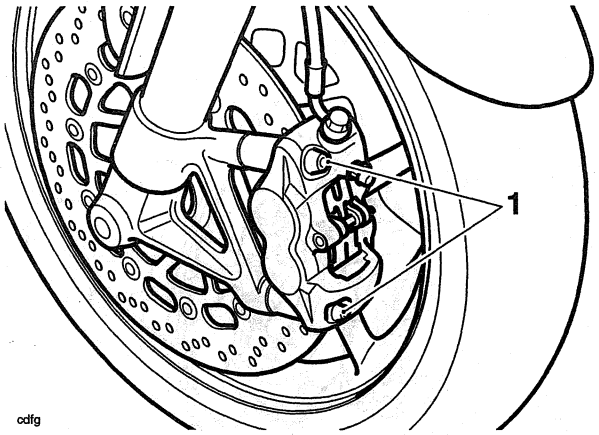
Brake fluid will be displaced from the hose joint as the caliper pistons are compressed. To prevent body damage, ensure that the displaced fluid does not come into contact with any part of the bodywork.

3. Remove the brake pads.




**1. Retaining pin**
**2. Anti-rattle spring**
**3. Brake pads**

4. Remove the two caliper bolts.




odfg

**1. Caliper bolts**

5. Manoeuvre the caliper clear of the disc, taking care not to damage the wheel.

## Disassembly

1. Undo and remove the four bolts which secure the two halves of the brake caliper together. Discard the bolts.
2. Carefully split the two halves of the caliper then remove and discard the joint seal.

**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.

**Warning**

Ensure that the caliper bores do not become scratched during piston removal and assembly. Ensure that the pistons remain square to their bores during fitment otherwise damage to the caliper could result.

A dangerous riding condition leading to an accident could result if this warning is ignored.

3. Cover the caliper half with a clean, heavy cloth and, using compressed air, remove the pistons one at a time.

**Warning**

Ensure the seal grooves in the caliper bores are not damaged during the removal of the seals. Damage to the seal grooves may allow brake fluid to leak past the seals resulting in a dangerous riding condition leading to loss of motorcycle control and an accident.

4. Remove the old piston seals and dust seals then thoroughly clean and dry the caliper bores and pistons. Discard the old seals, these must not be re-used.

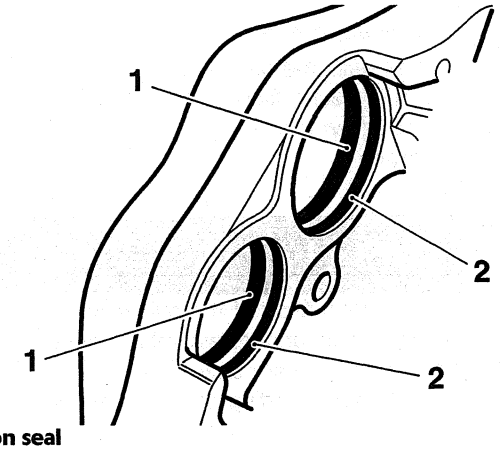
**Warning**

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.

5. Check the pistons and caliper bores for corrosion, scoring and damage. Renew as necessary.

## Assembly




odff

**1. Piston seal**
**2. Dust seal**

**Note:**

- **The piston seals are slightly thicker than the dust seals.**

1. Fit the piston seals and the dust seals to the caliper bores in the position shown above and apply a smear of silicone seal grease (Triumph part number T2020338) to the face of each seal which will contact the caliper piston in use.

**Warning**

Ensure that the silicone seal grease (Triumph part number T2020338) is applied to the face of the piston seal and dust seal which will contact the caliper piston in use, this will help to prevent the caliper piston from sticking.

Never omit to lubricate both seals with the seal grease. Failure to lubricate both seals with the correct seal grease may cause the caliper piston to stick. A sticking caliper piston will result in a dangerous riding condition leading to loss of motorcycle control and an accident.

**Warning**

Only use the silicone seal grease specified in this instruction (Triumph part number T2020338) to lubricate the piston seal and the dust seal. Using lubricant other than the silicone seal grease specified in this instruction may 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.

2. Carefully push the **dry** pistons fully into the caliper bores by hand.
3. Clean off any excess grease from the calipers.
4. Once all seals and pistons have been fitted, carefully clean the mating faces of both sides of the caliper then fit a new joint seal to the recess in one half of the caliper.

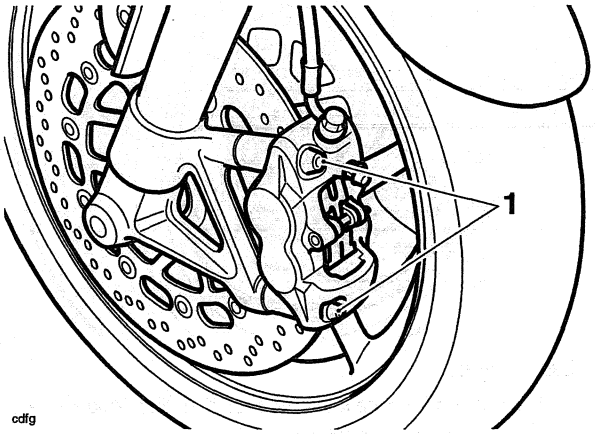
**Warning**

Ensure the mating faces of the caliper halves are clean and free from dust prior to assembly. Failure to ensure that the mating faces are clean and free from dust will result in a dangerous riding condition leading to loss of motorcycle control and an accident.

5. Apply a small drop of threadlocking solution (ThreeBond 1305 or equivalent) to the threads of new caliper bolts and secure the two halves of the caliper together. Tighten the caliper bolts to **24 Nm.**

### Installation

1. Position the caliper over the disc and tighten the caliper bolts to **35 Nm.**




**1. Caliper bolts**

2. Fit the brake pads to the caliper and locate the anti-rattle spring over the pads.

**Warning**

Do not apply more than a minimum coating of grease to the pad retaining pins. Excess grease may contaminate the brake pads, hydraulic seals and discs causing reduced braking efficiency and an accident.

3. Lubricate the pad retaining pins using a minimum amount of proprietary high temperature 'Copperslip' type grease. Push down in the centre of the anti rattle spring and fit the retaining pin.
4. Tighten the brake pad retaining pin to **17 Nm.** Refit the 'R' clip.
5. Connect the brake hose to the caliper, incorporating new sealing washers on each side of all hose connections.
6. Tighten the banjo bolt to **25 Nm.**

**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. Fill the master cylinder with new, DOT 4 brake fluid from a sealed container.
8. Bleed the front brake line (see page *14-12*).
9. Check for correct brake operation.

**Warning**

It is dangerous to operate the motorcycle with defective brakes; you must have your authorised Triumph dealer take remedial action before you ride the motorcycle again. Failure to take remedial action may result in reduced braking efficiency leading to loss of motorcycle control and an accident.

## Front Discs

**Warning**

Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

### Wear

1. Replace any brake disc if worn beyond the service limit or exceeds the disc run-out limit.

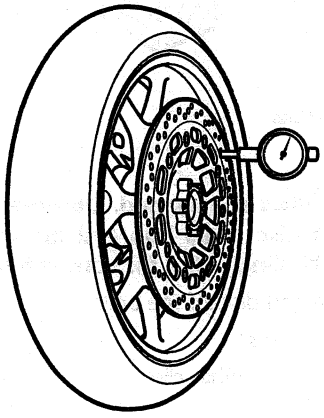
**Front Disc Thickness**

| | |
|---|---|
| Standard: | 4.5 mm |
| Service Limit: | 4.0 mm |

**Disc Run-out**

| | |
|---|---|
| Standard: | 0.1 mm |
| Service Limit: | 0.3 mm |

Measure disc run out using an accurate dial gauge mounted on a surface plate.



ceih

**1. Disc**
**2. Dial gauge**

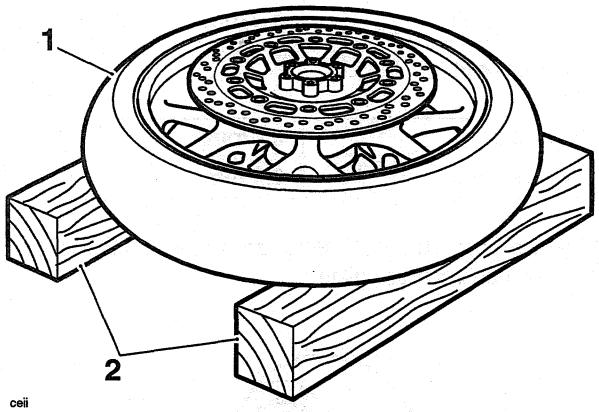
## Removal

**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.

2. Remove the front wheel (see page *15-6*).
3. **Motorcycles with ABS:** Remove the ABS pulser ring (see page *14-33*).
4. Support the wheel on blocks as illustrated to avoid damage to the wheel centre.




ceii

**1. Wheel**
**2. Support blocks**

**Note:**

- **The discs are handed. Observe the offset of each disc to its hub and the orientation of the cooling holes, for correct installation.**

5. Remove and discard the bolts.
6. Detach the disc.
7. Repeat for the other disc.

## Installation

1. Locate the first disc on the correct side of the wheel (offset of disc outwards) as noted during removal.
2. Fit new bolts and tighten to **22 Nm.**
3. Fit the other disc in the same way.
4. **Motorcycles with ABS:** Refit the ABS pulser ring (see page *14-33*)
5. Refit the wheel (see page *15-7*).
6. Check for correct brake operation. Rectify as necessary.

**Warning**

It is dangerous to operate the motorcycle with defective brakes; you must have your authorised Triumph dealer take remedial action before you ride the motorcycle again. Failure to take remedial action may result in reduced braking efficiency leading to loss of motorcycle control and an accident.

## Front Brake Master Cylinder

### Removal

**Warning**

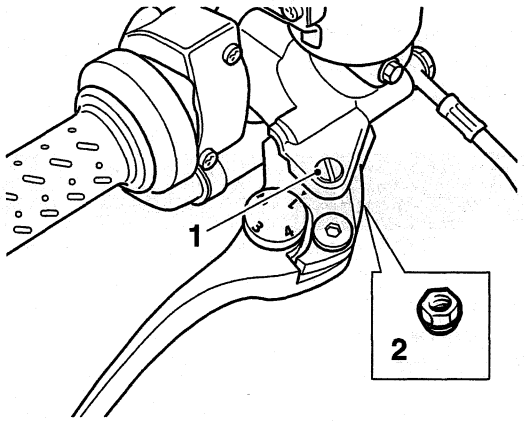
Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

1. Remove the seat (see page *16-9*).
2. Disconnect the battery, negative (black) lead first.

**Caution**

To prevent body damage, do not spill brake fluid onto any area of the bodywork.

3. To drain the fluid from the master cylinder, attach a tube to the right hand caliper bleed nipple, slacken the nipple and allow the fluid to drain into a suitable container. Operate the brake lever until all fluid has been expelled.
4. Note the setting of the brake lever adjuster to ensure it is returned to the same position when the overhaul operation is complete.
5. Remove the pivot locknut and bolt securing the brake lever to the master cylinder, and remove the lever.

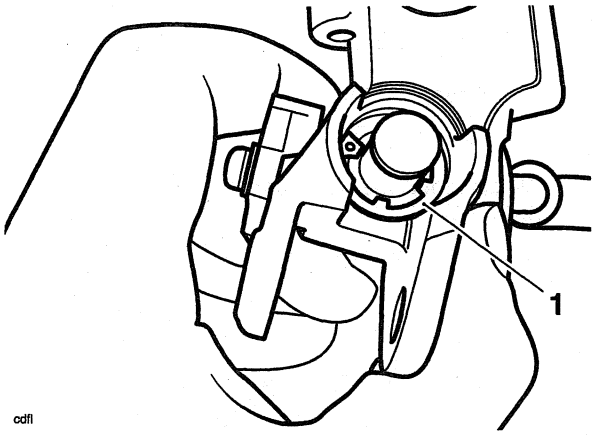



**1. Pivot bolt**
**2. Nut**

6. Disconnect from the master cylinder:
   - **brake hoses,**
   - **brake light switch connections.**
7. Release the clamp screws from the handlebar to remove the master cylinder.

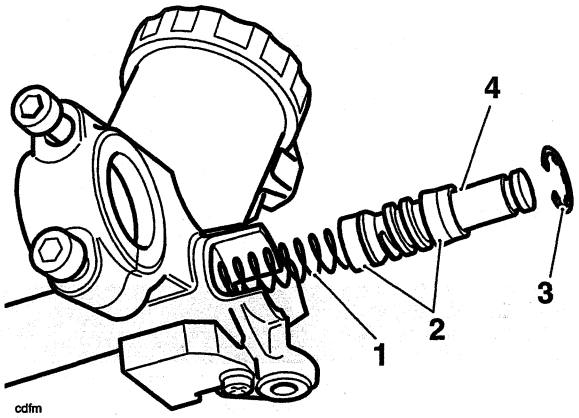
### Disassembly

1. Support or remove the reservoir.
2. Detach the boot from the lever end of the cylinder.
3. Remove the circlip from beneath the boot.




**1. Circlip**

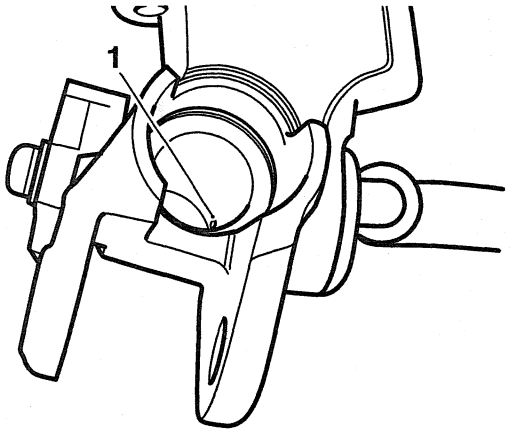
4. Remove the piston set from the master cylinder bore noting the relative position of the seals and piston components.




**1. Spring**
**2. Piston seals**
**3. Circlip**
**4. Piston**

## 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 ports in the cylinder are not blocked.




cdfn

**1. Port**

## 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.

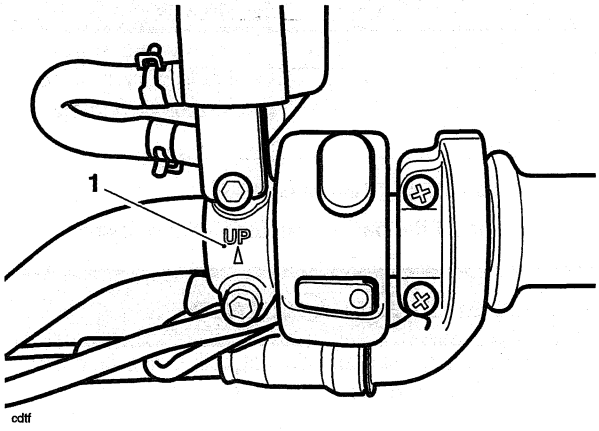
1. Lubricate the piston and cylinder with new, clean brake fluid.

**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.

2. Fit the new piston set into the master cylinder and retain with a new circlip.
3. Refit the master cylinder boot.

## Installation




cdtf

**1. Arrow mark**

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.
2. Tighten the clamp bolts, upper first and then the lower to **15 Nm.**
3. Connect the brake light switch.
4. Position the brake lever ensuring that the pivot boss is correctly aligned to the push rod. Fit and tighten the pivot bolt to **1 Nm,** and the locknut to **6 Nm.**
5. Connect the brake hose to the master cylinder using new sealing washers. Tighten the banjo bolt to **25 Nm.**

**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. Fill and bleed the front brakes (see page *14.9*).

**Warning**

Always return the lever adjuster to the original setting noted during removal. Operating the motorcycle with lever settings which are unfamiliar may lead to loss of control or an accident.

7. Reset the brake lever adjuster to the original setting.
8. Examine the system for correct operation and fluid leaks. Rectify as necessary.
9. Connect the battery positive, (red) lead first.
10. Refit the seat (see page *16.9*).
11. Check for correct brake operation. Rectify as necessary.

**Warning**

It is dangerous to operate the motorcycle with defective brakes and you must have your authorised Triumph dealer take remedial action before you ride the motorcycle again. Failure to take remedial action may result in reduced braking efficiency leading to loss of motorcycle control and an accident.

## Bleeding the Rear Brakes, Renewing Brake Fluid

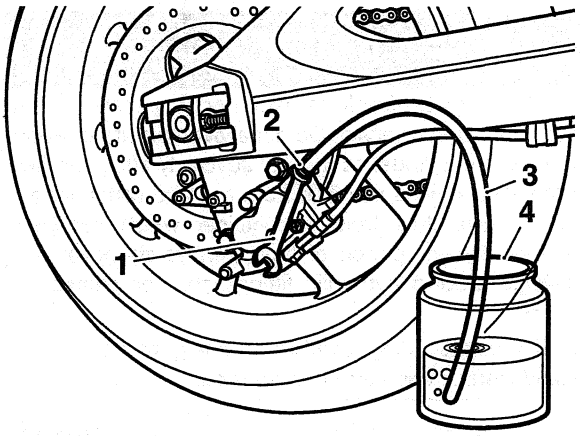
**Note:**

- **Models with ABS brakes: Refer to bleeding ABS brakes later in this section (see page *14-34*).**

**Warning**

Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

1. Remove the cap from the rear bleed nipple.
2. Attach a transparent tube to the bleed nipple.



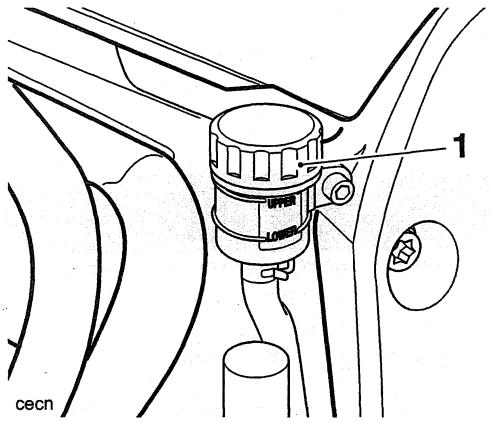

**1. Bleed nipple**
**2. Spanner**
**3. Bleed tube**
**4. Container**

3. Place the other end of the tube in a suitable receptacle containing new brake fluid.

**Caution**

To prevent body damage, do not spill brake fluid onto any area of the bodywork.

4. Remove the rear brake reservoir cover taking care not to spill any fluid.




**1. Rear brake fluid reservoir cap**

**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 opened for any period of time. Always check for fluid leakage around hydraulic fittings and for damage to hoses.

A dangerous riding condition leading to an accident could result if this warning is ignored.

5. Check the condition of the sealing diaphragm. Replace the diaphragm as necessary.
6. Release the bleed nipple.

**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.**

7. Slowly depress the brake pedal and, holding the pedal fully down, close the bleed nipple. Repeat steps 8 and 9 until no more air appears in the bleed tube.
8. Maintain the brake fluid level between the upper and lower reservoir levels whilst bleeding is being carried out.
9. When all air has been expelled from the system, hold down the brake pedal and close the bleed nipple. Tighten the nipple to **5.5 Nm**.
10. Fill the reservoir to the maximum 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.

11. Fit the reservoir cover and diaphragm. Check for correct diaphragm fitment before final tightening of the cover.
12. Remove the bleed tube from the nipple.
13. Replace the bleed nipple dust cap.
14. Check that the brake operates correctly.

**Warning**

It is dangerous to operate the motorcycle with defective brakes and you must have your authorised Triumph Dealer take remedial action. Failure to take remedial action may reduce braking efficiency leading to loss of motorcycle control and an accident.

## Rear Brake Pads

### Removal

**Warning**

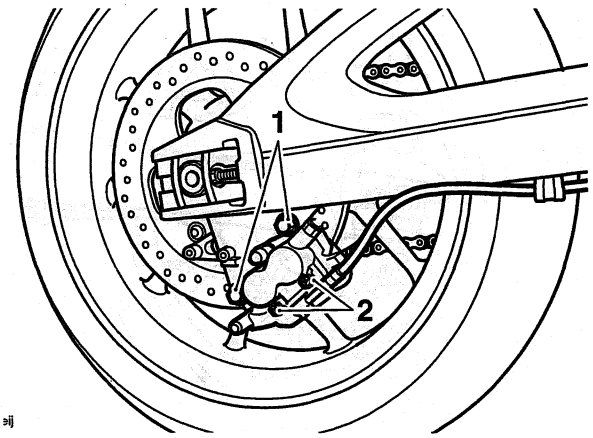
Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

1. Slacken the brake pad retaining pins.

**Warning**

Do not allow the caliper to hang on the brake hoses as this may damage the hoses and could lead to an accident.

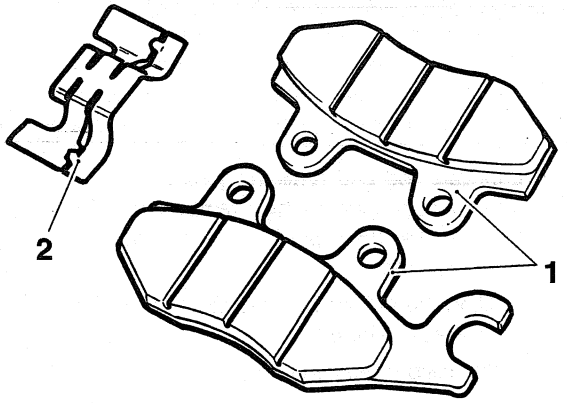
2. Remove the caliper mounting bolts and position the caliper to allow withdrawal of the pad retaining pins.




eij

**1. Caliper mounting bolts**
**2. Pad retaining pins**

3. Press downwards on both pads and remove the pad retaining pins.
4. Remove the brake pads and inspect for damage or wear beyond the service limit, replace if necessary.




gaed1

**1. Brake pads**
**2. Anti rattle spring**

5. Remove the anti-rattle spring and inspect for damage, replace if necessary.

### Installation

**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 mineral based grease may reduce braking efficiency resulting in an accident.

**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 or the rear wheel.

1. If fitting new pads, use hand pressure to compress the caliper pistons fully into their bores.
2. Fit the anti-rattle spring into the caliper.
3. Renew the brake pads as a pair or, if both pads are in a serviceable condition, clean the pad grooves before fitting them.

**Warning**

Do not apply more than a minimum coating of grease to the pad retaining pins. Excess grease may contaminate the brake pads, hydraulic seals and discs causing reduced braking efficiency and an accident.

4. Lubricate the pad retaining pins using a minimum amount of proprietary high temperature 'Copperslip' type grease. Press down on both pads and fit the retaining pins.
5. Position the caliper over the disc ensuring both pads are correctly aligned.
6. Fit the caliper retaining bolts, and tighten to **40 Nm**.
7. Tighten the brake pad retaining pins to **17 Nm**.
8. Pump the brake pedal to correctly position the caliper pistons.
9. Check the brake fluid level and top-up as required with new DOT 4 fluid.
10. Check that the brake operates correctly.

**Warning**

It is dangerous to operate the motorcycle with defective brakes and you must have your authorised Triumph Dealer take remedial action. Failure to take remedial action may reduce braking efficiency leading to loss of motorcycle control and an accident.

## Rear Brake Caliper

### Removal

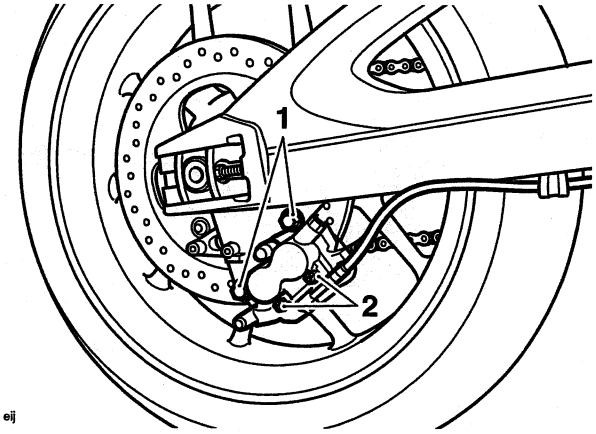
**Warning**

Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

**Caution**

To prevent body damage, do not allow brake fluid to contact any area of the bodywork or the rear wheel.

1. Disconnect the rear brake hose at the caliper and place the free end of the hose in a suitable container to collect brake fluid.
2. Slacken the pad retaining pins.
3. Remove the caliper mounting bolts.
4. Remove the brake caliper assembly.




eij

**1. Caliper mounting bolts**
**2. Pad retaining pins**

### Disassembly

1. Remove the brake pads (see page *14-25*).

**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.

2. 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.

### Inspection

1. Check the piston and caliper bores 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 (see page *14-15*).

### 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.

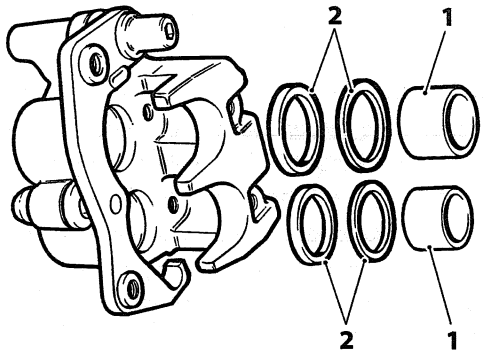
A dangerous riding condition leading to an accident could result if this warning is ignored.

**Warning**

Ensure that the caliper bores do not become scratched during removal and assembly.

A dangerous riding condition leading to an accident could result if this warning is ignored.

1. Fit new fluid seals to the caliper. Apply brake fluid to the outside of the caliper piston and fluid seal.



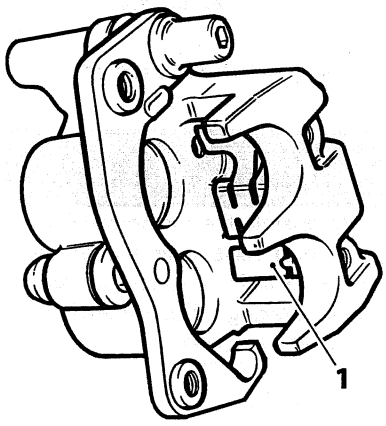

**1. Pistons**
**2. Seals**

**Warning**

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.

2. Carefully push both pistons into the caliper by hand.
3. Install the anti-rattle spring into the caliper.




**1. Anti rattle spring**

**Warning**

Do not apply more than a minimum coating of grease to the pad retaining pins. Excess grease may contaminate the brake pads, hydraulic seals and discs causing reduced braking efficiency and an accident.

4. Position the brake pads in the caliper. Lubricate the pad retaining pins using a minimum amount of proprietary high temperature 'Copperslip' type grease. Press down on both pads and fit the pad retaining pins.

### Installation

1. Position the caliper over the disc ensuring the pads are correctly aligned on both sides of the disc.
2. Fit the caliper retaining bolts, and tighten to **40 Nm**.
3. Tighten the brake pad retaining pins to **17 Nm**.
4. Connect the brake hose to the caliper using new washers on each side of the banjo bolt.
5. Tighten the brake light switch to **15 Nm**.

**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. Fill the master cylinder with new, DOT 4 brake fluid from a sealed container.
7. Bleed the rear brake (see page *14-23*).
8. Refit the upper chain guard and rear brake hose cover.
9. Check that the brake operates correctly.

**Warning**

It is dangerous to operate the motorcycle with defective brakes and you must have your authorised Triumph Dealer take remedial action. Failure to take remedial action may reduce braking efficiency leading to loss of motorcycle control and an accident.

## Rear Brake Disc

### Wear

1. Replace any brake disc if worn beyond the service limit or that exceeds the disc run-out limit.

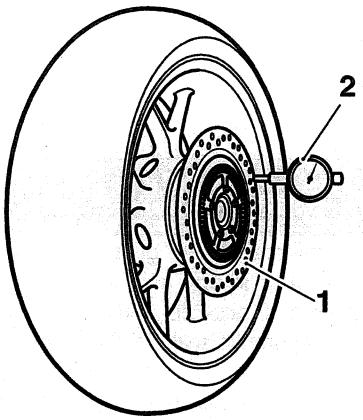
**Rear Disc Thickness**

| | |
|---|---|
| Standard: | 6.0 mm |
| Service Limit: | 5.0 mm |

**Disc Run-out**

| | |
|---|---|
| Standard: | 0.1 mm |
| Service Limit: | 0.3 mm |

Measure disc run out using an accurate dial gauge mounted on a surface plate.



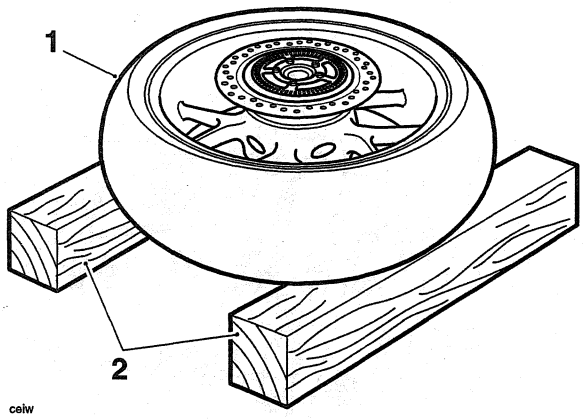

ceiw

**1. Disc**
**2. Dial gauge**

### Removal

1. Remove the rear wheel (see page *15-9*).

2. Support the wheel on blocks as illustrated to avoid damage to the wheel centre.




**1. Wheel**
**2. Support blocks**

3. **Motorcycles with ABS:** Remove the ABS pulser ring (see page *14-35*).
4. Remove and discard the four bolts to detach the disc.

### Installation

1. Locate the disc on the rear wheel.
2. Fit new bolts and tighten to **22 Nm**.
3. **Motorcycles with ABS:** Refit the ABS pulser ring (see page *14-35*)
4. Thoroughly clean and degrease the disc.
5. Refit the rear wheel (see page *15-9*).
6. Check that the brake operates correctly.

**Warning**

It is dangerous to operate the motorcycle with defective brakes and you must have your authorised Triumph Dealer take remedial action. Failure to take remedial action may reduce braking efficiency leading to loss of motorcycle control and an accident.

## Rear Master Cylinder

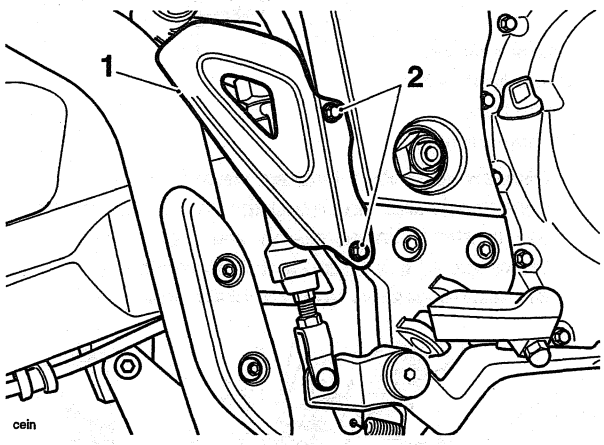
### Removal

1. Remove the seat (see page *16-9*).
2. Disconnect the battery, negative (black) lead first.

**Caution**

To prevent body damage, do not spill brake fluid onto any area of the bodywork or wheels.

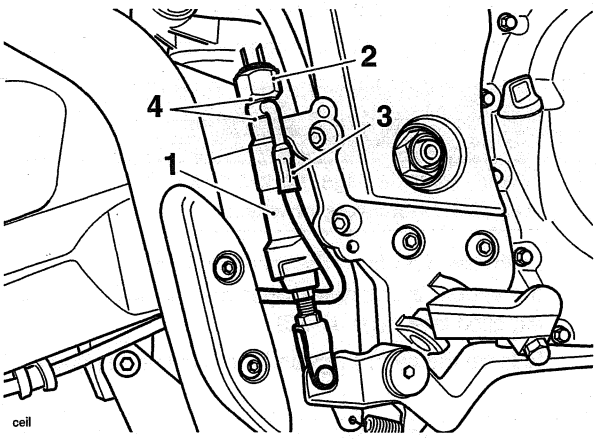
3. Drain the fluid from the master cylinder by bleeding the system at the rear caliper until all fluid has been expelled (see page *14-23*).
4. Release the two fixings and remove the heelguard.




**1. Heelguard**
**2. Fixings**

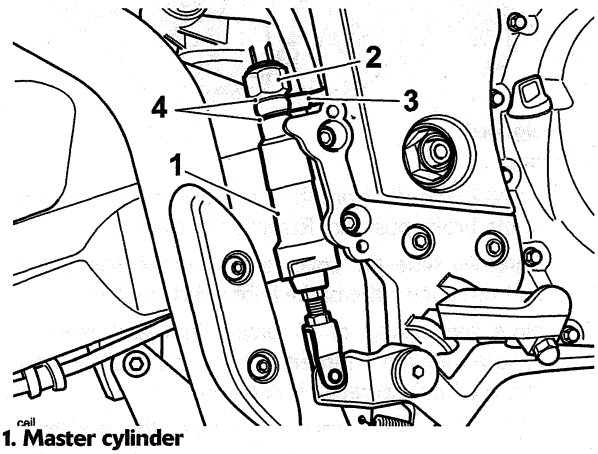
5. Remove the clip from the clevis pin at the lower end of the brake pushrod. Remove the clevis pin.
6. Carefully slide the cover off the brake light switch and disconnect the brake light switch multiplug.
7. Note the setting of all brake lines and hoses to ensure they are returned to the same position when the overhaul operation is complete.
8. Disconnect the reservoir hose from the rear brake fluid reservoir.

9. **Models without ABS brakes:** Release the rear brake light switch and disconnect the rear brake hose from the master cylinder. Remove and discard the sealing washers from the brake light switch.



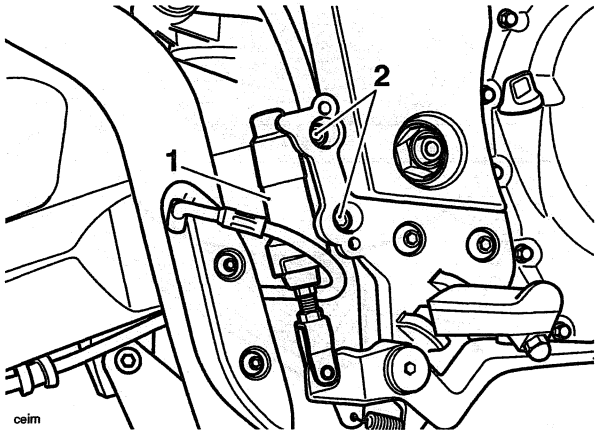

**1. Master cylinder**
**2. Brake light switch**
**3. Brake hose**
**4. Sealing washers**

10. **Models with ABS brakes:** Release the rear brake light switch and disconnect the rear brake line from the master cylinder, taking care not to bend the brake line as it is disconnected. Remove and discard the sealing washers from the brake light switch.




**1. Master cylinder**
**2. Brake light switch**
**3. Brake line**
**4. Sealing washers**

11. **All models:** Remove the two bolts securing the master cylinder to the frame and collect the master cylinder.




**1. Master cylinder**
**2. Fixings**

## Disassembly

1. Detach the boot from the cylinder and pushrod.
2. Remove and discard the circlip retaining the pushrod to the cylinder.
3. Remove the pushrod and 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.

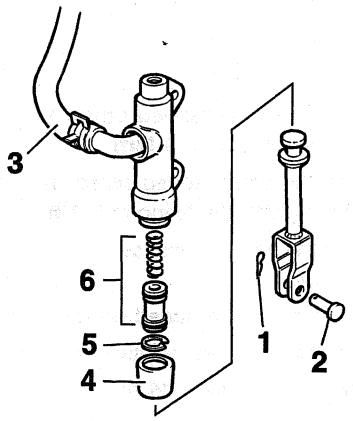
A dangerous riding condition leading to an accident could result if this warning is ignored.

1. Clean the master cylinder bore, piston and seals, with new brake fluid.
2. Ensure all ports are clear of obstruction.

**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. Install the spring and piston set together.
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.




galb

**1. Clip**
**2. Clevis pin**
**3. Reservoir hose**
**4. Dust boot**
**5. Circlip**
**6. Piston set**

### Installation

1. **All models:** Secure the master cylinder to the frame studs. Tighten the securing bolts to **27 Nm**.
2. Connect the reservoir hose to the rear brake fluid reservoir.
3. **Models with ABS brakes:** Incoporating new washers, fit the brake line and brake light switch to the master cylinder. Ensuring the brake line is located as noted on removal, tighten the switch to **15 Nm**.
4. **Models without ABS brakes:** Incoporating new washers, fit the brake hose and brake light switch to the master cylinder. Ensuring correct orientation of the brake hose, tighten the switch to **15 Nm**.
5. Refit the heelguard, tightening the fixings to **7 Nm.**
6. Connect the push rod to the brake pedal using the clevis pin and a new clip.
7. Connect the brake light switch multiplug and refit the cover.

**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.

8. Fill and bleed the rear brake (see page *14-23*).
9. Reconnect the battery, positive (red) lead first.
10. Fit the seat (see page *16-9*).

**Warning**

It is dangerous to operate the motorcycle with defective brakes and you must have your authorised Triumph Dealer take remedial action. Failure to take remedial action may reduce braking efficiency leading to loss of motorcycle control and an accident.

11. Check that the brake operates correctly.

## Bleeding the Front Brakes, Renewing Brake Fluid, Motorcycles with ABS

1. Complete the brake bleed procedure as for models without ABS brakes (see page *14-12*).
2. Connect the Triumph service diagnostic tool (See page *14-50*).
3. Follow the on screen menu to ABS diagnostics. From the menu, select 'BLEED SYSTEM' (see page *14-55*).
4. Select 'BLEED SYSTEM?' from the menu (see page *14-56*).

**Note:**

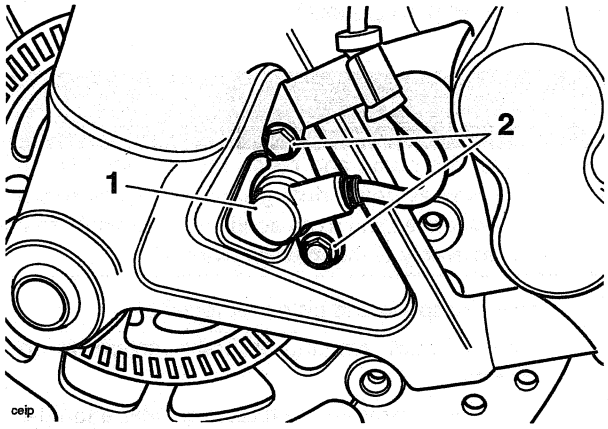
- **When the ABS modulator 2nd circuit is activated by the bleed command, the front brake lever travel will increase as ABS modulator solenoids are opened and will then decrease as the solenoids are automatically closed.**
- **Pressure must be applied to the front brake lever before operating the bleed sequence on the diagnostic tool. An assistant will be required to open the bleed nipple while pressure is applied to the brake lever.**

5. Apply pressure to the front brake lever, activate the bleed sequence on the diagnostic tool, and with assistance, release the bleed nipple.
6. Repeat the above procedure as necessary until all air is expelled from the system.
7. When all air has been expelled from the system, apply pressure to the brake lever and close the bleed nipple. Tighten the nipple to **5.5 Nm**.
8. Repeat the brake bleed procedure as for models without ABS brakes (see page *14-12*).

## Front ABS Wheel Speed Sensor

### Removal

1. Remove the seat (see page *16-9*).
2. Disconnect the battery, negative (black) lead first.
3. Disconnect the wheel speed sensor multiplug.
4. Release the wheel speed sensor harness from the brake hose clips.
5. Release the bolt securing the wheel speed sensor harness to the fork leg.
6. Release the bolts securing the wheel speed sensor to the fork leg, and remove the sensor.




**1. Front ABS wheel speed sensor**
**2. Fixings**

### Installation

1. Position the wheel speed sensor to the fork leg and tighten the fixings to **9 Nm**.
2. Secure the wheel speed sensor harness to the fork leg and tighten the fixing to **9 Nm**.
3. Secure the wheel speed sensor harness to the brake hose clips.
4. Connect the wheel speed sensor multiplug.
5. Connect the battery, positive (red) lead first.
6. Fit the seat (see page *16-9*).

## Front ABS Pulser ring

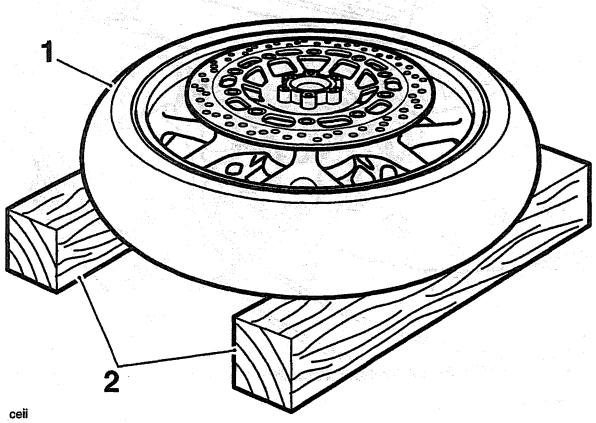
### Removal

1. Remove the front wheel (see page *15-6*).

**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.

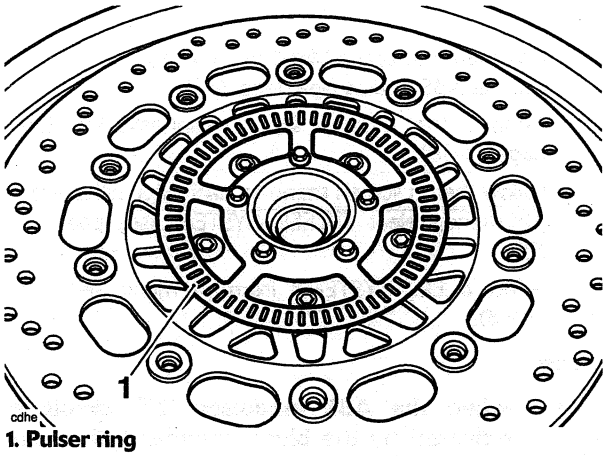
2. Support the wheel on blocks as illustrated to avoid damage to the wheel centre.




ceii

**1. Wheel**
**2. Support block**

3. Remove the five bolts to detach the pulser ring.




cdhe

**1. Pulser ring**

### Inspection

1. Check the pulser ring for damaged, missing or cracked teeth or distortion. Renew the pulser ring as necessary.

### Installation

1. Locate the pulser ring on the wheel. Tighten the fixings to **5 Nm.**
2. Refit the front wheel (see page *15-7*).

## Bleeding the Rear Brakes, Renewing Brake Fluid, Motorcycles with ABS

1. Complete the brake bleed procedure as for models without ABS brakes (see page *14-23*).
2. Connect the Triumph service diagnostic tool (See page *14-50*).
3. Follow the on screen menu to ABS diagnostics. From the menu, select 'BLEED SYSTEM' (see page *14-55*).
4. Select 'BLEED SYSTEM?' from the menu (see page *14-56*).

**Note:**

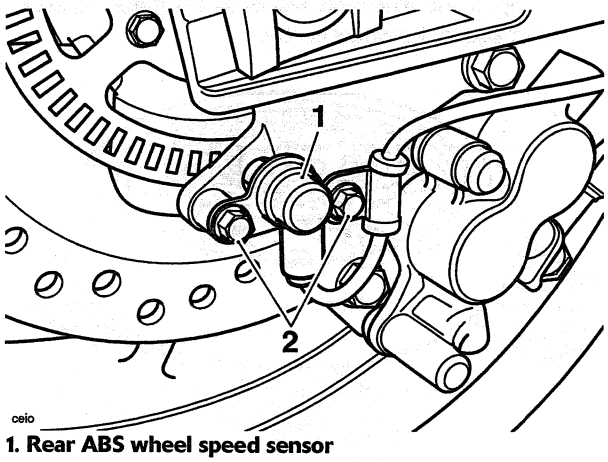
- **When the ABS modulator 2nd circuit is activated by the bleed command, the rear brake pedal travel will increase as ABS modulator solenoids are opened and will then decrease as the solenoids are automatically closed.**
- **Pressure must be applied to the rear brake pedal before operating the bleed sequence on the diagnostic tool. An assistant will be required to open the bleed nipple while pressure is applied to the brake pedal.**

5. Apply pressure to the rear brake pedal, activate the bleed sequence on the diagnostic tool, and with assistance, release the bleed nipple.
6. Repeat the above procedure as necessary until all air is expelled from the system.
7. When all air has been expelled from the system, hold down the brake pedal and close the bleed nipple. Tighten the nipple to **5.5 Nm**.
8. Repeat the brake bleed procedure as for models without ABS brakes (see page *14-23*).

## Rear ABS Wheel Speed Sensor

### Removal

1. Remove the seat (see page *16-9*).
2. Disconnect the battery, negative (black) lead first.
3. Remove the fuel tank (see page *10-99*).
4. Disconnect the wheel speed sensor multiplug.
5. Release the wheel speed sensor harness from its retaining 'P' clips.
6. Release the bolts securing the wheel speed sensor to the rear brake caliper carrier, and remove the sensor.




**1. Rear ABS wheel speed sensor**
**2. Fixings**

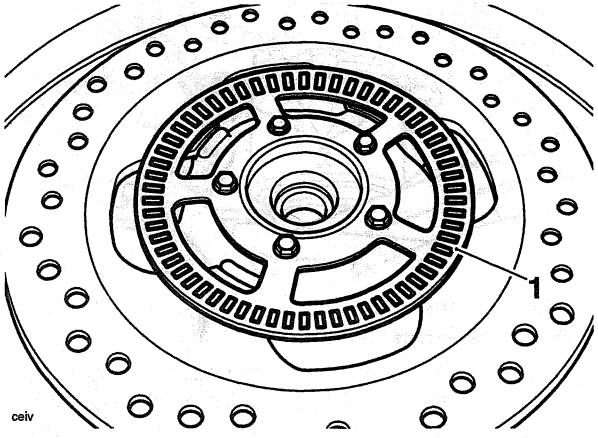
### Installation

1. Position the wheel speed sensor to the brake caliper carrier and tighten the fixings to **9 Nm.**
2. Secure the wheel speed sensor harness to its retaining clips. Tighten the 'P' clip fixings to **4.5 Nm.**
3. Connect the wheel speed sensor multiplug.
4. Refit the fuel tank (see page *10-100*).
5. Connect the battery, (red) lead first.
6. Fit the seat (see page *16-9*).

## Rear ABS Pulser Ring

### Removal

1. Remove the rear wheel (see page *15-9*).
2. Remove the five bolts and detach the pulser ring from the rear brakes disc.




**1. Pulser ring**

### Inspection

1. Check the pulser ring for damaged, missing or cracked teeth or distortion. Renew the pulser ring as necessary.

### Installation

1. Locate the pulser ring on to the rear brake disc and tighten the fixings to **5 Nm.**
2. Refit the rear wheel (see page *15-10*).

## ABS Hydraulic Modulator / ECM

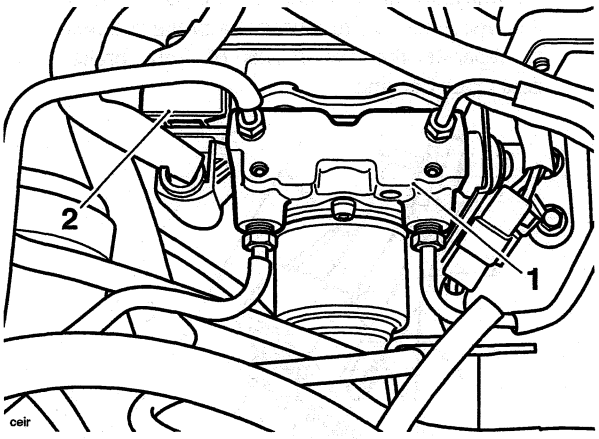
### Removal

1. Remove the seat (see page *16-9*).
2. Disconnect the battery, negative (black) lead first.
3. Remove the fuel tank (see page *10-99*).

**⚠ Caution**

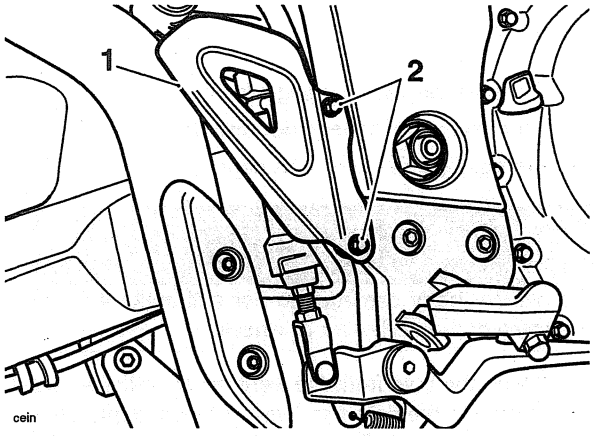
To prevent body damage, do not spill brake fluid onto any area of the bodywork or wheels.

4. Drain the fluid from the front master cylinder, attach a tube to the right hand caliper bleed nipple, slacken the nipple and allow the fluid to drain into a suitable container. Operate the brake lever until all fluid has been expelled (see page *14-12*).
5. Drain the fluid from the rear master cylinder by bleeding the system at the rear caliper until all fluid has been expelled (see page *14-23*).
6. Disconnect the ABS modulator multiplug (See page *14-59*).



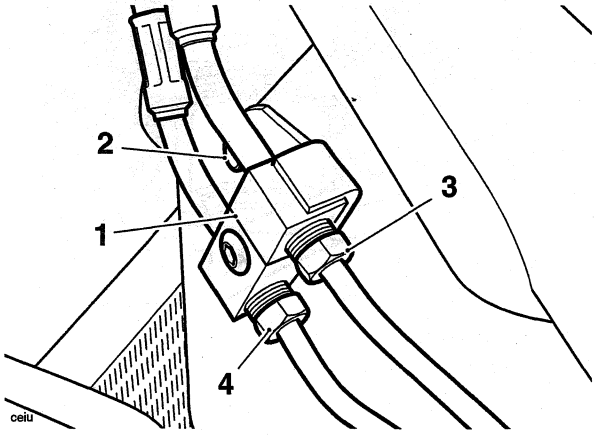

**1. ABS modulator**
**2. Multiplug**

7. Release the two fixings and remove the heelguard.



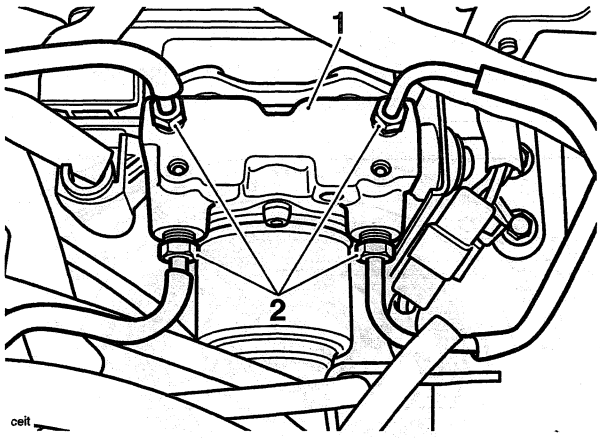

**1. Heelguard**
**2. Fixings**

8. Carefully slide the cover off the brake light switch and disconnect the switch wires.
9. Release the rear brake light switch and disconnect the rear brake line from the master cylinder, taking care not to bend the brake line as it is disconnected.
10. Remove the fixing securing the front brake lines to the frame (located behind the left hand side fairing). It is **not** necessary to loosen the brake line unions or to separate the two halves of front brake hose connector housing.



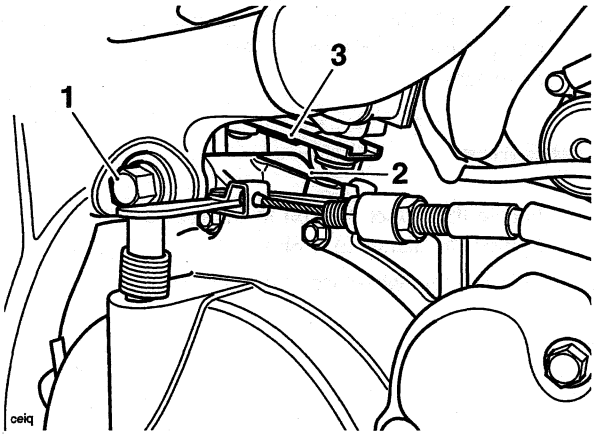

**1. Front brake hose connector housing**
**2. Fixing**
**3. Front brake line from master cylinder**
**4. Front brake line to calipers**

11. Loosen the four brake line unions and, taking care not to bend the brake lines, detach the lines from the ABS modulator.



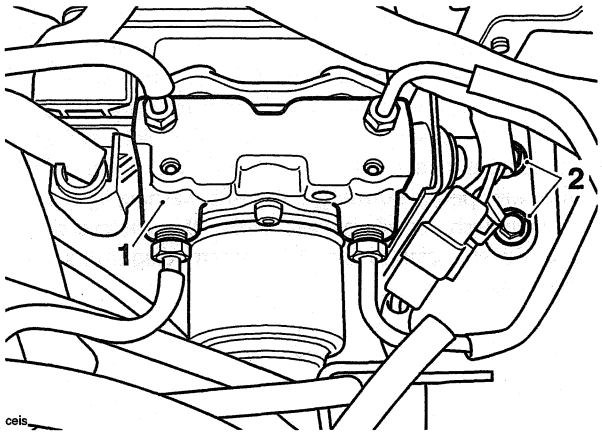

**1. ABS modulator**
**2. Brake line unions**

12. Remove the right hand rear engine mounting nut and bolt (located above the clutch) and discard the nut and bolt. It is not necessary to loosen the frame adjuster sleeve.
13. Withdraw the engine mounting bolt sufficiently to allow the ABS modulator bracket to be removed.




**1. Right hand rear engine mounting bolt**
**2. Nut**
**3. ABS modulator bracket**

14. Remove the two upper ABS modulator fixing bolts.

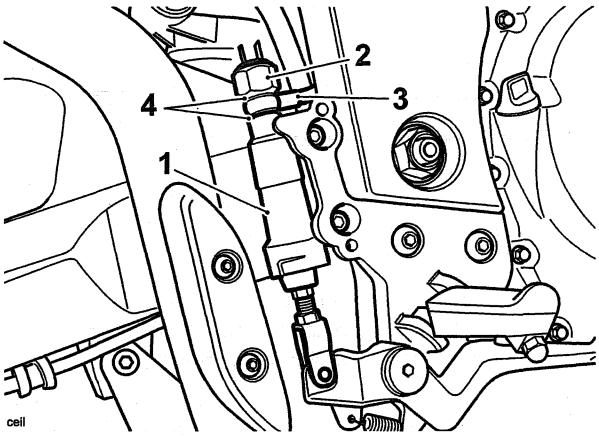



**1. ABS modulator**
**2. Upper fixings**

15. Carefully manoeuvre the modulator from the frame, taking care not to damage the brake lines. If the modulator is to be renewed, remove the mounting bracket from the modulator.

## Installation

1. Install the mounting bracket to the modulator. Tighten the fixings to **9 Nm.**
2. Carefully position the modulator to the frame, taking care not to damage the brake lines. Fit but do not fully tighten the upper fixing bolts.
3. Fit a new rear engine mounting bolt and install a new nut. Tighten to **85 Nm.**
4. Tighten the upper ABS modulator fixings to **9 Nm.**
5. Taking care not to bend the brake lines, refit the lines to the modulator. Do not tighten the brake line unions at this stage.
6. Incoporating new washers, fit the brake line and brake light switch to the master cylinder. Ensuring the brake line is located as noted on removal, tighten the switch to **15 Nm.**




**1. Master cylinder**
**2. Brake light switch**
**3. Brake line**
**4. Washers**

7. Connect the brake light switch multiplug and refit the cover.
8. Refit the heelguard, tightening the fixings to **7 Nm.**
9. Refit the fixing securing the front brake lines to the frame and tighten to **9 Nm.** Ensure the brake lines are fully inserted into the retaining clip located between the airbox and the frame, directly below the MAP sensor.
10. Tighten the brake line unions at the modulator to **17 Nm.**
11. Reconnect the ABS modulator multiplug, ensuring the locking device is fully engaged (See page *14-59*).
12. Bleed the front brakes (see page *14-32*).
13. Bleed the rear brakes (see page *14-34*).
14. Refit the fuel tank (see page *10-100*).
15. Reconnect the battery, positive (red) lead first.

**Warning**

It is dangerous to operate the motorcycle with defective brakes and you must have your authorised Triumph Dealer take remedial action. Failure to take remedial action may reduce braking efficiency leading to loss of motorcycle control and an accident.

16. Refit the seat (see page *16-9*).
17. Check that the brakes operate correctly.

# ABS

## System Description

The ABS versions of the Tiger are fitted with an electronic anti-lock brake system (ABS) which is designed to prevent the wheels from locking or skidding by reducing braking effort to the front or rear brake caliper as required.

The system consists of a hydraulic modulator and ECM assembly mounted to a bracket beneath the fuel tank, a front wheel speed sensor mounted to the front fork, and a rear wheel speed sensor mounted to the rear brake caliper carrier.

Both front and rear wheels have a pulser ring mounted on to the wheel, the front being mounted to the wheel hub, the rear being mounted to the rear wheel hub.

The front and rear master cylinders are connected via lines to the modulator and from the modulator the pipes connect to the brake calipers. The calipers and master cylinders are identical to the non-ABS equipped motorcycle.

The front and rear brake circuits operate as separate systems. The front and rear brakes are not connected in any way inside the modulator.

The modulator ECM continuously calculates the front and rear wheel speeds, and from these inputs the ECM calculates the estimated motorcycle speed, wheel deceleration/acceleration, the wheel speed difference and the wheel slip (skid) rate. This is calculated by comparing the calculated wheel speeds with the calculated vehicle speed, so that if one wheel speed deviates significantly from the other two readings, this wheel is calculated to be slipping (skidding).

Under braking, if the modulator detects that either wheel is about to slip, due to the brake force exceeding the available traction between the tyre and road surface (the wheel will begin to slip or 'skid'), the ECM very rapidly releases and re-applies the brake pressure to prevent the wheel from slipping.

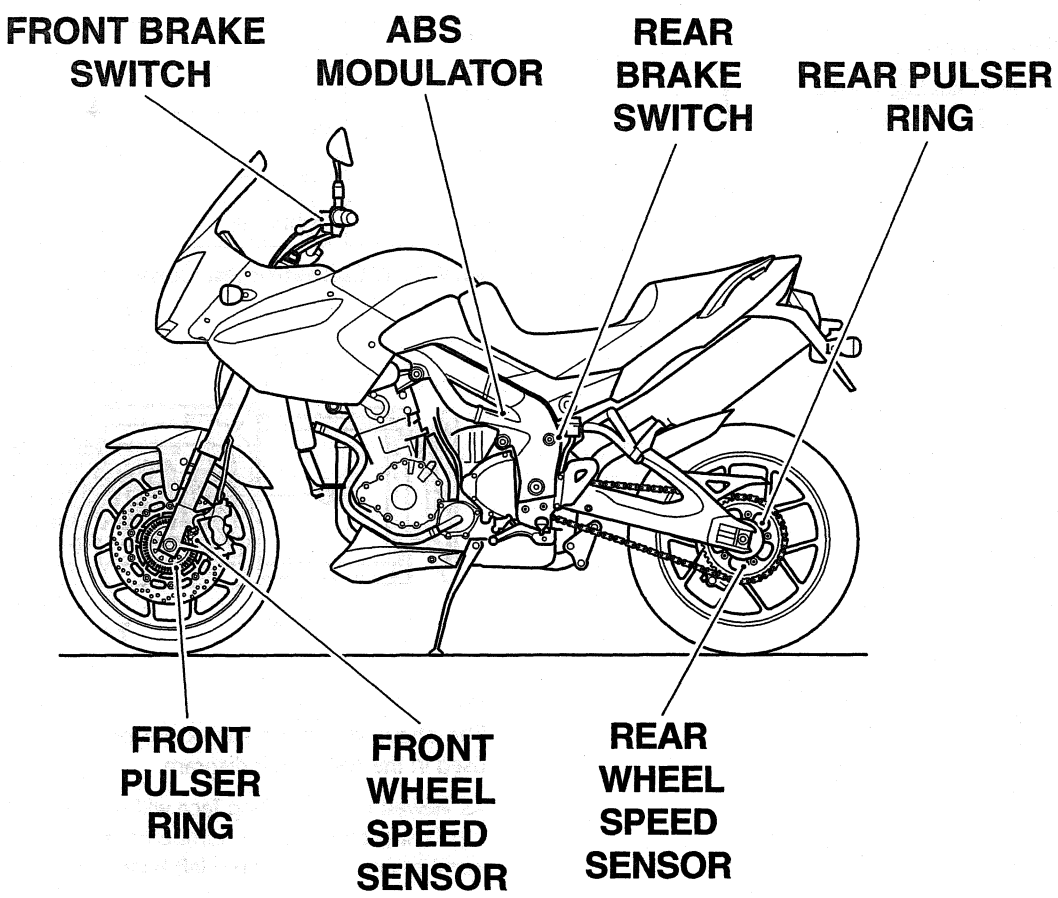
This is felt through the brake pedal or lever as a rapid 'pulsing'.

If the rider reduces braking effort, or traction increases (so that traction exceeds braking force, the wheel will rotate once more) the wheel will no longer lock up. The ABS system will detect this and stop controlling brake pressure, and return to its monitoring state.

The system has a self diagnostic function built-in which monitors the fail safe relay, solenoid valves, motor relay, wheel speed sensors, power supply and ground, as well as internal ECM functions. In the event of a malfunction being detected, the ECM will illuminate the ABS warning light, and store a diagnostic trouble code in the system memory. This stored data can then be recovered 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.

Under normal operation, the ABS warning light will stay illuminated after ignition on until the vehicle speed exceeds 6 mph (10 km/h). The ABS performs a self check and if no faults are found the light is extinguished. If a trouble code is stored the ABS warning light will stay illuminated and the ABS will not function, however the brakes will operate normally. If the ABS warning light does not extinguish, or illuminates whilst the motorcycle is being ridden, refer to the ABS system diagnostics (see page 14.42).

## Component Locations



## ABS System Circuit Diagram - Tiger

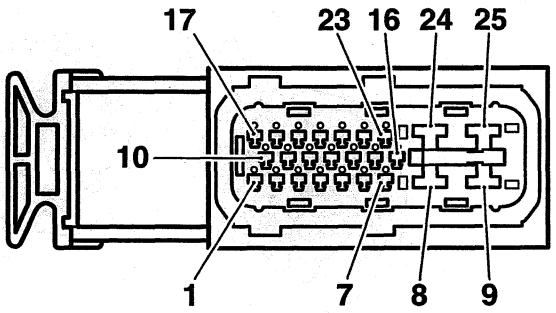
### Key To Wiring Circuit Diagram

| Key | Item Description |
|---|---|
| 1 | Regulator/Rectifier |
| 2 | ABS Fuse Box |
| 3 | ABS Module |
| 4 | Ignition Switch |
| 5 | Main Fuse Box |
| 6 | Diagnostic Connector |
| 7 | Engine Control Module |
| 8 | Front Whel Speed Sensor |
| 9 | Rear Whel Speed Sensor |
| 10 | Instruments |
| 11 | Rear Brake Light Switch |
| 12 | Front Brake Light Switch |
| 13 | Brake Light |

### Key To Wiring Colour Codes

| Code | Wiring Colour |
|---|---|
| B | Black |
| U | Blue |
| N | Brown |
| G | Green |
| S | Slate/Grey |
| O | Orange |
| K | Pink |
| R | Red |
| P | Purple |
| W | White |
| Y | Yellow |
| LG | Light Green |
| LU | Light Blue |

### ABS ECM Connector Pin Numbering

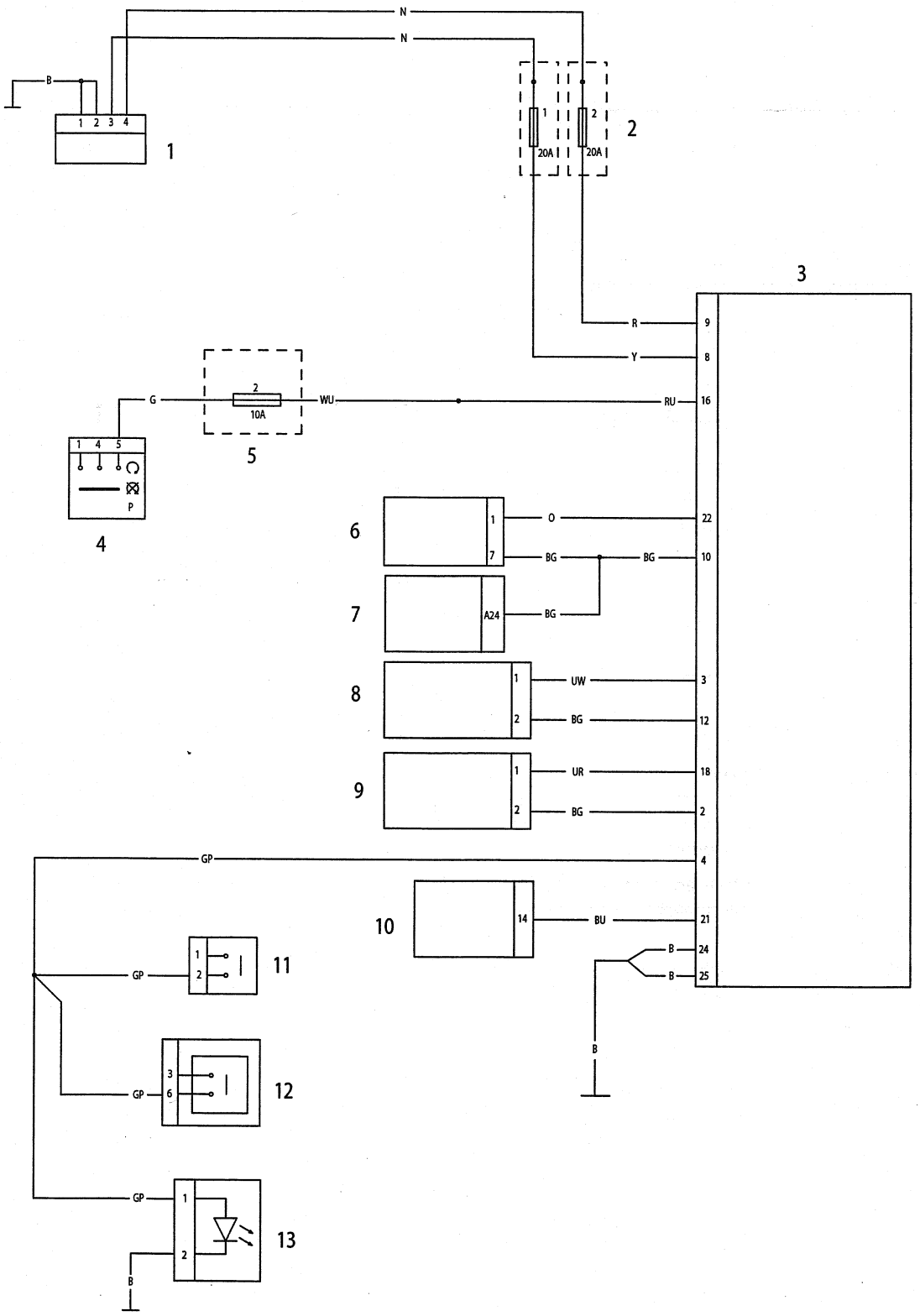



cdhg

The above illustration shows the pin numbering system used in the ABS circuit diagram.

As viewed on the mating face with the ABS ECM (as per the illustration), pins are numbered from left to right with number one in the bottom left hand corner.

## ABS System Circuit Diagram - Tiger

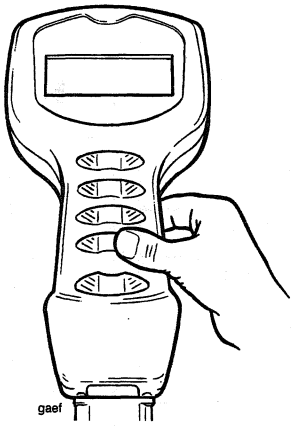


## System Diagnostics

The ABS 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 located under the seat (see page *14-50*). 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, read build data and bleed the brake system. The data and tests available are described on the following pages.




### 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 ABS data can be recovered from the motorcycle. The data available is:

| Function Examined | Result Reported (Scale) |
|---|---|
| Front wheel speed | KPH |
| Rear wheel speed | KPH |
| Brake switch status | ON / OFF |
| ABS warning light status | ON / OFF |

### Bleed System

Using the Triumph diagnostic tool, it is possible to bleed the ABS modulator of trapped air. This is necessary when the hydraulic brake system has been dismantled, or the ABS modulator renewed.

Full details of this procedure are provided later in this section.

### Build data

The following items of build data can also be read.

| Function Examined |
|---|
| ECM serial number |

## Diagnostic Trouble Codes

Diagnostic trouble codes (DTCs) are logged in the ABS 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.

DTCs can be removed at any time using the Triumph diagnostic tool

The system will log the diagnostic trouble codes listed below:

| Diagnostic Trouble Code (DTC) | Fault Description |
|---|---|
| C1611 | Front Wheel Sensor Open Circuit / Short Circuit |
| C1612 | Front Wheel Sensor Abnormal Input / Loosing Contact |
| C1613 | Rear Wheel Sensor Open Circuit / Short Circuit |
| C1614 | Rear Wheel Sensor Abnormal Input / Loosing Contact |
| C1621 | Front Wheel Pulser Gear Missing Teeth |
| C1623 | Rear Wheel Pulser Gear Missing Teeth |
| C1631 | Front Wheel Input Solenoid Open / Short Circuit |
| C1632 | Front Wheel Output Solenoid Open / Short Circuit |
| C1633 | Rear Wheel Input Solenoid Open / Short Circuit |
| C1634 | Rear Wheel Output Solenoid Open / Short Circuit |
| C1641 | Front Wheel Actuator (Hydraulic Control) Wheel Lock |
| C1643 | Rear Wheel Actuator (Hydraulic Control) Wheel Lock |
| C1651 | Motor - Lock |
| C1652 | Motor - Stuck OFF |
| C1653 | Motor - Stuck ON |
| C1654 | Solenoid Relay - Stuck OFF/ON |
| C1661 | Power Source Voltage Drop |
| C1662 | Power Source Voltage Rise |
| C1671 | Different Tyre Diameter |
| C1681 | Abnormal ECU |

### Diagnostic Trouble Codes

Dependant on the DTC stored, the ABS ECM will act in one of two ways:

- **Inhibit ABS operation immediately, irrespective of the ABS operating mode.**

Or:

- **Allow the ABS operation to complete before inhibiting the ABS.**

Once the ABS ECM has inhibited ABS function, the ECM will act in one of three ways:

- **Allow the ABS to resume operation if the fault clears.**

Or:

- **Allow ABS operation after an ignition cycle if the fault clears.**

Or:

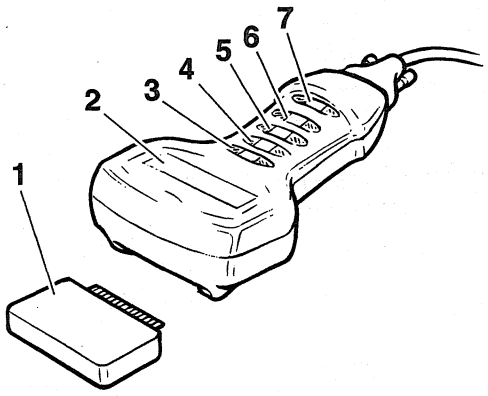
- **Inhibit the ABS function until the fault is rectified and the DTC erased.**

The ABS system will act on the DTC stored according to the following table:

| **Fault Description** | **ABS warning light illuminated when fault is logged** | **ABS operation is inhibited when fault is logged** | **ABS continues to operate when fault is logged** (Only when ABS is Active. When ABS is no longer active, operation is inhibited) | **ABS will resume operation if fault clears** |
|---|---|---|---|---|
| Front Wheel Sensor Open Circuit / Short Circuit | Yes | Yes | | No |
| Front Wheel Sensor Abnormal Input / Loosing Contact | Yes | Yes | Yes | Yes, if after ignition cycle, no fault is detected. DTC remains stored |
| Rear Wheel Sensor Open Circuit / Short Circuit | Yes | Yes | | No |
| Rear Wheel Sensor Abnormal Input / Loosing Contact | Yes | Yes | Yes | Yes, if after ignition cycle, no fault is detected. DTC remains stored |
| Front Wheel Pulser Gear Missing Teeth | Yes | | Yes | Yes, if after ignition cycle, no fault is detected for 1 second and speed exceeds 30 km/h. DTC remains stored |
| Rear Wheel Pulser Gear Missing Teeth | Yes | | Yes | Yes, if after ignition cycle, no fault is detected for 1 second and speed exceeds 30 km/h. DTC remains stored |
| Front Wheel Input Solenoid Open / Short Circuit | Yes | Yes | | No |
| Front Wheel Output Solenoid Open / Short Circuit | Yes | | Yes | No |

| Fault Description | ABS warning light illuminated when fault is logged | ABS operation is inhibited when fault is logged | ABS continues to operate when fault is logged (Only when ABS is Active. When ABS is no longer active, operation is inhibited) | ABS will resume operation if fault clears |
|---|---|---|---|---|
| Rear Wheel Input Solenoid Open / Short Circuit | Yes | Yes | | No |
| Rear Wheel Output Solenoid Open / Short Circuit | Yes | | Yes | No |
| Front Wheel Actuator (Hydraulic Control) Wheel Lock | Yes | | Yes | Yes, if after ignition cycle, no fault is detected. DTC remains stored |
| Rear Wheel Actuator (Hydraulic Control) Wheel Lock | Yes | | Yes | Yes, if after ignition cycle, no fault is detected. DTC remains stored |
| Motor - Lock | Yes | | Yes | No |
| Motor - Stuck OFF | Yes | | Yes | No |
| Motor - Stuck ON | Yes | | Yes | No |
| Solenoid Relay - Stuck OFF/ ON | Yes | Yes | | No |
| Power Source Voltage Drop | Yes, Light will extinguish if fault clears | Yes | | Yes, if voltage rises above a preset threshold for more than 10 seconds |
| Power Source Voltage Rise | Yes, Light will extinguish if fault clears | Yes | | Yes, if voltage drops below a preset threshold for more than 10 seconds |
| Different Tyre Diameter | Yes | Yes | | No |
| Abnormal ECU | Yes | Yes | | No |

## Service Diagnostic Tool




gajc

**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**
- **Bleed the system**

It is removable to allow replacement / update cards to be inserted.

The screen comprises four horizontal lines and twenty 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.

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | A | B | S | | 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 | | |
| | | C | L | E | A | R | | C | O | D | E | S | | | | | | | |
| | | B | L | E | E | D | | S | Y | S | T | E | M | | | | | | |
| | | R | E | A | D | | B | U | I | L | D | | D | A | T | A | | | |

**Typical screen showing symbol examples**

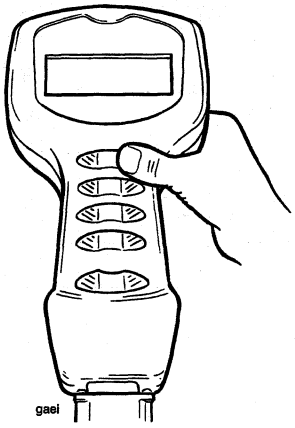
▲▼ Cursors to indicate that further lines of text are available to be seen above and/or below those already in view, by scrolling the text up or down using the 'Up' or 'Down' keys.

▶ 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

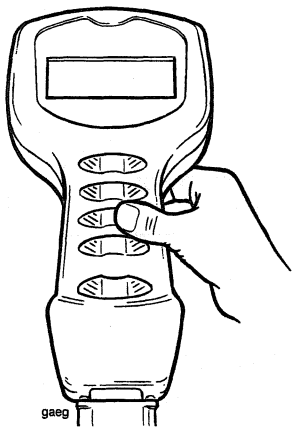
In most cases, the **Return** key (↵) enables the user to return to the screen last displayed.



gaei

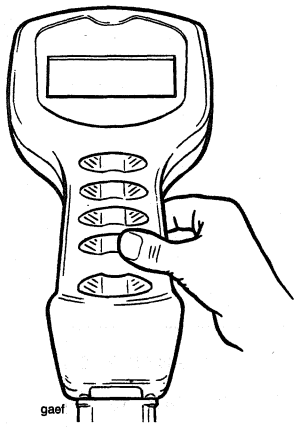
**Return Key**

The Up and Down keys - press to move the lines of text up or down.




**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**

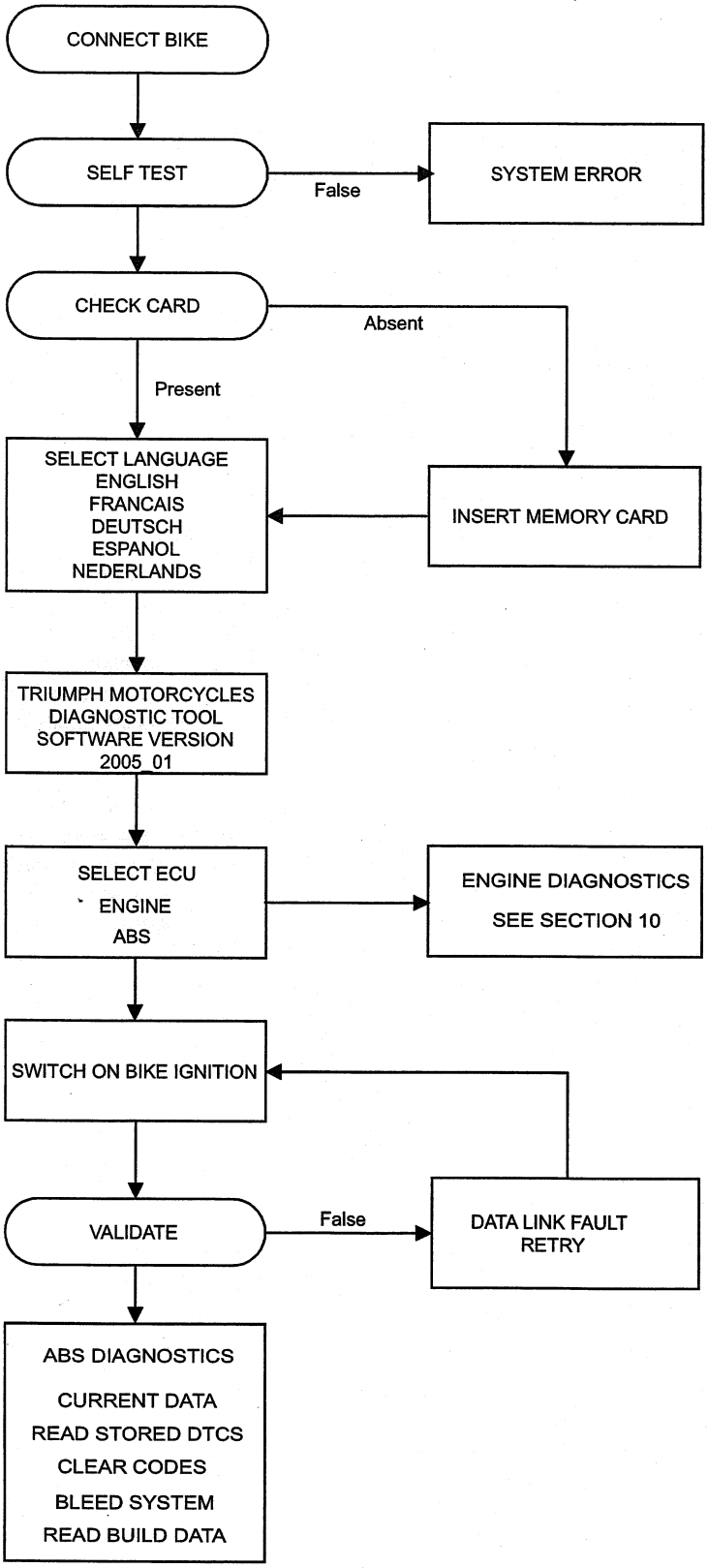
**Test Procedure**

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.

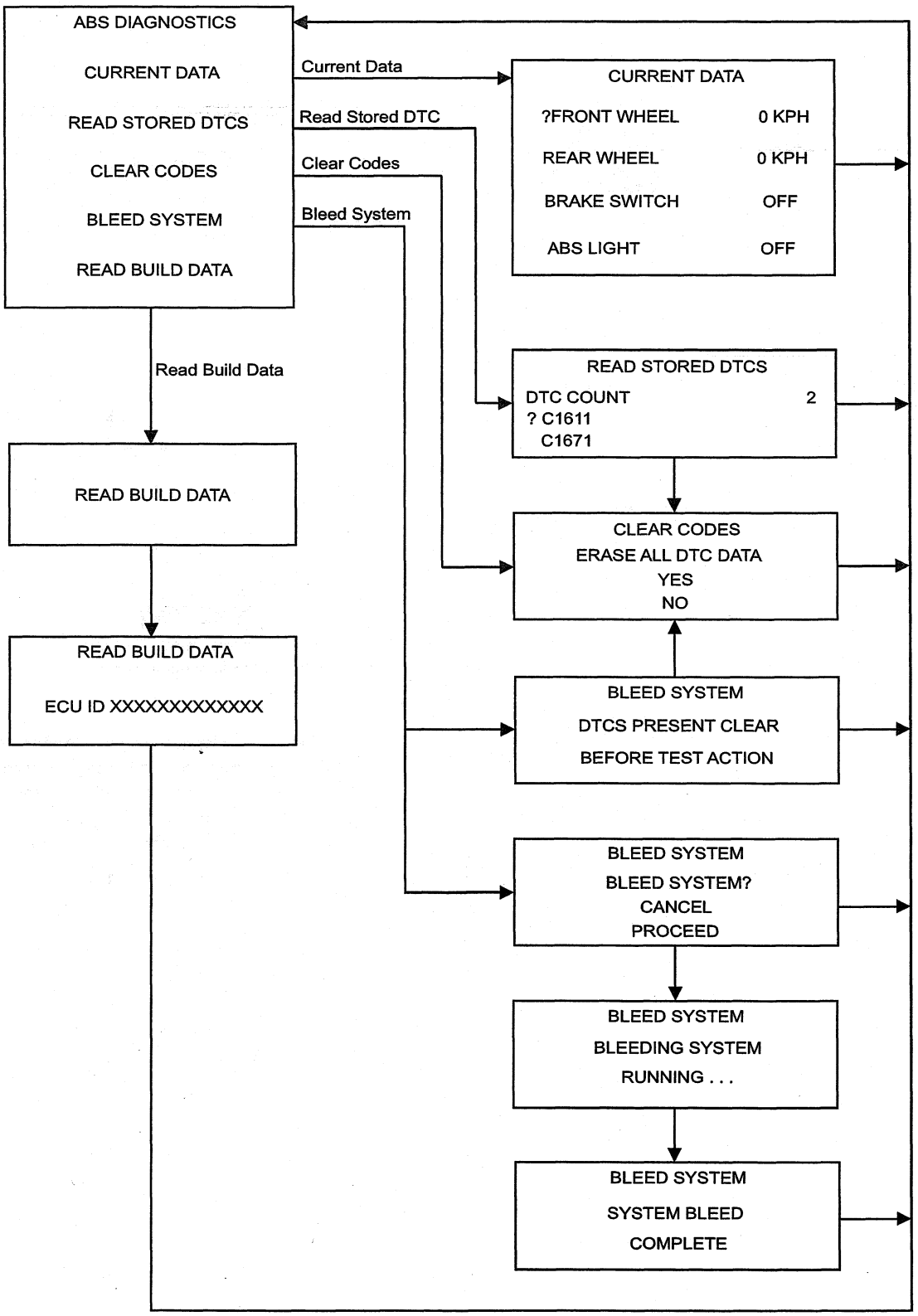
**Note:**

- **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 pages describe the tool operation in flow chart form.**

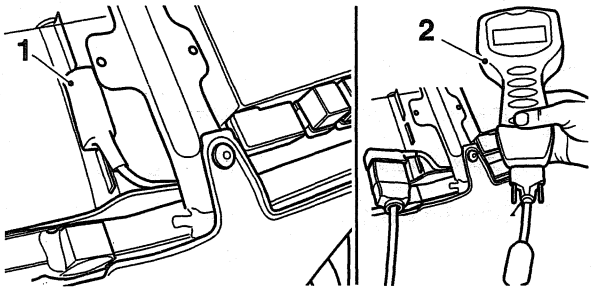
## Initialisation



## Diagnostics



## 1. Connection and Power-Up




**1. Connection to main harness**
**2. Triumph service diagnostic tool**

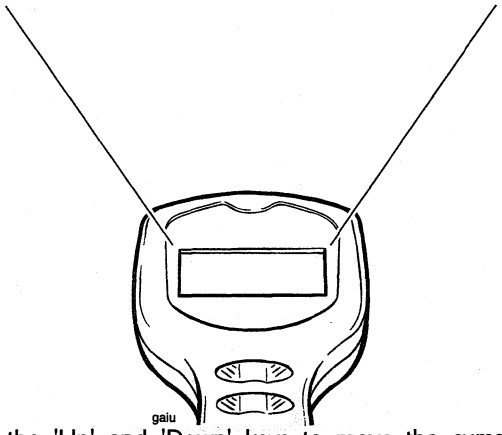
Connect the tool to the dedicated multiplug in the storage compartment under the seat.

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

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | S | E | L | E | C | T | | L | A | N | G | U | A | G | E | | |
| ► | | | | | | | E | N | G | L | I | S | H | | | | | | |
| | | | | | | | F | R | A | N | C | A | I | S | | | | | |
| | | | | | | | D | E | U | T | S | C | H | | | | | | |
| | | | | | | | E | S | P | A | N | O | L | | | | | | |
| | | | | | | | I | T | A | L | I | A | N | O | | | | | |
| | | | | | | | N | E | D | E | R | L | A | N | D | S | | | |




Use the 'Up' and 'Down' keys to move the cursor in column 1 and select the language required.

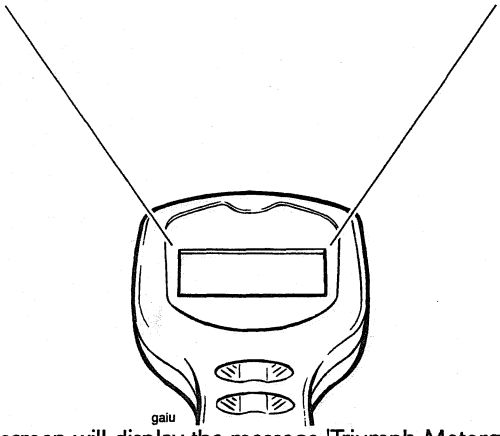
**Note:**

- **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

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | T | R | I | U | M | P | H | | M | O | T | O | R | C | Y | C | L | E | S |
| | | | | D | I | A | G | N | O | S | T | I | C | | T | O | O | L | | |
| S | O | F | T | W | A | R | E | | V | E | R | S | I | O | N | | | | |
| | | | | | | 2 | 0 | 0 | 6 | - | 0 | 3 | | | | | | | |



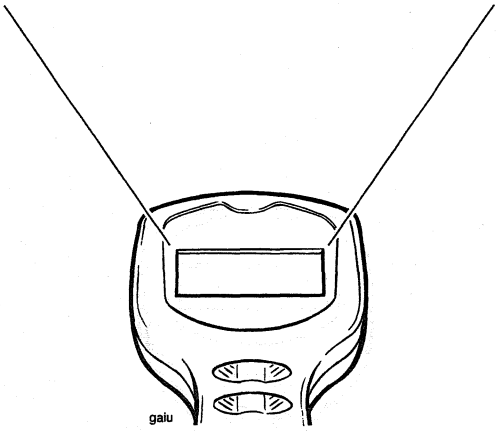

The screen will display the message 'Triumph Motorcycles Diagnostic Tool' and will also give the diagnostic software version and the software release year.

Press the validation key '*' to move on.

If the Return key (↵) is pressed, the tool will return to the 'SELECT LANGUAGE' display.

## 4 SELECT ECU

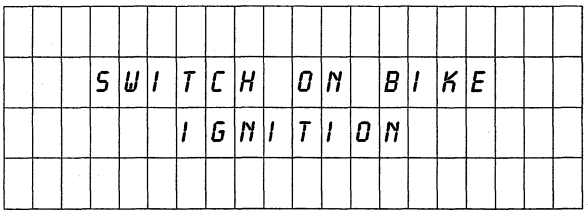
| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | S | E | L | E | C | T | | E | C | U |
| ▶ | E | N | G | I | N | E | | | | | | | | | | | | | |
| | A | B | S | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | |

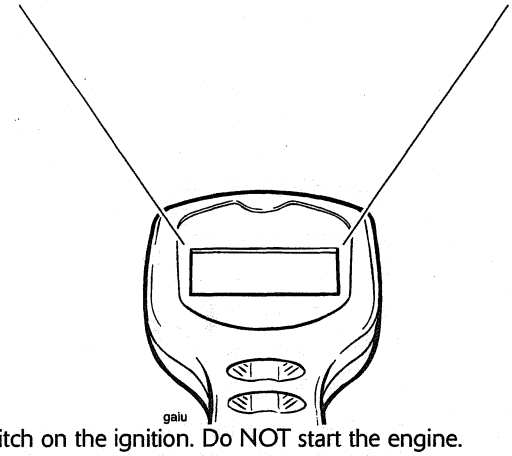



Use the 'Up' and 'Down' keys to scroll the text until the horizontal arrowhead is positioned opposite the 'ABS', and press the Validation key '*'.

'SWITCH ON BIKE IGNITION' will appear on the screen (see operation *5*).

## 5 SWITCH ON BIKE IGNITION



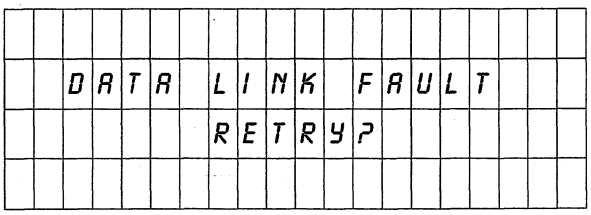

Switch on the ignition. Do NOT start the engine.

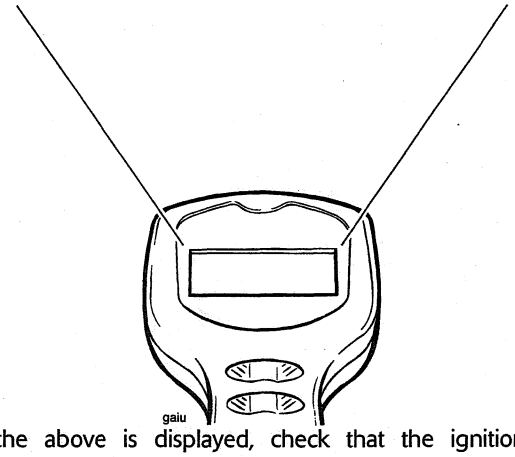
Press the validation key '*'. During a short delay period the tool will carry out certain validation checks.

If it detects a problem which will invalidate the test, 'DATA LINK FAULT RETRY?' will be displayed (see operation *6*).

If all is OK, 'ABS DIAGNOSTICS' will appear on the screen.

## 6 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 ABS ECM, flat battery etc.

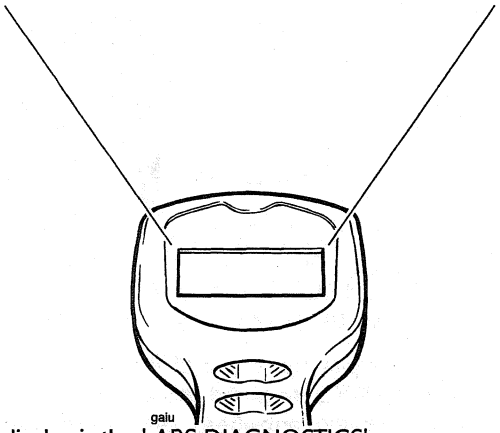
Press the Help key '?' for advice.

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, 'ABS DIAGNOSTICS' will be displayed (see operation *7*).

## 7 ABS DIAGNOSTICS

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | A | B | S | | 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 | | |
| | | C | L | E | A | R | | C | O | D | E | S | | | | | | | |
| | | B | L | E | E | D | | S | Y | S | T | E | M | | | | | | |
| | | R | E | A | D | | B | U | I | L | D | | D | A | T | A | | | |




This display is the ' ABS DIAGNOSTICS' menu.

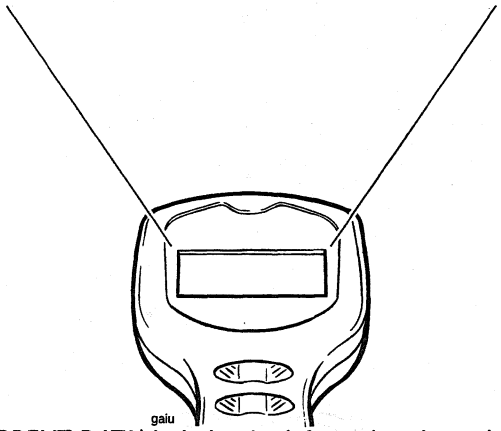
Use the 'Up' and 'Down' keys to scroll the text until the horizontal arrowhead is positioned opposite the desired choice, and press the Validation key '*'.

The choices are:

- **'CURRENT DATA'** (see operation *8*)
- **'READ STORED DTCS'** (see operation *10*)
- **'CLEAR DTCS'** (see operation *11*)
- **'BLEED SYSTEM'** (see operation *12*)
- **'READ BUILD DATA'** (see operation *18*)
- **If 'QUIT' is selected, the display will return to 'TRIUMPH MOTORCYCLES'.**

## 8 CURRENT DATA

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | C | U | R | R | E | N | T | | D | A | T | A |
| | | | | | | | | | | | | | | | | | | | |
| | P | F | R | O | N | T | | W | H | E | E | L | | | | 3 | | K | P | H |
| ▼ | R | E | A | R | | W | H | E | E | L | | | | | | 0 | | K | P | H |




'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. FRONT WHEEL 3 KPH

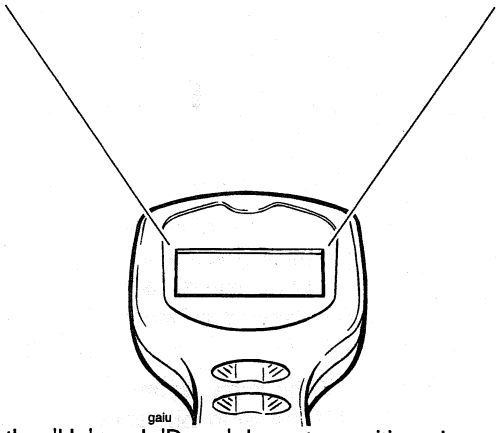
For a complete list of the items reported, see the table titled 'CURRENT DATA' earlier in this section.

Press any key to return to the 'CURRENT DATA' text. When all information has been noted, press either the Validation '*' or Return (↵) keys.

| Function Examined | Result Reported (Scale) |
|---|---|
| FRONT WHEEL | KPH |
| REAR WHEEL | KPH |
| BRAKE SWITCH | ON/OFF |
| ABS LIGHT | ON/OFF |

## 9 To select 'READ STORED DTCS' (Diagnostic Trouble Codes) from the ABS DIAGNOSTICS menu:

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | A | B | S | | 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 | | |
| ▼ | | C | L | E | A | R | | C | O | D | E | S | | | | | | | |
| | | B | L | E | E | D | | S | Y | S | T | E | M | | | | | | |
| | | R | E | A | D | | B | U | I | L | D | | D | A | T | A | | | |



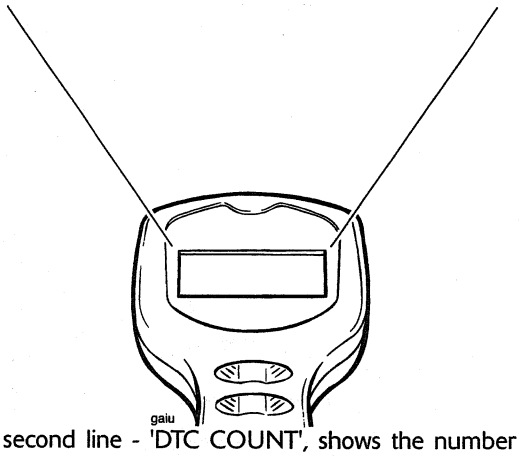

Use the 'Up' and 'Down' keys to position the cursor opposite 'READ STORED DTCS'.

Press the Validation key '*'.

'STORED DTCS' will be displayed.

## 10 STORED DTCS

| | | | | | | | | | S | T | O | R | E | D | | D | T | C | S |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | D | T | C | | C | O | U | N | T | | | | | | | | | 0 | 2 |
| ? | C | 1 | 6 | 1 | 1 | | • | | | | | | | | | | | | |
| ▼ | C | 1 | 6 | 7 | 1 | | | | | | | | | | | | | | |




The second line - 'DTC COUNT', shows the number of DTCs stored in the ABS ECM memory.

Lines 3 and 4 display up to two of the DTCs stored (if any). If additional DTCs 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 DTCs shown, press the Return key (↵) to return to MAIN MENU.

(If DTCs 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: C1611

Help text:

FRONT WHEEL SENSOR OPEN / SHORT CIRCUIT

Press the Validation key '*' to continue.

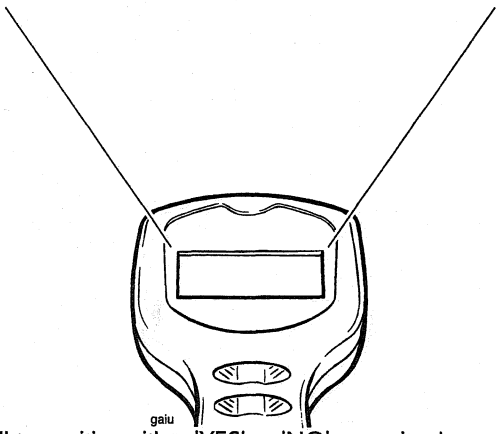
Scroll to 'CLEAR DTCS' and press the Validation key '*' to go on to operation *11*

**Note:**

- **A full list of all the possible DTCs can be found earlier in this section (see page *14-43*.**

## 11 CLEAR DTCS

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | S | T | O | R | E | D | | D | T | C | S |
| | E | R | A | S | E | | A | L | L | | D | T | C | | D | A | T | A | |
| ► | Y | E | S | | | | | | | | | | | | | | | | |
| | N | O | | | | | | | | | | | | | | | | | |




Scroll to position either 'YES' or 'NO' opposite the cursor.

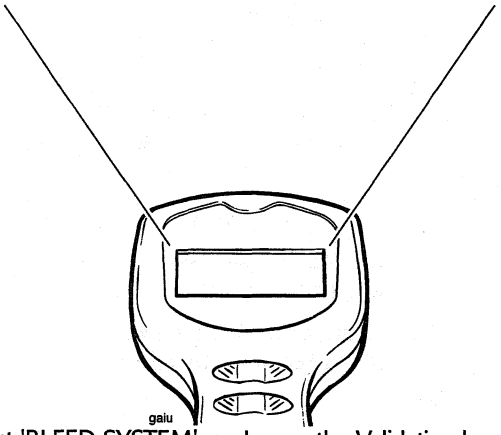
If 'YES' is selected, press the Validation key '*' to erase all DTC data from the memory. 'ABS DIAGNOSTICS' will then be displayed.

If 'NO' is selected, press the Validation key '*' to return to operation *7*.

That completes the DTC cycle.

## 12 To select 'BLEED SYSTEM' from the MAIN MENU:

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | A | B | S | | 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 | | | |
| | C | L | E | A | R | | C | O | D | E | S | | | | | | | | |
| ► | B | L | E | E | D | | S | Y | S | T | E | M | | | | | | | |
| ▼ | R | E | A | D | | B | U | I | L | D | | D | A | T | A | | | | |




Select 'BLEED SYSTEM', and press the Validation key '*'.

If no DTCs are stored, 'BLEED SYSTEM?' will be displayed (see operation *14*).

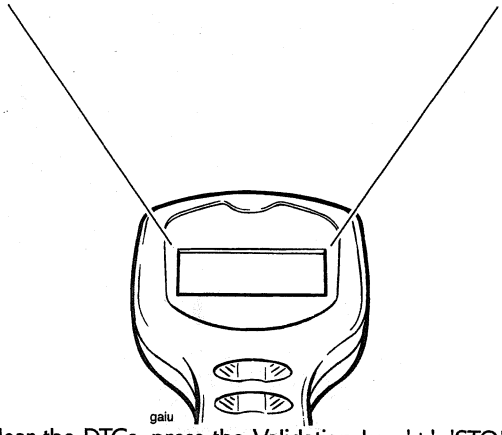
If one or more DTCs are stored, the message 'DTCS PRESENT CLEAR BEFORE TEST ACTION' will be displayed (see operation *14-56*).

**Note:**

- **The diagnostic tool will not allow the 'BLEED SYSTEM' command to be accessed until all DTCs in the memory are removed.**

## 13 BLEED SYSTEM - STORED DTCS

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | F | U | N | C | T | I | O | N | | T | E | S | T | S | |
| | D | T | C | S | | P | R | E | S | E | N | T | | C | L | E | A | R | |
| | B | E | F | O | R | E | | T | E | S | T | | A | C | T | I | O | N | |
| | | | | | | | | | | | | | | | | | | | | |




To clear the DTCs, press the Validation key '⁎'. 'STORED DTCS' will be displayed (see operation *10*).

Scroll to 'YES' and press the Validation key '⁎' to erase all DTC data; the MAIN MENU will be displayed again.

**Note:**

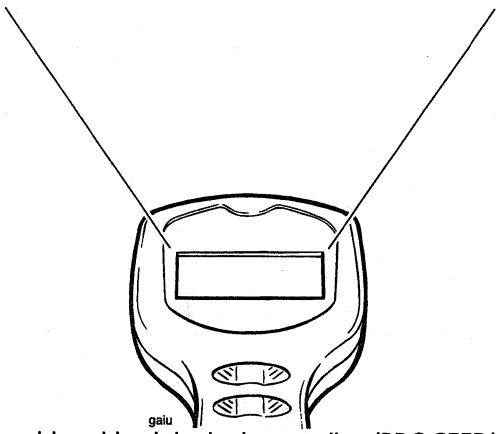
- **The fault(s) which caused the DTCs to be set must be rectified and cleared before continuing the Bleed System command.**
- **A full list of all the possible DTCs can be found earlier in this section.**

Select the 'ABS DIAGNOSTICS' menu and 'BLEED SYSTEM' again pressing the Validation key '⁎' each time.

Because the DTCs have now been erased, the 'BLEED SYSTEM?' (see operation *14*) will now be displayed.

## 14 BLEED SYSTEM?

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | B | L | E | E | D | | S | Y | S | T | E | M | |
| | | | | B | L | E | E | D | | S | Y | S | T | E | M | ? | | | | |
| ▶ | | P | R | O | C | E | E | D | | | | | | | | | | | | |
| | | C | A | N | C | E | L | | | | | | | | | | | | | |




If you wish to bleed the brakes, scroll to 'PROCEED' and press the Validation key '⁎'.

If you do not wish to bleed the brakes scroll down to 'CANCEL' and press the Validation key '⁎'. The display will return to the 'BLEED SYSTEM?' command.

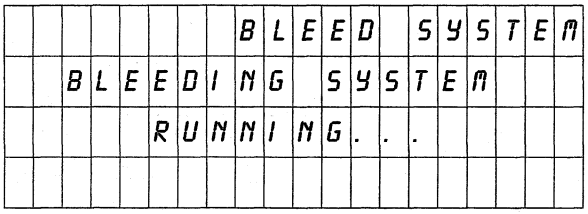
The ABS modulator solenoid valves are energised when the test is confirmed and ended when the bleed system command completes automatically (after approx. 7 seconds).

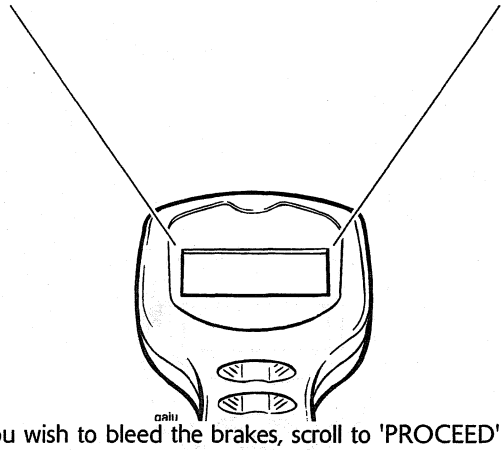
See Bleeding ABS Brakes earlier in this section (see page *14-32* for the front brakes or page *14-34* for the rear brake).

**Note:**

- **If the Return key (↵) is pressed, the tool will return to 'TRIUMPH MOTORCYCLES' (operation *3*).**

## 15 BLEEDING SYSTEM



If you wish to bleed the brakes, scroll to 'PROCEED' and press the Validation key '*'.

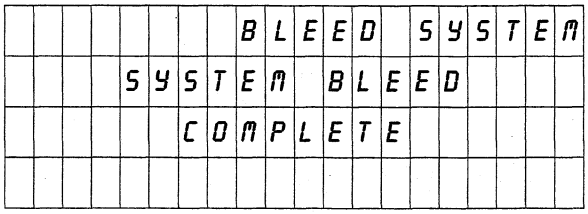
The ABS modulator solenoid valves are energised when the test is confirmed and ended when the bleed system command completes automatically.

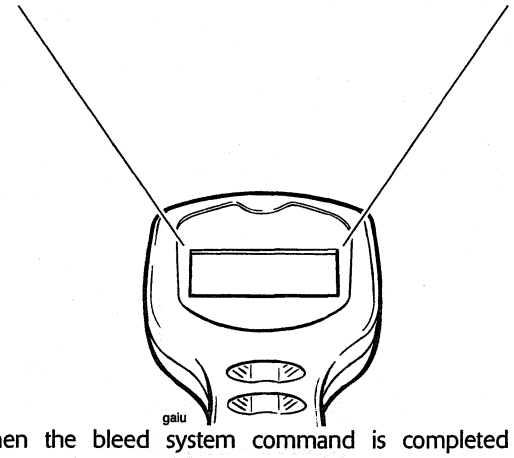
See Bleeding ABS Brakes earlier in this section (see page *14-32* for the front brakes or page *14-34* for the rear brake).

**Note:**

- **If the Return key (↵) is pressed, the tool will return to 'DIAGNOSTICS' menu (operation *7*).**

## 16 SYSTEM BLEED COMPLETE



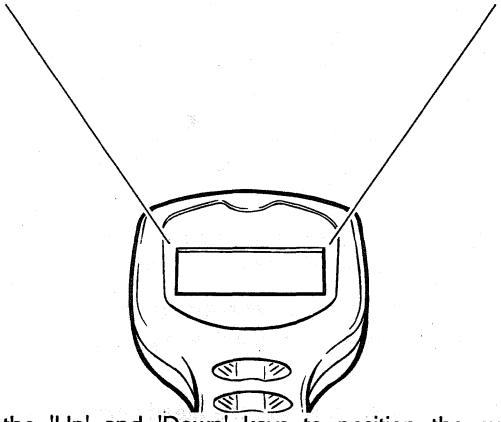
When the bleed system command is completed the display will read 'SYSTEM BLEED COMPLETE'.

Press the Validation key '*' to return to 'BLEED SYSTEM?' if the bleed system command is to be repeated (see operation *14*).

If you do not wish to repeat the bleed system command, press the Return key (↵). The display will return to 'TRIUMPH MOTORCYCLES' menu (operation *3*).

## 17 To select 'READ BUILD DATA' from the ABS DIAGNOSTICS menu:

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | A | B | S | | 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 | |
| | | C | L | E | A | R | | C | O | D | E | S | | | | | | |
| | | B | L | E | E | D | | S | Y | S | T | E | M | | | | | |
| ► | | R | E | A | D | | B | U | I | L | D | | D | A | T | A | | |



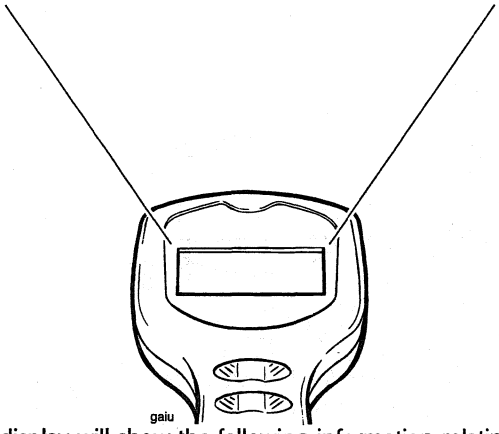
Use the 'Up' and 'Down' keys to position the cursor opposite 'READ BUILD DATA'.

Press the Validation key '*'.

'BUILD DATA' will be displayed.

## 18 READ BUILD DATA

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | R | E | A | D | | B | U | I | L | D | | D | A | T | A |
| | | | | | | | | | | | | | | | | | | |
| | | | E | C | U | | I | D | | X | X | X | X | X | X | | | |
| | | S | O | F | T | W | A | R | E | | V | E | R | S | I | O | N | : |
| P | R | O | D | U | C | T | I | O | N | | V | E | R | | | | | 1 |




The display will show the following information relating to the motorcycle under test.

- **ABS ECM Serial number**

Press the Validation '*' key to return to 'ABS DIAGNOSTICS' menu (operation 7).

## 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 multi-plugs.**

For example, the ABS electronic control module (ABS ECM) relies on the supply of accurate information to enable it to monitor and control the brake system. 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 that 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.**

### Disconnection of ABS ECM connector

**Caution**

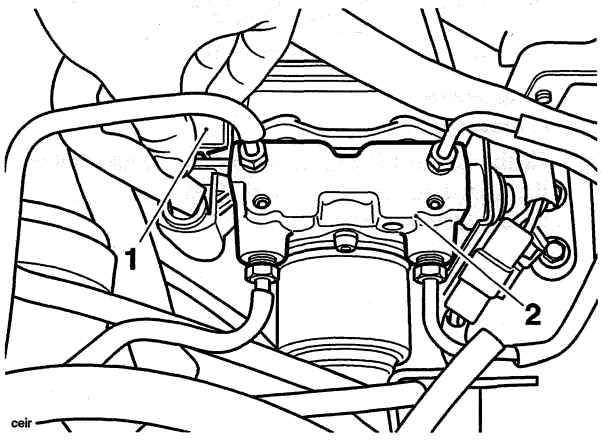
When disconnecting a connector, never pull directly on the wires as this may result in cable and connector damage.

**Caution**

Never disconnect the ABS ECM when the ignition switch is in the 'ON' position as this may cause multiple fault codes to be logged in the ECM memory.

Always disconnect an ECM after disconnecting the battery negative (black) lead first.

1. Lift up the locking device and gently pull back on the connector to release it from the ECM.




**1. Locking device**
**2. ABS modulator**

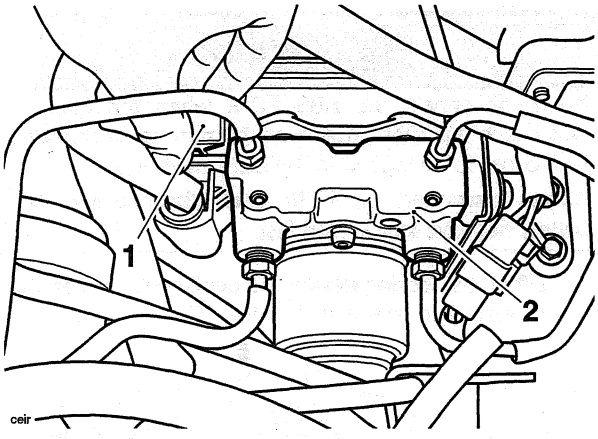
**Note:**

- **The ABS ECM is an integral part of the ABS modulator. Under no circumstances should the ECM be removed from the ABS modulator. If a new ECM is required, repair is by replacement of the ABS modulator and ECM as an assembly only.**

### Reconnection of ABS ECM connector

**Caution**

Damage to the connector pins may result if an attempt to fit the connectors incorrectly is made.




**1. Locking device**
**2. ABS modulator**

2. Fit the connector into its socket and, whilst holding the connector in place, push down gently on the locking device until it locks.

## Further Diagnosis

The tables that follow will, if used correctly, help to pinpoint a fault in the system once a diagnostic trouble code has been stored.

### Pinpoint Tests

### Before starting pinpoint tests:

1. Delete the stored DTCs.
2. Switch the ignition OFF and ON.

**Warning**

If the ABS is not functioning, the brake system will continue to function as a non-ABS braking system. Do not continue to ride for longer than is necessary with the indicator light illuminated. Ride with extreme caution when performing diagnostic troubleshooting on a non-functioning ABS system. In this situation braking too hard will cause the wheels to lock resulting in loss of motorcycle control and an accident.

3. Ride the motorcycle at a road speed in excess of 30 Km/h. If the DTC is repeated proceed to the relevant pinpoint test.
4. If the DTC is not repeated this indicates the DTC may have been stored due to external influences such as bad road surfaces or electrical interference.

### After completion of the pinpoint tests:

1. Delete the stored DTCs.
2. Switch the ignition OFF and ON.
3. Ride the motorcycle at a road speed in excess of 30 Km/h. If the DTC is repeated proceed to the relevant pinpoint test.
4. If a DTC is stored there is a further fault. Read the stored DTC and refer to the relevant pinpoint test.

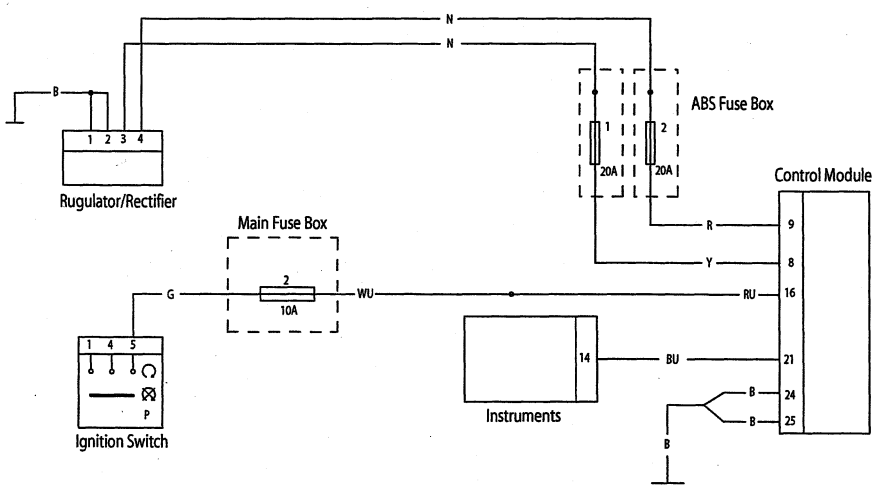
## ABS Warning Light ON (No DTCs Stored)

| Fault Code | Possible cause | Action |
|---|---|---|
| ABS Warning Light ON (No DTC's Stored) | ABS Ignition supply fuse/circuit fault<br>ABS Warning light circuit fault | Ensure ABS ECM connector is secure.<br>Disconnect ABS ECM connector and proceed to pinpoint test 1:- |

### Pinpoint Tests

| | Test | Result | Action |
|---|---|---|---|
| 1 | Check cable and terminal integrity:<br>- ABS ECM connector pin 16 and Ground pin 24 | OK | Proceed to test 2 |
| | | Faulty | Rectify fault, proceed to test 5 |
| 2 | Check cable continuity of the ABS ignition supply circuit: With the Ignition 'ON', check voltage between:<br>- ABS ECM connector pin 16 and Ground | Same as 'across battery' voltage | Proceed to test 3 |
| | | Less than 'across battery' voltage | Locate and rectify wiring fault, proceed to test 5 |
| 3 | Check cable continuity of the ABS warning light circuit:<br>Check voltage between:<br>- ABS ECM connector pin 21 and Ground | Voltage greater than 1.5 V | Proceed to test 4 |
| | | Voltage less than 1.5 V | Locate and rectify fault, proceed to test 5 |
| 4 | Check cable continuity of the ABS warning light circuit: - Short ABS ECM connector pin 21 and Ground pin 24 together:<br>Turn Ignition 'ON' | ABS warning light 'OFF' | Proceed to test 5 |
| | | ABS warning light 'ON' | Locate and rectify fault, proceed to test 5 |
| 5 | Reconnect ABS ECM harness, clear fault code and test ABS to verify fault cleared | OK | Action complete - quit test |
| | | Fault still present | Contact Triumph service |

### Circuit Diagram



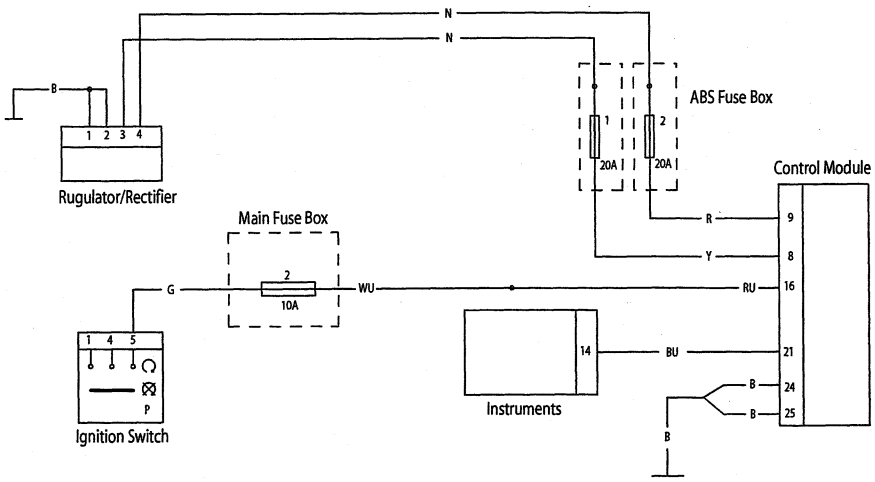
## ABS Warning Light Does not Illuminate (No DTCs Stored)

| Fault Code | Possible cause | Action |
|---|---|---|
| ABS Warning Light OFF (No DTC's Stored) | Warning light circuit fault<br>ABS ECM ground circuit fault | Ensure ABS ECM connector is secure.<br>Ensure ABS ECM ground connection is secure.<br>Disconnect ABS ECM connector and proceed to pinpoint test 1:- |

### Pinpoint Tests

| | Test | Result | Action |
|---|---|---|---|
| 1 | Check cable and terminal integrity:<br>- ABS ECM connector pin 16 and Ground | OK | Proceed to test 2 |
| | | Faulty | Rectify fault, proceed to test 6 |
| 2 | Check the ABS warning light circuit fuse (fuse 2): | OK | Proceed to test 3 |
| | | Faulty | Replace fuse, proceed to test 6 |
| 3 | Check cable for short to voltage: With Ignition 'OFF', check voltage between:<br>- ABS ECM connector pin 16 and Ground | 0 V | Proceed to test 4 |
| | | Above 3 V | Locate and rectify wiring fault, proceed to test 6 |
| 4 | Check cable for short to ground: With ignition 'ON', Check the ABS warning light circuit voltage between:<br>- ABS ECM connector pin 21 and Ground | Voltage greater than 1.5 V | Proceed to test 5 |
| | | Voltage less than 1.5 V | Locate and rectify fault, proceed to test 6 |
| 5 | Check cable for continuity: ABS ECM connector pin 24 and Ground:<br>Turn Ignition 'ON' | OK | Proceed to test 6 |
| | | Faulty | Locate and rectify fault, proceed to test 6 |
| 6 | Reconnect ABS ECM harness, clear fault code and test ABS to verify fault cleared | OK | Action complete - quit test |
| | | Fault still present | Contact Triumph service |

## Circuit Diagram



## Front Wheel Sensor Open Circuit / Short Circuit

| Fault Code | Possible cause | Action |
|---|---|---|
| C1611 | Front wheel speed sensor circuit fault | Ensure ABS ECM connector is secure.<br>Ensure wheel speed sensor connector is secure.<br>Disconnect ABS ECM connector and proceed to pinpoint test 1:- |

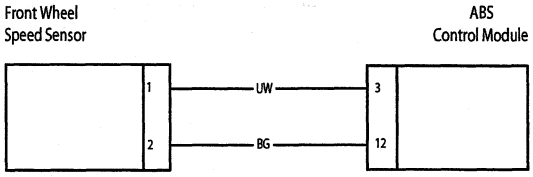
### Pinpoint Tests

| | Test | Result | Action |
|---|---|---|---|
| 1 | Check cable and terminal integrity: | OK | Proceed to test 2 |
| | - ABS ECM connector pin 3 and ABS ECM connector pin 12 | Faulty | Rectify fault, proceed to test 9 |
| 2 | Check cable for short circuit: | OK | Proceed to test 4 |
| | - ABS ECM connector pin 12 and Ground | Short circuit | Proceed to test 3 |
| 3 | Disconnect the front wheel speed sensor connector. Check cable for short circuit: | OK | Replace the wheel speed sensor, proceed to test 9 |
| | Wheel speed sensor connector pin 2 (motorcycle harness side) and Ground | Short circuit | Locate and rectify wiring harness fault, proceed to test 9 |
| 4 | Check cable for short circuit: | OK | Proceed to test 6 |
| | - ABS ECM connector pin 3 and Ground | Short circuit | Proceed to test 5 |
| 5 | Check cable for short circuit: | OK | Replace the wheel speed sensor, proceed to test 9 |
| | - Wheel speed sensor connector pin 1 (motorcycle harness side) and Ground | Short circuit | Locate and rectify wiring harness fault, proceed to test 9 |
| 6 | Check cable continuity: | OK | Proceed to test 7 |
| | - ABS ECM connector pin 12 and Wheel speed sensor connector pin 2 (motorcycle harness side) | Open circuit | Locate and rectify wiring harness fault, proceed to test 9 |
| 7 | Check cable continuity: | OK | Proceed to test 8 |
| | - ABS ECM connector pin 3 and Wheel speed sensor connector pin 1 (motorcycle harness side) | Open circuit | Locate and rectify wiring harness fault, proceed to test 9 |
| 8 | Reconnect the front wheel speed sensor connector. Check the wheel speed sensor operation: | 3 mA to 14 mA | Proceed to test 9 |
| | - Connect a suitable voltage supply between 4.5 V and 16 v between ABS ECM connector pin 12 (positive) and pin 3 (negative), and measure the current consumption of the wheel speed sensor | Faulty | Replace the wheel speed sensor, proceed to test 9 |
| 9 | Reconnect ABS ECM harness, clear fault code and test ABS to verify fault cleared | OK | Action complete - quit test |
| | | Fault still present | Contact Triumph service |

### Circuit Diagram

Wheel speed sensor current consumption data under typical conditions:

| Voltage | Min | Typical | Max |
|---|---|---|---|
| Low (4.5 V) | 3.1 mA | 4.1 mA | 5.3 mA |
| High (16V) | 8.1 mA | 10.5 mA | 13.6 mA |



## Front Wheel Sensor Abnormal Input / Loosing Contact

| Fault Code | Possible cause | Action |
|---|---|---|
| C1612 | Front wheel speed sensor poor signal<br>Incorrect Wheel speed sensor air gap<br>Damaged or dirty pulser ring<br>Loose or incorrectly installed wheel speed sensor | Ensure ABS ECM connector is secure.<br>Ensure wheel speed sensor connector is secure.<br>Proceed to pinpoint test 1:- |

### Pinpoint Tests

| | Test | Result | Action |
|---|---|---|---|
| 1 | Measure the air gap of the front wheel speed sensor between the sensor and the pulser ring:<br>-Air gap between 0.1 mm to 1.5 mm | OK | Proceed to test 2 |
| | | Faulty | Rectify the fault and proceed to test 5 |
| 2 | Check the pulser ring for damage or contamination by road grime or ferrous metal filings | OK | Proceed to test 3 |
| | | Faulty | Clean or replace the ABS pulser ring, proceed to test 5 |
| 3 | Check the wheel speed sensors for correct installation, and the fixings for correct torque | OK | Proceed to test 4 |
| | | Faulty | Rectify the fault and proceed to test 5 |
| 4 | Check the wheel speed sensor circuit (See page 14.64) | OK | Contact Triumph service |
| | | Faulty | Rectify the fault and proceed to test 5 |
| 5 | Clear fault code and test ABS to verify fault cleared | OK | Action complete - quit test |
| | | Fault still present | Contact Triumph service |

## Rear Wheel Sensor Open Circuit / Short Circuit

| Fault Code | Possible cause | Action |
|---|---|---|
| C1613 | Rear wheel speed sensor circuit fault | Ensure ABS ECM connector is secure.<br>Ensure wheel speed sensor connector is secure.<br>Disconnect ABS ECM connector and proceed to pinpoint test 1:- |

### Pinpoint Tests

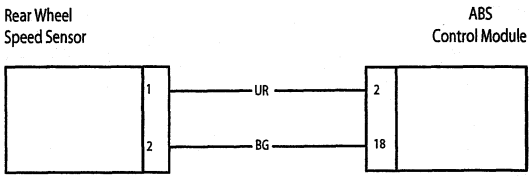
| | Test | Result | Action |
|---|---|---|---|
| 1 | Check cable and terminal integrity: | OK | Proceed to test 2 |
| | - ABS ECM connector pin 2 and ABS ECM connector pin 18 | Faulty | Rectify fault, proceed to test 9 |
| 2 | Check cable for short circuit: | OK | Proceed to test 4 |
| | - ABS ECM connector pin 2 and Ground | Short circuit | Proceed to test 3 |
| 3 | Disconnect the front wheel speed sensor connector. Check cable for short circuit: | OK | Replace the wheel speed sensor, proceed to test 9 |
| | - Wheel speed sensor connector pin 2 (motorcycle harness side) and Ground | Short circuit | Locate and rectify wiring harness fault, proceed to test 9 |
| 4 | Check cable for short circuit: | OK | Proceed to test 6 |
| | - ABS ECM connector pin 18 and Ground | Short circuit | Proceed to test 5 |
| 5 | Check cable for short circuit: | OK | Replace the wheel speed sensor, proceed to test 9 |
| | - Wheel speed sensor connector pin 1 (motorcycle harness side) and Ground | Short circuit | Locate and rectify wiring harness fault, proceed to test 9 |
| 6 | Check cable continuity: | OK | Proceed to test 7 |
| | - ABS ECM connector pin 2 and Wheel speed sensor connector pin 2 (motorcycle harness side) | Open circuit | Locate and rectify wiring harness fault, proceed to test 9 |
| 7 | Check cable continuity: | OK | Proceed to test 8 |
| | - ABS ECM connector pin 18 and Wheel speed sensor connector pin 1 (motorcycle harness side) | Open circuit | Locate and rectify wiring harness fault, proceed to test 9 |
| 8 | Reconnect the front wheel speed sensor connector. Check the wheel speed sensor operation: | 3 mA to 14 mA | Proceed to test 9 |
| | - Connect a suitable voltage supply between 4.5 V and 16 v between ABS ECM connector pin 2 (positive) and pin 18 (negative), and measure the current consumption of the wheel speed sensor | Faulty | Replace the wheel speed sensor, proceed to test 9 |
| | | Test continued overleaf | |

| | Test | Result | Action |
|---|---|---|---|
| 9 | Reconnect ABS ECM harness, clear fault code and test ABS to verify fault cleared | OK | Action complete - quit test |
| | | Fault still present | Contact Triumph service |

**Circuit Diagram**

Wheel speed sensor current consumption data under typical conditions:

| Voltage | Min | Typical | Max |
|---|---|---|---|
| Low (4.5 V) | 3.1 mA | 4.1 mA | 5.3 mA |
| High (16V) | 8.1 mA | 10.5 mA | 13.6 mA |



## Rear Wheel Sensor Abnormal Input / Loosing Contact

| Fault Code | Possible cause | Action |
|---|---|---|
| C1614 | Rear wheel speed sensor poor signal<br>Incorrect Wheel speed sensor air gap<br>Damaged or dirty pulser ring<br>Loose or incorrectly installed wheel speed sensor | Ensure ABS ECM connector is secure.<br>Proceed to pinpoint test 1:- |

### Pinpoint Tests

| | Test | Result | Action |
|---|---|---|---|
| 1 | Measure the air gap of the front wheel speed sensor between the sensor and the pulser ring:<br>- Air gap between 0.1 mm to 1.5 mm | OK | Proceed to test 2 |
| | | Faulty | Rectify the fault and proceed to test 5 |
| 2 | Check the pulser ring for damage or contamination by road grime or ferrous metal filings | OK | Proceed to test 3 |
| | | Faulty | Clean or replace the ABS pulser ring, proceed to test 5 |
| 3 | Check the wheel speed sensors for correct installation, and the fixings for correct torque: | OK | Proceed to test 4 |
| | | Faulty | Rectify the fault and proceed to test 5 |
| 4 | Check the wheel speed sensor circuit (See page 14.67) | OK | Contact Triumph service |
| | | Faulty | Rectify the fault and proceed to test 5 |
| 5 | Clear fault code and test ABS to verify fault cleared | OK | Action complete - quit test |
| | | Fault still present | Contact Triumph service |

## Front Wheel Pulser Gear Missing Teeth

| Fault Code | Possible cause | Action |
|---|---|---|
| C1621 | Incorrect Wheel speed sensor air gap<br>Damaged or dirty pulser ring<br>Loose or incorrectly installed wheel speed sensor<br>Damaged/incorrect wheels | Ensure ABS ECM connector is secure.<br>Proceed to pinpoint test 1:- |

### Pinpoint Tests

| | Test | Result | Action |
|---|---|---|---|
| 1 | Measure the air gap of the front wheel speed sensor between the sensor and the pulser ring:<br>- Air gap between 0.1 mm to 1.5 mm | OK | Proceed to test 2 |
| | | Faulty | Rectify the fault and proceed to test 5 |
| 2 | Check the pulser ring for damage or contamination by road grime or ferrous metal filings | OK | Proceed to test 3 |
| | | Faulty | Clean or replace the ABS pulser ring, proceed to test 5 |
| 3 | Check the wheel speed sensors for correct installation, and the fixings for correct torque: | OK | Proceed to test 4 |
| | | Faulty | Rectify the fault and proceed to test 5 |
| 4 | Check the motorcycle wheel for damage/ incorrect size | OK | Proceed to test 4 |
| | | Faulty | Rectify the fault and proceed to test 5 |
| 5 | Clear fault code and test ABS to verify fault cleared | OK | Action complete - quit test |
| | | Fault still present | Contact Triumph service |

## Rear Wheel Pulser Gear Missing Teeth

| Fault Code | Possible cause | Action |
|---|---|---|
| C1623 | Incorrect Wheel speed sensor air gap<br>Damaged or dirty pulser ring<br>Loose or incorrectly installed wheel speed sensor<br>Damaged/incorrect wheels | Ensure ABS ECM connector is secure.<br>Proceed to pinpoint test 1:- |

### Pinpoint Tests

| | Test | Result | Action |
|---|---|---|---|
| 1 | Measure the air gap of the front wheel speed sensor between the sensor and the pulser ring:<br>- Air gap between 0.1 mm to 1.5 mm | OK | Proceed to test 2 |
| | | Faulty | Rectify the fault and proceed to test 5 |
| 2 | Check the pulser ring for damage or contamination by road grime or ferrous metal filings | OK | Proceed to test 3 |
| | | Faulty | Clean or replace the ABS pulser ring, proceed to test 5 |
| 3 | Check the wheel speed sensors for correct installation, and the fixings for correct torque: | OK | Proceed to test 4 |
| | | Faulty | Rectify the fault and proceed to test 5 |
| 4 | Check the motorcycle wheel for damage/ incorrect size | OK | Proceed to test 4 |
| | | Faulty | Rectify the fault and proceed to test 5 |
| 5 | Clear fault code and test ABS to verify fault cleared. | OK | Action complete - quit test |
| | | Fault still present | Contact Triumph service |

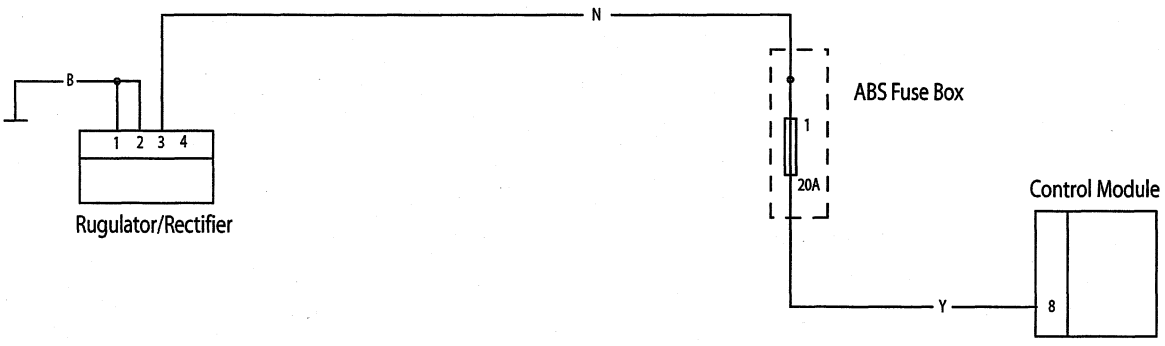
## Front or Rear Input/output solenoid Open / Short Circuit

| Fault Code | Possible cause | Action |
|---|---|---|
| Front: C1631; C1632<br>Rear: C1633; C1634<br>C1654 | ABS solenoid circuit fault | Ensure ABS ECM connector is secure.<br>Disconnect ABS ECM connector and proceed to pinpoint test 1:- |

### Pinpoint Tests

| | Test | Result | Action |
|---|---|---|---|
| 1 | Check cable and terminal integrity:<br>- ABS ECM connector pin 8 and Ground | OK | Proceed to test 2 |
| | | Faulty | Rectify fault, proceed to test 5 |
| 2 | Check the ABS solenoid fuse (fuse 1 in ABS fuse box): | OK | Proceed to test 3 |
| | | Faulty | Replace fuse, proceed to test 5 |
| 3 | Check cable continuity: With Ignition 'ON', check voltage between<br>- ABS ECM connector pin 8 and Ground | Same as 'across battery' voltage | Proceed to test 4 |
| | | Less than 'across battery' voltage | Locate and rectify wiring fault, proceed to test 5 |
| 4 | Check cable for continuity:<br>- ABS ECM connector pin 24 and Ground | OK | Proceed to test 5 |
| | | Faulty | Locate and rectify fault, proceed to test 5 |
| 5 | Clear fault code and test ABS to verify fault cleared | OK | Action complete - quit test |
| | | Fault still present | Contact Triumph service |

### Circuit Diagram



## Front or Rear Wheel Actuator (Hydraulic Control) Wheel Lock

| Fault Code | Possible cause | Action |
|---|---|---|
| C1641; C1643 | Binding brake<br>Incorrect Wheel speed sensor air gap<br>Loose or incorrectly installed wheel speed sensor | Ensure ABS ECM connector is secure.<br>Proceed to pinpoint test 1:- |

### Pinpoint Tests

| | Test | Result | Action |
|---|---|---|---|
| 1 | Check the relevant wheel for brake bind caused by caliper or master cylinder faults, or other mechanical causes | OK | Proceed to test 2 |
| | | Faulty | Rectify the fault and proceed to test 4 |
| 2 | Measure the air gap of the wheel speed sensor between the sensor and the pulser ring:<br>- Air gap between 0.1 mm to 1.5 mm | OK | Proceed to test 3 |
| | | Faulty | Rectify the fault and proceed to test 4 |
| 3 | Check the wheel speed sensors for correct installation, and the fixings for correct torque | OK | Proceed to test 4 |
| | | Faulty | Rectify the fault and proceed to test 4 |
| 4 | Clear fault code and test ABS to verify fault cleared | OK | Action complete - quit test |
| | | Fault still present | Contact Triumph service |

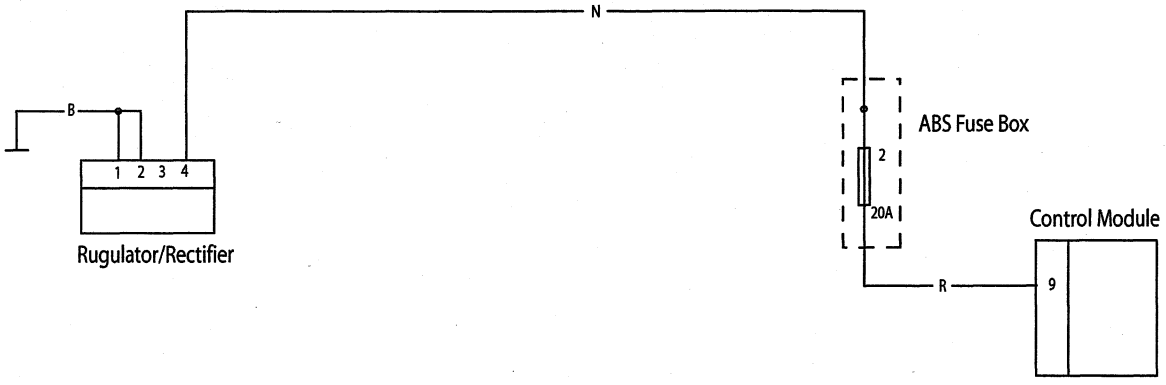
## Motor - Lock; Motor Stuck OFF; Motor stuck ON

| Fault Code | Possible cause | Action |
|---|---|---|
| C1651; C1652; C1653 | Motor circuit fault<br>Motor runs continually<br>Motor does not run at all | Ensure ABS ECM connector is secure.<br>Turn the ignition 'ON'.<br>Proceed to pinpoint test 1:- |

### Pinpoint Tests

| | Test | Result | Action |
|---|---|---|---|
| 1 | Check the motor function:<br>Check that with the motorcycle stationary and the ABS ACM modulator connected, the motor does not operate. | OK | Proceed to test 2 |
| | | Motor runs continually. | Contact Triumph service |
| 2 | Check the ABS motor circuit fuse (fuse 2 in ABS fuse box) | OK | Proceed to test 3 |
| | | Faulty | Replace fuse and proceed to test 5 |
| 3 | Check cable continuity: With Ignition 'ON', check voltage between:<br>- ABS ECM connector pin 9 and Ground | Same as 'across battery' voltage | Proceed to test 4 |
| | | Less than 'across battery' voltage | Locate and rectify wiring fault, proceed to test 5 |
| 4 | Check cable for continuity:<br>- ABS ECM connector pin 25 and Ground | OK | Proceed to test 5 |
| | | Faulty | Locate and rectify fault, proceed to test 5 |
| 5 | Reconnect ABS ECM harness, clear fault code and test ABS to verify fault cleared | OK | Action complete - quit test |
| | | Fault still present | Contact Triumph service |

### Circuit Diagram



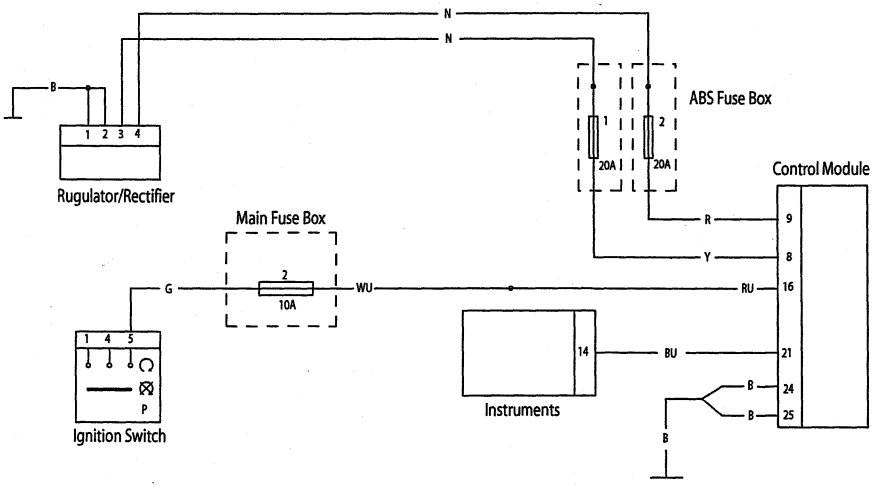
## Power Source Voltage Drop/Voltage Rise

| Fault Code | Possible cause | Action |
|---|---|---|
| C1661; C1662 | Power supply circuit fault<br>Battery charging circuit fault | Ensure ABS ECM connector is secure. Disconnect ABS ECM connector and proceed to pinpoint test 1:- |

### Pinpoint Tests

| | Test | Result | Action |
|---|---|---|---|
| 1 | Check cable and terminal integrity: | OK | Proceed to test 2 |
| | - ABS ECM connector pin 16 and Ground pin 24 | Faulty | Rectify fault, proceed to test 5 |
| 2 | Check the cable for continuity: | OK | Proceed to test 3 |
| | - ABS ECM connector pin 24 and Ground | Faulty | Rectify wiring harness fault, proceed to test 5 |
| 3 | Check battery voltage: With ignition 'ON', Check the voltage between: | Voltage greater than 10 V | Proceed to test 4 |
| | - ABS ECM connector pin 16 and Ground pin 24 | Voltage less than 10V | Locate and rectify fault, proceed to test 5 |
| 4 | Check battery voltage: Reconnect ABS ECM connector and start the engine, Check the voltage between: | Voltage between 10 V and 16 V | Proceed to test 4 |
| | - Battery positive (red) terminal and negative (black) terminal | Voltage greater than 16V | Check the battery charging circuit. Locate and rectify fault, proceed to test 5 |
| 5 | Clear fault code and test ABS to verify fault cleared. | OK | Action complete - quit test |
| | | Fault still present | Contact Triumph service |

### Circuit Diagram



## Different Tyre Diameter

| Fault Code | Possible cause | Action |
|---|---|---|
| C1671 | Incorrect diameter wheels installed<br>Incorrect tyre pressures<br>Incorrect Wheel speed sensor air gap<br>Damaged or dirty pulser ring | Ensure ABS ECM connector is secure.<br>Proceed to pinpoint test 1:- |

### Pinpoint Tests

| | Test | Result | Action |
|---|---|---|---|
| 1 | Check for installation of wheels and tyres of the correct size | OK | Proceed to test 2 |
| | | Faulty | Rectify fault, proceed to test 5 |
| 2 | Check the tyre pressures | OK | Proceed to test 3 |
| | | Faulty | Rectify fault, proceed to test 5 |
| 3 | Check the pulser ring for damage or contamination by road grime or ferrous metal filings | OK | Proceed to test 4 |
| | | Faulty | Clean or replace the ABS pulser ring, proceed to test 5 |
| 4 | Measure the air gap of the front wheel speed sensor between the sensor and the pulser ring:<br>- Air gap between 0 mm to 1.5 mm | OK | Proceed to test 5 |
| | | Faulty | Rectify the fault and proceed to test 5 |
| 5 | Clear fault code and test ABS to verify fault cleared | OK | Action complete - quit test |
| | | Fault still present | Contact Triumph service |

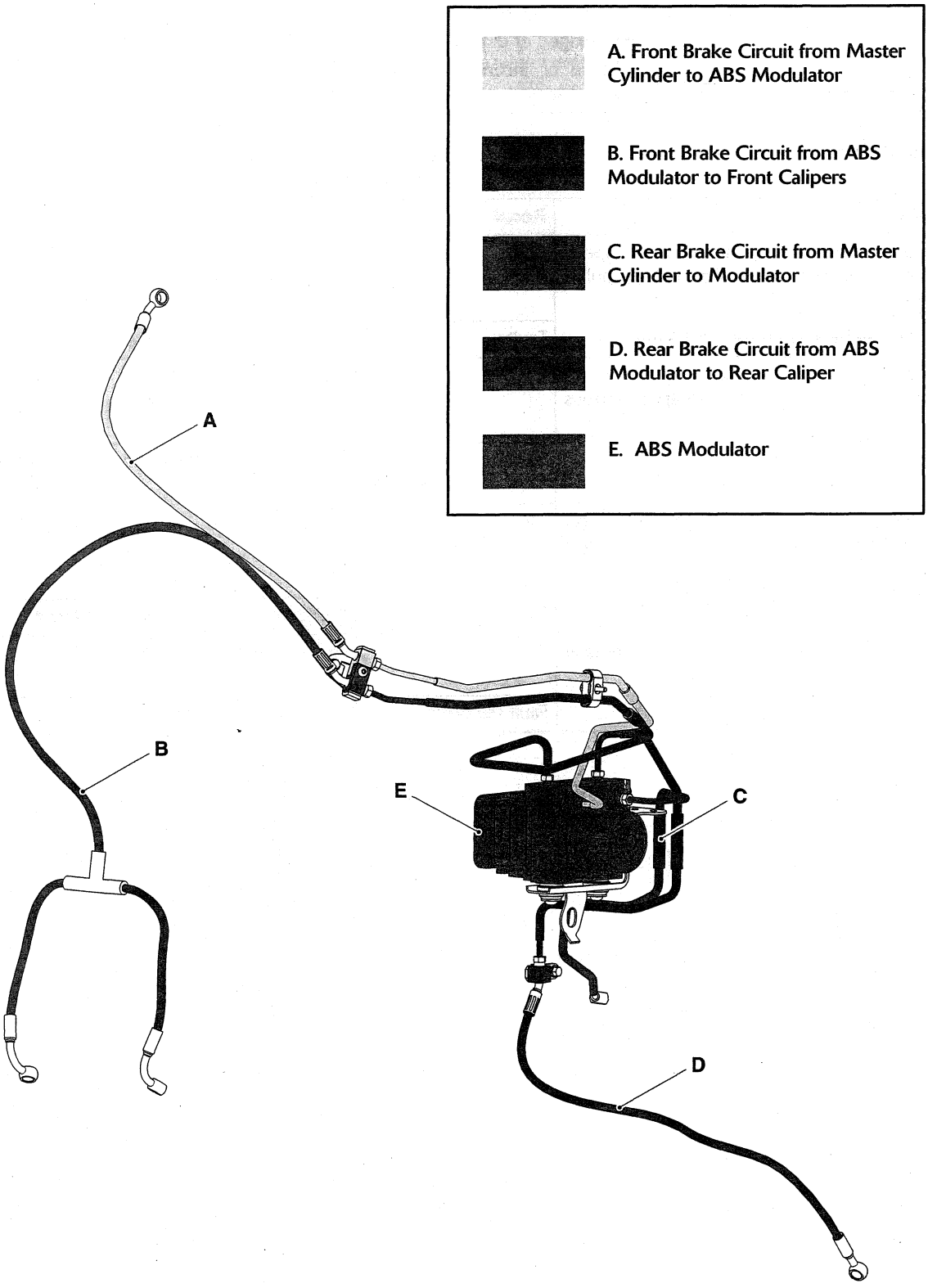
## Abnormal ECU

| Fault Code | Possible cause | Action |
|---|---|---|
| C1681 | Incorrect Wheel speed sensor air gap<br>Damaged or dirty pulser ring<br>Loose or incorrectly installed wheel speed sensor | Ensure ABS ECM connector is secure.<br>Proceed to pinpoint test 1:- |

### Pinpoint Tests

| | Test | Result | Action |
|---|---|---|---|
| 1 | Measure the air gap of the wheel speed sensors between the sensor and the pulser ring:<br>- Air gap between 0 mm to 1.5 mm | OK | Proceed to test 1 |
| | | Faulty | Rectify the fault and proceed to test 4 |
| 2 | Check the pulser rings for damage or contamination by road grime or ferrous metal filings | OK | Proceed to test 2 |
| | | Faulty | Clean or replace the ABS pulser ring, proceed to test 4 |
| 3 | Check the wheel speed sensors for correct installation, and the fixings for correct torque | OK | Proceed to test 4 |
| | | Faulty | Rectify the fault and proceed to test 4 |
| 4 | Clear fault code and test ABS to verify fault cleared. | OK | Action complete - quit test |
| | | Fault still present | Contact Triumph service |

## ABS Hydraulic Circuit Layout



# 15 Wheels/Tyres

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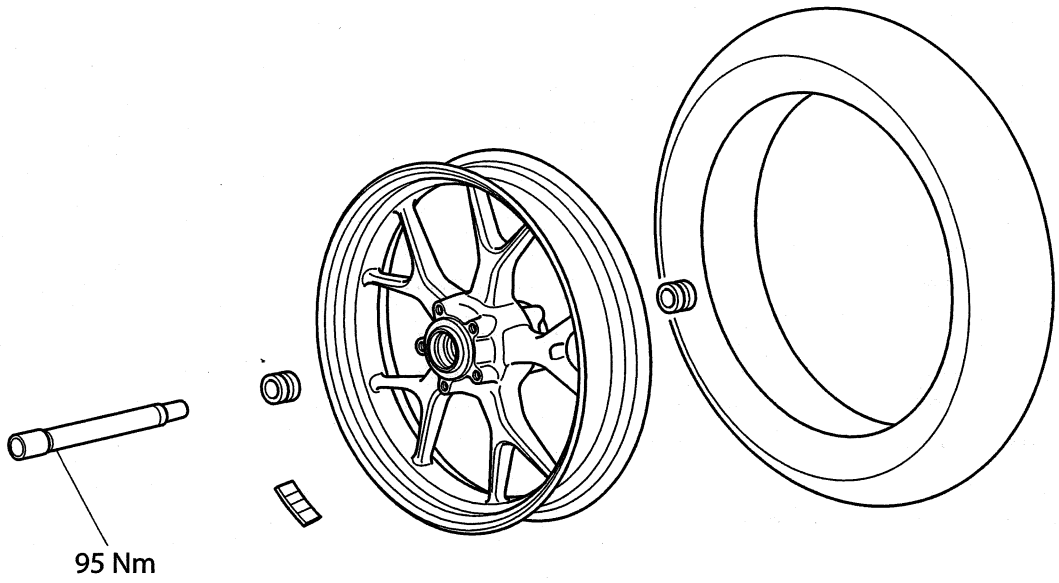
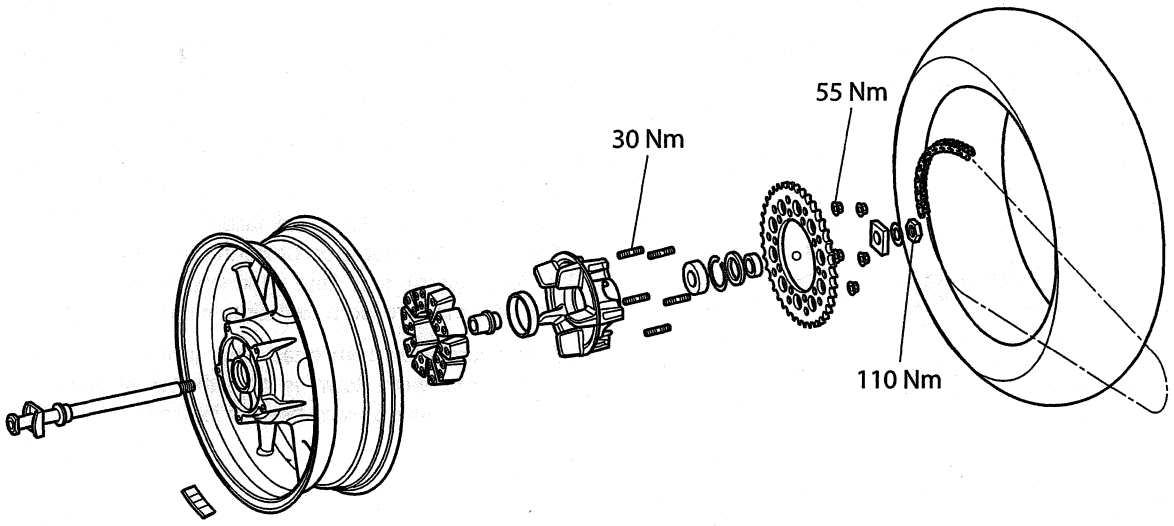
## Exploded view - Front Wheel

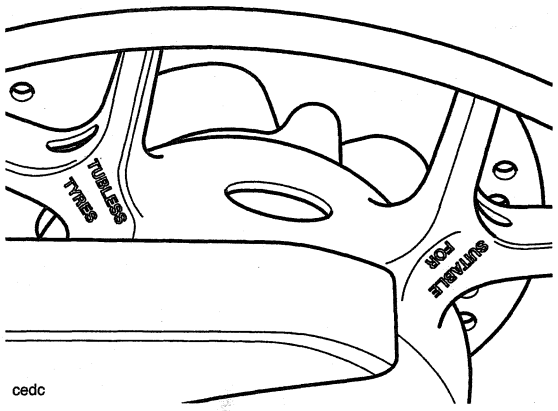


## Exploded View – Rear Wheel & Final Drive

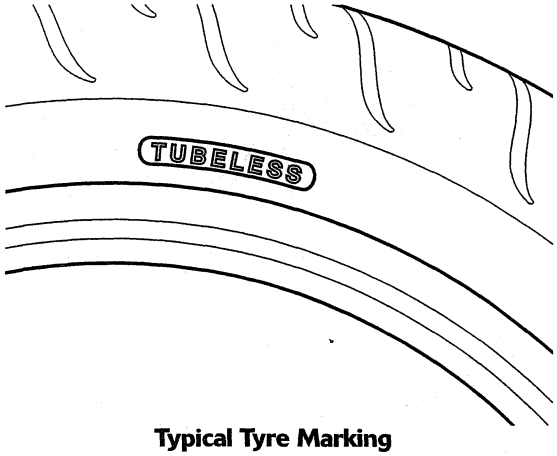


## Tyres

This model is equipped with tubeless tyres, valves, and wheel rims. Only tyres marked 'TUBELESS' and tubeless type tyre valves mounted on rims marked 'SUITABLE FOR TUBELESS TYRES' can be used.




**Typical Wheel Marking**




**Typical Tyre Marking**

**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.

### Tyre Pressures

Correct inflation pressure will provide maximum stability, rider comfort and tyre life.

Tyre pressures should be checked frequently and adjusted as necessary. Correct tyre pressures are:

Front - 2.34 Bar (34 Psi)

Rear - 2.90 Bar (42 Psi)

**Warning**

Incorrect tyre inflation will cause abnormal tread wear and instability problems which may lead to loss of control and an accident.

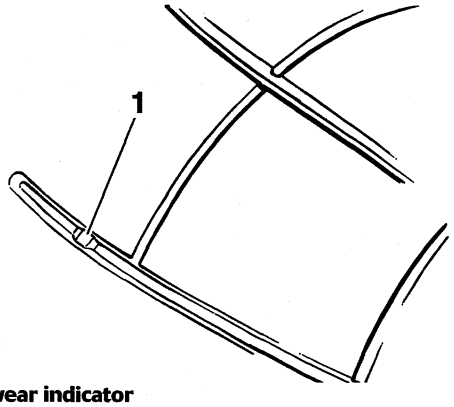
Under-inflation may result in the tyre slipping on, or coming off the rim. Over-inflation will cause instability and accelerated tread wear.

Both conditions are dangerous as they may cause loss of control leading to an accident.

### Tyre Wear/Wheel Inspection

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. Always replace wheels that are suspected of having become 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.

When tubeless tyres become punctured, leakage is often very slow. Always inspect tyres very closely for punctures.

Check the tyres for cuts, embedded nails or other sharp objects.

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.

| Speed | Minimum Tread Depth |
|---|---|
| Under 130 km/h (80 mph) | 2 mm (0.08 in) |
| Over 130 km/h (80 mph) | Rear 3 mm (0.12 in)<br>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.

**Warning**

Only operate this Triumph motorcycle at high speed in closed course on-road competition or on closed course race tracks. High speed operation should only then be attempted by riders who have been instructed in the techniques necessary for high speed riding and are familiar with the motorcycle's characteristics in all conditions. High speed operation in any other circumstances is dangerous and will lead to loss of motorcycle control and an accident.

### 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 sustains a puncture, the tyre must be replaced. Failure to replace a punctured tyre, or operation with a repaired tyre can lead to instability, loss of control or an accident.

Never use an inner tube to repair a punctured tyre. The rough surface inside the tyre can chafe the tube leading to instability, rapid deflation, 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.

**Warning**

On models fitted with ABS, the ABS computer operates by comparing the relative speed of the front and rear wheels. Use of non-recommended tyres can affect wheel speed and cause the ABS function not to operate, potentially leading to loss of control and an accident in conditions where the ABS would normally function.

**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 adversely affect handling leading to loss of control or an accident.

**Warning**

Do not install tube-type tyres on tubeless rims. The bead will not seat and the tyres could slip on the rims, causing tyre deflation that may result in a loss of vehicle control and an accident.

Do not install an inner tube inside a tubeless tyre. This may cause instability and excessive heat build-up may cause the tube to burst resulting in rapid tyre deflation, loss of vehicle control and 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 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

**Warning**

Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

1. Position the motorcycle on a paddock stand.
2. Detach both brake calipers (see page *14-16*).

**Note:**

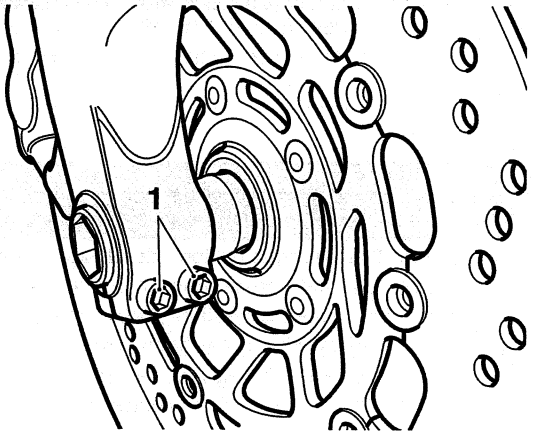
- **It is not necessary to disconnect the brake hoses.**

**Warning**

Do not allow the calipers to hang on the brake hoses as this may damage the hoses.

Damaged hoses could cause brake failure leading to loss of control and an accident.

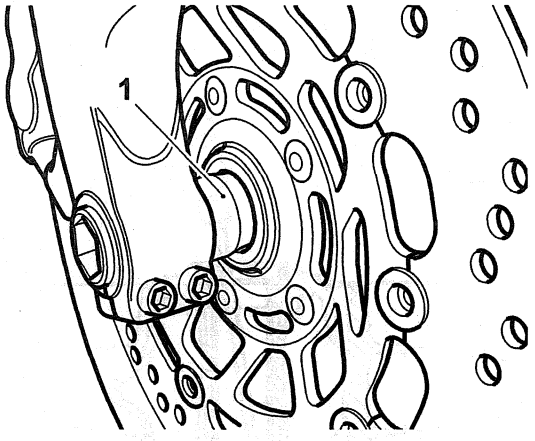
3. Raise and support the front of the motorcycle.
4. Slacken both pinch bolts at the lower end of the right hand fork.




**1. Fork pinch bolts**

5. Release and remove the wheel spindle, which is threaded into the left hand fork.

6. Remove the wheel and the wheel spacers.




**1. Wheel spacer (right hand shown)**

7. Place the wheel on wooden blocks.

**Warning**

Do not allow the wheel to rest on either brake disc as this may damage the disc and could lead to an accident.

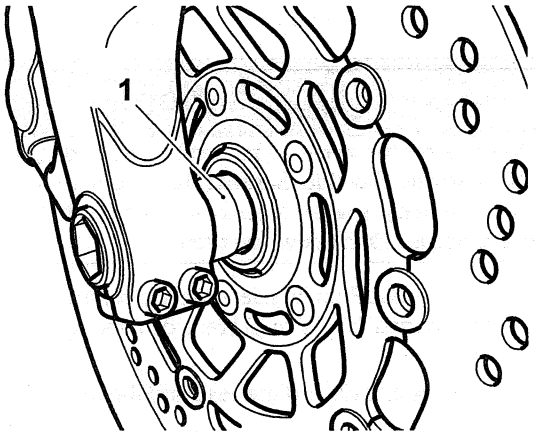
**Caution**

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.

8. Thoroughly clean all components and inspect for wear or damage.

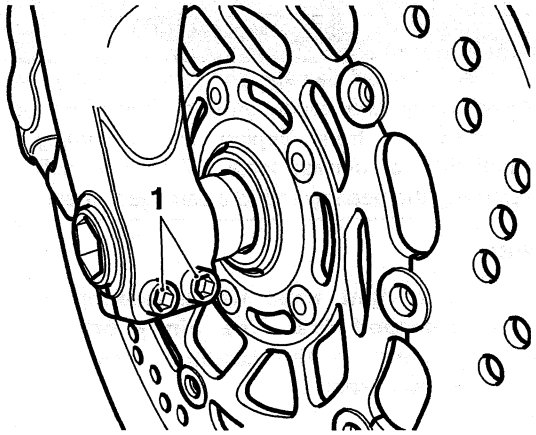
## Installation

1. Lightly smear the wheel spacers with grease and locate in the hubs.
2. Position the wheel between the forks ensuring the spacers remain in position on both sides.




**1. Wheel spacer (right hand shown)**

3. Refit the wheel spindle from the right hand side and tighten to **95 Nm.**
4. Lower the motorcycle to the ground and pump the front suspension to allow the right hand fork to 'float' to its natural position on the wheel spindle.
5. Tighten the fork pinch bolts to **20 Nm.**




**1. Fork pinch bolts**

6. Thoroughly clean and degrease the brake discs.
7. Fit the brake calipers (see page *14-18*).

## Front Wheel Bearing

### Removal

1. Remove the front wheel (See page *15-6*).
2. Models with ABS brakes: Remove the ABS pulser ring (See page *14-33*).

**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. Lay the wheel on its side while supporting the wheel on wooden blocks to prevent damage to the brake disc.
4. Remove and discard the seals and the bearing circlip.

**Warning**

Always wear eye, hand and face protection when using a drift as use of a hammer and drift can cause bearings to fragment. Pieces of fragmented bearing could cause eye and hand injuries if suitable protective apparel is not worn.

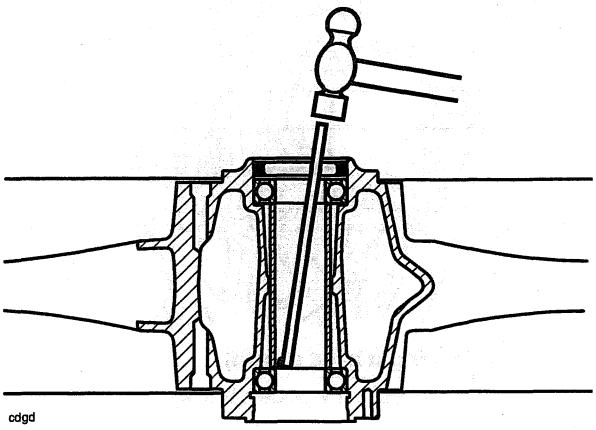
**Caution**

To prevent wheel damage and to aid bearing removal, always apply force evenly on both sides of the bearing to prevent it from 'tipping' and becoming stuck. Application of uneven force will lead to difficulty in removing the bearing and to a damaged wheel.

**Note:**

- **The right hand wheel bearing must be removed first. The pin punch must be located in the cut-outs provided in the centre sleeve.**

5. Using a suitable pin punch, through the centre of the wheel, drift out the right hand wheel bearing. Collect the centre sleeve. Remove the left hand wheel bearing in the same way.




**Wheel Bearing Removal**

### Inspection

**Warning**

Only remove raised witness marks from within the wheel. Removal of material below any raised areas will reduce the level of interference between the wheel and the bearings. Loss of interference could cause the bearing to become loose in the wheel leading to loss of motorcycle control and an accident.

1. Examine the wheel for any raised witness marks caused by the removal process. Remove any such marks with fine emery paper or a gentle file.

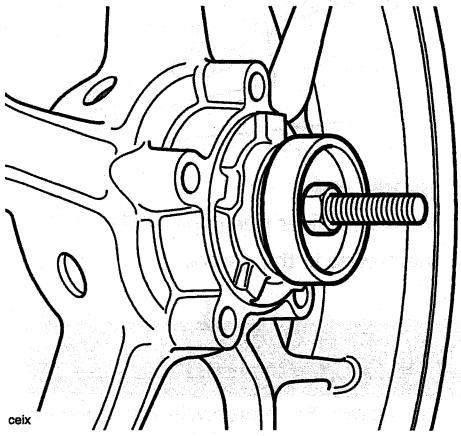
### Installation

**Note:**

- **Refer to the chart below for the correct tool and tool face when inserting bearings. Bearings are inserted by means of a draw-bolt acting on the insertion tool. A support tool is located on the opposite side of the wheel to the insertion tool and as the bolt is tightened, the bearing is drawn in to the wheel.**
- **Insert bearings with the marked or shielded side facing outwards and always fit a new bearing circlip and seals.**

| | Bearing insertion tool | Support tool |
|---|---|---|
| Left bearing | 3880070-T0310 Small face to bearing | 3880075-T0310 Large face to wheel |
| Right bearing | 3880070-T0310 Small face to bearing | 3880075-T0310 Large face to wheel |

1. Fit the wheel bearings and centre sleeve using the method described above.




**Tool 3880070 - T0301 in Position on Wheel**

2. Fit a new circlip.
3. Lubricate and fit new seals to the front wheel. Lubricate the seal's knife-edge with grease to NLGI 2 specification (we recommend Mobil HP222).
4. Models with ABS brakes: Refit the ABS pulser ring (See page *14-33*).
5. Fit the front wheel. (See page *15-7*).

## Rear Wheel

### Removal

**Warning**

Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

1. Raise and support the rear of the motorcycle to allow removal of the rear wheel.

**Warning**

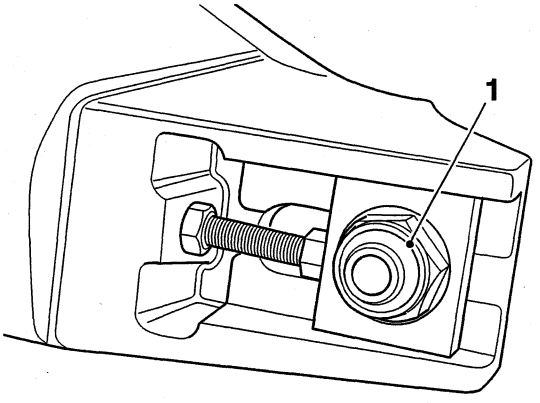
If the engine has recently been running, the exhaust system will be hot. Before working on or near the exhaust system, allow sufficient time for the exhaust system to cool as touching any part of a hot exhaust system could cause burn injuries.

**Warning**

Do not allow the caliper to hang on the brake hose as this may damage the hose.

Damaged hoses could cause brake failure leading to loss of control and an accident.

2. Remove the brake caliper (see page *14-26*) and tie aside.
3. Remove the nut from the rear wheel spindle.



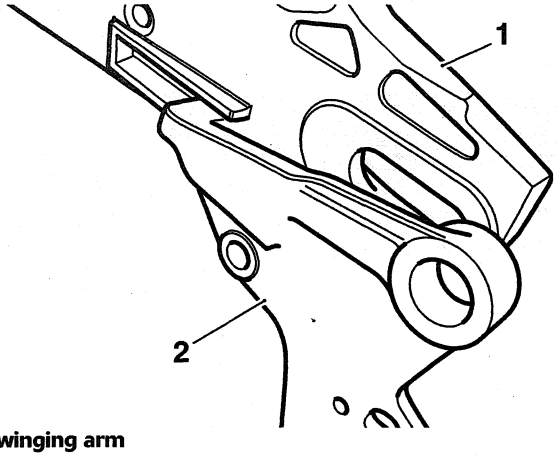

**1. Rear wheel spindle nut**

4. Support the wheel and withdraw the wheel spindle.
5. Noting its position, release the brake caliper carrier from the slot on the swinging arm and roll the wheel forward until the chain can be detached from the rear sprocket.

6. Withdraw the wheel and collect the flanged spacer from the right hand side and the plain spacer from the left hand side.
7. Place the wheel on wooden blocks with the drive sprocket uppermost.
8. If required, remove the final drive assembly (See page *15-12*).
9. If required, remove the brake disc (see page *14-28*).

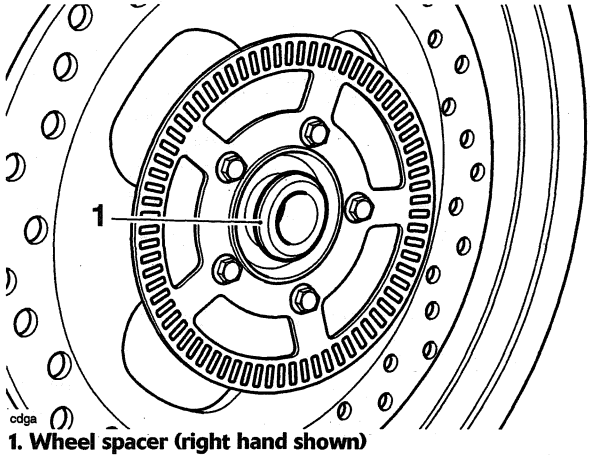
## Installation

1. If removed, refit the rear brake disc (see page *14-29*).
2. If removed, refit the final drive assembly (see page *15-12*).
3. Position the wheel within the swinging arm and refit the chain to the final drive sprocket.
4. Position the rear brake caliper carrier to the swinging arm as noted prior to removal. Align the boss on the carrier with the raised slot on the swinging arm.




cejb
**1. Swinging arm**
**2. Caliper carrier**

5. Refit the wheel spacers, flanged spacer to the right hand side (flange facing outwards) and plain spacer to the left.



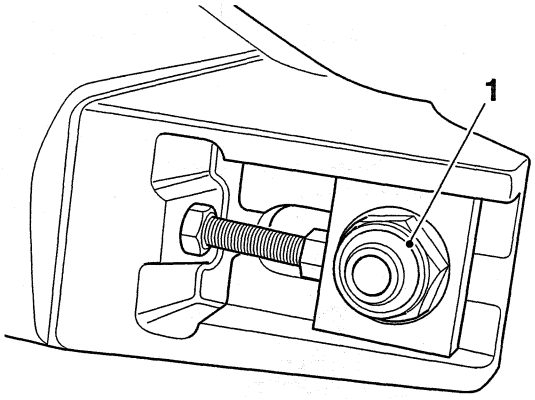

cdga
**1. Wheel spacer (right hand shown)**

6. Lift the rear wheel into position, aligning the wheel, caliper carrier and swinging arm.

**Warning**

Check that the spacers are still correctly positioned. Incorrectly fitted wheel spacers will cause a dangerous riding condition leading to loss of motorcycle control and an accident.

7. Fit the wheel spindle, ensuring the right hand chain adjuster block is installed, with the threaded end facing to the left.
8. Fit the left hand chain adjuster block, washer and a new nut.
9. Keeping the chain adjuster blocks in contact with the adjuster bolts, tighten the wheel spindle nut to **110 Nm**.




**1. Rear wheel spindle nut**

10. Refit the rear brake caliper (see page *14-28*).
11. Lower the motorcycle to the ground.

**Warning**

It is dangerous to operate the motorcycle with defective brakes; you must have your authorised Triumph dealer take remedial action before you attempt to ride the motorcycle again. Failure to take remedial action may reduce braking efficiency leading to loss of motorcycle control and an accident.

12. Check the operation of the rear brake.
13. Check and, if necessary, adjust the chain (see page *12-6*).

## Rear Wheel Bearings

### Removal

1. Remove the rear wheel (see page *15-9*).
2. Remove the final drive assembly (See page *15-12*).

**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. Place the wheel on wooden blocks to prevent damage to the brake disc.
4. Remove and discard the seals and the bearing circlip.

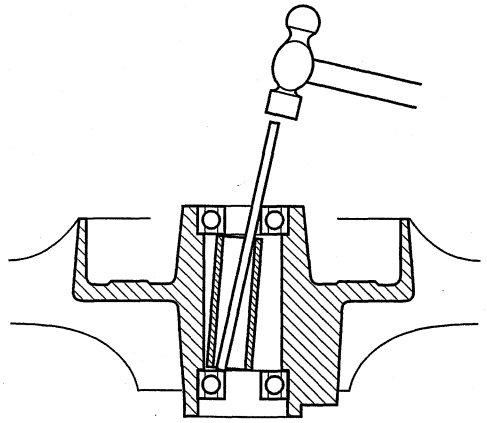
**Warning**

Always wear eye, hand and face protection when using a hammer and drift. Use of a hammer and drift can cause bearings to fragment. Pieces of fragmented bearing could cause eye and soft tissue injuries if suitable protective apparel is not worn.

**Caution**

To prevent wheel damage and to aid bearing removal, always apply force evenly on both sides of the bearing to prevent it from 'tipping' and becoming stuck. Application of uneven force will lead to difficulty in removing the bearing and to a damaged wheel.

5. Using a suitable pin punch, through the centre of the wheel, drift out the wheel bearings. Collect the centre sleeve.




**Rear Wheel Bearing Removal**

### Inspection

**Warning**

Only remove raised witness marks from within the wheel. Removal of material below any raised areas will reduce the level of interference between the wheel and the bearings. Loss of interference could cause the bearing to become loose in the wheel leading to loss of motorcycle control and an accident.

1. Examine the wheel for any raised witness marks caused by the removal process. Remove any such marks with fine emery paper or a gentle file.

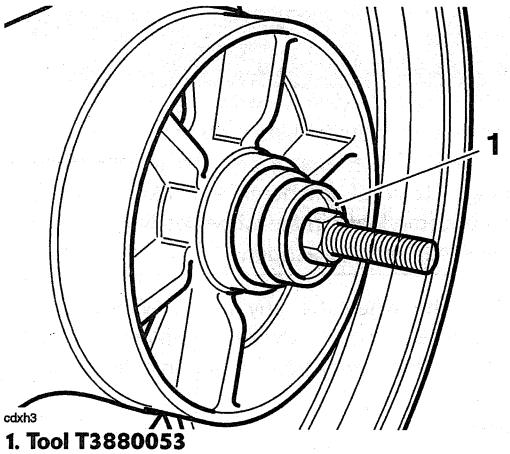
### Installation

**Note:**

- **Refer to the chart below for the correct tool and tool face when inserting bearings. Bearings are inserted by means of a draw-bolt acting on the insertion tool. A support tool is located on the opposite side of the wheel to the insertion tool and as the bolt is tightened, the bearing is drawn into the wheel.**
- **Insert the bearings with the marked or shielded side facing outwards and always fit a new bearing circlip and seals.**

| | Bearing insertion tool | Support tool |
|---|---|---|
| Left bearing | T3880053<br>Large face to bearing | 3880075 - T0301<br>Large face to Wheel |
| Right bearing | T3880053<br>Large face to bearing | 3880075 - T0301<br>Large face to wheel |

1. Fit the wheel bearings and centre sleeve using the method described on the previous page.




**1. Tool T3880053**

2. Fit a new circlip.
3. Lubricate and fit new seals to the rear wheel. Lubricate the seal's knife-edge with grease to NLGI 2 specification (we recommend Mobil HP222).
4. Refit the final drive assembly (see page *15-12*).
5. Fit the rear wheel (see page *15-10*).

## Final Drive

### Removal

**Warning**

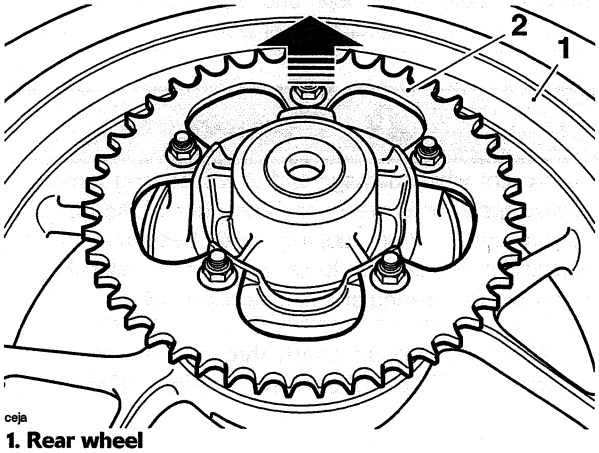
Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

1. Remove the rear wheel (see page *15-9*).

**Caution**

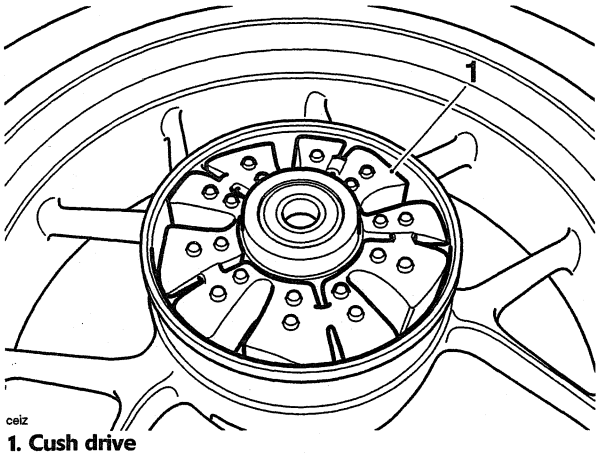
Do not allow the wheel to rest on the brake disc, as this may damage the disc. Support the wheel on wooden blocks, equally spaced around the rim, such that the brake disc is raised above the ground.

2. Place the wheel on wooden blocks with the drive sprocket uppermost.
3. Gently lever the drive flange from the wheel hub.




**1. Rear wheel**
**2. Drive flange**

4. Remove the cush drive rubbers.




**1. Cush drive**

## Inspection

1. Check the cush drive rubbers for deterioration, cracks etc.
2. Inspect the sprocket teeth for wear, damage and chips.
3. Check the wheel and drive flange for wear, cracks and damage.

## Installation

1. Install the cush drive rubbers to the wheel.
2. Refit the drive flange to the wheel.
3. Refit the rear wheel (see page *15-9*).

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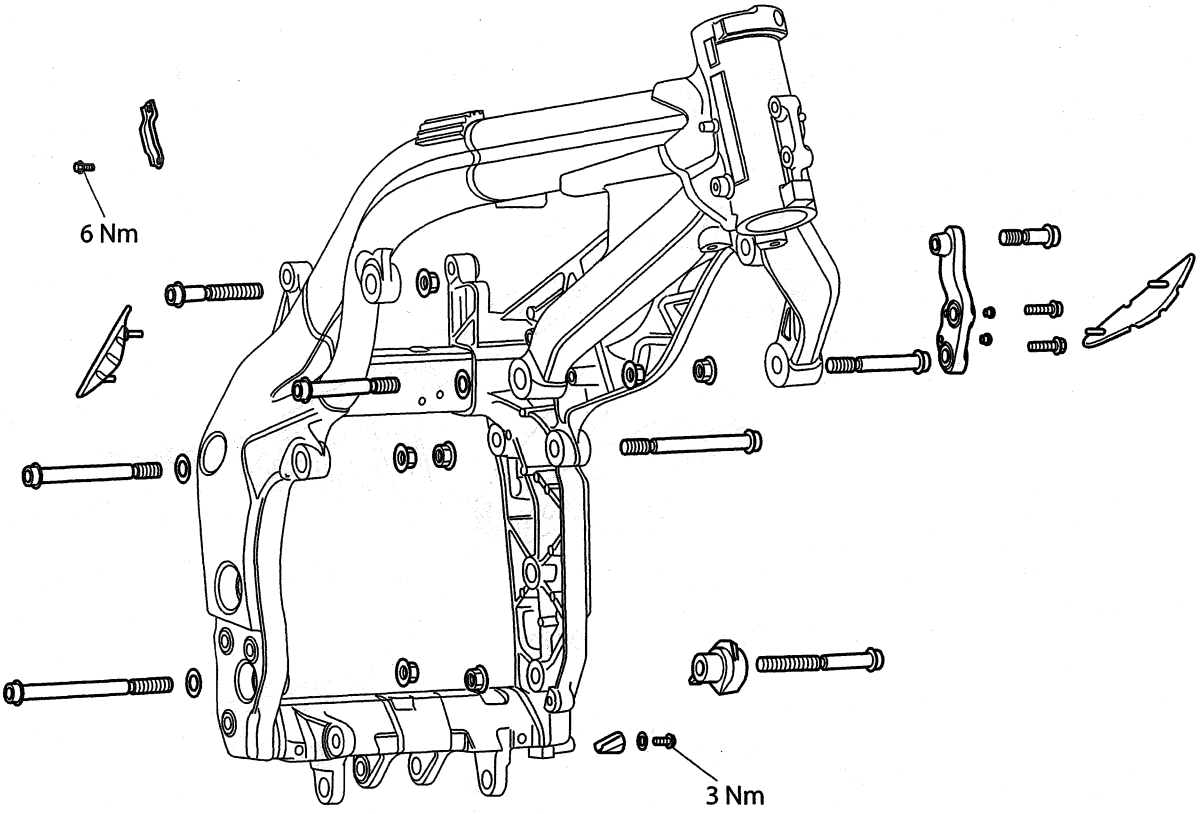
# 16 Frame and Bodywork

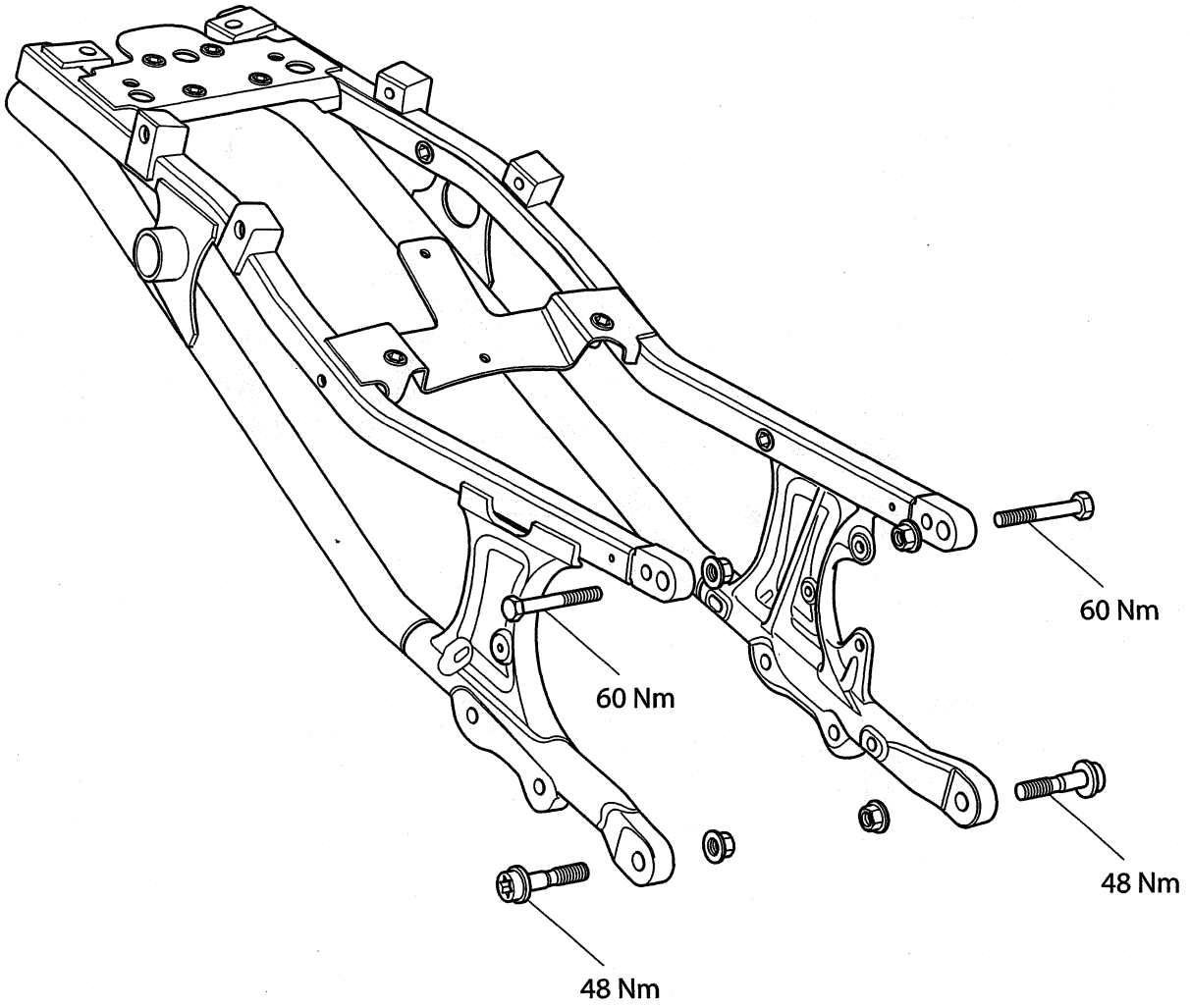
## Table of Contents

## Exploded View - Frame

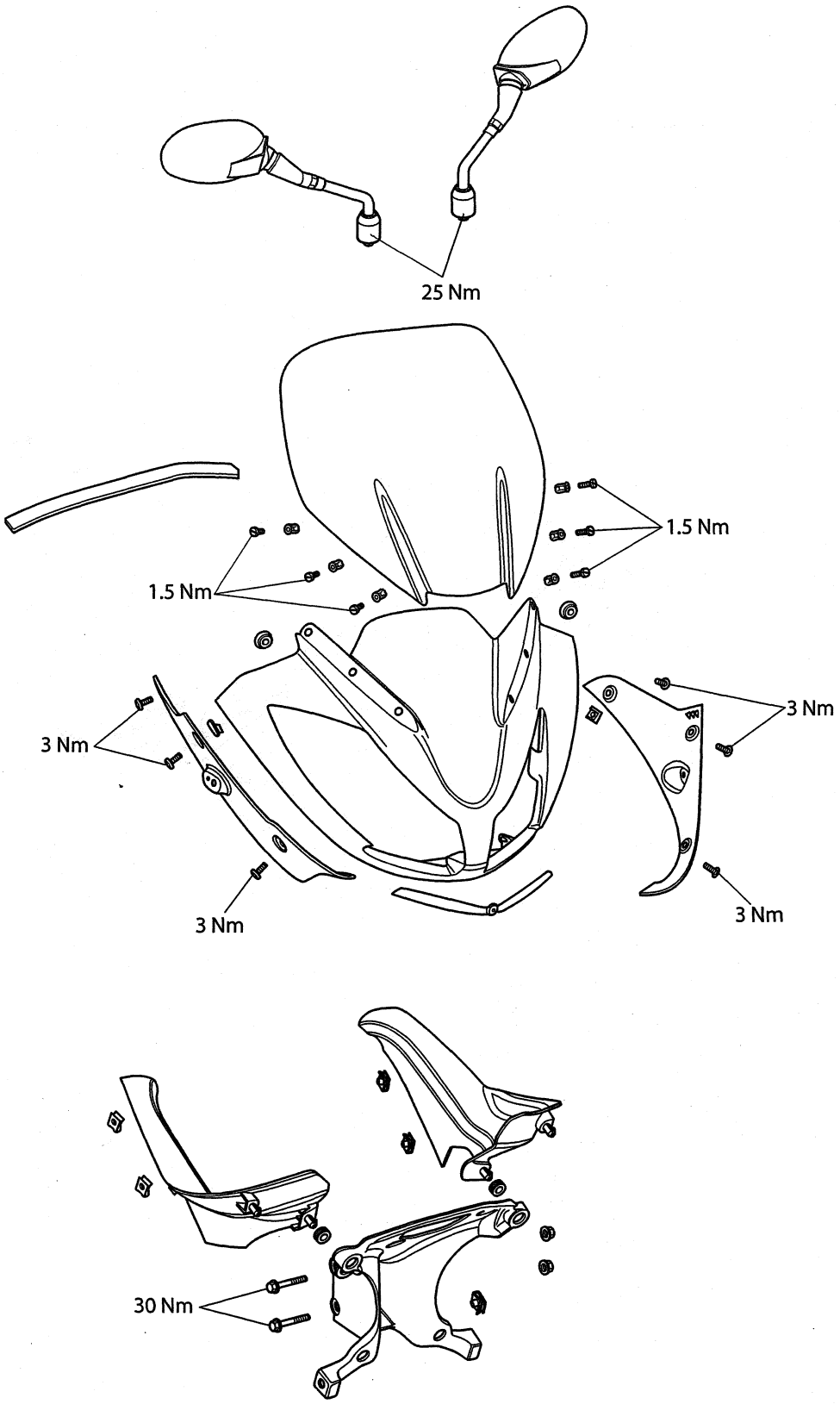
All engine mounting fixings - see text in section 9



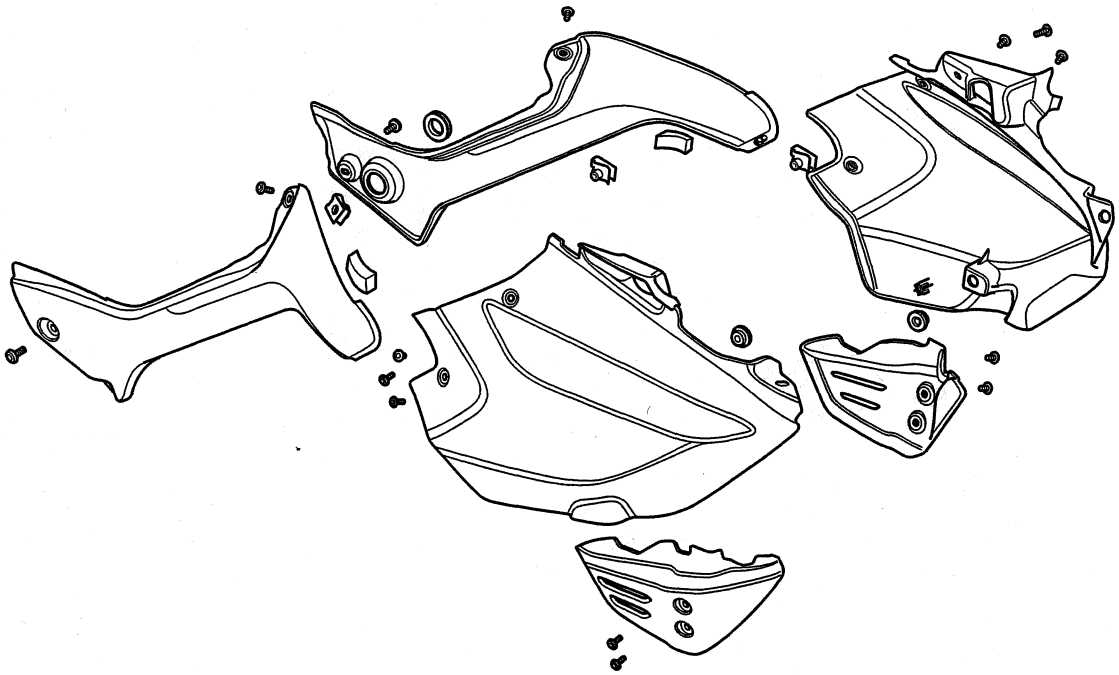
## Exploded View - Seat Rails



## Exploded View - Cockpit and Mountings

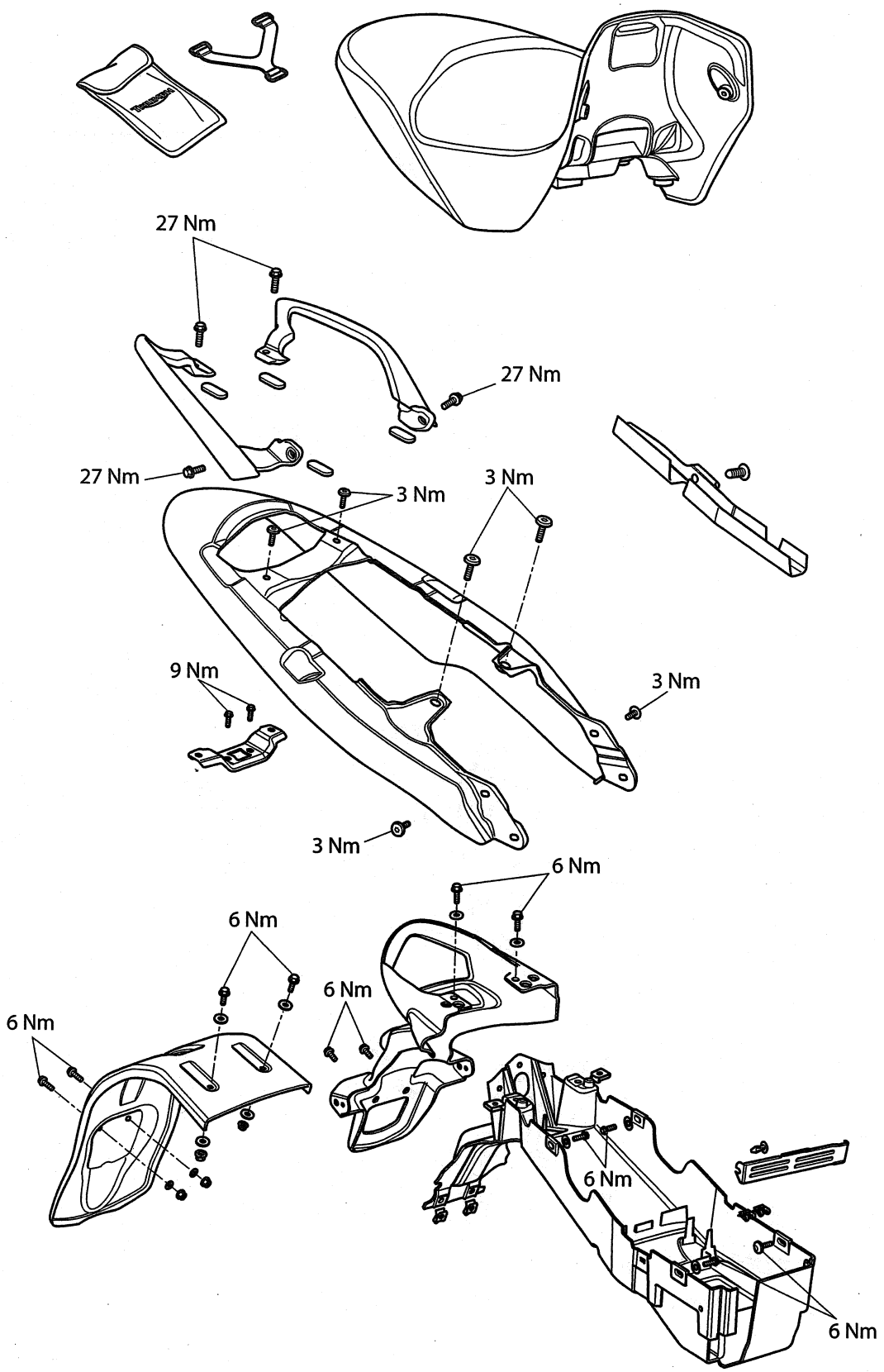


## Exploded View - Lower Fairings

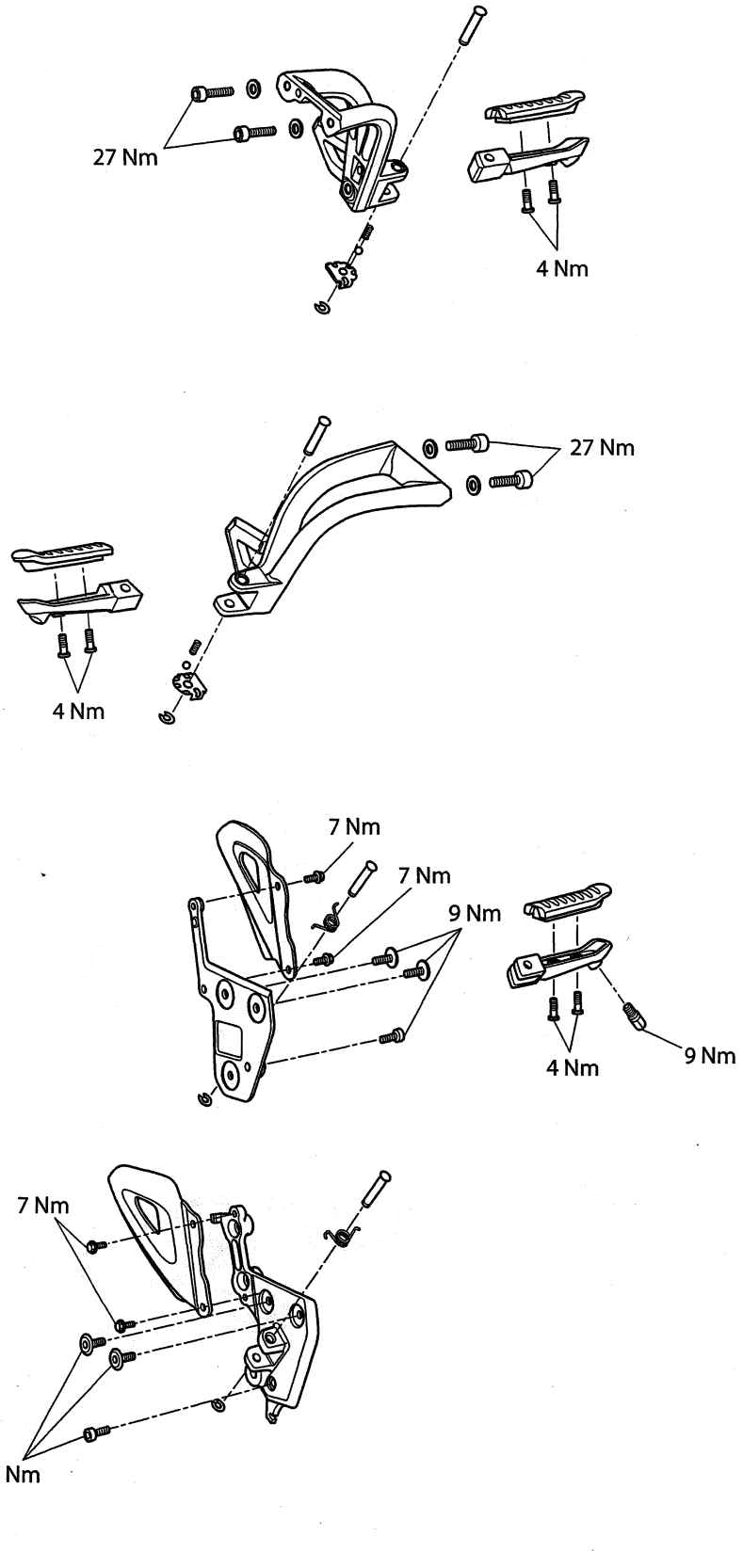


All fixings 3 Nm

## Exploded View - Rear Panels, Mudguard and Seat



## Exploded View - Footrests and Mountings

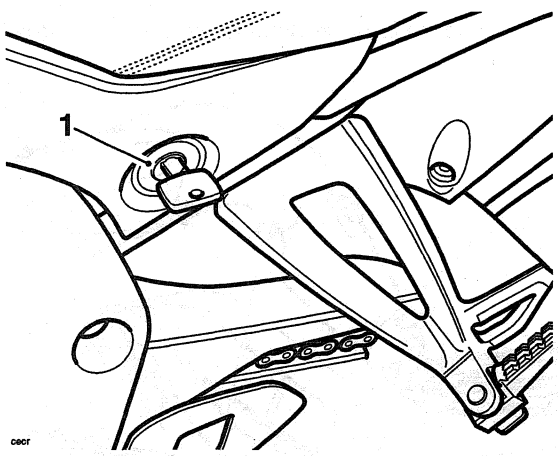


## Seat

### Removal

The seat lock is located on the left hand side of the battery tray, in line with the footrest mounting.

1. Insert the ignition key into the seat lock and turn it anti-clockwise while pressing down on the rear of the seat. This will release the seat from its lock and allow it to be slid rearwards for complete removal from the motorcycle.




**1. Seat lock**

### Installation

1. Position the seat to the upper fuel tank bracket and engage the top lip.
2. Ensure the seat's centre hooks slide under the frame bridge and press down on the rear of the seat to engage in the seat lock.
3. Grasp the seat and ensure that it is securely retained.

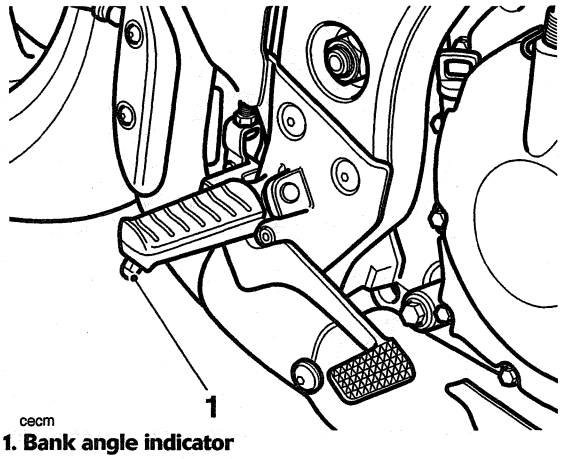
**Note:**

- **An audible 'click' can be heard when the seat is correctly engaged in the lock.**

## Frame, Footrests and Fixings

### Inspection

1. Inspect the frame, footrests and fairings for damage, cracks, chafing and other dangerous conditions. Check fairing and frame fixings for security.
2. Inspect the bank angle indicators on the rider's footrests for wear. The bank angle indicators are worn out when 10 mm of the bank indicator remains.




**1. Bank angle indicator**

**Warning**

Use of a motorcycle with bank angle indicators 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**

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 another accident which may result in injury or death.

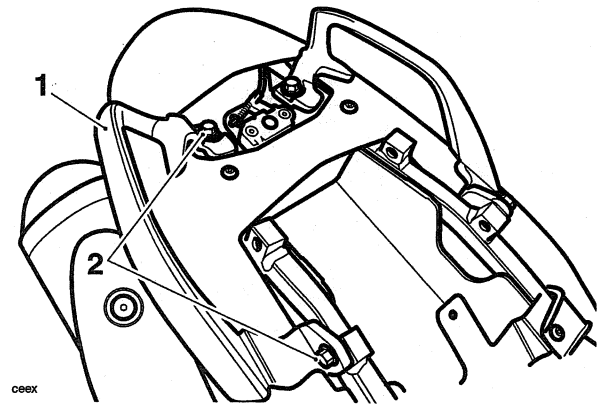
**Warning**

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.

## Rear Panel

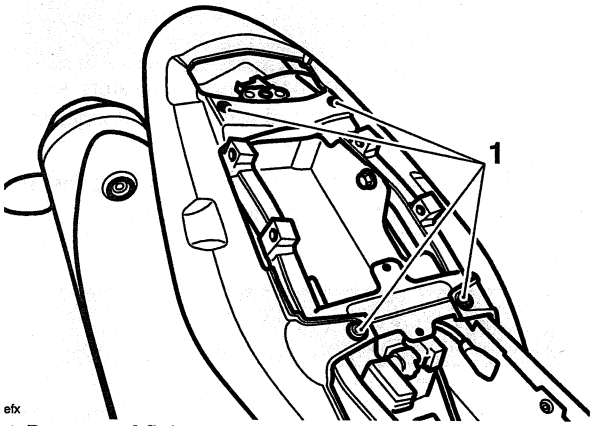
### Removal

1. Remove the seat (see page *16-9*).
2. Disconnect the battery, negative (black) lead first.
3. Remove the side panels (See page *16-10*).
4. Remove the grab handles.




**1. Grab handles**
**2. Fixings**

5. To release the rear panel assembly, remove the fixings shown in the illustration below.




**1. Rear panel fixings**

6. Gently pull the panel outwards.
7. Withdraw the panel assembly from the rear of the motorcycle.

### Installation

1. Installation is the reverse of removal noting the following:

**Note:**

- **Tighten the fixings to 3 Nm.**
- **Reconnect the battery, positive (red) lead first.**

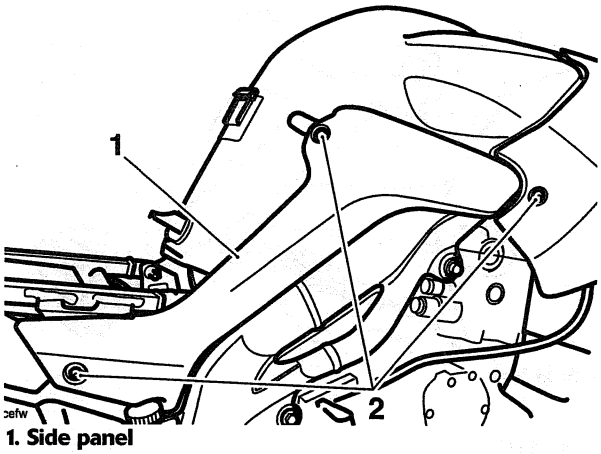
## Side Panels

### Removal

**Note:**

- **Follow the same procedure for both left and right hand sides.**

1. Remove the seat (see page *16-9*).
2. Disconnect the battery, negative (black) lead first.
3. Remove the two fixings securing the side panel to the fuel tank.
4. Remove the fixing securing the side panel to the rear panel.




**1. Side panel**
**2. Fixings**

5. Remove the side panel.

### Installation

1. Installation is the reverse of removal noting the following:

**Note:**

- **Tighten the fixings to 3 Nm.**
- **Reconnect the battery, positive (red) lead first.**

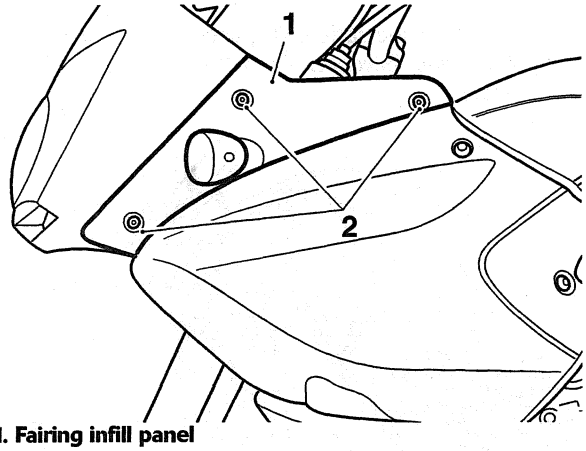
## Fairing Infill Panels

### Removal

**Note:**

- **Follow the same procedure for both left and right hand sides.**

1. Remove the seat (see page *16-9*).
2. Disconnect the battery, negative (black) lead first.
3. Remove the three fixings securing the infill panel to the cockpit and detach the panel.




**1. Fairing infill panel**
**2. Fixings**

4. Disconnect the turn indicator electrical connectors.
5. Remove the fairing infill panel.

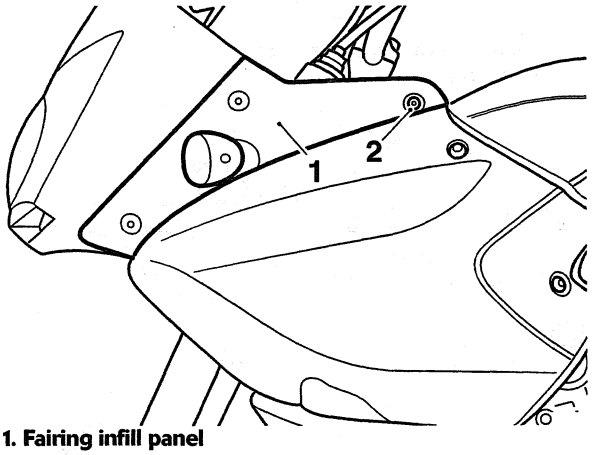
### Installation

1. Align the fairing infill panel to the cockpit and side fairing.
2. Connect the turn indicator electrical connectors.
3. Position the fairing infill panel to the cockpit, ensuring the lip on the upper edge of the infill panel hooks under the lower edge of the cockpit.

**Note:**

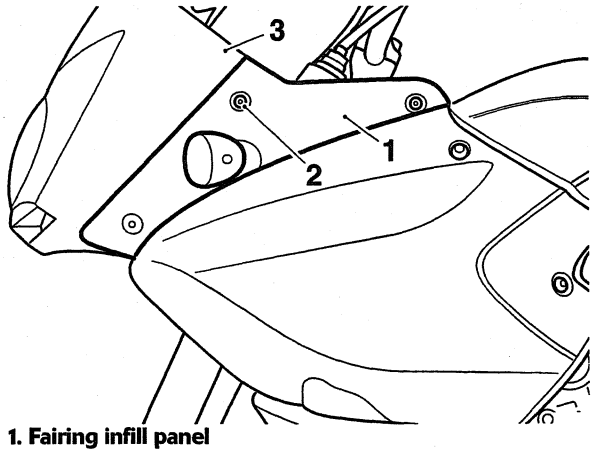
- **To ensure correct fitment of the fairing infill panel, the following installation sequence must be adhered to:**

4. Install the rear fixing and tighten to **3 Nm.**



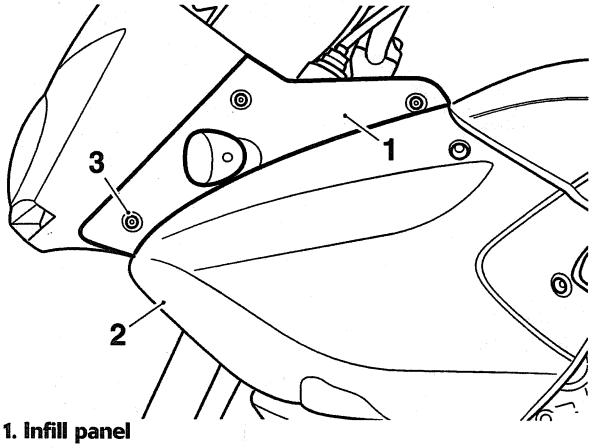

**1. Fairing infill panel**
**2. Rear fixing**

5. Align upper edge of the infill panel to the lower edge of the cockpit and install the centre fixing. Tighten to **3 Nm.**




**1. Fairing infill panel**
**2. Centre fixing**
**3. Cockpit**

6. Adjust the position of the side fairing, so that the gap between the side fairing and the infill panel is even along the panel's length, and install the front fixing. While maintaining the alignment, tighten the fixing to **3 Nm.**




**1. Infill panel**
**2. Side fairing**
**3. Front fixing**

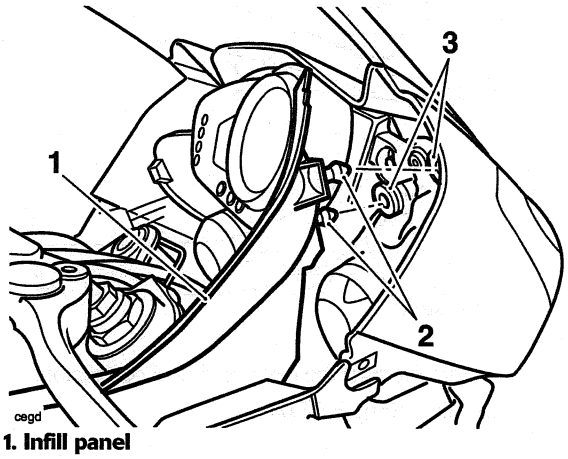
## Facia Infill Panels

### Removal

**Note:**

- **Follow the same procedure for both left and right hand sides.**

1. Remove the seat (see page *16-9*).
2. Disconnect the battery, negative (black) lead first.
3. Remove the fairing infill panel (see page *16-9*).
4. Remove the screw securing the facia infill panel to the cockpit.
5. To remove the facia infill panel pull to the rear to extract the bayonets from the grommets in the cockpit.




**1. Infill panel**
**2. Bayonets**
**3. Grommets**

6. Remove the panel.

### Installation

1. Installation is the reverse of removal noting the following:

**Note:**

- **Tighten the fixing to 3 Nm.**
- **Reconnect the battery, positive (red) lead first.**

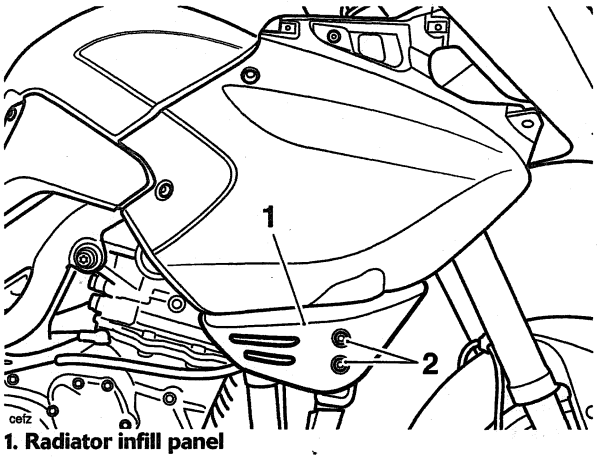
## Side Fairings

### Removal

**Note:**

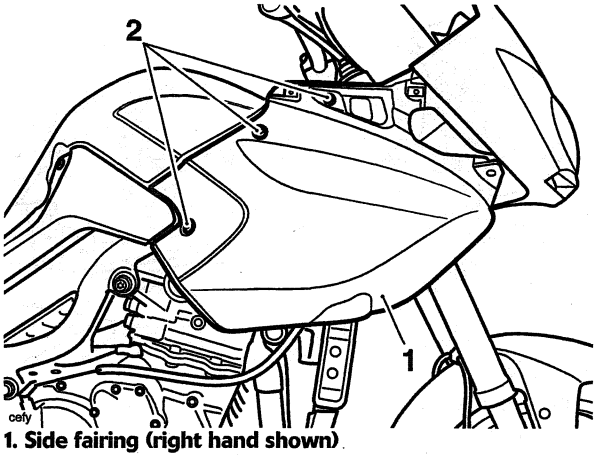
- **The cockpit does NOT need to be removed in order to remove the side fairings.**
- **Follow the same procedure for both left and right hand sides.**

1. Remove the seat (see page *16-9*).
2. Disconnect the battery, negative (black) lead first.
3. Remove the fairing infill panel for the fairing side to be removed (see page *16-11*).
4. Remove the two screws securing the radiator infill panel to the radiator and remove the panel.




**1. Radiator infill panel**
**2. Fixings**

5. Remove the screw securing the side fairing to the cockpit infill panel.
6. Remove the two screws securing the fairing to the fuel tank.




**1. Side fairing (right hand shown)**
**2. Side fairing retaining screws**

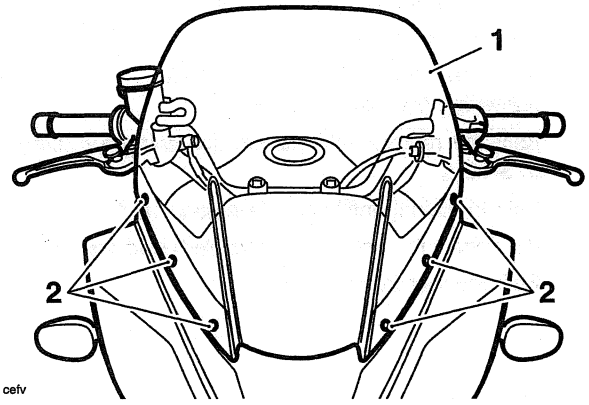
7. Ease the side fairing forwards to release it from the securing hook on the radiator.

### Installation

1. Position the side fairing to the motorcycle, ensuring the is panel is located behind the lower hook on the radiator.
2. Refit the side fairing to the fuel tank, tightening the fixings to **3 Nm.**
3. Refit the side fairing to the facia infill panel, tightening the fixing to **3 Nm.**
4. Refit the radiator infill panels, tightening the fixings to **3 Nm.**
5. Refit the fairing infill panel (see page *16-11*).
6. Reconnect the battery, positive (red) lead first.
7. Refit the seat (see page *16-9*).

## Windscreen

### Removal




cefv

**1. Windscreen**
**2. Fixings**

1. Release the six windscreen fixings.
2. Remove the windscreen.

### Installation

Installation is the reverse of removal noting the following.

**Note:**

- **Tighten the fixings to 1.5 Nm.**

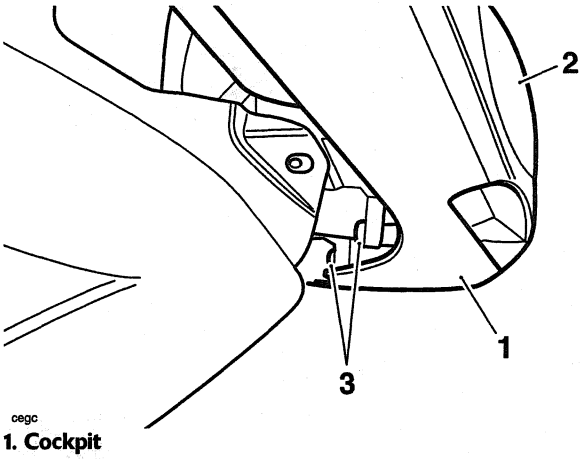
## Cockpit

### Removal

**Note:**

- **The cockpit is removed as an assembly. It is not necessary to remove the side fairings, instruments, windscreen or headlight unit.**

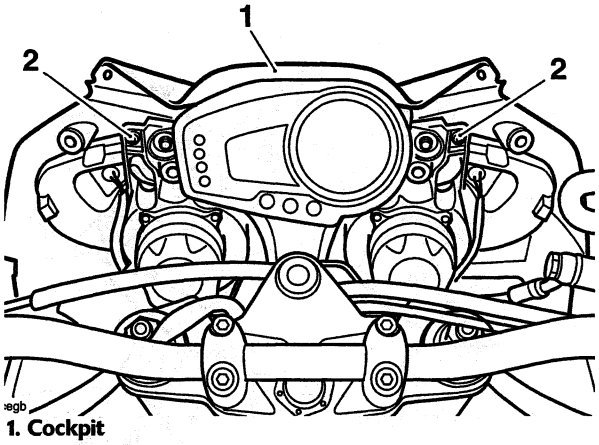
1. Remove the seat (see page *16-9*)
2. Disconnect the battery, negative (black) lead first.
3. Remove the facia and fairing infill panels (see page *16-11*).
4. Remove the two lower screws securing the cockpit to the headlight assembly.




cegc

**1. Cockpit**
**2. Headlight**
**3. Cockpit lower screws**

5. Remove the two upper screws securing the cockpit to the headlight assembly.



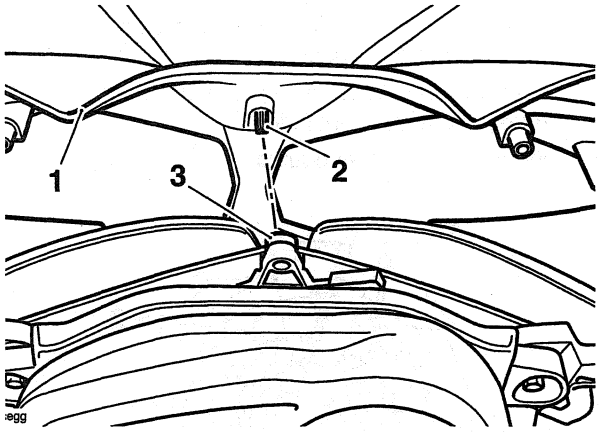

egb

**1. Cockpit**
**2. Cockpit upper screws**

6. Remove the cockpit in a forward direction.

### Installation

1. Position the cockpit locating stud to the headlight grommet.



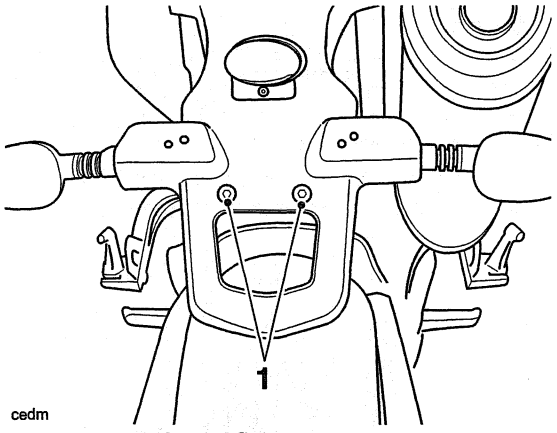

**1. Cockpit**
**2. Cockpit locating stud**
**3. Headlight grommet**

2. Refit the cockpit to the headlight, tightening the fixings to **3 Nm.**
3. Refit the facia and fairing infill panels (see page *16-11*).
4. Connect the battery, positive (red) lead first.
5. Refit the seat (see page *16-9*).

## Rear Mudguard

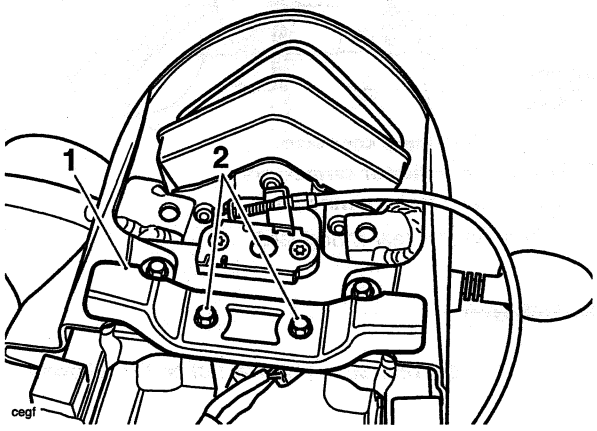
### Removal

1. Remove the seat (see page *16-9*)
2. Disconnect the battery, negative (black) lead first.
3. Remove the rear panel (see page *16-10*).
4. Remove the licence plate.
5. Remove the lower mudguard fixings, located behind the licence plate.



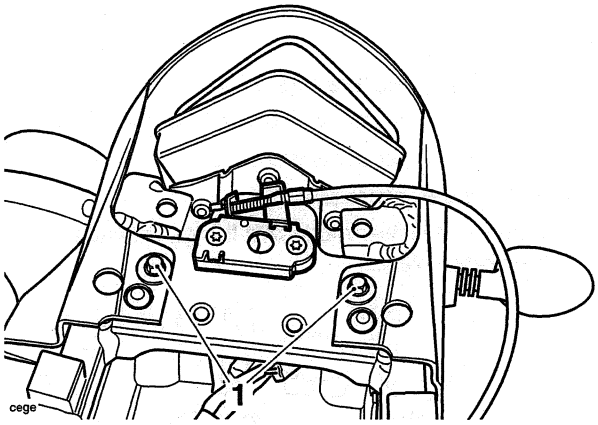

**1. Lower rear mudguard fixings**

6. Remove the fixings securing the rear panel bracket and remove the bracket.



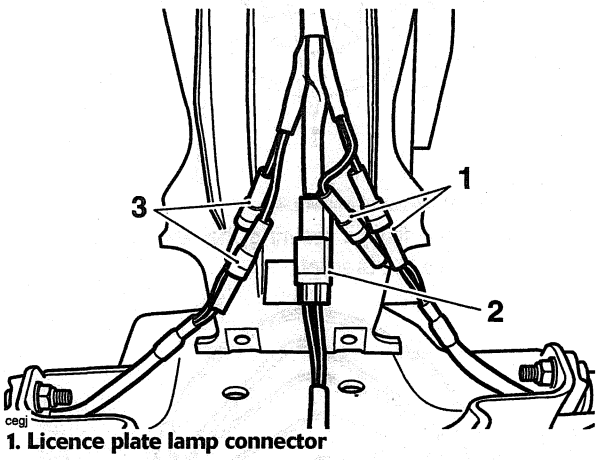

**1. Rear panel bracket**
**2. Fixings**

7. Remove the upper mudguard fixings and detach the mudguard.




**1. Lower rear mudguard fixings**

8. Noting their positions, disconnect the indicator and licence plate lamp electrical connections.




**1. Licence plate lamp connector**
**2. Right hand indicator connectors**
**3. Left hand indicator connectors**

9. Remove the rear mudguard.

### Installation

Installation is the reverse of removal noting the following:

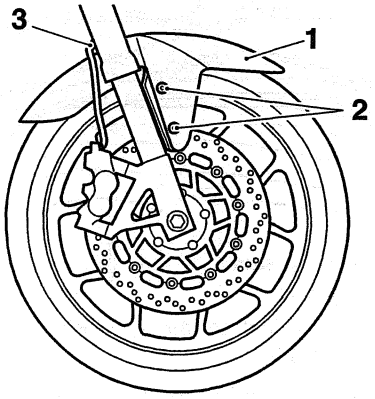
**Note:**

- **Connect the indicator and licence plate electrical connectors as noted during removal.**
- **Tighten the rear mudguard fixings to 6 Nm.**
- **Tighten the rear panel bracket fixings to 9 Nm.**
- **Reconnect the battery, positive (red) lead first.**

## Front Mudguard

### Removal

1. Detach the front brake hoses from the two retaining clips on the front mudguard.
2. Remove the four fixings securing the front mudguard to the front forks.
3. Remove the front mudguard.




**1. Front mudguard**
**2. Fixings**
**3. Brake hose retaining clips**

### Installation

Installation is the reverse of removal noting the following:

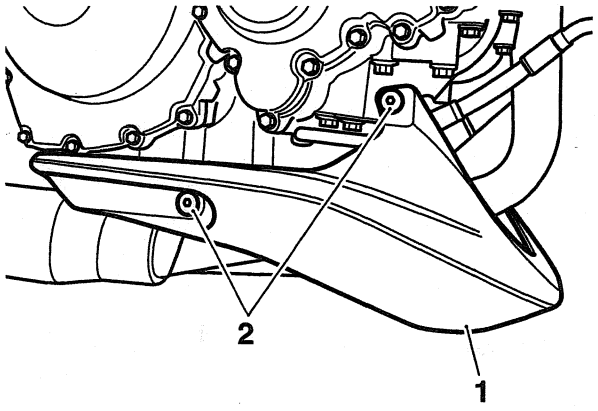
**Note:**

- **Tighten the mudguard fixings to 3 Nm.**

## Belly Pan

### Removal

1. Remove the four fixings securing the belly pan to the mounting brackets.
2. Remove the belly pan.




**1. Belly pan**
**2. Fixings (right hand shown)**

### Installation

Installation is the reverse of removal noting the following:

**Note:**

- **Tighten the belly pan fixings to 3 Nm.**

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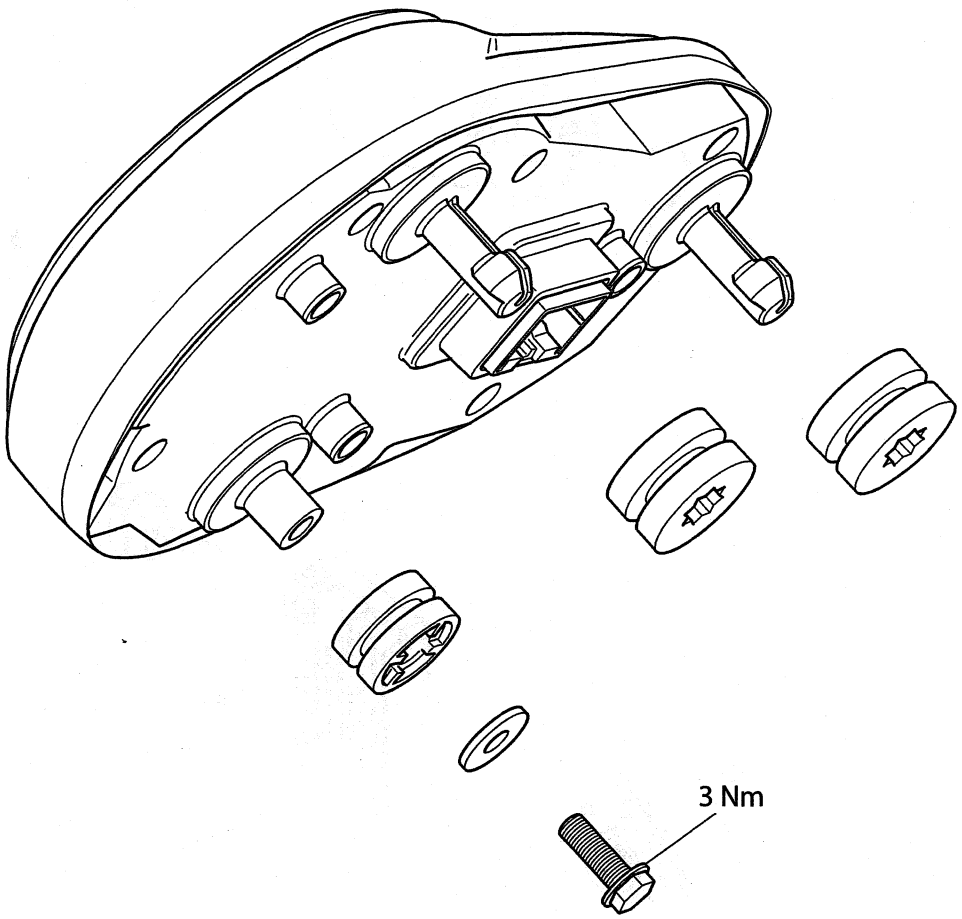
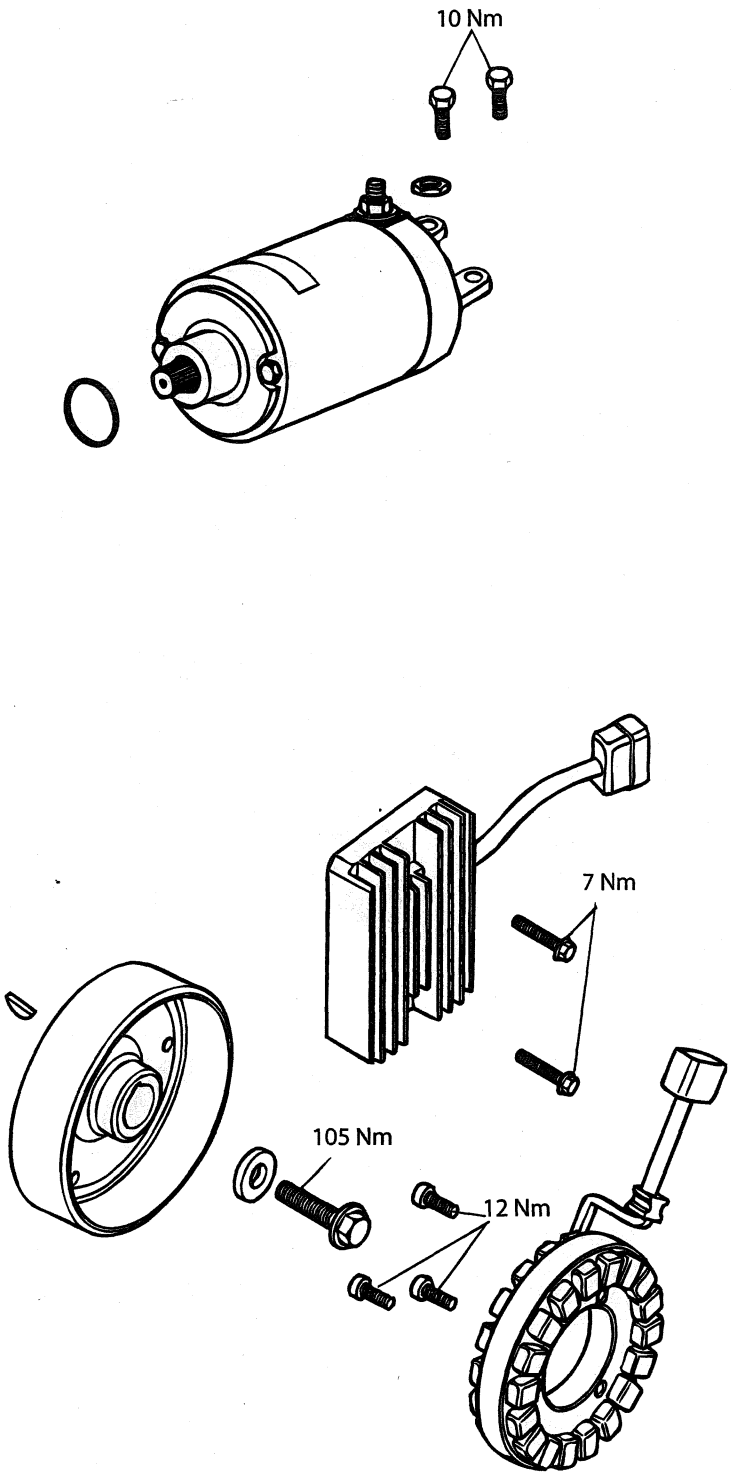
# 17 Electrical

## Table of Contents

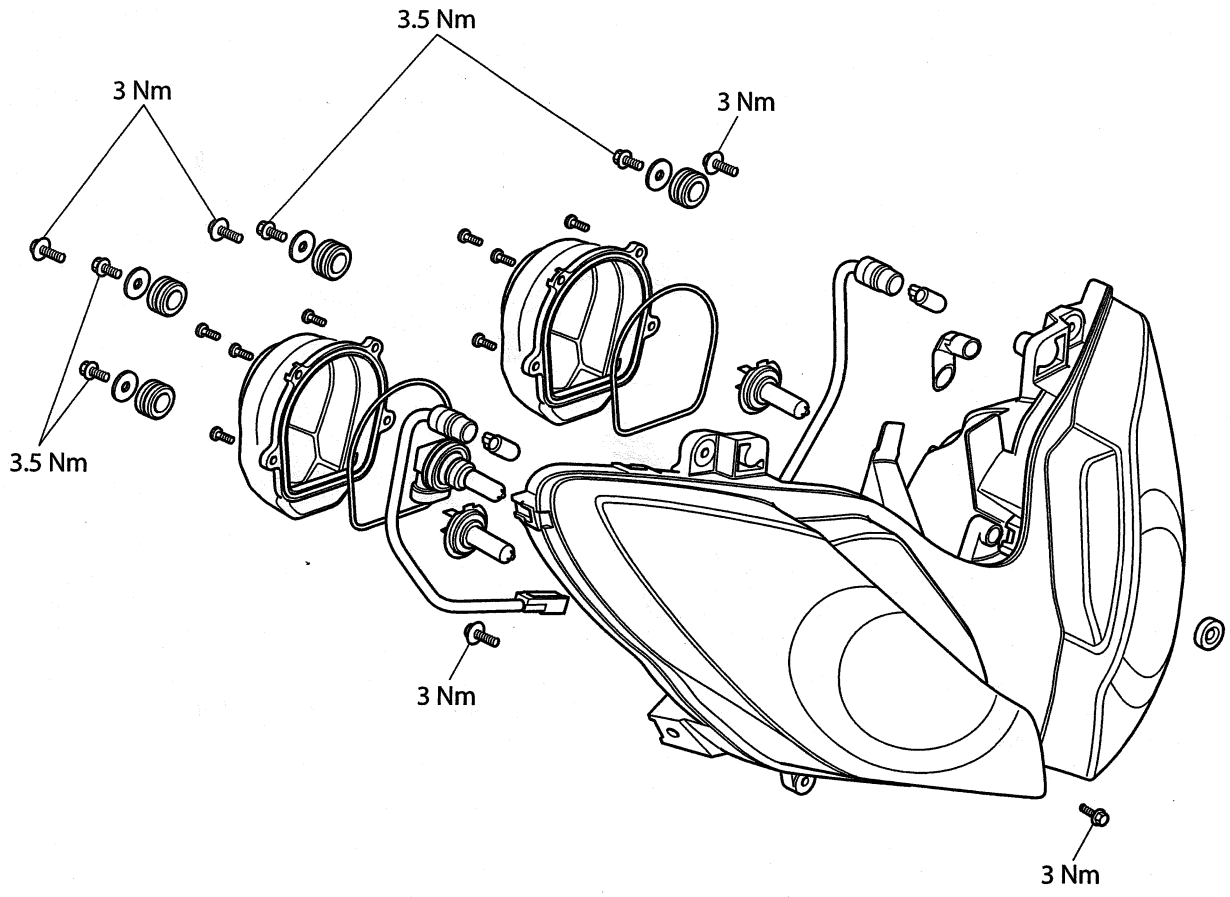
## Exploded View - Instruments



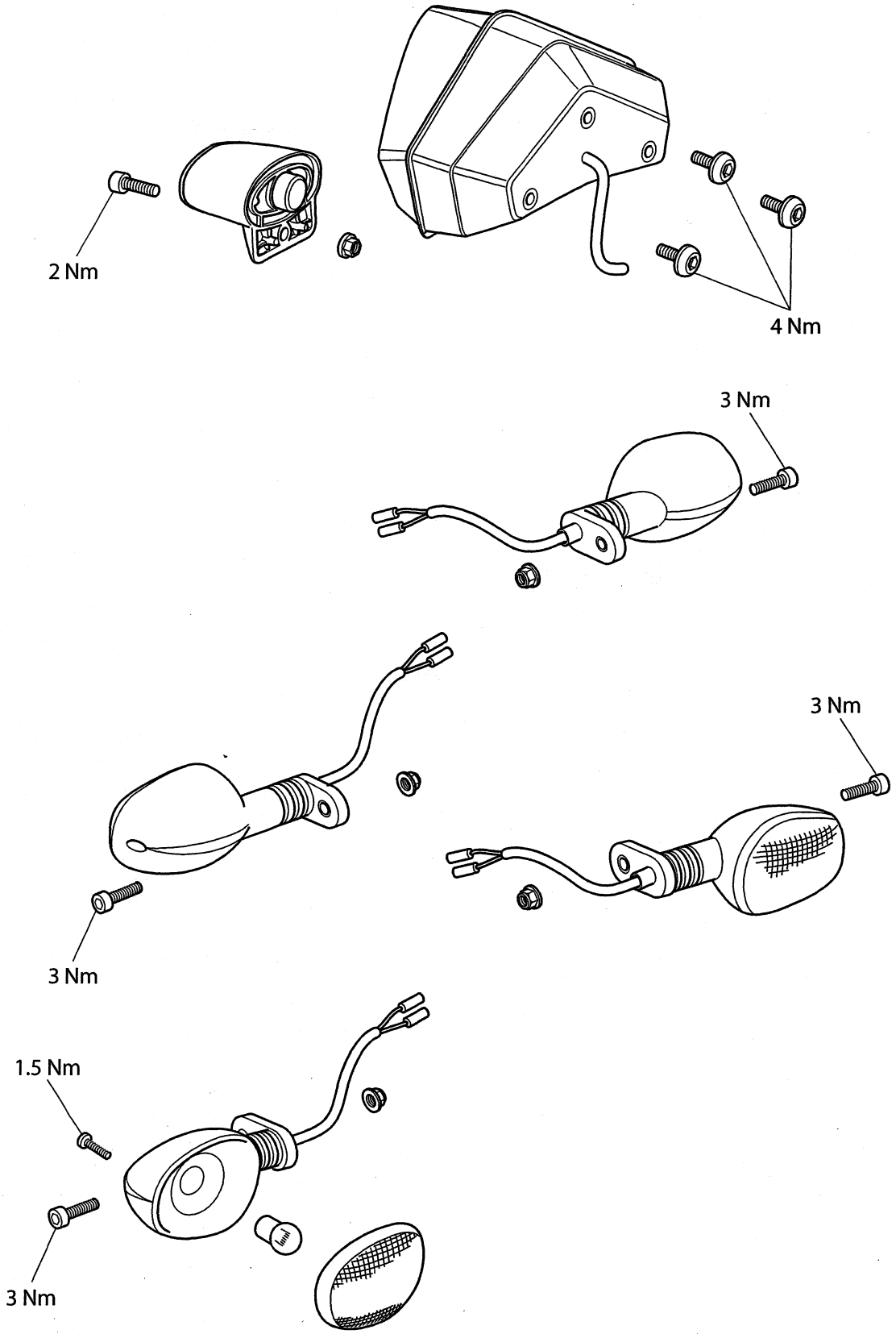
## Exploded View - Starter Motor & Alternator



## 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**

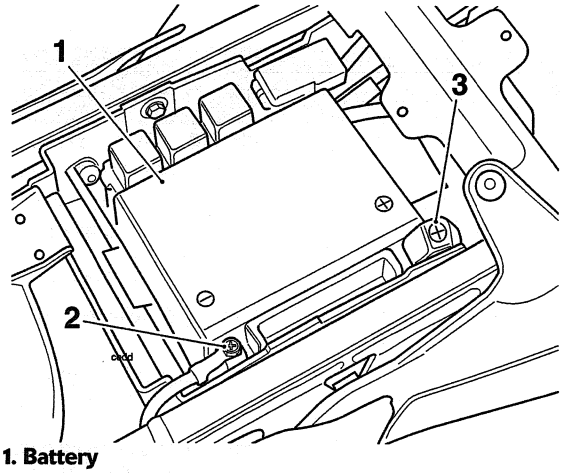
The battery electrolyte is corrosive and poisonous. Never swallow battery electrolyte or allow to come into contact with the skin. Always wear eye and skin protection when adjusting the electrolyte level.

### Battery Removal

**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. Remove the seat (see page *16-9*).
2. Disconnect the battery leads, negative (black) lead first.
3. Take the battery out of the case.




**1. Battery**
**2. Negative (-) terminal**
**3. Positive (+) terminal**

### 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 positive terminal with the protective cap.
5. Refit the seat (see page *16-9*).

## Battery Commissioning and Charging

### New Battery

In order to correctly and safely commission a new battery, the battery commissioning procedure listed below must be carefully followed. This is the only battery commissioning procedure that Triumph recommends. The procedure is designed to ensure that the battery is at its best when fitted to the motorcycle, and will provide the best possible performance and reliability.

Failure to comply with this procedure may lead to reduced battery performance and/or shorten the life of the battery.

**Warning**

The electrolyte solution is SULPHURIC ACID. Ensure that you read all the warnings supplied with the battery and are familiar with the necessary safety precautions and remedial actions should a spillage or contamination occur.

1. Read the instructions and warnings delivered with the battery.
2. Place the battery on a flat level surface and remove the sealing foil.
3. Remove the battery sealing strip from the electrolyte container (if applicable) and save for later in this procedure. Do not break the seal on the electrolyte container.
4. Place the electrolyte container and adapter (if applicable) on the battery and fill the battery according to the manufacturers instructions.
5. After starting to fill the battery with electrolyte, allow the battery to stand for 30 minutes with the filling container in place.
6. Check that all of the electrolyte has drained from the container. Do not remove the container at this point. If the container has not completely drained, tap the sides of the container to start the electrolyte flowing again.
7. After the electrolyte has drained into the battery, allow the battery to stand with the electrolyte container in place for a further 30 minutes for batteries 3Ah - 12Ah or 1 hour for batteries greater than 12Ah.
8. Remove the electrolyte container and adapter carefully, and dispose of immediately.
9. Place the sealing cap strip LOOSELY over the filling holes of the battery.
10. Charge the battery using the BatteryMate 150-9. Refer to the instructions supplied with the BatteryMate 150-9.
11. After charging is complete, press down firmly with both hands to seat the caps (do not use tools or force the caps into position).
12. Disconnect the charger and allow the battery to stand for 1 hour before fitting to the motorcycle.
13. Fit the battery to the motorcycle, positive (red) lead first.

### 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.

### Battery Already in Service

Use the guidelines in the table on the following page for charging. Always verify the battery condition before charging, and 30 minutes after charging.

**Note:**

- **A fully charged battery should read 12.8 volts or higher after the battery has been off the charger for 30 minutes or more.**

### Table of Battery Charging Times

| State of charge | Voltage | Action | Charge time (using BatteryMate 150-9) |
|---|---|---|---|
| 100% | 12.8V - 13.0V | None. Check at 6 months from date of manufacture | None required |
| 75% - 100% | 12.5V - 12.8V | May need slight charge. If no charge given, check in 3 - 4 months | 3 - 6 hours |
| 50% - 75% | 12.0V - 12.5V | Needs charge | 5 - 11 hours |
| 25% - 50% V | 11.5V - 12.0V | Needs charge | at least 13 hours |
| 0% - 25% | 11.5V or less | Needs recovery using BatteryMate 150-9. Re-test after recovery | 20 hours |

## Fuses

The fuse box is located beneath the seat.

To allow access to the fuse box, the seat must be removed.

A blown fuse is indicated when all of the systems protected by that fuse become inoperative. When checking for a blown fuse, use the table below to establish which fuse has blown.

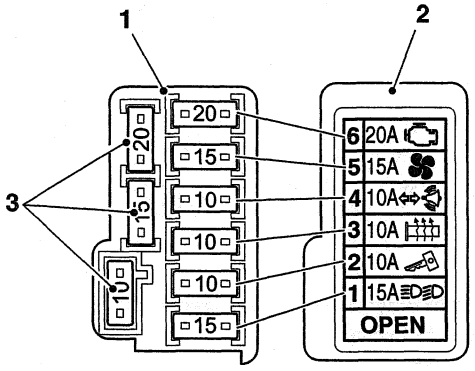
### Fuse Identification

| Circuit Protected | Position | Rating (Amps) |
|---|---|---|
| Dip and main beam headlights, starter relay | 1 | 15 |
| Ignition switch, starter circuit | 2 | 10 |
| Accessory socket, GPS (Global Positioning System), heated grips | 3 | 10 |
| Indicators, alarm, horn, auxiliary lights | 4 | 10 |
| Cooling fan | 5 | 15 |
| Engine management system | 6 | 20 |

**Note:**

- **The starter solenoid has an additional 30 Amp fuse, attached directly to the solenoid, beneath the seat.**

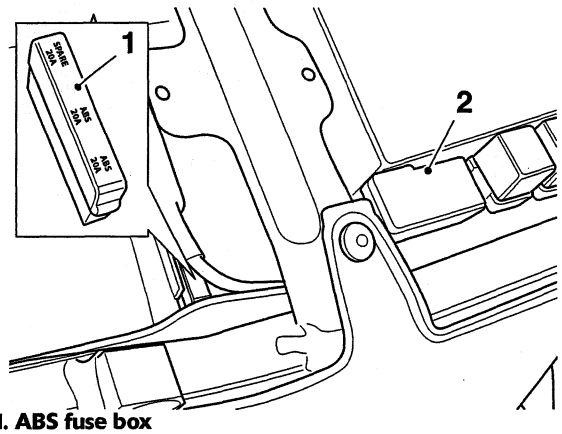
The fuse identification numbers listed in the table correspond with those printed on the fuse box cover, as shown below. Spare fuses are located at right angles to the main fuses and should be replaced if used.




**1. Fuse box**
**2. Fuse box cover**
**3. Spare fuses**

### ABS (Anti-lock Brake System) fusebox

Models equipped with ABS have an additional fusebox located under the seat, at the forward edge of the underseat storage box.




**1. ABS fuse box**
**2. Main fuse box**

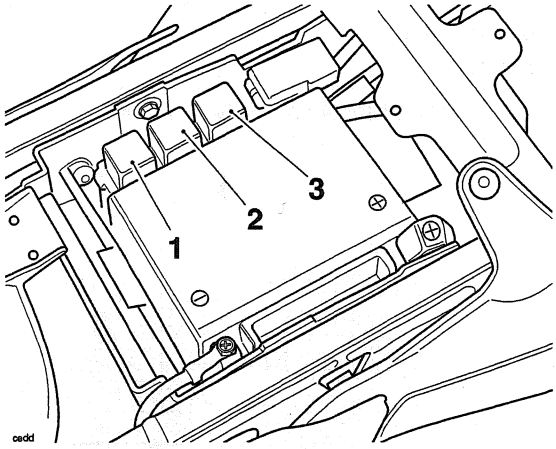
## Relay Pack

The relay pack is situated under the seat, adjacent to the battery.

**Note:**

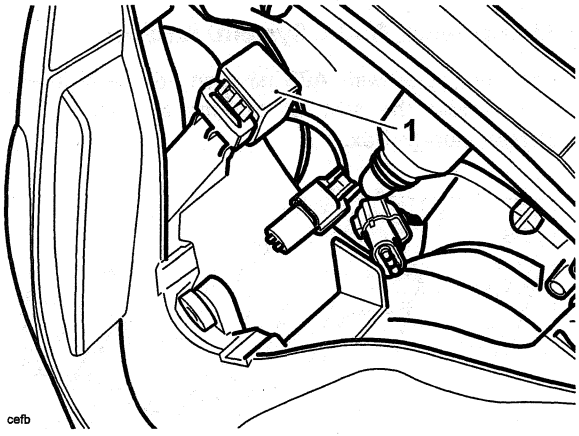
- **The relays are attached to their brackets by means of barbed extensions. Never exert extreme force when removing a relay as this may cause damage and never pull on the relay block connector.**

### Identification of Relays



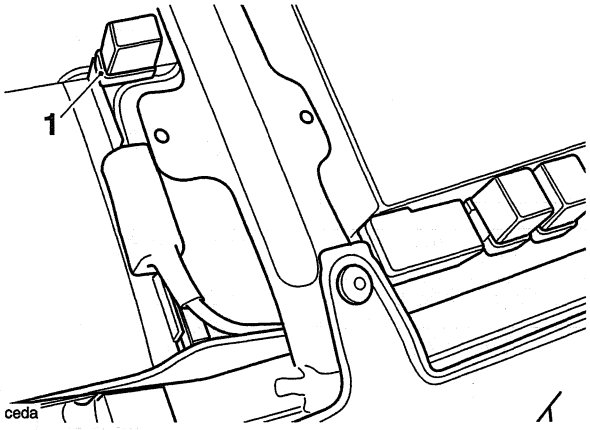

**1. Engine Management System (EMS) relay**
**2. Cooling fan relay**
**3. Starter relay**

The indicator relay is located inside the cockpit, attached to a blade on the right hand side of the headlight.




**1. Indicator Relay**

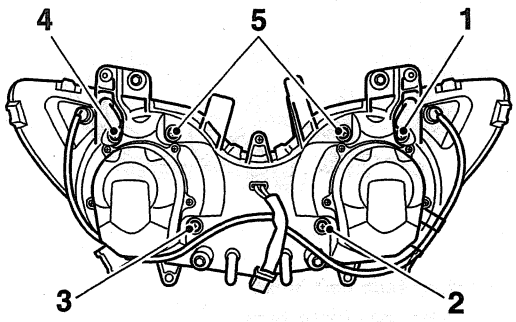
The fuel pump relay is located under the seat, adjacent to the diagnostic connector.




**1. Fuel pump relay**

## Headlight Adjustment

The headlights can be adjusted by means of vertical and horizontal adjustment screws located on the rear of each headlight.




cedg

**1. Horizontal adjustment screw (right hand)**
**2. Vertical adjustment screw (right hand)**
**3. Vertical adjustment screw (left hand)**
**4. Horizontal adjustment screw (left hand)**
**5. Pivot screws (DO NOT adjust these screws)**

**Note:**

- **If the horizontal headlight aim is to be adjusted, remove the cockpit infill panels to gain access to the adjustment screws.**

**Caution**

Do not adjust the pivot screws as this may cause the headlight reflector/projector to become detached from the pivot screw, leading to irreparable damage to the headlight.

- Switch on the headlight to be adjusted.
- Turn the vertical adjustment screws on each headlight clockwise to lower the beam or anti-clockwise to raise the beam.
- On the right hand headlight turn the horizontal adjustment screw clockwise to move the beam to the right or anti-clockwise to move the beam to the left.
- On the left hand headlight turn the horizontal adjustment screw clockwise to move the beam to the left or anti-clockwise to move the beam to the right.
- Switch the headlights off when the beam settings are satisfactory.

### Headlight Bulb Replacement

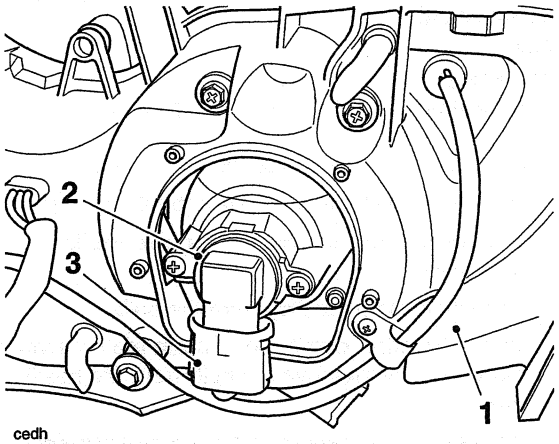
**Warning**

The bulb becomes 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.

**Note:**

- **It is not necessary to remove the headlights when bulb replacement becomes necessary.**

**Right Hand Side**

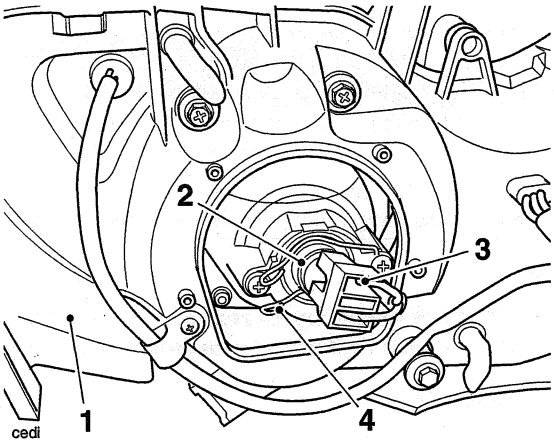



cedh

**1. Headlight unit**
**2. Bulb and bulb retainer**
**3. Multi-plug**

1. Remove the seat (see page *16-9*).
2. Disconnect the battery, negative (black) lead first.
3. Remove the four screws and remove the right hand bulb cover.
4. Disconnect the multi-plug from the bulb retainer.
5. Remove the bulb and bulb retainer from the headlight assembly by rotating it clockwise.
6. Installation is the reverse of the removal procedure.

### Left Hand Side




**1. Headlight unit**
**2. Bulb**
**3. Multi-plug**
**4. Wire retainer**

1. Remove the seat (see page *16-9*).
2. Disconnect the battery, negative (black) lead first.
3. Remove the four screws and remove the left hand bulb cover.
4. Disconnect the multi-plug from the bulb.
5. Detach the wire retainer from its clip (do not remove the screw) then remove the bulb from the headlight unit.
6. Installation is the reverse of the removal procedure.

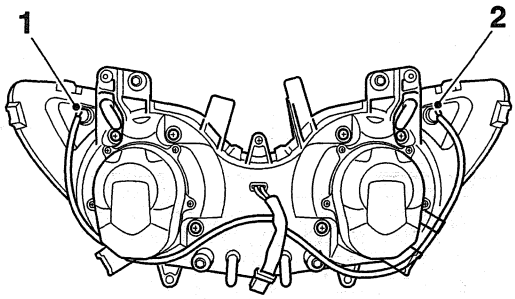
**Caution**

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 could result in ignition of the battery gases causing risk of injury.

### Front Position Light




**1. Position lamp bulb (left hand)**
**2. Position lamp bulb (right hand)**

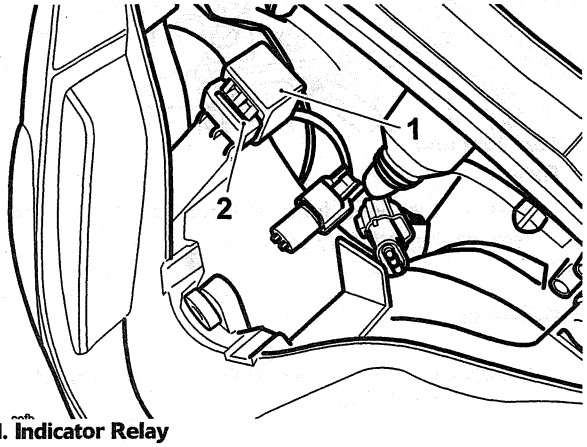
### Bulb Replacement

- The position lamps are fitted to the left and right of each headlight.
- To replace a bulb, remove the cockpit infill panel for the bulb to be replaced, detach the rubber retainer from the headlight and pull out the bulb.
- Installation is the reverse of the removal procedure.

## Headlight Assembly Removal

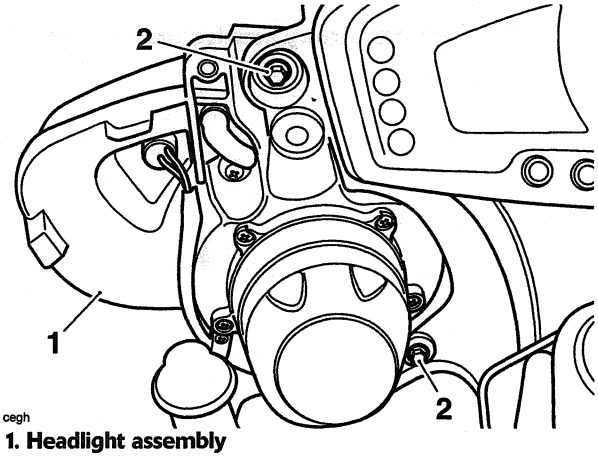
### Removal

1. Remove the seat (see page *16-9*).
2. Disconnect the battery, negative (black) lead first.
3. Remove the cockpit (see page *16-14*).
4. Detach the indicator relay from the blade on the headlight.



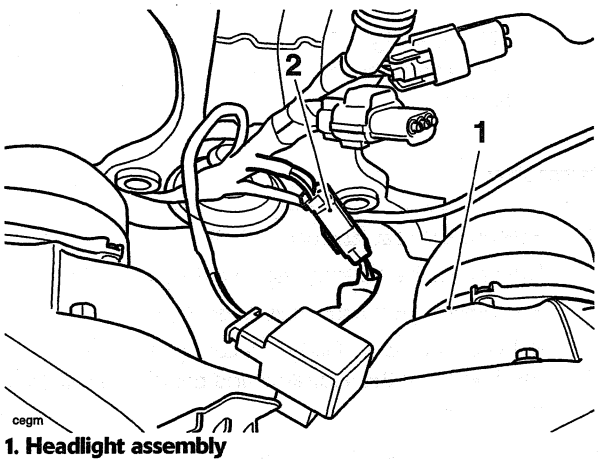

**1. Indicator Relay**
**2. Relay mounting blade**

5. Remove the four fixings from the headlight assembly and detach the headlight from the subframe.




cegh
**1. Headlight assembly**
**2. Fixings (left hand shown)**

6. Disconnect the electrical connector and remove the headlight




cegm
**1. Headlight assembly**
**2. Electrical connector**

### Installation

1. Position the headlight to the motorcycle and connect the electrical connector.
2. Position the headlight to the subframe ensuring the following:
   - The indicator relay is positioned above the headlight adjacent to its blade.
   - The headlight electrical connector is located inside the cockpit subframe and the wiring is not trapped between the headlight and subframe.
   - The heated grip and GPS (Global Positioning System) accessory electrical connectors are located above the headlight and not trapped between the headlight and the subframe.
3. Refit the headlight fixings and tighten to **3.5 Nm.**
4. Refit the indicator relay to the tang on the headlight.
5. Refit the cockpit (see page *16-15*).
6. Reconnect the battery, positive (red) lead first.
7. Refit the seat (see page *16-9*).
8. Check the headlight adjustment (see page *17-11*).

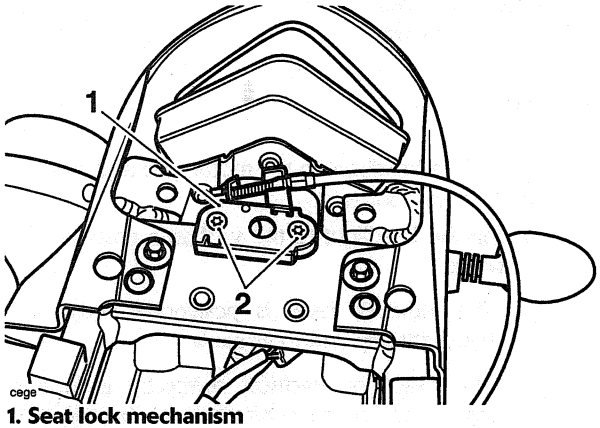
## Rear Light

**Note:**

- **The rear light is a sealed for life LED unit and must be replaced in the event of a failure.**

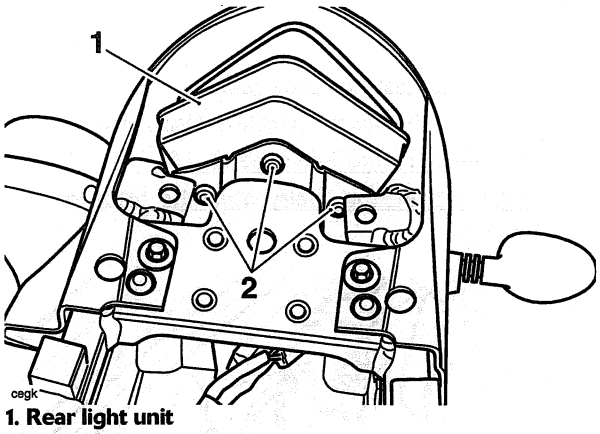
### Removal

1. Remove the seat (see page *16-9*).
2. Disconnect the battery, negative (black) lead first.
3. Remove the rear panel (see page *16-10*).
4. Release the two fixings securing the seat lock mechanism to the subframe and detach the seat lock mechanism.




**1. Seat lock mechanism**
**2. Fixings**

5. Disconnect the wiring harness.
6. Release the three fixings securing the rear light unit to the rear mudguard.




**1. Rear light unit**
**2. Fixings**

7. Release the light from the rear mudguard and remove the assembly upwards.

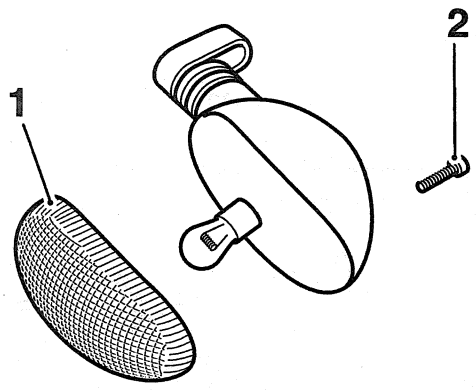
### Installation

1. Installation is the reverse of the removal procedure, noting the following:

**Note:**

- **Tighten the rear light fixings to 4 Nm.**
- **Tighten the rear panel bracket fixings to 9 Nm.**
- **Connect the battery positive (red) lead first.**

## Indicator Bulb Replacement




**1. Indicator lens**
**2. Lens screw**

The lens on each indicator light is held in place by a securing screw located in the body of the light.

1. Release the screw and remove the lens to gain access to the bulb for replacement.
2. Installation is the reverse of the removal procedure.

## Number Plate Light Bulb

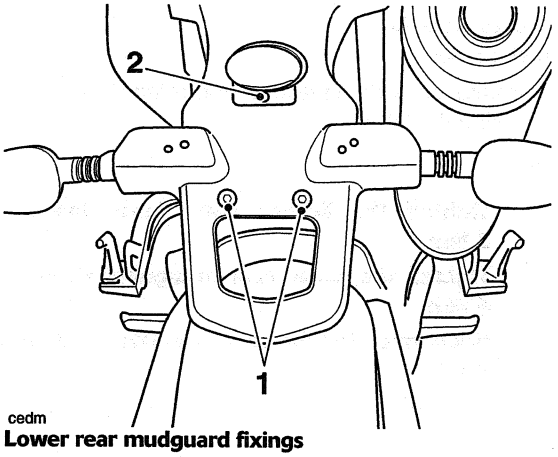
### Bulb Replacement

1. Remove the seat (see page *16-9*).
2. Disconnect the battery, negative (black) lead first.
3. Remove the licence plate.

**Caution**

Do not pull the rear mudguard more than is necessary to access the licence plate light's inside fixing nut. Damage to the rear mudguard will result from bending the mudguard too far.

4. Remove the two lower rear mudguard fixings. Gently pull the mudguard rearwards to allow access to the licence plate light retaining nut.
5. Counter-hold the nut to prevent it from turning and remove the licence plate light fixing screw. Collect the nut from the mudguard.




cedm

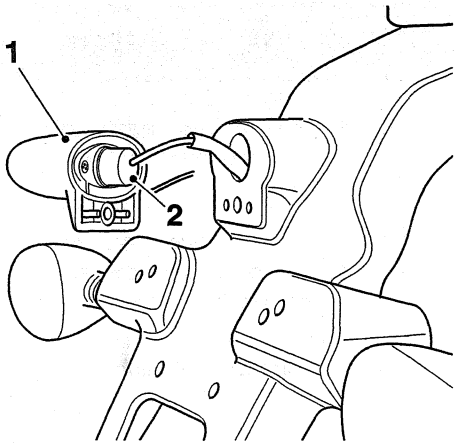
**1. Lower rear mudguard fixings**
**2. Licence plate light fixing screw**

6. Detach the licence plate light from the rear mudguard.

**Caution**

To avoid cable damage, do not pull the bulb holder using the cables. Pull only on the bulb holder.

7. Carefully remove the bulb holder from the back of the licence plate light unit and remove the bulb.




cedn

**1. Licence plate light**
**2. Bulb holder**

8. Installation is the reverse of the removal procedure, noting the following:

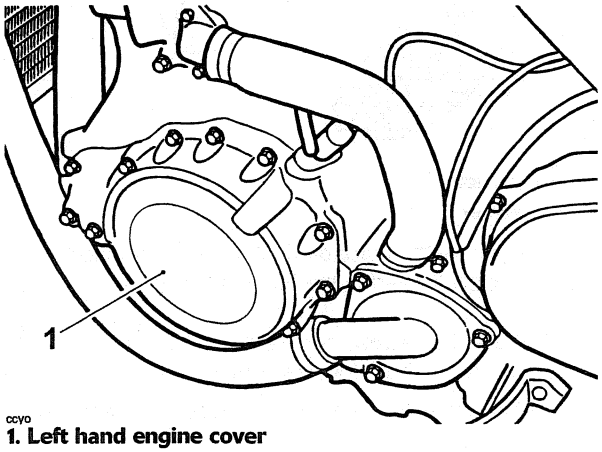
**Note:**

- **Tighten the licence plate lamp fixing to 3 Nm.**
- **Tighten the lower rear mudguard fixings to 6 Nm.**
- **Reconnect the battery, positive (red) lead first.**

## Alternator

### Removal

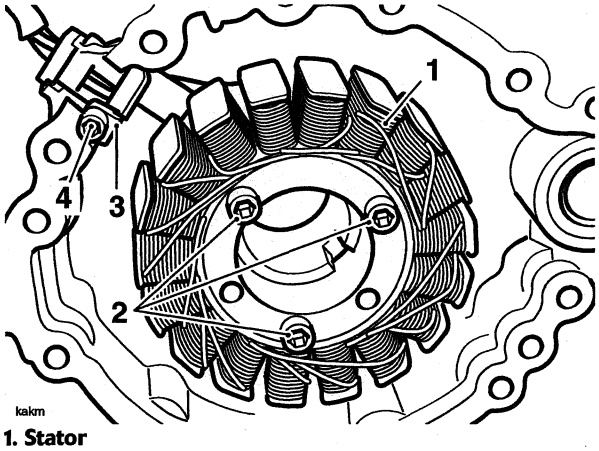
1. Remove the seat (see page *16-9*).
2. Disconnect the battery, negative (black) lead first.
3. Release the bolts securing the left hand crankshaft cover to the engine.




ccyo

**1. Left hand engine cover**

4. Remove the cover.
5. Withdraw the cover from the crankcase against the pull of the alternator magnet.
6. To remove the stator from the cover, release the three bolts in the centre of the cover and release the bolt securing the cable bracket.

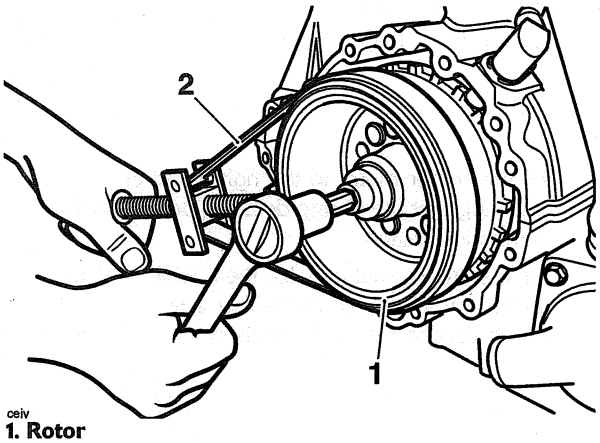



kakm

**1. Stator**
**2. Stator bolts**
**3. Cable bracket**
**4. Cable bracket bolt**

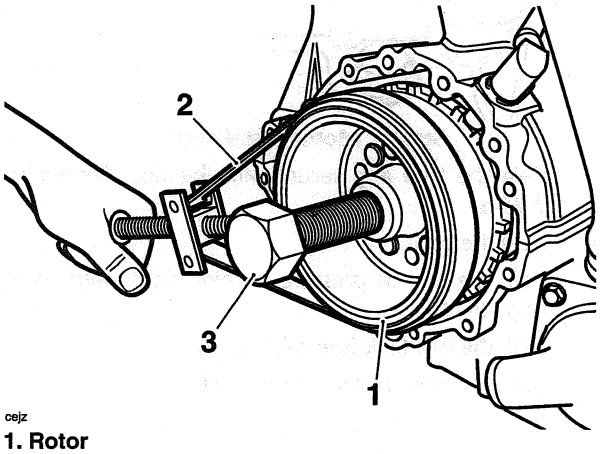
7. Withdraw the stator.

8. To remove the rotor, prevent the crankshaft from rotating using tool T3880375, and remove the centre bolt from the left hand end of the crankshaft.




ceiv
**1. Rotor**
**2. Tool T3880375**

9. With the rotor bolt removed, insert tool T3880203 to the centre of the alternator.
10. Tighten tool T3880203, while preventing the crankshaft from turning with tool T3880375, to release the taper seating of the rotor from the crankshaft.

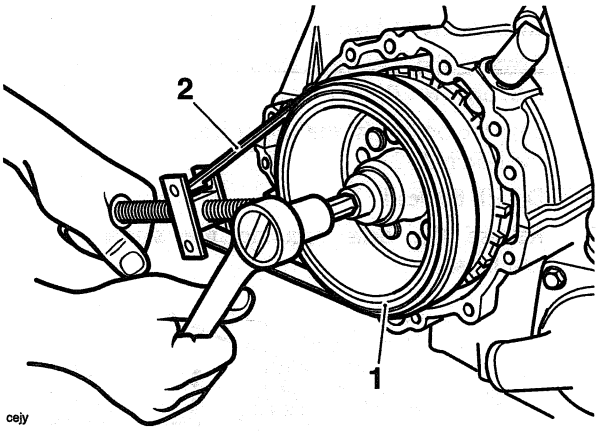



cejz
**1. Rotor**
**2. Tool T3880375**
**3. Tool T3880203**

11. Withdraw the rotor and tool as an assembly and then separate the tool from the rotor.

## Assembly

1. Assemble the rotor to the keyway on the crankshaft.
2. Refit tool T3880375 to prevent the crankshaft from rotating.
3. Tighten the rotor retaining bolt to **105 Nm**.



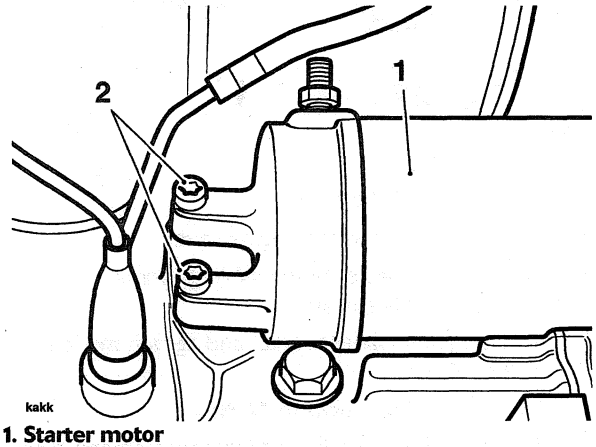

cejy
**1. Rotor**
**2. Tool T3880375**

4. Remove tool T3880375.
5. Locate the stator to the engine cover.
6. Apply silcone sealer to the cable grommet and align the cable to the exit slot.
7. Fit the cable retainer bracket and tighten the retainer bolt to **12 Nm**.
8. Tighten the stator bolts to **12 Nm**.
9. Refit the left hand engine cover incorporating a new gasket. Tighten the cover fixings to **9 Nm**.
10. Reconnect the battery positive (red) lead first.
11. Refit the seat (see page *16-9*).

## Starter Motor

### Removal

1. Remove the seat (see page *16-9*).
2. Disconnect the battery, negative (black) lead first.
3. Remove the fuel tank (see page *10-99*).
4. Remove the low oil pressure warning light switch (see page *8-11*).
5. Ease the boot from the starter lead and then release the lead nut.
6. Detach the lead.
7. Release the bolts securing the starter to the crankcase.




**1. Starter motor**
**2. Bolts**

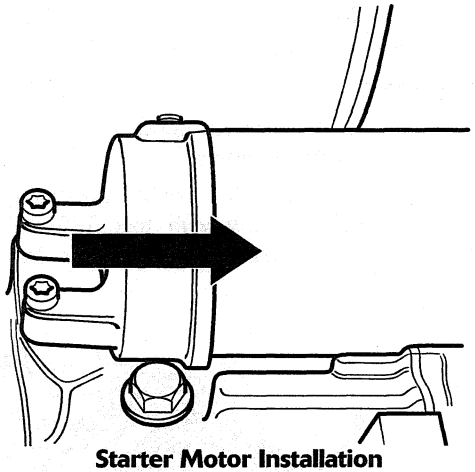
8. Ease the starter motor from the right hand engine cover while gently moving the camshaft oil feed pipe out of the way.

### Inspection

1. Ensure the motor turns freely and without binding.
2. Check the starter O-ring for damage and deterioration. Replace as necessary.

### Installation

1. Fit the starter motor to the right hand engine cover ensuring that the O-ring does not become damaged during installation.
2. Fit the starter motor bolts, then, whilst holding the starter motor firmly in position against the engine cover, tighten the starter motor bolts to **10 Nm.**



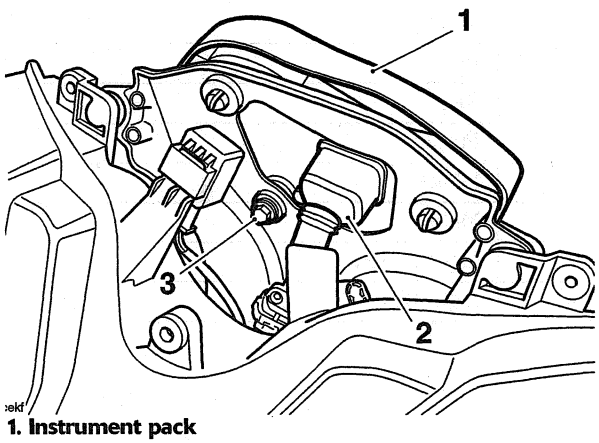
**Starter Motor Installation**

3. Refit the lead and secure with the nut. Tighten to **7 Nm.**
4. Refit the boot.
5. Refit the low oil pressure warning light switch (see page *8-11*).
6. Refit the fuel tank (see page *10-100*).
7. Reconnect the battery, positive (red) lead first.
8. Refit the seat (see page *16-9*).

## Instrument Pack

### Removal

1. Remove the seat (see page *16-9*).
2. Disconnect the battery, negative (black) lead first.
3. Remove the cockpit (see page *16-14*).
4. Detach the covering boot and disconnect the electrical connector from the instrument pack.
5. Release the fixing securing the instrument pack to the cockpit subframe.




**1. Instrument pack**
**2. Instrument pack connector**
**3. Instrument pack fixing**

6. Ease the instrument pack away from the bayonet and grommet fixings and remove the instrument pack.

### Installation

1. Position the instrument pack to the cockpit subframe and locate on the bayonet and grommet fixings.
2. Refit the fixing securing the instrument pack to the cockpit subframe and tighten to **3 Nm.**
3. Reconnect the electrical connector to the instrument pack and refit the covering boot.
4. Refit the cockpit (see page *16-15*).
5. Reconnect the battery, positive (red) lead first.
6. Refit the seat (see page *16-9*).

## Alternator Rectifier

**Note:**

- **The alternator rectifier is located on the left hand side of the frame, above the gearbox. The rectifier does not contain any serviceable parts and must be replaced if faulty.**

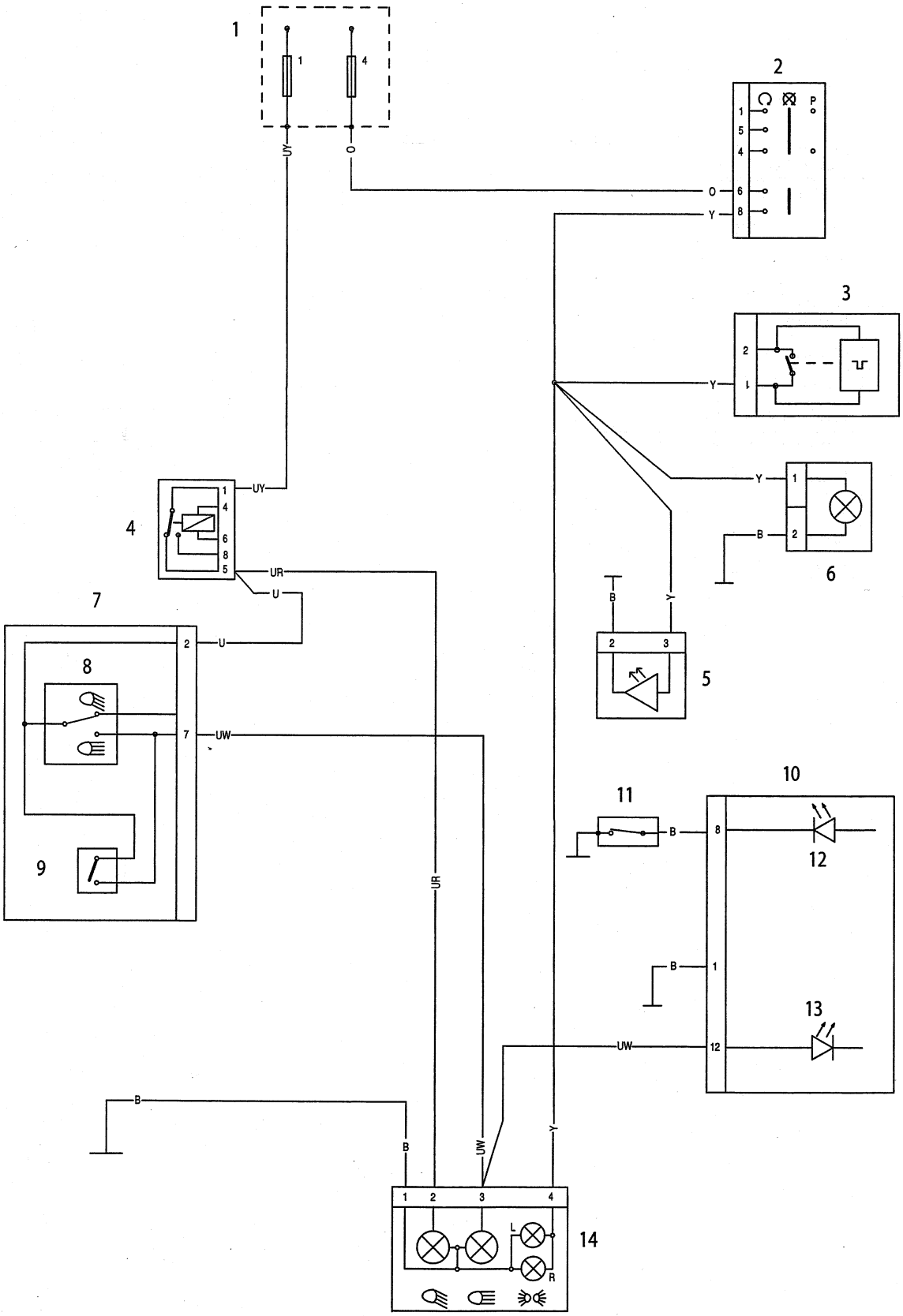
## Lighting Circuit Diagram

### Key to circuit diagram

| Key | Item Description |
|---|---|
| 1 | Fuse Box (Fuses 1 and 4) |
| 2 | Ignition Switch |
| 3 | Direction Indication Unit |
| 4 | Starter Relay |
| 5 | Tail Light |
| 6 | Number Plate Light |
| 7 | Left-hand Switch Cube Assembly |
| 8 | Main / Dip Beam Switch |
| 9 | Pass Switch |
| 10 | Instrument Assembly |
| 11 | Oil Pressure Switch |
| 12 | Oil Pressure Warning Light |
| 13 | Main Beam Warning Light |
| 14 | Headlight Assembly |

### Key to wiring colours

| Key | Wiring Colour |
|---|---|
| B | Black |
| U | Blue |
| N | Brown |
| G | Green |
| S | Slate / Grey |
| O | Orange |
| K | Pink |
| R | Red |
| P | Purple |
| W | White |
| Y | Yellow |
| LG | Light Green |
| LU | Light Blue |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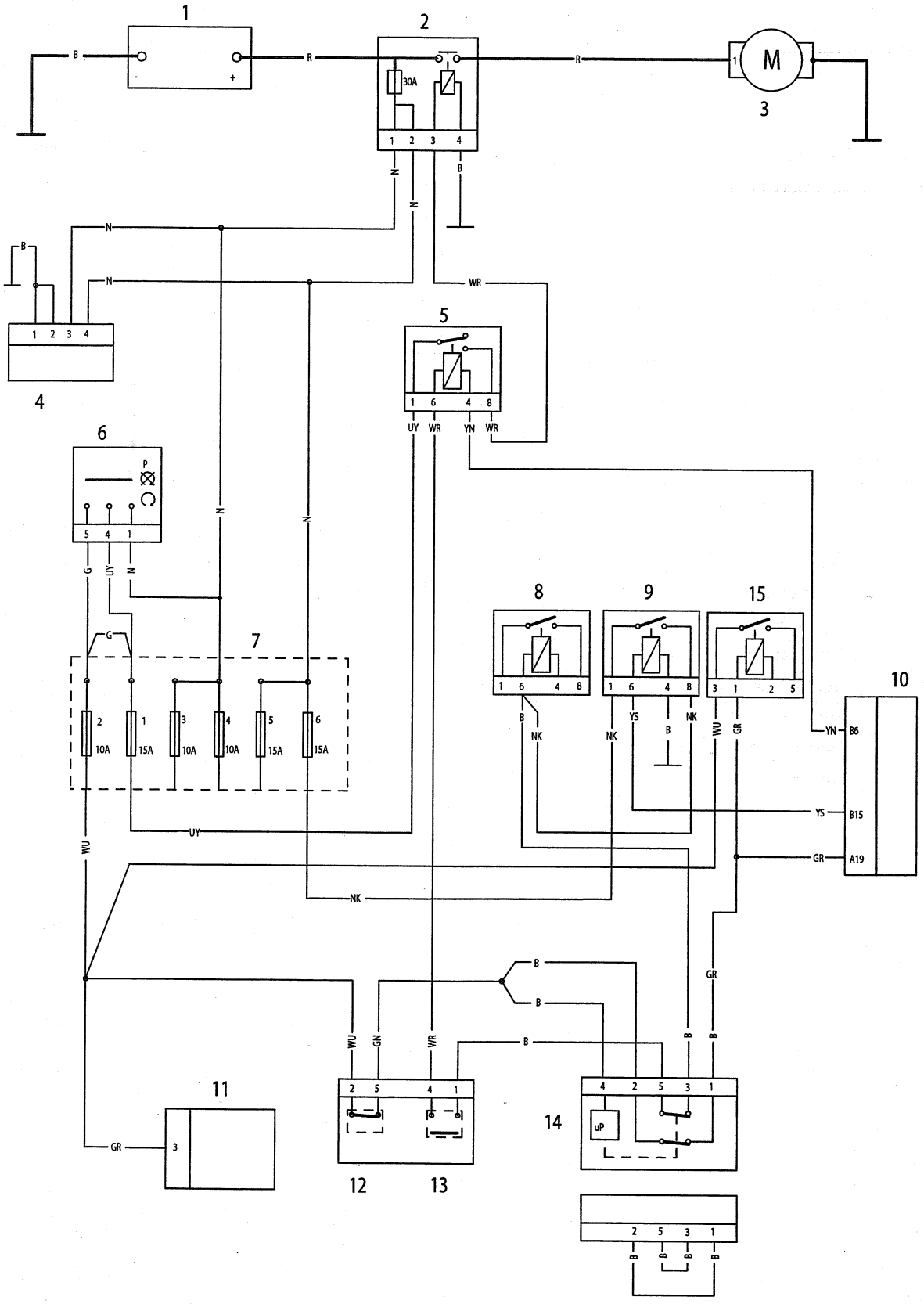
## Starting/charging Circuit Diagram

### Key to circuit diagram

| Key | Item Description |
|---|---|
| 1 | Battery |
| 2 | Starter Solenoid |
| 3 | Starter Motor |
| 4 | Regulator/rectifier |
| 5 | Starter Relay |
| 6 | Ignition Switch |
| 7 | Fuse Box |
| 8 | Cooling Fan Relay |
| 9 | Engine Control Module Relay |
| 10 | Engine Control Module |
| 11 | Instrument Assembly |
| 12 | Engine Kill Switch |
| 13 | Starter Switch |
| 14 | Alarm |
| 15 | Fuel Pump Relay |

### Key to wiring colours

| Key | Wiring Colour |
|---|---|
| B | Black |
| U | Blue |
| N | Brown |
| G | Green |
| S | Slate / Grey |
| O | Orange |
| K | Pink |
| R | Red |
| P | Purple |
| W | White |
| Y | Yellow |
| LG | Light Green |
| LU | Light Blue |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A19

## Auxiliary and Accessory Circuit

### Key to circuit diagram

| Key | Item Description |
|---|---|
| 1 | Fuse Box (Fuses 3 & 4) |
| 2 | Accessory Heated Handlebar Grips |
| 3 | Accessory Satellite Navigation system |
| 4 | Accessory Socket |
| 5 | Ignition Switch |
| 6 | Indicator Relay |
| 7 | Front Brake Light Switch |
| 8 | Horn Switch |
| 9 | Direction Indicator Switch |
| 10 | Horn |
| 11 | Rear brake light switch |
| 12 | Brake light |
| 13 | Instrument Assembly |
| 14 | Diagnostic connector |
| 15 | Direction indicator (Instruments) |
| 16 | Alarm LED |
| 17 | Front right direction Indicator |
| 18 | Front left direction Indicator |
| 19 | Alarm unit |
| 20 | Rear right direction indicator |
| 21 | Rear left direction indicator |

### Key to wiring colours

| Key | Wiring Colour |
|---|---|
| B | Black |
| U | Blue |
| N | Brown |
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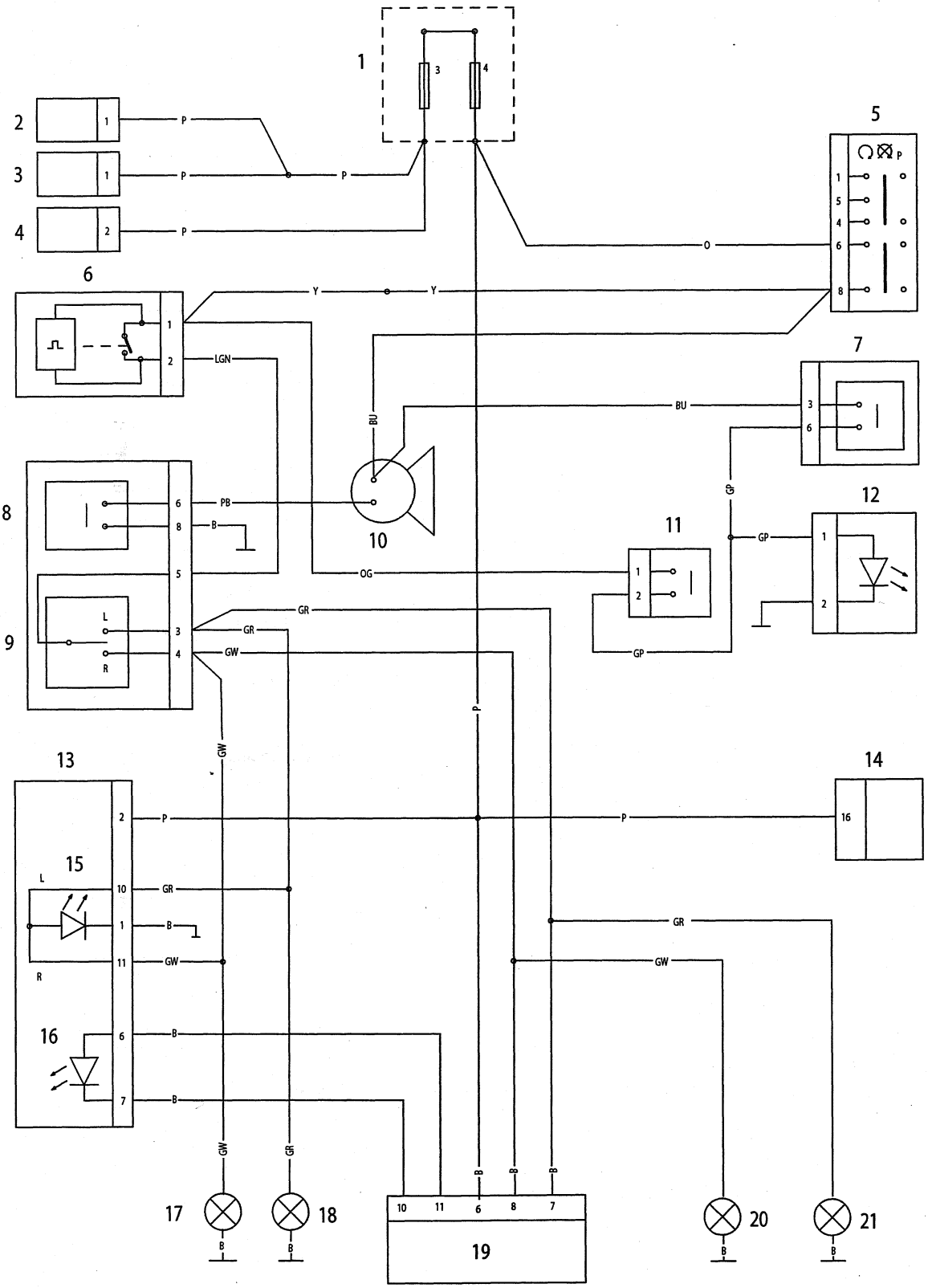
| S | Slate / Grey |
| O | Orange |
| K | Pink |
| R | Red |
| P | Purple |
| W | White |
| Y | Yellow |
| LG | Light Green |
| LU | Light Blue |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# Main Wiring Circuit Diagram - Models with ABS Brakes

## Key to circuit diagram

| Key | Item Description |
|---|---|
| 1 | Instrument Assembly |
| 2 | Vehicle Speed Sensor |
| 3 | Front Brake Lever Switch |
| 4 | Engine Kill Switch |
| 5 | Starter Button |
| 6 | Engine Control Module |
| 7 | Lambda Sensor |
| 8 | Fuel Injector 1 |
| 9 | Fuel Injector 2 |
| 10 | Fuel Injector 3 |
| 11 | Exhaust Air Injection Solenoid |
| 12 | Fall Detection Switch |
| 13 | Inlet Air Temperature Sensor |
| 14 | Coolant Temperature Sensor |
| 15 | Throttle Potentiometer |
| 16 | Ambient Pressure Sensor |
| 17 | MAP Sensor |
| 18 | Engine Management Relay |
| 19 | Fuel Level Sender |
| 20 | Neutral Switch |
| 21 | Cooling Fan Relay |
| 22 | Cooling Fan |
| 23 | 330 ohm resistor |
| 24 | Purge Valve |
| 25 | Ignition Coil 1 |
| 26 | Ignition Coil 2 |
| 27 | Ignition Coil 3 |
| 28 | Side stand Switch |
| 29 | Engine Earth |
| 30 | Crankshaft Sensor |
| 31 | Idle Speed Control Actuator |
| 32 | Diagnostic Connector |
| 33 | Rear Brake Lever Switch |
| 34 | RH Rear Indicator |
| 35 | Rear Light |
| 36 | Number Plate Light |
| 37 | LH Rear Indicator |
| 38 | Alarm Connector (Accessory) |
| 39 | Starter Motor |
| 40 | Starter Solenoid |
| 41 | Battery |
| 42 | Starter Relay |
| 43 | Rectifier / Regulator |
| 44 | Alternator |
| 45 | Fuse Box |
| 46 | Ignition Switch |
| 47 | Accessory Socket |
| 48 | Satellite Navigation Connector (Accessory) |
| 49 | Heated Handlebar Grips Connector (Accessory) |
| 50 | Fuel Pump |
| 51 | Direction Indicator Unit |
| 52 | Clutch Lever Switch |
| 53 | Horn Button |
| 54 | Direction Indicator Switch |
| 55 | Headlamp Dip Switch |
| 56 | Oil Pressure Switch |
| 57 | LH Front Indicator |
| 58 | Position Light |
| 59 | Headlight |
| 60 | Horn |
| 61 | RH Front Indicator |
| 62 | Fuel Pump Relay |
| 63 | ABS Modulator |
| 64 | ABS Fuse Box |
| 65 | Front Wheel Speed Sensor |
| 66 | Rear Wheel Speed Sensor |

## Key to wiring colours

| Key | Wiring Colour |
|---|---|
| B | Black |
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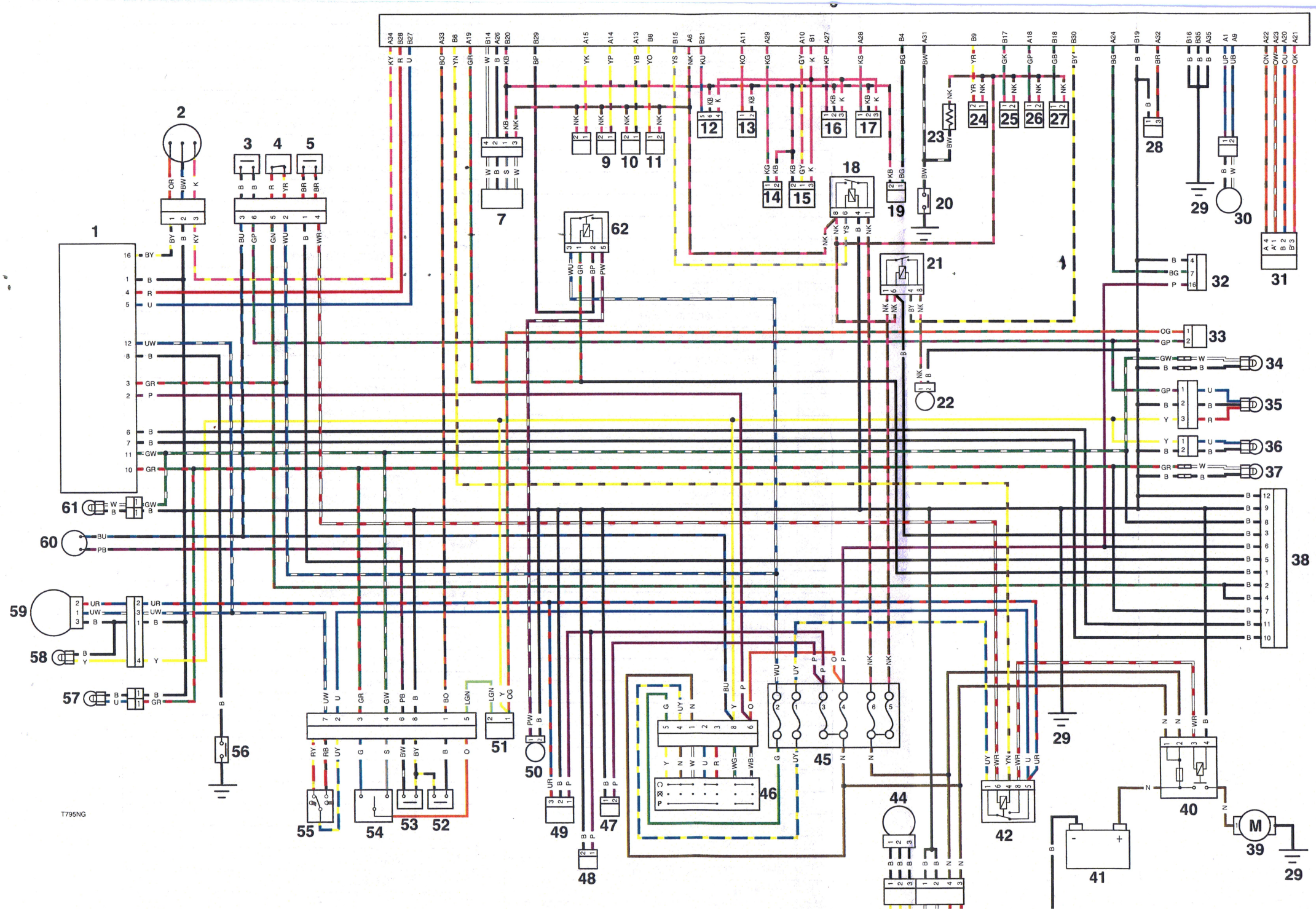
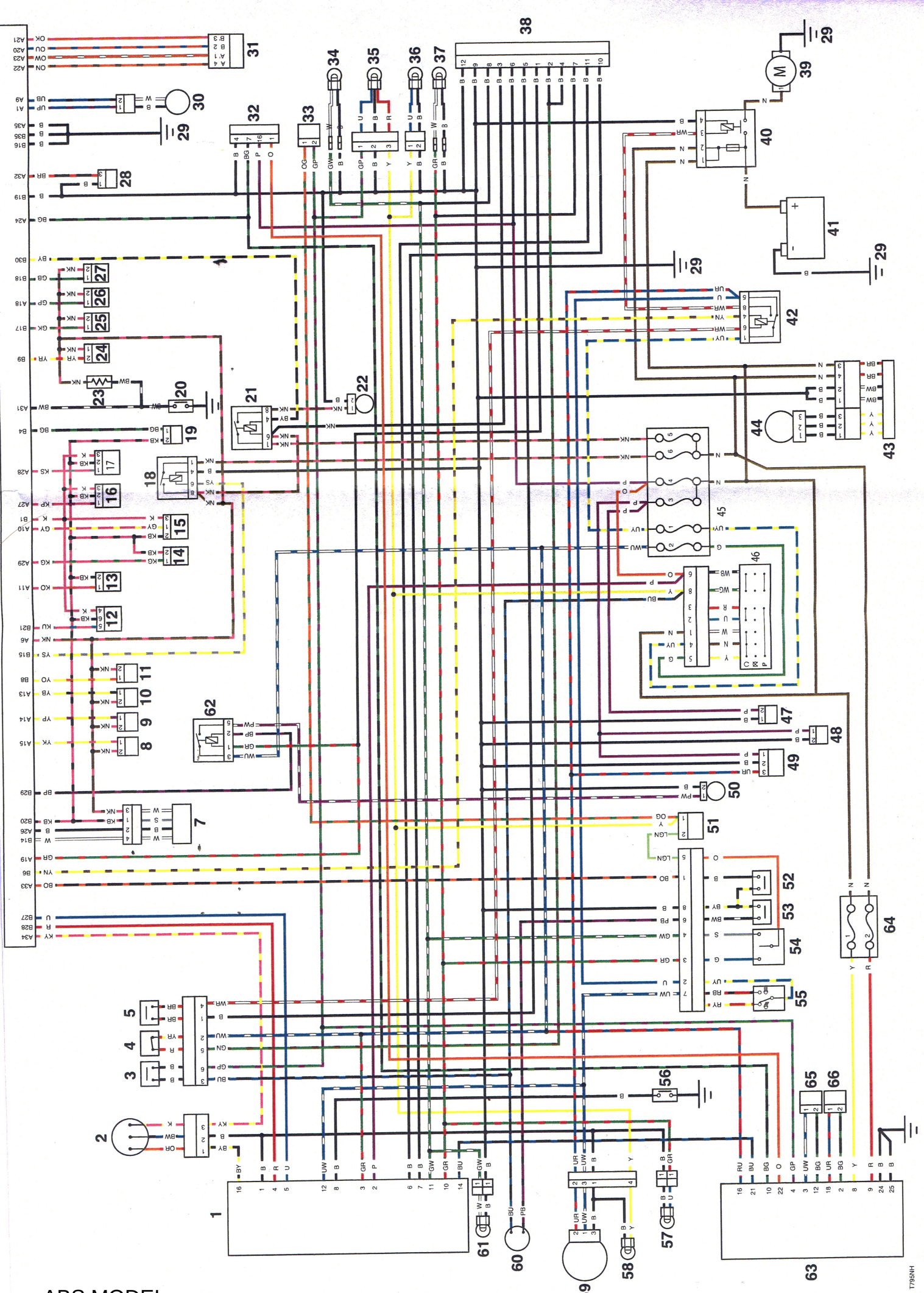

T795NG



ABS MODEL

# Main Wiring Circuit Diagram - Models without ABS Brakes

## Key to circuit diagram

| Key | Item Description |
|---|---|
| 1 | Instrument Assembly |
| 2 | Vehicle Speed Sensor |
| 3 | Front Brake Lever Switch |
| 4 | Engine Kill Switch |
| 5 | Starter Button |
| 6 | Engine Control Module |
| 7 | Lambda Sensor |
| 8 | Fuel Injector 1 |
| 9 | Fuel Injector 2 |
| 10 | Fuel Injector 3 |
| 11 | Exhaust Air Injection Solenoid |
| 12 | Fall Detection Switch |
| 13 | Inlet Air Temperature Sensor |
| 14 | Coolant Temperature Sensor |
| 15 | Throttle Potentiometer |
| 16 | Ambient Pressure Sensor |
| 17 | MAP Sensor |
| 18 | Engine Management Relay |
| 19 | Fuel Level Sender |
| 20 | Neutral Switch |
| 21 | Cooling Fan Relay |
| 22 | Cooling Fan |
| 23 | 330 ohm resistor |
| 24 | Purge Valve |
| 25 | Ignition Coil 1 |
| 26 | Ignition Coil 2 |
| 27 | Ignition Coil 3 |
| 28 | Side stand Switch |
| 29 | Engine Earth |
| 30 | Crankshaft Sensor |
| 31 | Idle Speed Control Actuator |
| 32 | Diagnostic Connector |
| 33 | Rear Brake Lever Switch |
| 34 | RH Rear Indicator |
| 35 | Rear Light |
| 36 | Number Plate Light |
| 37 | LH Rear Indicator |
| 38 | Alarm Connector (Accessory) |
| 39 | Starter Motor |
| 40 | Starter Solenoid |
| 41 | Battery |
| 42 | Starter Relay |
| 43 | Rectifier / Regulator |
| 44 | Alternator |
| 45 | Fuse Box |
| 46 | Ignition Switch |
| 47 | Accessory Socket |
| 48 | Satellite Navigation Connector (Accessory) |
| 49 | Heated Handlebar Grips Connector (Accessory) |
| 50 | Fuel Pump |
| 51 | Direction Indicator Unit |
| 52 | Clutch Lever Switch |
| 53 | Horn Button |
| 54 | Direction Indicator Switch |
| 55 | Headlamp Dip Switch |
| 56 | Oil Pressure Switch |
| 57 | LH Front Indicator |
| 58 | Position Light |
| 59 | Headlight |
| 60 | Horn |
| 61 | RH Front Indicator |
| 62 | Fuel Pump Relay |

## Key to wiring colours

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|---|---|
| B | Black |
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| K | Pink |
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| P | Purple |
| W | White |
| Y | Yellow |
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