



Bonneville T120

Motorcycle Service Manual

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TABLE OF CONTENTS

Introduction	1
General Information	2
Service Tools	3
Specifications	4
Torque Wrench Settings	5
Routings	6
Routine Maintenance	7
Engine Covers	8
Cylinder Head	9
Barrels and Pistons	10
Clutch	11
Crankshaft	12
Balancer	13
Transmission	14
Starter Drive and Sprag Clutch	15
Lubrication	16
Engine Removal and Installation	17
Fuel System and Engine Management	18
Cooling	19
Front Suspension	20
Rear Suspension	21
Brakes	22
Wheels and Tyres	23
Final Drive	24
Frame and Bodywork	25
Electrical	26

INTRODUCTION

Introduction

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

A basic knowledge of mechanics, including the proper use of tools and workshop procedures is necessary in order to carry out maintenance and repair work satisfactorily. Whenever the owner has insufficient experience or doubts regarding 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 electronic parts catalogue (EPC).
- 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.

Noise Control System

Tampering with the noise control system is prohibited.

Owners are warned that the law may prohibit:

1. **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,**
2. **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 parts other than genuine Triumph parts are fitted. In certain territories, legislation prohibits the fitting of parts not to the manufacturer's specification.

Tightening procedure

Generally, when installing a part with several bolts, nuts or screws, they should all be started in their holes and tightened to a snug fit, evenly and in a cross pattern. This is to avoid distortion of the part and/or 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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2 General Information

Table of Contents

Ignition System Safety Precautions.....	9
Dangerous Substances	9
Third Party Products	9
Fluoroelastomers.....	9
Oils	9
Health Protection Precautions.....	10
Environmental Protection Precautions	10
Brakes.....	10
Safety Instructions.....	11
Chassis Bearing Lubrication	14
Fuel Handling Precautions	15
Electrical Precautions	16
Glossary of Circuit Diagram Symbols.....	17
Electrical Testing	19
Circuit Diagrams.....	20
Tracing Circuits.....	20
CAN (Controller Area Networking)	22

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, antifreeze, 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!

Third Party Products

Warning

Many proprietary products, such as chemicals, solvents and cleaning agents, will cause damage to components if used incorrectly or inappropriately. Always follow the manufacturer's instructions printed on the product container's labels and obey the instructions given. These instructions are included for your safety and well-being.

Damage to the motorcycle components caused by the incorrect or inappropriate use of chemicals, solvents and cleaning agents may reduce the components efficiency, resulting in loss of motorcycle control and an accident.

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

Warning

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

Health Protection Precautions

- Avoid prolonged and repeated contact with oils, particularly used engine oils.
- Wear protective clothing, including impervious gloves where practicable.
- Do not put oily rags in pockets.
- Overalls must be cleaned regularly. Discard heavily soiled clothing and oil impregnated footwear.
- First aid treatment should be obtained immediately for open cuts and wounds. Always be aware of who your nearest First Aider is and where the medical facilities are kept.
- Use barrier creams, applying before each work period to protect the skin from the effects of oil and grease and to aid removal of the same after completing work.
- Wash with soap and water to ensure all oil is removed (skin cleansers and nail brushes will help). Preparations containing lanolin replace the natural skin oils which have been removed.
- Do not use petrol, kerosene, diesel fuel, gas oil, thinners or solvents for cleaning skin.
- If skin disorders develop, obtain medical advice without delay.
- Where practicable, degrease 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 DOT 4 specification brake fluid as listed in the General Information section of this manual. The use of brake fluids other than those DOT 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.

! Warning

Before installation, all internal brake components should be cleaned and lubricated with clean new DOT 4 brake fluid.

Never use solvents, petrol (gasoline), engine oil or any other petroleum distillate on internal brake components as this will cause deterioration of the hydraulic seals in the calipers and master cylinders.

A dangerous riding condition leading to loss of motorcycle control and an accident could result if this warning is ignored.

Safety Instructions**Jacking and Lifting****! Warning**

Always ensure that any lifting apparatus has adequate load and safety capacity for the weight to be lifted. Ensure the motorcycle is well supported to prevent any possibility of the machine falling prior to 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 antifreeze and corrosion inhibitors contains toxic chemicals which are harmful to the human body. Never swallow antifreeze, 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 antifreeze 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 antifreeze as specified in the Owner's Handbook. Never use a methanol based antifreeze as this does not contain the required corrosion inhibition properties.

Caution

Distilled water must be used with the antifreeze (see specification for antifreeze) 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 flashpoint 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 reuse 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 loosened 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 over tightening 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 reuse 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 loosen back castle nuts when fitting a 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 circlip groove. When installing circlips and retaining rings, take care to compress or expand them only enough to install them.

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

Self-Locking Nuts

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

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

Encapsulated Bolts

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 reused, 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.

With the sealing lip facing the lubricant, press or drift a seal to the depth of its housing, if the housing is shouldered, or flush with the face of the housing where no shoulder is provided.

Chassis Bearing Lubrication

Note:

- This information relates only to bearing lubrication. For the procedures necessary to replace a bearing, always refer to the relevant section of this Service Manual.
- Bearings installed in engine and transmission applications are not covered by this information. Refer to the Lubrication chapter or the relevant engine chapter for additional information.

General

For a bearing to be serviceable for its anticipated life span it must be checked, adjusted and lubricated at regular intervals, as specified in the service schedules given in the Owner's Handbook and this Service Manual.

A correctly lubricated bearing will have a film of lubrication that separates the moving parts, disperses heat and protects the bearing surfaces from corrosion.

Note:

- In all cases, use the lubricant recommended.
- Grease the bearing, not the cavity where it is located.
- A bearing that is not regularly checked and lubricated will have a reduced life span.

New Bearings

New bearings are typically protected with an oil preservative to prevent corrosion etc. during storage. This is NOT the lubrication for the bearing but DOES NOT need to be washed off prior to assembly and in-service lubrication.

When lubricating a new bearing with grease the following steps should be taken:

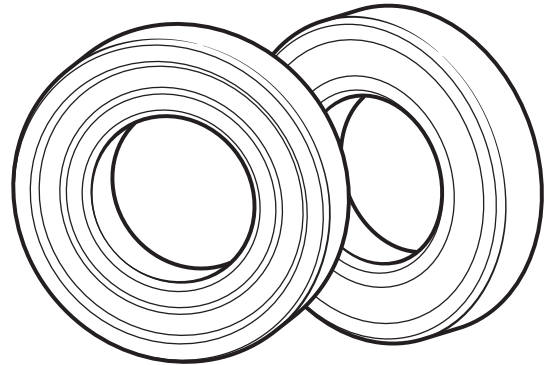
1. Do not clean off the oil preservative.
2. Grease must be forced between the roller elements and the roller cage.
3. Rotate the bearing to ensure that the grease is distributed over the entire circumference of the internal parts.
4. Any excess grease should be smeared on the outside of the rollers.

Lubrication and Checks While Servicing a Bearing

1. Disassemble parts as necessary to access the bearing.

2. Inspect the old grease covering the bearing, looking for signs of bearing damage, i.e. flakes or specks of metal.
3. Remove the old grease.
4. Check the bearing for smooth operation and visually check for corrosion, dents and flaking in the bearing race, rollers or cage. Replace if necessary.

Below/overleaf several common bearing types and the lubrication procedures for each are identified:

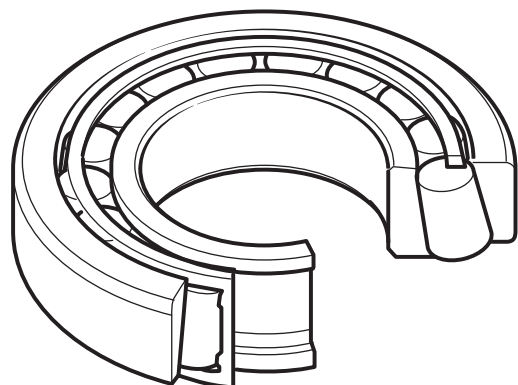


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Sealed Bearings

Note:

- Sealed bearings can be identified by their integrated seals.
- Sealed bearings are lubricated for life by the manufacturer.
- Any attempt to change the grease in a sealed bearing will damage the integrated seals. If the seals are damaged, dirt and water will ingress and the life of the bearing will be greatly reduced.

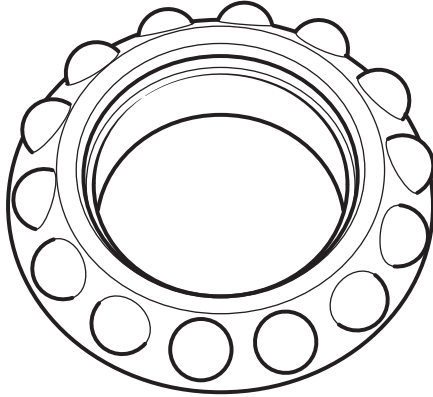


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Taper Bearings

1. Grease must be forced between the inner race and the roller carrier.

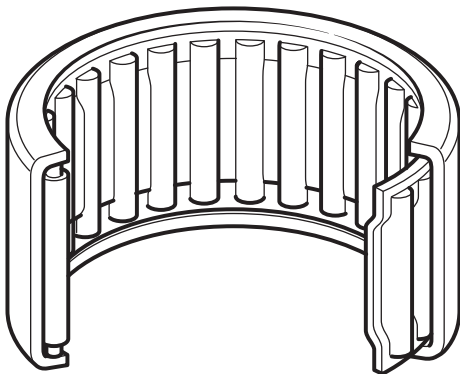
2. Rotate the bearing to ensure that the grease is distributed over the entire circumference of the internal parts.
3. Any excess grease should be smeared on the outside of the rollers.



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Angular Contact and Ball Bearing

1. Grease the bearing races and the ball bearing carrier.
2. Rotate the bearing to ensure that the grease is distributed over the entire circumference of the internal parts.



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Needle Roller Bearings

1. Coat the needle rollers with grease.
2. Ensure the needle rollers turn so that the grease is distributed over the entire circumference of the internal parts.
3. Assemble the parts, adjust and check as necessary.

Metal Bushes

1. Disassemble the parts as necessary to access the bush.

2. Remove the old grease.
3. Apply fresh grease to the metal bush.

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 to 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 (gasoline) 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

Warning

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 gases 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.

Glossary of Circuit Diagram Symbols

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

General Information

Connector



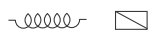
This illustration is used to show all multiplug type electrical connectors on Triumph circuit diagrams. The numbers in the box relate to the terminal numbers of the connector pins. On ECMs with two connectors, the number would be prefixed with the letters 'A' or 'B' to identify each connector. An additional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

Diode



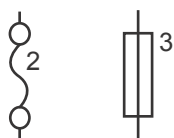
An electrical one-way valve. Diodes allow current to flow in one direction but will not allow it to return. The arrow, which forms part of the diode symbol, indicates the direction of current flow.

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



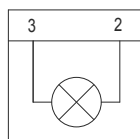
A fuse is a device which protects a circuit in the event of a fault. The fuse will 'blow' should a short circuit occur, protecting that circuit from further damage. The number next to the fuse on the circuit diagram indicates the position of the fuse in the fuse box.

Ground 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)



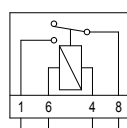
Triumph use LEDs for the alarm warning light, instrument illumination and warning lights, gear change lights and rear light/brake lights on various models.

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



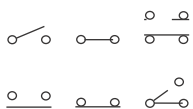
A device placed in a cable to reduce a voltage or restrict the maximum current a device can draw.

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 changeover.

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.

Ohm's 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 12 V is connected to a bulb of 60 W:

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

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

- the bulb resistance can be calculated by using -

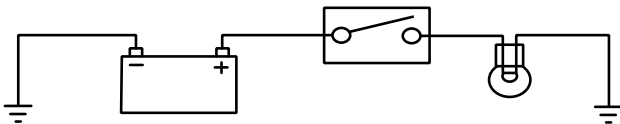
$$\frac{V}{I} = R \quad \frac{12}{5} = 2.4$$

General Information

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.

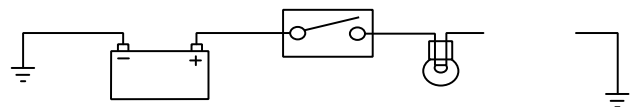
Both of these circuit diagrams use similar symbols to illustrate the various system components and will be accompanied by a key indicating circuit diagram components and wiring colour codes.

Circuit diagrams also depict the inner workings of a switch housing (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.

Tracing Circuits

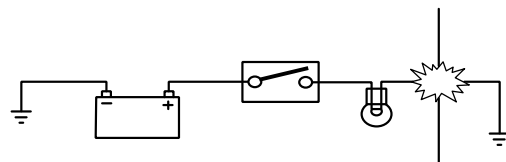
The following is a description of two types of common electrical failures, and some of the methods which may be used to find them.

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 be intermittent, making diagnosis difficult.

Short Circuit



A 'short cut' in an electrical circuit - current bypasses the intended circuit, either to ground 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 battery Voltage.

A short to ground means that the current is going to ground 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 battery voltage (12 Volts) 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:

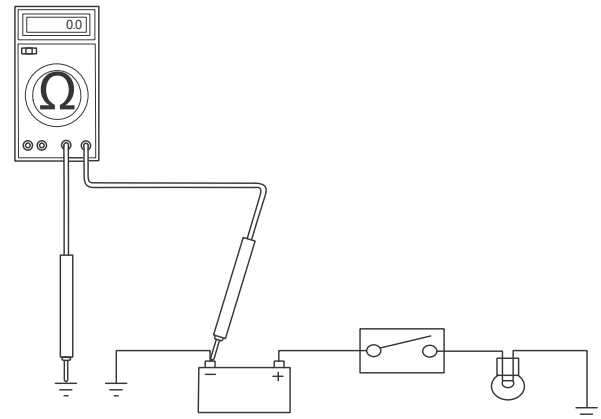
- a wire may diverge at a splice and go off to feed other circuits. If these circuits are working, check for wiring faults from the splice onwards.
- the circuit diagram is not an accurate guide to the actual location of the parts when fitted on the bike. It is a schematic diagram of the circuits.
- 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 ().

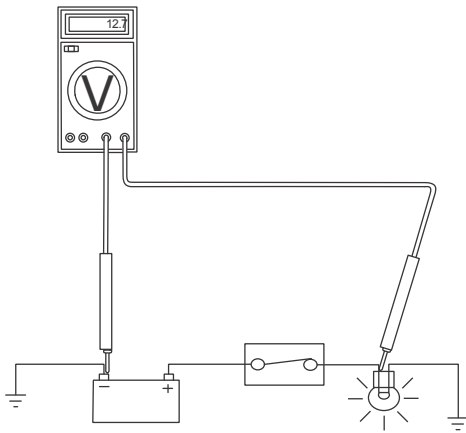
In the example below, the ground circuit continuity is being tested from the battery to the frame.



- Locate each end of the wire.
- Set the Digital Multi Meter (DMM) to resistance check Ohms.
- Probe each end of the wire.
- If there is continuity, the meter will usually beep 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 beep 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.



- 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.

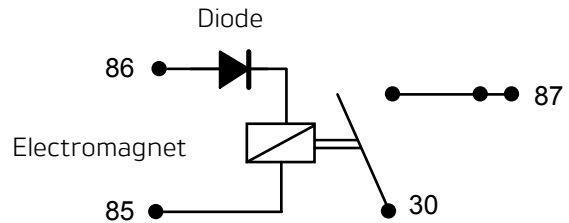
To locate a splice, it is necessary to peel back the insulation and examine the splice for its integrity. The most common fault is where one of the wires at the joint has come adrift usually causing the circuit it feeds or grounds to become 'dead'.

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.



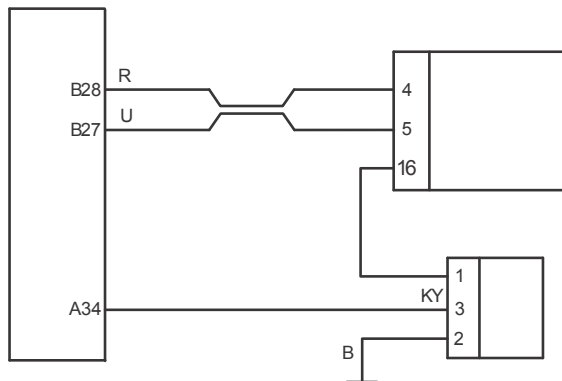
Make continuity checks across the electromagnet first, usually from pin 86 (positive) to pin 85 (negative). If a diode appears in the circuit use the diode check on the multimeter (Volts scale) in the direction of current flow. If there is no diode, use the resistance check facility. An open circuit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



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 uses CAN for communication between the following ECMs:

- Engine control module
- Instruments
- ABS module
- Immobiliser control module
- Diagnostic connector
- Audio system (if fitted).

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3 Service Tools

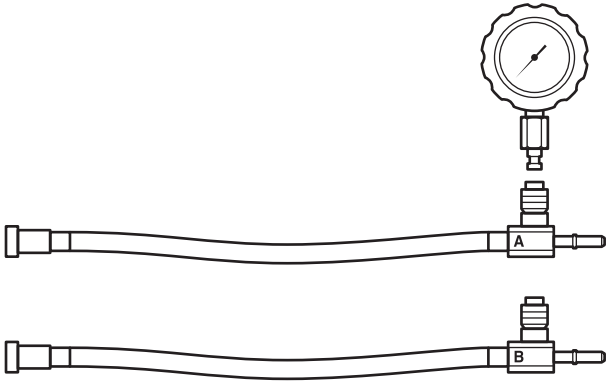
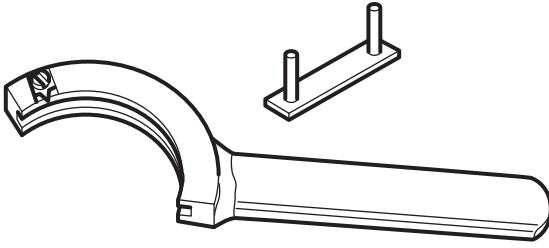
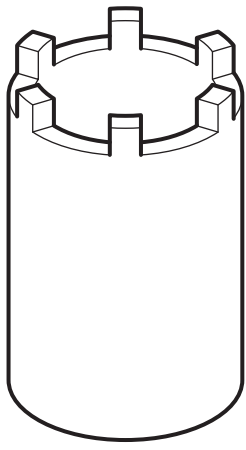
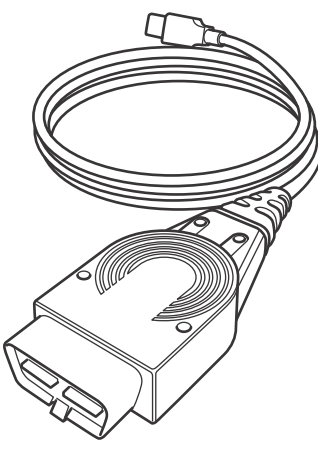
Table of Contents

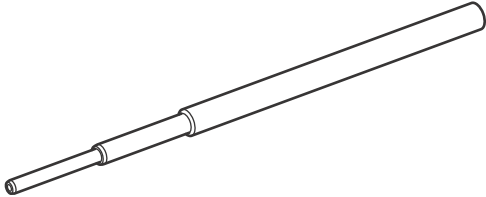
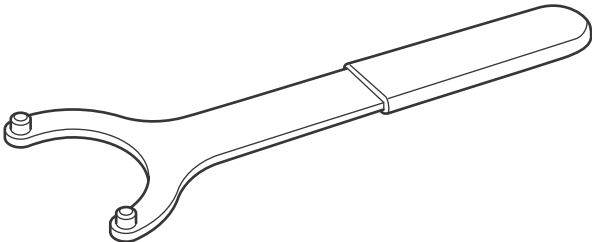
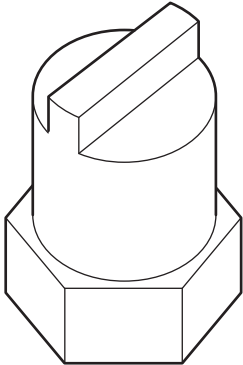
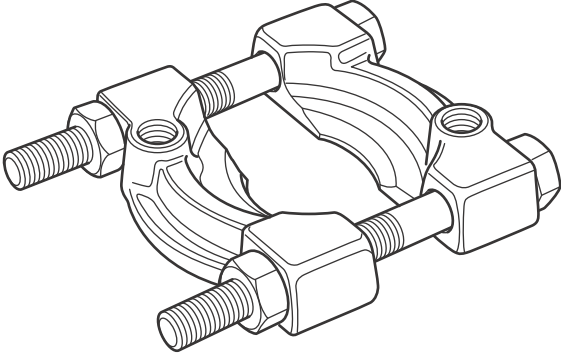
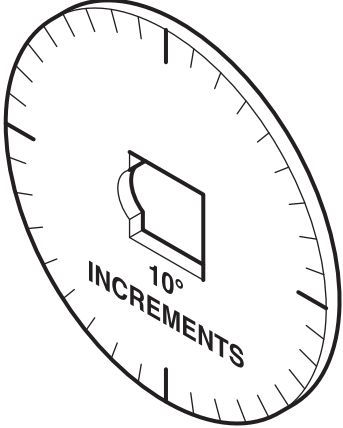
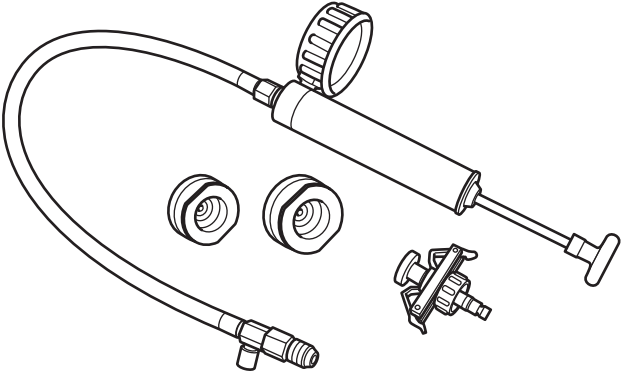
Service Tools and Garage Equipment..... 27

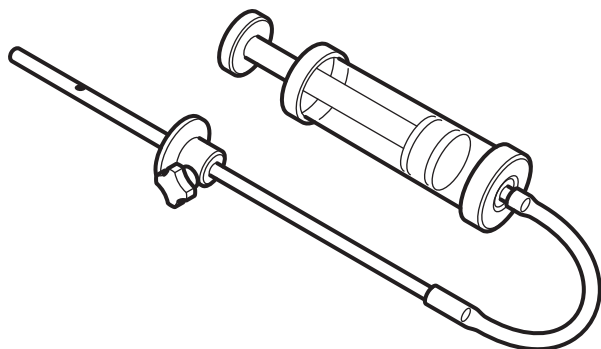
Service Tools and Garage Equipment

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:

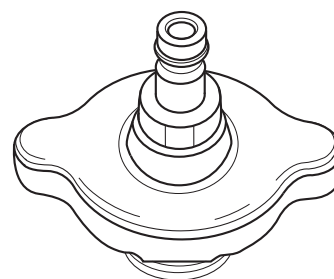
 Diagram showing a fuel pressure gauge with two hoses, labeled A and B, connected to it. The gauge has a circular face with a needle. Hose A is connected to the top of the gauge, and hose B is connected to the bottom. The hoses are flexible and have metal fittings at the ends. cdgh	 Diagram showing a balancer gear C-spanner. It consists of a long, straight handle with a curved end that fits over a balancer gear. There are two small pins or spacers shown separately, one with a single pin and the other with two pins.
T3880001 - Fuel Pressure Gauge	T3880016 - Balancer Gear C-Spanner
 Diagram showing a 50 mm socket. It is a cylindrical tool with a hexagonal base and a hexagonal top. The top has six raised lugs for gripping.	 Diagram showing a Triumph Diagnostic Interface. It is a cable with a coiled section and a connector at one end. The connector has a rectangular shape with a circular opening and several pins.
T3880023 - 50 mm Socket	T3880057 - Triumph Diagnostic Interface

 T3880039	 T3880041
T3880039 - Idler Gear Timing Pin	T3880041 - Idle Gear Timing Wrench
 cdoa	 T3880109
T3880104 - Swinging Arm Adjuster Wrench	T3880109 - Bearing Separator
 3880105-T0301 - Torque Angle Gauge	 cgwp T3880147 - Radiator and Cap Tester Kit

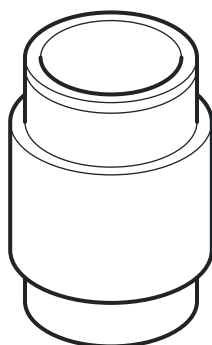


ccha

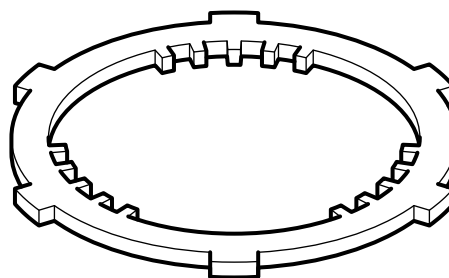
3880160 - T0301 - Fork Oil Filler/Evacuator



T3880176 - Radiator Pressure Test (use with 3880147)

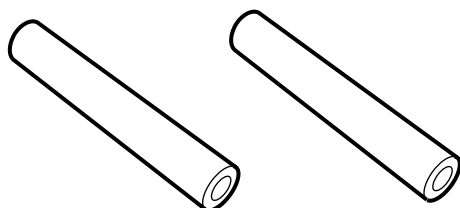


T3880184 - Fork Seals Drift

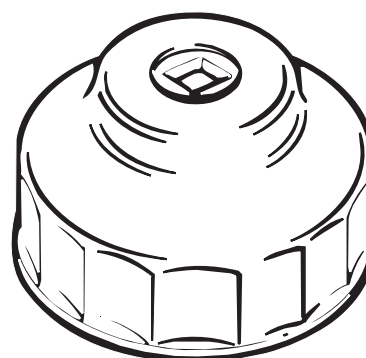


ccmi

T3880307 - Clutch Anti-rotation Jig

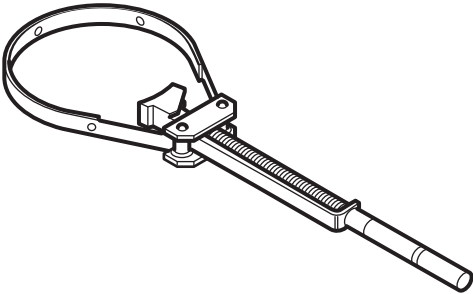
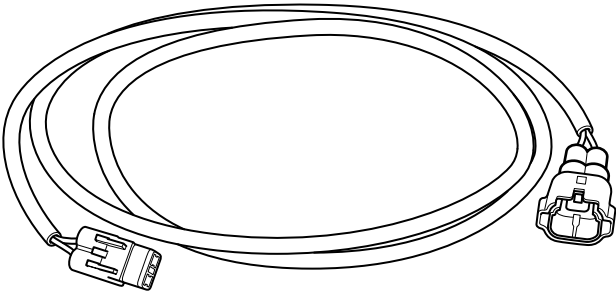
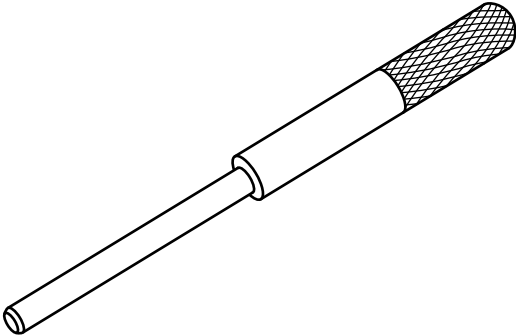
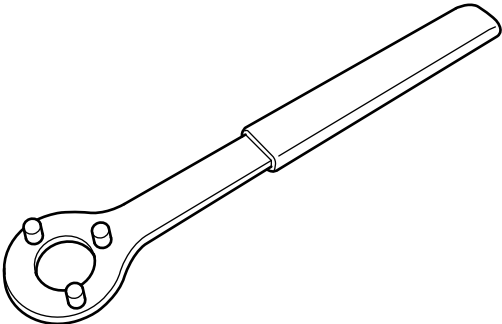
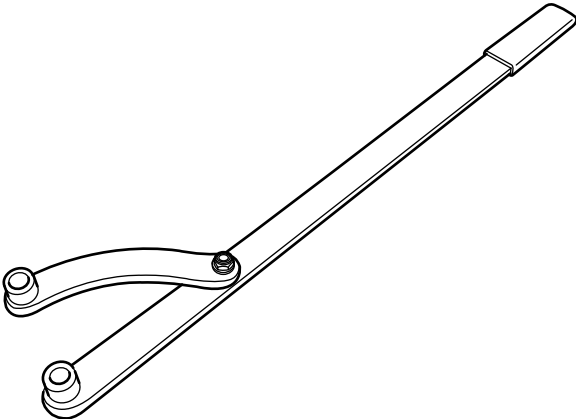


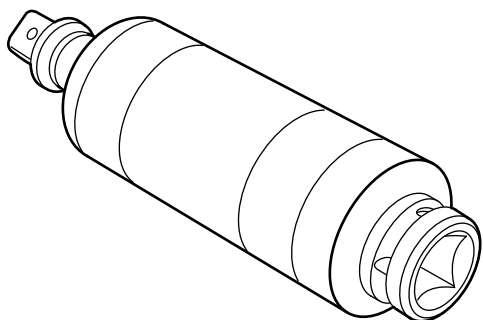
T3880308 - Cylinder Barrel Clamps



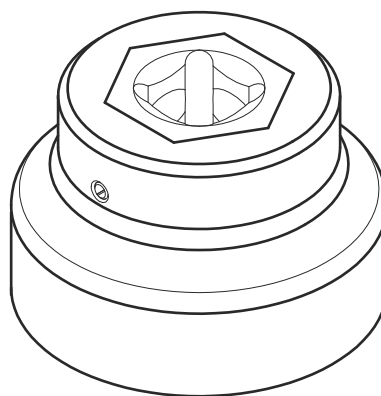
gahc

T3880313 - Oil Filter Wrench

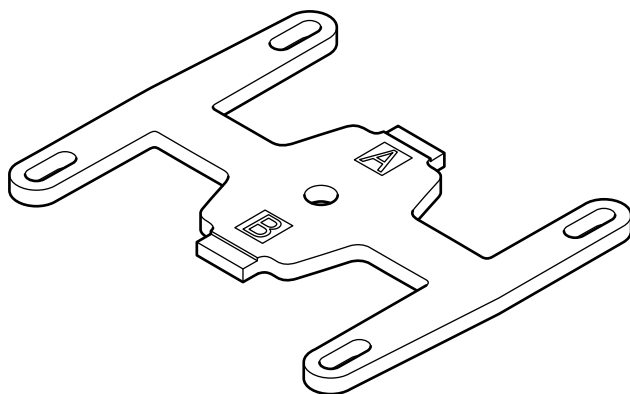
 cczh	
T3880365 - Alternator Housing Puller	T3880375 - Alternator Rotor Holder
 cjgu	
T3880391 - Fuel Pump Extension Cable	T3880601 - Camshaft Timing Pin
	
T3880603 - Oil Pump Restraint	T3880606 - Flywheel Restraint Handle



T3880609 - Timing Torque Limiter

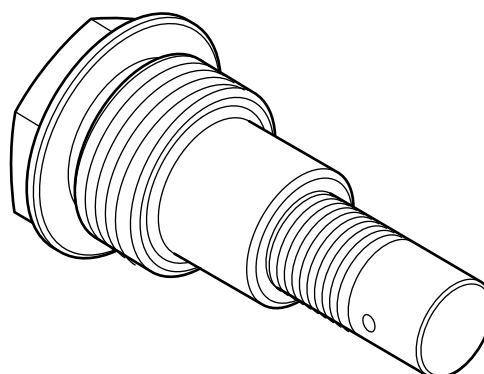


T3880649 - Timing Chain Tensioner Socket



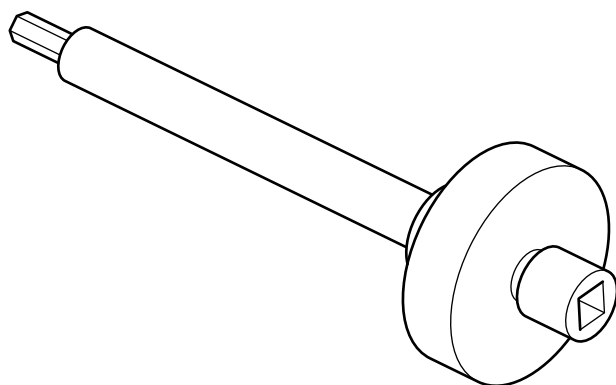
cjar

T3880650 - Camshaft Timing Plate



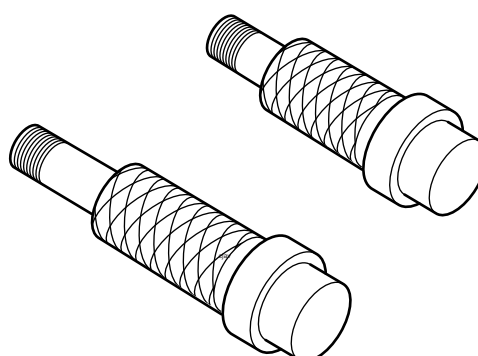
cjas

T3880651 - Timing Chain Tensioner

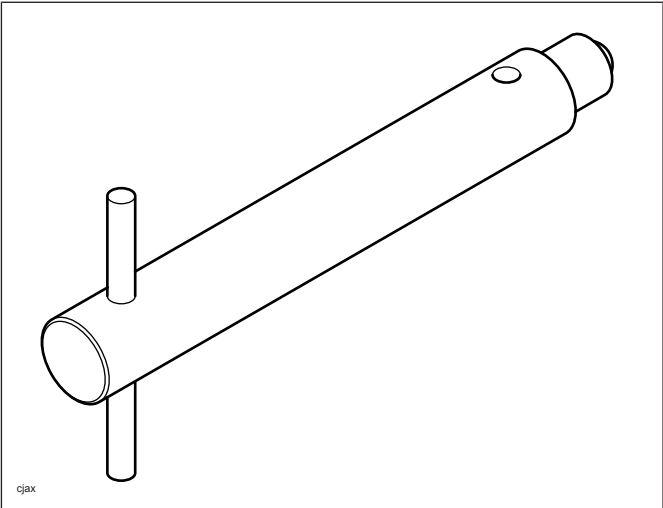


cjat

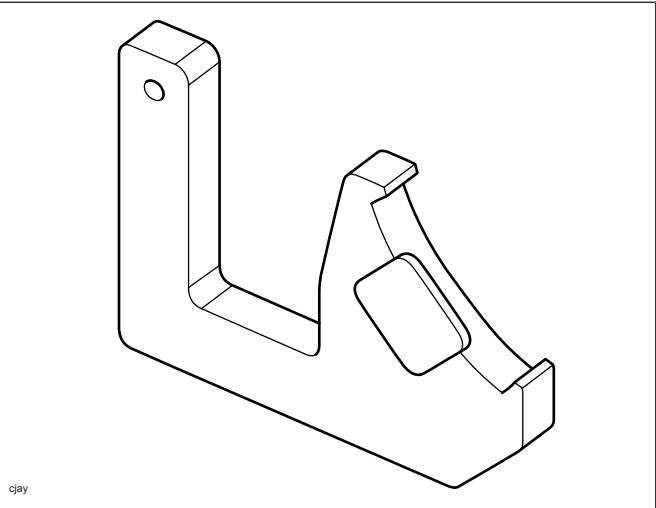
T3880652 - Dead Shaft Key Tool



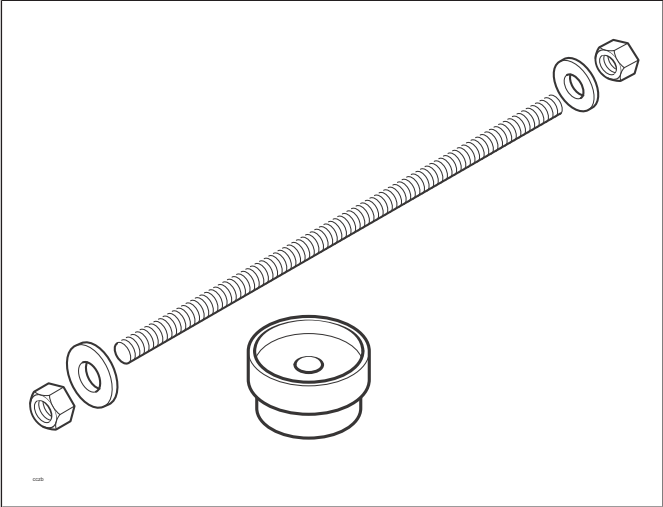
T3880656 - Pulley Wrench Pin Set



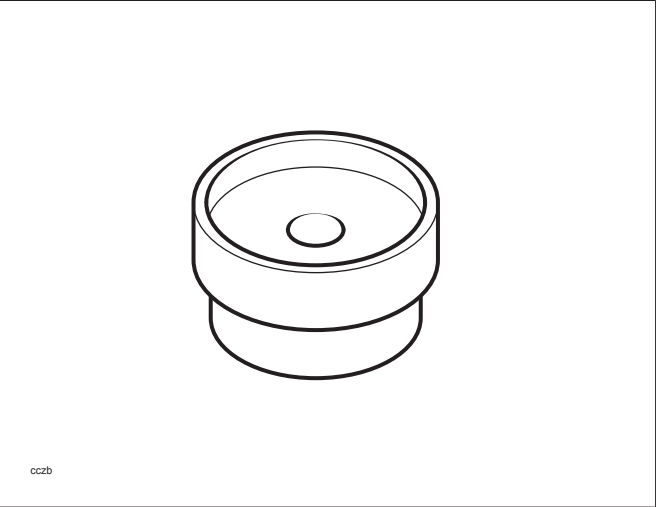
T3880809 - Rear Balancer Timing Tool



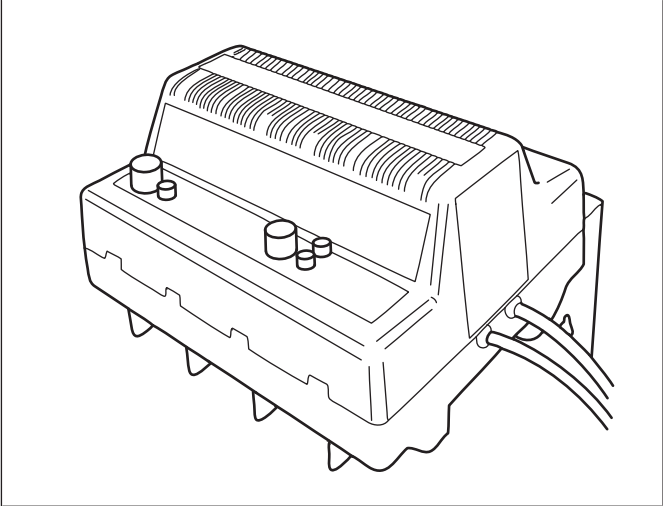
T3880811 - Front Balancer Timing Tool



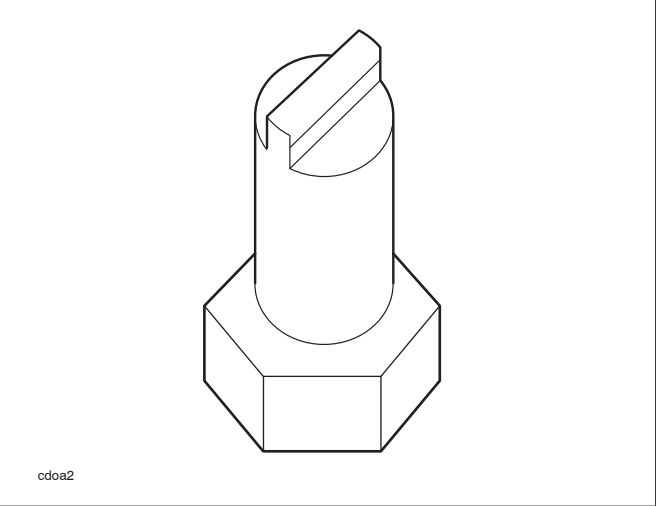
T3880053 - Wheel Bearing Extraction Kit



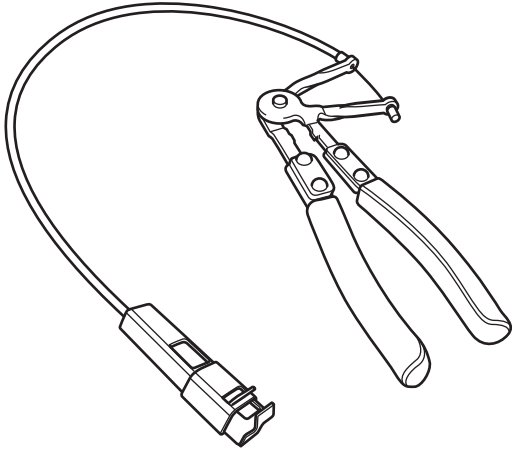
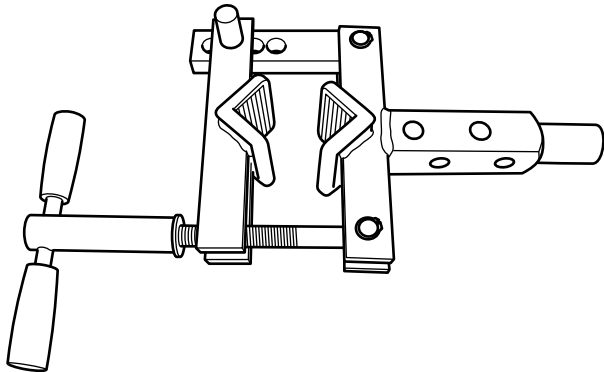
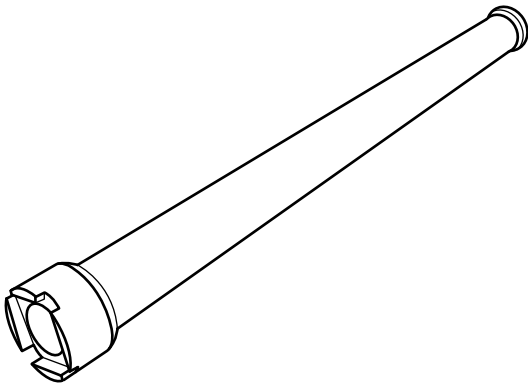
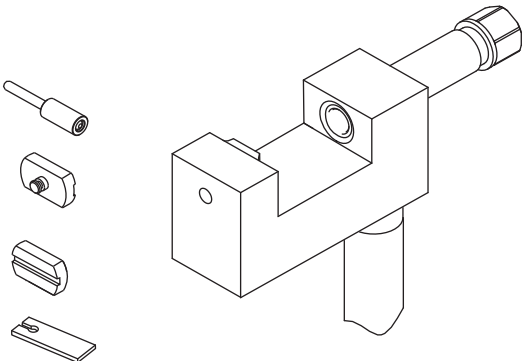
T3880075 - Bearing Installer



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



T3880377 - Engine Mounting Adjuster

	 cjlx
T3880207 - Hose Clip Pliers	T3880171 - Fork Holding Tool
	
T3880633 - Wrench Damper Tube	T3880635 - Final Drive Chain Cut and Rivet

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4 Specifications

Table of Contents

Cylinder Head and Valves.....	37
Camshafts.....	38
Clutch and Primary Drive.....	39
Engine.....	40
Piston.....	41
Crankshaft.....	42
Transmission.....	43
Final Drive.....	44
Lubrication.....	45
Ignition System.....	46
Fuel System.....	47
Emmissions Control System.....	48
Cooling System.....	49
Suspension.....	50
Brakes.....	51
Frame.....	52
Wheels and Tyres.....	53
Electrical Equipment.....	54

Cylinder Head and Valves

Cylinder head	Flatness tolerance	0.030 mm
Valve Head Diameter	Inlet	35.60 mm
	Exhaust	29.70 mm
Valve Lift	Inlet	10.3 mm
	Exhaust	9.2 mm
Valve Stem Diameter	Inlet	4.975 - 4.990 mm (standard)
		4.965 mm (service limit)
	Exhaust	4.970 - 4.980 mm (standard)
		4.960 mm (service limit)
Valve Guide Bore Diameter	Inlet	5.000 - 5.015 mm (standard)
		5.043 mm (service limit)
	Exhaust	5.000 - 5.015 mm (standard)
		5.043 mm (service limit)
Valve Stem to Guide Clearance	Inlet	0.010 - 0.040 mm (standard)
		0.078 mm (service limit)
	Exhaust	0.020 - 0.045 mm (standard)
		0.083 mm (service limit)
Valve Seat Width (in head)	Inlet	1.000 - 1.100 mm (standard)
		1.500 mm (service limit)
	Exhaust	1.200 - 1.300 mm (standard)
		1.700 mm (service limit)
Valve Seat Width (valve)		1.50 - 1.85 mm
Valve Seat Angle		90° inclusive
Valve Spring Length		49.9 mm
Inlet/Exhaust Valve Spring 'Load at Length'		214 N +/- 10 at 39.5 mm
Valve Clearance	Inlet	0.05 - 0.13 mm
	Exhaust	0.08 - 0.18 mm

Camshafts

Camshaft Timing (at 1 mm lift)	Inlet	Open 5.0° ATDC
		Close 41.0° ABDC
		Duration 216°
	Exhaust	Open 39.0° BBDC
		Close 4.0° BTDC
		Duration 215°
Camshaft Journal Diameter		22.930 - 22.960 mm
Camshaft Journal Clearance		0.040 - 0.091 mm (standard)
		0.130 mm (service limit)
Camshaft Journal Bore Diameter		23.000 - 23.021 mm
Camshaft End Float		0.05 - 0.20 (standard)
Camshaft Run-out		0.015 mm (standard)

Clutch and Primary Drive

Primary Drive Type	Gear
Reduction Ratio	1.26:1 (93/74)
Clutch Type	Wet multi-plate
No. of Friction Plates	8
Steel Plate Flatness Limit	0.15 mm
Friction Plate Flatness Limit	0.20 mm
Friction Plate Thickness (new)	2.90 - 3.10 mm
Friction Plate Thickness (service limit)	2.80 mm
Clutch Pack Height	38.00 mm + 0.34/-0.66 mm
Clutch Actuation Method	Cable
Cable Free Play (at lever)	2.0 - 3.0 mm

Specifications

Engine

Engine Configuration	Liquid cooled parallel twin, 270° firing angle
Arrangement	Transverse in-line
Displacement	1200 cc
Bore x Stroke	97.6 x 80 mm
Compression Ratio	10.00:1
Cylinder numbering	Left to right
Firing Order	1-2

Piston

Cylinder Barrel Diameter - 10 mm from the top of the barrel		97.585 - 97.601 mm (standard)
Cylinder Barrel Diameter - 97 mm from the top of the barrel		97.600 - 97.615 mm (standard)
Piston Diameter		97.570 - 97.580 mm (standard)
		97.530 mm (service limit)
Piston Ring to Groove Clearance	Top	0.02 - 0.07 mm (standard)
		0.085 mm (service limit)
	Second	0.02 - 0.06 mm (standard)
		0.075 mm (service limit)
Piston Ring Groove Width	Top	1.21 - 1.24 mm (standard)
	Second	1.01 - 1.03 mm (standard)
	Oil	2.51 - 2.53 mm (standard and service limit)
Piston Ring End Gap	Top	0.183 - 0.383 mm (standard)
		0.503 mm (service limit)
	Second	0.353 - 0.553 mm (standard)
		0.673 mm (service limit)
	Oil	0.153 - 0.703 mm (standard)
		0.843 mm (service limit)
Gudgeon Pin Bore Diameter In Piston		21.004 - 21.012 mm (standard)
		21.040 mm (service limit)
Gudgeon Pin Diameter		20.995 - 21.000 mm (standard)
		20.985 mm (service limit)
Connecting Rod Small End Diameter		21.016 - 21.029 mm (standard)
		21.039 mm (service limit)
Connecting Rod Big End Diameter		41.000 - 41.009 mm (standard)
Connecting Rod Big End Side Clearance		0.15 - 0.30 mm (standard)
		0.50 mm (service limit)

Crankshaft

Crankshaft Big End Journal Diameter	38.000- 37.984 mm (standard)
	37.9469 mm (service limit)
Crankshaft Big End Bearing Clearance	0.036 - 0.061 mm (standard)
	0.100 mm (service limit)
Crankshaft Main Journal Diameter	43.108 - 43.092 mm (standard)
	43.052 mm (service limit)
Crankshaft Main Bearing Clearance	0.018 - 0.042 mm (standard)
	0.100 mm (service limit)
Crankshaft End Float	0.05 - 0.20 mm (standard)
	0.50 mm (service limit)
Crankshaft Run-out	0.02 mm (standard)
	0.035 mm (service limit)

Transmission

Type	6 Speed, Constant Mesh
Gear Ratios Primary	1.26:1 (93/74)
1st	3.50:1 (49/14)
2nd	2.50:1 (45/18)
3rd	1.85:1 (37/20)
4th	1.48:1 (37/25)
5th	1.30:1 (35/27)
6th	1.17:1 (34/29)
Gear Selector Fork Thickness	5.90 - 6.00 mm (standard)
	5.80 mm (service limit)
Gear Selector Groove Width	6.10 - 6.20 mm (standard)
	6.30 mm (service limit)
Gear Selector Fork to Groove Clearance	0.1 - 0.3mm (standard)
	0.50 mm (service limit)

Specifications

Final Drive

Final Drive Type	Chain - DID 520 VM2, 102 links
Final Drive Ratio	2.41:1 (41/17)
Drive Chain Slack	See Final Drive Chain Adjustment, page 623

Lubrication

Oil Capacity (including filter, dry fill)	3.80 litres
Oil and Filter Change	3.40 litres
Oil Change only	3.20 litres
Recommended Oil Approval Rating	API SH (or higher) and JASO MA
Viscosity	10W/40 or 10W/50
Type	Semi or fully synthetic
Oil Pressure (in main gallery)	3.00 - 3.60 bar at 3,500 rpm
Oil Pump Rotor Tip Clearance	0.15 mm (standard)
	0.20 (service limit)
Oil Pump Body Clearance	0.15 - 0.239 mm (standard)
	0.369 mm (service limits)
Oil Pump Rotor End Float	0.04 - 0.09 mm (standard)
	0.12 mm (service limit)

Specifications

Ignition System

Type	Digital electronic
Electronic Rev-Limiter	7,000 rpm
Pick up Coil Air Gap	Fixed, not adjustable
Primary Coil Resistance	0.185 Kohms
Ignition Coil Type	Inductive, plug top
Spark Plug Type	NGK LMAR8A-9
Spark Plug Gap	0.9 mm +0.0/-0.1 mm

Fuel System

Fuel Type	Unleaded, 91 RON (CLC or AKI octane rating (R+M)/2 of 87 or higher)
Fuel Tank Capacity	11.8 litres
Low Level Warning Lamp	3.5 litres remaining
Fuel Pump Type	Submerged, electric
Fuel Pressure (nominal)	3.5 bar
Purge Control System	Modulated, vacuum

Emmissions Control System

Type	Multi point sequential
Idle Speed	1,000 rpm
Injector Type	Multi hole, solenoid operated plate valve
Throttle	Electronically controlled throttle bodies
Idle Speed Control	Electronic
Control Sensors	Atmospheric air pressure, throttle position, twist grip position, coolant temperature, crankshaft position, oxygen sensor, intake air temperature, gear position, MAP, vehicle speed (from ABS)
Catalysts	One, in the catalytic converter box
Oxygen Sensor	One per cylinder, heated, in header pipe
Evaporative Control	Activated carbon canister (certain markets only)

Cooling System

Coolant Mixture	Pre-mixed
Antifreeze Type	Triumph HD4X Hybrid OAT coolant
Cooling System Capacity	1.56 litres
Radiator Cap Opening Pressure	1.2 bar
Thermostat Opening Temperature	88°C
Cooling Fan Switch On Temperature	103°C
Temperature Gauge Sensor Resistance	173 Ohms (+/- 10%) at 100°C

Specifications

Suspension

Front Fork Travel	120 mm
Recommended Fork Oil Grade	KHL34-G10
Oil Level (spring, spring seat and spacer removed and fork fully compressed) - Right hand fork	126 mm
Oil Level (spring, spring seat and spacer removed and fork fully compressed) - Left hand fork	165 mm
Oil Volume (dry fill)	434 cc
Front Fork Pull Through	25.6 mm from lower edge of top yoke to the top of the inner tube (not the top cap)
Fork Spring Rate	K = 8.1 N/mm
Rear Wheel Travel	120.3 mm

Brakes

Front Type	Two piston sliding caliper acting on twin disc
Front Caliper Piston Diameter	27 mm
Front Disc Diameter	310 mm
Front Disc Thickness	5.5 mm (standard)
	5.0 mm (service limit)
Front Disc Run-out Max.	0.25 mm
Front Master Cylinder Diameter	14 mm
Recommended Fluid	DOT 4
Rear Type	Twin piston sliding caliper acting on single disc
Rear Caliper Piston Diameter	27 mm
Rear Disc Diameter	255 mm
Rear Disc Thickness	5.5 mm (standard)
	5.0 mm (service limit)
Rear Disc Run-out Max.	0.25 mm
Rear Master Cylinder Diameter	14 mm
Recommended Fluid	DOT 4

Specifications

Frame

Frame Type	Tubular steel
Rake	25.1°
Trail	102.4 mm
Maximum. Payload (rider, passenger, luggage and accessories)	210 kg

Wheels and Tyres

Front Wheel Size	MT 18 x 2.75
Front Wheel Rim Axial run-out	0.6 mm
Front Wheel Rim Radial Run-out	0.6 mm
Rear Wheel Size	MT 17 x 4.25
Rear Wheel Rim Axial run-out	0.6 mm
Rear Wheel Rim Radial Run-out	0.6 mm
Approved Tyres	A list of approved tyres specific to these models is available from your authorised Triumph dealer, or on the Internet at www.triumph.co.uk .

Specifications

Electrical Equipment

Battery Type	YTX12-BS
Battery Rating	12 V - 10 Amp. Hour
Alternator Rating	25 Amps at 1000 rpm
	46.5 Amps at 3000 rpm
Headlight	12 volt, 60/55 watt H4 halogen
Tail/Brake Light	LED
Directional Indicator Lights	12 volt, 10 watt

5 Torque Wrench Settings

Table of Contents

Cylinder Head	57
Clutch	58
Balancer, Crankshaft and Crankcase	59
Engine Covers	60
Transmission.....	61
Lubrication System.....	62
Final Drive	63
Cooling System	64
Fuel System, Exhaust System and Airbox	65
Front Suspension	67
Rear Suspension.....	68
Wheels	69
Front Brakes.....	70
Rear Brakes.....	71
ABS System.....	72
Frame, Footrests, Control Plates and Engine Mountings.....	73
Electrical	74

Cylinder Head

Application	Torque (Nm)	Notes
Camshaft cover to cylinder head	14 Nm	See Camshaft Cover - Installation, page 104
Camshaft drive chain tensioner to cylinder barrel	16 Nm	
Camshaft drive chain tensioner blade to cylinder head	10 Nm	Fit new fixing(s) if loosened or removed
Camshaft frame to cylinder head	10 Nm	See Camshaft - Installation, page 129
Camshaft sprocket to camshaft	22 Nm	Fit new fixing(s) if loosened or removed
Cylinder head to crankcase	*	See Cylinder Head - Installation, page 135
Camshaft idler shaft bolt	10 Nm	Fit new fixing(s) if loosened or removed
Flanged plug to cylinder head	22 Nm	Fit new fixing(s) if loosened or removed
Spark plugs	12 Nm	
Exhaust stud to cylinder head	10 Nm	Fit new fixing(s) if loosened or removed
Timing torque limiter	0.6 Nm	

Torque Wrench Settings

Clutch

Application	Torque (Nm)	Notes
Clutch centre nut	98 Nm	Fit new fixing(s) if loosened or removed Fit new Belleville washer
Clutch pressure plate to centre	10 Nm	
Clutch lever nut	3.5 Nm	
Clutch lever clamp bolts	12 Nm	
Switch housing screws	2.5 Nm	
Clutch switch to switch housing	2.5 Nm	
Clutch cable lower lock nut	3 Nm	
Clutch cable bracket	1.5 Nm	

Balancer, Crankshaft and Crankcase

Application	Torque (Nm)	Notes
Crankcase to crankcase bolts	*	See Crankcase - Assembly, page 171
Oil level sight glass	30 Nm	
Oil filler cap	3 Nm	
Dry seal plug	23 Nm	Fit new fixing(s) if loosened or removed
Flanged plug	10 Nm	
Breather plate to crankcase	12 Nm	Fit new fixing(s) if loosened or removed
Crankcase breather pipes to crankcase	9 Nm	Fit new fixing(s) if loosened or removed
Connecting rod big end bolts	*	See Connecting Rod - Installation, page 178
Sprag thrust washer fixings	12 Nm	Fit new fixing(s) if loosened or removed
Sprag clutch housing fixings	16 Nm	See Starter Drive/Sprag Clutch - Installation, page 236
Plug, front balancer shaft adjuster clamp	23 Nm	
Rear dead shaft retaining washer	12 Nm	Fit new fixing(s) if loosened or removed
Dead shaft clamp pinch bolt	10 Nm	
Dead shaft clamp retaining bolt	10 Nm	Fit new fixing(s) if loosened or removed
Dead shaft pre load	*	See Balancer Shafts Dynamic Adjustment, page 197

Engine Covers

Application	Torque (Nm)	Notes
Clutch cover to crankcase	10 Nm	Fit new fixing(s) if loosened or removed See Clutch Cover - Installation, page 98
Clutch cover embelisher to clutch cover	4 Nm	Fit new fixing(s) if loosened or removed
Clutch cover plug	3 Nm	
Sound suppression to clutch cover fixings	6 Nm	Fit new fixing(s) if loosened or removed
Cable cover to alternator cover	6 Nm	Fit new fixing(s) if loosened or removed
Alternator cover embelisher to cover	4 Nm	Fit new fixing(s) if loosened or removed
Front sprocket cover to crankcase	9 Nm	
Mesh cover to sprocket cover	4 Nm	
Front sprocket cover inner	6 Nm	Fit new fixing(s) if loosened or removed
Alternator cover to crankcase	10 Nm	
Sump to crankcase	10 Nm	
Sump plug	25 Nm	Fit new sealing washer(s)
Baffle to sump	6 Nm	

Transmission

Application	Torque (Nm)	Notes
Front sprocket to output shaft nut	180 Nm	Fit new fixing(s) if loosened or removed
Input shaft bearing retainer	7 Nm	Fit new fixing(s) if loosened or removed
Input selector fork plug	22 Nm	
Detent wheel to selector drum	12 Nm	Fit new fixing(s) if loosened or removed
Detent arm fixing	12 Nm	Fit new fixing(s) if loosened or removed
Detent arm spring fixing	12 Nm	
Gear change pedal rubber pin	12 Nm	
Selector drum bearing retaining screw	12 Nm	Fit new fixing(s) if loosened or removed
Output selector shaft retainer	12 Nm	Fit new fixing(s) if loosened or removed
Gear change pedal pinch bolt	8 Nm	
Starter drive flywheel	*	See Starter Drive/Sprag Clutch - Installation, page 236

Lubrication System

Application	Torque (Nm)	Notes
Oil pressure relief valve plug	10 Nm	
Oil pressure switch	15 Nm	Fit new sealing washer(s)
Oil filter adapter	10 Nm	
Oil filter	10 Nm	Apply clean engine oil to the seal(s)
Oil pump to crankcase	10 Nm	Fit new fixing(s) if loosened or removed
Oil cooling jet (pistons)	9 Nm	Fit new fixing(s) if loosened or removed
Oil pump drive chain guide fixings	9 Nm	Fit new fixing(s) if loosened or removed
Sump baffle plate to sump	6 Nm	
Oil pump drive sprocket to oil pump	12 Nm	
Oil pump rotor cover to oil pump body	11 Nm	
oil pump auxiliary chain guard	9 Nm	Fit new fixing(s) if loosened or removed

Final Drive

Application	Torque (Nm)	Notes
Rear sprocket to cush drive	55 Nm	See Rear Sprocket - Installation, page 631

Cooling System

Application	Torque (Nm)	Notes
Radiator to frame upper	6 Nm	
Thermostat housing to cylinder head	9 Nm	
Coolant expansion tank	4 Nm	
Coolant temperature sensor	18 Nm	Apply ThreeBond 1374 to the threads
Coolant return elbow to crankcase	12 Nm	Fit new fixing(s) if loosened or removed
Coolant manifold to crankcase	9 Nm	Fit new fixing(s) if loosened or removed
Coolant filler neck	3 Nm	
Radiator Grille	5 Nm	

Fuel System, Exhaust System and Airbox

Application	Torque (Nm)	Notes
Fuel tank to frame (pivot nut)	8 Nm	
Fuel pump mounting plate to fuel tank	5 Nm	
Fuel pump mounting bracket to fuel pump plate	7 Nm	Fit new fixing(s) if loosened or removed
Fuel hose bracket to fuel pump mounting bracket	4 Nm	
Fuel pump baffle clamp	3 Nm	
Fuel hose to fuel pump	15 Nm	Fit new sealing washer(s)
Exhaust intermediate pipe to catalytic converter clamp	10 Nm	
Right hand exhaust intermediate pipe to frame	19 Nm	
Exhaust headers to catalytic converter clamp	10 Nm	
Exhaust silencer to frame	19 Nm	
Left hand silencer to footrest hanger	19 Nm	
Exhaust headers to cylinder head	19 Nm	
Heat shield to exhaust intermediate pipe	9 Nm	
Exhaust catalytic converter heat shield to crankcase	19 Nm	
Catalytic converter to heat shield	15 Nm	
Catalytic converter front shield	5 Nm	
Exhaust silencer to intermediate pipe	20 Nm	
Oxygen sensor	25 Nm	
Airbox to frame	6 Nm	
Air intake hose clips	1.5 Nm	
Evaporative canister	1.4 Nm	
Crankshaft position sensor	6 Nm	Fit new fixing(s) if loosened or removed
Ambient air pressure sensor	2 Nm	
Air temperature sensor	1.5 Nm	
Gear position sensor	5 Nm	Fit new fixing(s) if loosened or removed
Immobiliser module	2 Nm	
Immobiliser module bracket	4 Nm	
Throttle position sensor cover	3 Nm	
Fuel rail to cylinder head	6 Nm	
Ignition coil assembly fixings	3 Nm	Fit new fixing(s) if loosened or removed
Air intake duct	1.5 Nm	
Air intake finisher	3 Nm	
Air intake finisher mounting	3 Nm	
Purge valve bracket	1.5 Nm	
Purge valve	1.5 Nm	
Air filter cover to airbox	1.5 Nm	
MAP sensor	2 Nm	Fit new fixing(s) if loosened or removed
Engine ECM bracket	4 Nm	

Torque Wrench Settings

Application	Torque (Nm)	Notes
Harness guide to crankcase (GPS)	4 Nm	Fit new fixing(s) if loosened or removed
Relay bracket	1.5 Nm	
Engine breather pipe clip	3 Nm	
Engine breather pipe mounting bracket	1.5 Nm	
Roll over valve bracket	1.5 Nm	
Throttle body transition piece to cylinder head	9 Nm	
Multiplug mounting bracket	3 Nm	Fit new fixing(s) if loosened or removed

Front Suspension

Application	Torque (Nm)	Notes
Upper yoke centre nut	90 Nm	
Upper yoke pinch bolt	24 Nm	
Lower yoke pinch bolt	45 Nm	
Instrument bracket to upper yoke	8 Nm	
Damping cylinder bolt	30 Nm	Fit new sealing washer(s) Apply ThreeBond 1342 to the threads
Damping rod to top cap lock nut	15 Nm	
Handlebar clamp bolt	24 Nm	
Heated grip to handlebar	2.5 Nm	Fit new fixing(s) if loosened or removed
Heated grip housings	0.5 Nm	
Handlebar end weights	5 Nm	Fit new fixing(s) if loosened or removed
Headstock bearing adjuster and lock nut	*	See Steering Head Bearing - Adjustment, page 494
Right hand switch housing fixings	1 Nm	
Left hand switch housing fixings	1 Nm	
Handlebar risers	38 Nm	
Twist grip housing	3.5 Nm	
Fork top cap	22 Nm	

Rear Suspension

Application	Torque (Nm)	Notes
Swinging arm pivot nut	110 Nm	See Swinging Arm - Installation, page 512
Swinging arm pivot bolt adjuster	6 Nm	See Swinging Arm - Installation, page 512
Drive chain slack adjuster lock nut	20 Nm	
Drive chain guard fixings	9 Nm	
Drive chain rubbing strip	9 Nm	
Rear suspension unit upper mounting bolt	28 Nm	
Rear suspension unit lower mounting bolt	28 Nm	

Wheels

Application	Torque (Nm)	Notes
Front wheel spindle/axle bolt	65 Nm	
Fork to wheel spindle pinch bolts	23 Nm	
Rear wheel spindle lock nut	110 Nm	
Rear sprocket to sprocket carrier	55 Nm	Fit new fixing(s) if loosened or removed
Sprocket carrier stud	30 Nm	See Rear Sprocket - Installation, page 631

Torque Wrench Settings

Front Brakes

Application	Torque (Nm)	Notes
Clutch cover to crankcase	10 Nm	Fit new fixing(s) if loosened or removed See Clutch Cover - Installation, page 98
Clutch cover embelisher to clutch cover	4 Nm	Fit new fixing(s) if loosened or removed
Clutch cover plug	3 Nm	
Sound suppression to clutch cover fixings	6 Nm	Fit new fixing(s) if loosened or removed
Cable cover to alternator cover	6 Nm	Fit new fixing(s) if loosened or removed
Alternator cover embelisher to cover	4 Nm	Fit new fixing(s) if loosened or removed
Front sprocket cover to crankcase	9 Nm	
Mesh cover to sprocket cover	4 Nm	
Front sprocket cover inner	6 Nm	Fit new fixing(s) if loosened or removed
Alternator cover to crankcase	10 Nm	
Sump to crankcase	10 Nm	
Sump plug	25 Nm	Fit new sealing washer(s)
Baffle to sump	6 Nm	

Rear Brakes

Application	Torque (Nm)	Notes
Brake hose to rear caliper	25 Nm	Fit new sealing washer(s)
Brake master cylinder to frame	24 Nm	
Master cylinder reservoir cap screws	1 Nm	
Brake master cylinder reservoir to relay bracket	3 Nm	
Brake hose to master cylinder	25 Nm	Fit new sealing washer(s)
Brake light switch bracket to control plate	5 Nm	
Brake hose P-clip to engine	5 Nm	
Brake caliper to carrier	40 Nm	
Brake disc to wheel	22 Nm	Fit new fixing(s) if loosened or removed
Brake hose P-clip bolt	5 Nm	
Brake pad retaining pin	18 Nm	

Torque Wrench Settings

ABS System

Application	Torque (Nm)	Notes
ABS modulator bracket to frame	9 Nm	Fit new fixing(s) if loosened or removed
ABS pulser ring to front brake disc	5 Nm	Fit new fixing(s) if loosened or removed
ABS modulator to bracket	9 Nm	Fit new fixing(s) if loosened or removed
Brake line union block to headstock	8 Nm	Fit new fixing(s) if loosened or removed
Anti-rotation moulding to ABS modulator	5 Nm	Fit new fixing(s) if loosened or removed
Rear brake line to modulator P-clip	5 Nm	
Rear ABS pulser ring to wheel	5 Nm	Fit new fixing(s) if loosened or removed
Hose routing moulding to crankcase	3 Nm	Fit new fixing(s) if loosened or removed
Brake line union to modulator	25 Nm	Fit new sealing washer(s)
Front brake hose to hard line union	25 Nm	Fit new sealing washer(s)
Hose guide to swinging arm	3 Nm	Fit new fixing(s) if loosened or removed

Frame, Footrests, Control Plates and Engine Mountings

Application	Torque (Nm)	Notes
Footrest rubber inserts	6 Nm	
Bank angle indicator	9 Nm	
Front control plate	24 Nm	
Rear footrest hanger	24 Nm	
Side stand switch	3 Nm	
Side and centre stand spring peg	7 Nm	
Front right hand cylinder head bolt to frame (stage one)	24 Nm	See Engine - Installation, page 265
Front right hand cylinder head bolt to frame (stage 2)	105 Nm	See Engine - Installation, page 265
Frame adjuster	5 Nm	See Engine - Installation, page 265
Front left hand cylinder head bolt to frame	105 Nm	See Engine - Installation, page 265
Lower rear crankcase mounting	80 Nm	See Engine - Installation, page 265
Upper rear crankcase mounting	80 Nm	See Engine - Installation, page 265
Cradle to crankcase mounting bolts	105 Nm	See Engine - Installation, page 265
Cradle to frame mounting bolts	40 Nm	
Front mudguard bracket to forks	12 Nm	Fit new fixing(s) if loosened or removed
Front mudguard to bracket	3 Nm	
Front mudguard stays to front forks	8 Nm	
Front mudguard stat to mudguard	3 Nm	
Rear mudguard to frame	10 Nm	Fit new fixing(s) if loosened or removed
Mirror	20 Nm	
Seat lock to frame	6 Nm	
Front sprocket inner cover	6 Nm	
Grab rail mounting assembly to frame	20 Nm	
Grab rail to grab rail mounting	20 Nm	
Rear light harness cover	2 Nm	
Sump guard bracket	19 Nm	Fit new fixing(s) if loosened or removed

Torque Wrench Settings

Electrical

Application	Torque (Nm)	Notes
Alternator rotor to crankshaft	*	see Alternator Rotor - Installation, page 705
Alternator stator to cover	12 Nm	
Alternator regulator to bracket	4 Nm	
Starter motor to crankcase	10 Nm	
Starter motor power lead connection	5 Nm	
Starter motor solenoid bracket	1.5 Nm	
Starter motor solenoid lead connection	4 Nm	
Spark plug	12 Nm	
Alternator regulator/rectifier	4 Nm	
Immobiliser ECU	2 Nm	
Ignition switch	12 Nm	
Headstock tidy	4 Nm	
Headlight vertical adjuster	10 Nm	
Rear light	2 Nm	
Rear light assembly	5 Nm	Fit new fixing(s) if loosened or removed
Front and rear direction indicator	3 Nm	
Fuse box bracket	3 Nm	
Wire guide to headstock	1.5 Nm	
Main harness to frame	3 Nm	
Instrument bracket to upper yoke	8 Nm	
Instruments	3 Nm	
Instruments cover	3 Nm	
Horn	24 Nm	
Rear light harness cover	4 Nm	
Alternator stator to alternator cover	12 Nm	
Ignition switch	12 Nm	
Tool 3880606 lock nut	10 Nm	
Fall detection switch bracket	3 Nm	
Fall detection switch	3 Nm	Fit new fixing(s) if loosened or removed
Relay bracket	1.5 Nm	
Headlight connector bracket to headlight bowl	1.5 Nm	

6 Routings

Table of Contents

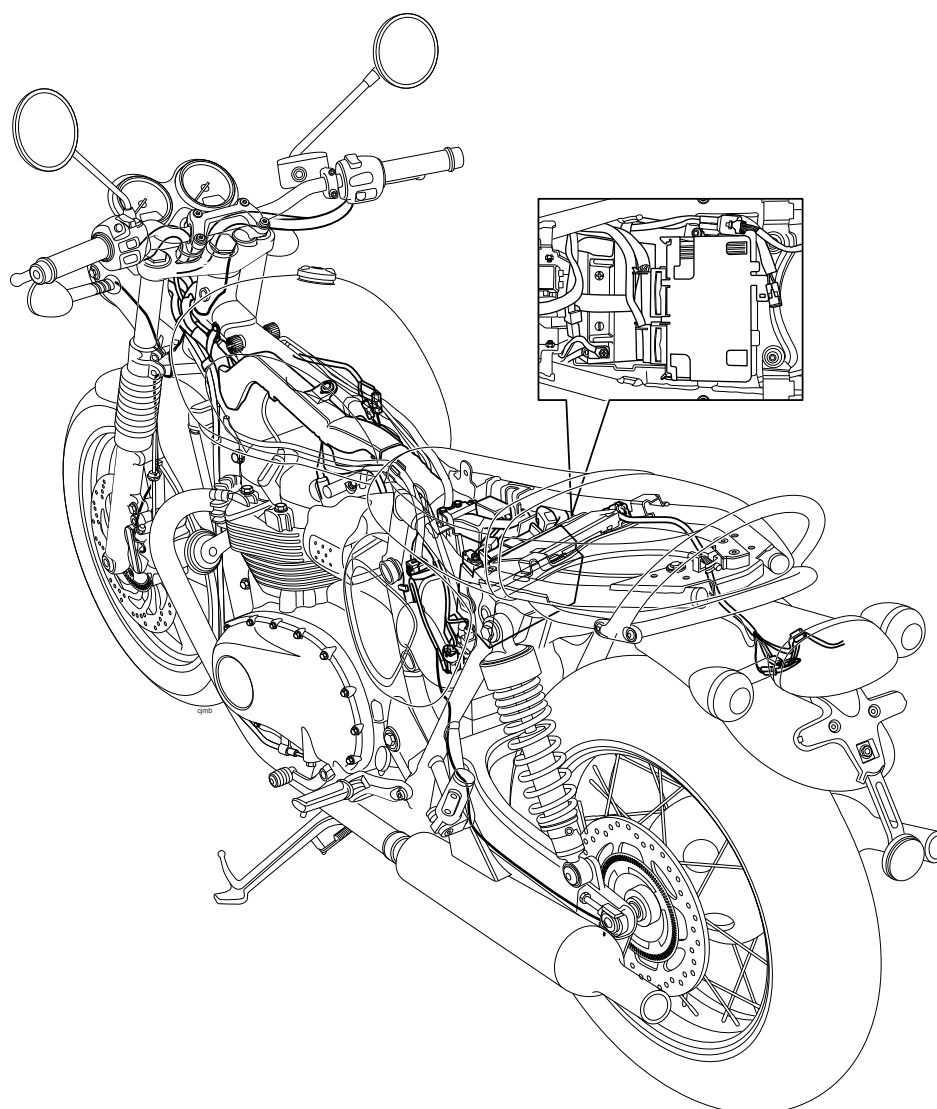
Main Wiring Harness Routing 77

Clutch Cable Routing 78

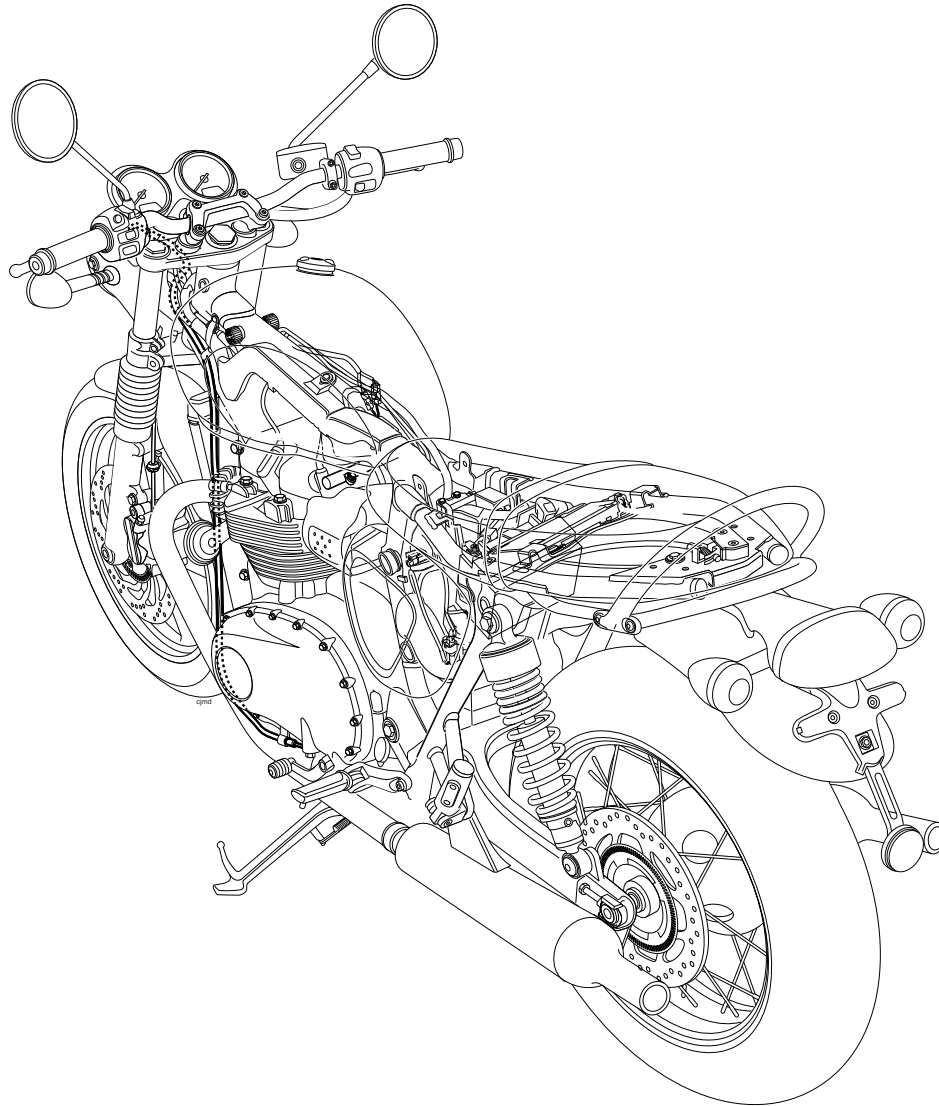
ABS Brake Hose routing 79

Evaporative Hose Routing 80

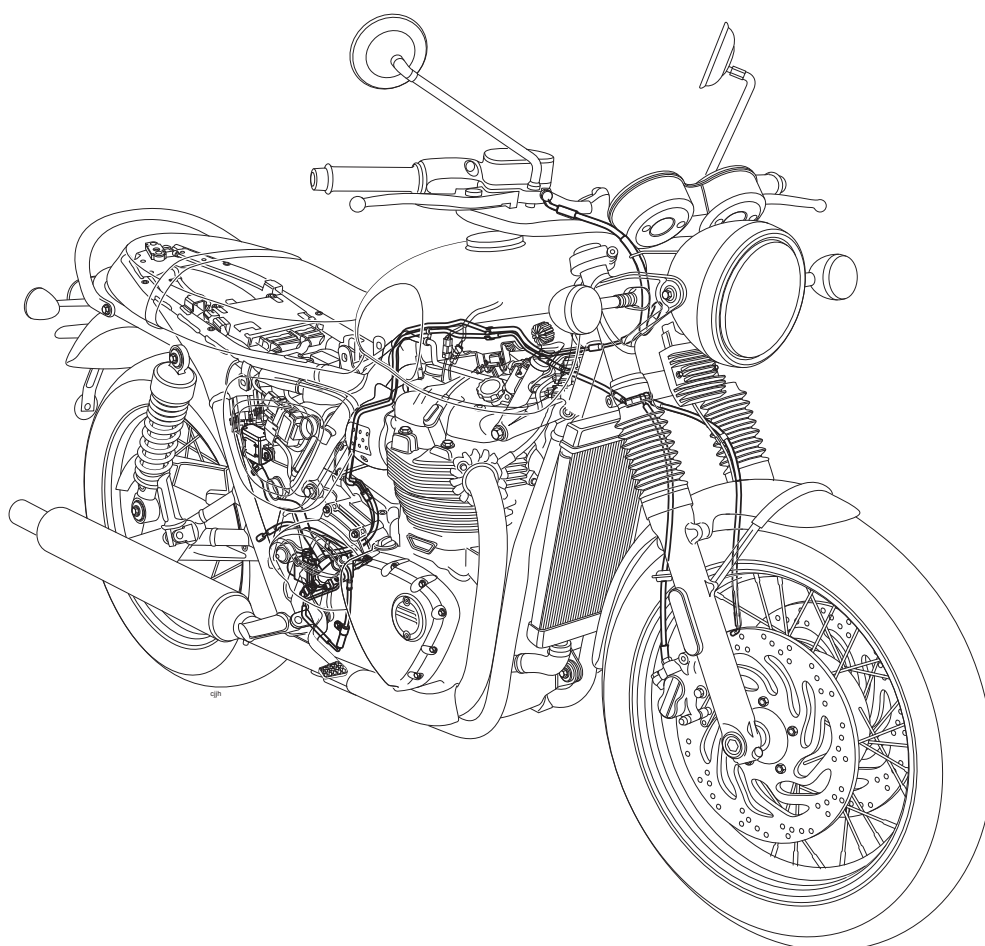
Main Wiring Harness Routing



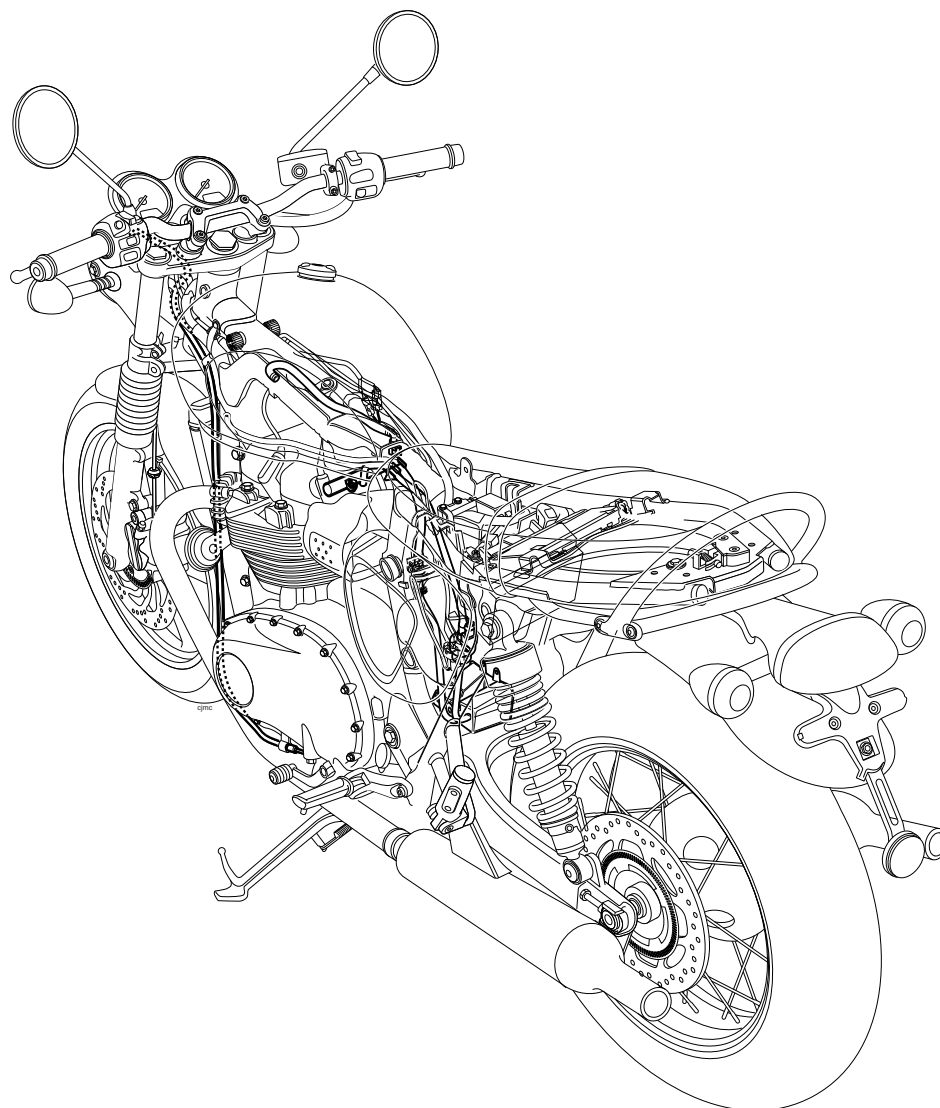
Clutch Cable Routing



ABS Brake Hose routing



Evaporative Hose Routing



7 Routine Maintenance

Table of Contents

Scheduled Maintenance..... 83

Scheduled Maintenance Table..... 84

Scheduled Maintenance

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.

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 may lead to loss of control and an accident.

Weather, terrain and geographical location affect 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.

Special tools, knowledge and training are required in order to correctly carry out the maintenance items listed in the scheduled maintenance chart. Only an authorised Triumph dealer will have this knowledge and equipment.

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.

2. Motorcycles travelling approximately 10,000 miles (16,000 km) per year must have the annual maintenance and the specified mileage based items carried out together.

3. Motorcycles travelling more than 10,000 miles (16,000 km) per year must have the mileage based items maintained as the motorcycle reaches the specified mileage. In addition to this, annual based items will require maintenance at their specified annual intervals.

In all cases maintenance must be carried out at or before the specified maintenance intervals shown. Consult an authorised Triumph dealer for advice on which maintenance schedule is most suitable for your motorcycle.

Triumph Motorcycles cannot accept any responsibility for damage or injury resulting from incorrect maintenance or improper adjustment.

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. The information that follows describes the procedures to follow when carrying out the daily checks and some simple maintenance and adjustment items.

Scheduled maintenance may be carried out by your authorised Triumph dealer in three ways; annual maintenance, mileage based maintenance or a combination of both, depending on the mileage the motorcycle travels each year.

- 1. Motorcycles travelling less than 10,000 miles (16,000 km) per year must be maintained annually. In addition to this, mileage based items require maintenance at their specified intervals, as the motorcycle reaches this mileage.**

Scheduled Maintenance Table

Operation Description	Odometer Reading in Miles (Km) or Time Period, whichever comes first					
		First Service	Annual Service	Mileage Based Service		
	Every	500 (800) 1 month	Year	10,000 and 30,000 (16,000 and 48,000)	20,000 (32,000)	40,000 (64,000)
Lubrication						
Engine - check for leaks	Day	•	•	•	•	•
Engine oil - renew	-	•	•	•	•	•
Engine oil filter - renew	-	•	•	•	•	•
Fuel System and Engine Management						
Fuel system - check for leaks, chafing etc.	Day	•	•	•	•	•
Throttle body plate (butterfly) - check/clean	-			•	•	•
Autoscan - Carry out a full Autoscan using the Triumph Diagnostic Tool (print a customer copy)	-	•	•	•	•	•
Exhaust clamp bolts - check/adjust	-	•	•	•	•	•
Air cleaner - renew	-			•	•	•
Fuel filter† - renew	-				•	•
Throttle bodies - balance	-			•	•	•
Fuel hoses - renew	Every 4 years regardless of mileage					
Evaporative loss hoses* - renew	Every 4 years regardless of mileage					
Ignition System						
Spark plugs - check	-			•		
Spark plugs - renew	-				•	•
Cooling System						
Cooling system - check for leaks	-	•	•	•	•	•
Coolant level - check/adjust	Day	•	•	•	•	•
Coolant - renew	Every 3 years regardless of mileage					
Engine						
Clutch cable - check/adjust	Day	•	•	•	•	•
Valve clearances - check	-				•	•
Wheels and Tyres						
Tyre wear/tyre damage - check	Day	•	•	•	•	•
Tyre pressures - check/adjust	Day	•	•	•	•	•
Wheels - inspect for damage	Day	•	•	•	•	•
Wheels - check wheels for broken or damaged spokes and check spoke tightness (models with spoked wheels only)	Day	•	•	•	•	•

Operation Description	Odometer Reading in Miles (Km) or Time Period, whichever comes first					
		First Service	Annual Service	Mileage Based Service		
	Every	500 (800) 1 month	Year	10,000 and 30,000 (16,000 and 48,000)	20,000 (32,000)	40,000 (64,000)
Wheel bearings - check for wear/smooth operation	-	•	•	•	•	•
Electrical						
All lights, instruments and electrical systems - check	Day	•	•	•	•	•
Steering and Suspension						
Steering - check for free operation	Day	•	•	•	•	•
Forks - check for leaks/smooth operation	Day	•	•	•	•	•
Fork oil - renew	-					•
Headstock bearings - check/adjust	-	•	•	•	•	•
Headstock bearings - lubricate	-				•	•
Brakes						
ABS and immobiliser ECMs - check for stored DTCs	-	•	•	•	•	•
Brake pads - check wear levels	Day	•	•	•	•	•
Brake master cylinders - check for fluid leaks	-	•	•	•	•	•
Brake calipers - check for fluid leaks and seized pistons	-	•	•	•	•	•
Brake fluid levels - check	Day	•	•	•	•	•
Brake fluid - renew	Every 2 years regardless of mileage					
Drive Chain						
Drive chain slack - check/adjust	Day	•	•	•	•	•
Drive chain - wear check	Every 500 miles (800 km)					
Drive chain - lubricate	Every 200 miles (300 km)					
Drive chain rubbing strip - check	-	•	•	•	•	•
Drive chain rubbing strip - renew	-				•	•
General						
Fasteners - inspect visually for security	Day	•	•	•	•	•
Bank angle indicators - inspect visually for wear	Day	•	•	•	•	•
Side stand/Centre stand - check operation	Day	•	•	•	•	•
* Evaporative system fitted to models for certain markets only.						
‡ Models with twin throttle bodies only.						

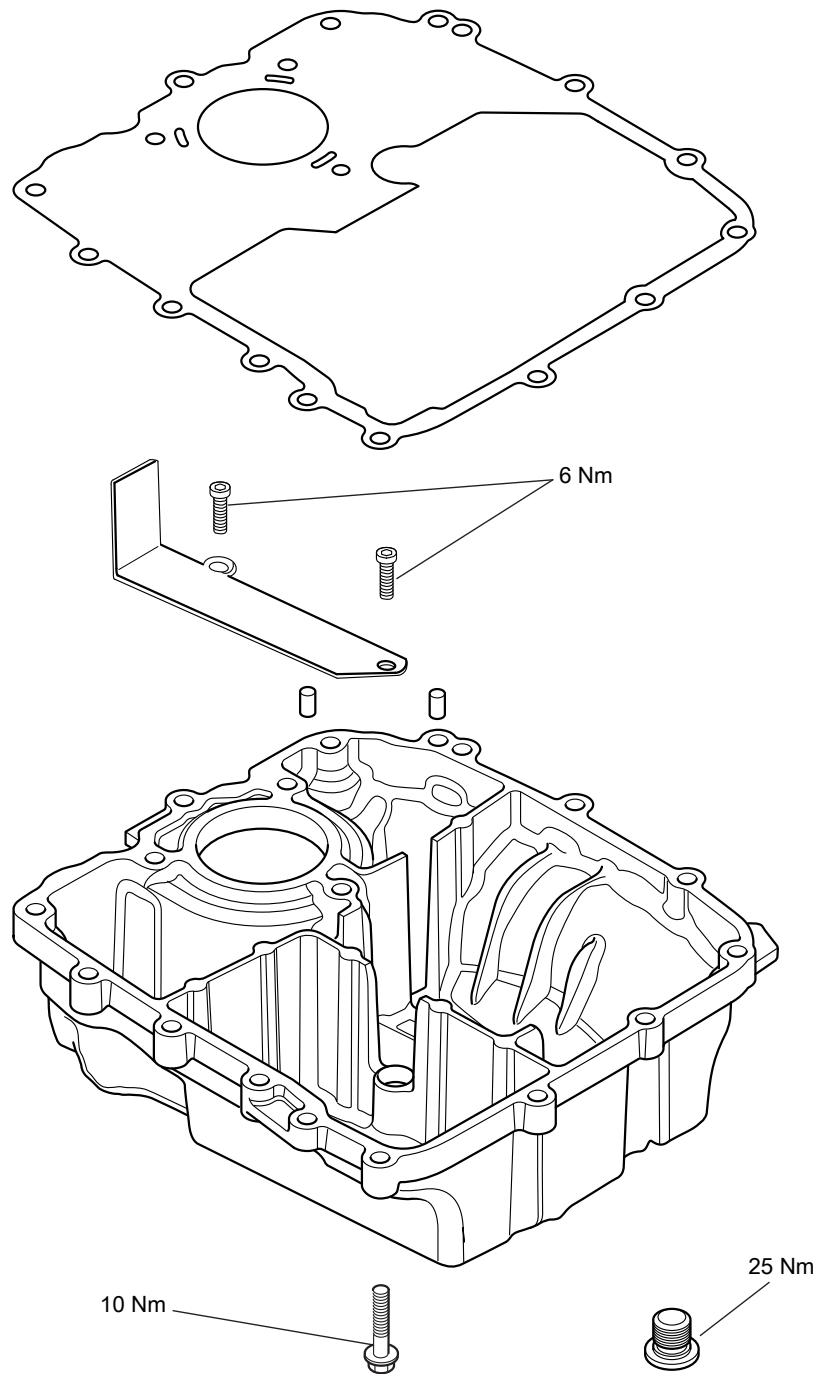
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8 Engine Covers

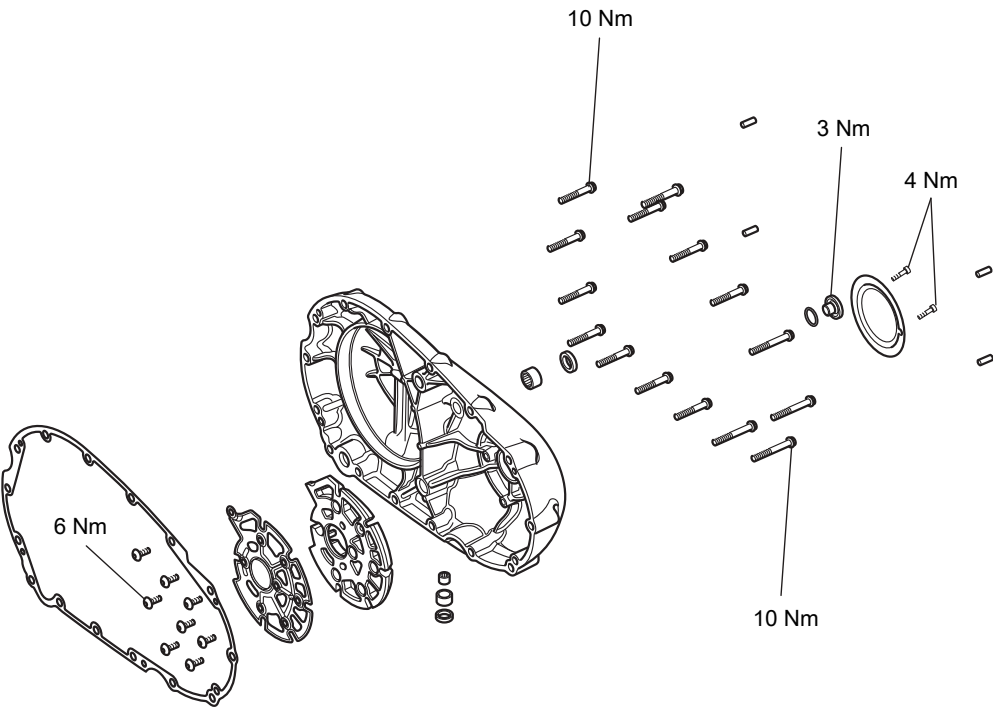
Table of Contents

Exploded View – Sump	89
Exploded View – Clutch Cover.....	90
Exploded View – Alternator Cover	91
Exploded View – Camshaft Cover.....	92
Exploded View – Sprocket Cover	93
Sump - Removal.....	94
Sump - Inspection.....	95
Sump - Installation	95
Clutch Cover - Removal	97
Clutch Cover - Installation	98
Alternator Cover - Removal	99
Alternator Cover - Installation.....	101
Camshaft Cover - Removal	103
Camshaft Cover - Installation.....	104
Front Sprocket Cover - Removal.....	105
Front Sprocket Cover - Inspection.....	105
Front Sprocket Cover - Installation	106

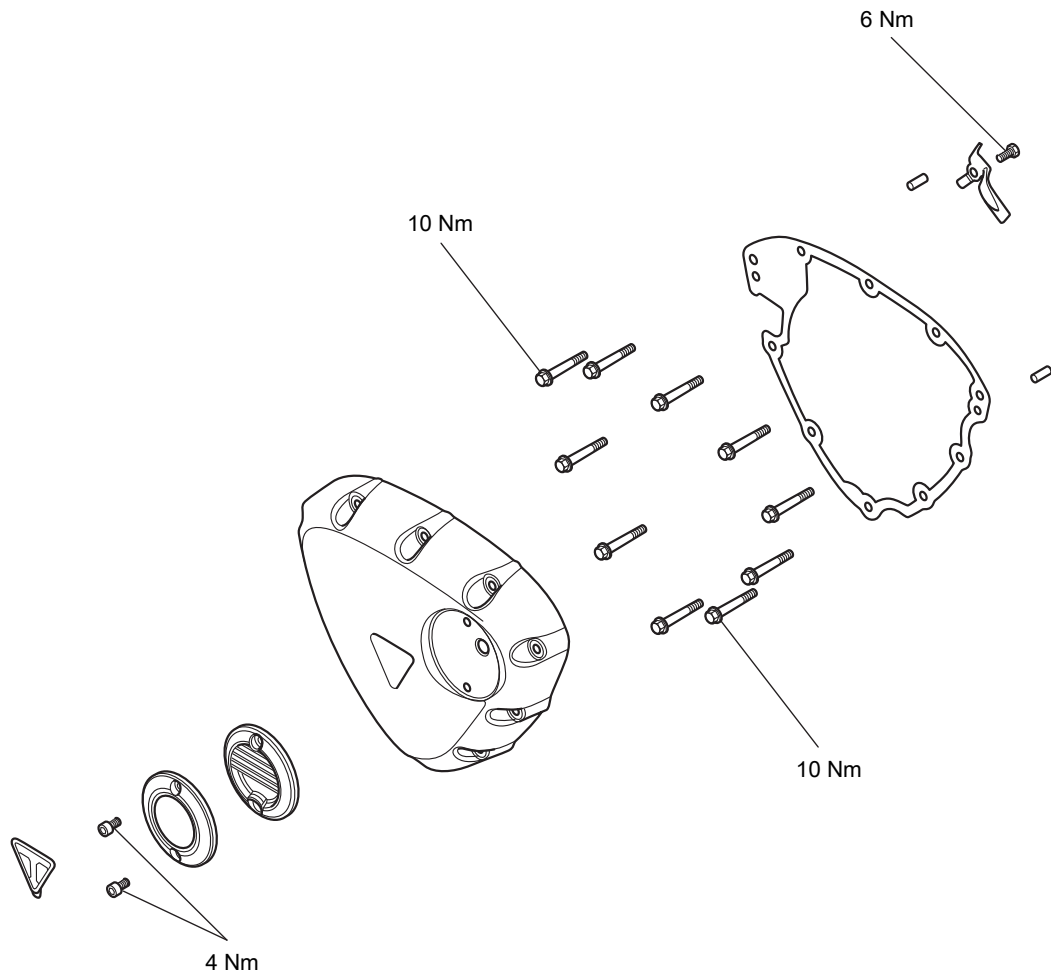
Exploded View - Sump



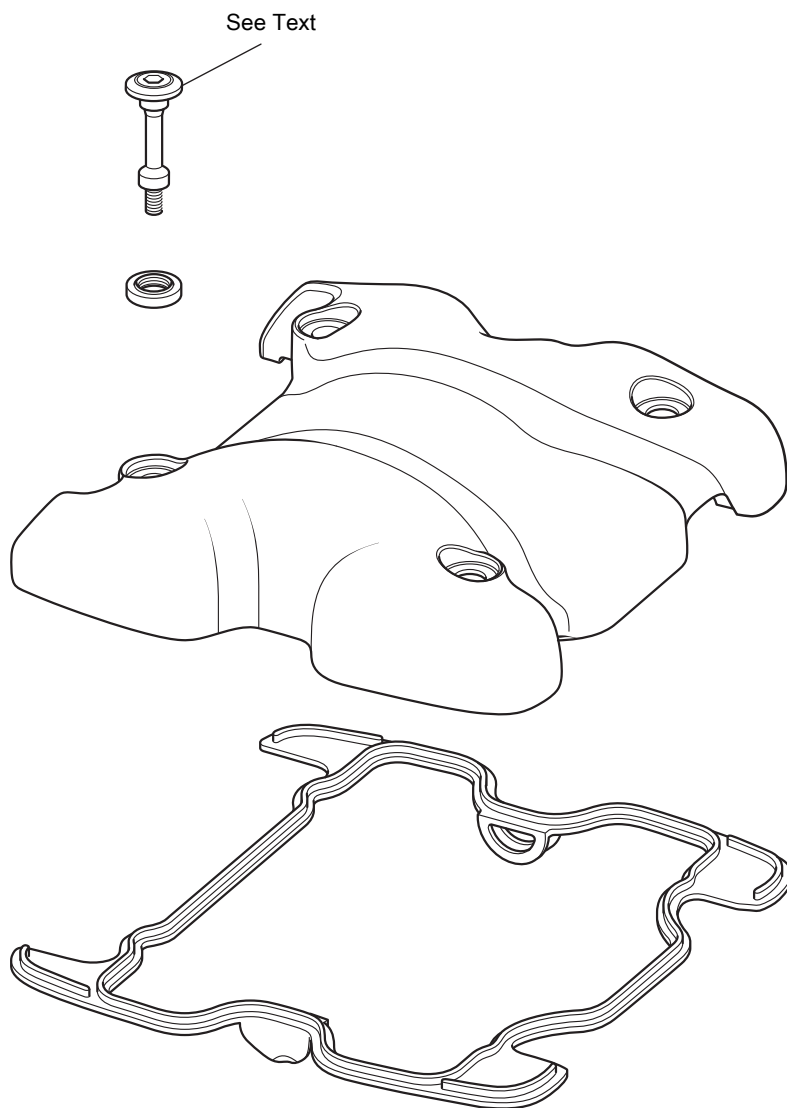
Exploded View – Clutch Cover



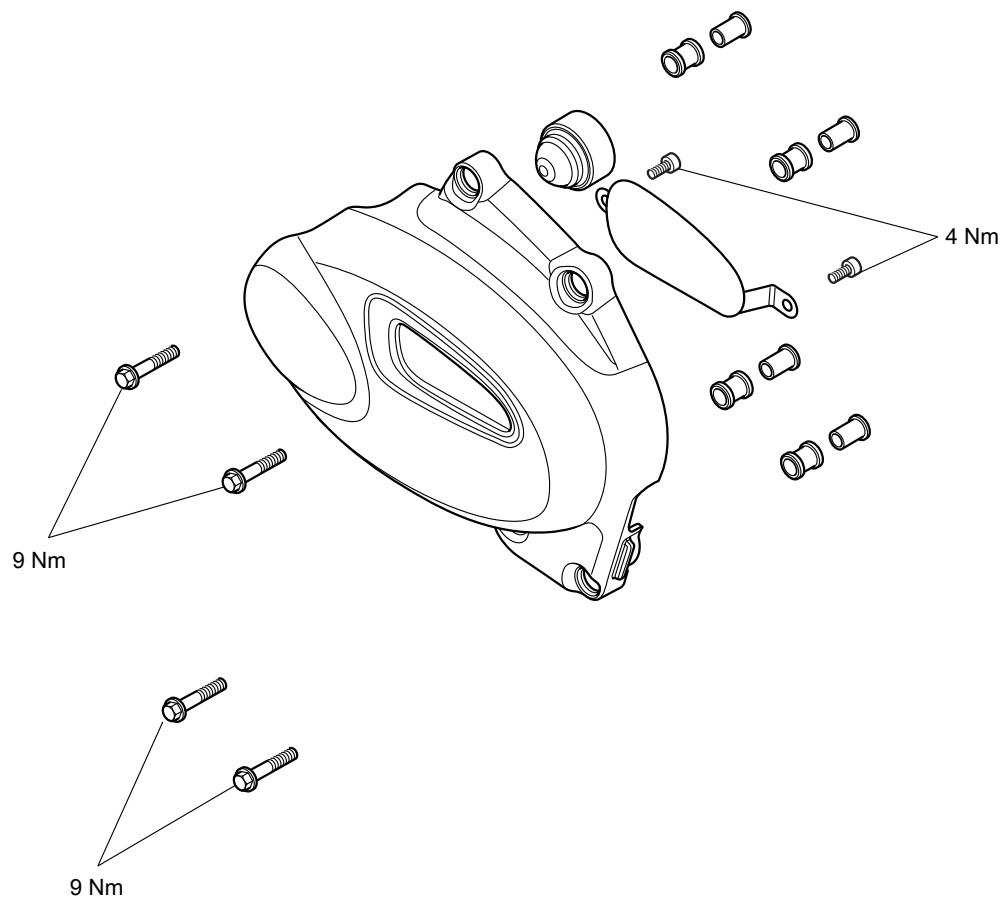
Exploded View – Alternator Cover



Exploded View - Camshaft Cover



Exploded View – Sprocket Cover



Sump - 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.

- Remove the seat (see Seat - Removal, page 645).
- Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
- Remove the fuel tank (see).
- Remove the exhaust system (see Exhaust Silencer - Removal, page 436 and Header and Exhaust Intermediate Pipes - Removal, page 439).
- Remove the engine cradles (see Cradle Assemblies - Removal, page 650).
- Remove the catalytic converter (see Exhaust Catalytic Converter - Removal, page 442).

Warning

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

Warning

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

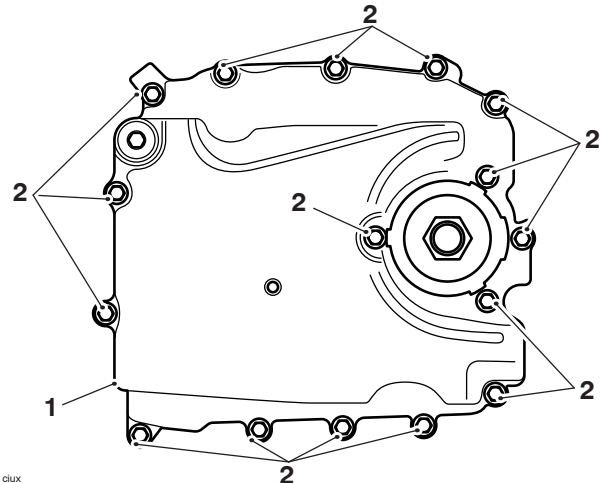
1. Drain the engine oil and remove the oil filter (see Oil and Oil Filter Change, page 246).

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.

2. Remove the sump to lower crankcase fixings.



1. Sump

2. Fixings

3. Release the sump from the lower crankcase.

Note:

- The water pump drain tube may remain attached to the water pump or become detached with the sump.
4. Collect the water pump drain tube.
 5. Remove and discard the four O- rings from the drain tube.

Sump - Inspection

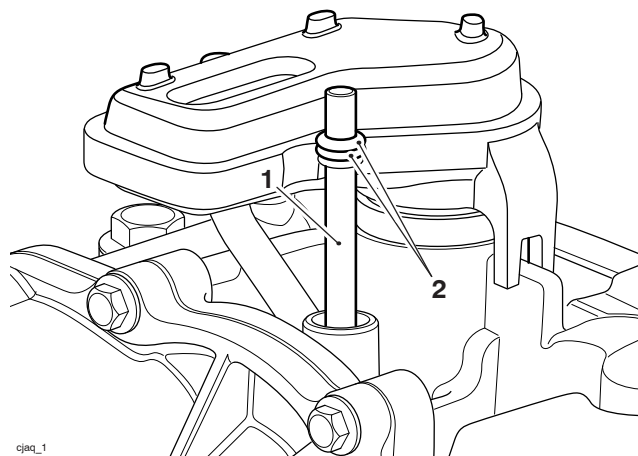
Warning

Ensure the oil pick-up is clean and free of blockages or restrictions. If the oil flow is restricted, oil pressure will be reduced and may cause severe engine damage.

1. Check the oil pick-up for blockages or restrictions. Remove and clean if found to be blocked or restricted.

Sump - Installation

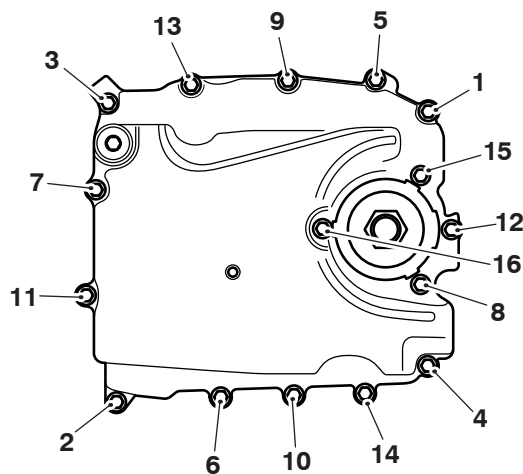
1. Incorporating new O-rings (two each end of the tube), position the water pump drain tube to the oil pump.



1. Water pump drain tube

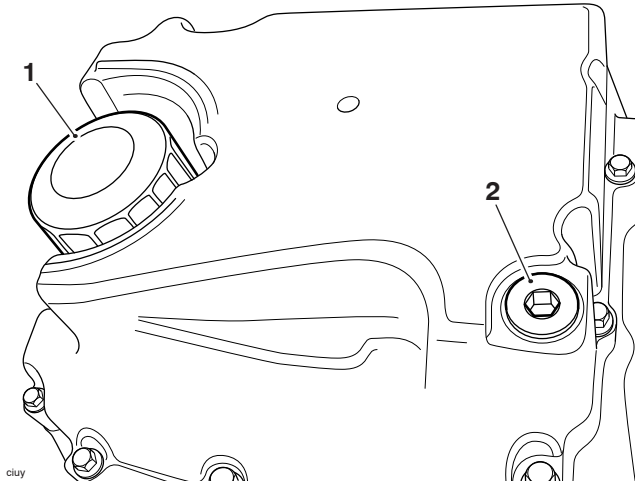
2. O-rings

2. Incorporating a new sump gasket/baffle, position the sump to the lower crankcase.
3. Tighten the sump fixings to 10 Nm in the sequence shown below.
4. Re-tighten the fixings one and two to 10 Nm.



Tightening Sequence

5. Using a new washer, refit the oil drain plug and tighten to 25 Nm.
6. Apply a thin smear of clean engine oil to the sealing ring of the new oil filter. Fit the oil filter using service tool T3880313 and tighten to 10 Nm.



1. Oil filter

2. Sump plug

- Refit the catalytic converter (see Exhaust Catalytic Converter - Installation, page 444).
- Refit the exhaust system (see Header and Intermediate Exhaust Pipes - Installation, page 441 and Exhaust Silencer - Installation, page 437).
- Refit the engine cradles (see Cradle Assemblies - Installation, page 652).
- Refit the fuel tank (see Fuel Tank - Installation, page 385).
- Fill the engine with the correct grade of engine oil (see Engine Oil - Specification, page 244).
- Reconnect the battery, positive (red) lead first and tighten the battery terminals to 4.5 Nm.

! Caution

Raising the engine speed above idle, before the oil reaches all parts of the engine can cause engine damage or seizure. Only raise engine speed after running the engine for 30 seconds to allow the oil to circulate fully.

! 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.

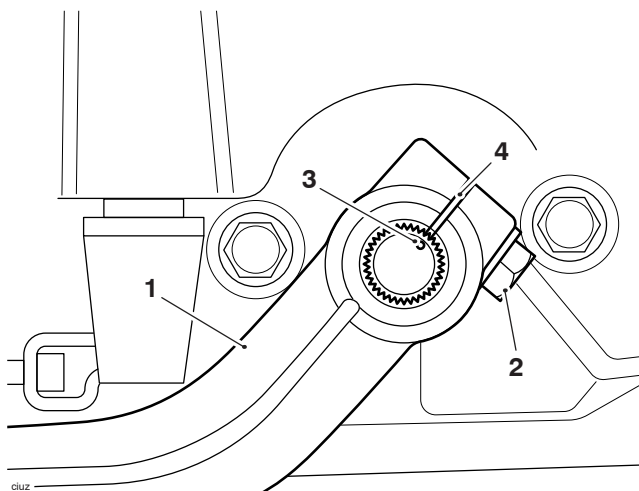
- Start the engine and ensure that the low oil pressure warning light goes out shortly after starting.
- Stop the engine and check the engine oil level. Adjust if necessary (see Engine Oil - Level Inspection, page 245).
- Refit the seat (see Seat - Installation, page 645).

Clutch Cover - 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.

- Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
1. Disconnect the clutch cable at the clutch cover (see Clutch Cable - Removal, page 155).
 2. Release the fixing and disconnect the gear change actuator arm at the clutch cover.

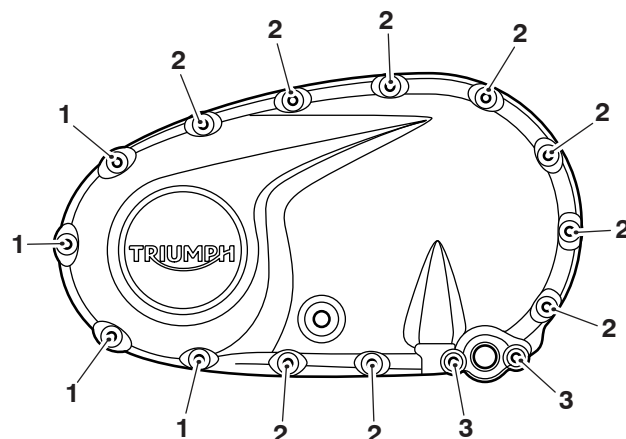


1. Gear change actuator arm
2. Fixing
3. Actuator arm alignment mark
4. Gear change shaft split line

Note:

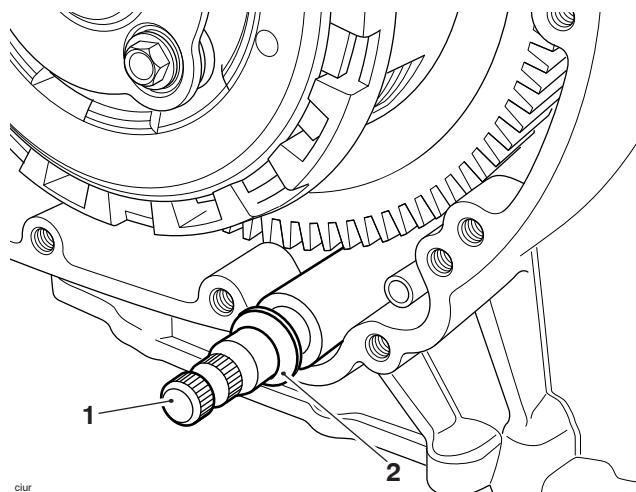
- Note the position of the clutch cable brackets prior to removal.

3. Release the fixings securing the clutch cover to the crankcases. Note the position of the encapsulated fixings and discard.



clup

1. Bolt M6 x 50 mm
2. Bolt M6 x 40 mm
3. Encapsulated fixings M6 x 35 mm
4. Place an oil catch tray beneath the clutch cover to collect any oil that may spill out on removal.
5. Carefully withdraw the cover.
6. Remove the gasket and clean the surfaces of the crankcase and the clutch cover using a lint free cloth.
7. Note the position of the washer on the gear change shaft.



clur

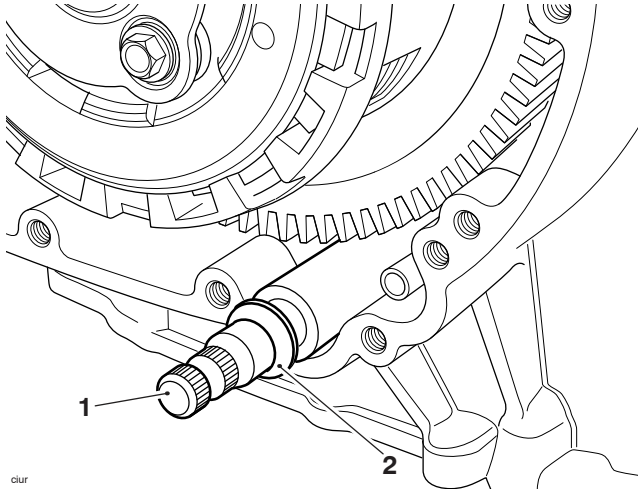
1. Gear change shaft
2. Flat washer

Clutch Cover - Installation

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. Ensure the flat washer is correctly positioned on the gear change shaft.



1. Gear change shaft

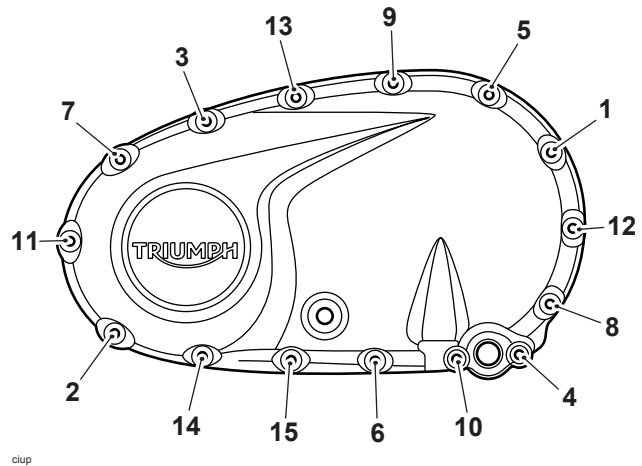
2. Flat washer

2. Thoroughly clean the cover and crankcase mating faces.
3. Position a new gasket to the crankcase.
4. Refit the cover ensuring that the gasket does not become dislodged.

Note:

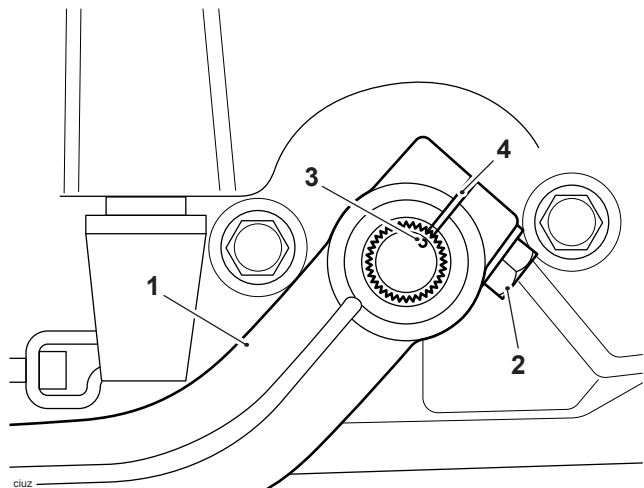
- Ensure that the lifter piece claw engages correctly with the pull rod during assembly. It may be necessary to rotate the lifter piece rack to allow assembly to take place.
 - Fixings 4 and 10 are encapsulated and must be replaced during fitment.
5. Refit the two brackets for the clutch cable and fixings as noted during removal, tighten the fixings as described below:
 - Tighten fixings 1 to 13 in the sequence shown below to 10 Nm.
 6. Fit the clutch cable bracket and tighten fixings 14 and 15 to 10 Nm.

- Re-tighten fixings one, two and six to 10 Nm.



Tightening Sequence

7. Align the split line on the gear change actuator arm with the alignment mark on the gear change shaft and fit the actuator arm to the spline. Fit the fixing and tighten to 8 Nm.



1. Gear change actuator arm

2. Fixing

3. Actuator arm alignment mark

4. Gear change shaft split line

8. Refit and adjust the clutch cable (see Clutch Cable - Installation, page 157).
 - Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
 - Refit the seat (see Seat - Installation, page 645).

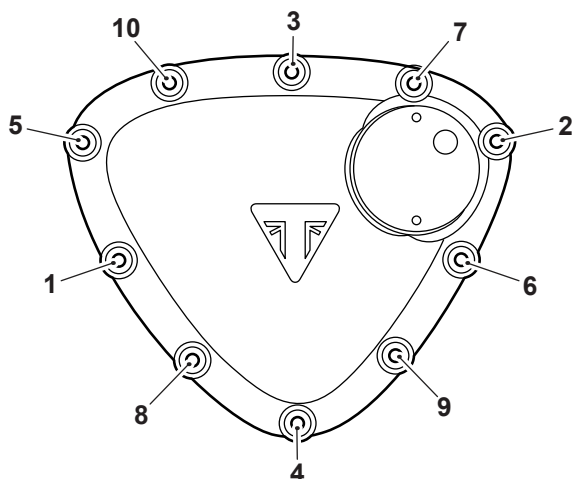
Alternator Cover - Removal

- Remove the seat (see Seat - Removal, page 645).
- Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
- Remove the fuel tank (see).

Warning

The rotor magnets are very strong. When handling the alternator cover the magnets may 'grab' the stator, causing injury to the hands or fingers. When handling the alternator cover wear suitable gloves and only grip the alternator cover by the outside surfaces; always keep hands and fingers clear when handling the alternator cover.

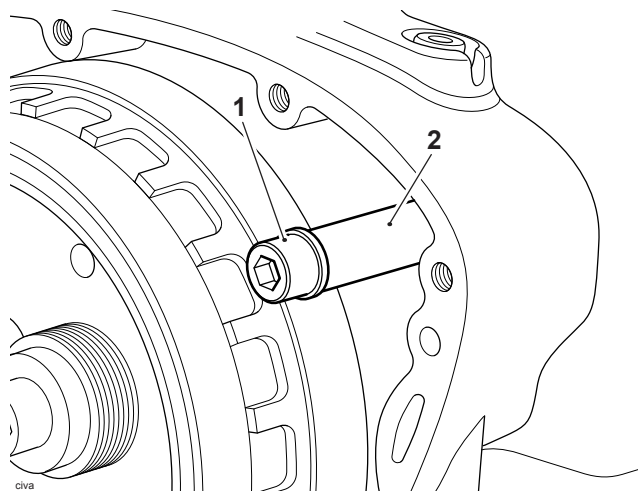
- Remove the right hand side panel (see Side Panels, page 646).
1. Release the fixings securing the alternator cover to the crankcases.



Removal Sequence

2. Place an oil catch tray beneath the alternator cover to collect any oil that may spill out on removal.
3. Carefully withdraw the cover.
4. Remove the gasket and clean the surfaces of the crankcase and the alternator cover using a lint free cloth.

5. Remove and discard the O-ring from the balancer dead shaft.



1. **O-ring**

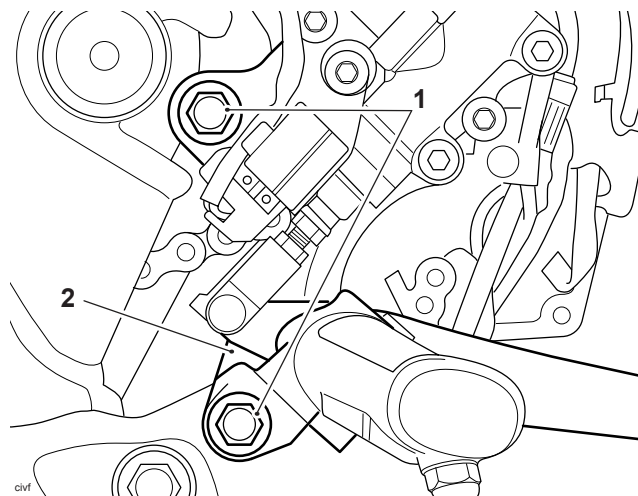
2. **Balancer dead shaft**

6. Remove the front sprocket cover (see Front Sprocket Cover - Removal, page 105).

Note:

- **Note the routing of the brake switch harness for installation.**

7. Remove the fixings and detach the right hand control plate from the frame.



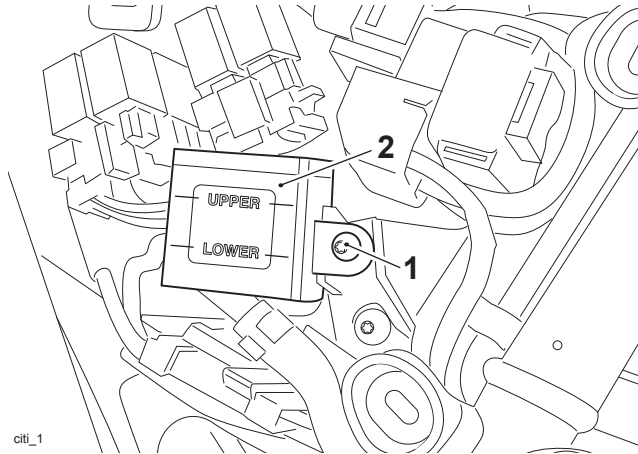
1. **Fixings**

2. **Control plate**

Caution

To prevent paint damage, do not spill brake fluid onto any area of the bodywork. Spilled brake fluid will damage paintwork.

8. Remove and discard the fixing and detach the rear brake fluid reservoir from the frame.

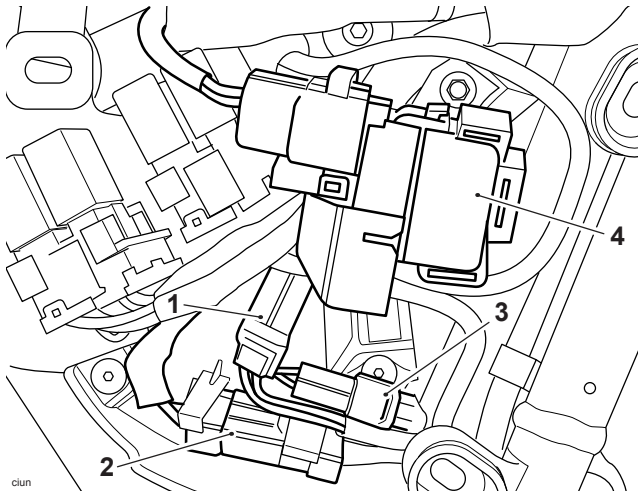


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1. Fixing

2. Brake fluid reservoir

9. Secure the rear brake fluid reservoir in an upright position.
10. Detach the following items from the relay bracket.
- Starter motor solenoid;
 - Alternator multiplug;
 - Gear position sensor multiplug;
 - Crankshaft position sensor multiplug.



cium

1. Gear position sensor multiplug

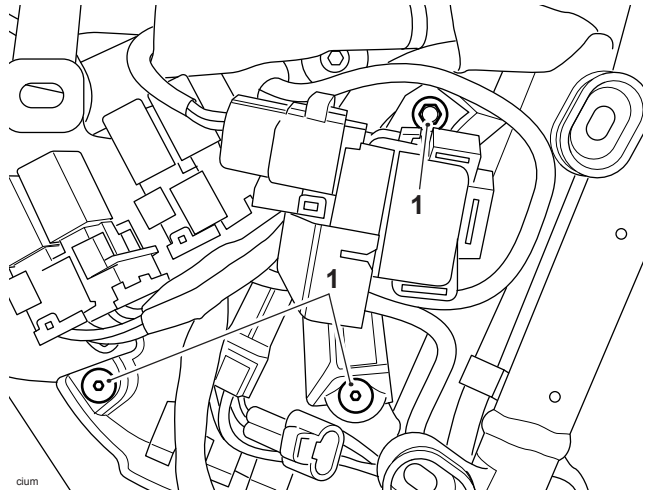
2. Crankshaft position sensor multiplug

3. Alternator multiplug

4. Starter motor solenoid

11. Disconnect the following from the main harness.
- Alternator electrical connector;
 - Crankshaft position sensor electrical connector;
 - Gear position sensor electrical connector.

12. Remove the three fixings securing the relay bracket to the air box.



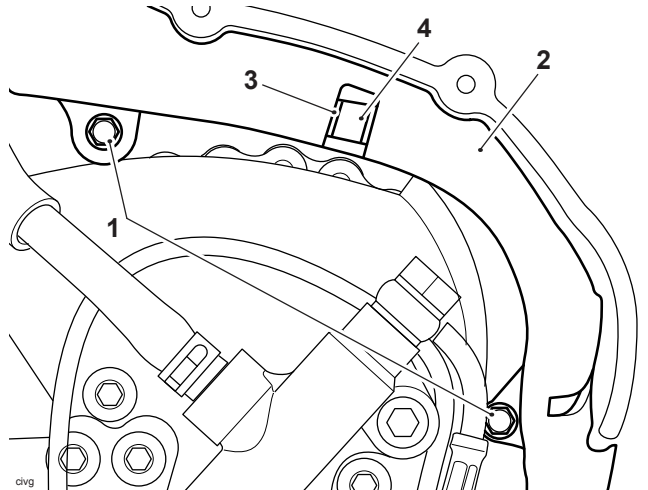
cium

1. Fixings

Note:

- The alternator and crankshaft position sensor share the same harness.
- Note that the white tape on the harnesses within the harness guide aligns with the upper gap for installation.

13. Route the alternator harness through the frame to the harness guide on the crankcase.
14. Remove and discard the fixings and detach the harness guide from the crankcase.



civg

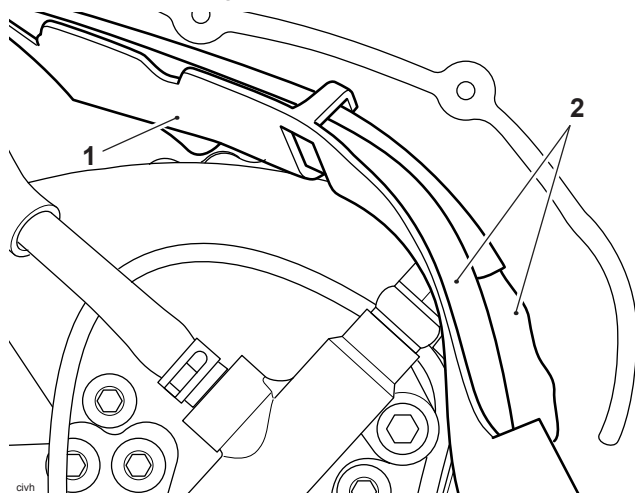
1. Fixings

2. Harness guide

3. Upper gap

4. White tape

15. Carefully remove the alternator harness from the harness guide.



1. Harness guide

2. Harness

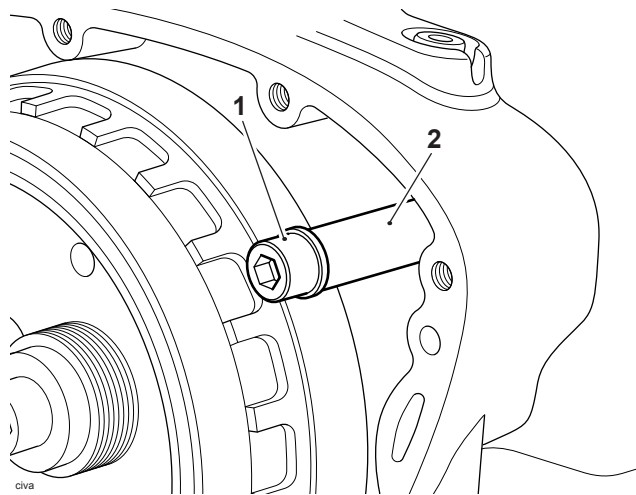
16. Release the fixings securing the alternator cover to the engine.
17. Withdraw the alternator cover from the crankcase.

Alternator Cover - Installation

Warning

The rotor magnets are very strong. When handling the alternator cover the magnets may 'grab' the stator, causing injury to the hands or fingers. When handling the alternator cover wear suitable gloves and only grip the alternator cover by the outside surfaces; always keep hands and fingers clear when handling the alternator cover.

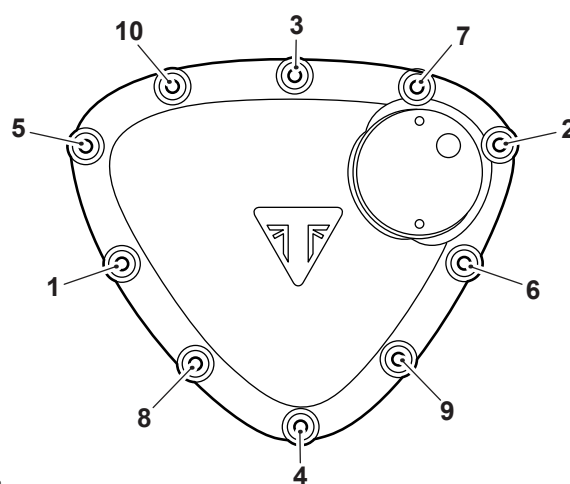
1. Fit a new O-ring to the balancer dead shaft.



1. O-ring

2. Balancer dead shaft

2. Position a new gasket to the crankcase dowels and refit the alternator cover.
3. Tighten the fixings to 10 Nm, in the sequence shown below.

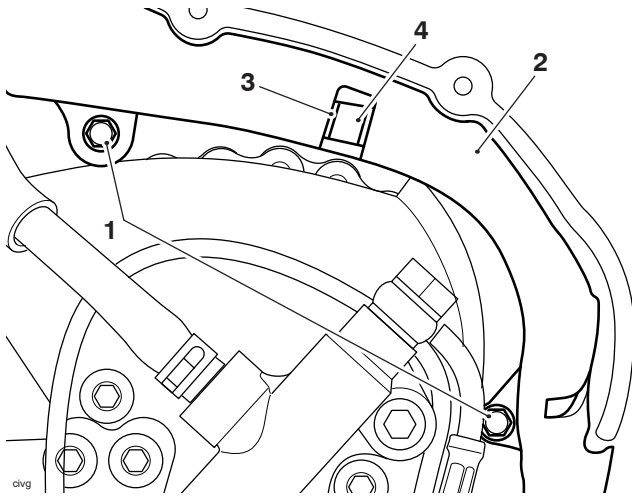


Tightening Sequence

4. Re-tighten fixings one and two to 10 Nm.

Engine Covers

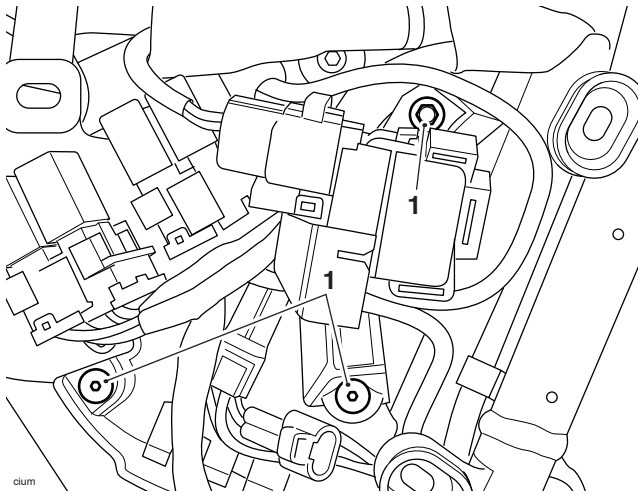
5. Carefully fit the alternator harness into the harness guide as noted for removal with the white tape shown in the upper gap.
6. Secure the harness guide to the crankcase and tighten the new fixings to 4 Nm.



1. Fixings

2. Harness guide

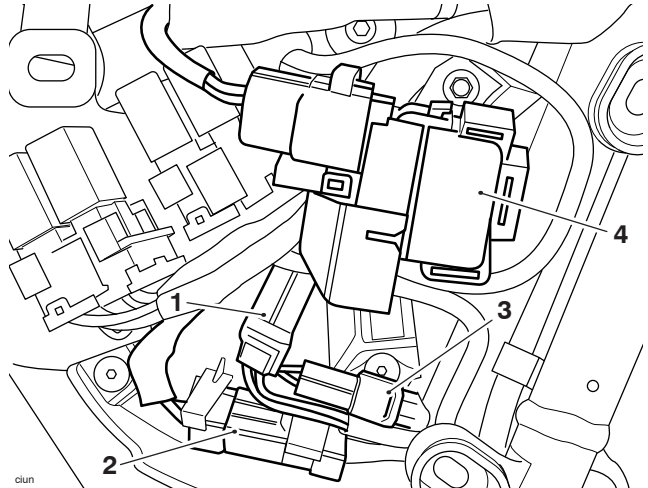
7. Route the alternator harness through the frame to the right hand side of the airbox, as noted for removal.
8. Secure the relay bracket to the airbox and tighten the three fixings to 1.5 Nm.



1. Fixings

9. Connect the alternator and crankshaft position sensor electrical connectors to the main harness.
10. Attach the following items to the relay bracket:
 - Starter motor solenoid;
 - Crankshaft position sensor electrical connector;

- Alternator electrical connector.



1. Gear position sensor electrical connector

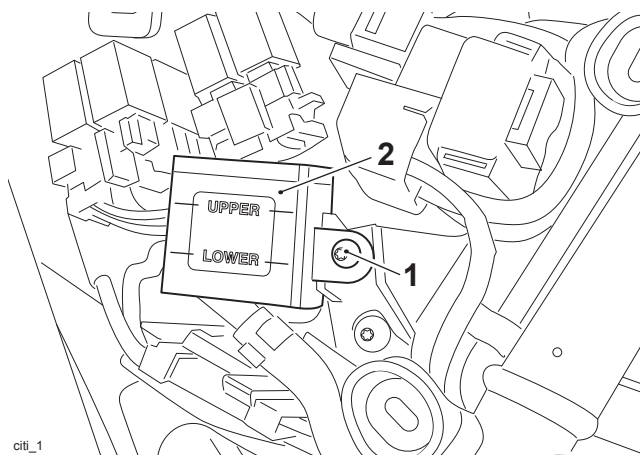
2. Starter motor solenoid

3. Alternator electrical connector

4. Crankshaft position sensor electrical connector

11. Refit the brake fluid reservoir to the frame, and tighten the new fixing to 3 Nm.

12. Reconnect the gear position sensor electrical connector to the main harness.

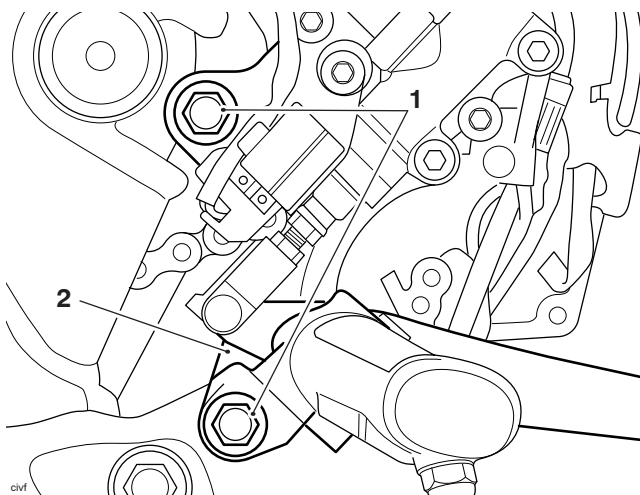


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1. Fixing

2. Brake fluid reservoir

13. Attach the right hand control plate to the frame and tighten the fixings to 24 Nm. Ensure the brake light switch harness is routed as noted for removal.



clvf

1. Fixings

2. Control plate

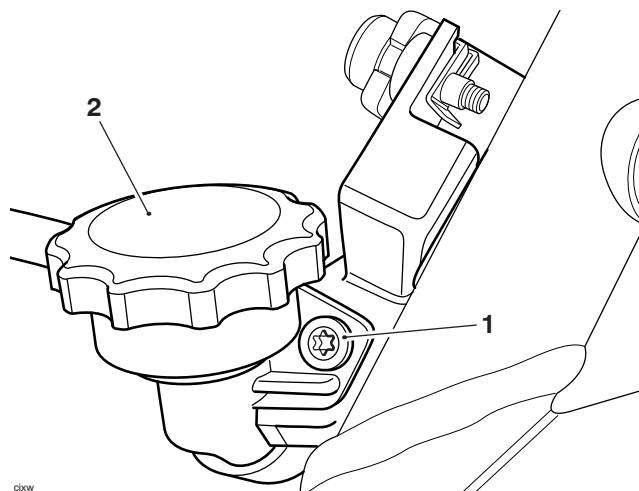
- Refit the front sprocket cover (see Front Sprocket Cover - Installation, page 106).
- Refit the right hand side panel (see Side Panels, page 646).
- Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
- Refit the seat (see Seat - Installation, page 645).

Camshaft Cover - 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.

- Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
 - Remove the fuel tank (see).
 - Remove the ignition coils (see Ignition Coils - Removal, page 699).
 - Remove the immobiliser/TPMS module (see Immobiliser/TPMS Control Module - Removal, page 406).
1. Remove the upper coolant tube fixing and reposition the coolant filler neck to allow clearance between the camshaft cover and the coolant filler cap.



clxw

1. Fixing

2. Upper coolant tube

2. Remove the spark plugs.
3. Progressively release the camshaft cover fixings.
4. Raise the camshaft cover and manoeuvre it towards the right hand side of the engine, where it can be removed.

Caution

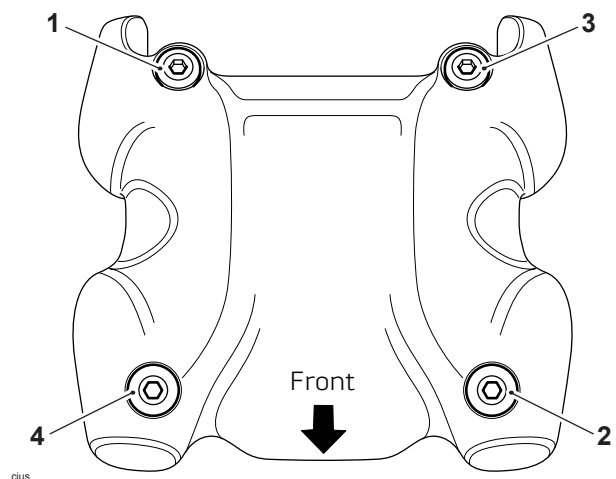
Never use a lever to remove the camshaft cover from the cylinder head.

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

5. Remove the camshaft cover gasket.
6. Discard the camshaft cover gasket and rubber seals.
7. Remove any residual oil from the mating face of the cylinder head using a lint free cloth.

Camshaft Cover - Installation

1. Fit a new camshaft cover seal to the camshaft cover. Ensure the groove in the gasket is correctly seated to the camshaft cover.
2. Position the camshaft cover to the cylinder head. Ensure that the seal remains in position.
3. Lubricate the new camshaft cover fixing seals with clean engine oil. Fit the camshaft cover fixings and seals and tighten until finger tight.
4. Tighten the fixings in the sequence shown to 14 Nm.



Tightening Sequence

5. Refit the spark plugs and tighten to 12 Nm.
6. Re-position the coolant filler neck. Refit the upper coolant tube fixing and tighten to 3 Nm.
 - Refit the immobiliser/TPMS module (see Immobiliser/TPMS Control Module - Installation, page 407).
 - Refit the ignition coils (see Ignition Coils - Installation, page 701).
 - Refit the fuel tank (see Fuel Tank - Installation, page 385).
 - Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
 - Refit the seat (see Seat - Installation, page 645).

Front Sprocket Cover - Removal

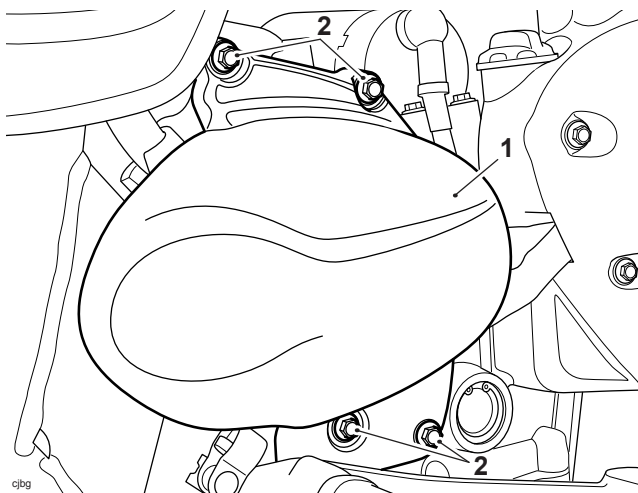
Warning

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

Rotating the rear wheel will cause the drive chain to rotate on the sprockets. To prevent injury, never place loose clothing, fingers or hands near the drive chain or sprockets. Loose clothing, fingers or the hands could become trapped as the drive chain rotates on the sprockets causing a crushing injury to the fingers, hands or other parts of the anatomy.

- Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
1. Remove the fixings securing the sprocket cover to the crankcase.



1. Sprocket cover
2. Fixings

Front Sprocket Cover - Inspection

Warning

Rotating the rear wheel will cause the drive chain to rotate on the sprockets. To prevent injury, never place loose clothing, fingers or hands near the drive chain or sprockets. Loose clothing, fingers or the hands could become trapped as the drive chain rotates on the sprockets causing a crushing injury to the fingers, hands or other parts of the anatomy.

1. Inspect the rubber grommets, flanged sleeves and rubber buffer for damage or wear.

Front Sprocket Cover - Installation

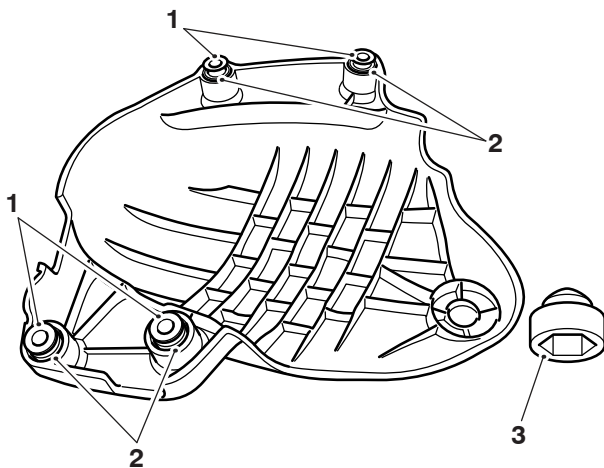
Warning

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

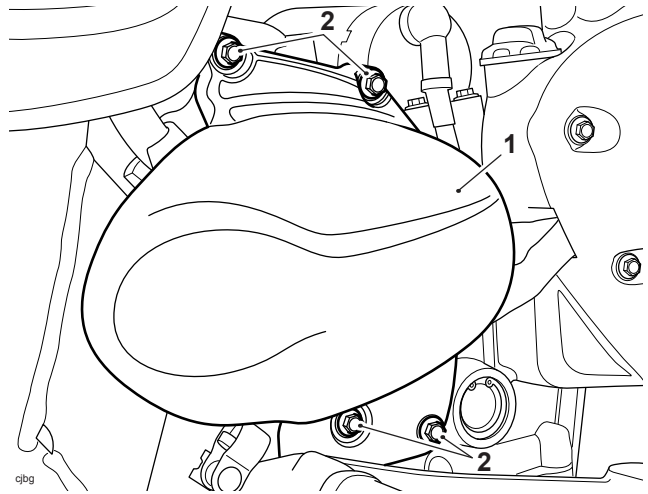
Rotating the rear wheel will cause the drive chain to rotate on the sprockets. To prevent injury, never place loose clothing, fingers or hands near the drive chain or sprockets. Loose clothing, fingers or the hands could become trapped as the drive chain rotates on the sprockets causing a crushing injury to the fingers, hands or other parts of the anatomy.

1. If removed, refit the grommets to the sprocket cover.
2. If removed, refit the rubber buffer to the swinging arm nut.



1. **Sprocket cover**
2. **Grommet**
3. **Rubber buffer**

3. Fit the sprocket cover, ensuring that the rubber buffer and the flanged sleeves remain in the correct position.
4. Fit the sprocket cover fixings and evenly and progressively tighten to 9 Nm. fixings.



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

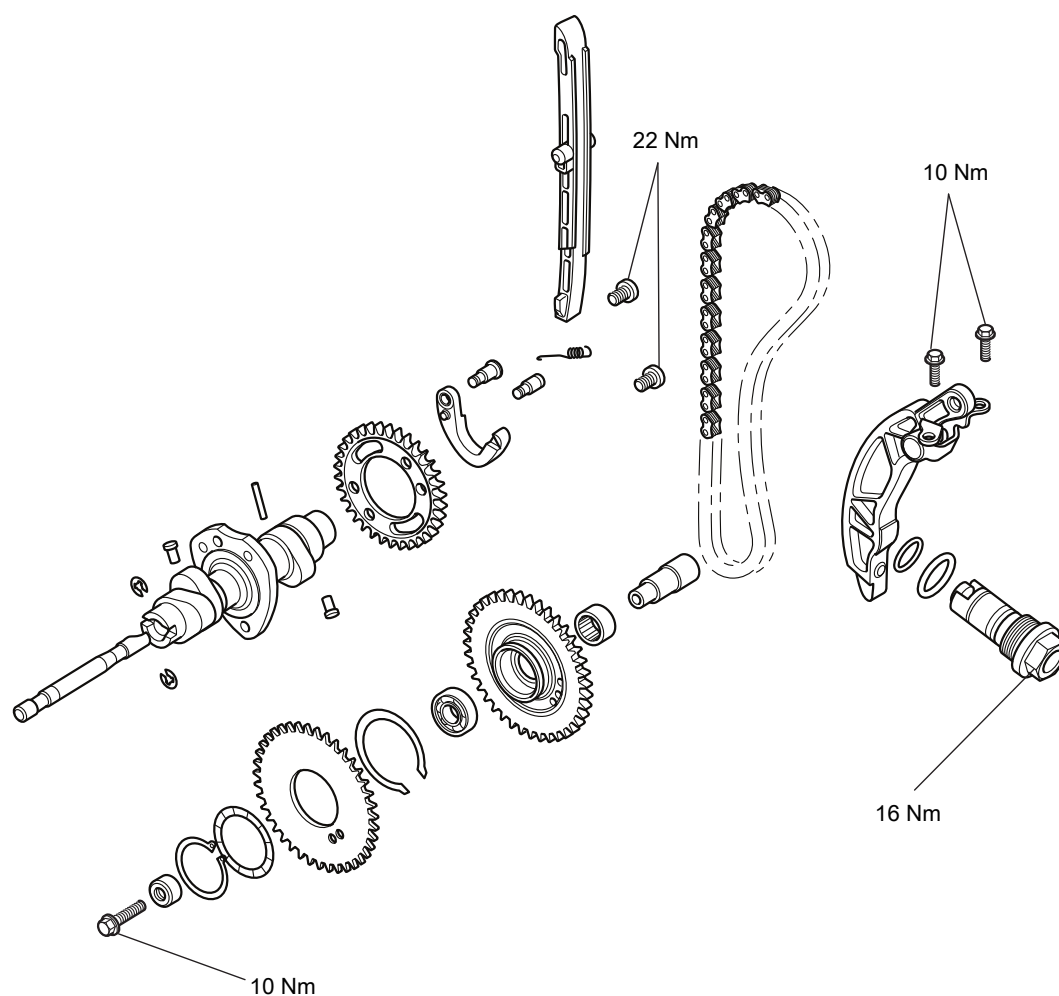
- Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
- Refit the seat (see Seat - Installation, page 645).

9 Cylinder Head

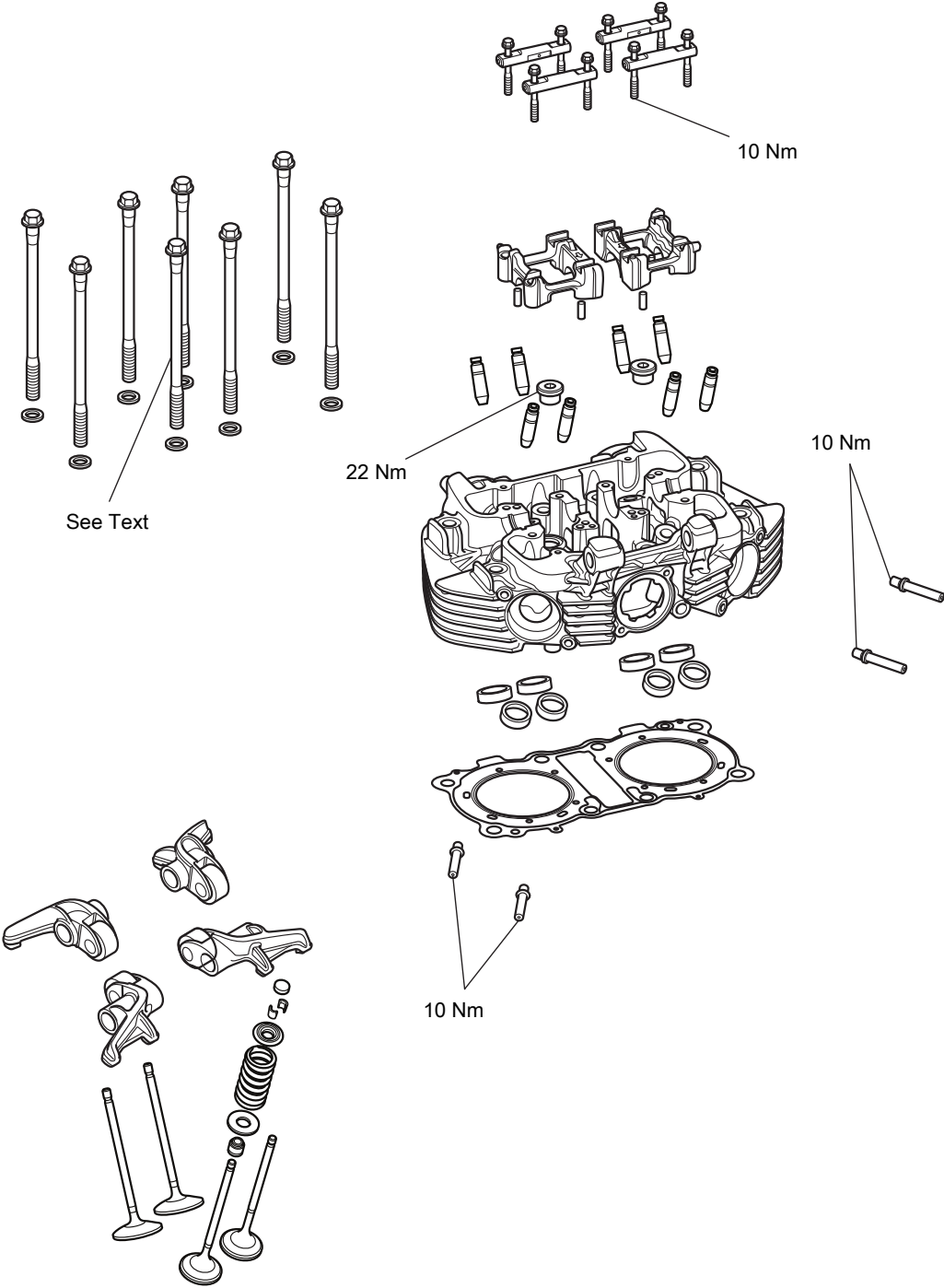
Table of Contents

Exploded View – Camshaft and Camshaft Drive.....	109
Exploded View – Cylinder Head.....	110
Cylinder Head - Description.....	111
Camshaft Drive Chain Tensioner - Removal.....	111
Camshaft Drive Chain Tensioner - Inspection.....	113
Camshaft Drive Tensioner - Installation.....	113
Camshaft Drive Chain and Idler Gear - Removal.....	116
Camshaft Chain - Inspection	117
Camshaft Drive Chain and Idler Gear - Installation.....	119
Camshaft Drive Chain Rubbing Blade - Removal.....	120
Camshaft Drive Chain Rubbing Blade - Inspection.....	121
Camshaft Drive Chain Rubbing Blade - Installation	122
Exhaust Decompressors.....	122
Camshaft - Removal.....	123
Camshaft - Identification.....	125
Camshaft - Inspection.....	125
Valve Clearance.....	127
Valve Clearance Adjustment.....	127
Camshaft - Installation.....	129
Cylinder Head - Removal.....	134
Cylinder Head - Inspection	135
Cylinder Head - Installation.....	135
Valves and Valve Stem Seals - Removal.....	137
Valves and Valve Stem Seals - Installation.....	138

Exploded View – Camshaft and Camshaft Drive



Exploded View – Cylinder Head



Cylinder Head - Description

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

A silent-running camshaft drive chain drives the single-overhead camshaft, which runs directly in the cylinder head without additional bearings.

The crankshaft drives an idler gear, which in turn drives the camshaft drive chain. The idler gear, and therefore the camshaft rotates in the opposite direction to the crankshaft.

The engine is fitted with a camshaft drive chain hydraulic tensioner. The tensioner is fed oil via a gallery in the crankcase. The combination of oil pressure and spring pressure pushes the plunger against the tensioner blade which tensions the camshaft drive chain. The hydraulic tensioner has an oil pressure relief valve located in the plunger that is set to open between 12 - 16 bar. The chain is guided by two nylon tensioner blades. The rubbing blade is located in the cylinder barrel by lugs on the blade. The cylinder head must be removed to remove this blade. The tensioner blade is secured to the cylinder head by two bolts at its upper end, and its lower end rests on the tensioner plunger.

Camshaft, valve, valve shim and valve seat wear affect the valve clearances. The effect of this wear is to change the clearance between the rocker and the adjustment shim, causing engine noise and/or improper running. If the valve clearances are incorrect, permanent damage to components in the valve-train will take place and engine performance will be affected.

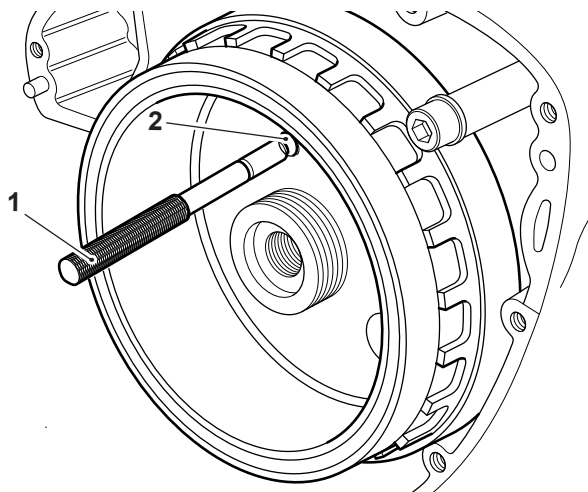
Oil is supplied to the cylinder head by an internal passageway inside the engine. Once it arrives at the cylinder head, it is passed through a restrictor, and is then delivered to the camshaft bearing journals along grooves and bolt holes in the camshaft frames. The camshaft lobes are splash fed by oil coming from the rocker arms.

Camshaft Drive Chain Tensioner - 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.

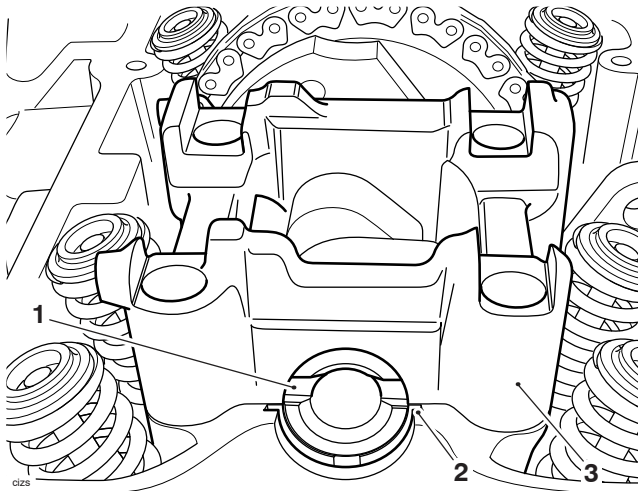
- Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
 - Remove the fuel tank (see).
 - Remove the ignition coils (see Ignition Coils - Removal, page 699).
 - Remove the immobiliser/TPMS module (see Immobiliser/TPMS Control Module - Removal, page 406).
 - Remove the camshaft cover (see Camshaft Cover - Removal, page 103).
 - Remove the alternator cover (see Alternator Cover - Removal, page 99).
1. Rotate the engine until the service tool T3880601 can be inserted through the hole in the alternator rotor, crankcase and into the idler gear.



1. T3880601 - Camshaft Timing Pin
2. Timing hole in alternator rotor

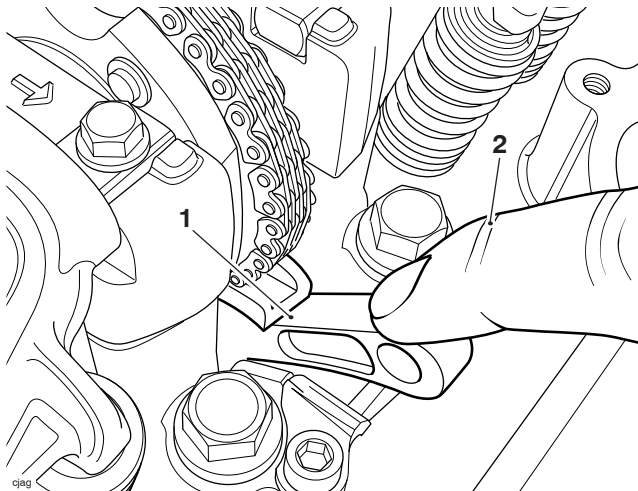
Cylinder Head

2. In addition to the alignment mark, at TDC, the offset slot on the camshaft will align with the upper surface of the cylinder head.



1. Camshaft slot
2. Cylinder head
3. Camshaft ladder (cylinder two)

3. With the aid of an assistant, hold the camshaft drive chain tensioner blade to keep the camshaft drive chain in position during removal of the tensioner.

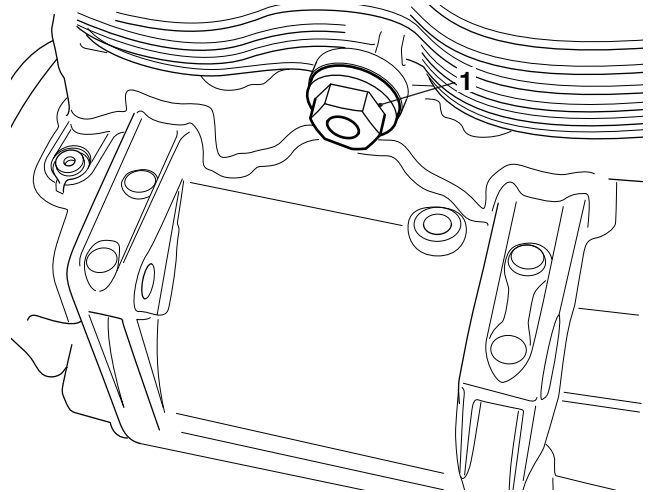


1. Camshaft drive chain tensioner blade
2. Tension (hand held)

Warning

The hydraulic tensioner is under spring tension. Always wear hand, eye, and face protection when withdrawing the tensioner. Take great care to minimise the risk of injury and loss of components.

4. Unscrew the hydraulic tensioner body until the plunger spring tension has been released.



1. Tensioner
5. Remove the hydraulic tensioner and discard the O-rings.

Camshaft Drive Chain Tensioner - Inspection

1. Inspect the camshaft drive chain tensioner spring for damage and deformation. Renew as necessary.
2. Inspect the tip of the camshaft drive chain tensioner plunger for wear and damage. Renew as necessary.

Camshaft Drive Tensioner - Installation

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. Ensure that the camshaft drive chain tensioner blade is in contact with the camshaft drive chain.
2. Check that the camshaft alignment slot aligns with the cylinder head.
3. To set the hydraulic tensioner onto the first tooth of the ratchet (i.e. minimum extension) carry out the following:

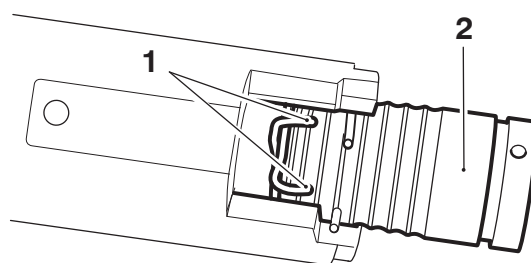
Note:

- If installing a new hydraulic tensioner, do not release the plunger before fitting.
- If installing the original hydraulic tensioner, the engine oil must be drained out of the tensioner to enable the plunger to be set onto the first tooth of the ratchet.

Warning

The plunger of the camshaft drive chain tensioner is under spring tension. Always wear hand, eye and facial protection when removing the tensioner as unprotected areas of the body can be injured if the spring tension is released in an unexpected or uncontrolled way.

4. Hold the resister ring ends together and pull out the plunger.

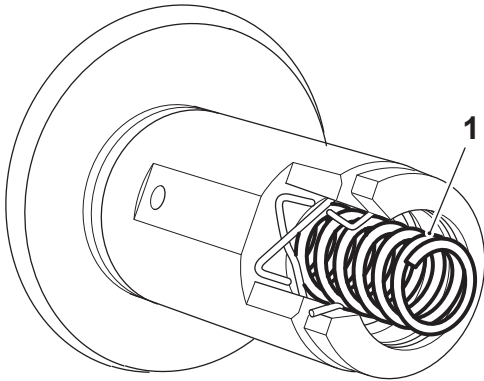


cfej_2

1. Resister ring ends
2. Plunger

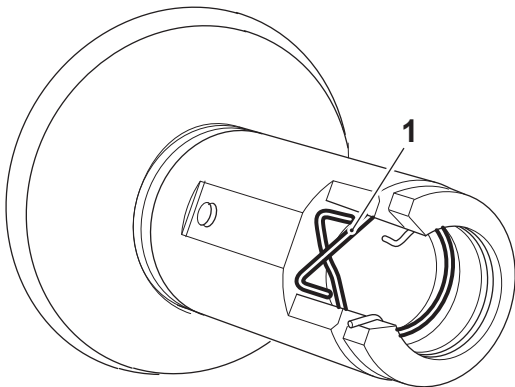
Cylinder Head

5. Remove the spring.



1. Spring

6. While holding the resister ring in place, drain the engine oil into a suitable container.
7. Ensure the resister ring is correctly located as shown below.

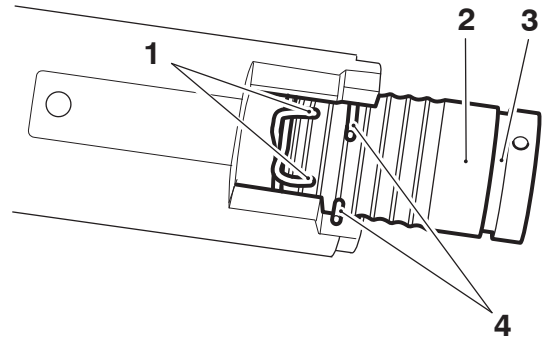


cfho

1. Resister ring

8. Refit the spring.
9. Support the tensioner in a soft jawed vice.

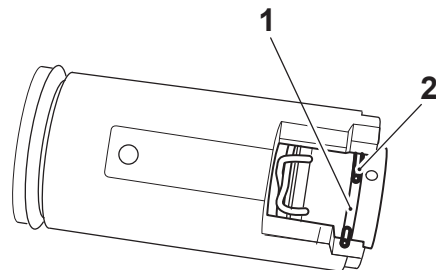
10. Hold the resister ends together, close the vice allowing the plunger to be pushed through the resister ring until the snap ring aligns with the snap ring groove.



cfei

1. Resister ring
2. Plunger
3. Snap ring groove
4. Snap ring

11. When the snap ring aligns with the snap ring groove, release the vice and move one end of the snap ring into the groove. Slowly release the plunger to ensure it is held in place.



cfej

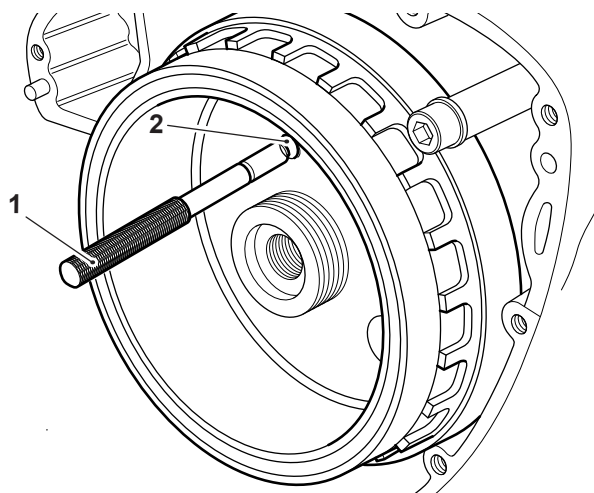
1. Snap ring groove
2. Snap ring

12. Fit two new O-rings to the camshaft drive chain tensioner body.
13. Fit the tensioner to the cylinder head as noted for removal. Tighten the tensioner to 16 Nm.
14. Release pressure to the camshaft drive chain tensioner blade, taking care not to move the tensioner blade.
15. Remove service tool T3880601.

16. To release the plunger from the snap ring holding the hydraulic tensioner, rotate the crankshaft anticlockwise until the plunger is released.
17. Rotate the crankshaft clockwise until the service tool T3880601 aligns with the hole in the crankcase and the crankshaft.
18. Check that there is tension in the camshaft drive chain and the slot at the camshaft end is correctly aligned.

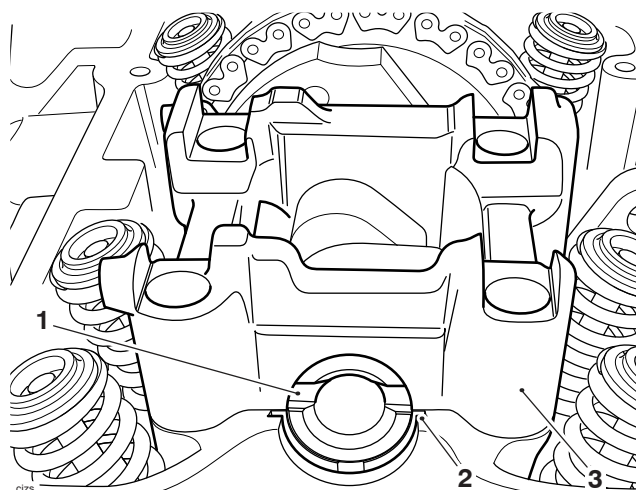
Note:

- After fitting to the engine, the hydraulic tensioner will be empty of engine oil. After starting the engine, the camshaft drive chain and tensioner blade will be noisy until full pressure is felt at the tensioner plunger. This could take up to 5 seconds.
19. Check that the tensioner plunger is correctly located in the middle of the camshaft drive chain tensioner blade when viewed from above.
 20. Rotate the engine through 4 full revolutions, and reset number 1 cylinder to TDC. Ensure that the service tool T3880601 aligns with the hole in the crankcase and the crankshaft.



1. T3880601 - Camshaft Timing Pin
2. Timing hole in alternator rotor

21. Check that the camshaft timing marks align as shown below.



1. Camshaft slot
2. Cylinder head
3. Camshaft ladder (cylinder two)

22. Recheck the tensioner plunger location against the camshaft drive chain tensioner blade.
23. Remove service tool T3880601.
 - Refit the alternator cover (see Alternator Cover - Installation, page 101).
 - Refit the camshaft cover (see Camshaft Cover - Installation, page 104).
 - Refit the immobiliser/TPMS module (see Immobiliser/TPMS Control Module - Installation, page 407).
 - Refit the ignition coils (see Ignition Coils - Installation, page 701).
 - Refit the fuel tank (see Fuel Tank - Installation, page 385).
 - Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
 - Refit the seat (see Seat - Installation, page 645).

Camshaft Drive Chain and Idler Gear - 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.

- Remove the seat (see Seat - Removal, page 645).
- Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
- Remove the fuel tank (see).
- Remove the engine (see Engine - Removal, page 261).
- Remove the camshaft cover (see Camshaft Cover - Removal, page 103).
- Remove the alternator cover (see Alternator Cover - Removal, page 99).

Warning

The rotor magnets are very strong. When handling the alternator cover the magnets may 'grab' the stator, causing injury to the hands or fingers. When handling the alternator cover wear suitable gloves and only grip the alternator cover by the outside surfaces; always keep hands and fingers clear when handling the alternator cover

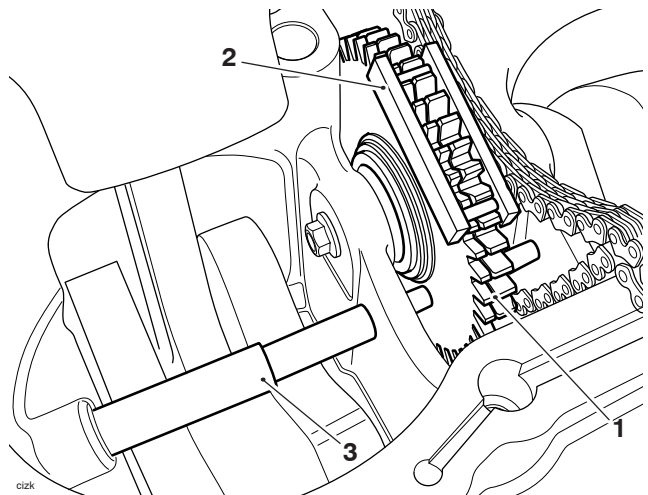
- Remove the alternator rotor (see Alternator Rotor - Removal, page 704).
1. Rotate the engine until service tool T3880039 can be inserted through the hole in the crankcase and into the idler gear.
 2. Remove the cylinder head (see Cylinder Head - Removal, page 134).
 3. Remove the cylinder barrels (see Barrels - Removal, page 142).

Warning

Never use a 'dot punch' to mark the camshaft drive chain, camshaft or camshaft driven gears. Severe engine damage will result if impact is applied to machined parts.

Note:

- To ensure the camshaft drive chain can be refitted in the same orientation, use a suitable marker pen to permanently mark one of the outer plates of the camshaft drive chain prior to removing the camshafts.
 - Note the side of which the marked outer plate is facing for installation.
4. Secure the idler gear in position using the locking plate supplied with service tool T3880016-2 by locking the gear teeth as shown below.

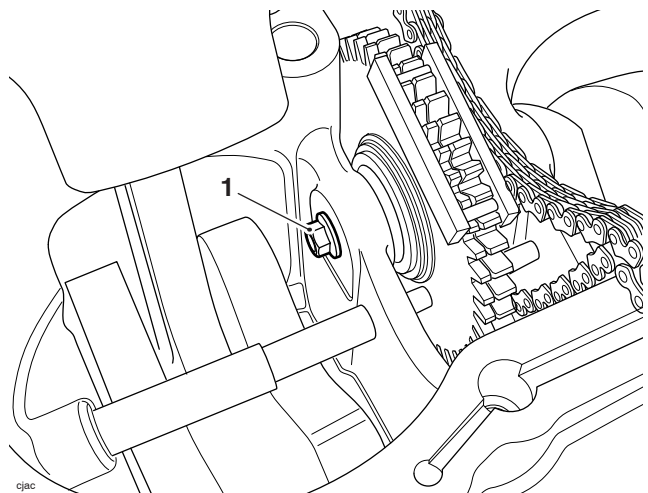


1. Idler gear

2. Locking plate (Part of T3880016 - Balancer Gear C-Spanner)

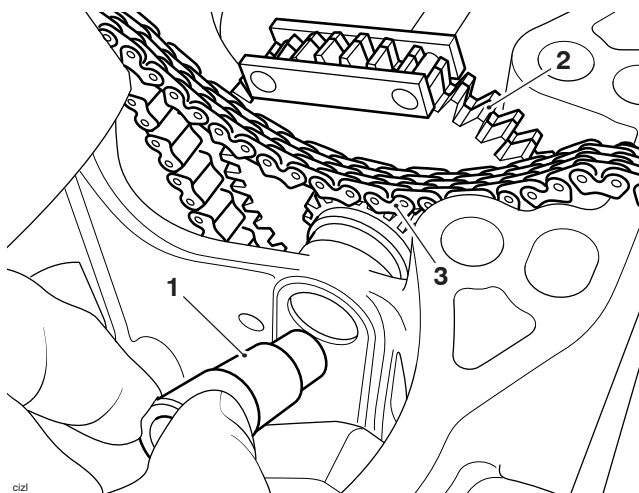
3. T3880039 - Idler Gear Timing Pin

5. Remove and discard the fixing from the idler gear shaft.



1. Fixing

6. Withdraw the idler gear shaft and collect the idler gear and camshaft drive chain from the upper crankcase.



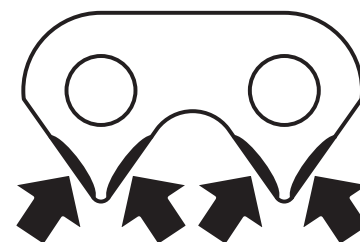
1. Idler gear shaft
2. Idler gear
3. Camshaft drive chain

7. Remove the camshaft drive chain from the idler gear.

Camshaft Chain - Inspection

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

1. Check for significant blue discolouration of the drive chain plates indicating excessive heat build-up.
2. Examine all pins for signs of rotation.
3. Check for cracking or deep scratching of the drive 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:

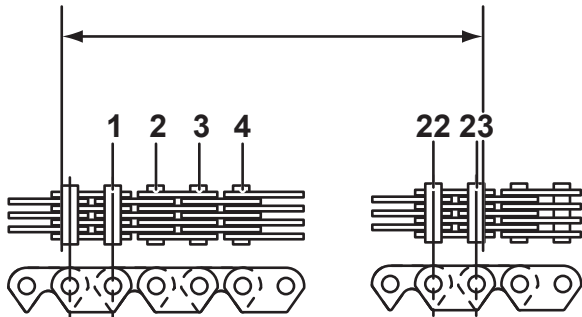
1. Remove the drive chain from the engine.
2. Suspend the drive chain from a pin or hook with a 13 kg weight attached at the lower end.



cajs

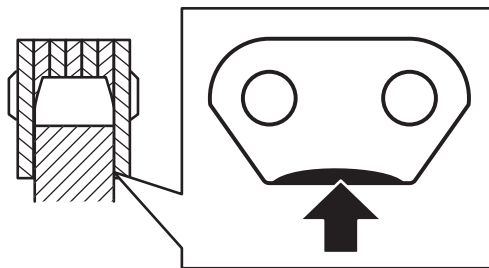
3. Measure across 23 links as shown in the diagram below. If the drive chain is within limits, the measurement should be no longer

than 147.50 mm. Measurements beyond 147.50 mm indicate that the drive chain must be replaced.



cajt

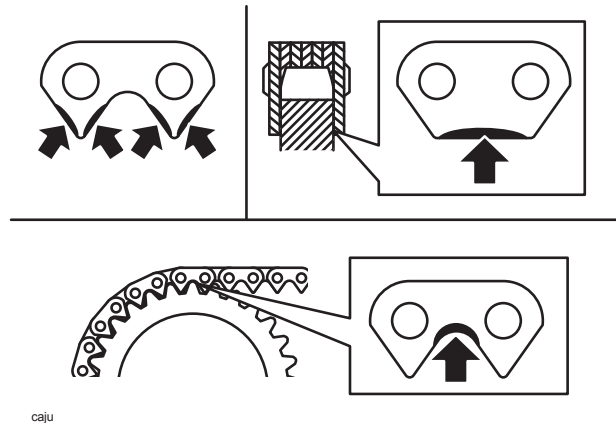
4. Check for severe wear of the inner surface of the outer plates at the side-contact points with the sprocket teeth.



ccru

5. Check for signs of stiffness or kinking.

6. Check for severe wear of the plates in the area shown below.

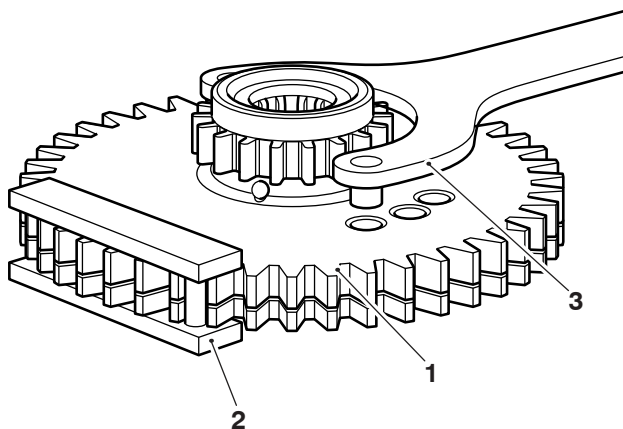


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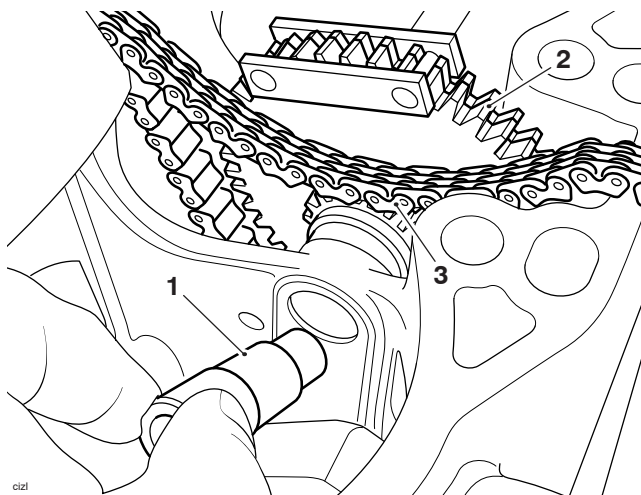
7. If any of these symptoms are evident, the camshaft drive chain must be replaced.

Camshaft Drive Chain and Idler Gear - Installation

1. Pre-load the backlash gear using service tool T3880041 and locking plate service tool T3880016-2 as shown below.

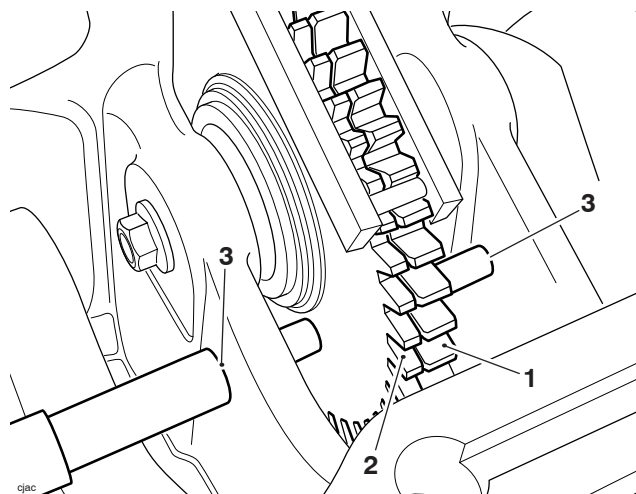


1. Idler gear
 2. Locking plate (part of T3880016 - Balancer Gear C-Spanner)
 3. T3880041 - Idle Gear Timing Wrench
2. Install the camshaft drive chain to the idler gear.
 3. Refit the idler gear to the upper crankcase and install the idler gear shaft. Ensure that the marked outer plate on the camshaft drive chain is facing the same direction as noted for removal.



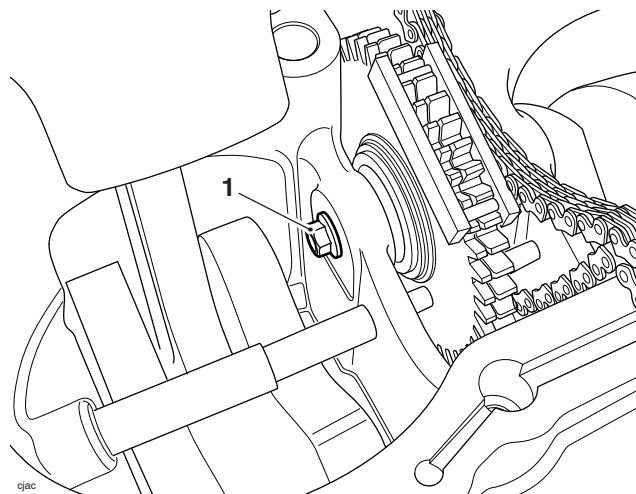
1. Idler gear shaft
2. Idler gear
3. Camshaft drive chain

4. Install service tool T3880039 through the hole in the crankcase (alternator side) and through the smaller hole in the idler gear, as shown below.



1. Idler gear
2. Backlash gear
3. T3880039 - Idler Gear Timing Pin

5. Install the idler gear shaft and a new fixing. Counter hold the idler shaft and tighten the fixing to 10 Nm.



1. Fixing
6. Refit the barrel assembly (see Barrels - Installation, page 143).
 7. Refit the cylinder head (see Cylinder Head - Installation, page 135).
 8. Refit the camshafts (see Camshaft - Installation, page 129).
 9. Recheck the tensioner plunger location against the camshaft drive chain tensioner blade.

10. Remove service tool T3880601 from the crankcase.
11. Remove service tool T3880039 from the idler gear.
 - Refit the camshaft cover (see Camshaft Cover - Installation, page 104).
 - Refit the alternator cover (see Alternator Cover - Installation, page 101).
 - Refit the engine (see Engine - Installation, page 265).
 - Refit the fuel tank (see Fuel Tank - Installation, page 385).
 - Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
 - Refit the seat (see Seat - Installation, page 645).

Camshaft Drive Chain Rubbing Blade - 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.

Note:

- **The camshaft drive chain rubbing blade can only be removed after the cylinder head has been removed.**
- **The camshaft drive chain tensioner blade can be removed without removing the cylinder head.**
- Remove the seat (see Seat - Removal, page 645).
- Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
- Remove the fuel tank (see).
- Remove the engine (see Engine - Removal, page 261).

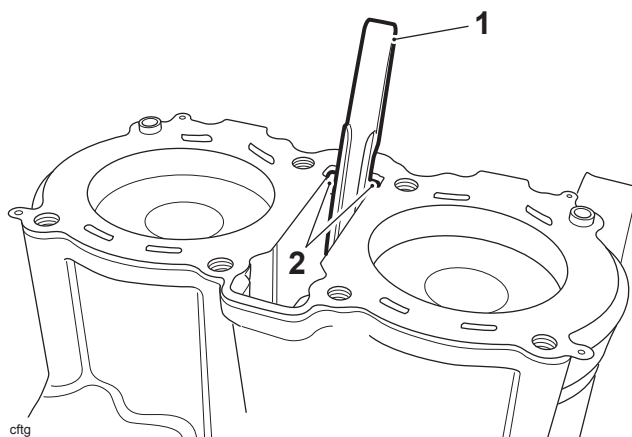
Warning

The rotor magnets are very strong. When handling the alternator cover the magnets may 'grab' the stator, causing injury to the hands or fingers. When handling the alternator cover wear suitable gloves and only grip the alternator cover by the outside surfaces; always keep hands and fingers clear when handling the alternator cover

- Remove the alternator cover (see Alternator Cover - Removal, page 99).
 - Remove the camshaft cover (see Camshaft Cover - Removal, page 103).
1. Rotate the engine until service tool T3880039 can be inserted through the hole in the alternator rotor, crankcase and into the idler gear.
 2. Remove the cylinder head (see Cylinder Head - Removal, page 134).

Note:

- **Note the position of the camshaft drive chain rubbing blade upper mounting for installation.**
3. Lift the camshaft drive chain tensioner rubbing blade out of the crankcase.



1. **Camshaft drive chain tensioner rubbing blade**
2. **Mounting lugs**

**Camshaft Drive Chain Rubbing Blade
- Inspection**

1. Inspect the camshaft drive chain blades for wear or damage. Renew as necessary.

Camshaft Drive Chain Rubbing Blade - Installation

1. Refit the camshaft drive chain rubbing blade. Ensure the lower mounting tip is correctly located in the upper crankcase and the lugs are located in the barrel as noted during removal.
2. Refit the cylinder head (see Cylinder Head - Installation, page 135).
3. Refit the camshafts (see Camshaft - Installation, page 129).
4. Refit the camshaft cover (see Camshaft Cover - Installation, page 104).
 - Refit the engine (see Engine - Installation, page 265).
 - Refit the fuel tank (see Fuel Tank - Installation, page 385).
 - Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
 - Refit the seat (see Seat - Installation, page 645).

Exhaust Decompressors

Note:

- **The de-compressor is an integral part of the camshaft. Any internal parts are not serviceable and can only be replaced as part of the camshaft. Always refer to the EPC for parts availability.**

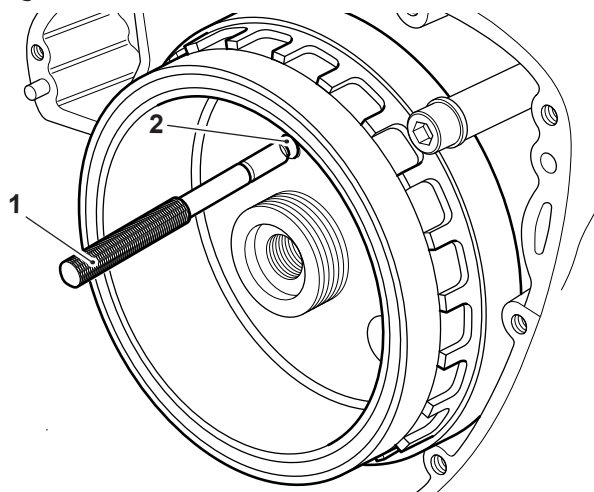
Camshaft - Removal

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.

Note:

- The camshaft can be removed from the cylinder head without complete removal of the camshaft drive chain. However, the camshaft drive chain must first be detached from the camshaft.
 - Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
 - Remove the fuel tank (see).
 - Remove the ignition coils (see Ignition Coils - Removal, page 699).
 - Remove the immobiliser/TPMS module (see Immobiliser/TPMS Control Module - Removal, page 406).
 - Remove the camshaft cover (see Camshaft Cover - Removal, page 103).
 - Remove the alternator cover (see Alternator Cover - Removal, page 99).
1. Rotate the engine until service tool T3880601 can be inserted through the hole in the alternator rotor, crankcase and into the idler gear.

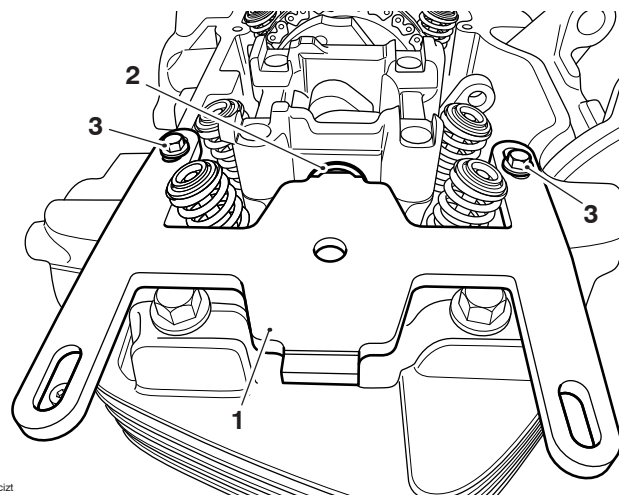


1. T3880601 - Camshaft Timing Pin
2. Timing hole in alternator rotor

2. In addition to the alignment mark, at TDC, the offset slot on the camshaft will align with the upper surface of the cylinder head.

Note:

- The service tool T3880650 has two different thickness edges marked A and B. If side A will not slide smoothly into the camshaft slot side use side B.
3. Insert the service tool T3880650 into the camshaft slot. Ensure that the tool is centrally located on the cylinder head and secure as shown below.



1. Camshaft slot
 2. T3880650 - Camshaft Timing Plate
 3. Fixings (6 x 12 mm)
4. Remove the camshaft drive chain tensioner (see Camshaft Drive Chain Tensioner - Removal, page 111).

Caution

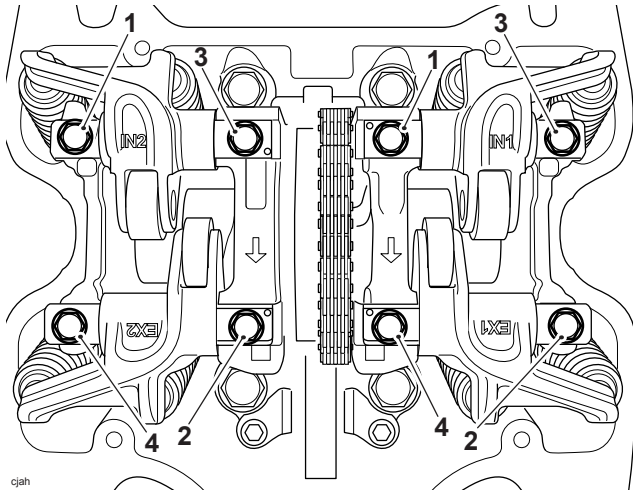
To avoid damage to the camshaft frames, always ensure as many camshaft lobes as possible are facing downwards. This will reduce stress on the camshaft frames during removal. Damage to the camshaft frames will result in replacement of the complete cylinder head.

Note:

- The camshaft frames can be removed either sequentially or simultaneously.

Cylinder Head

5. Evenly and progressively release the camshaft frame fixings in the sequence shown below.



Camshaft Frame Release Sequence

Caution

Failure to release the camshaft frame fixings progressively and evenly may result in damage to the camshaft frame, the camshaft or the cylinder head itself. A damaged camshaft frame cannot be replaced as an individual item. It can only be obtained as part of a new cylinder head.

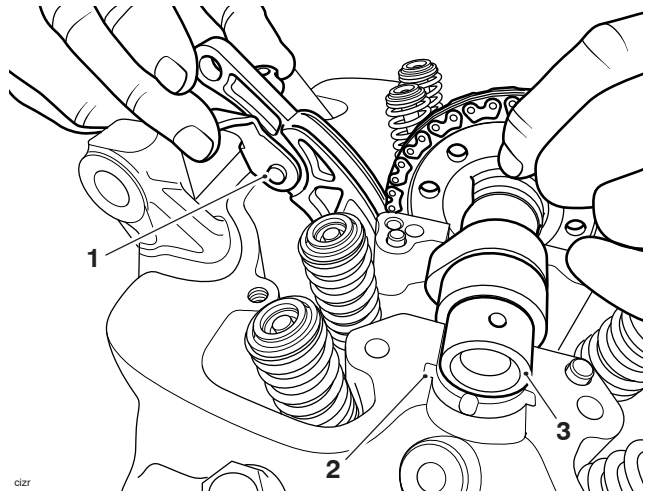
6. Once all of the upward force on the camshaft frames has been released, collect the bolts.

Caution

The camshaft frames are located to the cylinder head with dowels. When removing the camshaft frames collect the dowels at the same time. Failure to collect the dowels could cause them to fall into the crankcase and may cause serious damage to the engine.

7. Remove the camshaft frames.
8. Release the front camshaft timing chain tensioner blade and discard the fixings.

9. Raise the camshaft slightly from the bearing journals, and remove the camshaft drive chain tensioner blade.

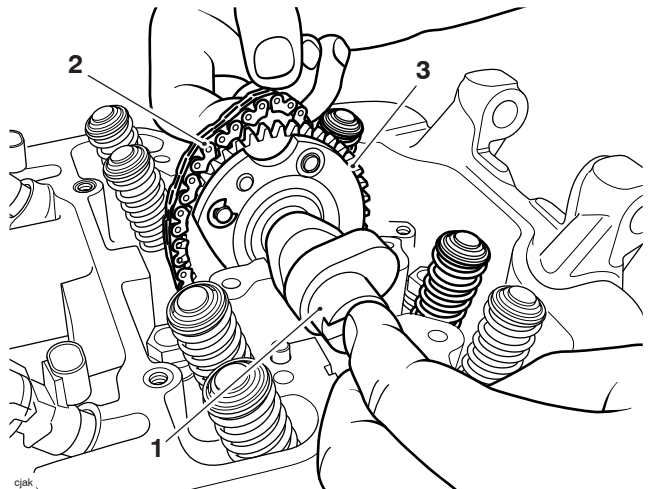


1. Tensioner guide

2. Bearing journal

3. Camshaft

10. Detach the camshaft drive chain from the camshaft.
11. Slide the camshaft to the right and remove it from the cylinder head.



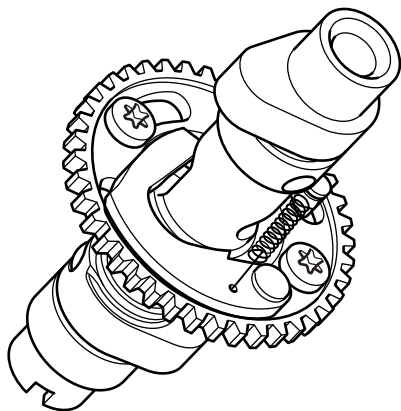
1. Inlet camshaft

2. Camshaft drive chain

12. Secure the camshaft drive chain to prevent it from falling into the crankcase.

Camshaft - Identification

The single camshaft has four lobes two inlet and two exhaust. The exhaust lobes contain decompressors, operated by the drive gear.



c12p

Camshaft

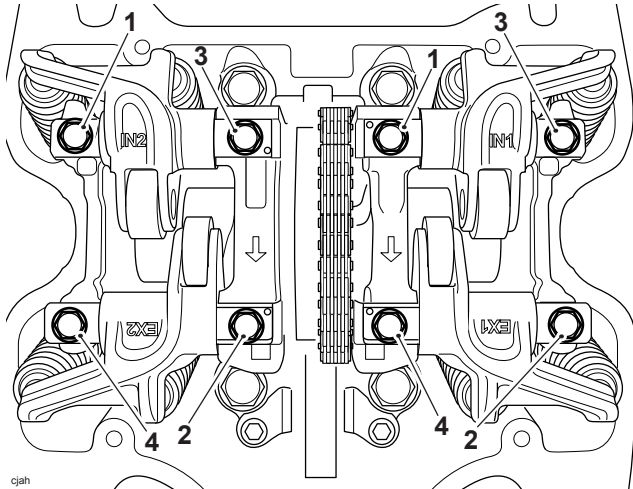
Camshaft - Inspection

1. Inspect the camshaft sprocket for damage and worn or broken teeth.
2. Inspect the bearing surfaces in the cylinder head and camshaft frame. If wear or damage is found, the cylinder head and the camshaft frames must be replaced.
3. Inspect the camshaft drive chain (see Camshaft Chain - Inspection, page 117).

Note:

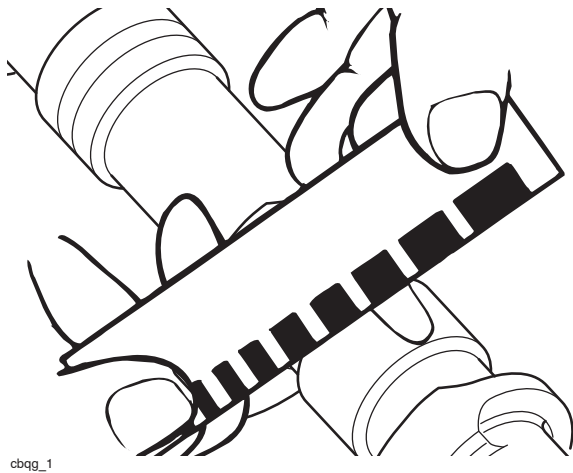
- **Inspect the decompressor for damaged or missing flyweights, worn or broken springs. Carefully inspect the pins on the decompressor for damage or wear.**
1. Check camshaft journal to camshaft frame clearance using Plastigauge (Triumph part number 3880150-T0301) as follows:
 - Position the camshaft to the cylinder head in its correct location. Ensure that the camshaft sprocket is positioned as for removal.
 - Wipe the exposed areas of one of the camshaft journals and the corresponding position on the camshaft frame.
 - Apply a thin smear of grease to the camshaft journal and a small quantity of silicone release agent to the corresponding position on the camshaft frame.
 - Size a piece of Plastigauge to fit across the camshaft journal.
 - Fit the Plastigauge to the camshaft journal using the grease to hold it in place.
 - Position the camshaft frames.
 - Fit the rocker shafts to the camshaft frames, at this stage, it is not necessary to fit the rocker arms.
 - Finger-tighten the camshaft frame bolts until the under head areas are in contact with the camshaft frame.

- In the sequence shown below, progressively tighten the camshaft frame bolts, until the camshaft frames are in full contact with the cylinder head. Tighten the bolts to 10 Nm.



Camshaft Frame Tightening Sequence

- Release and remove the camshaft frame as previously described.
- Utilising the gauge provided with the Plastigauge kit, measure the width of the now compressed Plastigauge.



Plastigauge Measurement

2. Calculate the camshaft journal clearance using the chart provided with the Plastigauge kit.
3. If the journal to camshaft frame clearance is within the specified tolerances (for specifications refer to Camshafts, page 38), remove the camshaft frame and clean off all traces of Plastigauge, silicone release agent and grease.
4. Check the diameter of the camshaft journals, (for specifications refer to Camshafts, page 38).
5. If any of the journal to camshaft frame clearances are outside the specified tolerances, but the camshaft journals are within their specified tolerances, the cylinder head must be replaced.

Valve Clearance

Camshaft, valve, valve shim and valve seat wear affect the valve clearances. The effect of this wear is to change the clearance between the rocker and the adjustment shim, causing engine noise and/or improper running. If the valve clearances are incorrect, permanent damage to components in the valve-train will take place and engine performance will be affected.

Note:

- **Valve clearance adjustment must be carried out with the engine cold.**
- **When replacing a valve shim, always refer to the EPC.**
- For valve clearance specifications (see Cylinder Head and Valves, page 37).

Valve Clearance Adjustment

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.

- Remove the seat (see Seat - Removal, page 645).
- Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
- Remove the fuel tank (see).

Note:

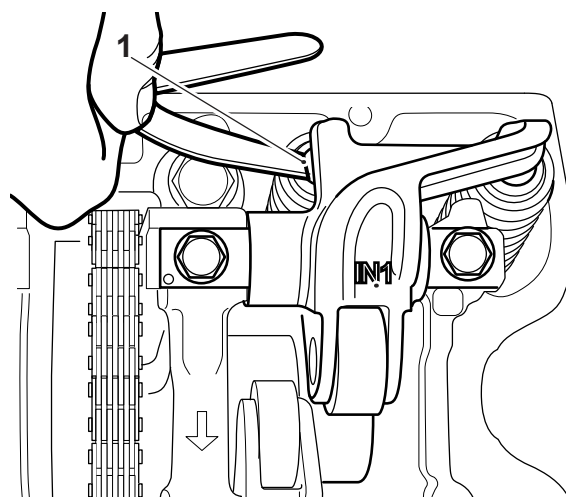
- **Valve clearance checking and adjustment must be carried out with the engine cold.**

1. Remove the camshaft cover (see Camshaft Cover - Removal, page 103).

Note:

- **Removing the spark plugs reduces compression therefore allowing the engine to be rotated freely.**

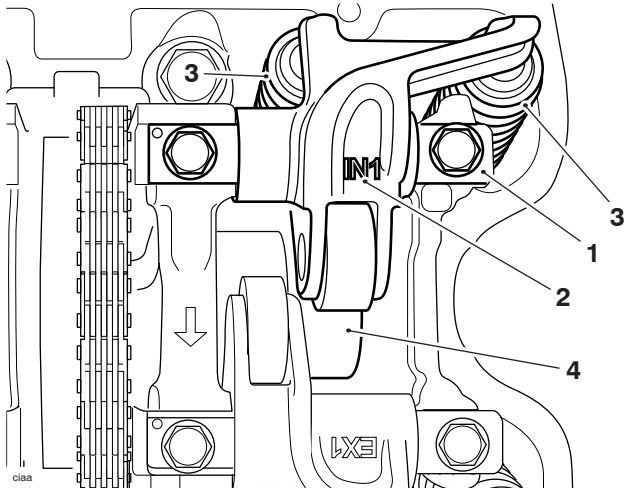
2. Remove the spark plugs.
3. Select a high gear and, using the rear wheel, rotate the engine until a camshaft lobe is positioned pointing directly away from the roller on the rocker shaft.
4. Using feeler gauges, measure and record the clearances for this pair of valves only.



1. Feeler gauges

5. Measure and record all valve clearances as described previously.

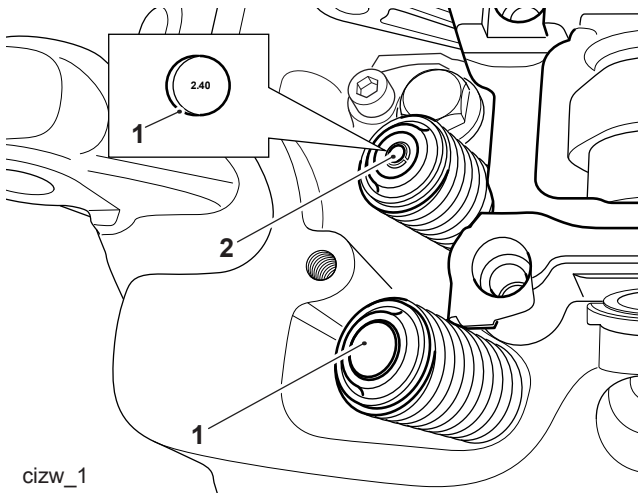
6. Remove the rocker shaft and rocker arm of a valve that requires adjustment.



1. Rocker shaft
2. Rocker arm
3. Shims (cylinder 1 inlet shown)
4. Camshaft

Note:

- The underside of the shim displays the shim size.
 - Always place the shim with the shim size facing towards the valve.
7. Remove the shim from the valve(s) that requires adjustment.



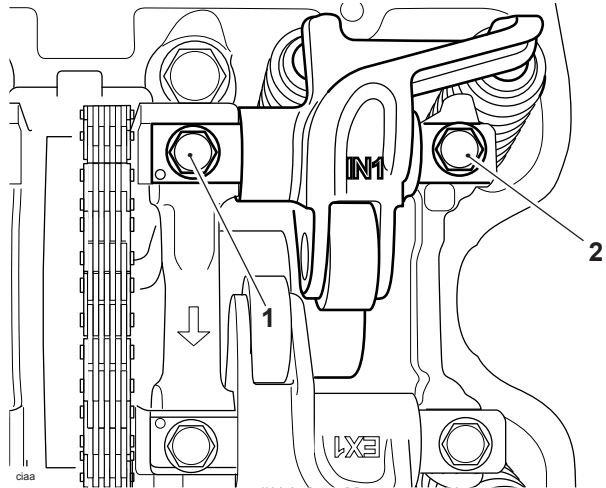
1. Shim
2. Valve

8. Measure the original shim, using a micrometer.
9. Calculate the shim thickness required to give the correct clearance, for specifications refer to Cylinder Head and Valves, page 37.
 - Clearance too small - Fit a thinner shim.
 - Clearance too large - Fit a thicker shim.

Note:

- Shims are available ranging from 2.00 mm to 3.20 mm in increments of 0.025 mm.

10. Fit the selected shim to the valve.
11. Refit the rocker arm and shaft, tighten the bolts in the sequence shown to 10Nm.



Rocker Shaft Tightening Sequence

12. Repeat the procedure until all valves requiring adjustment have been correctly set.
13. Rotate the engine several times to fully seat the shims.
14. Repeat the clearance checks on all valves, adjust as necessary.
15. Refit the camshaft cover (see Camshaft Cover - Installation, page 104).
 - Refit the fuel tank (see Fuel Tank - Installation, page 385).
 - Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
 - Refit the seat (see Seat - Installation, page 645).

Camshaft - Installation

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.

Accurate camshaft timing can only be obtained using the correct timing method and service tools as described below.

Caution

The camshaft sprockets are attached to the camshafts using slotted fixing holes. This allows for very accurate valve timing and therefore improved performance and fuel economy.

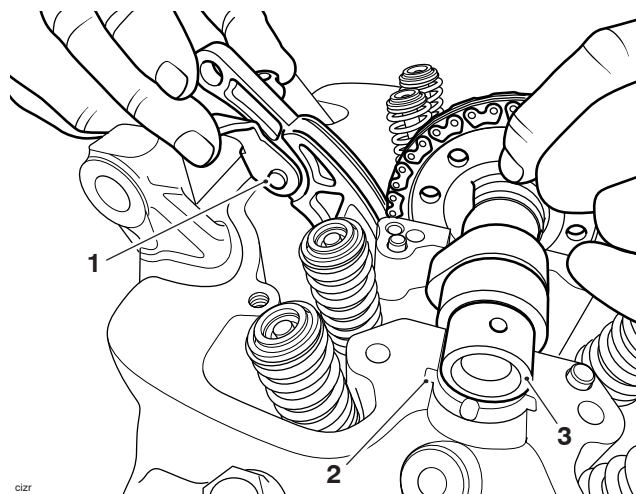
Never fit the camshaft sprockets without correctly setting the camshaft timing using the service tools and timing procedure described below. Severe engine damage will result from incorrect valve timing adjustment.

1. If not already installed, install the service tool T3880601.
2. Thoroughly clean the camshaft and journals. Lubricate the camshaft with clean engine oil before fitting to the cylinder head.

Note:

- **Ensure the sprocket fixings are centrally located within the slotted holes of the sprocket.**
 - **DO NOT tighten the fixings at this stage; the sprocket must be free to rotate.**
3. If removed, refit the camshaft sprocket noting its orientation, and secure using the original fixings.
 4. Locate the camshaft to the cylinder head from the right hand side, hooking the camshaft drive chain over the sprocket.
 5. Align the slot in the camshaft end to the upper surface of the cylinder head.

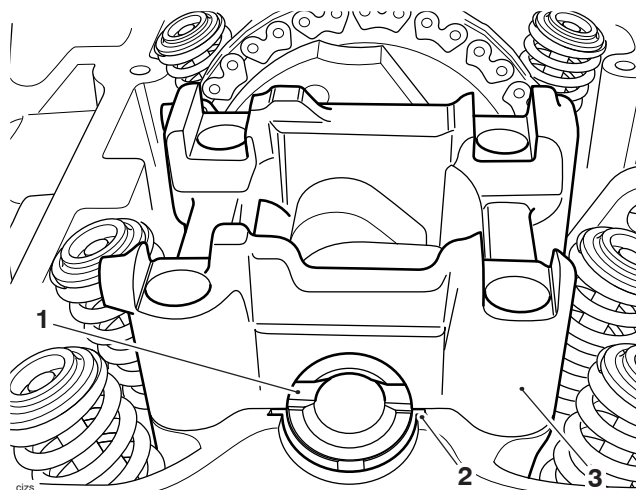
6. Lift the camshaft slightly from the bearing journals, refit the camshaft drive chain tensioner blade. Tighten the new fixings to 10 Nm.



1. Tensioner blade
2. Bearing journal
3. Camshaft

Note:

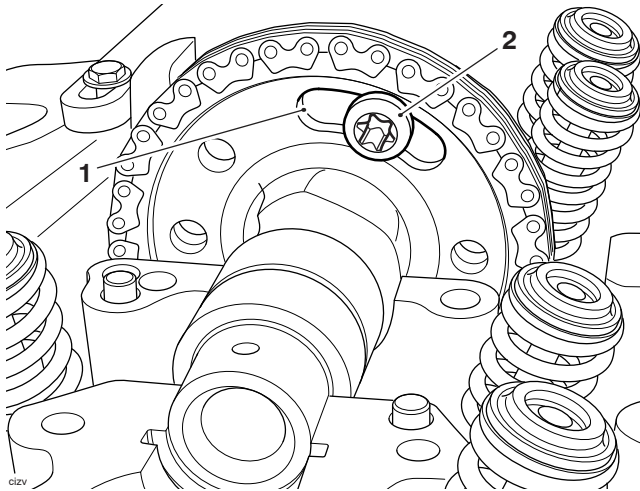
- **It is not necessary to fit the rocker arms at this stage.**
7. Temporarily secure number two cylinder camshaft ladder to the cylinder head with a rocker shaft and one fixing.



1. Camshaft slot
2. Cylinder head
3. Camshaft ladder (cylinder two)

8. Adjust the camshaft sprocket, so that the camshaft chain is taut on the inlet side (rear) of the engine.

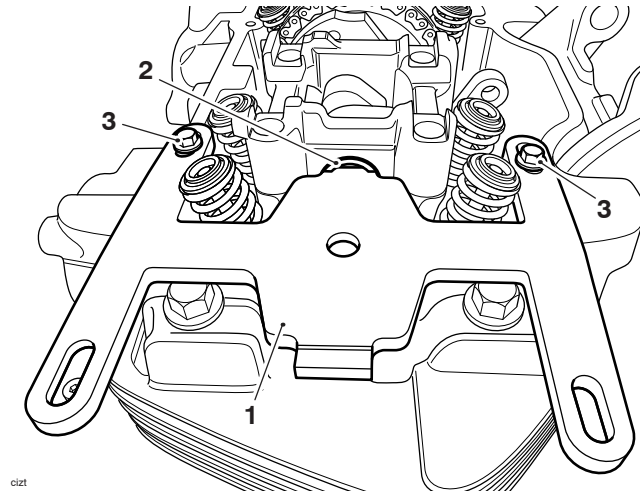
9. Ensure there is no slack in the chain between the crankshaft and the sprocket and the sprocket fixings are centrally located within the slotted holes.



1. Camshaft slot
2. Fixing (one of two on camshaft sprocket)

Note:

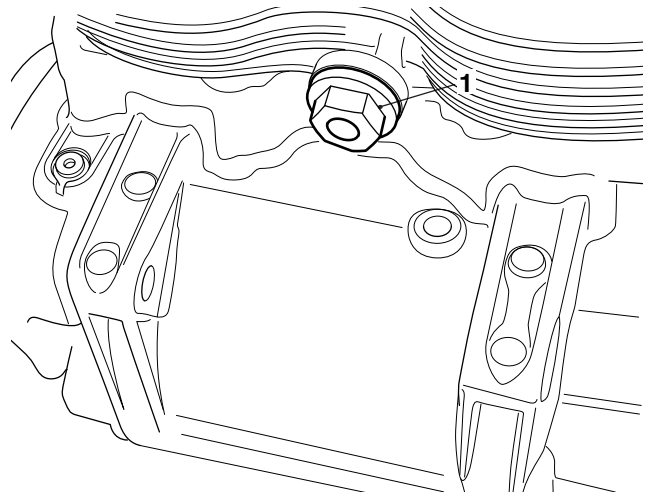
- The service tool T3880650 has two different thickness edges marked A and B. If side A will not slide smoothly into the camshaft slot side use side B.
10. Insert the service tool T3880650 into the camshaft slot. Ensure that the tool is centrally located on the cylinder head and secure as shown below.



1. T3880650 - Camshaft Timing Plate
2. Camshaft
3. Fixings (6 x 12 mm)

11. Check that the camshaft drive chain is engaged around the idler gear and the camshaft sprocket is positioned against the tensioner blade.

12. Fit the service tool T3880651 and tighten to 16 Nm.



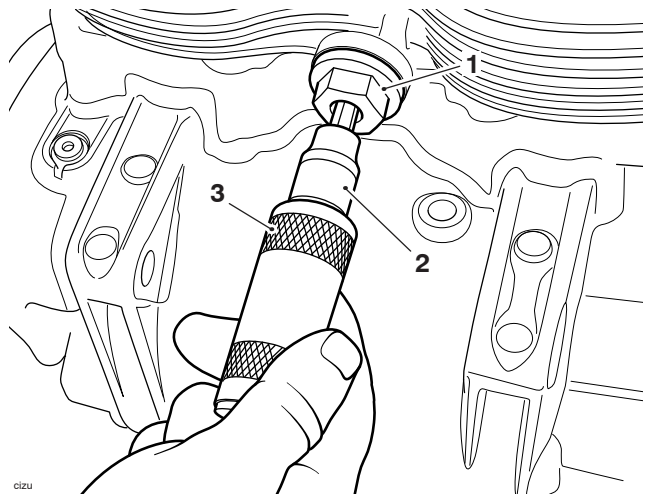
1. T3880651 - Timing Chain Tensioner

⚠ Caution

The torque value stated is very important to accurate timing. Always use the correct value of 0.6 Nm, as set using T3880609 - Timing Torque Limiter. Using an incorrect torque value will result in incorrect valve timing being set, or damage to the tensioner blade or other valve train components. Either condition may result in serious damage to the engine, reduced engine performance, or reduced fuel economy.

Note:

- The T3880609 - Timing Torque Limiter is pre-set to 0.6 Nm.
13. Using the service tool T3880609, tighten the internal screw thread to 0.6 Nm



1. T3880651 - Timing Chain Tensioner
2. Adaptor
3. T3880609 - Timing Torque Limiter

14. Remove and discard the accessible camshaft sprocket fixing. Install a new encapsulated fixing and tighten to 22 Nm.
15. Remove the service tool T3880601.

⚠ Caution

Always check that the service tool T3880650 has been removed before rotating the engine. Severe damage will result to the camshafts or service tool T3880650 if engine rotation is attempted with the tool installed.

16. Rotate the engine until the remaining sprocket fixing is accessible.
17. Refit the service tool T3880601.
18. Remove and discard the remaining camshaft sprocket fixing. Install a new encapsulated fixing and tighten to 22 Nm.
19. Remove service tool T3880601.

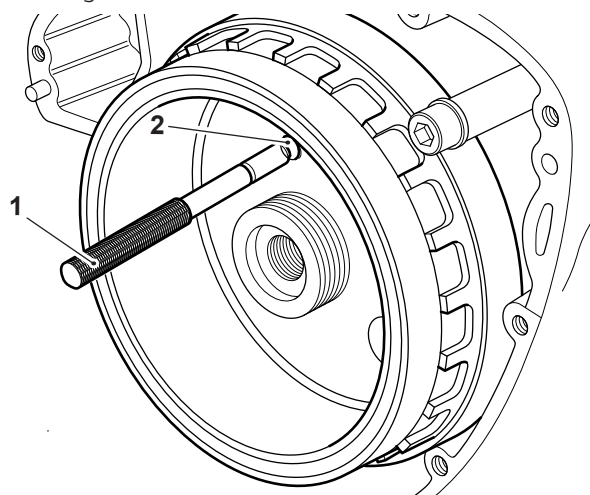
Note:

- **With the aid of an assistant, hold the camshaft drive chain taut during removal of the service tool T3880651.**
20. Release the tension on the service tool T3880651.
 21. Refit the timing chain tensioner, incorporating two new O-rings (see Camshaft Drive Tensioner - Installation, page 113).
 22. To activate the tensioner, rotate the crankshaft anti-clockwise two complete turns, using the fixing fitted to the end of the crankshaft. Stop rotation when number 1 cylinder is at top dead centre (TDC).

Note:

- **Before inserting the timing pin, ensure the slot on the camshaft is aligned with the upper surface of the cylinder head.**

23. Insert the service tool T3880601 into the timing holes in the crankcase and crankshaft.



civb

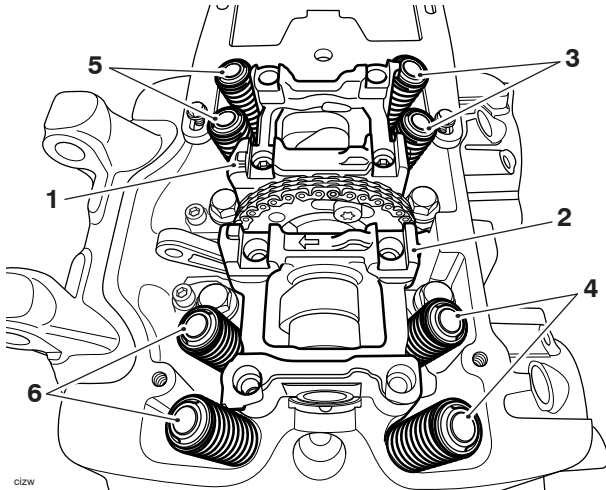
1. T3880601 - Camshaft Timing Pin

2. Timing hole in alternator rotor

Note:

- **The service tool T3880650 has two different thickness edges marked A and B. If side A will not slide smoothly into the camshaft slot side use side B.**
24. Check that the service tool T3880650 fits into the camshaft slot (to check that the camshaft timing has not moved during the removal of the service tool T3880651).
 25. Lubricate the camshaft bearing areas of the camshaft frame with a 50/50 solution of engine oil and molybdenum disulphide grease.
 26. Fit the shims to the valves as noted during removal.

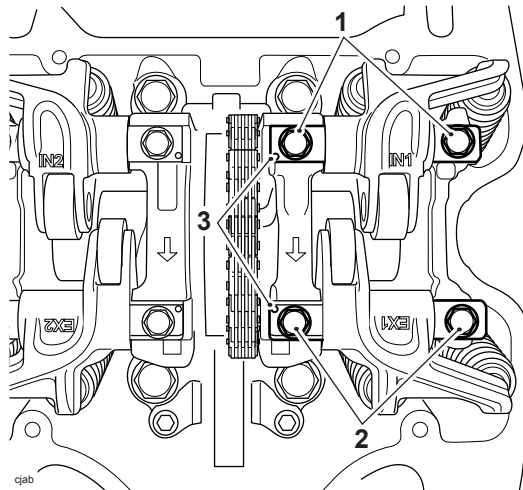
27. Position cylinder one camshaft frame to the cylinder head.



1. Camshaft ladder (cylinder 2)
2. Camshaft ladder (cylinder 1)
3. Shims (cylinder 2 inlet)
4. Shims (cylinder 1 inlet)
5. Shims (cylinder 2 exhaust)
6. Shims (cylinder 1 exhaust)

28. Remove the service tool T3880650.
29. Remove the service tool T3880601.
30. Lubricate the threads of the camshaft frame fixings with clean engine oil.
31. Fit the rocker shafts with the dot marks facing upwards and toward the camshaft drive gear.
32. Fit the inlet and exhaust rocker shafts to cylinder number one as shown below. Do not fully tighten at this stage.

33. Finger-tighten the fixings until the under head areas are in contact with the camshaft frame.

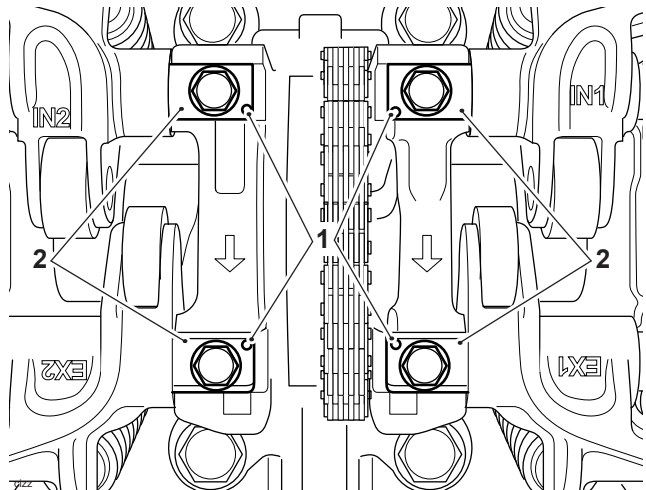


1. Fixings (inlet rocker shaft)
2. Fixings (exhaust rocker shaft)
3. Dot mark

34. Remove the fixing and rocker shaft from cylinder number two camshaft frame.
35. Lubricate the threads of the camshaft frame fixings with clean engine oil.

Note:

- The rocker shaft must be fitted with the dot marks facing upwards and toward the camshaft drive gear.
36. Fit the inlet and exhaust rockers and shafts to cylinder number two. Do not fully tighten at this stage.



1. Dot mark
2. Rocker shaft

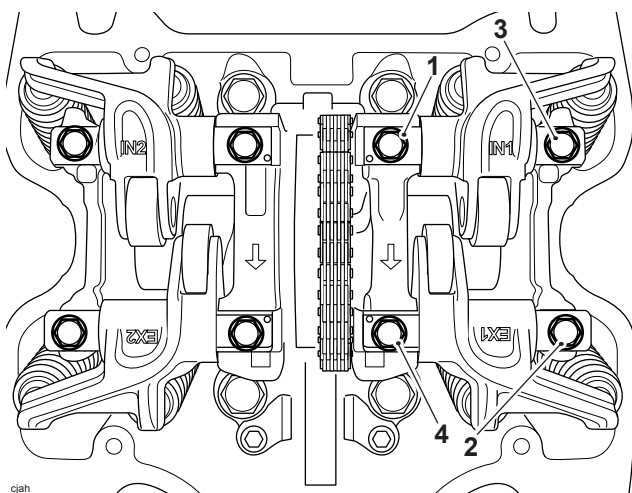
37. Finger tighten the fixings until the rocker shafts are in contact with the camshaft frame.

⚠ Caution

To avoid damage to the camshaft frame, always ensure as many camshaft lobes as possible are facing away from the rocker shaft. This will reduce stress on the camshaft frame during assembly. Damage to the camshaft frame will result in replacement of the cylinder head.

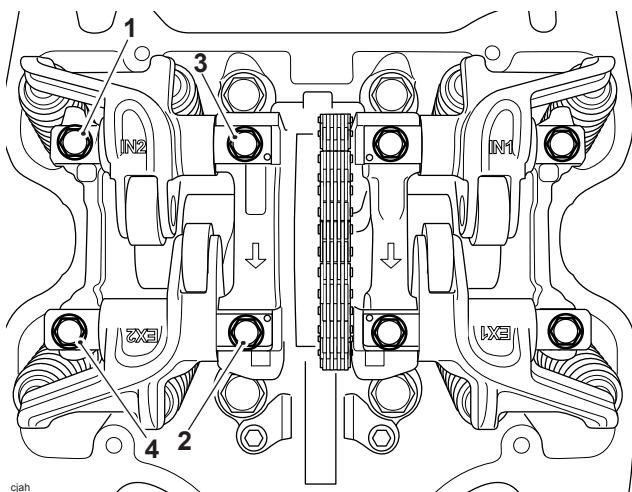
38. In the sequence shown below,

- Tighten cylinder one camshaft frame fixings, until the camshaft frames are in full contact with the cylinder head. Tighten the fixings to 10 Nm.



Cylinder One Camshaft Frame Tightening Sequence

- Tighten cylinder two camshaft frame fixings, until the camshaft frames are in full contact with the cylinder head. Tighten the fixings to 10 Nm.



Cylinder Two Camshaft Frame Tightening Sequence

⚠ 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.

39. Check all of the valve clearances and adjust as necessary until the correct clearances are achieved (see Valve Clearance Adjustment, page 127).

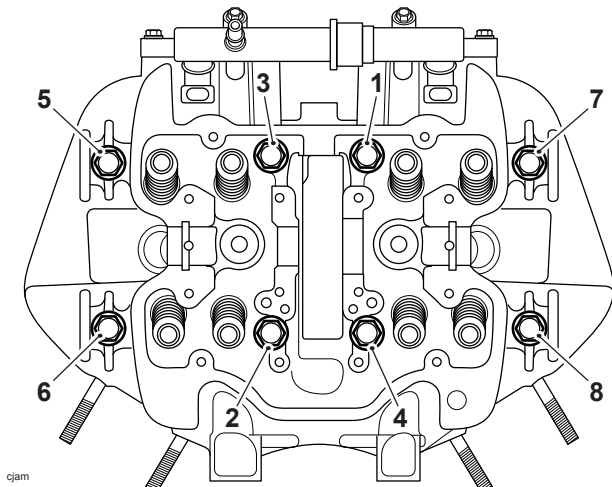
- Refit the alternator cover (see Alternator Cover - Installation, page 101).
- Refit the camshaft cover (see Camshaft Cover - Installation, page 104).
- Refit the immobiliser/TPMS module (see Immobiliser/TPMS Control Module - Installation, page 407).
- Refit the ignition coils (see Ignition Coils - Installation, page 701).
- Refit the fuel tank (see Fuel Tank - Installation, page 385).
- Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
- Refit the seat (see Seat - Installation, page 645).

Cylinder Head - 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.

- Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
 - Remove the fuel tank (see).
 - Remove the engine (see Engine - Removal, page 261).
 - Remove the camshaft cover (see Camshaft Cover - Removal, page 103).
 - Remove the camshaft (see Camshaft - Removal, page 123).
1. Noting their position and the thickness of the shims, remove all eight shims from the cylinder head.
 2. Progressively release the cylinder head bolts in the order shown below.



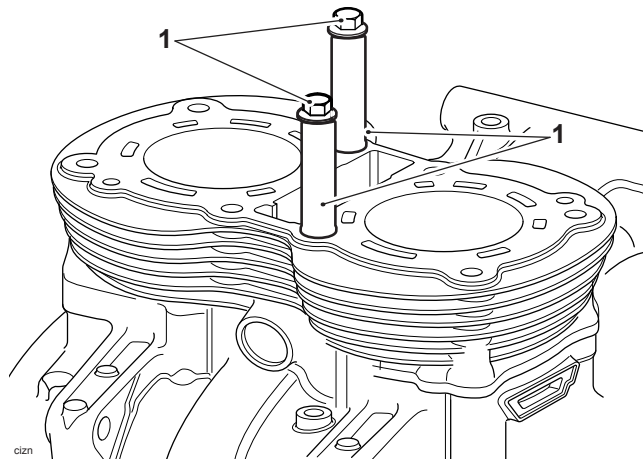
Cylinder Head Bolt Release Sequence

3. Remove the cylinder head bolts, retain the washers.

Note:

- **If necessary, lightly tap the cylinder head with a soft-faced mallet to break the gasket seal.**
4. Remove the cylinder head from the crankcase.

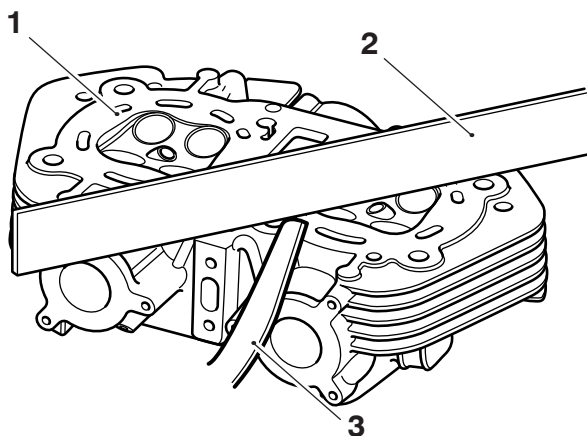
5. Remove and discard the cylinder head gasket.
6. Using service tool T3880308 and two of the cylinder head bolts, hold the cylinder barrel in position.



1. **Cylinder head bolts**
2. **T3880308 - Cylinder Barrel Clamps**

Cylinder Head - Inspection

1. Thoroughly clean the surface of the cylinder head and check for damage and/or pitting of the combustion chambers.
2. Using a straight edge and feeler gauges, check the cylinder head gasket face for warp, which could lead to gasket failure. Replace the cylinder head if warped beyond the flatness limit.



cizq

1. Cylinder head
2. Straight edge
3. Feeler gauges

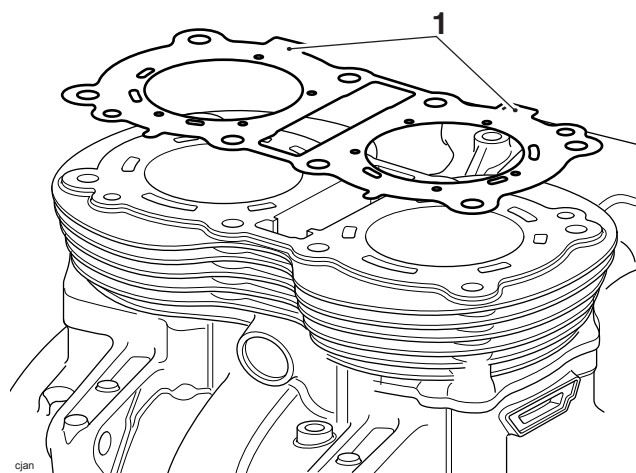
3. For specifications refer to Cylinder Head and Valves, page 37.
4. Inspect the valve guides for damage or wear.
5. If a valve guide is found to be worn beyond the service limit, the complete cylinder head must be renewed.
6. For specifications refer to Cylinder Head and Valves, page 37.
7. Check the camshaft drive chain rubbing blades. Renew if worn or damaged.

⚠ Caution

Ensure all traces of fluid (coolant, oil etc.) are removed from the threaded holes in the crankcase. Should any fluid remain in any of the threaded holes, severe crankcase damage could result from hydraulic locking of head bolts on assembly of the engine.

Cylinder Head - Installation

1. Thoroughly clean the upper faces of the cylinder barrel.
2. Refit the camshaft drive chain rubbing blade (see Camshaft Drive Chain Rubbing Blade - Installation, page 122).
3. Ensure that both cylinder head dowels are correctly located in the cylinder barrel.
4. Position a new cylinder head gasket to the cylinder barrel, ensuring the gasket is fitted with the lettering uppermost and to the rear of the engine.



1. Head gasket markings

5. Position the cylinder head over the camshaft drive chain rubbing blade and locate it onto the dowels.

⚠ Caution

Cylinder head bolts are re-usable.

If for any reason a cylinder head bolt is lost or deemed unusable the cylinder head bolts must be replaced as a set.

Failure to follow the correct tightening procedure or reuse of a single replacement cylinder head bolt may lead to engine damage and premature failure of the cylinder head gasket.

6. Position the washers onto the new cylinder head bolts and lubricate the bolt threads with clean engine oil.

Caution

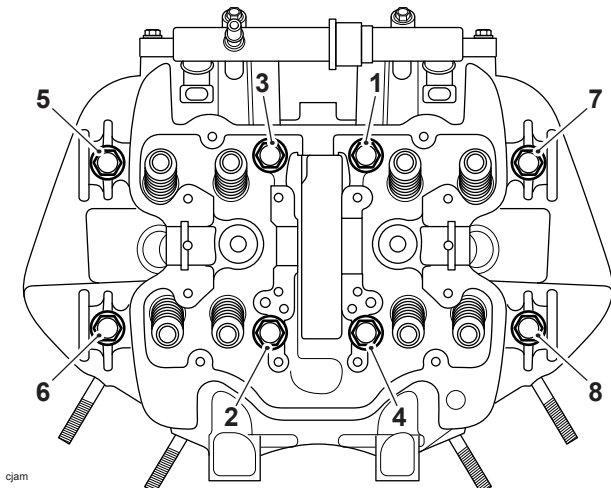
Use the correct procedure to tighten the cylinder head bolts carefully following the four-stage procedure below. This will ensure the long-term reliability of the cylinder head gasket.

Failure to follow the correct tightening procedure may lead to engine damage and premature failure of the cylinder head gasket.

Start the engine and allow it to idle while checking for air, oil, coolant and exhaust leaks.

Rectify as necessary.

7. In the following sequence, tighten the cylinder head bolts in four stages as follows:
 - Tighten the bolts to 20 Nm.
 - Tighten the bolts to 30 Nm.
 - Tighten the bolts through a further 150° using service tool 3880160-T0301 or similar to measure the torque-angle.
 - Tighten the bolts a further 60 Nm.

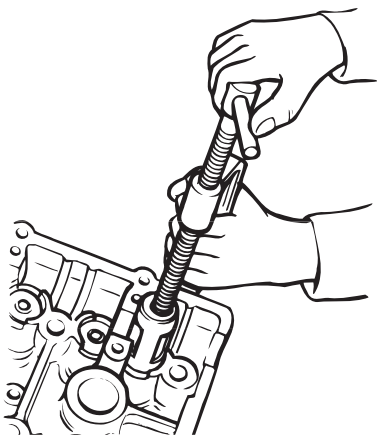


Tightening Sequence

8. Lubricate the valve shims with a 50/50 solution of molybdenum disulphide grease and engine oil, then refit them to their original locations in the cylinder head.
 - Refit the camshaft (see Camshaft - Installation, page 129).
 - Check and adjust the valve clearances (see Valve Clearance Adjustment, page 127).
 - Refit the camshaft cover (see Camshaft Cover - Installation, page 104).
 - Refit the engine (see Engine - Installation, page 265).
 - Refit the fuel tank (see Fuel Tank - Installation, page 385).
 - Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
 - Refit the seat (see Seat - Installation, page 645).

Valves and Valve Stem Seals - Removal

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



gadh

Valve removal

2. Once the collets are released, remove the following items:
 - Valve spring retainer
 - Valve spring
 - Valve spring base
 - Valve stem oil seal
 - Valve (deburr before removal).

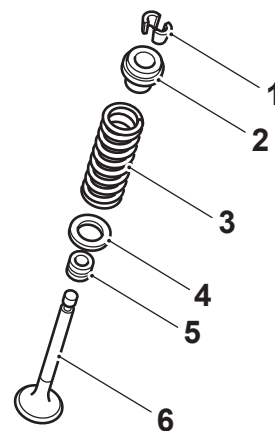


carr

1. **Valve stem seal**

Note:

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



ccrx

1. **Collets**
2. **Valve spring retainer**
3. **Valve spring**
4. **Valve spring base**
5. **Valve stem oil seal**
6. **Valve**

Valves and Valve Stem Seals - Installation

1. Lubricate the valve stems with a 50/50 solution of engine oil and molybdenum disulphide grease.
2. Install the valve into the valve guide and refit the spring base 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.

1. Install the valve spring over the valve stem. Ensure the close wound, colour coded ends of the springs are fitted downwards (towards the piston).
2. Fit the valve spring retainer.
3. Compress the valve spring ensuring that the spring is compressed squarely to prevent damage to the valve stem and cylinder head.
4. Fit the valve collets ensuring correct collet location in the spring retainer 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

Caution

the engine is running allowing the valves to contact the pistons. Any such valve to piston contact will cause severe engine damage.

Valve Face Inspection

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

Valve Stems

If a valve stem is found to be worn beyond the service limit, the valve must be renewed.

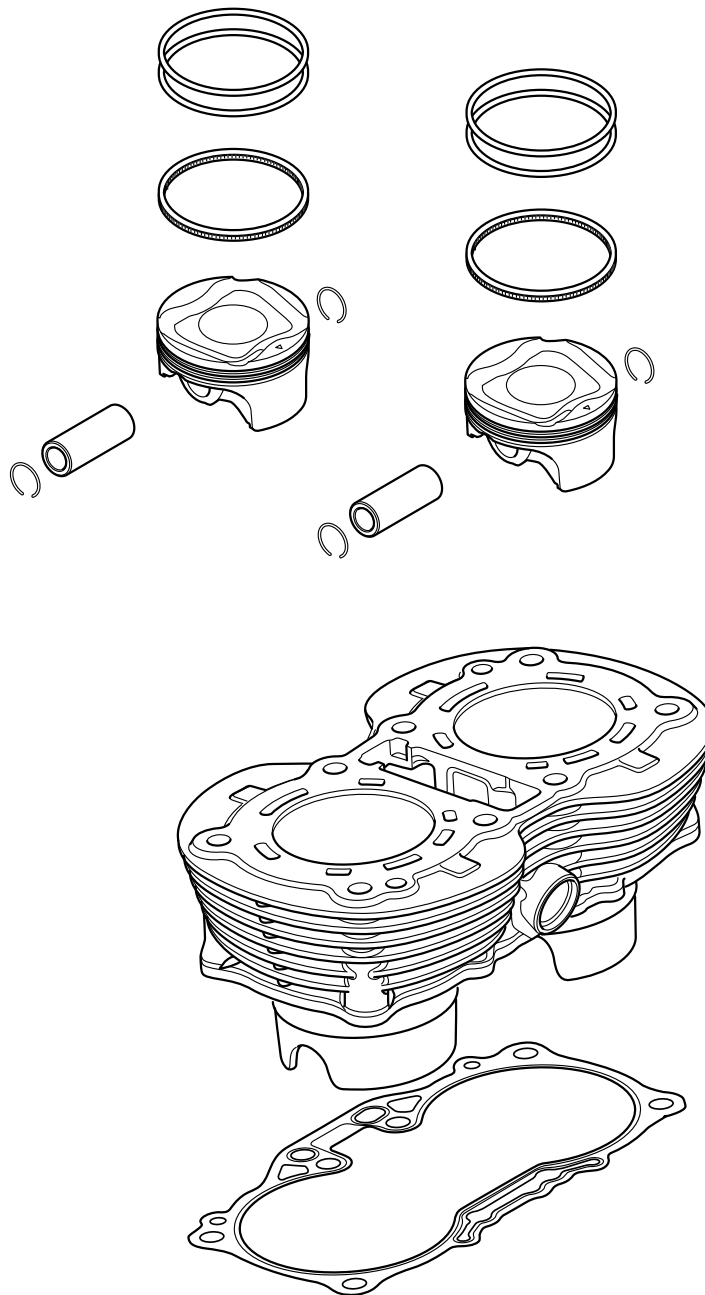
Refer to Cylinder Head and Valves, page 37.

10 Barrels And Pistons

Table of Contents

Exploded View - Barrels and Pistons.....	141
Barrels - Removal.....	142
Barrels - Inspection.....	143
Barrels - Installation.....	143
Piston Rings - Removal.....	145
Piston Ring to Groove - Clearance.....	145
Piston Ring - End Gap.....	146
Piston Rings - Assembly.....	146
Piston - Removal.....	147
Piston - Wear Check.....	148
Piston - Installation.....	149

Exploded View - Barrels and Pistons



Barrels - 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.

- Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
 - Remove the fuel tank (see).
 - Remove the engine (see Engine - Removal, page 261).
 - Remove the alternator cover (see Alternator Cover - Removal, page 99).
 - Remove the camshaft cover (see page Camshaft Cover - Removal, page 103).
 - Remove the cylinder head (see Cylinder Head - Removal, page 134).
1. Clean the area around the barrel base gasket joint to prevent dirt falling into the crankcase when the barrels are removed.
 2. Ensure the pistons are level with each other then break the seal of the base gasket joint.

Caution

Do not strike or lever against the barrel cooling fins to break the seal as the fins are easily damaged.

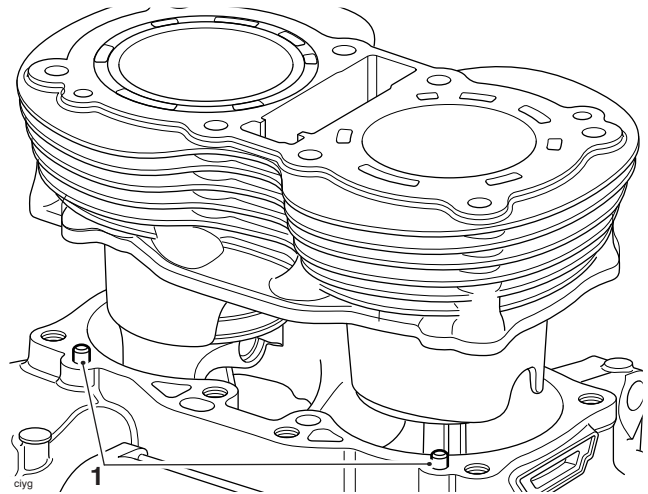
Note:

- **Secure the cam chain to ensure that it does not fall into the crankcase during removal of the barrels.**

Caution

Support the pistons as the barrels are removed to prevent piston damage.

3. Lift off the barrels and recover the locating dowels.



1. Locating dowels

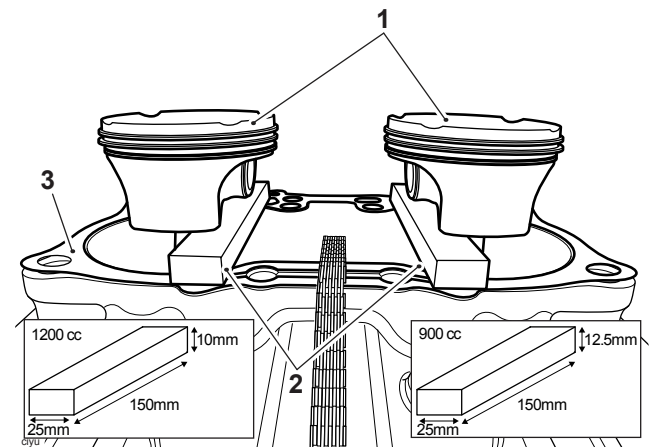
4. Remove and discard the base gasket.

Barrels - Inspection

1. The cylinder barrels are not measurable in service, (see Piston, page 41).

Barrels - Installation

1. Thoroughly clean the mating surfaces of the crankcase and barrels taking care not to damage the mating surfaces.
2. Fit a new base gasket and refit the locating dowels as noted during removal.
3. Using suitable spacers to support the pistons whilst preventing contact with the crankcase, rotate the crankshaft to position the pistons level with each other.



1. Pistons
2. Spacer
3. Crankcase

⚠ Caution

Do not allow the pistons to fall against the crankcase when turning the engine. Piston and/or crankcase damage could occur if the pistons are not supported while turning the engine.

4. Ensure the piston ring end gaps are correctly positioned (see Piston Rings - Assembly, page 146).

Note:

- Ensure the barrels and pistons are clean prior to installation.
5. Lubricate the piston rings and the cylinder bores with clean engine oil.

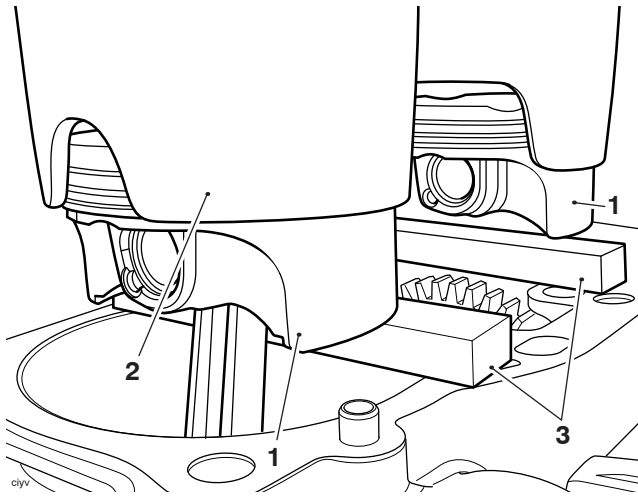
⚠ Caution

Do not allow the full weight of the barrels to rest unsupported on the pistons. Failure to support the barrels is likely to result in piston ring breakage.

Caution

Do not force the pistons into their bores. The base of each bore is chamfered to ease installation and excess force should not be needed. If either piston jams, lift the barrels slightly and check the rings are correctly located into their grooves before continuing. The use of force is likely to result in piston ring breakage.

6. With the aid of an assistant, ease the barrels carefully over the pistons whilst guiding the piston rings into the base of the cylinder bores.



- 1. Piston**
- 2. Barrel**
- 3. Spacer**

7. Slide the barrels fully down, remove the spacers and locate on the dowels.
8. Refit the cylinder head (see Cylinder Head - Installation, page 135).
9. Refit the camshafts (see page Camshaft - Installation, page 129).

10. Recheck the tensioner plunger location against the camshaft drive chain tensioner blade.
11. Remove service tool T3880039 from the crankcase.
 - Refit the alternator stator (see Alternator Rotor - Installation, page 705).
 - Refit the alternator cover to the engine (see Alternator Cover - Installation, page 101).
 - Refit the camshaft cover (see Camshaft Cover - Installation, page 104).
 - Refit the engine (see Engine - Installation, page 265).
 - Refit the fuel tank (see Fuel Tank - Installation, page 385).
 - Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
 - Refit the seat (see Seat - Installation, page 645).

Piston Rings - Removal

1. Ease the top compression ring out of its groove and remove it from the top of the piston.

Caution

Do not expand the piston rings any more than is necessary to allow them to be removed from the piston. The rings are brittle and will break if expanded too much.

2. Remove the second compression ring in the same way.

Note:

- The top and second compression rings are different and are not interchangeable (see *Piston Rings - Assembly*, page 146).
- Piston rings must be removed from the piston using hand pressure only. Do not overextend the piston rings during removal.
- If the piston rings are to be reused, note the orientation of the oil control rings prior to removal.

3. Remove the oil control rings and expanders.

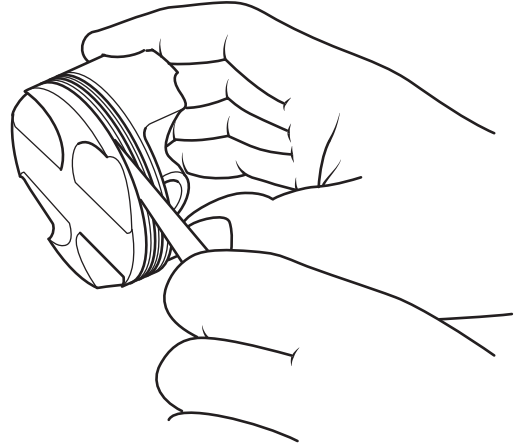
Note:

- If the piston rings are to be re-used, keep them with their respective piston to ensure they are refitted in their original locations.

Piston Ring to Groove - Clearance

Note:

- Prior to removing the rings, check the ring-to-groove clearance of each compression ring.
1. With the piston rings correctly installed on the piston, check the ring-to-groove clearance of each compression ring, using a feeler gauge.



capg

Piston Ring-to-Groove Clearance Check

2. When checking the piston ring to groove clearance, always refer to the specifications table (see *Piston*, page 41).

Note:

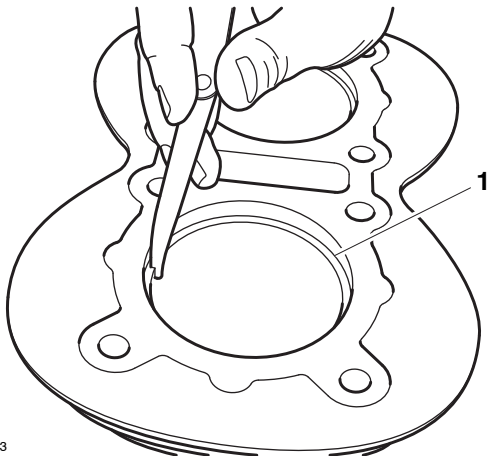
- If the ring-to-groove clearance is too large, replace the piston rings with a new set.
- If the gap remains too large with new piston rings, the piston must also be replaced.
- If the gap is too small, check the piston ring grooves closely for distortion, replacing the piston as necessary. Do not file the ring grooves.

Piston Ring - End Gap

1. Check each piston ring end gap as follows.

Note:

- The piston ring end gap must be measured in the cylinder bore to which the piston ring will be fitted to on installation.
- Ensure all piston rings are fitted in their original locations (if original rings are being reused) or to the piston/bore which the end gaps were checked (if new rings are being installed).
- Position the piston ring into the top of the cylinder bore.
- Using the piston crown, push the piston ring down into the bore (the piston will keep the piston ring square) until the third groove of the piston is level with the top of the bore.
- Remove the piston and measure the gap between the ends of the piston ring, using a feeler gauge.



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1. Checking piston ring end gap

2. When checking the piston ring end gap, always refer to the specifications table (see Piston, page 41).

Note:

- If the end gap is too large, replace the piston rings with a new set.
 - If the gap remains too large with new piston rings, both the pistons and barrels must be replaced.
 - If the gap is too small, check the cylinder bore for distortion, replacing as necessary.
 - Do not file the piston rings.
3. Repeat the procedure for the remaining piston rings.

Piston Rings - Assembly

1. Ensure the piston ring grooves are clean.

Note:

- Ensure all piston rings are fitted in their original locations (if original rings are being reused) or to the piston/bore which the end gaps were checked (if new rings are being fitted).

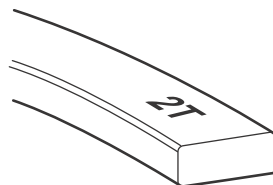
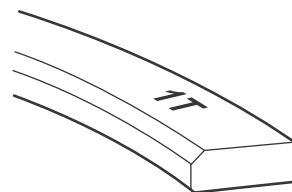
! Caution

Do not expand the piston rings any more than is necessary to allow them to be installed on the piston. The rings are brittle and will break if expanded too much.

2. Fit the oil control ring expander to the piston then install the upper and lower control rings (the oil control rings are both the same and can be fitted either way up).
3. Fit the second compression ring carefully to the piston, ensuring its **2T** mark is facing upwards.
4. Fit the top compression ring to the piston ensuring its **1T** mark is facing upwards.

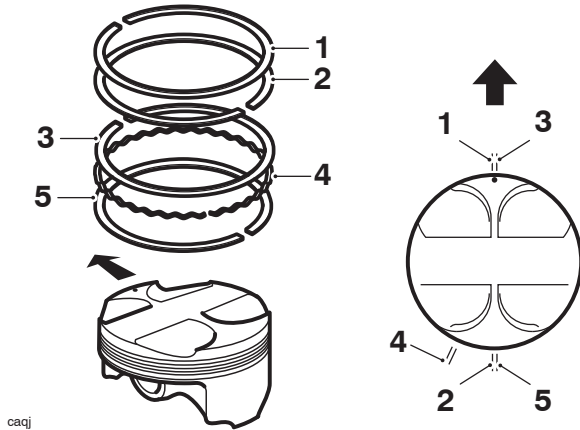
Note:

- Ensure the second and top compression rings are correctly installed.
- The second and top compression rings are different and are not interchangeable.
- The top ring can be identified by the chamfer on its upper inside edge.
- The second ring has no chamfer.



Piston Ring Identification

5. Ensure all piston rings move freely in their grooves.
6. Position the piston ring end gaps as follows (piston viewed from above, triangular mark facing forwards).



Piston Ring End Gap Locations

1. Top ring
2. Second ring
3. First steel oil control ring
4. Oil control ring expander
5. Second steel oil control ring

Note:

- The top compression ring gap should be in the 12 o'clock position.
- The second compression ring gap should be in the 6 o'clock position.
- The first oil control ring gap should be in the 12 o'clock position.
- The second oil control ring gap should be in the 6 o'clock position.
- The oil control ring expander gap should be in the 7 o'clock position.

Piston - 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.

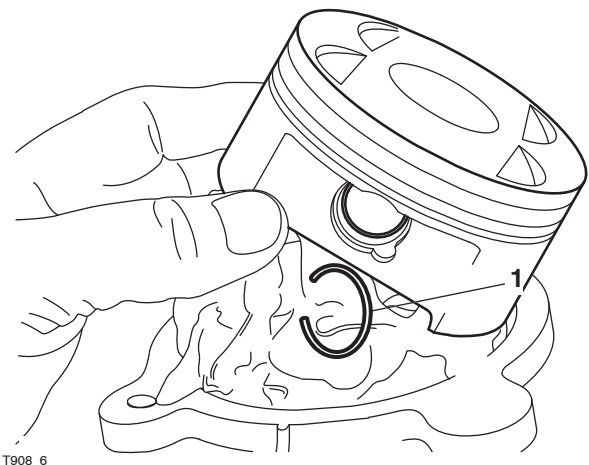
- Remove the seat (see Seat - Removal, page 645).
- Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
- Remove the fuel tank (see).
- Remove the cylinder barrel (see Barrels - Removal, page 142).

Note:

- If both pistons are being removed, mark each piston to ensure it is refitted in its original location.
1. Remove and discard the gudgeon pin circlip from one side of the piston.

Caution

If a circlip is dropped into the crankcase, it must be recovered before the crankshaft is rotated. Failure to do so will result in serious engine damage.



1. Circlip

2. Remove the gudgeon pin by pushing the pin through the piston and connecting 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 cylinder barrel when assembled.

Note:

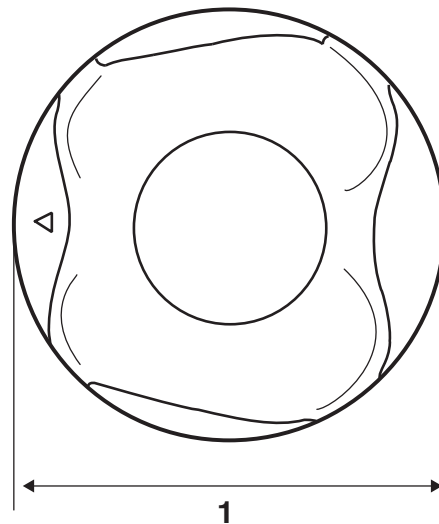
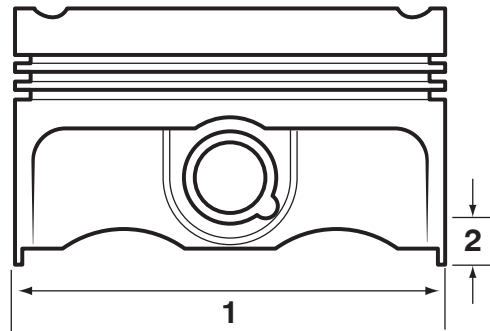
- If the gudgeon pin is found to be tight in the piston, check the piston for a witness mark caused by the circlip. Carefully remove the mark to allow the pin to be removed.
3. Remove the remaining circlip from the piston and discard it.
 4. Remove the piston rings.

Note:

- The rings may be removed using a proprietary piston ring expander tool or, if a tool is not available, carefully spread the ring opening using thumb pressure then push up on the opposite side of the ring to remove it from the piston.

Piston - Wear Check

1. Remove any carbon build-up from the piston crown. Inspect the piston crown for signs of pitting and check the piston skirt and ring grooves for signs of wear or scuffing. If any sign of damage is found, renew the piston.
2. Measure the piston outside diameter 10 mm $\pm$ 3 mm from the bottom of the piston and at 90° to the direction of the gudgeon pin.



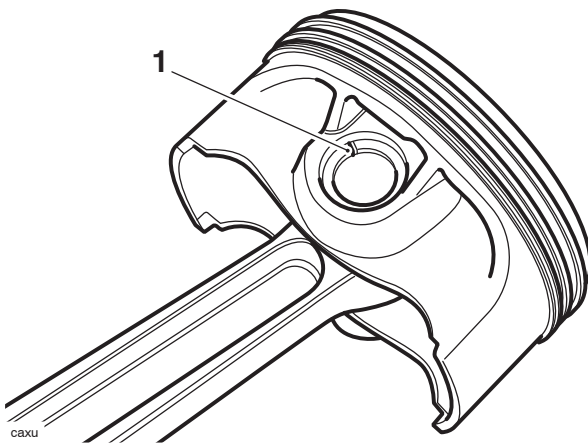
1. **Piston outside diameter**
2. **Measurement point**
3. Always refer to the specifications table (see Piston, page 41).
4. Replace the piston and rings if outside the specified limit.

Piston - Installation

1. Fit a new circlip to the inside of the piston. Ensure the circlip is correctly located in the piston groove.

Warning

Failure to use new gudgeon pin circlips could allow the pin to detach from the piston. This could seize the engine resulting in loss of motorcycle control and an accident.



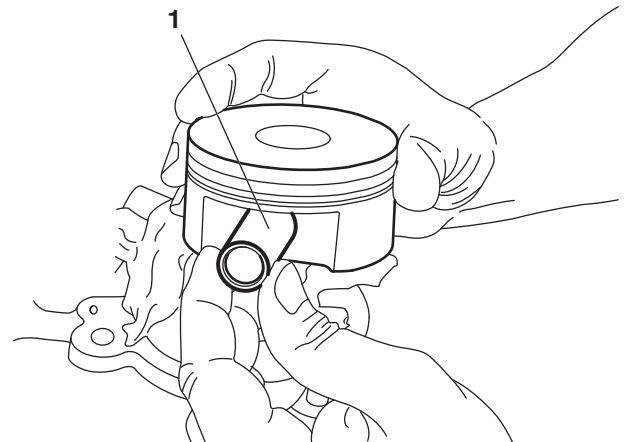
1. Circlip Fitment

2. Lubricate the connecting rod small-end and gudgeon pin with clean engine oil.
3. Align the piston with the connecting rod, ensuring the triangular mark on the piston crown is facing towards the front of the engine.

Note:

- If the original pistons are being refitted, ensure they are fitted in their original locations.

4. Insert the gudgeon pin into the piston and push it fully into position.

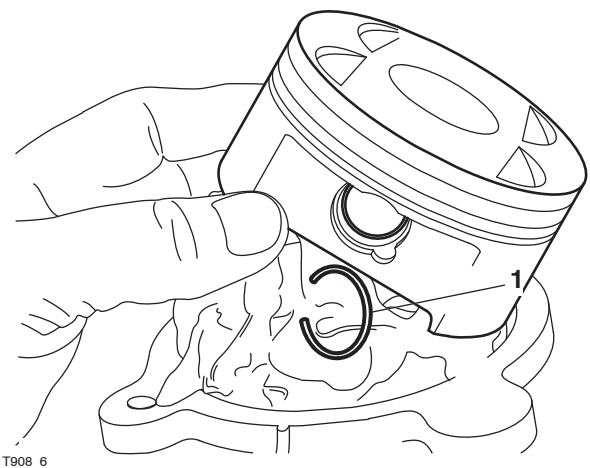


Gudgeon Pin

5. Secure the gudgeon pin in position with the remaining new circlip. Ensure the circlip is correctly located in the piston groove.

Caution

If a circlip is dropped into the crankcase, it must be recovered before the crankshaft is rotated. Failure to do so will result in serious engine damage.



1. Circlip



Caution

Do not allow the pistons to fall against the crankcase when turning the engine. Piston and/or crankcase damage could occur if the pistons are not supported while turning the engine.

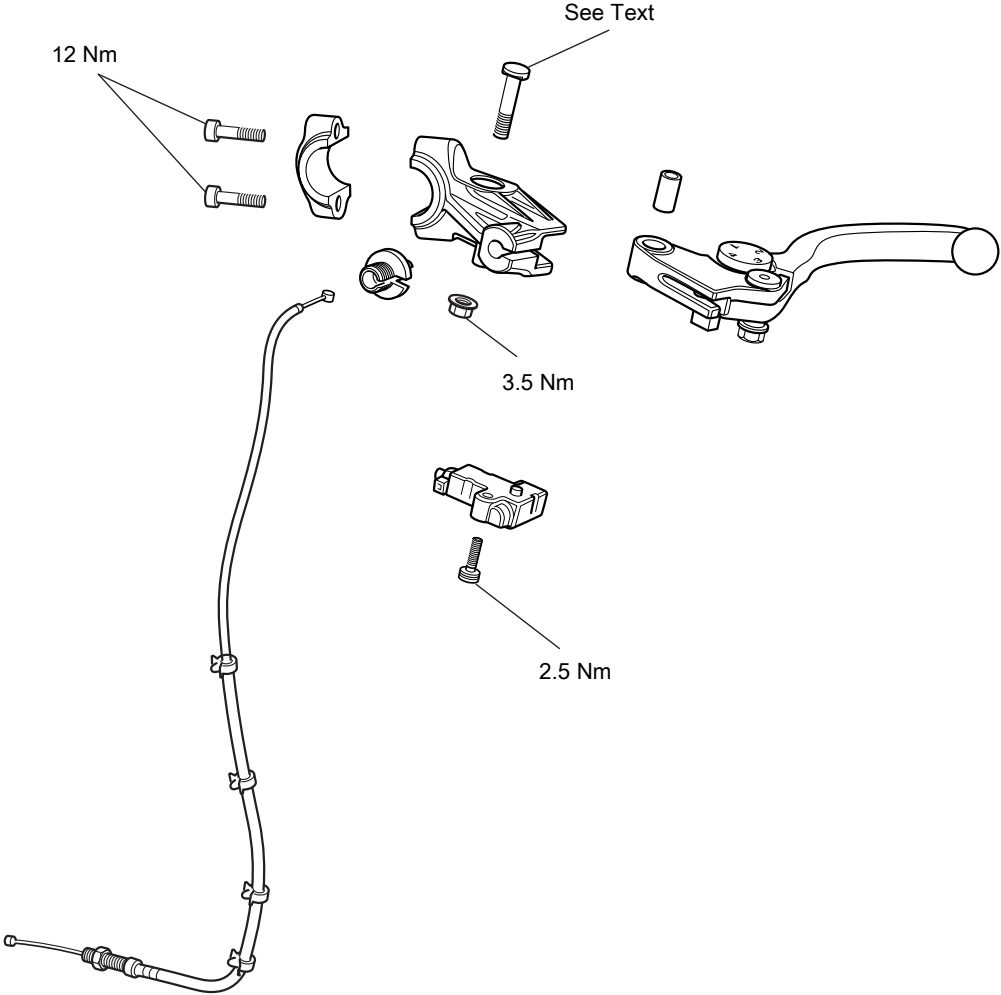
6. Install the remaining piston.
 - Refit the barrels (see Barrels - Installation, page 143).
 - Refit the cylinder head (see Cylinder Head - Installation, page 135).
 - Refit the alternator stator (see Alternator Rotor - Installation, page 705).
 - Refit the alternator cover to the engine (see Alternator Cover - Installation, page 101).
 - Refit the camshaft cover (see Camshaft Cover - Installation, page 104).
 - Refit the engine (see Engine - Installation, page 265).
 - Refit the fuel tank (see Fuel Tank - Installation, page 385).
 - Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
 - Refit the seat (see Seat - Installation, page 645).

11 Clutch

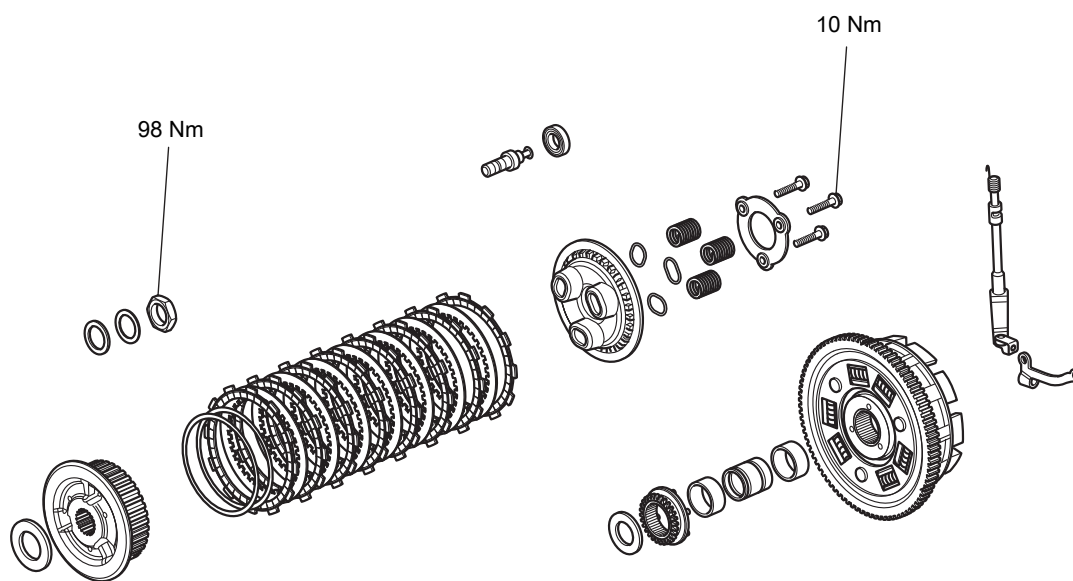
Table of Contents

Exploded View – Clutch Controls.....	153
Exploded View – Clutch.....	154
Clutch Cable - Removal.....	155
Clutch Cable - Inspection.....	156
Clutch Cable - Installation.....	157
Clutch - Removal	158
Friction Plate Inspection.....	159
Steel Plate Inspection	160
Clutch Pack - Height.....	160
Clutch - Installation.....	162

Exploded View – Clutch Controls



Exploded View - Clutch

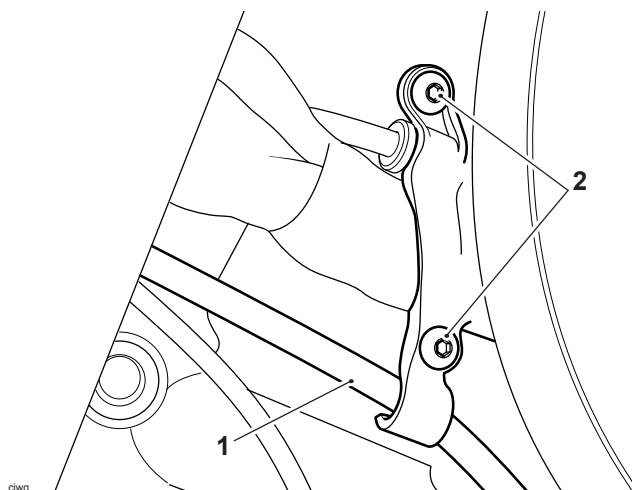


Clutch Cable - Removal

Warning

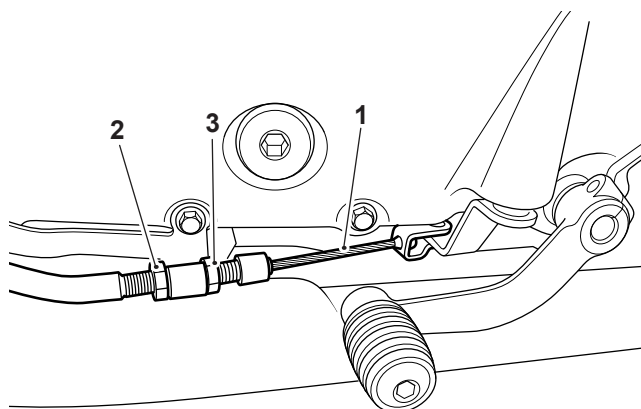
Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

1. From the left hand side of the headstock, remove the cable retaining bracket and discard it's fixings.



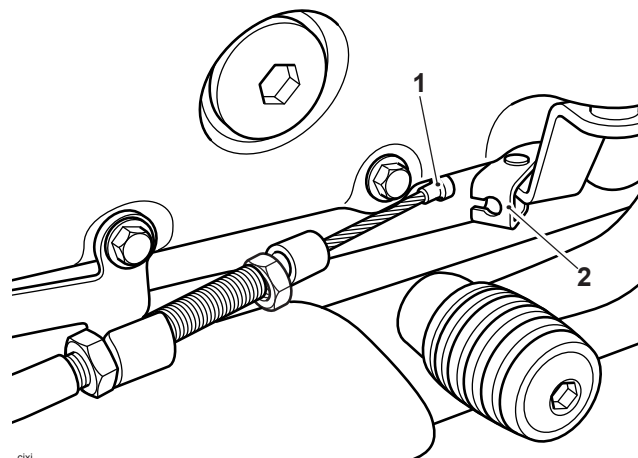
1. Clutch cable
2. Fixings

2. Loosen the cable lock nut, release the adjuster nut adjacent to the clutch cover to allow maximum play in the cable.



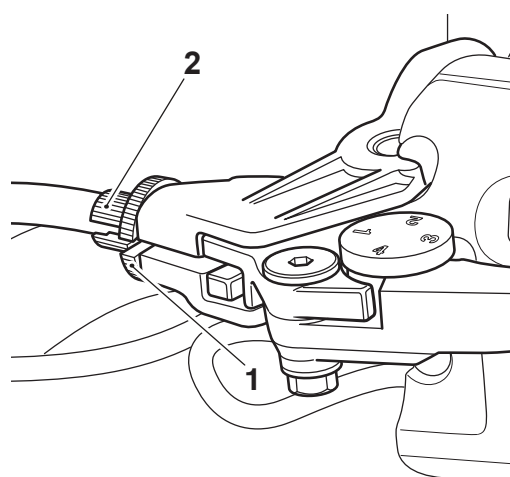
1. Clutch cable
2. Adjuster nut
3. Lock nut

3. Detach the inner clutch cable from the boss on the clutch actuating arm.



1. Clutch cable
2. Boss

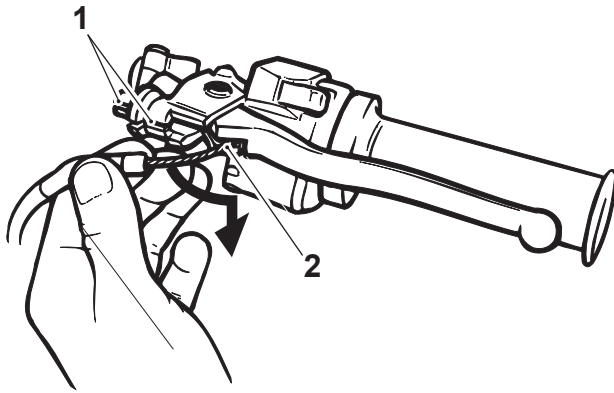
4. Disconnect the cable retaining guides from the frame down tube.
5. Align the slots in the lever adjuster and lock nut.



1. Lock nut
2. Lever adjuster

Clutch

6. Pull in the clutch lever and turn the inner cable adjuster anti-clockwise through the lock nut, until the cable can be detached from the lever.



gaau_1

1. Cable adjuster/lever bracket slots
2. Cable release point

Note:

- To ensure the same route can be followed on installation, tie a length of string to one end while pulling the cable through from the other. When installing the new cable, tie the string to one end of the cable and use it to guide the new cable into position.
7. Noting the cable routing, remove the cable from the motorcycle

Clutch Cable - Inspection

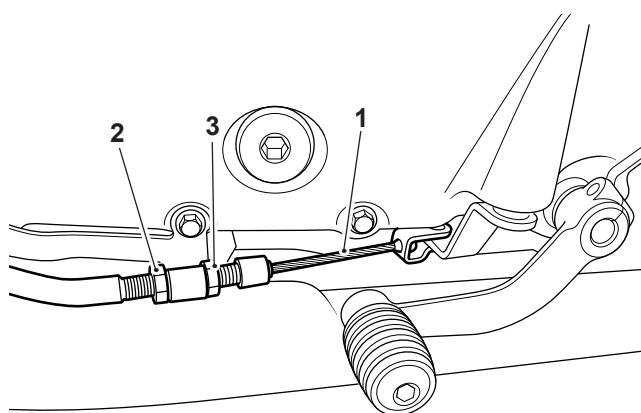
1. Check the inner cable for free movement through the outer cable.
2. Examine the inner cable for frayed strands.
3. Examine the two inner cable nipples for signs of looseness and damage. Replace the cable if necessary.

Clutch Cable - Installation

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 cable to the motorcycle following the same routing as noted during removal.
2. Attach the inner cable to the boss on the clutch actuating arm using a reversal of the removal process.
3. Refit the outer cable to the adjuster bracket at the clutch cover end.

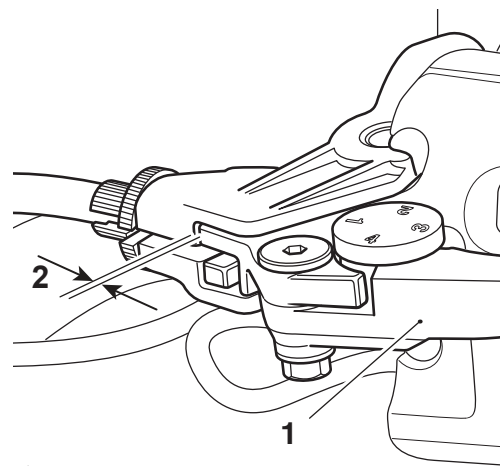


clwp

1. Clutch cable
2. Adjuster nut
3. Lock nut

4. Refit the cable retaining guides to the frame down tube.
5. Refit the cable retaining bracket to the frame and using new fixings tighten to 1.5 Nm.
6. Set the lever adjuster to a point where an equal adjustment is possible in both directions.
7. Set the adjuster bracket at the clutch cover end to give a preliminary setting of 2 - 3 mm of free play as measured at the lever.
8. Operate the clutch lever several times and recheck the amount of free play present.

9. Tighten the clutch adjuster bracket lock nut at the clutch cover end to 3 Nm.
10. Set the final adjustment of the cable to give 1 - 2 mm of free play at the lever by turning the adjuster nut and lock nut at the lever end. Secure the setting with the knurled lock nut.



1. Clutch lever
2. Correct setting, 1 - 2 mm

Clutch - Removal

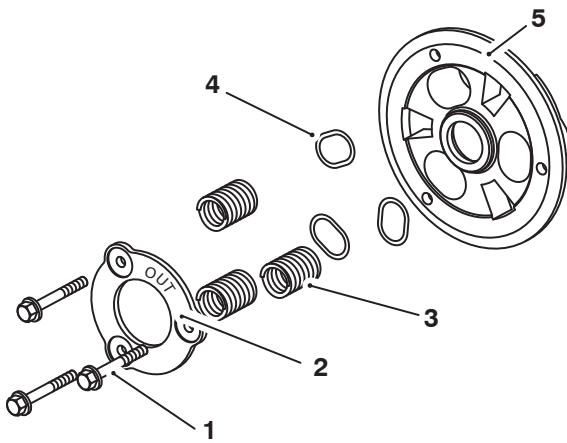
Warning

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.

- Remove the clutch cover (see Clutch Cover - Removal, page 97).

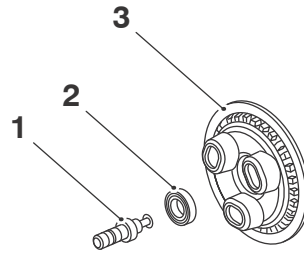
Note:

- **The spring seats will remain seated in the pressure plate during removal.**
1. Release the 3 fixings, remove the stopper plate, springs and pressure plate.



1. **Fixings**
2. **Stopper plate**
3. **Springs**
4. **Spring seats**
5. **Pressure Plate**

2. Remove the pull rod and bearing from the clutch pressure plate.

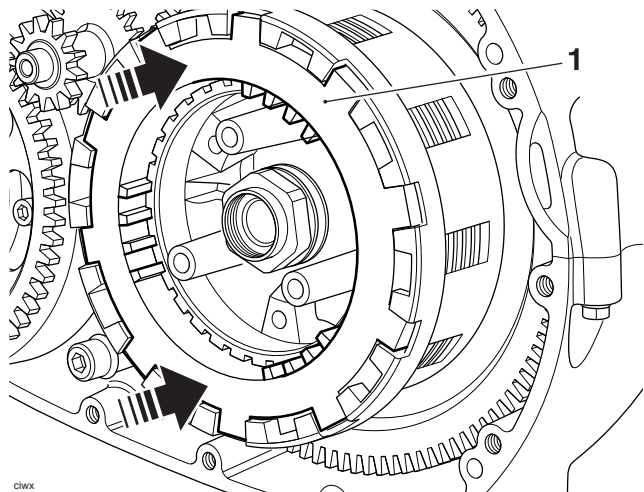


1. **Pull rod**
2. **Bearing**
3. **Clutch pressure plate**

3. Remove the clutch plates, anti-judder seat washers and springs, noting the orientation of the each component as they are removed.

Note:

- **The two outermost and the inner friction plate are different to the remainder and must not be fitted in any other position.**
 - **Refer to Friction Plate Inspection, page 159 for details of clutch friction plate inspection.**
4. Engage second gear and lock the inner and outer clutch drums together using service tool T3880307 as shown below.



1. **T3880307 - Clutch Anti-rotation Jig**

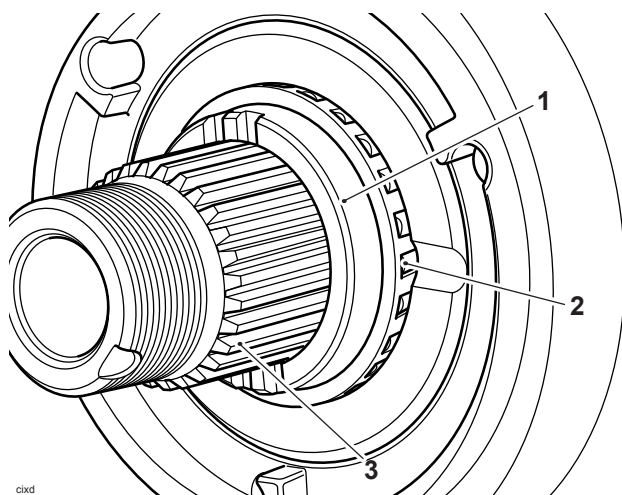
5. Release the clutch centre nut.
6. Remove the centre nut, Belleville washer, plain washer, clutch inner drum and thrust washer.

7. Discard both the Belleville washer and plain washer.

Caution

Do not remove the bearing sleeve from the shaft. Removing the bearing sleeve will allow the oil pump drive chain to become dislodged. If the oil pump drive chain becomes dislodged the oil pump will not operate causing severe engine damage.

8. Slide the bearing sleeve forward and backwards a maximum of 10 mm to allow the needle roller bearing to become dislodged.
9. Remove the needle roller bearing from the clutch outer drum.



1. **Bearing sleeve**
2. **Needle roller bearing**
3. **Shaft**

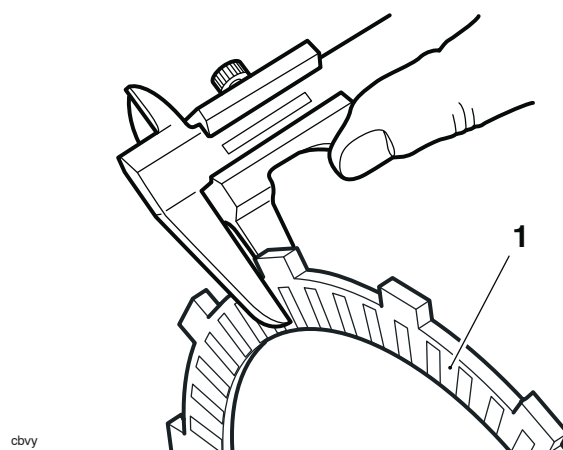
10. Slide the clutch outer drum away from the gearbox input shaft.

Friction Plate Inspection

Thickness

Note:

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



1. Clutch friction plate

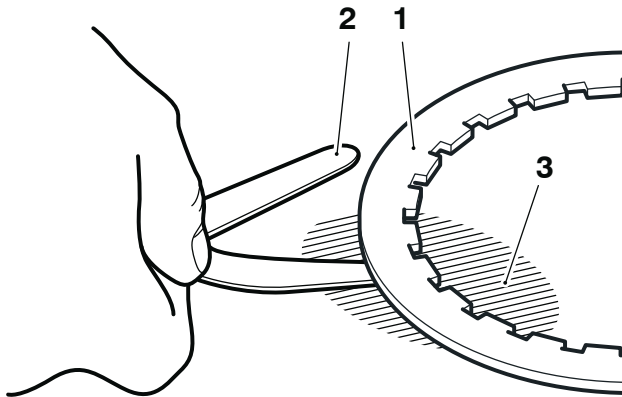
2. For the clutch friction plate thickness, refer to Clutch and Primary Drive, page 39.

Steel Plate Inspection

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 service limit thickness between the steel plate and surface plate. If the feeler gauge can be passed beneath the steel plate at any point, renew the plates as a set.



cbvz

1. Steel plate
2. Feeler gauge
3. Surface plate

2. For specifications refer to Clutch and Primary Drive, page 39.

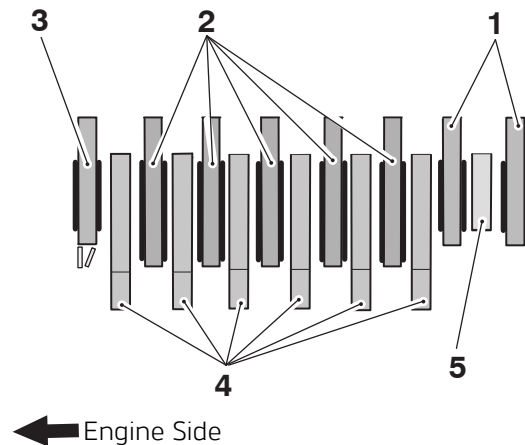
Clutch Pack - Height

Note:

- The clutch pack height is critical for a smooth operation of the transmission and must be measured prior to installation of new clutch plates.

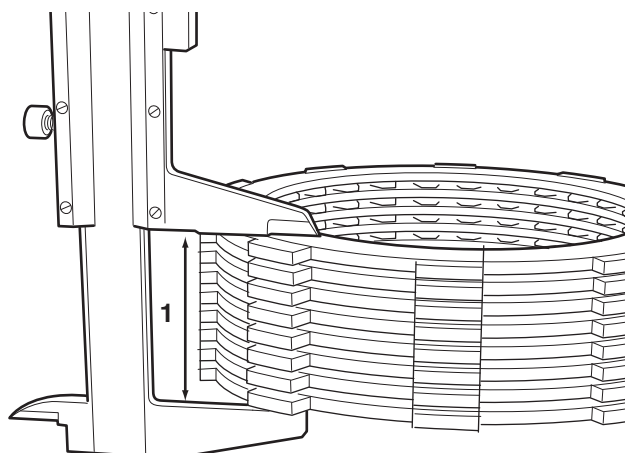
When building a new clutch pack, its height must be correct. To achieve this, build the new clutch pack using the following:

- 2 x new outer friction plates
 - 5 x new friction plates
 - 1 x new inner friction plate
 - 6 x steel plates, 2.0 mm thick
 - 1 x outer steel plate, 2.0 mm thick.
1. Arrange the new friction and new steel plates in a stack as shown below.



1. Outer friction plates
2. Friction plates
3. Inner friction plate
4. Steel plate, 2.0 mm thickness
5. Outer steel plate, 2.0 mm thickness

- Place the assembled clutch pack on a flat surface and measure its height as shown below.



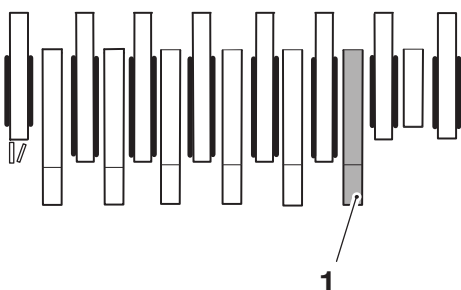
T0943_1

1. Clutch pack height

- The clutch pack height for this clutch assembly is shown in the specification table see Clutch and Primary Drive, page 39.
- If the clutch pack is too high, continue from step 5, omit step 6 then continue from step 7. If the clutch pack is too low, continue from step 6.

Note:

- 1.6 mm and 2.3 mm steel plates are available, refer to the Parts Catalogue for part numbers.
 - No more than one 1.6 mm thick steel plate is to be used in the clutch pack.
- If the clutch pack height is too high, replace the 2.0 mm steel plate indicated below with a new 1.6 mm steel plate.



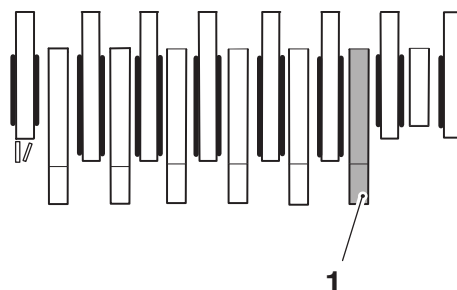
← Engine Side

1. 2.0 mm steel plate to be replaced

Note:

- No more than one 2.3 mm thick steel plate is to be used in the clutch pack.

- If the clutch pack height is too low, replace the 2.0 mm steel plate indicated below with a new 2.3 mm steel plate.



← Engine Side

1. 2.0 mm steel plate to be replaced

- Re-check the clutch pack height as described previously.

Clutch - Installation

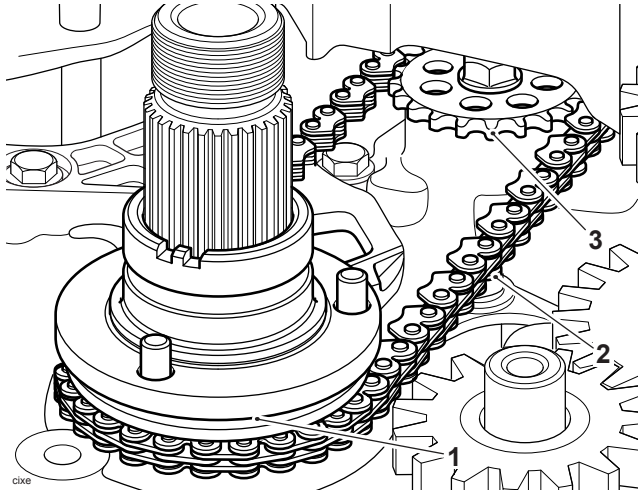
Warning

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

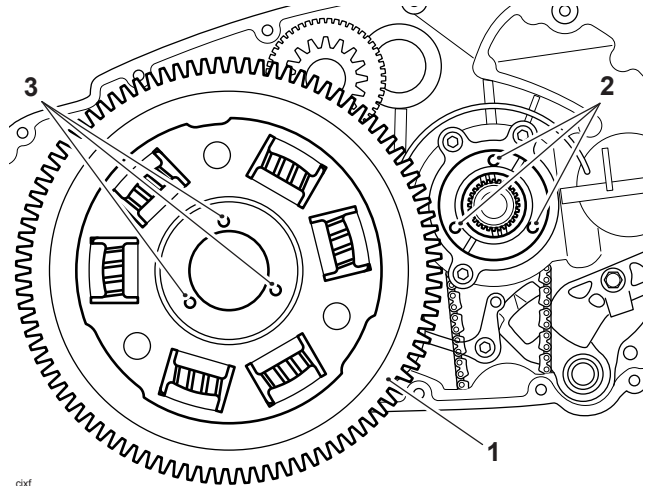
Ensure the oil pump drive chain is engaged with the oil pump drive gears. Running the engine without drive to the oil pump will stop oil supply to the engine. Running the engine without oil pressure will cause severe engine damage.

1. Visually check the oil pump drive chain is engaged with the drive gears.



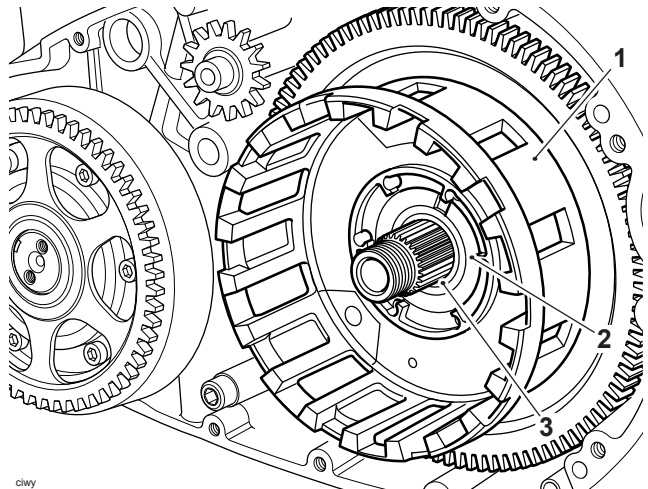
1. Oil pump drive sprocket
2. Oil pump drive chain
3. Pump sprocket

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



1. Clutch outer drum (rear view)
2. Oil pump sprocket drive pegs
3. Clutch outer drum sprocket drive holes

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

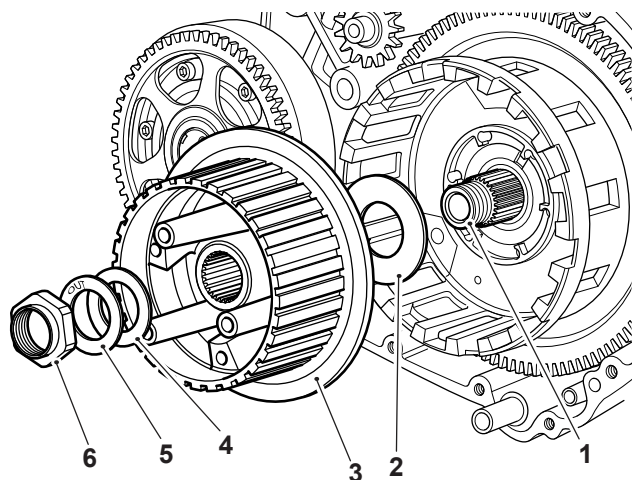


1. Outer drum
2. Bearing sleeve
3. Needle roller bearing

Note:

- When the bearing and sleeve are correctly fitted, it will be a flush fit with the clutch drum face.
4. Fit the thrust washer to the shaft.
 5. Fit the clutch inner drum.

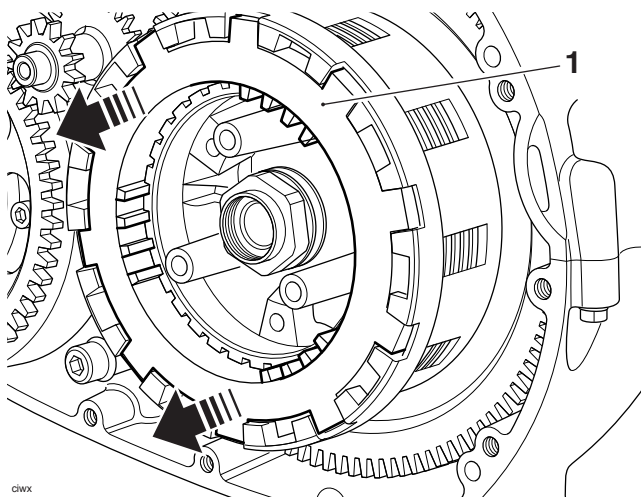
6. Fit the flat washer, a new Belleville washer (OUT mark facing outwards), and a new centre nut.



clxc

1. Shaft
2. Thrust washer
3. Clutch inner drum
4. Flat washer
5. Belleville Washer OUT Mark
6. Centre nut

7. Using service tool T3880307, lock the inner and outer drums together. Depress the rear brake pedal to prevent the engine turning, and tighten the centre nut to 98 Nm.
8. Remove service tool T3880307.



clwx

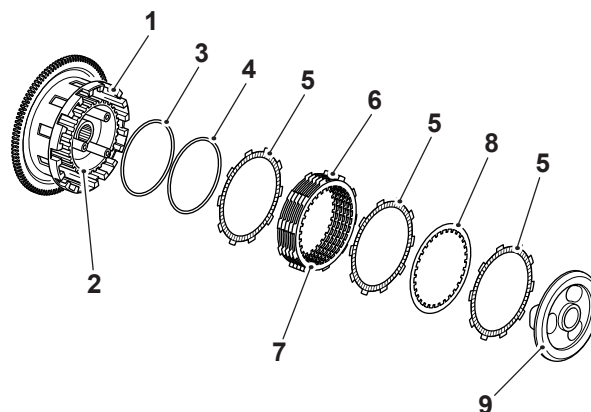
1. T3880307 - Clutch Anti-rotation Jig
9. Disengage second gear and check for free rotation of the clutch inner drum.
10. Using a suitable pin punch, stake the nut to the shaft.

Note:

- Always refer to the Clutch Pack - Height, page 160 prior to fitting new clutch plates to the motorcycle.
11. 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 inner and the two outermost friction plates are different to the other friction plates. They must be fitted in their noted positions.
- The outer steel plate is different to the other plates. It must be fitted in its noted position.



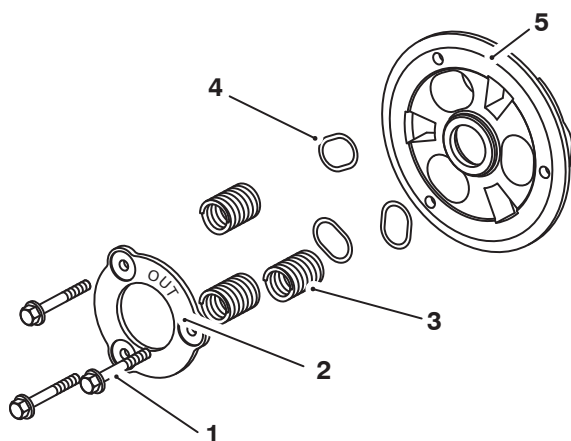
clww

1. Clutch outer drum
2. Clutch inner drum
3. Anti-judder seat washer
4. Anti-judder spring
5. Inner/outer friction plate
6. Friction plates
7. Steel plates
8. Steel plate (outer)
9. Pressure plate

12. Refit the clutch pull rod.
13. Fit the pressure plate. Ensure that the spring seats are fitted into the pressure plate as noted for removal.

Note:

- Note that the stopper plate has an OUT mark. This must face outwards when fitted.
 - There are spring seats located in the pressure plate. Ensure the seats are in the pressure plate prior to fitting the springs.
14. Fit the springs and stopper plate, ensure that the OUT mark on the stopper plate is facing outwards. Secure with the fixings and tighten to 10 Nm.



1. Fixings
2. Stopper plate
3. Springs
4. Spring seats
5. Pressure plate

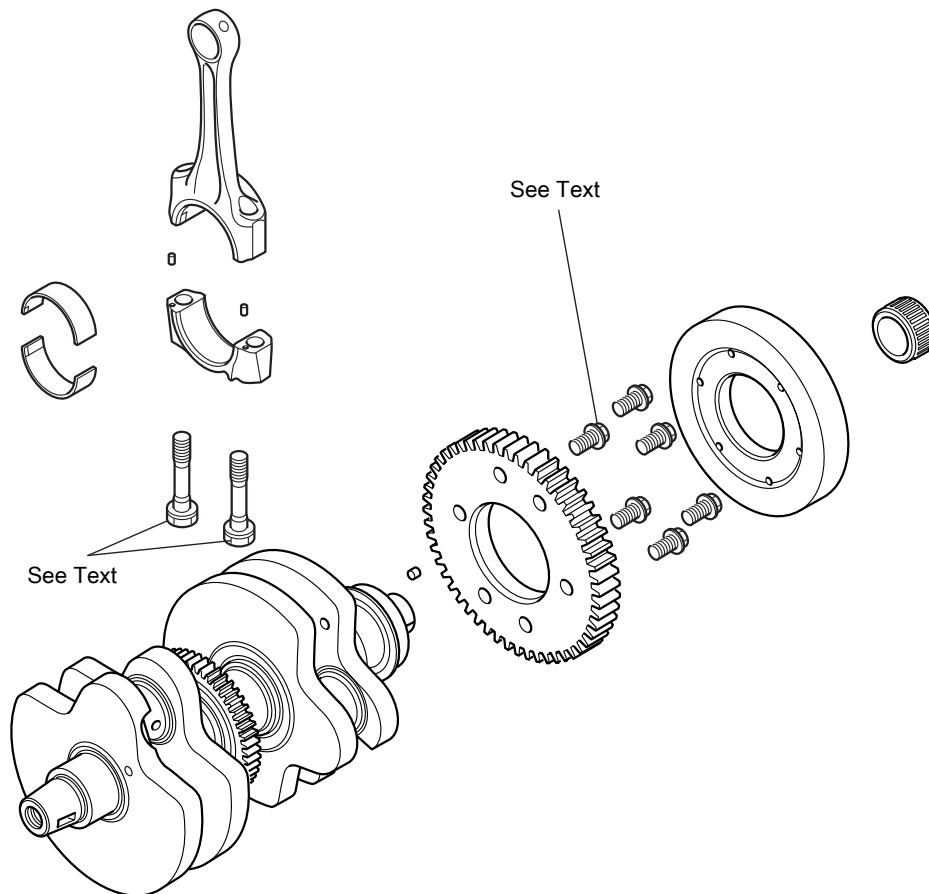
- Refit the clutch cover (see Clutch Cover - Installation, page 98).
- Refit the clutch cable (see Clutch Cable - Installation, page 157).
- Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
- Refit the seat (see Seat - Installation, page 645).

12 Crankshaft

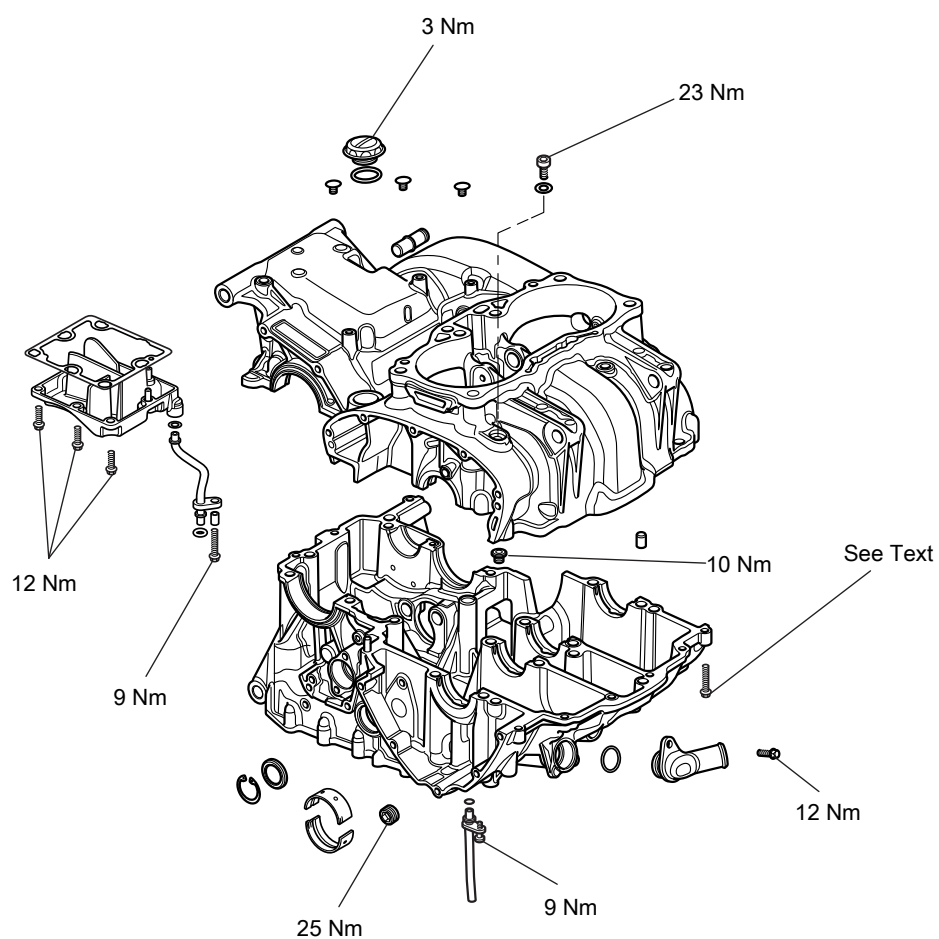
Table of Contents

Exploded View – Crankshaft and Connecting Rod	167
Exploded View – Crankcase	168
Crankcase.....	169
Crankcase - Removal.....	169
Crankcase - Assembly.....	171
Crankshaft - Removal	176
Crankshaft - Installation.....	176
Connecting Rods - Removal.....	177
Connecting Rod - Installation.....	178
Connecting Rod Big End Journal Checking, Measuring and Bearing Selection.....	179
Crankshaft Main Bearing/Journal Checking, Measuring and Bearing Selection.....	180
Coolant Manifold - Removal	182
Coolant Manifold - Installation.....	183
Breather Plate - Removal.....	184
Breather Plate - Installation.....	185

Exploded View – Crankshaft and Connecting Rod



Exploded View - Crankcase



Crankcase

⚠ Warning

The following procedures often require lifting of heavy components. To avoid injury, always lift heavy components with a hoist or block and tackle and never attempt to manually lift items that are too heavy. Injury may result from failure to use the correct lifting equipment.

⚠ Caution

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

Note:

- **The crankcase halves may be separated without removing the cylinder head.**

If the big end fixings have been loosened or removed, new fixings must be installed.

⚠ Caution

During crankcase assembly, ensure the two piston cooling jets are re-installed. If the piston cooling jets are omitted, oil pressure will be reduced. Running the engine with low oil pressure will cause severe engine damage.

Crankcase - Removal

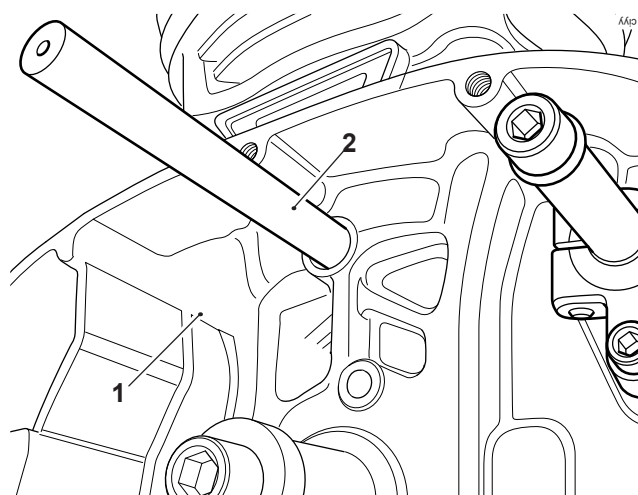
⚠ Warning

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.

- Remove the seat (see Seat - Removal, page 645).
- Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
- Remove the fuel tank (see).
- Remove the engine (see Engine - Removal, page 261).
- Remove the camshaft cover (see Camshaft Cover - Removal, page 103).
- Remove the sump (see Sump - Removal, page 94).
- Remove the clutch (see Clutch - Removal, page 158).
- Remove the alternator rotor (see Alternator Rotor - Removal, page 704).

Note:

- **To allow correct fitment of T3880039 - Idler Gear Timing Pin the engine may require rotating up to seven times.**
1. Align the timing holes in the crankcase and camshaft idler gear. Lock in position using service tool T3880039.



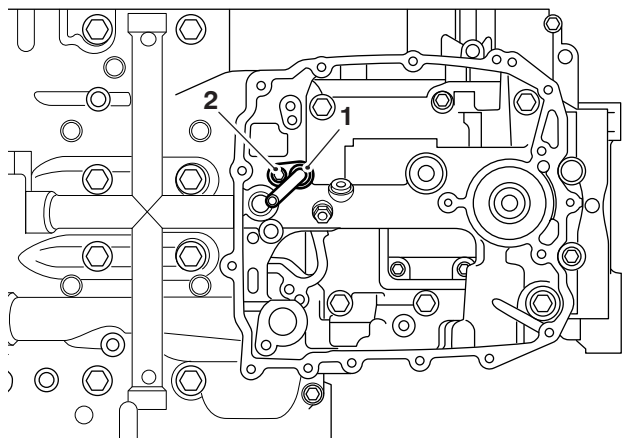
1. Crankcase

2. T3880039 - Idler Gear Timing Pin

2. Remove the oil and water pump (see Oil and Water Pump - Removal, page 248).

Crankshaft

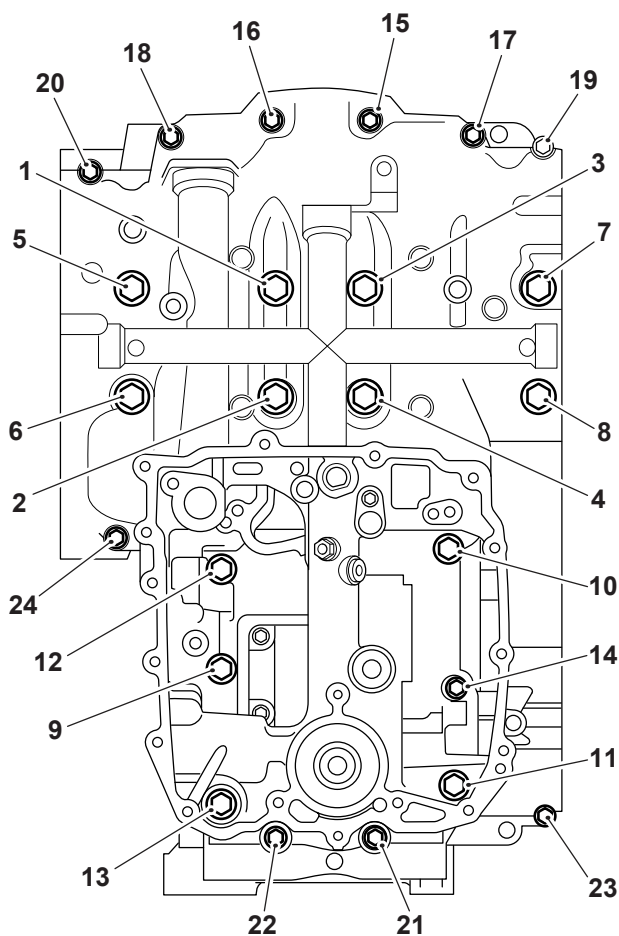
- Release the fixing and remove the coolant drain tube, discard the fixing and the O-ring.



1. Coolant drain tube

2. Fixing

- Release the lower crankcase fixings noting their positions in the sequence shown below.



Crankcase Fixing Release Sequence

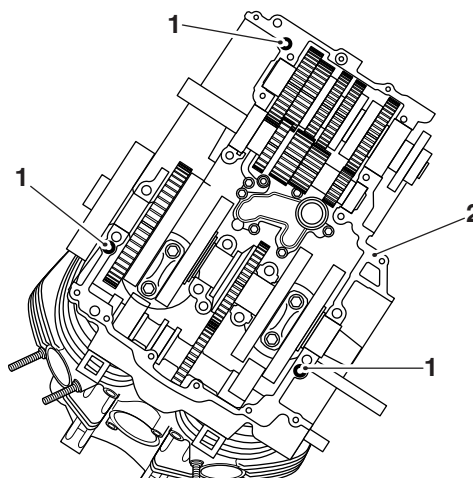


Caution

Do not use levers to separate the upper and lower sections of the crankcase as damage to the crankcases could result.

Note:

- Always check that all fixings have been released before attempting to separate the crankcases.
- Separate the lower crankcase from the upper crankcases noting the position of the three location dowels.



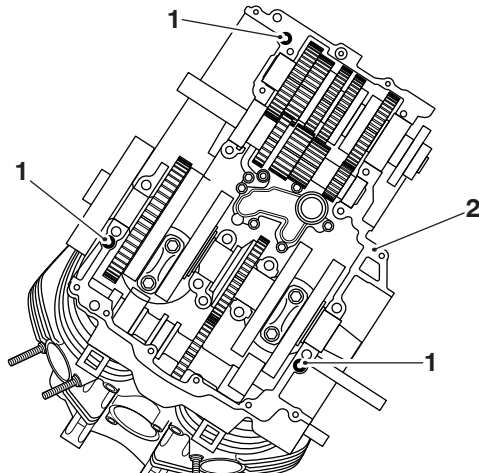
1. Dowels

2. Upper crankcase

- For removal of the:
 - Front balancer shaft, (see Front Balancer Shaft - Removal, page 191),
 - Rear balancer shaft, (see Rear Balancer Shaft - Removal, page 190),
 - Crankshaft, (see Crankshaft - Removal, page 176).
 - Selector forks and drum (see Selector Forks and Drum - Removal, page 211).
 - Coolant manifold, (see Coolant Manifold - Removal, page 182).
 - Breather plate, (see Breather Plate - Removal, page 184).

Crankcase - Assembly

1. Use high flashpoint solvent to clean the crankcase mating faces. Wipe the surfaces clean with a lint-free cloth.
2. Position the transmission shafts and the selector drum in the neutral position.
3. Ensure that the three dowels are located in position in the upper crankcase.



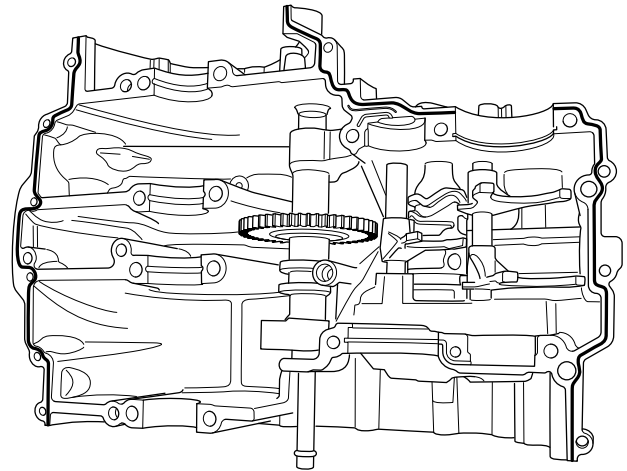
cyl

1. Dowels

2. Upper crankcase

4. Install and lubricate the crankshaft main bearing shells with clean engine oil (see page Crankshaft Main Bearing/Journal Checking, Measuring and Bearing Selection, page 180 before proceeding).
5. Install and lubricate the front balancer shaft with clean engine oil. (see Front Balancer Shaft - Installation, page 193).
6. Install and lubricate the rear balancer shaft with clean engine oil (see Rear Balancer Shaft - Installation, page 196).
7. Lubricate the crankshaft journals with clean engine oil.

8. Apply a 2 mm (+/-0.5 mm) bead of silicone sealant to the lower crankcase mating faces, (during manufacture, ThreeBond 1216E is used).



Sealer Areas

⚠ Caution

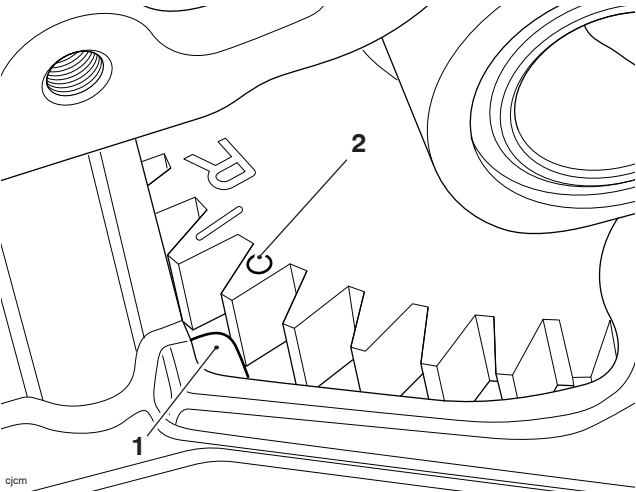
Do not use excessive amounts of sealer. The extra sealer may become dislodged and could block the oil passages in the crankcases, causing severe engine damage.

9. Position the lower crankcase to the upper. An assistant may be required to support the crankcase during alignment.

Note:

- **The rear balancer shaft will rotate one tooth when the upper and lower crankcase are joined.**
10. To check that the balancer shaft is correctly timed to the crankshaft proceed as follows:

11. Check that the dot mark on the rear balancer shaft is aligned with the tab on the crankcase, as shown below.



- 1. Lower crankcase identification mark
- 2. Rear balancer shaft dot mark

12. Locate the fixings into their respective positions in the lower crankcase as noted during removal and hand tighten.
13. Tighten the crankcase fixings as follows:

Note:

- The crankcase fixings are tightened in stages.

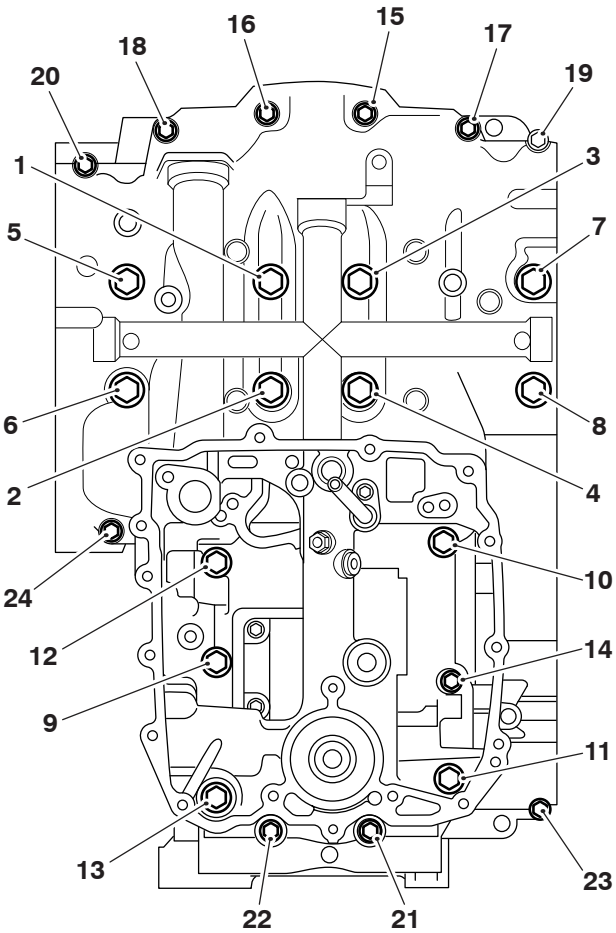
**Caution**

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

Stage 1 - All Fixings

14. In the sequence shown below:

- Tighten all of the crankcase fixings to 10 Nm.

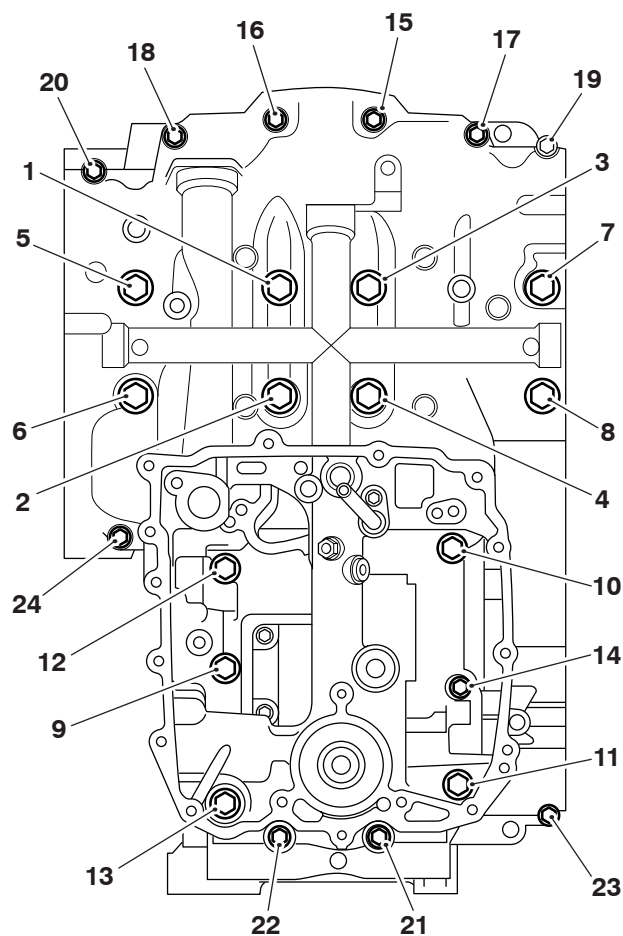


All Fixings Tightening Sequence

Stage 2

15. In the sequence shown below:

- Loosen fixings 1 to 8. through 140°, using service tool T3880105 or similar to measure the torque-angle.

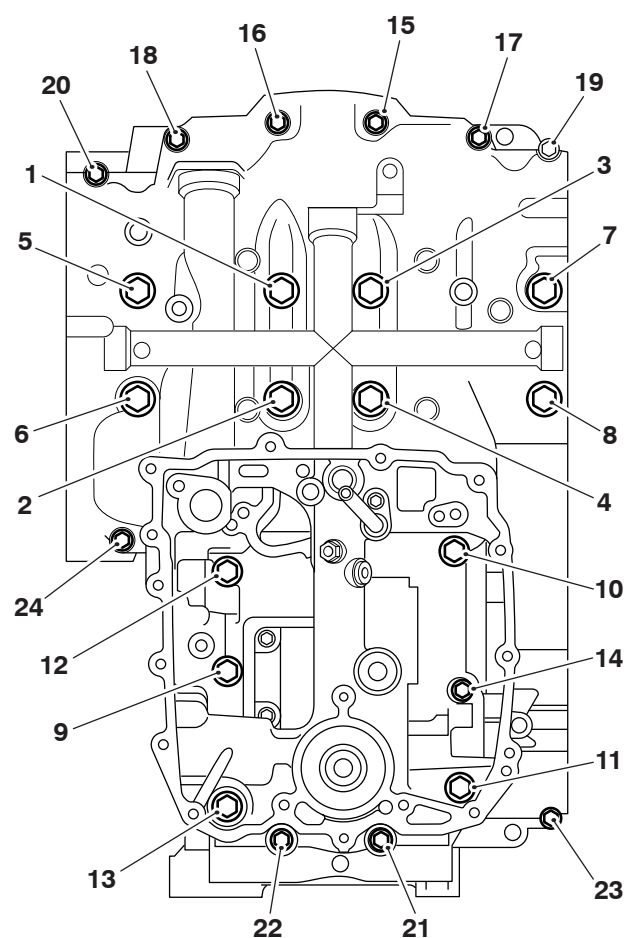


Fixings 1 to 8 Loosening Sequence

Stage 3

16. In the sequence shown below:

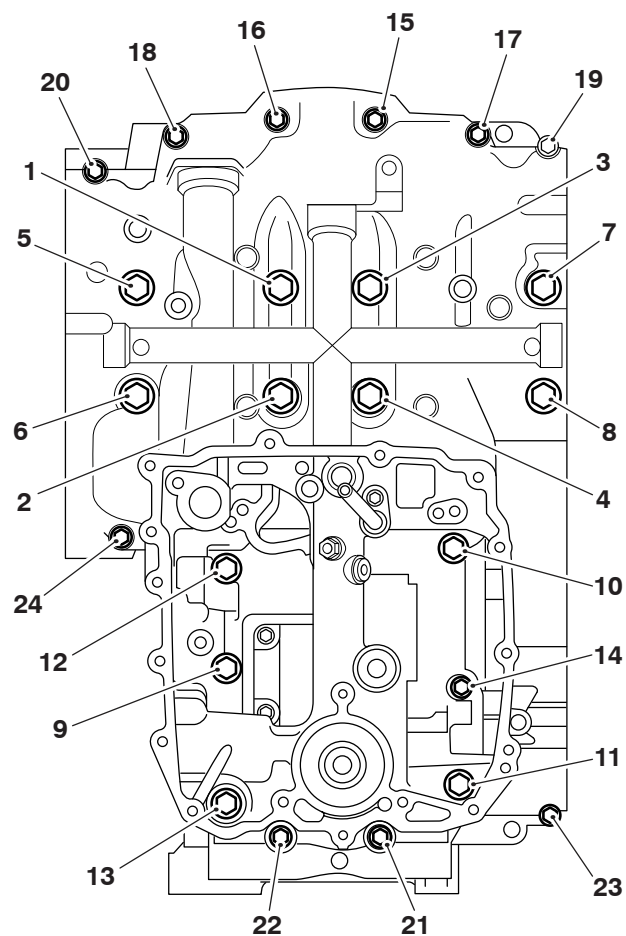
- Tighten fixings 1 to 8 to 10 Nm.



Fixings 1 to 8 Tightening Sequence

17. In the sequence shown below:

- Tighten fixings 1 to 8 through a further 75° using service tool T3880105 or similar to measure the torque-angle.

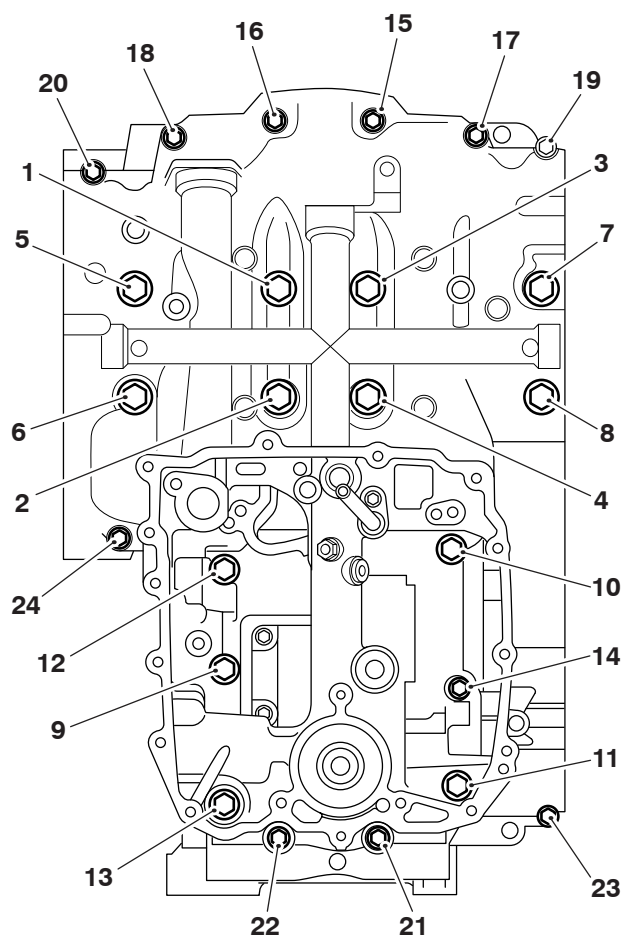


Fixings 1 to 8 Tightening Sequence

Stage 4

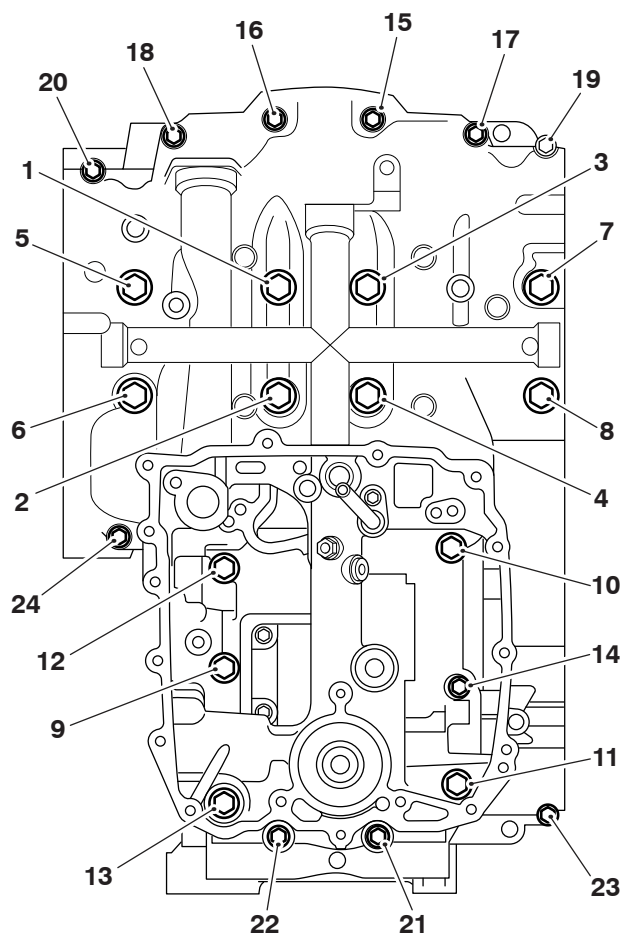
18. In the sequence shown below:

- Tighten fixings 9 to 13 to 32 Nm.



Fixings 9 to 13 Tightening Sequence

Stage 5



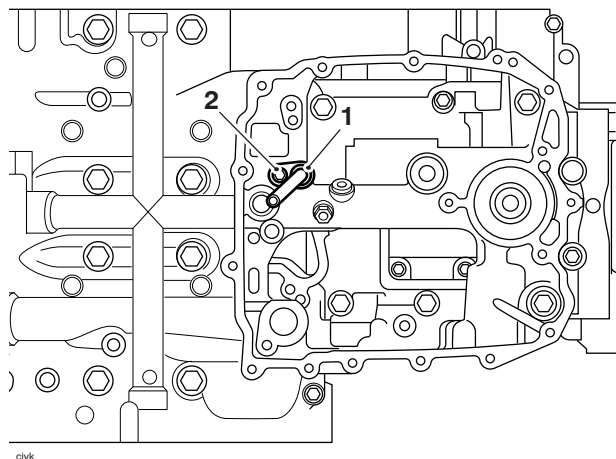
19. In the sequence shown below:
- Tighten fixings 14 to 24 to 12 Nm.

Fixings 14 to 24 Tightening Sequence

Note:

- Prior to fitting an O-ring coat the surfaces with a commercially available petroleum jelly.

20. Refit the breather drain tube, fit a new O-ring, tighten the new fixing to 9 Nm.



1. Breather drain tube

2. Fixing

- Refit the oil and water pump (see Oil and Water Pump - Installation, page 254).
- Refit the oil and water pump (see Oil and Water Pump - Installation, page 254).
- Refit the sump (see Sump - Installation, page 95).
- Refit the alternator (see Alternator Rotor - Installation, page 705).
- Refit the clutch (see Clutch - Installation, page 162).
- Refit the gear position sensor (see Gear Position Sensor - Installation, page 422).
- Refit the engine (see Engine - Installation, page 265).
- Refit the fuel tank (see Fuel Tank - Installation, page 385).
- Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
- Refit the seat (see Seat - Installation, page 645).

Crankshaft - 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.

- Remove the seat (see Seat - Removal, page 645).
- Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
- Remove the fuel tank (see).
- Remove the engine (see Engine - Removal, page 261).
- Separate the lower crankcase from the upper crankcase (see Crankcase - Removal, page 169).
- Remove the connecting rod big end caps and discard the bolts. (see Connecting Rods - Removal, page 177).

Note:

- **Support the connecting rods during crankshaft removal to prevent damage to the rods, liners and upper crankcase.**
1. Remove the crankshaft from the upper crankcase.

Crankshaft - Installation

Caution

Always check the main bearing journal clearance (see Crankshaft Main Bearing/Journal Checking, Measuring and Bearing Selection, page 180), before final assembly of the crankshaft. Failure to correctly select crankshaft bearings will result in severe engine damage.

1. Select and fit new main and big end bearing shells using the selection processes detailed on Crankshaft Main Bearing/Journal Checking, Measuring and Bearing Selection, page 180).
2. Lubricate all of the bearings with clean engine oil.
3. Ensure that the crankshaft is clean, and that the oil ways within the crankshaft are clean, free from blockages and debris.

Caution

The crankshaft to idler gear timing will be lost when the crankshaft is removed. Do not refit the crankshaft without first setting the crankshaft to idler gear timing. Incorrect idler gear timing will result in incorrect camshaft timing. Rotating or attempting to start an engine with incorrectly adjusted camshaft timing will result in severe engine damage.

4. Install the crankshaft to the upper crankcase, ensuring the crankshaft drive gear is correctly timed to the balancer shafts and idler gear (see Front Balancer Shaft - Installation, page 193).
5. Align the connecting rod big ends to the crankshaft pins.

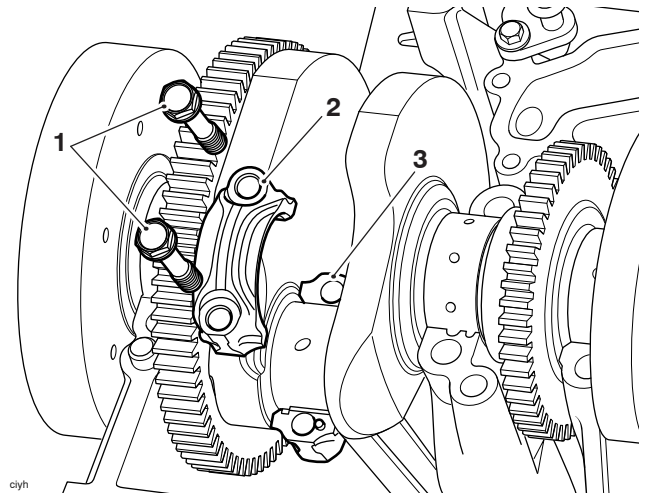
6. Fit and In the correct sequence, tighten the big end caps. (see Connecting Rod - Installation, page 178).
7. Assemble the crankcases (see page Crankcase - Assembly, page 171).
 - Refit the cylinder barrels (see Barrels - Installation, page 143).
 - Refit the cylinder head (see Cylinder Head - Installation, page 135).
 - Refit the engine (see Engine - Installation, page 265).
 - Refit the fuel tank (see Fuel Tank - Installation, page 385).
 - Reconnect the battery positive, (red) lead first see (Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
 - Refit the seat (see Seat - Installation, page 645).
 - Start the engine and ensure that the low oil pressure warning light goes out shortly after starting.
 - Stop the engine and check the engine oil level. Adjust if necessary (see Engine Oil - Level Inspection, page 245).

Connecting Rods - Removal

- Remove the seat (see Seat - Removal, page 645).
- Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
- Remove the fuel tank (see).

Note:

- **The connecting rods and caps are etch-marked on one side to identify their correct orientation. However, the cylinder from which they are individually removed should also be identified, using a paint marker or similar.**
- Remove the engine (see Engine - Removal, page 261).
- Remove the clutch (see Clutch - Removal, page 158).
- Remove the cylinder barrel (see Barrels - Removal, page 142).
- Separate the lower crankcase from the upper crankcase (see Crankcase - Removal, page 169).
- Remove and discard the connecting rod bolts.



1. Connecting rod bolts

2. Connecting rod cap

3. Connecting rod

1. Collect the connecting rod caps.
2. Collect the piston and connecting rod.
3. Label the assembly to identify the cylinder from which it was removed.

Connecting Rod - Installation

Note:

- **The big end bolts are treated with an anti-rust solution, which must not be removed.**
1. Clean the connecting rod with high flashpoint solvent.
 2. Fit the piston and connecting rod assemblies to the crankshaft.
 3. Select and fit the selected big end bearing shells to the connecting rods and big end caps (see Connecting Rod Big End Journal Checking, Measuring and Bearing Selection, page 179).

Warning

Always renew the big end bolts. The bolts are torqued near to their yield point when first installed and are severely weakened if reused. Reusing the original bolts may cause bolt breakage resulting in engine damage, loss of motorcycle control and an accident.

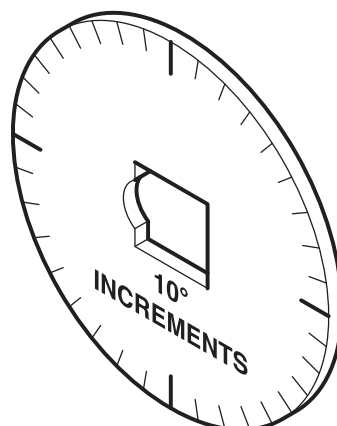
Warning

The torque characteristics of the connecting rod bolts are sensitive to the rate at which they are tightened. If all the torque is applied in one action, the bolts will be stretched beyond their yield point. This may cause bolt breakage resulting in engine damage, loss of motorcycle control and an accident.

Note:

- **Prior to fitting the big end bolts lubricate the under head and thread areas of the bolts with undiluted molybdenum disulphide grease.**
4. Fit new bolts to the connecting rods.
 5. Tighten the bolts, in two stages as follows:
 - Tighten to 14 Nm.

- Tighten through 210° using service tool T3880105 or similar.



cbxt

T3880105 - Torque Angle Gauge

- Assemble the crankcases (see Crankcase - Assembly, page 171).
- Refit the cylinder barrel (see Barrels - Installation, page 143).
- Refit the engine (see Engine - Installation, page 265).
- Refit the fuel tank (see Fuel Tank - Installation, page 385).
- Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
- Refit the seat (see Seat - Installation, page 645).

Connecting Rod Big End Journal Checking, Measuring and Bearing Selection

Using selective bearings compensates for minor differences in crankshaft main bearing journal and crankcase dimensions. For further information on bearing part number to colour cross-references, refer to the electronic parts catalogue EPC.

1. Measure the bearing and crankshaft journal clearance as follows.

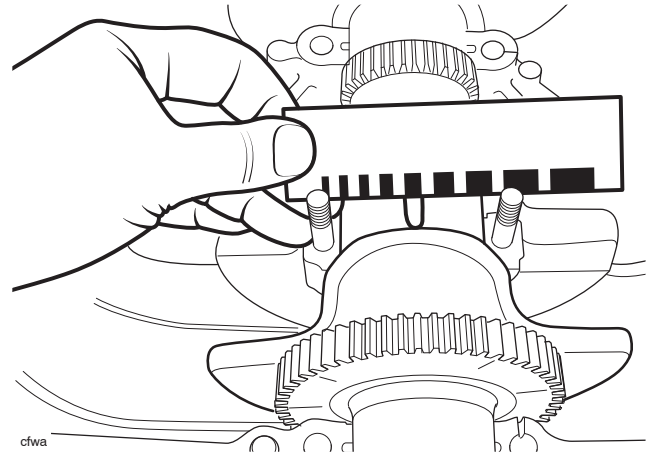
Note:

- **Do not turn the connecting rod and crankshaft during the clearance measurement as this will damage the Plastigauge. The crankshaft journal clearances are measured using Plastigauge (Triumph part number 3880150-T0301).**
2. Remove the bearing cap from the journal to be checked.
 3. Wipe the exposed areas of the crankshaft journal, and the bearing face inside the cap.
 4. Apply a thin smear of grease to the journal and a small quantity of silicone release agent to the bearing.
 5. Trim a length of the Plastigauge to fit across the journal. Fit the strip to the journal using the grease to hold the Plastigauge in place.
 6. Release the fixings and remove the cap being measured. Using the gauge provided with the Plastigauge kit, measure the width of the compressed Plastigauge.

Note:

- **The original fixings may be reused for bearing selection. Do not use new fixings as they may only be used once, even if the single use is related to bearing selection.**
7. Lubricate the threads of the fixing and the face of the fixing with molybdenum disulphide grease. Refit the lower crankcase and tighten the original fixings (see Crankshaft - Installation, page 176).
 8. Release the fixings and remove the cap being measured.

9. Using the Plastigauge kit, measure the width of the compressed Plastigauge.



Checking the Big End Bearing/Crankshaft Journal Clearance

10. For specifications refer to Crankshaft, page 42.
11. If the clearance exceeds the service limit, measure the diameter of the crankshaft bearing journal.

Note:

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

Connecting Rod Bearing Selection

Note:

- **Minor differences in 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 bearing shell as follows:
 2. Measure and record the diameter of each crankshaft bearing journal.
 3. Measure and record each bearing bore diameter (bearings removed, journal caps fitted and all fixings fully torqued) (see Connecting Rod - Installation, page 178).
 4. Select the correct bearings by matching the information found in the bearing selection chart.
 5. Install the new bearings.

Big End Bearing Selection Chart

Shell Colour	Connecting rod bore diameter	Big end bearing journal diameter
WHITE	41.000 to 41.009 mm	37.993 to 38.000 mm
RED	41.000 to 41.009 mm	37.984 to 37.992 mm

For instance:

Connecting rod Big End Diameter	37.966
Crankshaft Journal Diameter	41.004
Required Bearing	White

Note:

- Repeat the measurements for all respective journals.
- 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 that gives the greater running clearance.

Warning

Always confirm, using the Plastigauge method, that the running clearance is correct before final assembly. Severe engine damage could result from incorrect clearance resulting in loss of motorcycle control and an accident.

Crankshaft Main Bearing/Journal Checking, Measuring and Bearing Selection

Using selective bearings compensates for minor differences in crankshaft main bearing journal and crankcase dimensions. For further information on bearing part number to colour cross-references, refer to the EPC.

- Separate the lower crankcase from the upper crankcase (see Crankcase - Removal, page 169).

1. Measure the bearing to crankshaft journal clearance as follows.

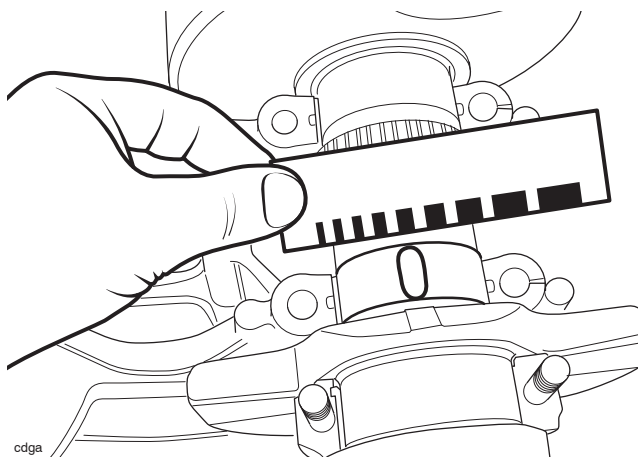
Note:

- Do not turn the connecting rods and crankshaft during the clearance measurement as this will damage the Plastigauge. The crankshaft journal clearances are measured using Plastigauge (Triumph part number 3880150-T0301).
2. Wipe the exposed areas of the crankshaft journals, and the bearing face inside the cap.
 3. Apply a thin smear of grease to the journals and a small quantity of silicone release agent to the bearings.
 4. Trim a length of the Plastigauge to fit across each journal. Fit the strip to the journal using the grease to hold the Plastigauge in position.

Note:

- The original fixings may be reused for bearing selection. Do not use new fixings as they may only be used once, even if the single use is related to bearing selection.
5. Lubricate the threads and the face of the fixings with molybdenum disulphide grease. Refit the crankcase and tighten the original fixings (see Crankcase - Assembly, page 171).
 6. Release the fixings and remove the crankcase.

7. Using the Plastigauge kit, measure the width of the compressed Plastigauge.



Checking the Crankshaft Journal Clearance

8. For specifications refer to Crankshaft, page 42.
9. If the clearance exceeds the service limit, measure the diameter of the crankshaft bearing journal.

Note:

- If any journal has worn beyond the service limit, the crankshaft must be replaced. Due to the techniques used during manufacture, the crankshaft cannot be reground and oversize bearings are not available.

Main Bearing Selection

Note:

- Minor differences in dimensions are compensated for by using selective bearings. For further information on bearing part number to colour cross-references, see the latest parts information.
- Select the correct bearings as follows:
 - Measure and record the diameter of each crankshaft bearing journal.
 - Measure and record each bearing bore diameter in the crankcase (bearings removed, journal caps fitted and all fixings fully torqued).
 - Select and install the correct bearings by matching the information found in the main bearing selection chart.
 - Install the new bearings.

Main Bearing Selection Chart

Shell Colour	Crankcase Bore	Crankshaft Journal Diameter	Running Clearance
Red	46.105 to 46.097	43.099 to 43.092	0.040 to 0.019
Red	46.114 to 46.106	43.108 to 43.100	0.041 to 0.019
Blue	46.114 to 46.106	43.099 to 43.092	0.041 to 0.020
Blue	46.123 to 46.115	43.108 to 43.100	0.042 to 0.020
Green	46.123 to 46.115	43.099 to 43.092	0.042 to 0.021

For instance:

Crankcase Bore	46.099 mm
Crankshaft Journal Diameter	43.095 mm
Required Bearing	RED

Warning

Always confirm, using the Plastigauge method, that the running clearance is correct before final assembly. Severe engine damage could result from incorrect clearance resulting in loss of motorcycle control and an accident.

Note:

- Repeat the measurements for all respective journals.
- 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 that gives the greater running clearance.

Coolant Manifold - 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.

- Remove the seat (see Seat - Removal, page 645).
- Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
- Remove the fuel tank (see).

Note:

- **The oil pump and water pump are supplied as an assembly and cannot be separated. This procedure covers the removal of the oil and water pump assembly.**
- Remove the engine (see Engine - Removal, page 261).

Warning

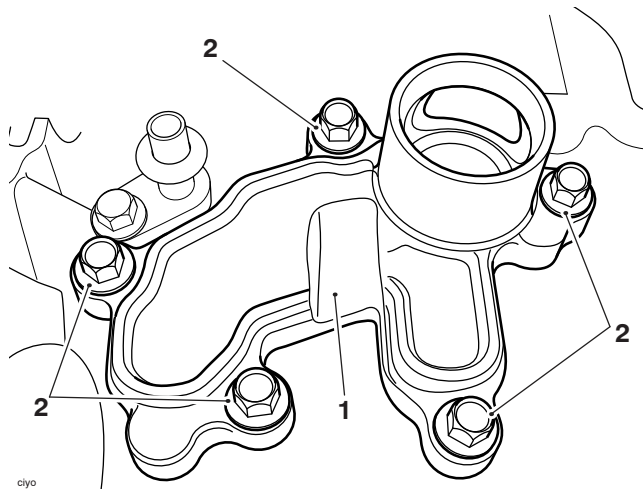
The oil may be hot to the touch. Contact with hot oil may cause the skin to be scalded or burned.

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.

- Separate the lower crankcase from the upper crankcase (see Crankcase - Removal, page 169).

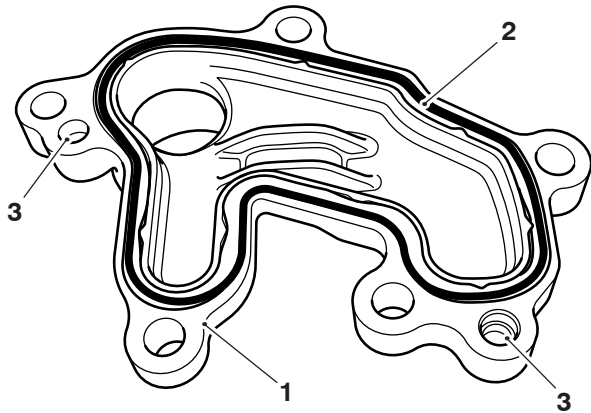
1. Remove the input and output shafts.
2. Release the fixings and remove the coolant manifold, discard the fixings and the sealing ring.



1. **Coolant manifold**
2. **Fixings**

Coolant Manifold - Installation

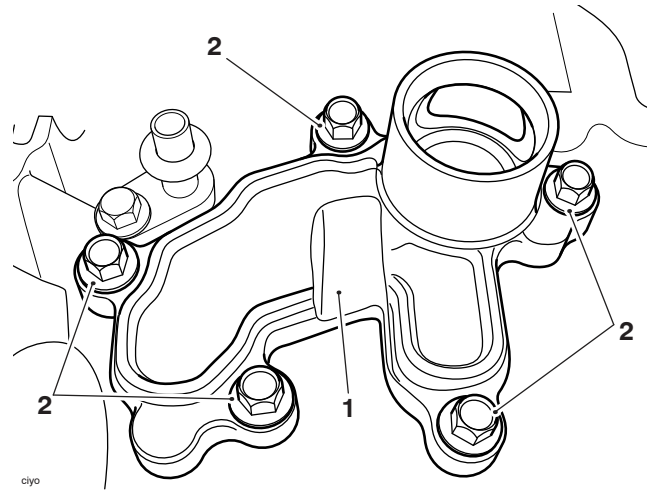
1. Fit a new sealing ring to the coolant manifold.



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1. Coolant manifold
2. Sealing ring
3. Dowel locating holes

2. Position the coolant manifold to the crankcase, ensuring the locating dowels are correctly positioned.
3. Install new fixings and tighten to 9 Nm.



ciyo

Tightening sequence

- Assemble the crankcases (see Crankcase - Assembly, page 171).
- Refit the engine (see Engine - Installation, page 265).
- Refit the engine cradles (see Cradle Assemblies - Installation, page 652).
- Refit the fuel tank (see Fuel Tank - Installation, page 385).
- Reconnect the battery, positive (red) lead first and tighten the battery terminals to 4.5 Nm.
- Start the engine and ensure that the low oil pressure warning light goes out shortly after starting.
- Stop the engine and check the engine oil level. Adjust if necessary (see Engine Oil - Level Inspection, page 245).
- Refit the seat (see Seat - Installation, page 645).

Breather Plate - 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

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 watercourses. To prevent pollution of watercourses etc., dispose of used oil sensibly. If in doubt contact your local authority.

Note:

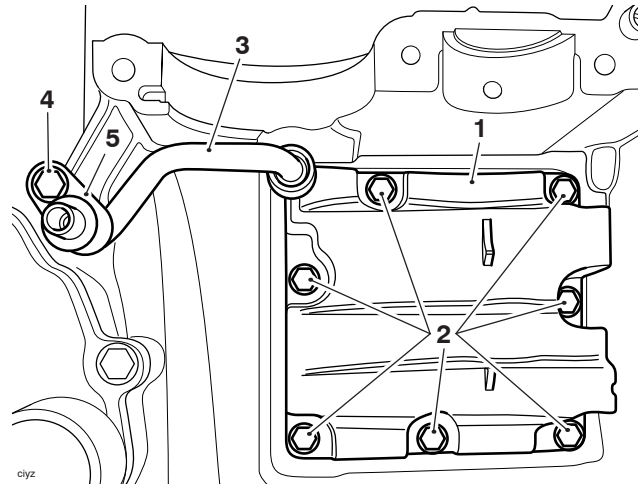
- **The oil pump and water pump are supplied as an assembly and cannot be separated. This procedure covers the removal of the oil and water pump assembly.**
- Remove the seat (see Seat - Removal, page 645).
- Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
- Remove the fuel tank (see).
- Remove the engine (see Engine - Removal, page 261).

Warning

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

- Separate the lower crankcase from the upper crankcase (see Crankcase - Removal, page 169).
1. Remove the breather drain tube from the crankcase, discard the fixing and the o-ring.

2. Remove the input and output shafts.
3. Remove the engine oil breather plate and baffle, discard the fixings.

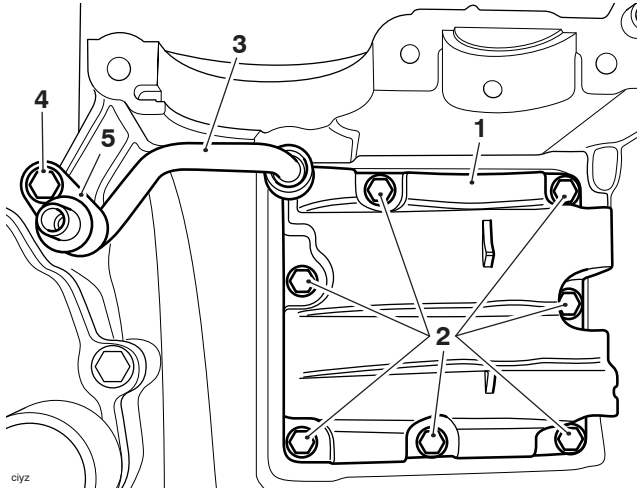


1. Oil breather plate
2. Fixings
3. Breather drain tube
4. Fixings
5. O-ring

Breather Plate - Installation

Note:

- Prior to fitting the O-ring coat the surfaces with petroleum jelly.
1. Using new fixings, fit the engine oil breather baffle and tighten to 12 Nm.
 2. Fit a new O-ring and install the breather drain tube to the crankcase. Ensure the tube is correctly installed in the breather housing.
 3. Install a new fixing and tighten to 9 Nm.



1. Oil breather plate
2. Fixings
3. Breather drain tube
4. Fixing
5. O-ring

- Assemble the crankcases (see Crankcase - Assembly, page 171).
- Refit the engine (see Engine - Installation, page 265).
- Refit the fuel tank (see Fuel Tank - Installation, page 385).
- Reconnect the battery, positive (red) lead first and tighten the battery terminals to 4.5 Nm.
- Start the engine and ensure that the low oil pressure warning light goes out shortly after starting.
- Stop the engine and check the engine oil level. Adjust if necessary (see Engine Oil - Level Inspection, page 245).
- Refit the seat (see Seat - Installation, page 645).

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13 Balancer

Table of Contents

Exploded View – Balancers 189

Introduction 190

Rear Balancer Shaft - Removal..... 190

Front Balancer Shaft - Removal 191

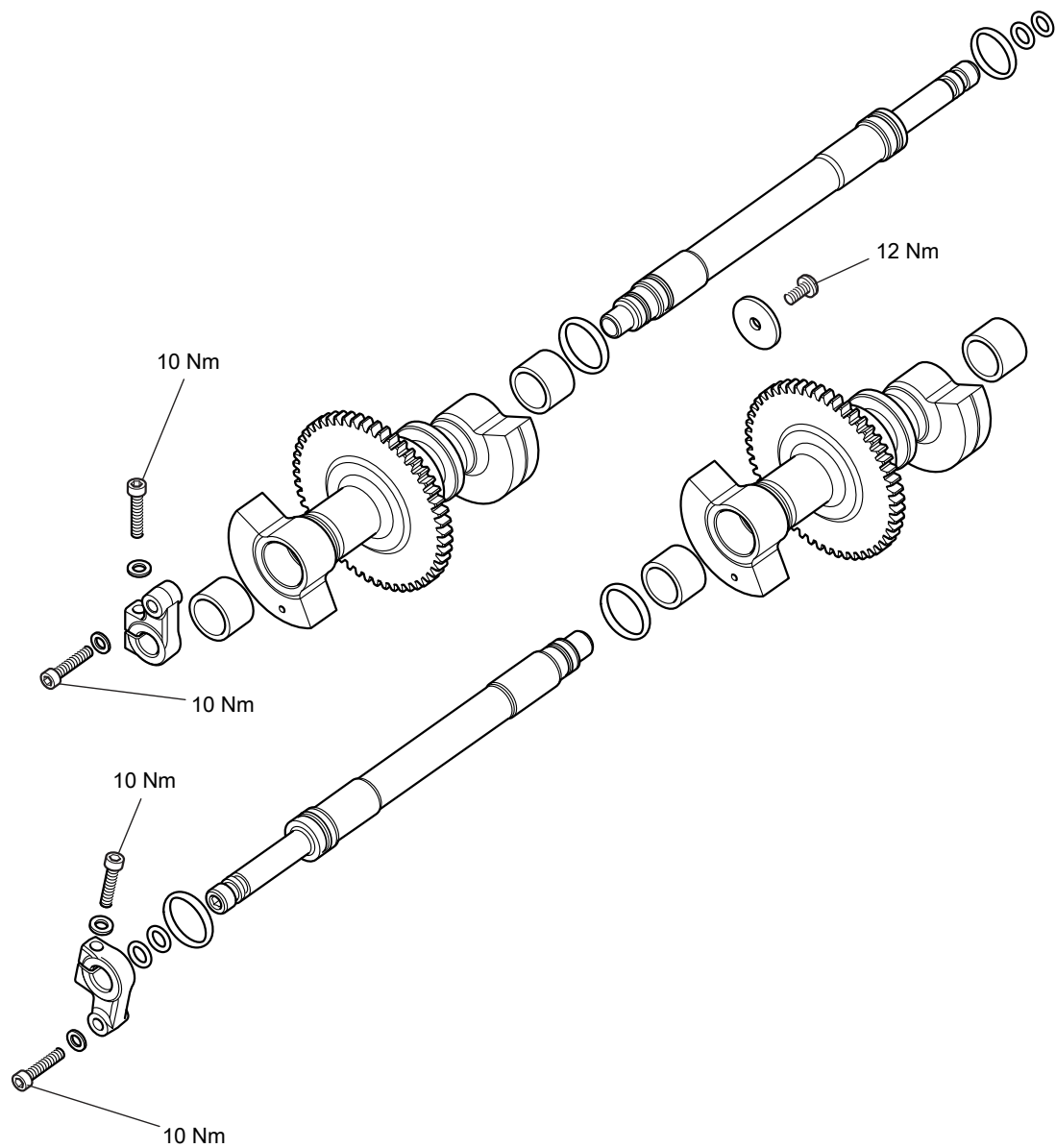
Balancer shafts - Inspection 193

Front Balancer Shaft - Installation..... 193

Rear Balancer Shaft - Installation 196

Balancer Shafts Dynamic Adjustment..... 197

Exploded View - Balancers



Introduction

Two balancer shafts are fitted to the engine, one in front of the crankshaft in the upper crankcase and one behind it in the lower crankcase. Each 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.

Rear Balancer Shaft - Removal

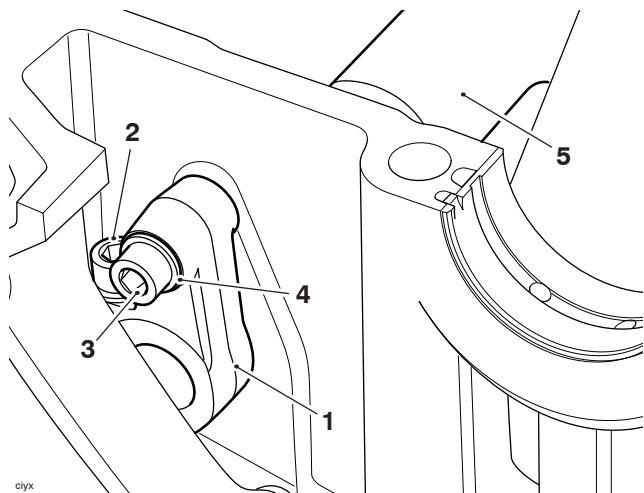
Warning

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.

- Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
 - Remove the fuel tank (see).
 - Remove the engine (see Engine - Removal, page 261).
 - Separate the lower crankcase from the upper crankcase (see Crankcase - Removal, page 169).
1. Remove the input and output shafts.

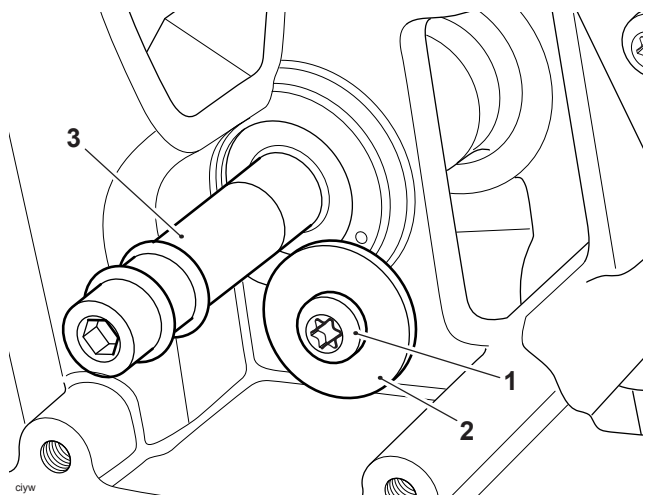
Note:

- **The rear dead shaft clamp is marked with the R facing away from the crankcase.**
2. Loosen but do not fully remove the dead shaft clamp locking screw,
 3. Remove the dead shaft clamp securing screw and washer.



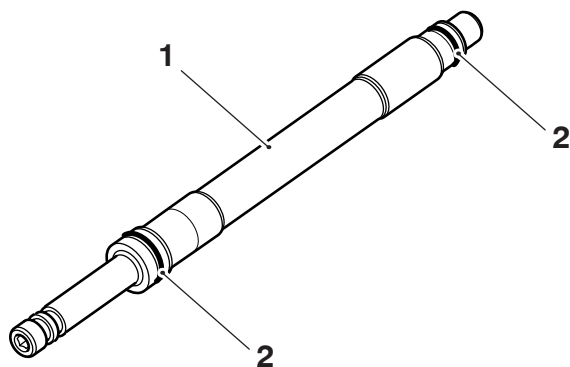
1. **Dead shaft clamp**
2. **Locking screw**
3. **Securing screw**
4. **Washer**
5. **Dead shaft**

4. Release the dead shaft screw and washer. Discard the dead shaft screw and retain the washer.



1. **Screw**
2. **Washer**
3. **Dead shaft**

5. Support the balancer shaft and noting its orientation slide the dead shaft from the crankcase.
6. Remove the balancer shaft.
7. Remove and discard the O-rings from the deadshaft.



1. **Deadshaft**
2. **O-rings**

Front Balancer Shaft - Removal

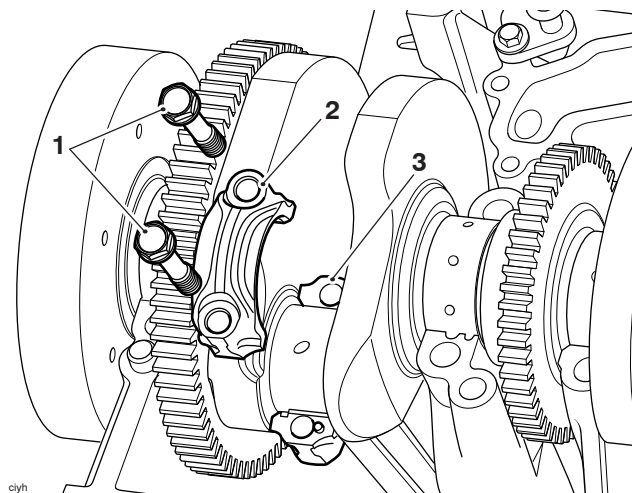
Warning

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.

- Remove the seat (see Seat - Removal, page 645).
- Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
- Remove the fuel tank (see).
- Remove the engine (see Engine - Removal, page 261).
- Separate the lower crankcase from the upper crankcase (see Crankcase - Removal, page 169).

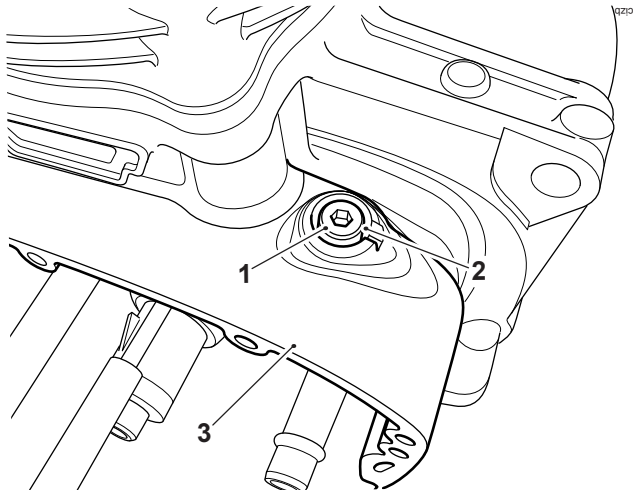
Note:

- **The connecting rods and caps should be identified, using a paint mark or similar.**
1. Remove and discard the connecting rod bolts.



1. **Connecting rod bolts**
 2. **Connecting rod cap**
 3. **Connecting rod**
2. Remove the crankshaft.

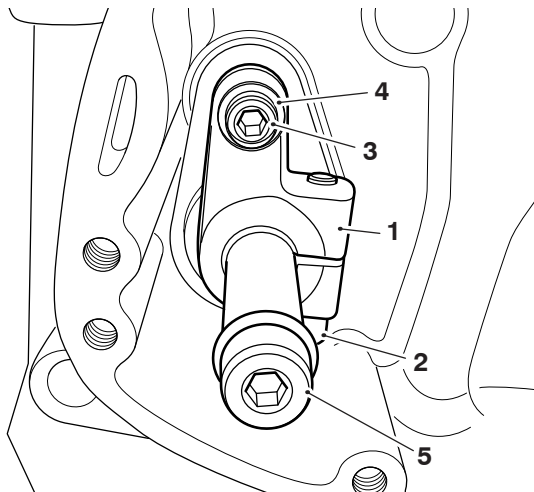
- Remove the front balancer shaft blanking screw and washer, discard the washer.



- Blanking screw
- Washer
- Upper crankcase

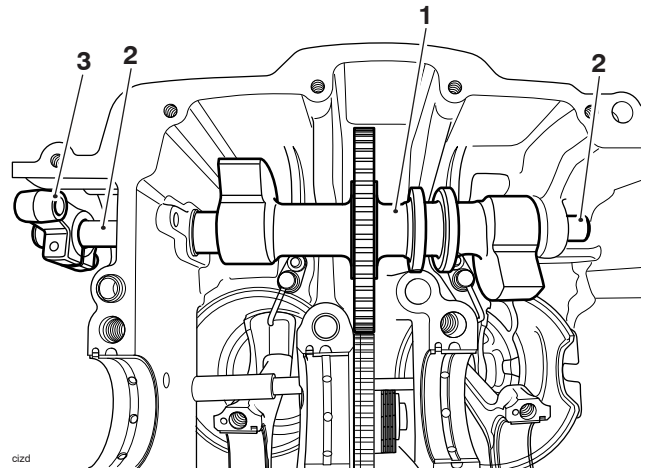
Note:

- The front dead shaft clamp is marked with the **F** facing away from the crankcase.
- Loosen but do not fully remove the dead shaft clamp locking screw.
 - Remove the dead shaft clamp securing screw and washer.

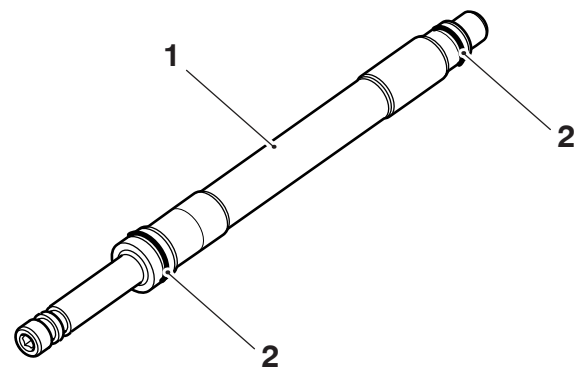


- Dead shaft clamp
- Locking screw
- Securing screw
- Washer
- Dead shaft

- Support the balancer shaft and noting its orientation slide the dead shaft from the crankcase.



- Balancer
 - Dead shaft
 - Dead shaft clamp
- Remove the balancer shaft.
 - Remove and discard the O-rings from the deadshaft.



- Deadshaft
- O-rings

Balancer shafts - Inspection

1. Inspect all gears for chipped or missing teeth.
2. Inspect all bearings for signs of seizure and any other damage. Check that all bearings rotate smoothly and without tight spots.

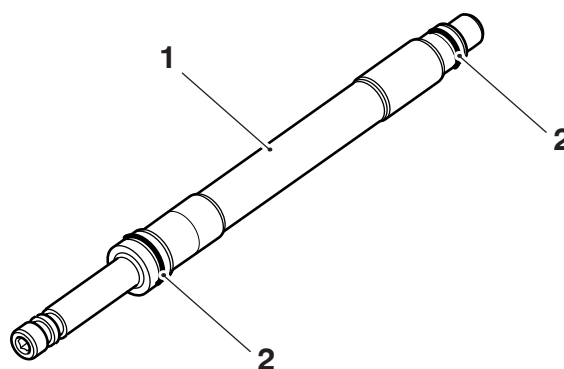
Front Balancer Shaft - Installation

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:

- **To ensure a correct relationship, the balancer shaft must be installed in a specific orientation relative to the crankshaft.**
1. Check service tool T3880039 is fully inserted into the idler gear, and that the camshaft to idler gear timing is correct.
 2. Fit a new O-ring to the grooves at each end of the deadshaft.



1. Deadshaft

2. O-rings

Caution

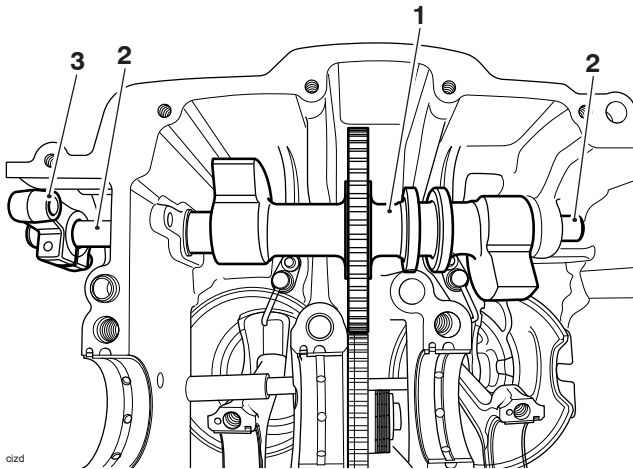
The balancer shaft gear is designed to mesh with the crankshaft gear.

Correct adjustment of the balancer shafts is critical to the performance of the engine and comfort of the rider.

Failure to correctly adjust the balancer shafts may cause serious engine damage and a poor rider experience.

3. Lubricate the balancer shaft, needle roller bearings and O-rings with clean engine oil.
4. Fit the balancer shaft into the crankcase as noted during removal.

- Support the balancer shaft and noting its orientation, slide the dead shaft through the balancer shaft and into the upper crankcase.

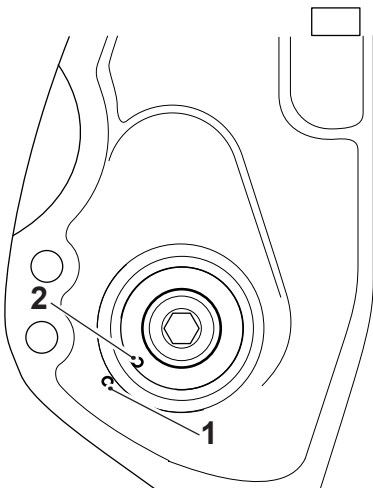


- Balancer**
- Dead shaft**
- Dead shaft clamp**

- Position the alignment mark on the dead shaft with the alignment mark on the crankcase.

Note:

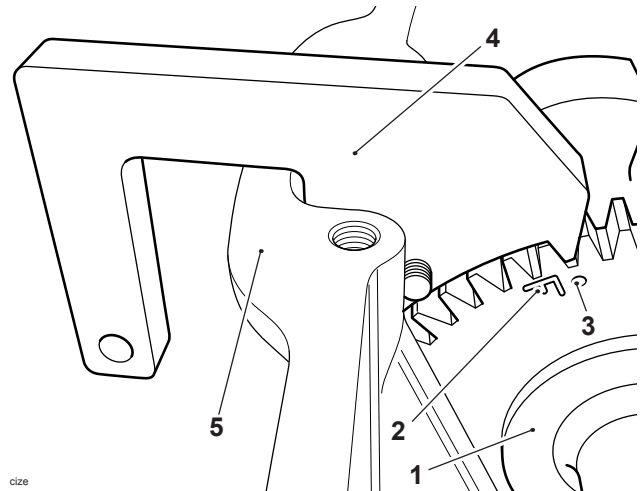
- The static alignment of the balancer shaft will allow for initial starting of the engine.
- Final adjustment must be carried out with the engine running and at operating temperature, see Balancer Shafts Dynamic Adjustment, page 197



- Alignment mark (Crankcase)**
- Alignment mark (Dead shaft)**

- Rotate the balancer shaft until the F and dot mark are visible.
- Position the peg on service tool T3880811 to the dot mark on the balancer shaft gear.

- Allow the balancer shaft to rotate anti-clockwise until the flat surface rests against the machined surface of the crankcase, as shown.



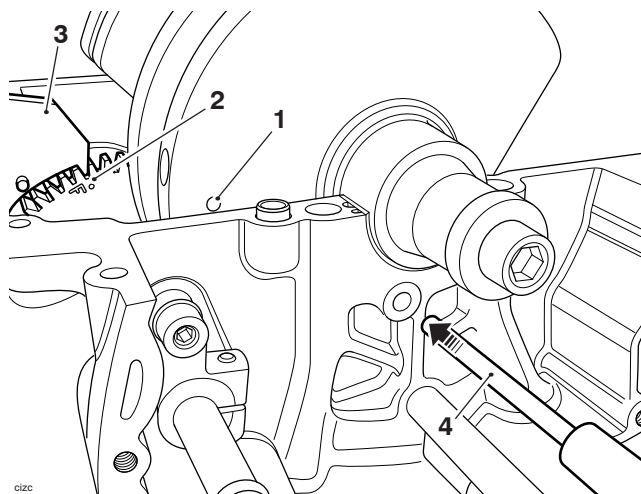
- Balancer shaft**
- Balancer shaft 'F' (front) mark**
- Balancer shaft alignment mark**
- T3880811 - Front Balancer Timing Tool**
- Crankcase**

- Clean the crankshaft, crankshaft bearings and big end bearings with a high flashpoint solvent.
- Lubricate the crank shaft and bearings with clean engine oil.
- Position the connecting rods as noted during removal.

Note:

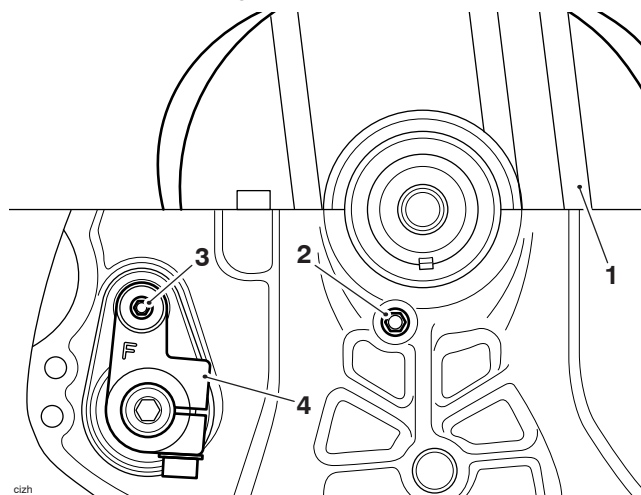
- As the crankshaft is lowered into position the balancer shaft will rotate and the T3880811 - Front Balancer Timing Tool will no longer rest against the crankcase.

13. Position the crankshaft to the crankshaft bearings, aligning the timing mark on the crankshaft with the machined surface of the crankcase.



1. Crankshaft timing mark
2. Balancer gear timing marks
3. T3880811 - Front Balancer Timing Tool
4. T3880601 - Camshaft Timing Pin

14. To check that the balancer shaft is correctly timed to the crankshaft proceed as follows:
- The alignment hole in the crank shaft is visible through the hole in the crankcase.
 - The alignment mark on the balancer shaft is visible through the screw hole in the dead shaft clamp.
 - The service tool T3880601 can be inserted fully, locking the crankshaft in position.

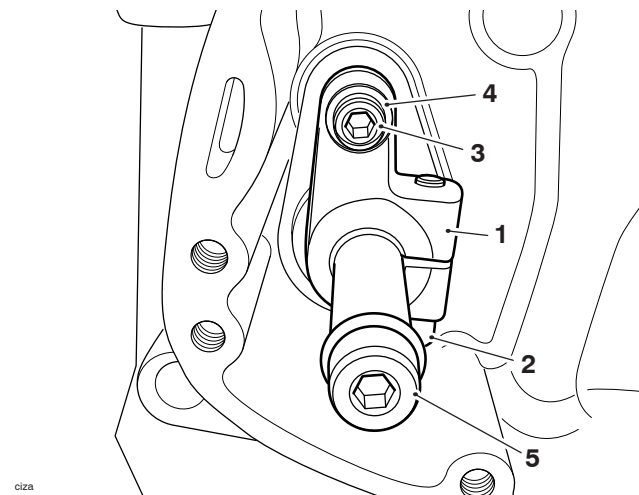


1. Crankshaft
2. Crankshaft dot mark
3. Front balancer shaft dot mark
4. Dead shaft clamp

Note:

- If the balancer shafts timing is incorrect, the procedure must be restarted from the beginning.

15. Refit the dead shaft clamp and tighten the securing screw to 10 Nm and then tighten the dead shaft clamp locking screw to 10 Nm.

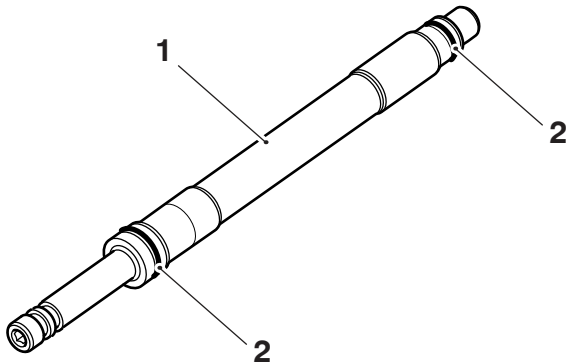


1. Dead shaft clamp
2. Locking screw
3. Securing screw
4. Washer
5. Dead shaft

- Refit the big end caps to the connecting rods (see Connecting Rod - Installation, page 178).
- Refit the crankcase halves (see Rear Balancer Shaft - Installation, page 196 and Crankcase - Assembly, page 171).
- Refit the alternator cover to the engine (see Alternator Cover - Installation, page 101).
- Refit the clutch cover (see Clutch Cover - Installation, page 98).
- Refit the camshaft cover (see Camshaft Cover - Installation, page 104).
- Refit the engine (see Engine - Installation, page 265).
- Refit the fuel tank (see Fuel Tank - Installation, page 385).
- Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
- Refit the seat (see Seat - Installation, page 645).

Rear Balancer Shaft - Installation

1. Fit a new O-ring to the grooves at each end of the deadshaft.



1. Deadshaft

2. O-rings

2. Lubricate the balancer shaft, needle roller bearings and O-rings with clean engine oil.
3. Position the balancer shaft as noted during removal.
4. Fit the dead shaft into the crankcase as noted during removal and insert the balancer shaft.



Caution

The balancer shaft gear is designed to mesh with the crankshaft gear.

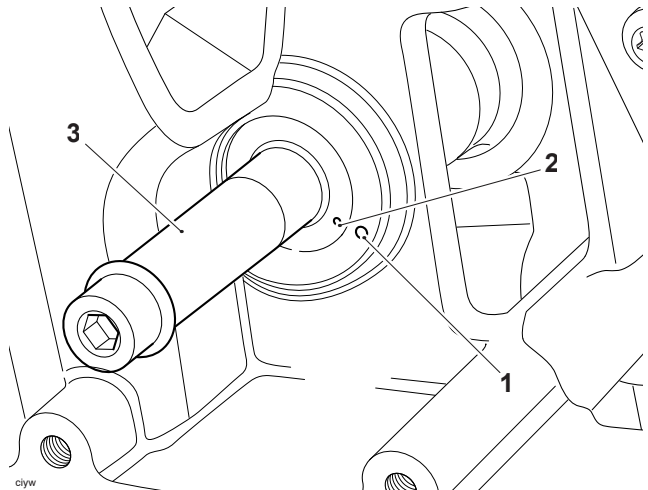
Correct adjustment of the balancer shafts is critical to the performance of the engine and comfort of the rider.

Failure to correctly adjust the balancer shafts may cause serious engine damage and a poor rider experience.

Note:

- The static alignment of the balancer shaft will allow for initial starting of the engine.
- Final adjustment must be carried out with the engine running and at operating temperature, see Balancer Shafts Dynamic Adjustment, page 197

5. Align the dot mark on the dead shaft with the dot mark on the crankcase.

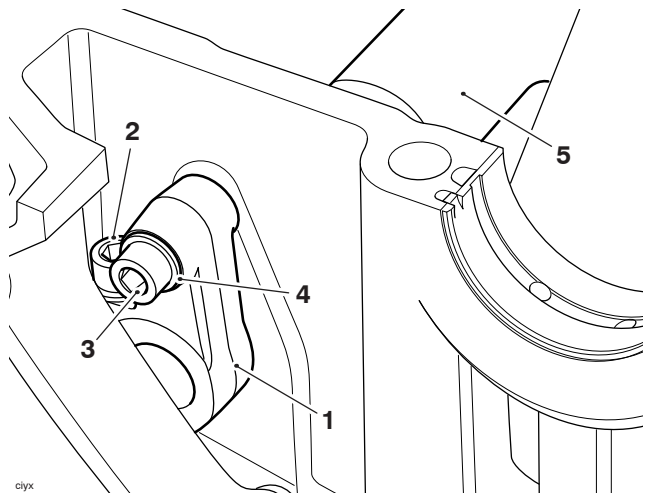


1. Crankcase dot mark

2. Dead shaft dot mark

3. Dead shaft

6. Fit a new screw to the washer, install the screw and washer to the dead shaft, ensuring the dot marks are aligned. Tighten to 12 Nm.
7. Position the balancer shaft so that the preload mark aligns with the crankcase identification mark.
8. Refit the dead shaft clamp and tighten the securing screw to 10 Nm and then tighten the dead shaft clamp locking screw to 10 Nm.



1. Dead shaft clamp

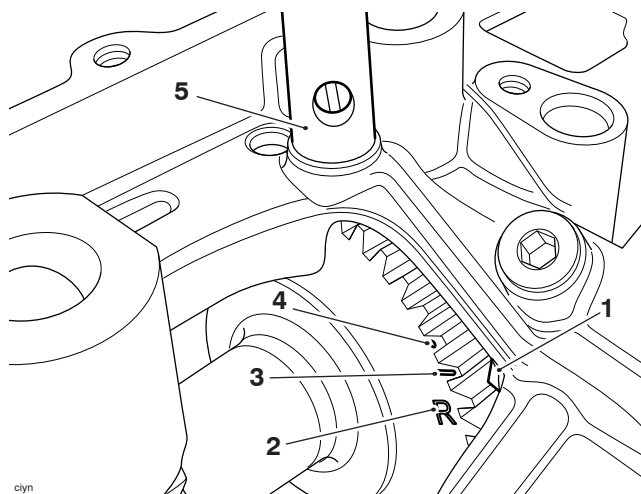
2. Dead shaft clamp locking screw

3. Securing screw

4. Washer

5. Balancer shaft

9. Lock the balancer shaft into position using service tool T3880809.
10. Lubricate the crank shaft and bearings with clean engine oil.



1. **Crankcase identification mark**
2. **Rear alignment mark**
3. **Preload mark**
4. **Dot mark**
5. **T3880809 - Rear Balancer Timing Tool**

- Refit the crankcase halves (see Crankcase - Assembly, page 171).
- Refit the alternator cover to the engine (see Alternator Cover - Installation, page 101).
- Refit the clutch cover (see Clutch Cover - Installation, page 98).
- Refit the camshaft cover (see Camshaft Cover - Installation, page 104).
- Refit the engine (see Engine - Installation, page 265).
- Refit the fuel tank (see Fuel Tank - Installation, page 385).
- Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
- Refit the seat (see Seat - Installation, page 645).

Balancer Shafts Dynamic Adjustment

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

If the engine has recently been running, the engine oil will be hot to the touch. Contact with the hot oils may cause damage to exposed skin. To avoid skin damage, do not touch hot oil.

Warning

If the engine has recently been running, the exhaust components may be hot to the touch. Contact with the hot components may cause damage to exposed skin. To avoid skin damage, always allow the hot parts to cool before working on the exhaust system.

Warning

The cooling fan is switched on and off by the Engine Control Module in response to a signal received from the coolant temperature sensor. To prevent injury, never place loose clothing, fingers or hands near the cooling fan, until the engine is stopped. Loose clothing, fingers or the hands could become trapped during cooling fan operation and cause crushing injury to the fingers, hands or other parts of the anatomy.

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.

Note:

- **Before dynamically adjusting the front and rear balancer shafts the engine coolant fan must have cycled once and the coolant temperature must be at least 103°C.**

Front Balancer Shaft Dynamic Adjustment

- 1. Start the motorcycles engine and allow to run to operating temperature.

**Caution**

The dead shaft is an eccentric shaft which runs inside the balancer shaft. When rotated the dead shaft therefore closes or opens the gap between the teeth of the balancer gear and the teeth of the crankshaft gear.

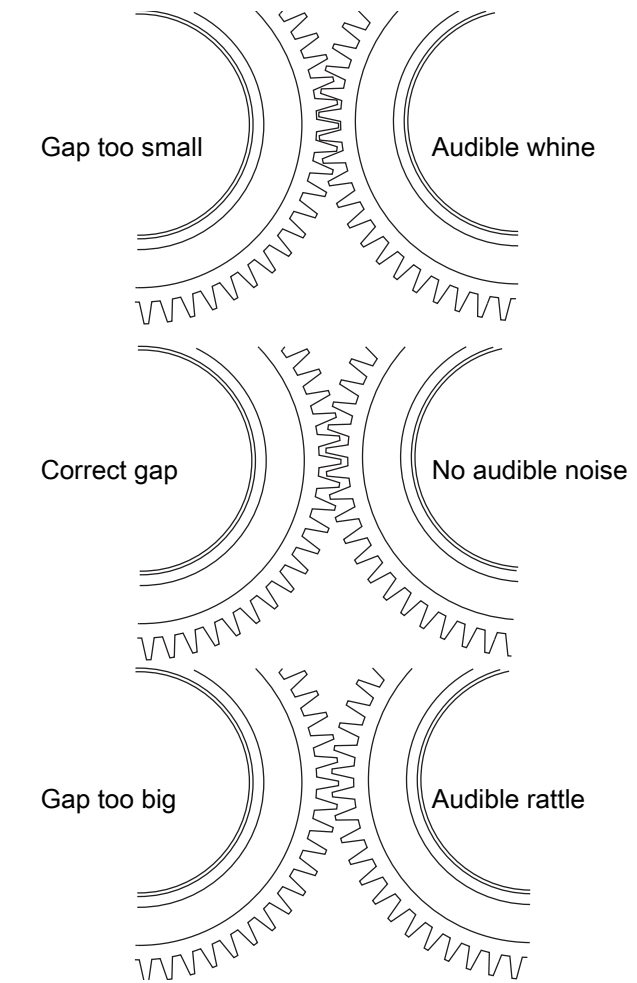
If the gap between the balancer gear and crankshaft gear is too small a whine is audible due to the increased load on the gear teeth and bearings.

If the gap between the balancer gear and crankshaft gear is too large a a rattle is audible due to the increased gap between the gear teeth.

The balancer shafts must always be adjusted in the same operation.

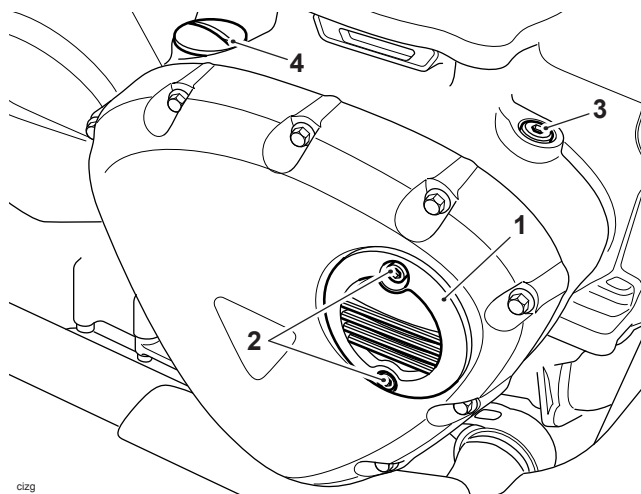
Adjusting the front or rear balancer shafts individually may cause the engine to whine or rattle.

Unsatisfactory adjustment of the balancer shafts may cause severe engine damage.



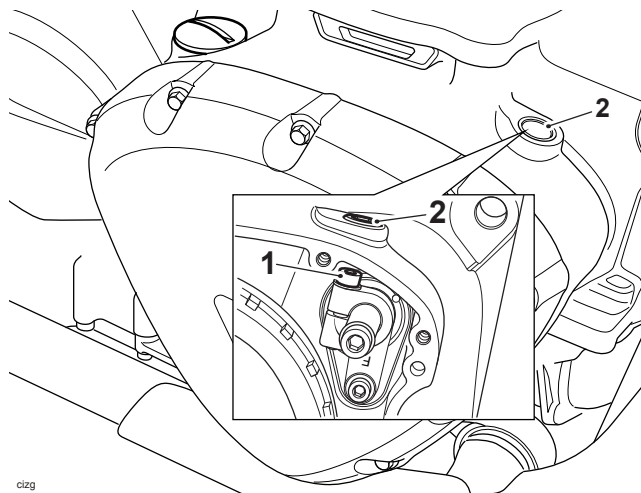
- 2. Stop the engine.

3. Remove the embellisher from the alternator cover and discard the fixings.
4. Remove the dead shaft clamp blanking plug and discard the washer.



1. Embellisher
2. Fixings
3. Dead shaft clamp blanking plug
4. Oil filler cap

5. Loosen the dead shaft clamp locking screw a maximum of two complete turns to allow smooth rotation of the balancer dead shaft in the clamp.



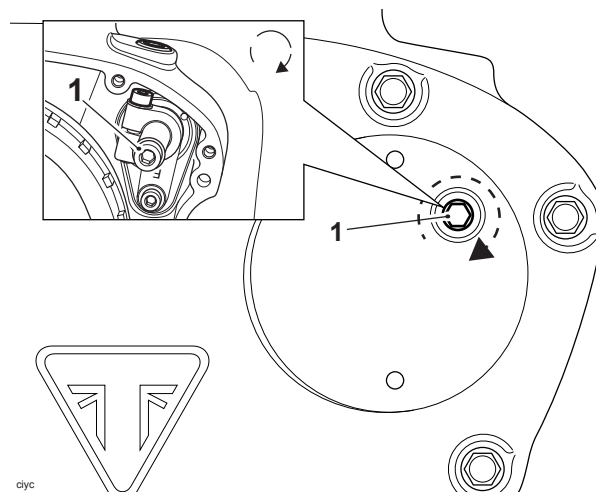
1. Dead shaft clamp locking screw
2. Blanking plug orifice

⚠ Caution

When adjusting the balancer shafts do not allow the gears to whine or rattle for a prolonged period.

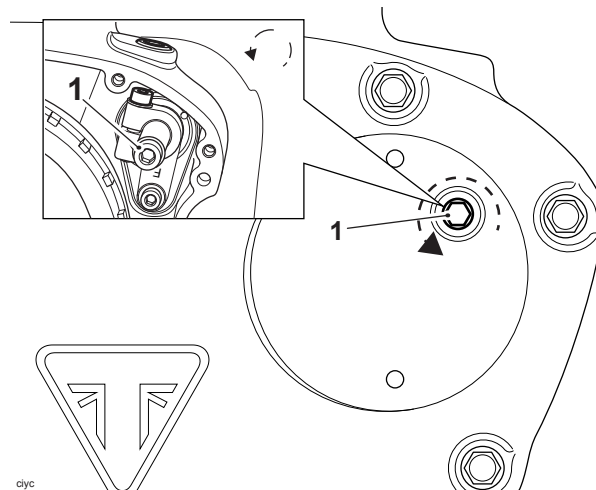
Allowing the gears to mesh incorrectly for extended periods may cause damage to the gears and or bearings.

6. Start the engine and allow to idle.
7. Gently rotate the dead shaft clockwise until a whining noise can just be heard.



1. Dead shaft

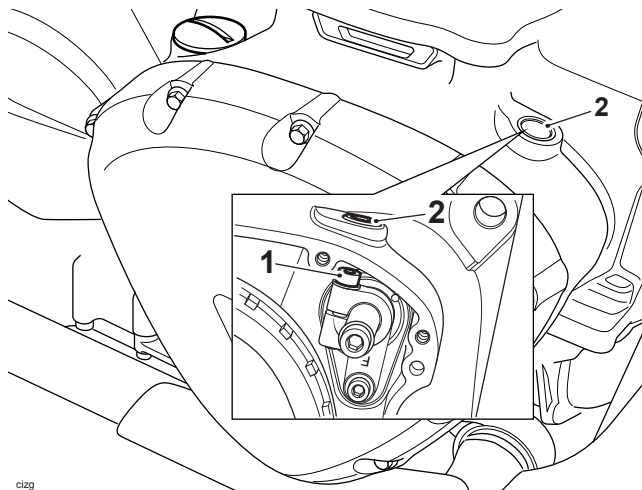
8. Rotate the dead shaft anti-clockwise until the whining noise can no longer be heard.



1. Dead shaft

9. Tighten the dead shaft clamp locking screw to 10 Nm.

10. Stop the engine.

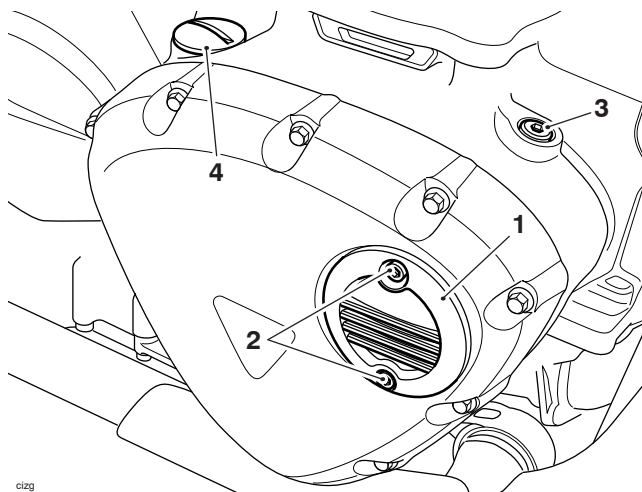


cizg

1. Dead shaft clamp locking screw

2. Blanking plug orifice

11. Wipe away any spilt oil from the crankcase.
12. Fit a new washer and tighten the dead shaft clamp blanking plug to 23 Nm.
13. Refit the embellisher cover to the alternator cover, tighten the new screws to 4 Nm.



cizg

1. Oil filler cap

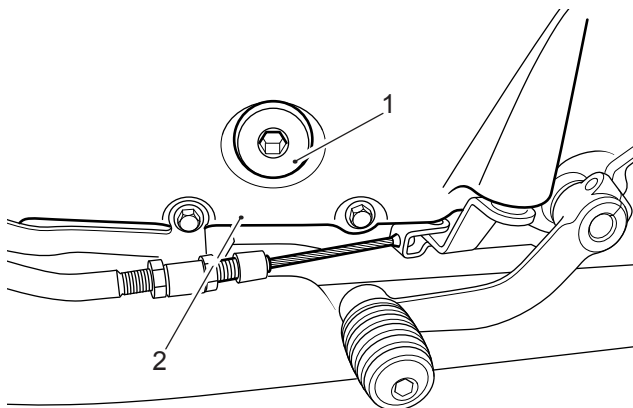
2. Embellisher

3. Dead shaft clamp blanking plug

4. Oil filler cap

Rear Balancer shaft Dynamic Adjustment

1. Remove the clutch cover plug.

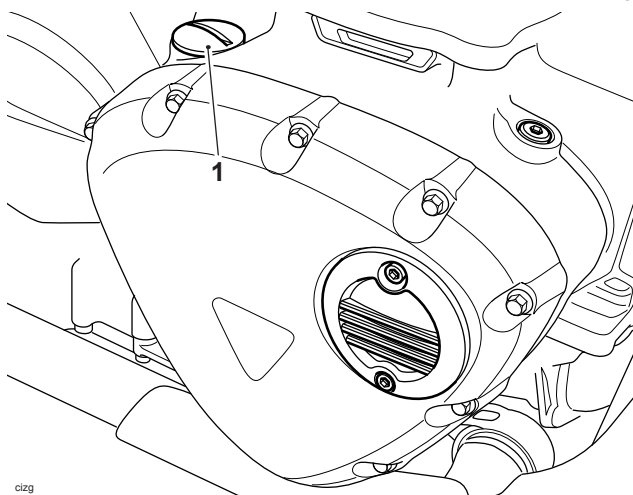


clwp_1

1. Clutch cover plug

2. Clutch cover

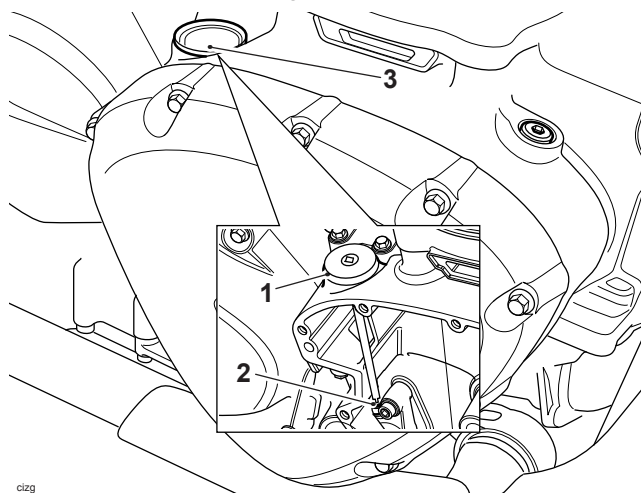
2. Remove the oil filler cap and discard the o-ring.



cizg

1. Oil filler cap

3. Using service tool T3880652, loosen the dead shaft clamp locking screw two full turns.

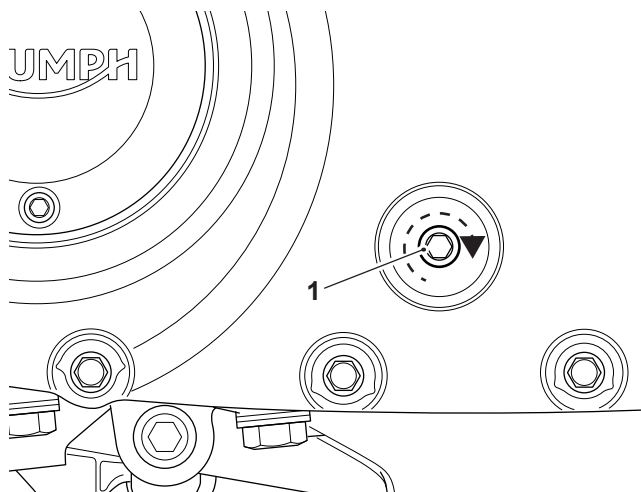


1. T3880652 - Dead Shaft Key Tool

2. Dead shaft clamp locking screw

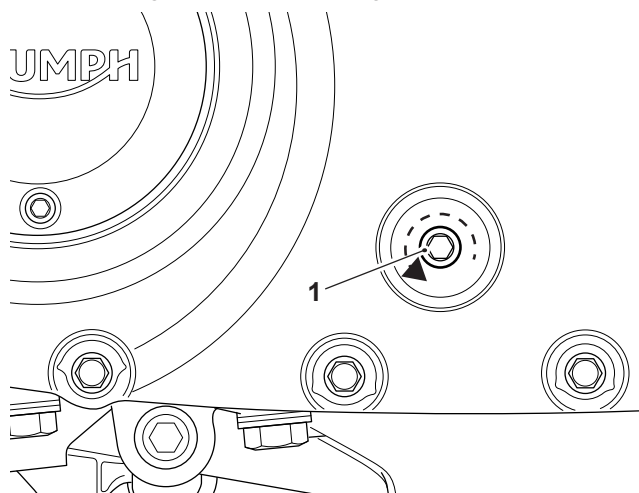
3. Oil filter orifice

4. Rotate the rear dead shaft clockwise until a whining noise can be heard.



1. Dead shaft

5. Rotate the dead shaft anti-clockwise until the whining noise can no longer be heard.

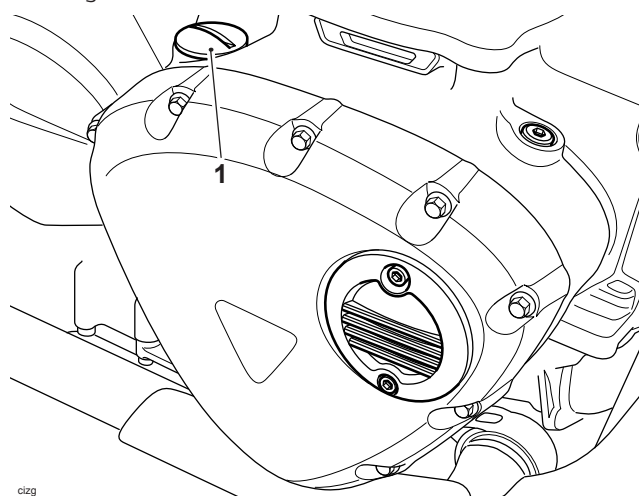


1. Dead shaft

6. Using service tool T3880652 tighten the dead shaft clamp locking screw to 10 Nm.

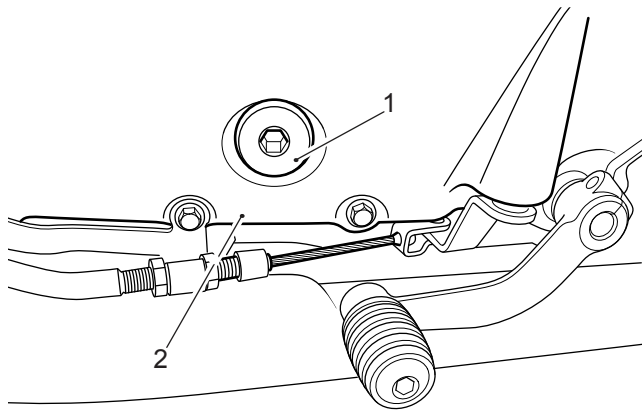
7. Wipe away any spilt oil from the upper crankcase.

8. Using a new O-ring refit the oil filler cap and tighten to 3 Nm.



1. Oil filler cap

9. Refit the clutch cover plug and tighten to 3 Nm.



cwp_1

- 1. Clutch cover plug**
- 2. Clutch cover**

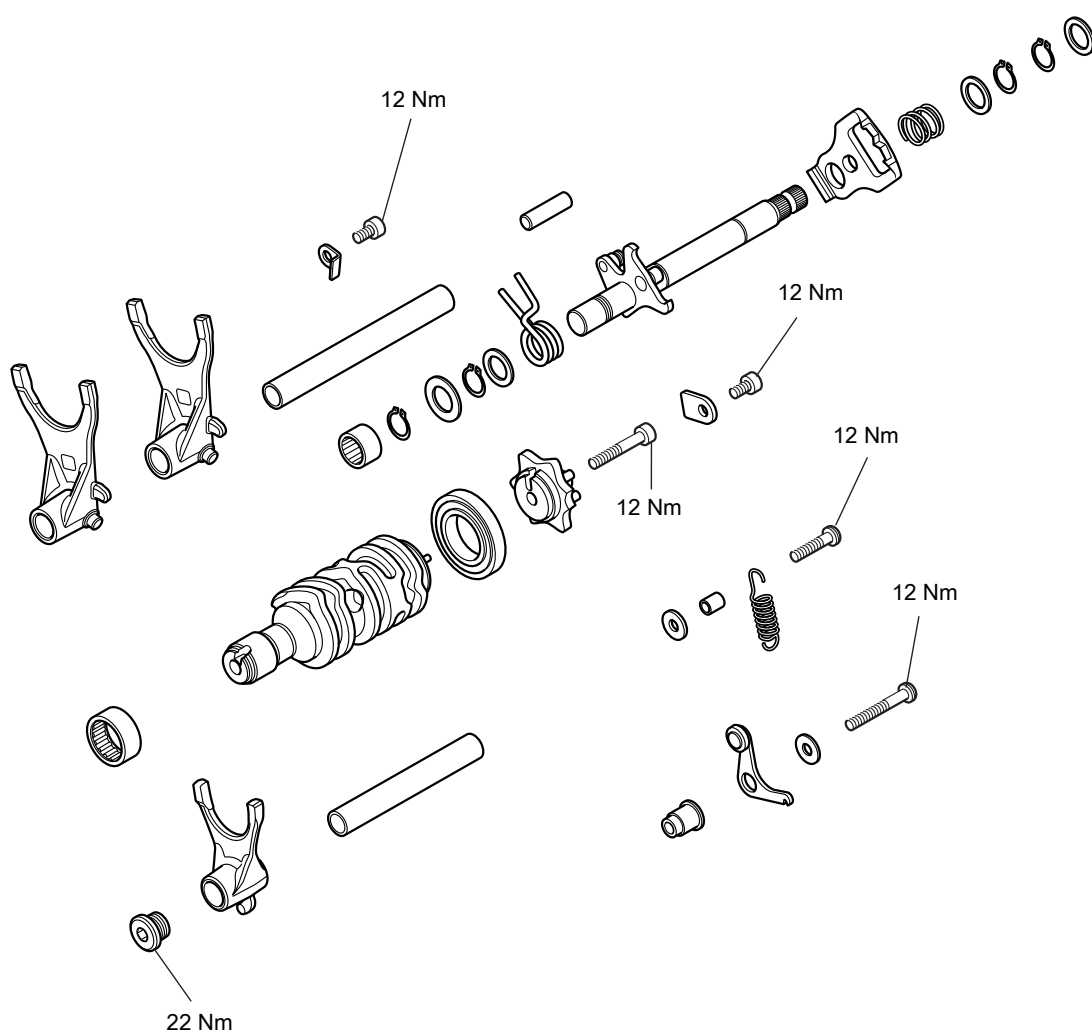
10. Inspect the engine oil level (see Engine Oil - Level Inspection, page 245).

14 Transmission

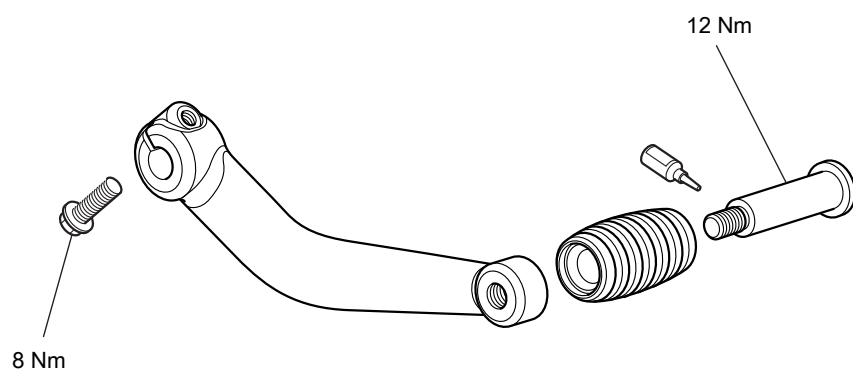
Table of Contents

Exploded View – Gear Selector.....	205
Exploded View – Gear Change Lever.....	206
Gear Change Shaft - Removal.....	207
Gear Change Shaft - Inspection.....	208
Gear Change Shaft - Installation	208
Gear Change Detent Wheel - Removal.....	209
Gear Change Detent Wheel - Installation	210
Selector Forks and Drum - Removal.....	211
Selector Forks and Drum Inspection	212
Selector Forks and Drum - Installation	213
Exploded View - Output Shaft.....	215
Output Shaft - Disassembly 6 speed.....	217
Output Shaft - Assembly 6 speed.....	220
Output Shaft - Inspection.....	224
Input Shaft	225
Input Shaft - Disassembly	227
Input Shaft - Inspection.....	228
Input Shaft - Assembly	228

Exploded View – Gear Selector



Exploded View – Gear Change Lever

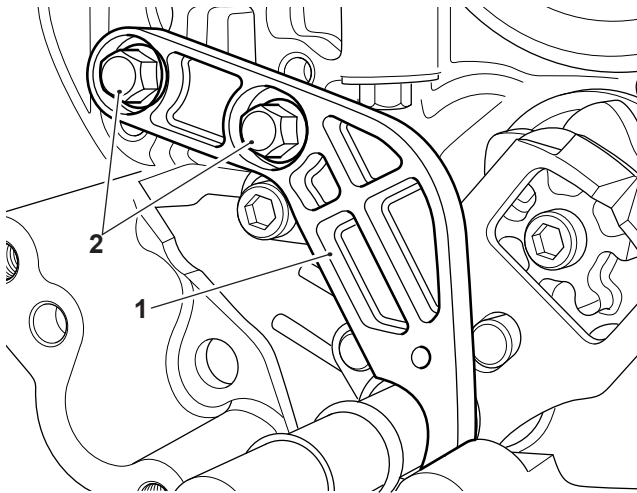


Gear Change Shaft - Removal

Warning

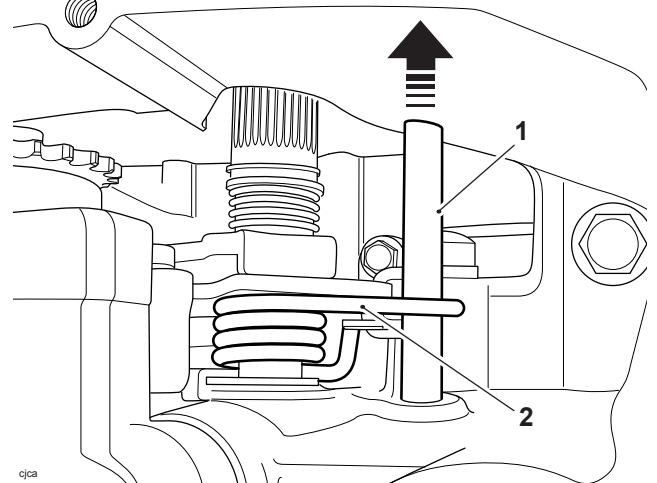
Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

- Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
 - Remove the clutch (see Clutch - Removal, page 158).
1. Remove and discard the fixings and remove the oil pump drive chain guide from the crankcase.



1. Oil pump drive chain guide
2. Fixings

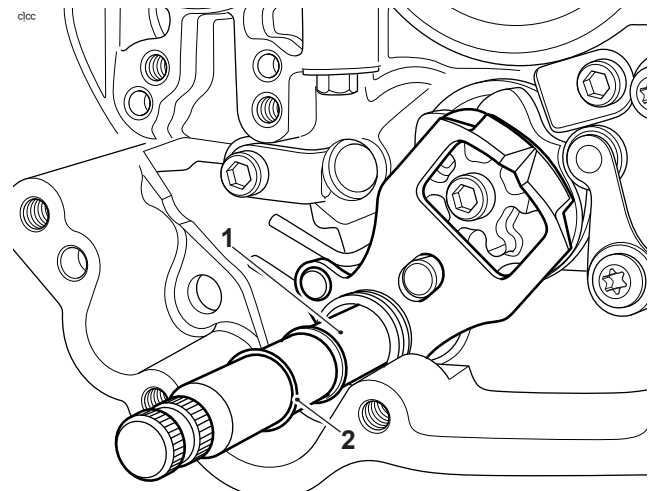
2. Withdraw the abutment dowel from the crankcase.



1. Abutment dowel

2. Abutment spring

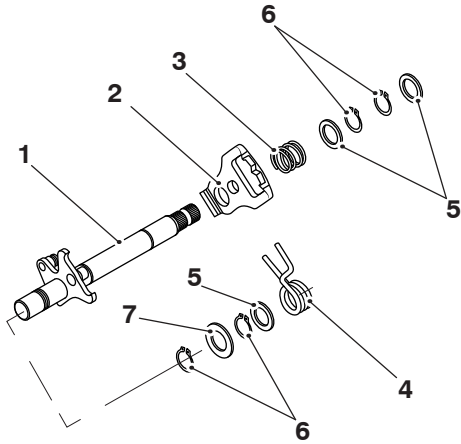
3. Collect the washer from the gear change shaft.
4. Withdraw the gear change shaft as an assembly.



1. Gear change shaft assembly
2. Washer

Gear Change Shaft - Inspection

1. Inspect the gear change shaft assembly and spring for damage or wear, the springs for over-extension (i.e. abnormal gaps between coils). Renew the components as necessary.



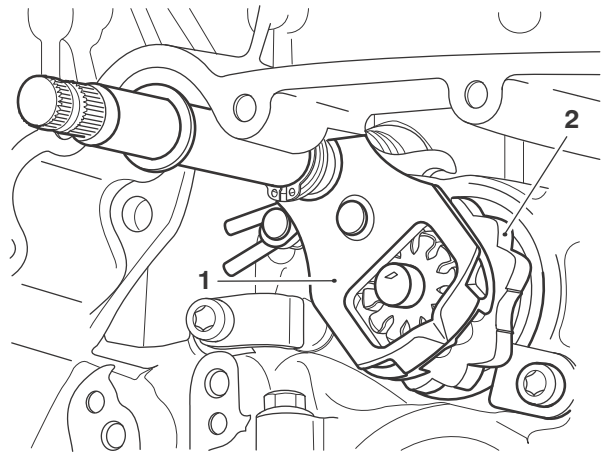
1. Gear change shaft assembly
2. Pivot plate
3. Spring (pivot plate)
4. Gear change return spring
5. Washer, 20 mm
6. Circlips
7. Washer, 25mm

Gear Change Shaft - Installation

Warning

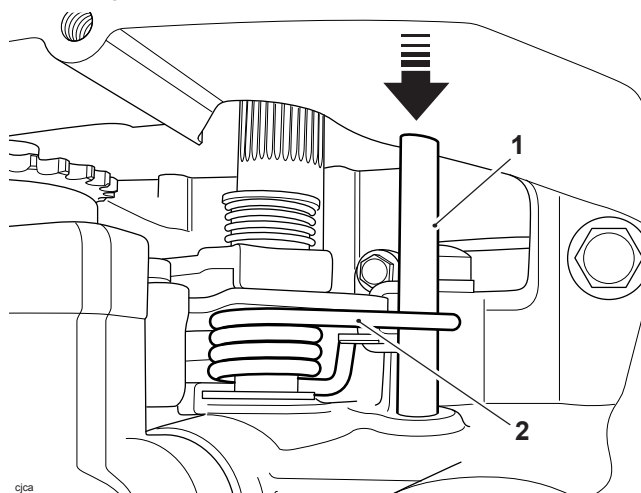
Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

1. Position the selector mechanism into the crankcase, locate the pivot plate to the detent wheel.



1. Pivot plate
2. Detent wheel

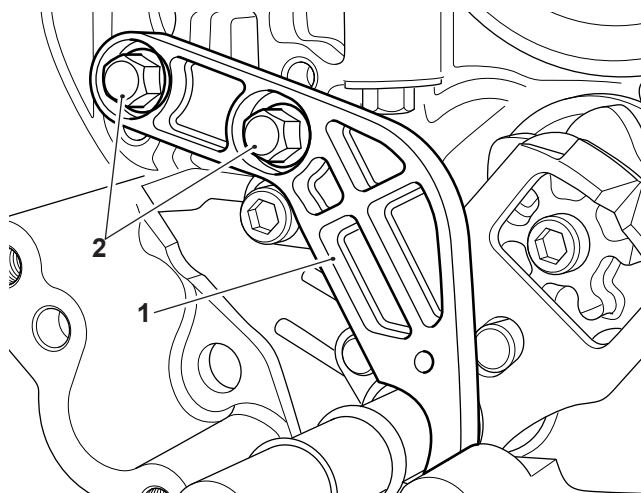
2. Insert the abutment dowel with the spring tangs positioned to either side.



1. Abutment dowel

2. Abutment spring

3. Refit the pump drive chain guide to the crankcase. Tighten the new fixings to 9 Nm.



1. Pump drive chain guide

2. Fixings

- Refit the clutch (see Clutch - Installation, page 162).
- Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
- Refit the seat (see Seat - Installation, page 645).

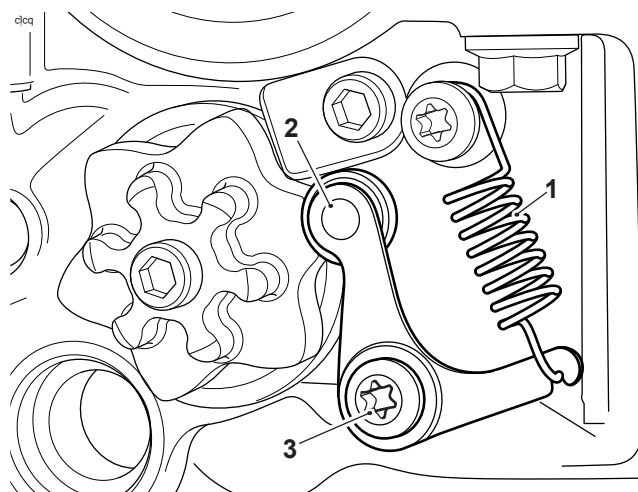
Gear Change Detent Wheel - Removal

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.

- Remove the seat (see Seat - Removal, page 645).
- Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
- Remove the gear change shaft (see Gear Change Shaft - Removal, page 207).

1. Release the detent arm spring.
2. Release the detent arm fixing and remove the detent arm.



1. Detent arm spring

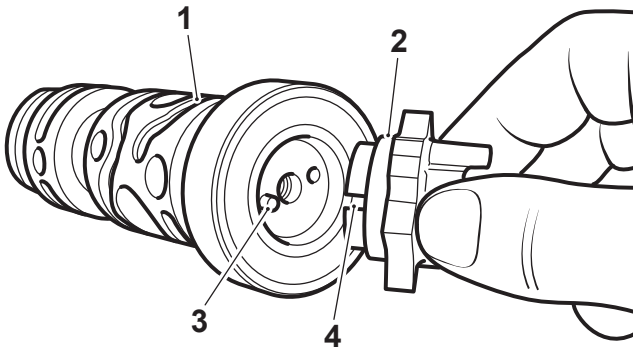
2. Detent arm

3. Fixing

3. Remove the fixing and the detent wheel from the selector drum.

Gear Change Detent Wheel - Installation

1. Lubricate the selector drum bearings with clean engine oil.
2. Refit the detent wheel to the selector drum, ensuring the pin on the drum locates in the slot in the detent wheel. Prevent the drum from turning and tighten the fixing to 12 Nm.



cfwy

1. Selector drum

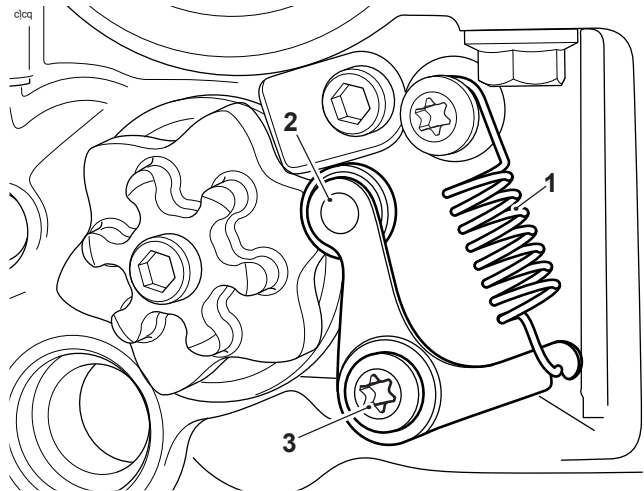
2. Detent wheel

3. Pin

4. Slot

3. Refit the spacer, detent arm, washer and fixing as noted during removal.

4. Tighten the fixing to 12 Nm.
5. Refit the detent arm spring.



1. Detent arm spring

2. Detent arm

3. Fixing

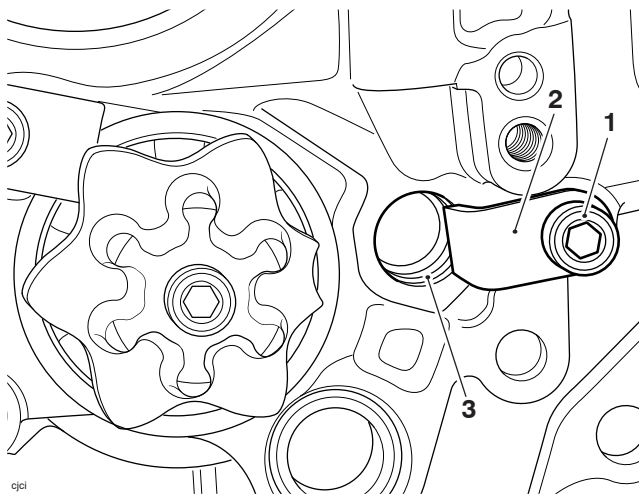
- Refit the gear change shaft (see Gear Change Shaft - Installation, page 208).
- Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
- Refit the seat (see Seat - Installation, page 645).

Selector Forks and Drum - Removal

Warning

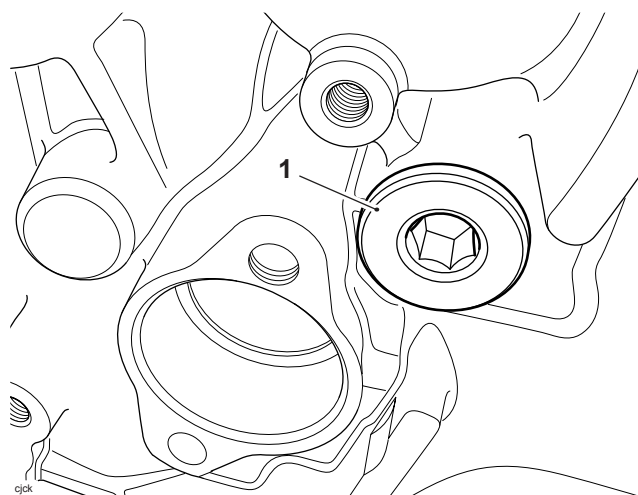
Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

- Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
 - Remove the fuel tank (see).
 - Remove the engine (see Engine - Removal, page 261).
 - Separate the lower crankcase from the upper crankcase (see Crankcase - Removal, page 169).
 - Remove the transmission shafts.
 - Remove the gear change selector shaft (see Gear Change Shaft - Removal, page 207).
 - Remove the gear position sensor (see Gear Position Sensor - Removal, page 420).
1. Remove and discard the fixing securing the output selector shaft retainer.



1. Fixing
2. Output selector shaft retainer.
3. Output selector shaft

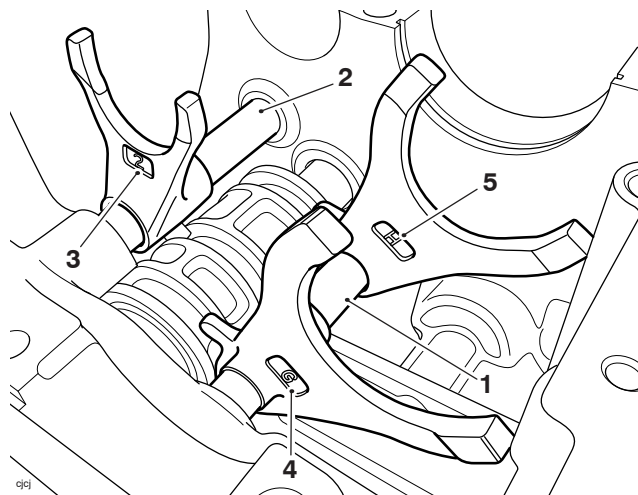
2. Remove and discard the fixing securing the input selector shaft.



1. Fixing

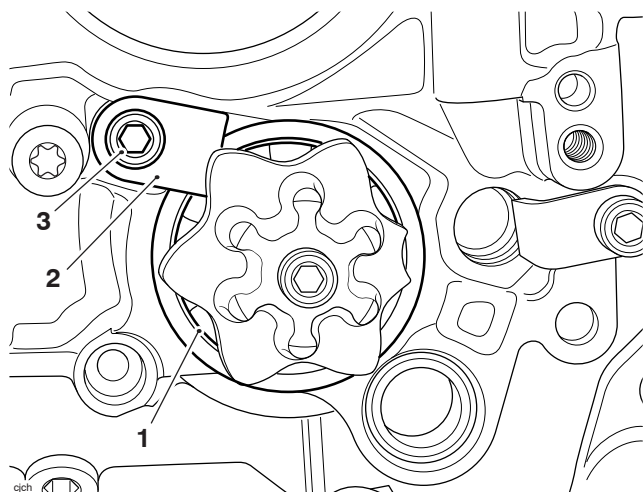
Note:

- Prior to removal, mark, or make a note of the relative positions of each selector fork in the selector drum.
3. Withdraw the input selector shaft and noting its orientation remove the fork.
 4. Withdraw the output selector shafts and noting their orientation, collect the two selector forks.



1. Output selector shaft
 2. Input selector shaft
 3. Selector fork (input shaft)
 4. Selector fork (output shaft)
 5. Selector fork (output shaft)
5. Remove the selector drum bearing keeper plate and discard the fixing.

6. Remove the selector drum.



- 1. Selector drum**
2. Fixing
3. Bearing keeper plate

7. If required, remove the fixing and remove the detent wheel from the selector drum.

Selector Forks and Drum Inspection

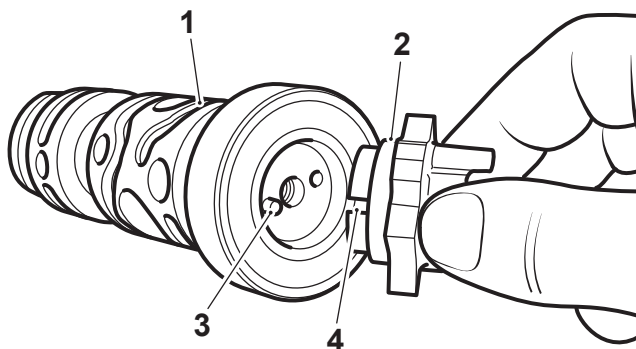
Inspect all bearings for damage or wear. Renew as necessary.

Inspect the selector forks and selector grooves for wear beyond the service limits. Renew the components as necessary.

- Refer to the specifications table (see Transmission, page 43).

Selector Forks and Drum - Installation

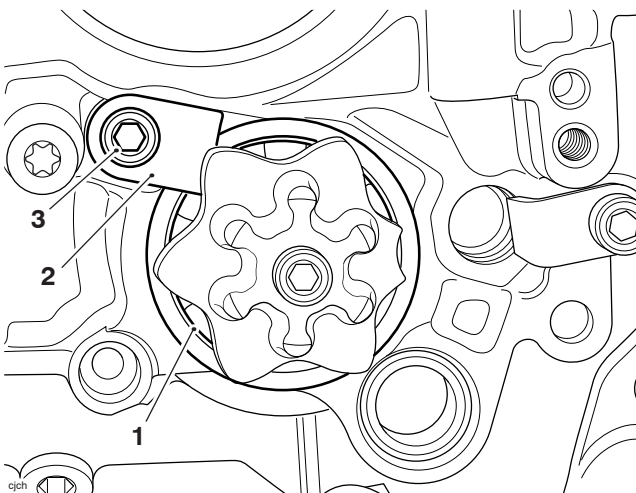
1. If removed, refit the detent wheel to the selector drum, ensuring the pin on the drum locates in the slot in the detent wheel. Prevent the drum from turning and tighten the fixing to 12 Nm.



cfwy

1. **Selector drum**
2. **Detent wheel**
3. **Pin**
4. **Slot**

2. Refit the selector drum, ensuring it is pushed fully into the crankcase.
3. Fit the bearing keeper plate and retain the plate in position using a new fixing. Tighten the fixing to 12 Nm.

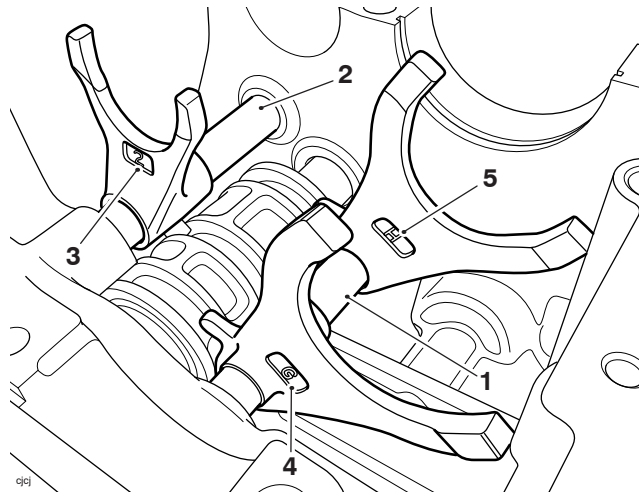


qjch

1. **Selector drum**
2. **Bearing keeper plate**
3. **Fixing**

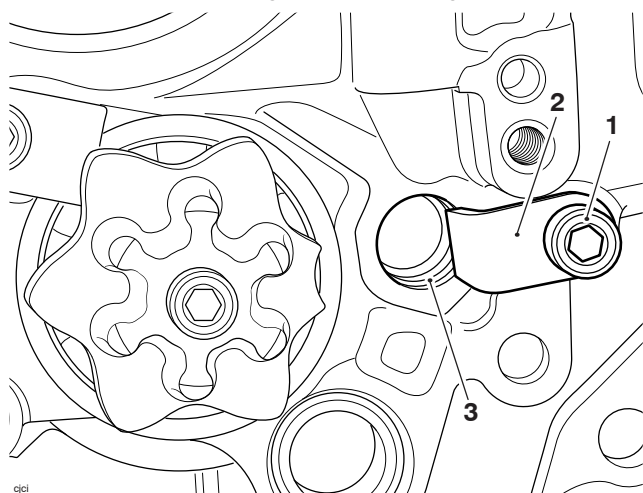
4. Lubricate the forks and shafts with clean engine oil.

5. Position the output selector fork shaft and selector forks to the crankcase as noted during removal.
6. Position the input selector fork shaft and selector fork to the crankcase as noted during removal.



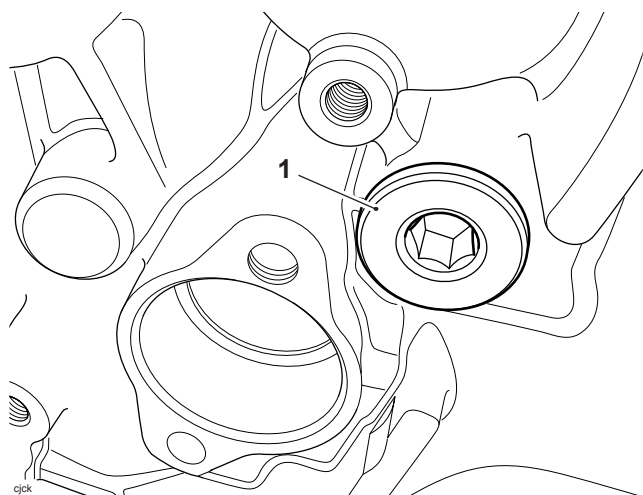
1. **Output selector shaft**
2. **Input selector shaft**
3. **Selector fork (input shaft)**
4. **Selector fork (output shaft)**
5. **Selector fork (output shaft)**

7. Using a new fixing secure the output selector shaft retainer, tighten the fixing to 12 Nm.



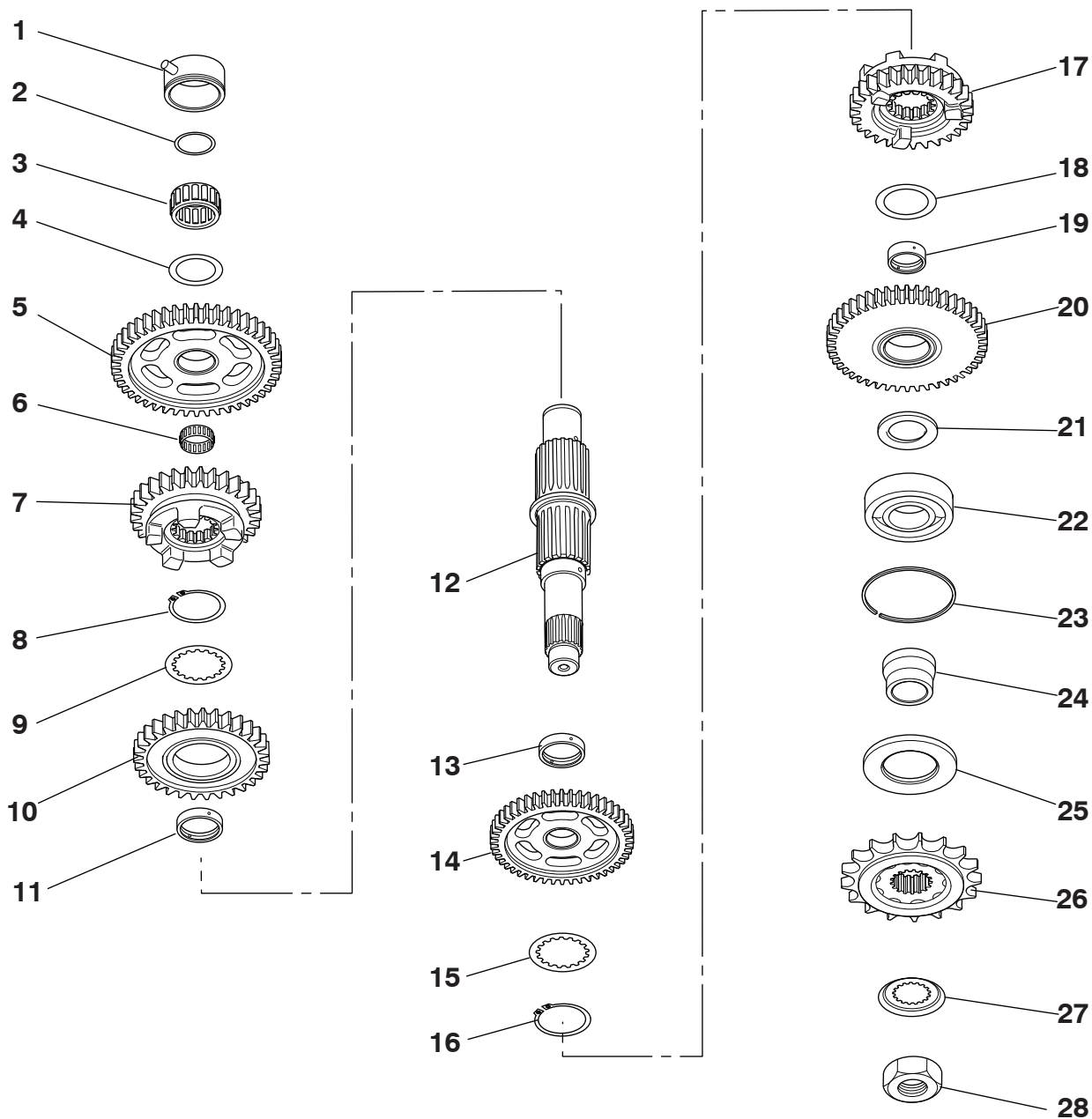
- 1. Fixing
- 2. Retainer
- 3. Selector shaft

8. Using a new fixing secure the input selector shaft, tighten the fixing to 22 Nm.



- 1. Fixing
 - Refit the gear position sensor (see Gear Position Sensor - Installation, page 422).
 - Refit the gear change shaft (see Gear Change Shaft - Installation, page 208).
 - Assemble the crankcases (see Crankcase - Assembly, page 171).
 - Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
 - Refit the seat (see Seat - Installation, page 645).

Exploded View - Output Shaft



1. Bearing outer carrier
2. Circlip
3. Needle roller bearing
4. Thrust washer
5. First gear
6. Needle roller bearing
7. Fifth gear
8. Circlip
9. Splined thrust washer
10. Fourth gear
11. Plain bush

- 12. Output shaft
- 13. Plain bush
- 14. Third gear
- 15. Splined thrust washer
- 16. Circlip
- 17. Sixth gear
- 18. Thrust washer
- 19. Plain bush
- 20. Second gear
- 21. Second gear spacer
- 22. Outer bearing
- 23. Snap ring
- 24. Distance sleeve
- 25. Output shaft seal
- 26. Sprocket
- 27. Tab washer
- 28. Sprocket nut

Output Shaft - Disassembly 6 speed

Warning

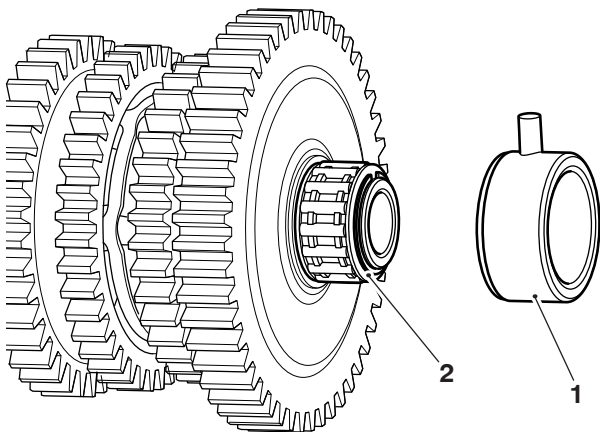
When using a press, always wear overalls, eye, face and hand protection. Objects such as bearings frequently break-up under load and the debris caused during break-up may cause damage and injury to unprotected parts of the body.

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.

Note:

- **Make a note or mark the orientation of all transmission parts prior to removal.**

1. Mark one side of the needle roller bearing outer carrier to denote its correct orientation and slide it away from the needle roller bearing.

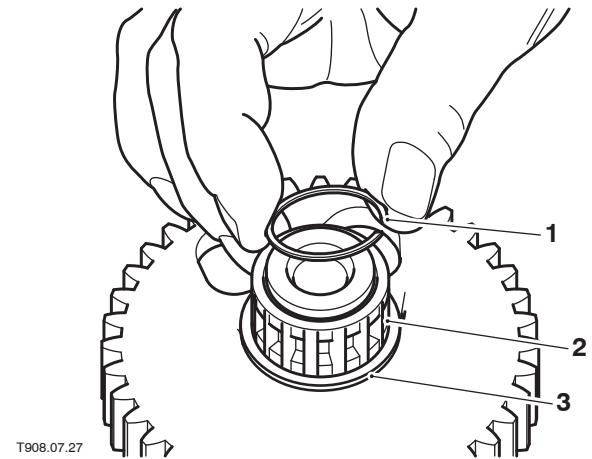


cjbz

1. **Bearing outer carrier**
2. **Needle roller bearing**

2. Remove and discard the circlip.
3. Noting its orientation, remove the bearing from the output shaft.

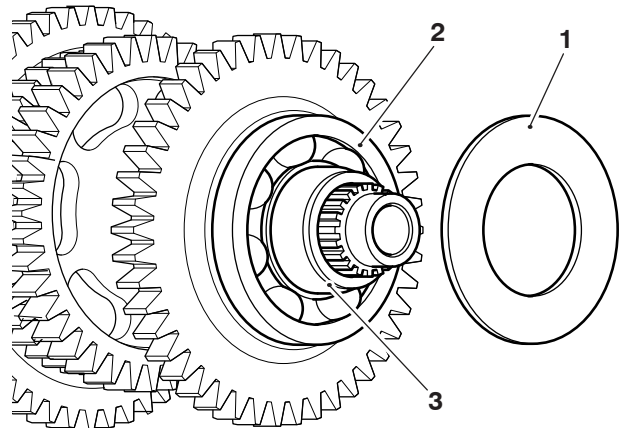
4. Remove the thrust washer.



T908.07.27

1. **Circlip**
2. **Needle roller bearing**
3. **Thrust washer**

5. Collect the output shaft seal.



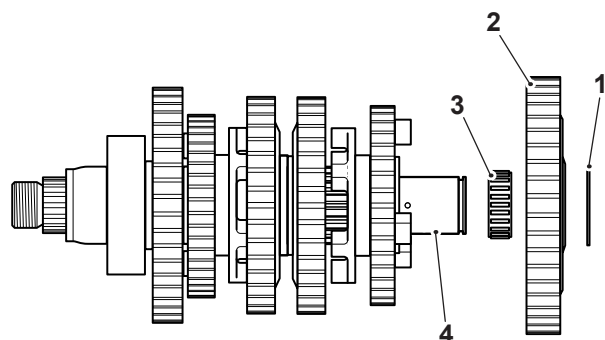
cjsk

1. **Output shaft seal**
2. **Roller bearing**
3. **Distance sleeve**

6. Mark one side of first gear to denote its correct orientation and remove it from the shaft.

Transmission

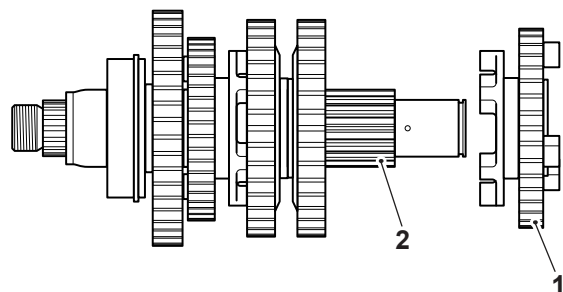
7. Remove the needle roller bearing from the shaft.



cjgh_2

1. Thrust washer
2. First gear
3. Needle roller bearing
4. Output shaft

8. Mark one side of fifth gear to denote its correct orientation and remove it from the shaft.

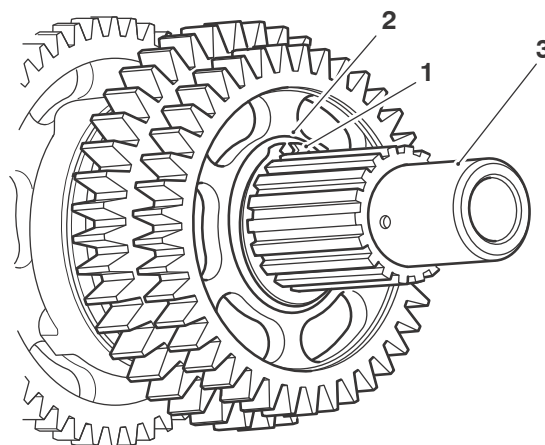


cjgg_1

1. Fifth gear
2. Output shaft

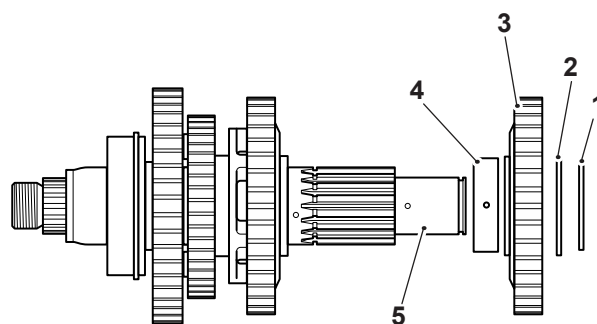
9. Remove the circlip and splined thrust washer.

10. Discard the circlip.



1. Circlip
2. Splined thrust washer
3. Output shaft

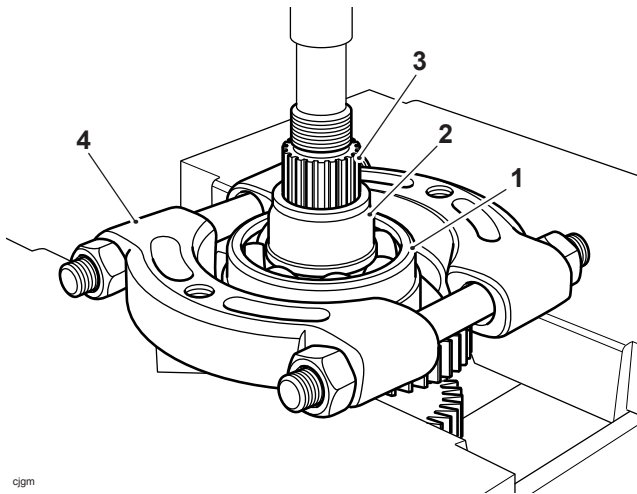
11. Mark one side of fourth gear to denote its correct orientation and remove it from the shaft.
12. Noting its orientation, remove the plain bush which runs inside the gear.



cjgf

1. Circlip
2. Splined thrust washer
3. Fourth gear
4. Plain bush
5. Output shaft

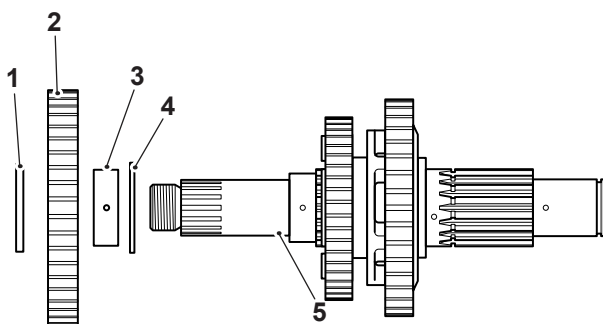
13. Working on the opposite end of the shaft, attach a proprietary bearing separator between the outer bearing and second gear as shown below. Using a press, remove the outer bearing and the distance sleeve.



cjgm

1. Bearing
2. Distance sleeve
3. Output shaft
4. Bearing separator

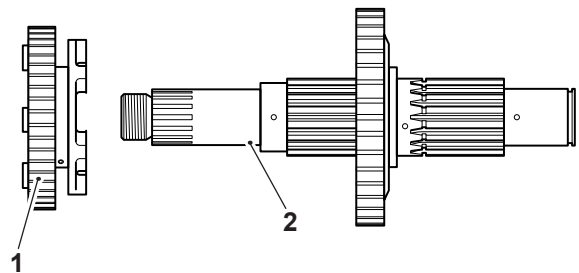
14. Discard the bearing.
15. Remove the second gear spacer.
16. Mark one side of second gear to denote its correct orientation and remove it from the shaft.
17. Noting its orientation, remove the plain bush from the shaft.
18. Remove the thrust washer from the shaft.



cjge_1

1. Second gear spacer
2. Second gear
3. Bush
4. Thrust washer
5. Output shaft

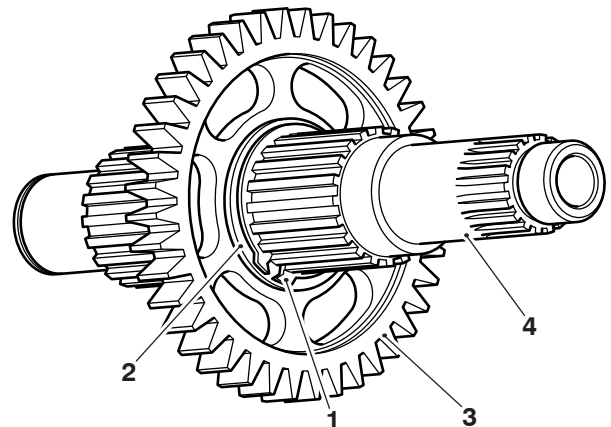
19. Noting its orientation, remove the sixth gear.



cjgd_1

1. Sixth gear
2. Output shaft

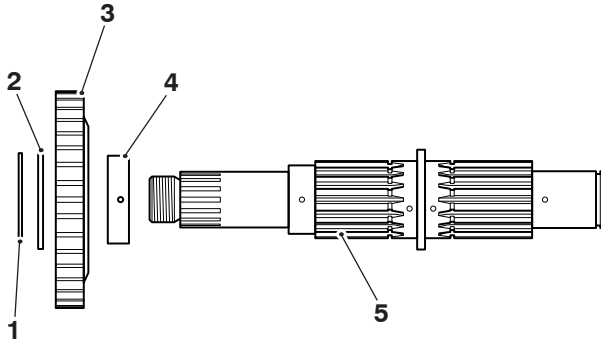
20. Remove the circlip and the splined thrust washer, discard the circlip.



cjgi

1. Circlip
2. Splined thrust washer
3. Third gear
4. Output shaft

21. Mark one side of third gear to denote its correct orientation and remove it from the shaft.
22. Noting it's orientation, remove the plain bush from the shaft.



cjgc

1. Circlip
2. Splined thrust washer
3. Third gear
4. Third gear bush
5. Output shaft

Output Shaft - Assembly 6 speed

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.

Caution

Bushes with oil holes must always be MISALIGNED with the corresponding oil holes in the output shaft. Reduced oil pressure and gear lubrication may result from alignment of the oil holes, which would cause premature wear of engine and transmission components.

Caution

Removing the output shaft bearing from the shaft will damage the bearing and snap ring. Never reuse removed bearings or snap rings as use of damaged or weakened components could lead to engine and transmission damage.

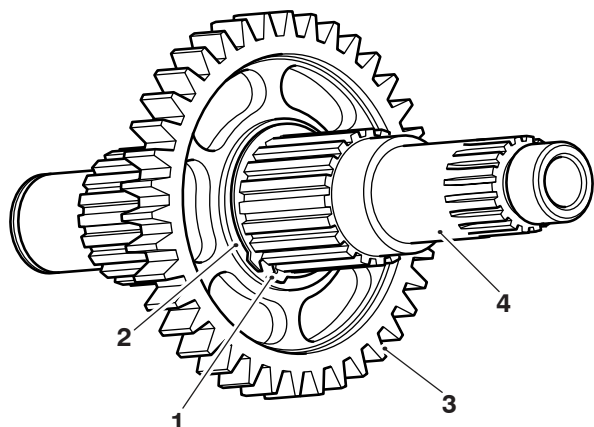
Caution

Press only on the bearing inner race to prevent bearing damage.

Note:

- Lubricate each gear, thrust washer and bush with clean engine oil during assembly.
1. Locate third gear and the plain bush to the shaft as noted during disassembly.

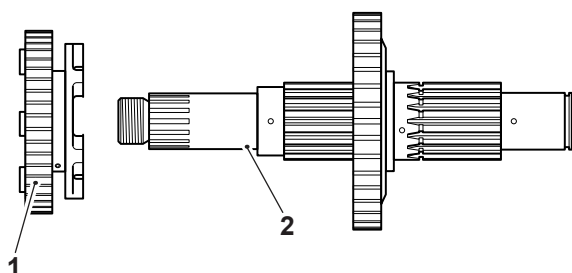
2. Fit the splined thrust washer and retain with a new circlip as shown below.



cjd

1. Circlip
2. Splined washer
3. Third gear
4. Output shaft

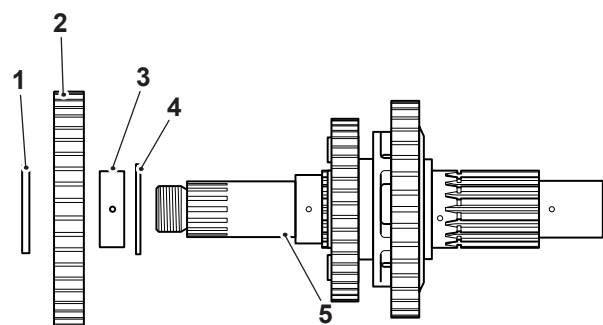
3. Fit the sixth gear as noted during disassembly.



cjd_1

1. Sixth gear
 2. Output shaft
4. Fit the thrust washer.
 5. Locate second gear and the plain bush to the shaft as noted during disassembly.

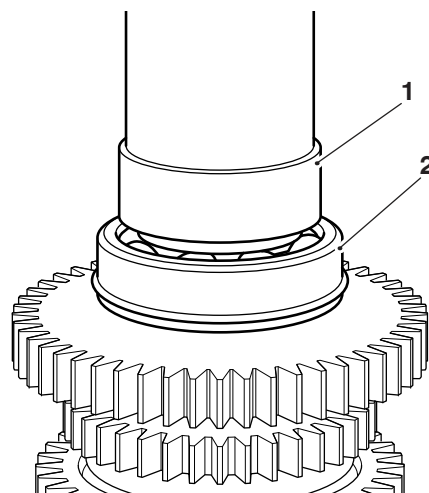
6. Fit the second gear spacer.



cjd_1

1. Second gear spacer
2. Second gear
3. Bush
4. Thrust washer
5. Output shaft

7. Place the output shaft on a press bar, align the inner race of the ball bearing to the output shaft.
8. Press the output shaft through the bearing until the bearing face contacts the thrust washer.



cjd

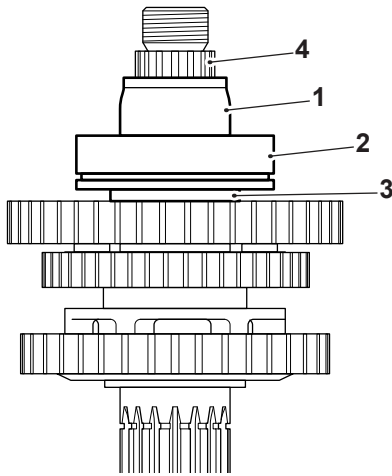
1. Output shaft
2. Ball Bearing

Note:

- Ensure the chamfered edge is facing away from the roller bearing.
9. Locate the distance sleeve to the bearing.

Transmission

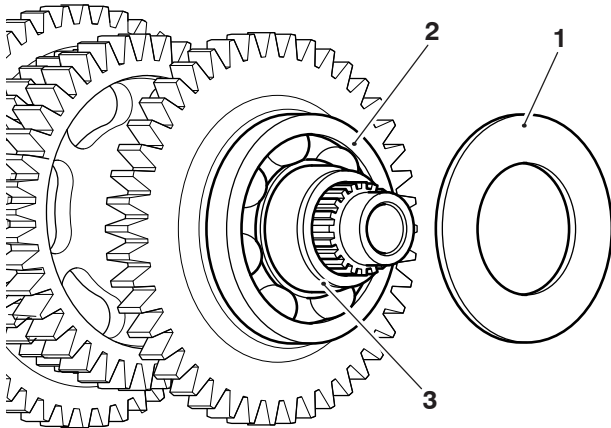
10. Press the output shaft through the distance sleeve until it comes into contact with the bearing face.



cjgb_1

1. Distance sleeve
2. Ball bearing
3. Spacer
4. Output shaft

11. Lubricate and fit a new output shaft seal.

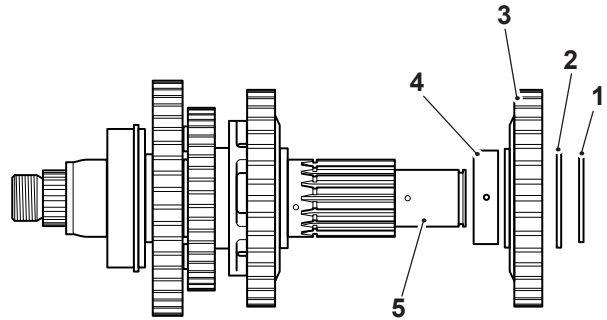


cjgk

1. Output shaft seal
2. Roller bearing

12. Distance sleeve
13. Fit the output sprocket, new tab washer and nut. Do not fully tighten the nut at this stage.
14. Working from the opposite end of the shaft, fit the plain bush as noted during disassembly.
15. Fit fourth gear as noted during disassembly.

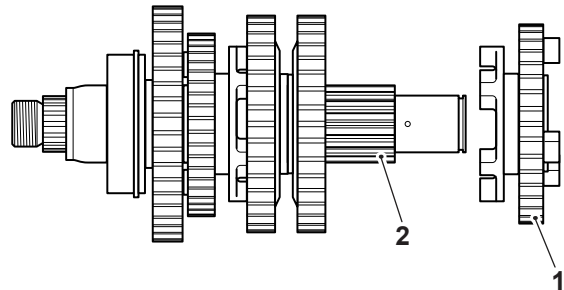
16. Fit the splined thrust washer and retain using a new circlip new circlip, as shown below.



cjgf

1. Circlip
2. Splined thrust washer
3. Fourth gear
4. Plain bush
5. Output shaft

17. Fit fourth gear as noted during disassembly. Ensure that the smaller dogs face towards fourth gear.

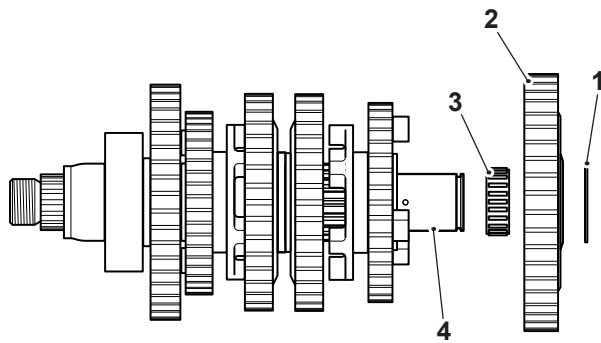


cjga_1

1. Fifth gear
2. Output shaft

18. Fit the plain bush as noted during disassembly.
19. Fit first gear as noted during disassembly.

20. Fit the thrust washer.

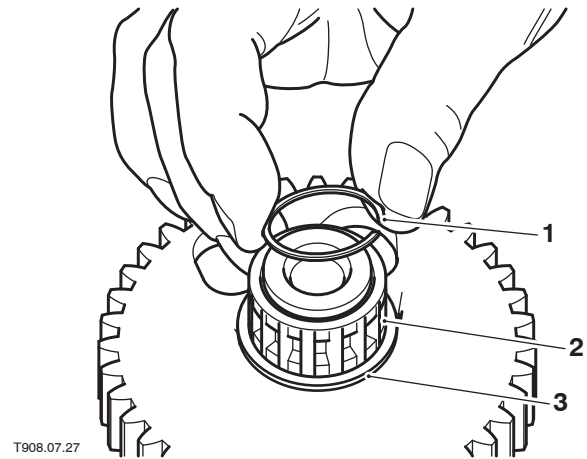


cjgh_2

1. Thrust washer
2. First gear
3. Needle roller bearing
4. Output shaft

21. Fit the roller bearing to the output shaft as noted during disassembly.

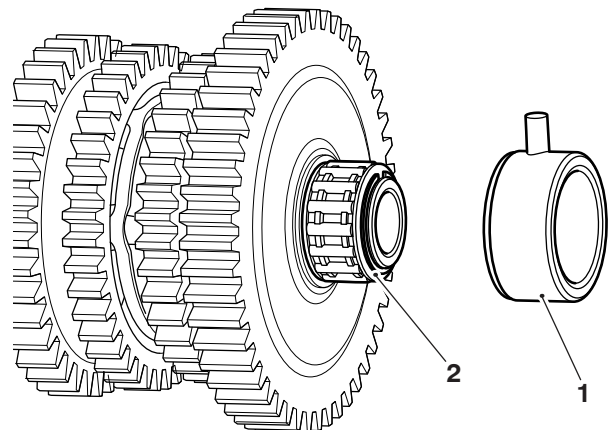
22. Retain the roller bearing using a new circlip.



T908.07.27

1. Circlip
2. Needle roller bearing
3. Thrust washer

23. Lubricate the bearing with oil and then slide the bearing outer roller carrier over the needle roller bearing in the orientation noted during disassembly.



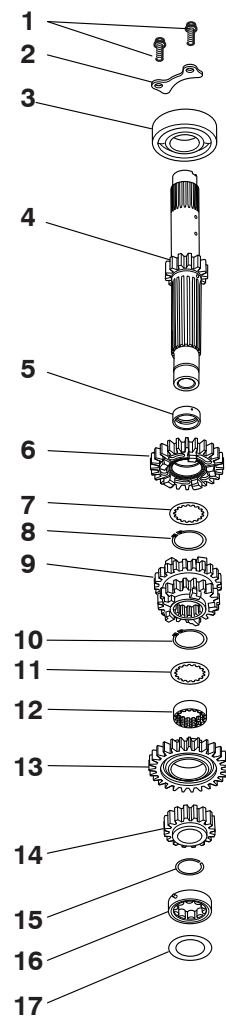
cjbz

1. Bearing outer carrier
2. Needle roller bearing

Output Shaft - Inspection

1. Examine all gears, bearings, bushes and thrust washers for damage, distortion, chipped teeth and wear beyond the service limits. Replace all defective components and always use new circlips, a new output shaft seal and a new sprocket tab washer to assemble the shaft.

Input Shaft



Transmission

1. Bearing retainer bolts
2. Bearing retainer plate
3. Ball bearing
4. Input shaft
5. Plain bush
6. Fifth gear
7. Splined thrust washer
8. Circlip
9. Third/fourth gear
10. Circlip
11. Splined thrust washer
12. Splined bush
13. Sixth gear
14. Second gear
15. Circlip
16. Roller bearing
17. Restrictor washer

Input Shaft - Disassembly

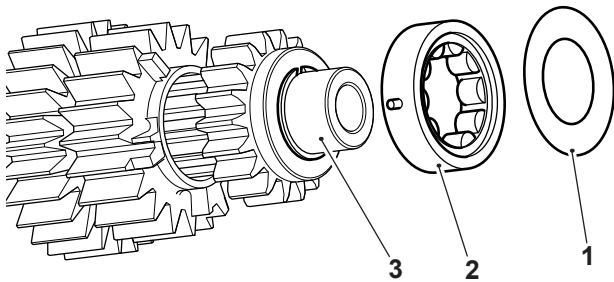
Warning

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.

Note:

- The gears on the input shaft can not be fully disassembled or assembled in service. If for any reason a gear requires replacing, the complete input shaft assembly must be replaced.
- Remove the restrictor washer, and roller bearing.



cjbx

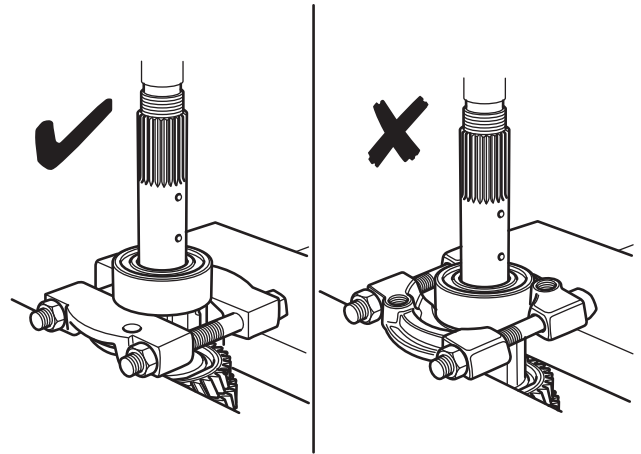
1. Restrictor washer
2. Roller bearing
3. Input shaft

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.

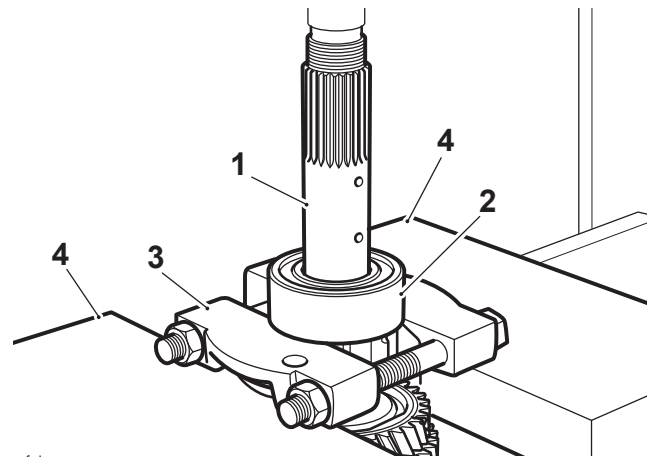
Never wear loose clothing, which could become trapped in the press and cause crushing injury to the hand, arms or other parts of the anatomy.

- Attach service tool T3880109 to the bearing, ensuring the flat side of the tool's jaws are in contact with the bearing.



Service Tool Installation

- Support the service tool T3880109 on press bars, then press the shaft through the bearing. Discard the bearing.



cfwh

1. Input shaft
2. Bearing
3. T3880109 - Bearing Separator
4. Press bars

Input Shaft - Inspection

Examine all gears, bearings, bushes and thrust washers for damage, distortion, chipped teeth and wear beyond the service limits. Replace all defective components.

Input Shaft - Assembly

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.

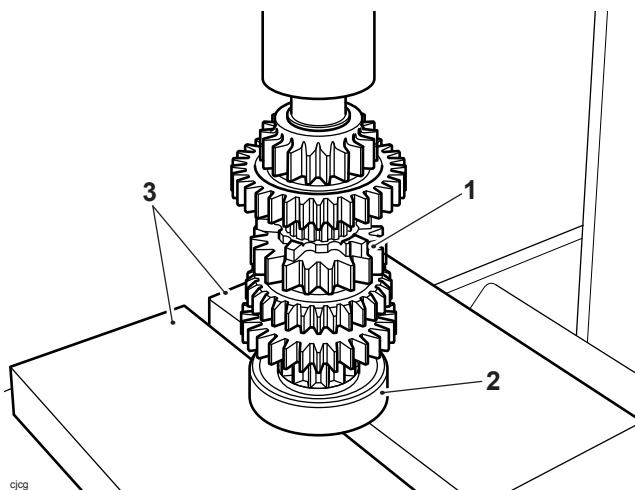
Caution

Removing the input shaft bearing from the shaft will damage the bearing. Never reuse removed bearings as use of damaged or weakened components could lead to engine and transmission damage.

Note:

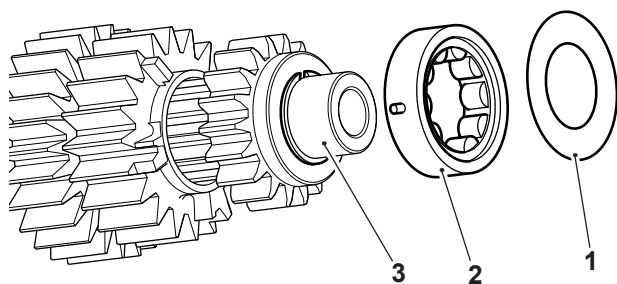
- **Lubricate the bearings with clean engine oil during assembly.**
1. Position a new bearing to the input shaft.
 2. Support the bearing on press bars as shown below, ensuring that the press bars support the inner race of the bearing.

3. Press the bearing fully on to the shaft.



1. Input shaft
2. Bearing
3. Press plates

4. Fit the roller bearing and restrictor washer to the input shaft.



1. Restrictor washer
2. Roller bearing
3. Input shaft

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15 Starter Drive And Sprag Clutch

Table of Contents

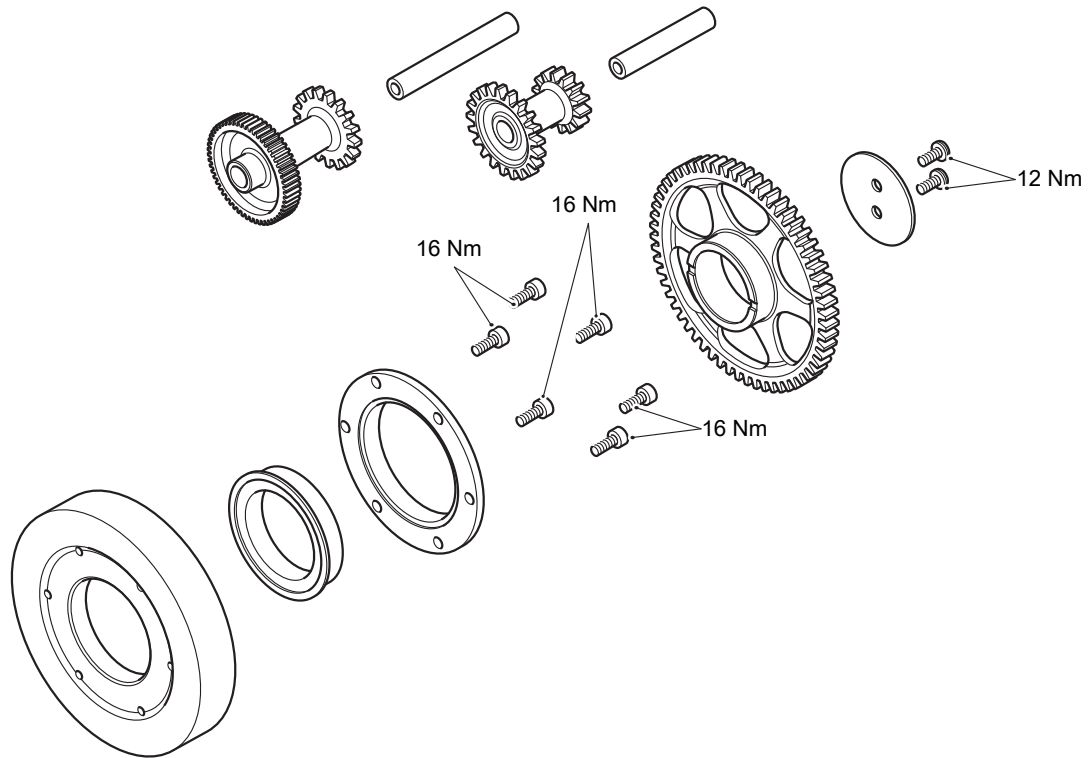
Exploded View - Starter and Sprag 233

Starter Drive/Sprag Clutch - Removal 234

Starter Drive/Sprag Clutch - Inspection 236

Starter Drive/Sprag Clutch - Installation..... 236

Exploded View - Starter and Sprag

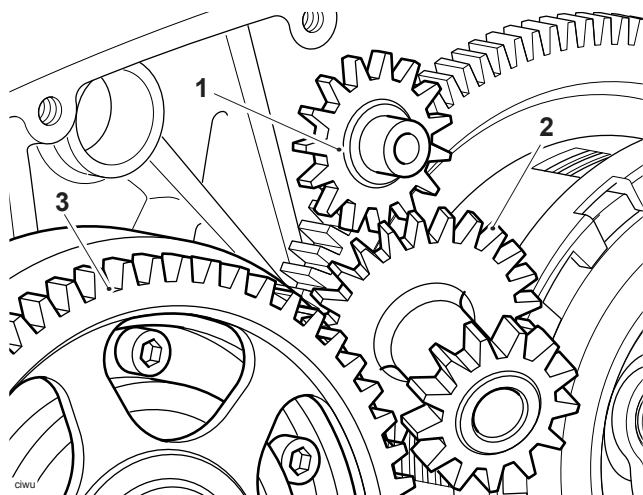


Starter Drive/Sprag Clutch - Removal

Warning

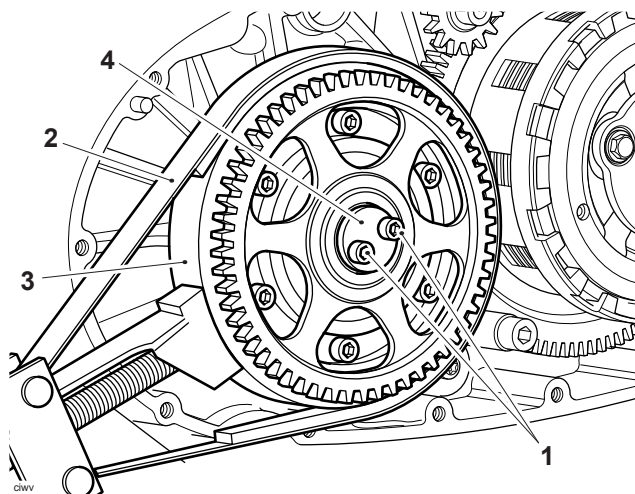
Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

- Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
 - Remove the fuel tank (see).
 - Remove the clutch cover (see Clutch Cover - Removal, page 97).
1. Whilst holding the first idler gear in position, withdraw the second starter idler shaft and gear, noting the fitted position of the components.

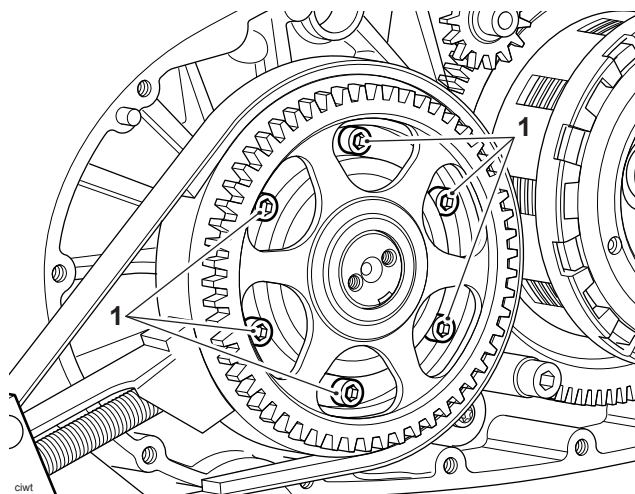


1. **Starter idler gear (first)**
2. **Starter idler gear (second)**
3. **Starter sprag gear**

2. Using service tool T3880375 to retain the flywheel, remove and discard the fixings securing the starter gear thrust washer to the sprag clutch housing, as shown below.

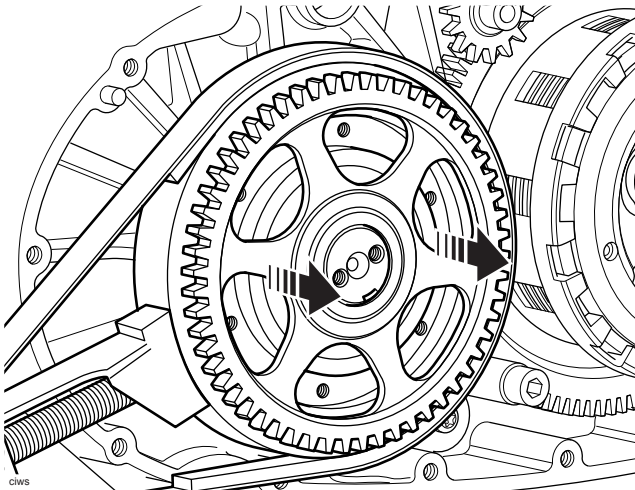


1. **Fixings**
 2. **T3880375 - Alternator Rotor Holder**
 3. **Sprag clutch housing**
 4. **Thrust washer**
3. Remove and discard the fixings securing the sprag clutch housing to the flywheel.



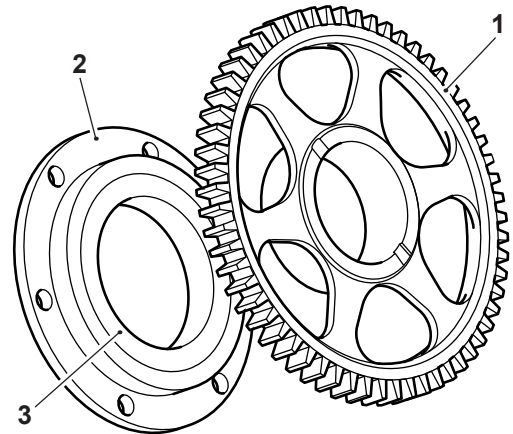
1. **Fixings**

4. Withdraw the starter sprag gear and sprag clutch assembly.



Starter Sprag Gear

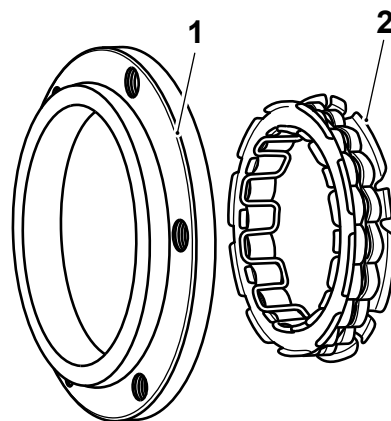
5. Remove the starter sprag gear from the sprag clutch housing and assembly.



cixh

1. Starter sprag gear
2. Sprag clutch housing
3. Sprag clutch

6. Remove the sprag clutch from the sprag clutch housing.



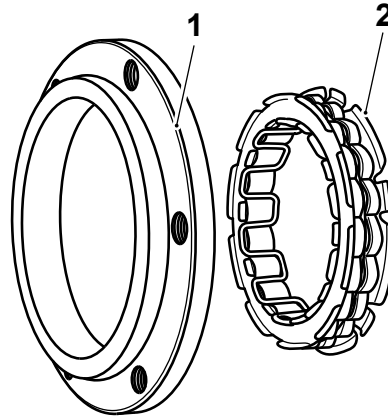
1. Sprag clutch housing
2. Sprag clutch

Starter Drive/Sprag Clutch - Inspection

1. Check the sprag clutch bearings for overheating, wear and/or non-smooth operation. Replace the sprag clutch if overheating, wear and/or non-smooth operation is found.
2. Examine all gears for chipped teeth and for any other damage.
3. With the sprag clutch mounted in the housing, check the sprag clutch for smooth, free movement in one direction only (as indicated by the arrow marked on the sprag clutch body).

Starter Drive/Sprag Clutch - Installation

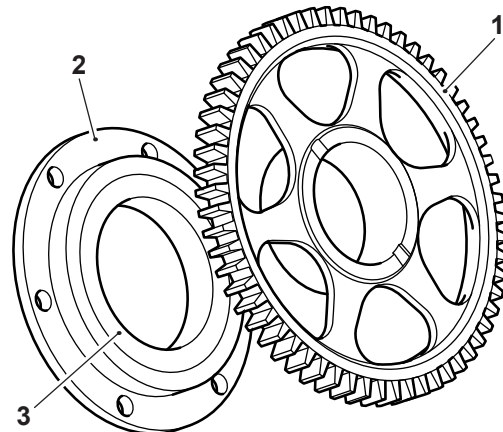
1. Locate the sprag clutch to the sprag clutch housing as shown below. Push firmly until the lip seats in the recess provided in the housing.



1. Sprag clutch housing

2. Sprag clutch

2. Fit the starter sprag gear to the sprag clutch.
3. Lubricate the crankshaft bearing with engine oil.
4. Fit the sprag clutch housing to the flywheel.
5. Ensure that the housing is squarely seated and is not jammed on the rotor.



1. Starter sprag gear

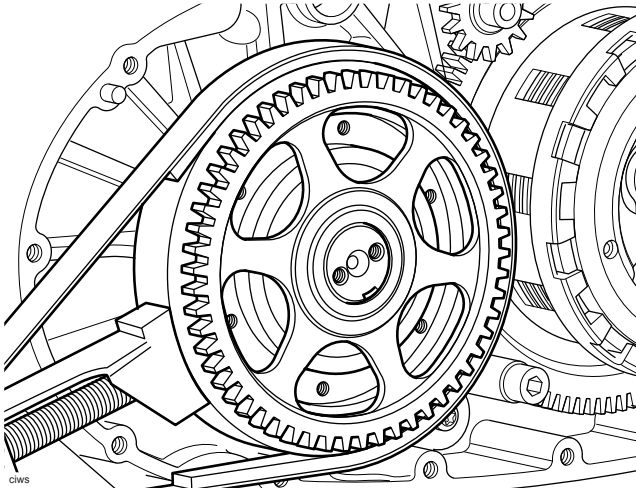
2. Sprag clutch housing

3. Sprag clutch

Note:

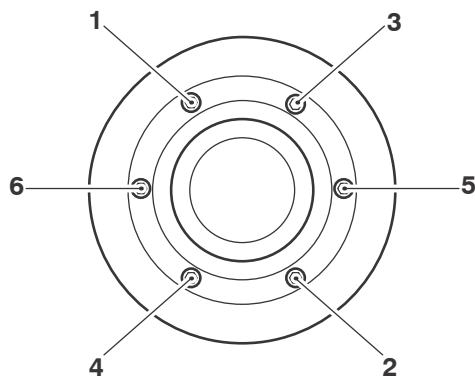
- Ensure the sprag is seated and flush fitting to the housing before tightening the fixings fully.

6. Align the drilled holes in the sprag clutch housing with the holes in the flywheel.



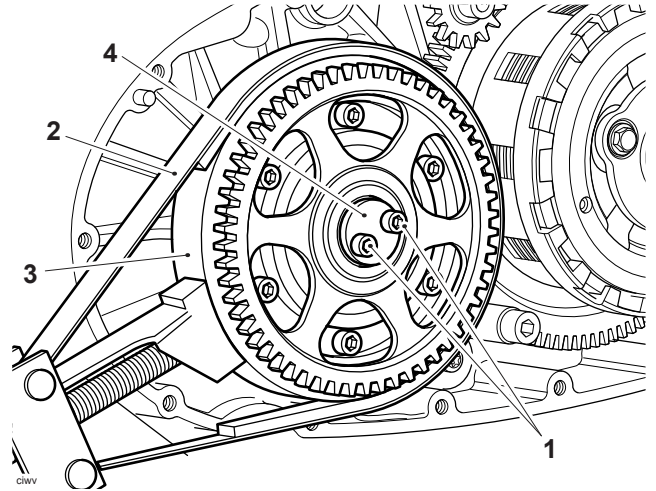
Sprag clutch housing assembly

7. Using service tool T3880375 to retain the flywheel and working in the sequence shown, fit the new fixings and tighten to 16 Nm. Repeatedly check the fixings in sequence until all are correctly torqued and do not move when checked, this will ensure the sprag clutch housing is correctly seated on the rotor.

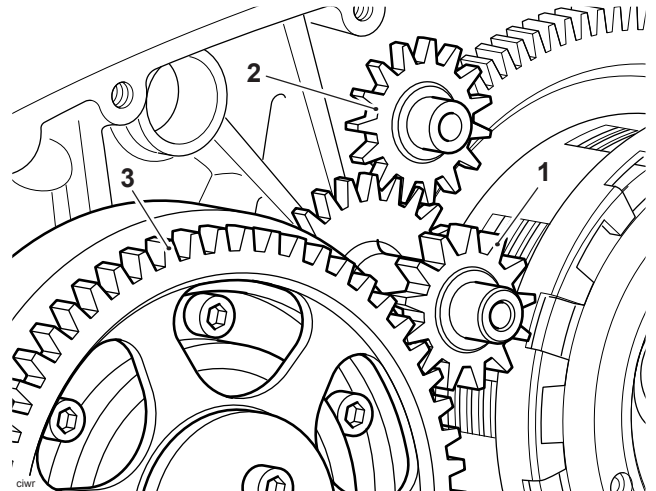


Tightening Sequence

8. Using tool T3880375 - Alternator Rotor Holder Tool to retain the flywheel and using new fixings secure the starter gear thrust washer to the flywheel. Tighten the fixings to 12 Nm.



1. **Fixings**
 2. **T3880375 - Alternator Rotor Holder**
 3. **Sprag clutch housing**
 4. **Thrust washer**
9. Refit the starter idler gear and shaft, as noted during removal.



1. **Starter idler gear (second)**
2. **Starter idler gear (first)**
3. **Starter sprag gear**
 - Refit the clutch cover (see Clutch Cover - Installation, page 98).
 - Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
 - Refit the seat (see Seat - Installation, page 645).

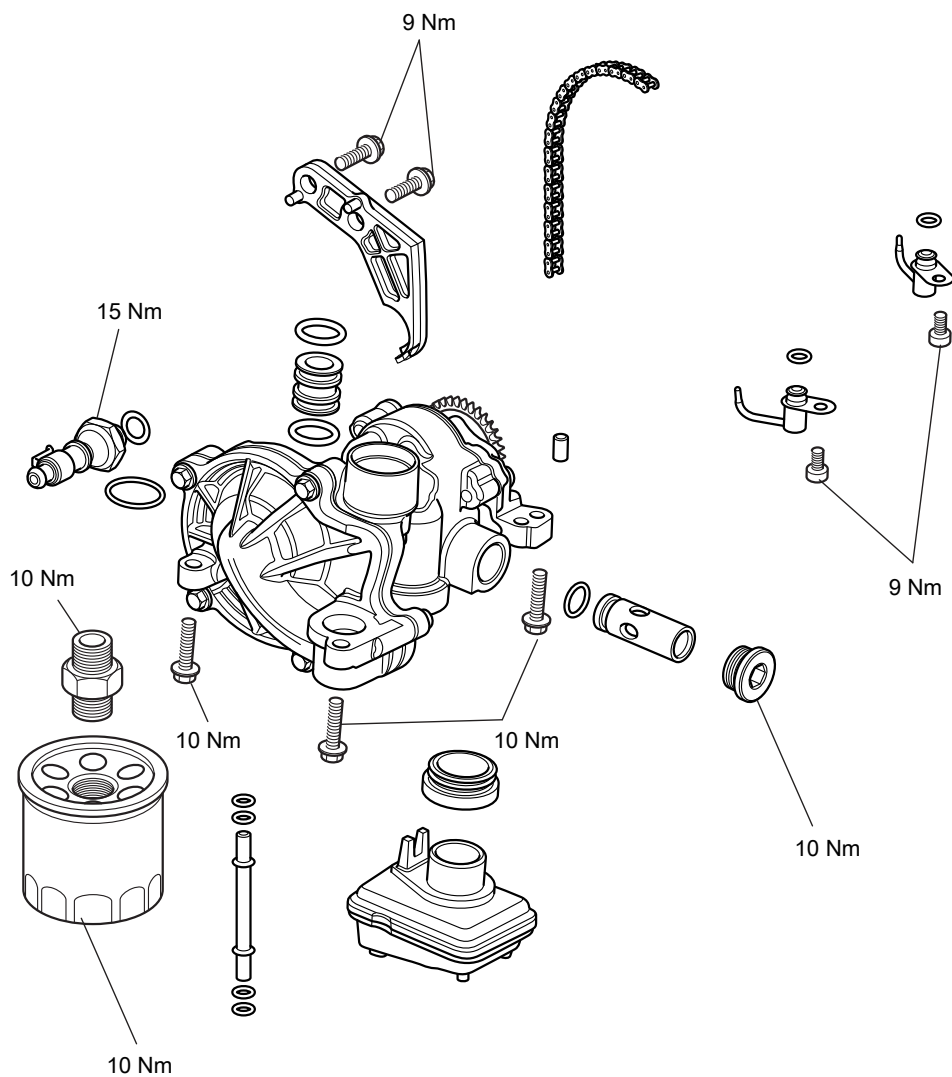
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16 Lubrication

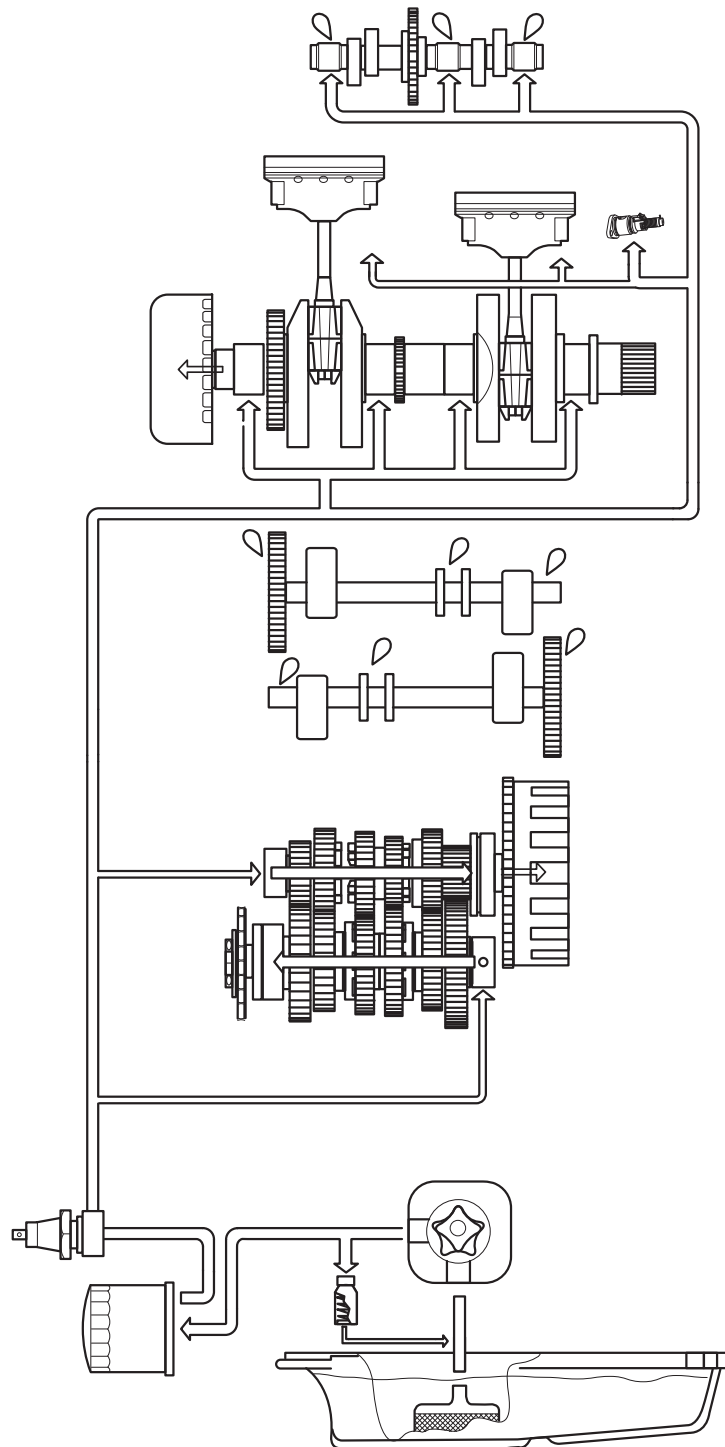
Table of Contents

Exploded View – Oil Filter and Pump	241
Oil Circuit Diagram	242
Oil Circuit	243
Engine Oil - Specification	244
Disposal of Used Engine Oil and Oil Filters	244
Engine Oil - Level Inspection	245
Oil and Oil Filter Change	246
Low Oil Pressure Warning Light Switch - Removal	247
Low Oil Pressure Warning Light Switch - Installation	248
Oil and Water Pump - Removal	248
Oil Pump Disassembly	251
Oil Pump Inspection	251
Oil Pump Rotor Tip Clearance	252
Oil Pump Body Clearance	252
Oil Pump End Clearance	253
Oil Pump - Assembly	254
Oil and Water Pump - Installation	254
Oil Pressure Relief Valve - Removal	257
Oil Pressure Relief Valve - Installation	258

Exploded View – Oil Filter and Pump



Oil Circuit Diagram



Oil Circuit

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 assembly which supplies pressurised oil to the lubrication circuit. The oil circuit is split into two parts - the Main circuit and the Transmission circuit.

Main Circuit

Pressurised oil flows past the oil pressure relief valve, which controls the maximum pressure in the oil circuit. The relief valve is set to open at 5.1 bar (74 lb/in²) and when open, returns high pressure oil directly to the oil pump inlet port.

The oil then flows through the oil filter. Filtered oil is then fed into the lower crankcase gallery. The low oil pressure switch is located in this gallery.

From here oil is distributed around the engine:

- A branch supplies oil to the main gallery below the main bearings. Here it is delivered to the crankshaft main bearings and, via drillings in the crankshaft, to the big end bearings.
- Oil is also fed to the alternator to aid cooling of the alternator. The oil is taken from the crankshaft oil feed and directed to the alternator stator and rotor.
- Spray jets located in the upper crankcase, above the front balance shaft, lubricate the pistons and connecting rod small ends. These jets are fed oil from the cylinder head oil feed.
- Another branch from the cylinder head oil feed supplies oil to the hydraulic camshaft drive chain tensioner.
- Oil is sent to the cylinder head via a drilling in the upper crankcase. From the crankcase the oil divides into the two front cylinder head bolt drillings, up through the cylinder barrels and into the cylinder head. One of the bolt drillings feeds the left hand cam shaft frame and the other feeds the right hand camshaft frame. Drillings and grooves in the camshaft frames allow oil to flow to the camshaft journals and rocker shafts. Oil from the cylinder head area lubricates the camshaft drive chain before draining back to the sump.

Transmission Circuit

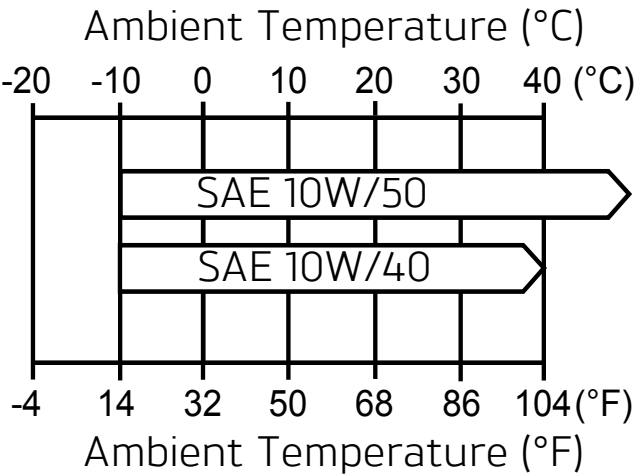
- Pressurised oil is directed via drillings to the input and output shafts and the clutch. Oil is circulated along the gearbox shafts to exit holes that feed directly to the bearings and gears before draining back to the sump.
- The selector drum is splash fed by oil returning to the sump from the transmission gears.

Engine Oil - Specification

Use semi or fully synthetic 10W/40 or 10W/50 motorcycle engine oil which meets specification API SH (or higher) **and** JASO MA, such as Castrol Power 1 Racing 4T, sold as Castrol Power RS Racing 4T in some countries.

Triumph recommends the fully synthetic 10W/40 motorcycle engine oil for most conditions. The oil viscosity may need to be changed to accommodate the ambient temperatures in your riding area.

Refer to the chart below for the correct oil viscosity (10W/40 or 10W/50) to be used in your riding area.



Disposal of Used Engine Oil and Oil Filters

To protect the environment, do not pour oil on the ground, down sewers or drains, or into watercourses. Do not place used oil filters in with general waste. If in doubt contact your local authority.

Oil Viscosity Temperature Range

**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.

Engine 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

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.

Warning

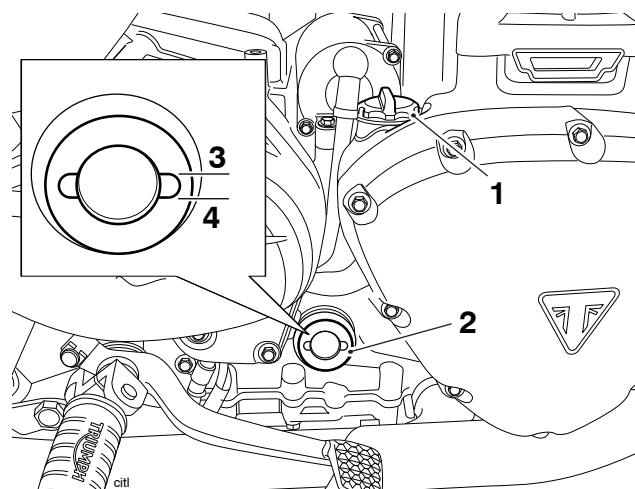
Motorcycle operation with insufficient, deteriorated, or contaminated engine oil will cause accelerated engine wear and may result in engine or transmission seizure. Seizure of the engine or transmission may lead to loss of motorcycle control and an accident.

Caution

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

1. Start the engine and run at idle for approximately five minutes.
2. Stop the engine, then wait for at least three minutes to allow the oil to settle.
3. Note the oil level visible in the sight-glass.

4. When correct, oil should be visible at a point between the upper level and the lower level on the sight-glass.



1. Filler
2. Sight-glass
3. Upper level (maximum)
4. Lower level (minimum)

Note:

- An accurate indication of the level of oil in the engine is only shown when the engine is at normal operating temperature and the motorcycle is upright (not on the side stand).
5. If it is necessary to top up the oil level, remove the filler plug and add oil, a little at a time, until the level registered in the sight glass is correct.
 6. Once the correct level is reached, fit and tighten the filler plug.

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.

Caution

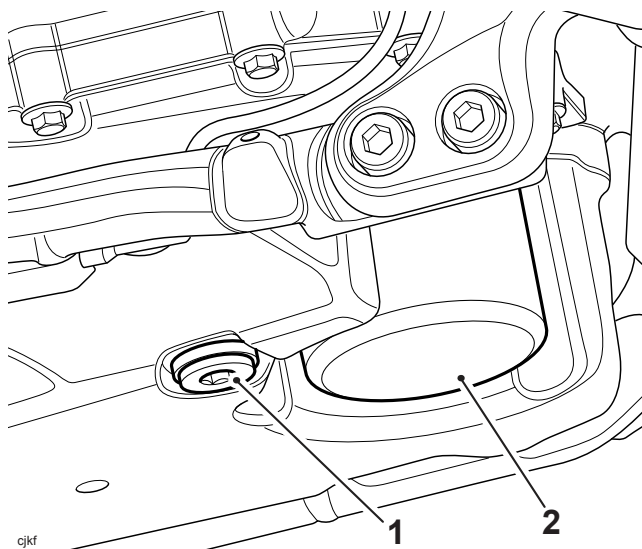
Do not pour engine oil on the ground, down sewers or drains, or into watercourses. To prevent pollution of watercourses etc., dispose of used oil sensibly. If in doubt contact your local authority.

1. Warm up the engine thoroughly, and then stop the engine.
2. Place a waste oil catch tray beneath the engine.

Warning

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

3. Remove the oil drain plug and discard the washer.



1. Oil drain plug
2. Oil filter

4. With the motorcycle on level ground, and on its side stand, allow the oil to completely drain.

5. Unscrew and remove the oil filter using service tool T3880313.
6. Dispose of the old filter in an environmentally friendly way.
7. Apply a smear of clean engine oil to the sealing ring of the new oil filter.
8. Using service tool T3880313, fit the new oil filter and tighten to 10 Nm.
9. Fit a new sealing washer to the drain plug.
10. Fit and tighten the drain plug to 25 Nm.
11. Fill the engine with new oil of the type and grade (see Engine Oil - Specification, page 244).
12. Start the engine and allow it to idle for a minimum of 30 seconds.

Caution

Raising the engine speed above idle before the oil reaches all parts of the engine can cause engine damage or seizure. Only raise engine speed after running the engine for 30 seconds to allow the oil to circulate fully.

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. Ensure that the oil pressure warning light extinguishes shortly after starting.
14. Stop the engine and check the oil level. Adjust if necessary.

Low Oil Pressure Warning Light Switch - 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

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.

Caution

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

The low oil pressure warning light switch is located in the lower crankcase, behind the sprocket cover.

- Remove the seat (see Seat - Removal, page 645).
- Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
- Remove the sprocket cover (see Front Sprocket Cover - Removal, page 105).

Warning

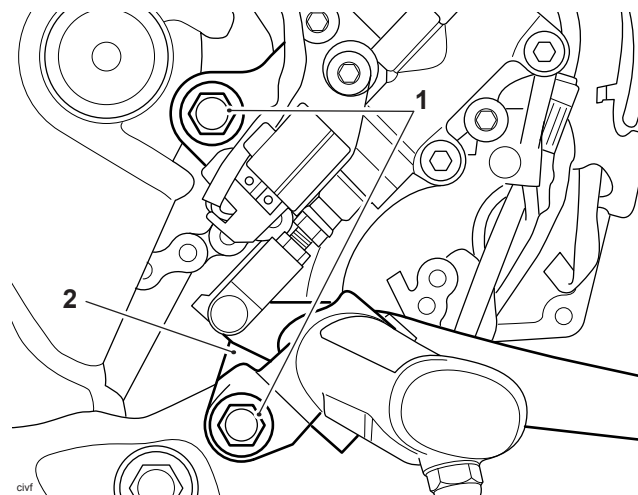
Do not allow a brake component to hang unsupported on the brake hose or line.

Brake hoses or lines that are not unsupported may become damaged or bent.

Bent or damaged brake hoses or lines lead to reduced braking efficiency causing loss of motorcycle control and an accident.

1. Remove the fixings and detach the right hand control plate from the frame.

2. With the aid of an assistant support the right hand control plate and the rear brake master cylinder.



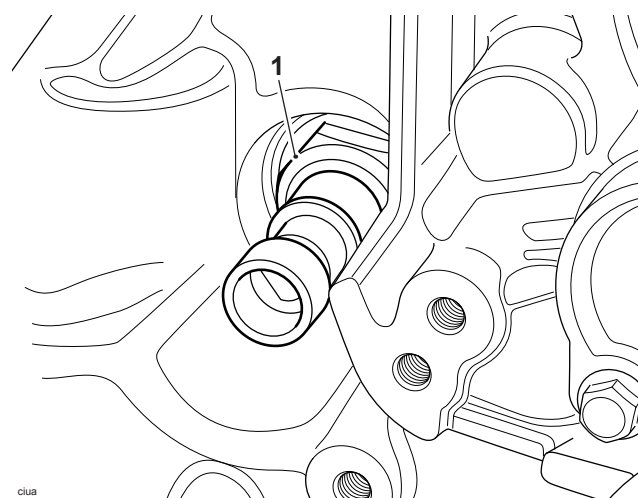
1. Fixings

2. Control plate

3. Disconnect the electrical connector.

Note:

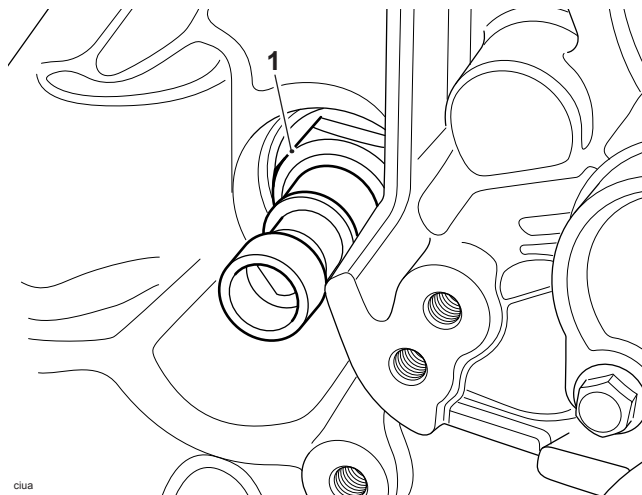
- A small amount of oil will drain from the oil gallery when the switch is removed.
4. Position a suitable receptacle to collect any displaced oil from the oil gallery.
 5. Remove the switch and discard the sealing washer.



1. Low oil pressure warning light switch

Low Oil Pressure Warning Light Switch - Installation

1. Incorporating a new sealing washer, fit the low oil pressure light switch
2. Tighten the switch to 15 Nm.



1. Low oil pressure warning light switch

3. Reconnect the electrical connector.
4. Refit the right hand control plate and tighten the fixings to 24 Nm.
5. Refit the sprocket cover (see Front Sprocket Cover - Installation, page 106).
6. Reconnect the battery positive, (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
7. Start the engine and ensure that the oil pressure warning light extinguishes shortly after starting.
8. Allow the engine to idle for a minimum of 30 seconds.

! 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.

9. Stop the engine and check the oil level as described (see Engine Oil - Level Inspection, page 245). Adjust if necessary.
10. Refit the seat (see Seat - Installation, page 645).

Oil and Water Pump - 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

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.

! Caution

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

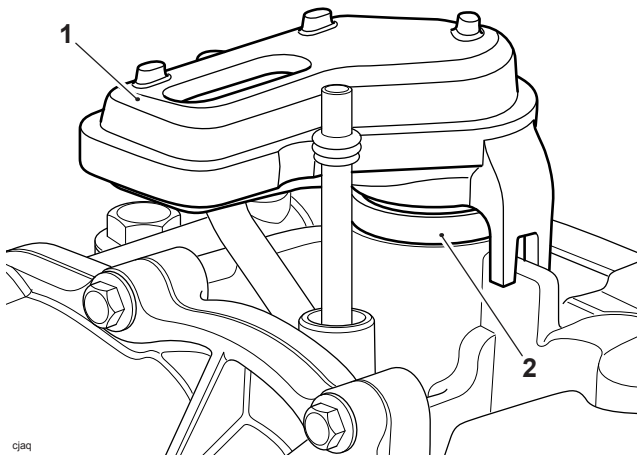
- Remove the seat (see Seat - Removal, page 645).
- Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).

Note:

- **The oil pump and water pump are supplied as an assembly and cannot be separated. This procedure covers the removal of the oil and water pump assembly.**
- Drain the coolant (see Coolant Replacement - Drainage, page 462).
- Drain the engine oil (see Oil and Oil Filter Change, page 246).
- Remove the sump (see Sump - Removal, page 94).
- Remove the clutch (see Clutch - Removal, page 158).

1. Release the oil pick-up from the oil seal.

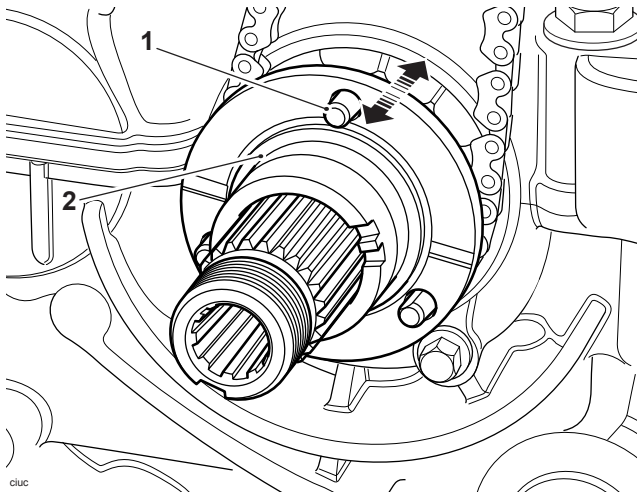
2. Remove and discard the oil seal.



1. Oil pick-up

2. Oil seal

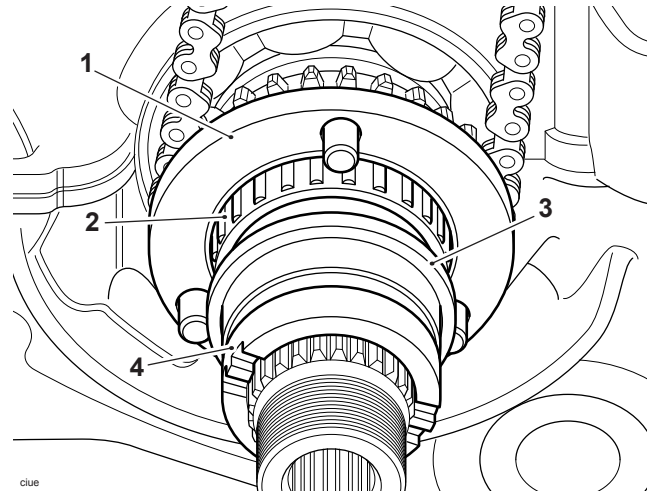
3. Slide the oil pump drive sprocket gently backwards and forwards and remove the needle roller bearing.



1. Oil pump drive sprocket

2. Needle roller bearing

4. Support the oil pump drive sprocket and carefully remove the bush, spacer and needle roller bearing while noting its orientation.



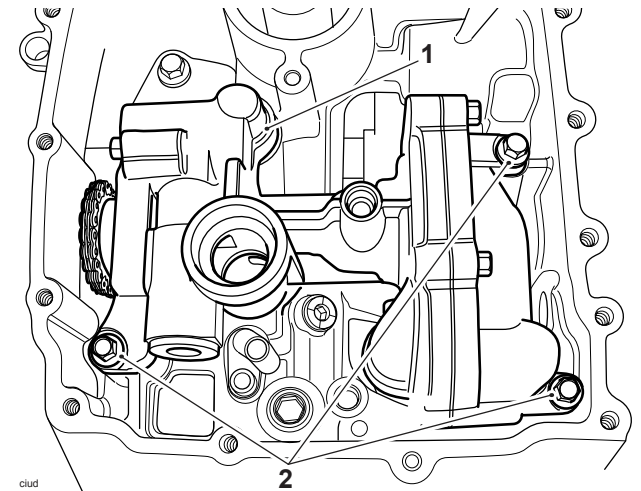
1. Oil pump drive sprocket

2. Needle roller bearing

3. Spacer

4. Bush

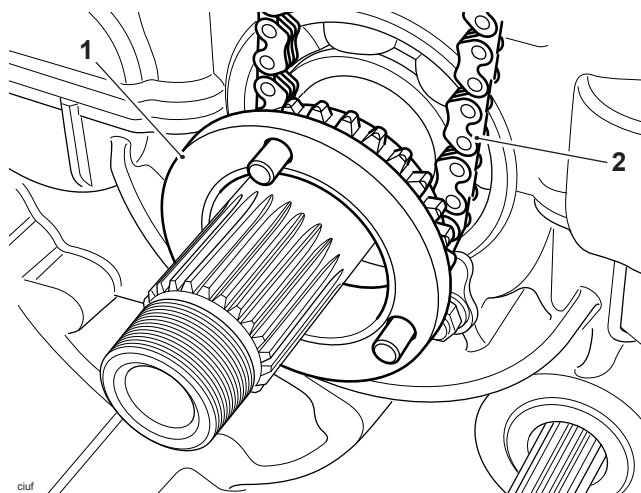
5. Release and discard the fixings securing the oil and water pump.



1. Oil and water pump

2. Fixings

6. Detach the drive chain from the oil pump drive sprocket.

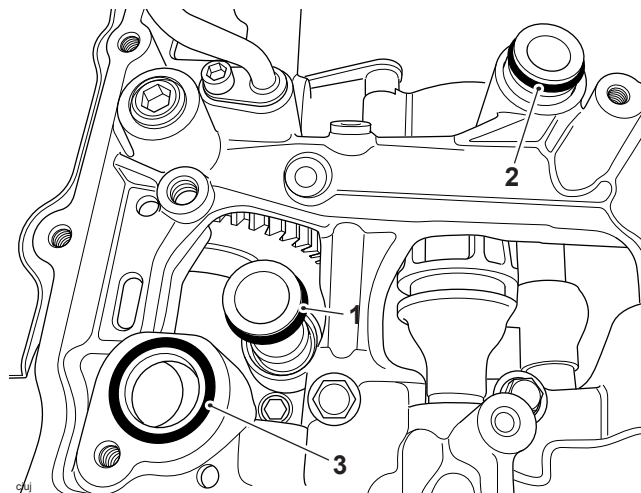


1. Oil pump drive sprocket
2. Drive chain

7. Carefully withdraw the oil and water pump from the crankcase.

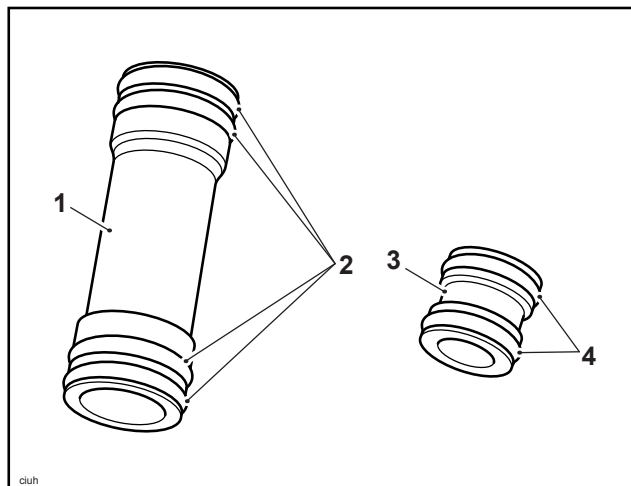
Note:

- The water pump inlet sleeve/O-rings can become dislodged during removal of the oil pump.
8. Remove the coolant outlet sleeve and the oil pump outlet sleeve from the crankcase.



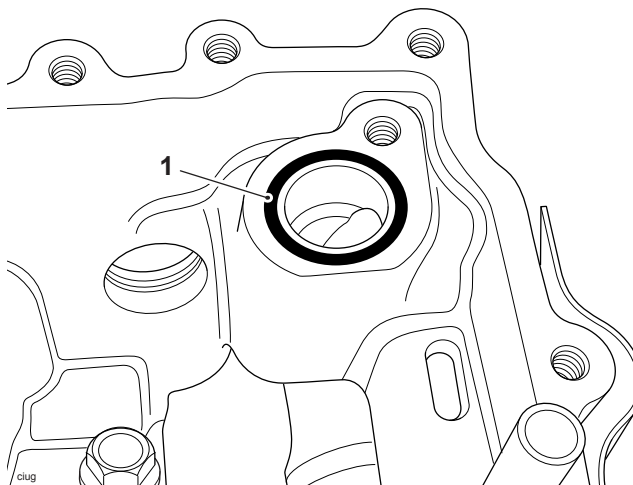
1. Coolant outlet sleeve
2. Oil outlet sleeve
3. Coolant inlet seal

9. Remove and discard the four O-rings from the coolant outlet sleeve and then remove and discard the two O-rings from the oil outlet sleeve.



1. Coolant outlet sleeve
2. O-ring (coolant)
3. Oil outlet sleeve
4. O-ring (oil)

10. Remove and discard the coolant inlet O-ring from the crankcase.

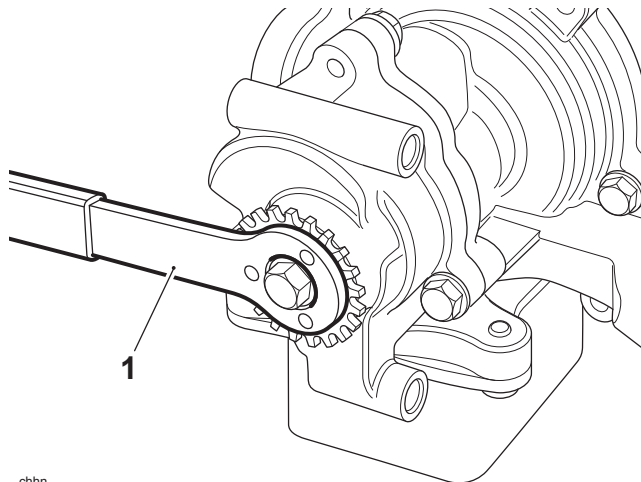


1. O-ring (coolant inlet)

Oil Pump Disassembly

Inspection

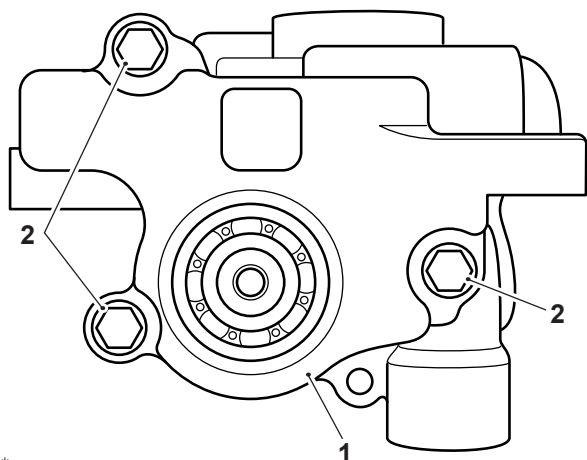
1. Using service tool T3880603 release the fixing and remove the drive sprocket and spacer washer.



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1. T3880603 - Oil Pump Restraint

2. Release the three fixings and withdraw the oil pump end plate.



cluk

1. Oil pump end plate

2. Fixings

⚠ Caution

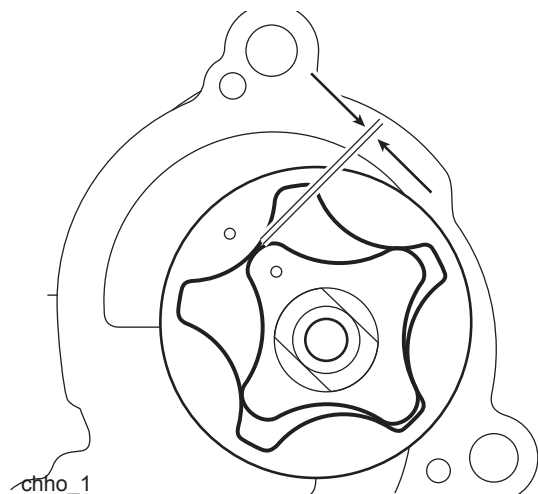
If any part of the oil pump is found to be outside the service limit, the complete pump must be replaced. Severe engine damage may result from the continued use of a faulty oil pump.

Oil Pump Inspection

1. Inspect the sprocket and chain for wear and/or damage. Replace the pump and chain if wear is found.
2. Check the shaft and shaft bearings for side and end float. Replace the pump if wear is found.
3. Carry out a visual inspection for corrosion and scale build-up around the coolant pump impeller and in the coolant pump body. Replace the pump assembly if necessary.

Oil Pump Rotor Tip Clearance

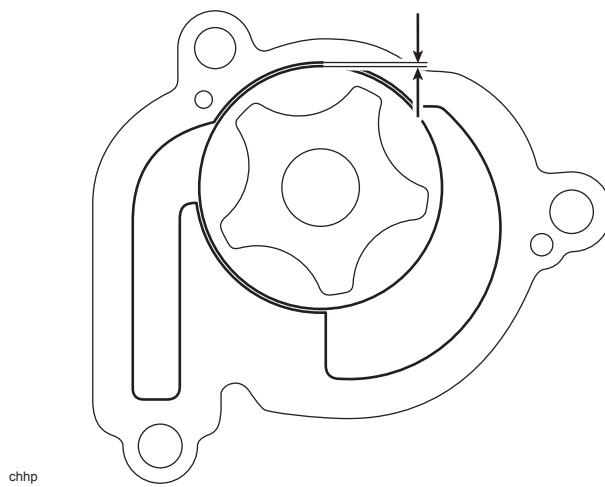
1. Measure the rotor tip clearance using feeler gauges.
2. For specifications refer to Lubrication, page 45.



Rotor Tip Clearance

Oil Pump Body Clearance

1. Measure the pump body clearance using feeler gauges.
2. For specifications refer to Lubrication, page 45.



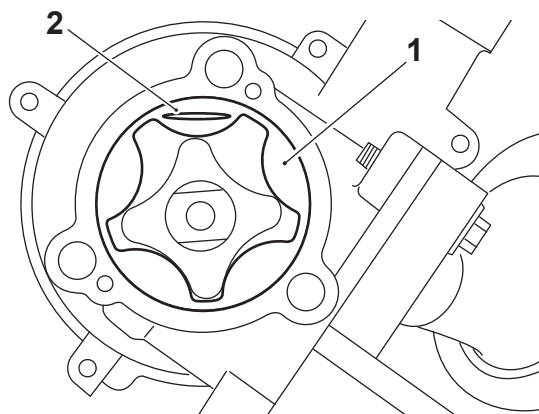
Pump Body Clearance

Oil Pump End Clearance

1. Remove the end plate from the pump.
2. Wipe the exposed areas of the rotors and the machined face of the end plate.

Note:

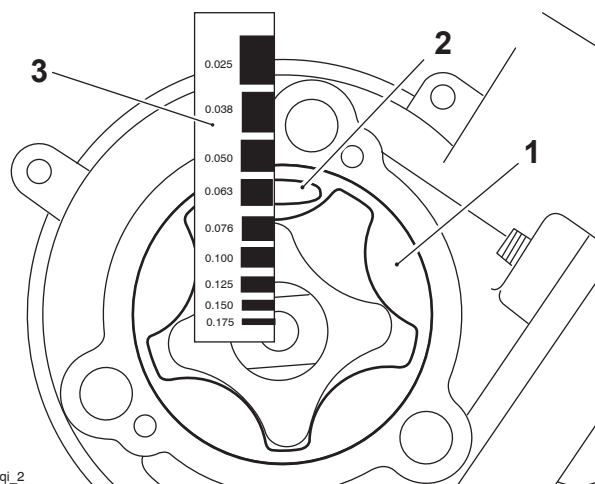
- The oil pump end clearance is measured using Plastigauge (Triumph part number 3880150-T0301). Do not turn the oil pump during the clearance measurement as this will damage the 'Plastigauge'.
3. Apply a thin smear of grease to the rotor and a small quantity of silicone release agent to the face of the end plate.
 4. Cut a length of the Plastigauge to fit across the rotor. Fit the strip to the rotor using the grease to hold the Plastigauge in place.



1. Outer rotor
2. Plastigauge

5. Without any twisting action, refit the oil pump cover and tighten its fixings to 11 Nm.
6. Release the bolts and carefully remove the end plate.
7. Using the gauge provided with the Plastigauge kit, measure the width of the compressed Plastigauge.

8. For specifications refer to Lubrication, page 45.



1. Rotor (outer)

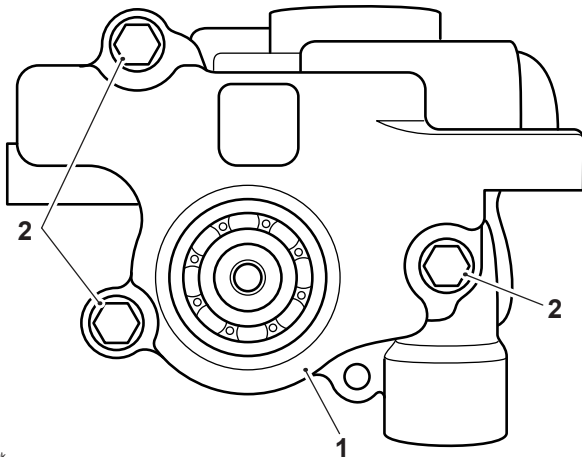
2. Plastigauge

3. Gauge, in millimetres

9. If the clearance measured is within the specified tolerance, clean off all traces of Plastigauge from the outer rotor and oil pump cover.
10. If any clearance measured is outside the service limits, renew the complete pump.

Oil Pump - Assembly

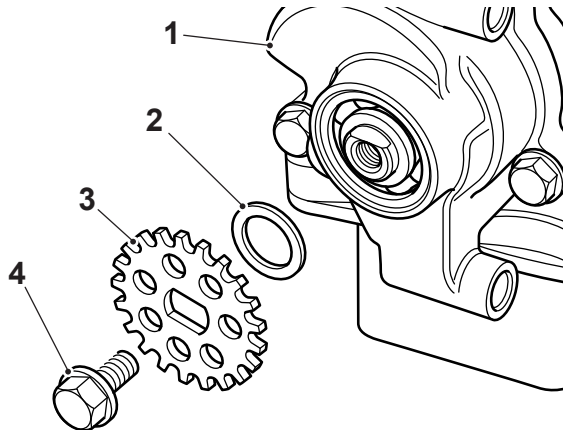
1. If all clearances are within service limits, liberally apply clean engine oil to all internal components and refit the rotor to the oil pump body.
2. Refit the end plate. Apply ThreeBond 1374 to the fixings, refit and tighten to 11 Nm.



1. Oil pump end plate

2. Fixings

3. Refit the spacer washer and drive sprocket. Apply ThreeBond 1374 to the fixing and tighten to 12 Nm.



1. Oil pump

2. Spacer washer

3. Drive sprocket

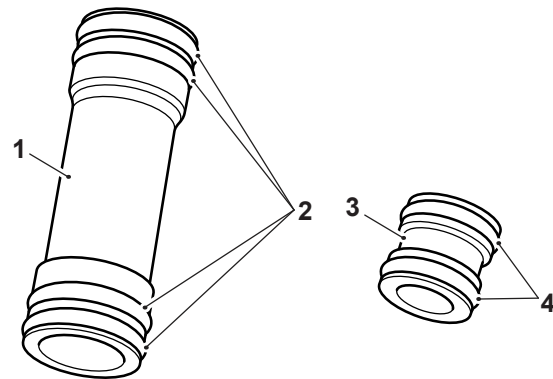
4. Fixing

Oil and Water Pump - Installation

! Caution

Before fitting the 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. Install four new O-rings to the water pump outlet sleeve.
2. Install two new O-rings to the oil pump outlet sleeve.



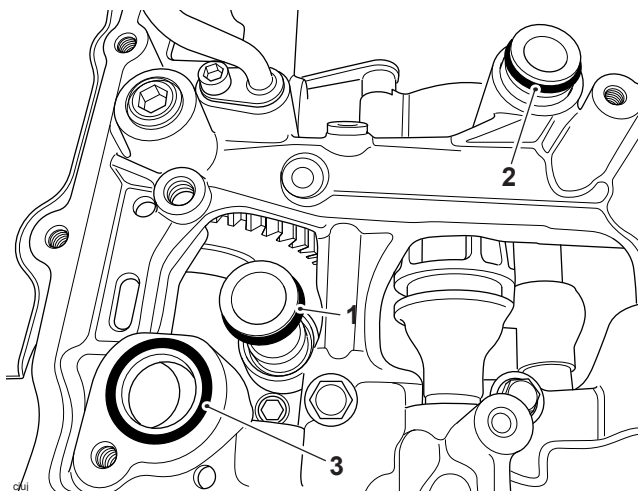
1. Coolant outlet sleeve

2. O-ring (coolant)

3. Oil outlet sleeve

4. O-ring (oil)

3. Fit the coolant outlet sleeve, the oil outlet sleeve and the coolant inlet O-ring to the crankcase.



1. Coolant outlet sleeve
2. Oil outlet sleeve
3. O-ring (coolant inlet)

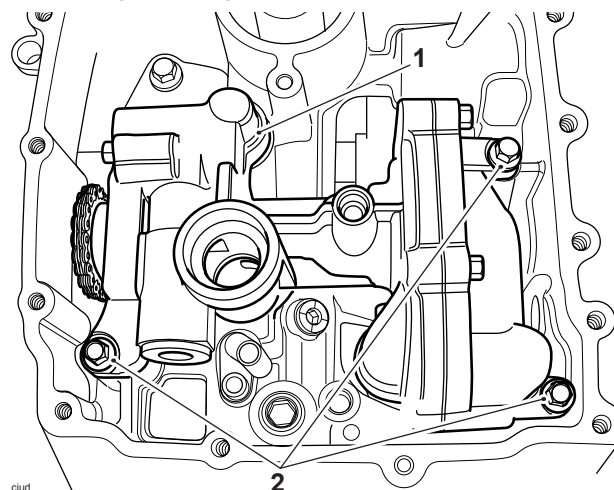
4. Fill the oil pump with new engine oil, turning the pump rotor as the oil is poured in to ensure all surfaces are coated with oil.
5. Position the oil and water pump to the crankcase inserting the oil pump outlet sleeve and the water pump outlet sleeve into the openings.

Caution

Do not use excessive force to insert the outlet sleeves into the oil pump. Severe oil pump or outlet sleeve damage may result from the use of excessive force.

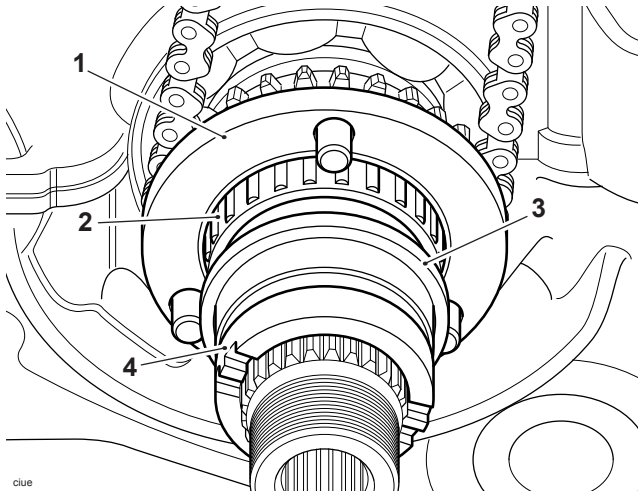
6. Feed the drive chain over the transmission input shaft and fit to the sprocket.
7. Fit the drive chain on to the oil pump sprocket.

8. Refit the oil and water pump. Install new fixings and tighten to 10 Nm.



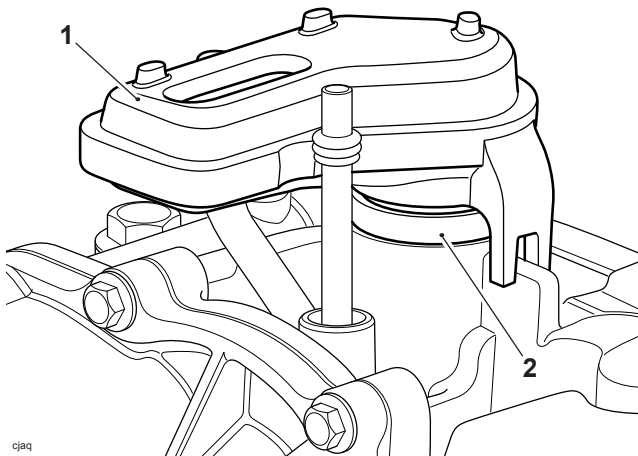
1. Pump
2. Fixings

9. Support the oil and water pump drive sprocket and carefully refit the bush spacer and needle roller bearing as noted during removal.



- 1. Drive sprocket**
- 2. Needle roller bearing**
- 3. Spacer**
- 4. Bush**

10. Install a new oil seal and refit the oil pick-up.



- 1. Oil pick-up**
- 2. Oil seal**

- Refit the clutch (see Clutch - Installation, page 162).
- Refit the sump, ensuring the water pump drain tube is correctly installed (see Sump - Installation, page 95).
- Refill the engine with oil (see Oil and Oil Filter Change, page 246).
- Refill the cooling system (see Coolant Replacement - Filling, page 463).
- Refit the fuel tank (see Fuel Tank - Installation, page 385).

- Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
- Refit the seat (see Seat - Installation, page 645).

Oil Pressure Relief Valve - 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

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.

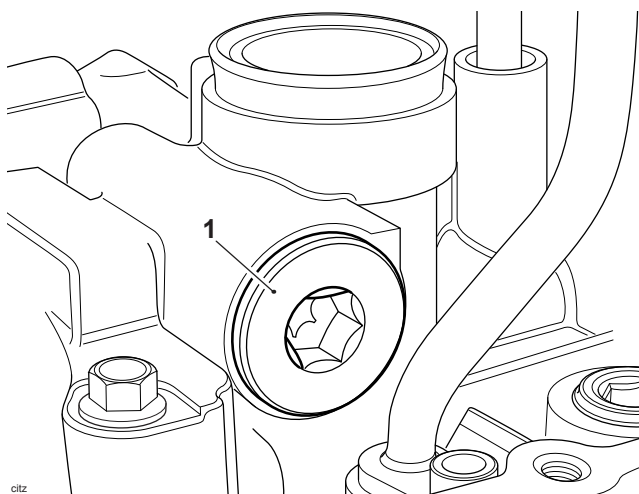
The oil pressure relief valve is located in the oil pump housing. It is positioned behind a threaded blanking plug in the oil pump body.

- Remove the seat (see Seat - Removal, page 645).
- Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
- Remove the sump (see Sump - Removal, page 94).

Warning

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

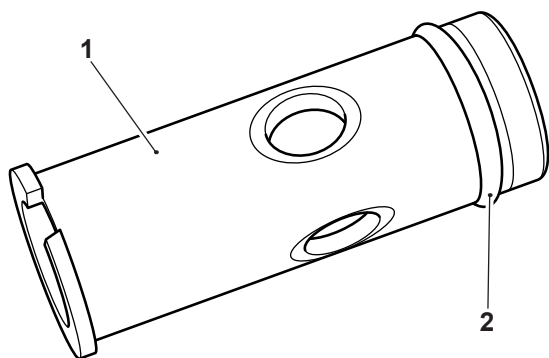
1. Remove the blanking plug.



1. **Blanking plug**

Oil Pressure Relief Valve - Installation

1. Lubricate the new O-ring with clean engine oil and fit to the oil pressure relief valve.



city

1. Oil pressure relief valve

2. O-ring

2. Refit the oil pressure relief valve as noted during removal.
3. Refit the blanking plug and tighten to 10 Nm.
4. Refit the sump, ensuring the water pump drain tube is correctly installed (see Sump - Installation, page 95).
 - Refit the fuel tank (see Fuel Tank - Installation, page 385).
 - Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
 - Refit the seat (see Seat - Installation, page 645).

17 Engine Removal And Installation

Table of Contents

Engine - Removal 261

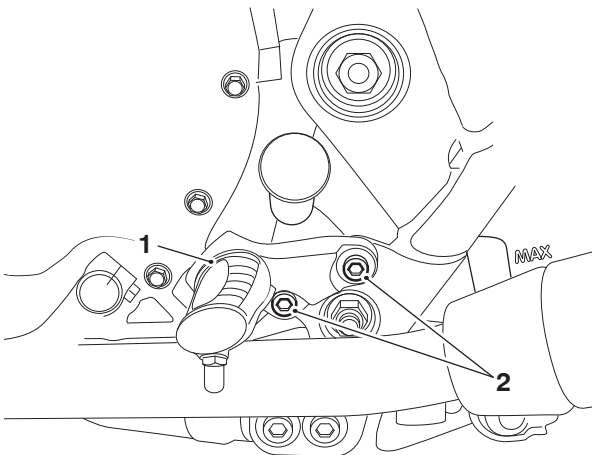
Engine - Installation..... 265

Engine - 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.

- Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
 - Remove the fuel tank (see).
 - Remove the side panels (see Side Panels, page 646).
1. From the top of the frame, disconnect the following electrical connectors:
 - Spark plug leads.
 - Fuel injectors
 - Coolant temperature sensor.
 2. Remove the rider's left hand foot rest.

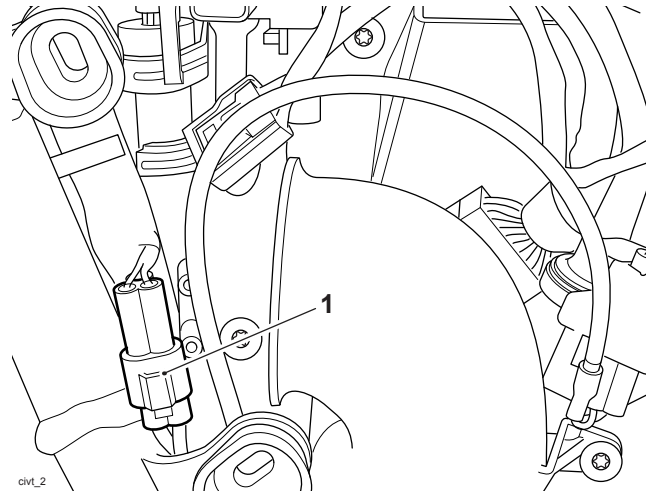


1. Riders left hand footrest
2. Fixings

Caution

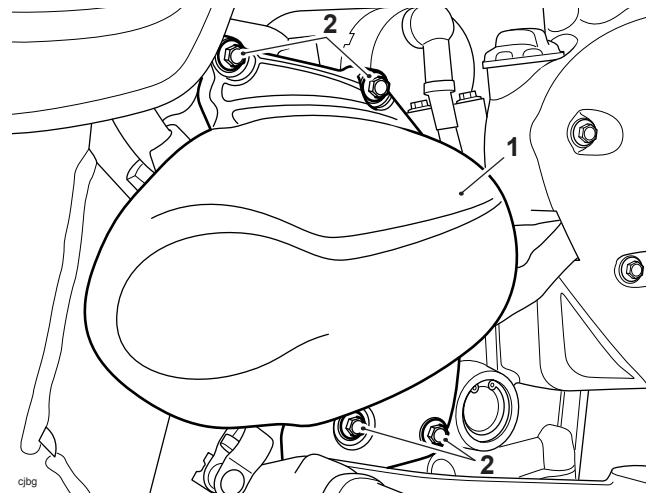
Note the routing and the retaining clips of the side stand switch harness for installation.

3. Disconnect the side stand switch electrical connector from the main harness and feed it down to the side stand switch.



1. Side stand switch electrical connector

4. Remove the left and right hand frame cradles (see Cradle Assemblies - Removal, page 650).
5. Remove the exhaust system (see Header and Exhaust Intermediate Pipes - Removal, page 439)
6. Disconnect the clutch cable from the crankcase (see Clutch Cable - Removal, page 155).
7. Remove the fixings securing the front sprocket cover to the crankcase.

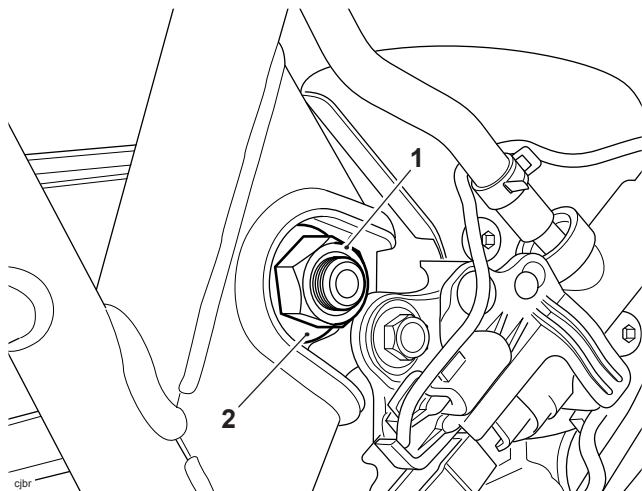


1. Front sprocket cover
2. Fixings

8. Carefully remove the swinging arm pivot cover on the left hand side of the frame.

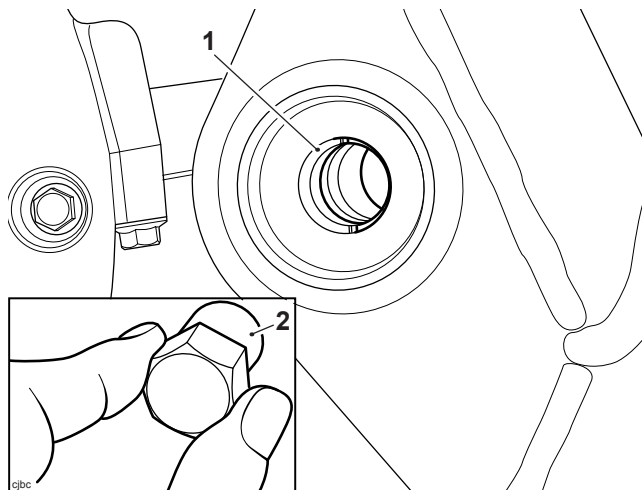
Engine Removal And Installation

9. Remove the swinging arm pivot nut and collect the washer on the right hand side of the frame.



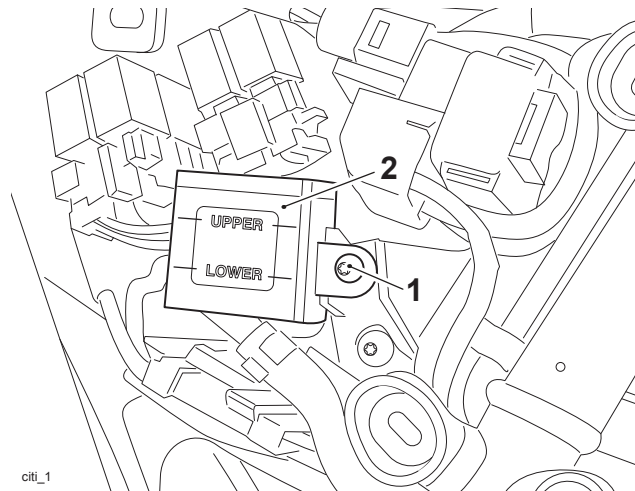
1. Nut
2. Washer

10. Support the swinging arm and remove the swinging arm spindle and washer from the left hand side.
11. Partially fit the swinging arm spindle on the right hand side to support the swinging arm.
12. Engage service tool T3880104 in the slots of the frame adjuster sleeve and rotate anticlockwise to loosen the sleeve fully.



1. Frame adjuster
2. T3880104 - Swinging Arm Adjuster Wrench

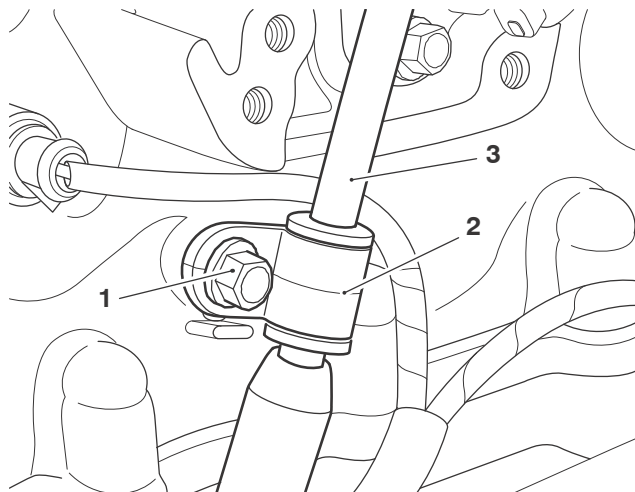
13. Remove and discard the fixing and detach the rear brake fluid reservoir from the relay bracket.



1. Fixing
2. Brake fluid reservoir

Note:

- Note the routing of the brake switch harness for installation.
14. Remove the fixing and detach the ABS brake line P-clip from the lower crankcase.

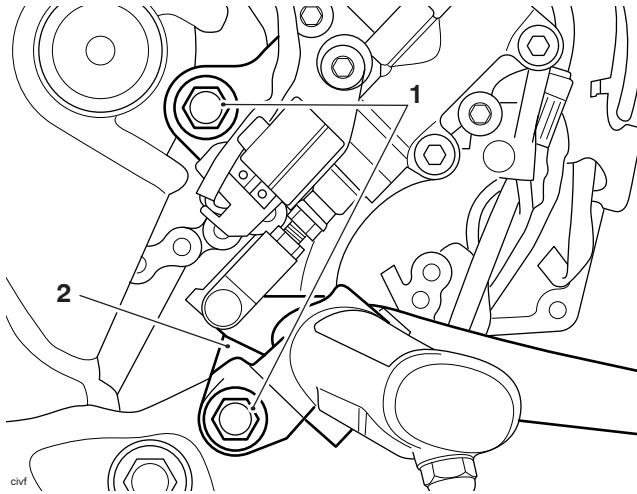


1. Fixing
2. P-clip
3. ABS brake line

Warning

Do not allow the brake caliper to hang on the brake hose as this may damage the hose. Damaged hoses could cause brake failure leading to loss of motorcycle control and an accident.

15. Remove the fixings and detach the right hand control plate and rear brake master cylinder assembly.

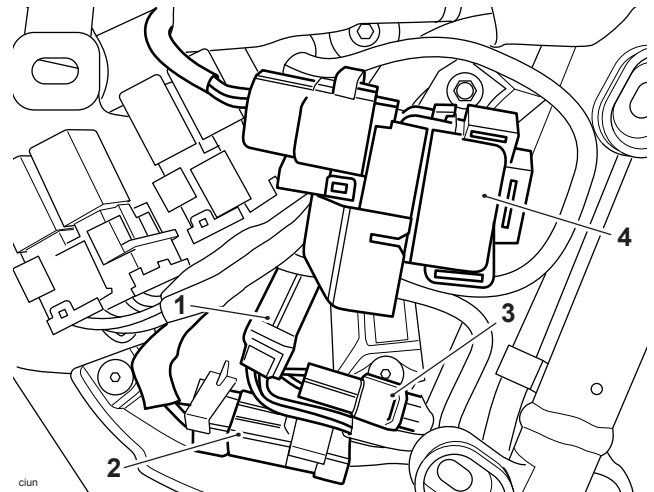


1. Fixings
2. Control plate

Note:

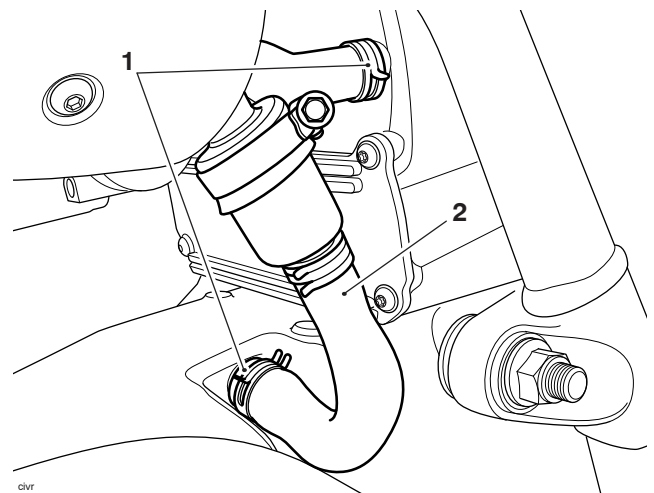
- It is not necessary to disconnect the brake lines to temporarily reposition the rear master cylinder assembly.
16. Position the control plate and master cylinder assembly rearwards, away from the frame.
 17. Loosen the drive chain and remove it from the front sprocket (see Final Drive Chain Adjustment, page 623).
 18. From the right hand side, disconnect the following electrical connectors:
 - Gear position sensor.
 - Alternator stator.
 - Crankshaft position sensor.

- Starter motor cable to starter solenoid fixing.



1. Gear position sensor multiplug
2. Alternator multiplug
3. Crankshaft position sensor multiplug
4. Starter motor solenoid

19. Disconnect the oil pressure switch electrical connector.
20. Noting their orientation route the cables away from the frame.
21. From the left hand side, disconnect the engine earth strap.
22. Disconnect the crankcase breather hose.



1. Hose clips
2. Engine breather pipe

23. Remove the throttle body and inlet manifold (see Throttle Body - Removal, page 426).
24. Drain the engine oil (see Oil and Oil Filter Change, page 246).
25. Drain the coolant (see Coolant Replacement - Drainage, page 462).

Engine Removal And Installation

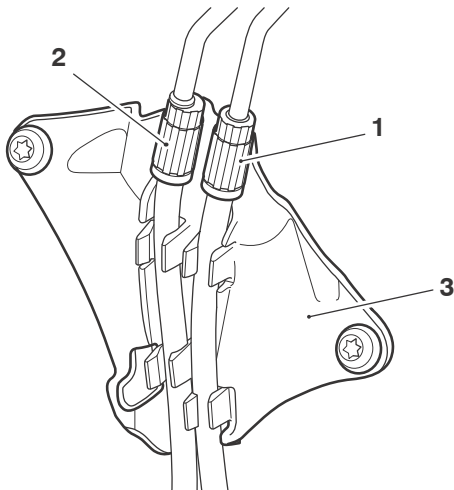
26. Remove the radiator (see page Radiator - Removal, page 471).
27. Release the engine mounting nuts. Collect the nuts and washers, leaving the bolts in position.
28. Remove the left hand cylinder head mounting bolt.
29. Using service tool T3880377 release the:
 - Rear cylinder head mounting adjuster on the left side of the frame,
 - Upper rear crankcase mounting adjuster,
 - Lower rear crankcase mounting adjuster,
 - Left hand cylinder head mounting adjuster.
30. Remove the right hand cylinder head mounting bolt.
31. Remove the remaining mounting bolts, collecting the spacer from the lower crankcase mounting bolt.

Caution

Two brake lines are attached to the brake line tidy on the rear of the crankcase.

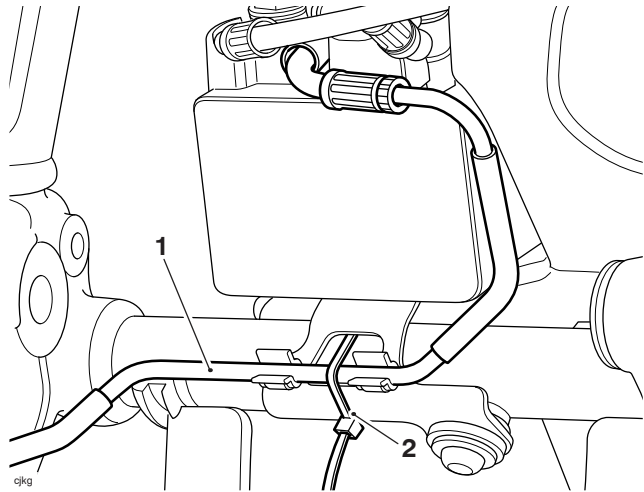
Failure to detach the brake lines from the brake line tidy will cause damage to the braking system.

32. Detach the brake lines from the brake line tidy and position away from the crankcase.



1. Brake line from ABS modulator to front master cylinder
2. Brake line from ABS modulator to front brake caliper
3. Brake line tidy

33. Lower the engine away from the frame, taking care to avoid damage to the brake pipes.
34. Using a proprietary cable tie, secure the brake line to the frame as shown to aid the engine installation procedure.



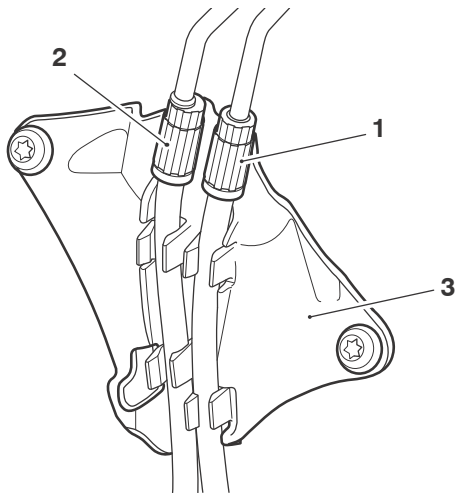
1. ABS brake line
2. Cable tie

Engine - Installation

Warning

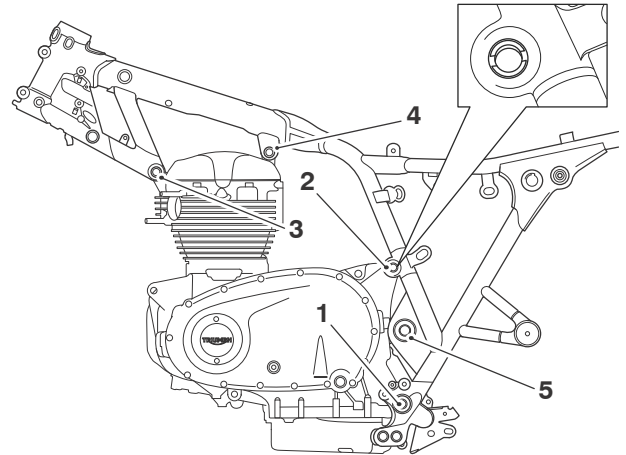
Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

1. Locate the engine to the frame aligning the engine mounting points with the corresponding positions on the frame.
2. Attach the brake lines to the brake line tidy.



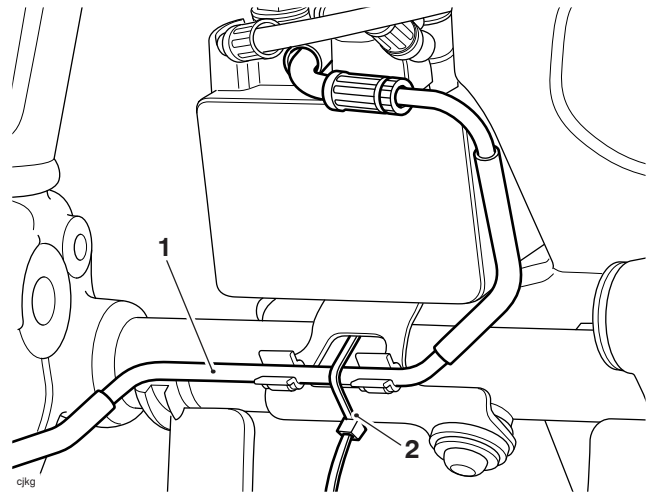
1. Brake line from ABS modulator to front master cylinder.
2. Brake line from ABS modulator to front brake caliper
3. Brake line tidy

3. Install the engine mounting bolts and the spacer to the lower crankcase mounting as noted during removal, do not fit the nuts or washers at this stage.



1. Lower rear crankcase adjuster
2. Upper rear crankcase adjuster
3. Left hand cylinder head frame adjuster
4. Rear cylinder head frame adjuster
5. Swinging arm adjuster

4. Remove the proprietary cable tie, fitted during the engine removal procedure.



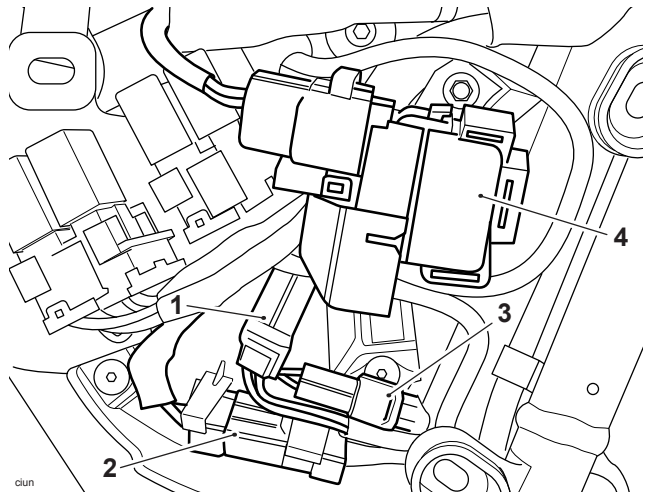
1. ABS brake line (engine removed for clarity)
2. Cable tie (engine removed for clarity)

5. Tighten the engine mounting bolts, nuts and adjusters in the following sequence:
 - Partially withdraw the lower rear crankcase mounting bolt and tighten the frame adjuster to 5 Nm using service tool T3880377. Refit the bolt and washer.
 - Partially withdraw the upper rear crankcase mounting bolt and tighten the frame adjuster to 5 Nm using service tool T3880377. Refit the bolt and washer.

Engine Removal And Installation

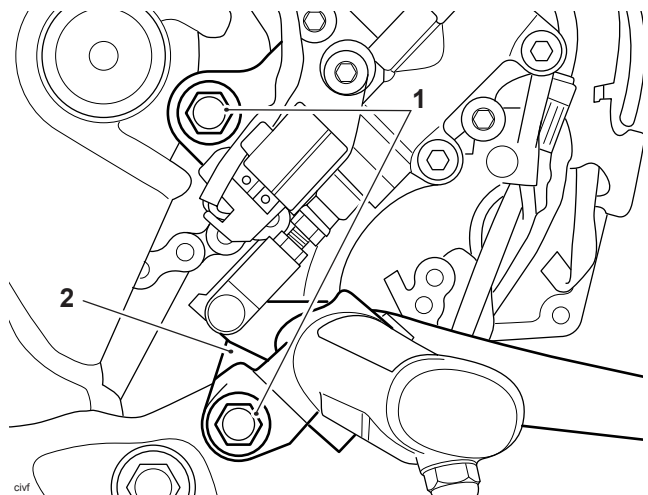
- Counter hold the front right hand cylinder head mounting nut and tighten the bolt to 24 Nm.
 - Withdraw the left hand cylinder head mounting bolt and tighten the frame adjuster to 5 Nm using service tool T3880377.
 - Withdraw the rear cylinder head mounting bolt and tighten the frame adjuster to 5 Nm using service tool T3880377.
6. Counter hold the lower rear crankcase mounting bolt and tighten the nut to 80 Nm.
 7. Counter hold the upper rear crankcase mounting bolt and tighten the nut to 80 Nm.
 8. Counter hold the front right hand cylinder head mounting nut and tighten the bolt to 105 Nm.
 9. Counter hold the front left hand cylinder head mounting nut and tighten the bolt to 105 Nm.
 10. Counter hold the nut and tighten the rear cylinder head mounting bolt to 105 Nm.
 11. Using service tool T3880104, tighten the swinging arm pivot bolt adjuster sleeve to 6 Nm.
 12. While supporting the swinging arm, remove the swinging arm spindle and fully insert it from the left hand side.
 13. Fit the washer and a new swinging arm spindle nut, tighten the nut to 110 Nm.
 14. Refit the coolant hose to the thermostat housing and secure using service tool T3880207.
 15. Refit the throttle body (see Throttle Body - Installation, page 429).
 16. Refit the clutch cable (see Clutch Cable - Installation, page 157).
 17. Refit the crankcase breather hose.
 18. Reconnect the engine earth strap, tightening the fixing to 6 Nm.
 19. Route the starter motor cable, crankshaft position sensor, alternator stator, and gear position sensor cables as noted during removal. Tighten the cable guide fixings to 4 Nm.
 20. Connect the electrical connectors as follows:
 - Gear position sensor,
 - Alternator stator,
 - Crankshaft position sensor,
 - Oil pressure switch.

21. Refit the starter motor cable to the solenoid, tighten the fixing to 4 Nm.



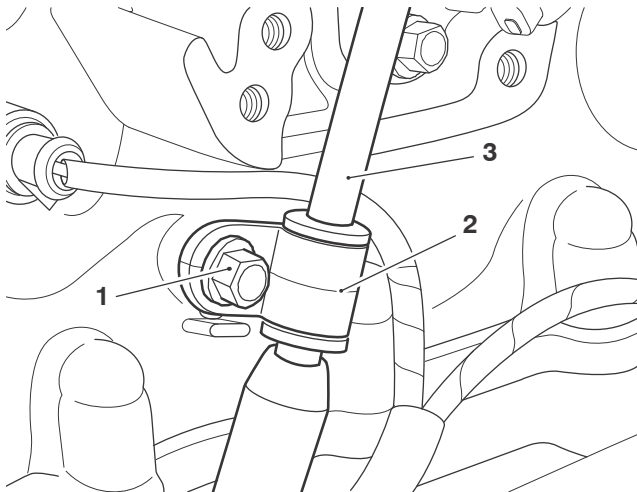
- 1. Gear position sensor multi-plug**
- 2. Alternator multi-plug**
- 3. Crankshaft position sensor multi-plug**
- 4. Starter motor solenoid**

22. Refit the rear brake master cylinder and control plate tighten the fixings to 24 Nm.



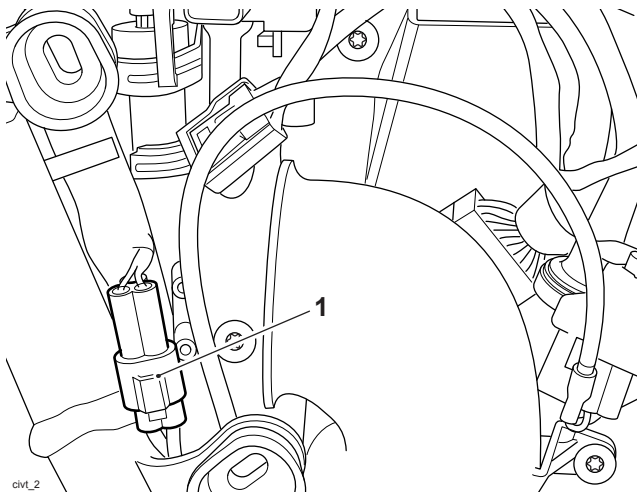
- 1. Fixings**
- 2. Control plate**

23. Refit the ABS brake line P-clip to the lower crankcase and tighten the fixing to 5 Nm.



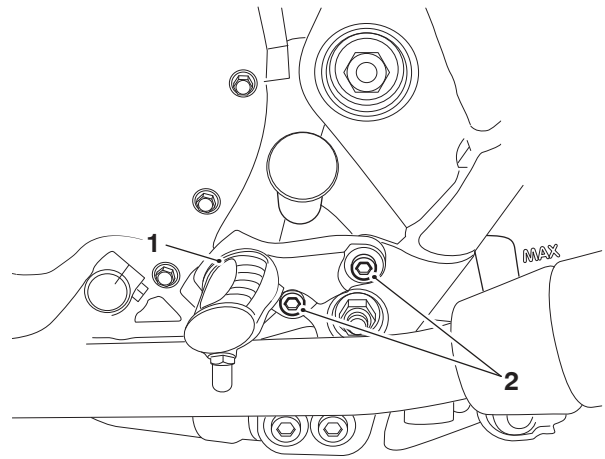
1. Fixing
2. P-clip
3. ABS brake line

24. Refit the brake fluid reservoir, tighten the fixing to 3 Nm.
25. Refit the front sprocket cover and tighten to 9 Nm.
26. Refit the swinging arm pivot cover to the left hand side of the frame.
27. Refit the radiator (see Radiator - Installation, page 473).
28. Refit the exhaust system (see Header and Intermediate Exhaust Pipes - Installation, page 441).
29. Refit the left and right hand frame cradles (see Cradle Assemblies - Installation, page 652).
30. Route the side stand switch harness to the left hand side of the airbox as noted for removal. Connect the electrical connector to the main harness.



1. Side stand switch electrical connector

31. Refit the rider's left hand foot rest, tighten the fixings to 24 Nm



1. Riders left hand footrest
2. Fixings

32. Connect the following electrical connectors:
- Coolant temperature sensor;
 - Fuel injectors;
 - Spark plug leads.
- Refill the engine with oil (see Oil and Oil Filter Change, page 246).
 - Refill the engine with coolant (see Coolant Replacement - Filling, page 463).
 - Refit the side panels (see Side Panels, page 646).
 - Refit the fuel tank (see Fuel Tank - Installation, page 385).
 - Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
 - Refit the seat (see Seat - Installation, page 645).

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18 Fuel System And Engine Management

Table of Contents

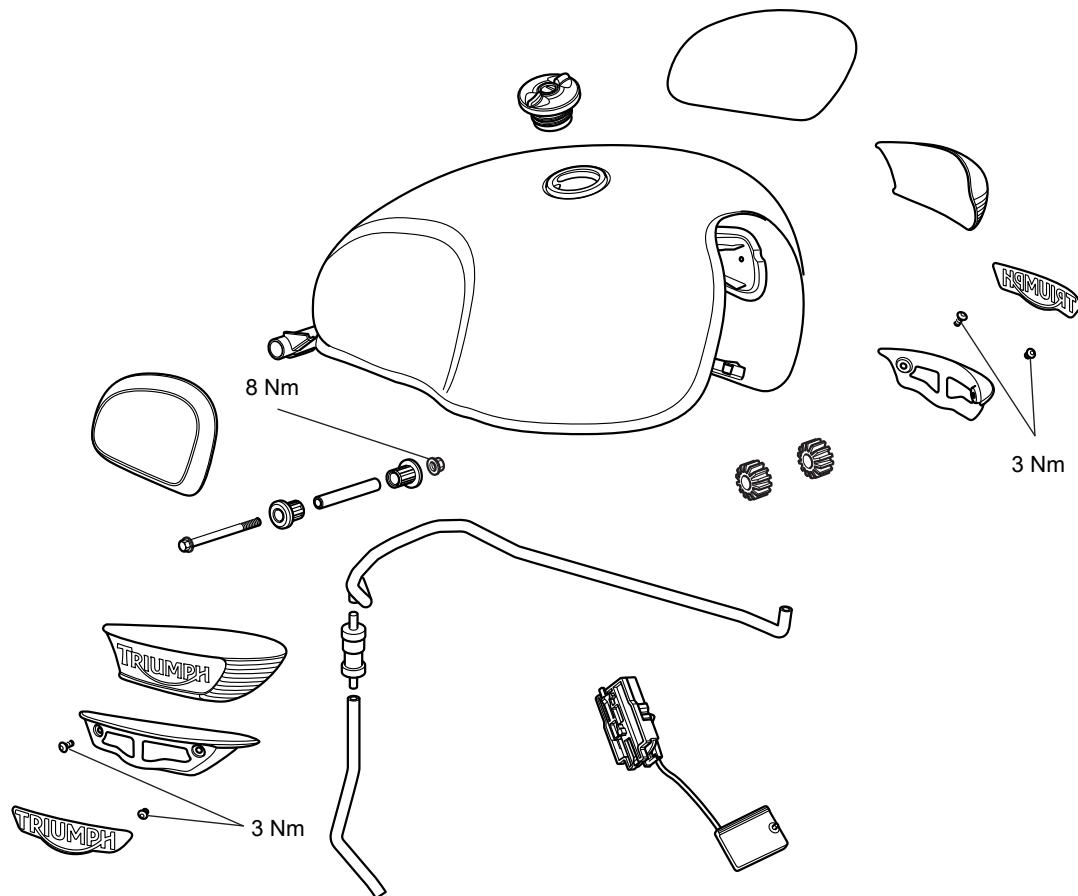
Exploded View – Fuel Tank	274
Exploded View – Fuel Pump.....	275
Exploded View – Fuel Rail, Throttles and Injectors	276
Exploded View – Airbox.....	277
Exploded View – Exhaust System.....	278
Exploded View – Evaporative System (if fitted).....	279
Exploded View – Immobiliser Control Module	280
Fuel Requirements.....	281
Glossary of Terms	282
Engine Management System.....	284
Sensor Locations	285
Actuators	286
Actuator Locations.....	287
Immobiliser System.....	288
Components Location	289
Engine Management Circuit Tables	290
Engine Management Circuit Diagram.....	291
ECM Connector Pin Numbering	292
System Diagnostics.....	292
Triumph Diagnostic Software	294
Cruise Control Switch Check	299
Instrument Panel Function Test	300
Diagnostic Trouble Codes	301
Immobiliser Control Module Diagnostic Trouble Codes.....	307
Electrical Connectors.....	308
Further Diagnosis	309
Crankshaft Sensor	310
Fuel Injectors.....	312
Throttle Position Sensor	314

Purge Valve	316
Ignition Coils.....	318
Coolant Temperature Sensor	320
Inlet Air Temperature Sensor	324
Fuel Pump Relay	326
System Voltage.....	328
Cooling Fan Relay	330
Oxygen Sensor	332
Oxygen Sensor Heater	334
Starter Motor Relay	336
Fall Detection Switch	338
CAN Communication.....	340
Instrument Communication (CAN).....	342
Ambient Air Pressure Sensor	344
Manifold Absolute Pressure (MAP) Sensor	346
Gear Position Sensor	348
Fuel Level Sensor Circuit	350
EMS Main Relay Circuit.....	352
EMS Ignition Voltage Input Circuit	354
5 Volt Sensor Supply Circuit.....	356
Twist Grip Position 1	358
Twist Grip Position Sensor 1 Correlation Error with Twist Grip Position 2.....	360
Twist Grip Position 2	362
Throttle Actuator Motor	364
Immobiliser Control Module Communication	366
ABS Modulator Communication.....	368
Brake Switches	370
Twist Grip Cruise Cancel Switch Circuit Malfunction.....	372
Cruise Control Prevented Due to Other Malfunction.....	372
Cruise Control Disabled Until Button Press Sequence Completed	372
Headlight Relay	374
Oxygen Sensor Reverse Connection.....	376
EEPROM Error	376
Engine ECM Internal Error	376
Traction Control Prevented Due to ABS Malfunction.....	376
Throttle Valve Drive Error	376
Tune Lock	376
Instrument ID Incompatible.....	377
Immobiliser and TPMS Control Module ID Incompatible.....	377

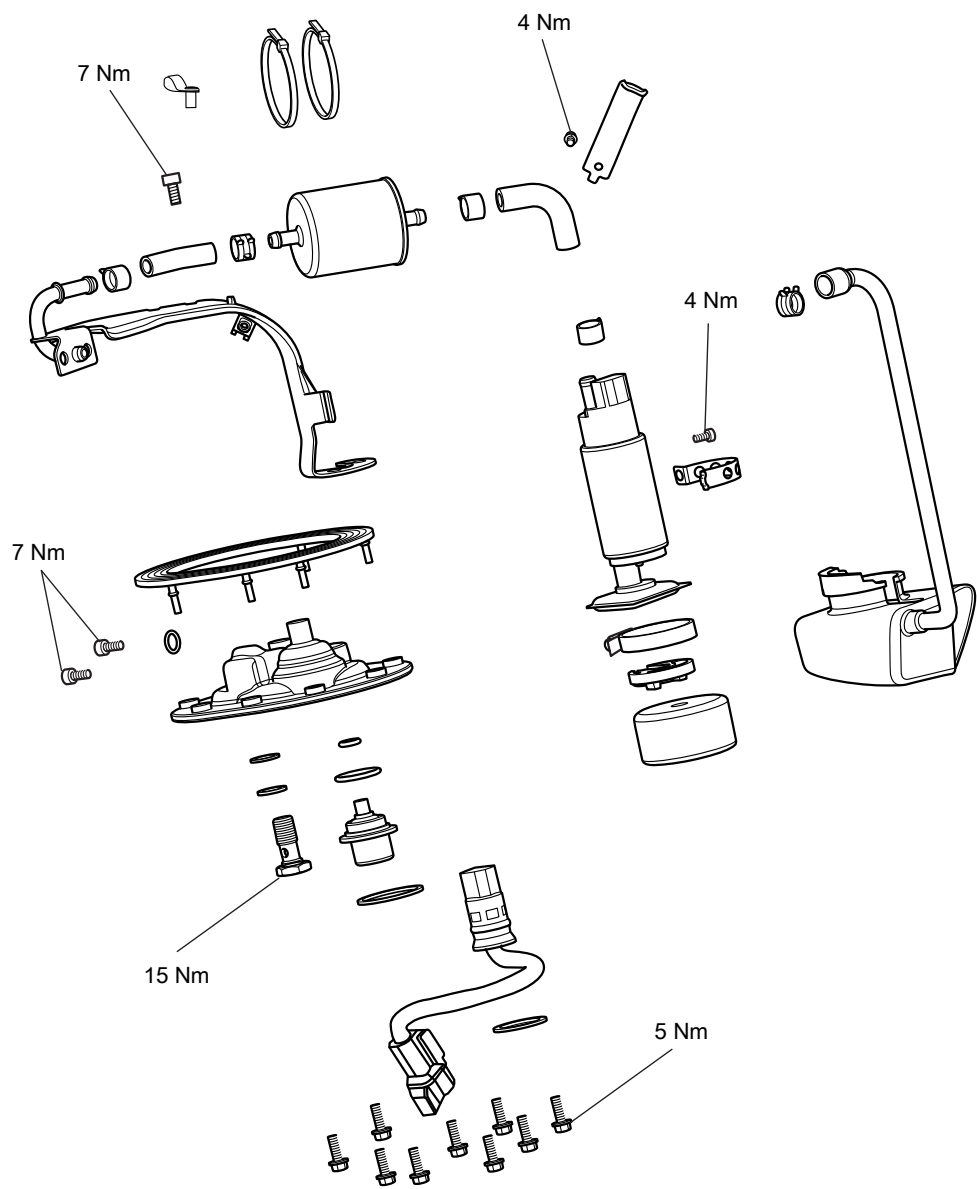
ABS Modulator ID Incompatible.....	377
Engine ECM Tamper Detected.....	378
Fault Finding - Non Electrical	378
Invalid Key: Key Authentication Unsuccessful.....	380
Vehicle Speed Sensor	382
Fuel Tank - Removal.....	383
Fuel Tank - Installation.....	385
Fuel Pressure Checking.....	386
Fuel Pump Assembly - Removal.....	387
Fuel Pump Assembly - Inspection.....	388
Fuel Pump Assembly - Installation.....	389
Fuel Filter - Removal.....	389
Fuel filter - Inspection.....	390
Fuel Filter - Installation	391
Fuel Pressure Regulator - Removal	391
Pressure Regulator - Inspection	392
Fuel Pressure Regulator - Installation	392
Fuel Pump - Removal	393
Fuel Pump - Inspection	394
Fuel Pump - Installation.....	394
Fuel Level Sensor - Removal.....	395
Fuel Level Sensor Installation	396
Air Filter Element - Removal.....	396
Air Filter Element - Installation	397
Airbox - Removal.....	398
Airbox - Installation	402
Engine Electronic Control Module (ECM) - Removal	404
Engine Electronic Control Module (ECM) - Installation.....	405
Immobiliser/TPMS Control Module - Removal	406
Immobiliser/TPMS Control Module - Installation.....	407
Twist Grip - Removal.....	408
Twist Grip - Installation	410
Twist Grip Position Sensor - Removal	412
Twist Grip Position Sensor - Installation.....	413
Intake Air Temperature Sensor - Removal.....	414
Intake Air Temperature Sensor - Installation.....	415
Coolant Temperature Sensor - Removal	415
Coolant Temperature Sensor - Installation.....	416
Manifold Absolute Pressure (MAP) Sensor - Removal.....	417

Manifold Absolute Pressure (MAP) Sensor - Installation.....	417
Ambient Air Pressure Sensor - Removal.....	418
Ambient Air Pressure Sensor - Installation.....	419
Fall Detection Switch - Removal.....	419
Fall Detection Switch - Installation.....	420
Gear Position Sensor - Removal.....	420
Gear Position Sensor - Installation.....	422
Crankshaft Position Sensor - Removal.....	424
Crankshaft Position Sensor - Installation.....	425
Throttle Actuator Motor.....	425
Throttle Position Sensor.....	426
Throttle Body - Removal.....	426
Throttle Body - Installation.....	429
Throttle Body Balancing.....	431
Fuel Injectors and Fuel Rail - Removal.....	433
Fuel Injectors and Fuel Rail - Installation.....	434
Engine Management Adaption.....	435
Exhaust Silencer - Removal.....	436
Exhaust Silencer - Installation.....	437
Header and Exhaust Intermediate Pipes - Removal.....	439
Header and Intermediate Exhaust Pipes - Installation.....	441
Exhaust Catalytic Converter - Removal.....	442
Exhaust Catalytic Converter - Installation.....	444
Evaporative Canister (if fitted) - Removal.....	445
Evaporative Canister (if fitted) - Installation.....	446
Purge Control Valve (if fitted) - Removal.....	447
Purge Control Valve (if fitted) - Installation.....	448
Evaporative Loss Control System – Certain Markets Only.....	449
Evaporative Control System – Engine Off.....	451
Evaporative Control System – Engine Running.....	452

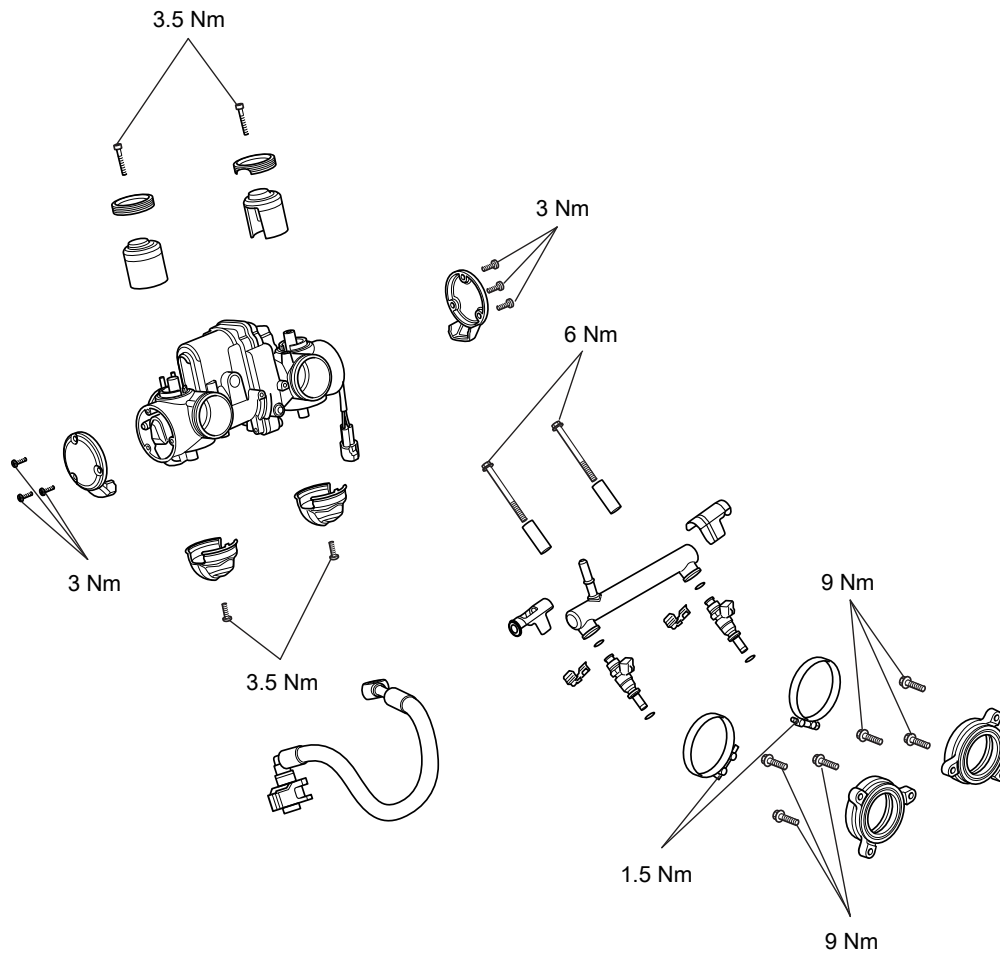
Exploded View – Fuel Tank



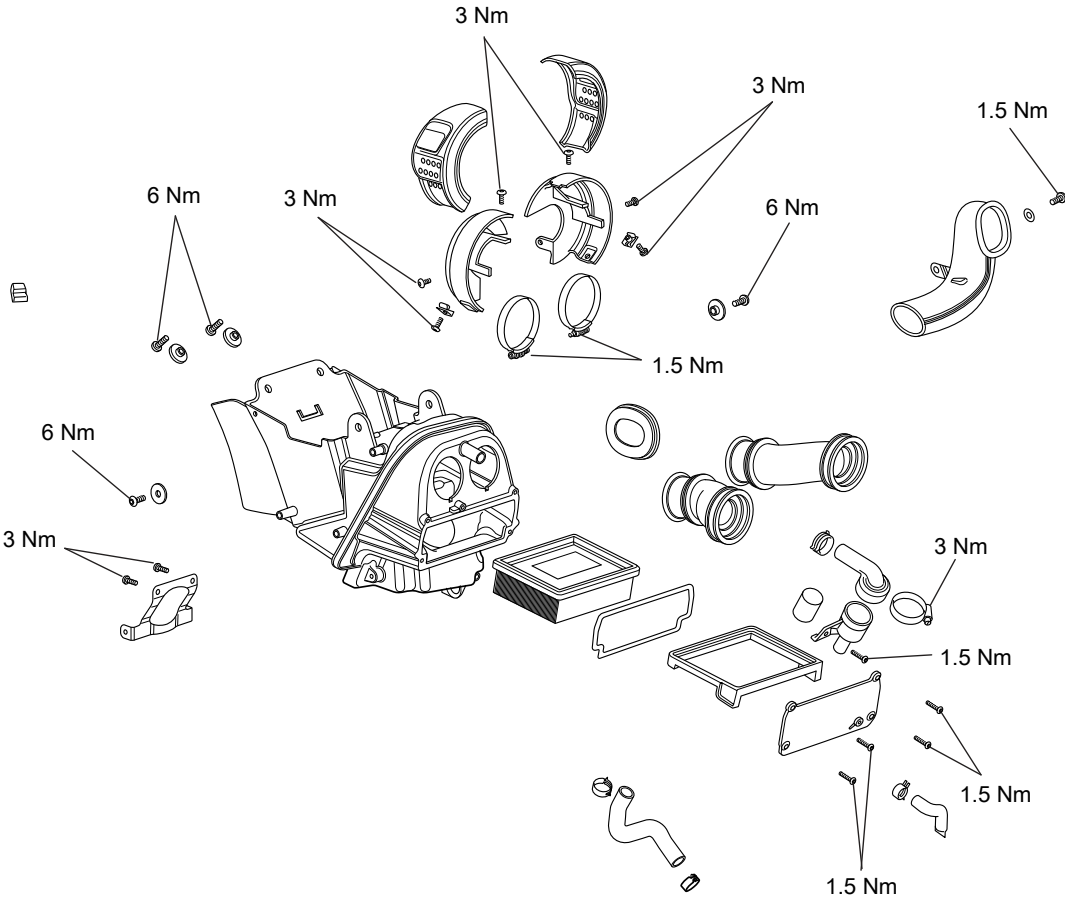
Exploded View – Fuel Pump



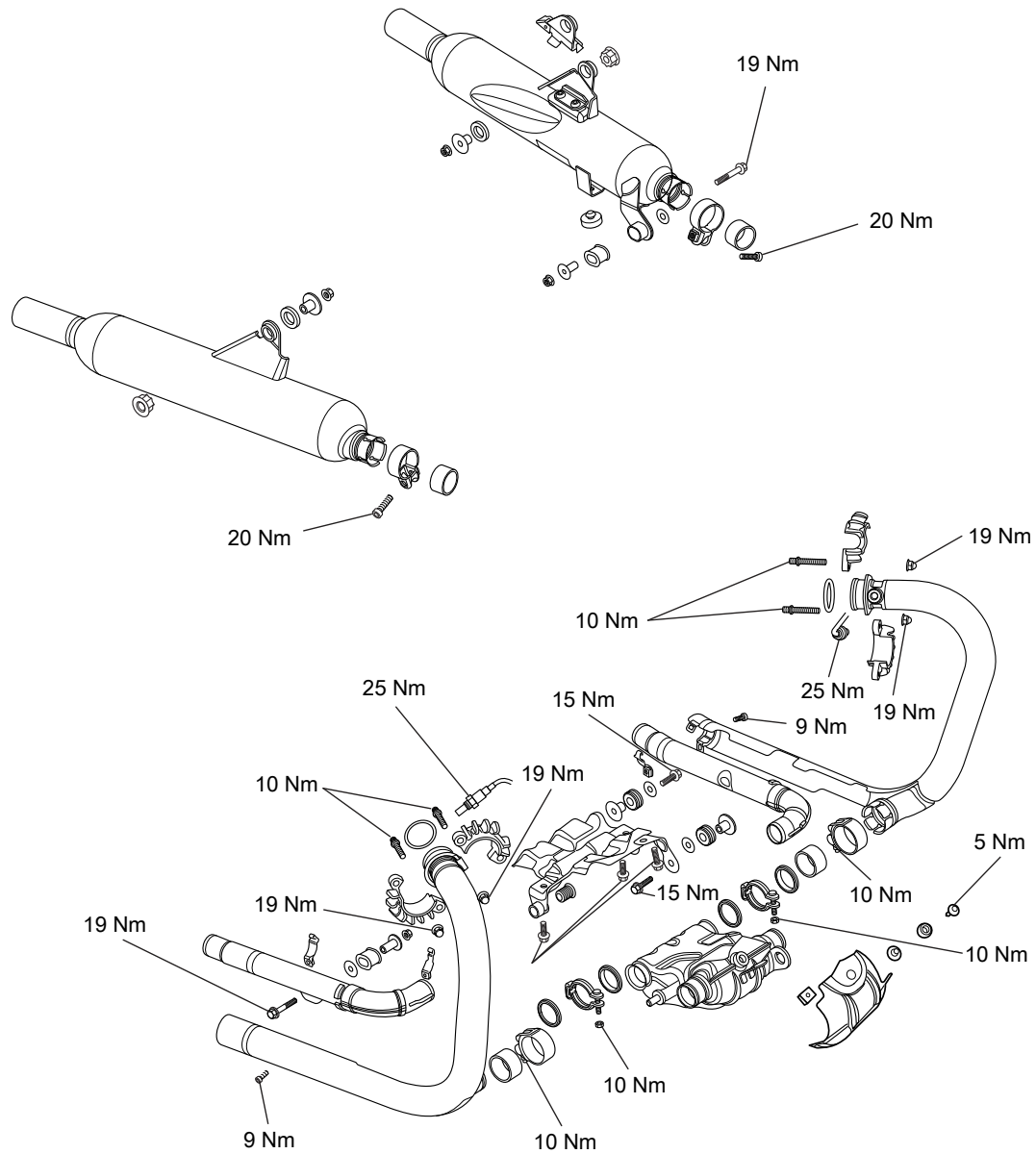
Exploded View – Fuel Rail, Throttles and Injectors



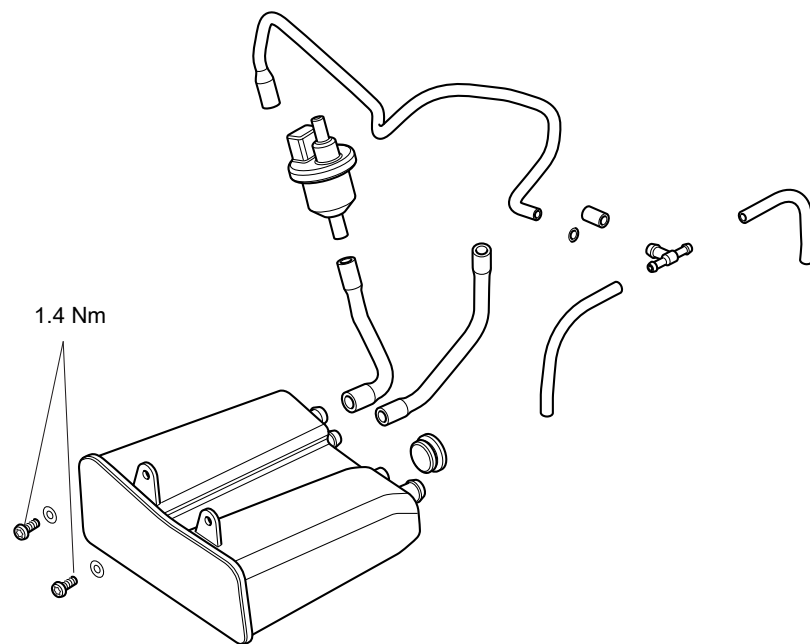
Exploded View – Airbox



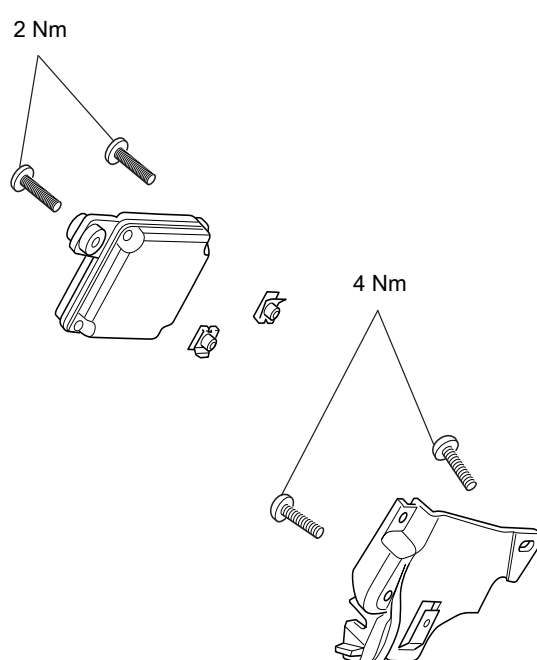
Exploded View - Exhaust System



Exploded View - Evaporative System (if fitted)



Exploded View – Immobiliser Control Module



Fuel Requirements

Fuel Requirements - all countries except USA

This model must be run on 91 RON or higher 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 87 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 airbox and intake hose.

Air temperature sensor

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

ATDC

After Top Dead Centre (TDC).

Ambient air pressure

Pressure of the air in the airbox.

Battery Voltage

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

BTDC

Before Top Dead Centre (TDC).

Catalytic converter

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.

Engine ECM

Engine Electronic Control Module.

Engine speed

The crankshaft revolutions per minute.

Fall detection

The fall detection switch will detect if the motorcycle is on its side and will cut power to the engine ECM immediately.

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 engine 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.

Immobiliser and Tyre Pressure Monitoring System (TPMS) Control Module

The control module for the immobiliser and TPMS system.

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 transmission.

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 engine Electronic Control Module (ECM) caused by an internal or external failure.

Oxygen sensor

The oxygen sensor measures the oxygen levels in the exhaust gases and feeds this information to the engine ECM. Based on this information, adjustments to air/fuel ratio are made.

Purge valve duty cycle

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

Sensor reference voltage

Supply voltage to the system sensors (nominally 5 volts).

Short circuit

A 'short cut' in an electrical circuit - current bypasses the intended circuit (usually to ground).

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.

Side stand 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 diagnostic software, fully open need not be 100% nor fully closed 0%.

Throttle actuator motor

Motor used to open/close the throttle.

Twist grip position sensor

The twist grip position sensor is used to relay twist grip position information to the engine ECM. The engine ECM uses this information to drive the throttle actuation motor to the correct position.

Throttle voltage

Voltage at the throttle potentiometer.

Transponder

A transponder-responder chip located in the ignition key. The transponder is activated by a radio signal sent out by the immobiliser control module, via an antenna located around the ignition switch. If the immobiliser control module does not receive the correct code signal from the transponder, the immobiliser will remain active and the engine will not start.

Engine Management System

System Description

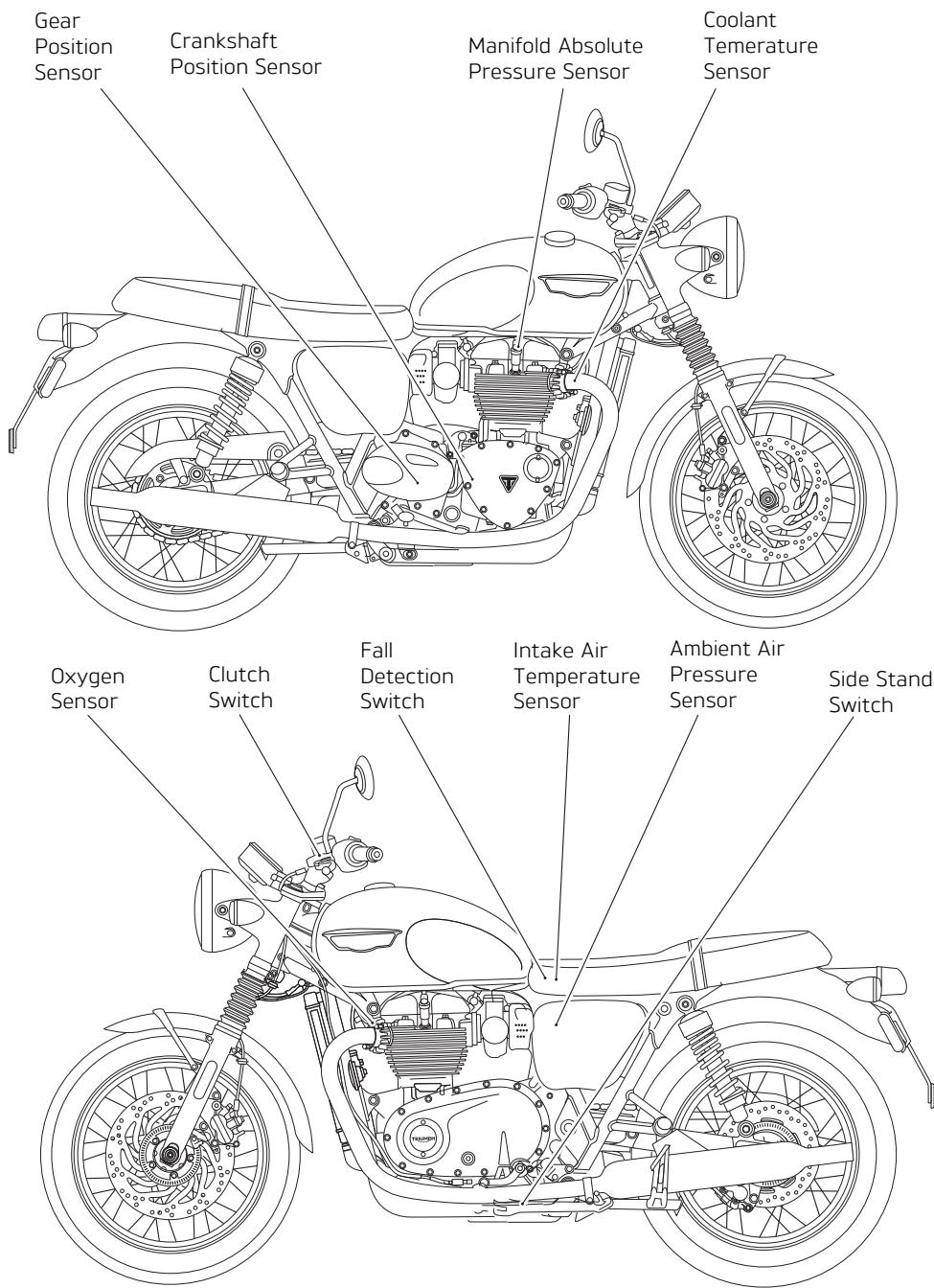
This model is fitted with an electronic engine management system which encompasses control of both ignition and fuel delivery. The engine electronic control module (ECM) draws information from sensors positioned around the engine, cooling and air intake systems and precisely calculates ignition advance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

In addition, the system has an on-board diagnostic function. For additional information, see System Diagnostics, page 292.

System Sensors

- **Intake air temperature sensor** - situated on top of the airbox. As the density of the air changes with temperature (therefore the amount of oxygen available to ignite the fuel), an intake air temperature sensor is fitted. Changes in air temperature are compensated for by adjusting the amount of fuel injected to a level consistent with clean combustion and low emissions.
- **Ambient air pressure sensor** - situated behind left hand side panel. The ambient air 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 below the fuel tank, connected to the manifold by a length tube. The MAP sensor provides information to the engine 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 alternator cover. The crankshaft position sensor detects movement of teeth attached to the alternator rotor. The teeth give a reference point from which the actual crankshaft position is calculated. The crankshaft position sensor information is used by the engine 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 front of the cylinder head near the thermostat housing. Coolant temperature information, received by the engine ECM, is used to optimise fueling at all engine temperatures and to calculate hot and cold start fueling requirements.
- **Oxygen sensors** - situated in the exhaust header pipe system close to the cylinder head. The oxygen sensors constantly feed information to the engine 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 side stand leg. If the side stand is in the down position, the engine will not run unless the transmission is in neutral.
- **Fall detection switch** - situated on top of the airbox. The fall detection switch will detect if the motorcycle is on its side and will cut power to the engine 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.
- **Gear position sensor** - situated in the lower crankcase, below the drive chain front sprocket. The gear position sensor provides the engine ECM with selected gear information. This is used to prevent the engine from starting if the transmission is in gear. The sensor also provides information to the neutral lamp in the instruments.

Sensor Locations



Actuators

System Actuators

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

- **Throttle actuator motor** - situated at the rear of the throttle body. The throttle actuator motor opens and closes the throttle plate in the throttle body, in response to commands from the engine ECM. The throttle actuator motor is an integral part of the throttle bodies.
- **Canister purge valve (certain markets only)** - situated behind the left hand side cover. 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 engine ECM to give control over the rate at which the canister is purged.
- **Injectors** - located in the cylinder head. The engine is fitted with two 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 engine ECM using data received from the various sensors in the system.
- **Ignition coils** - situated above the camshaft cover, attached to the frame. There are two coils fitted, one for each of the spark plugs. The engine ECM controls the point at which the coils are switched on and off. In calculating the switch-on time, the engine 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 behind the right hand side panel. When the ignition is switched on, the main power relay is powered up to provide a stable voltage supply for the engine ECM.
- **Fuel pump** - situated inside the fuel tank. The electric pump delivers fuel into the fuel system, via a pressure regulator, at a constant 3.5 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 fuel at 3.5 bar pressure is available to the

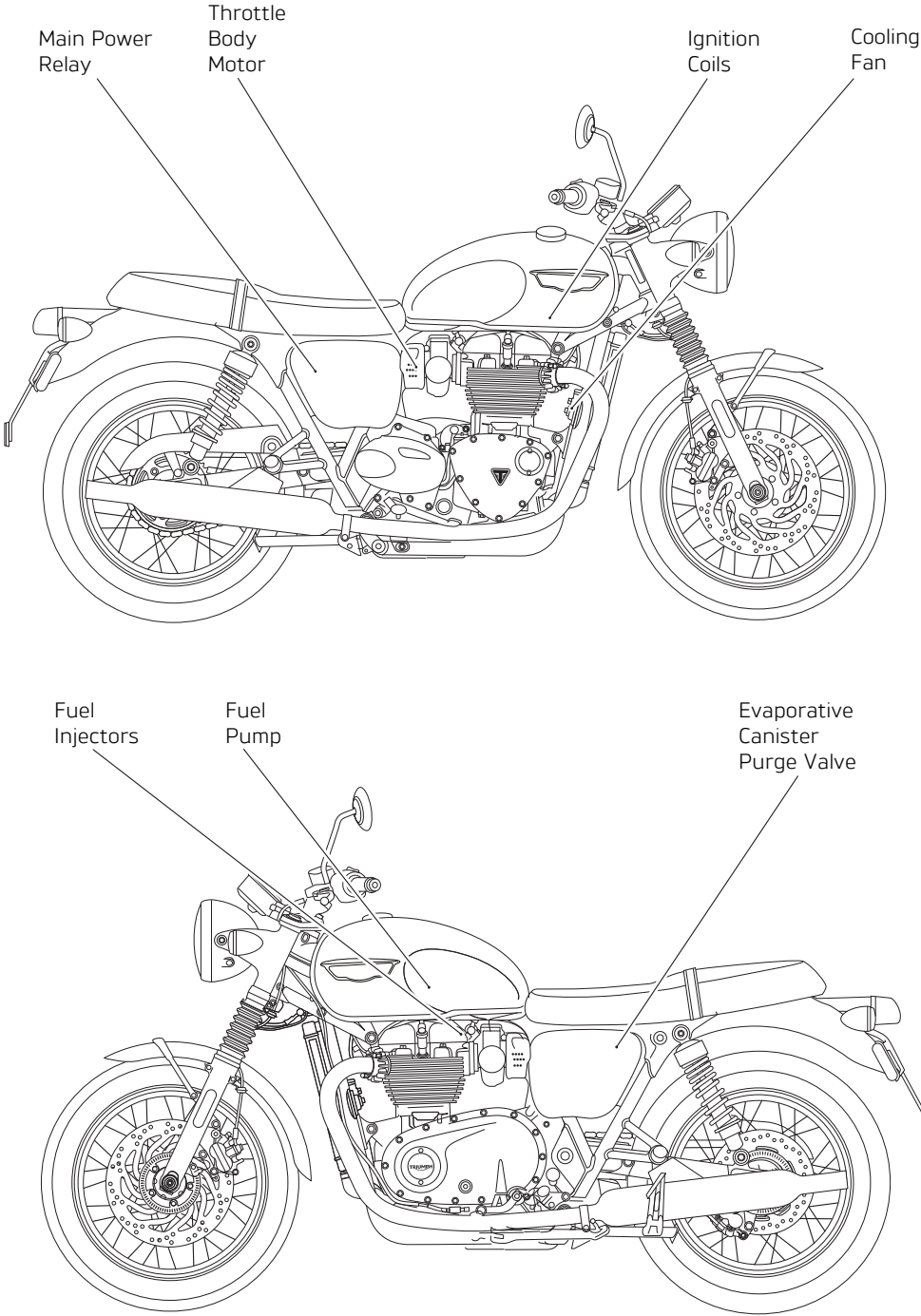
system as soon as the engine is cranked. Fuel pressure is controlled by a regulator also situated inside the fuel tank.

- **Cooling fan** - situated behind the radiator. The engine 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 engine ECM. When the coolant temperature falls sufficiently, the engine ECM turns the cooling fan off. The fan only becomes operational when the engine is running. It will not operate at any other time.

Note:

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

Actuator Locations



Immobiliser System

System Description

The Bonneville T120 is fitted with an electronic immobiliser system to help protect it against theft. This system has to be paired with the engine ECM and the ignition keys which contains a transponder chip. If all the components are correctly paired, the immobiliser will allow the engine to start. The Triumph Diagnostic Tool is the only way these components can be paired.

In addition, the system has an on-board diagnostic function. This ensures that, should a malfunction occur in the immobiliser system, a malfunction code is stored in the immobiliser control module's memory. This stored data can be recovered using the Triumph Diagnostic Tool (see Immobiliser Control Module Diagnostic Trouble Codes, page 307).

System Components and Operation

- **Transponder chip** - situated inside the ignition key. The chip is activated by the antenna coil when the ignition switch is turned to the ON position.
- **Antenna coil** - situated around the ignition switch. When the ignition switch is turned to the ON position, and the transponder chip is activated, the signal from the chip is sent to the immobiliser control module.
- **Immobiliser control module** - situated behind the headstock next to the coolant filler neck. This control module communicates with the transponder chip in the key and the ECM and will only allow the engine to start if a matching signal is received.
- **Alarm/immobiliser warning indicator light** - situated in the instrument pack. The light will flash for 24 hours to show that the engine immobiliser is on. When the ignition switch is turned to the ON position the immobiliser and indicator light will be off. If the indicator light remains on it indicates that the immobiliser has a malfunction that requires investigation.
- If an accessory alarm is fitted, the immobiliser indicator light will only illuminate when the conditions described in the accessory alarm instructions are met.

Keys

When the motorcycle is delivered from the factory it is supplied with two keys. Keys can be deleted or added to the immobiliser system using the Triumph Diagnostic Tool. A maximum of four keys can be added to the system.

To ensure the immobiliser system functions correctly note the following:

- Do not put any magnetic materials on the same key ring as the motorcycle key.
- Do not have two of the motorcycle ignition keys on the same key ring, keep the spare key in a safe place.
- Do not put any other ignition key with a transponder chip fitted near the motorcycle key when in use.
- Do not modify the immobiliser system.
- Do not submerge the key in water or any other fluid.
- Do not drop or strike the key against hard material.

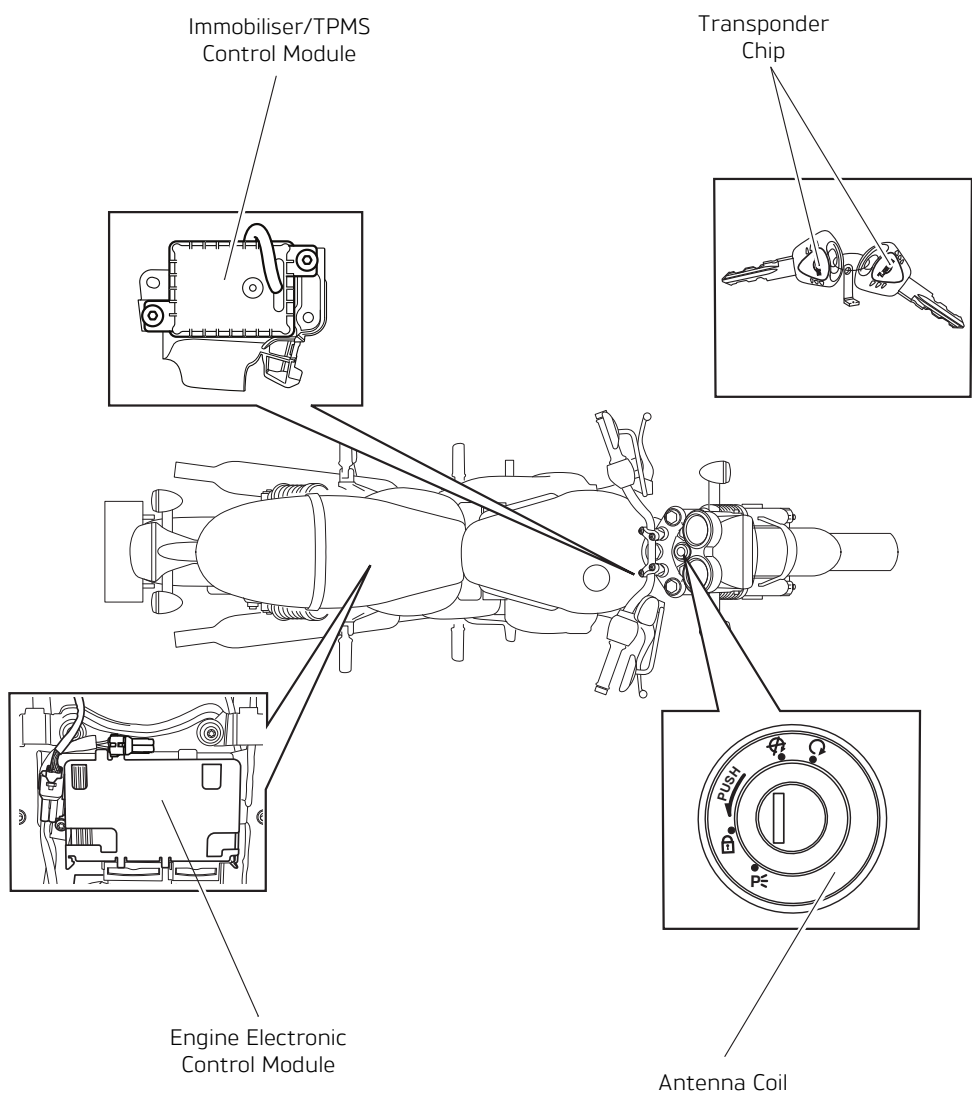
Diagnostics

To fully diagnose the immobiliser system it is necessary to check for fault codes in the immobiliser control module using the Triumph Diagnostic Tool (see System Diagnostics, page 292).

Further Diagnosis

The tables that start on page Immobiliser Control Module Diagnostic Trouble Codes, page 307, if used correctly, help to pinpoint a fault in the system once a diagnostic trouble code has been stored.

Components Location



Engine Management Circuit Tables

Key to Circuit Diagram

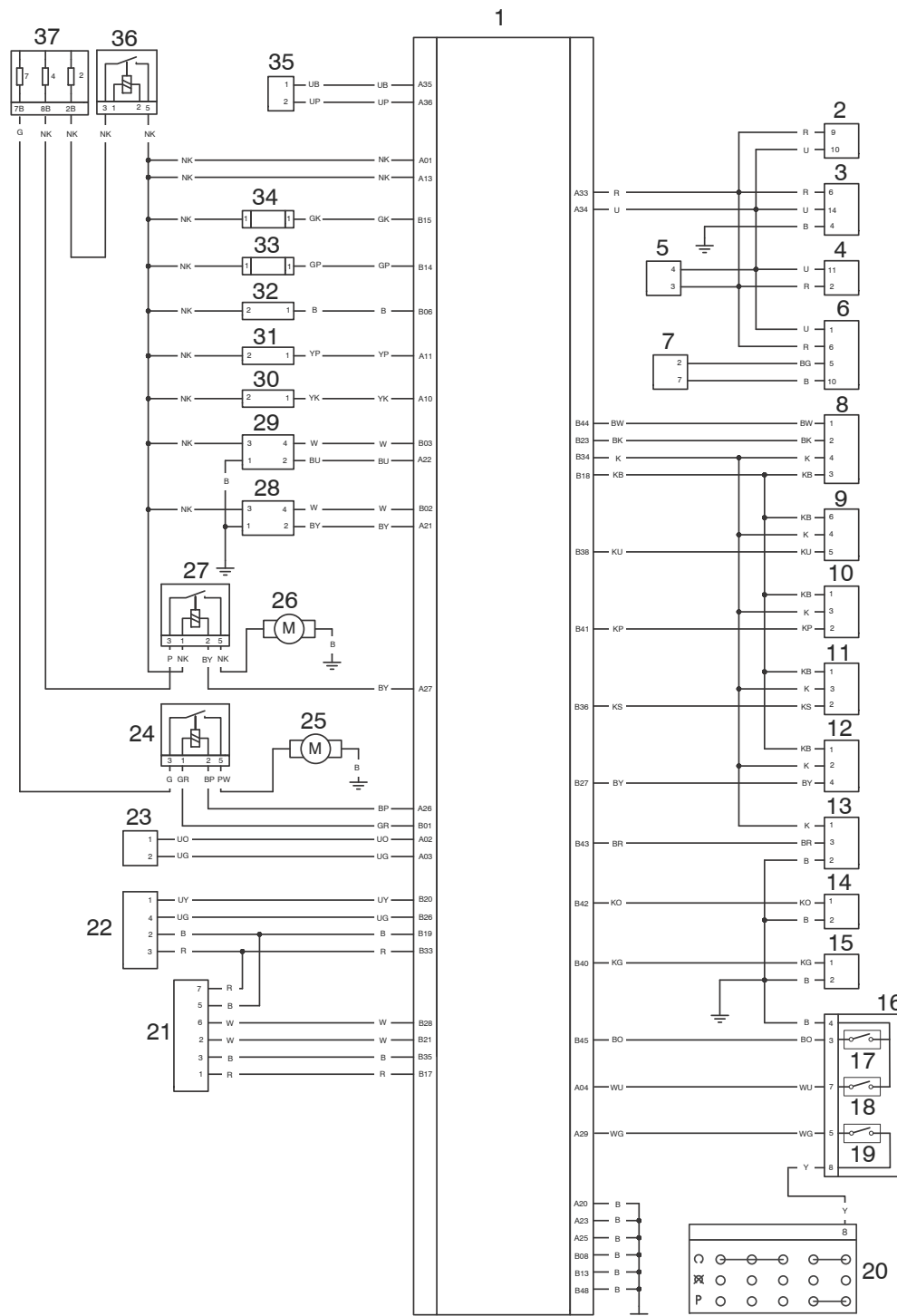
Key	Item Description
1	Engine Electronic Control Module
2	Instrument Assembly Connector
3	Diagnostic Connector
4	ABS Module Connector
5	Bluetooth® Module
6	Immobiliser
7	Ignition Switch
8	Gear Position Sensor
9	Fall Detection Switch
10	Ambient Air Pressure Sensor
11	MAP Sensor
12	Fuel Level Sender
13	Side Stand Switch
14	Intake Air Temperature Sensor
15	Coolant Temperature Sensor
16	Left Hand Switch Housing - 8 Way Connector
17	Clutch Switch
18	Main Beam Switch
19	Cruise Control Switch (if fitted)
20	Ignition Switch
21	Twist Grip Position Sensor
22	Throttle Position sensor
23	Throttle Drive Motor
24	Fuel Pump Relay
25	Fuel Pump
26	Cooling Fan
27	Cooling Fan Relay
28	Oxygen Sensor - Cylinder 1
29	Oxygen Sensor - Cylinder 2
30	Fuel Injector - Cylinder 1
31	Fuel Injector - Cylinder 2
32	Purge Valve
33	Ignition Coil - Cylinder 1
34	Ignition Coil - Cylinder 2

Key	Item Description
35	Crankshaft Position Sensor
36	EMS Relay
37	Fuse Box

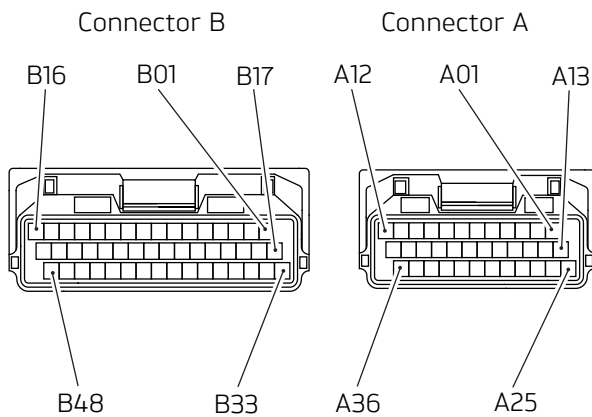
Key To Wiring Colour Codes

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

Bonneville T120



ECM Connector Pin Numbering



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

The smaller connector's pins are prefixed A and the larger connector 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.

System Diagnostics

The engine management system has an on-board diagnostics feature which allows service technicians to retrieve stored data from the ECM using Triumph diagnostic software. **Full details of the Triumph diagnostic software operation and how to interpret the results are given in the Triumph Diagnostic Tool User Guide.**

The software is connected, via an interface cable, 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 software 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 predetermined 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 predetermined 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 software.**

Note:

- **In some 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 Software

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 diagnostic software.

The tables indicate which tests are performed by the on-board system and what information can be retrieved by the Triumph diagnostic software.

Note:

- **Full details of how to operate the software and how to interpret the data can be found in the Triumph Diagnostic Tool User Guide, which can be downloaded by authorised Triumph dealers from www.triumphonline.net.**

Build Data

The **Build Data** screen will display the following information:

- Motorcycle model
- Vehicle Identification Number (VIN)
- ECM type
- ECM ID
- ECM serial number
- Tune number
- Date of last tune download
- Total tune downloads since manufacture
- The lock status of the ECM (ECM Locked, Unlocked or Not Applicable).

Current Data

The data available under Current Data is:

Function Examined	Result Reported (Scale)
Fuel system status 1	open or closed loop operation
Fuel system status 2	open or closed loop operation/engine not running
Calculated load value	%
Engine coolant temperature	°C
Short term fuel trim - bank 1	%
Short term fuel trim - bank 2	%
Intake manifold absolute pressure	mmHg
Engine speed	rpm
Vehicle speed	km/h
Ignition timing advance - cylinder 1	degrees
Intake air temperature	°C
Absolute throttle position	%
Bank 1 - oxygen sensor 1	Volts
Bank 1 - oxygen sensor 1 - short term fuel trim	%
Bank 2 - oxygen sensor 2	Volts
Bank 2 - oxygen sensor 2 - short term fuel trim	%

Sensor Data

When using this function it is possible to check the status of various sensors and actuators.

The data sets are divided into eight groups - Sensor Voltages, Sensor Readings, Injector Data, Ignition Data, Idle Speed and Throttle Data, Inputs, Outputs and Adaption Status. Each of these screens is described on the following pages.

Sensor Voltages

The data available under Sensor Voltages is:

Item Checked	Result Unit
Battery voltage	Volts
Voltage from ignition switch to ECM	Volts
Air temperature sensor voltage	Volts
Coolant temperature sensor voltage	Volts
Atmospheric pressure sensor voltage	Volts
Manifold absolute pressure sensor 1 voltage	Volts
Manifold absolute pressure sensor 2 voltage	Volts
Throttle position sensor voltage	Volts
Fuel level sensor voltage	Volts
Oxygen sensor output 1 voltage	Volts
Oxygen sensor output 2 voltage	Volts
Exhaust butterfly valve sensor voltage†	Volts

† Applies to models fitted with an exhaust butterfly valve only. All other models will show **Not Applicable** in this field.

Sensor Readings

The data available under Sensor Readings is:

Item Checked	Result Unit
Air temperature	°C
Coolant temperature	°C
Ambient air pressure	mmHg
Manifold absolute pressure (one reading per cylinder)	mmHg
Low fuel light	on/off
Oxygen sensor 1 heater status	on/off
Oxygen sensor 2 heater status	on/off
Exhaust butterfly valve sensor voltage†	%

† Applies to models fitted with an exhaust butterfly valve only. All other models will show **Not Applicable** in this field.

Injector Data

The data available under Injector Data is:

Item Checked	Result Unit
Injector 1 pulse time	milliseconds
Injector 2 pulse time	milliseconds

Ignition Data

The data available under Ignition Data is:

Item Checked	Result Unit
Ignition timing cyl 1	degrees BTDC
Ignition timing cyl 2	degrees BTDC
Coil 1 dwell time	milliseconds
Coil 2 dwell time	milliseconds

Fuel System And Engine Management

Idle Speed and Throttle Data

The data available under Idle Speed and Throttle Data is:

Item Checked	Result Unit
Engine speed	rpm
Idle reference speed	rpm
Idle speed control current steps	numeric
Idle speed control target steps	numeric
Throttle position	% open
Secondary air injection status ‡	SAI on/off

‡ Applies to models fitted with secondary air injection only. All other models will show **Not Applicable** in this field.

Inputs

The data available under Inputs is:

Item Checked	Result Unit
Starter switch status	switch on/off
Side stand status	up/down
Fall detection switch status	normal/over
Clutch switch status	release/grip
Neutral switch status	gear/neutral
Gear position status	numeric value or neutral
Vehicle speed	km/h
Calculated load	%

Outputs

The data available under Outputs is:

Item Checked	Result Unit
EMS main relay status	relay on/off
Fuel pump relay status	on/off
Starter relay status	starter on/off
Malfunction indicator light status	MIL on/off
Cooling fan status	fan on/off
Purge valve duty cycle	%
Accessory control relay status	relay on/off
Headlight relay status	headlight on/off

Adaption Status

Because the fuel system is adaptive, the engine management system is able to automatically adjust to new working conditions, such as changes in altitude, component wear, air leaks etc. This screen displays information on the adaption status of the vehicle which will show if it has adapted or not.

Function Examined	Report Method
Closed Throttle Position Adapted	adapted/not adapted
Idle speed control adaption status	%
Oxygen sensor 1 adaption range (off idle)	%
Oxygen sensor 1 adaption range (idle)	%

Function Examined	Report Method
Oxygen sensor 1 adaption status (off idle)	%
Oxygen sensor 1 adaption status (idle)	%
Oxygen sensor 2 adaption range (off idle)	%
Oxygen sensor 2 adaption range (idle)	%
Oxygen sensor 2 adaption status (off idle)	%
Oxygen sensor 2 adaption status (idle)	%

Function Tests

The system allows the diagnostic software 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 others, if faults are present, DTCs will be logged.

The Function Tests available are:

Function Examined	Report Method
Instrument Panel	Observe instrument panel, refer to Service Manual
Idle Air Control Stepper Motor †	Observe throttle position/Stored fault code*
Purge Valve	Listen for valve operation/Stored fault code*
Fuel Pump - Priming	Listen for fuel pump operation/Stored fault code*
Fuel Pump - Continuous Operation	Fuel pressure test/Listen for fuel pump operation/Stored fault code*
Cooling Fan Control	Observe the cooling fan/Stored fault code*
Secondary Air Injection†	Listen for valve operation/Stored fault code*
Exhaust Butterfly Valve Actuator †	Listen or observe for exhaust butterfly valve actuator operation/Stored fault code*

* If a fault is detected.

†Test will only be displayed if the component is fitted.

Adjust Tune

Using the Triumph diagnostic software, it is possible to:

- reset the adaptations
- balance the throttle bodies.

To reset the adaptations, see Engine Management System, page 284

Freeze-Frame Data

Freeze-frame data is stored at the time a DTC is recorded (confirmed) by the ECM. If multiple DTCs are recorded, the freeze-frame data which is stored will relate to the first recorded DTC only.

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

Function Examined	Result Reported (Scale)
DTC	Diagnostic Trouble Code (DTC) number
Fuel system status 1	open or closed loop operation
Fuel system status 2	open or closed loop operation
Calculated load	%
Coolant temperature	°C
Short term fuel trim - bank 1	%
Short term fuel trim - bank 2	%
Intake manifold absolute pressure	mmHg

Fuel System And Engine Management

Function Examined	Result Reported (Scale)
Engine speed	rpm
Vehicle speed	km/h
Ignition advance	degrees
Intake air temperature	°C
Throttle position	%
Oxygen sensor 1 output voltage	Volts
Oxygen sensor 1 short term fuel trim	%
Oxygen sensor 2 output voltage	Volts
Oxygen sensor 2 short term fuel trim	%

Cruise Control Switch Check

The cruise control switch check is required after certain DTCs or defects have been repaired which relate to the ride by wire system or cruise control system, or after the adaptations have been reset. The switch check requires the user to operate the switches in order, following the instructions on screen.

The following switches will be checked:

- Front brake switch
- Rear brake switch
- Twist grip cruise cancel switch (operated by holding the twist grip in the fully closed position)
- Cruise control ON/OFF switch

A malfunction of any switch will not necessarily cause a DTC to be stored and may prevent the cruise control from operating correctly.

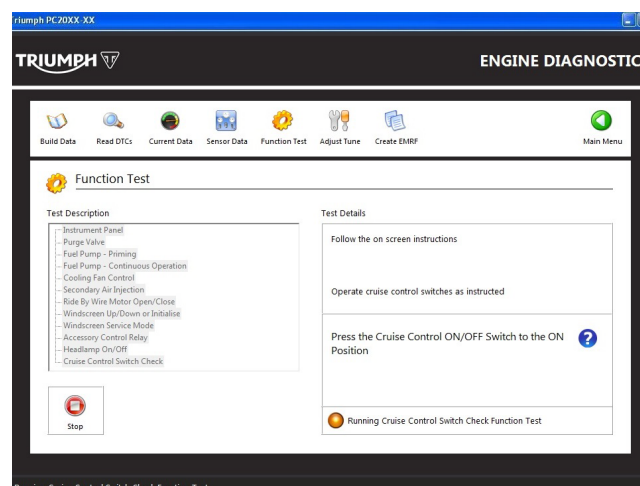
Note:

- If the cruise control switch check is not carried out, the green cruise control warning light will illuminate when the ignition is turned to the ON position but the cruise function will be disabled.

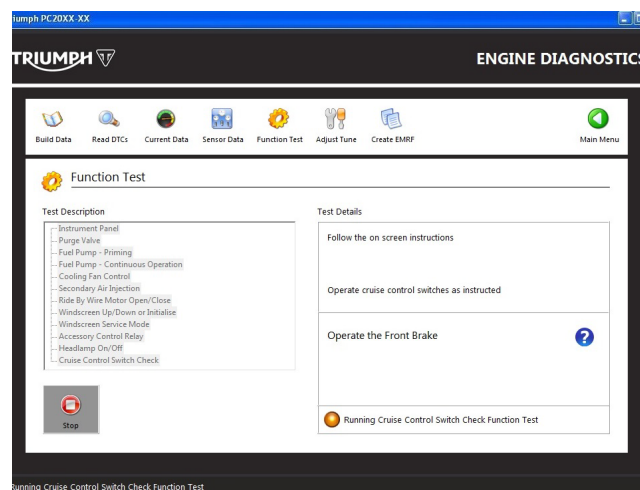
Cruise Control Switch Check Function

If the engine is running you will be prompted to turn it off before the test will start.

If the cruise control is turned on, you will be prompted to turn it off before the test will start.



Follow the on-screen instructions to operate and then release each switch in turn.



Instrument Panel Function Test

On the diagnostic software navigate to and select the 'FUNCTIONS TESTS' option.

Click the start button and observe the instruments for the following:

- Tachometer needle moves to 5,000 rpm
- Speedometer needle moves to 60 mph
- The neutral indicator, fuel warning light and malfunction indicator light (MIL) lights alternate on and off
- Fuel gauge goes to full then increments down to zero
- The gear position display will sequentially display the following, -, 1, N, 4, 5, N, 1 then 2
- End of test. Instruments return to normal operation.

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 software 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 software.

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	Pinpoint test page number
P0030	Oxygen sensor 1 heater open circuit or short to ground	3	40	Yes	Oxygen Sensor Heater, page 334
P0032	Oxygen sensor 1 heater short circuit to battery Voltage	3	40	Yes	Oxygen Sensor Heater, page 334
P0050	Oxygen sensor 2 heater open circuit or short to ground	3	40	Yes	Oxygen Sensor Heater, page 334
P0052	Oxygen sensor 2 heater short circuit to battery Voltage	3	40	Yes	Oxygen Sensor Heater, page 334
P0105	Manifold absolute pressure sensor 1 open circuit or short circuit to 5 Volt sensor supply	3	40	Yes	Manifold Absolute Pressure (MAP) Sensor, page 346
P0107	Manifold absolute pressure sensor 1 short circuit to ground	3	40	Yes	Manifold Absolute Pressure (MAP) Sensor, page 346
P0110	Intake air temperature sensor open circuit or short circuit to 5 Volt sensor supply	3	40	Yes	Inlet Air Temperature Sensor, page 324
P0112	Intake air temperature sensor short circuit to ground	3	40	Yes	Inlet Air Temperature Sensor, page 324

Fuel System And Engine Management

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	Pinpoint test page number
P0115	Engine coolant temperature sensor open circuit or short circuit to 5 Volt sensor supply	3	40	Yes	Coolant Temperature Sensor, page 320
P0117	Engine coolant temperature sensor short circuit to ground	3	40	Yes	Coolant Temperature Sensor, page 320
P0120	Throttle position sensor 1 short circuit to battery Voltage or open circuit	3	40	Yes	Throttle Position Sensor, page 314
P0122	Throttle position sensor 1 short circuit to ground	3	40	Yes	Throttle Position Sensor, page 314
P0130	Oxygen sensor 1 open circuit or short circuit to battery Voltage	3	40	Yes	Oxygen Sensor, page 332
P0131	Oxygen sensor 1 short circuit to ground	3	40	Yes	Oxygen Sensor, page 332
P0150	Oxygen sensor 2 circuit open circuit or short circuit to battery Voltage	3	40	Yes	Oxygen Sensor, page 332
P0151	Oxygen sensor 2 short circuit to ground	3	40	Yes	Oxygen Sensor, page 332
P0201	Injector 1 circuit malfunction	3	40	Yes	Fuel Injectors, page 312
P0202	Injector 2 circuit malfunction	3	40	Yes	Fuel Injectors, page 312
P0220	Throttle position sensor 2 short circuit to battery Voltage or open circuit	3	40	Yes	Throttle Position Sensor, page 314
P0222	Throttle position sensor 2 short circuit to ground	3	40	Yes	Throttle Position Sensor, page 314
P0335	Crankshaft sensor circuit malfunction	3	40	Yes	Crankshaft Sensor, page 310
P0351	Ignition coil 1 malfunction	3	40	Yes	Ignition Coils, page 318

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	Pinpoint test page number
P0352	Ignition coil 2 malfunction	3	40	Yes	Ignition Coils, page 318
P0443	Purge valve short circuit to ground or open circuit	3	40	Yes	Purge Valve, page 316
P0459	Purge valve short circuit to battery Voltage	3	40	Yes	Purge Valve, page 316
P0460	Fuel level sensor circuit malfunction	3	40	No	Fuel Level Sensor Circuit, page 350
P0500	Vehicle speed sensor malfunction	3	40	Yes	Vehicle Speed Sensor, page 382
P0560	System Voltage - battery circuit malfunction	3	40	Yes	System Voltage, page 328
P056C	Twist grip cruise cancel switch circuit malfunction	3	40	Yes	Twist Grip Cruise Cancel Switch Circuit Malfunction, page 372
P0571	Brake 1 switch malfunction	3	40	Yes	Brake Switches, page 370
P0603	EEPROM Error	0	40	No	EEPROM Error, page 376
P0606	ECM internal error	0	0	Yes	Engine ECM Internal Error, page 376
P0616	Starter relay short circuit to ground or open circuit	3	40	Yes	Starter Motor Relay, page 336
P0617	Starter relay short circuit to battery Voltage	3	40	Yes	Starter Motor Relay, page 336
P0914	Gear position sensor short circuit to ground or open circuit	3	40	Yes	Gear Position Sensor, page 348
P0917	Gear position sensor short circuit to 5 Volt sensor supply	3	40	Yes	Gear Position Sensor, page 348
P1105	Manifold absolute pressure sensor 1 pipe malfunction	3	40	Yes	Manifold Absolute Pressure (MAP) Sensor, page 346
P1131	Oxygen sensor circuits reversed	3	40	Yes	Oxygen Sensor Reverse Connection, page 376

Fuel System And Engine Management

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	Pinpoint test page number
P1135	Traction Control prevented due to ABS malfunction	3	40	Yes	Traction Control Prevented Due to ABS Malfunction, page 376
P1231	Fuel pump relay short circuit to ground or open circuit	3	40	Yes	Fuel Pump Relay, page 326
P1232	Fuel pump relay short circuit to battery Voltage	3	40	Yes	Fuel Pump Relay, page 326
P1508	Unmatched immobiliser ECM	3	40	Flashing	Immobiliser and TPMS Control Module ID Incompatable, page 377
P1520	Unmatched ABS module	3	40	Flashing	ABS Modulator ID Incompatible, page 377
P1521	CAN fault - lost communication with ABS module or ABS system status error	3	40	Yes	ABS Modulator Communication, page 368
P1552	Cooling fan relay short circuit to ground or open circuit	3	40	Yes	Cooling Fan Relay, page 330
P1553	Cooling fan relay short circuit to battery Voltage or over temp	3	40	Yes	Cooling Fan Relay, page 330
P1571	Brake 2 switch malfunction	3	40	Yes	Brake Switches, page 370
P1574	Cruise Control Prevented Due to Other Malfunction	3	40	Yes	Cruise Control Prevented Due to Other Malfunction, page 372
P1575	Cruise Control disabled until button press sequence completed	3	40	Yes	Cruise Control Disabled Until Button Press Sequence Completed, page 372
P1576	Brake 1 switch correlation error with brake switch 2	3	40	Yes	Brake Switches, page 370
P1577	Brake 2 switch correlation error with brake switch 1	3	40	Yes	Brake Switches, page 370
P1604	ECM tamper detected - return to Triumph	0	0	Yes	Engine ECM Tamper Detected, page 378

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	Pinpoint test page number
P1605	ECM locked by the tune lock function	Only if tune lock is unlocked		Flashing	Tune Lock, page 376
P1607	ECM ride by wire internal error	3	40	Yes	Engine ECM Internal Error, page 376
P1608	ECM ride by wire internal error	3	40	Yes	Engine ECM Internal Error, page 376
P1614	Instrument ID incompatible	Only if Instrument ID Matching		Flashing	Instrument ID Incompatible, page 377
P1619	Headlamp relay short circuit to ground or open circuit	0	40	No	Headlight Relay, page 374
P1620	Headlamp relay short circuit to battery Voltage	0	40	No	Headlight Relay, page 374
P1631	Fall detection circuit short circuit to ground	3	40	Yes	Fall Detection Switch, page 338
P1632	Fall detection circuit short circuit to battery Voltage	3	40	Yes	Fall Detection Switch, page 338
P1650	CAN fault - lost communication with Immobiliser ECM	3	40	Yes	Immobiliser Control Module Communication, page 366
P1659	Ignition power supply malfunction	3	40	Yes	EMS Ignition Voltage Input Circuit, page 354
P1685	Main relay circuit malfunction	3	40	Yes	EMS Main Relay Circuit, page 352
P1690	CAN Fault	3	40	Yes	CAN Communication, page 340
P1695	CAN fault - lost communication with Instrument panel	0	40	No	Instrument Communication (CAN), page 342
P1698	5 Volt sensor supply malfunction	3	40	Yes	5 Volt Sensor Supply Circuit, page 356
P2100	Throttle actuator control motor open circuit	3	40	Yes	Throttle Actuator Motor, page 364
P2102	Throttle actuator control internal motor relay does not operate	3	40	Yes	Throttle Valve Drive Error, page 376

Fuel System And Engine Management

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	Pinpoint test page number
P2103	Throttle actuator control internal motor relay operates continually	3	40	Yes	Throttle Valve Drive Error, page 376
P2111	Throttle valve drive error (stuck open)	3	40	Yes	Throttle Valve Drive Error, page 376
P2119	Throttle valve drive error	3	40	Yes	Throttle Valve Drive Error, page 376
P2120	Twist grip position sensor 1 short circuit to ground or open circuit	3	40	Yes	Twist Grip Position 1, page 358
P2123	Twist grip position sensor 1 short circuit to battery Voltage	3	40	Yes	Twist Grip Position 1, page 358
P2125	Twist grip position sensor 2 short circuit to ground or open circuit	3	40	Yes	Twist Grip Position 2, page 362
P2128	Twist grip position sensor 2 short circuit to battery Voltage	3	40	Yes	Twist Grip Position 2, page 362
P2135	Throttle position sensor 1 correlation error with throttle position sensor 2	3	40	Yes	Throttle Position Sensor, page 314
P2138	Twist grip position sensor 1 correlation error with twist grip position sensor 2	3	40	Yes	Twist Grip Position Sensor 1 Correlation Error with Twist Grip Position 2, page 360
P2226	Ambient air pressure sensor circuit open circuit or short circuit to 5 Volt sensor supply	3	40	Yes	Ambient Air Pressure Sensor, page 344
P2228	Ambient air pressure sensor circuit short circuit to ground	3	40	Yes	Ambient Air Pressure Sensor, page 344

Immobiliser Control Module Diagnostic Trouble Codes

Diagnostic trouble codes (DTCs) are logged in the immobiliser/TPMS control module memory when there is a confirmed fault in the system.

The codes are reported to the Triumph Diagnostic Tool as a four digit code.

The system will log the Diagnostic Trouble Codes listed below:

Diagnostic Code (DTC)	Trouble	Fault Description	Warning Light/Information
L0008		Invalid key: Key authentication unsuccessful	Alarm/Immobiliser light ON

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**

For example, the engine electronic control module (engine 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 engine 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.

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 the Engine ECM Connectors

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.

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.

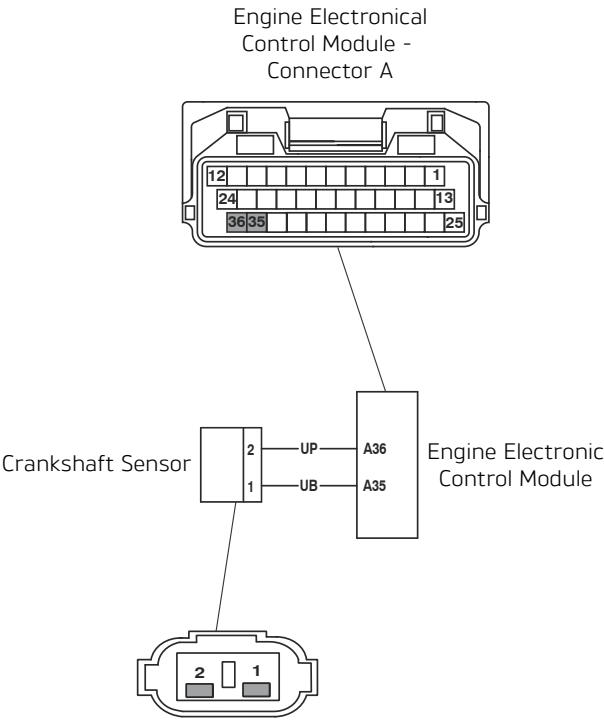
Crankshaft Sensor

Fault Code	Possible cause	Action
P0335	Crankshaft sensor circuit malfunction	View and note diagnostic software 'freeze-frame' data if available. Ensure sensor is fitted correctly and connector is secure. Disconnect the engine ECM and proceed to pinpoint test 1:

Pinpoint Tests

Test	Result	Action
1 Check terminal and cable integrity: - ECM pin A35 - ECM pin A36	OK	Disconnect sensor and proceed to test 2
	Faulty	Rectify fault, proceed to test 6
2 Check cable for short circuit: - ECM pin A35 to ground - ECM pin A36 to ground	OK	Proceed to test 3
	Short circuit	Locate and rectify wiring fault, proceed to test 6
3 Check cable continuity: - ECM pin A35 to sensor pin 1 - ECM pin A36 to sensor pin 2	OK	Proceed to test 4
	Open circuit	Locate and rectify wiring fault, proceed to test 6
4 Check cable for short circuit: - ECM pin A35 to ECM pin A36	OK	Proceed to test 5
	Short circuit	Locate and rectify wiring fault, proceed to test 6
5 Check crankshaft toothed wheel: - Damage to teeth - magnetic debris contamination	OK	Renew crankshaft sensor, 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



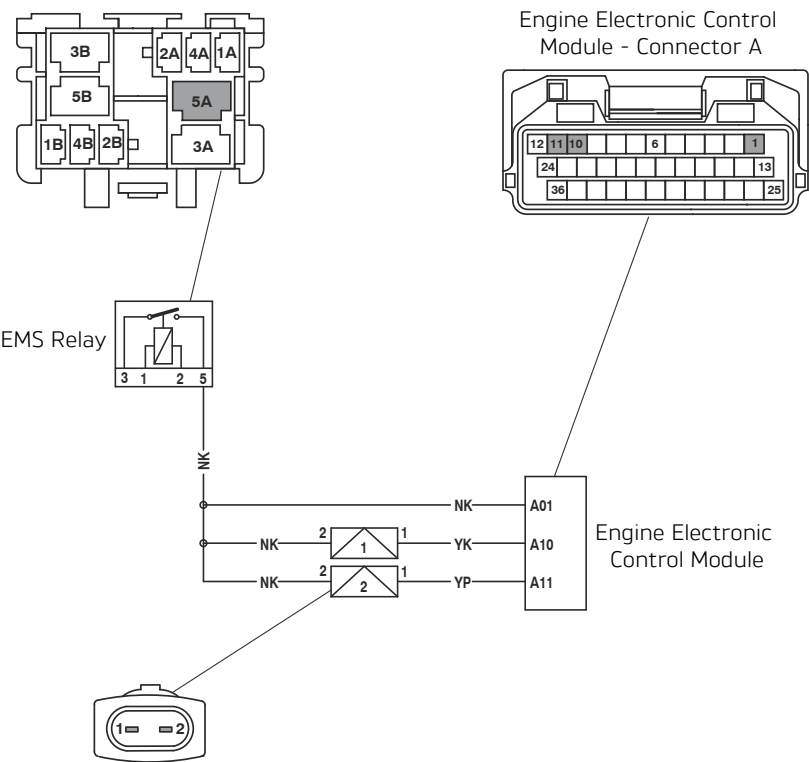
Fuel Injectors

Fault Code	Possible cause	Action
P0201	Injector 1 circuit malfunction	View and note diagnostic software 'freeze-frame' data if available. Ensure relevant injector connector is secure. Disconnect the engine ECM and proceed to pinpoint test 1:
P0202	Injector 2 circuit malfunction	

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity: - ECM pin A10 - ECM pin A11	OK	Proceed to test 2
	Faulty	Rectify fault, proceed to test 7
2 Check resistance value: - ECM pin A01 to ECM pin A10 (injector 1) - ECM pin A01 to ECM pin A11 (injector 2)	11.4 to 13 Ohms	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: - ECM pin A10 to ground - ECM pin A11 to ground	OK	Proceed to test 7
	Short circuit	Locate and rectify wiring fault, proceed to test 7
4 Check cable continuity: - EMS relay pin 5 to relevant injector pin 2 - ECM pin A10 to injector 1 pin 1 - ECM pin A11 to injector 2 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: - ECM pin A01 to ECM pin A10 (injector 1) - ECM pin A01 to ECM pin A11 (injector 2)	OK	Proceed to test 6
	Short circuit	Locate and rectify wiring fault, proceed to test 7
6 Check relevant injector resistance: - Injector pin 1 to injector pin 2	11.4 to 12.6 Ohms	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



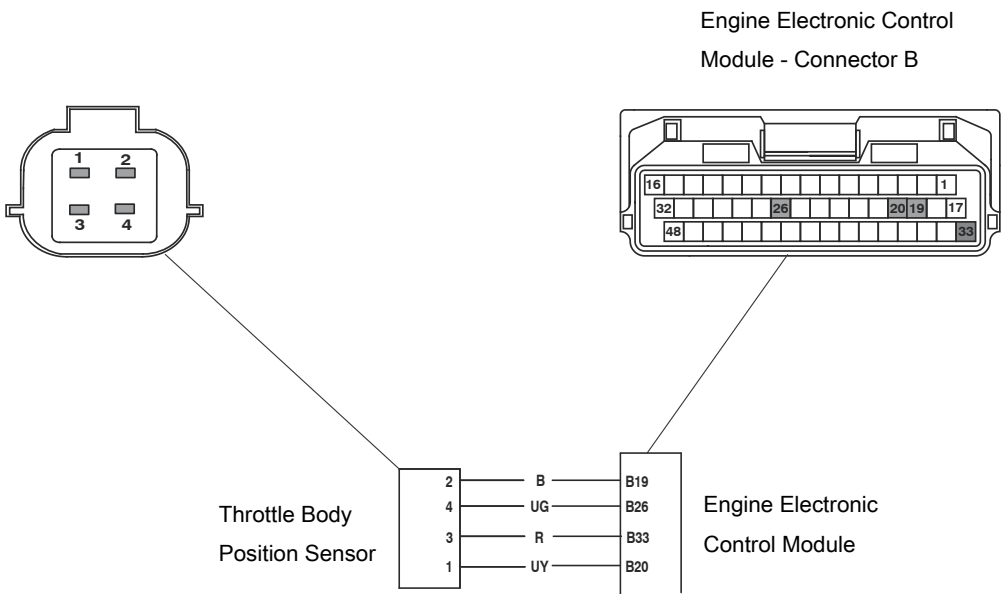
Throttle Position Sensor

Fault Code	Possible cause	Action
P0120	Throttle position sensor 1 short circuit to battery Voltage or open circuit	View and note diagnostic software 'freeze-frame' data if available. View and note diagnostic software 'sensor' data. Ensure throttle position sensor connector is secure. Disconnect the engine ECM and proceed to pinpoint test 1:
P0122	Throttle position sensor 1 short circuit to ground	
P0220	Throttle position sensor 2 short circuit to battery Voltage or open circuit	
P0222	Throttle position sensor 2 short circuit to ground	
P2135	Throttle position sensor 1 correlation error with throttle position sensor 2	

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity: - ECM pin B19 - ECM pin B33 - ECM pin B20 - ECM pin B26	OK	Disconnect sensor and proceed to test 2
	Faulty	Rectify fault, proceed to test 5
2 Check cable for short circuit: - ECM pin B20 to ground - ECM pin B26 to ground	OK	Proceed to test 3
	Short circuit	Locate and rectify wiring fault, proceed to test 5
3 Check cable continuity: - ECM pin B20 to throttle body connector pin 6 - ECM pin B20 to throttle position sensor connector pin 1 - ECM pin B26 throttle position sensor connector pin 4 - ECM pin B19 to throttle position sensor connector pin 2 - ECM pin B33 to throttle position sensor connector pin 3	OK	Proceed to test 4
	Open circuit	Locate and rectify wiring fault, proceed to test 5
4 Check cable for short circuit: - ECM pin B33 to ECM pin B20 - ECM pin B33 to ECM pin B26	OK	Renew the throttle body, 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



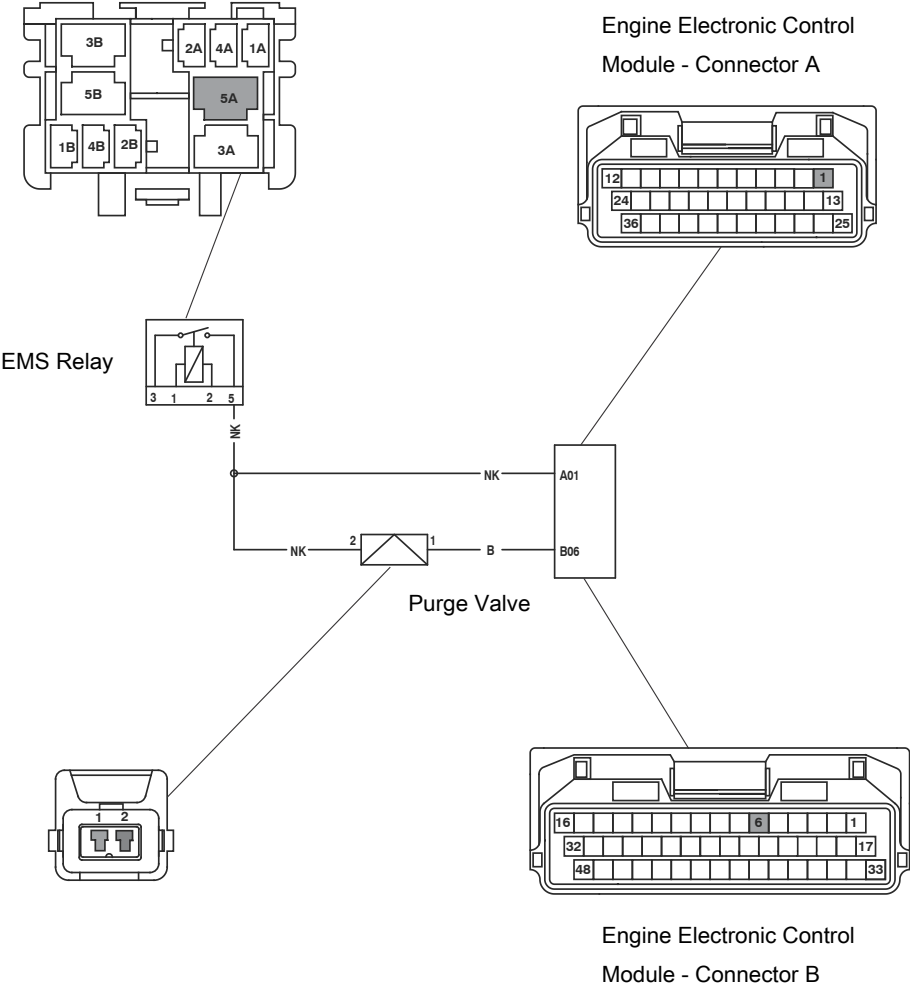
Purge Valve

Fault Code	Possible cause	Action
P0443	Purge valve short circuit to ground or open circuit	View and note diagnostic software 'sensor' data. Ensure purge valve connector is secure. Disconnect the engine ECM and proceed to pinpoint test 1:
P0459	Purge valve short circuit to battery Voltage	Disconnect the purge valve and proceed to pinpoint test 5:

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity: - ECM pin B06 - EMS relay pin 5	OK	Proceed to test 2
	Faulty	Rectify fault, proceed to test 7
2 Check resistance value: - ECM pin A01 to ECM pin B06	22 to 30 Ohms	Proceed to test 3
	Open circuit	Disconnect purge valve and proceed to test 4
	Short circuit	Disconnect purge valve and proceed to test 5
3 Check cable for short circuit: - ECM pin B06 to ground	OK	Proceed to test 7
	Short circuit	Locate and rectify wiring fault, proceed to test 7
4 Check cable continuity: - EMS relay pin 5 to valve pin 2 - ECM pin B06 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: - ECM pin A01 to ECM pin B06	OK	Proceed to test 6
	Short circuit	Locate and rectify wiring fault, proceed to test 7
6 Check purge valve resistance: - Valve pin 1 to valve pin 2	22 to 30 Ohms	Proceed to test 7
	Faulty	Renew purge valve, proceed to test 7
7 Reconnect harness, clear fault code and run diagnostic software function test to visually verify operation of purge valve.	OK	Action complete - quit test
	Fault still present	Contact Triumph service

Circuit Diagram



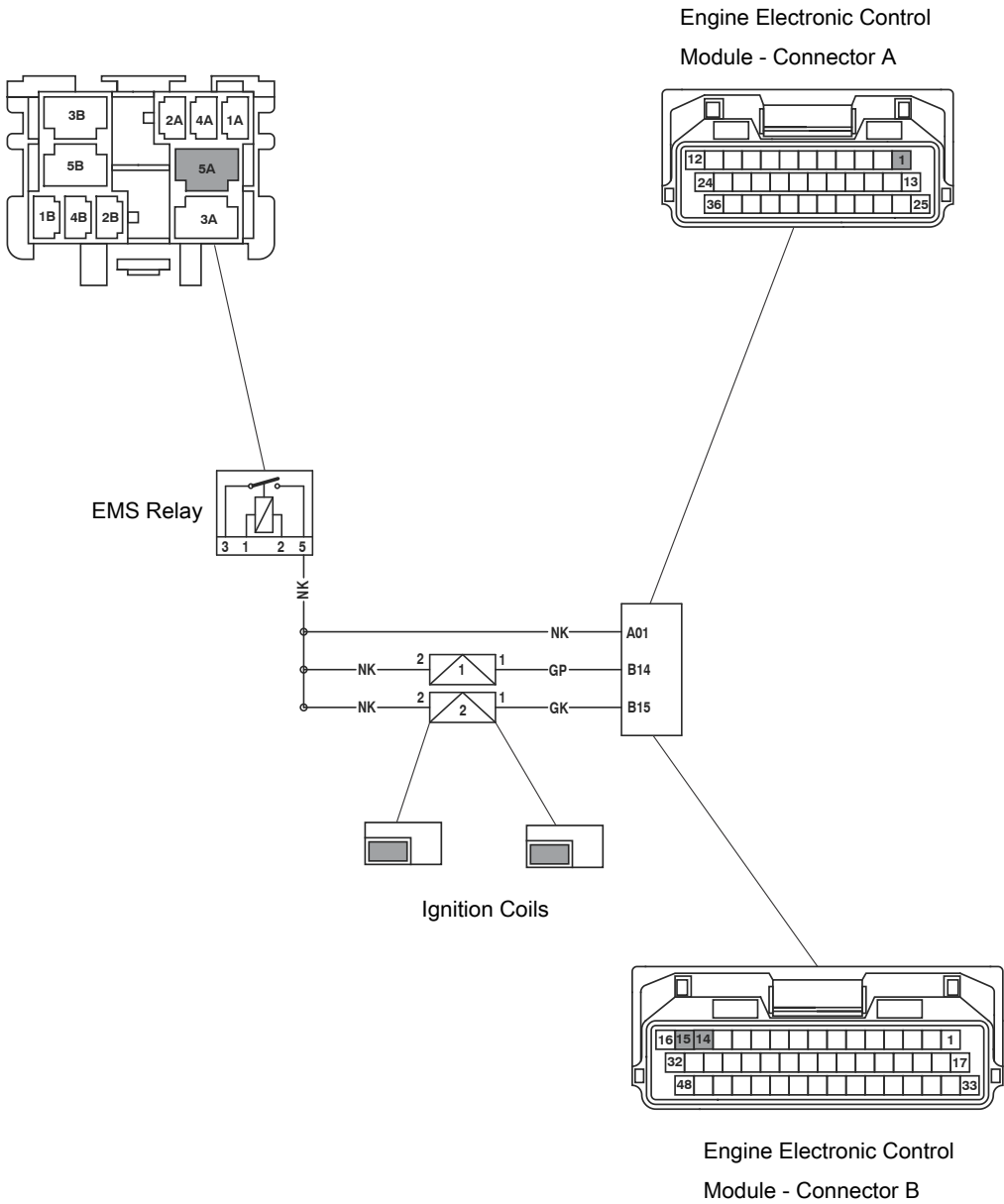
Ignition Coils

Fault Code	Possible cause	Action
P0351	Ignition coil 1 malfunction	View and note diagnostic software 'freeze-frame' data if available. Ensure relevant ignition coil connector is secure. Disconnect the engine ECM and proceed to pinpoint test 1:
P0352	Ignition coil 2 malfunction	

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity: - ECM pin B14 - ECM pin B15 - EMS relay pin 5	OK	Proceed to test 2
	Faulty	Rectify fault, proceed to test 7
2 Check resistance value: ECM pin A01 to - ECM pin B14 (ignition coil 1) - ECM pin B15 (ignition coil 2)	3.0 to 4.2 Ohms	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: - ECM pin B14 to ground - ECM pin B15 to ground	OK	Proceed to test 6
	Short circuit	Locate and rectify wiring fault, proceed to test 6
4 Check cable continuity: - EMS relay pin 5 to relevant ignition coil pin - ECM pin B14 to ignition coil 1 pin 1 - ECM pin B15 to ignition coil 2 pin 1	OK	Proceed to test 5
	Open circuit	Locate and rectify wiring fault, proceed to test 6
5 Check relevant ignition coil resistance: - Ignition coil pin 1 to ignition coil pin 2	3.0 to 4.2 Ohms	Proceed to test 6
	Faulty	Renew relevant ignition coil, 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



Coolant Temperature Sensor

Fault Code	Possible cause	Action
P0115	Engine coolant temperature sensor open circuit or short circuit to 5 Volt sensor supply	View and note diagnostic software 'freeze-frame' data if available. View and note diagnostic software 'sensor' data. Ensure sensor connector is secure. Disconnect the engine ECM and proceed to pinpoint test 1:
P0117	Engine coolant temperature sensor short circuit to ground	Disconnect temperature sensor and proceed to pinpoint test 6:

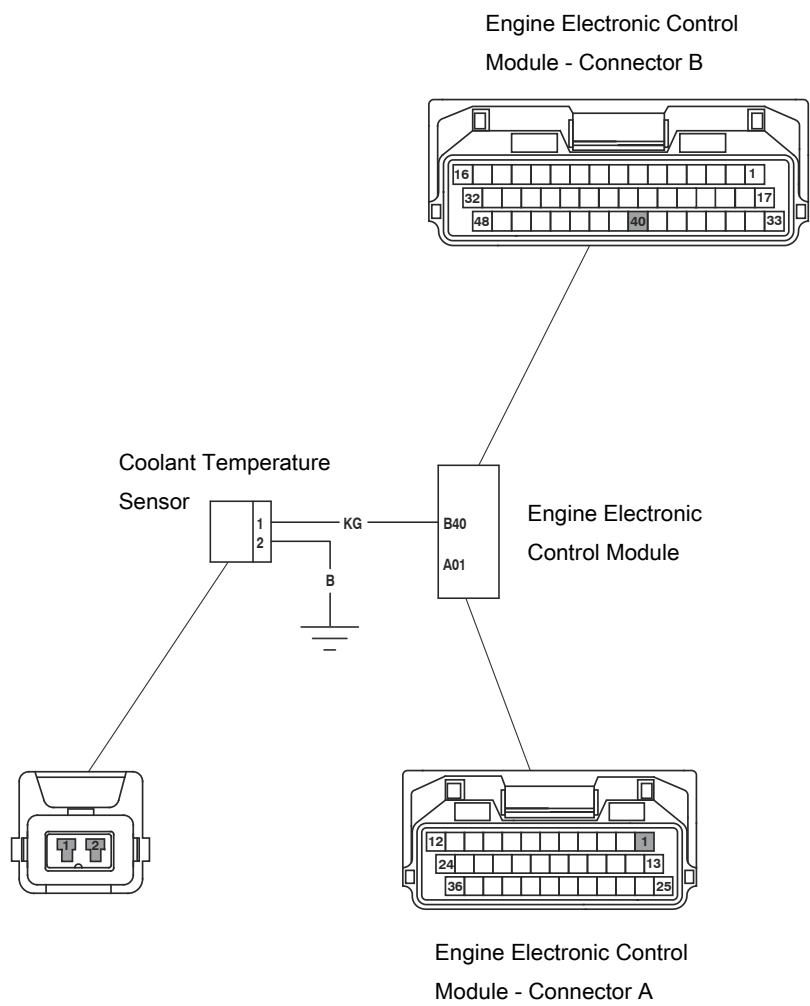
Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity: - ECM pin B40	OK	Proceed to test 2
	Faulty	Rectify fault, proceed to test 7
2 Check resistance value: - ECM pin B40 to ground (Temperature dependent - see overleaf)	OK	Proceed to test 6
	Open circuit	Disconnect temperature sensor and proceed to test 3
	Short circuit	Disconnect temperature sensor and proceed to test 4
3 Check cable continuity: - ECM pin B40 to sensor pin 1 - Ground 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: - ECM pin B40 to ECM pin A01	OK	Proceed to test 5
	Short circuit	Locate and rectify wiring fault, proceed to test 7
5 Check sensor resistance: - Sensor pin 1 to sensor pin 2 (Temperature dependent - see overleaf)	OK	Proceed to test 7
	Faulty	Renew temperature sensor, proceed to test 7
6 Check cable for short circuit: - ECM pin B40 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:

Cold engine:	Resistance Value
20°C ambient	2.22 to 2.71 K Ohms
-10°C ambient	8.50 to 10.25 K Ohms
Warm engine:	Resistance Value
-	100 to 400 Ohms

Circuit Diagram



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Inlet Air Temperature Sensor

Fault Code	Possible cause	Action
P0110	Intake air temperature sensor open circuit or short circuit to 5 Volt sensor supply	View and note diagnostic software 'freeze-frame' data if available. View and note diagnostic software 'sensor' data. Ensure sensor connector is secure. Disconnect the engine ECM and proceed to pinpoint test 1:
P0112	Intake air temperature sensor short circuit to ground	Disconnect the engine ECM and inlet air temperature sensor and proceed to pinpoint test 6:

Pinpoint Tests

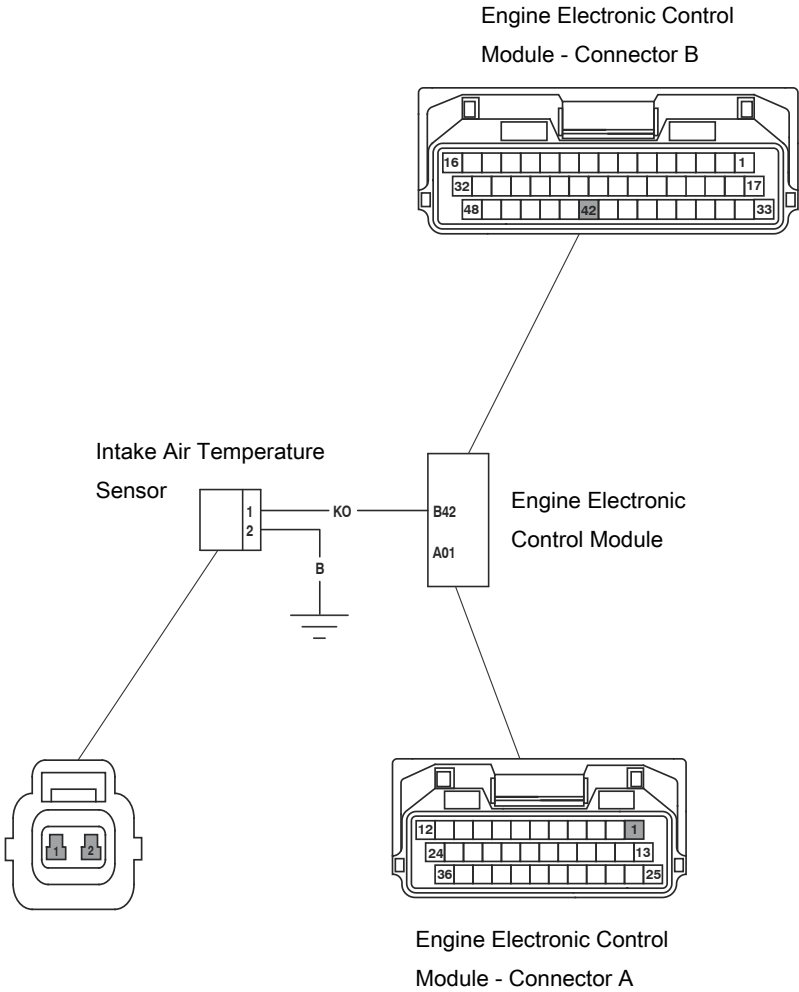
Test	Result	Action
1 Check cable and terminal integrity: - ECM pin B42	OK	Proceed to test 2
	Faulty	Rectify fault, proceed to test 7
2 Check resistance value: - ECM pin B42 to ground (Temperature dependent - see below)	OK	Proceed to test 6
	Open circuit	Disconnect temp sensor and proceed to test 3
	Short circuit	Disconnect temp sensor and proceed to test 4
3 Check cable continuity: - ECM pin B42 to sensor pin 1 - Ground 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: - ECM pin B42 to ECM pin A01	OK	Proceed to test 5
	Short circuit	Locate and rectify wiring fault, proceed to test 7
5 Check sensor resistance: - Sensor pin 1 to sensor pin 2 (Temperature dependent - see below)	OK	Proceed to test 7
	Faulty	Renew air temperature sensor, proceed to test 7
6 Check cable for short circuit: - ECM pin B42 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:

If engine is warm, remove the sensor and allow time to cool to ambient temperature prior to test.

Ambient Temperature	Resistance Value
80°C	200 to 400 Ohms
20°C	2.35 to 2.65 K Ohms
-10°C	8.50 to 10.25 K Ohms

Circuit Diagram



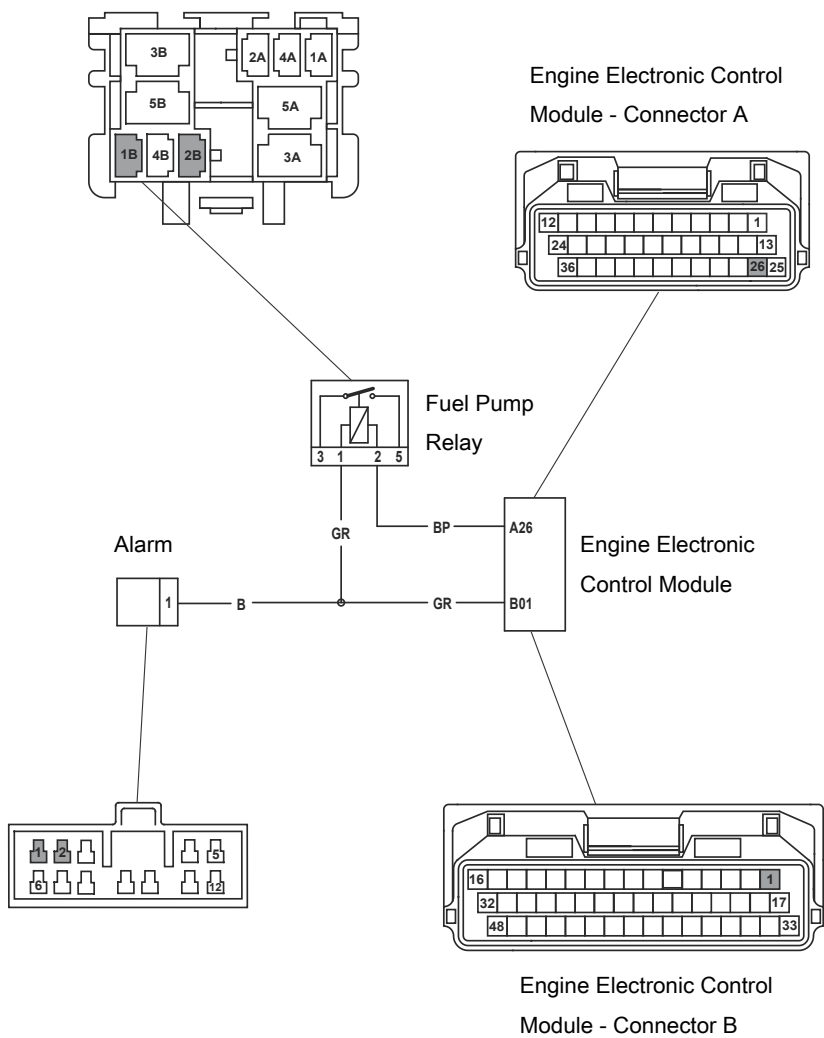
Fuel Pump Relay

Fault Code	Possible cause	Action
P1231	Fuel pump relay short circuit to ground or open circuit	Check if pump runs briefly when ignition is switched on. Ensure fuel pump relay connector is secure. Disconnect the engine ECM and proceed to pinpoint test 1:
P1232	Fuel pump relay short circuit to battery Voltage	Disconnect the engine ECM and fuel pump relay and proceed to pinpoint test 4:

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity: - ECM pin A26 - Alarm pin 1 - Alarm pin 2	OK	Disconnect fuel pump relay and proceed to test 2
	Faulty	Rectify fault, proceed to test 5
2 Check cable for short circuit: - ECM pin A26 to ground	OK	Proceed to test 3
	Short circuit	Locate and rectify wiring fault, proceed to test 5
3 Check cable continuity: - ECM pin A26 to fuel pump relay pin 2 - Alarm pin 1 to fuel pump relay pin 1	OK	Proceed to test 4
	Open circuit	Locate and rectify wiring fault, proceed to test 5
4 Check cable for short circuit: - ECM pin A26 to ECM pin A01	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 software function test to verify fault cleared.	OK	Action complete - quit test
	Fault still present	Contact Triumph service

Circuit Diagram



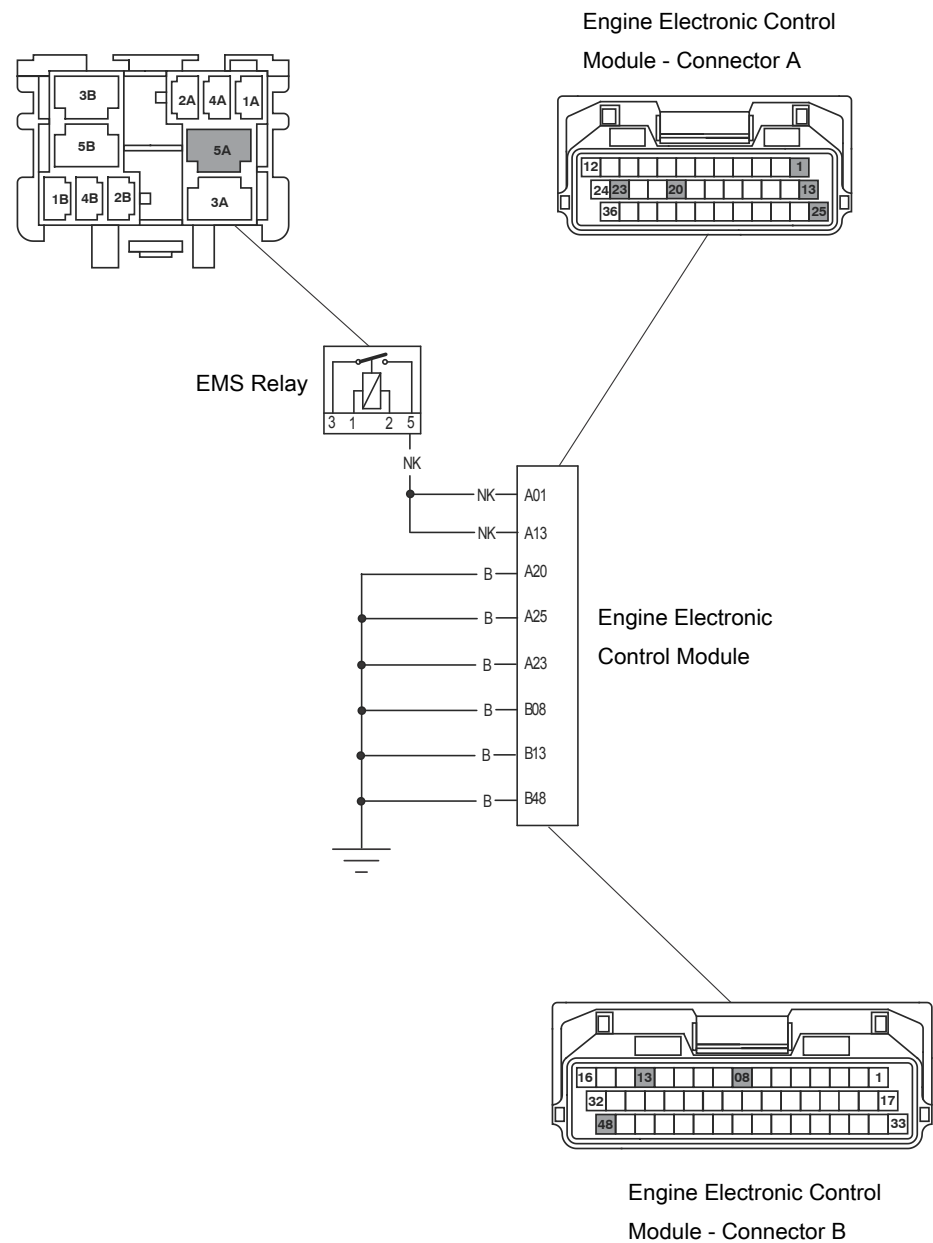
System Voltage

Fault Code	Possible cause	Action
P0560	System voltage - battery circuit malfunction	View and note diagnostic software 'sensor' data. Ensure voltage across battery is acceptable, note voltage.
		Disconnect the engine ECM and proceed to pinpoint test 1:

Pinpoint Tests

Test		Result	Action
1	Check cable and terminal integrity: - ECM pin A01 - ECM pin A13 - EMS relay pin 5	OK	Proceed to test 2
		Faulty	Rectify fault, proceed to test 3
2	With Ignition on check voltage at: - ECM pin A01	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



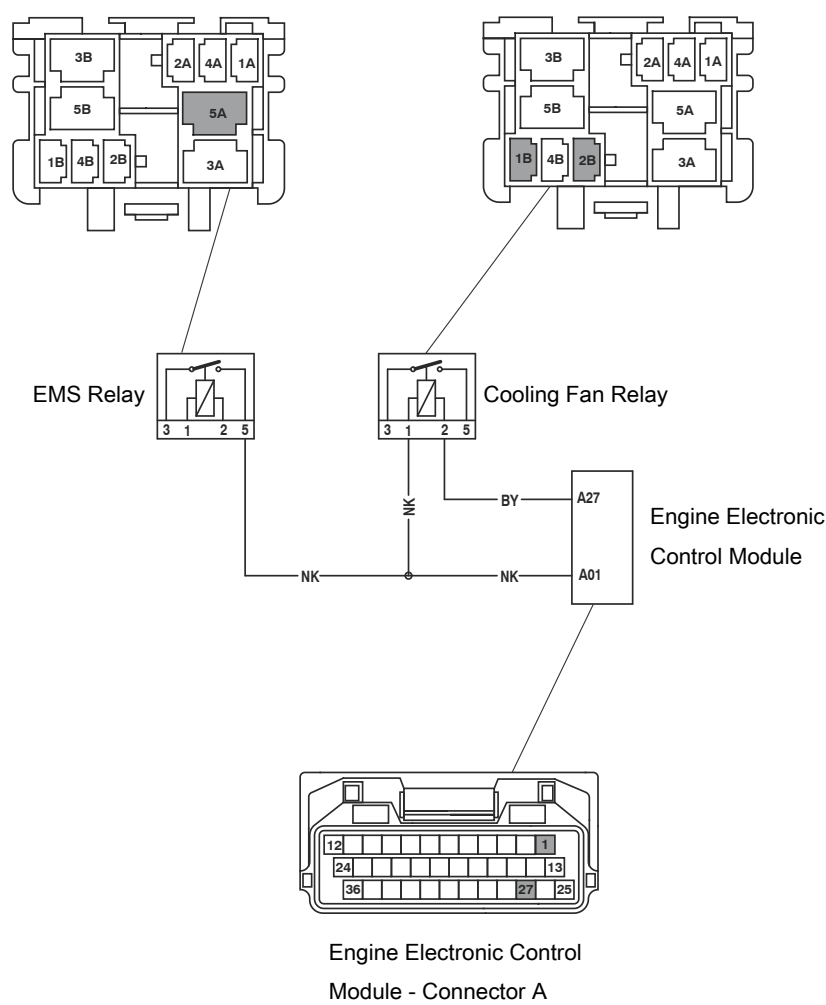
Cooling Fan Relay

Fault Code	Possible cause	Action
P1552	Cooling fan relay short circuit to ground or open circuit	View and note diagnostic software 'sensor' data. Ensure fan relay connector is secure. Disconnect the engine ECM and proceed to pinpoint test 1:
P1553	Cooling fan relay short circuit to battery Voltage or over temp	Disconnect the engine ECM and fan relay and proceed to pinpoint test 4:

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity: - ECM pin A27 - EMS relay pin 5	OK	Disconnect fan relay and proceed to test 2
	Faulty	Rectify fault, proceed to test 5
2 Check cable for short circuit: - ECM pin A27 to ground	OK	Proceed to test 3
	Short circuit	Locate and rectify wiring fault, proceed to test 5
3 Check cable continuity: - ECM pin A27 to fan relay pin 2 - EMS relay pin 5 to fan relay pin 1	OK	Proceed to test 4
	Open circuit	Locate and rectify wiring fault, proceed to test 5
4 Check cable for short circuit: - ECM pin A27 to ECM pin A01	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 software function test to visually verify operation of cooling fan.	OK	Action complete - quit test
	Fault still present	Contact Triumph service

Circuit Diagram



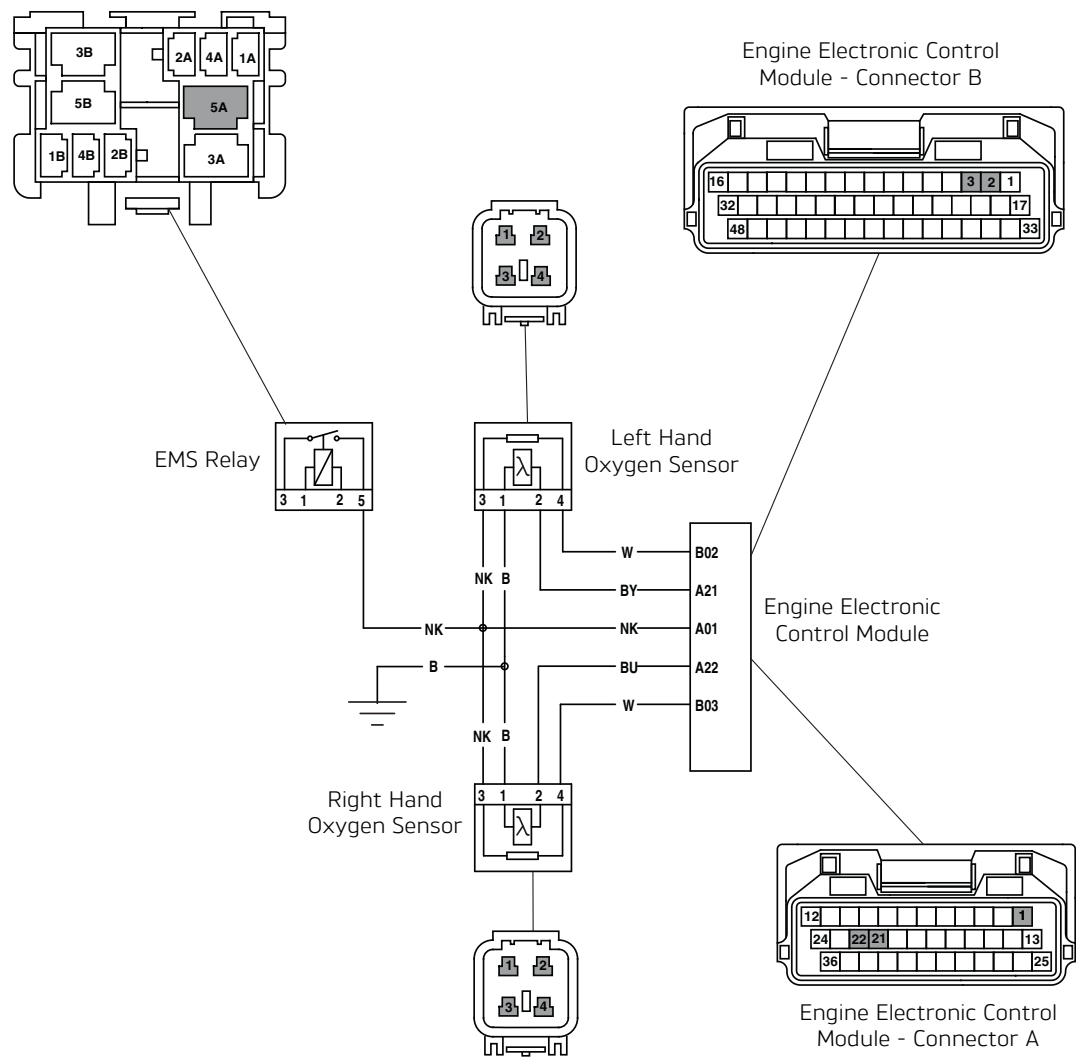
Oxygen Sensor

Fault Code	Possible cause	Action
P0130	Oxygen sensor 1 open circuit or short circuit to battery Voltage	View and note 'freeze-frame' data if available. View and note 'sensor' data. Ensure sensor connector is secure. Disconnect the engine ECM and proceed to pinpoint test 1:
P0131	Oxygen sensor 1 short circuit to ground	
P0150	Oxygen sensor 2 circuit open circuit or short circuit to battery Voltage	
P0151	Oxygen sensor 2 short circuit to ground	

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity: - ECM pin B02 - ECM pin B03 - EMS relay pin 5	OK	Disconnect oxygen sensors and proceed to test 2
	Faulty	Rectify fault, proceed to test 5
2 Check cable for short circuit: - ECM pin B02 to ground - ECM pin B03 to ground	OK	Proceed to test 3
	Short circuit	Locate and rectify wiring fault, proceed to test 4
3 Check cable continuity: - ECM pin B02 to left hand oxygen sensor pin 4 - ECM pin B03 to right hand oxygen sensor pin 4 - ECM pin A01 to relevant oxygen sensor pin 3	OK	Proceed to test 4
	Open circuit	Locate and rectify wiring fault, proceed to test 4
4 Check cable for short circuit: - ECM pin A01 to ECM pin B02 (left hand oxygen sensor) - ECM pin A01 to ECM pin B03 (right hand oxygen sensor)	OK	Renew relevant oxygen 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. Check adaption status.	OK	Action complete - quit test
	Fault still present	Contact Triumph service

Circuit Diagram



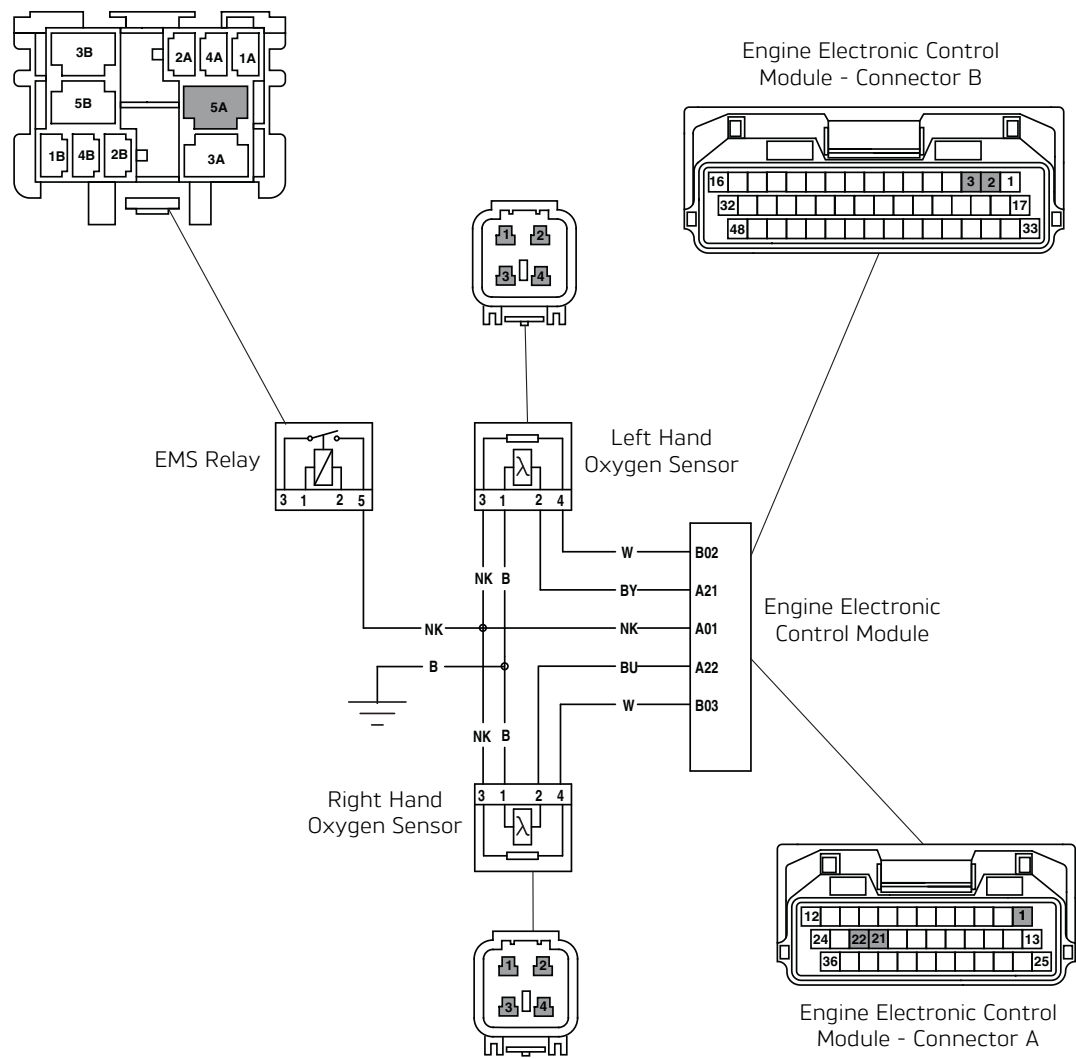
Oxygen Sensor Heater

Fault Code	Possible cause	Action
P0030	Oxygen sensor 1 heater open circuit or short to ground	View and note 'freeze-frame' data if available. View and note 'sensor' data. Ensure sensor connector is secure. Disconnect the engine ECM and proceed to pinpoint test 1:
P0050	Oxygen sensor 2 heater open circuit or short to ground	
P0032	Oxygen sensor 1 heater short circuit to battery Voltage	Disconnect oxygen sensor and proceed to pinpoint test 4:
P0052	Oxygen sensor 2 heater short circuit to battery Voltage	

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity: - ECM pin A21 - ECM pin A22	OK	Disconnect oxygen sensors and proceed to test 2
	Faulty	Rectify fault, proceed to test 5
2 Check cable for short circuit: - ECM pin A21 to ground - ECM pin A22 to ground	OK	Proceed to test 3
	Short circuit	Locate and rectify wiring fault, proceed to test 5
3 Check cable continuity: - ECM pin A21 to left hand oxygen sensor pin 2 - ECM pin A22 to right hand oxygen sensor pin 2	OK	Proceed to test 5
	Open circuit	Locate and rectify wiring fault, proceed to test 5
4 Check cable for short circuit: - ECM pin A01 to ECM pin A21 (left hand oxygen sensor) - ECM pin A01 to ECM pin A22 (right hand oxygen sensor)	OK	Renew relevant oxygen 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



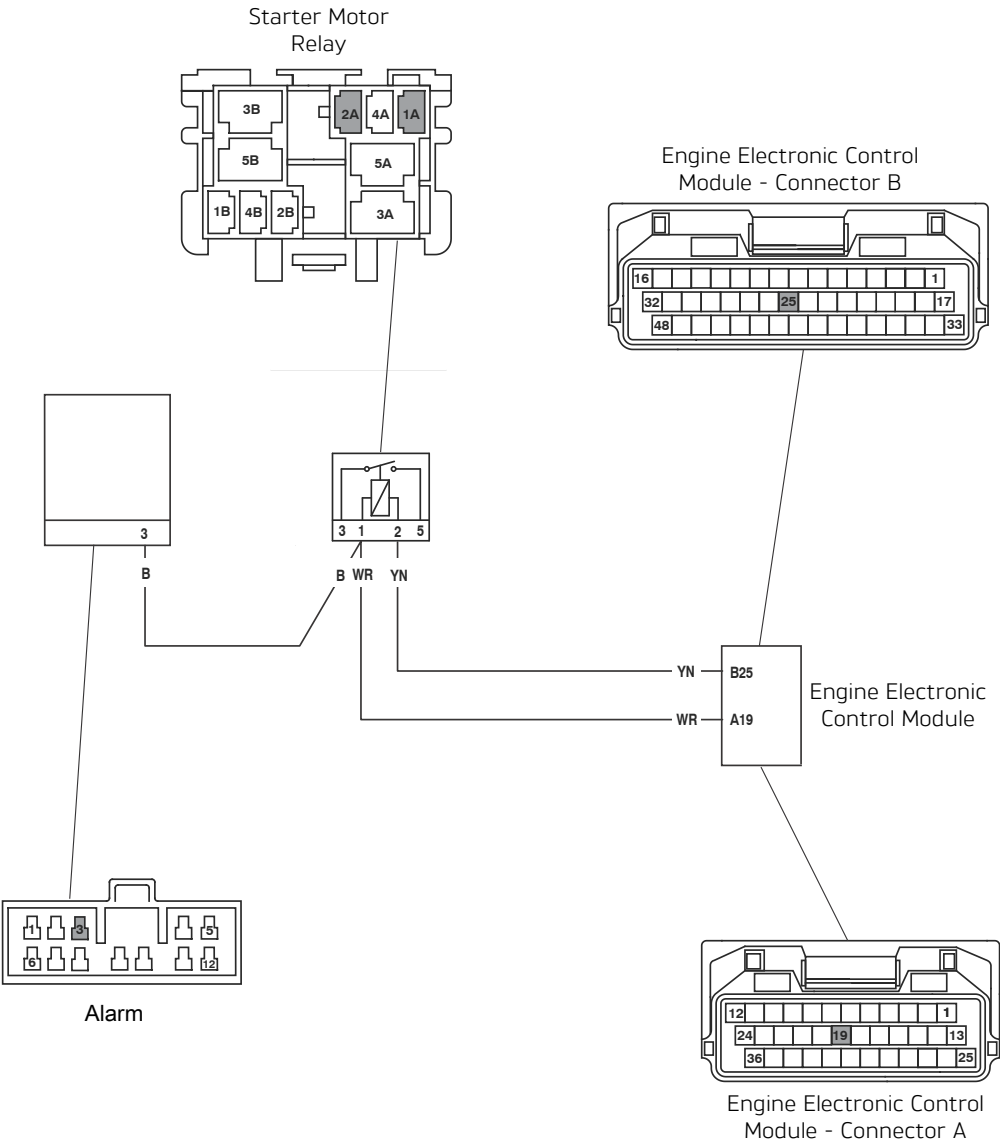
Starter Motor Relay

Fault Code	Possible cause	Action
P0616	Starter relay short circuit to ground or open circuit	Ensure starter motor relay connector is secure. Disconnect the engine ECM and proceed to pinpoint test 1:
P0617	Starter relay short circuit to battery Voltage	Disconnect the engine ECM and starter motor relay proceed to pinpoint test 4:

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity: - ECM pin B25 - ECM pin A19 - Starter Relay pin 1 - Starter Relay pin 2	OK	Disconnect starter relay and proceed to test 2
	Faulty	Rectify fault, proceed to test 5
2 Check cable for short circuit: - ECM pin B25 to ground - ECM pin A19 to ground	OK	Proceed to test 3
	Short circuit	Locate and rectify wiring fault, proceed to test 5
3 Check cable continuity: - ECM pin B25 to starter relay pin 2 - ECM pin A19 to starter relay pin 1	OK	Proceed to test 4
	Open circuit	Locate and rectify wiring fault, proceed to test 5
4 Check cable for short circuit: - ECM pin B25 to ECM pin A01	OK	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



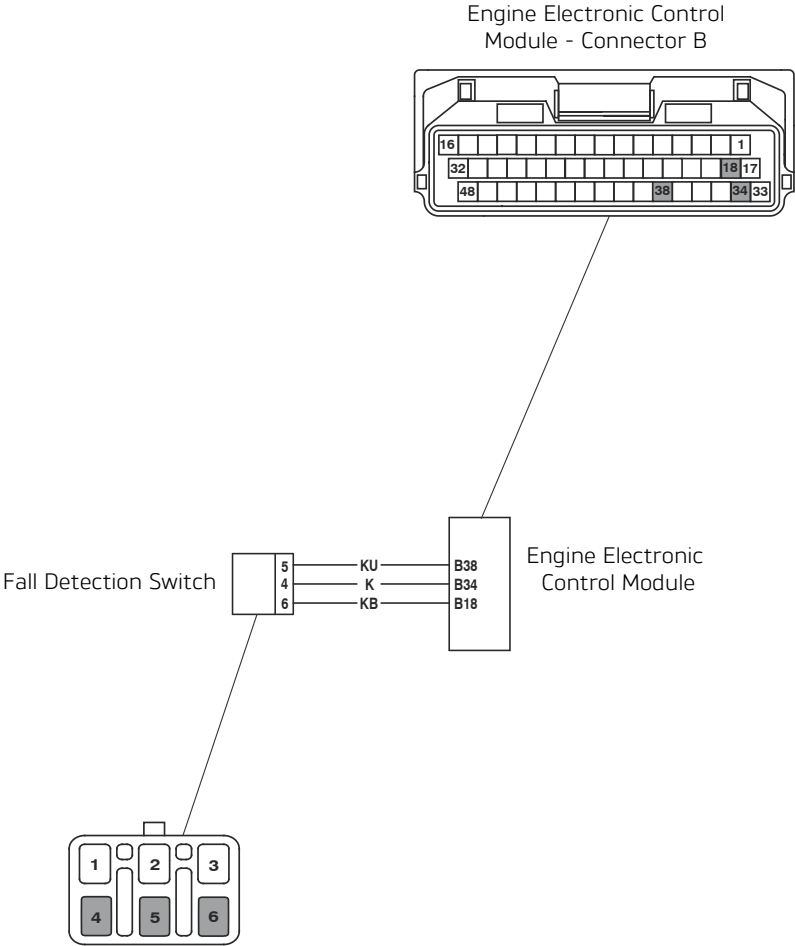
Fall Detection Switch

Fault Code	Possible cause	Action
P1631	Fall detection circuit short circuit to ground	View and note 'freeze-frame' data if available. View and note 'sensor' data. Ensure switch connector is secure. Disconnect the engine ECM and proceed to pinpoint test 1:
P1632	Fall detection circuit short circuit to battery Voltage	

Pinpoint Tests

Test		Result	Action
1	Check cable and terminal integrity: - ECM pin B18 - ECM pin B34 - ECM pin B38 - Sensor pin 4, 5, 6	OK	Disconnect sensor and proceed to test 2
		Faulty	Rectify fault, proceed to test 4
2	Check cable for short circuit: - ECM pin B38 to ECM pin B18 - ECM pin B38 to ECM pin B34	OK	Proceed to test 3
		Short circuit	Locate and rectify wiring fault, proceed to test 4
3	Check cable continuity: - ECM pin B34 to sensor pin 4 - ECM pin B18 to sensor pin 6	OK	Proceed to test 4
		Open circuit	Locate and rectify wiring fault, proceed to test 4
4	Reconnect harness, clear fault code.	OK	Action complete - quit test
		Fault still present	Contact Triumph service

Circuit Diagram



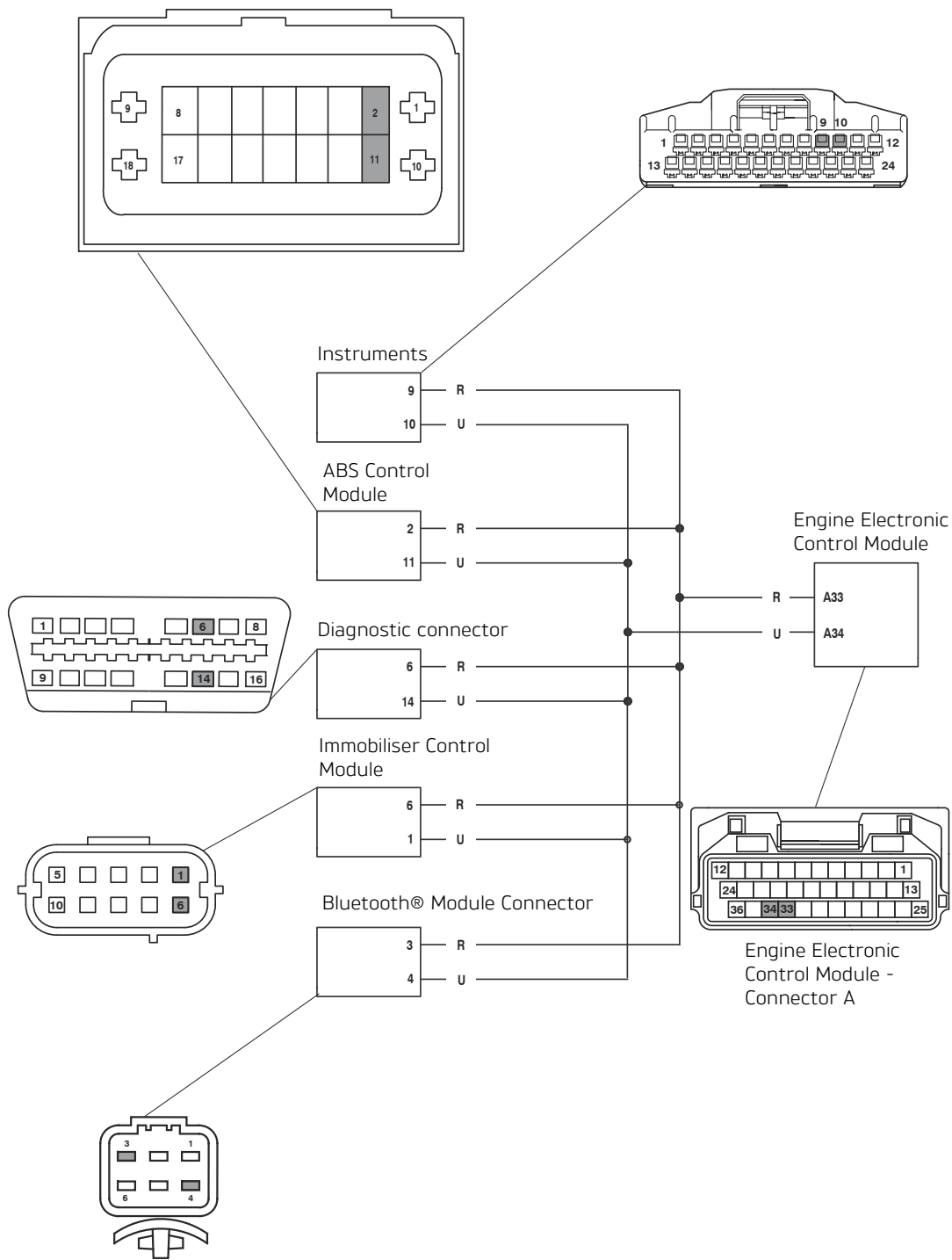
CAN Communication

Fault Code	Possible cause	Action
P1690	CAN Fault	View and note 'freeze-frame' data if available. View and note 'sensor' data. Ensure Instrument connector is secure. Disconnect the engine ECM and proceed to pinpoint test 1:

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity: - ECM pin A34 - ECM pin A33 - Instrument pin 9 - Instrument pin 10 - ABS module pin 2 - ABS module pin 11 - Immobiliser module pin 1 - Immobiliser module pin 6 - Bluetooth® module pin 3 ‡ - Bluetooth® module pin 4 ‡	OK	Disconnect instruments and proceed to test 2
	Faulty	Rectify fault, proceed to test 5
2 Check cable for short circuit: - ECM pin A34 to ground - ECM pin A33 to ground	OK	Proceed to test 3
	Short circuit	Locate and rectify wiring fault, proceed to test 5
3 Check cable continuity: - ECM pin A34 to Instrument pin 10 - ECM pin A33 to Instrument pin 9 - ECM pin A34 to ABS control module pin 11 - ECM pin A33 to ABS control module pin 2 - ECM pin A34 to Immobiliser module pin 1 - ECM pin A33 to Immobiliser module pin 6 - ECM pin A34 to Bluetooth® module pin 4 ‡ - ECM pin A33 to Bluetooth® module pin 3 ‡	OK	Proceed to test 4
	Open circuit	Locate and rectify wiring fault, proceed to test 5
4 Check cable for short circuit: - ECM pin A34 to ECM pin A33	OK	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
‡ Bluetooth® is an optional accessory.		

Circuit Diagram



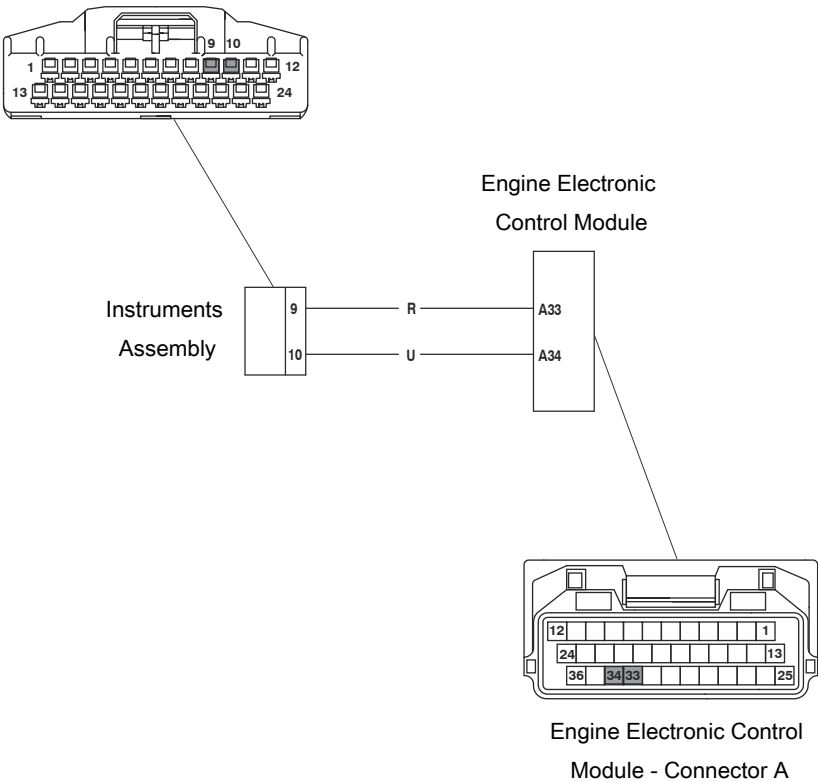
Instrument Communication (CAN)

Fault Code	Possible cause	Action
P1695	CAN fault - lost communication with Instrument panel	View and note 'freeze-frame' data if available. Disconnect the engine ECM and proceed to pinpoint test 1:

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity: - ECM pin A33 - ECM pin A34 - Instrument pin 9 - Instrument pin 10	OK	Disconnect instruments and proceed to test 2
	Faulty	Rectify fault, proceed to test 5
2 Check cable for short circuit: - ECM pin A33 to ground - ECM pin A34 to ground	OK	Proceed to test 3
	Short circuit	Locate and rectify wiring fault, proceed to test 5
3 Check cable continuity: - ECM pin A33 to Instrument pin 9 - ECM pin A34 to Instrument pin 10	OK	Proceed to test 4
	Open circuit	Locate and rectify wiring fault, proceed to test 5
4 Check cable for short circuit: - ECM pin A33 to ECM pin A34	OK	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



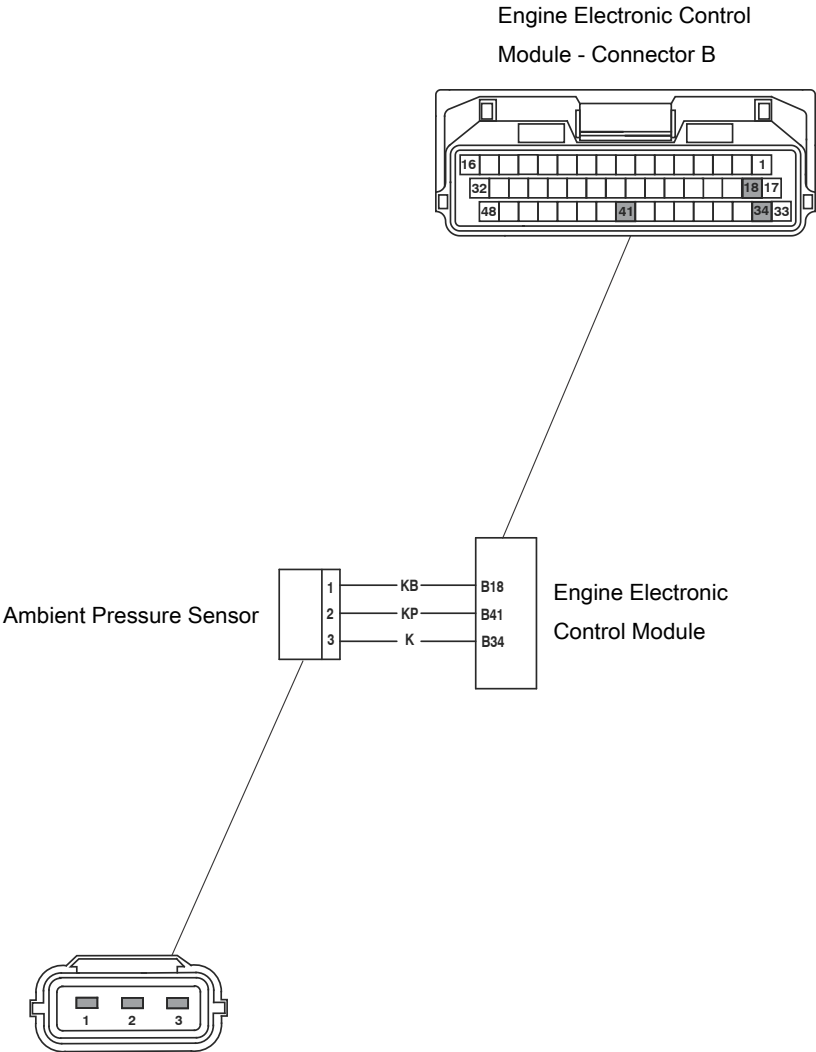
Ambient Air Pressure Sensor

Fault Code	Possible cause	Action
P2228	Ambient air pressure sensor circuit short circuit to ground	View and note 'freeze-frame' data if available.
P2226	Ambient air pressure sensor circuit open circuit or short circuit to 5 Volt sensor supply	View and note 'sensor' data. Ensure sensor connector is secure. Disconnect the engine ECM and proceed to pinpoint test 1:

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity: - ECM pin B18 - ECM pin B34 - ECM pin B41 - Sensor pin 1, 2, 3	OK	Disconnect barometric pressure sensor and proceed to test 2
	Faulty	Rectify fault, proceed to test 4
2 Check cable for short circuit: - ECM pin B41 to ECM pin B18 - ECM pin B41 to ECM pin B34	OK	Proceed to test 3
	Short circuit	Locate and rectify wiring fault, proceed to test 4
3 Check cable for continuity: - ECM pin B34 to sensor pin 3 - ECM pin B18 to sensor pin 1 - ECM pin B41 to sensor pin 2	OK	Renew barometric pressure sensor and proceed to test 4
	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



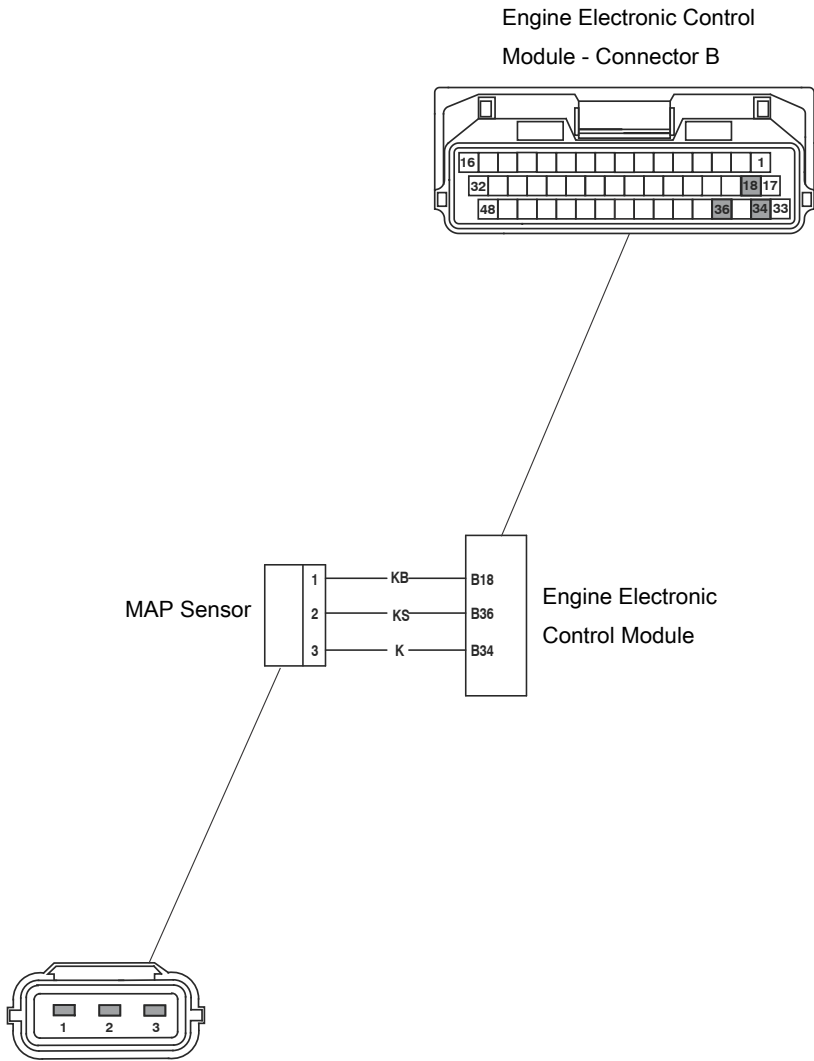
Manifold Absolute Pressure (MAP) Sensor

Fault Code	Possible cause	Action
P0107	Manifold absolute pressure sensor 1 short circuit to ground	View and note 'freeze-frame' data if available. View and note 'sensor' data. Ensure sensor connector is secure. Disconnect the engine ECM and proceed to pinpoint test 1:
P0105	Manifold absolute pressure sensor 1 open circuit or short circuit to 5 Volt sensor supply	
P1105	Manifold absolute pressure sensor 1 pipe malfunction	Check connection/condition of pipes from MAP sensors to throttle body.

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity: - ECM pin B18 - ECM pin B34 - ECM pin B36 - Sensor pin 1, 2, 3	OK	Disconnect MAP sensors and proceed to test 2
	Faulty	Rectify fault, proceed to test 4
2 Check cable for short circuit: - ECM pin B36 to ECM pin B18 - ECM pin B36 to ECM pin B34	OK	Proceed to test 3
	Short circuit	Locate and rectify wiring fault, proceed to test 4
3 Check cable for continuity: - ECM pin B34 to MAP sensor pin 3 - ECM pin B18 to MAP sensor pin 1 - ECM pin B36 to MAP sensor pin 2	OK	Renew relevant MAP pressure sensor, 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



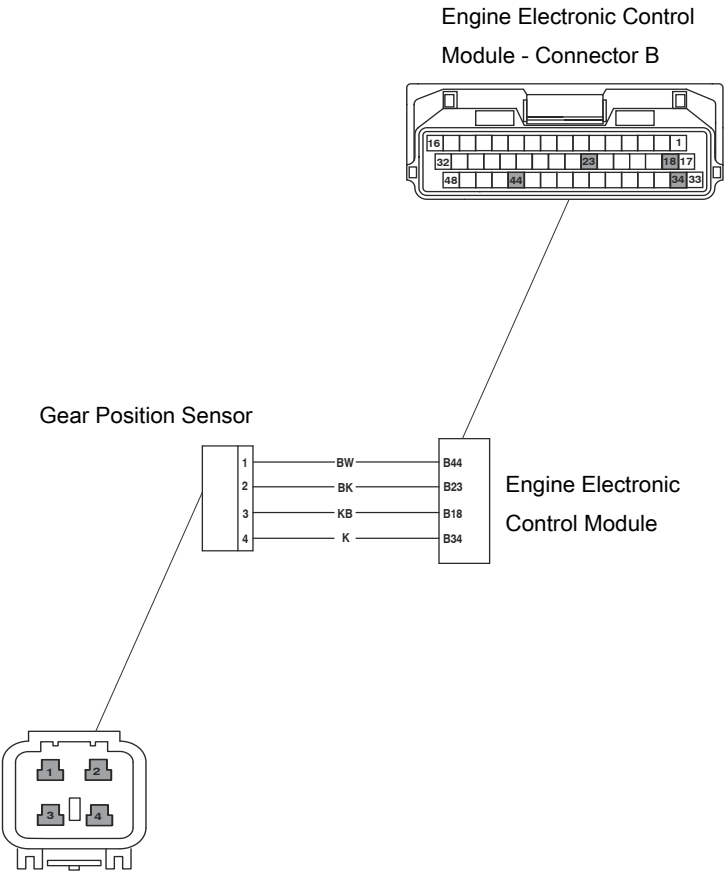
Gear Position Sensor

Fault Code	Possible cause	Action
P0914	Gear position sensor short circuit to ground or open circuit	View and note 'freeze-frame' data if available.
P0917	Gear position sensor short circuit to 5 Volt sensor supply	View and note 'sensor' data. Ensure sensor connector is secure. Disconnect the engine ECM and proceed to pinpoint test 1:

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity: - ECM pin B23 - ECM pin B44	OK	Disconnect sensor and proceed to test 2
	Faulty	Rectify fault, proceed to test 5
2 Check cable for short circuit: - ECM pin B23 to ground - ECM pin B34 to ground - ECM pin B44 to ground	OK	Proceed to test 3
	Short circuit	Locate and rectify wiring fault, proceed to test 5
3 Check cable continuity: - ECM pin B23 to sensor pin 2 - ECM pin B18 to sensor pin 3 - ECM pin B34 to sensor pin 4 - ECM pin B44 to sensor pin 1	OK	Proceed to test 4
	Open circuit	Locate and rectify wiring fault, proceed to test 5
4 Check cable for short circuit: - ECM pin B23 to ECM pin B44 - ECM pin B23 to ECM pin B34	OK	Renew gear position sensor and contact pin 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



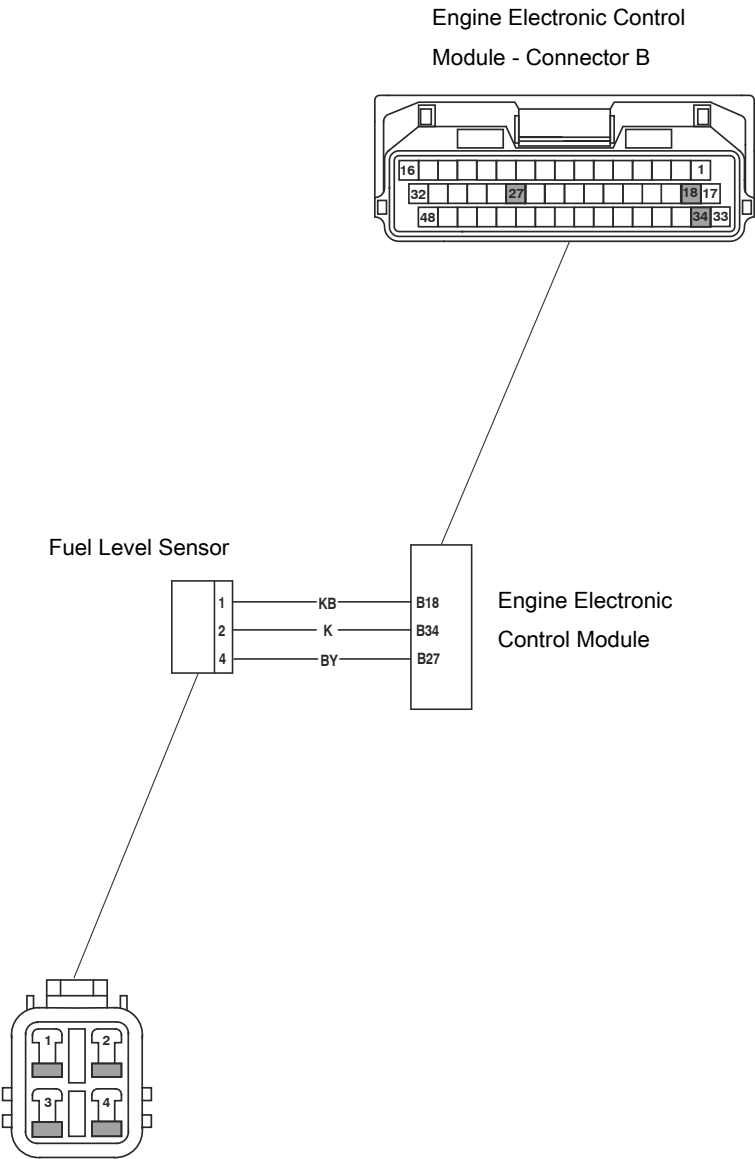
Fuel Level Sensor Circuit

Fault Code	Possible cause	Action
P0460	Fuel level sensor circuit malfunction	View and note 'freeze-frame' data if available. View and note 'sensor' data. Ensure sensor connector is secure. Disconnect the engine ECM and proceed to pinpoint test 1:

Pinpoint Tests

Test		Result	Action
1	Check cable and terminal integrity: - ECM pin B27	OK	Disconnect sensor and proceed to test 2
		Faulty	Rectify fault, proceed to test 4
2	Check cable for short circuit: - ECM pin B27 to ground - ECM pin B34 to ground	OK	Proceed to test 3
		Short circuit	Locate and rectify wiring fault, proceed to test 4
3	Check cable continuity: - ECM pin B27 to sensor pin 4 - ECM pin B34 to sensor pin 2 - ECM pin B18 to sensor pin 1	OK	Proceed to test 4
		Open circuit	Locate and rectify wiring fault, proceed to test 4
5	Reconnect harness, clear fault code.	OK	Action complete - quit test
		Fault still present	Contact Triumph service

Circuit Diagram



EMS Main Relay Circuit

Fault Code	Possible cause	Action
P1685	Main relay circuit malfunction	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 90 seconds. Identify EMS main relay on the harness. Check that relay operates when the ignition is switched ON and the stop and run switch is in the RUN position.	OK	Proceed to test 4
	Faulty	Disconnect EMS main relay and engine ECM. Proceed to test 4
2 Check cable for short circuit: - ECM pin B31 to ground - ECM pin A01 to ground	OK	Proceed to test 3
	Short circuit	Locate and rectify wiring fault, replace Fuse 5 and proceed to test 6
3 Check cable and terminal integrity: - ECM pin B31 - EMS main relay pin 1 - EMS main relay pin 2 - EMS main relay pin 3 - EMS main relay pin 5	OK	Disconnect main relay and proceed to test 4
	Faulty	Rectify fault, proceed to test 5
4 Check fuse box fuse 2 integrity	OK	Proceed to test 5
	Short circuit	Replace fuse and proceed to test 5
5 Check cable continuity: - ECM pin A01 to EMS main relay pin 5 - ECM pin B31 to EMS relay pin 1 - EMS main relay pin 2 to ground - EMS main relay pin 3 to fuse box fuse 2	OK	Replace EMS main relay and proceed to test 6
	Open circuit	Locate and rectify wiring fault, proceed to test 6
6 Reconnect harness, clear fault code. Switch ignition off for longer than 90 seconds. 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

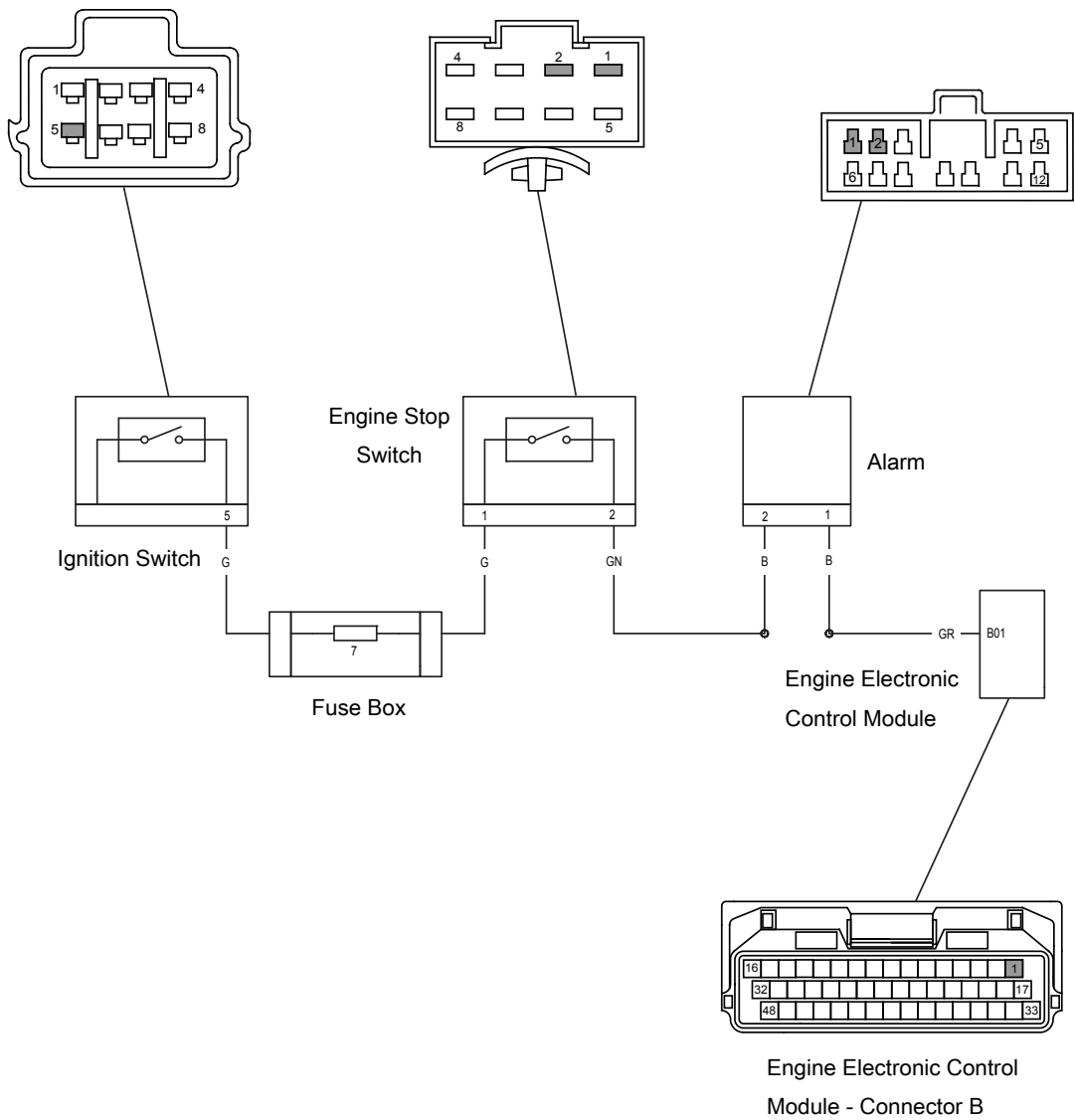
EMS Ignition Voltage Input Circuit

Fault Code	Possible cause	Action
P1659	Ignition power supply malfunction	Disconnect the engine ECM and proceed to pinpoint test 1:

Pinpoint Tests

Test	Result	Action
1 Check fuse box Fuse 7 integrity.	OK	Proceed to test 3
	Faulty	Proceed to test 2
2 Check cable for short circuit: - ECM pin B01 to ground	OK	Replace Fuse 10 and proceed to test 3
	Short circuit	Locate and rectify wiring fault, replace Fuse 10 and proceed to test 5
3 Check cable and terminal integrity: - ECM pin B01 - Alarm connector pin 1 - Alarm connector pin 2 - Right hand switch housing pin 1 (8 pin connector) - Right hand switch housing pin 2 (8 pin connector)	OK	Proceed to test 4
	Faulty	Rectify fault, proceed to test 5
4 Check cable continuity: - ECM pin B01 to fuse box Fuse 7 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



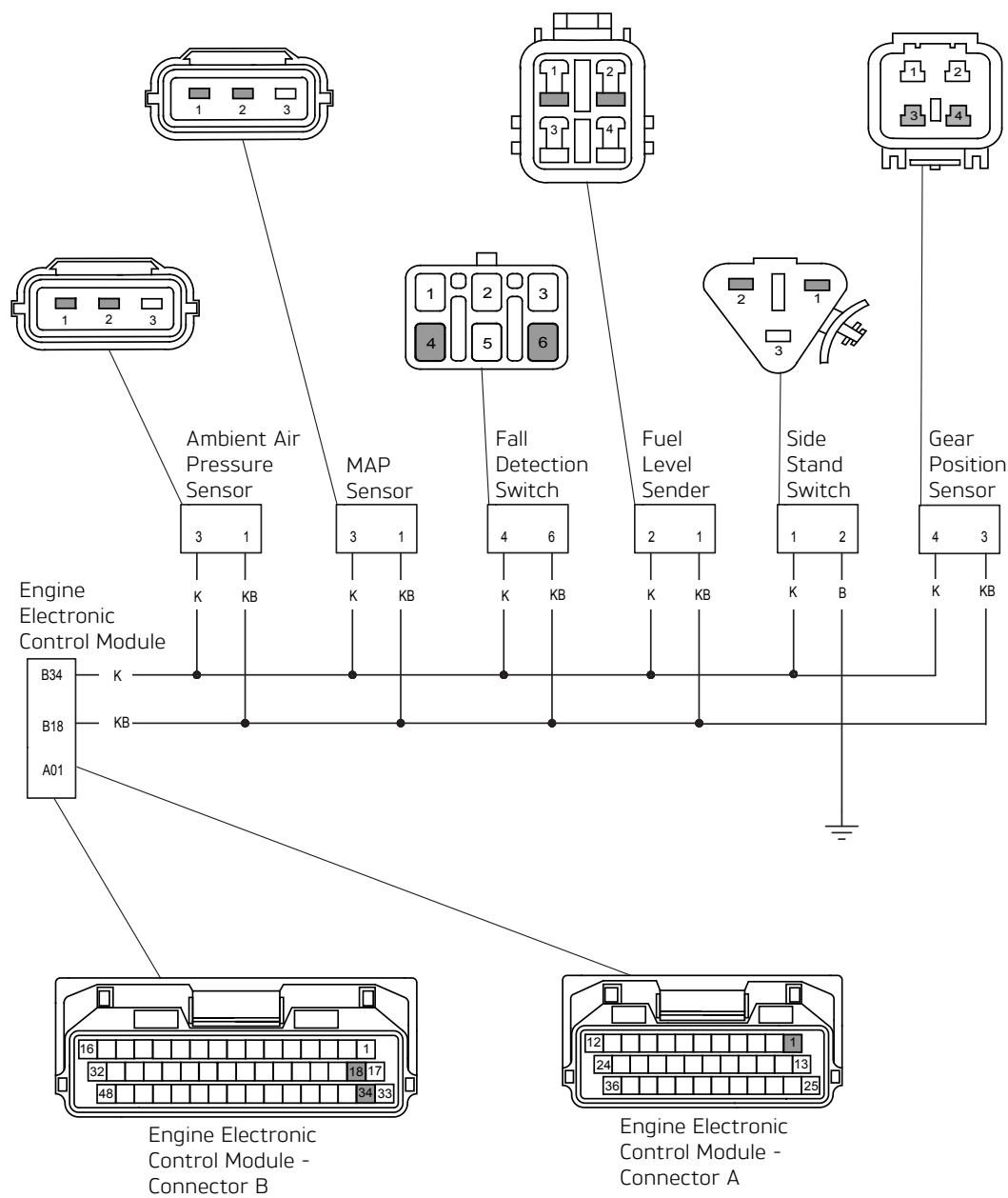
5 Volt Sensor Supply Circuit

Fault Code	Possible cause	Action
P1698	5 Volt sensor supply malfunction	View and note 'sensor' data. Note ECM sensors requiring a power supply will not be active. Disconnect the engine ECM and proceed to pinpoint test 1:

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity: - ECM pin B18 - ECM pin B34	OK	Proceed to test 2
	Faulty	Rectify fault, proceed to test 5
2 Check cable for short circuit - ECM pin B18 to ECM pin B34	OK	Proceed to test 4
	Faulty	Proceed to test 3
3 Disconnect the following sensors in turn: - MAP sensor - Ambient pressure sensor - Fall detection sensor - Fuel level sensor - Side stand switch - Gear position sensor and retest for short circuit - ECM pin B18 to ECM pin B34	OK	Replace sensor last removed and proceed to test 5
	Faulty	Proceed to test 4
4 Check cable for short circuit: - ECM pin B18 to ground - ECM pin B34 to ground - ECM pin B18 to A01 - ECM pin B34 to A01 - ECM pin B18 to battery positive - ECM pin B34 to battery positive	OK	Proceed to test 5
	Short circuit	Locate and rectify wiring fault, proceed to test 5
5 Reconnect harness, clear fault code and use diagnostic software to check for correct sensor outputs and 5 volt sensor supply voltage level.	OK	Action complete - quit test
	Fault still present	Contact Triumph service

Circuit Diagram



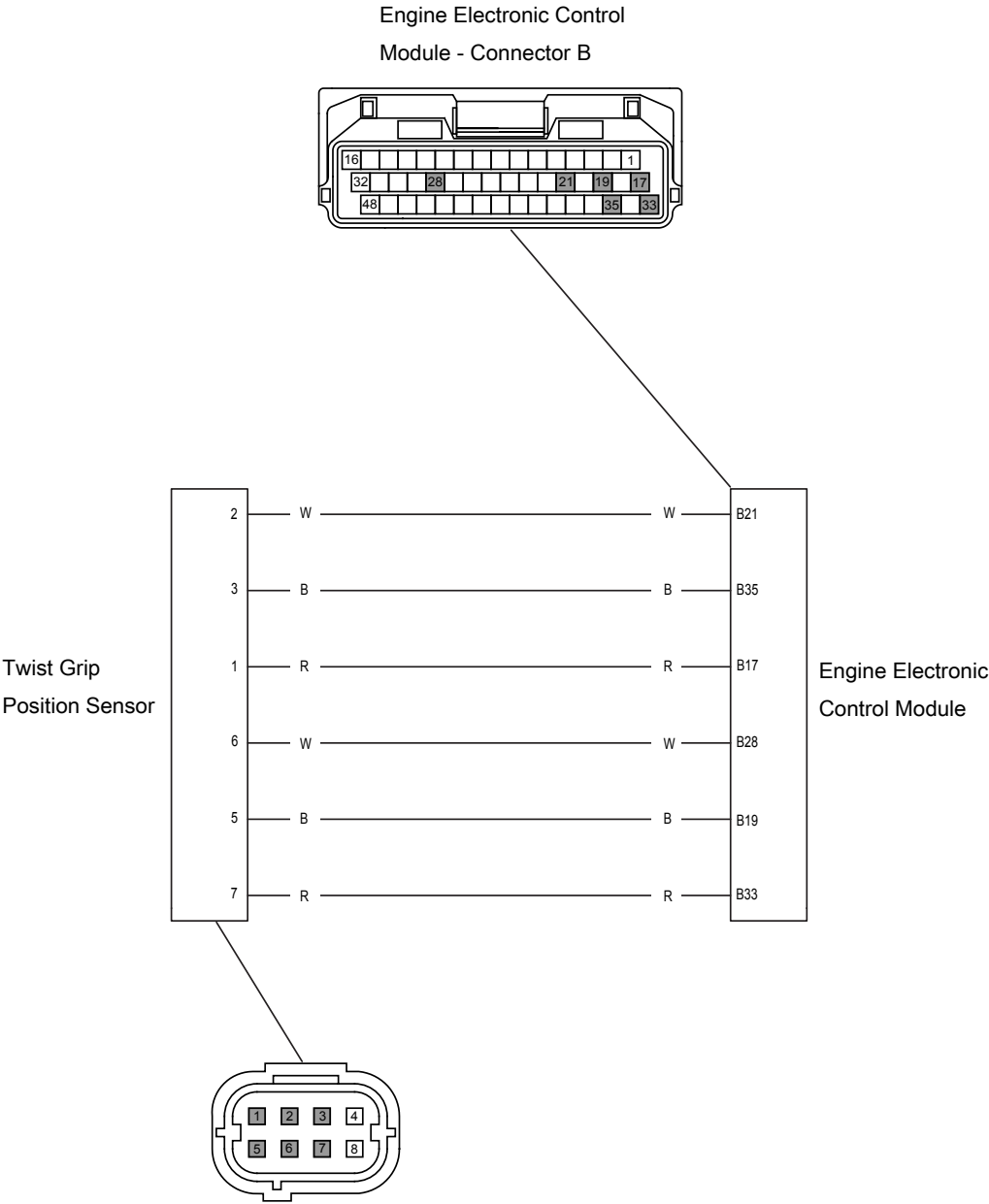
Twist Grip Position 1

Fault Code	Possible cause	Action
P2120	Twist grip position sensor 1 short circuit to ground or open circuit	View and note 'sensor' data. Note ECM sensors requiring a power supply will not be active. Ensure twist grip position sensor is secure. Disconnect the engine ECM and proceed to pinpoint test 1:
P2123	Twist grip position sensor 1 short circuit to battery Voltage	

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity: - ECM pin B17 - ECM pin B21 - ECM pin B35	OK	Disconnect twist grip position sensor and proceed to test 2
	Faulty	Rectify fault, proceed to test 5
2 Check cable for short circuit: - ECM pin B21 to ground	OK	Proceed to test 3
	Short circuit	Locate and rectify wiring fault, proceed to test 5
3 Check cable continuity: - ECM pin B17 to sensor pin 1 - ECM pin B21 to sensor pin 2 - ECM pin B35 to sensor pin 3	OK	Proceed to test 4
	Open circuit	Locate and rectify wiring fault, proceed to test 5
4 Check cable for short circuit: - ECM pin B21 to ECM pin B17 - ECM pin B21 to ECM pin B35	OK	Renew twist grip 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



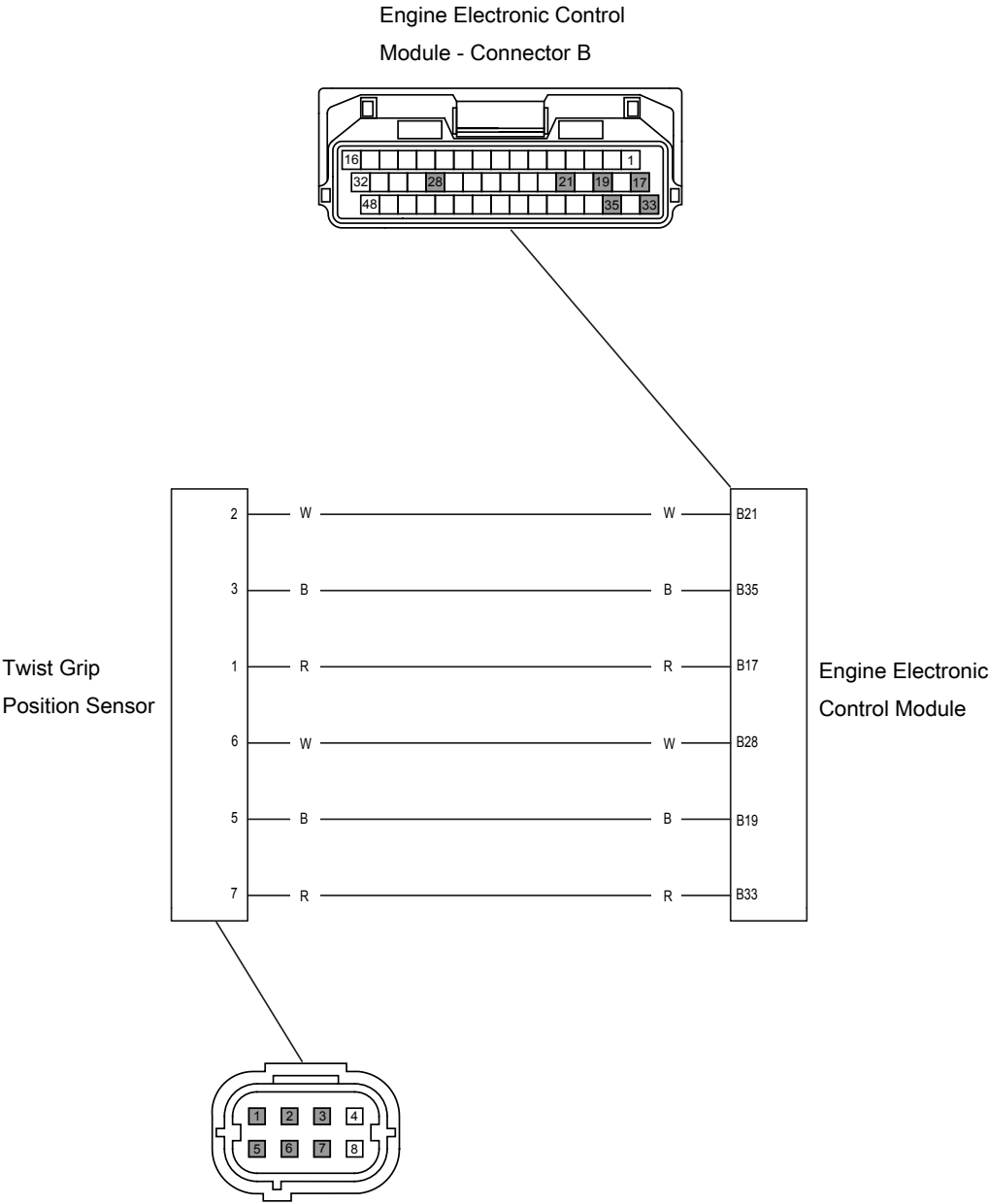
Twist Grip Position Sensor 1 Correlation Error with Twist Grip Position 2

Fault Code	Possible cause	Action
P2138	Twist grip position sensor 1 correlation error with twist grip position sensor 2	View and note diagnostic tool freeze frame data if available. View and note diagnostic tool sensor data. Disconnect twist grip position sensor and proceed to pinpoint test 1:

Pinpoint Tests

Test	Result	Action
1 Turn the ignition on and measure the Voltage between: - ECM pin B33 and ECM pin B19 - ECM pin B17 and ECM pin B35	5V DC	Proceed to test 2
	Faulty	Rectify fault, proceed to test 2
2 Check cable continuity: - ECM pin B21 to sensor pin 2 - ECM pin B28 to sensor pin 6	OK	Renew the twist grip and proceed to test 3
	Open circuit	Rectify 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



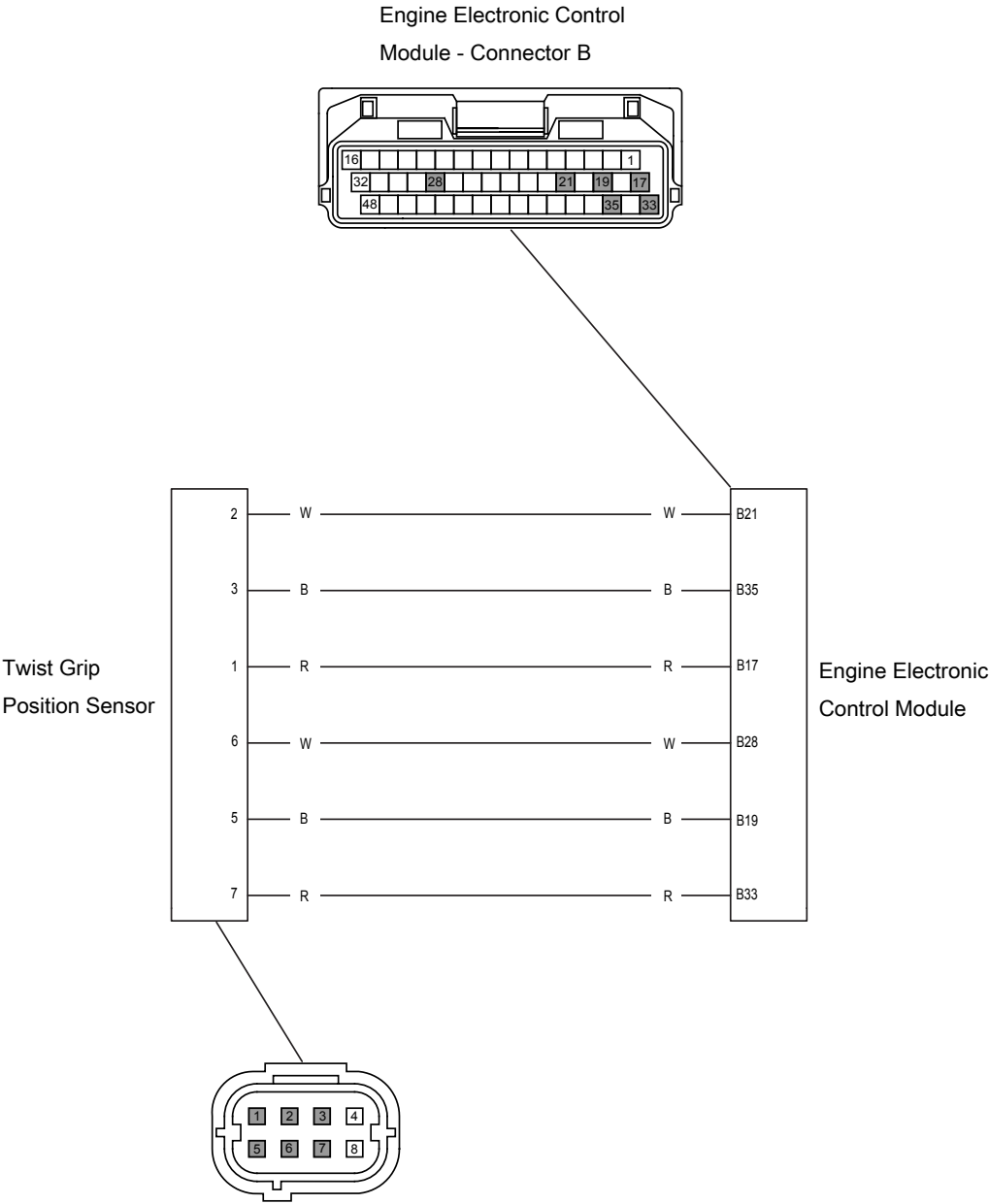
Twist Grip Position 2

Fault Code	Possible cause	Action
P2125	Twist grip position sensor 2 short circuit to ground or open circuit	View and note 'sensor' data. Note ECM sensors requiring a power supply will not be active. Ensure twist grip position sensor is secure. Disconnect the engine ECM and proceed to pinpoint test 1:
P2128	Twist grip position sensor 2 short circuit to battery Voltage	

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity: - ECM pin B19 - ECM pin B28 - ECM pin B33	OK	Disconnect twist grip position sensor and proceed to test 2
	Faulty	Rectify fault, proceed to test 5
2 Check cable for short circuit: - ECM pin B28 to ground	OK	Proceed to test 3
	Short circuit	Locate and rectify wiring fault, proceed to test 5
3 Check cable continuity: - ECM pin B19 to sensor pin 5 - ECM pin B28 to sensor pin 6 - ECM pin B33 to sensor pin 7	OK	Proceed to test 4
	Open circuit	Locate and rectify wiring fault, proceed to test 5
4 Check cable for short circuit: - ECM pin B28 to ECM pin B19 - ECM pin B28 to ECM pin B33	OK	Renew twist grip 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



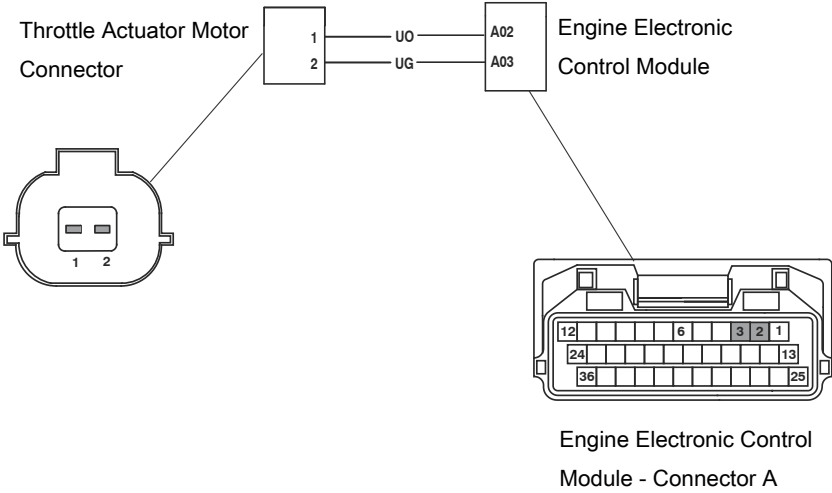
Throttle Actuator Motor

Fault Code	Possible cause	Action
P2100	Throttle actuator short circuit to ground or short circuit to battery Voltage Throttle actuator with default spring open circuit	View and note diagnostic tool freeze frame data if available. View and note diagnostic tool sensor data. Ensure throttle actuator motor connector is secure. Disconnect the engine ECM and proceed to pinpoint test 1:

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity: - ECM pin A02 - ECM pin A03 - Throttle actuator motor connector pin 1 - Throttle actuator motor connector pin 2	OK	Disconnect throttle actuator connector and proceed to test 2
	Faulty	Rectify fault, proceed to test 5
2 Check cable for short circuit: - ECM pin A02 to ground - ECM pin A03 to ground	OK	Proceed to test 3
	Short circuit	Locate and rectify wiring fault, proceed to test 4
3 Check cable for short circuit: - ECM pin A02 to ECM pin A01 - ECM pin A03 to ECM pin A01	OK	Proceed to test 4
	Short circuit	Locate and rectify wiring fault, proceed to test 4
4 Check cable for short circuit: - Throttle actuator motor connector pin 1 - Throttle actuator motor connector pin 2	OK	Renew twist grip position sensor, proceed to test 5
	Short circuit	Renew throttle body and 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



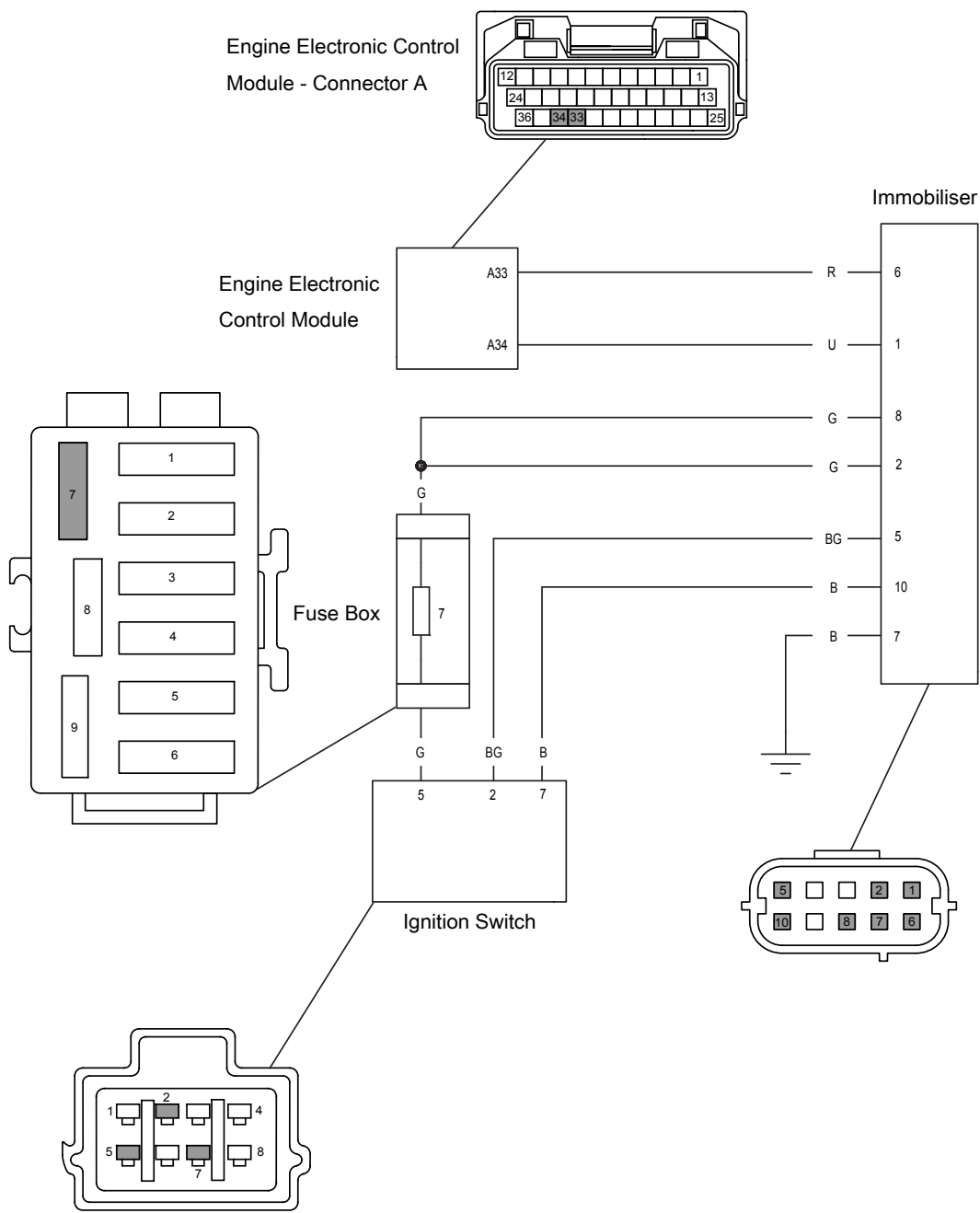
Immobiliser Control Module Communication

Fault Code	Possible cause	Action
P1650	CAN fault - lost communication with Immobiliser ECM	View and note 'freeze-frame' data if available. Ensure immobiliser control module connector is secure. Ensure the ignition switch is turned to the OFF position. Proceed to pinpoint test 1:

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity: - ECM pin A33 - ECM pin A34 - Immobiliser pin 1 - Immobiliser pin 2 - Immobiliser pin 6 - Immobiliser pin 7 - Immobiliser pin 8	OK	Disconnect the engine ECM and proceed to test 2
	Faulty	Rectify fault, proceed to test 6
2 Check cable for short circuit: - ECM pin A33 to ground - ECM pin A34 to ground	OK	Disconnect immobiliser, ignition switch and proceed to test 3
	Faulty	Locate and rectify wiring fault, proceed to test 6
3 Check fuse box Fuse 7 integrity.	OK	Proceed to test 5
	Faulty	Proceed to test 4
4 Check cable for short circuit: - Immobiliser pin 2 to ground - Immobiliser pin 8 to ground	OK	Proceed to test 5
	Faulty	Locate and rectify wiring fault, replace relevant fuse, proceed to test 6
5 Check cable continuity: - ECM pin A33 to immobiliser pin 6 - ECM pin A34 to Immobiliser pin 1 - Immobiliser pin 7 to ground - Fuse box Fuse 7 to immobiliser pin 2 - Fuse box Fuse 7 to immobiliser pin 8	OK	Proceed to test 6
	Fault still present	Locate and rectify wiring fault, proceed to test 6
6 Reconnect harness, clear fault code and run engine.	OK	Action complete - quit test
	Fault still present	Contact Triumph service

Circuit Diagram



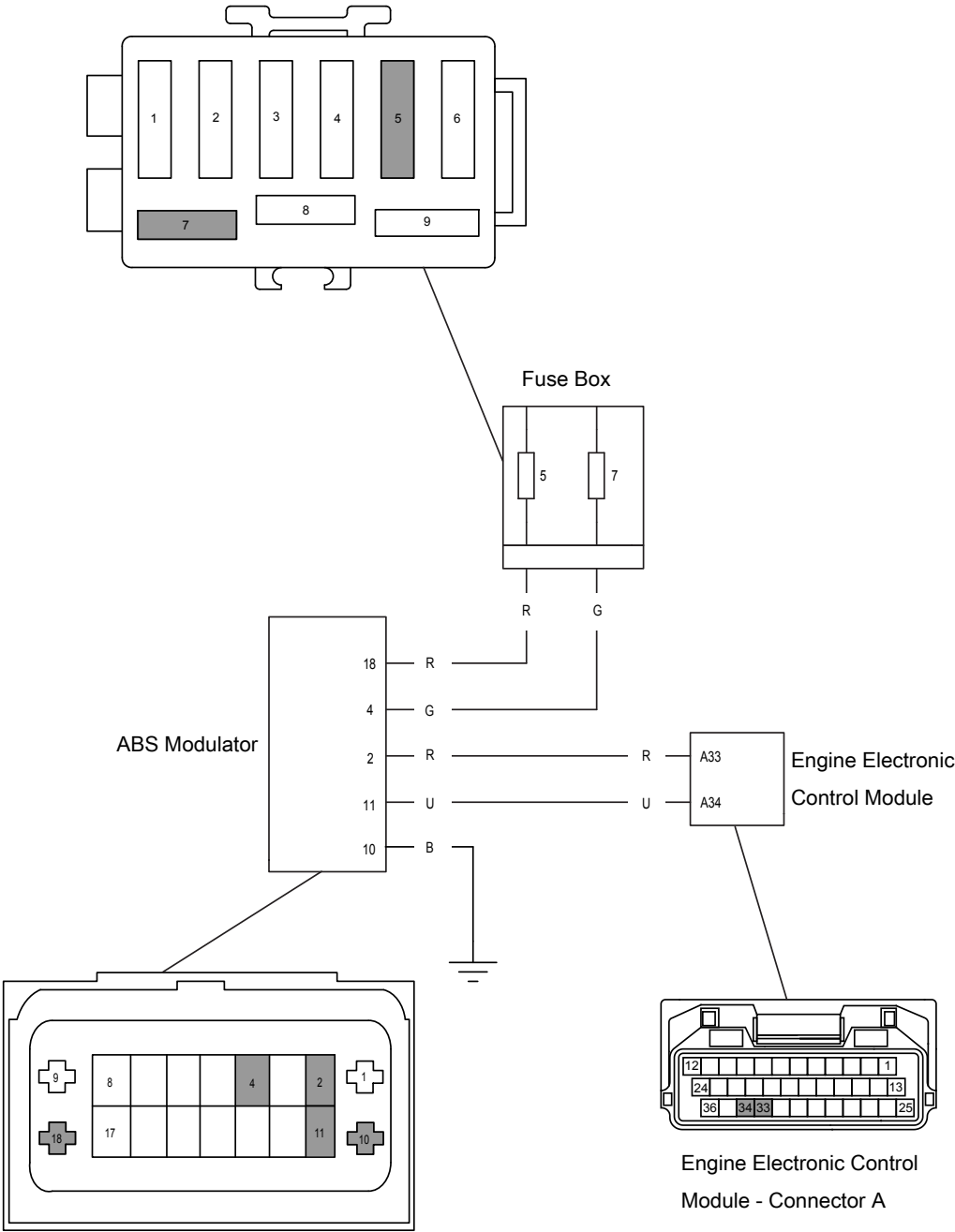
ABS Modulator Communication

Fault Code	Possible cause	Action
P1521	CAN fault - lost communication with ABS module or ABS system status error	View and note 'freeze-frame' data if available. Ensure ABS modulator connector is secure. Proceed to pinpoint test 1:

Pinpoint Tests

	Test	Result	Action
1	Check cable and terminal integrity: - ECM pin A33 - ECM pin A34 - ABS modulator pin 2 - ABS modulator pin 4 - ABS modulator pin 10 - ABS modulator pin 11 - ABS modulator pin 18	OK	Disconnect the engine ECM and proceed to test 2
		Faulty	Rectify fault, proceed to test 6
2	Check cable for short circuit: - ECM pin A33 to ground - ECM pin A34 to ground	OK	Disconnect ABS modulator and proceed to test 3
		Faulty	Locate and rectify wiring fault, proceed to test 6
3	Check fuse box Fuse 5 and 7 integrity.	OK	Proceed to test 5
		Faulty	Proceed to test 4
4	Check cable for short circuit: - ABS pin 2 to ground - ABS pin 11 to ground	OK	Proceed to test 5
		Faulty	Locate and rectify wiring fault, replace relevant fuse, proceed to test 6
5	Check cable continuity: - ECM pin A33 to ABS pin 2 - ECM pin A34 to ABS pin 11 - ABS pin 4 to ground - Fuse box Fuse 5 to ABS pin 18 - Fuse box Fuse 7 to ABS pin 4	OK	Proceed to test 6
		Fault still present	Locate and rectify wiring fault, proceed to test 6
6	Reconnect harness, clear fault code and run engine.	OK	Action complete - quit test
		Fault still present	Contact Triumph service

Circuit Diagram



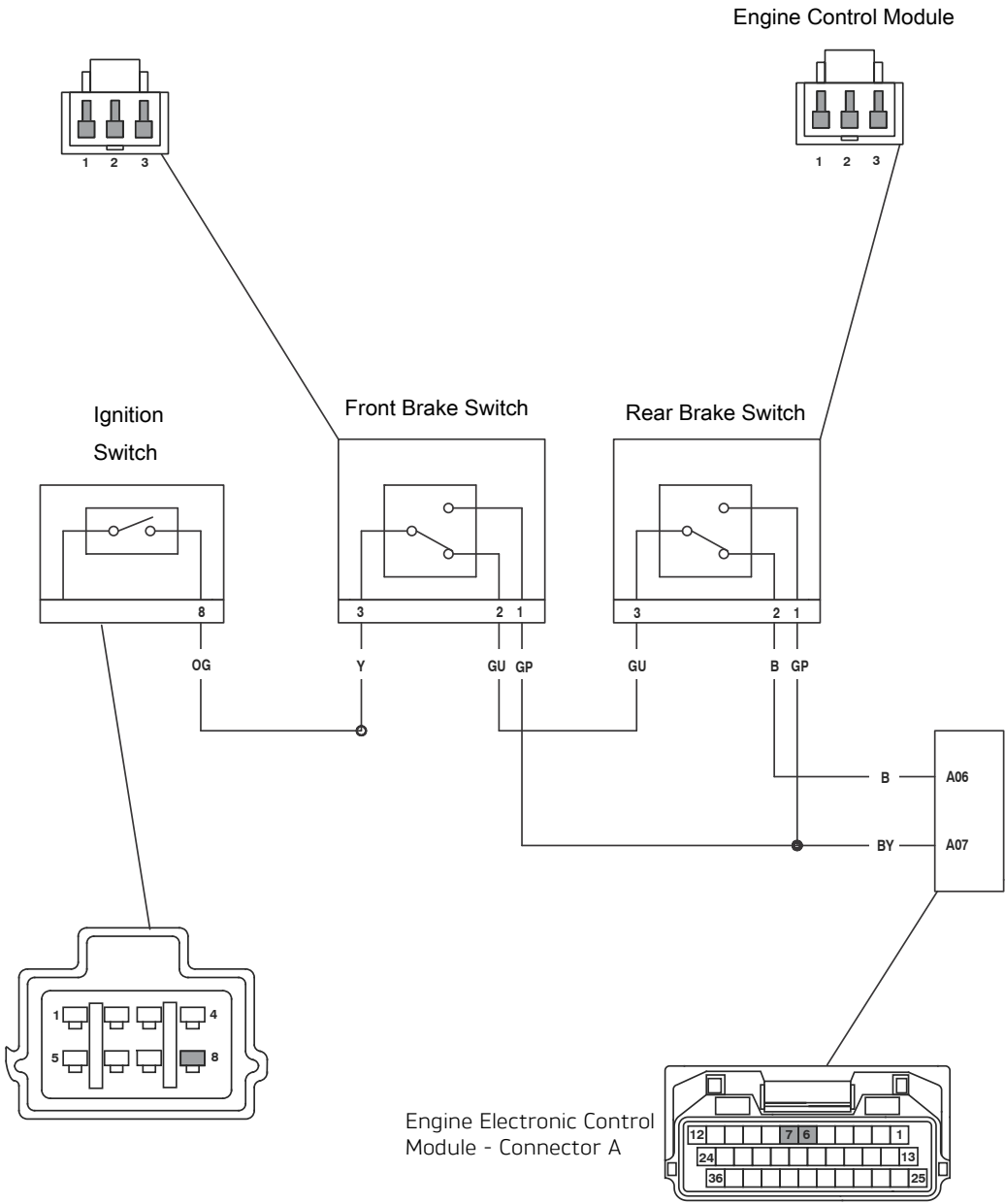
Brake Switches

Fault Code	Possible cause	Action
P0571	Brake 1 switch malfunction	View and note freeze frame data if available. Ensure brake switches connectors are secure. Disconnect engine ECM and proceed to pinpoint test 1:
P1576	Brake 1 switch correlation error with brake switch 2	
P1571	Brake 2 switch malfunction	
P1577	Brake 2 switch correlation error with brake switch 1	

Pinpoint Tests

	Test	Result	Action
1	Turn ignition on, operate rear brake switch and check brake light operation	OK	Proceed to test 2
		Faulty	Rectify fault, proceed to test 6
2	Check cable and terminal integrity: - ECM pin A06 - ECM pin A07 - Ignition switch pin 8	OK	Disconnect front and rear brake switches connector, proceed to test 3
		Faulty	Rectify fault, proceed to test 6
3	With brakes released, check front and rear brake switch operation: The following should be short circuit - Front brake switch pin 2 to pin 3 - Rear brake light switch pin 2 to pin 3 The following should be open circuit - Front brake switch pin 1 to pin 3 - Rear brake light switch pin 1 to pin 3	OK	Proceed to test 4
		Faulty	Replace relevant brake switch, proceed to test 6
4	Check cable continuity: - ECM pin A07 to front brake switch pin 1 - ECM pin A07 to rear brake switch pin 1 - ECM pin A06 to rear brake switch pin 1	<10V	Proceed to test 5
		>5V	Locate and rectify wiring fault, proceed to test 6
5	With the ignition switch on, measure the following Voltages: - ECM pin A06 to ground - Rear brake switch pin 2 - Rear brake switch pin 3 - Front brake switch pin 2 - Front brake switch pin 3 - Ignition switch pin 8	OK	Proceed to test 6
		Faulty	Locate and rectify wiring fault, proceed to test 6
6	Reconnect harness, clear fault code and run engine.	OK	Action complete - quit test
		Fault still present	Contact Triumph service

Circuit Diagram



Twist Grip Cruise Cancel Switch Circuit Malfunction

Fault Code	Possible cause	Action
P056C	Twist grip cruise cancel switch circuit malfunction	View and note 'freeze-frame' data if available. Check front and rear brake switches and the rear wheel speed sensor.

Cruise Control Prevented Due to Other Malfunction

Fault Code	Possible Cause	Action
P1574	Cruise control prevented due to other malfunction condition	Check that there is no other DTC linked to the engine management system stored Check front and rear brake switches, cruise control cancel switch and the rear wheel speed sensor

Cruise Control Disabled Until Button Press Sequence Completed

Fault Code	Possible cause	Action
P1575	Cruise control disabled until button press sequence completed After certain DTCs have been stored and subsequently repaired, the cruise control will be disabled until a test of the systems various switches has been performed	Carry out the button press sequence (see Cruise Control Switch Check, page 299).

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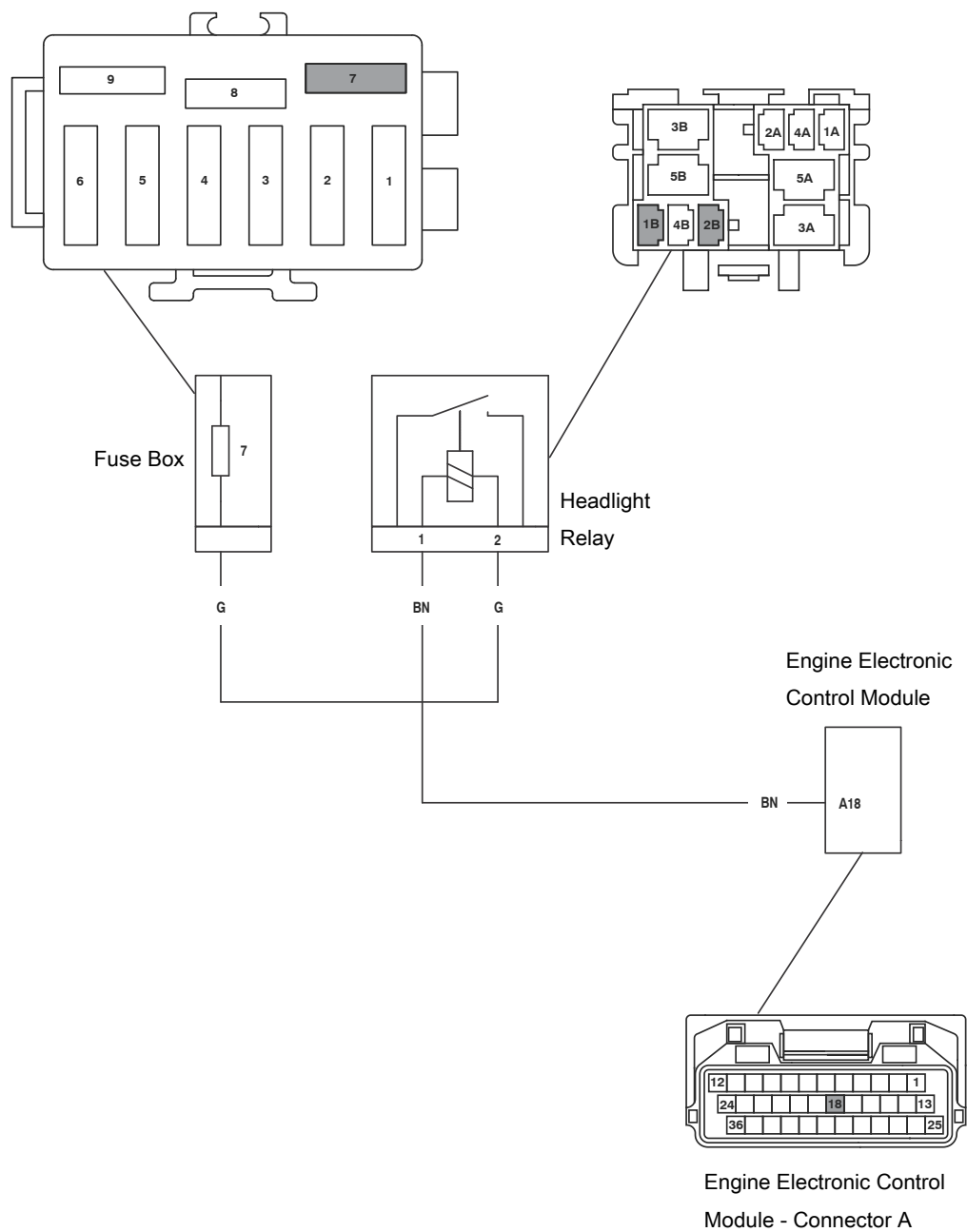
Headlight Relay

Fault Code	Possible cause	Action
P1619	Headlamp relay short circuit to ground or open circuit	View and note 'freeze-frame' data if available. Disconnect the engine ECM and proceed to pinpoint test 1:
P1620	Headlamp relay short circuit to battery Voltage	Disconnect the engine ECM and headlight relay and proceed to pinpoint test 4:

Pinpoint Tests

	Test	Result	Action
1	Check cable and terminal integrity: - ECM pin A18 - Headlamp relay pin 1 - Headlamp relay pin 2 - Check fuse box fuse 7 integrity	OK	Disconnect headlight relay and proceed to test 2
		Faulty	Rectify fault, proceed to test 5
2	Check cable for short circuit: - ECM pin A18 to ground	OK	Proceed to test 3
		Faulty	Locate and rectify wiring fault, replace relevant fuse, proceed to test 5
3	Check cable continuity: - ECM pin A18 to headlight relay pin 1 - Fuse box Fuse 7 to headlight relay pin 2	OK	Renew headlight relay, proceed to test 5
		Faulty	Locate and rectify wiring fault, proceed to test 5
4	Check cable for short circuit: - ECM pin A18 to fuse box fuse 7	OK	Renew headlight relay, proceed to test 5
		Short circuit	Renew headlight relay, 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



Oxygen Sensor Reverse Connection

Fault Code	Possible cause	Action
P1131	Oxygen sensor circuits reversed	Check oxygen sensor connections and swap cylinder number 1 and cylinder number 2 connections if incorrect.

EEPROM Error

Fault Code	Possible cause	Action
P0603	EEPROM error	View and note 'freeze frame' data if available. No tests available - contact Triumph service.

Engine ECM Internal Error

Fault Code	Possible cause	Action
P0606	Engine ECM internal error	Contact Triumph service.
P1607	Engine ECM ride by wire internal error	
P1608		

Traction Control Prevented Due to ABS Malfunction

Fault Code	Possible cause	Action
P1135	Traction Control prevented due to ABS malfunction	Check that there is no other DTC linked to the ABS system or CAN communication stored. Contact Triumph service.

Throttle Valve Drive Error

Fault Code	Possible cause	Action
P2111	Throttle valve drive error (stuck open)	View and note 'freeze-frame' data if available. View and note 'sensor' data. Check throttle body for mechanical malfunctions. Clear fault code and contact Triumph service if fault is still present.
P2119	Throttle valve drive error	
P2102	Throttle actuator control internal motor relay does not operate	
P2103	Throttle actuator control internal motor relay operates continually	

Tune Lock

Fault Code	Possible cause	Action
P1605	Engine ECM locked by the tune lock function	This is also identified by a fast flashing MIL indication, and a disabled engine management system. Unlock the engine ECM using the diagnostic software and supplied unlock code from Triumph service.

Instrument ID Incompatible

Fault Code	Possible cause	Action
P1614	Instrument ID incompatible	This is also identified by a fast flashing MIL indication, and a disabled engine management system.

Pinpoint Tests

Test	Result	Action
1 Check engine ECM part number is correct for the motorcycle.	OK	Proceed to test 2
	Incorrect	Replace engine ECM with correct part and proceed to test 3
2 Check that the tune is correct for the motorcycle, using the diagnostic software.	OK	Proceed to test 3
	Incorrect	Update tune using diagnostic software, proceed to test 3
3 Clear fault code, check for normal operation.	OK	Action complete - quit test
	Fault still present	Contact Triumph service

Immobiliser and TPMS Control Module ID Incompatible

Fault Code	Possible cause	Action
P1508	Unmatched Immobiliser/chassis ECM, causing the engine 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 Follow the Pair ECM and Immobiliser procedure as described in the Triumph Diagnostic Tool user guide	OK	Action complete - quit test
	Fault still present	Contact Triumph service

ABS Modulator ID Incompatible

Fault Code	Possible cause	Action
P1520	Unmatched ABS module	This is also identified by ABS warning light indication. Proceed to pinpoint test 1:

Pinpoint Tests

	Test	Result	Action
1	Check ABS modulator part number is correct for the motorcycle.	OK	Proceed to test 2
		Incorrect	Replace ABS modulator 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

Engine ECM Tamper Detected

Fault Code	Possible cause	Action
P1604	Engine ECM tamper detected - return to Triumph	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
	Low fuel pressure caused by loose fuel pipes to the fuel pump and filter
Cutting out at idle	Throttle bodies out of balance
	Low fuel pressure caused by loose fuel pipes to the fuel pump and filter
	Low fuel pressure
	Weak mixture caused by air leak at the throttle body/transition piece to cylinder head face
Idle speed too low/high	Incorrect closed throttle position setting
Diagnostic software malfunctions during tune download procedure	Low battery voltage
Throttle hang-up	Incorrect closed throttle position setting
Bike will start but cuts out immediately	Low fuel pressure caused by loose fuel pipes to the fuel pump and filter
	Low fuel pressure due to split fuel filter
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
	Thermostat fault

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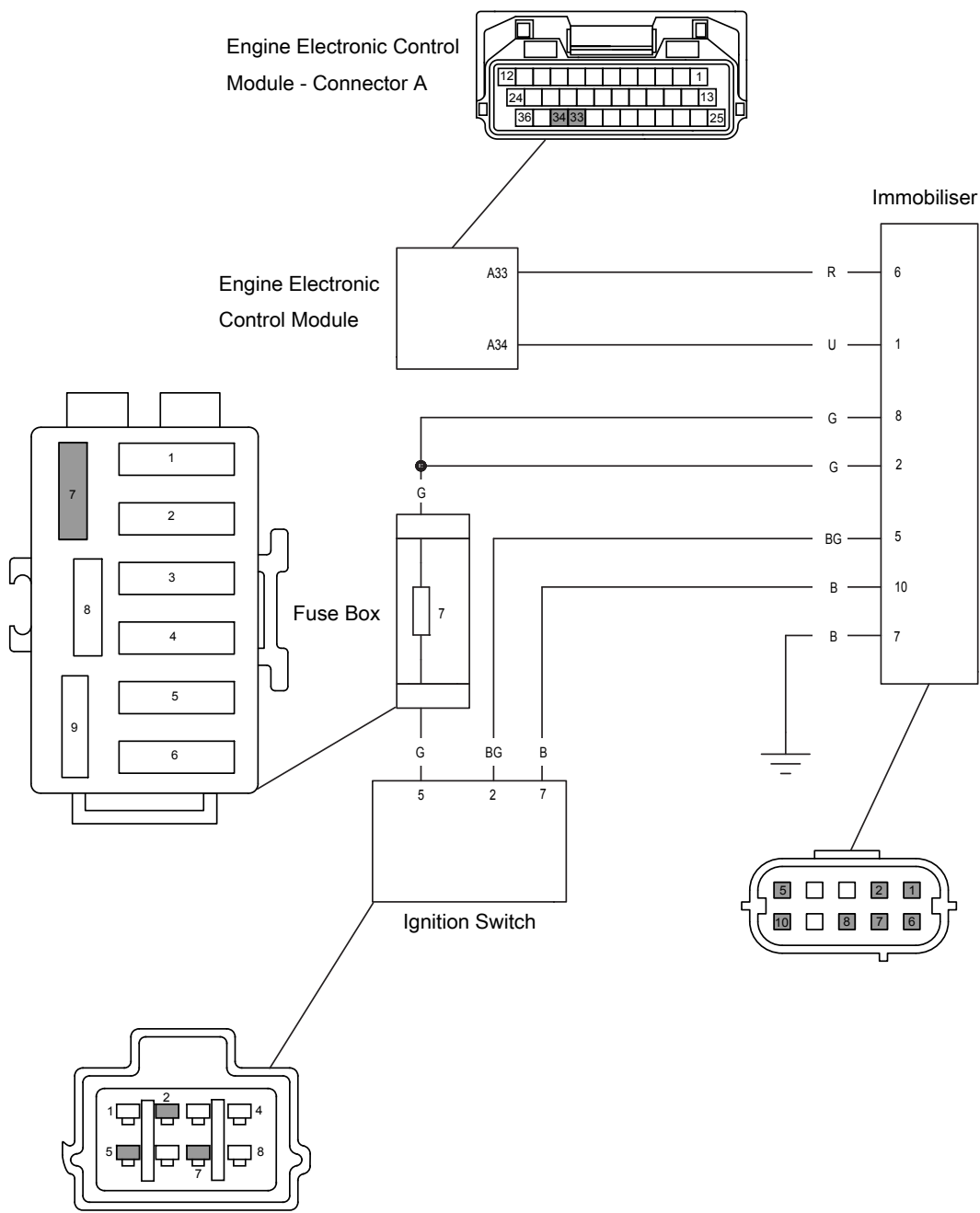
Invalid Key: Key Authentication Unsuccessful

Fault Code	Possible cause	Action
L0008 or Alarm/immobiliser warning indicator light is on when the ignition switch is at the ON position (only visible on motorcycles without the accessory alarm fitted)	Invalid key: Key authentication unsuccessful	Check that the key has been registered with the immobiliser control module, if it is a new key or an additional key. Check that there are no additional keys with a transponder chip fitted close to the ignition key and proceed to pinpoint test 1:

Pinpoint Tests

	Test	Result	Action
1	If available, try to start the motorcycle with the second registered key:	OK	Transponder chip in the key not functioning correctly. Register a new key using the Triumph Diagnostic Tool then proceed to test 5
		Faulty	Proceed to test 2
2	Check the condition of cable, connector housing and terminals for the following: - Ignition switch - Immobiliser control module	OK	Disconnect the ignition switch, proceed to test 3
		Faulty	Rectify fault, proceed to test 5
3	Check antenna coil resistance: - Ignition switch pin 2 to ignition switch pin 7	7 to 13 Ohms	Proceed to test 4
		Faulty	Replace the ignition switch, register new keys and proceed to test 5
4	Check cable continuity: - Ignition switch pin 2 to Immobiliser control module pin 5 - Ignition switch pin 7 to Immobiliser control module pin 10	OK	Proceed to test 4
		Faulty	Rectify 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



Vehicle Speed Sensor

Fault Code	Possible cause	Action
P0500	Wheel speed sensor fault	Refer to the following ABS DTCs. Front Wheel Sensor Open Circuit/Short Circuit, page 578 Front Wheel Sensor Abnormal Input/Losing Contact, page 585 Rear Wheel Sensor Open Circuit/Short Circuit, page 582 Rear Wheel Sensor Abnormal Input/Losing Contact, page 585

Fuel Tank - Removal

Warning

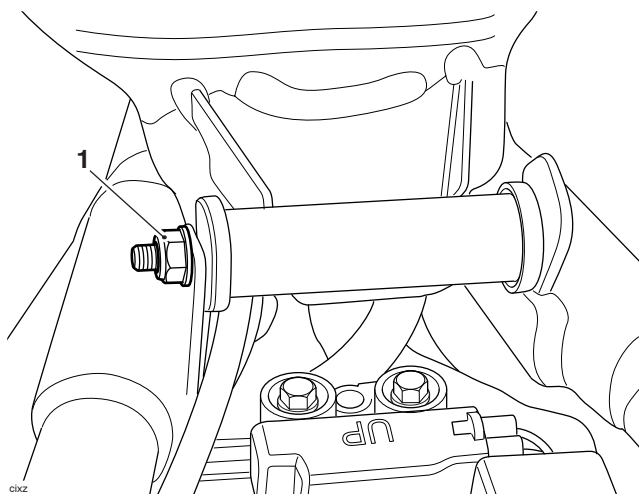
Observe the warning advice given in the General Information section on the safe handling of fuel and fuel containers.

A fire, causing personal injury and damage to property could result from spilled fuel or fuel not handled or stored correctly.

Warning

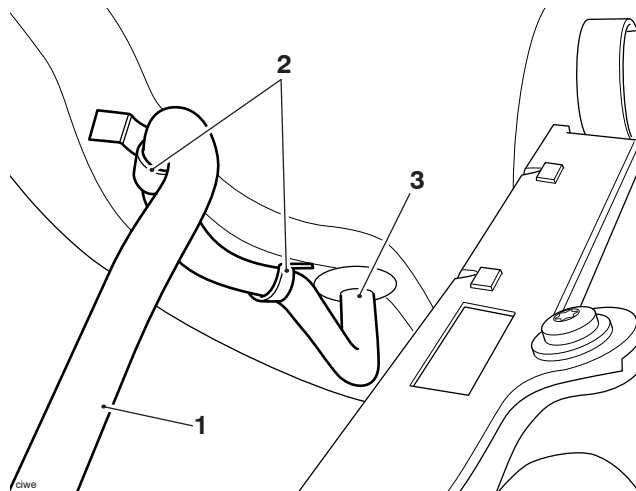
Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

- Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
1. Remove the fixing securing the rear of the fuel tank to the frame.

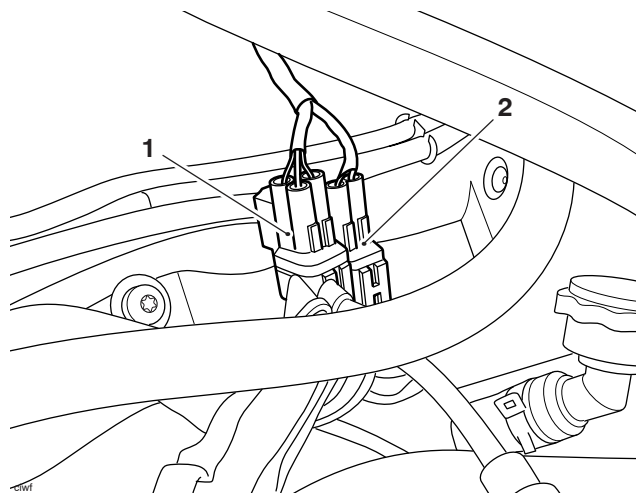


1. **Fixings**
2. Pivot the fuel tank upwards at the rear.

3. Detach the breather hose from its retaining clips on the fuel tank then disconnect it from the fuel tank.



1. **Breather hose**
2. **Retaining clips**
3. **Fuel tank spigot**
4. Disconnect the electrical connectors for the fuel pump and the fuel level sensor from the main harness.



1. **Fuel level sensor electrical connector**
2. **Fuel pump electrical connector**

Warning

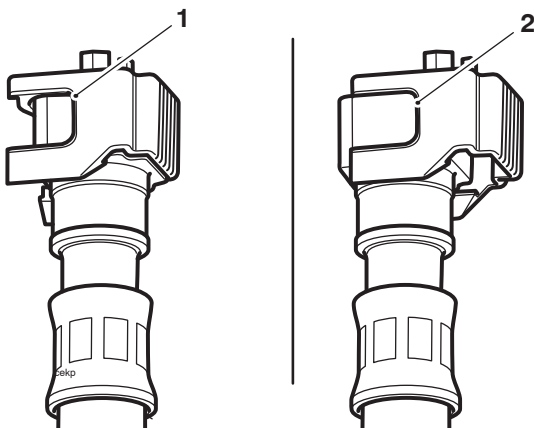
If the fuel rail is dismantled without first reducing pressure, fuel may escape causing clothing and components to be coated with fuel.

This would represent a serious fire hazard which could lead to burn injuries and damage to property.

5. Temporarily reconnect the battery, positive (red) lead first and tighten the terminals to 4.5 Nm.

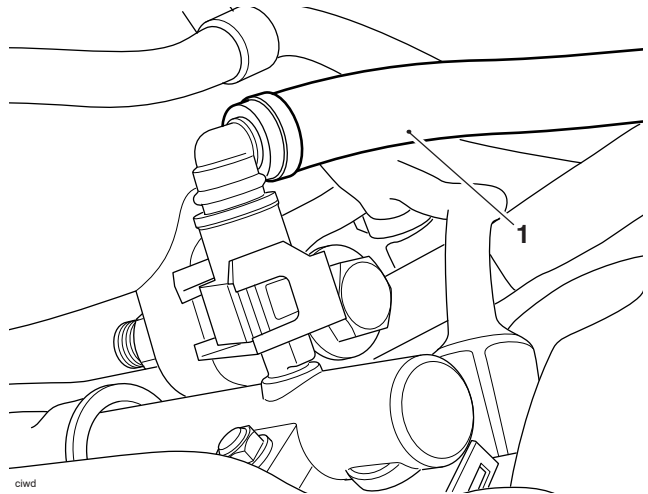
Note:

- Because fuel stored in the fuel rail will be at 3.5 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.
 - When disconnected, the fuel tank is self-sealing but a small amount of fuel may dribble from the hose.
 - To protect the components under the fuel tank, place suitable material over the components to absorb the small amount of fuel that may come from the fuel tank and its fuel lines.
6. Briefly crank the engine to reduce the fuel pressure in the fuel rail.
 7. Disconnect the battery, negative (black) lead first.
 8. To release the double check clip, ease the latch away from the connector until the release buttons are exposed.



1. Locked Position
2. Unlocked Position

9. Disconnect the fuel hose by squeezing the sides of the connector and pulling the hose free from its spigot on the fuel pump rail. Collect any fuel remaining in the hose in a suitable container.



1. Fuel hose

10. Detach the fuel pump and fuel level sensor electrical connectors from the ignition coil bracket.
11. Slide the tank rearwards to detach it from the frame.
12. Take care not to lose the front mounting and rear mounting rubbers. Renew any mounting rubber which shows signs of damage.

Fuel Tank - Installation

Warning

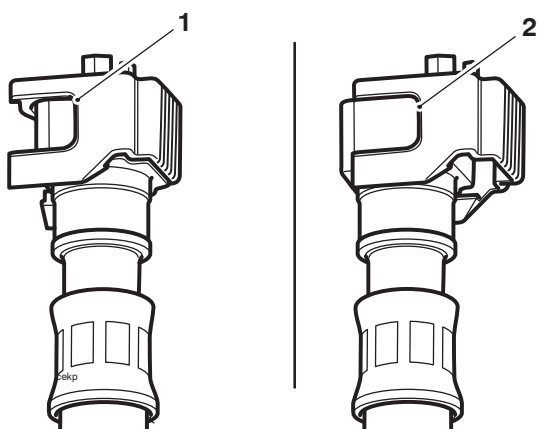
Observe the warning advice given in the General Information section on the safe handling of fuel and fuel containers.

A fire, causing personal injury and damage to property could result from spilled fuel or fuel not handled or stored correctly.

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. Ensure the front and rear mounting rubbers are correctly fitted.
2. Manoeuvre the tank into position, engaging it with the front mounting rubbers.
3. Reconnect the fuel feed hose by gently pushing inwards until the hose engages with a click.
4. Slide the double check latch to the locked position until the release buttons are covered. If the latch will not slide into position, then the fuel hose is not fully home on its spigot and must therefore be refitted correctly.



1. Locked Position

2. Unlocked Position

5. Attach and connect the breather pipe to the fuel tank.
6. Connect the electrical connectors for the fuel pump and the fuel level sensor to the main harness and attach them to the ignition coil bracket.

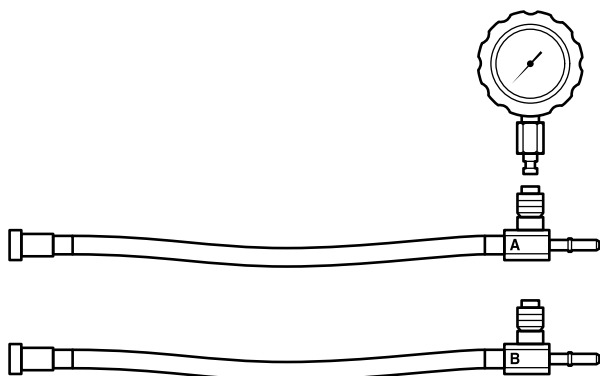
7. Lower the tank into position ensuring the breather pipe is not trapped, kinked or twisted.
8. Tighten the rear fuel tank mounting bolt to 8 Nm.
 - Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
 - Refit the seat (see Seat - Installation, page 645).

Fuel Pressure Checking

Warning

Observe the fuel handling precautions given in the General Information section.

Fuel pressure is checked using service tool T3880001.



cdgh

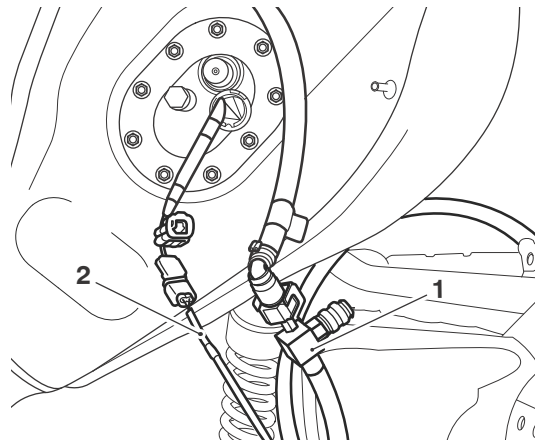
T3880001 - Fuel Pressure Gauge

1. Remove the fuel tank (see Fuel Tank - Removal, page 383) and place on a suitable support, close to the motorcycle.
2. Using the service tool T3880391, carefully connect the fuel pump connection on the main harness to the fuel tank.
3. Select the fuel pressure gauge adapter marked 'A' from service tool T3880001.

Warning

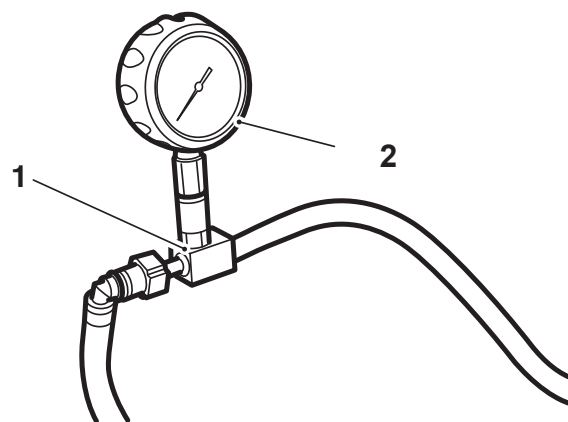
Always use the correct fuel pressure gauge adapter. Use of an incorrect adapter will result in a fuel leak. A fuel leak can result in a fire causing damage to property and injury to persons.

4. Connect the adapter hose to the fuel pump plate outlet and fuel hose as shown in the illustration below.



1. **Adaptor hose 'A'**
2. **T3880391 - Fuel Pump Extension Cable**

5. Connect the fuel pressure gauge to the adapter hose as shown below by pushing the gauge spigot into the adapter until a click can be heard.



cdvr_2

1. **Adapter hose**
2. **Fuel pressure gauge**

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.
6. Ensure the gauge is visible to the side of the motorcycle.
 7. Start the engine and observe the fuel pressure reading on the gauge.

Note:

- The fuel pressure should be 3.5 bar nominally.

8. When fuel pressure checking is complete, disconnect the fuel pressure gauge adapter and wiring extension. Collect any fuel in the hose in a suitable container.
9. Refit the fuel tank (see Fuel Tank - Installation, page 385).

Fuel Pump Assembly - Removal

Warning

Observe the warning advice given in the General Information section on the safe handling of fuel and fuel containers.

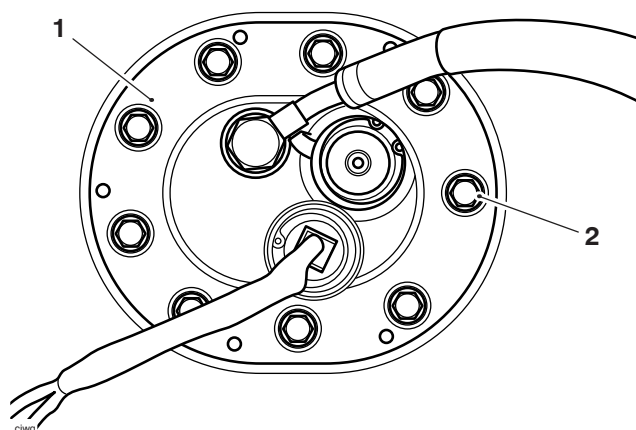
A fire, causing personal injury and damage to property could result from spilled fuel or fuel not handled or stored correctly.

- Remove the seat (see Seat - Removal, page 645).
- Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).

Warning

Never drain fuel from the tank using non-approved, non-professional standard fuel handling equipment. A fire causing destruction of property and injury to persons may result from use of non-approved fuel handling equipment.

1. Using proprietary professional automotive workshop equipment approved for fuel handling, drain all fuel from the fuel tank.
2. Remove the fuel tank (see Fuel Tank - Removal, page 383).
3. Invert the fuel tank and place on a protective surface to prevent paint damage.
4. Remove the ring of fixings securing the fuel pump mounting plate to the tank.

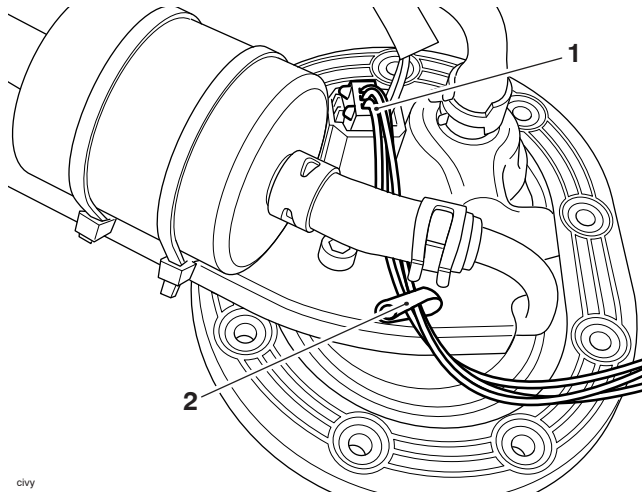


1. Fuel pump mounting plate

2. Fixing

5. Detach the pump assembly from the fuel tank.
6. Disconnect the fuel level sensor from the electrical connector on the fuel pump plate.

7. Detach the P-clip for the fuel level sensor harness from the fuel pump bracket.



1. Electrical connector

2. P-clip

8. Remove the fuel pump assembly and discard the fuel pump plate seal.

Fuel Pump Assembly - Inspection

1. Inspect all hoses for cracks, splits, fraying and other damage. Replace as necessary.
2. Check all hose clamps for cracks and signs of distortion. Replace as necessary.

Fuel Pump Assembly - Installation

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. Position a new fuel pump plate seal to the fuel pump plate as noted for removal.
2. Route the fuel level sensor as noted for removal and connect it to the electrical connector on the fuel pump plate.
3. Attach the P-clip for the fuel level sensor harness to the fuel pump bracket.
4. Refit the fuel pump assembly to the fuel tank. Fit and tighten the fixings to 5 Nm working on diagonally opposite fixings to spread the clamping load evenly.
5. Refit the fuel tank (see Fuel Tank - Installation, page 385).
6. Refill the fuel tank with the fuel drained during removal, and check carefully for fuel leaks.
 - Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
 - Refit the seat (see Seat - Installation, page 645).

Fuel Filter - Removal

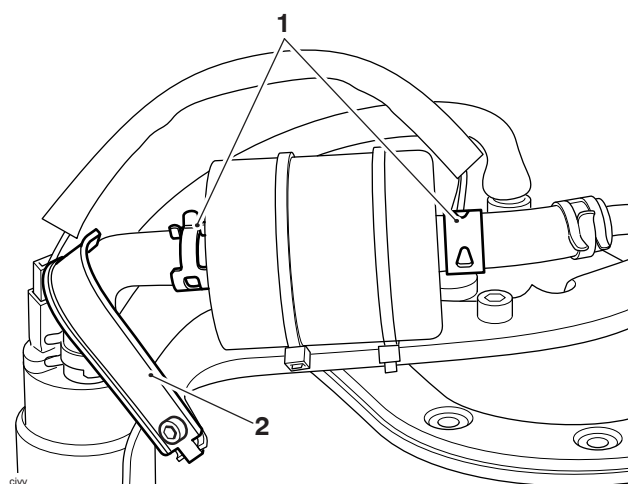
Warning

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.

- Remove the fuel pump assembly (see Fuel Pump Assembly - Removal, page 387).

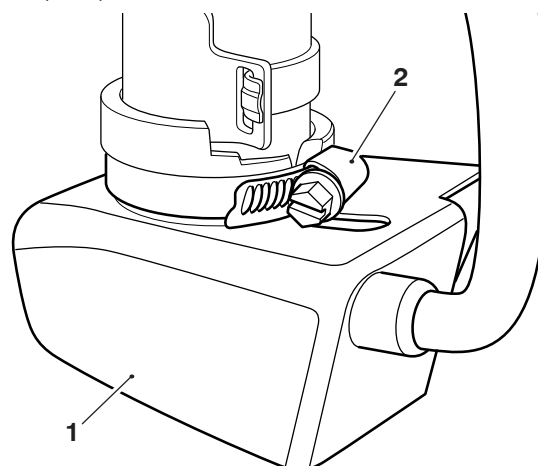
1. Release the two fuel hose clips from either side of the fuel filter.
2. Remove the hose bracket from the fuel pump bracket.



1. Hose clips

2. Hose bracket

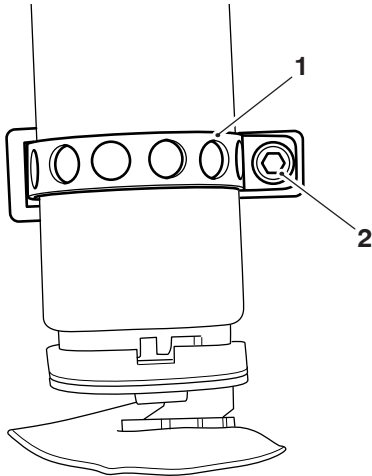
3. Carefully detach the baffle housing from the fuel pump.



1. Baffle housing

2. Hose clip

4. Remove the fuel pump securing bolt and strap.

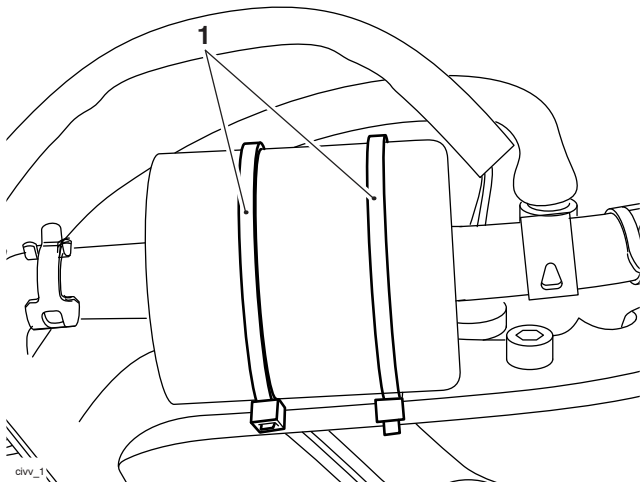


clvx

1. Strap

2. Bolt

5. Disconnect the fuel pump hose from the fuel filter inlet.
6. Remove and discard the two fuel filter cable ties.



clvv_1

1. Cable ties

Note:

- Prior to removing the filter, note the direction of the arrow on the side of the filter. The arrow should point away from the fuel pump, towards the pressure regulator.
7. Remove the fuel filter from the outlet hose.

Fuel filter - Inspection

1. Inspect all hoses for cracks, splits, fraying and other damage. Replace as necessary.
2. Check all hose clamps for cracks and signs of distortion. Replace as necessary.

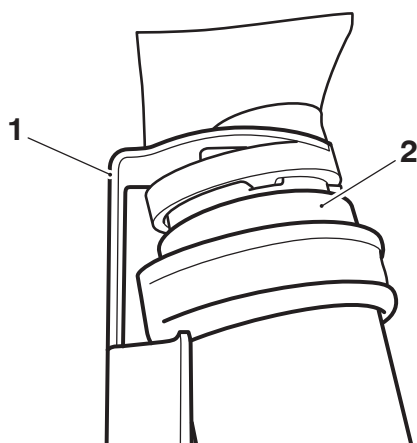
Fuel Filter - Installation

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. Install the fuel filter to the outlet hose, ensuring the arrow on the filter points away from the pump. Secure the hose with the hose clip.
2. Check and ensure that the feet of the rubber isolator engage correctly in the fork.



1. Fork

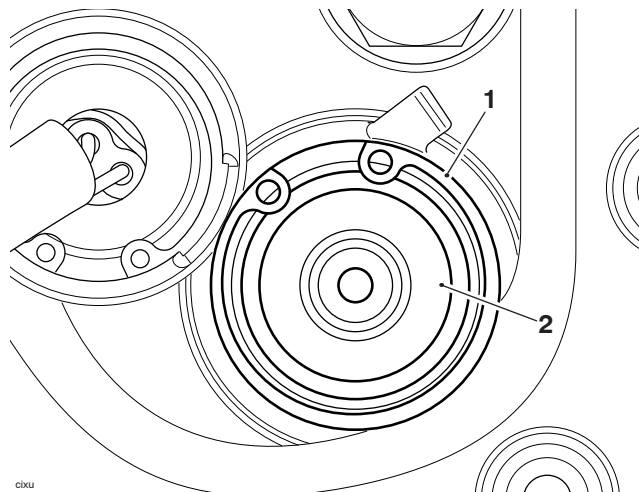
2. Isolator feet

3. Secure the fuel filter to the fuel pump bracket with two new cable ties.
4. Connect the fuel pump hose to the fuel filter and secure with the hose clip.
5. Refit the fuel pump securing bolt and strap and tighten the bolt to 4 Nm.
6. Refit the hose bracket to the fuel pump bracket and tighten its fixing to 7 Nm.
7. Carefully refit the baffle material into the front of the baffle housing.
8. Refit the baffle housing to the fuel pump as noted for removal.
 - Refit the fuel pump assembly (see Fuel Pump Assembly - Installation, page 389).

Fuel Pressure Regulator - Removal

- Remove the fuel pump assembly (see Fuel Pump Assembly - Removal, page 387).

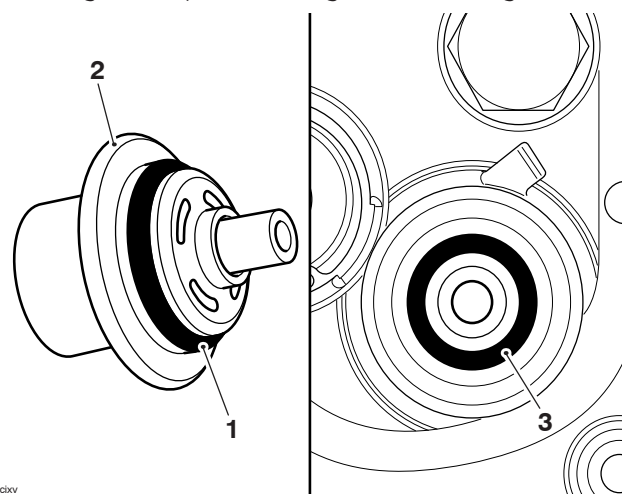
1. Remove and discard the circlip securing the fuel pressure regulator in its housing.



1. Circlip

2. Fuel pressure regulator

2. Remove the fuel pressure regulator from the fuel pump plate. Discard the large O-ring from the fuel pressure regulator and the small O-ring in the pressure regulator housing.



1. Large O-ring

2. Fuel pressure regulator

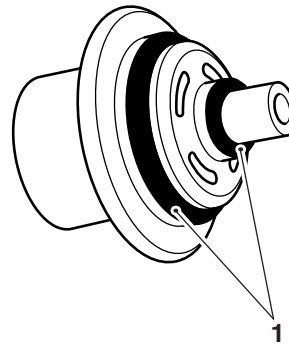
3. Small O-ring

Pressure Regulator - Inspection

1. Inspect all hoses for cracks, splits, fraying and other damage. Replace as necessary.
2. Check all hose clamps for cracks and signs of distortion. Replace as necessary.

Fuel Pressure Regulator - Installation

1. Install new O-rings to the fuel pressure regulator.



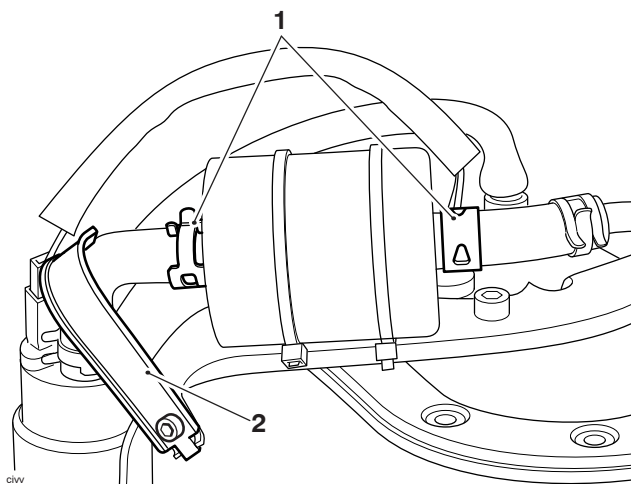
cixv_1

1. O-rings

2. Apply a small amount of grease, conforming to NLGI 2 specification, to the two O-rings.
 3. Position the fuel pressure regulator squarley to the fuel pump plate and press it evenly into its housing.
 4. Secure the fuel pressure regulator with a new circlip.
 5. Refit the hose and secure with the hose clip. Check for any fuel leaks and rectify if necessary.
- Refit the fuel pump assembly (see Fuel Pump Assembly - Installation, page 389).

Fuel Pump - Removal

- Remove the fuel pump assembly (see Fuel Pump Assembly - Removal, page 387).
- Release the fuel hose clip from the fuel pump side of the fuel filter.
 - Remove the hose bracket from the fuel pump bracket.

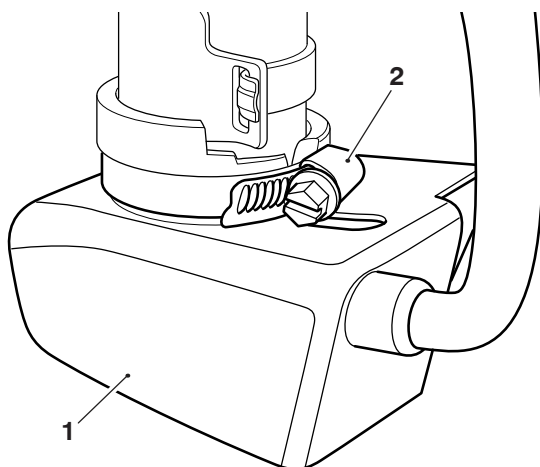


- Hose clips**
- Hose bracket**

- Release the hose clip securing the baffle housing to the fuel pump.
- Reposition the hose clip and carefully slide the baffle housing off the fuel pump body.

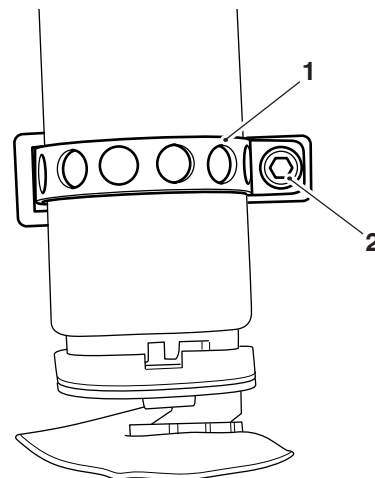
Note:

- Note the orientation of the baffle housing for installation.
- It is not necessary to disconnect the baffle housing hose from the fuel pressure regulator unless it is to be removed at the same time as the fuel pump.



- Baffle housing**
- Hose clip**

- Remove the baffle housing hose clip over the inlet filter.
- Disconnect the fuel pump electrical connector.
- Remove the fuel pump securing bolt and strap.



- Strap**
- Bolt**

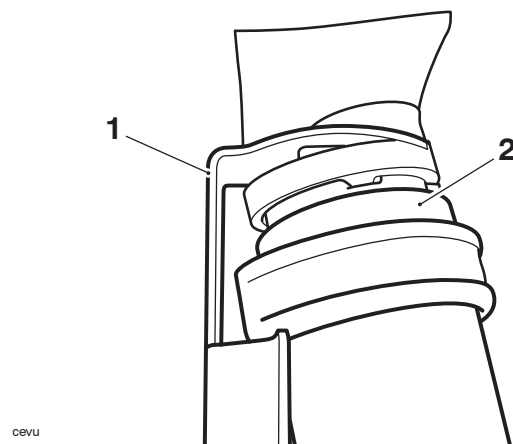
- Detach the fuel pump and connector hose from the fuel pump bracket as an assembly.
- If necessary, release the hose clip and remove the connector hose from the pump.

Fuel Pump - Inspection

1. Inspect all hoses for cracks, splits, fraying and other damage. Replace as necessary.
2. Check all hose clamps for cracks and signs of distortion. Replace as necessary.

Fuel Pump - Installation

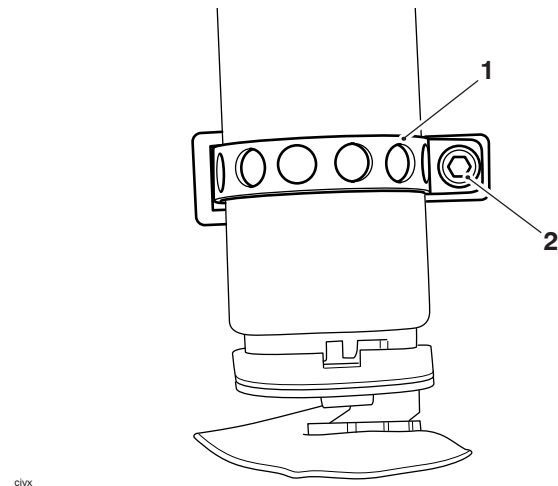
1. If removed, refit the connector hose to the fuel pump. Secure with the hose clip.
2. Position the fuel pump to the bracket, ensuring the feet of the rubber isolator engage correctly in the fork.



1. Fork

2. Isolator feet

3. Align the fuel pump to the fuel pump bracket and fit the connector hose on to the fuel filter.
4. Fit the fuel pump strap, secure with a new bolt and tighten to 4 Nm.



1. Strap

2. Bolt

5. Reconnect the fuel pump electrical connector.
6. Position the baffle housing hose clip loosely over the fuel pump body.

7. Check that the baffle material within the baffle housing is positioned as noted for removal.
8. Refit the baffle housing over the fuel pump, as noted for removal. Refit the hose clip and tighten to 3 Nm.
 - Refit the fuel pump assembly (see Fuel Pump Assembly - Installation, page 389).

Fuel Level Sensor - Removal

Warning

Observe the warning advice given in the General Information section on the safe handling of fuel and fuel containers.

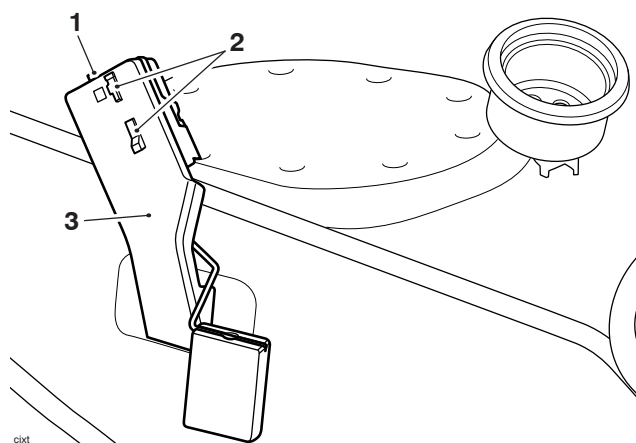
A fire, causing personal injury and damage to property could result from spilled fuel or fuel not handled or stored correctly.

Note:

- The fuel level sensor is located inside the fuel tank on the right hand side.
- Access to the fuel level sensor is through the aperture for the fuel pump.
- Remove the fuel pump assembly (see Fuel Pump Assembly - Removal, page 387).

Note:

- The mounting for the fuel level sensor is located inside the fuel tank. The illustration shows the bracket outside the fuel tank for clarity.
1. Release the locking device and slide the fuel level sensor up the bracket and release the two locating lugs from the bracket.



1. Locking device
2. Locating lugs
3. Bracket

2. Remove the fuel level sensor.

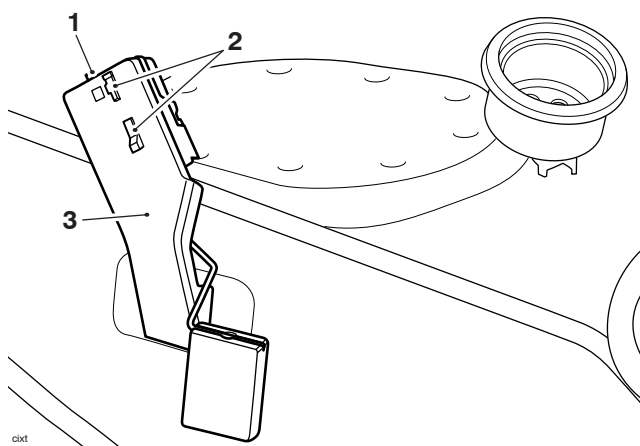
Fuel Level Sensor Installation

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. Align the two locating lugs into the holes in the bracket.
2. Slide the fuel level sensor down the bracket for the locking device to engage and secure the sensor.



1. Locking device

2. Locating lugs

3. Bracket

- Refit the fuel pump assembly (see Fuel Pump Assembly - Installation, page 389).
- Refit the fuel tank (see Fuel Tank - Installation, page 385).

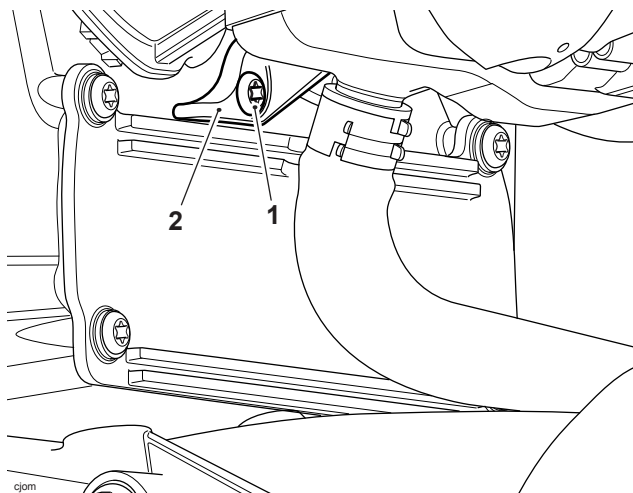
Air Filter Element - Removal

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.

- Remove the left and right hand side panels (see Side Panels, page 646).

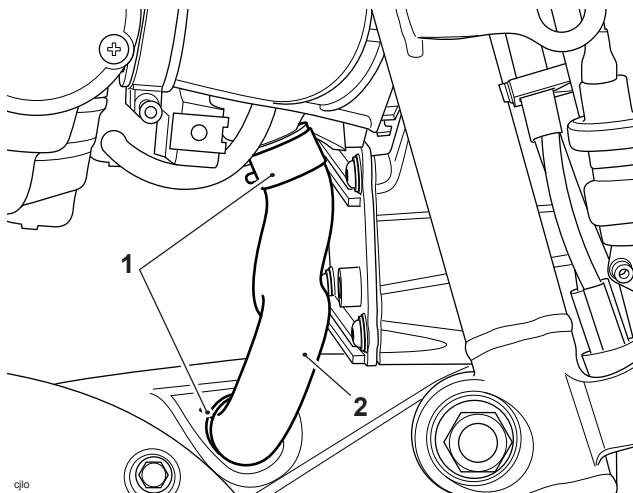
1. Remove the fixing securing the engine breather hose bracket to the airbox.



1. Fixing

2. Engine breather hose bracket

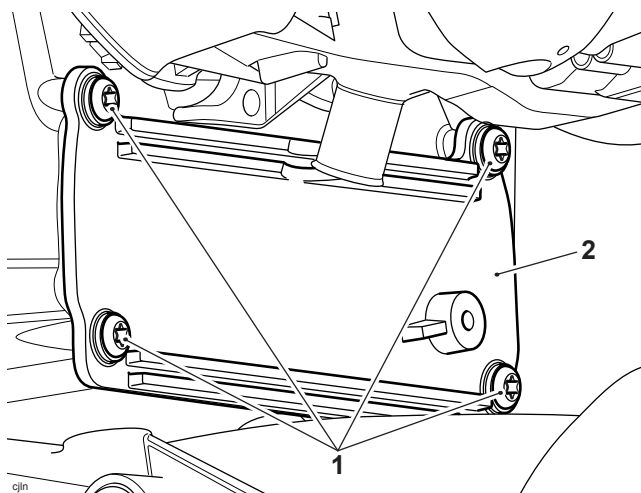
2. Release the two hose clips and remove the engine breather hose.



1. Hose clips

2. Engine breather hose

3. Release the four fixings securing the air filter cover to the airbox.



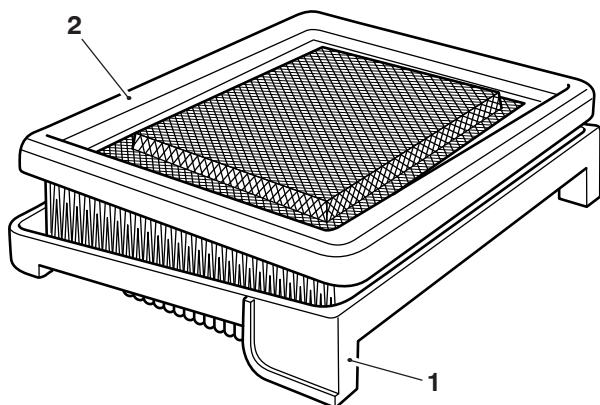
1. Fixings

2. Air filter cover

4. Remove the air filter cover and remove the air filter element from the housing.
5. Inspect the cover seal for damage, replace if necessary.

Note:

- Note the orientation of the air filter moulding for installation.
6. Remove the air filter cassette from the air filter.



1. Cassette

2. Air filter element

Air Filter Element - Installation

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.

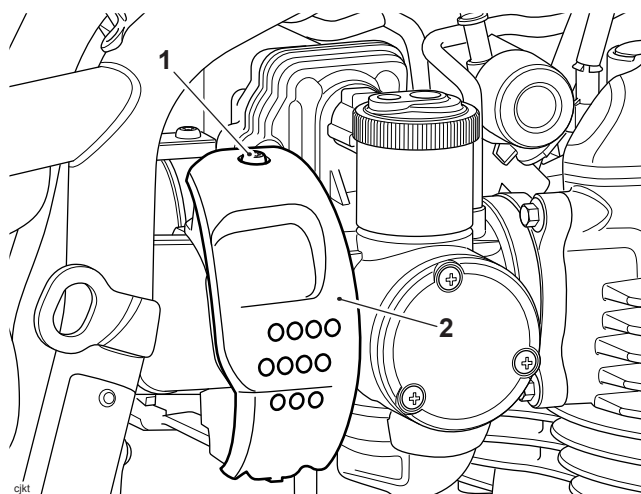
1. Clean the air filter cover and interior of the airbox.
2. Locate the new filter element into the air filter cassette, as noted for removal.
3. Fit the air filter and cassette assembly into the airbox.
4. Refit the air filter cover and tighten its fixings to 1.5 Nm.
5. Refit the engine breather hose and secure with the hose clips.
6. Secure the engine breather hose bracket to the airbox and tighten the fixing to 1.5 Nm.
 - Refit the left and right hand side panels (see Side Panels, page 646).

Airbox - Removal

Warning

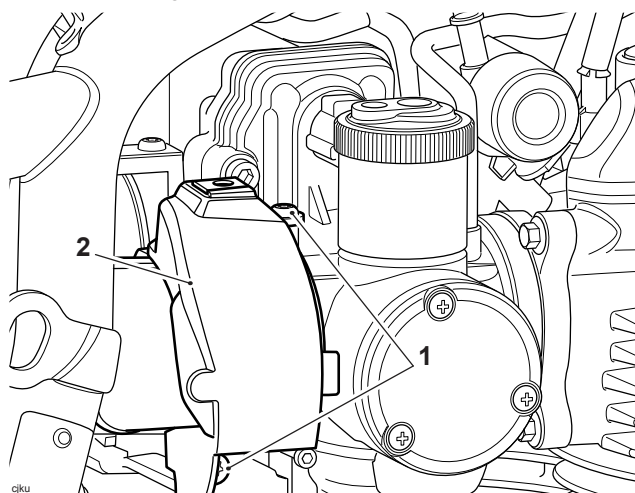
Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

- Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
 - Remove the fuel tank (see).
 - Remove the left and right hand side panels (see Side Panels, page 646).
 - Remove the rear wheel (see Rear Wheel - Removal, page 612).
 - Remove the rear mudguard (see Rear Mudguard - Removal, page 647).
 - If fitted, remove the evaporative canister (see Evaporative Canister (if fitted) - Removal, page 445).
1. Remove the fixing and remove the air intake finishers.

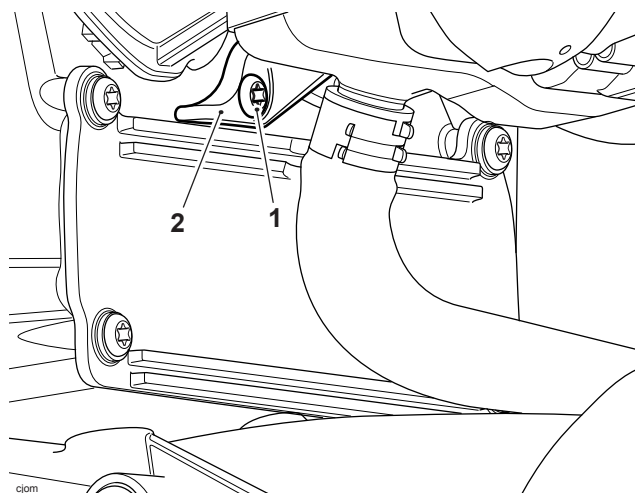


1. **Fixing**
2. **Air intake finisher (right hand side shown)**

2. Remove the two fixings and remove the mountings for the air intake finisher.

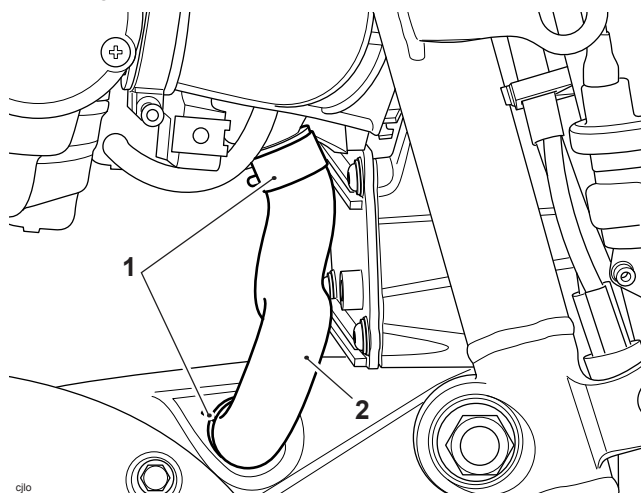


1. **Fixings**
2. **Mounting (right hand side shown)**
3. Remove the fixing securing the engine breather hose bracket to the airbox.



1. **Fixing**
2. **Engine breather hose bracket**

4. Release the two hose clips and remove the engine breather hose.

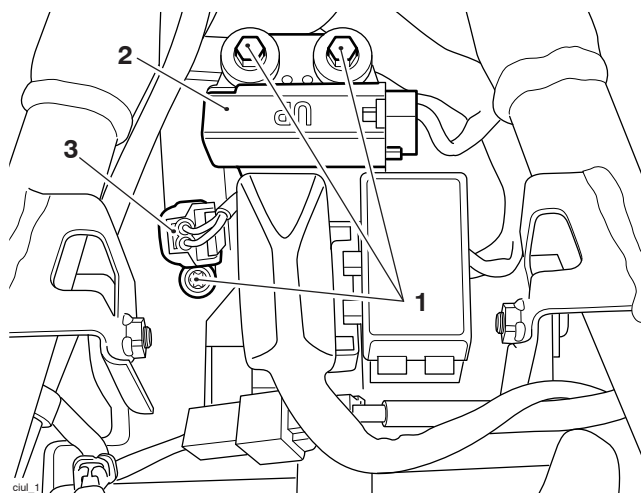


1. Hose clips
2. Engine breather hose

Note:

- Before the disconnection of any wiring, note the routing of all wiring and wiring connectors on both sides of the airbox.

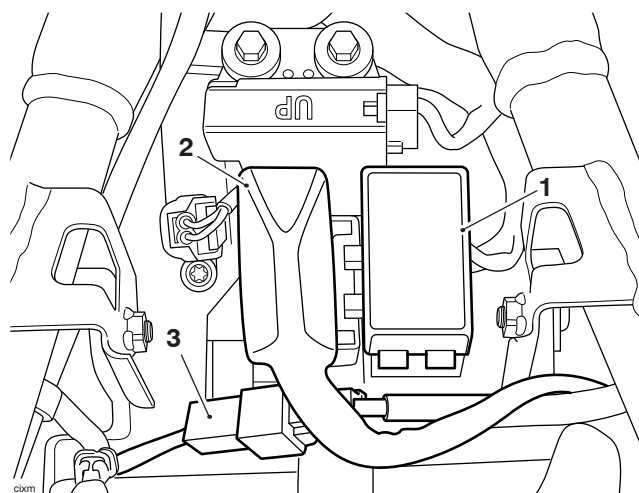
5. Remove the fixing and detach the air intake temperature sensor from the airbox.
6. Remove and discard the fixings securing the fall detection switch to the airbox.



1. Fixings
2. Fall detection switch
3. Air temperature sensor

7. Detach the fuse box and the diagnostic connector from the air box.

8. Disconnect the battery negative lead connector.

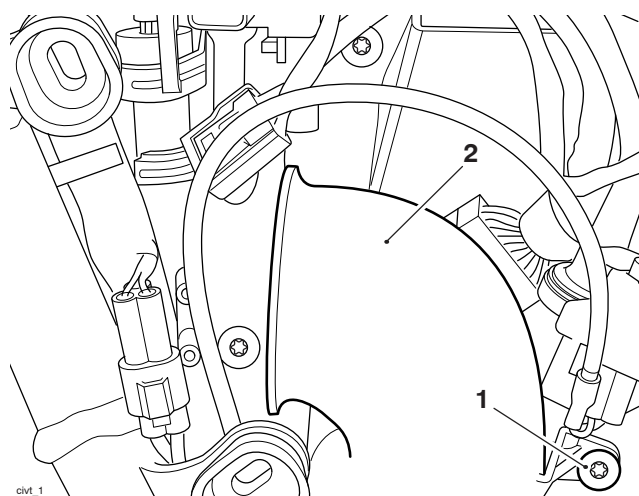


1. Fuse box
2. Diagnostic connector
3. Battery negative lead connector

Note:

- The seal for the air intake may come off with the air intake duct.

9. Remove the fixing and remove the air intake duct on the left hand side of the airbox.

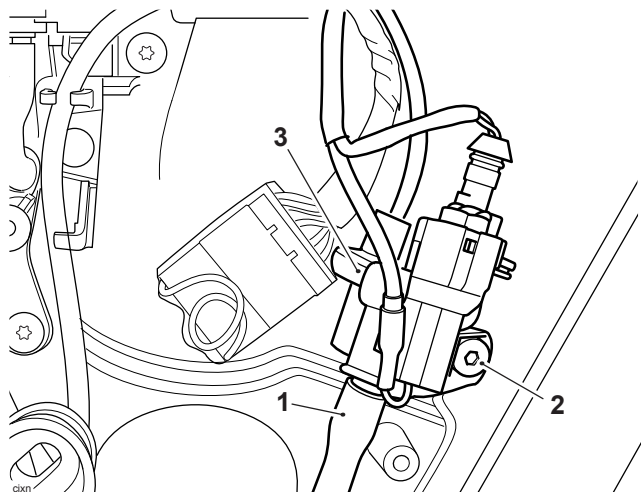


1. Fixing
2. Air intake duct

Note:

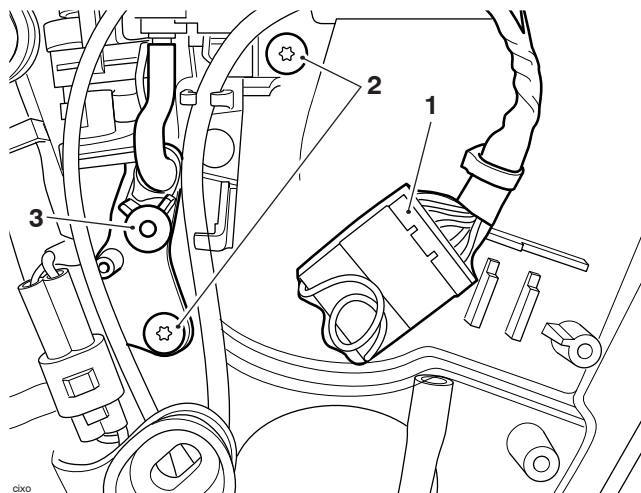
- If fitted, note the position and orientation of the purge control valve and its bracket for installation.

10. If fitted, detach the lower hose from the purge control valve, remove the fixing and detach the purge control valve and remove its bracket from the airbox.



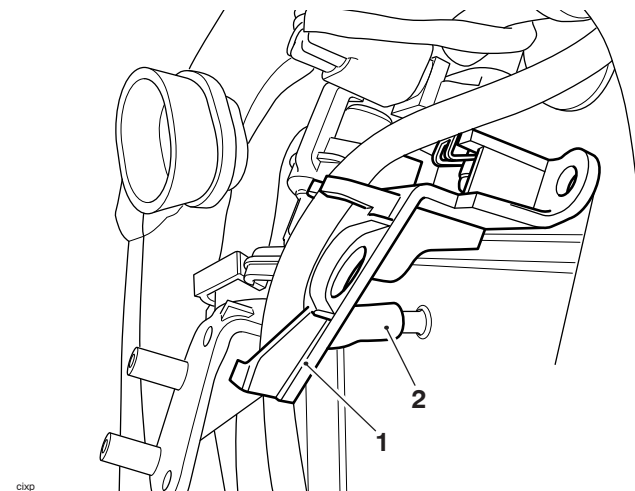
1. Lower hose
2. Fixing
3. Purge control valve

11. Carefully detach the accessory alarm multiplug from the airbox.
12. Remove the two fixings and detach the roll over valve bracket from the airbox.



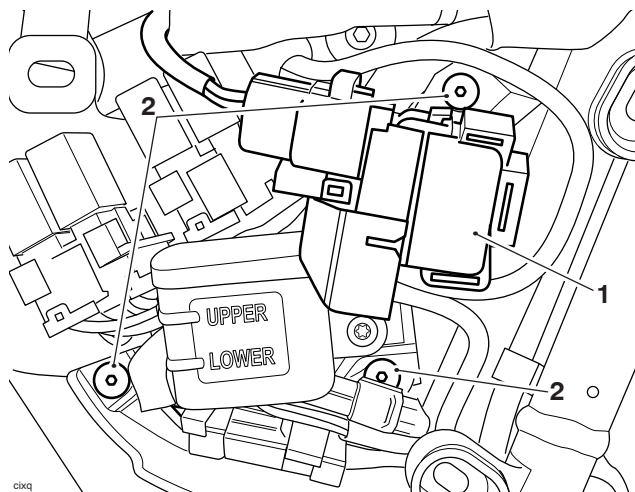
1. Accessory alarm multiplug
2. Fixings
3. Roll over valve bracket

13. Lift the roll over valve bracket and detach the ambient air pressure sensor hose from the airbox.



1. Roll over valve bracket
2. Ambient air pressure hose

14. Detach the starter motor solenoid from the relay bracket on the right hand side of the airbox.
15. Remove the three fixings and detach the relay bracket from the airbox.

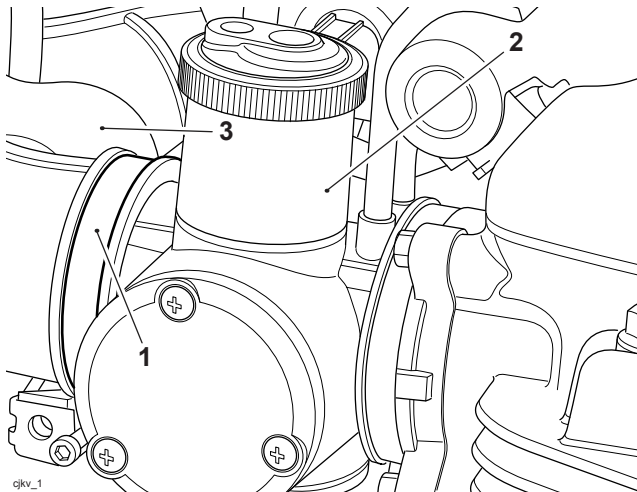


1. Starter motor solenoid (detached)
2. Fixings

Note:

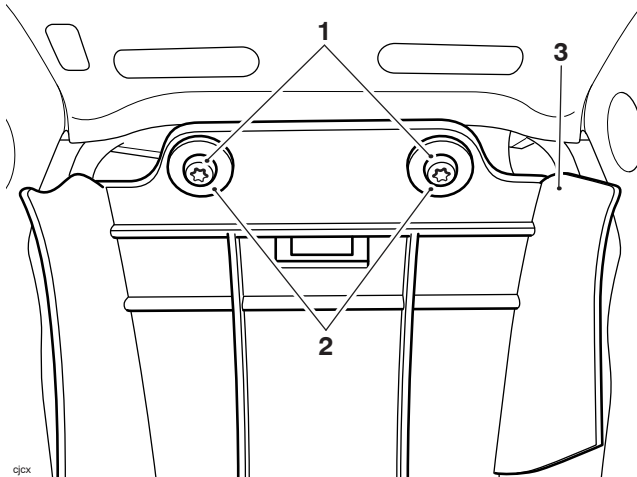
- Note the position of the clamp for the throttle body intake hose for installation.

16. Loosen the clamps for the throttle body intake hoses.



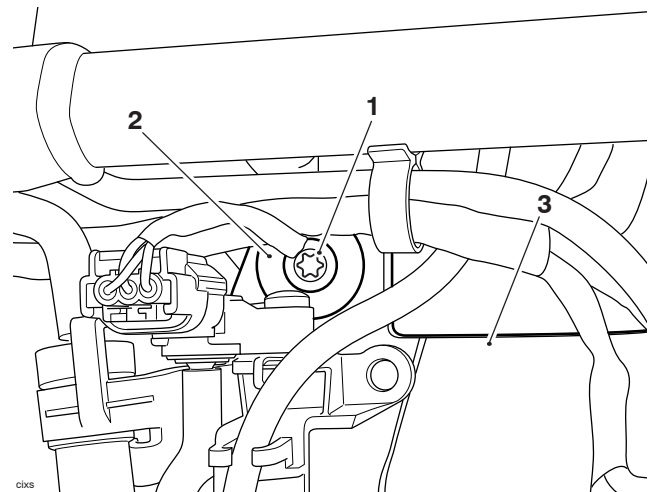
1. Clamp (right hand side shown)
2. Throttle body
3. Airbox

17. Remove the two fixings and their shouldered washers from under the rear of the airbox.



1. Fixings
2. Shouldered washers
3. Airbox

18. Remove the fixing and shouldered washer from both sides of the airbox.



1. Fixing
2. Shouldered washer
3. Airbox

Note:

- When removing the airbox, ensure that the brake lines on the right hand side of the frame do not get damaged.

19. Manoeuvre the airbox rearward to remove it from the motorcycle.

Airbox - Installation

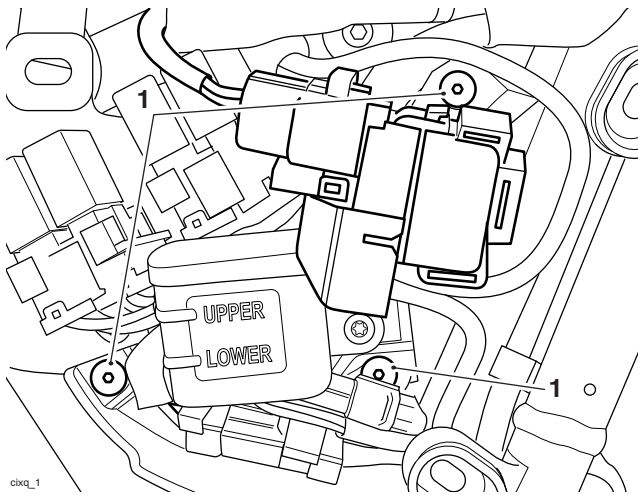
Warning

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:

- **When installing the airbox, ensure that the brake lines on the right hand side of the frame do not get damaged.**

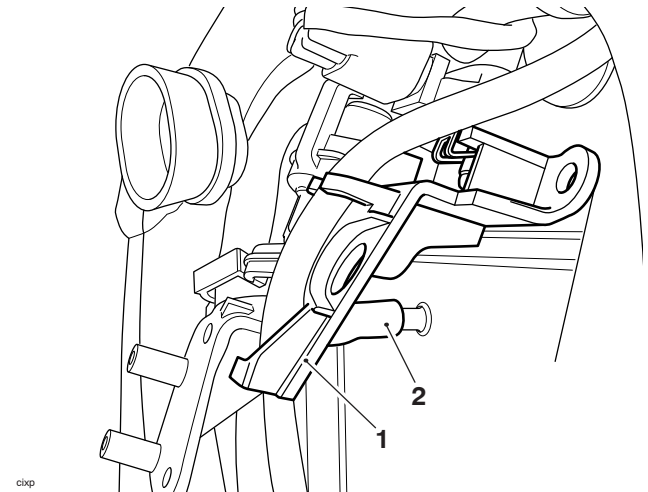
1. Position the airbox to the frame ensuring the throttle body air ducts are correctly aligned to the throttle bodies.
2. Check that the harnesses and hoses are routed as noted on removal.
3. Secure the airbox with the four shouldered washers and fixings, tighten the fixings to 6 Nm.
4. Tighten the intake hose clamps to 1.5 Nm.
5. Refit the relay bracket to the right hand side of the airbox, ensuring the harness is not trapped, and tighten the three fixings to 1.5 Nm.



1. Fixings

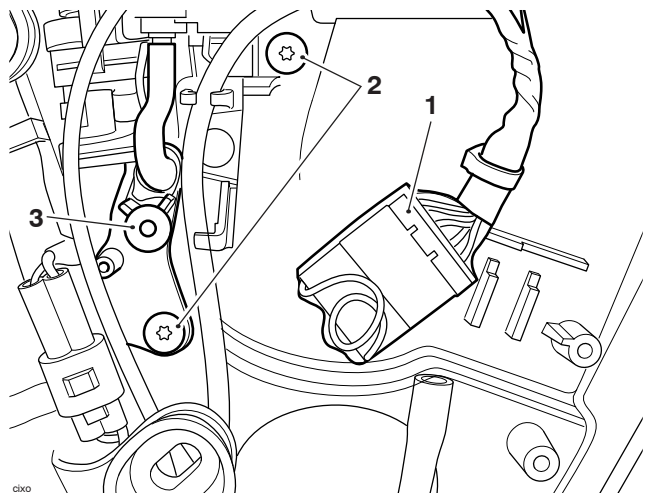
6. Refit the starter motor solenoid to the relay bracket.

7. Attach the ambient air pressure sensor hose to the left hand side of the airbox.



1. Ambient air pressure sensor hose

8. Refit the roll over valve bracket, ensuring the harness is not trapped, and tighten the two fixings to 1.5 Nm.
9. Carefully attach the accessory alarm multiplug to the airbox.



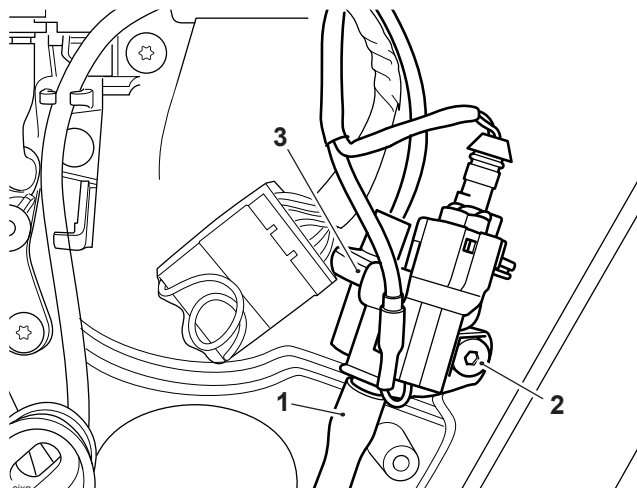
1. Accessory alarm multiplug

2. Fixings

3. Roll over valve bracket

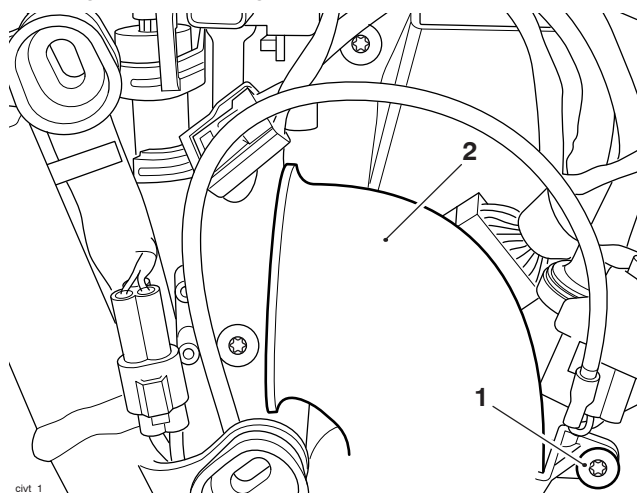
10. If fitted, position the purge control valve and its bracket to the airbox as noted for removal. Fit its fixing and tighten to 1.5 Nm.

11. Refit the lower hose to the purge control valve.



- 1. Lower hose
- 2. Fixing
- 3. Purge control valve

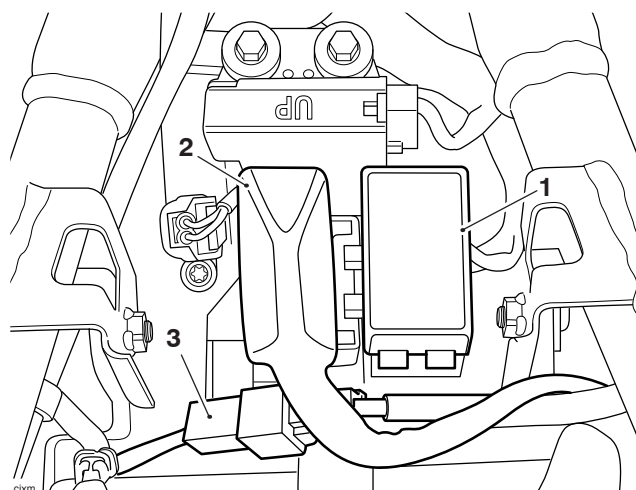
12. If necessary, refit the air intake duct seal to the airbox.
13. Refit the air intake duct to the airbox and tighten its fixing to 1.5 Nm.



- 1. Fixings
- 2. Air intake duct

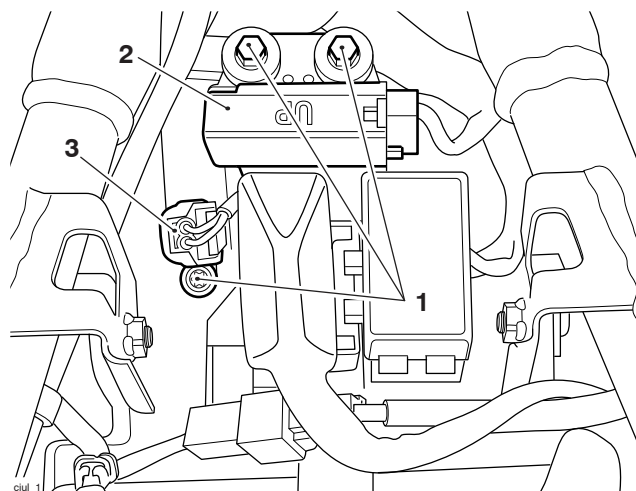
14. Reconnect the battery negative lead connector.

15. Attach the fuse box and the diagnostic connector to the top of the airbox.



- 1. Fuse box
- 2. Diagnostic connector
- 3. Battery negative lead

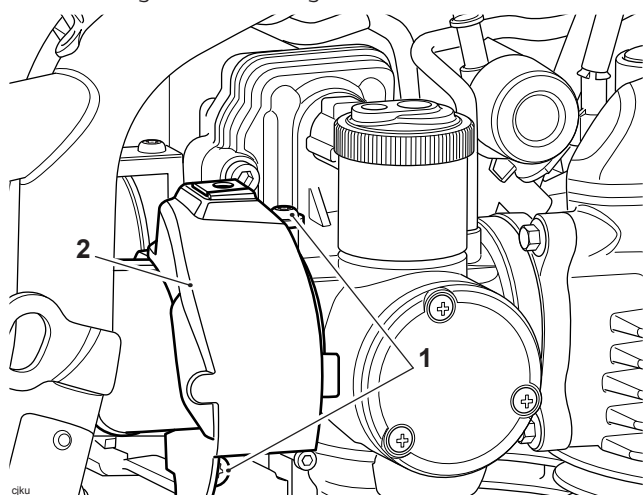
16. Attach the air intake temperature sensor to the airbox and tighten its fixing to 1.5 Nm.
17. Attach the fall detection switch to the airbox and tighten the new fixings to 3 Nm.



- 1. Fixings
- 2. Fall detection switch
- 3. Air temperature sensor

18. Refit the engine breather hose and secure with the hose clips.
19. Secure the engine breather hose bracket to the airbox and tighten the fixing to 1.5 Nm.

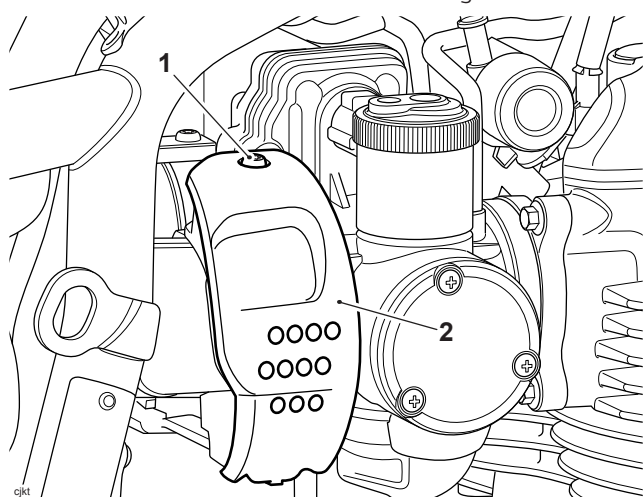
20. Fit the mountings for the air intake finisher and tighten its fixings to 3 Nm.



1. Fixings

2. Mounting (right hand side shown)

21. Fit the air intake finishers and tighten to 3 Nm.



1. Fixing

2. Air intake finisher (right hand side shown)

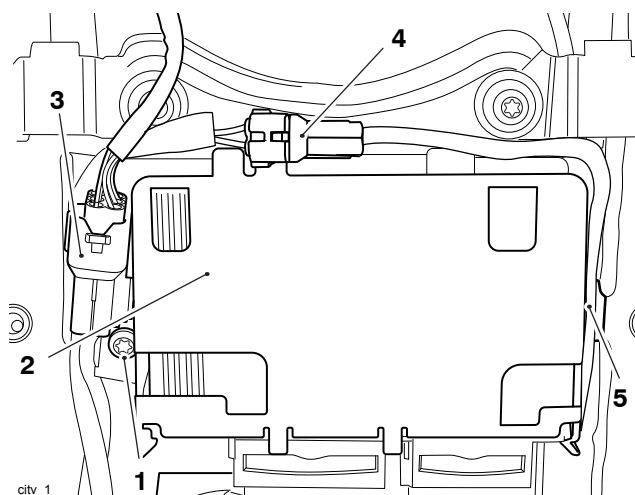
- If removed, refit the evaporative canister (see Evaporative Canister (if fitted) - Installation, page 446).
- Refit the rear mudguard (see Rear Mudguard - Installation, page 648).
- Refit the rear wheel (see Rear Wheel - Installation, page 614).
- Refit the left and right hand side panels (see Side Panels, page 646).
- Refit the fuel tank (see Fuel Tank - Installation, page 385).
- Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
- Refit the seat (see Seat - Installation, page 645).

Engine Electronic Control Module (ECM) - 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.

- Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
1. Remove and discard the fixing securing the engine ECM bracket to the frame.
 2. Partially raise the right hand side of the bracket and release the locating lug on the left hand side from the frame.
 3. Detach the rear lights electrical connector from its lug on the engine ECM bracket.
 4. Disconnect the USB electrical connector.



1. Fixing

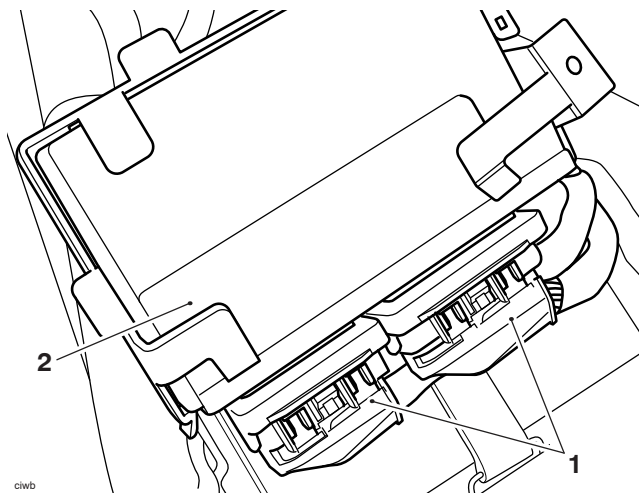
2. Engine ECM bracket

3. Rear lights electrical connector

4. USB electrical connector

5. Locating lug

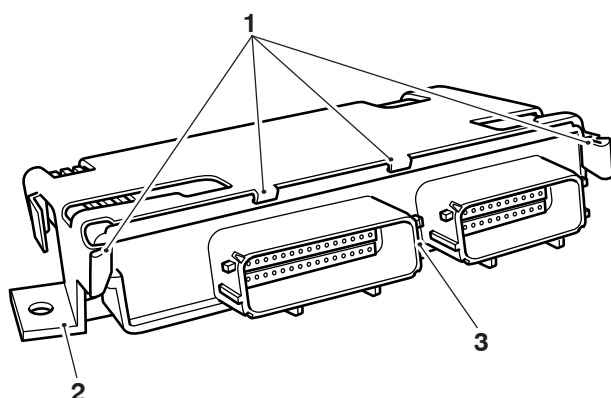
5. Disconnect the two electrical connectors (see Electrical Connectors, page 308) and remove the engine ECM and bracket assembly.



1. Engine ECM connectors

2. Engine ECM

6. Release the four locking tangs and remove the engine ECM from its bracket.



1. Locking tangs

2. Engine ECM bracket

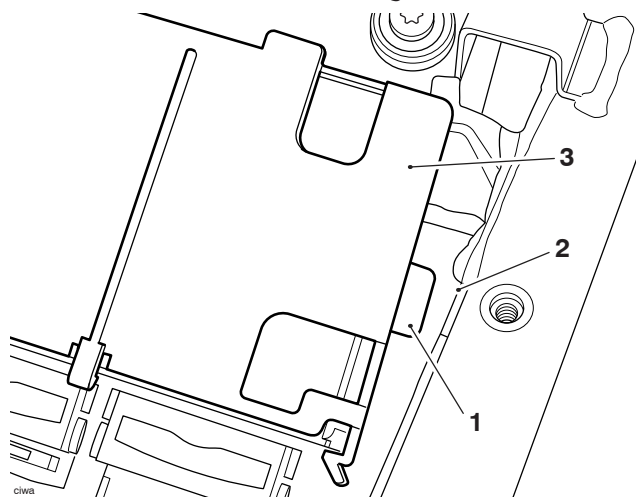
3. Engine ECM

Engine Electronic Control Module (ECM) - Installation

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. Fit the engine ECM into the mounting bracket.
2. Reconnect the engine ECM connectors (see Electrical Connectors, page 308).
3. Reconnect the USB electrical connector.
4. Attach the rear lights electrical connector onto its locating lug on the engine ECM bracket.
5. Locate the locating lug on the left hand side of the bracket into its locating hole in the frame.



1. Locating lug

2. Locating hole

3. Engine ECM bracket

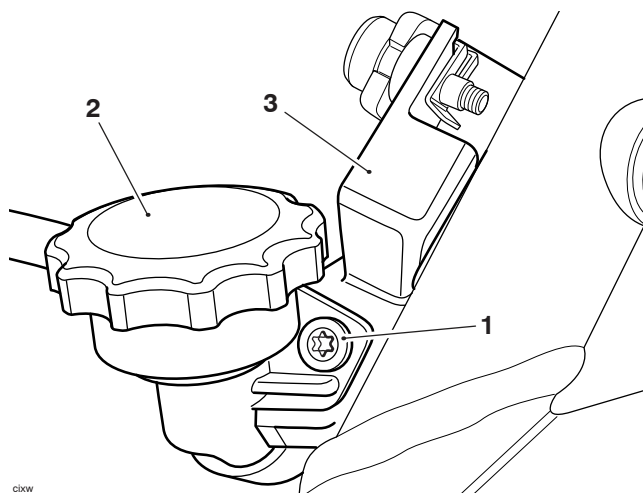
6. Secure the engine ECM bracket with a new fixing and tighten to 4 Nm.
 - Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
 - Refit the seat (see Seat - Installation, page 645).

Immobiliser/TPMS Control Module - Removal

Warning

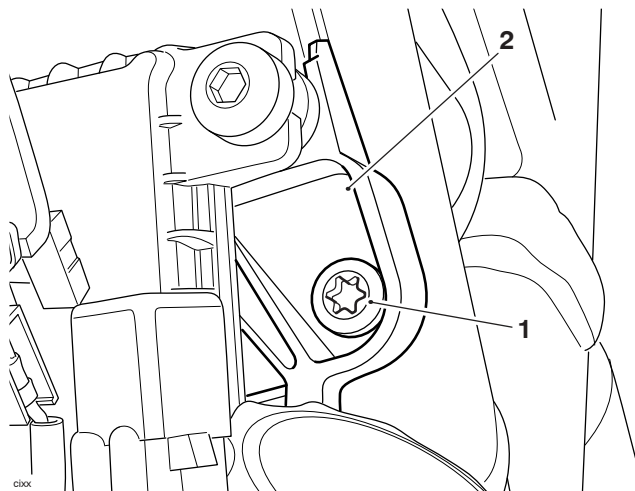
Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

- Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
 - Remove the fuel tank (see).
1. Remove the fixing and detach the coolant filler neck from the immobiliser/TPMS control module bracket.



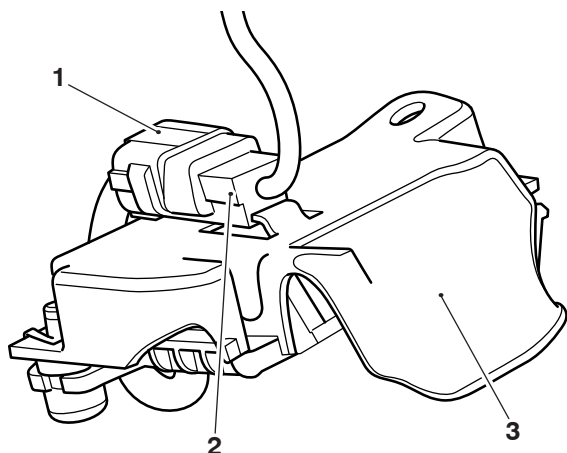
1. Fixing
2. Coolant filler neck
3. Immobiliser/TPMS control module bracket

2. Remove the two fixings (one either side) and detach the immobiliser/TPMS control module and bracket assembly from the frame.



1. Fixing (right hand side shown)
2. Immobiliser/TPMS control module bracket
3. Carefully manoeuvre the immobiliser/TPMS control module and bracket assembly through to the left hand side of the frame.
4. Disconnect the immobiliser/TPMS electrical connector from the main harness.

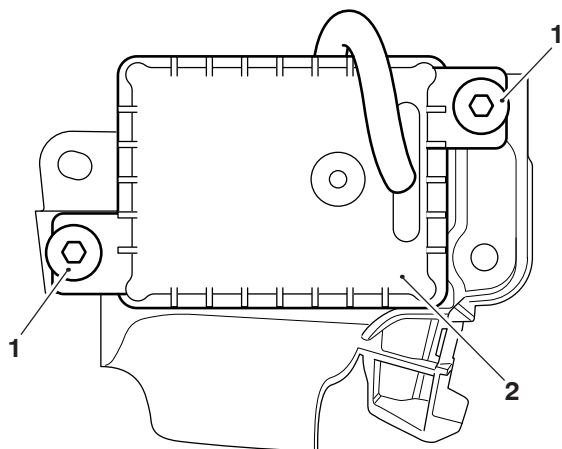
5. Release the locking device, detach the main harness electrical connector from the bracket and remove the immobiliser/TPMS control module and bracket assembly.



cixz

1. Immobiliser/TPMS electrical connector
2. Main harness electrical connector
3. Bracket

6. Remove the fixings and remove the immobiliser/TPMS control module from its bracket.



cjdy

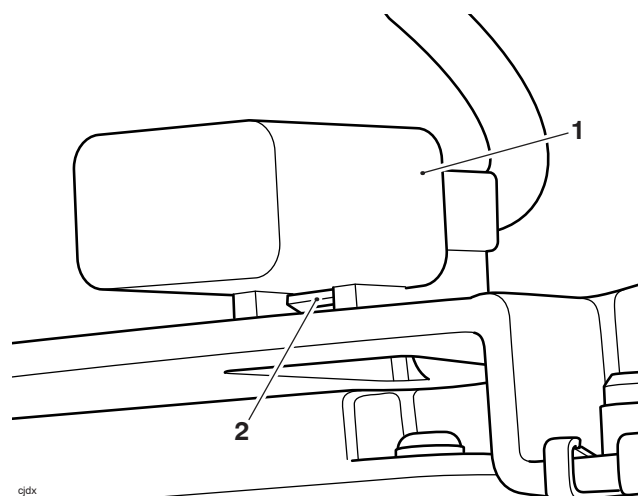
1. Fixings
2. Immobiliser/TPMS control module

Immobiliser/TPMS Control Module - Installation

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.

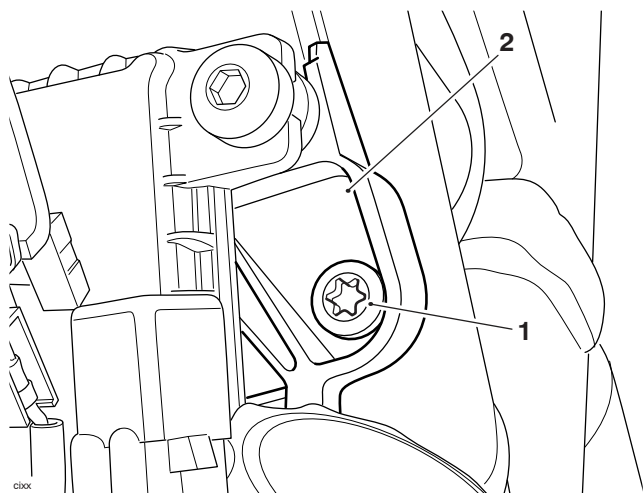
1. Fit the immobiliser/TPMS control module to its bracket and tighten the fixings to 2 Nm.
2. Securely attach the main harness electrical connector to the bracket.



cjdx

1. Harness electrical connector
2. Locking device
3. Connect the immobiliser/TPMS electrical connector to the main harness.

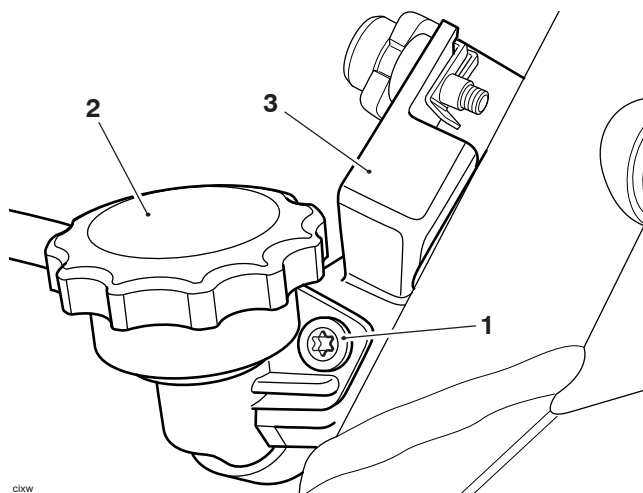
- Carefully manoeuvre the immobiliser/TPMS control module and bracket assembly to the frame and tighten the fixings to 4 Nm.



1. Fixing (right hand side shown)

2. Immobiliser/TPMS control module bracket

- Attach the coolant filler neck to the immobiliser/TPMS control module bracket and tighten the fixing to 3 Nm.



1. Fixing

2. Coolant filler neck

3. Immobiliser/TPMS control module bracket

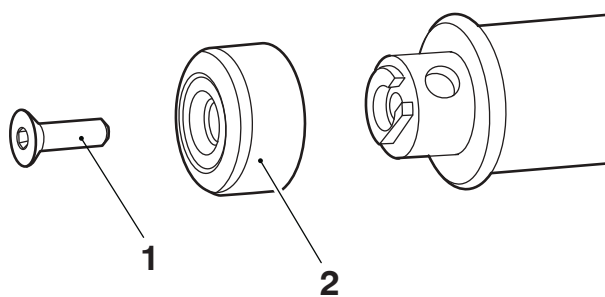
- Refit the fuel tank (see Fuel Tank - Installation, page 385).
- Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
- Refit the seat (see Seat - Installation, page 645).

Twist Grip - 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.

- Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
- Remove the right hand handlebar end weight. Discard the fixing.



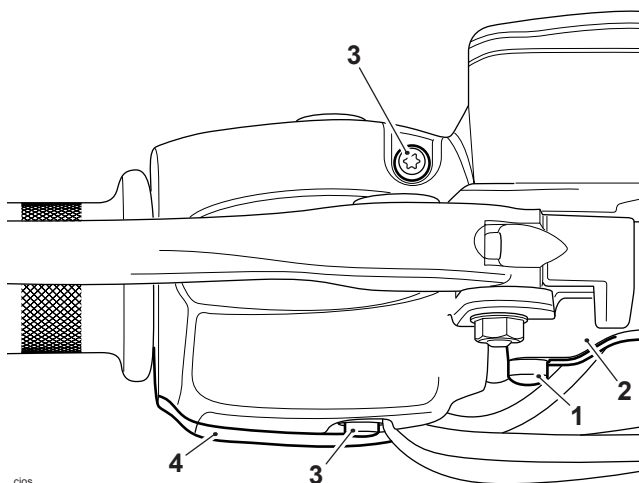
cccw_5

1. Fixing

2. End weight

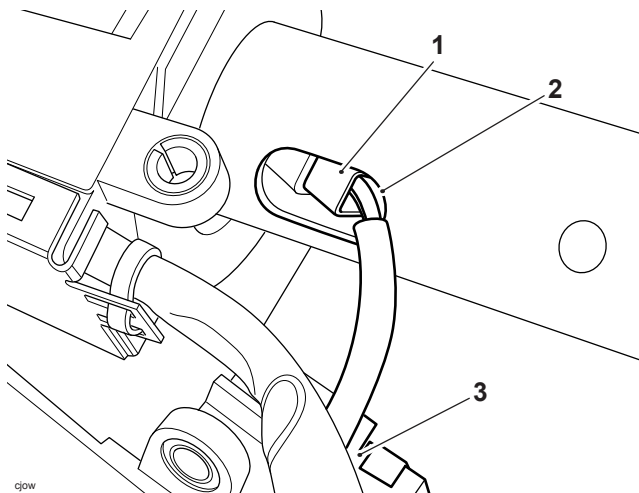
- Detach the brake light switch and bracket from the master cylinder.

- Remove the two fixings and detach the switch housing from the handlebar.



- Brake light switch fixings
- Brake light switch and bracket
- Switch housing fixings
- Switch housing

- Slide the heated twist grip further down the handlebar until the heated grip electrical connector is visible at the second hole in the handlebar.
- Disconnect the electrical connector for the heated grip from the switch housing.



- Heated grip electrical connector
- Second hole
- Switch housing

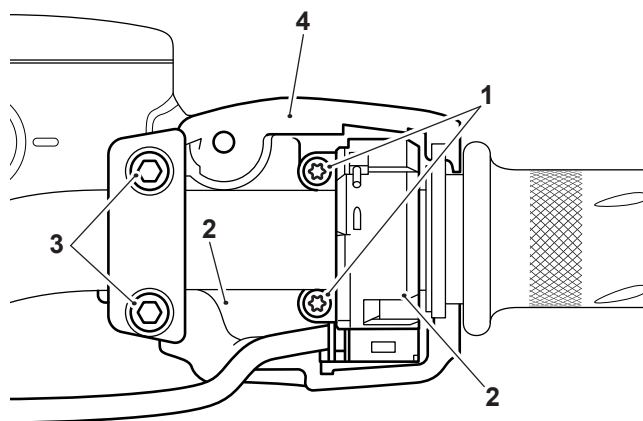
Note:

- Note the orientation of the twist grip position sensor for installation.
- Remove the fixings securing the twist grip position sensor to the master cylinder. Discard the fixings.

Caution

To prevent paint damage, do not spill brake fluid onto any area of the bodywork or frame. Spilled brake fluid will damage paintwork.

- Release the fixings and remove the clamp from the master cylinder. Detach the master cylinder from the handlebars and support it in an upright position.



- Fixings for the twist grip position sensor
- Twist grip position sensor
- Fixings for master cylinder
- Master cylinder

Note:

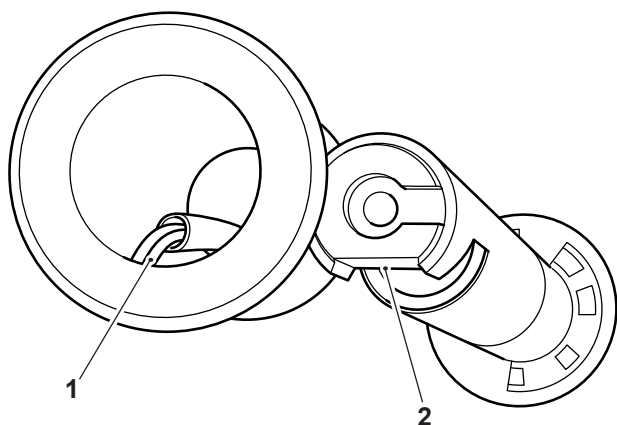
- Note the position and orientation of the twist grip to its position sensor for installation.
- Slide the twist grip off the handlebar while carefully feeding the harness into the handlebar.

Twist Grip - Installation

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.

When fitting the heated grips, ensure the heated grip harness is held in position and is positioned by the flat edge of the handlebar.



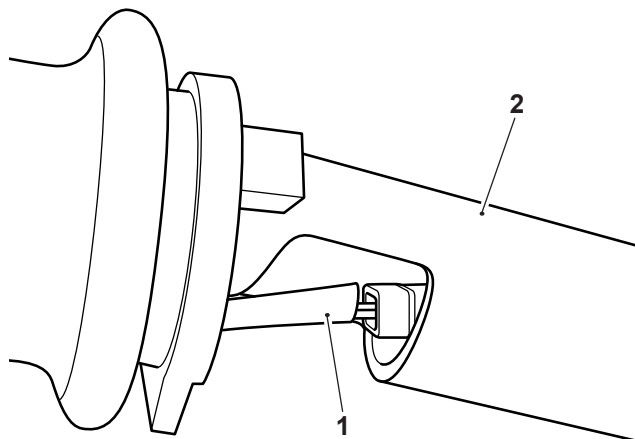
cjot

1. Heated grip harness
2. Flat edge on handlebar

Caution

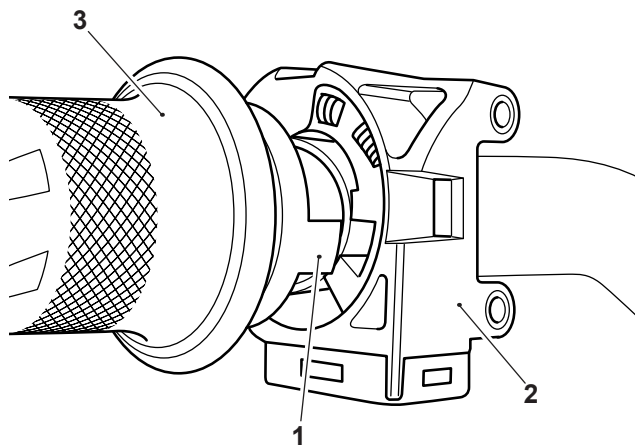
When fitting the heated grips, do not excessively twist the grip forward or rearward. Excessive twisting of the grip may damage the heated grip harness.

1. Guide the heated twist grip harness under the flat edge of the handlebar, through the first hole and into the handlebar.



cjou

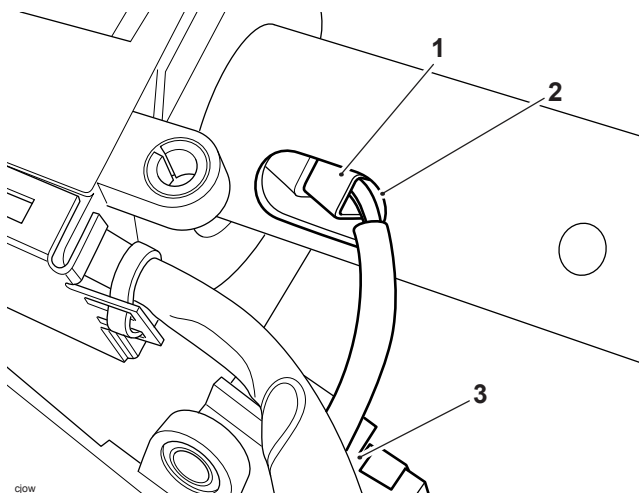
1. Heated grip harness
 2. Handlebar
2. While holding the harness inside the heated twist grip in position, slide the twist grip onto the handle until its electrical connector is visible at the second hole.
 3. Position the twist grip position sensor to the heated twist grip. Ensure the locating lug on the twist grip fully engages with its gap in the position sensor.



cjov

1. Heated twist grip locating lug
 2. Twist grip position sensor
 3. Heated twist grip
4. Pull the electrical connector out of the handlebar and connect it to the switch housing.

5. Slide the heated twist grip back until its electrical connector is inside the handlebar.



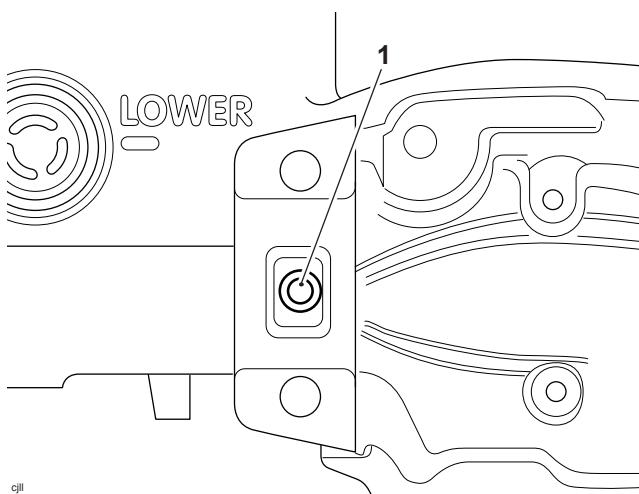
1. Heated grip electrical connector
2. Second hole
3. Switch housing

6. Position the master cylinder to the handlebar and fit the twist grip position sensor to it. Tighten the two new fixings to 2.5 Nm. Ensure the heated twist grip remains correctly fitted to the position sensor.

Caution

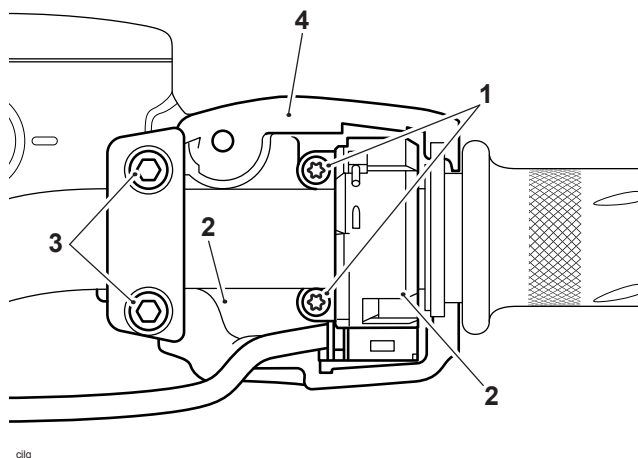
When fitting the heated grips, do not excessively twist the grip forward or rearward. Excessive twisting of the grip may damage the heated grip harness.

7. Position the master cylinder onto the handlebar ensuring its locating lug fits into its hole on the handlebar.



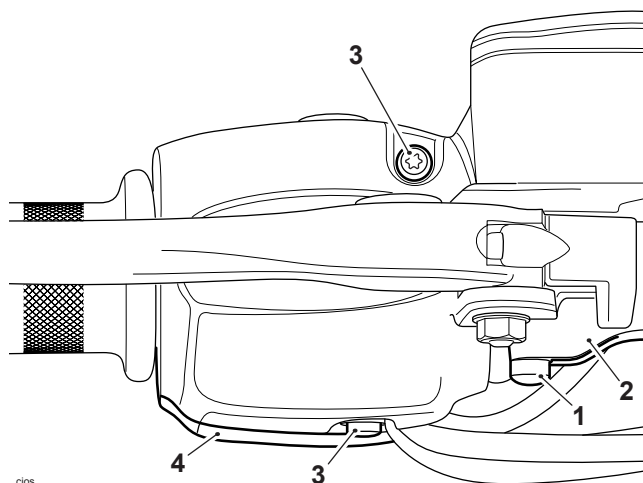
1. Master cylinder locating lug

8. Fit the master cylinder clamp and tighten the fixings, upper one first, to 12 Nm.



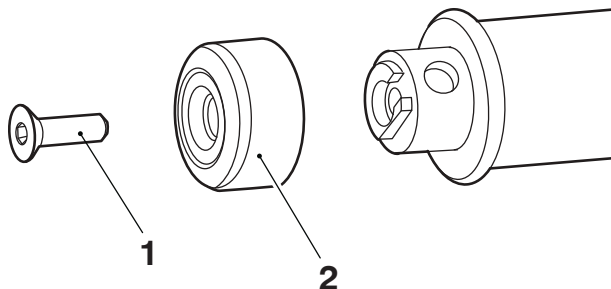
1. Fixings for the twist grip position sensor
2. Twist grip position sensor
3. Fixings for the master cylinder
4. Master cylinder
9. Fit the switch housing to the master cylinder and tighten its fixings to 1 Nm.

10. Fit the brake light switch to the master cylinder and tighten its fixing to 2.5 Nm.



1. Fixing (brake light switch)
2. Brake light switch housing
3. Fixings (switch housing)
4. Switch housing

11. Refit the right hand handlebar end weight and tighten its new fixing to 5 Nm.



1. Fixing
2. End weight

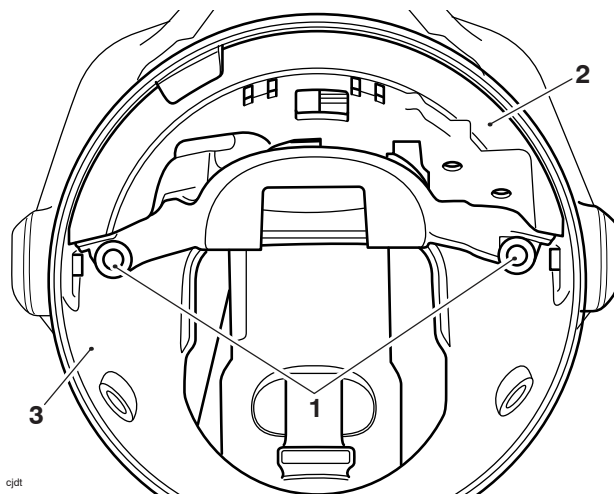
- Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
- Refit the seat (see Seat - Installation, page 645).

Twist Grip Position Sensor - 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.

- Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
 - Remove the headlight from the headlight bowl (see Headlight - Removal, page 679).
1. Release the fixings and detach the harness bracket from the headlight bowl.

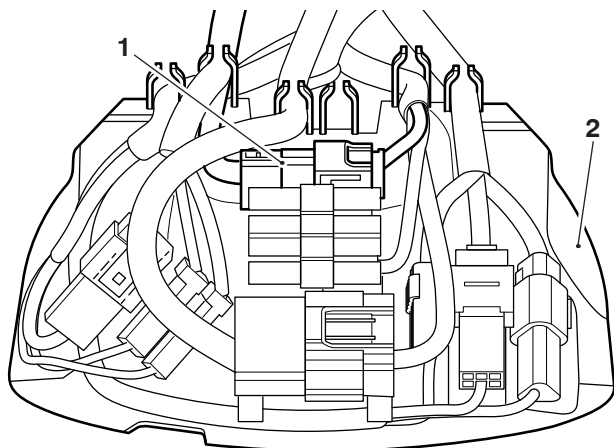


1. Fixings
2. Harness bracket
3. Headlight bowl

Note:

- Note the routing of the twist grip harness for installation.

- On the back of the harness bracket, locate and disconnect the twist grip electrical connector from the main harness.



cjcz

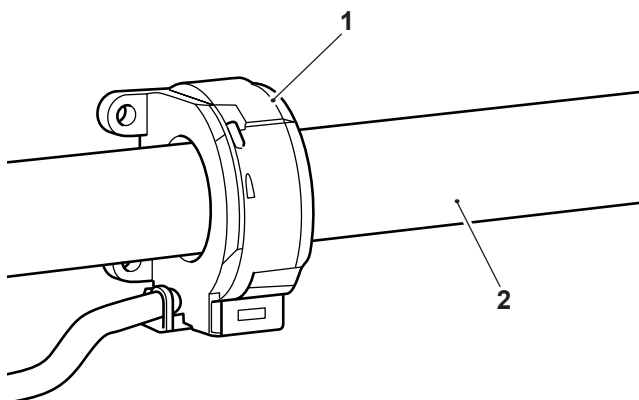
- Twist grip electrical connector**
- Harness bracket**

Note:

- Note the routing of the twist grip harness for installation.
- Route the twist grip harness out of the headlight bowl.
 - Remove the twist grip (see Twist Grip - Removal, page 408).

Note:

- Note the orientation of the twist grip position sensor for installation.
- Remove the twist grip position sensor from the handlebar.



cjcz

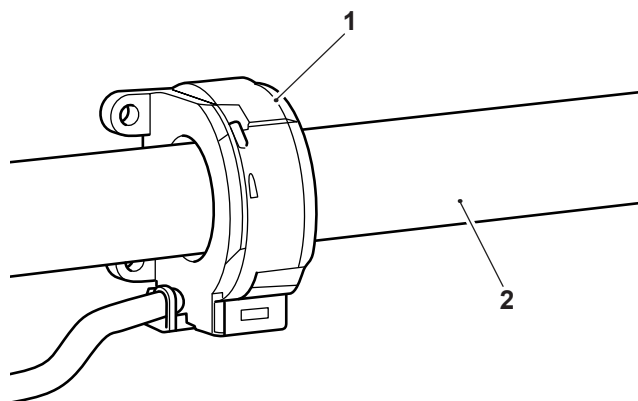
- Twist grip position sensor**
- Handlebar**

Twist Grip Position Sensor - Installation

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.

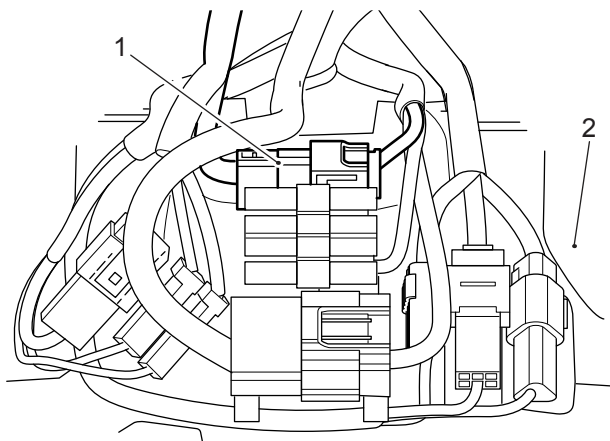
- Position the twist grip position sensor to the handlebar as noted for removal.



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- Twist grip position sensor**
 - Handlebar**
- Refit the twist grip (see Twist Grip - Installation, page 410).
 - Route the twist grip harness to the headlight bowl as noted for removal.

- On the back of the harness bracket, connect the twist grip electrical connector to the main harness.

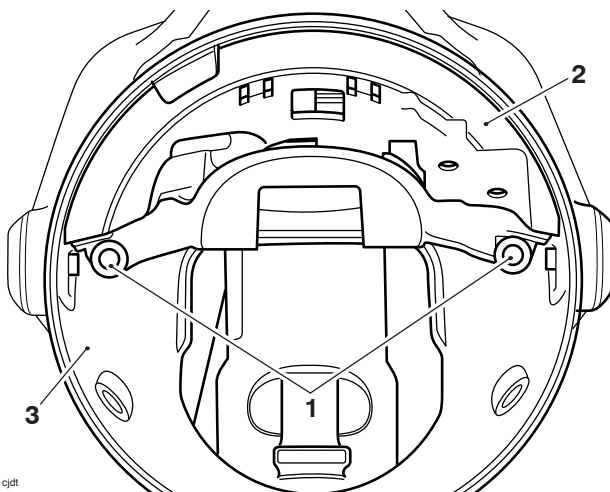


cjcz

1. Twist grip electrical connector

2. Harness bracket

- Fit the harness bracket to the headlight bowl and tighten the fixings to 1.5 Nm.



cjdt

1. Fixings

2. Harness bracket

3. Headlight bowl

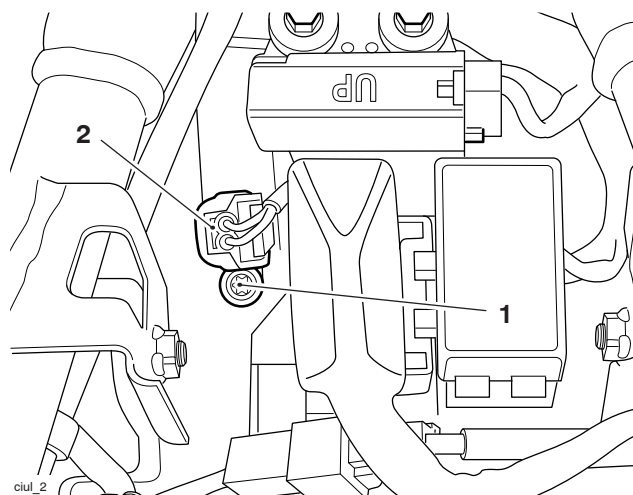
- Refit the headlight to the headlight bowl (see Headlight - Installation, page 680).
- Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
- Refit the seat (see Seat - Installation, page 645).

Intake Air Temperature Sensor - 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.

- Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
- Disconnect the electrical connector from the sensor.
 - Remove the fixing and remove the sensor from the airbox.



ciul_2

1. Electrical connector

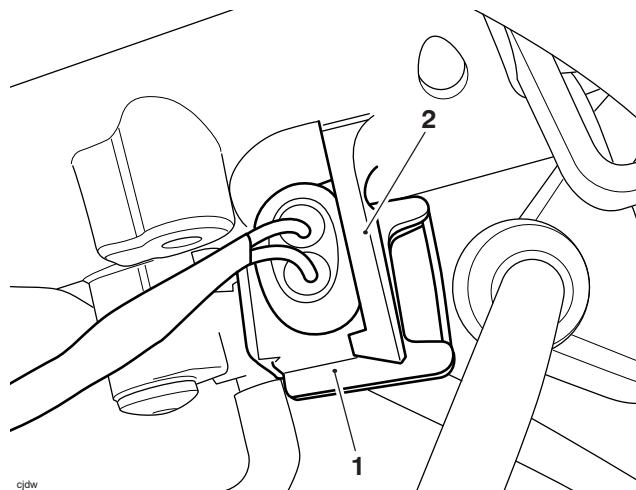
2. Fixing

Intake Air Temperature Sensor - Installation

1. Fit the sensor to the airbox and secure with the fixing. Tighten to 1.5 Nm.
2. Reconnect the electrical connector to the sensor.
 - Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
 - Refit the seat (see Seat - Installation, page 645).

Coolant Temperature Sensor - Removal

- Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
 - Remove the fuel tank (see).
1. Drain the cooling system (see Coolant Replacement - Drainage, page 462).
 2. Detach the coolant temperature connector from the ignition coils bracket.



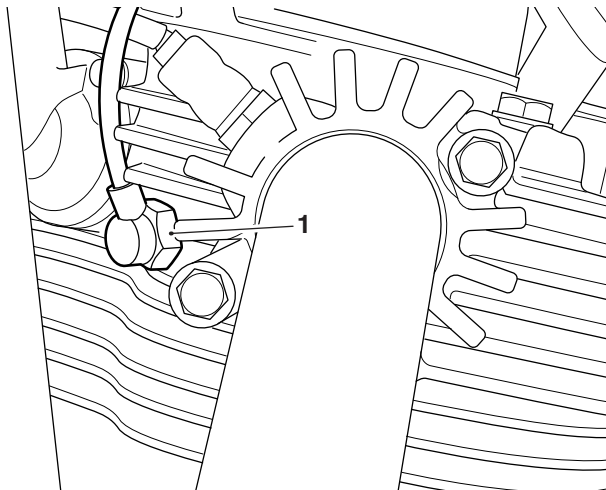
1. Coolant temperature sensor connector

2. Ignition coils bracket

3. Press the wire locking device fully in and detach the coolant temperature sensor from the main harness.

Note:

- **Note the routing of the coolant temperature harness for installation.**
4. Remove the rubber cover and using a suitable 19 mm slotted socket, remove the coolant temperature sensor from the cylinder head.



1. Coolant temperature sensor

Coolant Temperature Sensor - Installation

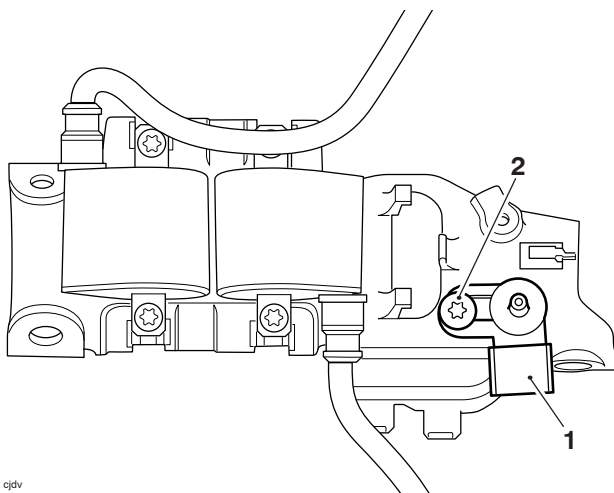
1. Fit the coolant temperature sensor into the cylinder head and tighten to 18 Nm.
2. Route the wiring as noted prior to removal and reconnect the sensor to the main harness.
3. Refit the coolant temperature sensor electrical connector to the ignition coils bracket.
4. Refill the cooling system (see Coolant Replacement - Filling, page 463).
 - Refit the fuel tank (see Fuel Tank - Installation, page 385).
 - Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
 - Refit the seat (see Seat - Installation, page 645).

Manifold Absolute Pressure (MAP) Sensor - 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.

- Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
 - Remove the fuel tank (see).
 - Remove the ignition coils and bracket assembly (see Ignition Coils - Removal, page 699).
1. Remove the fixing and remove the MAP sensor.



1. **MAP sensor**
2. **Fixing**

Manifold Absolute Pressure (MAP) Sensor - Installation

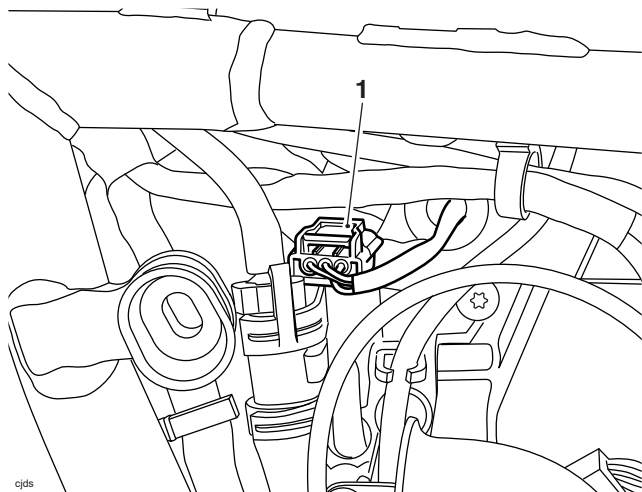
1. Fit the sensor to the ignition coils bracket and tighten the fixing to 2 Nm.
 - Refit the ignition coils and bracket assembly (see Ignition Coils - Installation, page 701).
 - Refit the fuel tank (see Fuel Tank - Installation, page 385).
 - Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
 - Refit the seat (see Seat - Installation, page 645).

Ambient Air Pressure Sensor - 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.

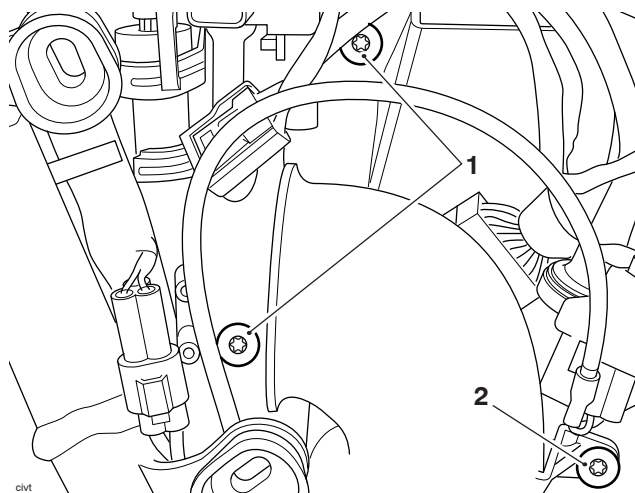
- Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
 - Remove the left hand side cover (see Side Panels, page 646).
1. Disconnect the electrical connector from the sensor.



1. Electrical connector

2. Remove the two fixings securing the sensor bracket to the airbox.

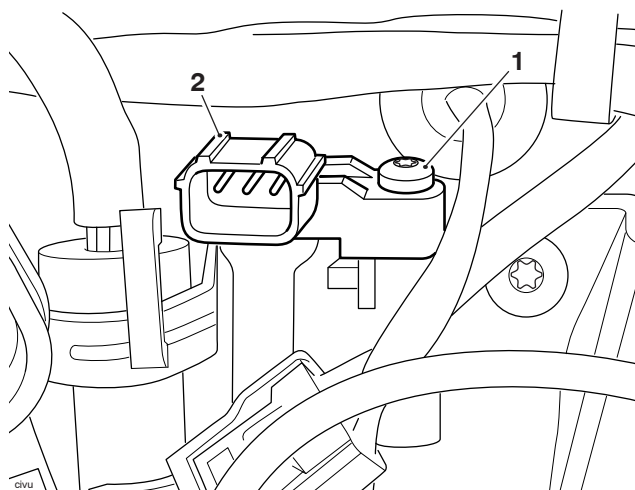
3. Remove the fixing securing the air intake duct to the airbox.



1. Sensor bracket fixings

2. Intake duct fixing

4. Carefully move the sensor bracket and remove the fixing securing the ambient air pressure sensor to it.



1. Fixing

2. Ambient air pressure sensor

5. Detach the hose and remove the ambient air pressure sensor.

Ambient Air Pressure Sensor - Installation

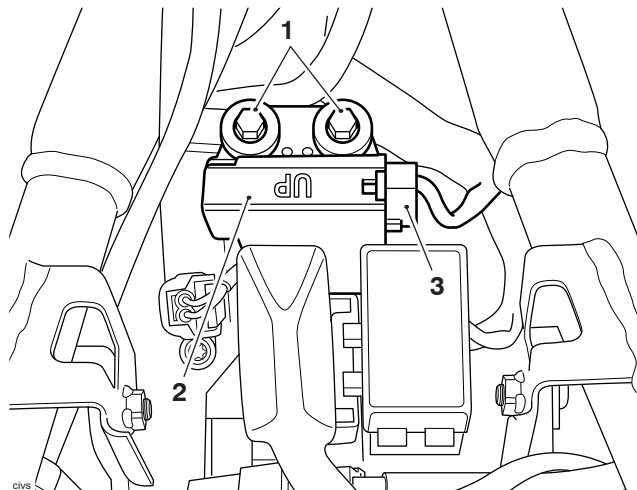
1. Fit the hose to the ambient pressure sensor.
2. Carefully move the sensor bracket and fit the ambient air pressure sensor, secure with the fixing and tighten to 2 Nm.
3. Fit the fixing securing the air intake duct to the airbox and tighten to 1.5 Nm.
4. Fit the two fixings securing the sensor bracket to the airbox, and tighten to 2 Nm.
5. Connect the electrical connector to the ambient air pressure sensor.
 - Refit the left hand side cover (see Side Panels, page 646).
 - Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
 - Refit the seat (see Seat - Installation, page 645).

Fall Detection Switch - 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.

- Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
1. Remove and discard the fixings securing the fall detection switch to the airbox.
 2. Disconnect the electrical connector and remove the fall detection switch.



1. **Fixings**
2. **Fall detection switch**
3. **Electrical connector**

Fall Detection Switch - Installation

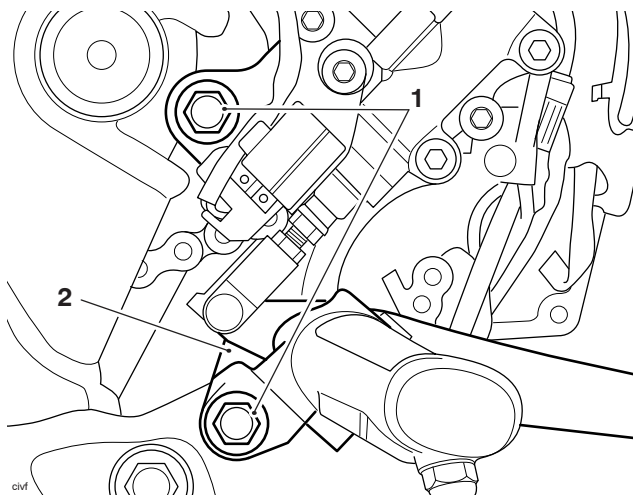
1. Connect the electrical connector to the fall detection switch.
2. Fit the fall detection switch to the airbox and tighten the new fixings to 3 Nm.
 - Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
 - Refit the seat (see Seat - Installation, page 645).

Gear Position Sensor - Removal

Warning

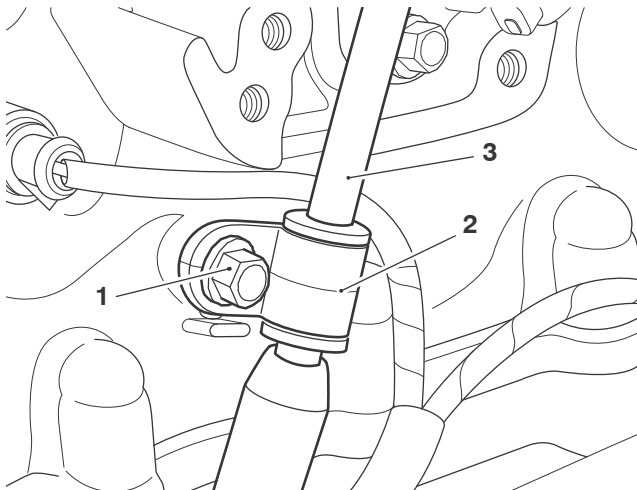
Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

- Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
 - Remove the right hand side panel (see Side Panels, page 646).
 - Remove the front sprocket cover (see Front Sprocket Cover - Removal, page 105).
1. Remove the fixings and detach the right hand control plate from the frame.



1. **Fixings**
2. **Control plate**

- Remove the fixing and detach the ABS line P-clip from the lower crankcase.

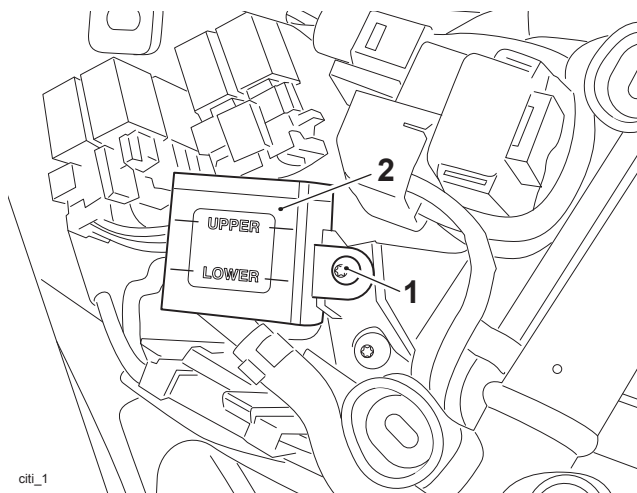


- Fixing
- P-clip
- ABS line

⚠ Caution

To prevent paint damage, do not spill brake fluid onto any area of the bodywork. Spilled brake fluid will damage paintwork.

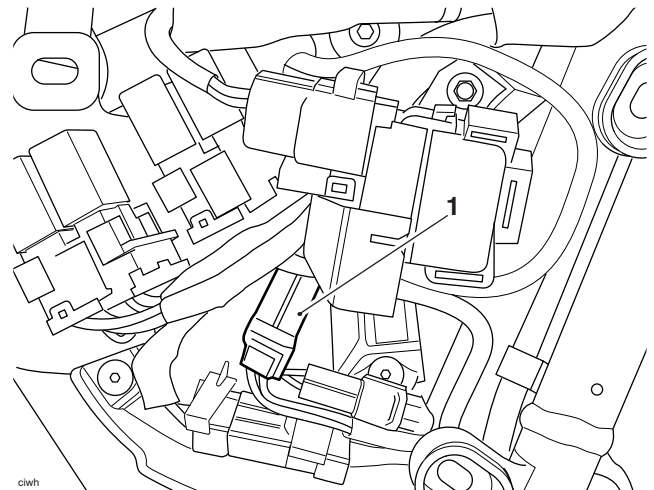
- Remove and discard the fixing and detach the rear brake fluid reservoir from the relay bracket.



- Fixing
- Brake fluid reservoir

- Detach the gear position sensor electrical connector from the relay bracket.

- Disconnect the gear position sensor electrical connector from the main harness.



- Gear position sensor electrical connector

Note:

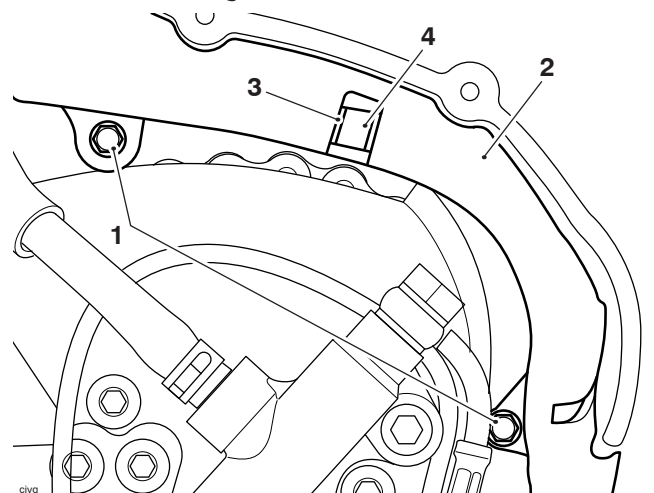
- Note the routing of the gear position sensor harness for installation.

- Route the gear position sensor harness through the frame to the harness guide on the crankcase.

Note:

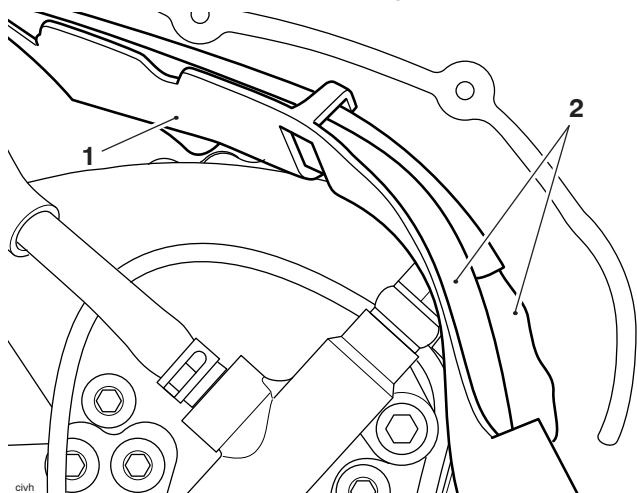
- Note that the white tape on the harnesses within the harness guide aligns with the upper gap for installation.

- Remove and discard the fixings and detach the harness guide from the crankcase.



- Fixings
- Harness guide
- Upper gap
- White tape

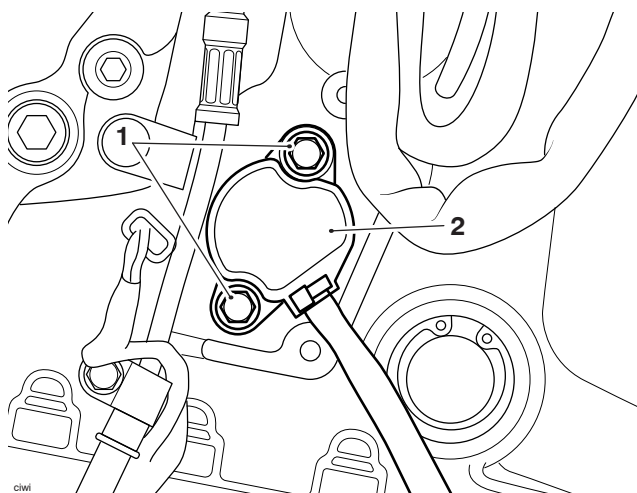
8. Carefully remove the gear position sensor harness from the harness guide.



1. Harness guide

2. Harness

9. Remove and discard the two fixings and remove the gear position sensor.



1. Fixings

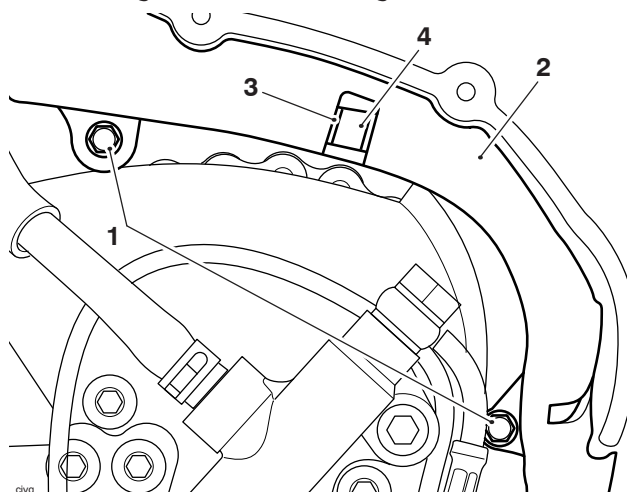
2. Gear position sensor

Gear Position Sensor - Installation

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. Fit a new O-ring to the sensor. Lubricate the O-ring with a smear of petroleum jelly.
2. Position the sensor to the engine, ensuring that the sensor engages with the slot in the selector drum shaft. Secure with the two new fixings and tighten to 5 Nm.
3. Carefully fit the gear position sensor harness into the harness guide as noted for removal with the white tape shown in the upper gap.
4. Secure the harness guide to the crankcase and tighten the new fixings to 4 Nm.



1. Fixings

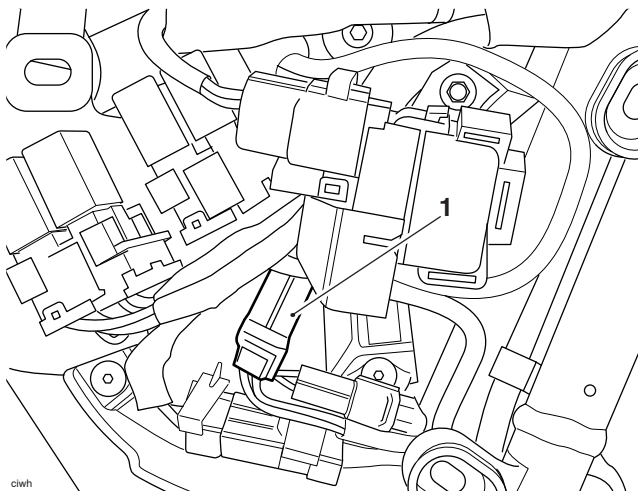
2. Harness guide

3. Upper gap

4. White tape

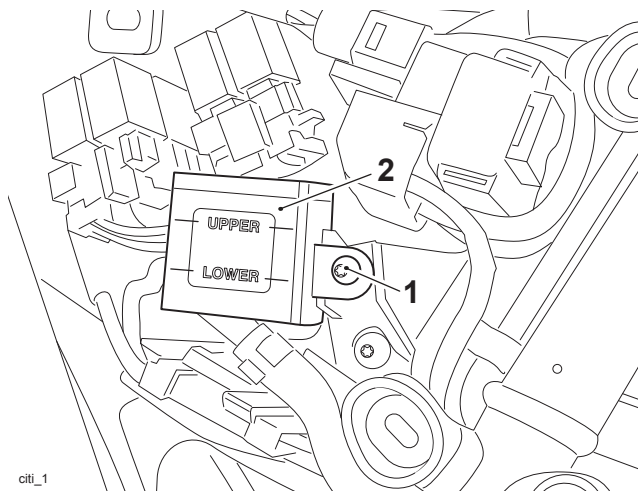
5. Route the gear position sensor harness through the frame to the right hand side of the airbox, as noted for removal. Connect the

gear position sensor electrical connector to the main harness and attach it to the relay bracket.



1. Gear position sensor electrical connector

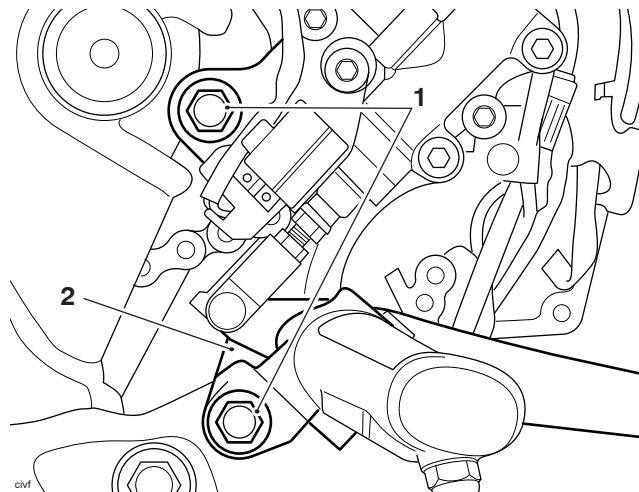
6. Refit the brake fluid reservoir to the relay bracket, and tighten the new fixing to 3 Nm.



1. Fixing

2. Brake fluid reservoir

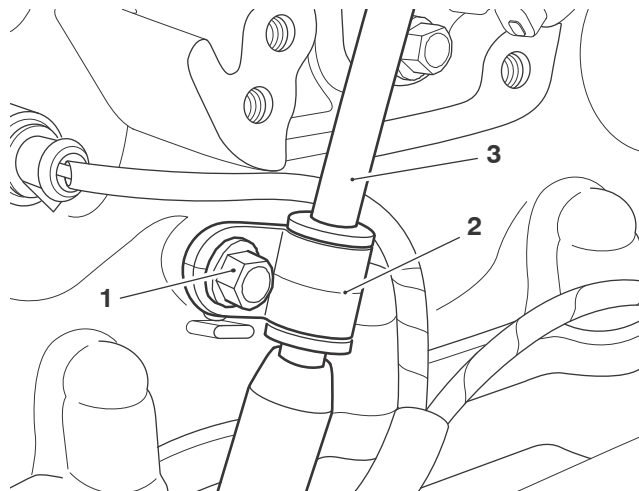
7. Attach the right hand control plate to the frame and tighten the fixings to 24 Nm. Ensure the brake light switch harness is routed as noted for removal.



1. Fixings

2. Control plate

8. Refit the brake line P-clip to the lower crankcase and tighten the fixing to 5 Nm.



1. Fixing

2. P clip

3. ABS line

- Refit the front sprocket cover (see Front Sprocket Cover - Installation, page 106).
- Refit the right hand side panel (see Side Panels, page 646).
- Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
- Refit the seat (see Seat - Installation, page 645).

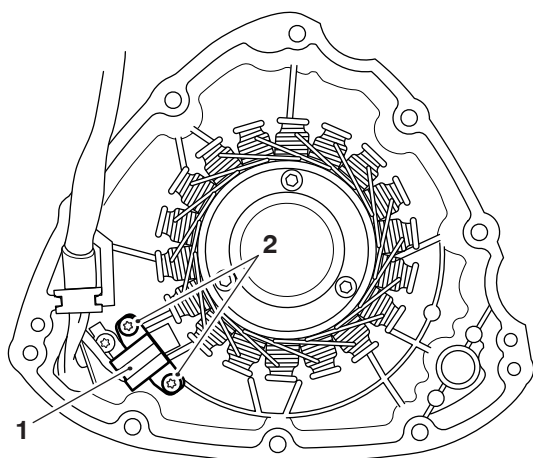
Crankshaft Position Sensor - Removal

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.

Note:

- If the crankshaft position sensor needs to be replaced, the alternator stator will also be replaced as they are one assembly.
 - Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
 - Remove the right hand side panel (see Side Panels, page 646).
 - Remove the alternator cover (see Alternator Cover - Removal, page 99).
1. Remove and discard the fixings securing the crankshaft position sensor to the alternator cover.

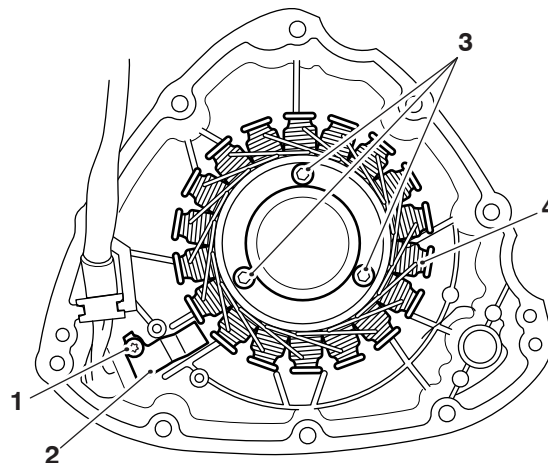


1. Crankshaft position sensor
2. Fixings

Note:

- Note the routing of the alternator harness for installation.

2. Remove and discard the fixing and remove the harness cover from the alternator cover.
3. Remove and discard the fixings securing the stator to the alternator cover and remove the stator.



1. Fixing
2. Harness cover
3. Fixings
4. Stator

Crankshaft Position Sensor - Installation

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 stator to the alternator cover and route the harness as noted for removal. Secure the stator with new fixings and tighten to 12 Nm.
2. Fit the harness cover and tighten the new fixing to 6 Nm.

Note:

- **The air gap for the crankshaft position sensor is not adjustable.**
3. Fit the crankshaft position sensor with two new fixings and tighten to 9 Nm.
 - Refit the alternator cover to the engine (see Alternator Cover - Installation, page 101).
 - Refit the right hand side panel (see Side Panels, page 646).
 - Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
 - Refit the seat (see Seat - Installation, page 645).

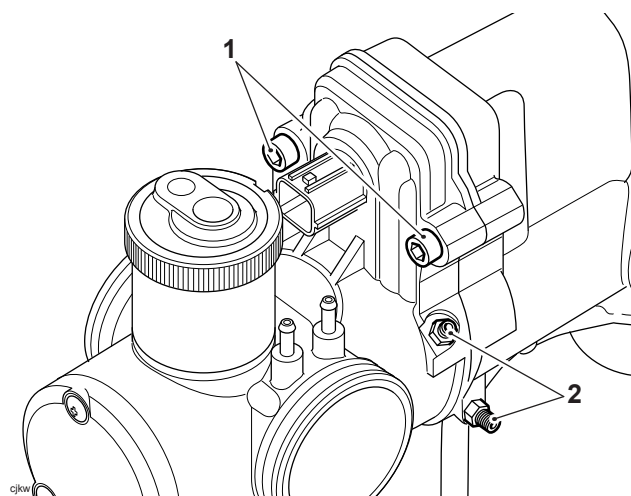
Throttle Actuator Motor

Caution

The fixings for the throttle actuator motor and the butterfly hard stop adjustment screws are marked with yellow paint and must not be loosened or removed.

If the fixings or adjustment screws have been loosened or removed the throttle body assembly must be replaced as there are no means to reset the throttle actuator motor to its correct position.

The throttle actuator motor is an integral part of the throttle body and cannot be adjusted or replaced separately.



1. Throttle actuator motor fixings (two shown)

2. Butterfly hard stop adjustment screws

The only adjustment permitted on the throttle body is throttle balance adjustment (see Throttle Body Balancing, page 431).

Throttle Position Sensor

Note:

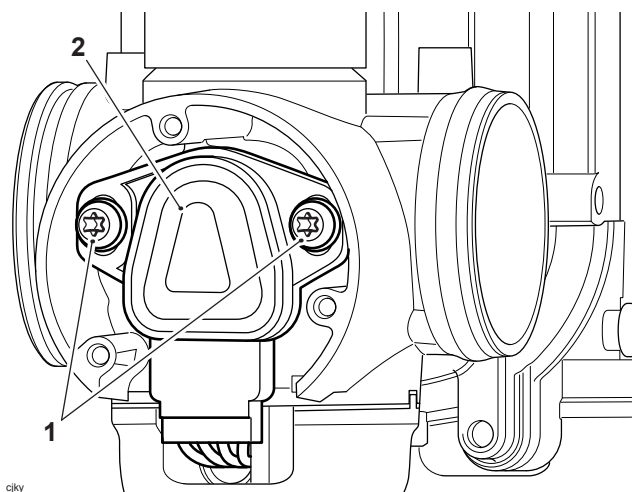
- The fixings for the throttle position sensor are marked with yellow paint and must not be loosened or removed. If the fixings have been loosened or removed any warranty claims for the throttle bodies will be rejected.

⚠ Caution

The fixings for the throttle position sensor are marked with yellow paint and must not be loosened or removed.

If the fixings have been loosened or removed the throttle body assembly must be replaced as there are no means to reset the throttle position sensor to its correct position.

The throttle position sensor can not be removed, replaced or adjusted in service. If necessary, the throttle bodies and throttle position sensor must be replaced as an assembly.



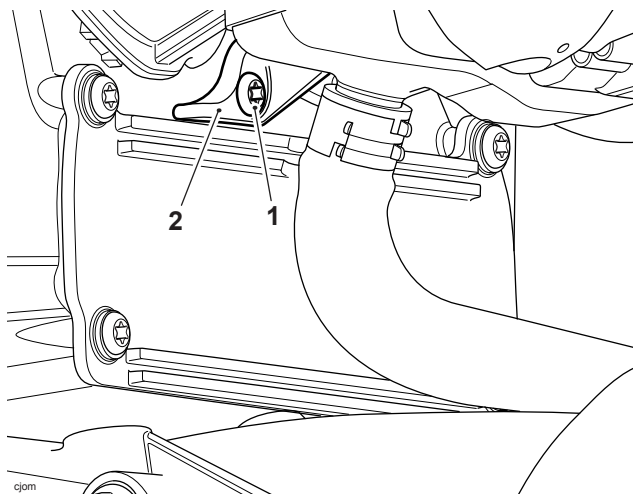
1. Fixings
2. Throttle position sensor

Throttle Body - Removal

⚠ Warning

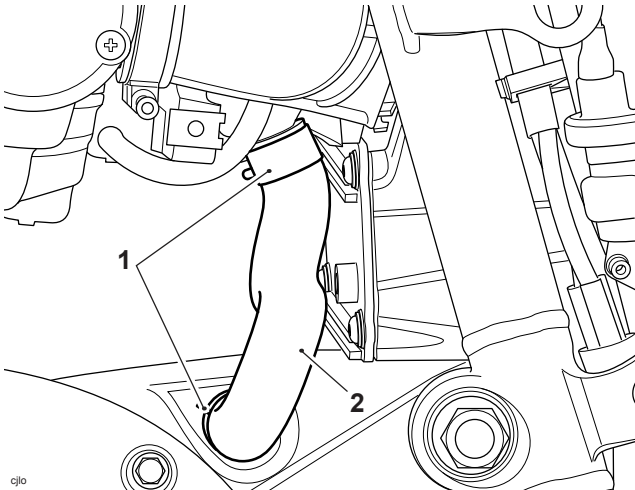
Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

- Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
 - Remove the fuel tank (see).
 - Remove the left and right hand side panels (see Side Panels, page 646).
1. Protect the crankcase, crankcase covers and starter motor painted surfaces from damage, using suitable self adhesive tape such as masking tape.
 2. Remove the fixing securing the engine breather hose bracket to the airbox.



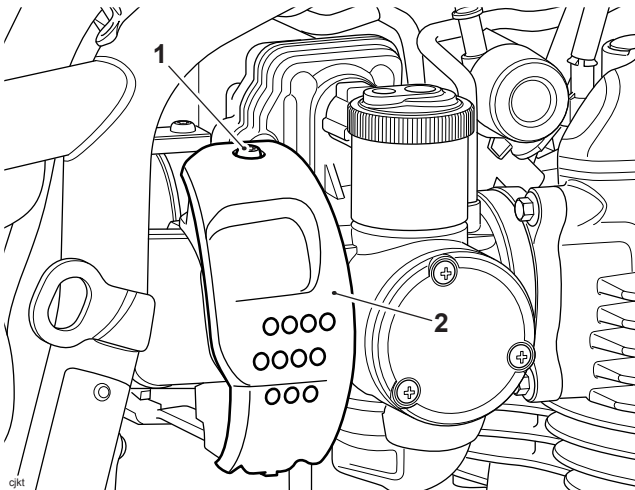
1. Fixing
2. Engine breather hose bracket

3. Release the two hose clips and remove the engine breather hose.



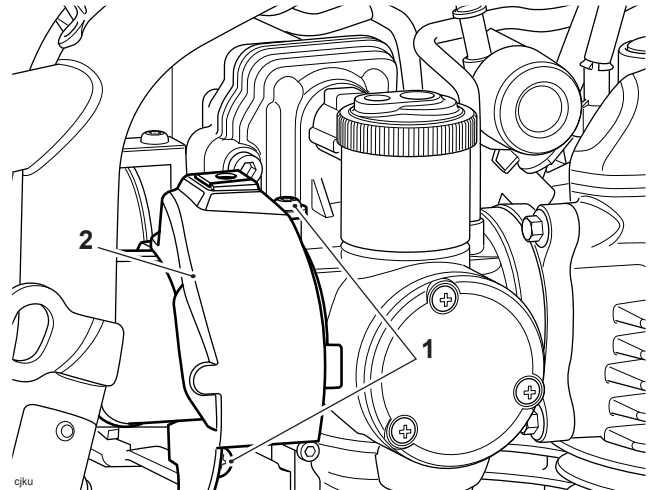
1. Hose clips
2. Engine breather hose

4. Remove the fixing and remove the air intake finishers.



1. Fixing
2. Air intake finisher (right hand side shown)

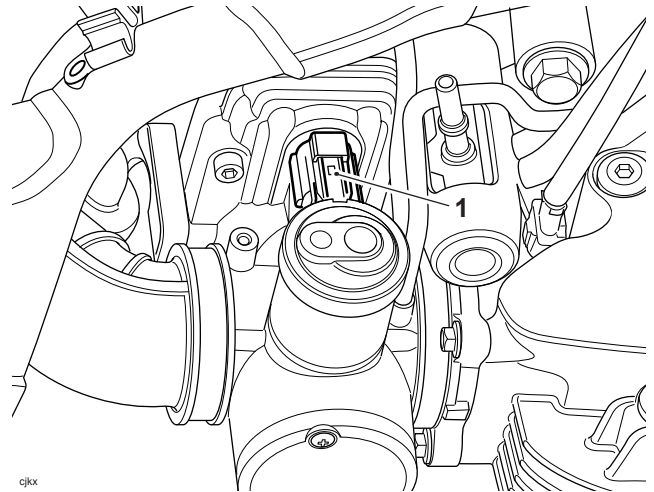
5. Remove the two fixings and remove the mountings for the air intake finisher.



1. Fixings
2. Mounting (right hand side shown)

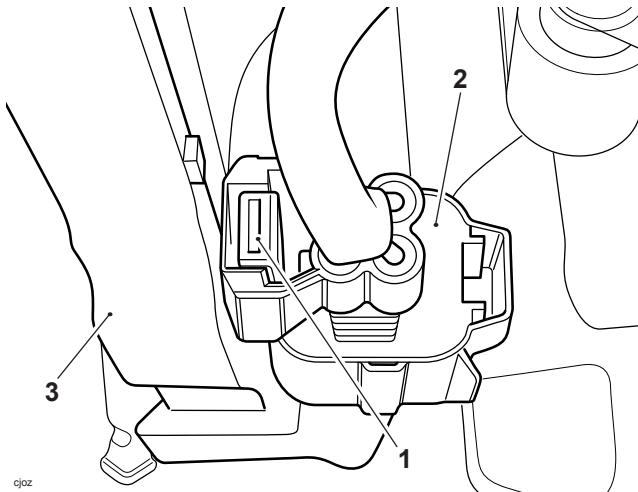
Note:

- Note the routing for the throttle actuator and throttle position harnesses for installation.
6. Disconnect the throttle actuator motor multiplug.



1. Multiplug
7. Release the locking device and detach the throttle position sensor multiplug from the mounting bracket.

8. Disconnect the throttle position sensor multiplug from the main harness.



1. Locking device
2. Throttle position sensor multiplug
3. Mounting bracket

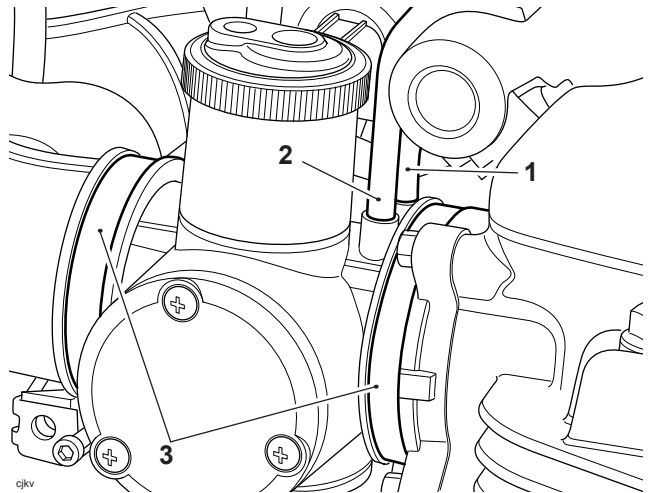
Note:

- Note which spigots on the throttle bodies the MAP sensor hose is fitted to and, if fitted, which spigot the evaporative emissions hose is fitted to for installation.
9. Disconnect the MAP hoses and the evaporative emissions hoses (if fitted) from the throttle bodies.

Note:

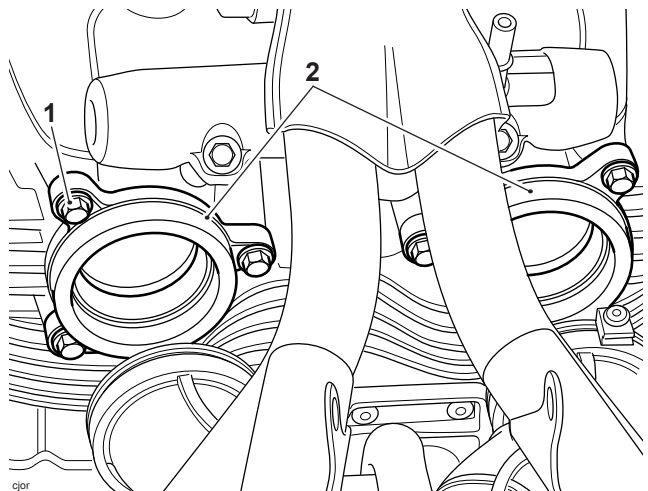
- The clamps securing the throttle bodies to the transition pieces have a spacer fitted between the clamp ends.
- The threaded lug is not secure and may fall out when the fixing has been released.

10. Remove the throttle body four hose clamps.



1. Evaporative hose (if fitted)
2. MAP sensor hose
3. Hose clamps

11. Carefully detach the throttle bodies from the transition piece hoses and the airbox hoses and remove the throttle bodies.
12. To remove the transition pieces from the cylinder head, remove the fixings and remove the transition piece(s).



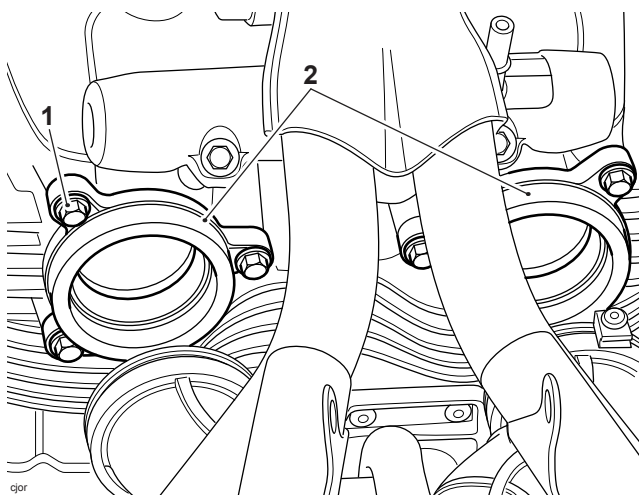
1. Fixings
2. Transition pieces

Throttle Body - Installation

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. Thoroughly clean the transition piece to cylinder head mating faces.
2. Refit the transition piece to the cylinder head and tighten the fixings to 9 Nm.



1. **Fixings**
2. **Transition pieces**

Note:

- While installing the throttle bodies, route the throttle position sensor and throttle actuator motor harnesses as noted for removal.

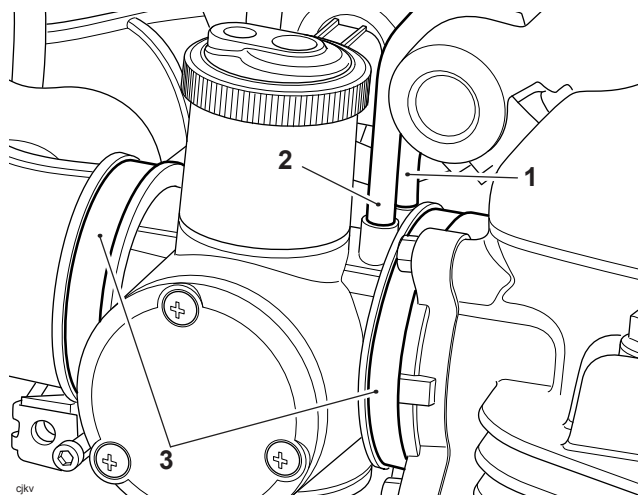
3. Carefully fit the throttle bodies to transition piece hoses and the airbox hoses.

Note:

- Ensure that the clamps securing the throttle bodies have the threaded lug fitted and the spacer on the fixing between the two ends of the clamp.

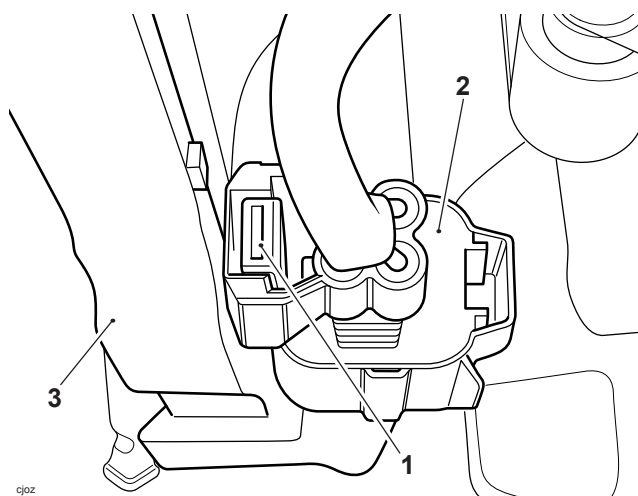
4. Fit the throttle body four hose clamps and tighten to 1.5 Nm.

5. Connect the MAP hose and the evaporative emissions hose (if fitted) to the throttle bodies, as noted for removal.



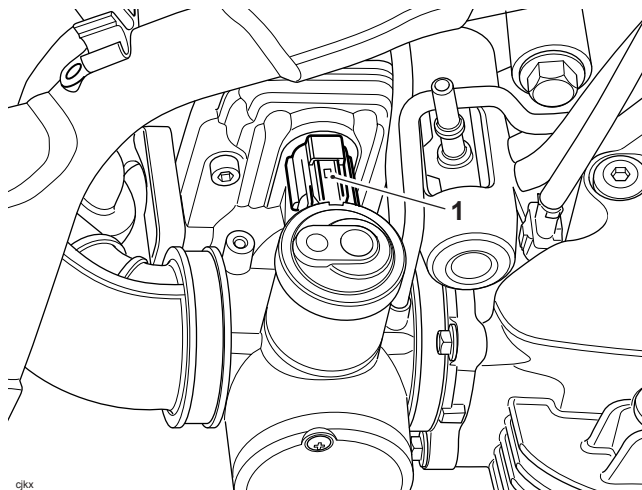
1. **Evaporative hose (if fitted)**
2. **MAP sensor hose**
3. **Hose clamps**

6. Connect the throttle position sensor multiplug to the main harness and secure it to the bracket.



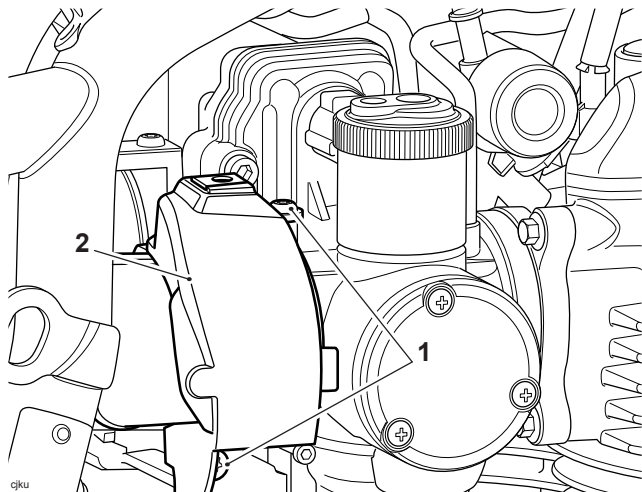
1. **Locking device**
2. **Throttle position sensor multiplug**
3. **Mounting bracket**

7. Connect the throttle actuator motor multiplug.



1. Multiplug

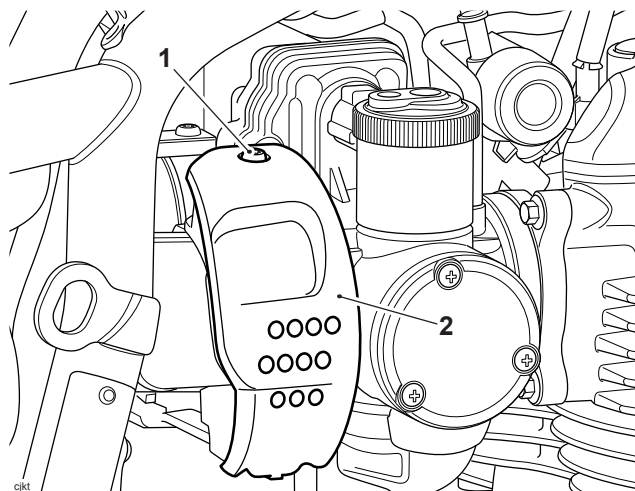
8. Fit the mountings for the air intake finisher and tighten the fixings to 3 Nm.



1. Fixings

2. Mounting (right hand side shown)

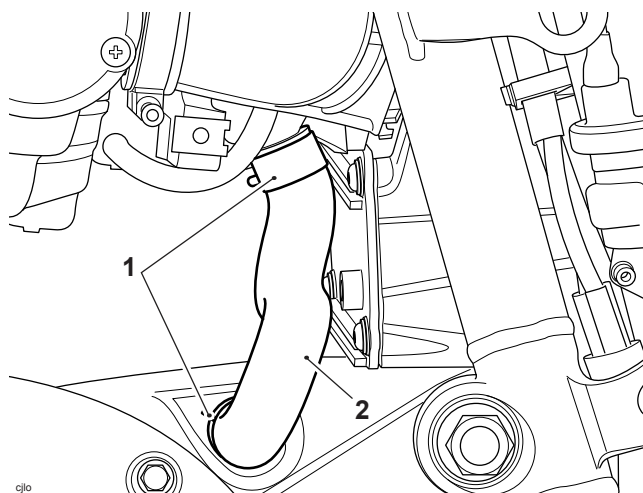
9. Fit the air intake finishers and tighten the fixing to 3 Nm.



1. Fixing

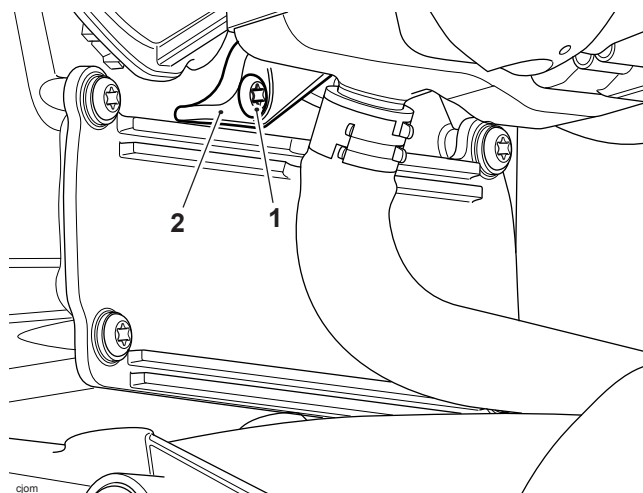
2. Air intake finisher (right hand side shown)

10. Fit the engine breather hose and secure with the two hose clips.



1. Hose clips
2. Engine breather hose

11. Secure the engine breather hose bracket to the airbox and tighten the fixing to 1.5 Nm.



1. Fixing
2. Engine breather hose bracket

- Refit the left and right hand side panels (see Side Panels, page 646).
- Refit the fuel tank (see Fuel Tank - Installation, page 385).
- Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
- Refit the seat (see Seat - Installation, page 645).

Throttle Body Balancing

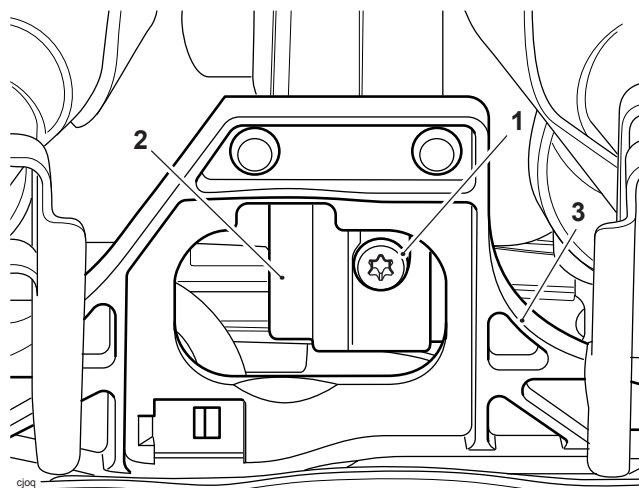
Note:

- The throttles cannot be balanced using equipment to measure vacuum in each throttle. Instead, the Triumph diagnostic tool must be used.
- Remove the seat (see Seat - Removal, page 645).
- Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
- Remove the fuel tank (see).
- Remove the airbox (see Airbox - Removal, page 398).

Warning

If the engine has recently been running, the components beneath the fuel tank may be hot to the touch.

1. Remove the anti-tamper Torx T30 blanking screw from the throttle control motor housing, located between cylinders one and two.



1. Throttle balance blanking screw
2. Throttle body
3. Bracket

2. Temporarily refit the fuel tank and reconnect the fuel supply and fuel pump connection using service tool T3880001 (minus the fuel pressure gauge) and service tool T3880391 (see Fuel Pressure Checking, page 386).
3. Using proprietary professional automotive workshop equipment approved for fuel handling, partially refill the fuel tank with the fuel removed earlier.
4. Temporarily reconnect the battery, positive (red) lead first.

- 5. Attach exhaust extraction hoses to the silencers.
- 6. Attach the Triumph diagnostic tool, start the engine.
- 7. When the engine temperature is at operating temperature navigate to ADJUST TUNE (see System Diagnostics, page 292).
- 8. Select BALANCE THROTTLES.

Adjust Tune Procedure

Adjust the throttle balance as described in the Service Manual until balanced
Press cancel to cancel the adjustment process
Press OK to finish

Throttle Status:	Throttles Balanced
Cylinder 1 MAP Pressure:	480 mmHg
Cylinder 2 MAP Pressure:	481 mmHg

Adjusting parameter - Balance Throttles

Balance Throttles Screen

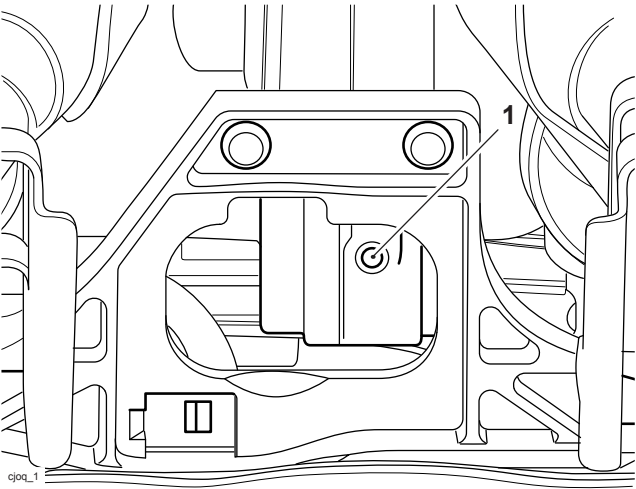
Note:

- The balance throttles screen shows the vacuum value of each throttle in mmHg. In addition, when the throttles are balanced to an acceptable range of each other the words 'THROTTLES BALANCED' in green text will appear on the right of the screen. At this point, no further adjustment is necessary or productive.
- If the throttles are not balanced to each other the words 'THROTTLES UNBALANCED' in red text will appear on the right of the screen. At this point adjustment will be necessary.

Warning

Total cleanliness must be observed at all times whilst the throttle balance blanking screw is removed, and adjustment must take place in a dirt/dust-free environment. Dirt or dust ingress to the throttle motor housing will cause the throttles to stick, leading to loss of motorcycle control and an accident.

- 9. Using a suitable Torx T20 screwdriver, adjust the throttle adjuster until the words 'THROTTLES BALANCED' appear on the diagnostic tool.



1. Adjuster

- 10. When balanced, stop the engine and disconnect the diagnostic tool.
- 11. Refit the anti-tamper Torx T30 blanking screw to the throttle control motor housing and tighten to 5 Nm.
- 12. Disconnect the battery, negative (black) lead first.
- 13. Using proprietary professional automotive workshop equipment approved for fuel handling, drain any remaining fuel from the fuel tank.
 - Refit the airbox (see Airbox - Installation, page 402).
 - Refit the fuel tank (see Fuel Tank - Installation, page 385).
 - Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
 - Refit the seat (see Seat - Installation, page 645).

Fuel Injectors and Fuel Rail - Removal

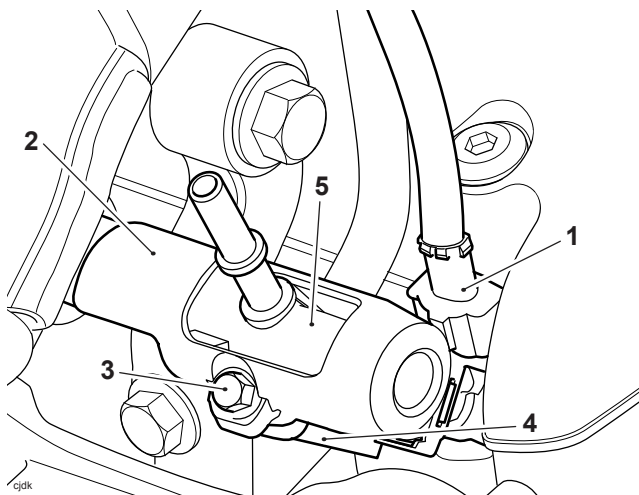
Warning

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.

- Remove the seat (see Seat - Removal, page 645).
- Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
- Remove the fuel tank (see).
- Remove the throttle bodies (see Throttle Body - Removal, page 426).

Note:

- **The fuel rail and injectors are removed from the cylinder head together.**
1. Disconnect the electrical connector from the fuel injectors.
 2. Remove the two fixings securing the fuel rail and fuel rail covers to the cylinder head. Collect the spacers between the fuel rail and cylinder head and the two covers.



1. **Electrical connector (right hand side shown)**
2. **Fuel rail cover (right hand side shown)**
3. **Fixing (right hand side shown)**
4. **Spacer**
5. **Fuel rail**

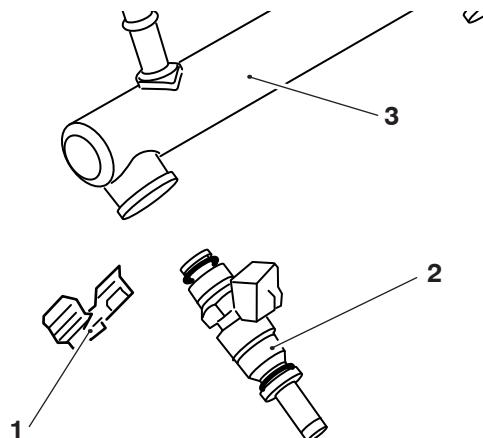
3. Gently ease the fuel rail and injectors upwards to release them from the cylinder head.

Note:

- **The fuel injectors are not to be removed from the fuel rail unless they are to be replaced.**

Note:

- If the injectors require replacing continue from step 4.
 - Note the position of the retaining clip for installation.
4. Carefully remove the retaining clips securing the fuel injectors to the fuel rail.
 5. Ease each injector from the fuel rail.

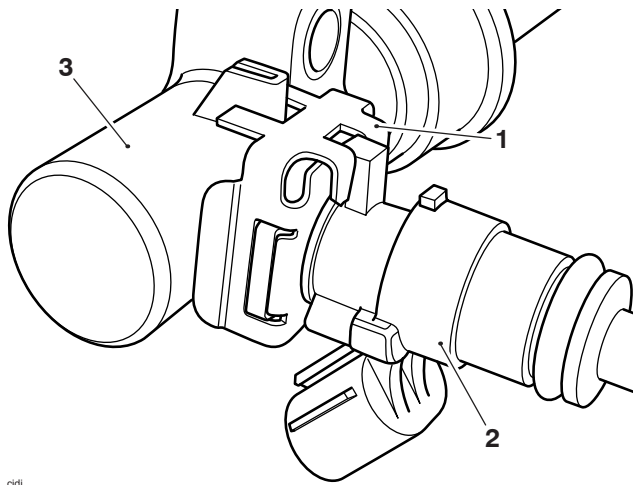


1. **Retaining clip**
2. **Injector**
3. **Fuel rail**

Fuel Injectors and Fuel Rail - Installation

Note:

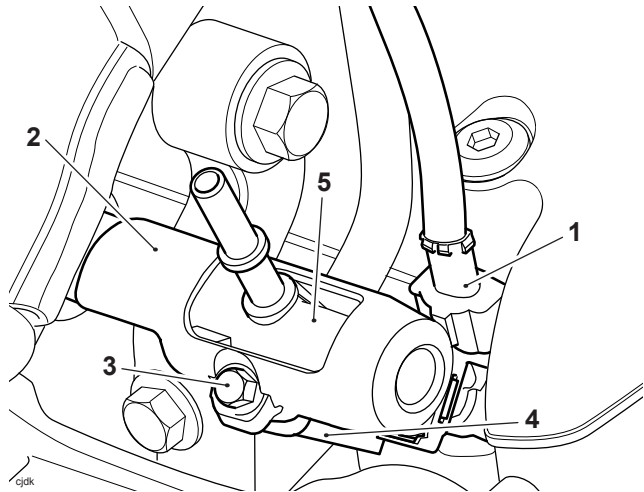
- If the fuel injectors have been removed from the fuel rail, continue from step 1 and omit steps 3 and 4.
 - If the fuel injectors have not been removed, continue from step 3.
1. Lightly lubricate the O-rings with clean engine oil and fit the new fuel injectors to the fuel rail.
 2. Fit the retaining clip for each fuel injector as noted for removal.



1. Retaining clip
2. Fuel injector
3. Fuel rail

3. Remove and discard the O-ring on the fuel injector.
4. Fit a new O-ring using finger pressure only.
5. Lightly lubricate the O-ring on the injectors and fit the injector/fuel rail assembly to the cylinder head, orientating each injector such that the electrical connection is facing upwards.

6. Fit the spacers between the fuel rail and cylinder head, fit the fuel rail covers, fit and tighten the fixings to 6 Nm.



1. Electrical connector (right hand side shown)
 2. Fuel rail cover (right hand side shown)
 3. Fixing (right hand side shown)
 4. Spacer
 5. Fuel rail
7. Connect the electrical connectors to the fuel injectors.
 - Refit the throttle bodies (see Throttle Body - Installation, page 429).
 - Refit the fuel tank (see Fuel Tank - Installation, page 385).
 - Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
 - Refit the seat (see Seat - Installation, page 645).

Engine Management Adaption

General Information

The engine management system fitted to this model is adaptive. This means that the system is able to learn about new or changing operating conditions and continuously adapt itself without needing to constantly make major adjustments from a fixed baseline setting.

Adaptive changes can become necessary because of changing rider behaviour, changes in the region in which the bike is operated (i.e. operation at high altitude where it was previously used at sea level) or because a new part may have been fitted which has slightly different characteristics to the old part. All adaptive changes are automatic and require no intervention by rider or dealer.

Adaption Status

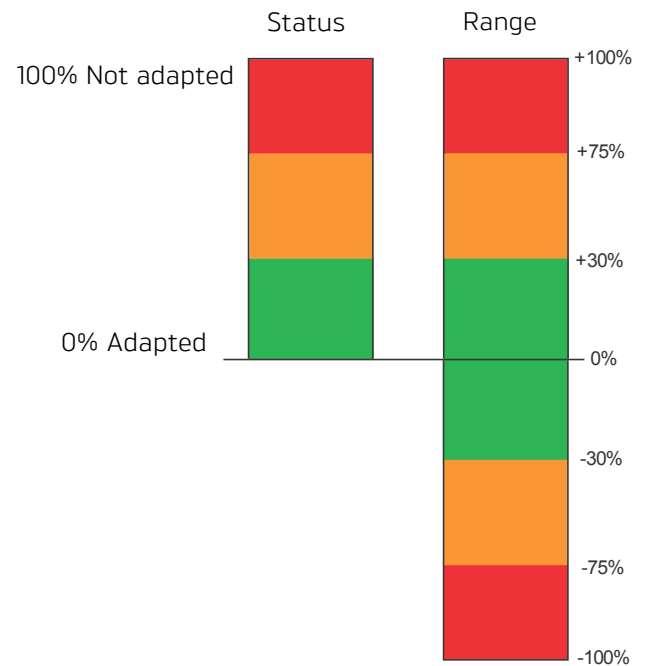
To see if a motorcycle has fully adapted, a facility named 'ADAPTION STATUS' is provided on the diagnostic tool. The following adaption details can be examined:

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)	%

Terminology

Where the term 'status' is used, this indicates how far the present operating parameter is from the stored (baseline) value. The nearer these figures are to zero the better as it indicates the motorcycle has adapted to its current operating conditions.

The term 'range' indicates how much (in percentage terms) of the adjustment range has been used to reach the current operating status.



Typical Values

In a correctly adapted motorcycle, the following will be typical:

Function Examined	Read Out
Closed throttle position reference status	Adapted
Idle speed control adaption status	Between +100 and -100%
Oxygen sensor adaption status (off idle)	0% +/- 10%
Oxygen sensor adaption range (off idle)	Between +100 and -100%
Oxygen sensor adaption status (idle)	0% +/- 10%
Oxygen sensor adaption range (idle)	Between +100 and -100%

Forcing Adaption to Take Place

If the read out indicates that the motorcycle is not adapted, the following will force the system to make adaptations:

! Warning

Never start the engine or let it run for any length of time in a closed area. The exhaust fumes are poisonous and may cause loss of consciousness

Warning

and death within a short time. Always operate the motorcycle in the open-air or in an area with adequate ventilation.

Note:

- Resetting adaptations with the motorcycle connected to an exhaust extraction system may cause incorrect values to be set, causing poor engine running. Always reset the adaptations with the engine disconnected from any exhaust extraction system whilst ensuring the motorcycle is positioned in a well ventilated area.
- Ensure the engine is cold.
 - WITHOUT TOUCHING THE THROTTLE, start the engine and allow it to warm up until the cooling fan comes on.
 - Leave the engine to idle for a further 12 minutes.

Note:

- As an alternative to the above process, connect the diagnostic tool, select **ADJUST TUNE** (see the Triumph Diagnostic Tool User Guide) and select **RESET ADAPTIONS**. This will force a fast adaption routine to take place in around five seconds. For this to happen, the engine **MUST** be running, it must be at normal operating temperature and in closed loop control mode. Under any other conditions fast adaption will not take place and may cause default values to be loaded, which may then require a normal 12 minute adaption routine to be run.

Fault Indications

If 'range' figures at 100% are seen, then the adjustment has reached maximum indicating a mechanical fault exists on the motorcycle. This can be due to a number of faults but the most likely causes will be low/high fuel pressure, faulty injectors or air leaks at the throttle bodies or airbox.

In these circumstances, locate and rectify the fault, and reset the adaptations as described above.

Exhaust Silencer - 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

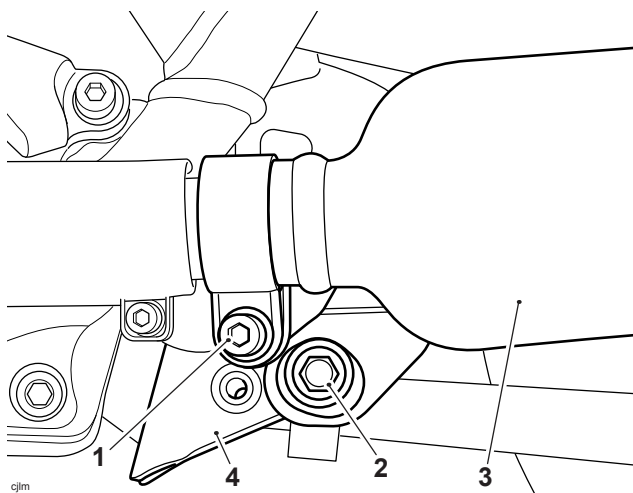
If the engine has recently been running, the exhaust components may be hot to the touch. Contact with the hot components may cause damage to exposed skin. To avoid skin damage, always allow the hot parts to cool before working on the exhaust system.

Note:

- Always note the position and orientation of the exhaust clamps prior to releasing them, and return them to the noted position and orientation on assembly.
- Release the clamps securing the silencers to the intermediate pipe.

Note:

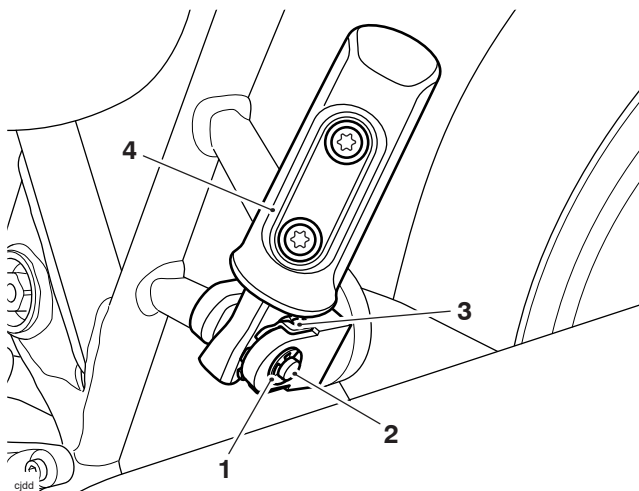
- Note the position of the washers and rubber bushes in the footrest hanger for installation.
- Left hand silencer only:** Remove the rear fixing securing the silencer to the frame. Discard the lock nut.



- Silencer clamp fixing (left hand side shown)**
- Fixing**
- Silencer**
- Frame**

Note:

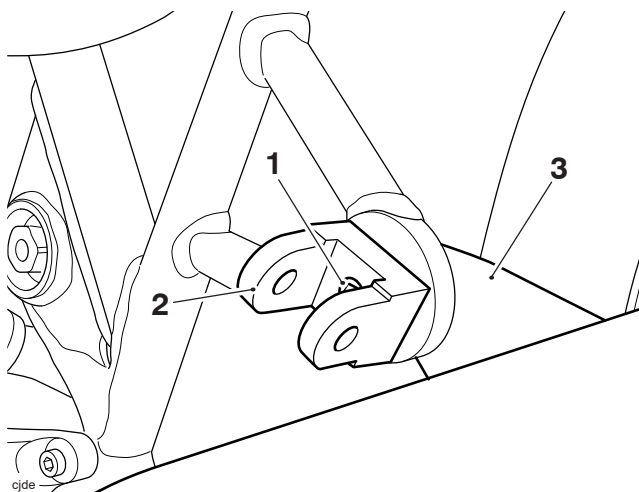
- **Note the position of the rear foot peg detent plate and ball bearing for installation.**
3. Remove the E-clip, clevis pin and foot peg from its mounting.



1. E-clip
2. Clevis pin
3. Detent plate
4. Rear foot peg

Note:

- **Note the position of the washers and rubber bushes in the silencer mounting for installation.**
4. Support the silencer, remove the rear foot peg mounting and remove the silencer. Discard the lock nut.

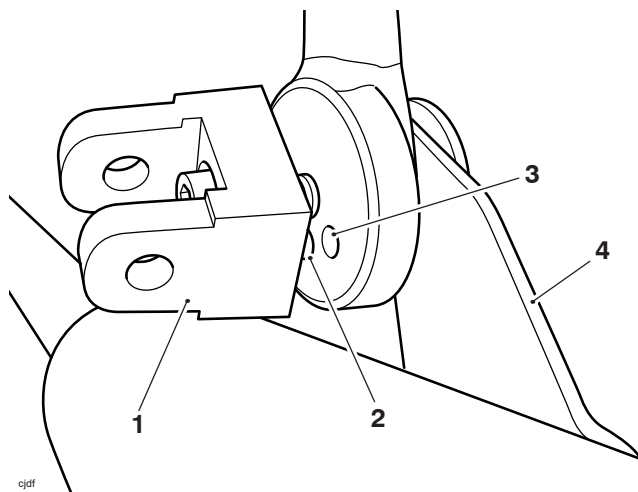


1. Fixing
2. Mounting
3. Silencer

5. Remove and discard the exhaust gasket.

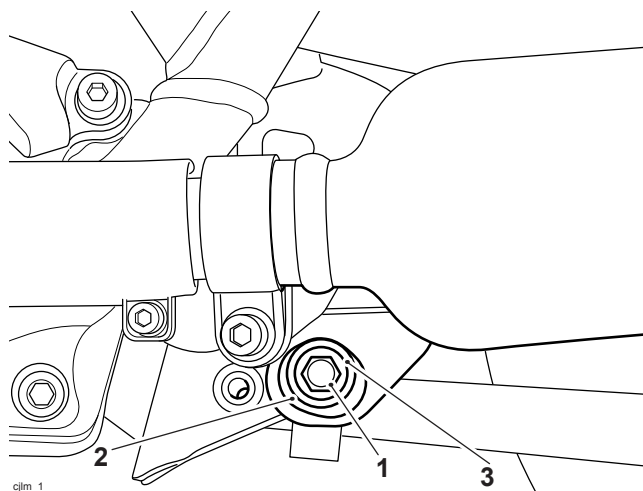
Exhaust Silencer - Installation

1. Check rubber mountings for cracks and wear, replace if necessary.
2. Fit a new exhaust silencer gasket and position the clamp over the joint.
3. Position the silencer onto the intermediate pipe.
4. Align the silencer rear mounting to the frame and fit the rear foot peg mounting. Ensure the locating peg on the mounting aligns with the locating hole in the frame. Tighten the bolt and new lock nut to 19 Nm.



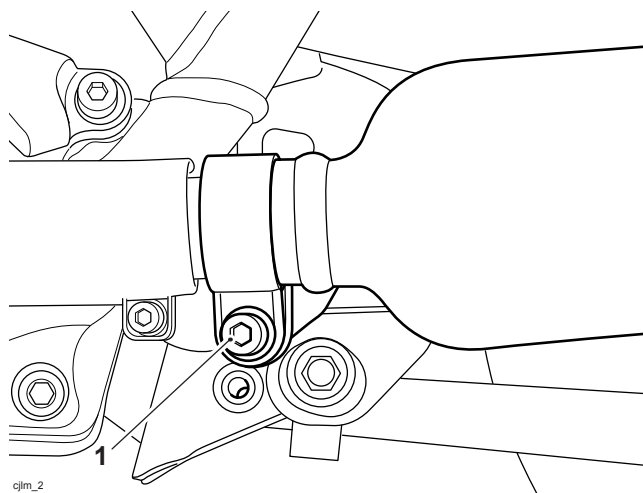
1. Mounting
2. Locating peg
3. Locating hole
4. Silencer

5. **Left hand silencer only:** Fit the front rubber bushes and washer as noted for removal, fit the bolt and new lock nut and tighten to 19 Nm.



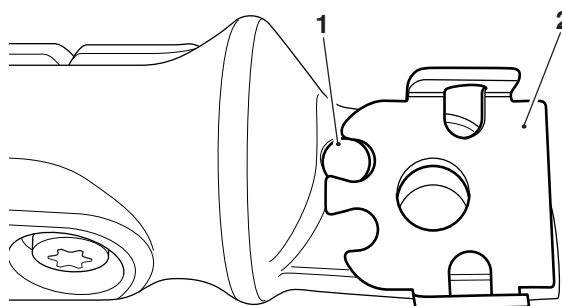
- 1. Bolt
- 2. Rubber bush
- 3. Washer

6. Position the silencer clamps as noted for removal and tighten to 20 Nm.



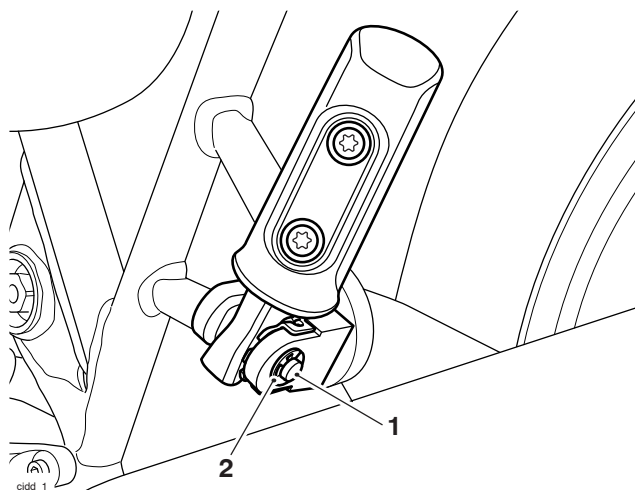
1. Silencer clamp fixing (left hand side shown)

7. Fit the ball bearing and detent plate to the foot peg, as noted for removal.



- 1. Ball bearing
- 2. Detent plate

8. Hold the detent plate and ball bearing in place and fit to the foot peg hanger.
9. Fit the clevis pin and secure with the E-clip.



- 1. Clevis pin
- 2. E-clip

10. Start the engine and check for exhaust gas leaks. Rectify if necessary.

Header and Exhaust Intermediate Pipes - 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

If the engine has recently been running, the exhaust components may be hot to the touch. Contact with the hot components may cause damage to exposed skin. To avoid skin damage, always allow the hot parts to cool before working on the exhaust system.

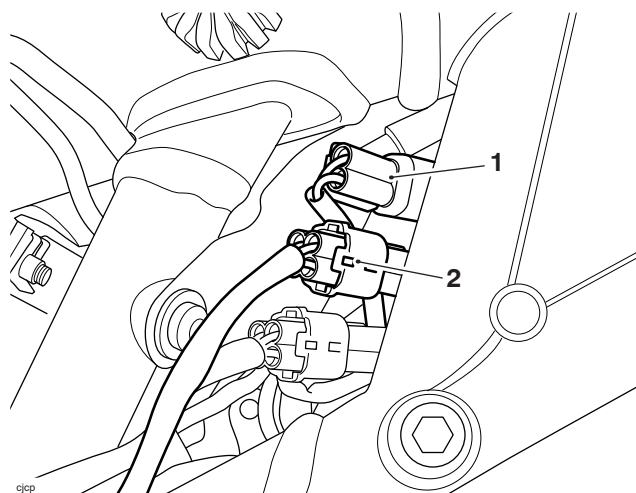
Note:

- Always note the position and orientation of exhaust clamps prior to releasing them, and return them to the noted position and orientation on assembly.
- Remove the seat (see Seat - Removal, page 645).
- Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
- Remove the engine cradle assemblies (see Cradle Assemblies - Removal, page 650).
- Remove the fuel tank (see Fuel Tank - Removal, page 383).

Note:

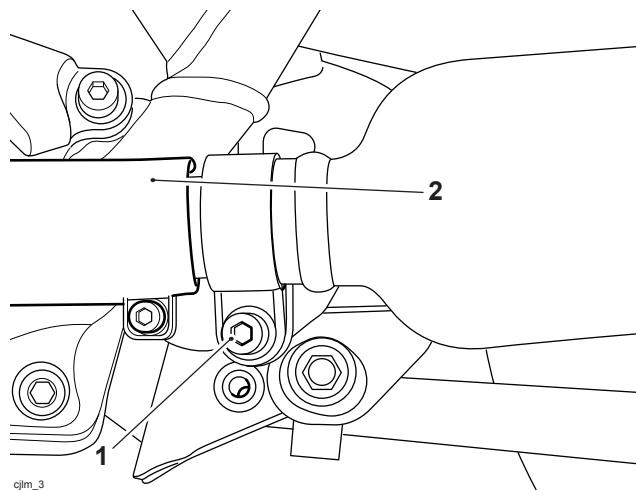
- Note the routing of the oxygen sensor harness for installation.
- The oxygen sensor electrical connections must not be swapped between cylinders. If the connections are swapped over, engine malfunctions will occur.
- The right hand (Cylinder 2) oxygen sensor connector on the main harness has a red connector (main harness side).
- The oxygen sensors are NOT marked. Always ensure the right hand oxygen sensor harness is connected to the main harness connector with the red connector.

1. Disconnect the oxygen sensors from the main harness.



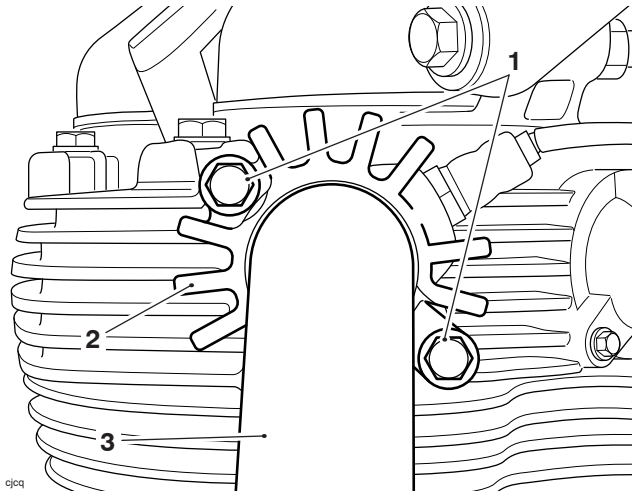
1. Left hand oxygen sensor connector
2. Right hand oxygen sensor connector

2. Remove the clamp securing the rear of the exhaust header pipe to the exhaust intermediate pipe.



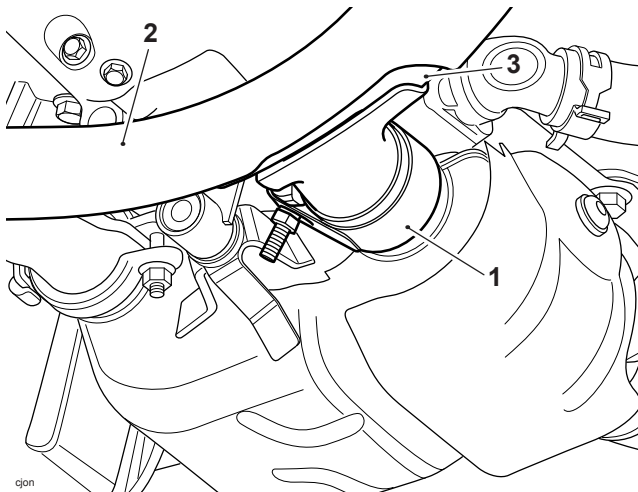
1. Fixing (left hand side)
2. Exhaust header pipe heat shield

3. Remove the fixings and the finned clamps securing the exhaust header pipe to the cylinder head.



1. Fixings
2. Finned clamps
3. Exhaust header pipe

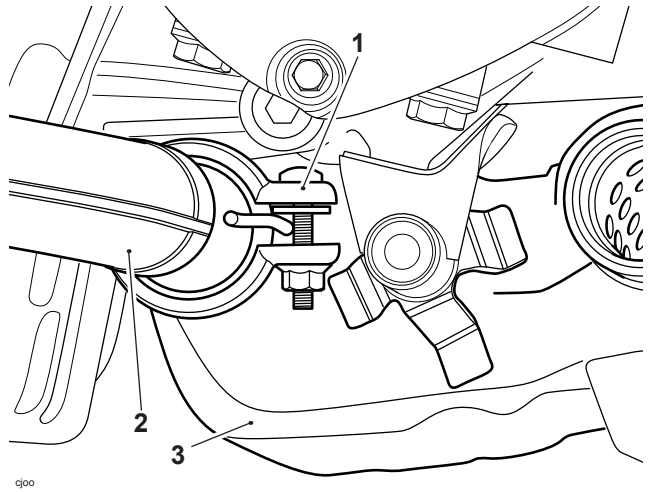
4. Loosen the clamp securing the exhaust header pipe to the catalytic converter.



1. Clamp
2. Exhaust header pipe heat shield
3. Exhaust header pipe

5. Detach the exhaust header pipe from the catalytic converter and remove the exhaust header pipe. Remove and discard the gasket from the cylinder head ports.
6. Remove and discard the exhaust header pipe gasket from the catalytic converter.
7. If necessary, remove the oxygen sensor.
8. Remove the exhaust silencer (see Exhaust Silencer - Removal, page 436).

9. Loosen the clamp securing the intermediate pipe to the catalytic converter. Remove the exhaust intermediate pipe.



1. Exhaust clamp
2. Exhaust intermediate pipe (right hand side)
3. Catalytic converter

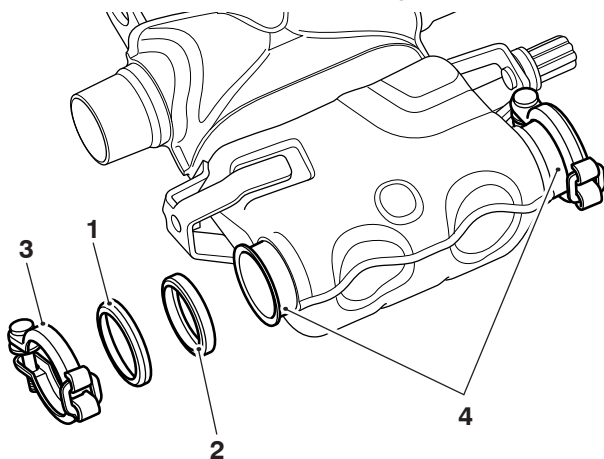
10. Remove and discard the exhaust intermediate pipe to catalytic converter gasket.

Header and Intermediate Exhaust Pipes - Installation

Warning

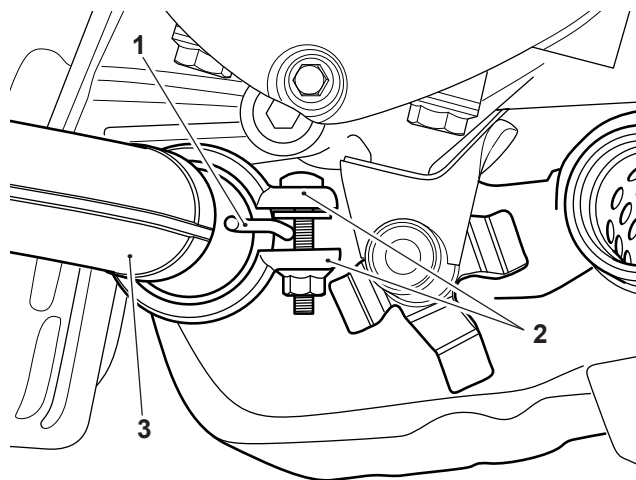
Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

1. Fit a new exhaust gasket and the flanged sleeve to the exhaust intermediate pipe port on the catalytic converter.
2. If removed, apply a thin smear of anti-seize compound to the threads of the clamp and fit to the exhaust intermediate pipe port on the catalytic converter. Do not tighten the clamp.



1. Gasket
2. Flanged sleeve
3. Clamp
4. Exhaust intermediate pipe ports

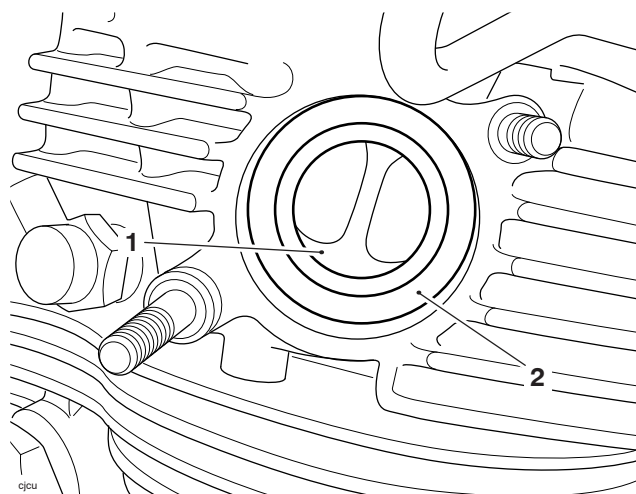
3. Attach the exhaust intermediate pipe to the catalytic converter, ensure the anti-rotation rod is placed between the two halves of the clamp. Do not tighten the clamp at this stage.



1. Anti-rotation rod
2. Clamp
3. Exhaust intermediate pipe (right hand side)
4. Fit the exhaust silencer (see Exhaust Silencer - Installation, page 437).
5. Tighten the exhaust intermediate pipe to catalytic converter clamp to 10 Nm.
6. If removed, apply a thin smear of anti-seize compound to the threads of the oxygen sensor, install the oxygen sensor and tighten to 25 Nm.

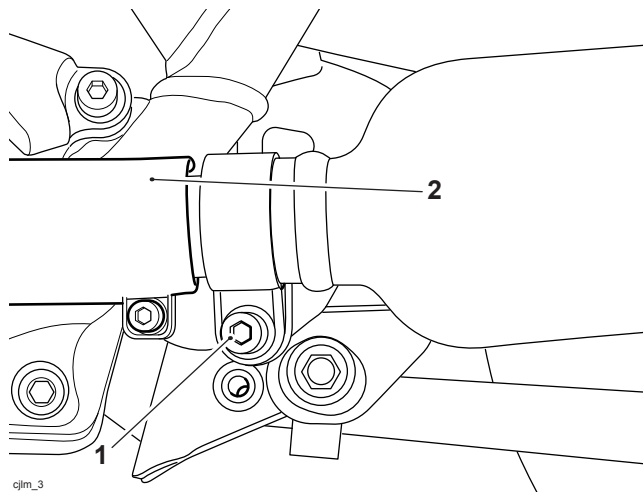
Note:

- To retain the gaskets during assembly, apply a smear of grease or petroleum jelly to the gasket faces in the head.
7. Fit new gaskets to the cylinder head ports.



1. Cylinder head port
2. Gasket

8. Apply a proprietary high temperature grease to the header pipe studs on the cylinder head.
9. Locate the exhaust header pipe to the cylinder head, ensure the gasket does not become displaced during assembly. Fit the fixings to the cylinder head studs but do not fully tighten at this stage.
10. Attach the exhaust header pipe to the catalytic converter, do not tighten the clamp at this stage.
11. Tighten the exhaust header to cylinder head fixings to 19 Nm.
12. Tighten the exhaust header pipe to catalytic converter clamp to 10 Nm.
13. Fit the clamp securing the rear of the exhaust header pipe to the exhaust intermediate pipe and tighten to 9 Nm.



1. Fixing

2. Exhaust header pipe heat shield (left hand side)

14. Route the oxygen sensor harness as noted for removal and connect to the main harness as noted for removal.
 - Refit the engine cradle assemblies (see Cradle Assemblies - Installation, page 652).
 - Refit the fuel tank (see Fuel Tank - Installation, page 385).
 - Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
 - Refit the seat (see Seat - Installation, page 645).
 - Start the engine and check for exhaust gas leaks. Rectify if necessary.

Exhaust Catalytic Converter - 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

If the engine has recently been running, the exhaust components may be hot to the touch. Contact with the hot components may cause damage to exposed skin. To avoid skin damage, always allow the hot parts to cool before working on the exhaust system.

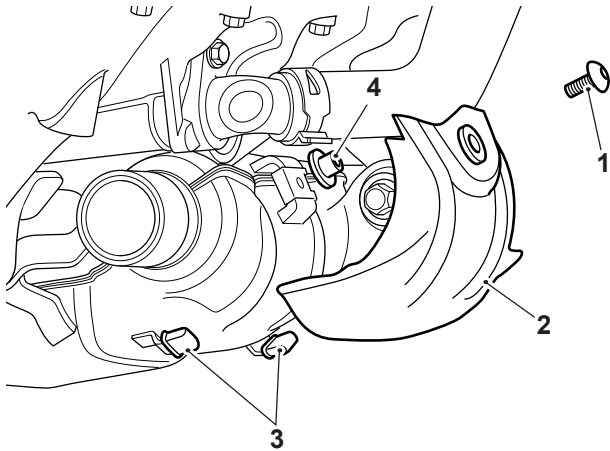
Note:

- **Always note the position and orientation of exhaust clamps prior to releasing them, and return them to the noted position and orientation on assembly.**
- Remove the seat (see Seat - Removal, page 645).
- Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
- Remove the exhaust header and intermediate pipes (see Header and Exhaust Intermediate Pipes - Removal, page 439).

Note:

- **Note the position of the shouldered washer for installation.**

1. Remove the fixing and move the front heat shield forward to detach it from its lower locating lugs and remove the heat shield. Collect the shouldered washer.

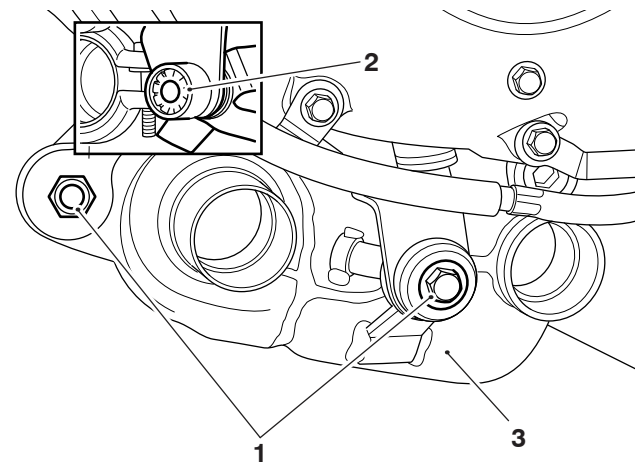


cjdp

- 1. Fixing**
- 2. Heat shield**
- 3. Locating lugs**
- 4. Shouldered washer**

2. Remove the two fixings and rubber mountings securing the catalytic converter to its heat shield.
3. Manoeuvre the catalytic converter down and to the left hand side to disengage its locating lug from the right hand side of the heat shield.

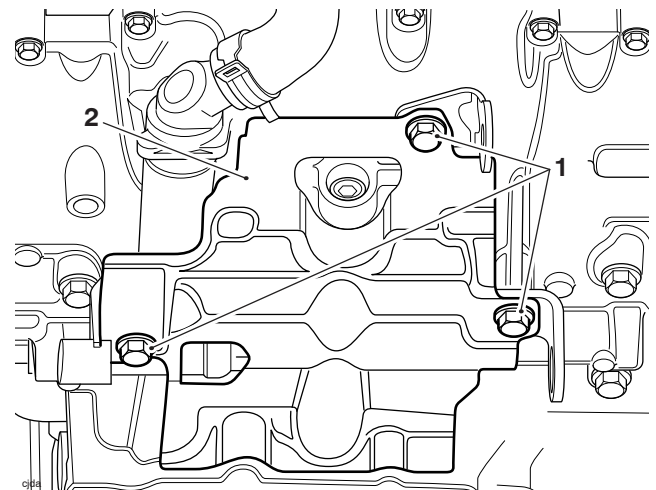
4. Remove the catalytic converter from the motorcycle.



cjdp

- 1. Fixings (left hand side)**
- 2. Locating lug (right hand side)**
- 3. Catalytic converter**

5. If required, remove the three fixings and remove the heat shield.



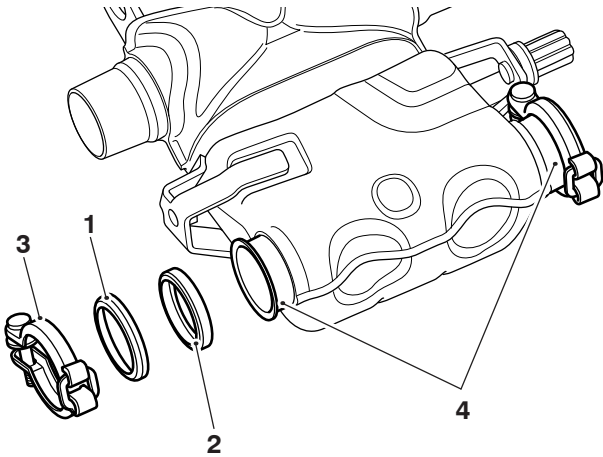
- 1. Fixings**
- 2. Heat shield**

Exhaust Catalytic Converter - Installation

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.

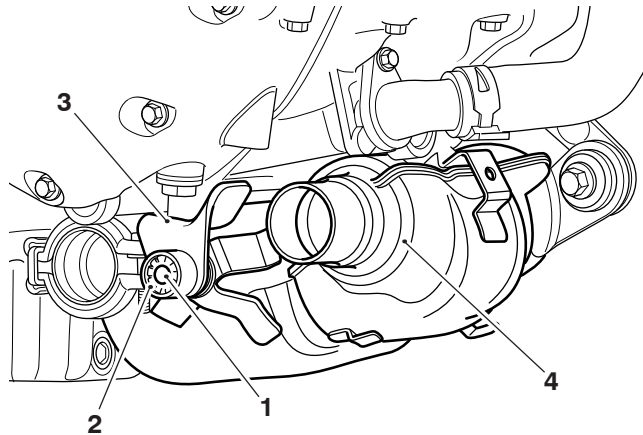
1. If removed, refit the catalytic converter heat shield and tighten the fixings to 19 Nm.
2. Fit the gasket and flanged sleeve to the exhaust intermediate pipe ports on the catalytic converter.
3. Fit the clamp, as noted for removal. Do not tighten the clamp.



cjdb

1. **Gasket**
 2. **Flanged sleeve**
 3. **Clamp**
 4. **Exhaust intermediate pipe ports**
4. Check the mounting rubber for cracks, replace if necessary.

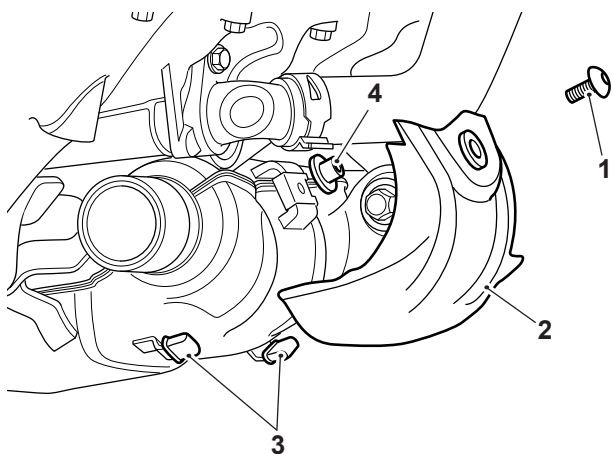
5. Position the catalytic converter into its heat shield, ensure the locating lug and its rubber mounting fully engages into the heat shield.



cjdi

1. **Locating lug**
 2. **Rubber mounting**
 3. **Heat shield**
 4. **Catalytic converter**
6. Fit the fixings and rubber mountings. Tighten the fixings to 15 Nm.
 7. Fit the shouldered washer to the heat shield as noted for removal.

8. Position the heat shield onto its lower locating lugs on the catalytic converter.
9. Secure the heat shield with its fixing and tighten to 5 Nm.



cjlp

1. **Fixing**
2. **Heat shield**
3. **Locating lugs**
4. **Shouldered washer**

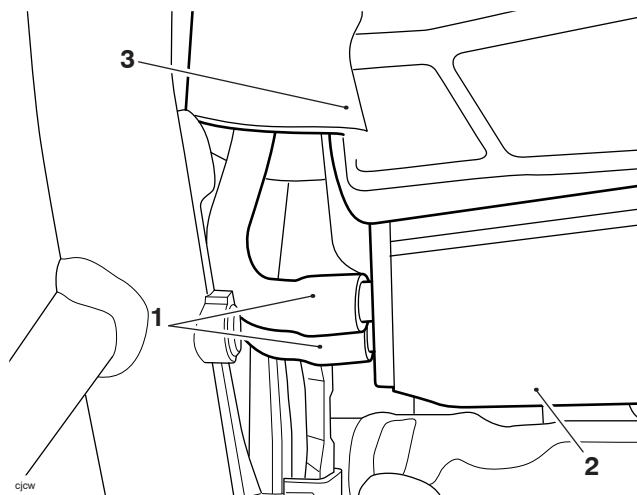
- Refit the exhaust header and intermediate pipes (see Header and Intermediate Exhaust Pipes - Installation, page 441).
- Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
- Refit the seat (see Seat - Installation, page 645).
- Start the engine and check for exhaust gas leaks. Rectify if necessary.

Evaporative Canister (if fitted) - 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.

- Remove the rear wheel (see Rear Wheel - Removal, page 612).
 - Remove the left and right hand side panels (see Side Panels, page 646).
1. Detach the two hoses on the left hand side of the evaporative canister.

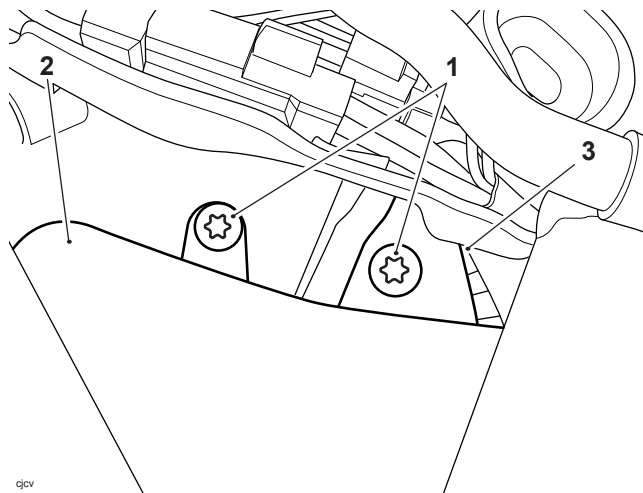


1. **Hoses**
2. **Evaporative canister**
3. **Airbox**

Note:

- Note the position of the two hoses attached to the left hand side of the evaporative canister for installation.

2. Remove the fixings and washers securing the evaporative canister to the right hand side of the airbox.



1. Fixings

2. Evaporative canister

3. Airbox

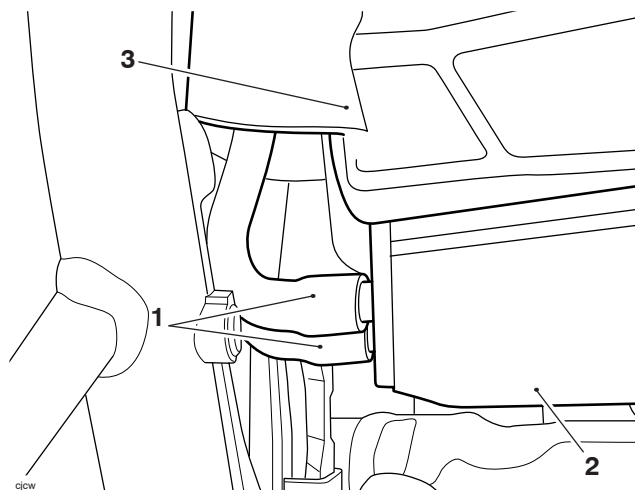
3. Slide the evaporative canister to the right hand side to release its locating lug from the airbox grommet and remove.

Evaporative Canister (if fitted) - Installation

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. Fit the evaporative canister to the motorcycle, ensure the locating lug on the left hand side locates into its hole in the airbox grommet.
2. Align the right hand side to the air box, fit the fixings and tighten to 1.4 Nm.
3. Connect the two hoses to the left hand side of the evaporative canister as noted for removal.



1. Hoses

2. Evaporative canister

3. Airbox

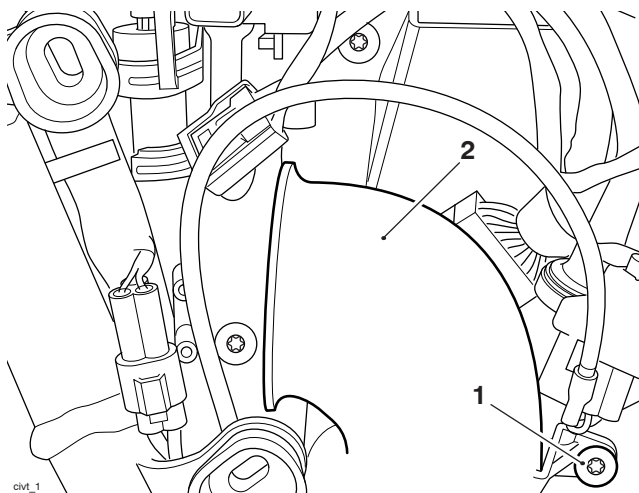
- Refit the rear wheel (see Rear Wheel - Installation, page 614).
- Refit the left and right hand side panels (see Side Panels, page 646).

Purge Control Valve (if fitted) - 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.

- Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
 - Remove the left hand side panel (see Side Panels, page 646).
1. Remove the fixing and remove the air intake duct on the left hand side of the airbox.

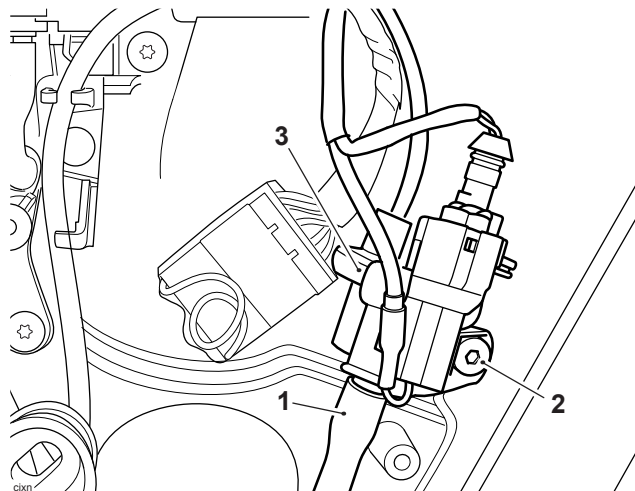


1. **Fixing**
2. **Air intake duct**

Note:

- **Note the position and orientation of the purge control valve and its bracket for installation.**

2. Detach the lower hose from the purge control valve, remove the fixing and detach the purge control valve and remove its bracket.



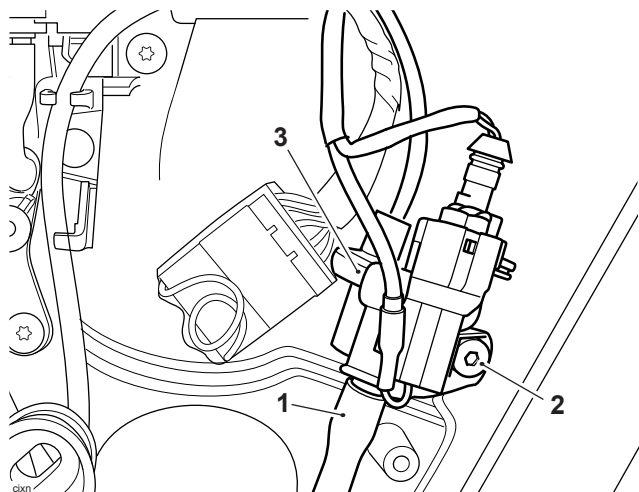
1. **Lower hose**
 2. **Fixing**
 3. **Purge control valve**
3. Press the wire locking device fully in and disconnect the electrical connector from the purge control valve.
 4. Detach the upper hose and remove the purge control valve.

Purge Control Valve (if fitted) - Installation

Warning

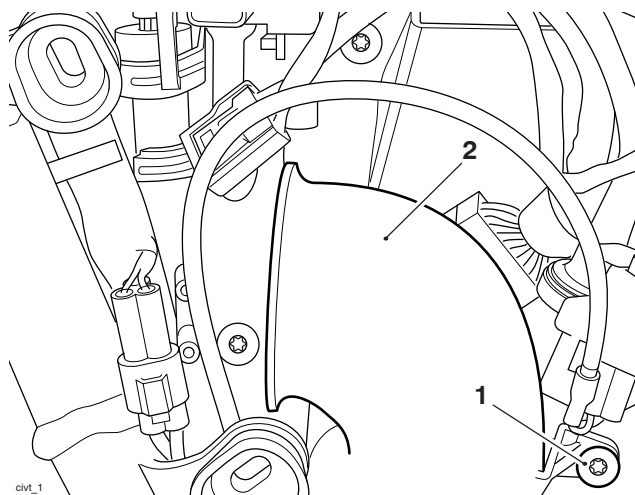
Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

1. Connect the electrical connector and the upper hose to the purge control valve.
2. Position the purge control valve to the airbox as noted for removal. Secure in position with its bracket and tighten the fixing to 1.5 Nm.
3. Refit the lower hose to the purge control valve.



1. Lower hose
2. Fixing
3. Purge control valve

4. If necessary, refit the air intake duct seal to the airbox. Ensure that the larger rubber flange of the seal faces outwards.
5. Refit the air intake duct to the airbox and tighten its fixing to 1.5 Nm.



1. Fixings

2. Air intake duct

- Refit the left hand side panel (see Side Panels, page 646).
- Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
- Refit the seat (see Seat - Installation, page 645).

Evaporative Loss Control System – Certain Markets Only

Some models in certain markets are fitted with a system to control the evaporation of fuel vapour to the atmosphere.

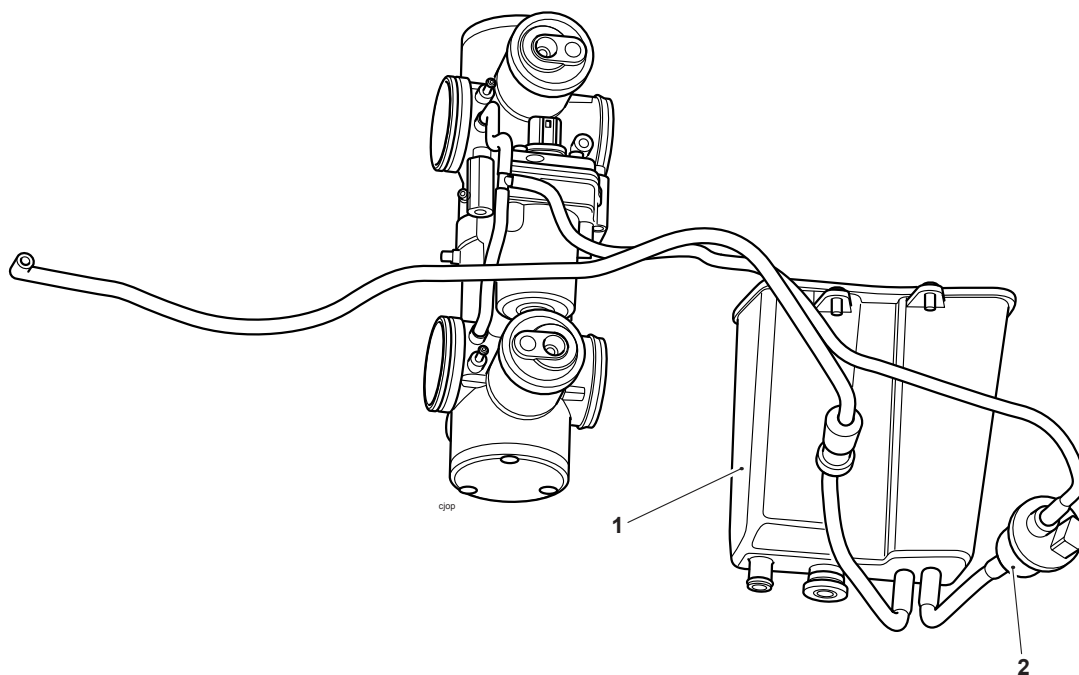
A carbon filled evaporative canister absorbs vapour while the engine is not running. When the engine is started, the vapour is returned to the engine and burnt.

There are two distinct phases to the system's operation; engine off and engine running. These two conditions are explained overleaf.

Component Locations

Evaporative Canister - under the airbox.

Purge Control Valve - (electronically controlled by the ECM) left hand side of the airbox behind the side panel.

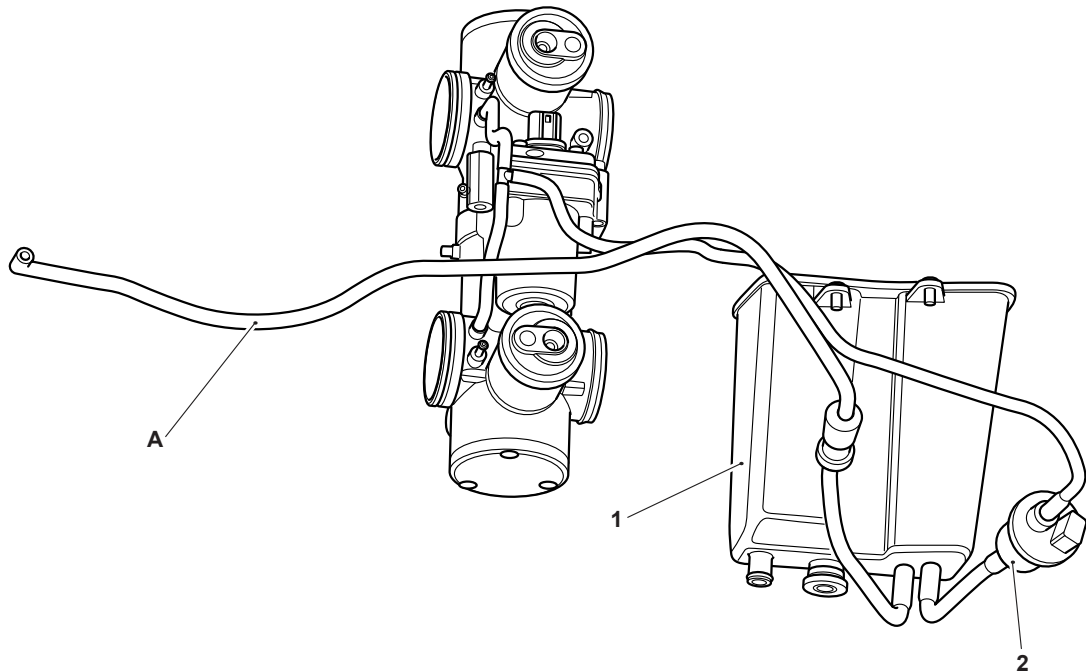


1. Evaporative canister
2. Purge control valve

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 evaporative canister which stores the vapour.

Once in the canister, vapour cannot return to the fuel tank because the purge valve is closed.



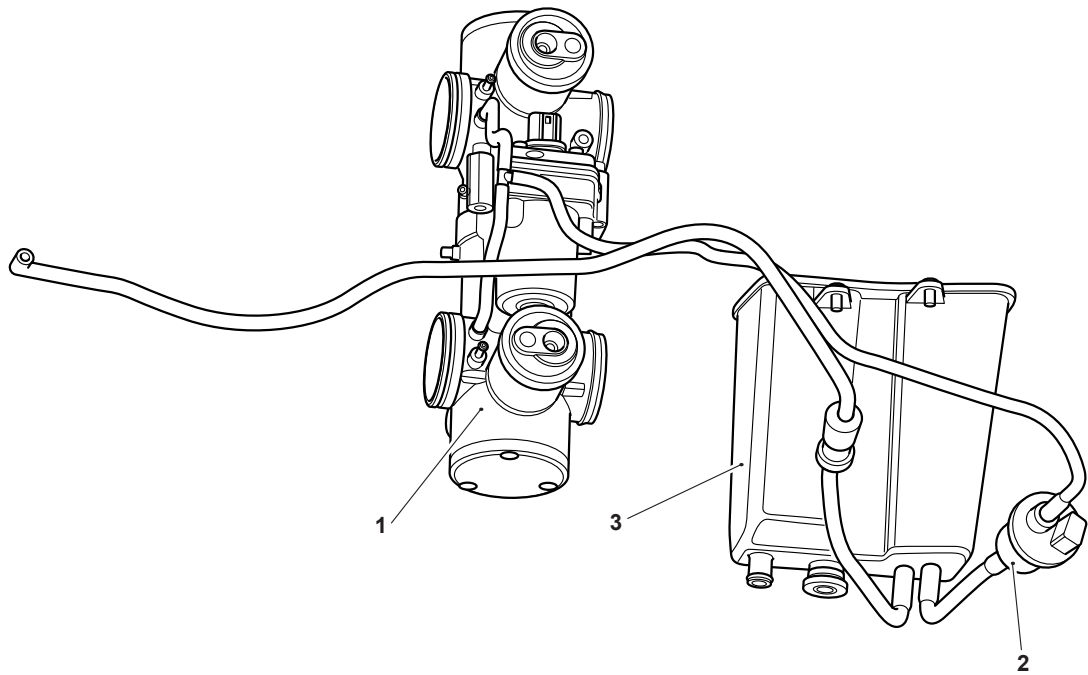
1. Evaporative canister
2. Purge valve

Evaporative Control System – Engine Running

When the engine is started, a vacuum is applied to the purge hose from the throttle bodies.

At certain times, the ECM opens the purge valve. The vacuum applied to the purge valve now begins to draw stored vapour from the carbon filled evaporative canister 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.



1. Throttle bodies
2. Purge valve
3. Evaporative canister

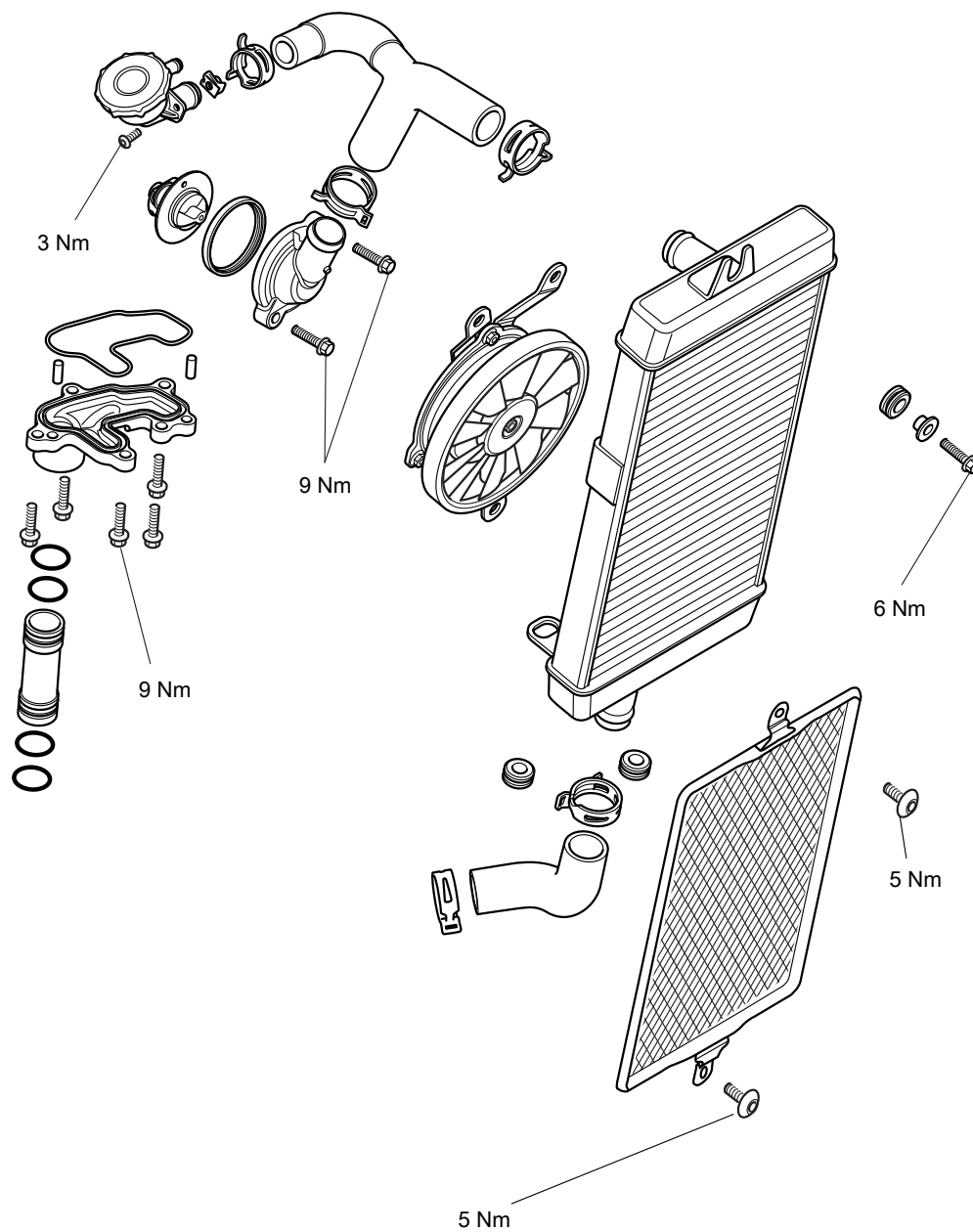
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19 Cooling

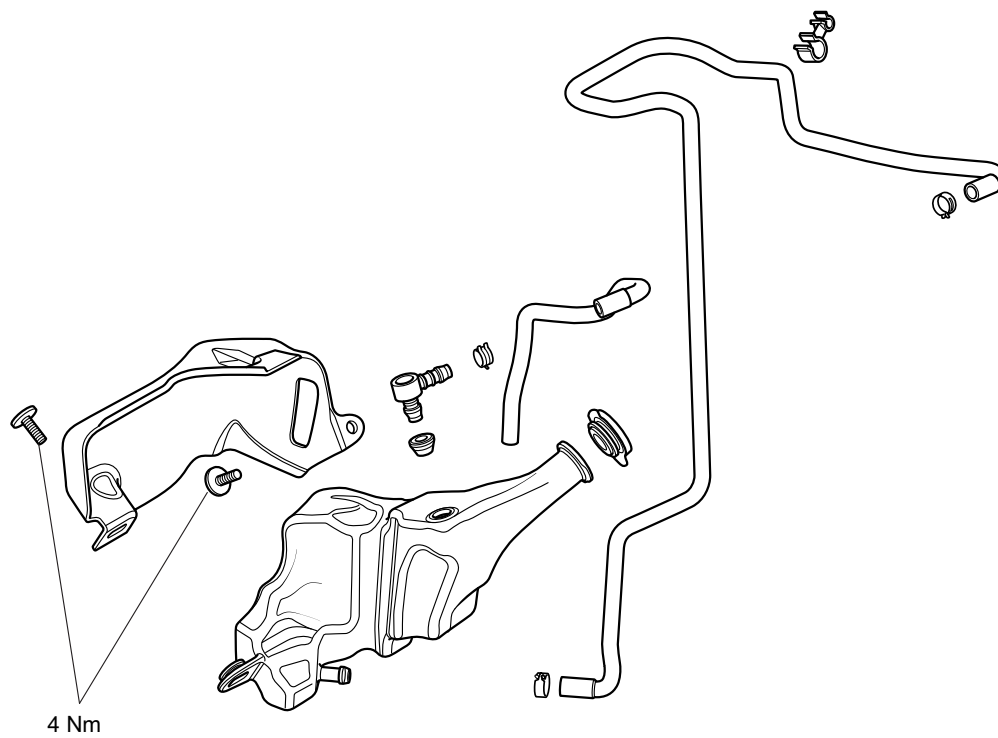
Table of Contents

Exploded View - Radiator and Hoses	457
Exploded View - Coolant Expansion Tank.....	458
Radiator Hoses	459
Radiator and Cooling Fan Inspection.....	459
Coolant.....	460
Coolant Level Inspection.....	461
Coolant Level Adjustment.....	462
Coolant Replacement - Drainage.....	462
Coolant Replacement - Filling.....	463
Water Pump	465
Water Pump - Inspection	465
Coolant System Pressure Test.....	466
Coolant Pressure Cap Test	467
Thermostat - Removal.....	469
Thermostat - Inspection.....	470
Thermostat - Installation	470
Radiator - Removal.....	471
Radiator - Installation.....	473

Exploded View - Radiator and Hoses



Exploded View - Coolant Expansion Tank



Radiator Hoses

Check the radiator hoses for cracks or deterioration, and hose clamps for tightness in accordance with scheduled maintenance requirements.

Radiator and Cooling Fan Inspection

Radiator

Caution

Using high pressure water, such as from a pressure-washer, can damage the radiator fins and impair the radiator's efficiency.

Do not obstruct or deflect airflow through the radiator by installing unauthorised accessories in front of the radiator or behind the cooling fan. Interference with the radiator airflow can lead to overheating and consequent engine damage.

1. Check the radiator for stone damage.
2. Check the radiator core for damage to fins or obstructions to air flow.
3. Clean off any obstructions with a stream of low-pressure water.

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. Rectify any damage.

Cooling Fan

Warning

The cooling fan is turned on or off by the chassis ECM, in response to a request sent by the engine ECM. The request from the engine ECM to turn the cooling fan on or off, is sent to the chassis ECM in response to a signal received from the coolant temperature sensor.

To prevent injury, never place loose clothing, fingers or hands near the cooling fan, until the engine is stopped. Loose clothing, fingers or the hands could become trapped during cooling fan operation and cause crushing injury to the fingers, hands or other parts of the anatomy.

The motorcycle is fitted with a thermostatically controlled electric fan situated behind the radiator. When the fan operates with the motorcycle stationary or at slow speed, cool air is drawn through the radiator from the front of the motorcycle.

Cooling

1. Check that the cooling fan spins freely and without tight spots.
2. Check the cooling fan blades for signs of heat distortion.
3. Rectify as necessary.

Coolant

A year-round, Hybrid Organic Acid Technology (known as Hybrid OAT or HOAT) coolant is installed in the cooling system when the motorcycle leaves the factory. It is coloured green, contains a 50% solution of ethylene glycol based antifreeze, and has a freezing point of -35°C (-31°F).

Always change the coolant at the intervals specified in the Scheduled Maintenance chart.

Warning

The standard coolant mixture contains toxic chemicals that are harmful to the human body. Never swallow neat antifreeze or any of the coolant mixture.

Caution

The antifreeze incorporated in the coolant mixture contains a corrosion inhibitor that helps prevent damage to the cooling system and engine. 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 antifreeze listed in the Specification section and never use a methanol based antifreeze as this does not contain the required corrosion inhibition properties.

Note:

- **HD4X Hybrid OAT coolant, as supplied by Triumph, is premixed and does not need to be diluted prior to filling or topping up the cooling system.**

Caution

If hard water is used in the cooling system, it will cause scale accumulation in the engine and radiator and considerably reduce the efficiency of the cooling system. Reduced cooling system efficiency may cause the engine to overheat and suffer severe damage.

Coolant 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.

Caution

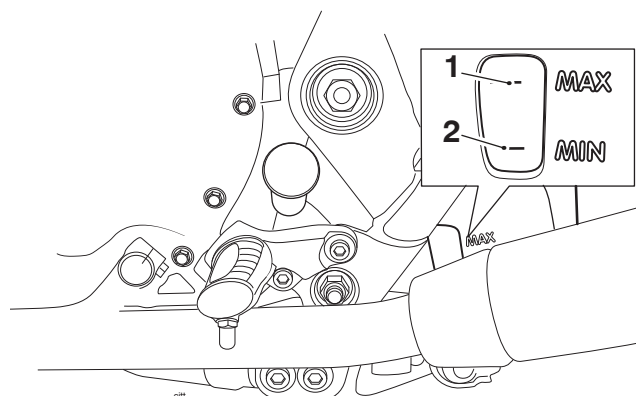
If the coolant level is found to be low, or if coolant has to be added regularly, inspect the cooling system for coolant leaks. If necessary, pressure test the system to locate the source of the leak and rectify as necessary. Loss of coolant may cause the engine to overheat and suffer severe damage.

1. Position the motorcycle on level ground and in an upright position.

Note:

- Only inspect the coolant level when the engine is cold.
- The coolant level within the expansion tank can be inspected without removing any covers. The expansion tank can be viewed from the left hand side of the motorcycle, towards the rear of the engine. Always inspect the coolant level with the engine cold.

2. The coolant level must be between the MAX (upper line) and MIN (lower line) marks in the expansion tank.



1. MAX mark

2. MIN mark

3. If the level of coolant is low, remove the cap from the expansion tank and add coolant mixture as necessary to bring the level up to the MAX mark. Refit the cap (see Coolant Level Adjustment, page 462).

Coolant Level Adjustment

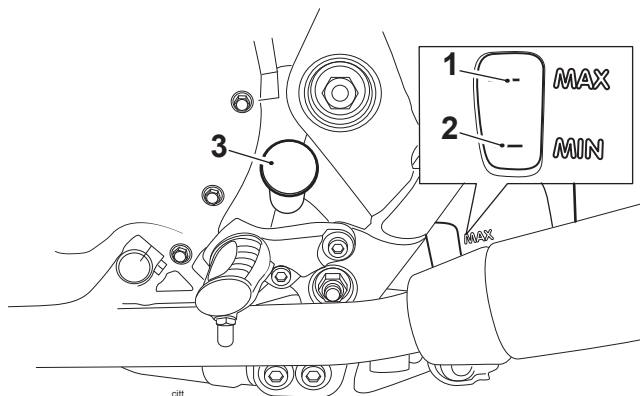
Warning

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

Do not remove the expansion tank or coolant pressure cap when the engine is hot. When the engine is hot, the coolant inside the cooling system will be hot and may also be under pressure. Contact with hot coolant will cause scalds and skin damage.

1. Allow the engine to cool for a minimum of 30 minutes.
2. Remove the cap from the expansion tank, and add coolant mixture through the filler opening until the level reaches the MAX mark. Refit the cap.



1. Maximum level
2. Minimum level
3. Filler opening

Note:

- If the coolant level is being checked because the coolant has overheated, also check the level in the radiator and top up if necessary.
- In an emergency, distilled water can be added to the cooling system. However, the coolant must then be drained and replenished with HD4X Hybrid OAT coolant as soon as possible.

Coolant Replacement - Drainage

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.

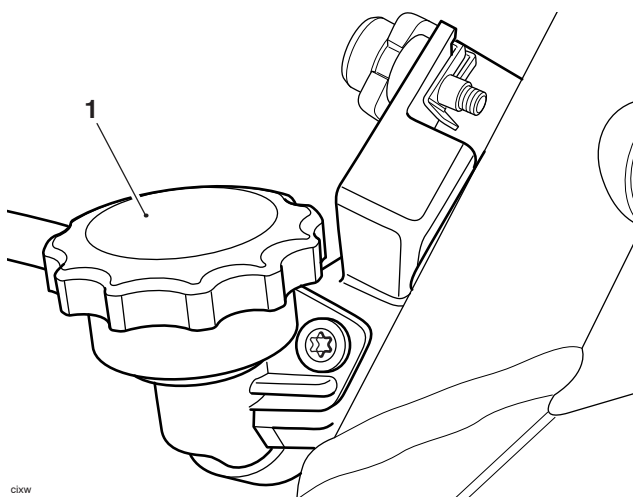
Warning

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 hot coolant will cause scalds and skin damage.

Note:

- Prior to disassembly of the coolant hoses, note the orientation and position of the hose clamps to help ensure that they are returned to the same positions and orientation on assembly.
- Use service tool T3880207 for removal and installation of the hose clamps.
- Remove the seat (see Seat - Removal, page 645).
- Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
- Remove the fuel tank (see).

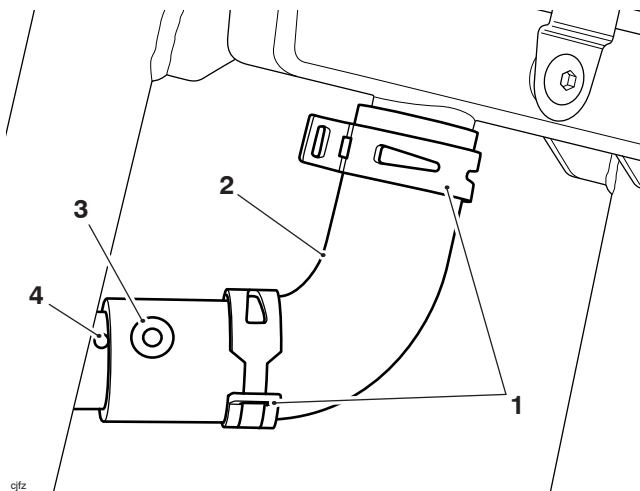
1. Remove the coolant pressure cap.



1. Radiator cap

2. Position a container below the engine and radiator to collect the displaced coolant.

3. Using service tool T3880207, release the hose clamps then release the bottom hose from the radiator and allow the coolant to drain.



1. **Hose clamps**
 2. **Bottom hose**
 3. **Coolant hose alignment mark**
 4. **Hose alignment mark**
4. Disconnect the bottom hose.

Coolant Replacement - Filling

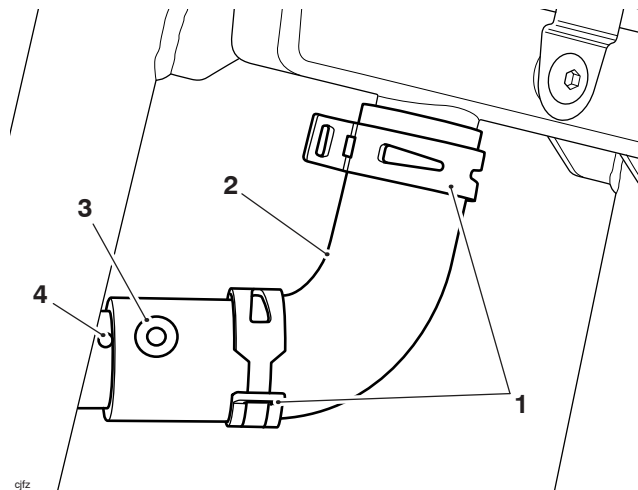
Warning

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

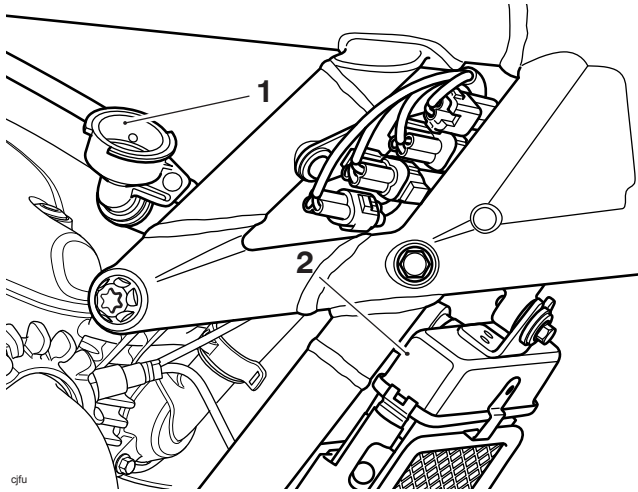
Do not remove the coolant pressure cap when the engine is hot. When the engine is hot, the coolant inside the radiator is hot and also under pressure. Contact with hot coolant will cause scalds and skin damage.

1. Refit the bottom hose. Ensure the hose clamp is positioned to the alignment mark as noted for removal.



1. **Hose clamps**
2. **Bottom hose**
3. **Coolant hose alignment mark**
4. **Hose alignment mark**

2. With the aid of an assistant, raise the rear wheel until the filler opening is above the radiators upper coolant tank.



1. Filler opening

2. Radiators upper coolant tank

3. Slowly add coolant mixture to the system, through the filler opening, until coolant escapes from the filler opening.

Note:

- If the system has filled correctly and fully, there should be coolant visible through the filler opening.

Note:

- During filling, squeezing the bottom hose with both hands will help to pump coolant around the system and remove trapped air.
4. Refit the coolant pressure cap.
 5. Lower the motorcycle's rear wheel to the ground.
 6. Refit the fuel tank (see Fuel Tank - Installation, page 385).
 7. Reconnect the battery, positive (red) lead first and tighten the battery terminals to 4.5 Nm.
 8. Start the motorcycle and allow the engine to idle. Briefly raise the engine speed several times to allow any air to be expelled from the system.
 9. Stop the engine and allow it to cool.
 10. With the aid of an assistant, raise the fuel tank to allow access to the coolant pressure cap.
 11. Remove the coolant pressure cap.

12. If necessary, top up the system through the filler.
13. Refit the coolant pressure cap.
 - Refit the fuel tank (see Fuel Tank - Installation, page 385).
 - Check the expansion tank level and top up if necessary (see Coolant Level Inspection, page 461).
 - Refit the seat (see Seat - Installation, page 645).

Water Pump



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:

- The oil pump and water pump are supplied as an assembly and cannot be separated. For additional information, refer to Oil Pump (see Oil and Water Pump - Removal, page 248 for removal and Oil and Water Pump - Installation, page 254 for installation).

Water Pump - Inspection

1. Remove the pump outer cover to check for corrosion and scale build-up around the impeller and in the pump body. Renew the pump if leakage is evident.
2. Check the water pump shaft and shaft bearings for side and end float. Renew the pump if wear is evident.
3. Check the water pump face and shaft seals for signs of leakage. Renew the pump if leakage is evident.

Coolant System Pressure Test

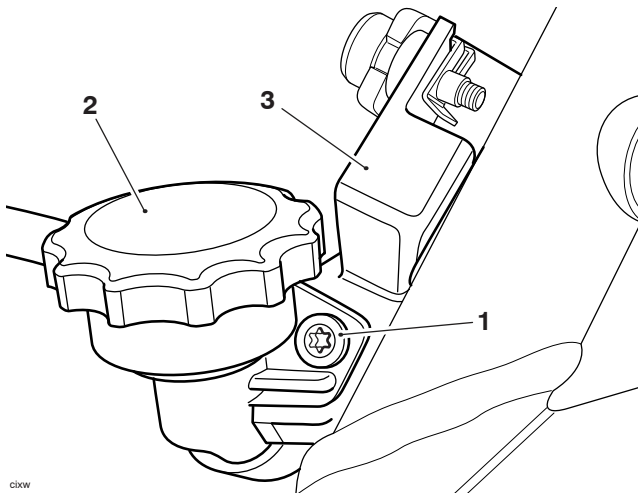
Warning

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

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 hot coolant will cause scalds and skin damage.

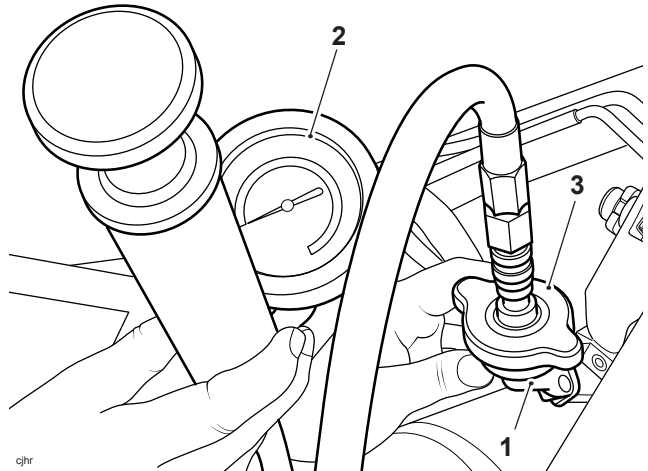
- Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
 - Remove the fuel tank (see).
1. Remove the fixing and position the coolant filler neck away from the immobiliser bracket.



1. Fixing
2. Coolant filler cap
3. Immobiliser bracket

2. Remove the coolant filler cap.
3. Select the service tool T3880176 bayonet type adapter and securely fasten to the coolant filler neck.

4. Carefully connect the hand pump (part of T3880147 - Radiator and Cap Tester Kit) to the service tool T3880176 ensuring an air tight seal is maintained.



1. Coolant filler neck
2. T3880176 - Radiator Pressure Test (use with 3880147)
3. Hand held pump (part of T3880147 - Radiator and Cap Tester Kit)

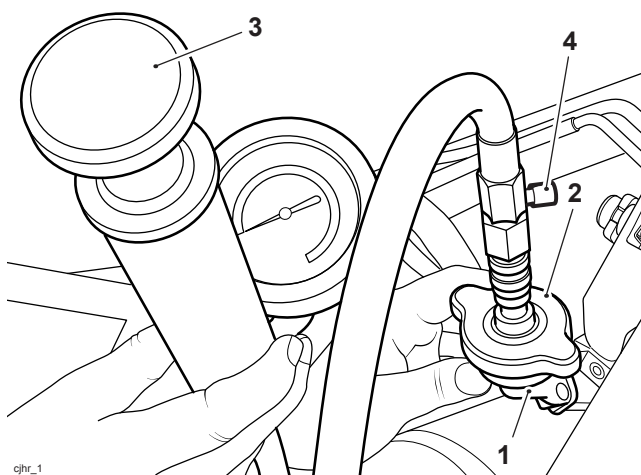
Note:

- Do not exceed 1.2 bar when carrying out a coolant pressure test.
5. Pressurise the cooling system to the operating pressure, using the hand pump taking care not to exceed 1.2 bar.
 6. Hold the pressure for a minimum of 10 minutes, whilst visually inspecting the external components of the coolant system for leaks.

Note:

- If the engine oil is contaminated further exploratory investigation will be required.
 - Engine oil with a hazy or milky appearance may indicate water emulsion.
 - If the engine oil is contaminated rectify the cause of the problem and then renew the oil and filter.
7. Remove the engine oil filler cap and check for contamination of the engine oil caused by coolant escaping into the engine sump.

8. De-pressurise the coolant test kit using the pressure release valve.



- 2. Coolant filler neck**
3. Bayonet type connector
4. Hand held pump
5. Pressure release valve

9. Detach the service tool T3880176 bayonet type adapter from the coolant filler neck.
10. Refit the coolant filler neck and tighten the fixing to 3 Nm.
- Fill the coolant expansion tank to the maximum mark (see Coolant Level Adjustment, page 462).
 - Refit the coolant pressure cap.
 - Refit the fuel tank (see Fuel Tank - Installation, page 385).
 - Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
 - Refit the seat (see Seat - Installation, page 645).

Coolant Pressure Cap Test

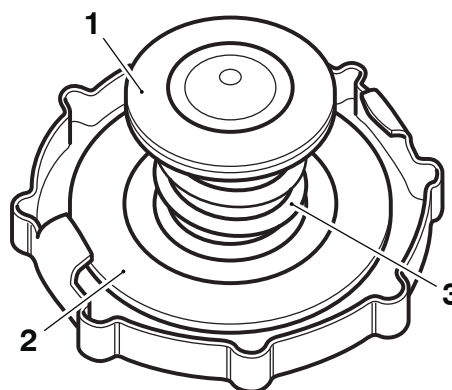
⚠ Warning

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

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 hot coolant will cause scalds and skin damage.

- Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
 - Remove the fuel tank (see).
1. Allow the engine temperature to cool for at least 30 minutes.
 2. Remove the coolant pressure cap.
 3. Check the condition of the upper and lower seals of the coolant pressure cap.



ccbf

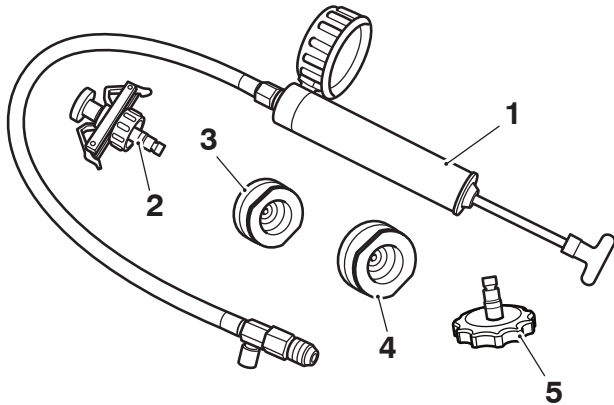
- 1. Lower Seal**
2. Upper Seal
3. Spring

Note:

- If there is any sign of damage or deterioration replace the cap.
4. Pressure test the cap and cooling system to the blow off pressure of 1.2 bar as described using service tool T3880147.

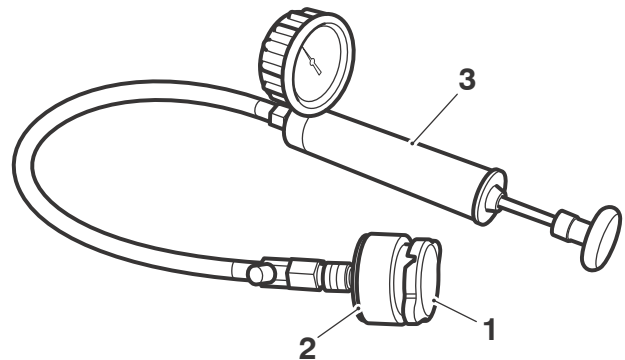
Note:

- It is recommended to carry out coolant pressure cap and cooling system pressure tests consecutively.



1. Hand held pump
 2. Bayonet type connector
 3. Pressure cap test adapter 44 mm
 4. Pressure cap test adapter 46 mm
 5. Coolant cap type connector
5. Select the correct test adapter and securely fasten to the pressure cap.

6. Carefully connect the hand pump to the adapter ensuring an air tight seal is maintained.



cgwq

1. Pressure cap
2. Test adapter
3. Hand held pump

7. Pressure test the cap to it's 1.2 bar blow off pressure. If the coolant cap opens at a lower pressure, fails to open at the correct pressure or the seal leaks, replace the cap.
- Refit the fuel tank (see Fuel Tank - Installation, page 385).
 - Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
 - Refit the seat (see Seat - Installation, page 645).

Thermostat - 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.

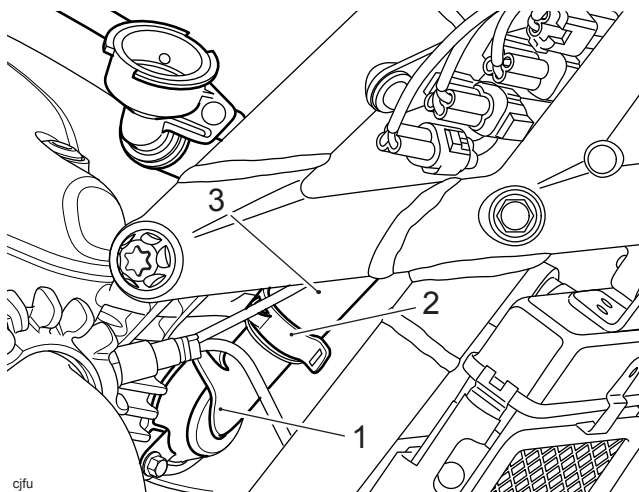
- Remove the seat (see Seat - Removal, page 645).
- Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
- Remove the fuel tank (see).

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 hot coolant will cause scalds and skin damage.

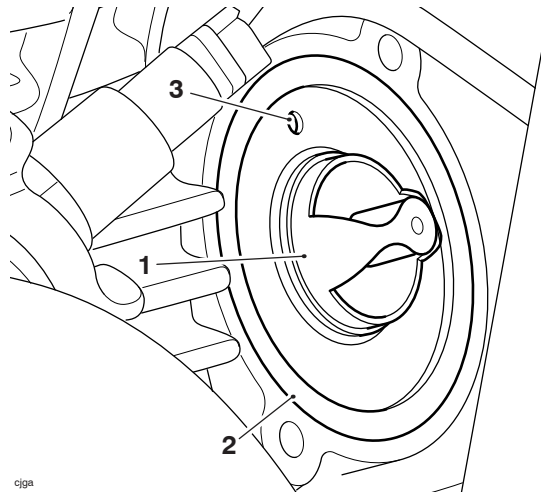
Note:

- Prior to disassembly of the coolant hoses, note the orientation and position of the hose clamps to help ensure that they are returned to the same positions and orientation on assembly.
 - Drain the coolant (see Coolant Replacement - Drainage, page 462).
1. Release the hose clamp from the thermostat housing.



1. Thermostat housing
2. Hose clamp
3. Top hose

2. Release the fixings securing the thermostat housing to the cylinder head, and withdraw the housing downwards, detaching it from the top hose.
3. Remove the housing, collect the thermostat and discard the seal.



1. Thermostat
2. Thermostat seal
3. Bypass hole

Thermostat - Inspection

1. Inspect the thermostat at room temperature. If the thermostat is open, it must be replaced.
2. To check the thermostat is opening at the correct temperature, suspend the thermostat in a container of water and raise the temperature of the water until the thermostat opens.
 - Refer to the General Information section for the correct thermostat opening temperature.
3. If the temperature at which thermostat opening takes place is incorrect, replace the thermostat.

Thermostat - Installation

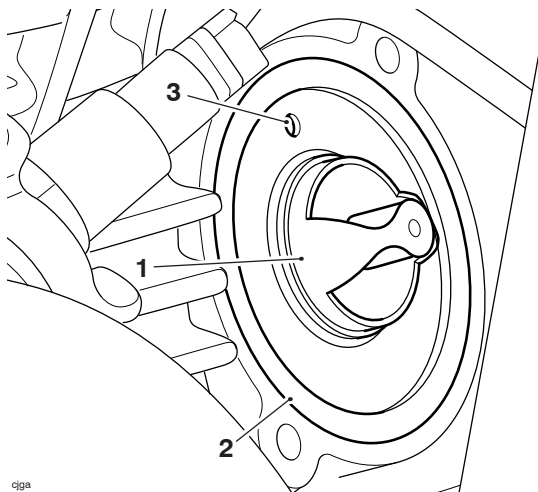
Warning

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

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 hot coolant will cause scalds and skin damage.

1. Clean the mating surfaces of the cylinder head and thermostat housing.
2. Position a new seal to the thermostat, seating the thermostat into the groove in the seal.
3. Locate the thermostat into the cylinder head with the centre bars of the thermostat in a horizontal position, and the bypass hole positioned uppermost.



1. **Thermostat**
2. **Thermostat seal**
3. **Bypass hole**

4. Reconnect the top hose to the thermostat housing. Ensure the hose clamp is positioned as noted during removal.
5. Locate the thermostat housing to the cylinder head, ensuring that the top hose is fully seated on to the thermostat outlet. Tighten the fixings to 9 Nm.
 - Refill the cooling system (see Coolant Replacement - Filling, page 463).
 - Check the expansion tank level and top up if necessary (see Coolant Level Inspection, page 461).
 - Refit the fuel tank (see Fuel Tank - Installation, page 385).
 - Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
 - Refit the seat (see Seat - Installation, page 645).

Radiator - Removal

Warning

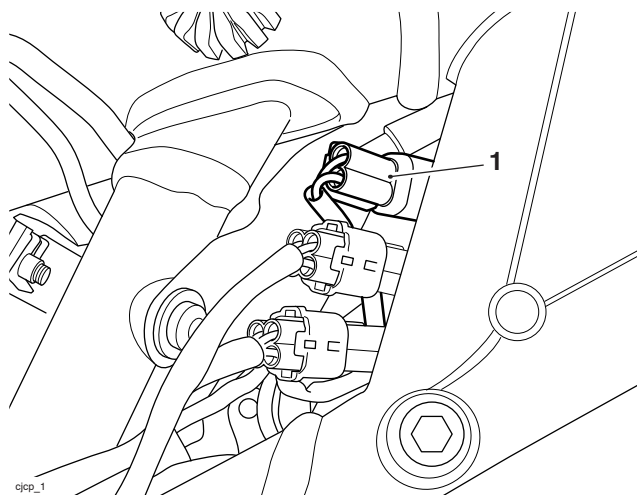
Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

Warning

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 hot coolant will cause scalds and skin damage.

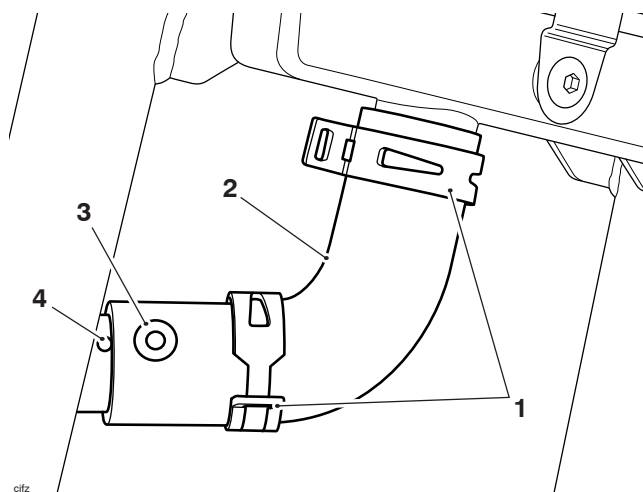
Note:

- Prior to disassembly of the coolant hoses, note the orientation and position of the hose clamps to help ensure that they are returned to the same positions and orientation on assembly.
 - Use T3880207 - Hose Clip Pliers for their removal and installation.
 - Refit the engine cradles (see Cradle Assemblies - Installation, page 652).
 - Drain the coolant (see Coolant Replacement - Drainage, page 462).
1. Disconnect the cooling fan electrical connector.



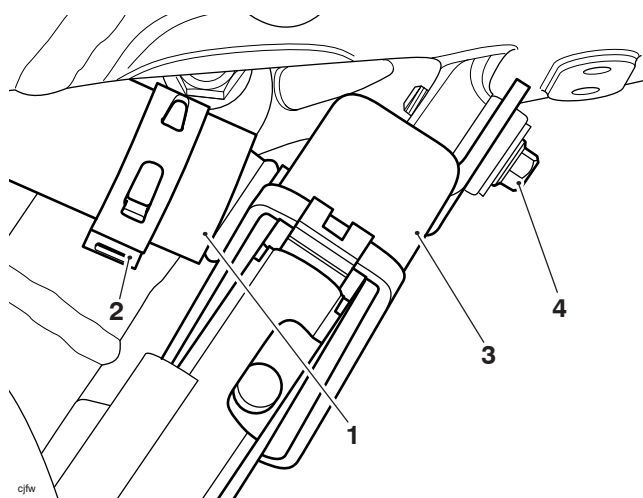
1. Cooling fan electrical connector

2. Disconnect the bottom hose from the radiator.



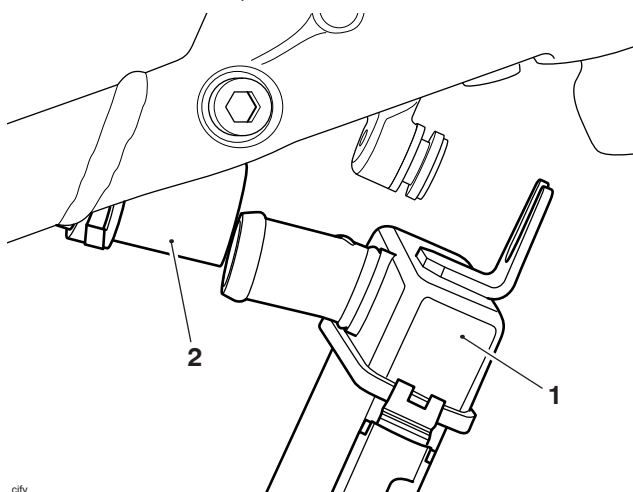
1. Hose clamps
2. Bottom hose
3. Coolant hose alignment mark
4. Outlet pipe alignment mark

3. Disconnect the top hose clamp from the radiator.
4. Release the fixing securing the radiator to the frame,



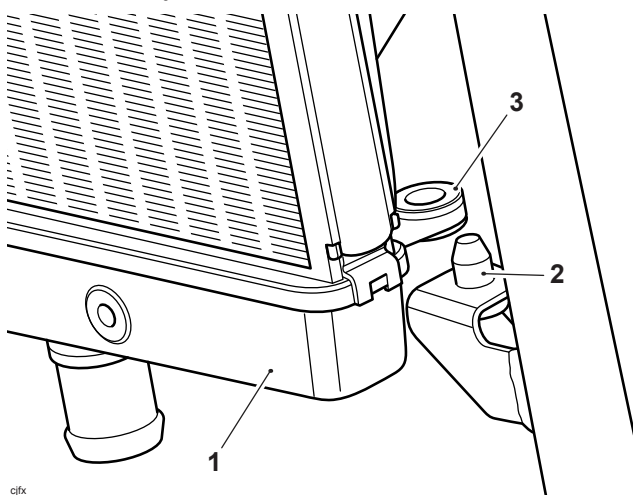
1. Top hose
2. Hose clamp
3. Radiator
4. Fixing

5. Release the top hose.



1. Radiator
2. Top hose

6. Raise the radiator and rubber mounting from its lower mounting on the left hand cradle assembly.



1. Radiator
2. Radiator lower mounting
3. Rubber mounting

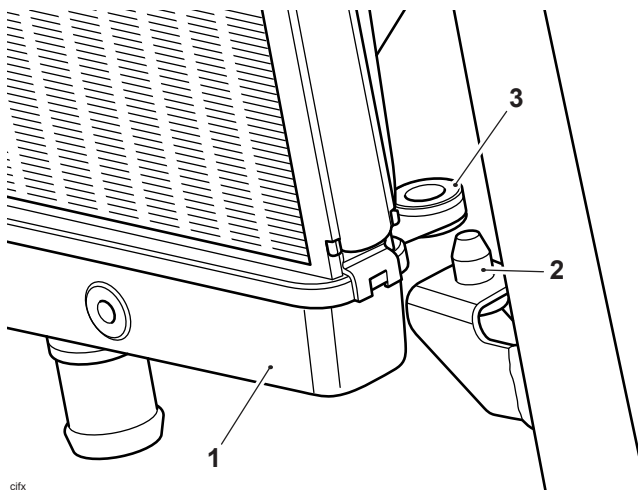
7. Remove the radiator from the motorcycle, taking care not to damage the radiator, left hand frame cradle or front mudguard.

Radiator - Installation

Warning

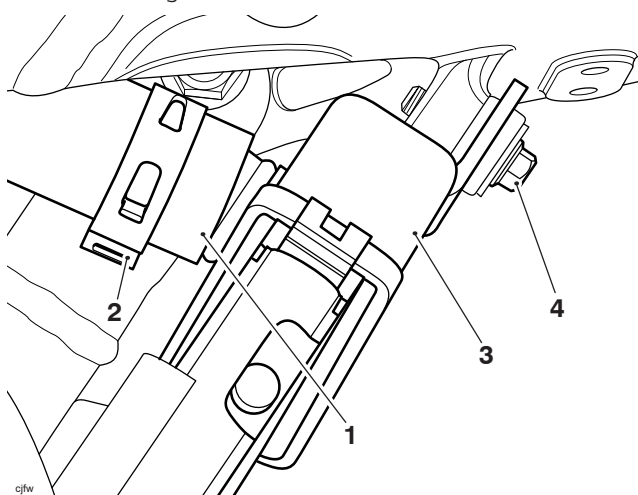
Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

1. Align the radiator's lower rubber mounting to its mounting on the left hand cradle assembly.



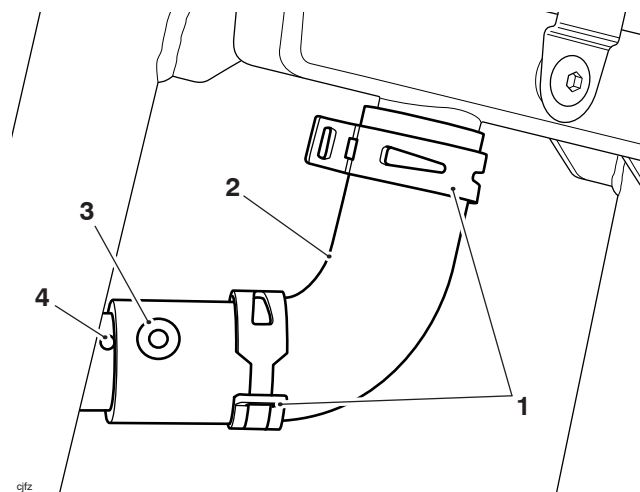
1. Radiator
2. Radiator lower mounting
3. Rubber mounting

2. Refit the radiator to the top hose, ensure the top hose clamp is positioned as noted during removal.
3. Align the radiator upper mounting and tighten the fixing to 6 Nm.



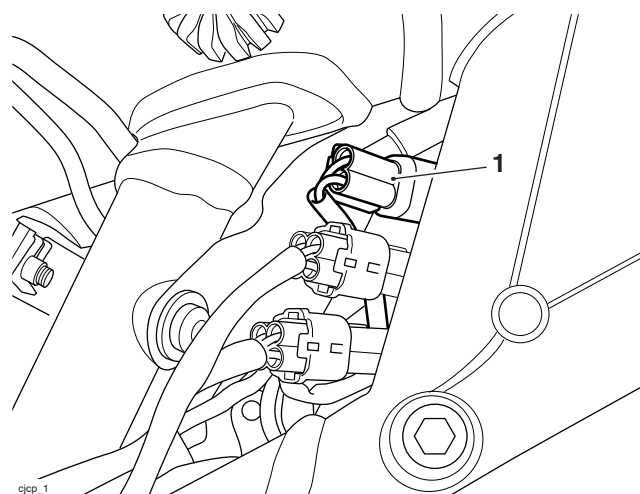
1. Top hose
2. Clamp
3. Radiator
4. Fixing

4. Refit the right hand frame cradle assembly (see Cradle Assemblies - Installation, page 652).
5. Refit the bottom hose, positioning the clamps as noted during removal.



1. Clamps
2. Bottom hose
3. Coolant hose alignment mark
4. Outlet pipe alignment mark

6. Re-connect the cooling fan electrical connector.



1. Cooling fan electrical connector

7. Refill the cooling system (see Coolant Replacement - Filling, page 463).
8. Check the expansion tank level and top up if necessary (see Coolant Level Inspection, page 461).
 - Refit the fuel tank (see Fuel Tank - Installation, page 385).
 - Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
 - Refit the seat (see Seat - Installation, page 645).

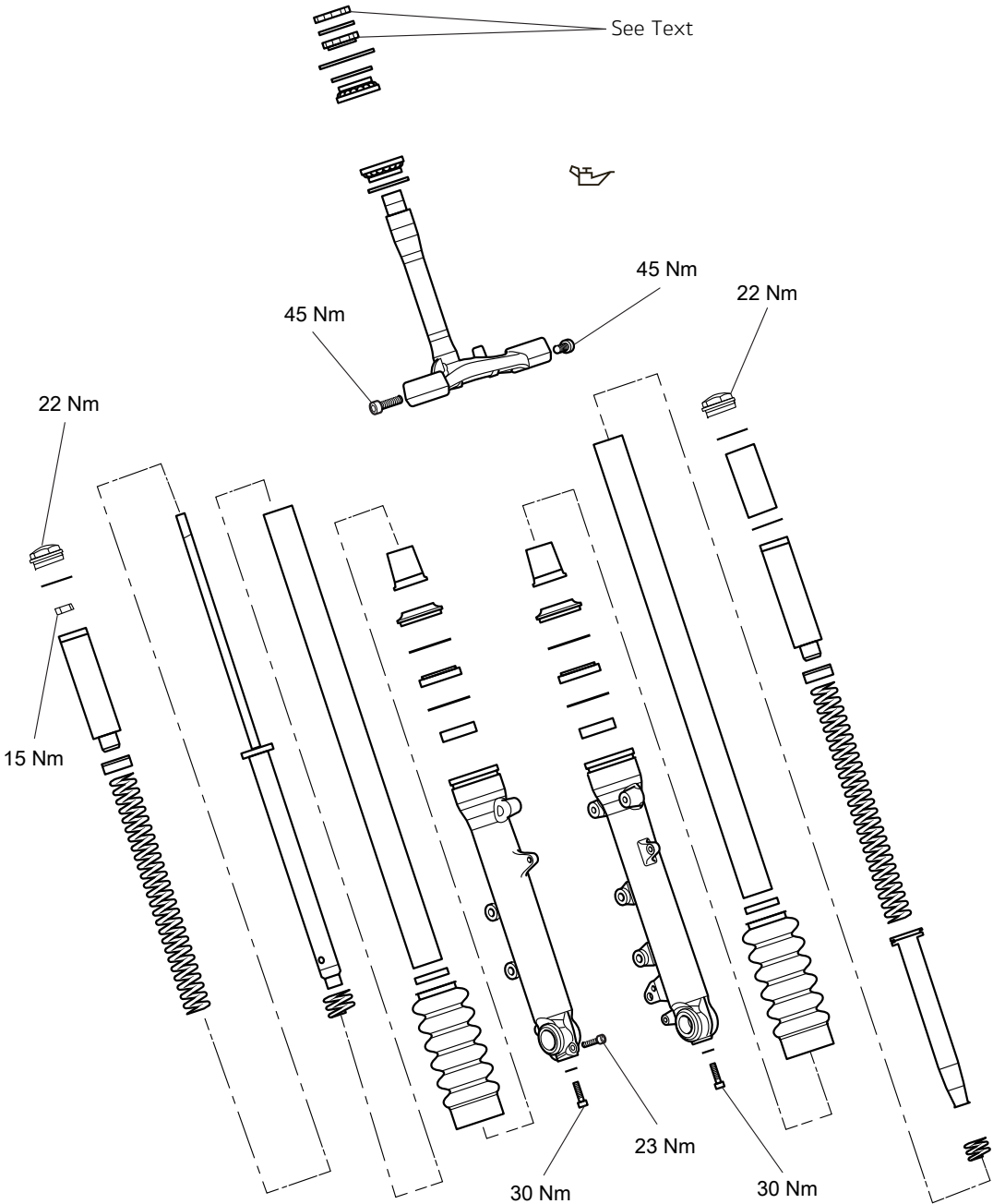
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20 Front Suspension

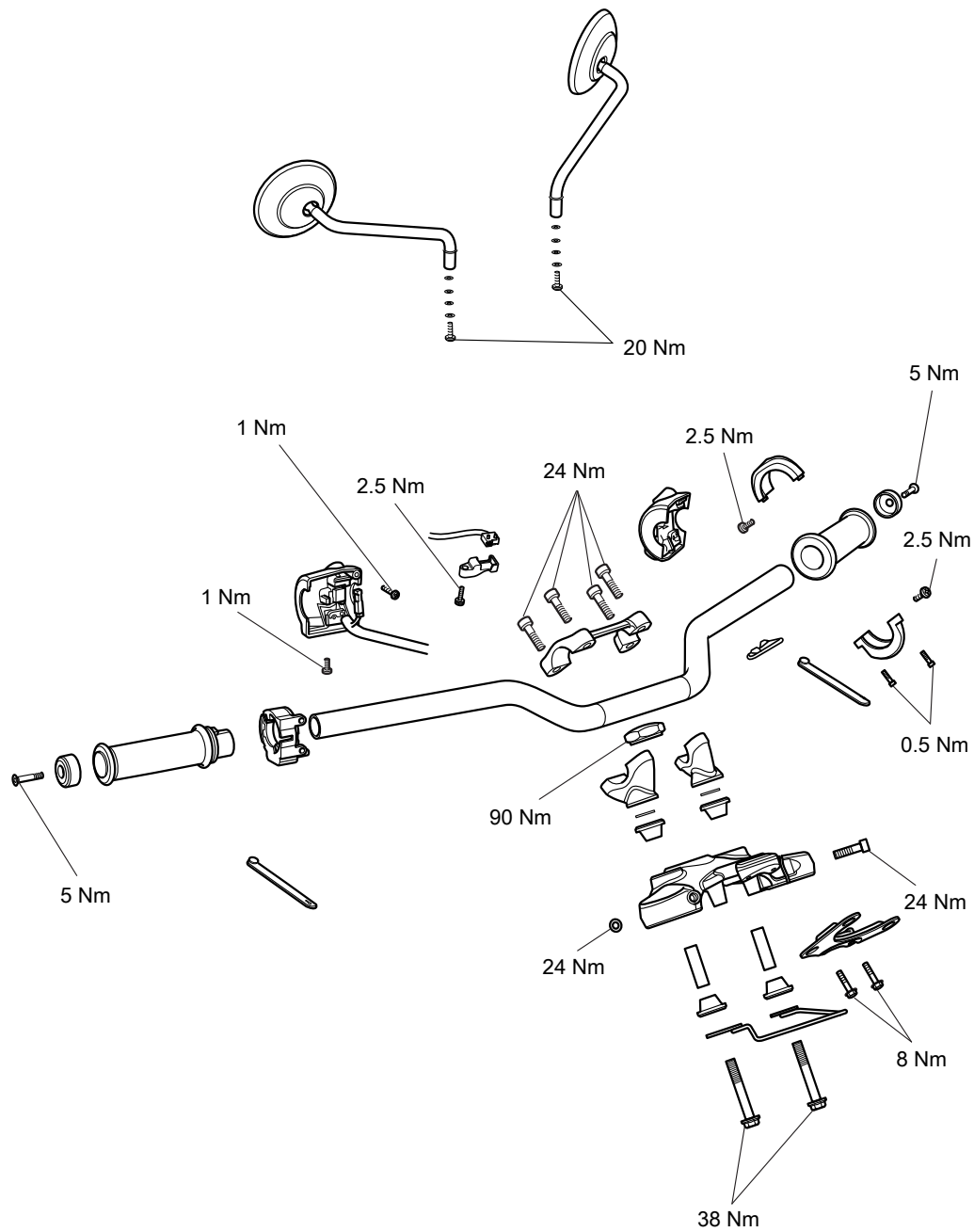
Table of Contents

Exploded View – Front Fork, Bottom Yoke and Steering Head Bearings	477
Exploded View – Handlebars and Top Yoke	478
Fork Inspection.....	479
Front Fork - Removal	479
Front Fork - Installation.....	481
Fork Oil Change - Oil Draining - Right Hand Fork.....	482
Fork Oil Change - Oil Draining - Left Hand Fork.....	483
Fork Oil Change - Oil Refilling	484
Front Fork - Left Hand - Disassembly	486
Front Fork - Right Hand - Disassembly	487
Front Fork - Inspection	489
Front Fork - Left Hand - Assembly	490
Front Fork - Right Hand - Assembly	492
Steering Head Bearing - Check	494
Steering Head Bearing - Adjustment.....	494
Handlebars - Removal.....	496
Handlebars - Installation.....	496
Upper Yoke - Removal	498
Upper Yoke - Installation.....	499
Lower Yoke and Headstock Bearings - Removal.....	500
Lower Yoke and Headstock Bearings - Bearing Removal	501
Lower Yoke and Headstock Bearings - Installation	501

Exploded View – Front Fork, Bottom Yoke and Steering Head Bearings



Exploded View - Handlebars and Top Yoke



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.

- Raise and support the front of the motorcycle.
- Remove the front wheel (see Front Wheel - Removal, page 609).

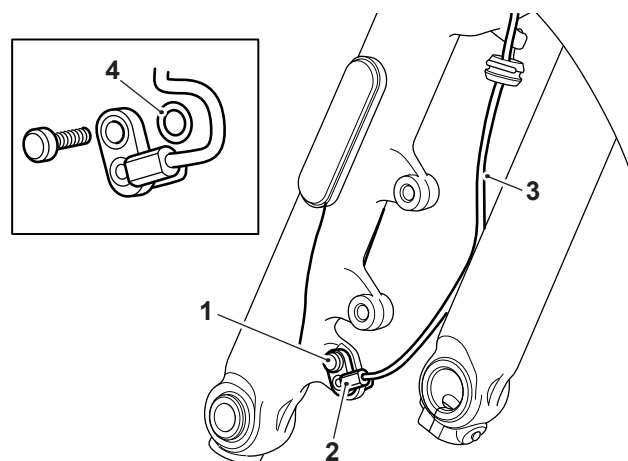
Warning

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.

- Remove the front mudguard (see Front Mudguard - Removal, page 646).

Note:

- **Note the routing of the ABS wheel speed sensor harness for installation.**
 - **There is a shim between the ABS wheel speed sensor and the front fork leg.**
1. Release the fixing and detach the ABS wheel speed sensor from the left hand fork leg, and collect the shim.

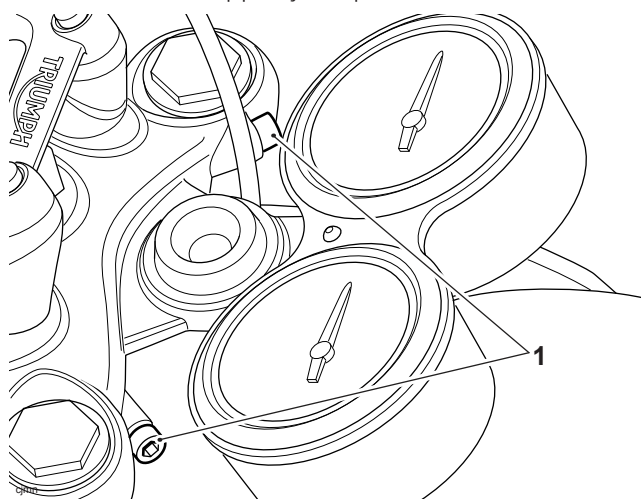


qjbb

1. Fixing
2. Front ABS wheel speed sensor
3. ABS wheel speed sensor harness
4. Shim

Note:

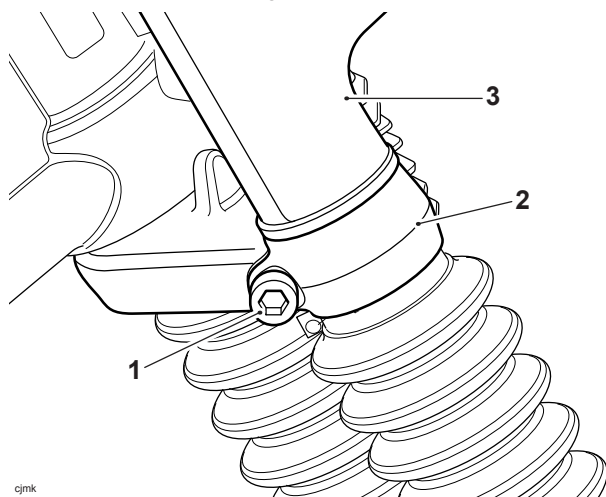
- If the forks are to be dismantled, loosen the fork top caps.
2. Loosen the upper yoke pinch bolt.



1. Upper yoke pinch bolt

Note:

- If both forks are being removed, ensure the headlight and bracket assembly is securely supported.
 - Do not allow the headlight and bracket assembly to hang by its harness.
3. Loosen the lower yoke pinch bolt and slide the fork down through the yokes.



1. Pinch bolt
2. Lower yoke
3. Headlight bracket

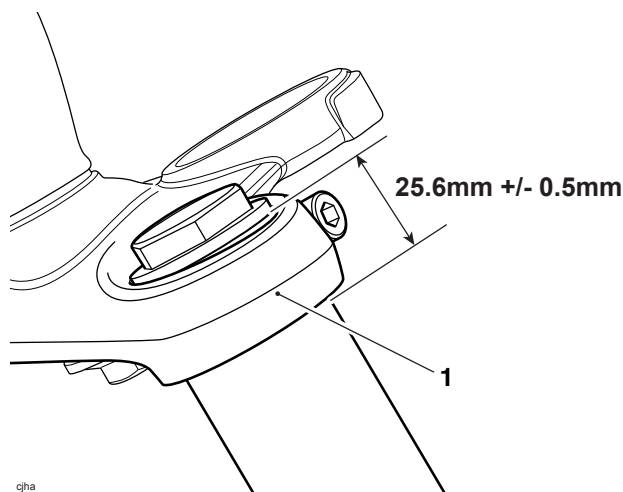
! Caution

Care must be taken when removing the forks, to ensure that the outer surfaces do not become scratched.

4. Remove the forks from the lower yoke.

Front Fork - Installation

1. Position the headlight bracket and mounting rubbers between the upper and lower yoke.
2. Install each fork through the lower yoke.
3. Position the fork through the lower yoke so that the lip of the outer tube, not the top cap, is 25.6 mm above the lower surface of the upper yoke.



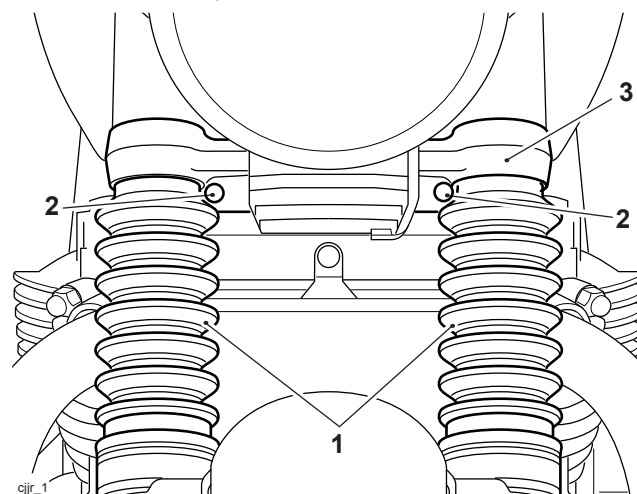
1. Upper yoke

4. Tighten the lower yoke pinch bolts to 45 Nm.
5. If the fork top caps have been loosened, tighten them to 22 Nm.
6. Tighten the upper yoke clamp bolts to 24 Nm.

! Warning

Move the handlebars to the 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.

7. Position the top of the fork gaiter to the lower edge of upper yoke and tighten the clip to 3 Nm. Ensure that the fixing head for the clip is facing forward and is positioned as shown in the following illustration.



1. Front fork gaiters fitted correctly

2. Clamp

3. Lower yoke

8. Refit the front mudguard (see Front Mudguard - Installation, page 647).
9. Route and secure the ABS wheel speed sensor harness as noted for removal and fit the wheel speed sensor and shim to the fork leg. Tighten the fixing to 9 Nm.
10. Install the front wheel (see Front Wheel - Installation, page 611).
11. The air gap between the ABS pulser ring and the sensor must be between 0.40 mm and 1.20 mm. Check, and if necessary, adjust the air gap (see Air Gap Measurement, page 555).
12. Lower the motorcycle to the ground and park it on the side stand.

Fork Oil Change - Oil Draining - Right Hand Fork

- Remove the fork assembly (see Front Fork - Removal, page 479).

Caution

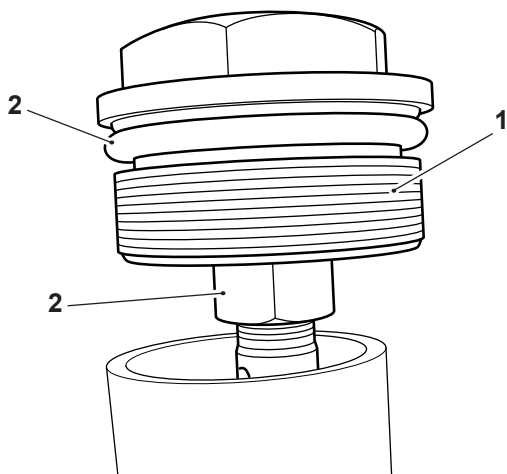
When securing the fork in service tool T3880171, take care not to over tighten the clamp as this will cause the fork tube to distort beyond repair.

- Using a soft jawed vice, clamp the service tool T3880171 such that the fork can be mounted vertically.
- With the top cap facing upwards, very gently clamp the fork inner tube into service tool T3880171.

Warning

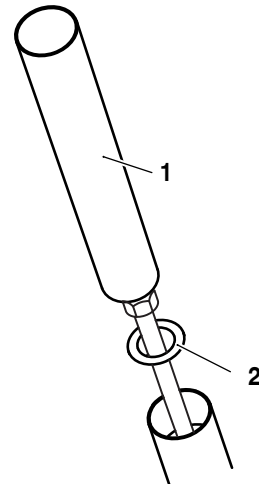
The top cap is under pressure from the fork spring. As the last few threads of the cap are unscrewed, keep the cap pushed firmly into the tube to prevent it being forcibly expelled as the threads release. To prevent injury, always wear eye, face and hand protection when removing the top cap.

- Carefully unscrew the top cap from the fork inner tube.
- Loosen the lock nut and remove the top cap.



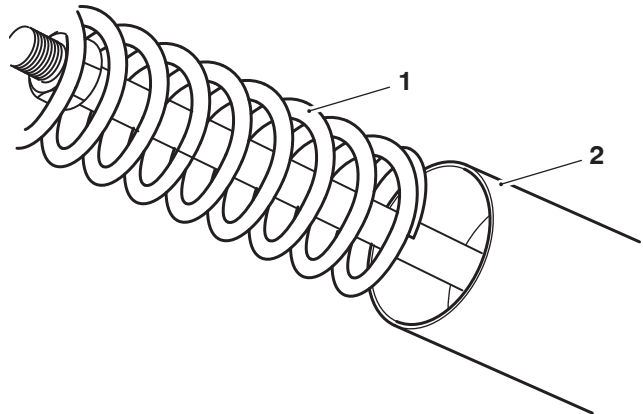
- Top cap**
- Damper lock nut**
- O-ring**

- Remove the spacer and spring seat.



- Spacer**
- Spring seat**

- Lift out the spring.



- Spring**
- Fork inner tube**

- Invert the fork and pour out the fork oil into a suitable container. Pump the fork assembly to remove all oil.

Fork Oil Change - Oil Draining - Left Hand Fork

- Remove the fork assembly (see Front Fork - Removal, page 479).

⚠ Caution

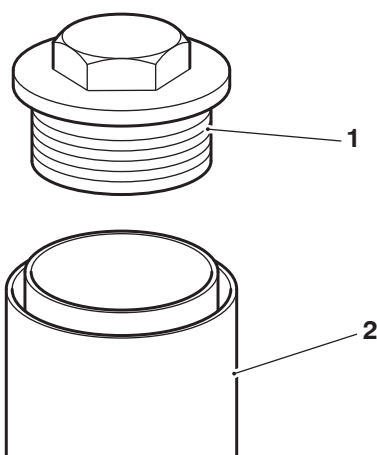
When securing the fork in service tool T3880171, take care not to over tighten the clamp as this will cause the fork tube to distort beyond repair.

- Using a soft jawed vice, clamp the service tool T3880171 such that the fork can be mounted vertically.
- With the top cap facing upwards, very gently clamp the fork inner tube into service tool T3880171.

⚠ Warning

The top cap is under pressure from the fork spring. As the last few threads of the cap are unscrewed, keep the cap pushed firmly into the tube to prevent it being forcibly expelled as the threads release. To prevent injury, always wear eye, face and hand protection when removing the top cap.

- Carefully unscrew the top cap from the fork inner tube.

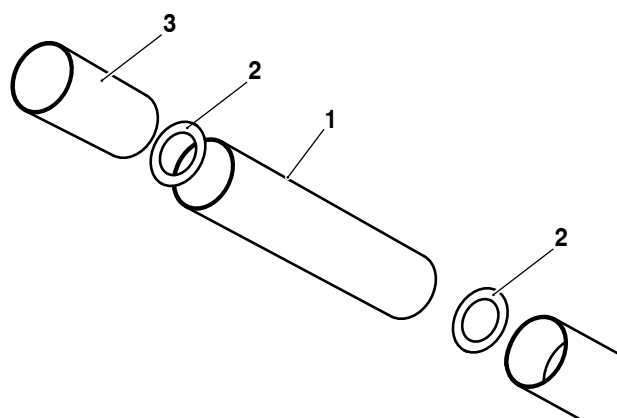


- Top cap
- Fork inner tube

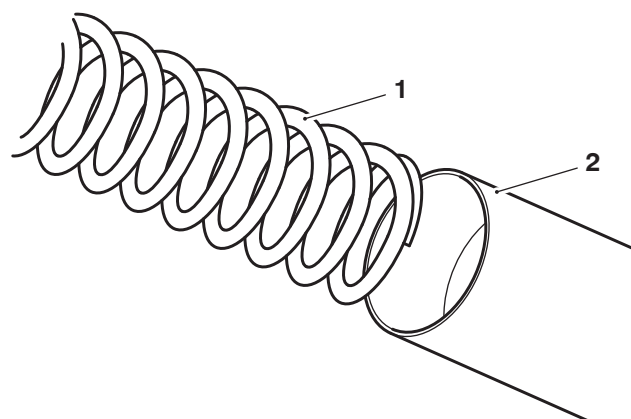
Note:

- Note the position of the two spacers and the two spring seats for installation.

- Remove the two spacers and spring seats.



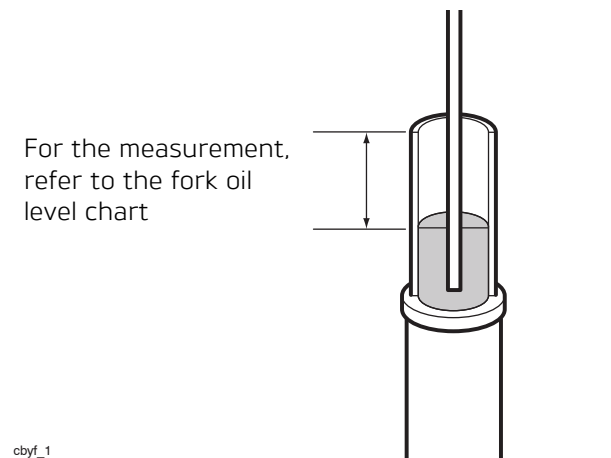
- Upper spacer
- Spring seats
- Lower spacer
- Lift out the spring.



- Spring
- Fork inner tube
- Invert the fork and pour out the fork oil into a suitable container. Pump the fork assembly to remove all oil.

Fork Oil Change - Oil Refilling

The oil level is measured from the upper surface of the fork inner tube, with the spring removed and the fork fully compressed.



Fork Oil Level (spring, spring seat and spacer removed and the fork fully compressed)

Fork Oil Level Chart

Warning

Any variation from the figures quoted in the fork oil level chart could result in an unsafe riding condition leading to loss of motorcycle control and an accident.

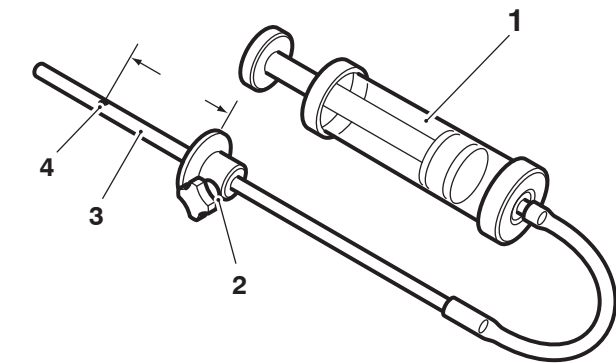
Left Hand Fork

Oil Level*	Oil Volume	Oil Grade	Fork Pull Through
165 mm	434 cc	KHL34-G10	Lip of the outer tube 25.6 mm above the lower surface of the upper yoke
* Spring, Spring Seat and Spacer Removed and Fork Fully Compressed			

Right Hand Fork

Oil Level*	Oil Volume	Oil Grade	Fork Pull Through
126 mm	434 cc	KHL34-G10	Lip of the outer tube 25.6 mm above the lower surface of the upper yoke
* Spring, Spring Seat and Spacer Removed and Fork Fully Compressed			

- Return the fork to an upright position and fill the fork with the specified fork oil until the oil level is slightly above the recommended level.
- Pump the fork assembly 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 level to stabilise.
- Refer to the oil level chart and set the scale on service tool 3880160-T0301 to the specified level.



- cbyg_1
- 3880160 -T0301 - Fork Oil Filler/Evacuator**
 - Adjuster plate**
 - Scale area**
 - Hole (zero position)**

Note:

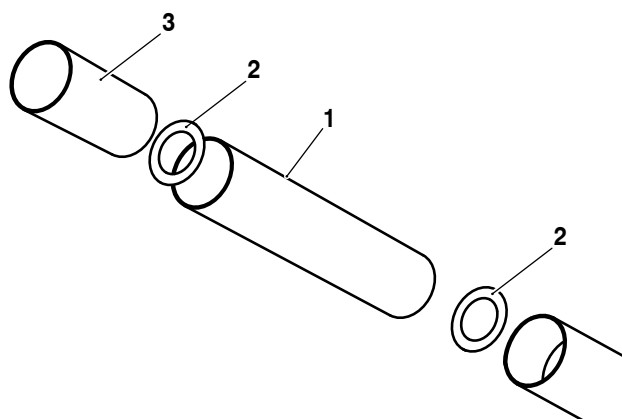
- Zero level on the tool is set at the small exit hole in the side of the scale tube, NOT AT THE END TIP. Do not attempt to block this side hole as this will cause the final fluid level to be incorrect.**
- Insert the scale end of the tool into the fork inner tube.
 - Hold the tool adjuster plate level with the upper surface of the fork inner tube and draw fluid into the syringe until fluid flow ceases (empty the syringe if the body becomes full before fluid flow stops).
 - 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.

Fork Assembly

Left Hand Fork

- Extend the inner tube and insert the fork spring.

2. Fit the spring seats and spacers as noted for removal.



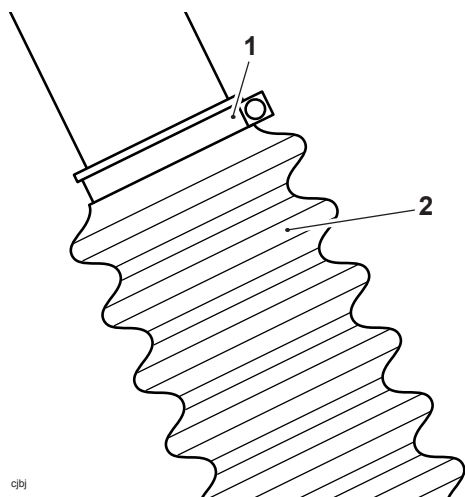
1. Upper spacer
2. Spring seats
3. Lower spacer

3. Lubricate the O-ring with a smear of fork oil then screw the top cap fully into the inner tube.

Warning

Keep the top cap under pressure until you are sure it is fully engaged with the inner tube threads. To prevent injury, always wear eye, face and hand protection when refitting the top cap.

4. Refit the gaiter to the front fork. Do not tighten its retaining clamp at this stage.



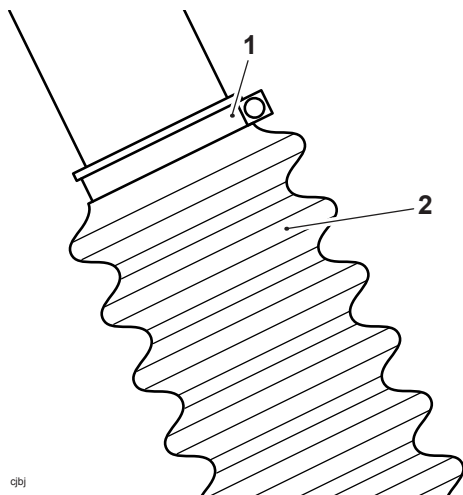
1. Clamp
2. Gaiter

Note:

- It is much easier to tighten the top cap when the fork is securely clamped in the lower yoke.
- Refit the fork (see Front Fork - Installation, page 481) and tighten the top cap to 22 Nm.

Front Fork - Left Hand - Disassembly

- Remove the fork assembly (see Front Fork - Removal, page 479).
- If not already done, release the torque on the damping cylinder bolt, then lightly retighten it to prevent fluid loss.
 - Drain the fork oil (see Fork Oil Change - Oil Draining - Left Hand Fork, page 483).
 - Loosen the clip and remove the gaiter from the front fork.



- Clip
- Gaiter



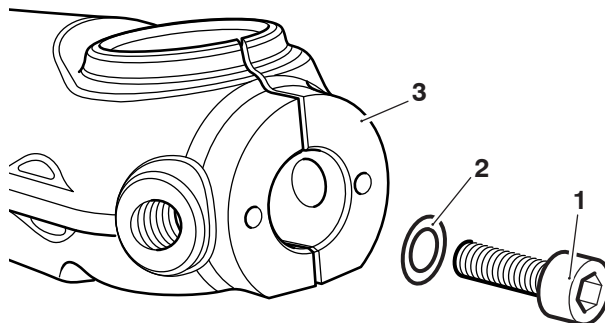
Caution

When securing the fork in service tool T3880171, take great care not to over tighten the clamp as this will cause the fork tube to distort beyond repair.

Note:

- It may be necessary to hold the damping cylinder using a proprietary fork damper holding tool when removing the damping cylinder bolt.

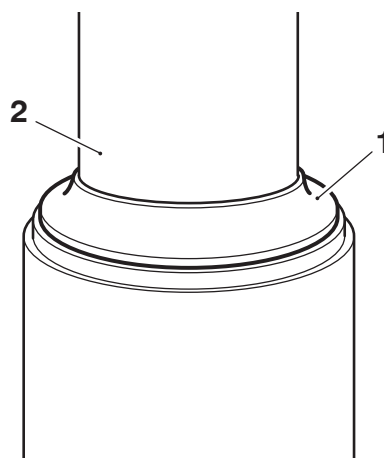
- Remove the damping cylinder bolt and sealing washer from the base of the outer tube. Discard the sealing washer.



cjoy

- Damping cylinder bolt
- Sealing washer
- Outer tube

- Invert the fork and remove the damping cylinder and rebound spring.
- Ease the dust seal out of position and slide it off the inner tube.



ceto_1

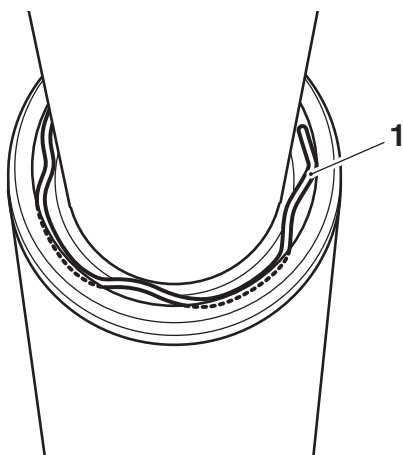
- Dust seal
- Inner tube



Caution

Keep the fork fully compressed whilst removing the circlip. Any accidental damage to the inner tube will then be confined to the area which is normally above the oil seal.

7. Carefully ease the circlip out from the top of the outer tube.



cetn

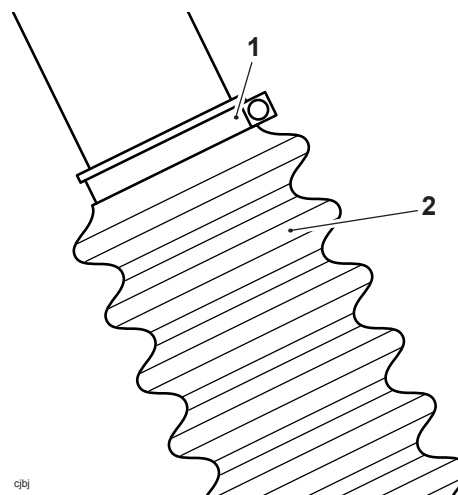
1. Circlip

8. Compress the fork then pull the inner tube sharply out of the outer tube. Repeat this procedure until the top bush and seal are forced out of position and the inner and outer tube can be separated.
9. Invert the outer tube and tip out the damper rod seat and its spring.
10. Slide the oil seal, washer and upper bush off the top of the inner tube.
11. Carefully slide the lower bush off the inner tube.

Front Fork - Right Hand - Disassembly

- Remove the fork assembly (see Front Fork - Removal, page 479).

1. If not already done, release the torque on the damping cylinder bolt, then lightly retighten it to prevent fluid loss.
2. Drain the fork oil (see Fork Oil Change - Oil Draining - Right Hand Fork, page 482).
3. Loosen the clip and remove the gaiter from the front fork.



cjbj

1. Clip

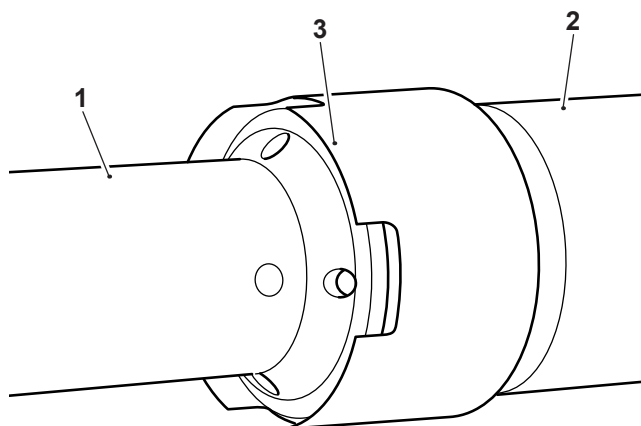
2. Gaiter

⚠ Caution

When securing the fork in service tool T3880171, take great care not to over tighten the clamp as this will cause the fork tube to distort beyond repair.

Front Suspension

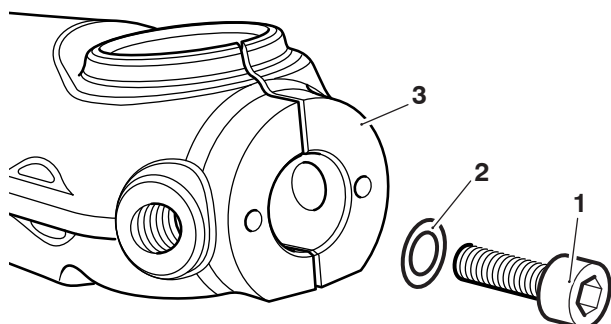
4. Insert service tool T3880633 over the damping cylinder inside the fork. Ensure the lugs on the service tool engage into the slots of the damping cylinder.



cjmi

1. Damping cylinder (shown removed for clarity)
2. T3880633 - Wrench Damper Tube
3. Lug on service tool

5. While holding service tool T3880633 remove the damping cylinder bolt and sealing washer from the base of the outer tube. Discard the sealing washer.

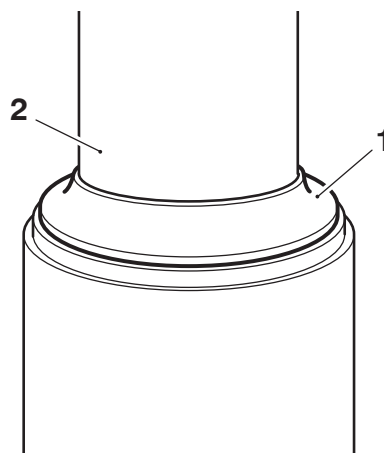


cjoy

1. Damping cylinder bolt
2. Sealing washer
3. Outer tube

6. Invert the fork and remove the damping Cylinder.

7. Ease the dust seal out of position and slide it off the inner tube.



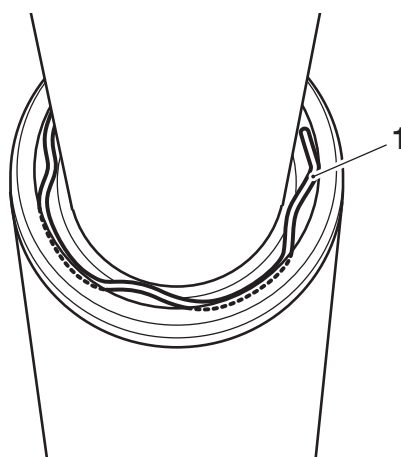
ceto_1

1. Dust seal
2. Inner tube

Caution

Keep the fork fully compressed whilst removing the circlip. Any accidental damage to the inner tube will then be confined to the area which is normally above the oil seal.

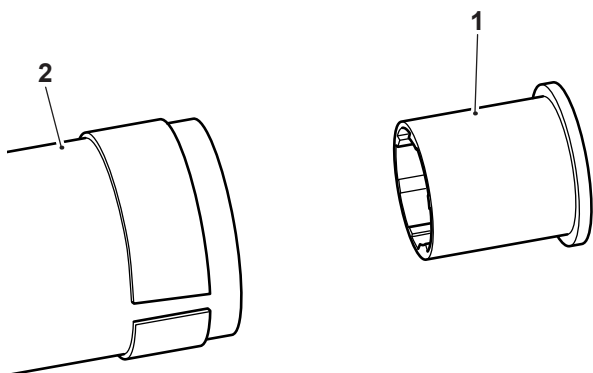
8. Carefully ease the circlip out from the top of the outer tube.



cetn

1. Circlip
9. Compress the fork then pull the inner tube sharply out of the outer tube. Repeat this procedure until the top bush and seal are forced out of position and the inner and outer tube can be separated.
10. Slide the oil seal, washer and upper bush off the top of the inner tube.

11. Carefully slide the lower bush off the inner tube.
12. Remove the damping cylinder seat from the lower end of the fork inner tube.



cjme

1. Damping cylinder seat
2. Fork inner tube

Front Fork - Inspection

1. Thoroughly clean and examine all components for damage, wear, scoring, corrosion etc., paying particular attention to the bushes and damper rod piston ring. Renew as necessary.
2. Always renew the oil seal, dust seal and the damper rod bolt sealing washer every time the fork is dismantled.

Front Fork - Left Hand - Assembly

Warning

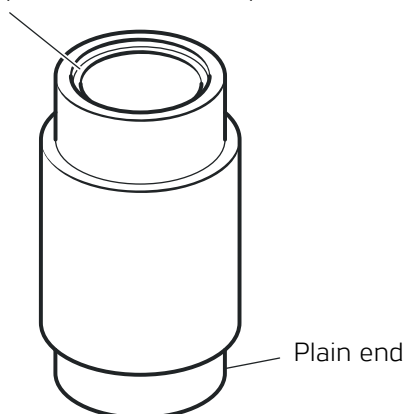
The front forks comprise many precision machined parts. Total cleanliness must be observed at all times and assembly must take place in a dirt/dust-free environment.

Dirt ingress may cause damage to the fork parts, leading to incorrect operation, instability, loss of motorcycle control or an accident.

Note:

- During assembly of the fork, service tool **T3880184** will be used extensively. In the text, reference to a plain end and a stepped end will be made. This describes the two ends of the tool as shown in the diagram below.

Stepped end (with internal recess)

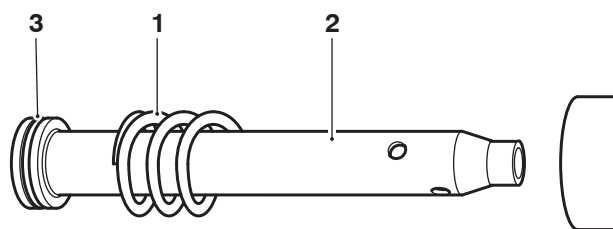


CCZJ

T3880184 - Fork Seals Drift

1. If removed, refit the lower bush to the inner tube.
2. Lubricate the damping cylinder piston ring and the upper and lower bushes for the inner tube with clean fork oil.

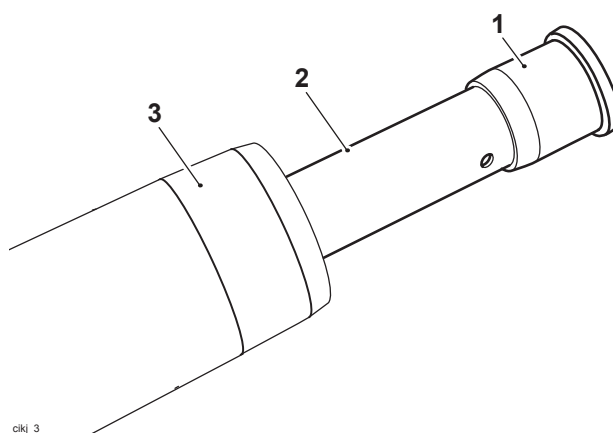
3. Fit the rebound spring to the damping cylinder then insert the assembly into the fork inner tube.



T908.11.13_1

1. **Rebound spring**
2. **Damping cylinder**
3. **Piston ring**

4. Fit the damping cylinder seat securely to the end of the damping cylinder then insert the inner tube assembly into the fork outer tube.

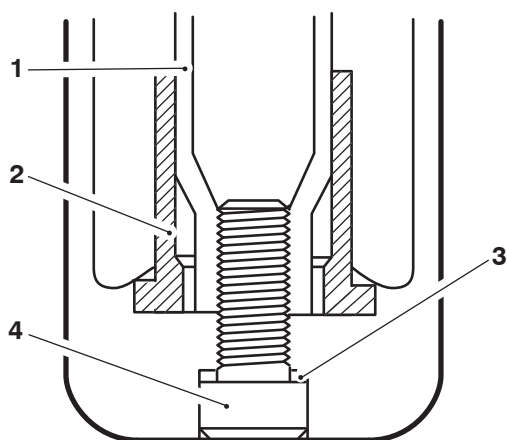


clkj_3

1. **Damping cylinder seat**
2. **Damping cylinder**
3. **Fork inner tube**

5. Fit a new sealing washer to the damping cylinder bolt then apply locking compound (ThreeBond 1342) to the bolt threads.

6. Ensure the damping cylinder and seat are correctly located in the outer tube then fit the damping cylinder bolt. Tighten the damping cylinder bolt to 30 Nm.



kagj_1

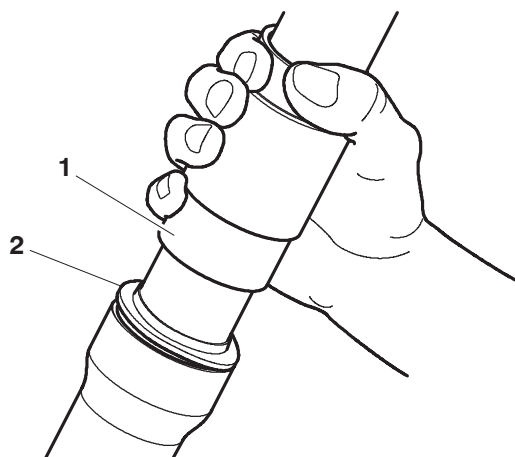
1. **Damping cylinder**
2. **Damping cylinder seat**
3. **Sealing washer**
4. **Bolt**

7. Slide the top bush along the inner tube and locate it in the outer tube. Drift the bush into position using the plain end of service tool T3880184.

! Caution

Keep the fork fully compressed whilst installing the bush, oil seal and circlip. Any accidental damage to the inner tube will then be confined to the area which is normally above the oil seal.

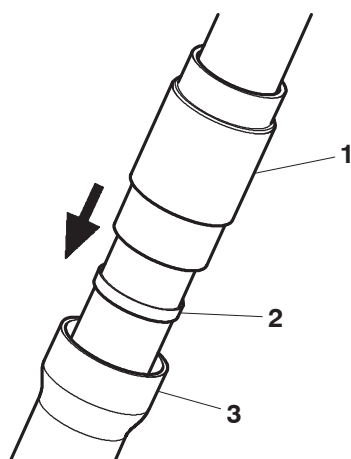
8. Slide the washer along the inner tube and locate it in the outer tube.
9. Lubricate the lip of the new oil seal with fork oil. Ensure the seal is the correct way around then ease it onto the inner tube. Gently drift the seal into position in the outer tube using the stepped end of service tool T3880184.
10. Secure the oil seal in position with the circlip, ensuring it is correctly located in its groove.
11. Fit the new dust seal onto the inner tube and gently drift it into position in the outer tube using the stepped end of service tool T3880184.



11.11-3

1. **T3880184 - Fork Seals Drift**
2. **Dust seal**

12. Refill the fork with new oil (see Fork Oil Change - Oil Refilling, page 484).



11.11-2

1. **T3880184 - Fork Seals Drift**
2. **Top bush**
3. **Outer tube**

Front Fork - Right Hand - Assembly

Warning

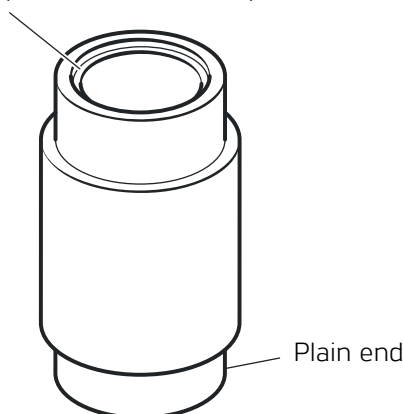
The front forks comprise many precision machined parts. Total cleanliness must be observed at all times and assembly must take place in a dirt/dust-free environment.

Dirt ingress may cause damage to the fork parts, leading to incorrect operation, instability, loss of motorcycle control or an accident.

Note:

- During assembly of the fork, service tool **T3880184** will be used extensively. In the text, reference to a plain end and a stepped end will be made. This describes the two ends of the tool as shown in the diagram below.

Stepped end (with internal recess)

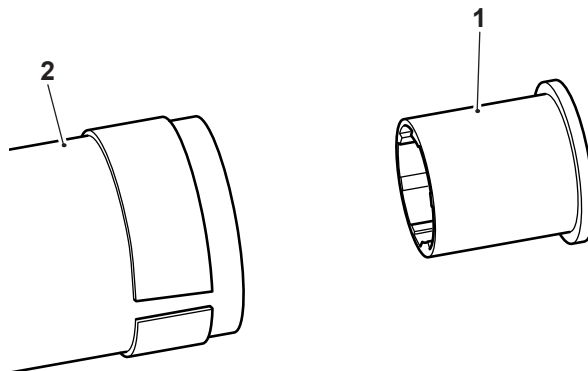


CCZJ

T3880184 - Fork Seals Drift

1. If removed, refit the lower bush to the inner tube.
2. Lubricate the upper and lower bushes for the inner tube with clean fork oil.

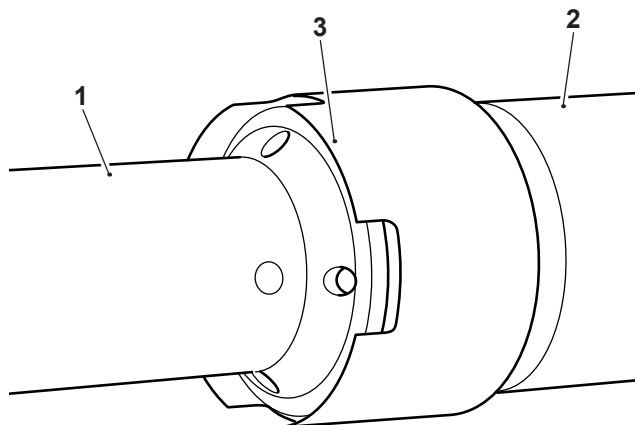
3. Fit the damping cylinder seat into the lower end of the fork inner tube.



cjme

1. **Damping cylinder seat**
2. **Fork inner tube**

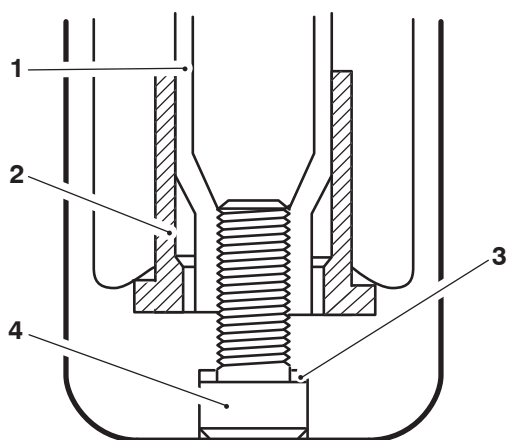
4. Insert the fork inner tube assembly into the fork outer tube.
5. Attach service tool T3880633 to the damping cylinder. Ensure the lugs on the service tool engage into the slots of the damping cylinder.



cjmi

1. **Damping cylinder (shown removed for clarity)**
2. **T3880633 - Wrench Damper Tube**
3. **Lug on service tool**
6. Fit the damping cylinder into the fork inner tube.
7. Fit a new sealing washer to the damping cylinder bolt then apply locking compound (ThreeBond 1342) to the bolt threads.

8. Ensure the damping cylinder and seat are correctly located in the outer tube then fit the damping cylinder bolt. Tighten the damping cylinder bolt to 30 Nm.



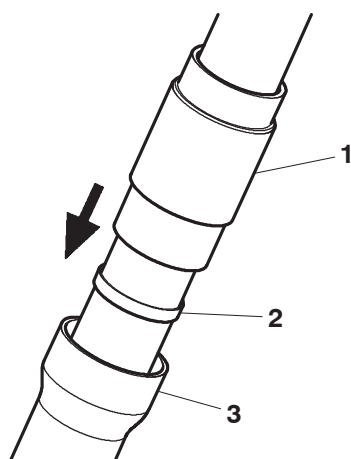
kagj_1

1. Damping cylinder
2. Damping cylinder seat
3. Sealing washer
4. Bolt

9. Slide the top bush along the inner tube and locate it in the outer tube. Drift the bush into position using the plain end of service tool T3880184.

! Caution

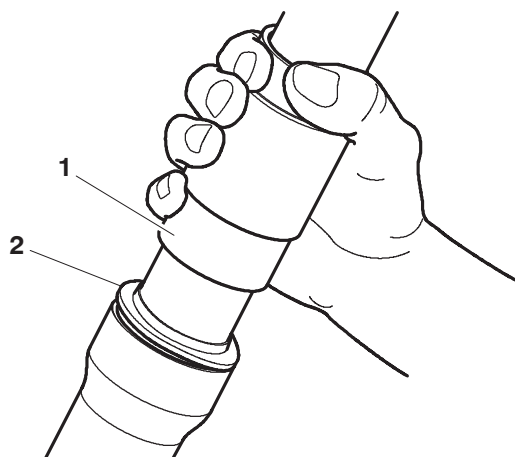
Keep the fork fully compressed whilst installing the bush, oil seal and circlip. Any accidental damage to the inner tube will then be confined to the area which is normally above the oil seal.



11.11-2

1. T3880184 - Fork Seals Drift
2. Top bush
3. Outer tube

10. Slide the washer along the inner tube and locate it in the outer tube.
11. Lubricate the lip of the new oil seal with fork oil. Ensure the seal is the correct way around then ease it onto the inner tube. Gently drift the seal into position in the outer tube using the stepped end of service tool T3880184.
12. Secure the oil seal in position with the circlip, ensuring it is correctly located in its groove.
13. Fit the new dust seal onto the inner tube and gently drift it into position in the outer tube using the stepped end of service tool T3880184.



11.11-3

1. T3880184 - Fork Seals Drift
2. Dust seal

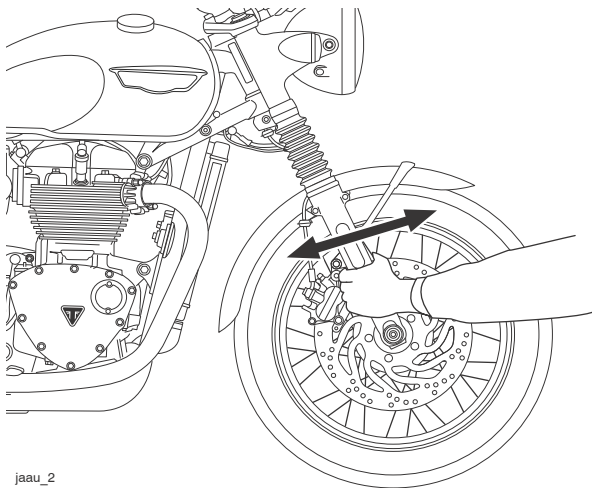
14. Refill the fork with new oil (see Fork Oil Change - Oil Refilling, page 484).

Steering Head Bearing - Check

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 motorcycle so that the front wheel is clear of the ground.
2. Move the handlebars from lock-to-lock whilst checking for signs of tight spots or notchiness (bearings overtightened).
3. Hold the lower end of the front forks and try to move them forward and backward to check for signs of free play in the bearings (bearings insufficiently tightened or worn).



Checking for Free Play in Steering Head Bearings

4. Adjust as described in Steering Head Bearing - Adjustment, page 494 then lower the motorcycle to the ground.

Steering Head Bearing - Adjustment

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.

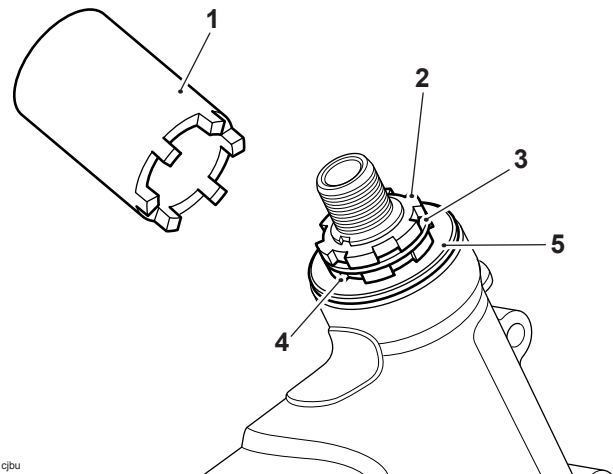
- Remove the seat (see Seat - Removal, page 645).
- Disconnect the battery, negative (black) lead first.

Warning

If the lower yoke fixings are also loosened, the forks will no longer support the weight of the motorcycle.

Do not loosen the lower yoke fixings as, in this condition, the motorcycle could topple over causing damage and/or risk of injury.

- Remove the upper yoke (see Upper Yoke - Removal, page 498).
1. Using service tool T3880023 loosen the lock nut and adjuster nut.



1. **T3880023 - 50 mm Socket**

2. **Lock nut**

3. **Tab washer**

4. **Adjuster nut**

5. **Dust seal**

2. Adjust the bearing free play as follows:
 - Remove the lock nut, tab washer and adjuster nut.
 - Thoroughly clean the threads on the steering stem.
 - Refit the adjuster nut and tighten to 40 Nm.

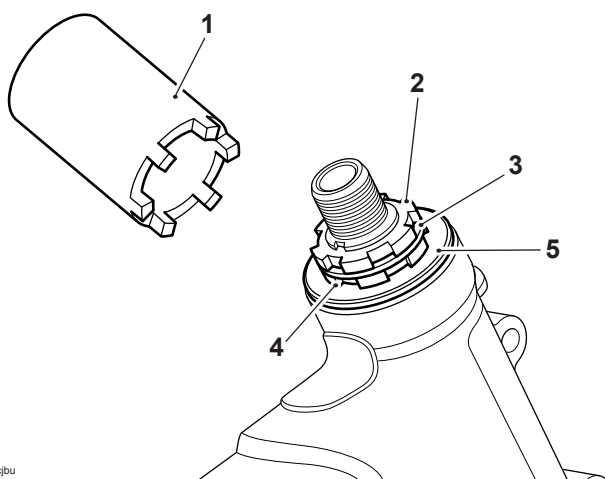
- Loosen the adjuster nut, then re-tighten to 15 Nm.
- Fit the tab washer and lock nut.

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 motorcycle control and an accident.

Note:

- **Ensure the adjuster nut does not move as the lock nut is tightened.**
 - With the bearing free play correctly set, hold the adjuster nut stationary then tighten the lock nut to 40 Nm.



- 1. T3880023 - 50 mm Socket**
- 2. Lock nut**
- 3. Tab washer**
- 4. Adjuster nut**

- Refit the upper yoke (see Upper Yoke - Installation, page 499).
- Check that the free play has been eliminated and that the steering can be turned freely from lock-to-lock without any sign of tightness. Readjust if necessary.

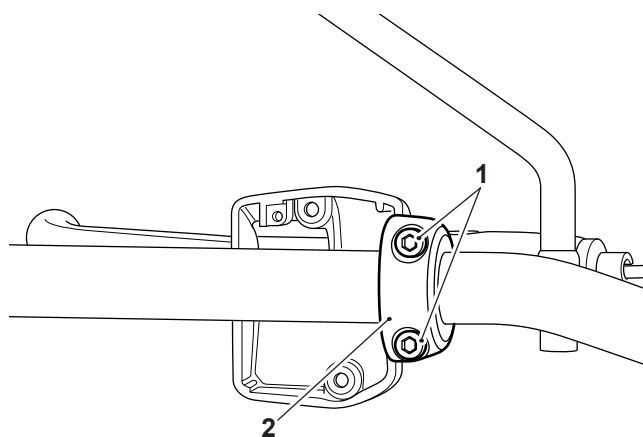
Warning

Operation of the motorcycle with incorrectly adjusted steering head bearings, either too loose or too tight, may cause a dangerous riding condition leading to loss of motorcycle control and an accident.

- Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
- Refit the seat (see Seat - Installation, page 645).

Handlebars - Removal

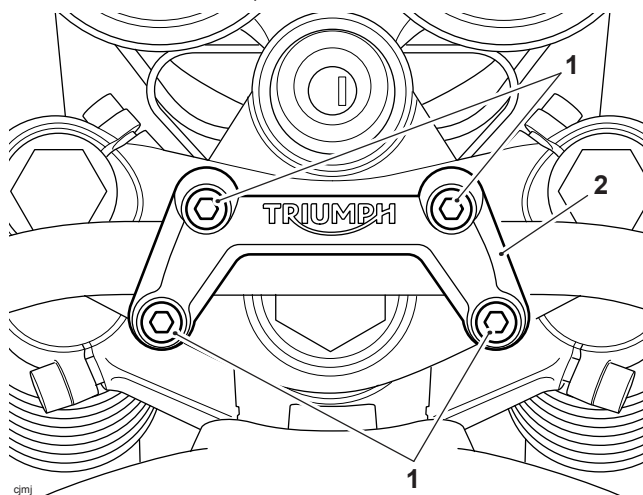
- Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
 - Remove the heated twist grip (see Twist Grip - Removal, page 408).
 - Remove the heated grip (see Heated Grips - Removal, page 693).
1. Release the fixings and remove the clamp from the clutch lever assembly. Position the clutch lever to one side.



1. Fixings

2. Clamp

2. Support the handlebars and remove the handlebar clamp bolts.



1. Fixings

2. Handlebar clamp

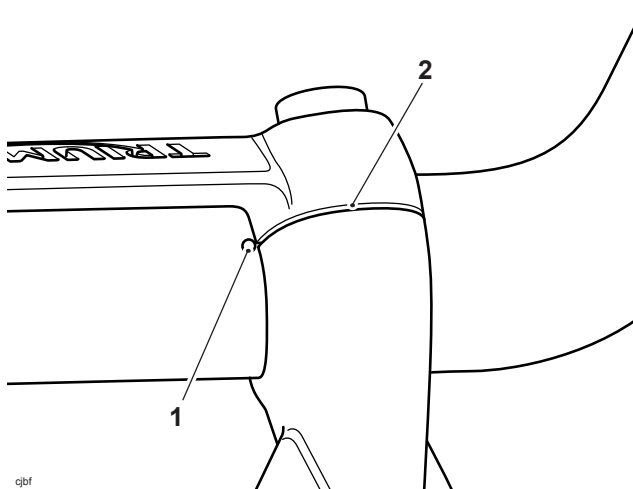
3. Remove the clamp and the handlebars.

Handlebars - Installation

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. Locate the handlebars on to the risers, fit the clamp and the fixings. Do not fully tighten at this stage.
2. Rotate the handlebars so that the centre of the alignment mark on the handlebar aligns with the split line of the left hand riser.

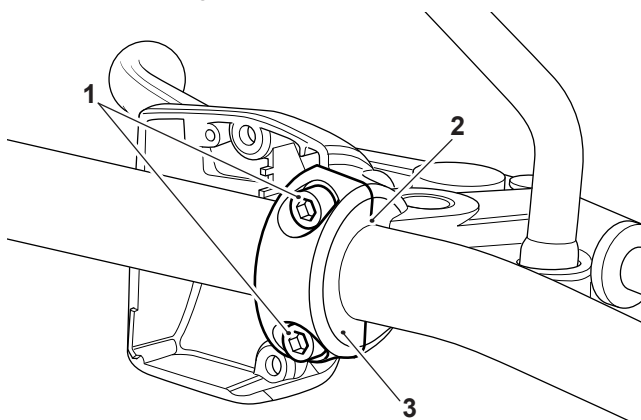


1. Alignment mark

2. Split line (left hand riser)

3. Tighten the handlebar clamp fixings, front ones first, to 24 Nm.
4. Fit the heated twist grip (see Twist Grip - Installation, page 410).
5. Locate the clutch lever assembly to the handlebar and fit the clamp.

6. Align the clutch lever split line with the alignment mark on the handlebar. Tighten the clamp fixings, upper one first, to 12 Nm.



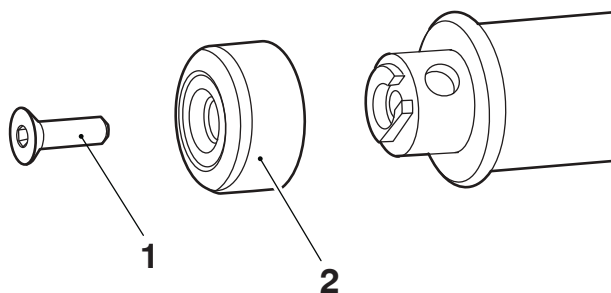
cjmf

1. Fixings

2. Handlebar alignment mark

3. Clamp

7. Fit the heated grip (see Heated Grips - Installation, page 695).
8. Fit the handlebar end weights to the handlebar ends, and tighten the fixings to 5 Nm.



ccow_5

1. Fixing

2. End weight

Warning

Move the handlebars to the 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 motorcycle control and an accident.

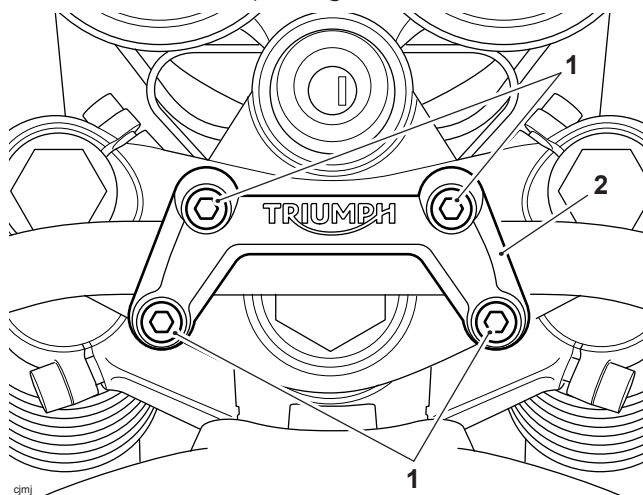
- Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
- Refit the seat (see Seat - Installation, page 645).

Upper Yoke - 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.

- Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
 - Remove the instruments (see Instruments - Removal, page 691).
1. Support the handlebars and remove the handlebar clamp fixings.

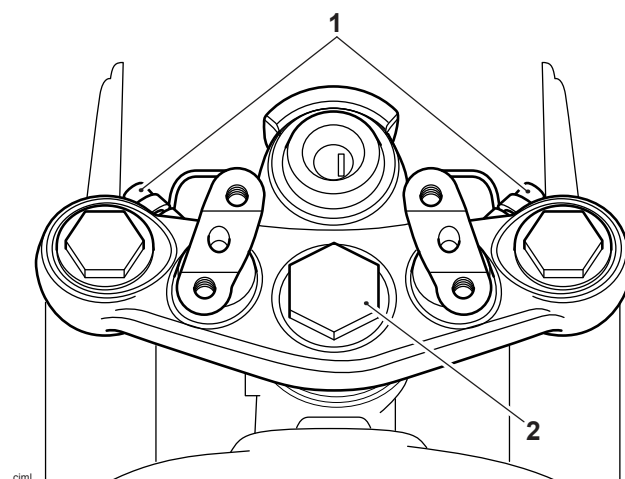


1. Fixings

2. Handlebar clamp

2. As an assembly, raise the handlebars until clear of the upper yoke. Rest the assembly forward of the steering stem such that access to the headstock top nut is unrestricted. Ensure the master cylinder remains upright.
3. Loosen the upper yoke pinch bolts.

4. Loosen and remove the top nut from the steering stem.



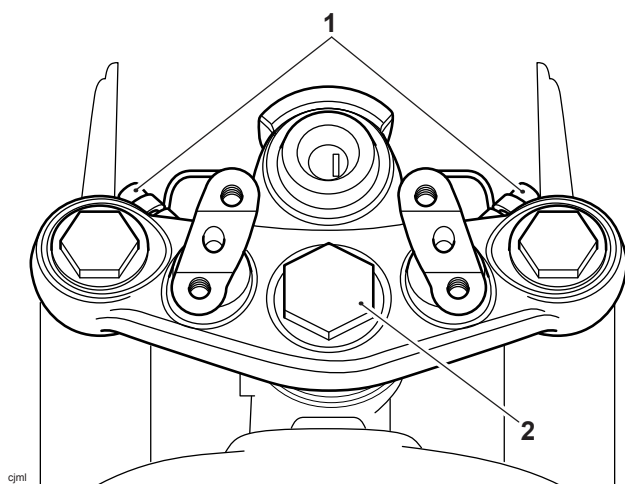
1. Upper yoke pinch bolt

2. Top nut

5. Remove the upper yoke.

Upper Yoke - Installation

1. Refit the upper yoke. Ensure the headlight bracket and mounting rubbers are between the upper and lower yoke.

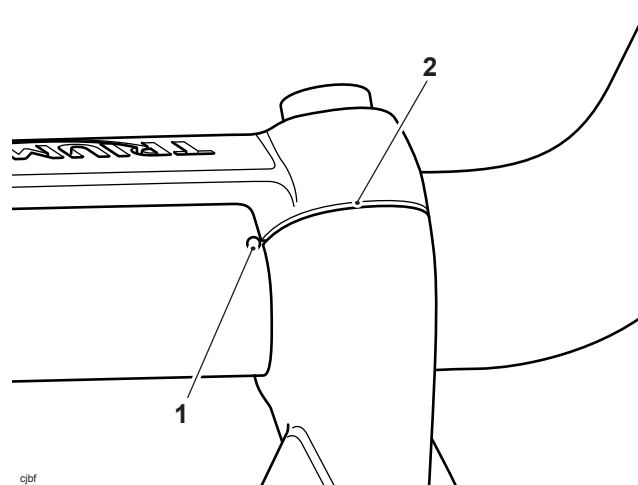


1. Upper yoke pinch bolt

2. Top nut

2. Fit and tighten the top nut to 90 Nm.
3. Tighten the upper yoke pinch bolts to 24 Nm.
4. Locate the handlebars on to the risers, fit the clamp and the fixings. Do not fully tighten at this stage.

5. Rotate the handlebars so that the centre of the alignment mark on the handlebar aligns with the split line of the left hand riser.



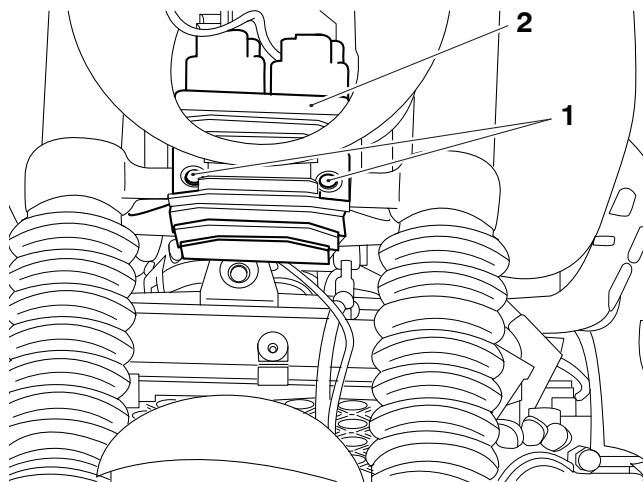
1. Alignment mark

2. Split line

6. Tighten the handlebar clamp fixings, front ones first, to 24 Nm.
 - Refit the instruments (see Instruments - Installation, page 692).
 - Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
 - Refit the seat (see Seat - Installation, page 645).

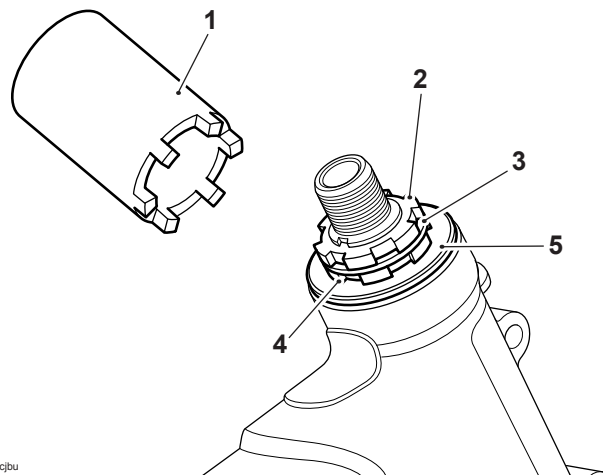
Lower Yoke and Headstock Bearings - Removal

- Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
 - Remove both front forks (see Front Fork - Removal, page 479).
 - Remove the upper yoke (see Upper Yoke - Removal, page 498).
1. Remove the fixings and detach the regulator/rectifier from the lower yoke.



1. **T3880023 - 50 mm Socket**
2. **Fixings**
3. **Regulator/rectifier**

2. Using service tool T3880023 remove the lock nut, tab washer, adjuster nut and the dust seal.



1. **T3880023 - 50 mm Socket**

2. **Lock nut**
3. **Tab washer**
4. **Adjuster nut**
5. **Dust seal**

3. Remove the lower yoke from below the frame headstock.

Lower Yoke and Headstock Bearings - Bearing Removal

1. Using a suitable drift, evenly and progressively drive the bearing outer races from the frame headstock.

Caution

Protect the threads of the lower yoke when using a press or puller as damaged threads may mean replacing the lower yoke completely.

2. Remove the bearing inner race from the lower yoke using a press or puller.

Note:

- Note the orientation of the dust seal for installation.
3. Remove the dust seal from the lower yoke.

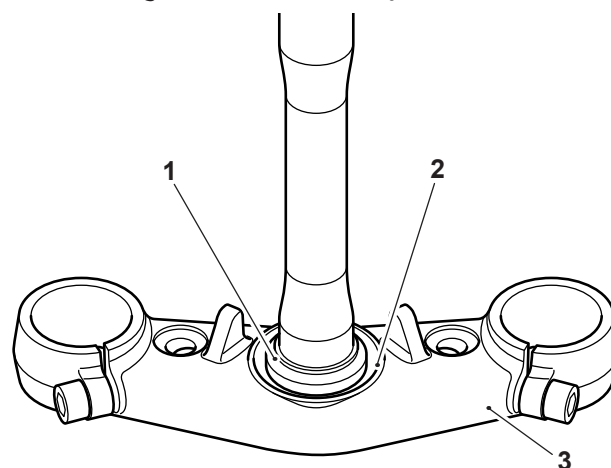
Lower Yoke and Headstock Bearings - Installation

1. Fit a new dust seal to the steering stem on the lower yoke as noted for removal.

Caution

Protect the threads of the lower yoke when using a press or a puller as damaged threads may mean replacing the lower yoke completely.

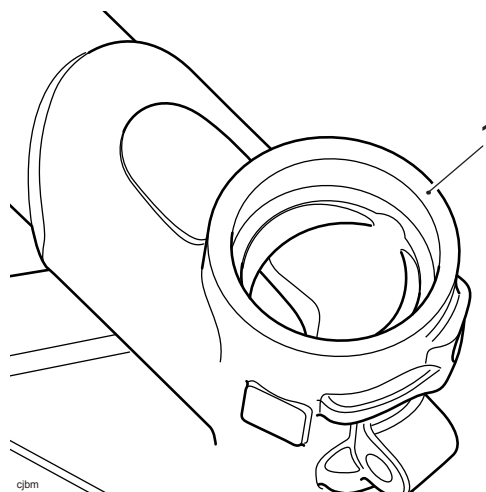
2. Press a new lower bearing inner race onto the steering stem of the lower yoke.



1. Dust seal

2. Bearing inner race

3. Evenly and progressively drive the new upper and lower bearing outer races into the frame headstock.



1. Headstock

4. Lubricate the headstock bearings using grease conforming to NLGI 2 specification.
5. Fit the bearing to the bearing inner race on the steering stem.

6. Insert the lower yoke to the frame headstock, fit the upper bearing, inner race, dust seal and retain with the adjuster nut.
7. Adjust the bearing free play as follows:
 - Remove the adjuster nut.
 - Thoroughly clean the threads on the steering stem.
 - Refit the adjuster nut and tighten to 40 Nm.
 - Loosen the adjuster nut, then re-tighten to 15 Nm.
 - Fit the tab washer and lock nut.

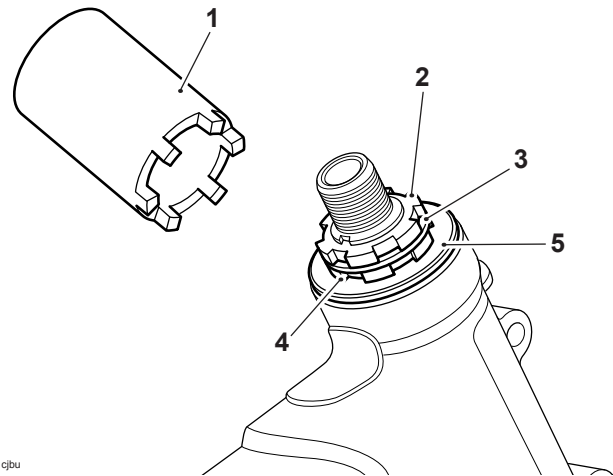
Warning

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 motorcycle control and an accident.

Note:

- **Ensure the adjuster nut does not move as the lock nut is tightened.**

- With the bearing free play correctly set, hold the adjuster nut stationary then tighten the lock nut to 40 Nm.



1. **T3880023 - 50 mm Socket**

2. **Lock nut**

3. **Tab washer**

4. **Adjuster nut**

5. **Dust seal**

- Refit the upper yoke (see Upper Yoke - Installation, page 499).
- Refit both front forks (see Front Fork - Installation, page 481).
- Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
- Refit the seat (see Seat - Installation, page 645).

Warning

Operation of the motorcycle with incorrectly adjusted steering head bearings, either too loose or too tight, may cause a dangerous riding condition leading to loss of motorcycle control and an accident.

- Check and if necessary correct the headlight adjustment (see Headlight Vertical Adjustment, page 678).
- Check that the free play has been eliminated and that the steering can be turned freely from lock-to-lock without any sign of tightness. Readjust if necessary

21 Rear Suspension

Table of Contents

Exploded View – Swinging Arm 505

Exploded View – Rear Suspension Units 506

Rear Suspension Units - Removal 507

Rear Suspension Unit - Inspection..... 507

Rear Suspension Units - Installation..... 508

Swinging Arm - Removal 508

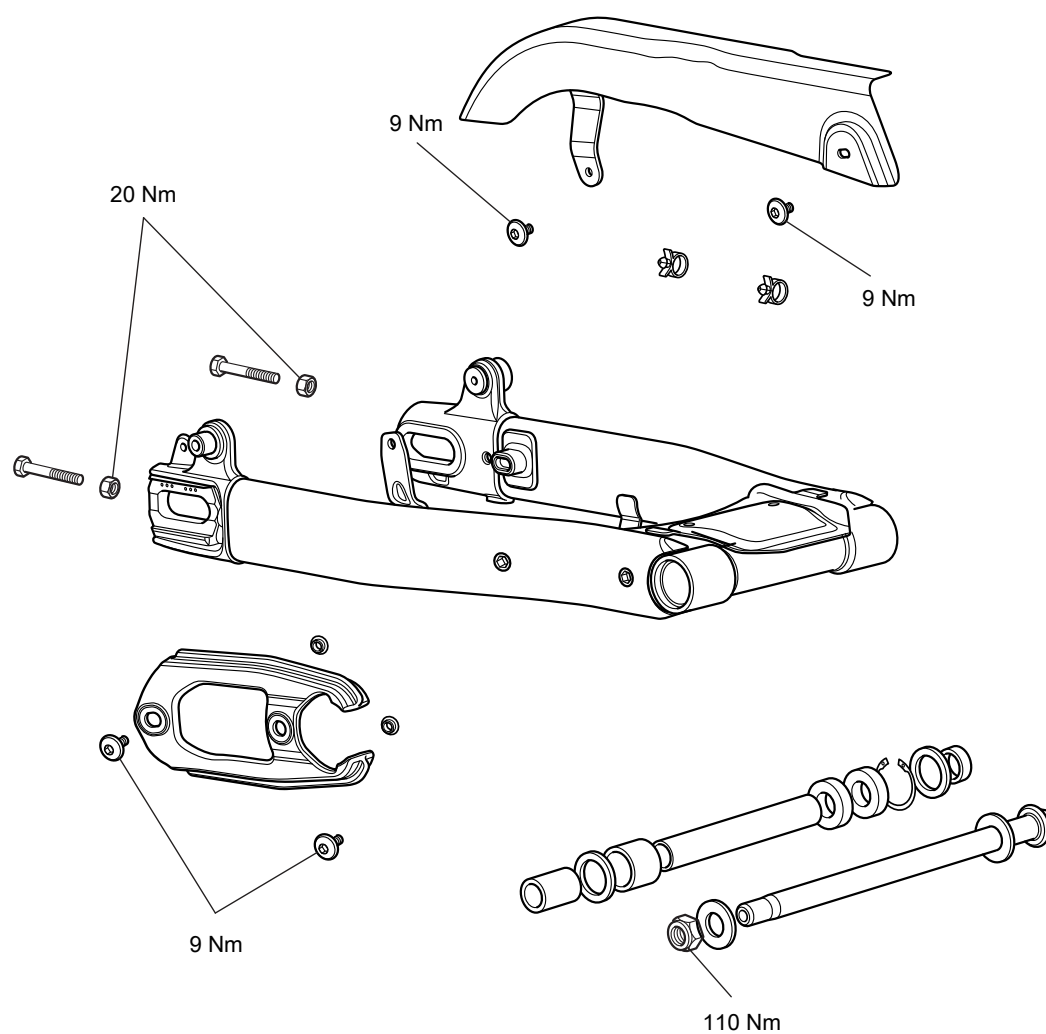
Swinging Arm - Disassembly 510

Swinging Arm - Inspection 511

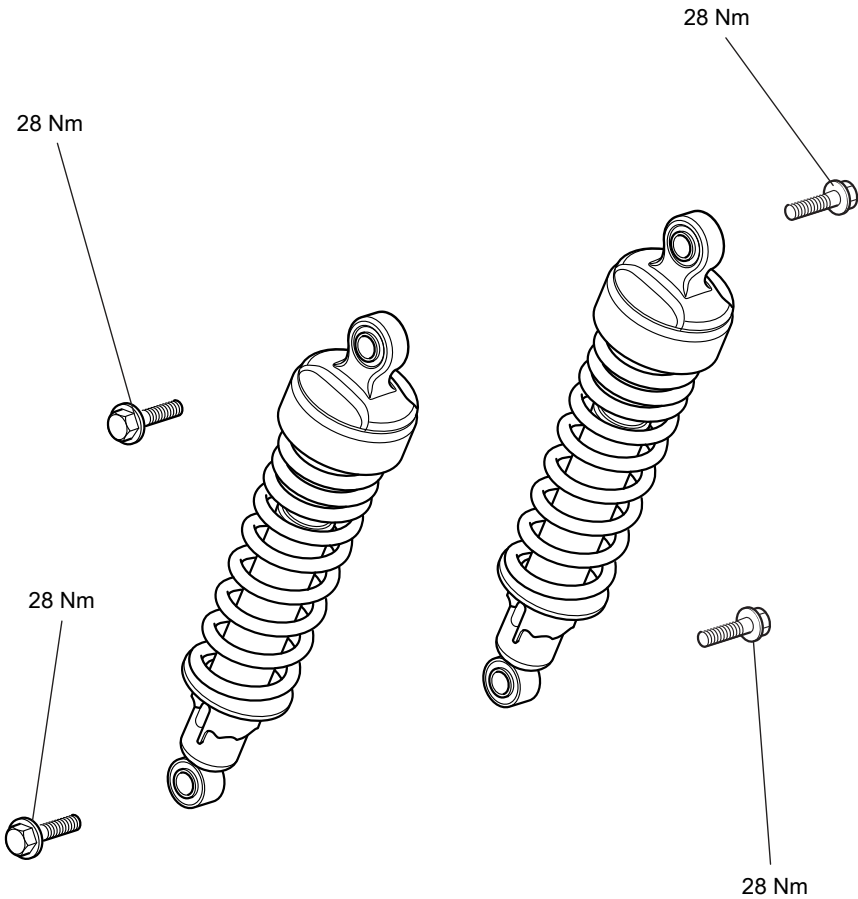
Swinging Arm - Assembly 511

Swinging Arm - Installation..... 512

Exploded View – Swinging Arm



Exploded View – Rear Suspension Units



Rear Suspension Units - Removal

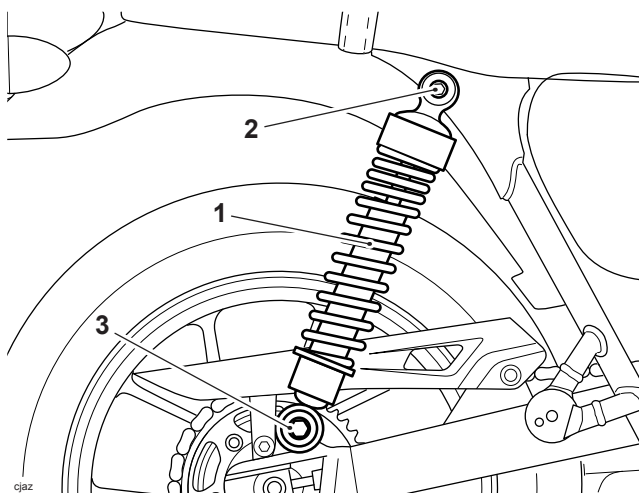
Warning

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 motorcycle so that the rear wheel is clear of the ground.
2. Remove the exhaust silencers (see Exhaust Silencer - Removal, page 436).

Note:

- **If both suspension units are to be removed, place a block beneath the rear wheel to prevent it dropping when the second unit is removed.**
3. Loosen and remove the upper and lower mounting bolts then remove the suspension unit from its mounting spigots. Discard the bolts.



1. **Rear suspension unit**
2. **Upper mounting bolt**
3. **Lower mounting bolt**
4. Repeat step 3 for the other rear suspension unit (if required).

Rear Suspension Unit - Inspection

1. Remove all traces of dirt and inspect for damage/wear to the mountings and springs.
2. Inspect the unit closely for fluid leaks from all parts of the unit and for cracks and damage to the springs. If there is any damage, or any leaks are evident, both rear suspension units must be renewed as a matched pair.
3. Check the mounting rubbers for cracks and signs of elongation. Replace as necessary.

Warning

Always renew both rear suspension units as a pair, even if only one appears to be faulty. If only one suspension unit is replaced, the handling of the motorcycle could be adversely affected. This could result in an unsafe riding condition leading to a loss of motorcycle control and an accident.

Rear Suspension Units - Installation

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.

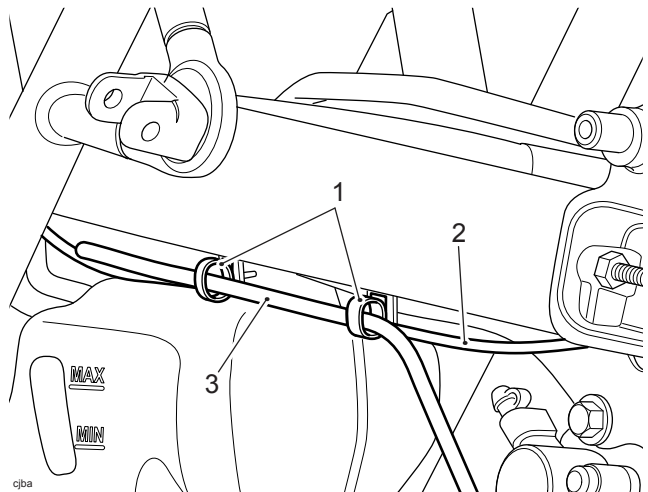
1. Locate the suspension units to the mounting spigots, articulating the swinging arm until the distance between the upper and lower spigots allows the units to fit.
2. Fit new mounting bolts and tighten to 28 Nm.
3. Repeat step 2 for the other rear suspension unit (if removed).
4. Refit the exhaust silencers (see Exhaust Silencer - Installation, page 437).
5. Remove the wheel support (if fitted), lower the motorcycle to the ground and park it on the side stand.

Swinging Arm - Removal

Warning

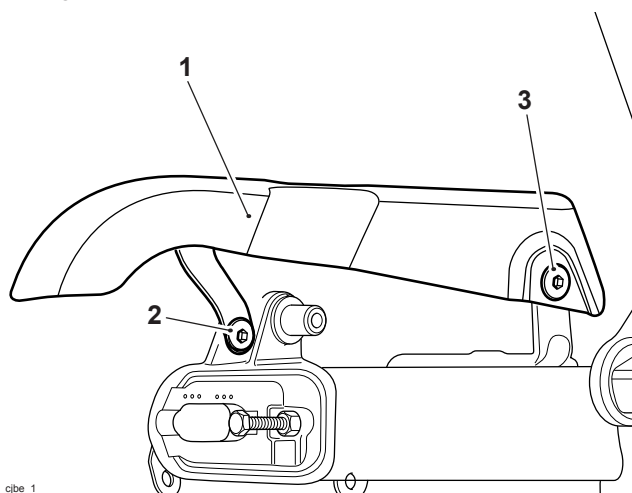
Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

- Support the motorcycle so that the rear wheel is clear of the ground, with no weight on the swinging arm and suspension units.
 - Remove the rear wheel (see Rear Wheel - Removal, page 612).
 - Remove the rear suspension units (see Rear Suspension Units - Removal, page 507).
1. Detach the ABS sensor cable and brake hose clips from the left hand side of the swinging arm.



1. **Clips**
2. **ABS sensor cable**
3. **Brake hose**

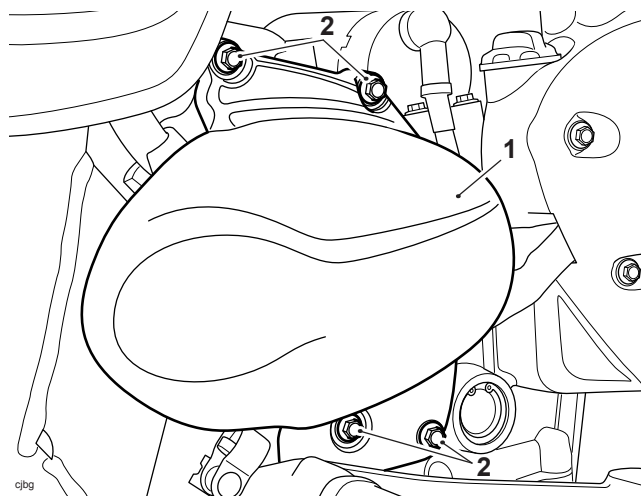
2. Release the fixings and remove the chain guard.



cjbe_1

1. Chain guard
2. Rear fixing
3. Front fixing

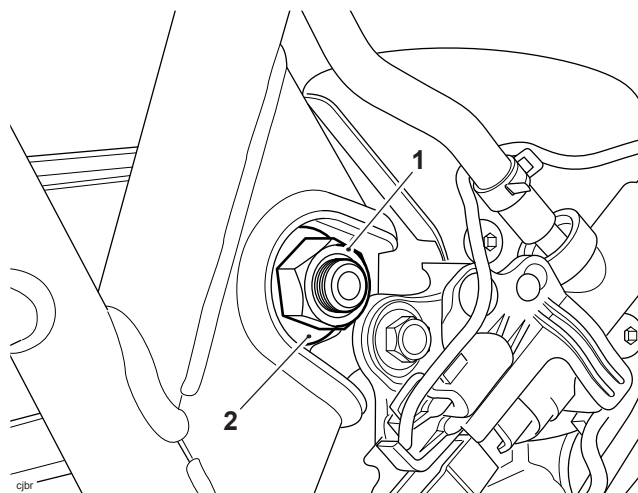
3. Carefully remove the swinging arm pivot cover on the left hand side of the frame.
4. Remove the fixings securing the front sprocket cover to the crankcase.



cjbg

1. Front sprocket cover
2. Fixings

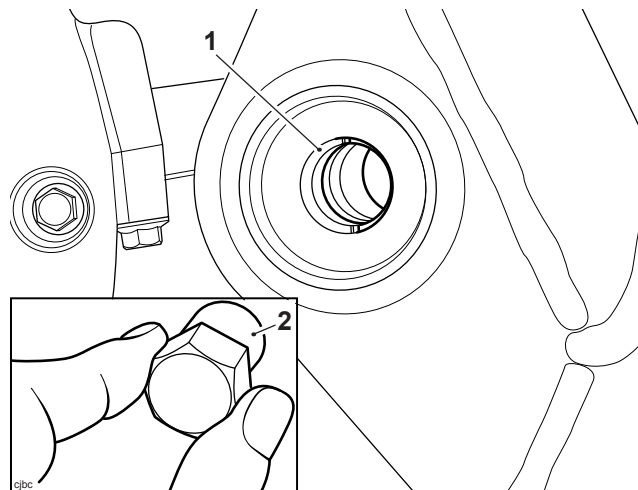
5. Remove the swinging arm pivot nut and collect the washer on the right hand side of the frame.



cjbr

1. Nut
2. Washer

6. Support the swinging arm and remove the swinging arm spindle and washer from the left hand side.
7. Partially fit the swinging arm spindle on the right hand side to support the swinging arm.
8. Engage service tool T3880104 in the slots of the frame adjuster sleeve and rotate anticlockwise to loosen the sleeve fully.



cjbc

1. Frame adjuster
2. T3880104 - Swinging Arm Adjuster Wrench

9. Support the swinging arm and withdraw the swinging arm spindle from the right hand side.

Note:

- When removing the swinging arm, ensure that the harness and hoses on the left hand side of the frame do not get damaged.
10. Carefully manoeuvre the swinging arm rearwards and remove from the frame.

Swinging Arm - Disassembly



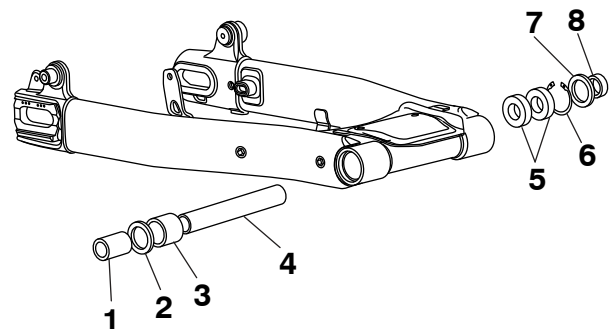
Warning

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.

- Support the motorcycle so that the rear wheel is clear of the ground, with no weight on the swinging arm and suspension units.
 - Remove the swinging arm (see Swinging Arm - Removal, page 508).
1. Remove the left hand ball bearings by drifting through from the right.
 2. Collect the spacer tube.

Note:

- The needle roller bearing in the right hand side of the arm cannot be removed undamaged.
3. Remove the right hand needle roller bearing by drifting through from the left.



1. Sleeve
2. Seal
3. Needle roller bearing
4. Spacer tube
5. Ball bearings
6. Circlip
7. Seal
8. Spacer

Swinging Arm - Inspection

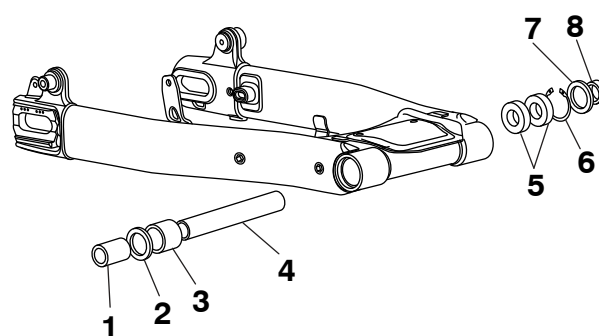
1. Check all swinging arm bearings for damage, pitting, and cracks. Replace as necessary.
2. Check the swinging arm for damage. Replace as necessary.
3. Check the wheel bearings for damage, pitting, and cracks. Replace as necessary.
4. Check all bearing seals for damage, splits etc. Replace as necessary.
5. Check the drive chain for wear, damage etc. Replace as necessary.
6. Check both drive chain sprockets for wear, damage etc. Replace as necessary.

Swinging Arm - Assembly

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. Install the bearings (marked faces outwards), sleeves and seals etc. into the swinging arm in the order shown in the following illustration. Use new seals throughout.



1. **Sleeve**
 2. **Seal**
 3. **Needle roller bearing**
 4. **Spacer tube**
 5. **Ball bearings**
 6. **Circlip**
 7. **Seal**
 8. **Spacer**
- Refit the swinging arm (see Swinging Arm - Installation, page 512)

Swinging Arm - Installation

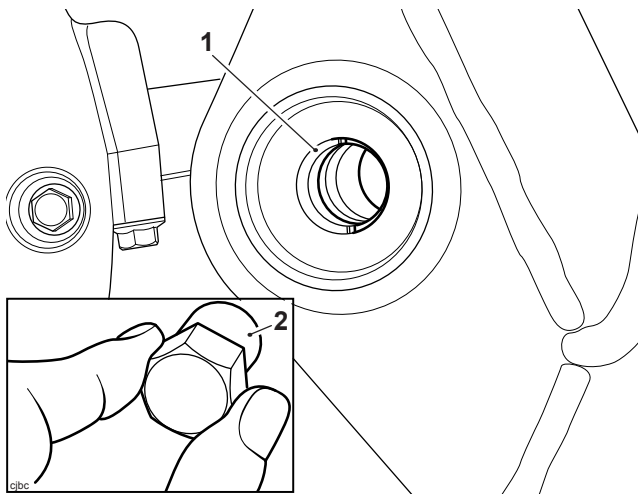
Warning

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:

- **When installing the swinging arm, ensure that the harness and hoses on the left hand side of the frame do not get damaged.**

1. Position the swinging arm to the frame.
2. Refit the swinging arm spindle from the right hand side such that it will support the swinging arm, but not pass all the way through the frame adjuster sleeve. This will allow service tool T3880104 to engage in the slot in the frame adjuster sleeve.
3. Using service tool T3880104, tighten the swinging arm pivot bolt adjuster sleeve to 6 Nm.

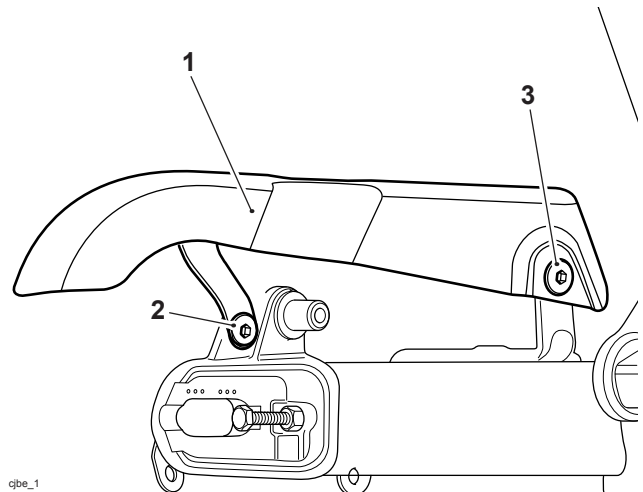


1. Frame adjuster

2. T3880104 - Swinging Arm Adjuster Wrench

4. While supporting the swinging arm, remove the swinging arm spindle and fully insert it from the left hand side.
5. Fit the washer and a new swinging arm spindle nut, tighten the nut to 110 Nm.
6. Refit the front sprocket cover and tighten to 9 Nm.
7. Refit the swinging arm pivot cover to the left hand side of the frame.

8. Refit the drive chain guard and tighten its fixings to 9 Nm.

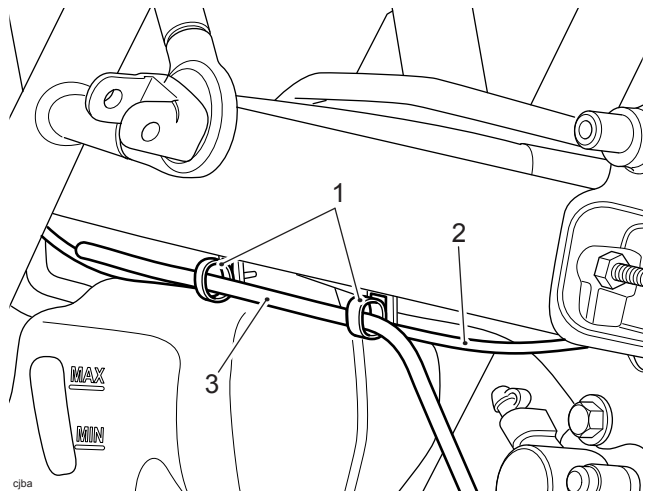


1. Chain guard

2. Rear fixing

3. Front fixing

9. Attach the ABS sensor cable and brake hose clips to the left hand side of the swinging arm.



1. Clips

2. ABS sensor cable

3. Brake hose

- Refit the rear suspension units (see Rear Suspension Units - Installation, page 508).
- Refit the rear wheel (see Rear Wheel - Installation, page 614)
- Lower the motorcycle to the ground and park it on the side stand.
- Pump the rear brake pedal to position the rear brake pads.

22 Brakes

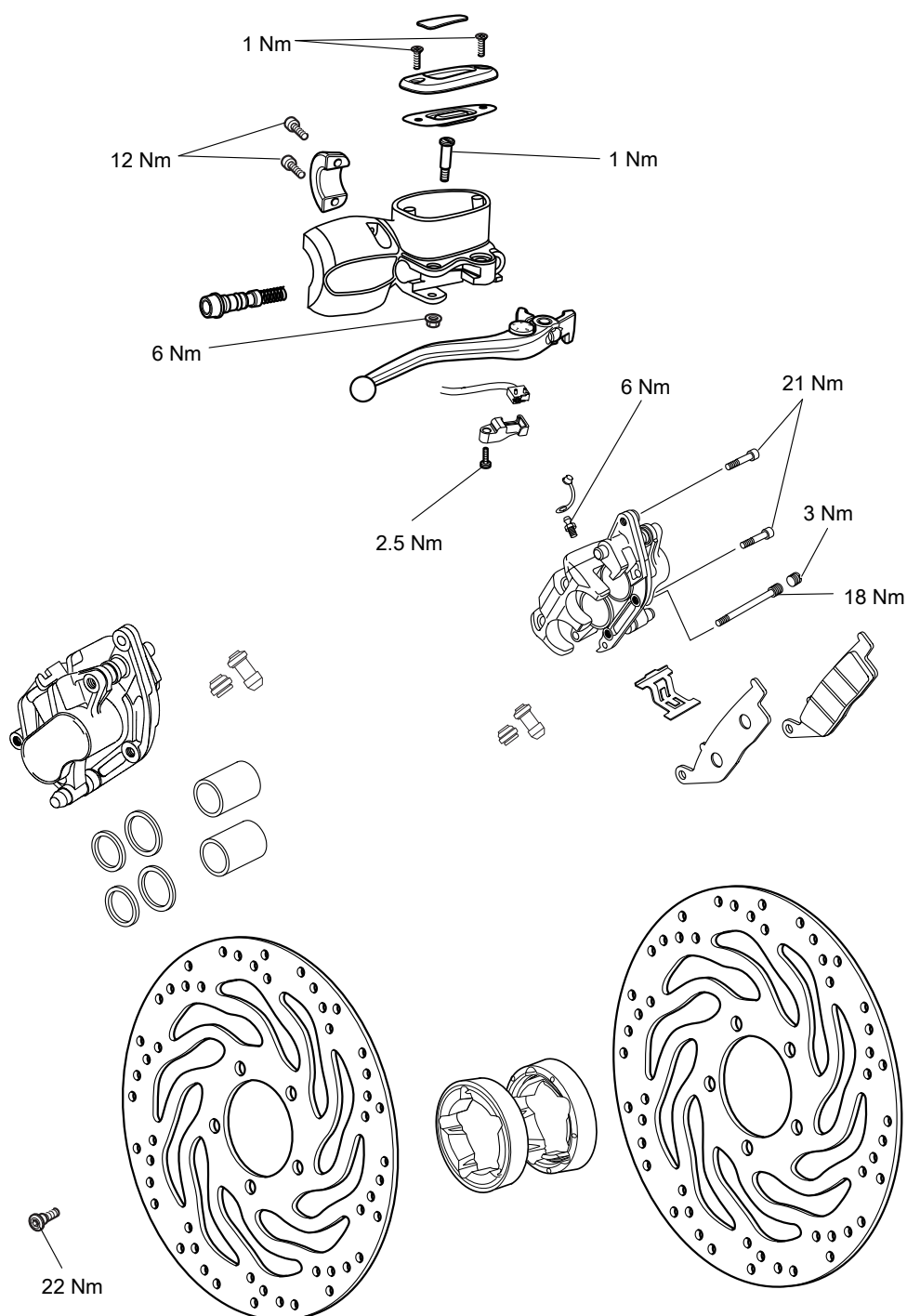
Table of Contents

Exploded View – Front Brake Master Cylinder, Caliper and Brake Disc	517
Exploded View – Rear Brake Master Cylinder, Caliper and Brake Disc	518
Exploded View – ABS System.....	519
Braking System Maintenance Safety Precautions	520
Brake Fluid Level Inspection	521
Changing Brake Fluid	523
Brake Pads Wear	523
Brake Wear Inspection	524
Breaking-in New Brake Pads and Discs	524
Bleeding the Front Brakes, Renewing Brake Fluid.....	525
Front Brake Pads - Removal.....	527
Front Brake Pads - Inspection	528
Front Brake Pads - Installation	529
Front Brake Caliper - Removal.....	530
Front Brake Caliper - Disassembly.....	531
Front Brake Caliper - Inspection.....	531
Front Brake Caliper - Assembly	532
Front Brake Caliper - Installation.....	533
Front Brake Disc - Wear	533
Front Brake Disc - Removal	534
Front Brake Disc - Installation.....	535
Front Brake Master Cylinder - Removal.....	535
Front Brake Master Cylinder - Disassembly	536
Front Brake Master Cylinder - Inspection.....	537
Front Brake Master Cylinder - Assembly	538
Front Brake Master Cylinder - Installation.....	538
Bleeding the Rear Brakes, Renewing Brake Fluid	540
Rear Brake Pads - Removal	542
Rear Brake Pads - Inspection	542

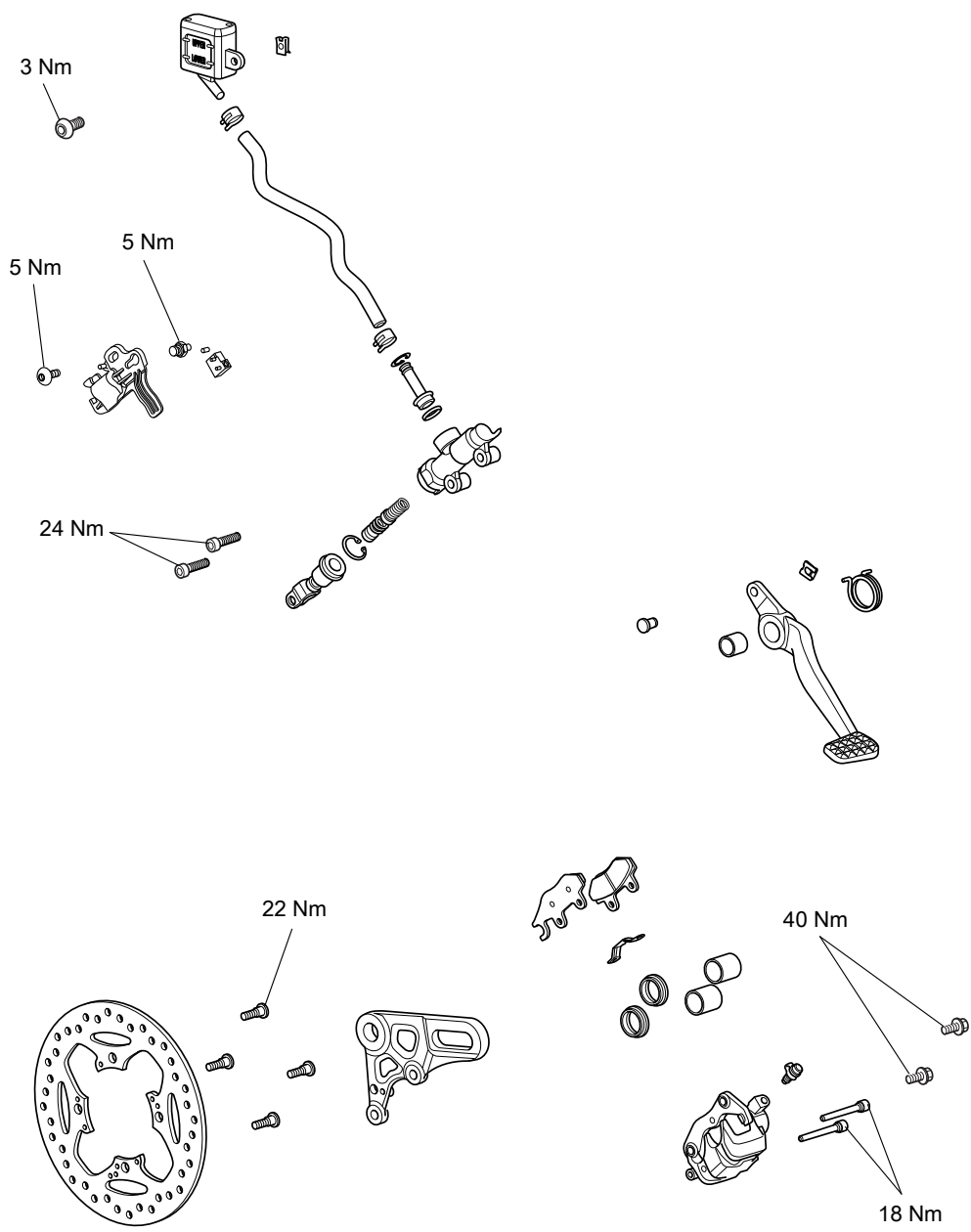
Rear Brake Pads - Installation.....	543
Rear Brake Caliper - Removal	544
Rear Brake Caliper - Disassembly	544
Rear Brake Caliper - Inspection	545
Rear Brake Caliper - Assembly	545
Rear Brake Caliper - Installation.....	546
Rear Brake Disc - Wear	547
Rear Brake Disc - Removal.....	547
Rear Brake Disc - Installation	548
Rear Brake Master Cylinder - Removal	548
Rear Brake Master Cylinder - Disassembly	550
Rear Brake Master Cylinder - Inspection	551
Rear Brake Master Cylinder - Assembly	551
Rear Brake Master Cylinder - Installation.....	552
Front ABS Wheel Speed Sensor - Removal	554
Front ABS Wheel Speed Sensor - Installation.....	555
Air Gap Measurement	555
Front ABS Pulser Ring - Removal	556
Front ABS Pulser Ring - Inspection	556
Front ABS Pulser Ring - Installation.....	557
Rear ABS Wheel Speed Sensor - Removal.....	557
Rear ABS Wheel Speed Sensor - Installation	558
Rear ABS Pulser Ring - Removal.....	559
Rear ABS Pulser Ring - Inspection.....	559
Rear ABS Pulser Ring - Installation	560
ABS Hydraulic Modulator/ECM - Removal	560
ABS Hydraulic Modulator/ECM - Installation.....	562
Anti-lock Brake System (ABS)	564
ABS System Circuit Tables	566
ABS System Circuit Diagram.....	567
System Diagnostics	567
Triumph Diagnostic Software - ABS.....	568
Diagnostic Trouble Codes	569
ABS Electrical Connectors.....	572
Further Diagnosis	573
ABS Warning Light ON (No DTCs Stored).....	574
ABS Warning Light Does not Illuminate (No DTCs Stored).....	576
Front Wheel Sensor Open Circuit/Short Circuit	578
Rear Wheel Sensor Open Circuit/Short Circuit	582

Front Wheel Sensor Abnormal Input/Losing Contact.....	585
Rear Wheel Sensor Abnormal Input/Losing Contact.....	585
Front Wheel Pulser Ring Missing Teeth.....	586
Rear Wheel Pulser Ring Missing Teeth.....	587
Front or Rear Input/Output solenoid Open/Short Circuit.....	588
Incorrect Tyre Size Detected	590
Front or Rear Wheel Actuator (Hydraulic Control) Wheel Lock.....	590
Motor – Lock; Motor Stuck OFF; Motor stuck ON.....	592
Power Source Voltage Drop/Voltage Rise.....	594
CAN Fault.....	596
ABS ECM Internal Error	598
ABS Hydraulic Circuit Layout	599

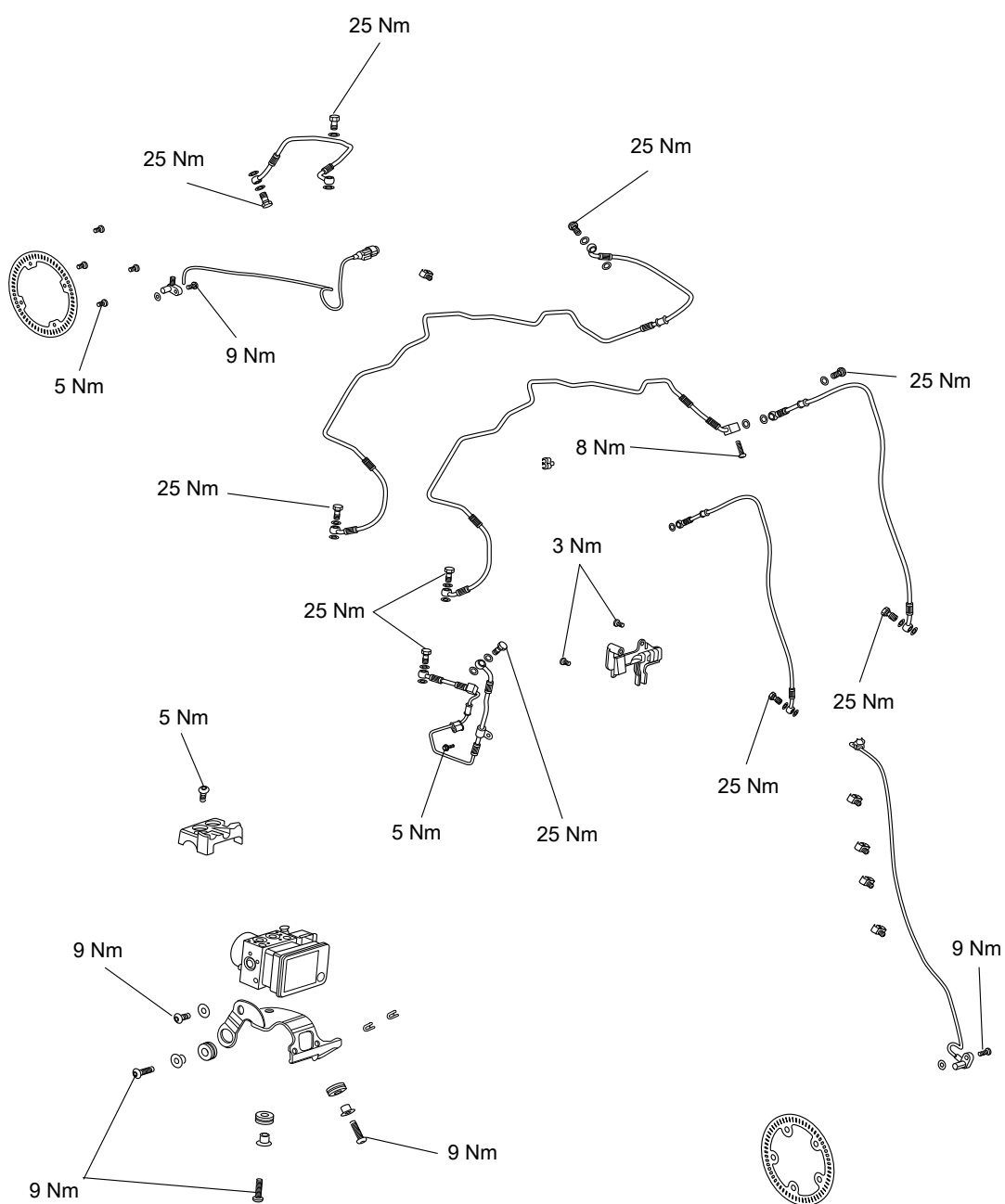
Exploded View – Front Brake Master Cylinder, Caliper and Brake Disc



Exploded View – Rear Brake Master Cylinder, Caliper and Brake Disc



Exploded View – ABS System



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 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 LOSS OF MOTORCYCLE CONTROL AND 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 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 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.

Warning

Use only DOT 4 specification brake fluid as listed in the General Information section of this manual. The use of brake fluids other than those DOT 4 fluids listed in the General Information section

Warning

may reduce the efficiency of the braking system leading to loss of motorcycle control and an accident.

Failure to change the brake fluid at the interval specified in the Scheduled Maintenance chart may reduce braking efficiency resulting in loss of motorcycle control and 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 loss of motorcycle control and an accident.

Warning

Before installation, all internal brake components should be cleaned and lubricated with clean new DOT 4 brake fluid.

Never use solvents, petrol (gasoline), engine oil or any other petroleum distillate on internal brake components as this will cause deterioration of the hydraulic seals in the calipers and master cylinders.

A dangerous riding condition leading to loss of motorcycle control and an accident could result if this warning is ignored.

⚠ Warning

A magnetised brake disc and/or a magnetised ABS pulser ring may cause problems with the ABS sensor which will illuminate the ABS warning light and disable the ABS.

To prevent these parts becoming magnetised, we strongly recommend that magnets, and items that contain magnets, must not be stored near or placed on brake discs or ABS pulser rings.

This includes parts fitted to motorcycles, parts removed during motorcycle service and new parts in dealer stores.

Examples of items that may contain magnets, are listed below:

- Alternator rotor
- Magnetic fuel tank bags
- Audio speakers
- Magnetic dial test indicator stand
- Magnetic parts tray.

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.

Brake Fluid Level Inspection

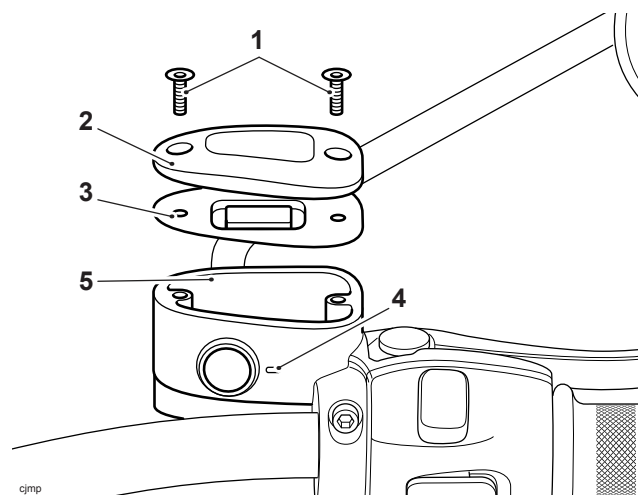
⚠ Warning

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.

Front Brake Fluid Reservoir

1. The brake fluid level must be kept between the upper and lower level lines with the motorcycle on its side stand and the steering on full left lock.



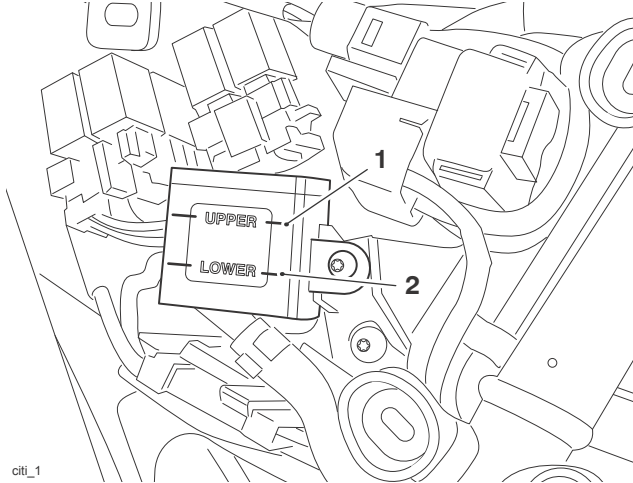
1. **Fixings**
2. **Reservoir cap**
3. **Diaphragm**
4. **Lower level line**
5. **Upper level line**

Front Brake Fluid Level Adjustment

1. Remove the two fixings.
2. Remove the reservoir cap and the diaphragm seal.
3. Fill the reservoir to the upper level line using new DOT 4 fluid from a sealed container.
4. Refit the reservoir cap and diaphragm seal ensuring that the diaphragm seal is correctly positioned between the cap and the reservoir body.
5. Refit the two fixings and tighten to 1 Nm.

Rear Brake Fluid Reservoir

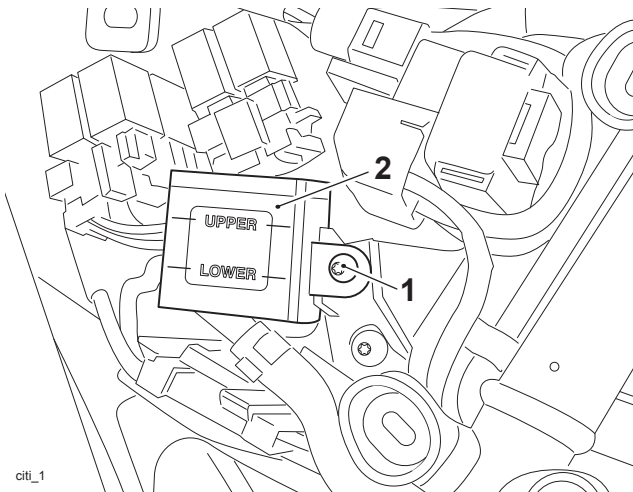
1. Remove the right hand side panel (see Side Panels, page 646).
2. The brake fluid level must be kept between the upper and lower level lines (reservoir held horizontal).



1. Upper level line
2. Lower level line

Rear Brake Fluid Level Adjustment

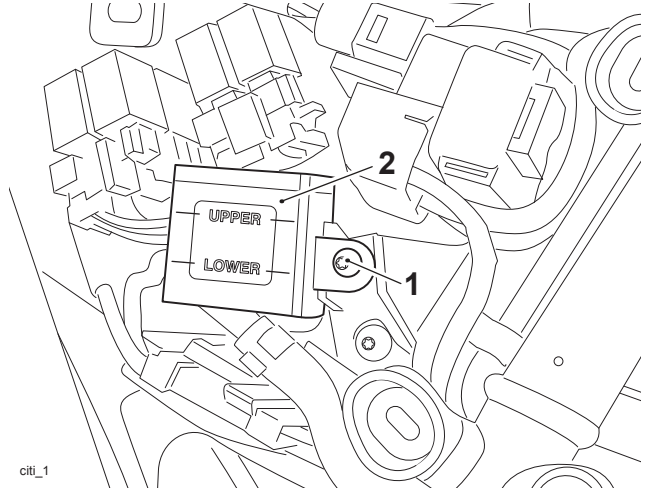
1. Remove and discard the fixing and detach the rear brake fluid reservoir from the relay bracket.



1. Fixing
2. Brake fluid reservoir

2. Release the cap screws and remove the reservoir cover noting the position of the sealing diaphragm.
3. Fill the reservoir to the upper level line using new DOT 4 fluid from a sealed container.

4. Refit the reservoir cap ensuring that the diaphragm seal is correctly positioned between the cap and the reservoir body. Tighten the cap retaining screws to 1 Nm.
5. Refit the brake fluid reservoir to the relay bracket, and tighten the new fixing to 3 Nm.



1. Fixing
2. Brake fluid reservoir

6. Refit the right hand side panel (see Side Panels, page 646).

Changing Brake Fluid

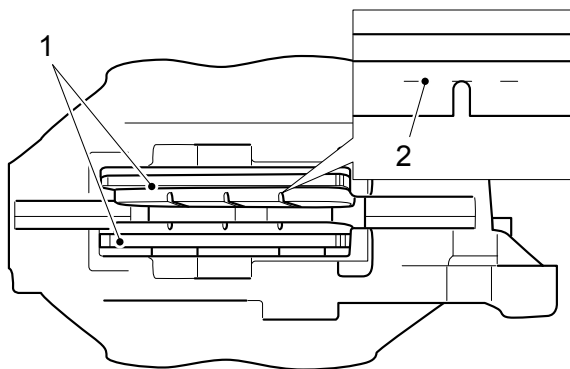
Brake fluid must be changed every two calendar years, irrespective of the mileage the motorcycle has covered in that time.

Brake Pads Wear

Front and rear brake 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 1.5 mm. 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

1. **Brake pads**
2. **Minimum thickness line**

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 simultaneously. Replacing individual pads will reduce braking efficiency and may cause loss of motorcycle control and an accident.

Breaking-in New Brake Pads and Discs

After replacement brake discs and/or pads have been fitted to the motorcycle, we recommend a period of careful breaking-in that will optimise the performance and longevity of the discs and pads. The recommended distance for breaking in new pads and discs is 200 miles (300 km).

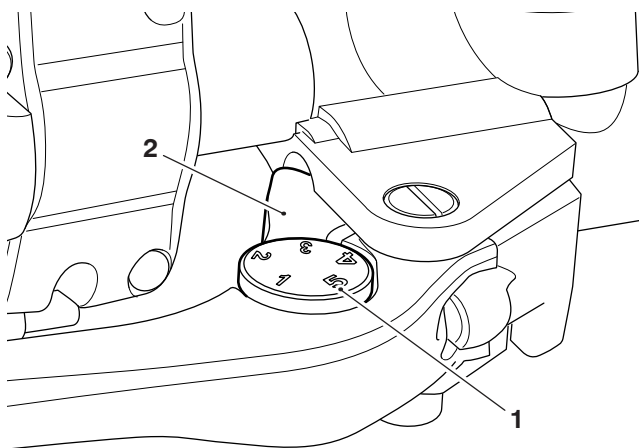
After fitting new brake discs and/or pads avoid extreme braking, ride with caution and allow for greater braking distances during the breaking-in period.

Bleeding the Front Brakes, Renewing Brake Fluid

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.



cjev

1. **Adjuster wheel**
2. **Arrow mark**

2. Turn the handlebars to bring the fluid reservoir to a level position.
3. Remove the safety clip.
4. Remove the reservoir cap.

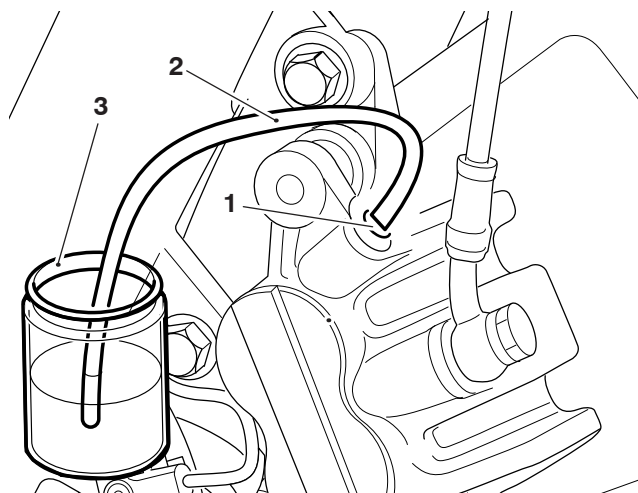
Warning

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 that 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 loss of motorcycle control and an accident could result if this warning is ignored.

Caution

To prevent paint damage, do not spill brake fluid onto any area of the bodywork. Spilled brake fluid will damage paintwork.

5. Check the condition of the reservoir sealing diaphragm. Replace if necessary.
6. Remove the rubber cap from the bleed nipple on the caliper.
7. 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.



1. **Bleed nipple**
2. **Bleed tube**
3. **Container**
8. Release the bleed nipple.

Caution

During bleeding, do not allow the fluid level to fall below the lower level mark in the reservoir. If the fluid level is allowed to fall below this mark, air may enter the system and the sequence of bleeding must be repeated.

9. Get an assistant to slowly pull the brake lever to the handlebar.
10. With the lever held fully against the handlebar, close the bleed nipple. Once the bleed nipple is closed, release the brake lever.
11. Repeat steps 8 and 9 until no more air appears in the bleed tube.
12. When all air has been expelled from the system, hold the lever fully against the handlebar and close the bleed nipple.

13. Connect the Triumph Diagnostic Interface (see System Diagnostics, page 567).
14. Follow the on screen menu to ABS Diagnostics. From the menu, select **BLEED SYSTEM** (see System Diagnostics, page 567).

Caution

On pressing the Start button, the diagnostic software will send a command to the ABS ECM to open the 2nd **circuit** solenoid.

When the ABS modulator 2nd circuit is activated by the bleed command, the front brake lever travel will increase as the 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.

15. Apply pressure to the front brake lever, press the **Start** button to activate the bleed sequence on the diagnostic tool, and with assistance, release one of the bleed nipples.
16. Get an assistant to slowly pull the brake lever to the handlebar.
17. With the lever held fully against the handlebar, close the bleed nipple. Once the bleed nipple is closed, release the brake lever.
18. Repeat steps 15 and 16 until no more air appears in the bleed tube, maintaining the brake fluid level between the upper and lower reservoir levels whilst bleeding is being carried out.
19. The bleed sequence will run for 20 seconds. Press the **Stop** button to end the bleed sequence at any time. Once the bleed sequence has completed, the diagnostic tool will display the message **ABS system bleed complete**.

Caution

The ABS module must be allowed to cool between bleeding operations. Always allow the ABS modulator to cool for 5 minutes before starting the bleed procedure again. Failure to follow this instruction may result in damage to the ABS modulator.

20. Repeat the above procedure a minimum of twice or as necessary until all air is expelled from the system.

21. When all air has been expelled from the system, apply pressure to the brake lever and close the bleed nipple.
22. Disconnect the Triumph diagnostic interface.
23. Repeat steps 8 and 9 until no more air appears in the bleed tube.
24. When all air has been expelled from the system, apply pressure to the brake lever and close the bleed nipple and tighten it to 6 Nm.
25. Remove the bleed tube.
26. Replace the bleed nipple cap.
27. Fill the reservoir to the upper level with new DOT 4 fluid.

Warning

Use only DOT 4 specification brake fluid as listed in the General Information section of this manual. The use of brake fluids other than those DOT 4 fluids listed in the General Information section may reduce the efficiency of the braking system leading to loss of motorcycle control and an accident.

Observe the brake fluid handling warnings given earlier in this section of the manual.

Caution

To prevent paint damage, do not spill brake fluid onto any area of the bodywork. Spilled brake fluid will damage paintwork.

28. When the caliper has been bled, ensure the brake lever operation has a firm resistive feel to it, does not feel spongy and that the lever cannot be pulled directly back to the handlebar. Take remedial action as necessary.
29. Refit the reservoir cap ensuring that the diaphragm seal is correctly positioned between the cap and the reservoir body.
30. Refit the safety clip.

Warning

Always return the lever adjuster to the original setting as noted in paragraph 1. Operating the motorcycle with lever settings that are unfamiliar may lead to loss of control or an accident.

31. Reset the brake lever adjuster to the original setting.
32. Check the operation of the front brake. 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 attempt to ride the motorcycle again. Failure to take remedial action may reduce braking efficiency leading to loss of motorcycle control and an accident.

Front Brake Pads - Removal

Warning

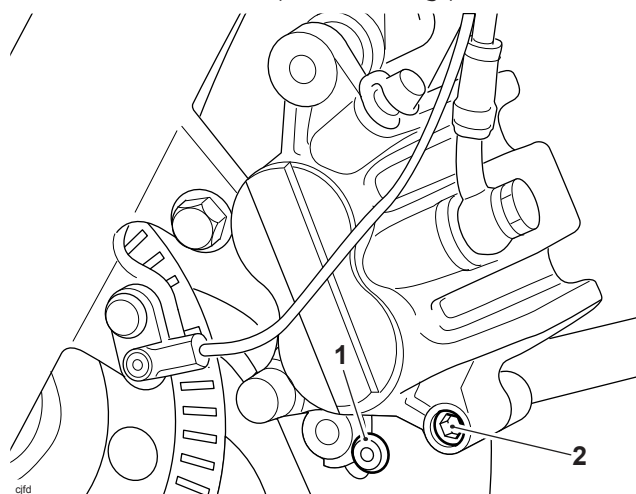
Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

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.

1. Remove the brake pad retaining pin plug and loosen the brake pad retaining pin.

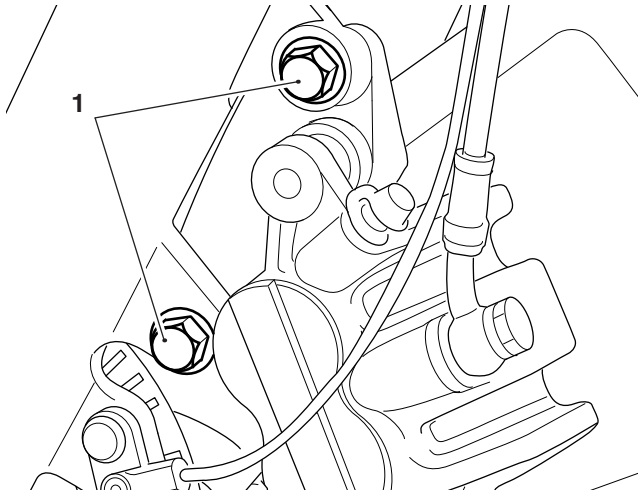


1. **Brake pad retaining pin plug**
2. **Brake pad retaining pin**

Warning

Do not allow the caliper to hang on the brake hose as this may damage the hoses and could lead to loss of motorcycle control and an accident.

2. Remove the caliper mounting fixings and slide the brake caliper off the brake disc.



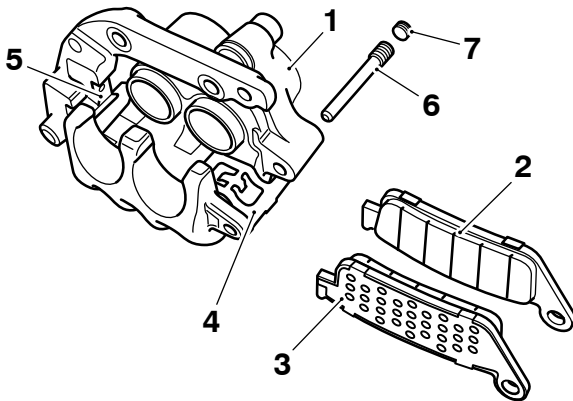
1. Brake caliper fixings



Caution

Note the positions of the heat isolation pad and the two shims for installation.

3. Remove the brake pad retaining pin and remove the brake pads from the caliper. Take care not to lose the brake pad retainer from the mounting bracket or the anti-rattle spring from the brake caliper.



ceqv_2

1. Brake caliper
2. Brake pad
3. Heat isolation pad
4. Anti-rattle spring
5. Brake pad retainer
6. Brake pad retaining pin
7. Brake pad retaining pin plug

Front Brake Pads - Inspection

1. Check the brake pad retainer, anti-rattle spring and retaining pin. Renew any component which shows signs of damage or corrosion.
2. Check the brake caliper body slides easily on the mounting bracket pins and check there is no sign of leakage from the piston seals. Rectify any problems before installing the brake pads.
3. Inspect the brake pads for wear (see Brake Wear Inspection, page 524).

Front Brake Pads - Installation

⚠ Warning

Never use mineral-based grease (such as lithium or copper based grease) in any area where contact with the braking system hydraulic seals and dust seals is possible. Mineral-based grease will damage the hydraulic seals and dust seals in the calipers and master cylinders.

Damage caused by contact with mineral-based grease may reduce braking efficiency resulting in loss of motorcycle control and an accident.

⚠ 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.

1. If new brake pads are being installed, push the pistons fully back into the caliper body. Keep an eye on the fluid level in the reservoir whilst retracting the pistons to prevent fluid spillage.
2. Ensure the brake pad retainer is correctly fitted to the mounting bracket and the anti-rattle spring is securely clipped onto the caliper body.

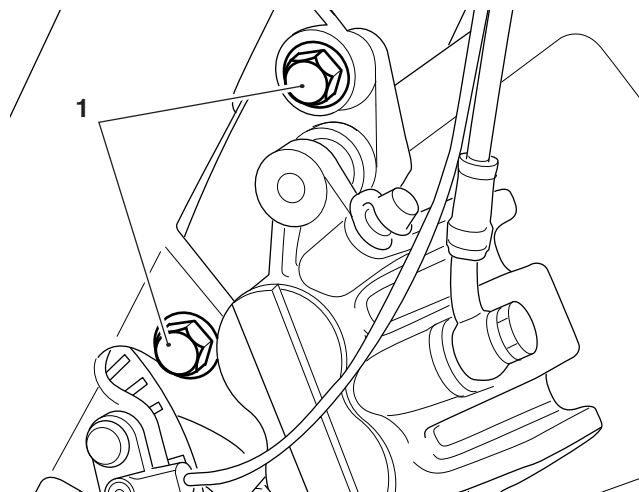
⚠ Warning

Do not apply more than a minimum coating of grease to the pad retaining pin. Excess grease may contaminate the brake pads, hydraulic seals and brake discs causing reduced braking efficiency leading to loss of motorcycle control and an accident.

3. Lubricate the brake pad retaining pin with a thin smear of proprietary high temperature copper based grease.
4. Ensure the single heat isolation pad is fitted to the back of the inner brake pad (caliper piston side) and a shim is fitted to both brake pads, as noted for removal.
5. Fit the brake pads to the brake caliper with their friction material surfaces facing each other. Locate the brake pad upper ends in the

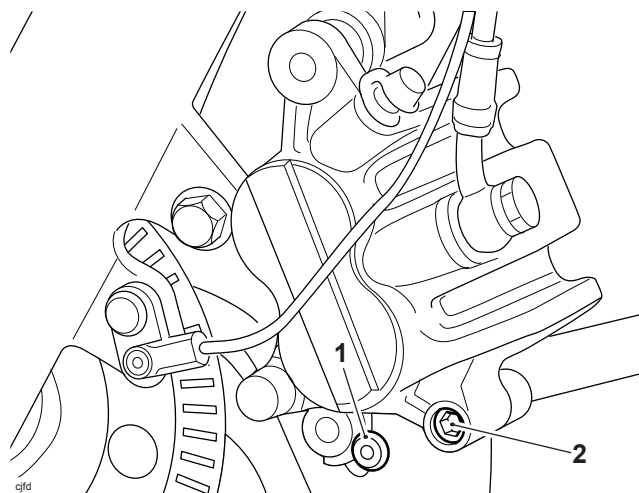
mounting bracket retainer then align them with the caliper body and insert the retaining pin.

6. Slide the brake caliper onto the brake disc, ensuring the brake pads pass either side of the brake disc, fit the fixings and tighten to 21 Nm.



1. Brake caliper fixings

7. Tighten the brake pad retaining pin to 18 Nm.
8. Fit the brake pad retaining pin plug to the brake caliper and tighten to 3 Nm.



1. Brake pad retaining pin plug

2. Brake pad retaining pin

9. Pump the brake lever to correctly position the caliper pistons.

⚠ Warning

Use only DOT 4 specification brake fluid as listed in the General Information section of this manual. The use of brake fluids other than those DOT 4 fluids listed in the General Information section

Warning

may reduce the efficiency of the braking system leading to an accident. Observe the brake fluid handling warnings given on page Brakes, page 10.

Caution

To prevent paint damage, do not spill brake fluid onto any area of the bodywork. Spilled brake fluid will damage paintwork.

10. Check the front brake fluid level and top up as required with new DOT 4 fluid.
11. Check the operation of the front brake. 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 attempt to ride the motorcycle again. Failure to take remedial action may reduce 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 paint damage, do not spill brake fluid onto any area of the bodywork. Spilled brake fluid will damage paintwork.

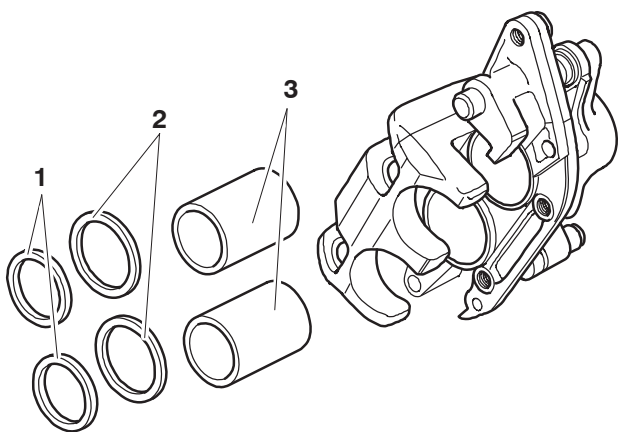
1. Disconnect the brake hose at the front caliper and place the free end of the hose in a suitable container to collect the brake fluid. Discard the two sealing washers.
2. Remove the brake pads (see Front Brake Pads - Removal, page 527).

Front Brake Caliper - Disassembly

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.

1. Separate the caliper and mounting bracket.
2. Cover the brake caliper opening with a clean, heavy cloth and, using either compressed air or by reconnecting the master cylinder and pumping the brake lever, eject both pistons from the caliper at the same time.



1. **Dust seals**
2. **Piston seals**
3. **Pistons**

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.

3. Extract the dust seals and piston seals, taking care not to damage the brake caliper bores.
4. Check the pistons, caliper and mounting bracket for signs of damage, paying particular attention to the caliper bores and pistons. If damage is present, renew the worn component or the complete caliper assembly.

Front Brake Caliper - Inspection

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 loss of control of the motorcycle or an accident could result if this warning is ignored.

1. Check the pistons and caliper bores for corrosion, scoring and damage. Renew as necessary.
2. Inspect the brake pads for damage and wear beyond the service limit. Renew as necessary.

Front Brake Caliper - Assembly

1. If all components are serviceable, obtain a piston seal kit and reassemble the caliper as follows:

Warning

Always renew caliper seals after removal of the pistons. An effective hydraulic seal can only be made if new seals are fitted.

A dangerous riding condition leading to loss of motorcycle control and an accident could result if this warning is ignored.

Warning

Before installation, all internal brake components should be cleaned and lubricated with clean new DOT 4 brake fluid.

Never use solvents, petrol (gasoline), engine oil, or any other petroleum distillate on internal brake components as this will cause deterioration of the hydraulic seals in the calipers and master cylinders.

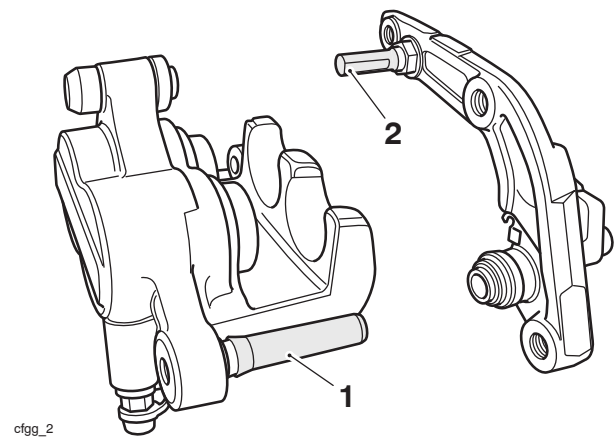
A dangerous riding condition leading to loss of motorcycle control and an accident could result if this warning is ignored.

2. Ensure all components are clean, then fit the new seals to their grooves in the caliper bores.
3. Lubricate the fluid seals, caliper bore and the outside of the pistons with clean DOT 4 brake fluid.
4. Ease the pistons squarely back into the bores, taking care not to displace the seals.

Warning

Never use mineral based grease (such as lithium or copper based grease) in any area where contact with the braking system hydraulic seals and dust seals is possible. Mineral based grease will damage the hydraulic seals and dust seals in the calipers and master cylinders. Damage caused by contact with mineral based grease may reduce braking efficiency resulting in loss of motorcycle control and an accident.

5. Lubricate the mounting bracket pins with a suitable silicone based brake grease then reassemble the bracket and caliper. Ensure the pin gaiters are correctly located on both the bracket and caliper.



1. **Caliper sliding pin**
2. **Caliper bracket sliding pin**

Front Brake Caliper - Installation

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 paint damage, do not spill brake fluid onto any area of the bodywork. Spilled brake fluid will damage paintwork.

1. Fit the brake pads (see Front Brake Pads - Installation, page 529).
2. Connect the brake hose to the caliper incorporating new sealing washers on each side of the brake hose union.
3. Tighten the brake hose union to 25 Nm.

Warning

Use only DOT 4 specification brake fluid as listed in the General Information section of this manual. The use of brake fluids other than those DOT 4 fluids listed in the General Information section may reduce the efficiency of the braking system leading to loss of motorcycle control and an accident.

Observe the brake fluid handling warnings given earlier in this section of the manual.

4. Fill the master cylinder with new, DOT 4 brake fluid from a sealed container.
5. Bleed the front brake. (see Bleeding the Front Brakes, Renewing Brake Fluid, page 525).
6. Check the operation of the front brake. 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 Disc - Wear

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.

Front Brake Disc Wear

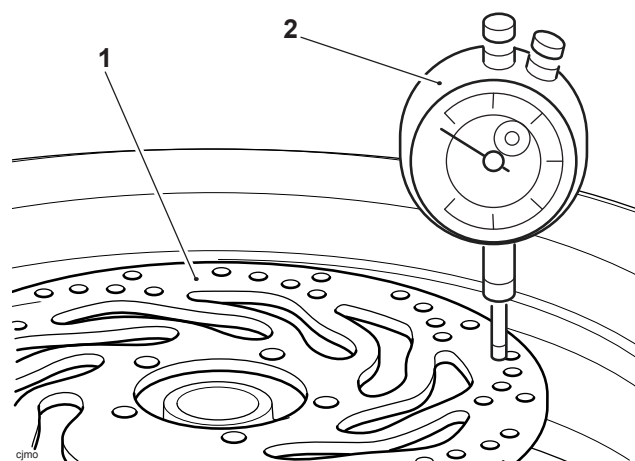
Front Brake Disc Thickness

Standard	5.5 mm
Service limit	5.0 mm

Brake Disc Run-out

Service limit	0.25 mm

1. Measure disc run out using an accurate dial gauge mounted on a surface plate.



1. Disc

2. Dial gauge

2. Replace any brake disc worn beyond the service limit or exceeding the disc run-out limit.

Front Brake Disc - 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 front wheel (see Front Wheel - Removal, page 609).

Warning

To avoid wheel damage, always support the wheel as instructed below. A dangerous riding condition leading to loss of motorcycle control and an accident could result if this warning is ignored.

Caution

The fixings securing the left hand brake disc to the wheel also secures the ABS pulser ring.

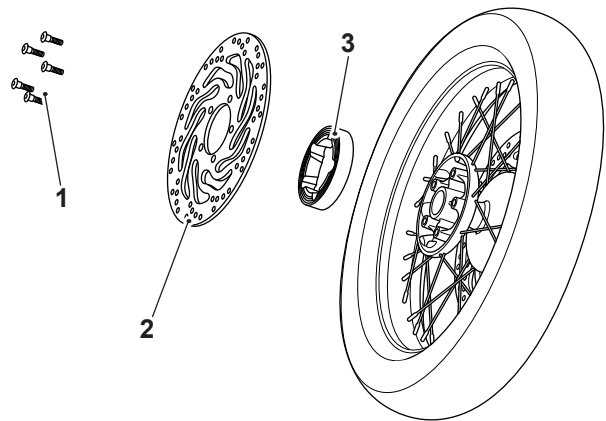
Note the orientation of the brake discs and the ABS pulser ring fitted for installation.

2. Support the wheel on blocks to avoid damage to the wheel centre and brake disc.
3. Remove and discard the brake disc fixings and remove the brake disc and the ABS pulser ring, if fitted.

Note:

- The edge of the front brake damper is tapered and will fit in only one way. Note the orientation of the front brake damper for installation.

4. Remove the front brake damper.



cjmn

1. Fixings

2. Brake disc (right hand side shown)

3. Front brake damper

5. Repeat steps three and four for the other side.

Front Brake Disc - Installation

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. Check the front brake damper for deterioration and cracks, replace if necessary.
2. Fit the front brake damper to the wheel as noted for removal.

Note:

- **The ABS pulser ring is to be fitted to the left hand brake disc.**
3. Locate the brake discs and ABS pulser ring (left hand side) to the wheel as noted during removal.
 4. Fit new disc fixings and tighten to 22 Nm.
 5. Refit the wheel (see Front Wheel - Installation, page 611).
 6. Check and, if necessary, adjust the air gap between the wheel speed sensor and the ABS pulser ring (see Air Gap Measurement, page 555).
 7. Check the operation of the front brake. 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 attempt to ride the motorcycle again. Failure to take remedial action may reduce braking efficiency leading to loss of motorcycle control and an accident.

Front Brake Master Cylinder - Removal

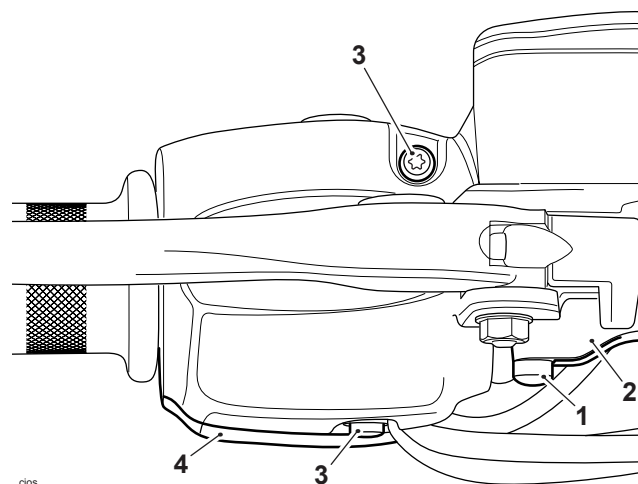
Warning

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.

Caution

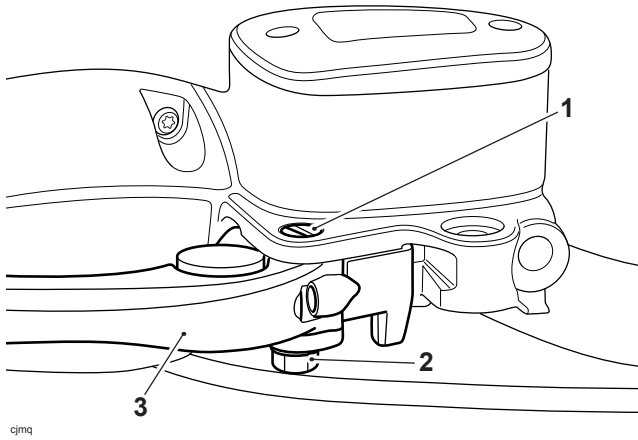
To prevent paint damage, do not spill brake fluid onto any area of the bodywork. Spilled brake fluid will damage paintwork.

- Remove the mirror (see Mirrors - Removal, page 654).
1. To drain the fluid from the master cylinder, attach a tube to the front brake caliper bleed nipple, loosen the nipple and operate the brake lever until all fluid has been expelled into a suitable container.
 2. Disconnect the brake hose from the master cylinder and discard the two sealing washers.
 3. Detach the brake light switch and bracket from the master cylinder.
 4. Remove the two fixings and detach the switch housing from the handlebar.



1. Brake light switch fixing
2. Brake light switch and bracket
3. Switch housing fixings
4. Switch housing

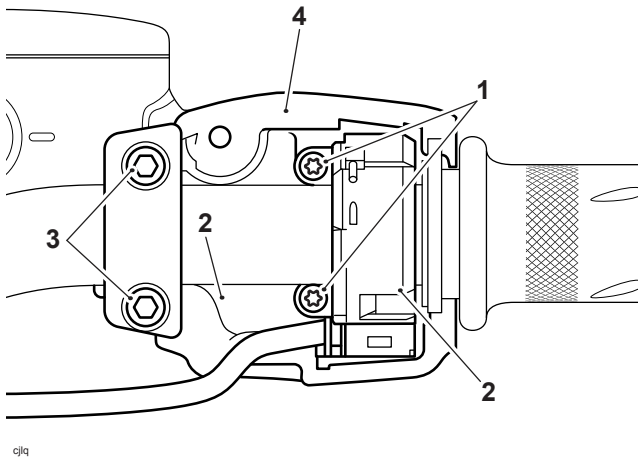
5. Remove the pivot bolt and lock nut securing the brake lever to the master cylinder. Remove the brake lever.



1. Pivot bolt
2. Lock nut
3. Brake lever

Note:

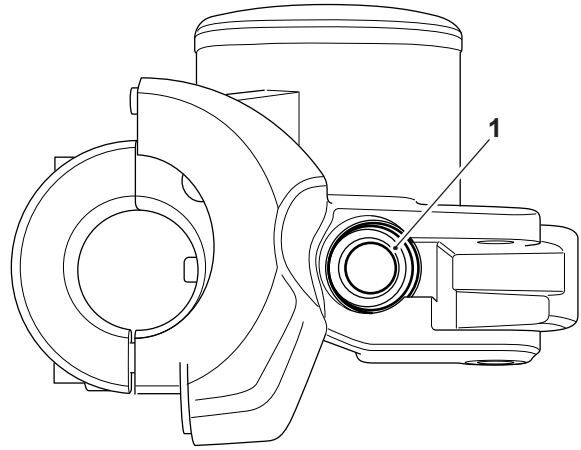
- Note the orientation of the twist grip position sensor for installation.
6. Release the fixings securing the twist grip position sensor to the master cylinder. Discard the fixings.
 7. Release the clamp fixings from the handlebar to remove the master cylinder.



1. Fixings for the twist grip position sensor
2. Twist grip position sensor
3. Fixings for master cylinder
4. Master cylinder

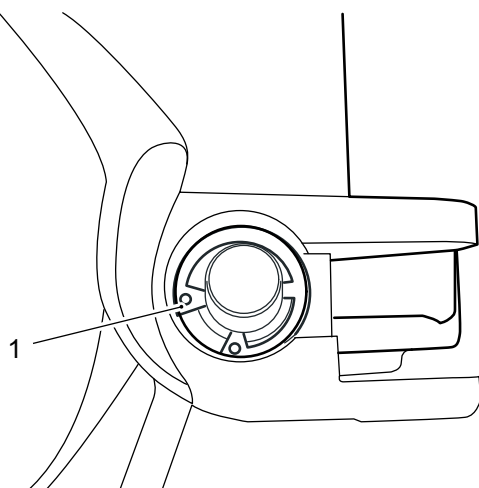
Front Brake Master Cylinder - Disassembly

1. Detach the dust cover from the lever end of the cylinder.



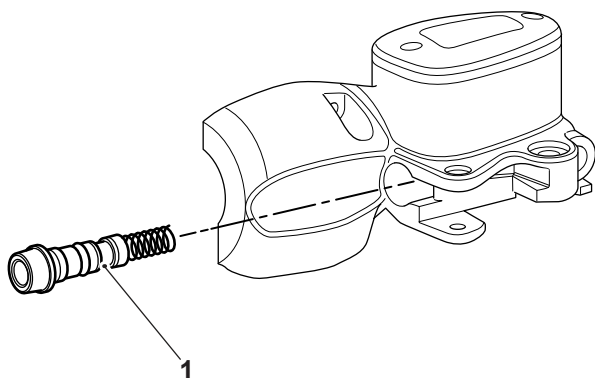
1. Dust cover

2. Remove the circlip from beneath the dust cover.



1. Circlip

3. Remove the piston set from the master cylinder bore noting the relative position of the seals.

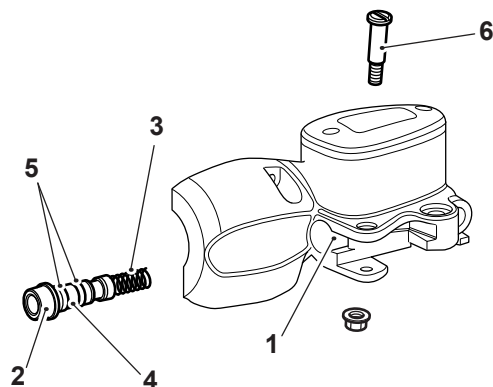


cjms

1. Piston Set

Front Brake Master Cylinder - Inspection

1. Check the following for wear, damage, cracks or deterioration:



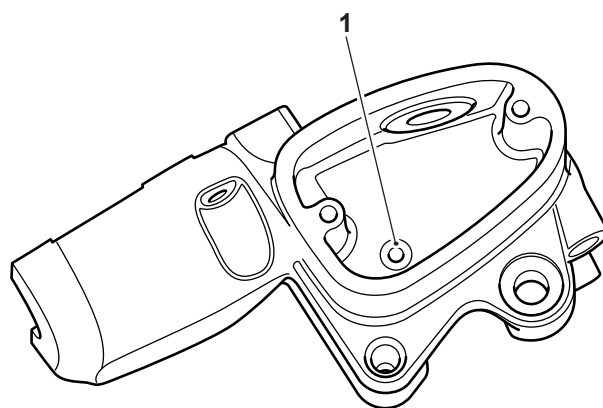
cjms

1. Cylinder bore
2. Dust cover
3. Spring
4. Piston
5. Seals
6. Pivot bolt

Caution

Always renew the piston and seal set if the cylinder is dismantled.

2. Check that the relief and supply ports on the cylinder are not blocked.



cjaj

1. Ports

Front Brake Master Cylinder - Assembly

! Warning

Never use mineral-based grease (such as lithium or copper based grease) in any area where contact with the braking system hydraulic seals and dust seals is possible. Mineral-based grease will damage the hydraulic seals and dust seals in the calipers and master cylinders.

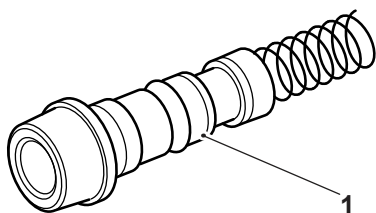
Damage caused by contact with mineral-based grease may reduce braking efficiency resulting in loss of motorcycle control and an accident.

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 loss of motorcycle control and 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.



1. Piston set

3. Refit the master cylinder dust cover.

Front Brake Master Cylinder - Installation

! 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

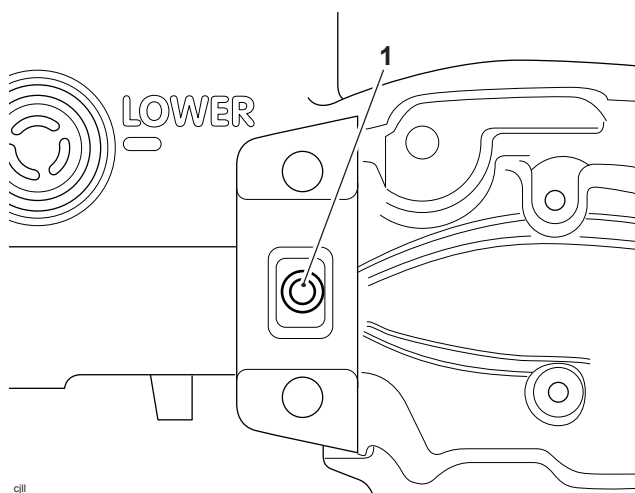
To prevent paint damage, do not spill brake fluid onto any area of the bodywork. Spilled brake fluid will damage paintwork.

1. Position the master cylinder to the handlebar and fit the twist grip position sensor to it. Tighten the two new fixings to 2.5 Nm. Ensure the heated twist grip remains correctly fitted to the position sensor.

! Caution

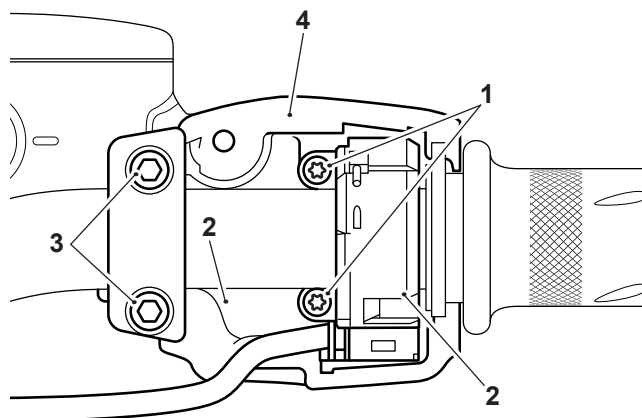
When fitting the master cylinder, do not excessively twist the twist grip forward or rearward. Excessive twisting of the grip may damage the heated grip harness.

2. Position the master cylinder onto the handlebar ensuring its locating lug fits into its hole on the handlebar.



1. Master cylinder locating lug

3. Fit the master cylinder clamp and tighten the fixings, upper one first, to 12 Nm.



cj19

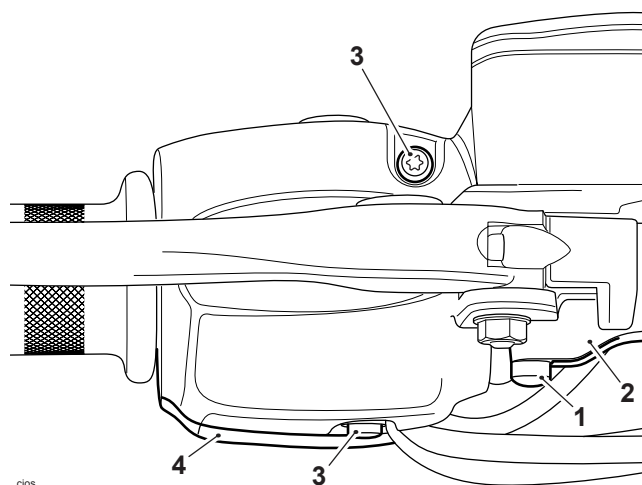
1. Fixings for the twist grip position sensor

2. Twist grip position sensor

3. Fixings for the master cylinder

4. Master cylinder

4. Fit the switch housing to the master cylinder and tighten its fixings to 1 Nm.
5. Fit the brake light switch to the master cylinder and tighten its fixing to 2.5 Nm.



cj19

1. Fixings

2. Switch housing

6. Position the brake lever ensuring that the pivot boss is correctly aligned to the master cylinder push rod.
7. Fit and tighten the pivot bolt to 1 Nm, and the lock nut to 6 Nm.
8. Connect the brake hose to the master cylinder incorporating new sealing washers to each side of the union. Tighten the union bolt to 25 Nm.

Warning

Use only DOT 4 specification brake fluid as listed in the General Information section of this manual. The use of brake fluids other than those DOT 4 fluids listed in the General Information section may reduce the efficiency of the braking system leading to loss of motorcycle control and an accident.

Observe the brake fluid handling warnings given earlier in this section of the manual.

Caution

To prevent body damage, do not spill brake fluid onto any area of the bodywork. Spilled brake fluid will damage paintwork.

9. Fill and bleed the front brakes (see Bleeding the Front Brakes, Renewing Brake Fluid, page 525).
10. Examine the system for correct operation and fluid leaks. Rectify as necessary.
11. Check the operation of the front brake. 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 attempt to ride the motorcycle again. Failure to take remedial action may reduce braking efficiency leading to loss of motorcycle control and an accident.

- Refit the mirror (see Mirrors - Installation, page 654).

Bleeding the Rear Brakes, Renewing Brake Fluid

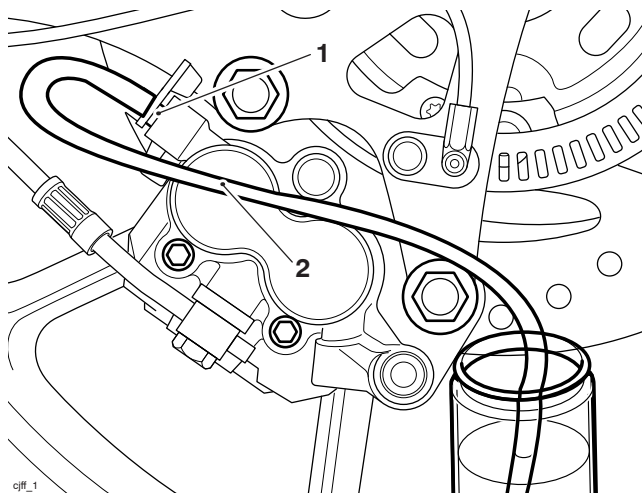
! Warning

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 paint damage, do not spill brake fluid onto any area of the bodywork. Spilled brake fluid will damage paintwork.

1. Remove the cap from the rear bleed nipple.
2. Attach a transparent tube to the bleed nipple.
3. Place the other end of the tube in a suitable receptacle containing new brake fluid.



1. Bleed nipple
2. Bleed tube

! 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 that 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 loss of motorcycle control and an accident could result if this warning is ignored.

! Caution

To prevent paint damage, do not spill brake fluid onto any area of the bodywork. Spilled brake fluid will damage paintwork.

4. Release the cap screws and remove the reservoir cover noting the position of the sealing diaphragm.
5. Check the condition of the reservoir sealing diaphragm. Replace if necessary.
6. Release the bleed nipple.

! Caution

During bleeding, do not allow the fluid level to fall below the lower level mark in the reservoir. If the fluid level is allowed to fall below this mark, air may enter the system and the sequence of bleeding must be repeated.

7. Get an assistant to slowly depress the brake pedal and, holding the pedal fully down, close the bleed nipple.
8. Repeat steps 6 and 7 until no more air appears in the bleed tube.
9. When all air has been expelled from the system, hold the pedal fully down and close the bleed nipple.
10. Connect the Triumph Diagnostic Interface (see System Diagnostics, page 567).
11. Follow the on screen menu to ABS Diagnostics. From the menu, select **BLEED SYSTEM** (see System Diagnostics, page 567).

! Caution

On pressing the Start button, the diagnostic software will send a command to the ABS ECM to open the 2nd **circuit** solenoid.

When the ABS modulator 2nd circuit is activated by the bleed command, the rear brake pedal travel will increase as the 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 rear brake pedal.

12. Apply pressure to the rear brake pedal, press the **Start** button to activate the bleed sequence on the diagnostic tool and release the bleed nipple.
13. Slowly depress the brake pedal and, holding the pedal fully down, close the bleed nipple. Repeat until no more air appears in the bleed tube, maintaining the brake fluid level between the upper and lower reservoir levels whilst bleeding is being carried out.
14. Repeat steps 12 and 13 until no more air appears in the bleed tube, maintaining the brake fluid level between the upper and lower reservoir levels whilst bleeding is being carried out.
15. The bleed sequence will run for a maximum of 20 seconds. Press the **Stop** button to end the bleed sequence at any time. Once the bleed sequence has completed, the diagnostic tool will display the message **ABS system bleed complete**.

Caution

The ABS module must be allowed to cool between bleeding operations. Always allow the ABS modulator to cool for 5 minutes before starting the bleed procedure again. Failure to follow this instruction may result in damage to the ABS modulator.

16. Repeat the above procedure a minimum of twice or as necessary until all air is expelled from the system.
17. When all air has been expelled from the system, apply pressure to the brake lever and close the bleed nipple.
18. Disconnect the Triumph diagnostic Interface.
19. Repeat steps 6 and 7 until no more air appears in the bleed tube.
20. When all air has been expelled from the system, apply pressure to the brake pedal and close the bleed nipple and tighten it to 6 Nm.
21. Remove the bleed tube.
22. Replace the bleed nipple cap.
23. Fill the reservoir to the upper level with new DOT 4 fluid.

Warning

Use only DOT 4 specification brake fluid as listed in the General Information section of this manual. The use of brake fluids other than those DOT 4 fluids listed in the General Information section

Warning

may reduce the efficiency of the braking system leading to loss of motorcycle control and an accident.

Observe the brake fluid handling warnings given earlier in this section of the manual.

Caution

To prevent paint damage, do not spill brake fluid onto any area of the bodywork. Spilled brake fluid will damage paintwork.

24. When the caliper has been bled, ensure the brake pedal operation has a firm resistive feel to it, does not feel spongy and that the brake pedal does not have excessive movement. Take remedial action as necessary.
25. Refit the reservoir cap ensuring that the diaphragm seal is correctly positioned between the cap and the reservoir body. Tighten the cap retaining screws to 1 Nm.
26. Check the operation of the rear brake. Rectify as necessary.

Warning

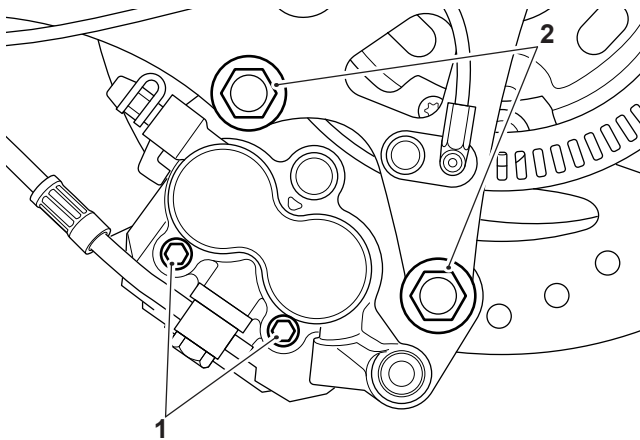
It is dangerous to operate the motorcycle with defective brakes; you must have your authorised Triumph dealer take remedial action before you attempt to ride the motorcycle again. Failure to take remedial action may reduce braking efficiency leading to loss of motorcycle control and an accident.

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.

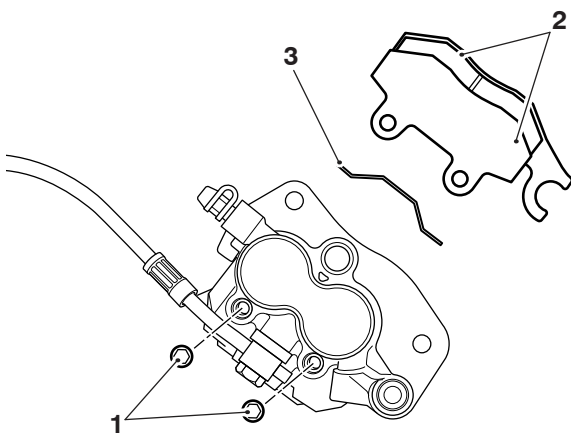
1. Remove the right hand side panel to gain access to the rear brake fluid reservoir (see Side Panels, page 646).
2. Loosen the brake pad retaining pins.
3. Remove the rear brake caliper mounting fixings and slide the caliper off the brake disc.



cjff

- 1. Brake pad retaining pins**
- 2. Brake caliper mounting fixings**

4. Remove the brake pad retaining pins.
5. Remove the brake pads and the anti-rattle spring.

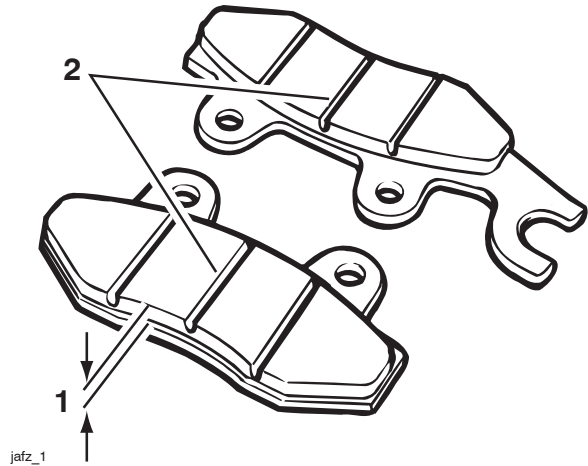


cjfg

- 1. Brake pad retaining pins**
- 2. Brake pads**
- 3. Anti-rattle spring**

Rear Brake Pads - Inspection

1. Check the friction material of each brake pad for signs of contamination and measure its thickness. If the friction material of either pad is contaminated or has worn beyond the service limit, renew both pads as a set.



jafz_1

- 1. Friction material thickness (service limit 1.5 mm)**

- 2. Brake pads**

2. Check the anti-rattle spring and retaining pins. Renew any component which shows signs of damage or corrosion.
3. Check the caliper body slides easily on the mounting bracket pins and check there is no sign of leakage from the piston seals. Rectify any problems before installing the brake pads.

Rear Brake Pads - Installation

⚠ 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

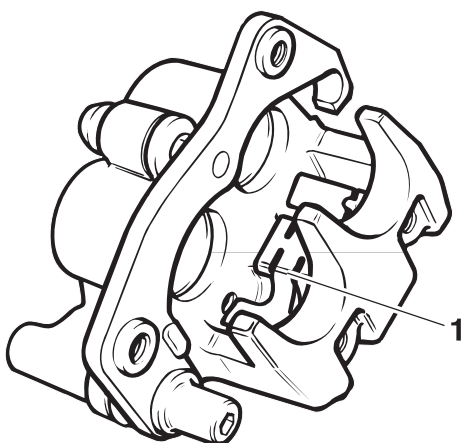
Never use mineral-based grease (such as lithium or copper based grease) in any area where contact with the braking system hydraulic seals and dust seals is possible. Mineral-based grease will damage the hydraulic seals and dust seals in the calipers and master cylinders.

Damage caused by contact with mineral-based grease may reduce braking efficiency resulting in loss of motorcycle control and 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 new pads are being installed, push the pistons fully back into the caliper body. Keep an eye on the fluid level in the reservoir whilst retracting the pistons to prevent fluid spillage.
2. Install the anti-rattle spring into the caliper.



gakw

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.

3. Lubricate the brake pad retaining pins with a thin smear of proprietary high temperature copper based grease.
4. Fit the brake pads into the caliper with their friction material facing each other. Ensure both pads are correctly located then align them with the caliper body and fit the retaining pins.
5. Slide the caliper onto the disc, ensuring the pads pass either side of the disc, fit the fixings and tighten to 40 Nm.
6. Tighten the pad retaining pins to 18 Nm.
7. Pump the brake pedal to correctly position the caliper pistons.
8. Check the brake fluid level and top up as required with new DOT 4 fluid.
9. Check the operation of the rear brake. Rectify as necessary.

⚠ Warning

Use only DOT 4 specification brake fluid as listed in the General Information section of this manual. The use of brake fluids other than those DOT 4 fluids listed in the General Information section may reduce the efficiency of the braking system leading to loss of motorcycle control and an accident.

Observe the brake fluid handling warnings given earlier in this section of the manual.

⚠ Warning

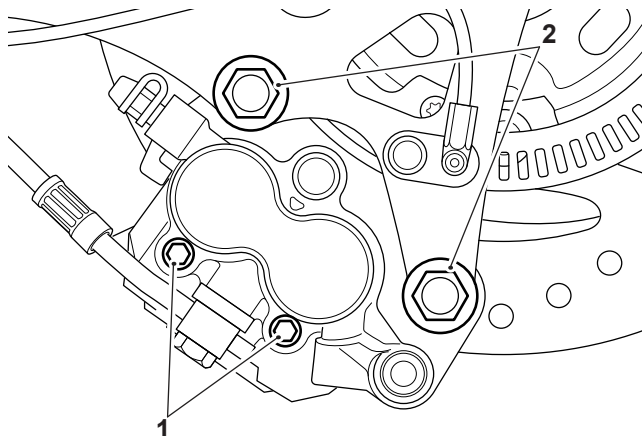
It is dangerous to operate the motorcycle with defective brakes; you must have your authorised Triumph dealer take remedial action before you attempt to ride the motorcycle again. Failure to take remedial action may reduce braking efficiency leading to loss of motorcycle control and an accident.

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.

1. Disconnect the rear brake hose at the caliper and place the free end of the hose into a suitable container to collect the brake fluid. Discard the two sealing washers.
2. If the brake caliper is to be disassembled, loosen the two brake pad retaining pins.
3. Remove the rear brake caliper mounting fixings and slide the caliper off the brake disc.



off

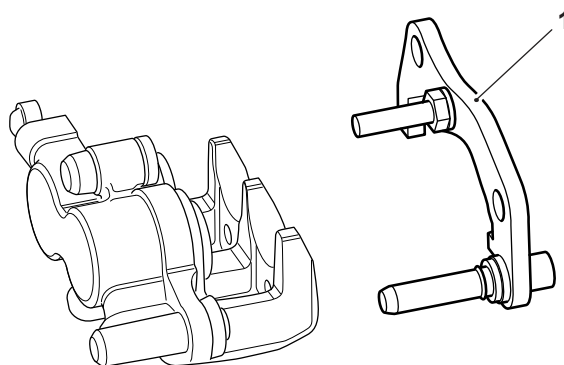
1. **Brake pad retaining pins**
2. **Brake caliper mounting fixings**
4. If the brake caliper is to be disassembled, remove the brake pads and the anti-rattle spring.

Rear Brake Caliper - Disassembly

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.

1. Separate the brake caliper and the mounting bracket.



1. **Mounting bracket**
2. Cover the caliper opening with a clean, heavy cloth and, using either compressed air or by reconnecting the master cylinder and pumping the rear brake pedal, eject both pistons from the caliper at the same 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.

3. Extract the dust seals and piston seals, taking care not to damage the caliper bores.

Rear Brake Caliper - Inspection

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 loss of control of the motorcycle or an accident could result if this warning is ignored.

1. Check the pistons, caliper, mounting bracket and mounting bracket sliding pin gaiters for signs of damage, paying particular attention to the caliper bores and pistons. If damage is present, renew the worn component or the complete caliper assembly.

Rear Brake Caliper - Assembly

1. If all components are serviceable, obtain a piston seal kit and reassemble the caliper as follows:

Warning

Always renew caliper seals after removal of the pistons. An effective hydraulic seal can only be made if new seals are fitted.

A dangerous riding condition leading to an accident could result if this warning is ignored.

Warning

Before installation, all internal brake components should be cleaned and lubricated with clean new DOT 4 brake fluid.

Never use solvents, petrol (gasoline), engine oil, or any other petroleum distillate on internal brake components as this will cause deterioration of the hydraulic seals in the calipers and master cylinders.

A dangerous riding condition leading to loss of motorcycle control and an accident could result if this warning is ignored

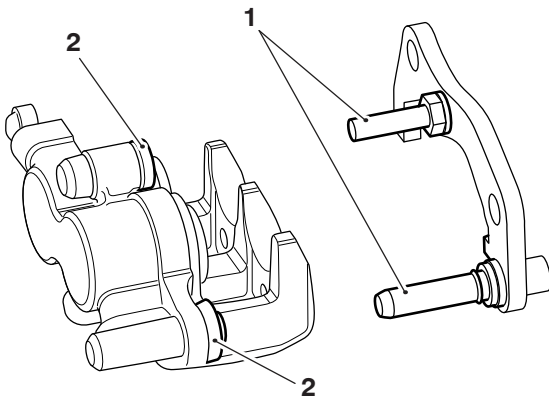
2. Ensure all components are clean, then fit the new seals to their grooves in the caliper bores.
3. Lubricate the fluid seals, caliper bore and the outside of the pistons with clean DOT 4 brake fluid.
4. Ease the pistons squarely back into the bores, taking care not to displace the seals.

Warning

Never use mineral based grease (such as lithium or copper based grease) in any area where contact with the braking system hydraulic seals and dust seals is possible. Mineral based grease will damage the hydraulic seals and dust seals in the calipers and master cylinders. Damage caused by contact with mineral based grease may reduce braking efficiency resulting in an accident.

5. Lubricate the mounting bracket pins with silicone based grease (such as T2022021 supplied by Triumph) then reassemble the

bracket and caliper. Ensure the pin gaiters are correctly located on both the bracket and caliper.



cjh_1

1. Sliding pins
2. Sliding pin gaiters

Rear Brake Caliper - Installation

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. If the caliper has been overhauled, install the brake pads.
2. Slide the caliper onto the brake disc, ensure the pads pass either side of the brake disc, and fit the mounting bolts. Tighten the mounting bolts to 40 Nm.
3. Connect the brake hose to the caliper incorporating new sealing washers on each side of the brake hose union.
4. Tighten the brake hose union bolt to 25 Nm.
5. Bleed the rear brake (see Bleeding the Rear Brakes, Renewing Brake Fluid, page 540).
6. Check the operation of the brake and carry out a thorough leak check before riding the motorcycle.

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.

Rear Brake Disc - Wear

Wear

Warning

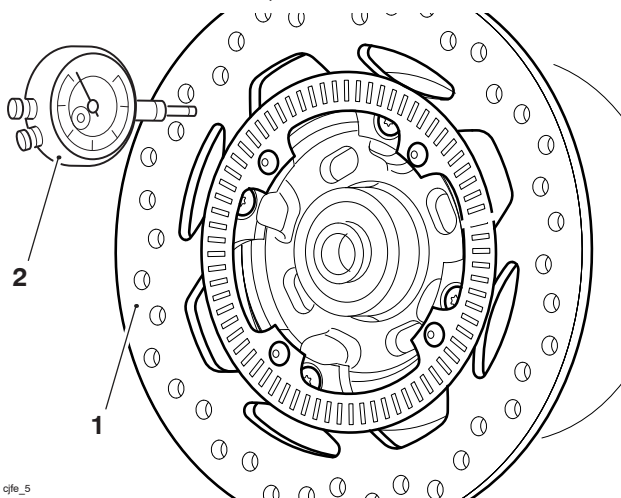
Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

1. Replace any brake disc worn beyond the service limit or exceeding the disc run-out limit.

Rear Disc Thickness	
Standard	5.5 mm (standard)
Service limit	5.0 mm (service limit)

Disc Run-out	
Service limit	0.25 mm

Measure disc run-out using an accurate dial gauge mounted on a surface plate.



1. Brake disc (front wheel shown)
2. Dial gauge

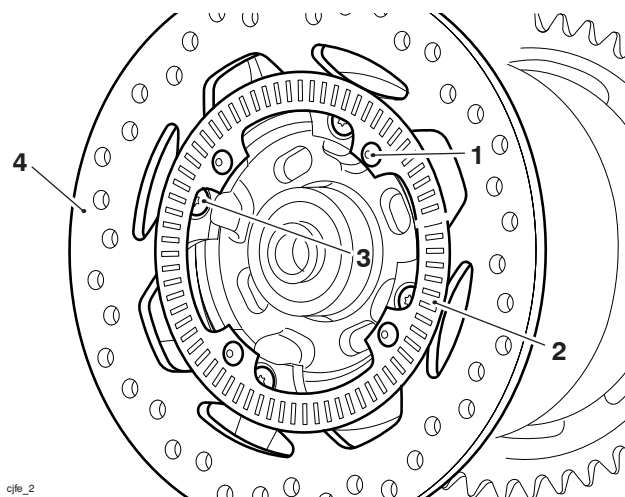
Rear Brake Disc - Removal

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.

- Remove the rear wheel (see Rear Wheel - Removal, page 612).

1. Support the wheel on blocks to avoid damage to the wheel centre.
2. Remove and discard the fixings and remove the ABS pulser ring.
3. Remove and discard the fixings and remove the brake disc.



1. Fixings (ABS pulser ring)
2. ABS pulser ring
3. Fixing (rear brake disc)
4. Rear brake disc

Rear Brake Disc - Installation

1. Locate the brake disc to the wheel.
2. Fit new fixings and tighten to 22 Nm.
3. Locate the ABS pulser ring to the rear brake disc.
4. Fit new fixings and tighten to 5 Nm.
 - Refit the rear wheel (see Rear Wheel - Installation, page 614).
 - Check and, if necessary, adjust the air gap between the wheel speed sensor and the ABS ring (see Air Gap Measurement, page 555).
 - Check the operation of the rear brake. Rectify as necessary.

Rear Brake Master Cylinder - Removal

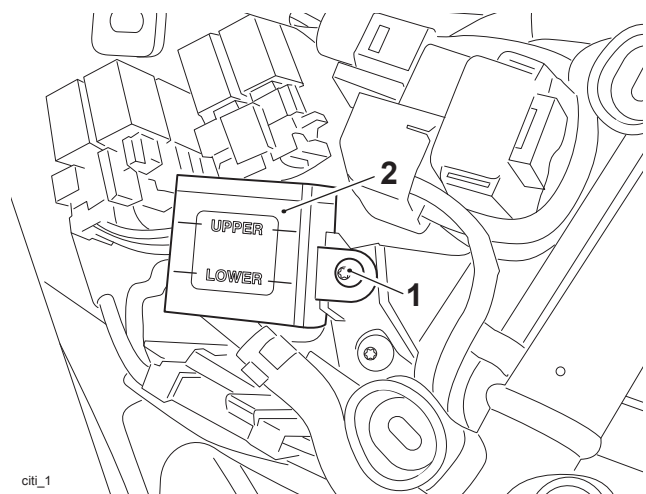
Warning

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.

Caution

To prevent paint damage, do not spill brake fluid onto any area of the bodywork. Spilled brake fluid will damage paintwork.

- Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
 - Remove the front sprocket cover (see Front Sprocket Cover - Removal, page 105).
1. Drain the fluid from the master cylinder by bleeding the system at the rear brake caliper until all fluid has been expelled.
 2. Remove and discard the fixing and detach the rear brake fluid reservoir from the relay bracket.



1. Fixing

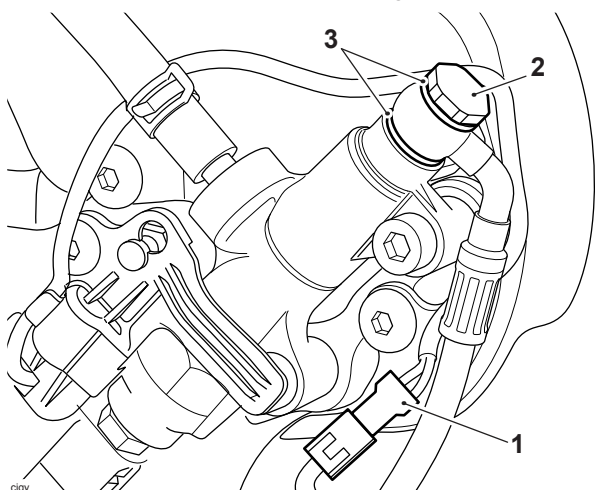
2. Brake fluid reservoir

Caution

Note the routing of the brake switch harness for installation.

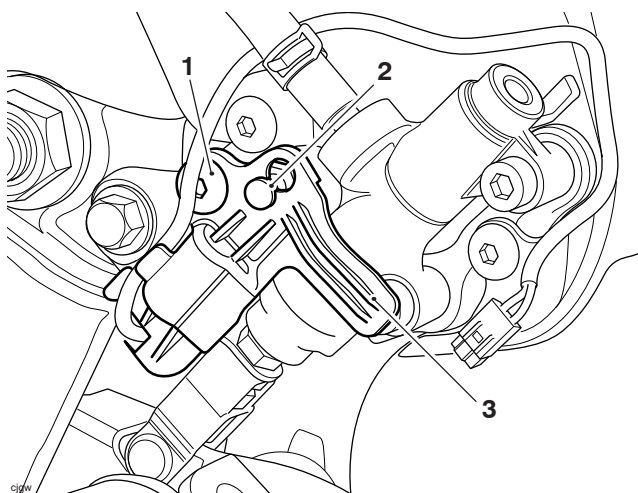
3. Disconnect the rear brake light switch from the main harness.

4. Disconnect the brake line from the rear master cylinder. Discard the sealing washers.



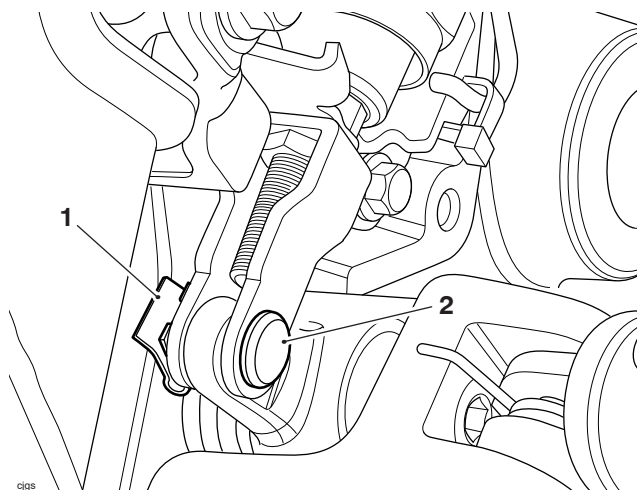
1. Brake light switch electrical connector
2. Brake line union bolt
3. Sealing washers

5. Remove the fixing securing the brake light switch and bracket assembly to the right hand control plate.
6. Slide the brake light switch rearwards and detach it from its locating pin on the right hand control plate.



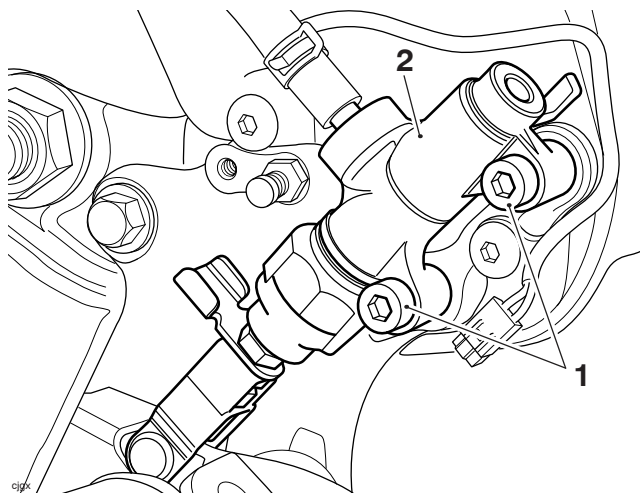
1. Fixing
2. Locating pin
3. Brake light switch and bracket assembly

7. Remove the clip and clevis pin at the lower end of the brake pushrod.



1. Clip
2. Clevis pin

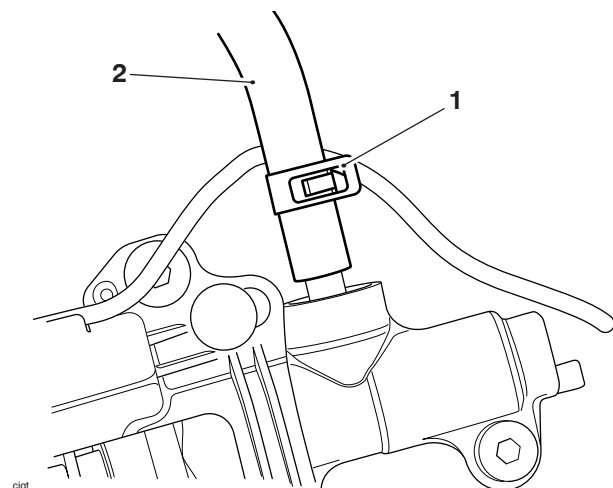
8. Remove the two fixings and remove the rear brake master cylinder from the right hand control plate.



1. Fixings

2. Rear brake master cylinder

9. Release the clip, and noting its orientation, remove the brake fluid reservoir and hose from the master cylinder.

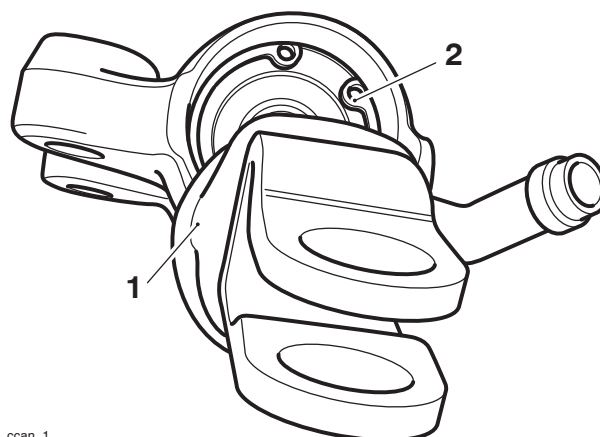


1. Hose clip

2. Hose

Rear Brake Master Cylinder - Disassembly

1. Remove the rubber boot from the cylinder and pushrod.
2. Remove the circlip retaining the pushrod to the cylinder.

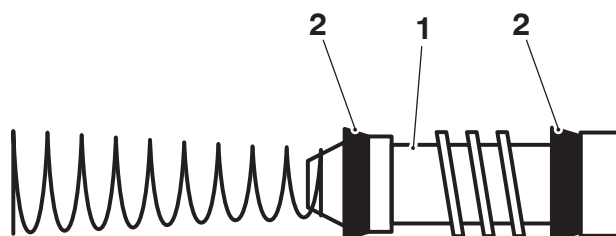


ccan_1

1. Rubber boot

2. Circlip

3. Remove the pushrod and piston set from the master cylinder bore noting the relative position of the seals and piston components.



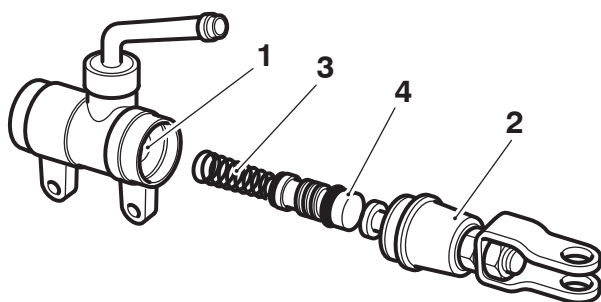
ccao

1. Piston

2. Seals

Rear Brake Master Cylinder - Inspection

1. Check the following for wear, damage, cracks or deterioration:



ccad

1. **Cylinder bore**
2. **Dust cover**
3. **Spring**
4. **Piston**

2. Examine the pushrod for distortion and other damage. Replace as necessary.

Rear Brake Master Cylinder - Assembly

! Warning

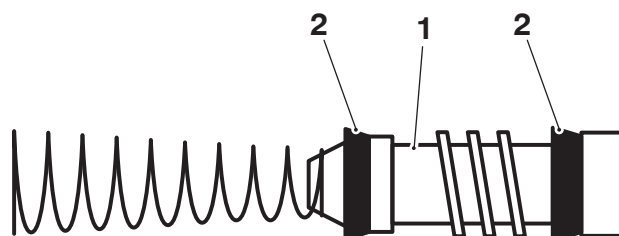
Never use mineral-based grease in any part of the braking system or in any area where contact with the braking system is possible. Mineral-based grease will damage the hydraulic seals in the calipers and master cylinders. A dangerous riding condition leading to loss of motorcycle control and an accident could result from use of mineral grease.

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 loss of motorcycle control and an accident could result from incorrect assembly of the master cylinder.

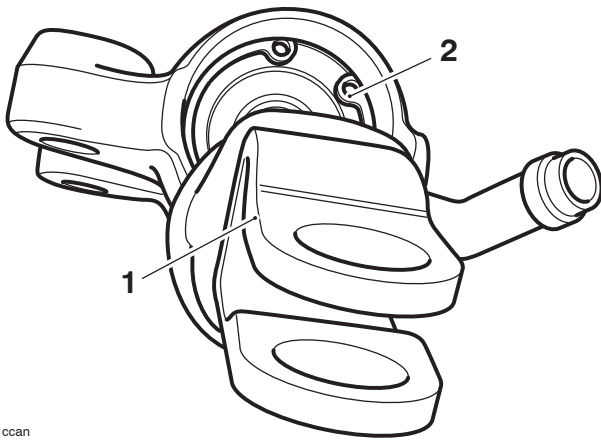
2. Fit the new piston and seal set into the master cylinder.



ccao

1. **Piston**
2. **Seals (in correct orientation)**
3. Apply a small amount of brake grease to the pushrod.

4. Install the pushrod in the master cylinder, compress the spring and retain the assembly with a new circlip.



ccan

1. **Pushrod**
2. **Circlip**

5. Refit the master cylinder boot.

Rear Brake Master Cylinder - Installation

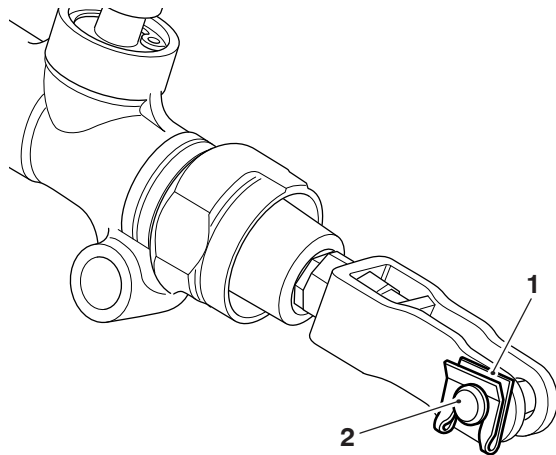
! Warning

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 paint damage, do not spill brake fluid onto any area of the bodywork. Spilled brake fluid will damage paintwork.

1. Refit the brake fluid reservoir and its hose to the master cylinder as noted on for removal. Secure with the clip.
2. Fit the rear brake master cylinder to the right hand control plate and tighten the fixings to 24 Nm.
3. Position the brake pedal to the pushrod, engage the clevis and retain it with the clip. Ensure the clip is fitted as shown below:

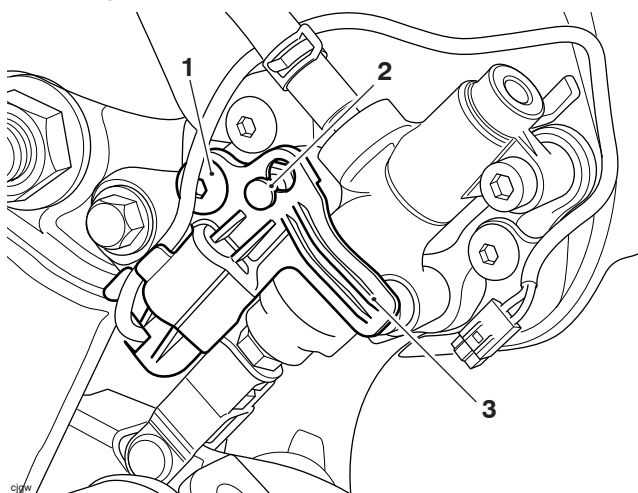


cjgz

1. **Clip**
2. **Clevis pin**

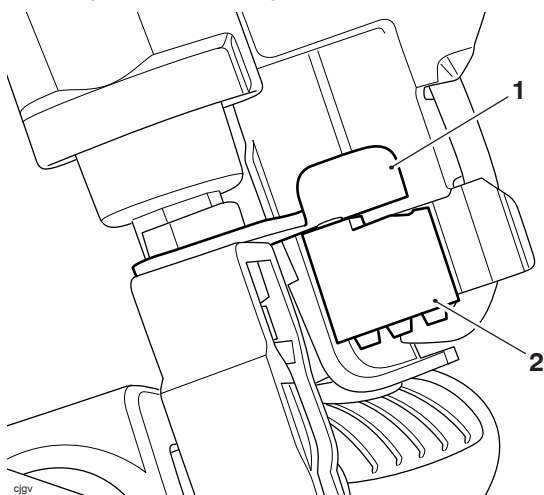
4. Refit the rear brake fluid reservoir to the relay bracket and tighten the new fixing to 3 Nm.
5. Position the brake light switch and bracket assembly to its locating pin on the right hand control plate.

6. Fit a new fixing but do not fully tighten at this stage.



1. **Fixing**
2. **Locating pin**
3. **Brake light switch and bracket assembly**

7. Slide the brake switch assembly forward until it stops against the switch actuation plate. Tighten the fixing to 5 Nm.



1. **Switch actuation plate**
2. **Brake light switch (control plate removed for clarity)**

8. Incorporating new washers to either side of the union, fit the hard-line. Tighten the union bolt to 25 Nm.
9. Connect the rear brake light switch to the main harness.

Warning

leading to loss of motorcycle control and an accident. Observe the brake fluid handling warnings given earlier in this section of the manual.

- Reconnect the battery, positive (red) lead first and tighten the battery terminals to 4.5 Nm.
- Refit the front sprocket cover (see Front Sprocket Cover - Installation, page 106)
- Fill and bleed the rear brake system (see Bleeding the Rear Brakes, Renewing Brake Fluid, page 540).
- Refit the seat (see Seat - Installation, page 645).

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.

- Check the operation of the rear brake. Rectify as necessary.

Warning

Use only DOT 4 specification brake fluid as listed in the General Information section of this manual. The use of brake fluids other than those DOT 4 fluids listed in the General Information section may reduce the efficiency of the braking system

Front ABS Wheel Speed Sensor - Removal

Warning

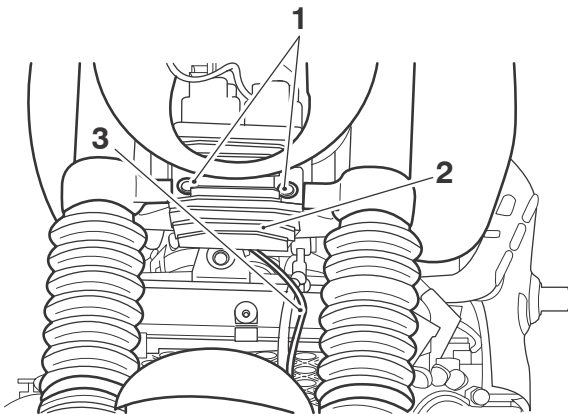
Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

- Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
 - Remove the headlight from the headlight bowl (see Headlight - Removal, page 679).
1. Disconnect the wheel speed sensor electrical connector from the main harness, located inside the headlight.

Caution

Note the routing of the wheel speed sensor harness and it clips for installation.

2. Remove the fixings and detach the regulator/rectifier from the lower yoke.
3. Route the front ABS wheel speed sensor harness down to the front brake caliper.



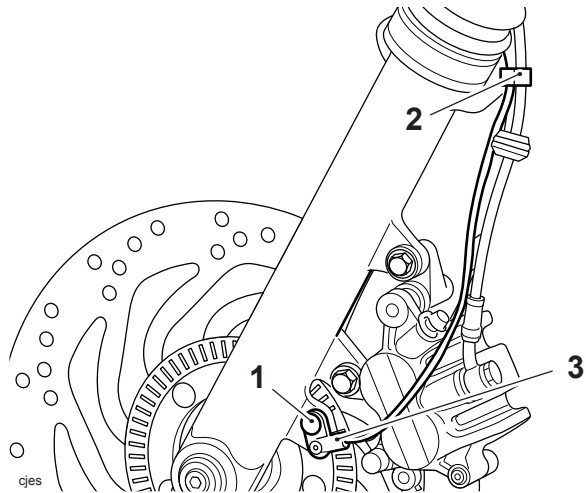
1. **Fixings**
2. **Regulator/rectifier**
3. **ABS wheel speed sensor harness**

4. Detach the front ABS wheel speed sensor harness from the clips on the front brake line.

Note:

- There is a shim between the wheel speed sensor and the front fork leg.

5. Release the fixing securing the wheel speed sensor to the fork leg.
6. Remove the wheel speed sensor and collect the shim.



1. **Fixing**
2. **Clip (to brake line, one shown)**
3. **Front ABS wheel speed sensor**

Front ABS Wheel Speed Sensor - Installation

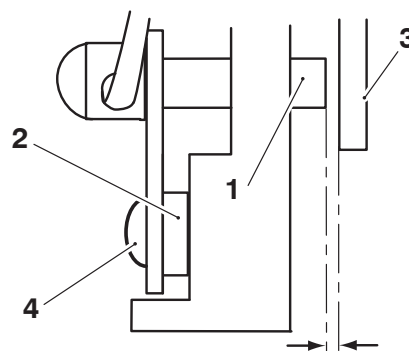
Warning

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 wheel speed sensor and shim to the fork leg, as noted for removal. Fit the fixing and tighten to 9 Nm.
2. Secure the wheel speed sensor harness to the brake hose clips.
3. Route the harness as noted for removal and connect the wheel speed sensor electrical connector to the main harness.
4. Fit the regulator/rectifier to the lower yoke and tighten the fixings to 4 Nm.
5. Refit the headlight to the headlight bowl (see Headlight - Installation, page 680).
6. The air gap between the wheel speed sensor and the pulser ring must be between 0.4 mm and 1.2 mm. Check, and if necessary, adjust the air gap (see Air Gap Measurement, page 555).
 - Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
 - Refit the seat (see Seat - Installation, page 645).

Air Gap Measurement

1. Using feeler gauges, measure the air gap between the wheel speed sensor and the pulser ring.



cdhj_1

0.40 mm to 1.20 mm

1. ABS sensor (front sensor shown)

2. Shim

3. Pulser ring

4. Fixing

2. Rotate the wheel and repeat the measurement in several places to ensure the pulser ring is not distorted or bent. Renew a damaged pulser ring.
3. Adjust the air gap using the correct shim to achieve an air gap between 0.40 mm and 1.20 mm.
4. Shims are available in the following sizes:
 - shims - 0.5 mm, 1.0 mm, 1.5 mm and 2.0 mm.
5. If necessary, remove the wheel speed sensor, fit the correct thickness shim and refit the wheel speed sensor and tighten the fixing to 9 Nm.
6. Repeat the air gap measurement. Readjust as necessary.

Front ABS Pulser Ring - Removal

Note:

- **The front ABS pulser ring is mounted on the left hand brake disc.**
1. Remove front brake disc and pulser ring (see Front Brake Disc - Removal, page 534).

Front ABS Pulser Ring - Inspection

1. Check the pulser ring for damaged, missing or cracked teeth or distortion. Renew the pulser ring as necessary.

Front ABS Pulser Ring - Installation

Note:

- The front ABS pulser ring is mounted on the left hand brake disc.
1. Fit the front brake disc and ABS pulser ring (see Front Brake Disc - Installation, page 535).

Rear ABS Wheel Speed Sensor - Removal

Warning

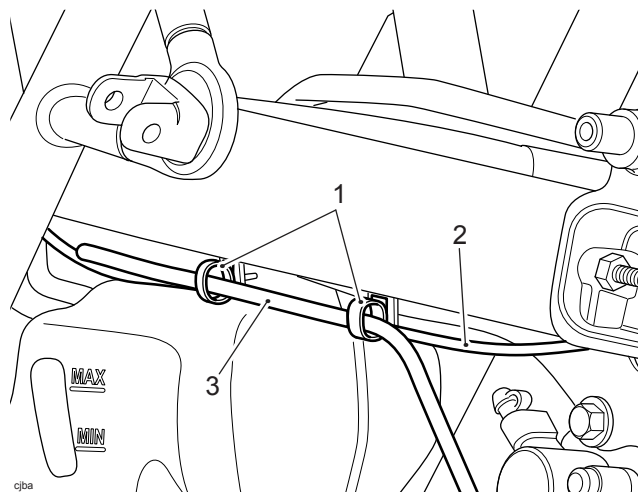
Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

- Remove the seat (see Seat - Removal, page 645).
- Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
- Remove the left hand side panel (see Side Panels, page 646).

Caution

Note the routing of the wheel speed sensor harness and it clips for installation.

1. Disconnect the wheel speed sensor electrical connector, identified as the white connector.
2. Detach the ABS sensor cable and brake hose clips from the left hand side of the swinging arm.



1. Clips
2. ABS sensor cable
3. Brake hose

Caution

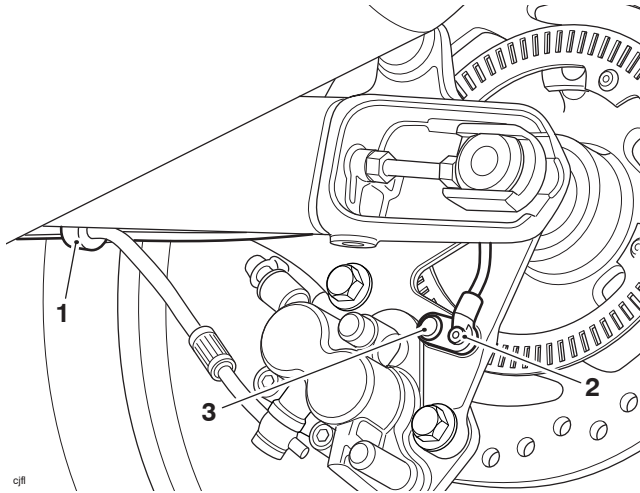
Note the routing of the ABS wheel speed sensor harness for installation.

3. Route the sensor harness to the rear caliper.

Caution

Note the location of the shim for the ABS wheel speed sensor for installation.

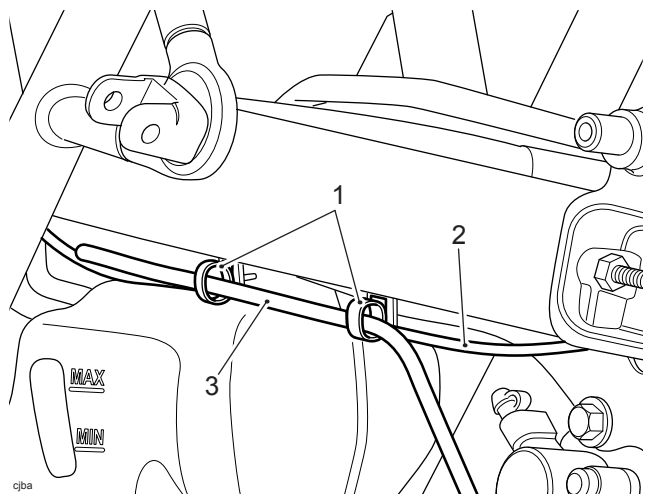
4. Release the fixing securing the wheel speed sensor to the rear brake caliper carrier, and remove the sensor. Collect the shim.



1. Retaining clip (one shown)
2. Fixing
3. Rear ABS wheel speed sensor

Rear ABS Wheel Speed Sensor - Installation

1. Position the wheel speed sensor and shim to the brake caliper carrier, as noted for removal. Fit the fixing and tighten to 9 Nm.
2. Route and secure the ABS wheel speed sensor harness to its retaining clips as noted for removal.
3. Connect the wheel speed sensor electrical connector to the main harness.
4. Refit the left hand side panel (see Side Panels, page 646).
5. Attach the ABS sensor cable and brake hose clips to the left hand side of the swinging arm.

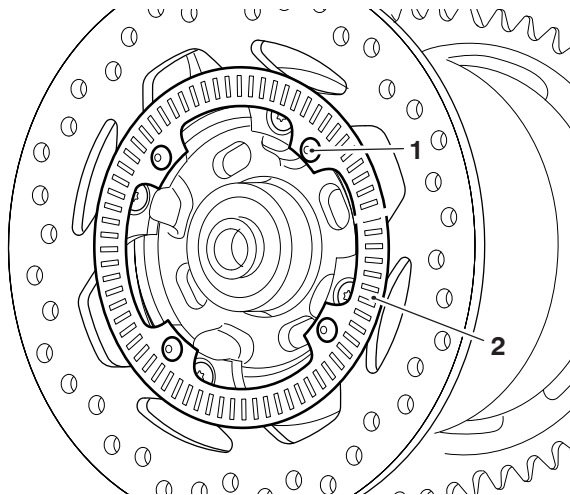


1. Clips
2. ABS sensor cable
3. Brake hose

6. The air gap between the wheel speed sensor ring and the sensor must be between 0.40 mm and 1.20 mm. Check, and if necessary, adjust the air gap (see Air Gap Measurement, page 555).
 - Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
 - Refit the seat (see Seat - Installation, page 645).

Rear ABS Pulser Ring - Removal

- Remove the rear wheel (see Rear Wheel - Removal, page 612).
- Remove and discard the five fixings and remove the pulser ring.



- 1. Fixings (ABS pulser ring)**
- 2. ABS pulser ring**

Rear ABS Pulser Ring - Inspection

- Check the pulser ring for damaged, missing or cracked teeth or distortion. Renew the pulser ring as necessary.

Rear ABS Pulsar Ring - Installation

1. Locate the pulser ring on the brake disc, fit new fixings and tighten to 5 Nm.
2. Refit the rear wheel (see Rear Wheel - Installation, page 614).
3. Check and, if necessary, adjust the air gap between the wheel speed sensor and the ABS pulser ring (see Air Gap Measurement, page 555).

ABS Hydraulic Modulator/ECM - Removal

Warning

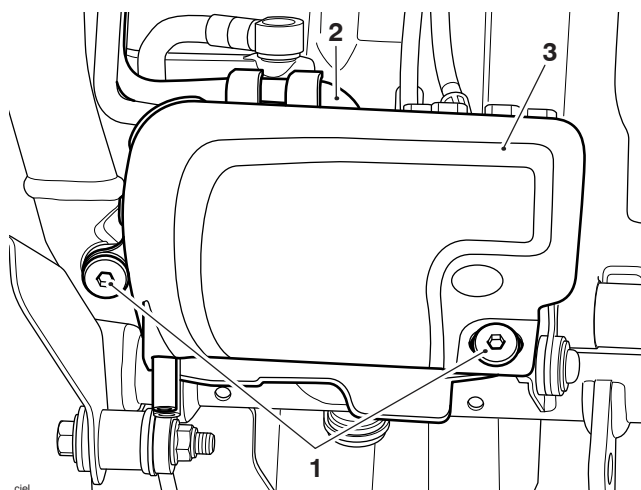
Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

Caution

To prevent paint damage, do not spill brake fluid onto any area of the bodywork. Spilled brake fluid will damage paintwork.

- Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
 - Remove the swinging arm (see Swinging Arm - Removal, page 508).
1. Drain the brake fluid from the front master cylinder by bleeding the system at the front caliper until all fluid has been expelled (see Bleeding the Front Brakes, Renewing Brake Fluid, page 525).
 2. Drain the fluid from the rear master cylinder by bleeding the system at the rear caliper until all fluid has been expelled (see Bleeding the Rear Brakes, Renewing Brake Fluid, page 540).
 3. Detach the ABS modulator harness from the coolant expansion tank cover.

4. Remove the fixings and remove the coolant expansion tank cover.



1. Fixings
2. ABS modulator harness
3. Coolant expansion tank cover

Caution

When loosening the ABS modulator brake line unions, hold the ABS modulator.

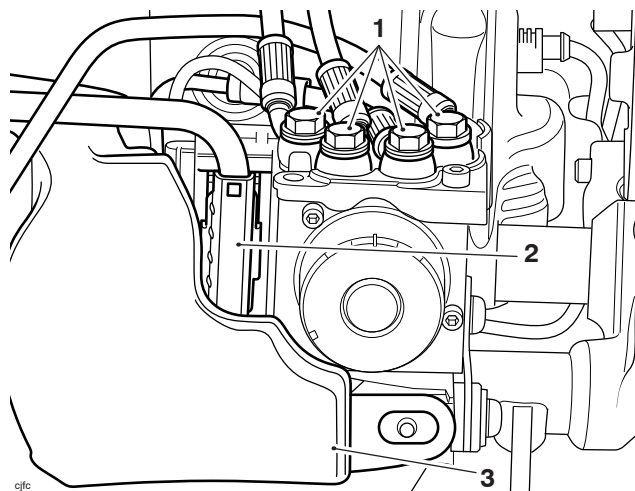
Note the position of the four brake lines on the ABS modulator for installation.

5. Remove the four brake line unions and discard the sealing washers.

Note:

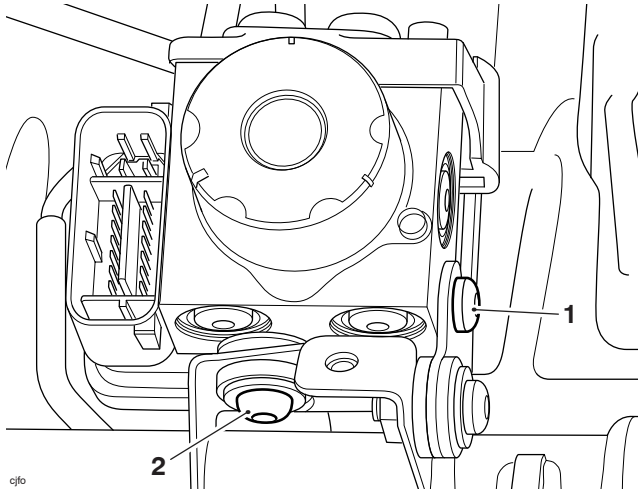
- Note the position of the coolant expansion tank for installation.

6. Reposition the coolant expansion tank and disconnect the ABS modulator multiplug (see ABS Electrical Connectors, page 572).



1. Fixings
2. ABS modulator harness
3. Coolant expansion tank

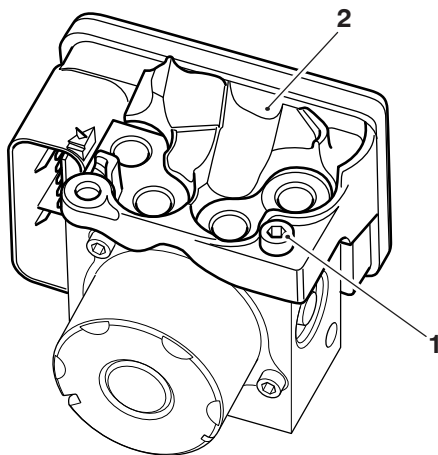
7. Remove the two fixings shown in the following illustration and remove the ABS modulator. Discard the fixings.



1. Fixing (ABS modulator to bracket)

2. Fixing (ABS modulator bracket to frame)

8. If necessary, release the fixing and remove the anti-rotation moulding from the ABS modulator. Discard the fixing.



1. Fixing

2. Anti-rotation moulding

ABS Hydraulic Modulator/ECM - Installation

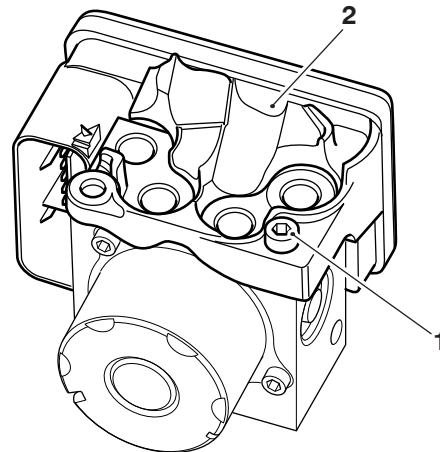
⚠ Warning

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 paint damage, do not spill brake fluid onto any area of the bodywork. Spilled brake fluid will damage paintwork.

1. If removed, fit the anti-rotation moulding and tighten the new fixing to 5 Nm.

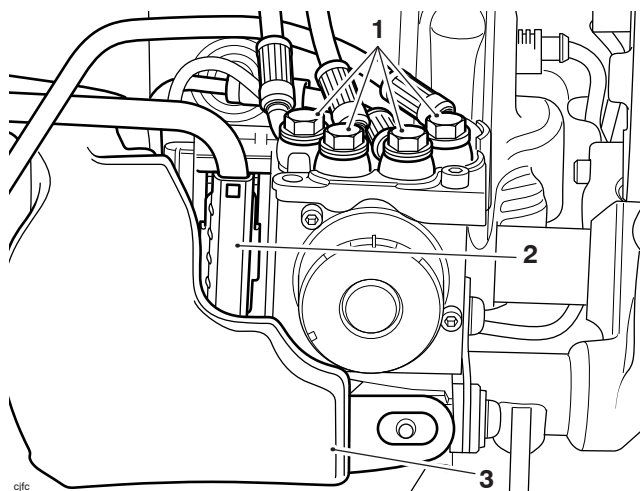


1. Fixing

2. Anti-rotation moulding

2. Position the ABS modulator onto its bracket. Fit new fixings and tighten to 9 Nm.
3. Connect the ABS modulator multiplug (see ABS Electrical Connectors, page 572).

4. Incorporating new washers to either side of the unions, fit the brake lines to the ABS modulator as noted for removal. Tighten the brake line unions to 25 Nm.



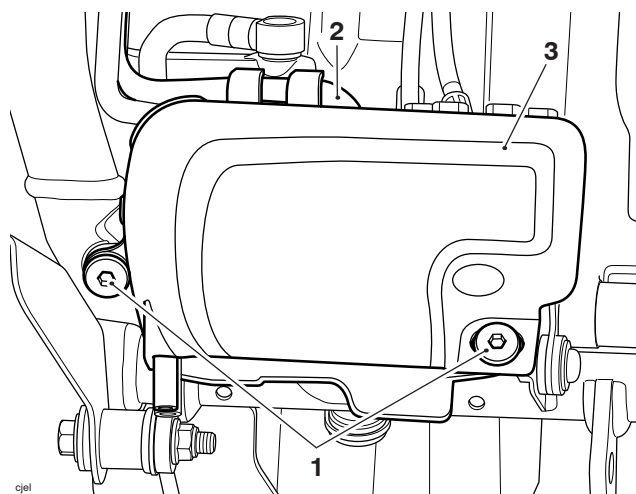
1. Fixings

2. ABS modulator harness

3. Coolant expansion tank

5. Position the coolant expansion tank as noted for removal.

6. Fit the coolant expansion tank cover and tighten the fixings to 4 Nm.
7. Attach the ABS modulator harness to the coolant expansion tank.



1. Fixings

2. ABS modulator harness

3. Coolant expansion tank cover

- Fit the swinging arm (see Swinging Arm - Installation, page 512).
- Reconnect the battery, positive (red) lead first and tighten the battery terminals to 4.5 Nm.
- Refit the seat (see Seat - Installation, page 645).
- Bleed the front brakes (see Bleeding the Front Brakes, Renewing Brake Fluid, page 525).
- Bleed the rear brakes (see Bleeding the Rear Brakes, Renewing Brake Fluid, page 540).
- Check the operation of the front and rear brakes. Rectify as necessary.

Warning

It is dangerous to operate the motorcycle with defective brakes; 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.

Anti-lock Brake System (ABS)

System Description

The Bonneville T120 is fitted with an electronic anti-lock brake system 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 swinging arm, 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 hub.

The front and rear master cylinders are connected via lines to the modulator and from the modulator the lines connect to the brake calipers.

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 slipping, 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 reapplies the brake pressure to prevent the wheel from slipping.

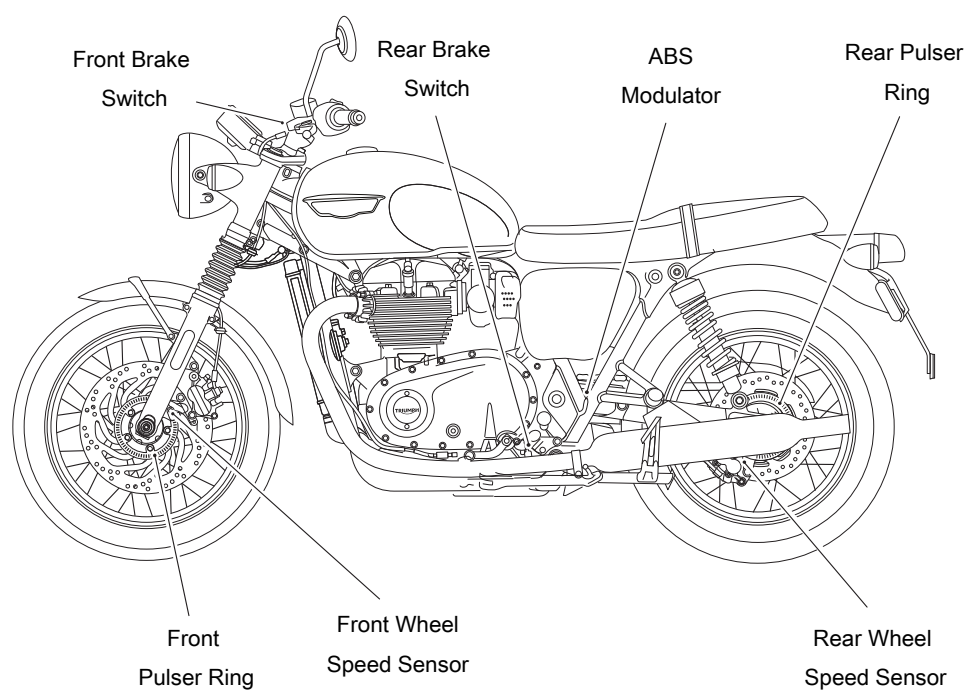
This is felt through the brake pedal or lever as a rapid 'pulsing'.

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 the Triumph Diagnostic 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 flash on and off after the ignition is switched on and 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 System Diagnostics, page 567).

Component Locations



ABS System Circuit Tables

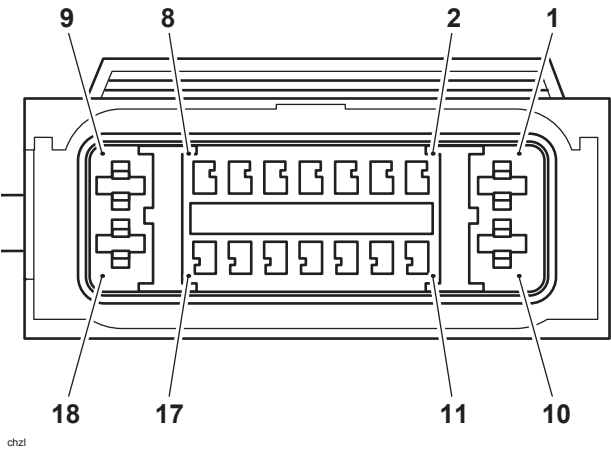
Key To Wiring Circuit Diagram

Key	Item Description
1	ABS Modulator
2	Fuse Box
3	Front Brake Switch
4	Rear Brake Switch
5	Engine Electronic Control Module - Connector A
6	Rear Light Sub-harness Connector
7	Front Wheel Speed Sensor
8	Rear Wheel Speed Sensor
9	Instruments Connector
10	Diagnostic Connector

Key To Wiring Colour Codes

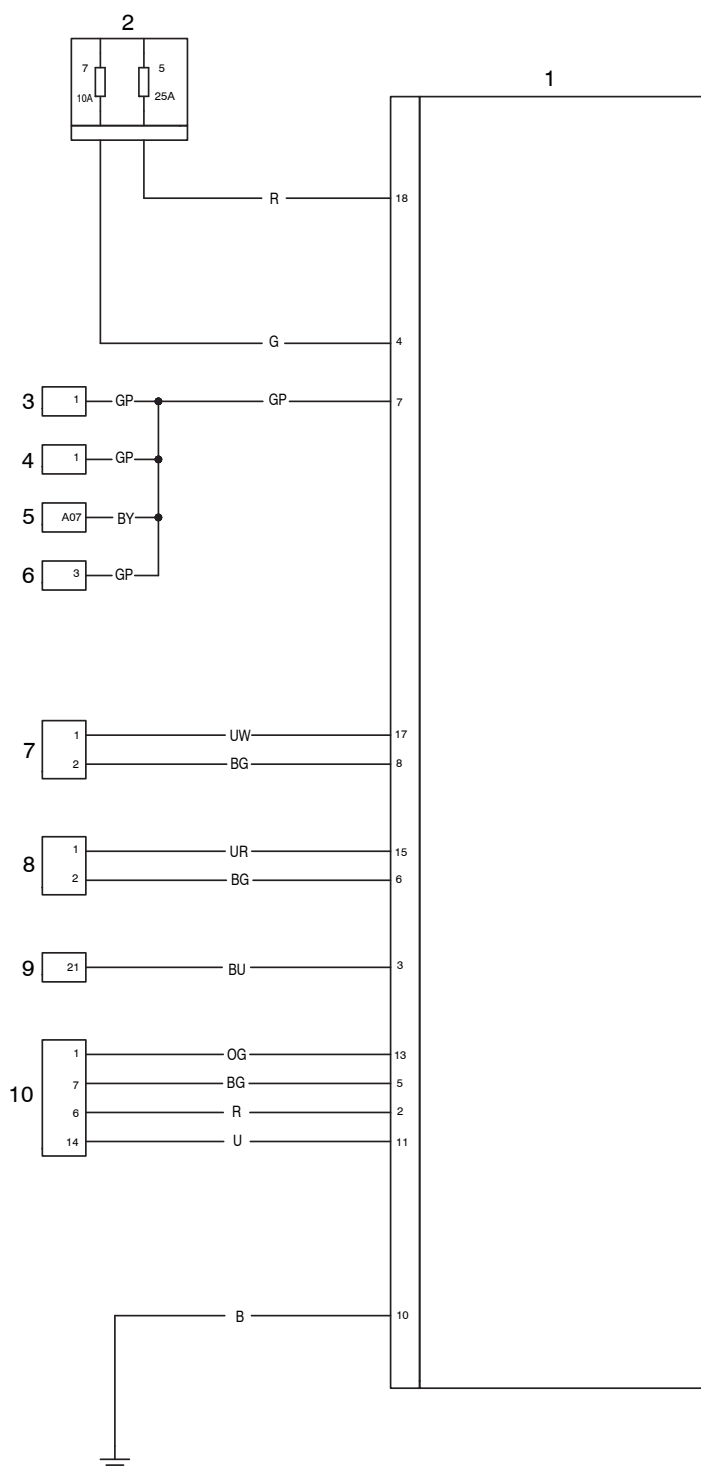
Code	Wiring Colour
B	Black
U	Blue
N	Brown
G	Green
S	Slate/Grey
O	Orange
K	Pink
R	Red
P	Purple
W	White
Y	Yellow
LG	Light Green
LU	Light Blue

ABS ECM Connector Pin Numbering



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 right to left with number one in the top right hand corner.

ABS System Circuit Diagram



System Diagnostics

The ABS system has an on-board diagnostics feature which allows service technicians to retrieve stored data from the ECM using Triumph diagnostic software. Full details of the Triumph diagnostic software operation and how to interpret the results are given in the Triumph Diagnostic Tool User Guide.

The software is connected, via an interface cable, 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 software 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.

Diagnostic Tool Connection

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.

Triumph Diagnostic Software - ABS

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 diagnostic software.

The tables indicate which tests are performed by the on-board system and what information can be retrieved by the Triumph diagnostic software.

Note:

- **Full details of how to operate the software can be found in the Triumph Diagnostic Tool User Guide, which can be downloaded by authorised Triumph dealers from www.triumphonline.net.**

Build Data

The **Build Data** screen will display the following information:

Function Examined
ECM type
ECM ID number
Software version number

Current Data

The **Current Data** screen will display the following information:

Function Examined	Result Reported (Scale)
Front wheel speed	km/h
Rear wheel speed	km/h
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.

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 Codes

Dependant on the DTC stored, the ABS ECM will act in one of two ways:

1. Inhibit ABS operation immediately, irrespective of the ABS operating mode;
or
2. 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:

1. Allow the ABS to resume operation if the fault clears;
or
2. Allow ABS operation after an ignition cycle if the fault clears;
or
3. 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 table:

Note:

- **ABS is Active means that the ABS system is completing an ABS manoeuvre.**

Brakes

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 (DTC still stored for 40 cycles)
Front Wheel Sensor Open Circuit/Short Circuit	Yes	Yes		No DTC stored for 40 cycles
Front Wheel Sensor Abnormal Input/Losing Contact	Yes	Yes	Yes	Yes, if after ignition cycle, no fault is detected. DTC remains stored - for 40 cycles
Rear Wheel Sensor Open Circuit/Short Circuit	Yes	Yes		No
Rear Wheel Sensor Abnormal Input/Losing Contact	Yes	Yes	Yes	Yes, if after ignition cycle, no fault is detected. DTC remains stored - for 40 cycles
Front Wheel Pulser Gear Missing Teeth	Yes	Yes	Yes	Yes, if after ignition cycle, no fault is detected for 1 second and speed exceeds 30 km/h. DTC remains stored - for 40 cycles
Rear Wheel Pulser Gear Missing Teeth	Yes	Yes	Yes	Yes, if after ignition cycle, no fault is detected for 1 second and speed exceeds 30 km/h. DTC remains stored - for 40 cycles
Front Wheel Input Solenoid Open/Short Circuit	Yes	Yes		No
Front Wheel Output Solenoid Open/Short Circuit	Yes		Yes	No
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	Yes, if after ignition cycle, no fault is detected. DTC remains stored
Rear Wheel Actuator (Hydraulic Control) Wheel Lock	Yes	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

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 (DTC still stored for 40 cycles)
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

ABS Electrical Connectors

Before beginning any diagnosis, the following connector related information should be noted:

Note:

- **A major cause of hidden electrical faults can be traced to faulty electrical connectors.**

For example:

- Dirty/corroded terminals
- Damp terminals
- Broken or bent cable pins within multiplugs.

For example, the 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.

Reconnection of the ABS ECM Connector

Caution

Damage to the connector pins may result if an attempt to fit the connectors incorrectly is made.

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 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.

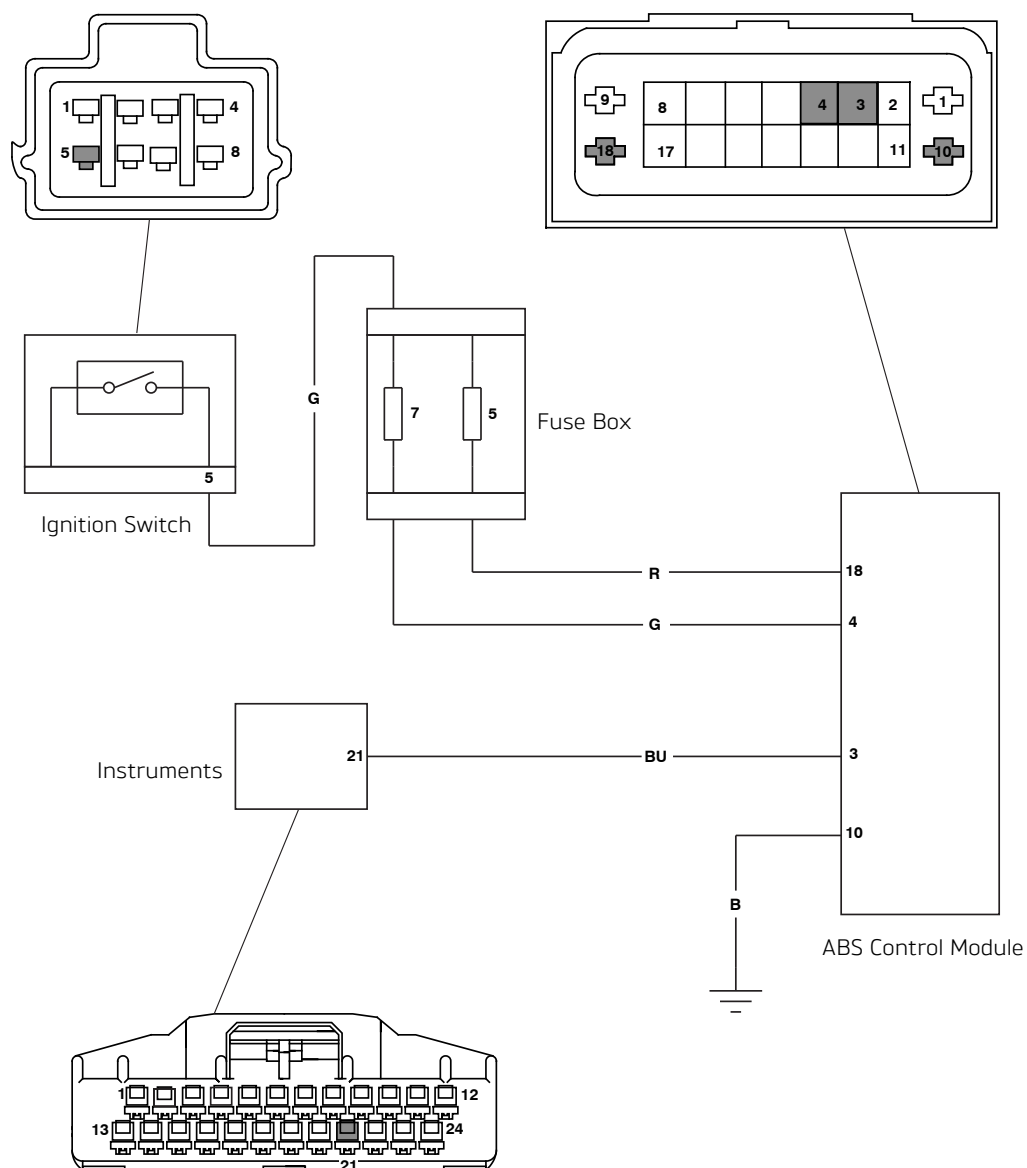
ABS Warning Light ON (No DTCs Stored)

Fault Code	Possible cause	Action
ABS Warning Light ON (No DTCs Stored)	ABS Ignition supply fuse/circuit fault ABS Warning light 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: - ABS ECM connector pin 4 and ground pin 10	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: - ABS ECM connector pin 4 and ground pin 10	Voltage greater than 10 V	Proceed to test 3
	Voltage less than 10 V	Locate and rectify wiring fault, proceed to test 5
3 Check cable continuity of the ABS warning light circuit: Check voltage between: - ABS ECM connector pin 3 and ground pin 10	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 3 and ground pin 10 together: 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



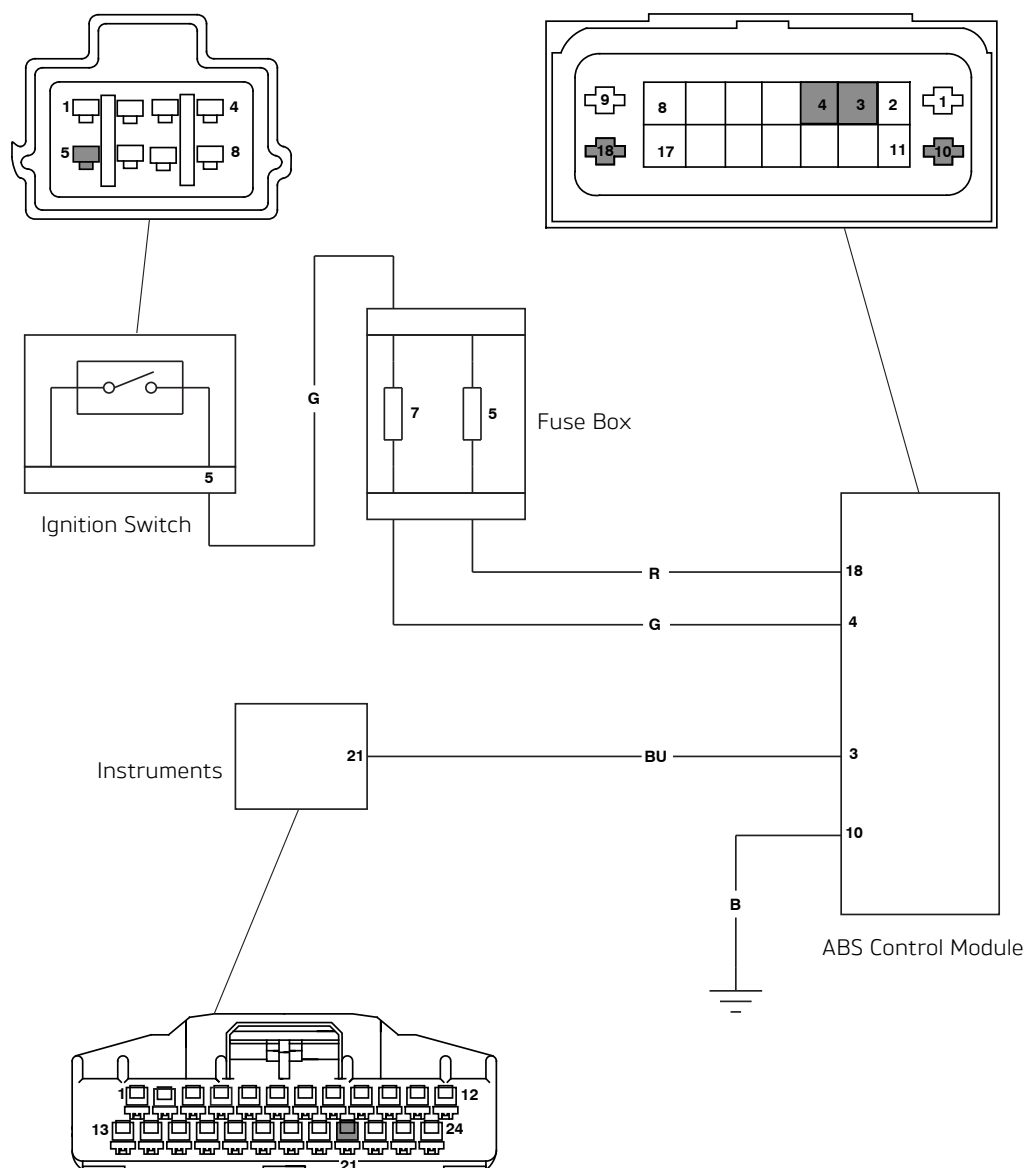
ABS Warning Light Does not Illuminate (No DTCs Stored)

Fault Code	Possible cause	Action
ABS Warning Light OFF (No DTCs Stored)	Warning light circuit fault ABS ECM ground circuit fault	Ensure ABS ECM connector is secure. Ensure ABS ECM ground connection is secure. Disconnect ABS ECM connector and proceed to pinpoint test 1:

Pinpoint Tests

Test	Result	Action
1 Check the ABS warning light circuit and ignition fuses in the fuse box (fuse 7 and 5:	OK	Proceed to test 2
	Faulty	Rectify fault, proceed to test 6
2 Check cable and terminal integrity: - ABS ECM connector pin 4 and ground pin 10	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: - ABS ECM connector pin 4 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: - ABS ECM connector pin 3 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 10 and ground:	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 sensor short circuit to ground or open circuit	Ensure ABS ECM connector is secure. Ensure wheel speed sensor connector is secure. Disconnect ABS ECM connector and proceed to pinpoint test 1:

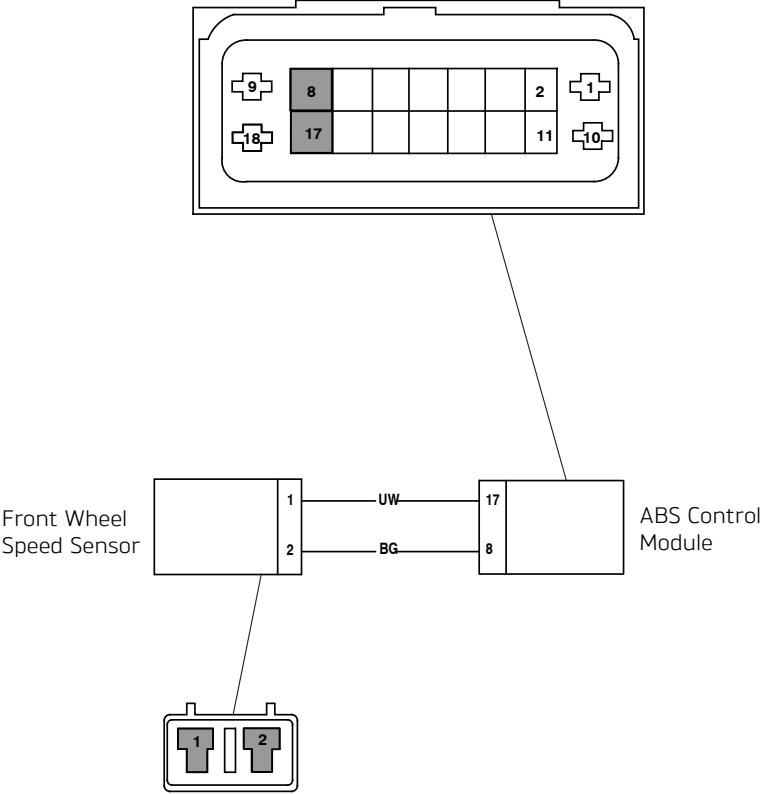
Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity: - ABS ECM connector pin 17 and ABS ECM connector pin 8	OK	Proceed to test 2
	Faulty	Rectify fault, proceed to test 9
2 Check cable for short circuit: - ABS ECM connector pin 8 and ground	OK	Proceed to test 4
	Short circuit	Proceed to test 3
3 Disconnect the front wheel speed sensor connector. Check cable for short circuit: - Wheel speed sensor connector pin 2 (motorcycle harness side) and ground	OK	Replace the wheel speed sensor, proceed to test 9
	Short circuit	Locate and rectify wiring harness fault, proceed to test 9
4 Check cable for short circuit: - ABS ECM connector pin 17 and ground	OK	Proceed to test 6
	Short circuit	Proceed to test 5
5 Check cable for short circuit: - Wheel speed sensor connector pin 1 (motorcycle harness side) and ground	OK	Replace the wheel speed sensor, proceed to test 9
	Short circuit	Locate and rectify wiring harness fault, proceed to test 9
6 Check cable continuity: - ABS ECM connector pin 8 and wheel speed sensor connector pin 2 (motorcycle harness side)	OK	Proceed to test 7
	Open circuit	Locate and rectify wiring harness fault, proceed to test 9
7 Check cable continuity: - ABS ECM connector pin 17 and wheel speed sensor connector pin 1 (motorcycle harness side)	OK	Proceed to test 8
	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: - Connect a suitable voltage supply between 10 V and 16 V between ABS ECM connector pin 8 (positive) and pin 17 (negative), and measure the current consumption of the wheel speed sensor	1.8 mA to 16.8 mA	Proceed to test 9
	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:

Supply Voltage	Min	Typical	Max
10 - 16 V	5.9 mA	7.5 mA	16.8 mA



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Rear Wheel Sensor Open Circuit/Short Circuit

Fault Code	Possible cause	Action
C1613	Rear wheel sensor short circuit to ground or open circuit	Ensure ABS ECM connector is secure. Ensure wheel speed sensor connector is secure. Disconnect ABS ECM connector and proceed to pinpoint test 1:

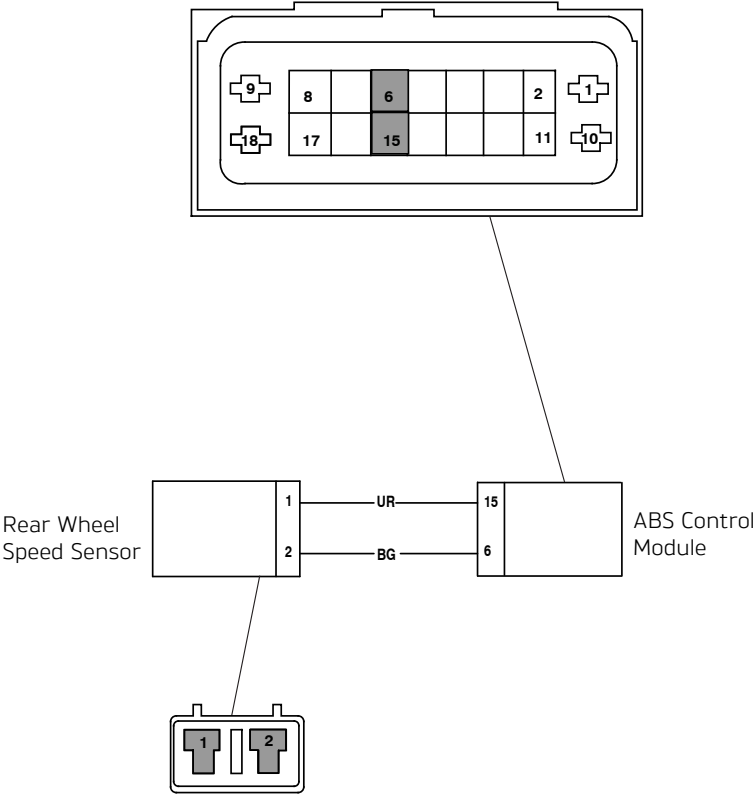
Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity: - ABS ECM connector pin 6 and ABS ECM connector pin 15	OK	Proceed to test 2
	Faulty	Rectify fault, proceed to test 9
2 Check cable for short circuit: - ABS ECM connector pin 6 and ground	OK	Proceed to test 4
	Short circuit	Proceed to test 3
3 Disconnect the rear wheel speed sensor connector. Check cable for short circuit: - Wheel speed sensor connector pin 6 (motorcycle harness side) and ground	OK	Replace the wheel speed sensor, proceed to test 9
	Short circuit	Locate and rectify wiring harness fault, proceed to test 9
4 Check cable for short circuit: - ABS ECM connector pin 15 and ground	OK	Proceed to test 6
	Short circuit	Proceed to test 5
5 Check cable for short circuit: - Wheel speed sensor connector pin 1 (motorcycle harness side) and ground	OK	Replace the wheel speed sensor, proceed to test 9
	Short circuit	Locate and rectify wiring harness fault, proceed to test 9
6 Check cable continuity: - ABS ECM connector pin 6 and wheel speed sensor connector pin 2 (motorcycle harness side)	OK	Proceed to test 7
	Open circuit	Locate and rectify wiring harness fault, proceed to test 9
7 Check cable continuity: - ABS ECM connector pin 15 and wheel speed sensor connector pin 1 (motorcycle harness side)	OK	Proceed to test 8
	Open circuit	Locate and rectify wiring harness fault, proceed to test 9
8 Reconnect the rear wheel speed sensor connector. Check the wheel speed sensor operation: - Connect a suitable voltage supply between 10 V and 16 V between ABS ECM connector pin 6 (positive) and pin 15 (negative), and measure the current consumption of the wheel speed sensor	1.8 mA to 16.8 mA	Proceed to test 9
	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:

Supply Voltage	Min	Typical	Max
10 - 16 V	5.9 mA	7.5 mA	16.8 mA



Front Wheel Sensor Abnormal Input/Losing Contact

Fault Code	Possible cause	Action
C1612	Front wheel sensor incorrect or missing signal Incorrect wheel speed sensor air gap Damaged or dirty pulser ring Loose or incorrectly installed wheel speed sensor	Ensure ABS ECM connector is secure. Ensure wheel speed sensor connector is secure. 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: - Air gap between 0.40 mm and 1.20 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 Front Wheel Sensor Open Circuit/Short Circuit, page 578)	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

Rear Wheel Sensor Abnormal Input/Losing Contact

Fault Code	Possible cause	Action
C1614	Rear wheel sensor incorrect or missing signal Incorrect wheel speed sensor air gap Damaged or dirty pulser ring Loose or incorrectly installed wheel speed sensor	Ensure ABS ECM connector is secure. Proceed to pinpoint test 1:

Pinpoint Tests

Test	Result	Action
1 Measure the air gap of the rear wheel speed sensor between the sensor and the pulser ring: - Air gap between 0.40 mm and 1.20 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 Rear Wheel Sensor Open Circuit/ Short Circuit, page 582)	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

Front Wheel Pulser Ring Missing Teeth

Fault Code	Possible cause	Action
C1621	Front wheel pulser ring missing teeth Damaged or dirty pulser ring Loose or incorrectly installed wheel speed sensor Damaged/incorrect wheels	Ensure ABS ECM connector is secure. 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: - Air gap between 0.40 mm and 1.20 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 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

Rear Wheel Pulser Ring Missing Teeth

Fault Code	Possible cause	Action
C1623	Rear wheel pulser ring missing teeth Damaged or dirty pulser ring Loose or incorrectly installed wheel speed sensor Damaged/incorrect wheels	Ensure ABS ECM connector is secure. Proceed to pinpoint test 1:

Pinpoint Tests

Test	Result	Action
1 Measure the air gap of the rear wheel speed sensor between the sensor and the pulser ring: - Air gap between 0.40 mm and 1.20 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 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

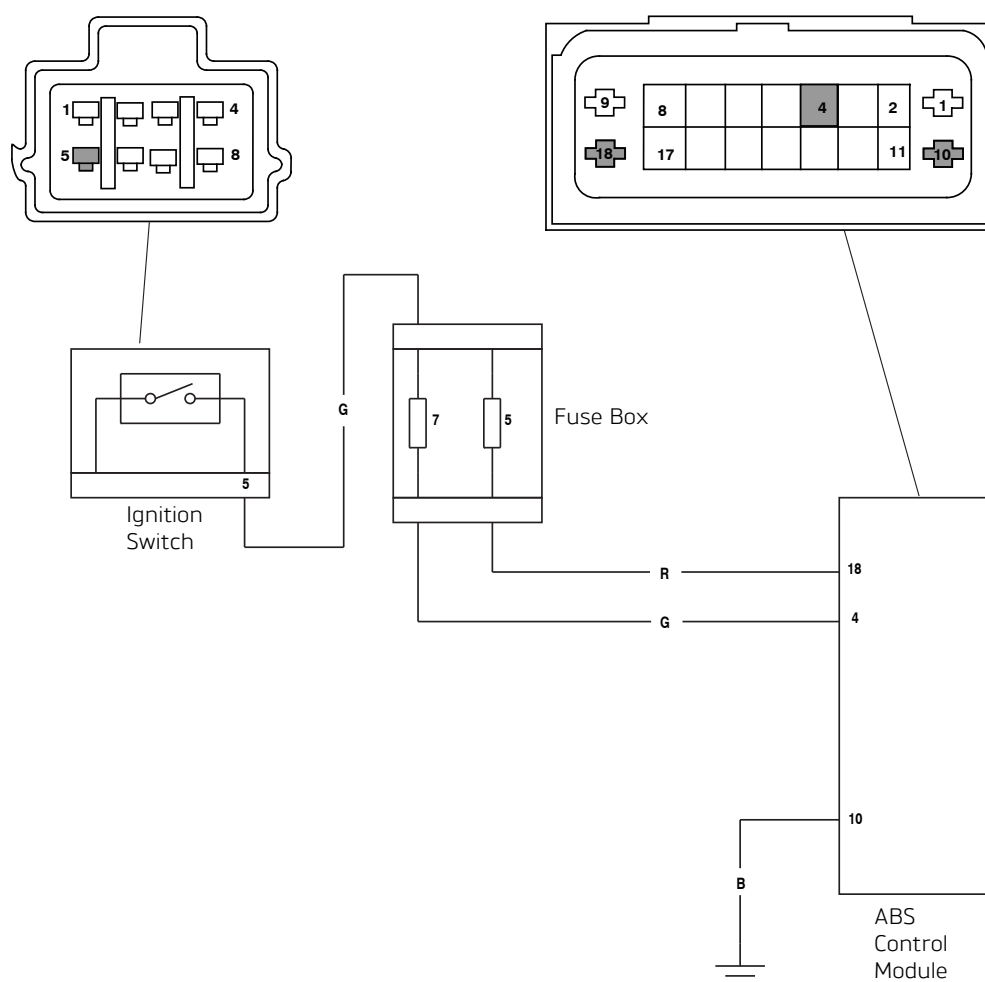
Front or Rear Input/Output solenoid Open/Short Circuit

Fault Code	Possible cause	Action
C1631	Front wheel input solenoid short circuit to ground or open circuit	Ensure ABS ECM connector is secure. Disconnect ABS ECM connector and proceed to pinpoint test 1:
C1632	Front wheel output solenoid short circuit to ground or open circuit	
C1633	Rear wheel input solenoid short circuit to ground or open circuit	
C1634	Rear wheel output solenoid short circuit to ground or open circuit	
C1635	Master cylinder isolation valve short circuit to ground or open circuit	
C1636	Low pressure feed valve short circuit to ground or open circuit	
C1654	Solenoid relay does not operate or operates continually	

Pinpoint Tests

Test	Result	Action
1 Check the ABS main fuse in the fuse box (fuse 5):	OK	Proceed to test 3
	Faulty	Proceed to test 2
2 Check cable and terminal integrity: - ABS ECM connector pin 18 and ground pin 10	OK	Replace fuse, proceed to test 5
	Faulty	Rectify fault, replace fuse, proceed to test 5
3 Check cable continuity: With ignition 'ON', check voltage between: - ABS ECM connector pin 18 and ground pin 10	Voltage greater than 11 V	Proceed to test 4
	Voltage less than 11 V	Locate and rectify fault, proceed to test 5
4 Check cable for continuity: - ABS ECM connector pin 10 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



Incorrect Tyre Size Detected

Fault Code	Possible cause	Action
C1671	Incorrect tyre size detected Incorrect tyre pressures Incorrect wheel speed sensor air gap Damaged or dirty pulser ring	Ensure ABS ECM connector is secure. 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 rings 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 wheel speed sensors between the sensor and the pulser ring: - Air gap between 0.40 mm to 1.20 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

Front or Rear Wheel Actuator (Hydraulic Control) Wheel Lock

Fault Code	Possible cause	Action
C1641;	Front Wheel Actuator (Hydraulic Control) Wheel Lock Binding brake Incorrect Wheel speed sensor air gap Loose or incorrectly installed wheel speed sensor	Ensure ABS ECM connector is secure. Proceed to pinpoint test 1:
C1643	Rear Wheel Actuator (Hydraulic Control) Wheel Lock Binding brake Incorrect Wheel speed sensor air gap Loose or incorrectly installed wheel speed sensor	

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: - Air gap between 0.40 mm to 1.20 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

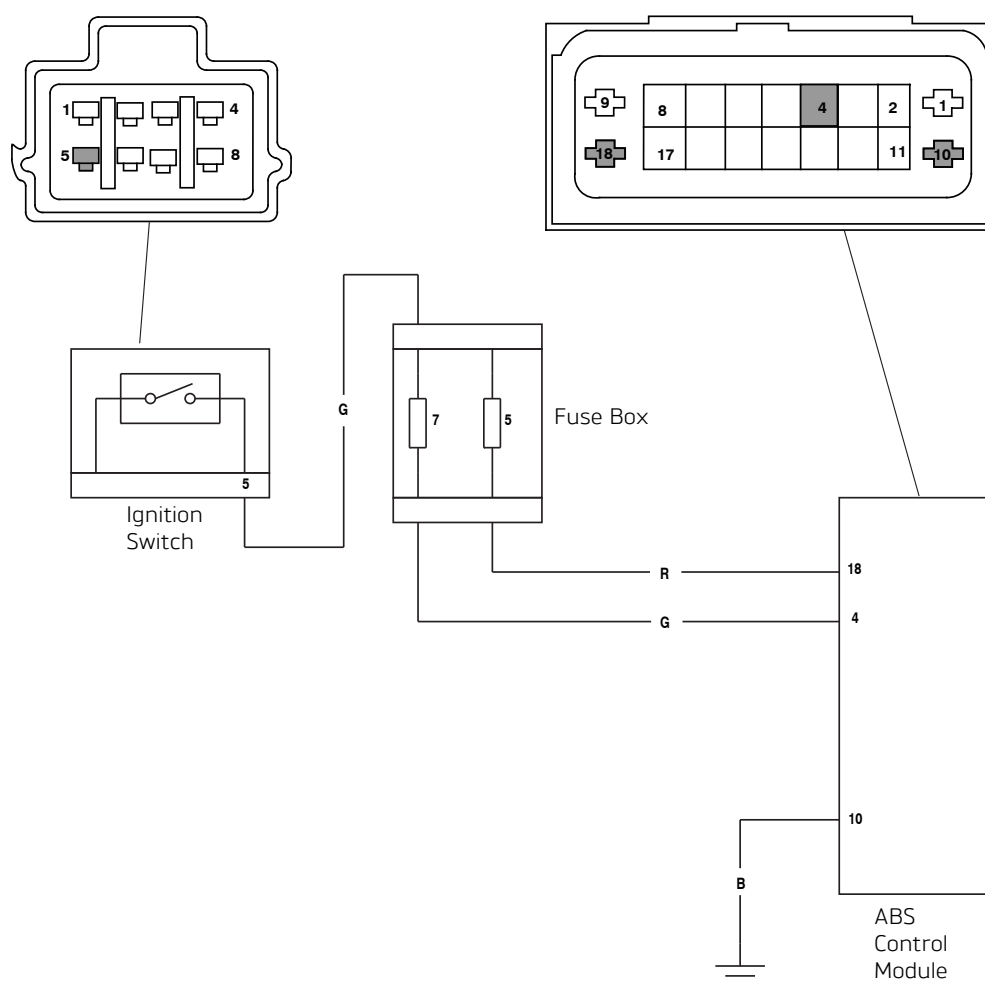
Motor – Lock; Motor Stuck OFF; Motor stuck ON

Fault Code	Possible cause	Action
C1651	Motor - Circuit fault	Ensure ABS ECM connector is secure. Turn the ignition 'ON'. Proceed to pinpoint test 1:
C1652	Motor - Does not run	
C1653	Motor - Runs continually	

Pinpoint Tests

Test	Result	Action
1 Check the ABS main fuse in the fuse box (fuse 5)	OK	Proceed to test 2
	Faulty	Replace fuse and proceed to test 5
2 Check the motor function: Check that with the motorcycle stationary and the ABS ECM modulator connected, the motor does not operate	OK	Proceed to test 3
	Motor runs continually	Contact Triumph service
3 Check cable continuity: With ignition 'ON', check voltage between: - ABS ECM connector pin 18 and ground pin 10	Voltage greater than 11 V	Proceed to test 4
	Voltage less than 11 V	Locate and rectify wiring fault, proceed to test 5
4 Check cable for continuity: - ABS ECM connector pin 10 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



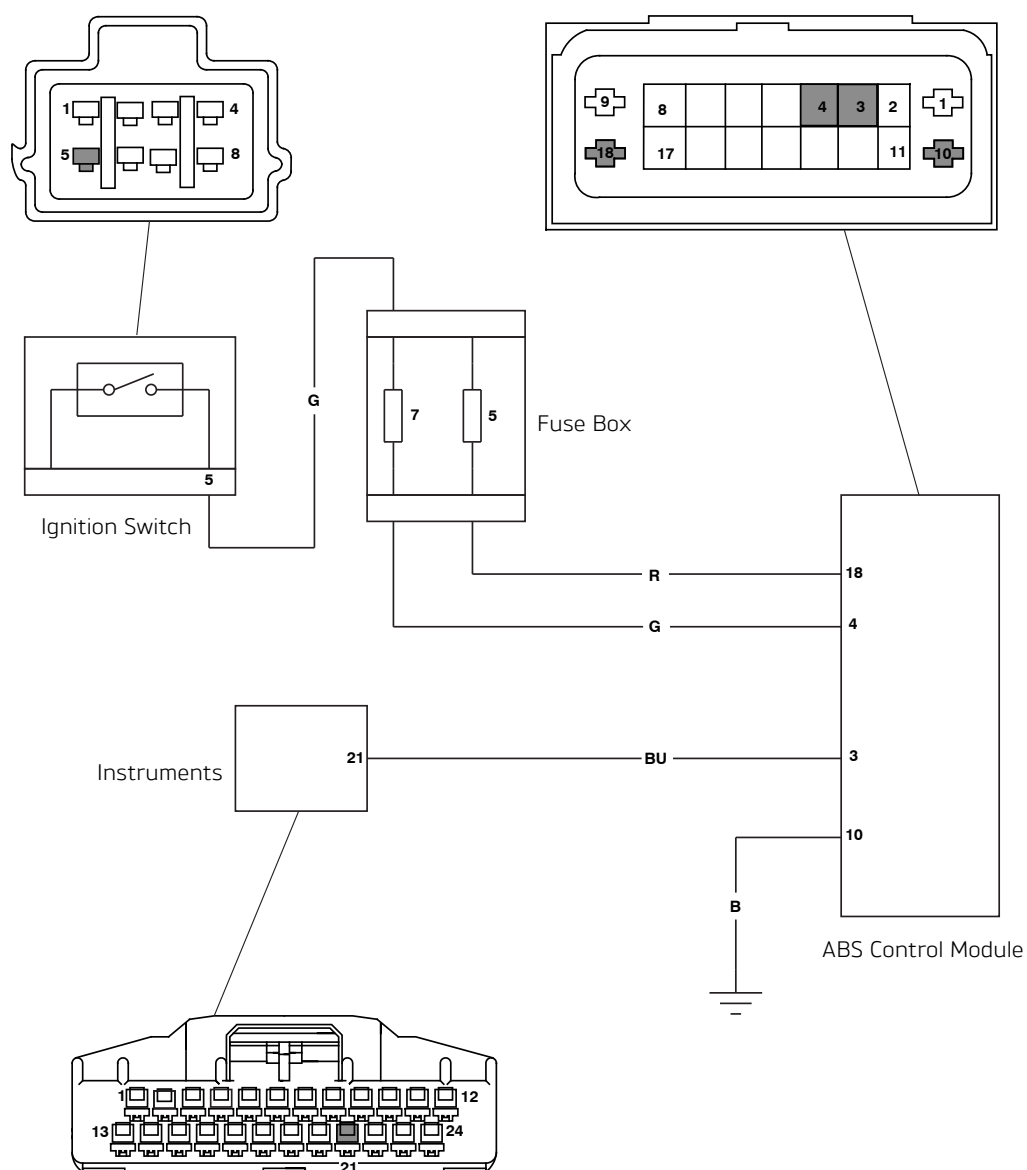
Power Source Voltage Drop/Voltage Rise

Fault Code	Possible cause	Action
C1661;	Power source voltage too low	Ensure ABS ECM connector is secure. Disconnect ABS ECM connector and proceed to pinpoint test 1:
C1662	Power source voltage too high	

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity: - ABS ECM connector pin 4 and ground pin 10	OK	Proceed to test 2
	Faulty	Rectify fault, proceed to test 5
2 Check the cable for continuity: - ABS ECM connector pin 10 and ground	OK	Proceed to test 3
	Faulty	Rectify wiring harness fault, proceed to test 5
3 Check battery voltage: With ignition 'ON', check the voltage between: - ABS ECM connector pin 4 and ground pin 10	Voltage greater than 11 V	Proceed to test 4
	Voltage less than 11 V	Locate and rectify fault, proceed to test 5
4 Check battery voltage: Reconnect ABS ECM connector and start the engine, check the voltage between: - Battery positive (red) terminal and negative (black) terminal	Voltage between 11 V and 16 V	Proceed to test 5
	Voltage greater than 16 V	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



CAN Fault

Fault Code	Possible cause	Action
C1682	CAN fault - lost communication with engine ECM	Ensure ABS ECM connector is secure. Proceed to pinpoint test 1:
C1683	CAN fault - lost communication with instrument panel	
C1684	CAN fault - all communication lost	

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity: - ABS ECM connector pin 2 - ABS ECM connector pin 11	OK	Disconnect instruments and proceed to test 2
	Faulty	Rectify fault, proceed to test 5
2 Check the cable for continuity: - ABS ECM pin 2 to ground - ABS ECM pin 11 to ground	OK	Proceed to test 3
	Short circuit	Rectify wiring harness fault, proceed to test 5
3 Check cable continuity: - ABS ECM pin 2 to ECM pin A33 - ABS ECM pin 11 to ECM pin A34 - ABS ECM pin 2 to Instruments pin 9 - ABS ECM pin 11 to Instruments pin 10 - ABS ECM pin 2 to Diagnostic connector pin 6 - ABS ECM pin 11 to Diagnostic connector pin 14 - ABS ECM pin 2 to Immobiliser module pin 6 - ABS ECM pin 11 to Immobiliser module pin 1	OK	Proceed to test 4
	Open circuit	Rectify wiring harness fault, proceed to test 5
4 Check cable for short circuit: - ABS ECM pin 2 to ABS ECM pin 11	OK	Proceed to test 5
	Short circuit	Rectify wiring harness 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

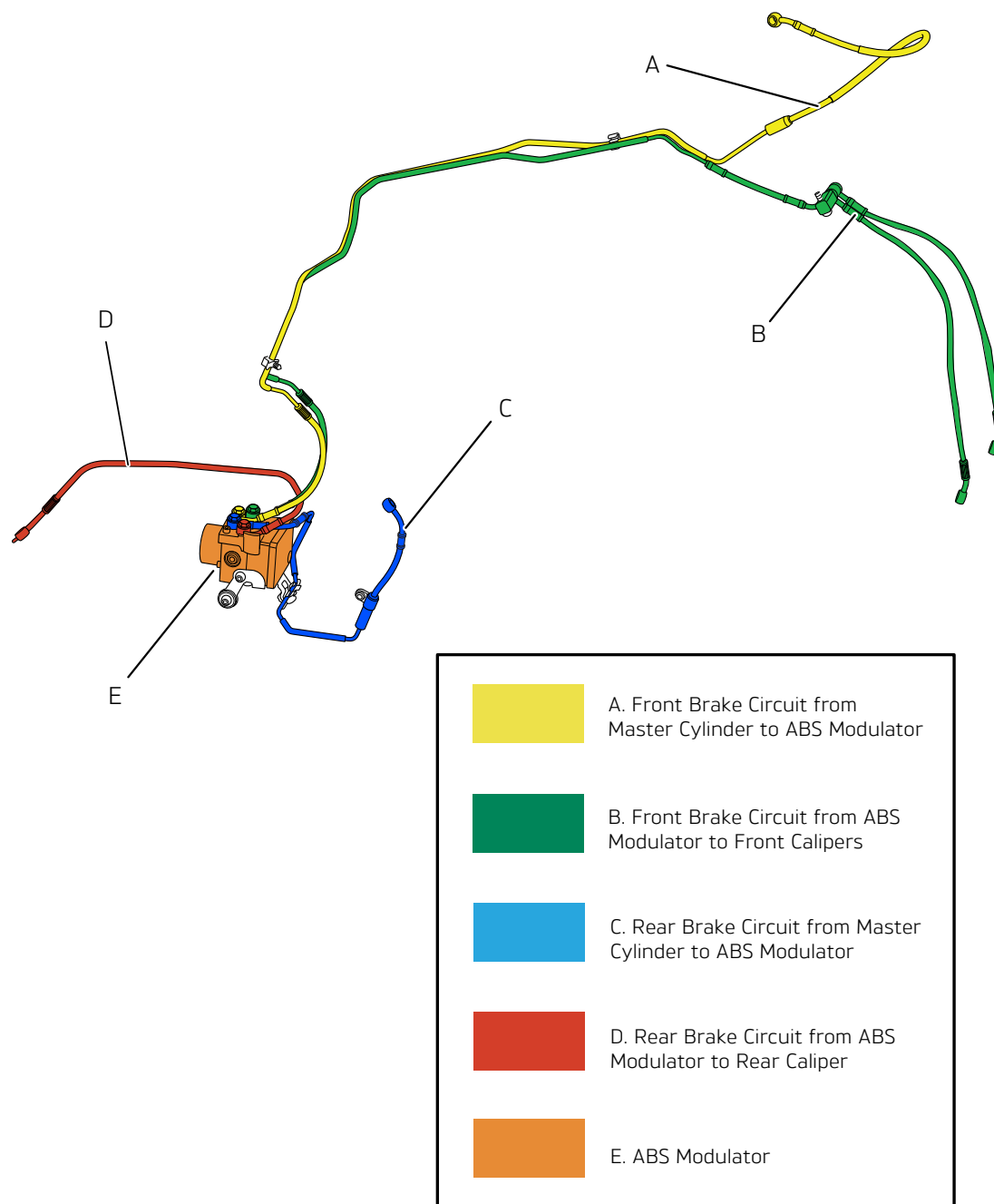
ABS ECM Internal Error

Fault Code	Possible cause	Action
C1681	ABS ECM internal error Incorrect wheel speed sensor air gap Damaged or dirty pulser ring Loose or incorrectly installed wheel speed sensor	Ensure ABS ECM connector is secure. 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: - Air gap between 0.40 mm to 1.20 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



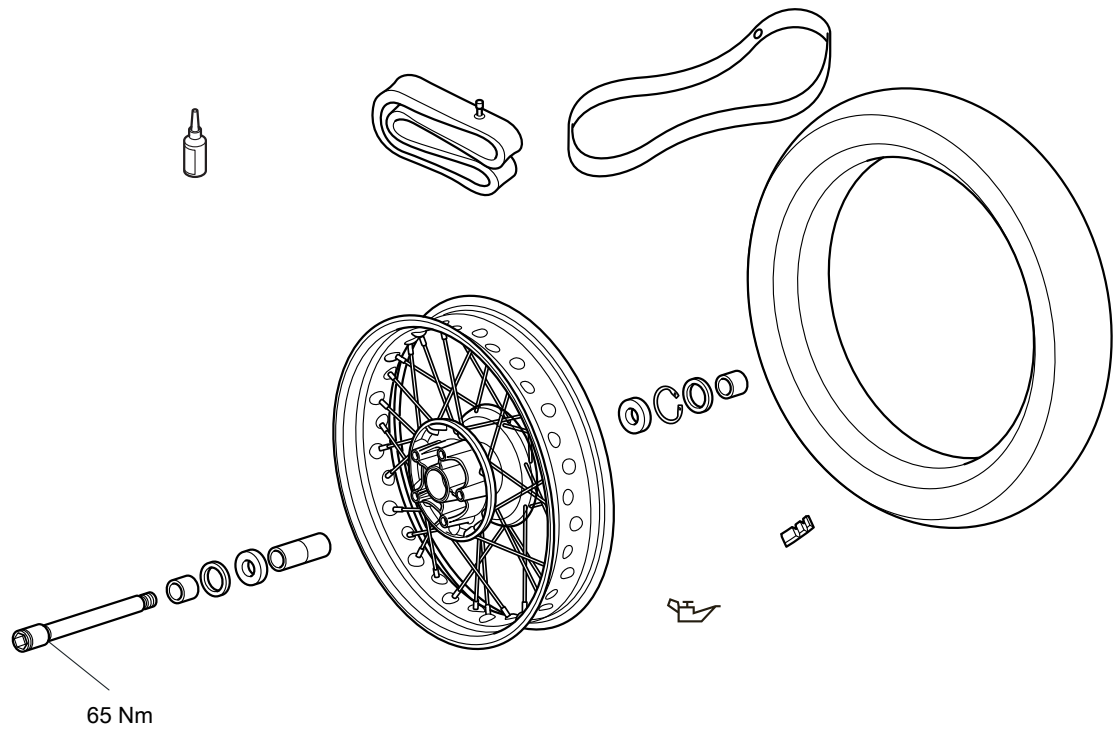
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23 Wheels And Tyres

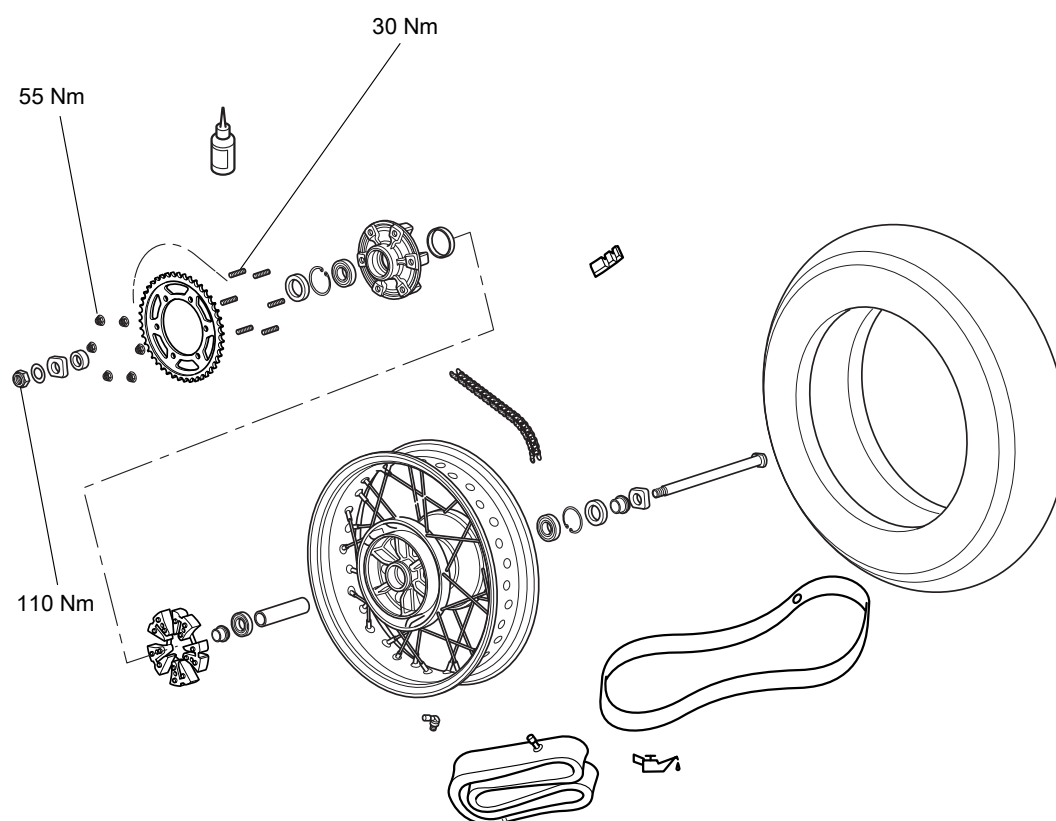
Table of Contents

Exploded View – Front Wheel	603
Exploded View – Rear Wheel and Cush Drive	604
Tyres	605
Tyre Inflation Pressures.....	605
Minimum Recommended Tread Depth	606
Important Tyre Information.....	607
Tyre Wear/Wheel Inspection	608
Front Wheel - Removal.....	609
Front Wheel - Inspection.....	610
Front Wheel - Installation	611
Rear Wheel - Removal	612
Rear Wheel - Inspection	613
Rear Wheel - Installation.....	614
Front and Rear Wheel Bearings - Removal.....	615
Inspection - Bearings.....	616
Front and Rear Wheel Bearings - Installation	616

Exploded View – Front Wheel



Exploded View – Rear Wheel and Cush Drive



Tyres

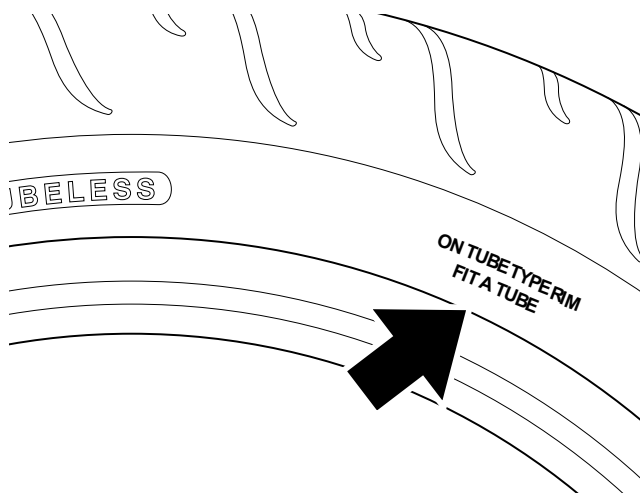
Street Twin is fitted with tubeless tyres, valves and wheel rims. Use only tyres marked 'TUBELESS' and tubeless valves on rims marked 'SUITABLE FOR TUBELESS TYRES'.

Warning

Inner tubes must only be used on motorcycles fitted with spoked wheels and with tyres marked 'TUBE TYPE'.

Some brands of approved tyres marked 'TUBELESS' may be suitable for use with an inner tube. Where this is the case, the tyre wall will be marked with text permitting the fitment of an inner tube (see illustration below).

Use of an inner tube with a tyre marked 'TUBELESS', and NOT marked as suitable for use with an inner tube, or use of an inner tube on an alloy wheel marked 'SUITABLE FOR TUBELESS TYRES' will cause deflation of the tyre resulting in loss of motorcycle control and an accident.



Typical Tyre Marking - Tubeless Tyre Suitable For Use With An Inner Tube

Tyre Inflation Pressures

Warning

Incorrect tyre inflation will cause abnormal tread wear and instability problems that may lead to loss of control and an accident.

Underinflation may result in the tyre slipping on, or coming off the rim. Overinflation will cause instability and accelerated tread wear.

Both conditions are dangerous as they may cause loss of control leading to an accident.

Correct inflation pressure will provide maximum stability, rider comfort and tyre life. Always check tyre pressures before riding when the tyres are cold. Check tyre pressures daily and adjust if necessary. See the Specification section for details of the correct inflation pressures.

Minimum Recommended Tread Depth

In accordance with the periodic 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 specified in the table below:

Under 80 mph (130 km/h)	0.08 in (2 mm)
Over 80 mph (130 km/h)	Rear 0.12 in (3 mm) Front 0.08 in (2 mm)

 **Warning**

This Triumph motorcycle 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 racetracks. 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.

 **Warning**

Operation with excessively worn tyres is hazardous and will adversely affect traction, stability and handling which may lead to loss of control and 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. Operation with punctured or damaged tyres will adversely affect motorcycle stability and handling which may lead to loss of control or an accident.

Check the rims for dents or deformation. Operation with damaged or defective wheels or tyres is dangerous and loss of motorcycle control or an accident could result.

Always consult your authorised Triumph dealer for tyre replacement, or for a safety inspection of the tyres.

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. A list of approved tyres specific to this model is available from your authorised Triumph dealer, or on the internet at www.triumph.co.uk.

Warning

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 motorcycle 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 and control leading to loss of control or an accident.

Warning

Inner tubes must only be used on motorcycles fitted with spoked wheels and with tyres marked 'TUBE-TYPE'.

Use of an inner tube with a tyre marked 'TUBELESS' and/or on an alloy wheel can lead to loss of motorcycle control and an accident.

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. A list of approved tyres

Warning

specific to this model is available from your authorised Triumph dealer, or on the internet at www.triumph.co.uk.

Warning

If a tyre or inner tube sustains a puncture, the tyre and inner tube must be replaced together. Failure to replace a punctured tyre and inner tube together, or operation with a repaired tyre or inner tube can lead to instability, loss of motorcycle control or an accident.

If tyre or inner tube damage is suspected, such as after striking the kerb, ask your authorised Triumph dealer to inspect the tyre both internally and externally and to also inspect the inner tube. Remember, tyre damage may not always be visible from the outside. Operation of the motorcycle with damaged tyres could lead to loss of motorcycle control and an accident.

When replacing a 'TUBE-TYPE' tyre on a spoked wheel, always inspect the rim tape (rim protection band) to ensure that it is correctly protecting the tube from the spoke threads. A damaged rim tape may lead to rapid tyre deflation causing loss of control and an accident.

Warning

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 motorcycle 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

The use of tyres other than those listed at your authorised Triumph dealer, or on the internet, at www.triumph.co.uk, may adversely affect handling leading to loss of motorcycle control or an accident. Use the recommended tyre options only in the combinations listed at your authorised Triumph dealer, or on the internet at www.triumph.co.uk. Do not mix tyres from different manufacturers or tyres from the same manufacturer but from another option.

Warning

Accurate wheel balance is important 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 motorcycle 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 potentially resulting in tyre deflation, loss of motorcycle 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 manufacturer's 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 motorcycle 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/160 km) to become accustomed to the new handling characteristics.

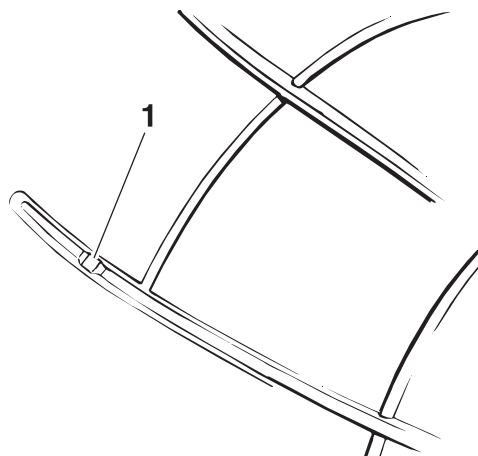
After both 24 hours and 100 miles (160 km), the tyre pressures should be checked and adjusted and the tyre examined for correct seating and rectified as necessary.

Use of a motorcycle when not accustomed to its handling characteristics, with incorrect tyre pressures or an incorrectly seated tyre is dangerous and may lead to loss of motorcycle control and 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.



gafj

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 and 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. Operation with punctured or damaged tyres will adversely affect motorcycle stability and handling which may lead to loss of control or an accident.

Check the rims for dents or deformation. Operation with damaged or defective wheels or tyres is dangerous and loss of motorcycle control or an accident could result.

Always consult your authorised Triumph dealer for tyre replacement, or for a safety inspection of the tyres.

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.

! Warning

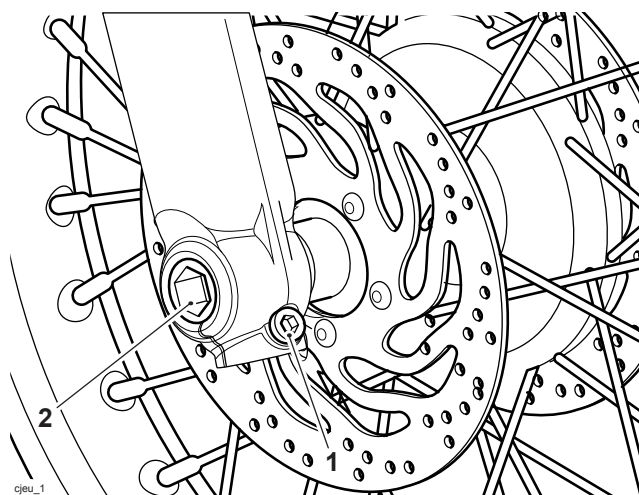
Do not allow the brake caliper to hang on the brake hose as this may damage the hose.

Damaged hoses could cause brake failure leading to loss of motorcycle control and an accident.

1. Raise and support the front of the motorcycle.

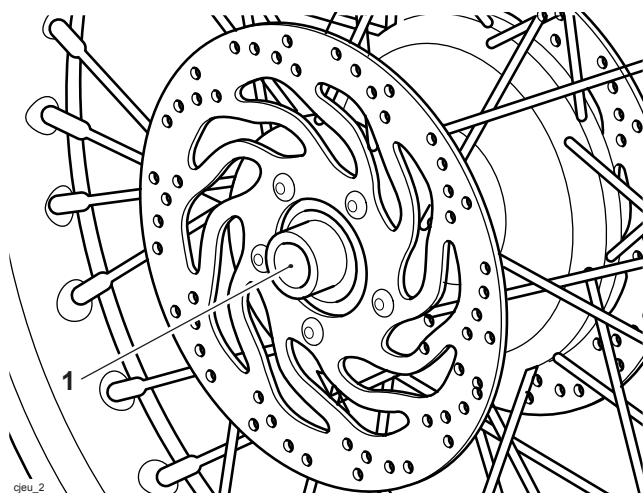
Note:

- **It is not necessary to disconnect the brake hoses.**
2. Detach and support the front brake calipers (see Front Brake Pads - Removal, page 527).
 3. Loosen the pinch bolt at the lower end of the right hand fork.
 4. Working from the right hand side, release and remove the wheel spindle which is threaded into the left hand fork.



1. Pinch bolt
2. Wheel spindle

5. Remove the wheel, recovering the spacers from both sides.



1. Spacer (right hand shown)

6. Place the wheel on wooden blocks to prevent damage to the brake discs.

Warning

Do not allow the wheel to rest on the brake disc as this may damage the disc leading to loss of motorcycle control and an accident.

Caution

To prevent wheel and wheel bearing damage, ensure dirt and debris are not allowed to enter the wheel bearings.

7. Thoroughly clean all components and inspect for wear or damage.

Front Wheel - Inspection

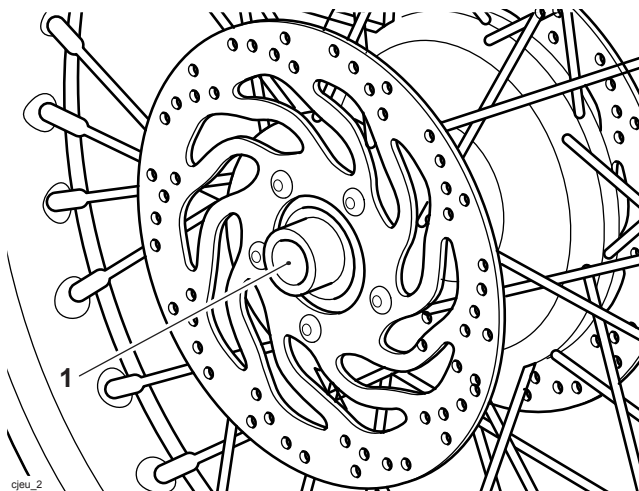
1. Check the wheel bearings spin smoothly with no signs of play. If not, renew the bearings (see Front and Rear Wheel Bearings - Removal, page 615).

Front Wheel - Installation

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. Lightly smear the spacers with grease and locate into the left hand and right hand sides of the hub.



1. Spacer (right hand shown)

2. Position the wheel between the forks.
3. Raise the wheel until it is in alignment with the spindle holes in both forks. Take care to not dislodge the spacers.
4. Refit the wheel spindle from the right hand side and tighten to 65 Nm.
5. Thoroughly clean and degrease the brake discs.
6. Fit the brake caliper and tighten the mounting bolts to 21 Nm.
7. Check that the brake disc is centrally located to the caliper on the left hand side. If not, apply gentle pressure to the fork to ensure the disc is centred with the caliper.
8. Maintaining the above position, tighten the fork pinch bolt to 23 Nm.
9. Check the operation of the front brake. 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 attempt to ride the motorcycle again. Failure to

Warning

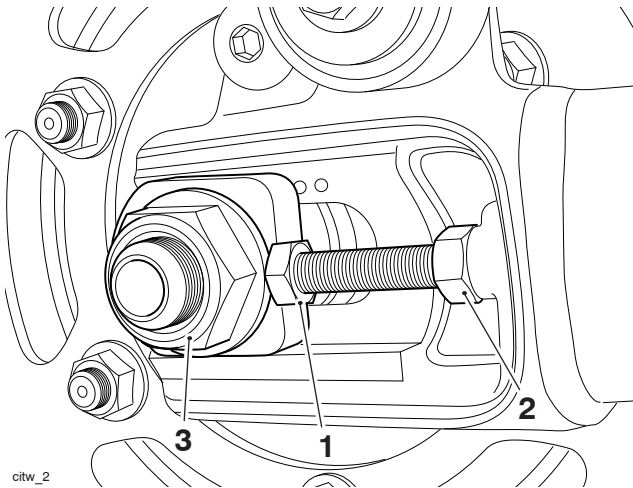
take remedial action may reduce braking efficiency leading to loss of motorcycle control and an accident.

Rear Wheel - Removal

Warning

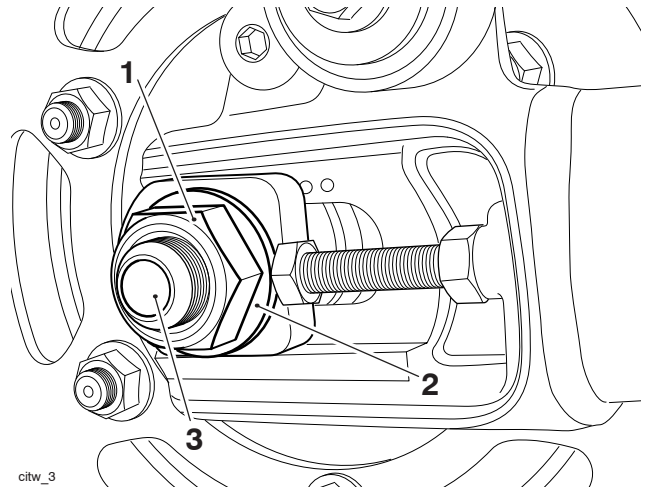
Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

- Remove the exhaust silencers (see Exhaust Silencer - Removal, page 436).
1. Support the motorcycle so the rear wheel is raised clear of the ground.
 2. Loosen the wheel spindle nut.
 3. Release the lock nuts on both the left hand and right hand chain adjuster bolts.



1. **Adjuster bolt**
2. **Adjuster bolt lock nut**
3. **Rear wheel spindle nut**

4. Remove the spindle nut and washer then support the wheel and withdraw the spindle. Discard the nut.



1. **Nut**
2. **Washer**
3. **Spindle**

5. Lower the wheel to the ground, and noting its position, release the brake caliper and carrier from the slot on the swinging arm.

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 motorcycle control and an accident.

6. Roll the wheel forward until the drive chain can be detached from the rear sprocket.
7. Manoeuvre the wheel out of position and recover the spacers from the hub and drive flange.

Warning

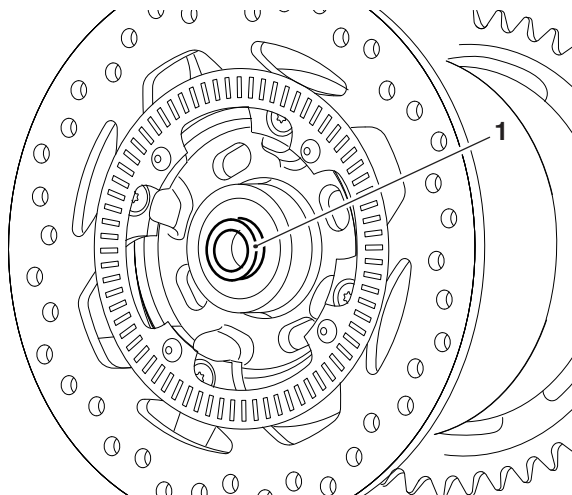
Do not allow the wheel to rest on the brake disc as this may damage the disc leading to loss of motorcycle control and an accident.

Caution

To prevent wheel and wheel bearing damage, ensure dirt and debris are not allowed to enter the wheel bearings.

Rear Wheel - Inspection

1. Check the wheel bearings spin smoothly with no signs of play. If not, renew the bearings (see Front and Rear Wheel Bearings - Removal, page 615).



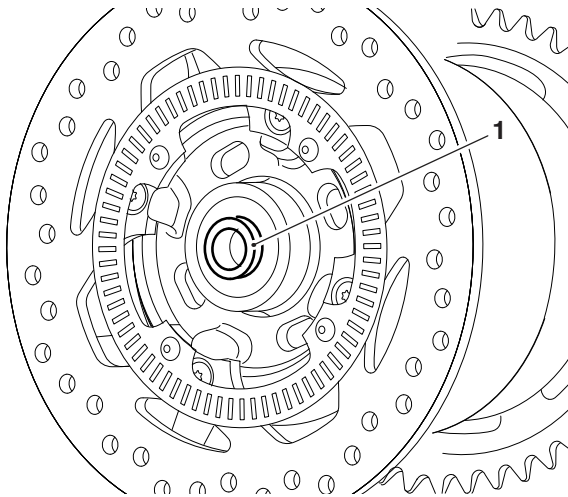
1. **Spacer (left hand shown)**

Rear Wheel - Installation

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.

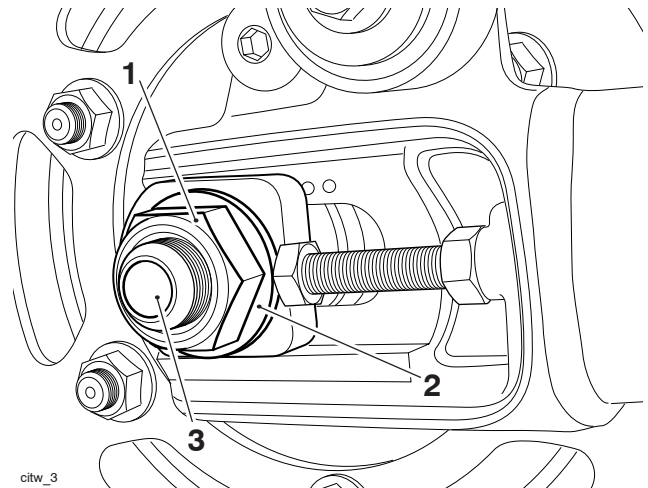
1. Lubricate the lips of the wheel bearing seals with a smear of multipurpose grease.
2. Fit the spacer to the hub and drive flange.



1. Spacer (left hand shown)

3. Position the wheel in between the swinging arm and engage the drive chain with the sprocket.
4. Fit the brake caliper mounting plate, locating its slot on the swinging arm lug.
5. Lift the wheel into position, ensuring the spacers and caliper mounting plate remain correctly positioned, and insert the spindle from the left hand side.

6. Fit the washer and a new nut to the spindle and hand tighten.



- 1. Nut**
- 2. Washer**
- 3. Spindle**

7. Lower the motorcycle to the ground and adjust the drive chain free movement (see Final Drive Chain Adjustment, page 623), then tighten the spindle nut to 110 Nm.
8. Operate the brake pedal a few times to ensure the brake pads are in firm contact with the disc.
9. Refit the exhaust silencers (see Exhaust Silencer - Installation, page 437).
10. Check the operation of the rear brake. 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 attempt to ride the motorcycle again. Failure to take remedial action may reduce braking efficiency leading to loss of motorcycle control and an accident.

Front and Rear Wheel Bearings - Removal

- Remove the front wheel (see Front Wheel - Removal, page 609).
- Remove the rear wheel (see Rear Wheel - Removal, page 612).

Warning

To avoid wheel damage, always support the wheel as instructed below. A dangerous riding condition leading to loss of motorcycle control and an accident could result if this warning is ignored.

1. Support the wheel on blocks to prevent damage to the sprcket and wheel rim.

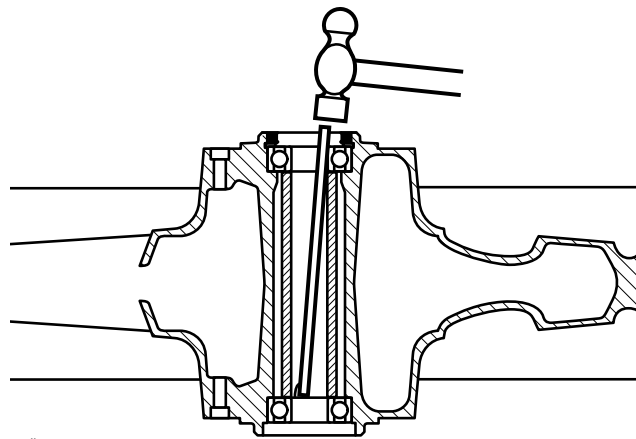
Warning

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.

2. Remove and discard the seal (two on the front wheel, one on the rear) and the bearing circlip.
3. Using a suitable pin punch through the centre of the wheel, drift out the wheel bearings. Collect the centre sleeve.



Wheel Bearing Removal

Inspection - Bearings

1. Check the wheel bearings spin smoothly with no signs of play. If not, renew the bearings.

Front and Rear Wheel Bearings - 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 bearings with the marked or shielded side facing outwards and always fit a new bearing circlip and seals.

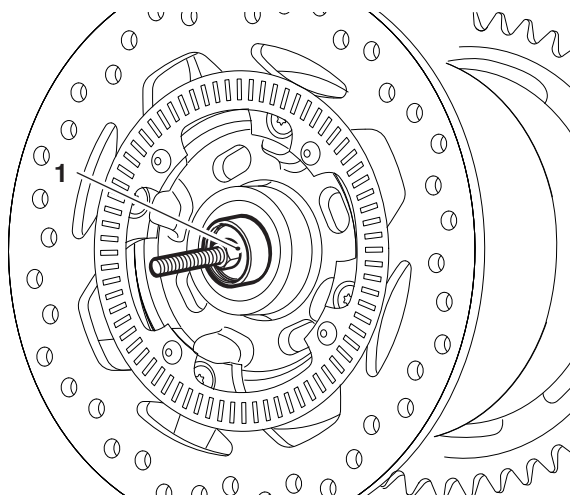
Front Wheel Bearing Tool Selection Chart

	Bearing insertion tool	Support tool
Left bearing	service tool T3880053 Small face to bearing	service tool T3880075 Large face to wheel
Right bearing	service tool T3880053 Small face to bearing	service tool T3880075 Large face to wheel

Rear Wheel Bearing Tool Selection Chart

	Bearing insertion tool	Support tool
Left bearing	service tool T3880053 Large face to bearing	service tool T3880075 Large face to wheel
Right bearing	service tool T3880053 Large face to bearing	service tool T3880075 Large face to wheel

1. Fit the wheel bearings and centre sleeve using the method described above.



cjfe_1

- 1. T3880075 - Bearing Installer in position on rear wheel**
2. Fit a new circlip.
3. Lubricate and fit new seal(s) to the wheel. Lubricate the seal's knife-edge with grease to NLGI 2 specification.
 - Fit the front wheel (see Front Wheel - Installation, page 611).
 - Refit the rear wheel (see Rear Wheel - Installation, page 614).

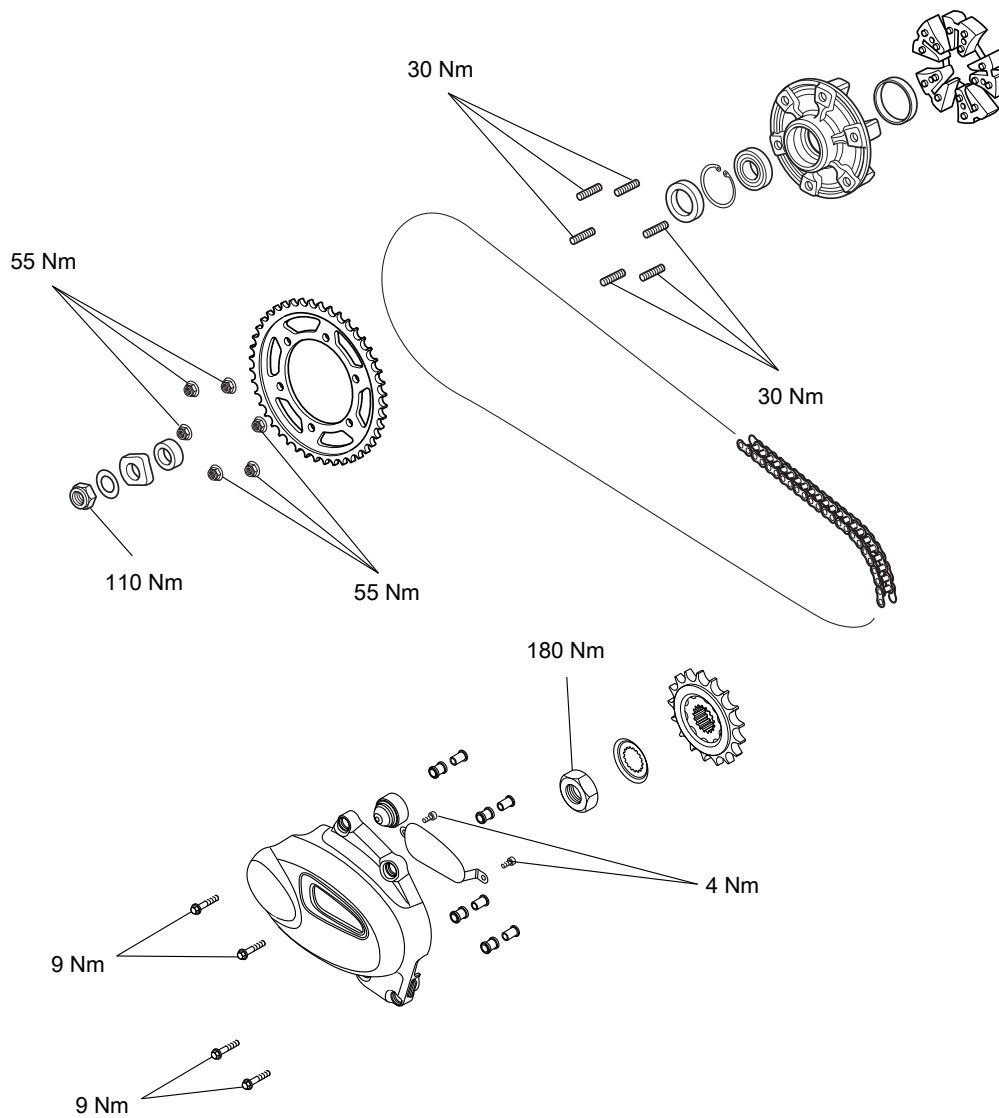
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24 Final Drive

Table of Contents

Exploded View – Final Drive	621
Final Drive Chain	622
Final Drive Chain Lubrication.....	622
Final Drive Chain Adjustment.....	623
Drive Chain and Sprocket Wear Inspection.....	624
Drive Chain Replacement	625
Front Sprocket - Removal.....	628
Front Sprocket - Installation	629
Rear Sprocket - Removal.....	630
Rear Sprocket - Installation.....	631
Rear Sprocket Carrier and Cush Drive - Removal.....	631
Rear Sprocket Carrier and Cush Drive - Inspection	632
Rear Sprocket Carrier and Cush Drive - Installation.....	633
Rear Sprocket Carrier Bearings - Disassembly	633
Rear Sprocket Carrier Bearings - Assembly	634

Exploded View – Final Drive



Final 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 drive chain is badly worn or incorrectly adjusted (either too loose or too tight) the drive chain could jump off the sprockets or break.

Warning

A drive 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 drive chain must be adjusted with the motorcycle in an upright position, resting on its wheels, and with no additional weight on it.**

Final Drive 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 drive chain lubricant as recommended in the specification section.

Correct application is critical for drive chain lubrication. Apply the lubricant for one full drive 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 drive 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 drive 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

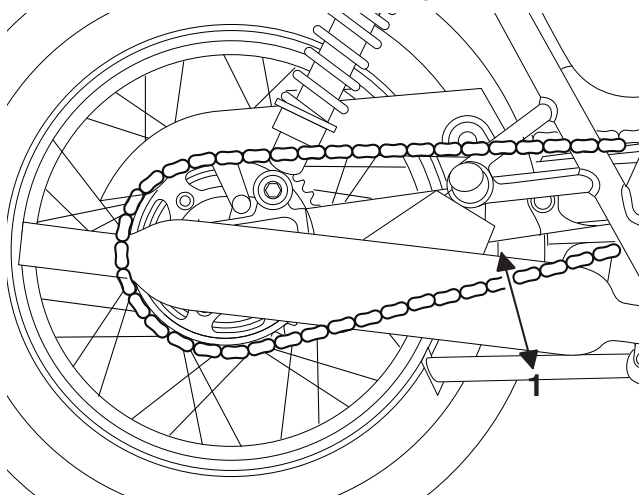
Do not use a power jet washer to clean the chain as this may cause damage to the chain components.

Final Drive Chain Adjustment

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.

Drive Chain Free movement Inspection



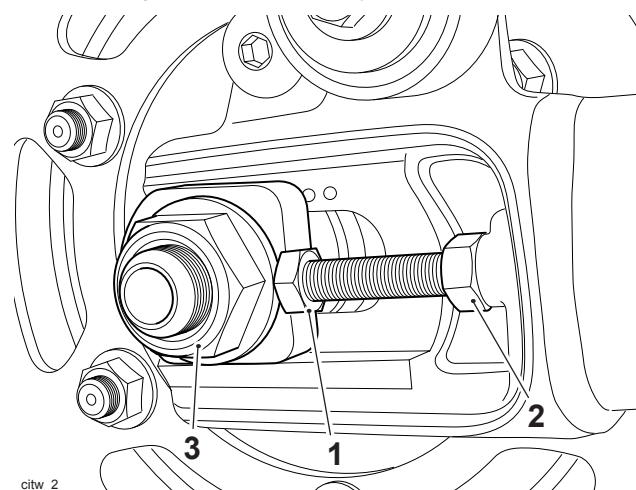
1. Maximum movement position

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 drive chain has least slack. Measure the drive chain's vertical movement, mid-way between sprockets.
3. If correct, the vertical movement of the drive chain midway between the sprockets should be 20 - 30 mm.

Drive Chain Free movement Adjustment

1. Loosen the wheel spindle nut.

2. Release the lock nuts on both the left hand and right hand chain adjuster bolts.



1. Adjuster bolt
2. Adjuster bolt lock nut
3. Rear wheel spindle nut

3. Moving both adjusters by an equal amount, turn the adjuster bolts clockwise to increase chain free-movement and counter clockwise to reduce chain free-movement.
4. When the correct amount of chain free movement has been set, push the wheel into firm contact with the adjusters.

Caution

Check for equal adjustment on both sides using the graduation marks on the swinging arm.

5. Tighten both adjuster lock nuts to 20 Nm and the rear wheel spindle nut to 110 Nm.
6. Repeat the chain adjustment check. Re-adjust if necessary.

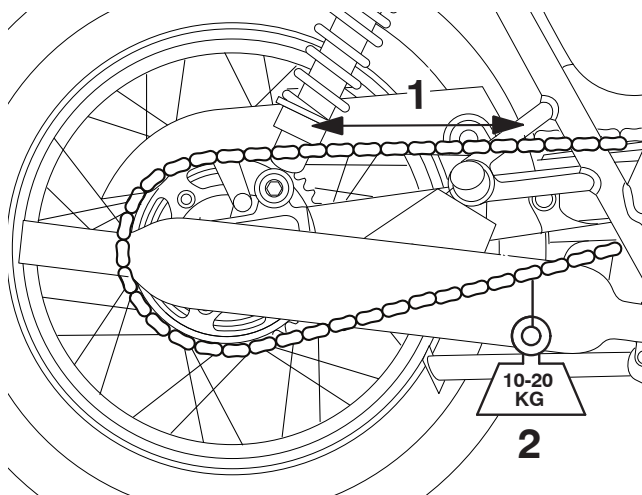
Warning

Operation of the motorcycle with insecure adjuster lock nuts 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.

Drive Chain and Sprocket Wear 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.



1. Measurement across 20 links

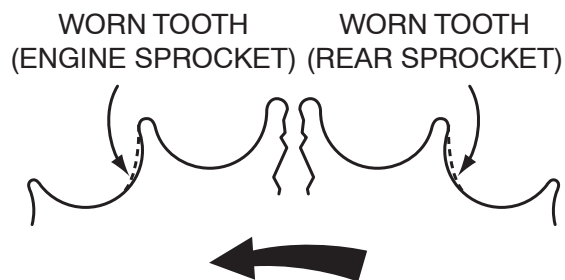
2. 10 - 20 kg Weight

1. Stretch the chain taut by hanging a 10 - 20 kg (20 - 40 lb) weight on the drive chain.
2. Measure a length of 20 links on the straight part of the drive chain from pin centre of the 1st pin to pin centre of the 21st pin. Repeat the test at various sections of the drive chain to establish an average reading. This is because the drive chain may wear unevenly.
3. If the length exceeds the service limit of 319 mm (12.56 in), the chain must be replaced.

Warning

A drive chain that breaks or jumps off the sprockets could snag on the engine sprocket or lock the rear wheel, severely damaging the motorcycle and causing loss of motorcycle control and an accident.

4. Examine the whole length of the drive chain. If there are any excessively tight or loose sections, loose pins or damaged rollers, the drive chain should be replaced.
5. Inspect sprockets for unevenly or excessively worn teeth. Also examine the sprockets for damaged teeth.



cool

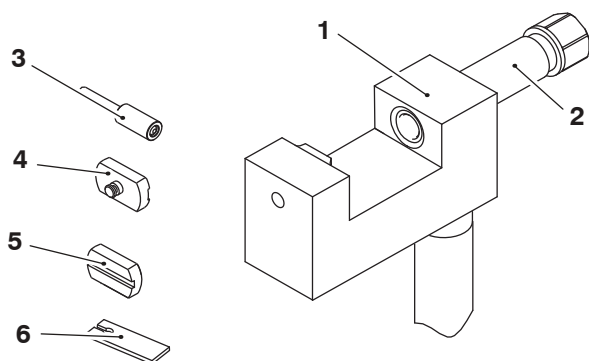
Drive Chain Replacement

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.

Rivet Link Type

The following instructions for the replacement of rivet link type drive chains requires the use of service tool T3880635.

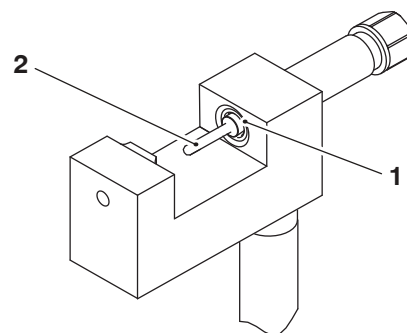


T3880635 - Final Drive Chain Cut and Rivet

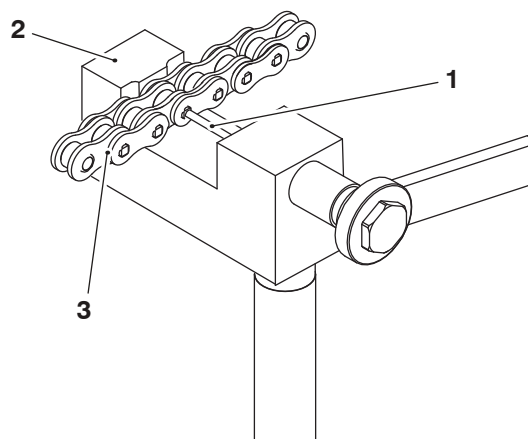
1. **Service tool body**
2. **Pin holder**
3. **Cut/rivet pin**
4. **Plate holder A**
5. **Plate holder B**
6. **Gauge**

1. Support the motorcycle on a stand so the rear wheel is clear of the ground.

2. Insert the cut/rivet pin into the pin holder so its smaller diameter end (cutting point) is facing away from the holder as shown.



1. **Pin holder**
2. **Cut/rivet pin**
3. If required, file the domed heads of the chain link pins flat.
4. Position service tool T3880635 so that the drive chain is between the cut/rivet pin and the service tool body with the pin to be removed aligned with the hole service tool body.
5. Turn the pin holder clockwise until its pin contacts the link pin. Ensure that the pin is centralised on the link pin to be removed.



1. **Guide plate holder**
2. **Service tool body**
3. **Drive chain**
6. Retain the tool body and rotate the pin holder clockwise until the link pin is pressed out from the chain.
7. Remove the tool and separate the two ends of the chain.

Note:

- The replacement chain is supplied in a split condition, complete with a link kit to join the two ends.



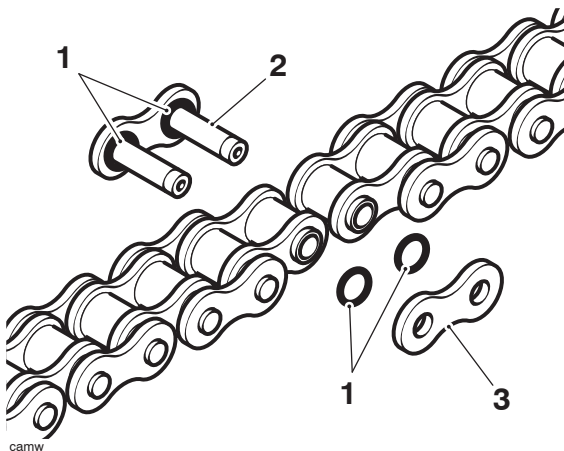
Caution

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.

- 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:

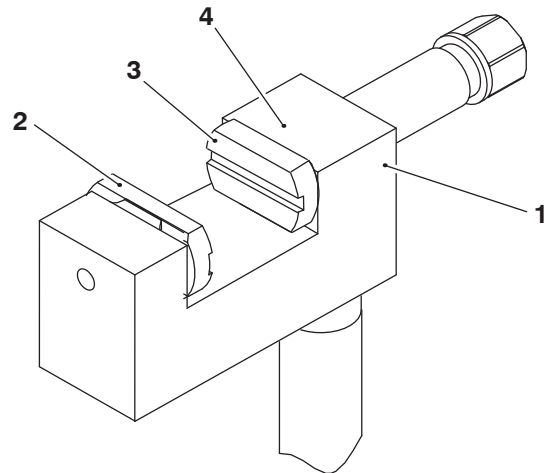
- Do not use the new connector link as the special grease on it may be removed.
- Using the new link supplied with the chain kit, join the two ends of the chain. Ensure that the O-rings are positioned as shown below and the link plate is fitted with its markings facing outwards.



- O-rings
- Link
- Link plate

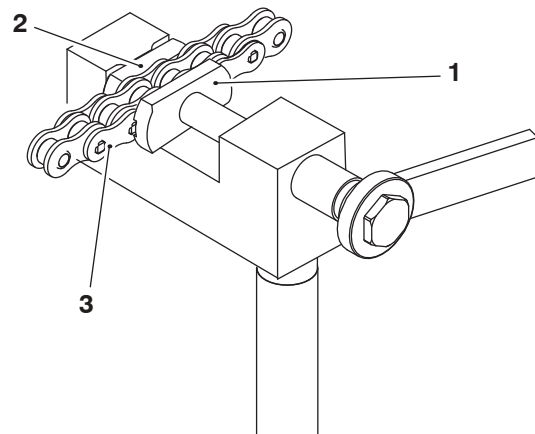
- Insert the cut/rivet pin into the pin holder so its larger diameter end (riveting point) is facing away from holder as shown.

- Fit the guide plate A to the service tool as shown below.



- Cut/rivet pin
- Guide plate B
- Guide plate A
- Service tool body

- Fit the new connecting link plate to the new link by hand or with a suitable pair of pliers.
- Position service tool T3880635 so that the new connecting link plate of the drive chain is in contact with guide plate A.
- Rotate the pin holder clockwise until the drive chain link makes contact with guide plate B.
- Ensure the connecting link is correctly positioned and then continue to rotate the pin holder to press the connecting link fully on.



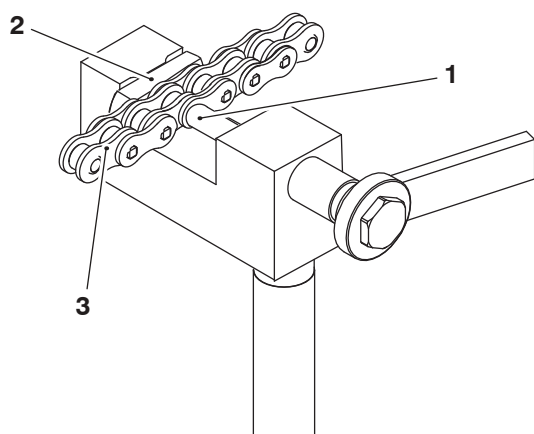
- Guide plate A
- Guide plate B
- Drive chain

16. Rotate the pin holder counter clockwise and remove the Guide plate A and insert the cut/rivet pin into the pin holder so its larger diameter end (riveting point) is facing away from the holder.
17. Align one of the split link pins to the cut/rivet pin then turn the pin holder clockwise until the pin contacts the split link pin. Ensure the split link pin is centrally located on the cut/rivet pin.

Note:

- **The riveting end of the cut/rivet pin is shaped to prevent over tightening. Over tightening may cause damage to the connecting link pin and the cut/rivet pin.**

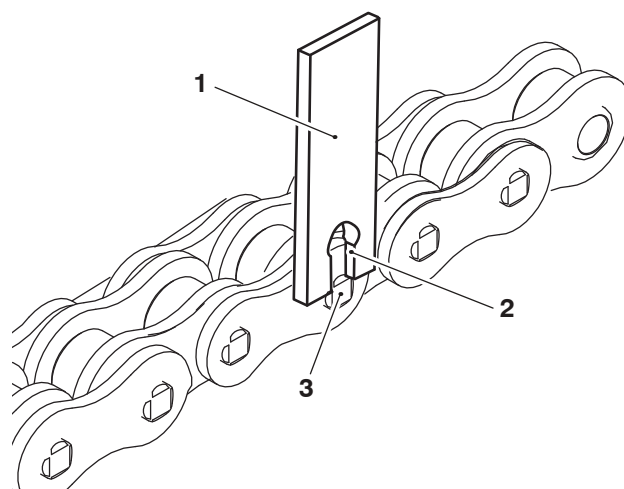
18. Retain the tool body then tighten the pin holder until the split link end is riveted-over.



1. Cut rivet pin
2. Guide plate B
3. Drive chain

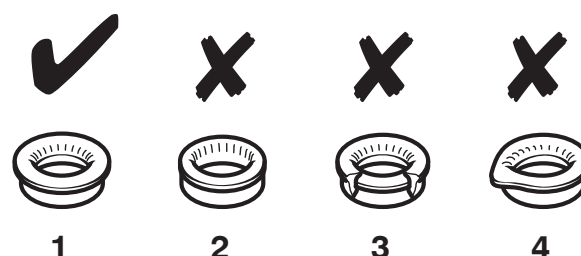
19. Back off the pin holder and rivet the remaining split link pin as described above.

20. Remove the tool from the chain and using the gauge from service tool T3880635 check that both the split link pins are correctly riveted. The rivet should not pass through the slot on the gauge.



1. Gauge
2. Slot
3. Rivet

21. Also check that both the split link pins are correctly riveted as shown below.



cana

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 motorcycle control and an accident.

Endless Type

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.

- Remove the swinging arm (see Swinging Arm - Removal, page 508).
1. Free the chain from the front sprocket and remove it from the motorcycle.
 2. Locate the new chain on the front sprocket.
- Refit the swinging arm (see Swinging Arm - Installation, page 512)

Front Sprocket - Removal

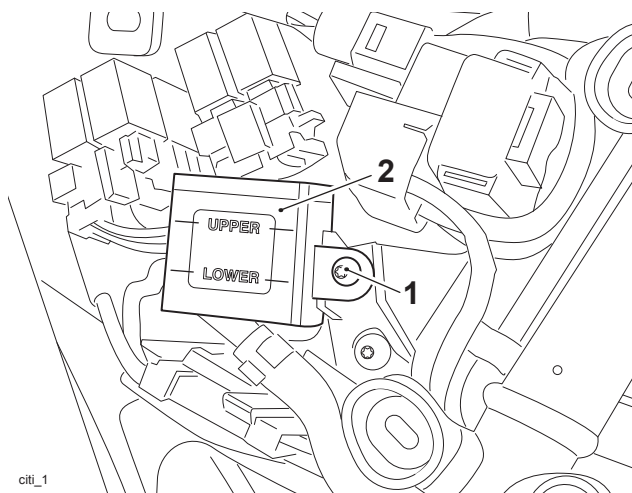
Warning

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 paint damage, do not spill brake fluid onto any area of the bodywork. Spilled brake fluid will damage paintwork.

- Position the motorcycle on the side stand.
 - Remove the front sprocket cover (see Front Sprocket Cover - Removal, page 105).
 - Remove the right hand side panel (see Side Panels, page 646).
1. Remove and discard the fixing and detach the rear brake fluid reservoir from the relay bracket.



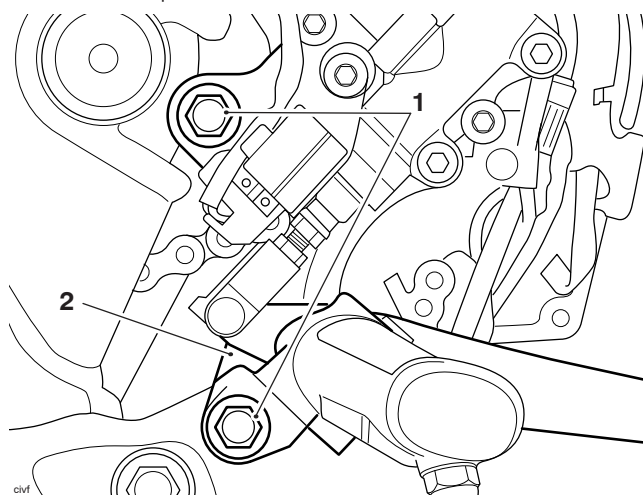
1. Fixing

2. Brake fluid reservoir

Note:

- Note the routing of the brake switch harness for installation.

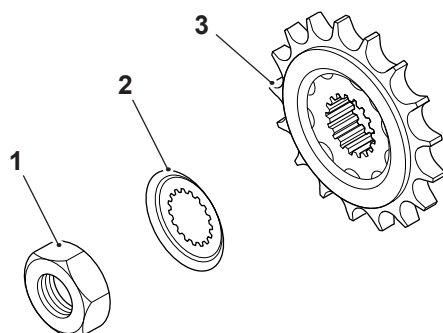
2. Remove the fixings and detach the right hand control plate from the frame.



1. Fixings

2. Control plate

3. Bend back the front sprocket lock washer.
4. Have an assistant sit on the motorcycle, select sixth gear and apply the front brake hard.
5. Loosen the front sprocket nut.



1. Nut

2. Lock washer

3. Front sprocket

6. Remove the front sprocket nut and discard the lock washer.
7. Set the drive chain adjustment to allow maximum free play in the drive chain.

Note:

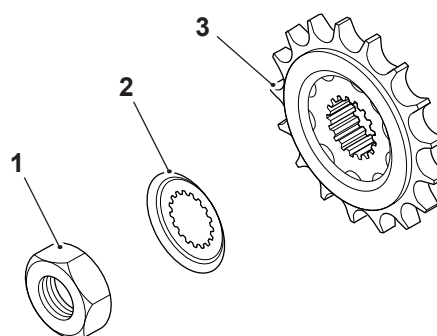
- **Note the orientation of the front sprocket for installation.**
8. Disengage the front sprocket from the drive chain and slide it off the output shaft.

Front Sprocket - Installation

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. Fit the front sprocket, as noted for removal, and engage it with the drive chain.
2. Fit a new lock washer engaging it with the output shaft splines, and fit the sprocket nut hand tight.



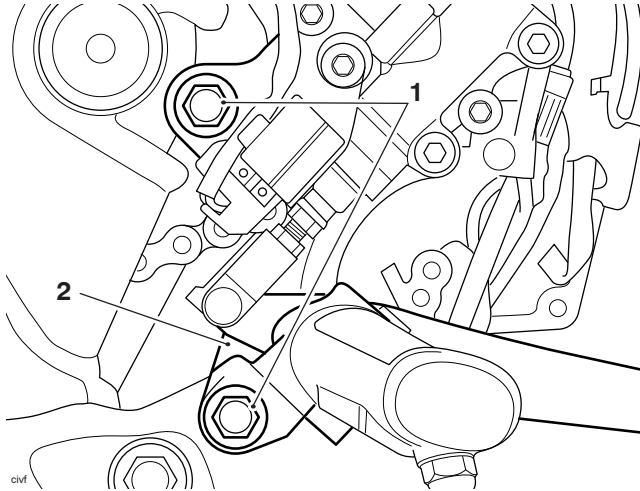
1. Nut

2. Lock washer

3. Front sprocket

3. Have an assistant sit on the motorcycle, select sixth gear and apply the front brake hard.
4. Tighten the front sprocket nut to 180 Nm.
5. Secure the front sprocket nut in position by bending the lock washer down to contact one of the nut flats.
6. Adjust the final drive chain free movement (see Final Drive Chain Adjustment, page 623).

7. Attach the right hand control plate to the frame and tighten the fixings to 24 Nm. Ensure the brake light switch harness is routed as noted for removal.



1. Fixings

2. Control plate

8. Attach the rear brake fluid reservoir to the relay bracket and tighten the new fixing to 3 Nm.
 - Refit the right hand side panel (see Side Panels, page 646).
 - Refit the front sprocket cover (see Front Sprocket Cover - Installation, page 106).

Rear Sprocket - Removal

! 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.

- Remove the rear wheel (see Rear Wheel - Removal, page 612).

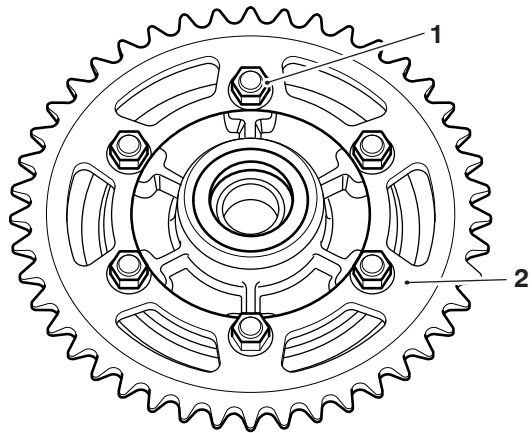
1. Place the wheel on wooden blocks with the drive chain sprocket uppermost.

Note:

- If the studs for the rear sprocket become loose or removed, they must be replaced.
2. Evenly and progressively, remove and discard the rear sprocket lock nuts.

Note:

- Note the orientation of the rear sprocket for installation.
3. Remove the rear sprocket.



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1. Lock nut

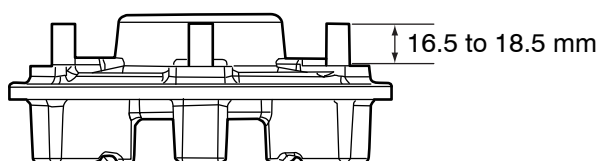
2. Sprocket

Rear Sprocket - Installation

⚠ 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.

1. If necessary, replace any rear sprocket studs that have been loosened or removed as follows:
 - Remove and discard any of the studs that have become loose.
 - Fit new studs and tighten to 30 Nm.
 - Check the height of the studs when fitted to the sprocket carrier. The top of the stud must be between 16.5 to 18.5 mm above the sprocket carrier face.



1. **Height of stud (16.5 to 18.5 mm)**
2. Fit the rear sprocket to the sprocket carrier as noted for removal.
3. Fit new lock nuts, evenly and progressively tighten to 55 Nm.
 - Refit the rear wheel (see Rear Wheel - Installation, page 614).

Rear Sprocket Carrier and Cush 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.

⚠ Caution

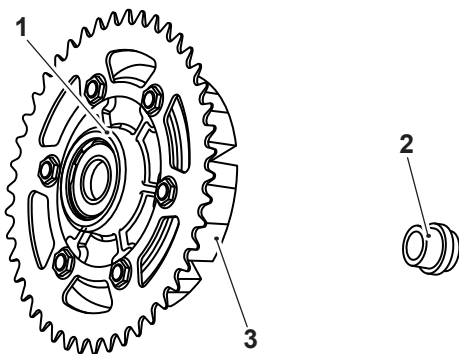
Do not allow the wheel to rest on the brake disc, as this may damage the disc. Support the wheel on wooden blocks, equally spaced around the rim, such that the brake disc is raised above the ground.

- Remove the rear wheel (see Rear Wheel - Removal, page 612).
1. Place the wheel on wooden blocks with the drive chain sprocket uppermost.

Note:

- **Note the position and orientation of the spacer for installation.**

2. Gently lever the drive chain sprocket and flange from the wheel hub. Collect the spacer.



Rear Sprocket Carrier and Cush Drive - Inspection

1. Check the cush drive rubbers for deterioration and cracks.
2. Inspect the sprocket teeth for wear, damage and chips.
3. Check the wheel and drive flange for wear, cracks and damage.

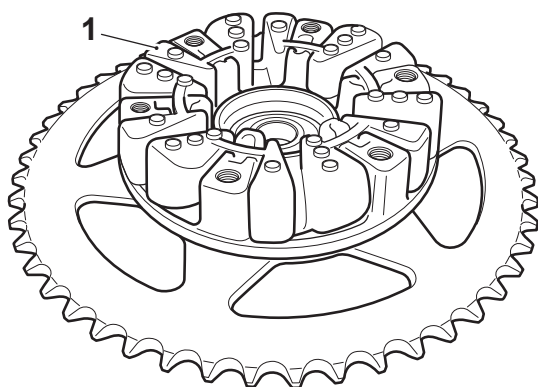
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1. Rear sprocket carrier

2. Spacer

3. Cush drive rubber

3. Remove the cush drive rubber.



1. Cush drive rubber

Rear Sprocket Carrier and Cush Drive - Installation

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.

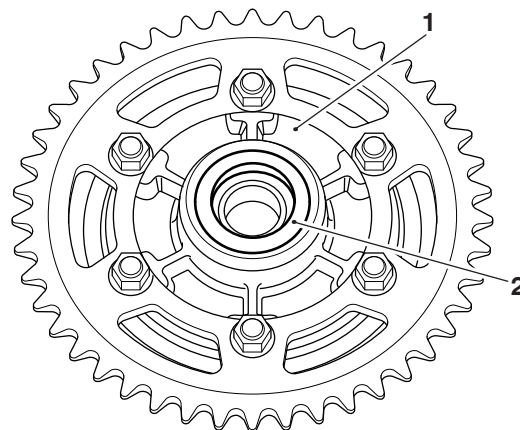
Caution

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.

1. Install the cush drive rubbers to the wheel hub.
2. Fit the spacer to the wheel hub as noted for removal.
3. Refit the sprocket carrier to the wheel.
 - Refit the rear wheel (see Rear Wheel - Installation, page 614).

Rear Sprocket Carrier Bearings - Disassembly

1. Remove the rear sprocket carrier and cush drive (see Rear Sprocket Carrier and Cush Drive - Removal, page 631).
2. Remove and discard the seal.

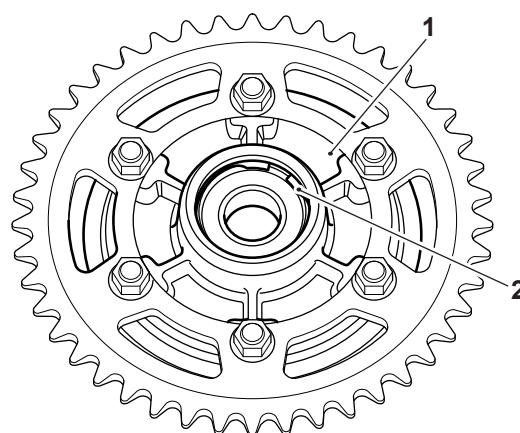


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1. Sprocket carrier

2. Seal

3. Remove and discard the bearing circlip.



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1. Sprocket carrier

2. Circlip

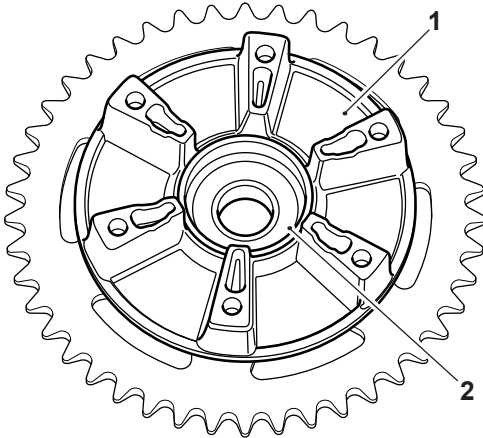
Warning

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 sprocket carrier 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 drive flange.

4. Turn the sprocket carrier over, and use a pin punch to drift out the ball bearing.



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1. **Sprocket carrier**
2. **Ball bearing**

Rear Sprocket Carrier Bearings - Assembly

Warning

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

Never wear loose clothing, which could become trapped in the press and cause crushing injury to the hand, arms or other parts of the anatomy.

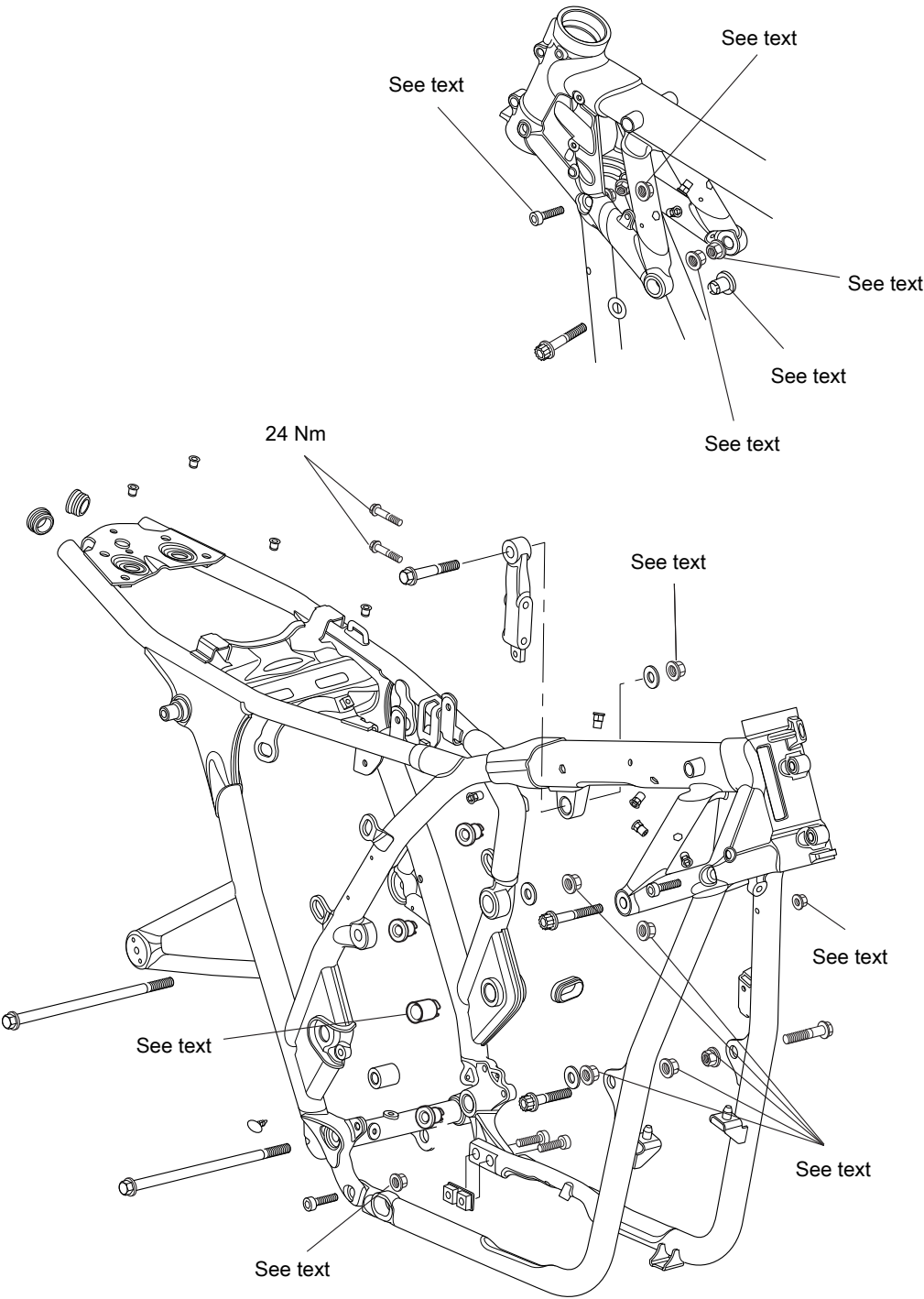
1. Position the ball bearing, marked side facing outwards, to the drive flange.
2. Using a suitable press, fully insert the ball bearing into the sprocket carrier.
3. Fit a new circlip.
4. Install a new seal, marked side facing outwards, to the sprocket carrier.
5. Lubricate the seal's knife-edge with grease to NLGI 2 specification.
6. Install the cush drive rubbers to the wheel hub.
7. Fit the spacer to the wheel hub as noted for removal.
8. Refit the sprocket carrier to the wheel.

25 Frame And Bodywork

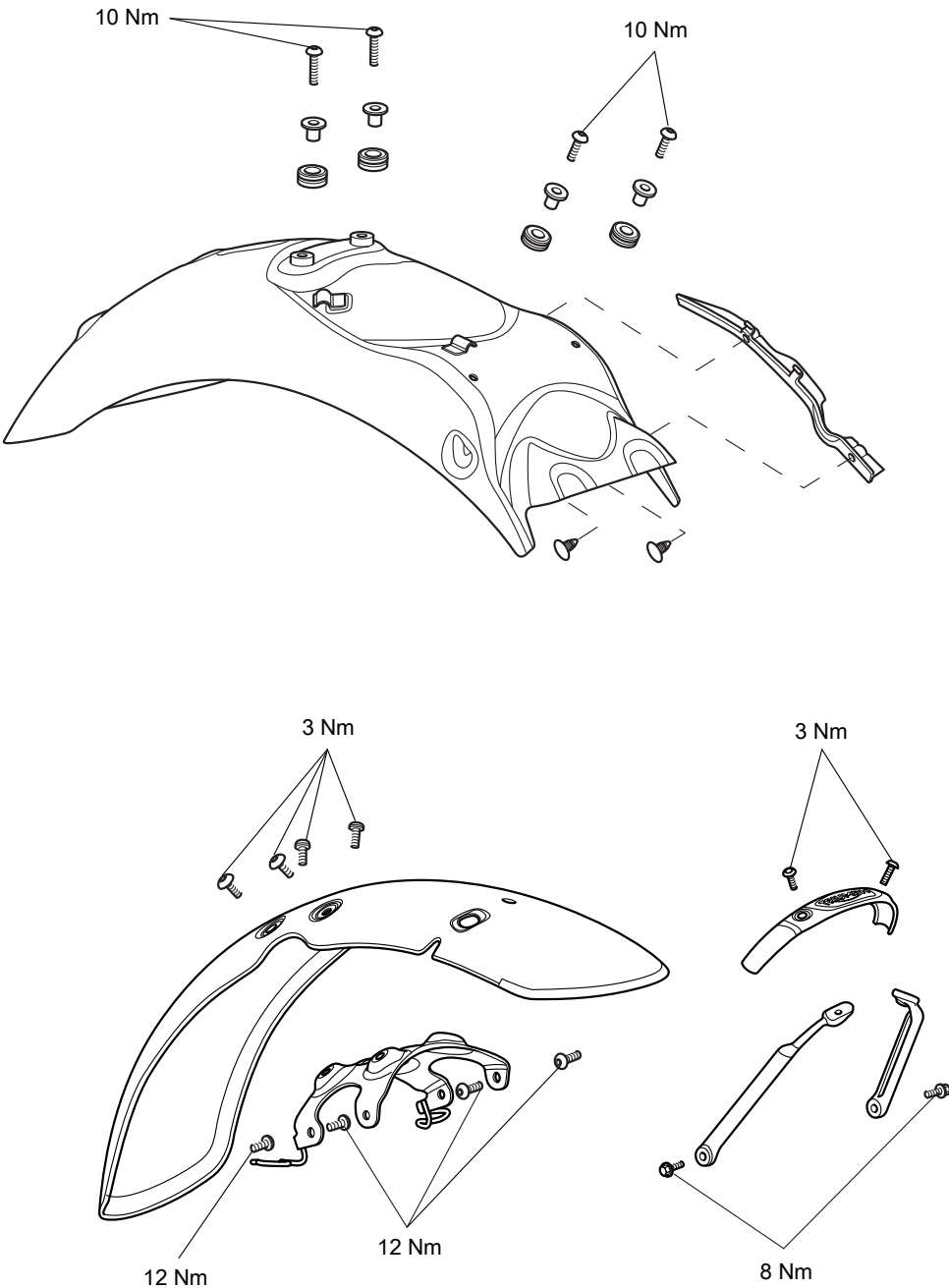
Table of Contents

Exploded View – Frame and Fixings.....	637
Exploded View – Front and Rear Mudguards.....	638
Exploded View – Front and Rear Footrests.....	639
Exploded View – Seat.....	640
Exploded View – Side Panels.....	641
Exploded View – Grab Rail.....	642
Exploded View – Centre and Side Stand.....	643
General Frame Inspection.....	644
Bank Angle Indicators.....	644
Seat – Removal.....	645
Seat – Installation.....	645
Side Panels.....	646
Front Mudguard – Removal.....	646
Front Mudguard – Installation.....	647
Rear Mudguard – Removal.....	647
Rear Mudguard – Installation.....	648
Passenger Grab Rail – Removal.....	649
Passenger Grab Rail – Installation.....	649
Cradle Assemblies – Removal.....	650
Cradle Assemblies – Installation.....	652
Mirrors – Removal.....	654
Mirrors – Installation.....	654
Side Stand – Removal.....	655
Side Stand – Installation.....	655
Centre Stand – Removal.....	656
Centre Stand – Installation.....	656

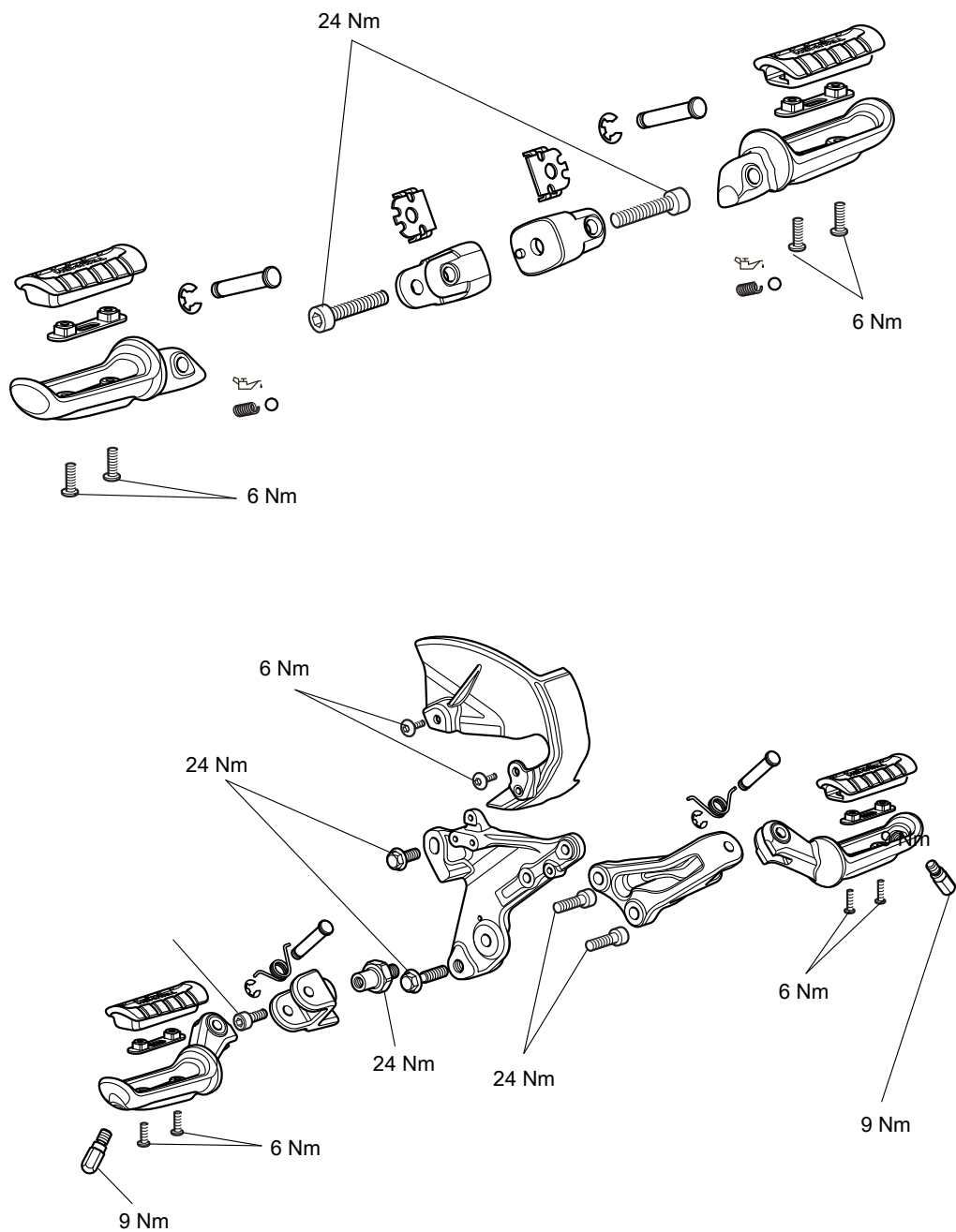
Exploded View – Frame and Fixings



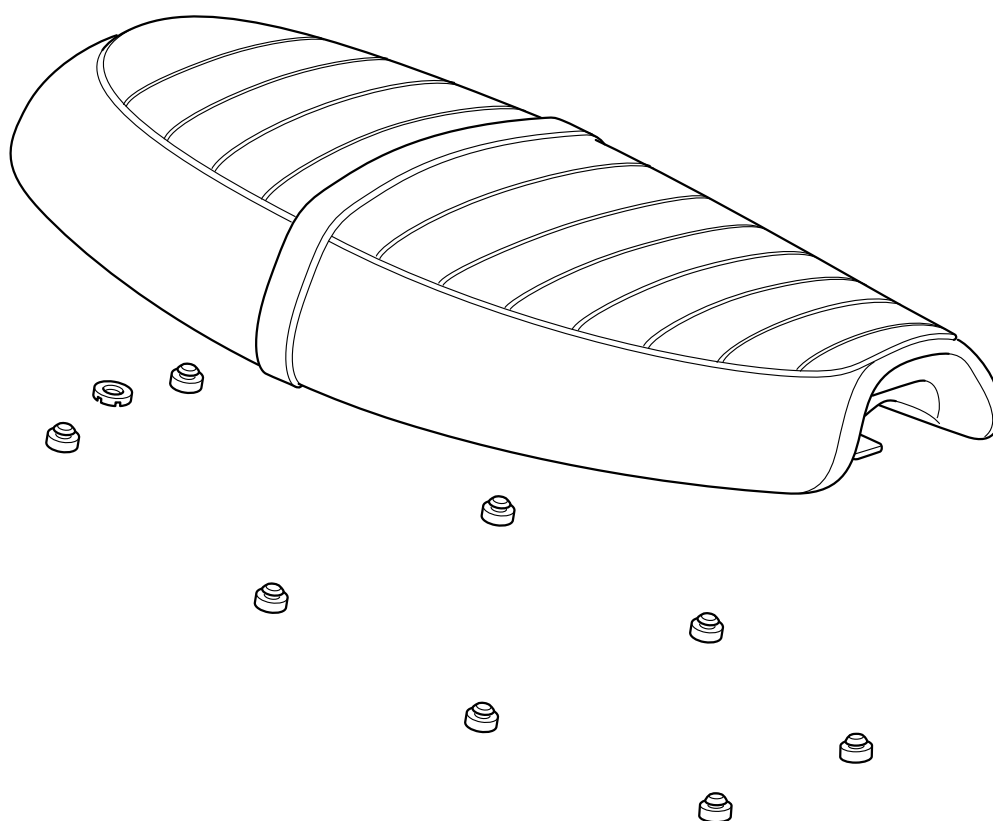
Exploded View - Front and Rear Mudguards



Exploded View - Front and Rear Footrests



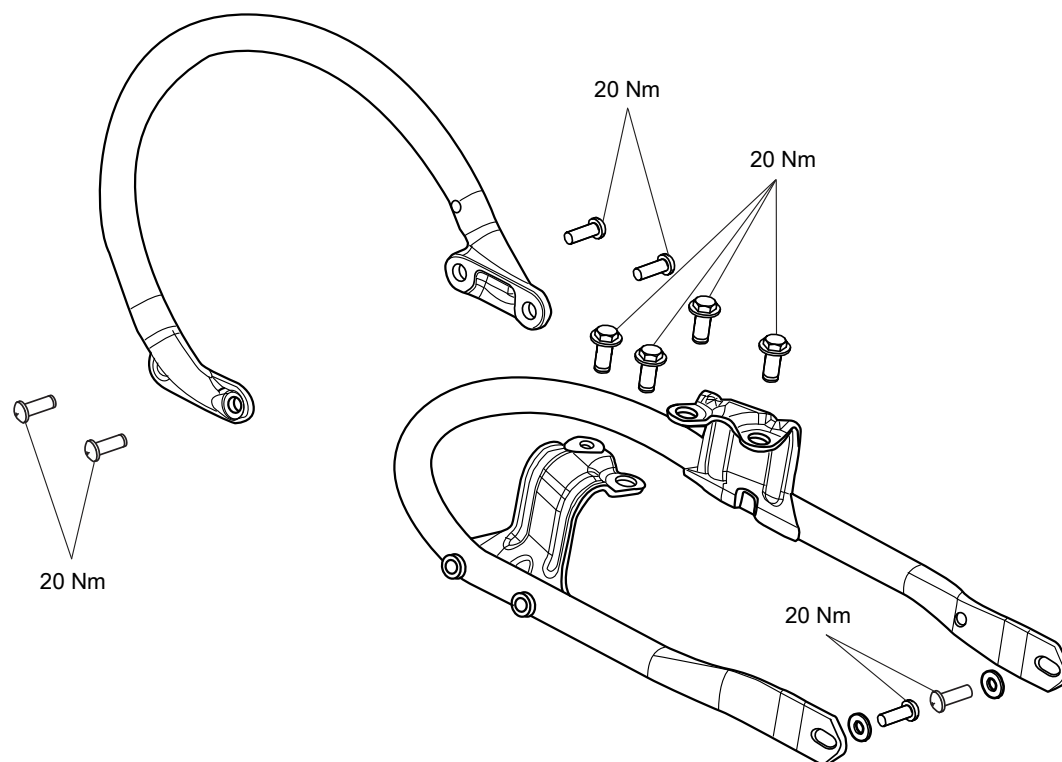
Exploded View - Seat



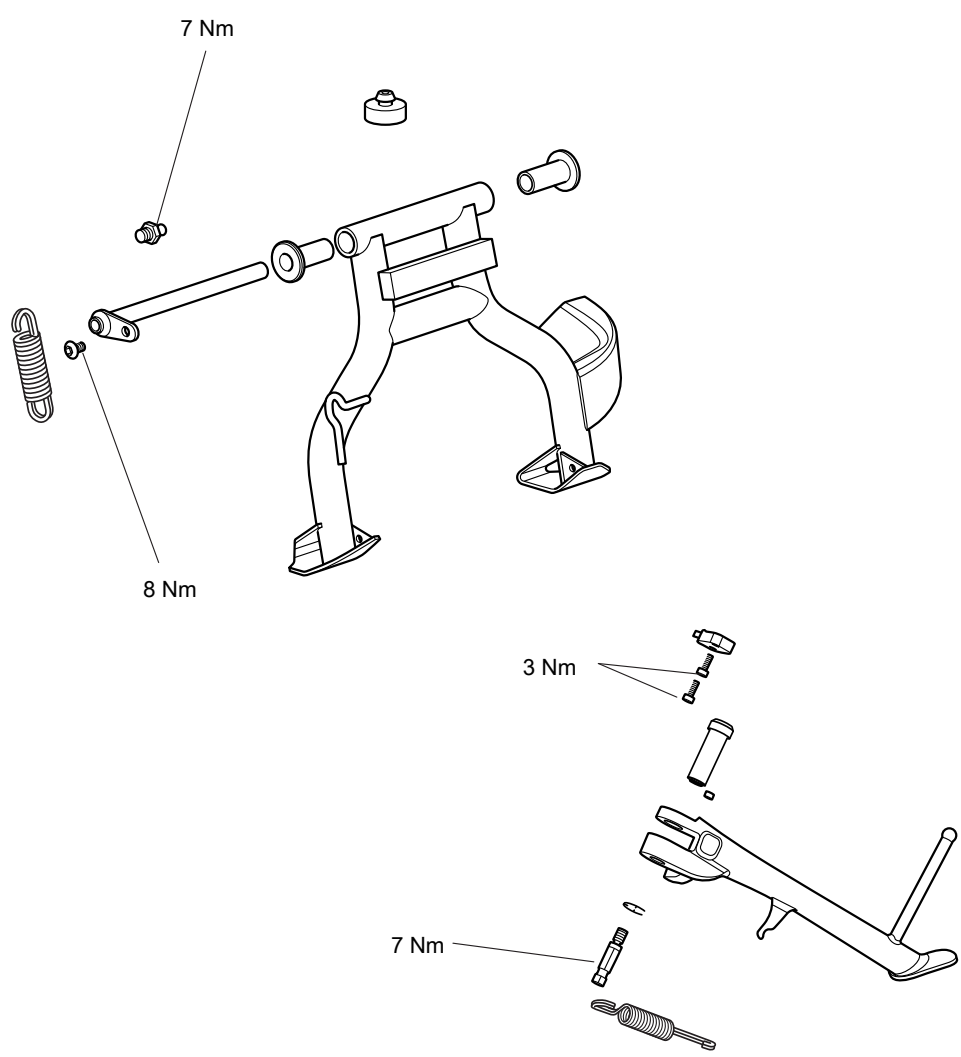
Exploded View - Side Panels



Exploded View - Grab Rail



Exploded View - Centre and Side Stand



General Frame Inspection

1. Inspect the frame, bodywork and footrests for accident and other damage, cracks, splits and general dilapidation. Check all fixings for security. If any faults are found, rectify as necessary. If any faults with the frame are found, the frame must be replaced; repairs to the frame are not permitted.

Warning

If the motorcycle is involved in an accident or collision it must be taken to an authorised Triumph dealer for inspection and repair before it is ridden again.

Warning

The frame must not be modified in any way. Any modification to the frame, such as welding or drilling, may weaken the structure causing an unsafe riding condition leading to loss of motorcycle control and an accident.

2. Check the operation of the side stand to make sure it is securely held in the retracted position by the spring. Rectify any faults.

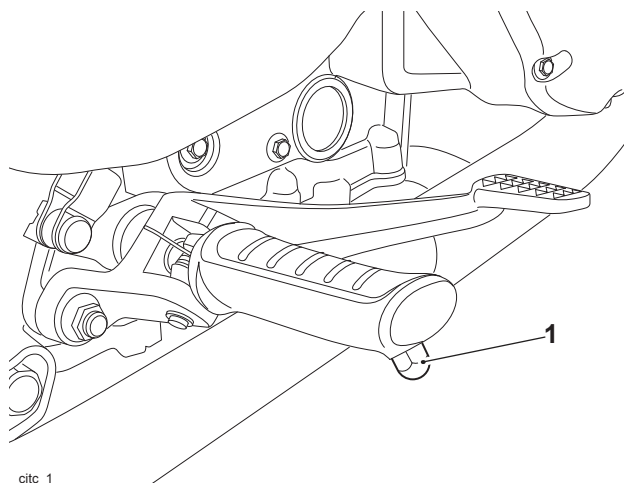
Warning

If the return spring is faulty, the side stand could extend whilst the motorcycle is being ridden. This will cause an unsafe riding condition, which could lead to loss of motorcycle control and an accident.

Bank Angle Indicators

Bank Angle Indicators

1. Inspect the bank angle indicators on the rider's footrests for wear. The bank angle indicators are worn out when 5 mm of the bank angle peg remains.



1. Bank Angle Indicators

Warning

Use of a motorcycle with bank angle indicators worn beyond the maximum limit (when the bank angle indicator is worn to a minimum 5 mm in length) will allow the motorcycle to be banked to an unsafe angle. Therefore, always replace the bank angle indicator pegs when they are worn to 5 mm in length.

Banking to an unsafe angle may cause instability, loss of motorcycle control and an accident.

Warning

The bank angle pegs must not be used as a guide to how far the motorcycle may be safely banked. This depends on many various conditions including, but not limited to, road surface, tyre condition and weather. Banking to an unsafe angle will lead to loss of motorcycle control and an accident.

Seat - Removal

Warning

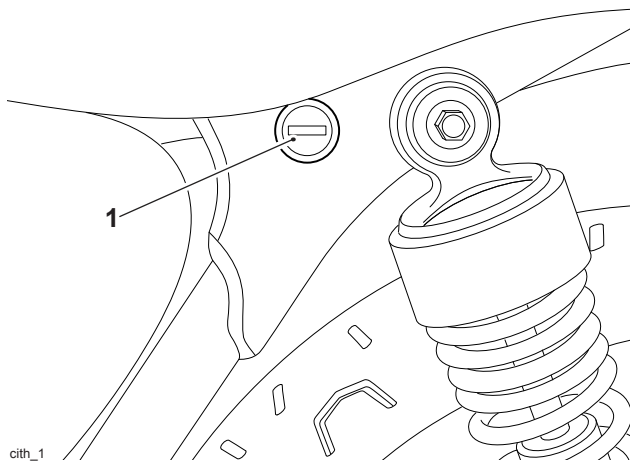
Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

Caution

To prevent damage to the seats or seat covers, care must be taken not to drop the seats. Do not lean the seats against the motorcycle or any surface which may damage the seats or seat covers. Instead, place the seats, with the seat cover facing upwards, on a clean, flat surface which is covered with a soft cloth.

Do not place any item on the seats which may cause damage or staining to the seat covers.

1. Insert the ignition key into the seat lock and turn it anticlockwise while pressing down on the rear of the seat.
2. Lift the seat up from the back and slide rearwards for complete removal from the motorcycle.



1. Seat lock

Seat - Installation

1. Engage the seat's tongue under the fuel tank.

Note:

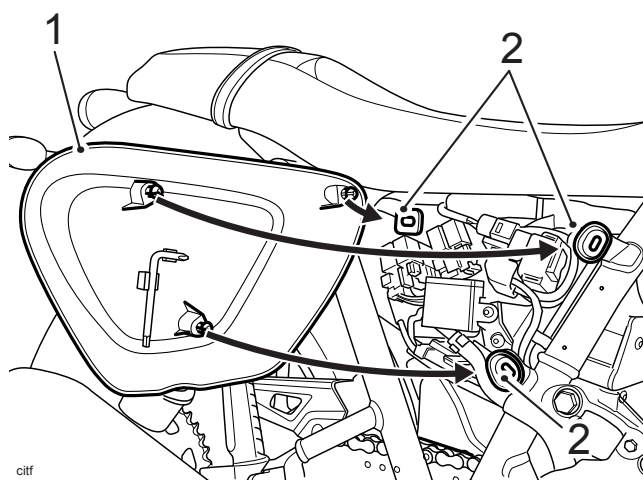
- **An audible click can be heard when the seat is correctly engaged in the lock.**
2. Press firmly down in the centre of the seat to engage the seat lock.

Warning

To prevent detachment of the seat during riding, after fitting always grasp the seat and pull firmly upwards. If the seat is not correctly secured it will detach from the lock. A loose or detached seat could cause loss of motorcycle control and an accident.

3. Grasp the seat and ensure that it is securely retained.

Side Panels



1. Side panel (right hand shown)

2. Grommets

To remove either side panel, grasp the panel firmly in both hands and pull the panel away from the motorcycle until it clears the three retaining grommets (leaving the grommets in place).

To refit, position the three locating dowels to the grommets, then press firmly to secure the panel.

Finally, grasp the panel and make sure that it is fully retained.

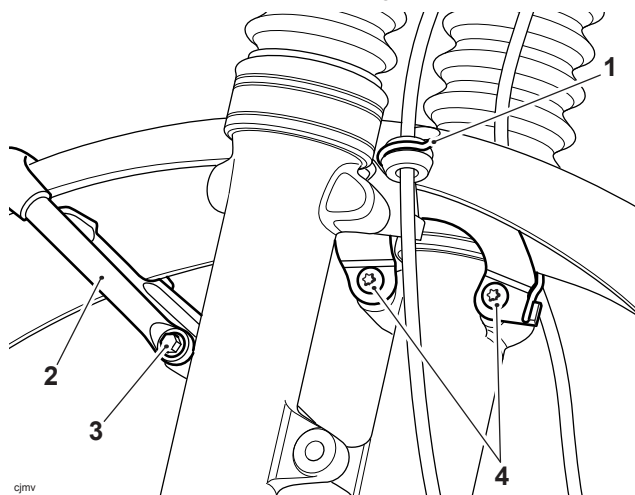
Front Mudguard - Removal

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.

- Remove the front wheel (see Front Wheel - Removal, page 609).

1. Detach the front brake hoses from their wire guides on both sides of the front mudguard.
2. Remove the fixings and detach the both mudguard stays from the front forks.
3. Remove and discard the four fixings securing the front mudguard to the front forks and carefully remove the mudguard.



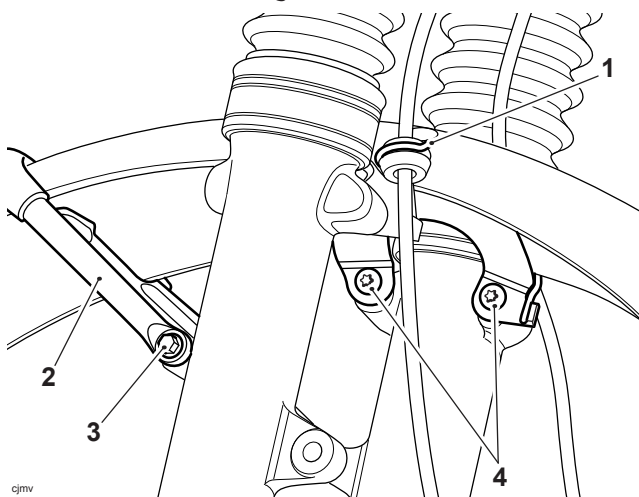
1. Brake hose cable guide (left hand side shown)
2. Mudguard stay (left hand side shown)
3. Mudguard stay fixing
4. Mudguard fixings

Front Mudguard - Installation

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. Carefully manoeuvre the mudguard into position between the front forks.
2. Fit four new fixings and tighten to 12 Nm.
3. Attach the mudguard stays to the front forks and tighten their fixings to 3 Nm.
4. Attach the front brake hose to its wire guide on the front mudguard.



1. Brake hose cable guide (left hand side shown)
2. Mudguard stay (left hand side shown)
3. Mudguard stay fixing
4. Mudguard fixings

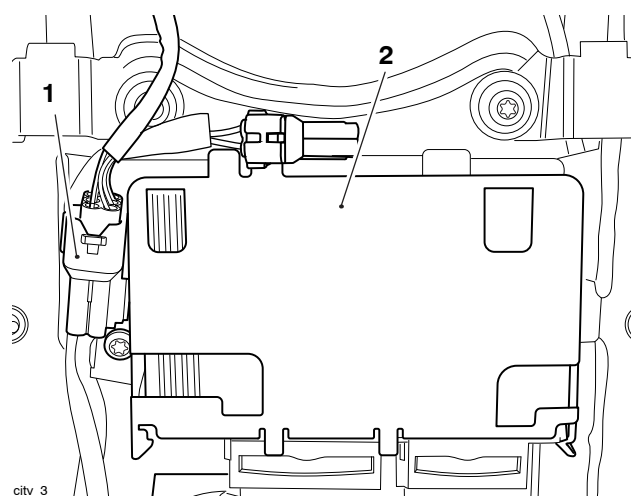
- Refit the front wheel (see Front Wheel - Installation, page 611).

Rear Mudguard - Removal

Warning

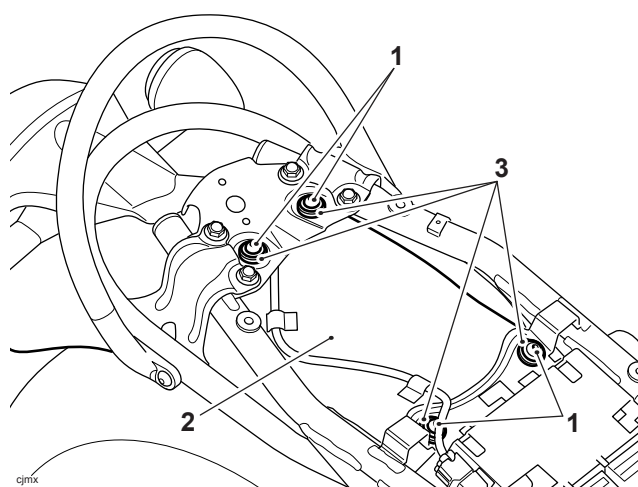
Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

- Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
1. Disconnect the rear light electrical connector from the main harness.



1. Rear light electrical connector
2. Engine ECM

2. Remove the four fixings and flanged sleeves, carefully remove the rear mudguard. Discard the fixings.



1. Fixings
2. Rear mudguard
3. Flanged sleeves

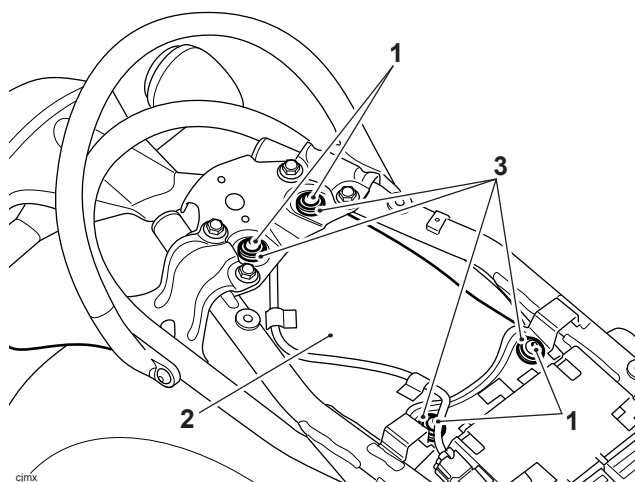
Rear Mudguard - Installation

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.

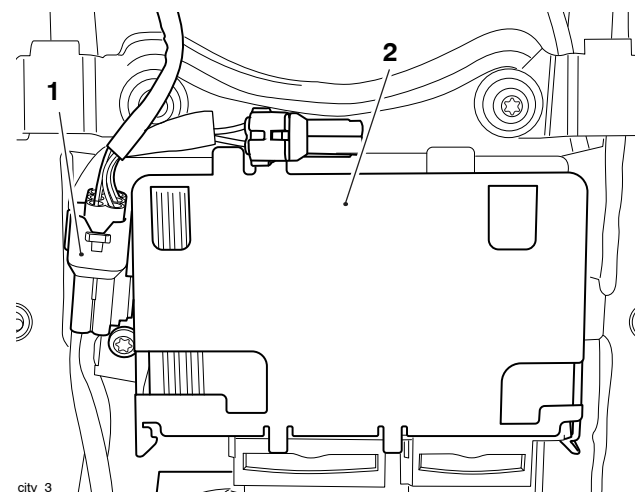
1. Carefully locate the mudguard to the frame, positioning the locating holes to the holes in the frame.

2. Fit the flanged sleeves and the new fixings. Tighten the fixings to 10 Nm.



1. **Fixings**
2. **Rear mudguard**
3. **Flanged sleeves**

3. Connect the rear light electrical connector to the main harness.



1. **Rear light electrical connector**
2. **Engine ECM**

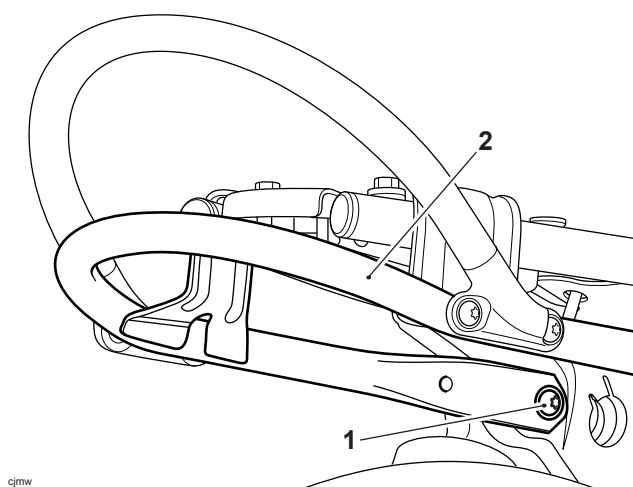
- Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
- Refit the seat (see Seat - Installation, page 645).

Passenger Grab Rail - 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.

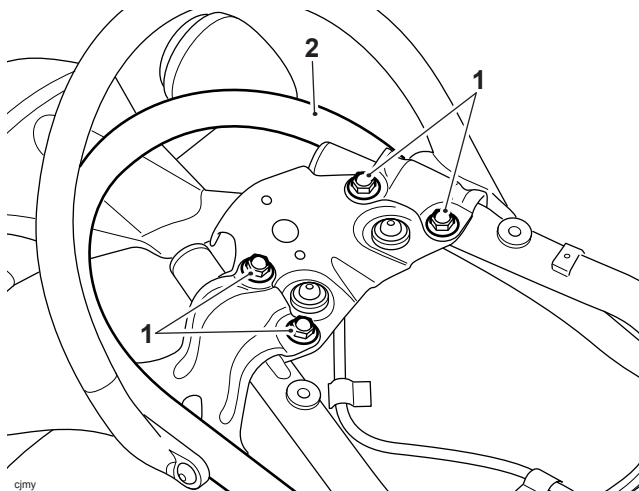
- Remove the rear mudguard (see Rear Mudguard - Removal, page 647).
- 1. Remove the fixings securing the front of the grab rail to the frame.



1. Fixing

2. Grab rail

2. Remove the four fixings securing the rear of the grab rail to the frame. Remove the grab rail.



1. Fixings

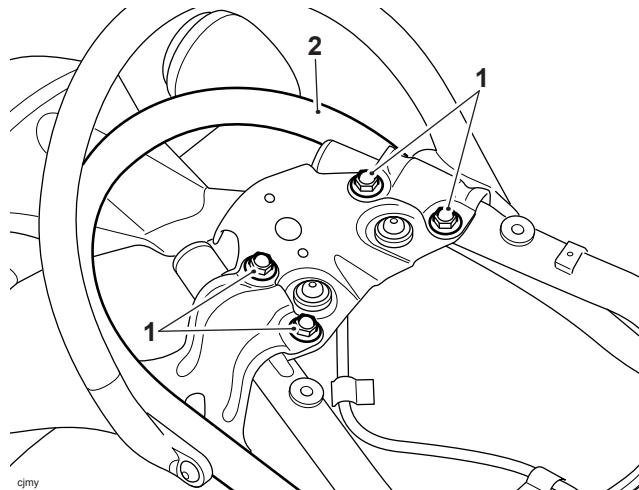
2. Grab rail

Passenger Grab Rail - Installation

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.

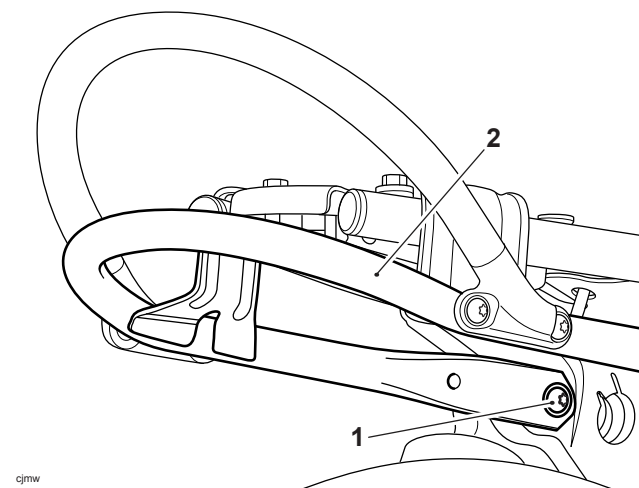
1. Align the grab rail to the frame and fit the rear fixings. Do not fully tighten at this stage.



1. Fixings

2. Grab rail

2. Secure the front of the grab rail to the frame and tighten the fixings to 20 Nm.



1. Fixing

2. Grab rail

3. Tighten the grab rail rear fixings to 20 Nm.
 - Refit the rear mudguard (see Rear Mudguard - Installation, page 648).

Cradle Assemblies - 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.

- Remove the seat (see Seat - Removal, page 645).
- Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).

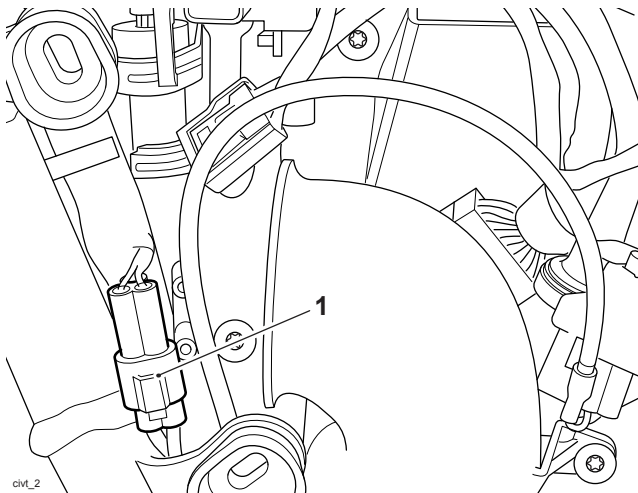
Left Hand Cradle Assembly

1. Remove the left hand side panel (see Side Panels, page 646).

Caution

Note the routing and the retaining clips of the side stand switch harness for installation.

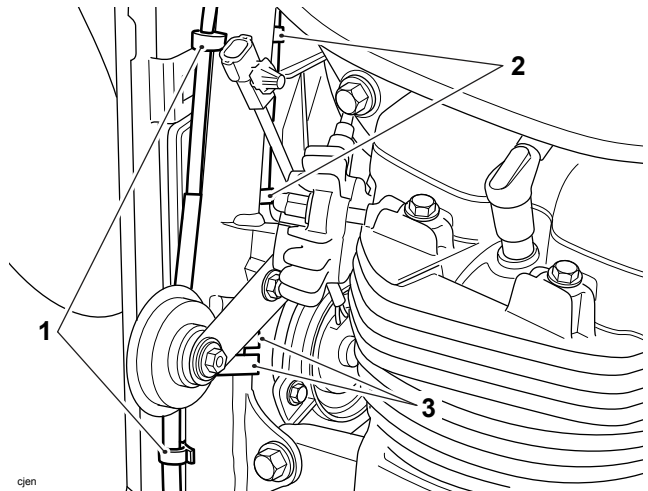
2. Disconnect the side stand switch electrical connector from the main harness and feed it down to the side stand switch.



1. Side stand switch electrical connector

3. Detach the two clutch cable clips from the cradle assembly.
4. Detach the two harness clips from the cradle assembly.

5. Disconnect the two wires from the horn.

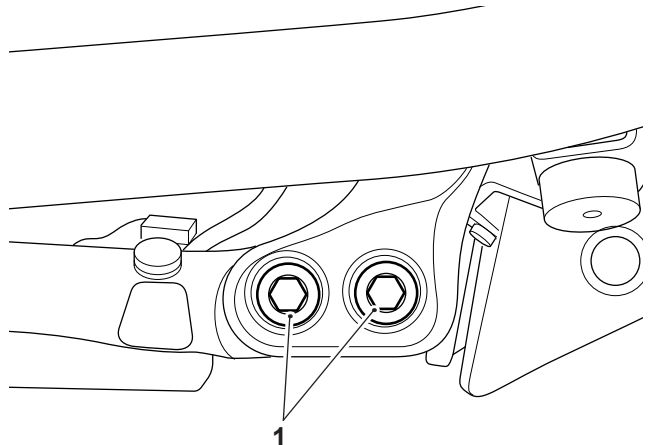


1. Clips (clutch cable)

2. Clips (harness, exhaust header removed for clarity)

3. Horn connectors

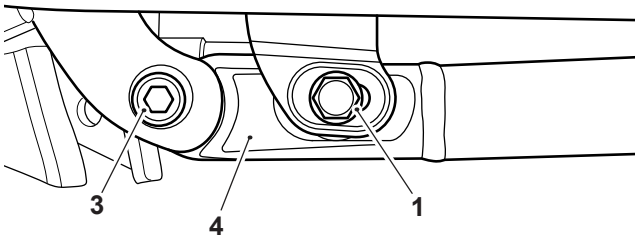
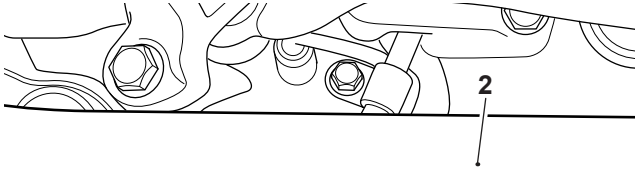
6. Remove the cradle assembly two rear mounting bolts and collect the nuts.



1. Mounting bolts

Right Hand Cradle Assembly

1. Remove the cradle's rear mounting bolt and nut.
2. Remove the nut and bolt securing the exhaust intermediate pipe to the cradle assembly.

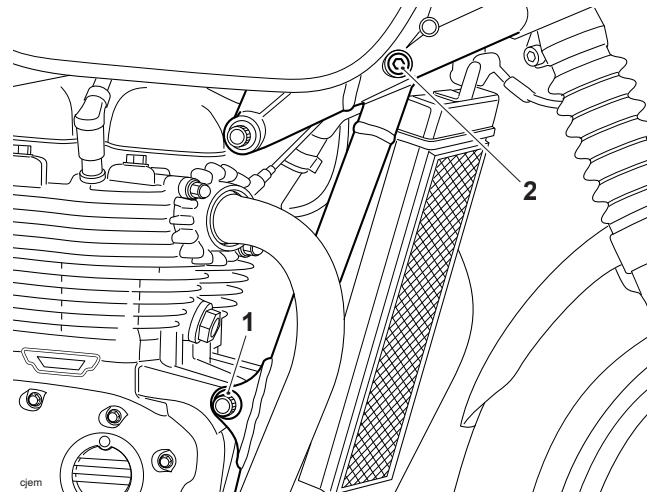


1. Bolt
2. Intermediate exhaust pipe
3. Bolt
4. Cradle assembly

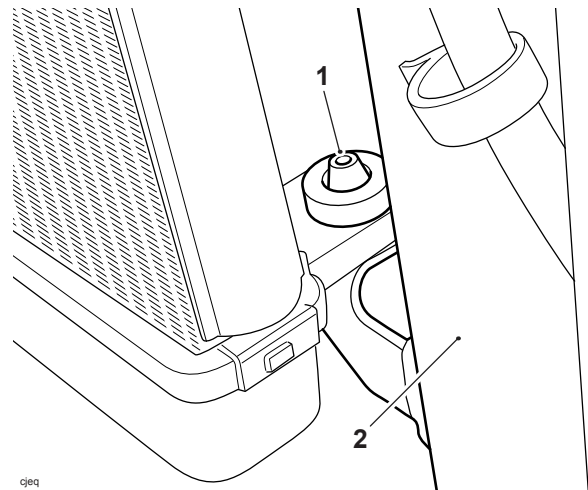
Both Cradle Assemblies

1. Remove the crankcase front mounting nut and bolt.

2. Remove the nut and bolt securing the cradle assemblies to the headstock.



1. Bolt (to crankcase front mounting)
2. Bolt (to headstock)
3. Detach the cradle assembly from the lower mounting of the radiator and remove the cradle assembly.



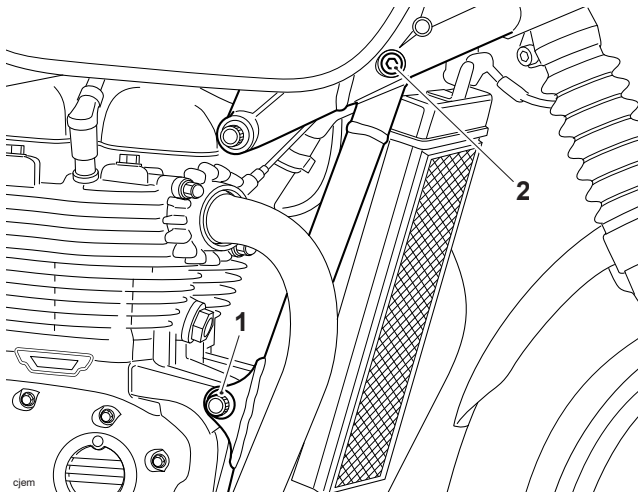
1. Radiator lower mounting
2. Cradle assembly (left hand side shown)

Cradle Assemblies - Installation

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 cradle assembly to the frame, ensure the lower mounting of the radiator is attached to the cradle assembly.
2. Fit the crankcase front mounting nut and bolt, do not fully tighten at this stage.
3. Fit the nut and bolt securing the cradle assembly to the headstock, do not fully tighten at this stage.

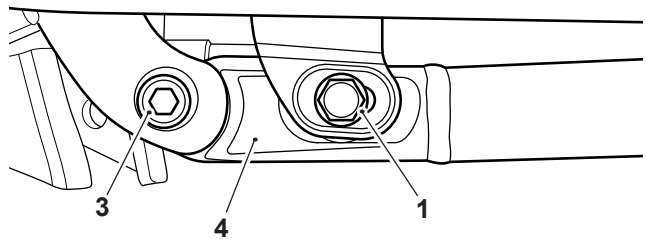
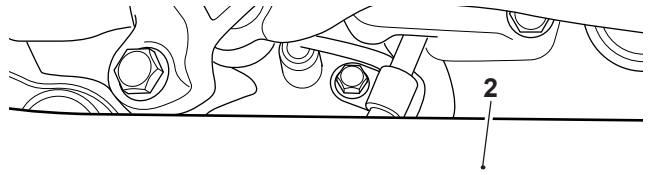


1. **Bolt (to crankcase front mounting)**
2. **Bolt (to headstock)**

Right Hand Cradle Assembly

1. Fit the cradle assembly rear mounting bolt and nut, do not fully tighten at this stage.

2. Fit the nut and bolt to secure the exhaust intermediate pipe to the cradle assembly. Do not fully tighten at this stage.



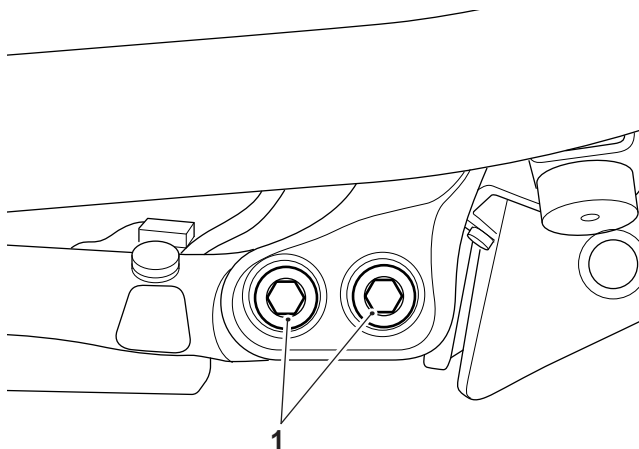
1. **Bolt**
2. **Intermediate exhaust pipe**
3. **Bolt**
4. **Cradle assembly**

Note:

- When tightening the cradle assembly mounting bolts and nuts, hold the nut and torque the bolt.
3. Tighten the cradle assembly to headstock bolt to 40 Nm.
 4. Tighten the cradle assembly rear mounting bolt to 40 Nm
 5. Tighten cradle assembly to crankcase bolt to 105 Nm.
 6. Tighten the exhaust intermediate pipe to cradle assembly to 19 Nm.

Left Hand Cradle Assembly

1. Fit the cradle assembly two rear mounting bolts and captivated nuts, do not fully tighten at this stage.

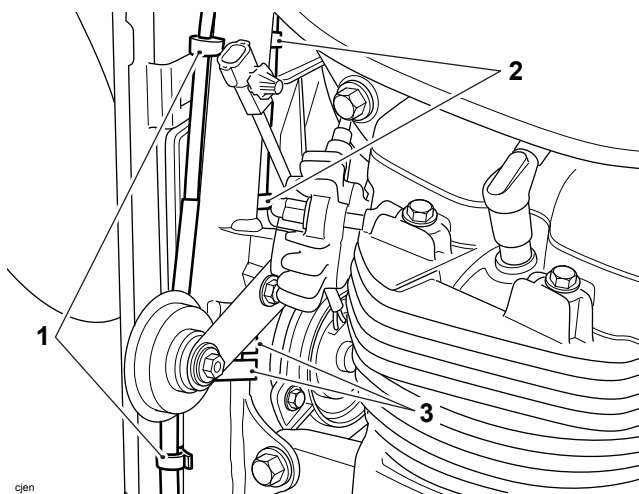


cjep

1. Mounting bolts

Note:

- When tightening the cradle assembly mounting bolts and nuts, hold the nut and torque the bolt.
2. Tighten the cradle assembly to headstock bolt to 40 Nm.
 3. Tighten the cradle assembly rear mounting bolts to 40 Nm.
 4. Tighten cradle assembly to crankcase bolt to 105 Nm.
 5. Connect the two wires to the horn.
 6. Refit the clips for the clutch cable and horn harness to the cradle assembly



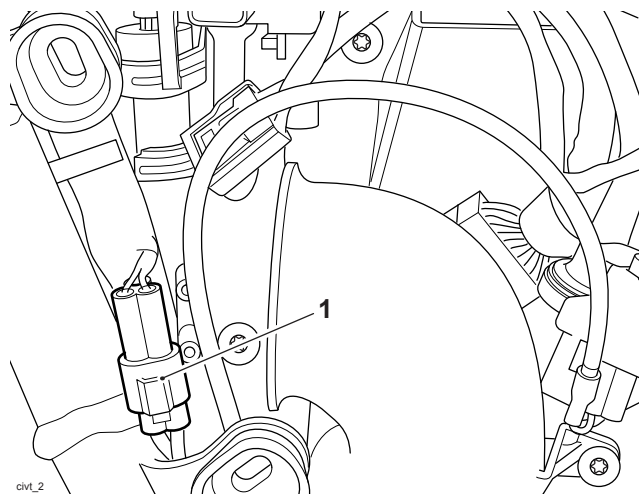
cjen

1. Clips (clutch cable)

2. Clips (harness, exhaust header removed for clarity)

3. Horn connectors

7. Route the side stand switch harness to the left hand side of the airbox as noted for removal. Connect the electrical connector to the main harness.



civ1_2

1. Side stand switch electrical connector

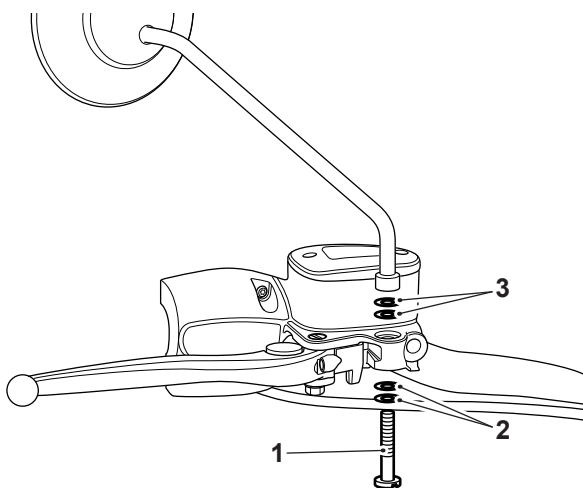
8. Fit the left hand side panel (see Side Panels, page 646).

Both Cradle Assemblies

- Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
- Refit the seat (see Seat - Installation, page 645).

Mirrors - Removal

1. Remove the mirror fixing and collect the two lower washers.
2. Remove the mirror and collect the two upper washers.



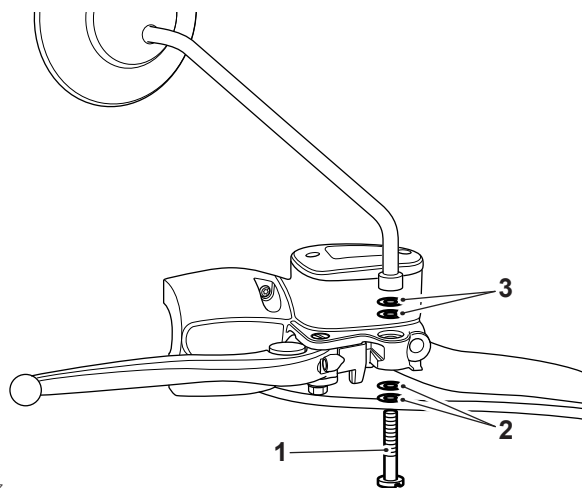
1. Fixing
2. Washers (2 lower)
3. Washers (2 upper)

Mirrors - Installation

Warning

If the mirror fixing is too loose, the mirror may blow back at speed. This will result in a loss of vision to the rear of the motorcycle. It is dangerous to ride a motorcycle without sufficient rearward vision.

1. Fit the two upper washers into the housing for the mirror.
2. Fit the two lower washers to the mirror fixing.
3. Align the mirror to its mounting and fit the mirror fixing. Do not fully tighten at this stage.
4. Position the mirror arm to give rear visibility in the riding position and tighten the fixing to 20 Nm.



1. Fixing
2. Washers (2 lower)
3. Washers (2 upper)
5. Repeat the procedure for the other mirror.

Side Stand - Removal

Warning

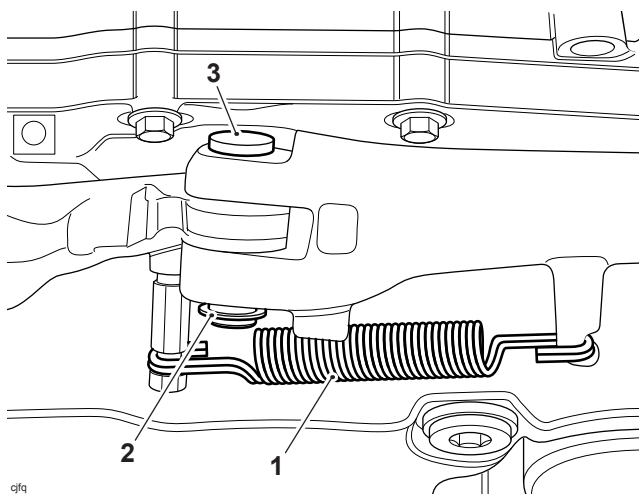
Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

1. Raise and support the motorcycle.

Warning

Wear hand, eye and face protection when unhooking the stand spring. Take great care to minimise the risk of personal injury and loss of components.

2. Remove the left hand exhaust intermediate pipe (see Header and Exhaust Intermediate Pipes - Removal, page 439).
3. With the side stand in the up position, unhook the spring from the side stand and remove it from the motorcycle.
4. Remove and discard the E-clip securing the clevis pin.
5. Remove the clevis pin and remove the side stand.



1. Spring
2. E-clip
3. Clevis pin

Side Stand - Installation

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. Lubricate the clevis pin shoulder and side stand pivot with multipurpose grease.
2. Fit the side stand to the motorcycle and insert the clevis pin.
3. Fit a new E-clip to secure the clevis pin.

Warning

Wear hand, eye and face protection when fitting the stand spring. Take great care to minimise the risk of personal injury and loss of components.

4. Hook the spring onto its frame lug then carefully hook it onto the side stand lug.
5. Refit the left hand exhaust intermediate pipe (see Header and Intermediate Exhaust Pipes - Installation, page 441).
6. Check the operation of the side stand before riding the motorcycle. Ensure the spring holds the stand securely in the retracted position.

Centre Stand - 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 motorcycle.

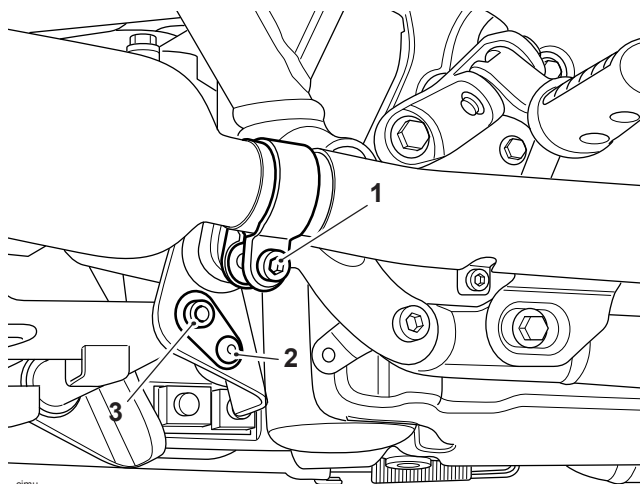
Note:

- **Note the position and orientation of the exhaust clamp for installation.**
2. Loosen the right hand exhaust silencer clamp and position it such that the centre stand spindle can be removed.

Warning

Wear hand, eye and face protection when unhooking the stand spring. Take great care to minimise the risk of personal injury and loss of components.

3. With the centre stand in the up position, unhook the spring from the centre stand and remove it from the motorcycle.
4. Remove and discard the fixing securing the centre stand spindle to the frame.
5. Remove the spindle and remove the centre stand.



1. Exhaust silencer clamp
2. Fixing
3. Centre stand spindle

Centre Stand - Installation

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. Lubricate the centre stand spindle with multipurpose grease.
2. Fit the centre stand to the motorcycle and insert the Spindle. Tighten the new fixing to 8 Nm.

Warning

Wear hand, eye and face protection when fitting the stand spring. Take great care to minimise the risk of personal injury and loss of components.

3. Hook the spring onto its frame lug then carefully hook it onto the centre stand lug.
4. Position the right hand silencer exhaust clamp as noted for removal and tighten to 20 Nm.
5. Check the operation of the centre stand before riding the motorcycle. Ensure the spring holds the stand securely in the retracted position.

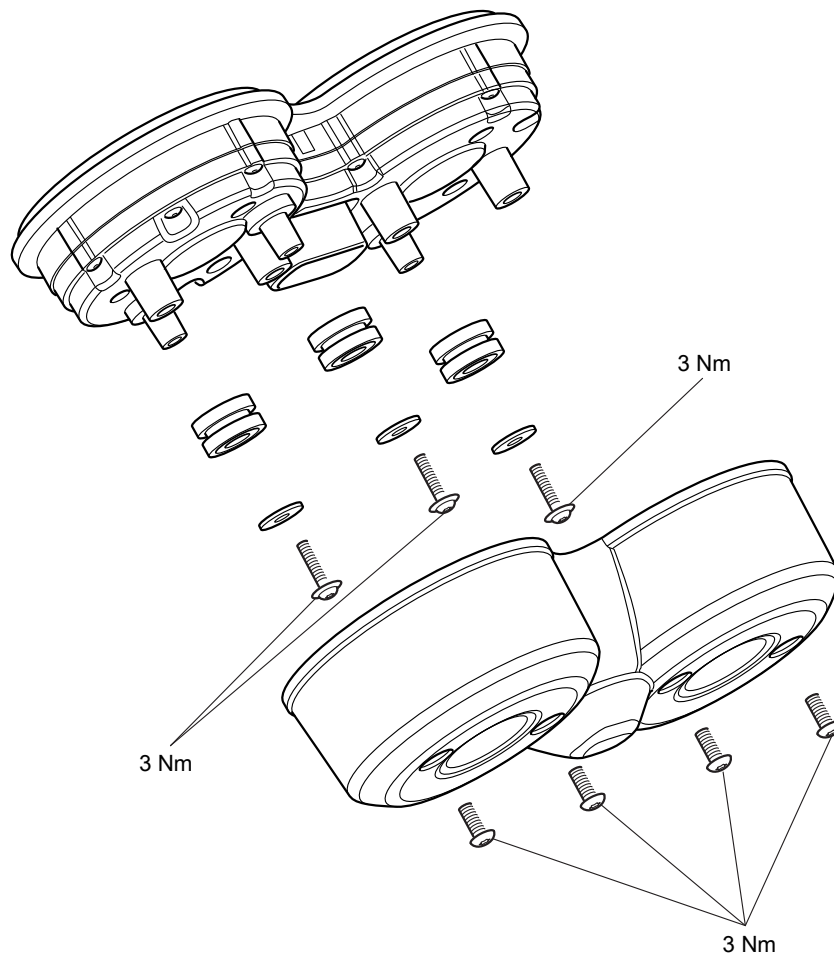
26 Electrical

Table of Contents

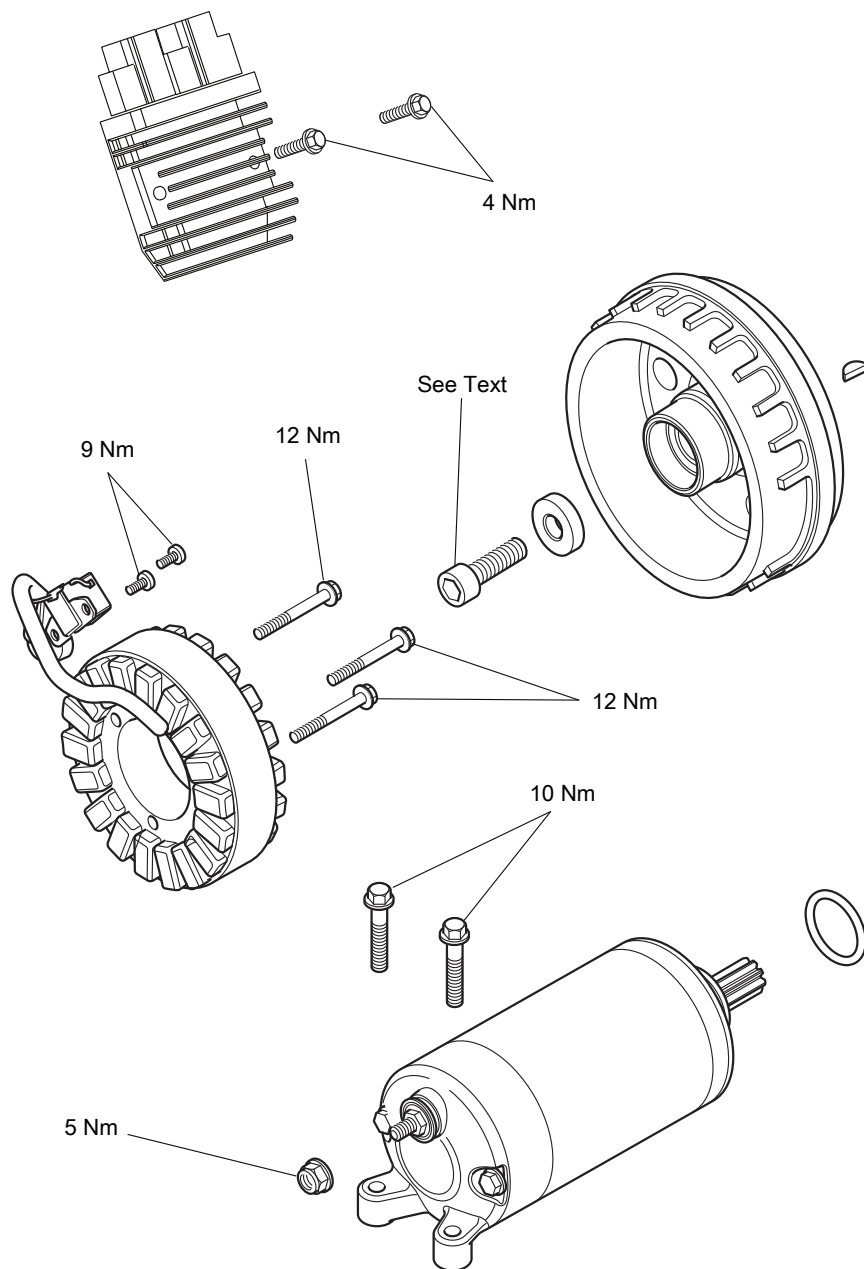
Exploded View – Instruments	660
Exploded View – Alternator and Starter Motor	661
Exploded View – Headlight.....	662
Exploded View – Rear Lights.....	664
Exploded View – Indicators	665
Exploded View – Battery, Horn and Wiring.....	666
Battery	667
Battery Disposal	667
Battery - Removal.....	668
Battery - Installation.....	668
Battery Commissioning and Charging.....	669
Battery Maintenance	670
Battery Already in Service.....	670
Fuse Box.....	671
Starting Circuit	672
Diagnosis – Starter Circuit.....	674
Alternator/Charging System	676
Headlight	678
Headlight Vertical Adjustment.....	678
Headlight - Removal	679
Headlight - Installation.....	680
Headlight and Daytime Running Light Bulb Replacement.....	681
Headlight and Position Light Bulb Replacement	682
Headlight Bracket - Removal.....	683
Headlight Bracket - Installation.....	684
Rear Light - Removal	684
Rear Light - Installation.....	686
Bulb Replacement LED	687
Direction Indicator Lights - Bulb Replacement	688

Front Direction Indicators - Removal	688
Front Direction Indicators - Installation	689
Rear Direction Indicators - Removal.....	689
Rear Direction Indicators - Installation.....	690
Instruments - Removal.....	691
Instruments - Installation	692
Heated Grips - Removal.....	693
Heated Grips - Installation	695
Side Stand Switch - Removal.....	697
Side Stand Switch - Installation	698
Ignition Coils - Removal.....	699
Ignition Coils - Installation	701
Alternator Stator - Removal.....	702
Alternator Stator - Installation	703
Alternator Rotor - Removal	704
Alternator Rotor - Installation.....	705
Alternator Regulator/Rectifier - Removal.....	706
Alternator Regulator/Rectifier - Installation.....	706
Starter Motor - Removal.....	707
Starter Motor - Installation	707
Alternator Stator	708
Regulator/Rectifier	712
Lighting Circuit tables.....	716
Lighting Circuit Diagram.....	717
Starting and Charging Circuit Tables.....	718
Starting and Charging Circuit Diagram	719
Auxiliary and Accessory Circuit Tables.....	720
Auxiliary and Accessory Circuit Diagram	721
Engine Management Circuit Tables	722
Engine Management Circuit Diagram.....	723
ABS System Circuit Tables	724
ABS System Circuit Diagram.....	725
Complete Main Harness Table.....	726
Complete Main Harness Diagram	728

Exploded View - Instruments

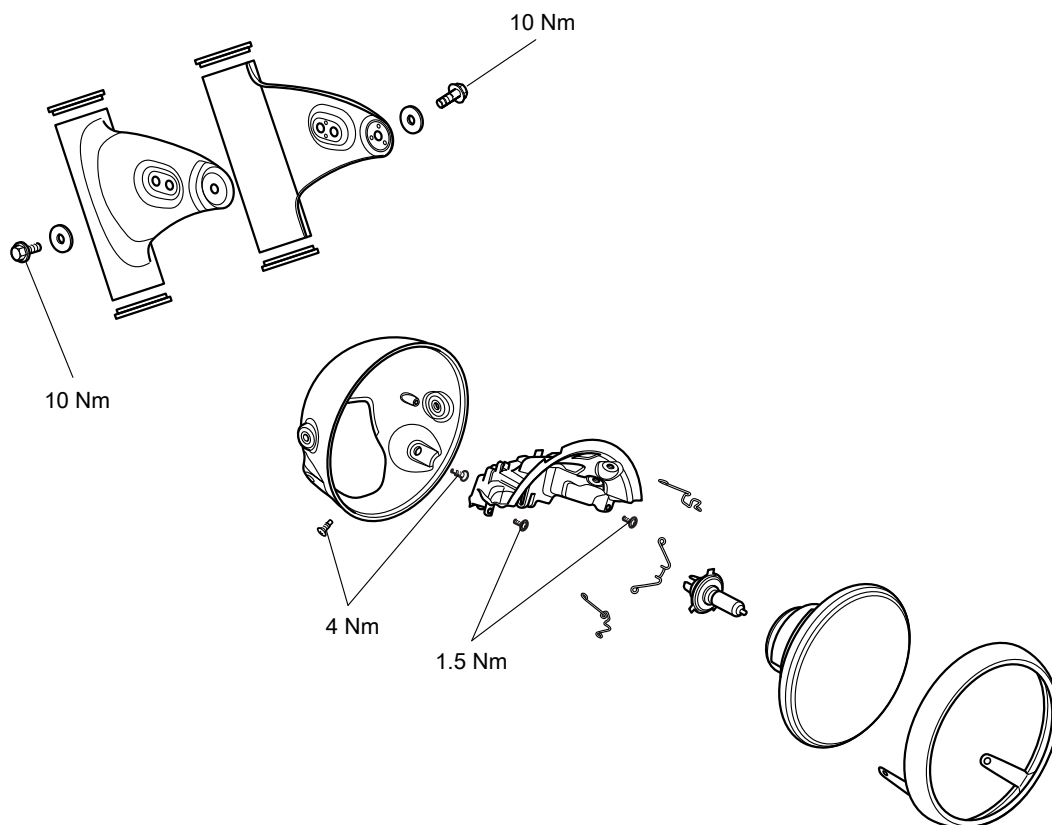


Exploded View - Alternator and Starter Motor

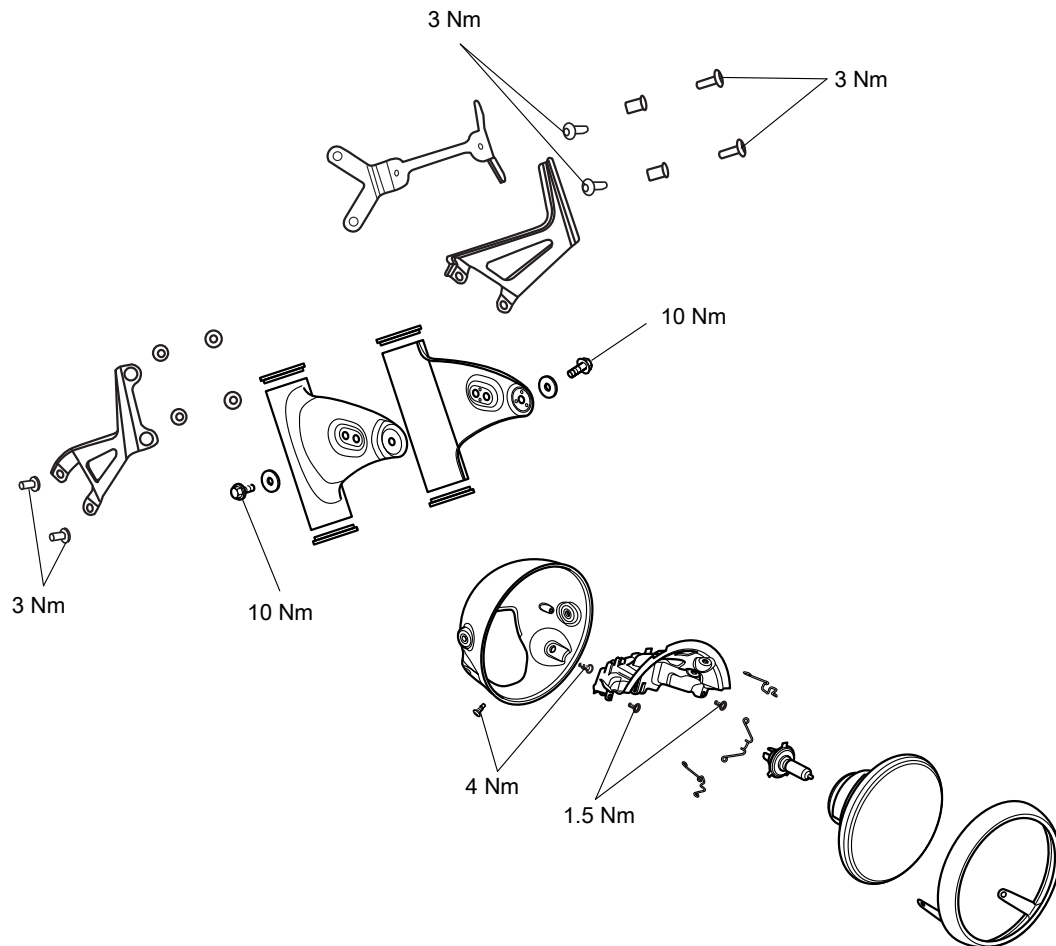


Exploded View - Headlight

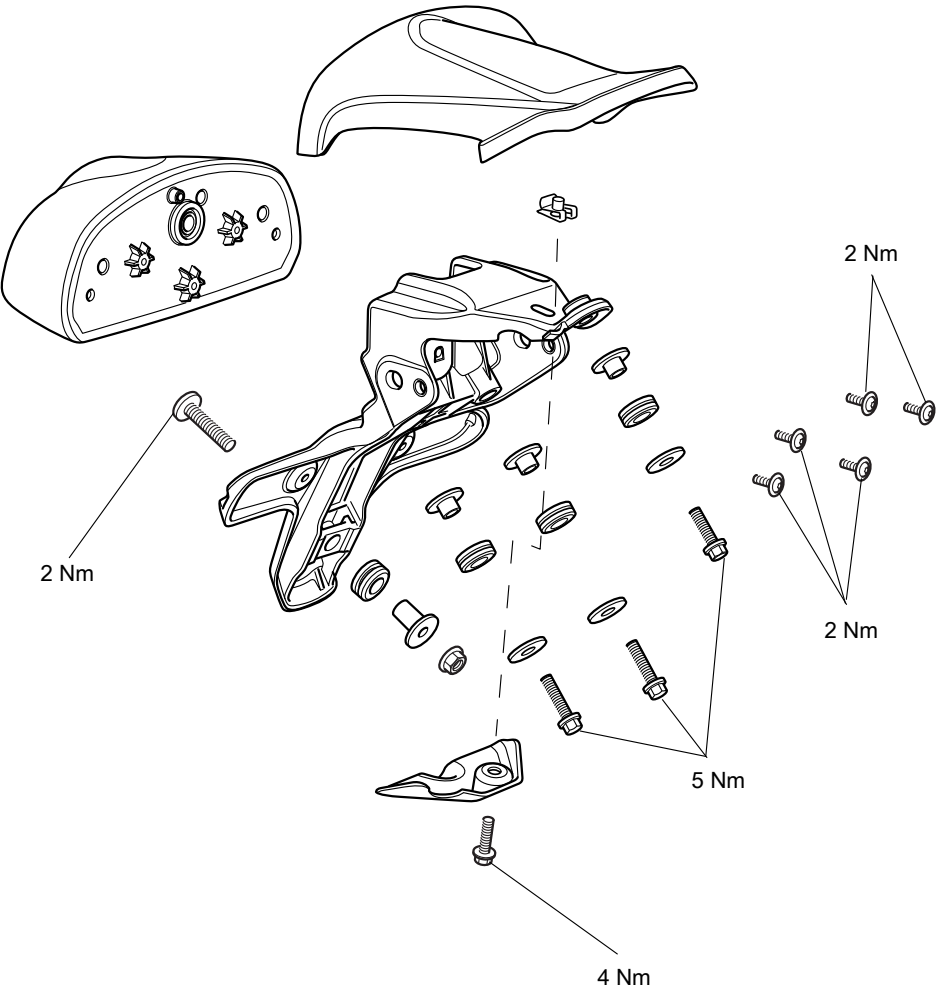
All Markets Except India and Indonesia



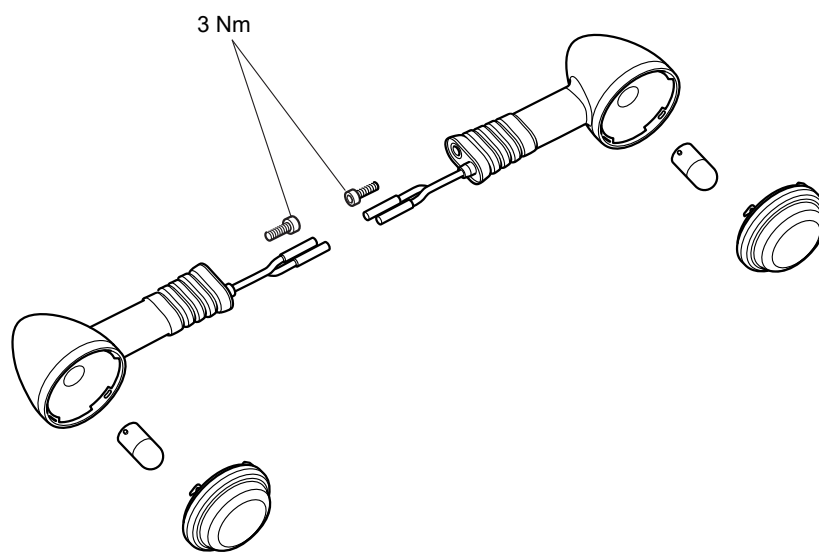
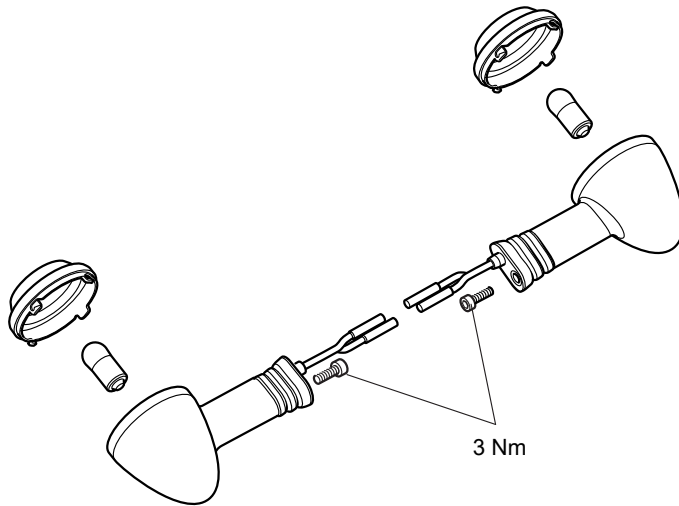
India and Indonesia Markets Only



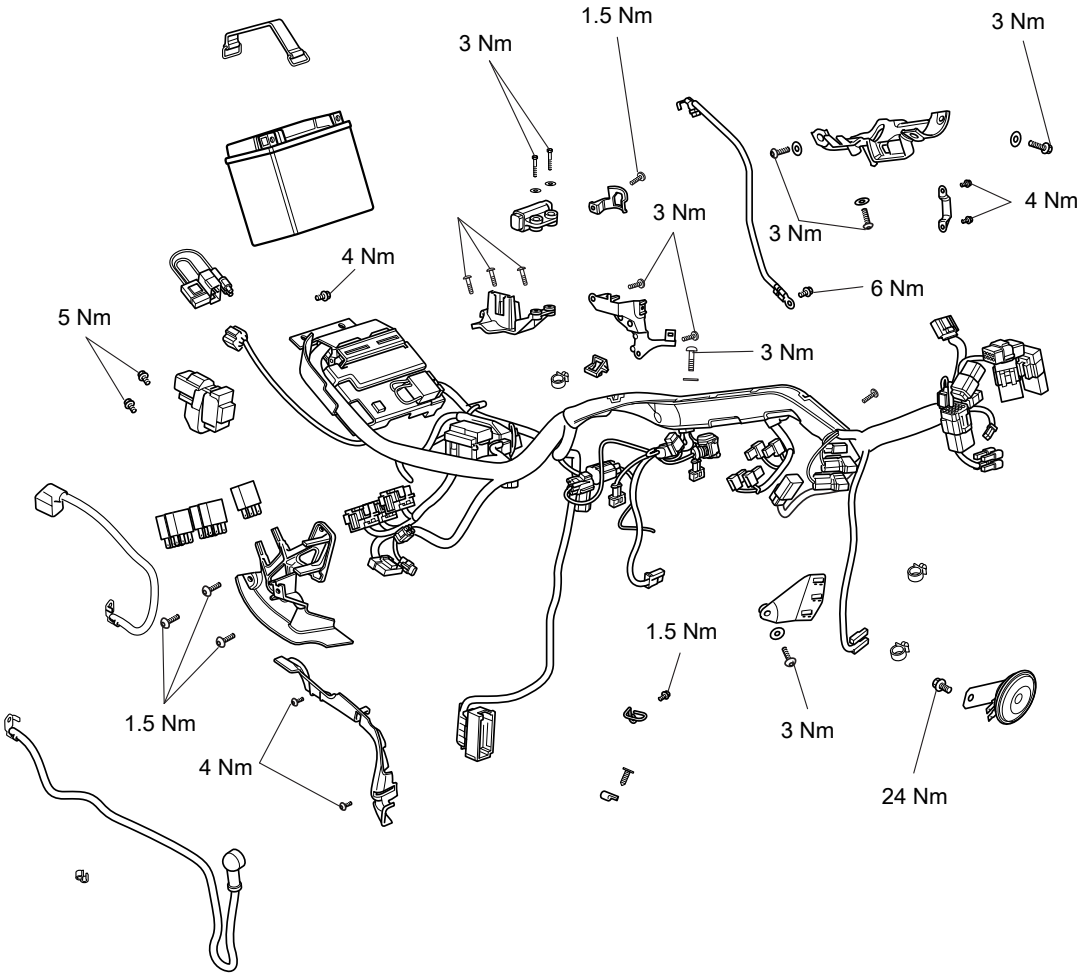
Exploded View – Rear Lights



Exploded View - Indicators



Exploded View – Battery, Horn and Wiring



Battery

Warning

Under some circumstances, the battery can give 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 attach jump leads to 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 gases causing a risk of personal injury.

Battery Disposal

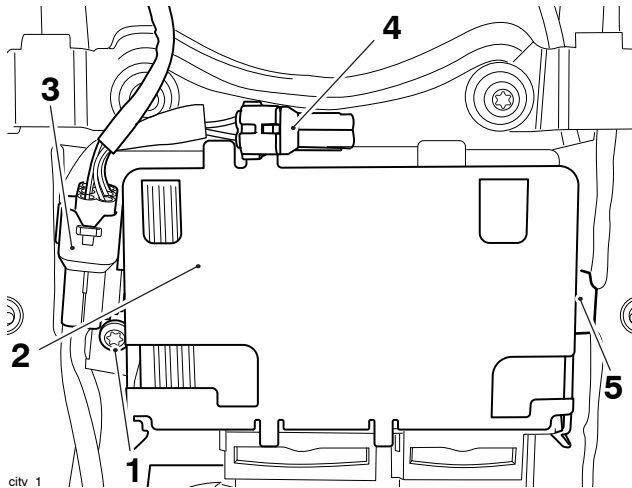
Should the battery ever require replacement, the original battery must be handed to a recycling agent who will ensure that the dangerous substances from which the battery is manufactured do not pollute the environment.

Battery - 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 Seat - Removal, page 645).
2. Disconnect the battery leads, negative (black) lead first.
3. Remove and discard the fixing securing the engine ECM bracket to the frame.
4. Partially raise the right hand side of the bracket and release the locating lug on the left hand side from the frame.
5. Detach the rear lights electrical connector from its lug on the engine ECM bracket.
6. Disconnect the USB electrical connector.



1. **Fixing**
2. **Engine ECM bracket**
3. **Rear lights electrical connector**
4. **USB electrical connector**
5. **Locating lug**
7. Position the engine ECM to one side.

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.

8. Remove the battery strap.
9. Take the battery out of the case.

Battery - Installation

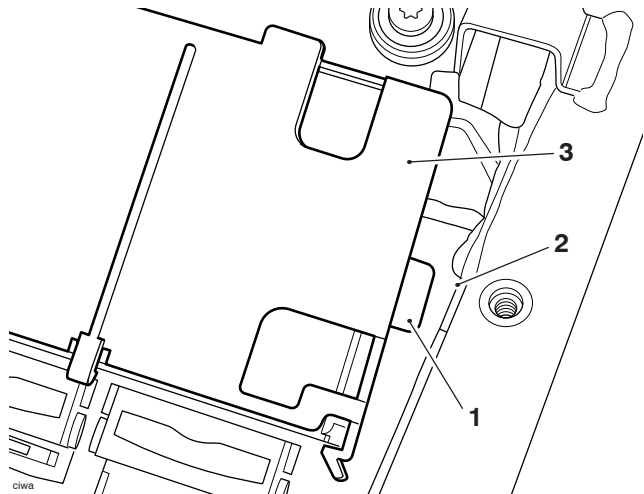
Warning

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

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 and secure with the battery strap.
2. Reconnect the USB electrical connector.
3. Attach the rear lights electrical connectors onto its locating lug on the engine ECM bracket.
4. Locate the locating lug on the left hand side of the bracket into its locating hole in the frame.



1. **Locating lug**
2. **Locating hole**
3. **Engine ECM bracket**
5. Secure the engine ECM bracket with a new fixing and tighten to 4 Nm.
6. Reconnect the battery, positive (red) lead first and tighten the battery terminals to 4.5 Nm.
7. Apply a light coat of grease to the terminals to prevent corrosion.
8. Cover the positive terminal with the protective cap.
9. Refit the seat (see Seat - Installation, page 645).

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 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.

1. Ensure the VIN number printed on the anti-tamper label attached to the battery matches the motorcycle VIN.
2. Check the battery carefully for damage.

Caution

Ensure the electrolyte container part number matches the battery part number to be filled. Battery life will be greatly reduced if the incorrect volume (either too little or too much) of acid is added to the battery.

3. Read the instructions and warnings delivered with the battery.
4. Place the battery on a flat level surface and remove the sealing foil.

5. Remove the battery sealing strip from the electrolyte container and save for later in this procedure. Place the sealing strip on a clean surface, with the upper side facing downwards to avoid contamination of the sealing strip. Do not break the seal on the electrolyte container.
6. Place the electrolyte container on the battery and fill the battery according to the manufacturers instructions.
7. After starting to fill the battery with electrolyte, allow the battery to stand for 30 minutes with the filling container in place.
8. 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.
9. After the electrolyte has drained into the battery, allow the battery to stand with the electrolyte container in place for a further 2 hours.
10. Remove the electrolyte container carefully, and dispose of immediately.
11. Place the sealing cap strip LOOSELY over the filling holes of the battery.
12. Charge the battery using the BatteryMate Battery Charger. Refer to the instructions supplied with the BatteryMate Battery Charger.

Caution

The caps must be fitted (after charging) within two hours of filling the battery with acid. Leaving the battery open to the atmosphere for longer than is necessary will start to reverse the chemical reaction which takes place within the battery, greatly reducing the battery's service life.

13. After charging is complete, press down firmly with both hands to seat the caps (do not use tools or force the caps into position).
14. Disconnect the charger and allow the battery to stand for 1 hour before fitting to the motorcycle.
15. 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 checking the voltage and routine recharging such as during storage. It is not possible to adjust the electrolyte level in the battery.

Note:

- The charge level in the battery must be maintained to maximise the battery life.

With normal use of the motorcycle, the charging system will keep the battery charged. If the motorcycle is unused, the battery will gradually discharge due to battery self discharge and the continuous current drain for the clock and the engine control module memory.

The rate of battery discharge can be greatly increased by the addition of electrical security systems or other accessories.

Allowing a battery to discharge, or leaving it discharged over a period of time, causes sulphation of the lead plates within the battery.

Sulphation is a normal chemical reaction inside the battery and over a period of time sulphate will crystallise on to the lead plates making charging difficult or impossible. The result is a permanently damaged battery, which would not be covered by the motorcycle warranty.

Keeping a battery at full charge reduces the chance of it freezing in cold conditions. Allowing a battery to freeze can cause serious internal damage to the battery.

When leaving the motorcycle standing for more than a few days, regularly check the battery voltage using a digital multimeter. Should the battery voltage fall below 12.8 V, charge the battery using the BatteryMate Battery Charger - see latest Parts Catalogue for part number information. Refer to the instructions supplied with the BatteryMate Battery charger.

For extended periods of storage (beyond two weeks) the battery should be removed and the battery voltage checked regularly and charged when below 12.8 V.

Battery Already in Service

Note:

- Before carrying out the following procedure the battery must be disconnected and removed from the motorcycle.

Use the guidelines in the table below 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%	12.8 V - 13.0 V	None. Check at 6 months from date of manufacture	None required
75% - 100%	12.5 V - 12.8 V	May need slight charge. If no charge given, check in 3 - 4 months	3 - 6 hours
50% - 75%	12.0 V - 12.5 V	Needs charge	5 - 11 hours
25% - 50%	11.5 V - 12.0 V	Needs charge	At least 13 hours
0% - 25%	11.5 V or less	Needs recovery using BatteryMate 150-9. Retest after recovery	20 hours

Fuse Box

Warning

Always replace blown fuses with new ones of the correct rating (as specified on the fuse box cover) and never use a fuse of higher rating.

Use of an incorrect fuse could lead to an electrical problem, resulting in motorcycle damage, loss of motorcycle control and an accident.

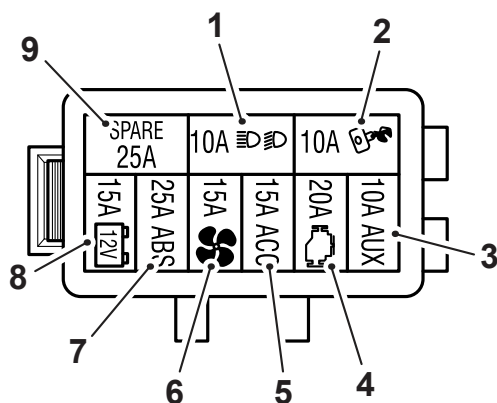
A blown fuse is indicated when all of the systems protected by that fuse become inoperative. When checking for a blown fuse, refer to the fuse identification table to establish which fuse has blown.

The fuse box is located underneath the seat.

To allow access to the fuse box, the seat must be removed (see Seat - Removal, page 645).

Note:

- Numbers shown in the following illustration correspond to the position numbers in the fuse identification table.



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1. Fuse box

Fuse Identification Table

Position	Circuit Protected	Rating (Amps)
1	Dip and high headlight beams	15
2	Ignition switch, starter circuit	10
3	Auxiliary lights	10
4	Engine management system	15
5	Accessory socket	5
6	Cooling fan	15
7	ABS	25

Position	Circuit Protected	Rating (Amps)
8	Instruments and alarm	15
9	USB port socket	5

Starting Circuit

All Triumph models are equipped with an electric start system. This system consists of a starter relay, starter motor, starter switch, side stand 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 side stand 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), side stand and clutch switches.

Note:

- **On all new models from Daytona 675 onwards which use a CAN communication, the engine will not crank if the instruments, ABS ECM, or immobiliser/chassis ECM (if fitted) are disconnected.**

Rectify any defects as necessary.

General Fault Finding – Starter Motor and Relay

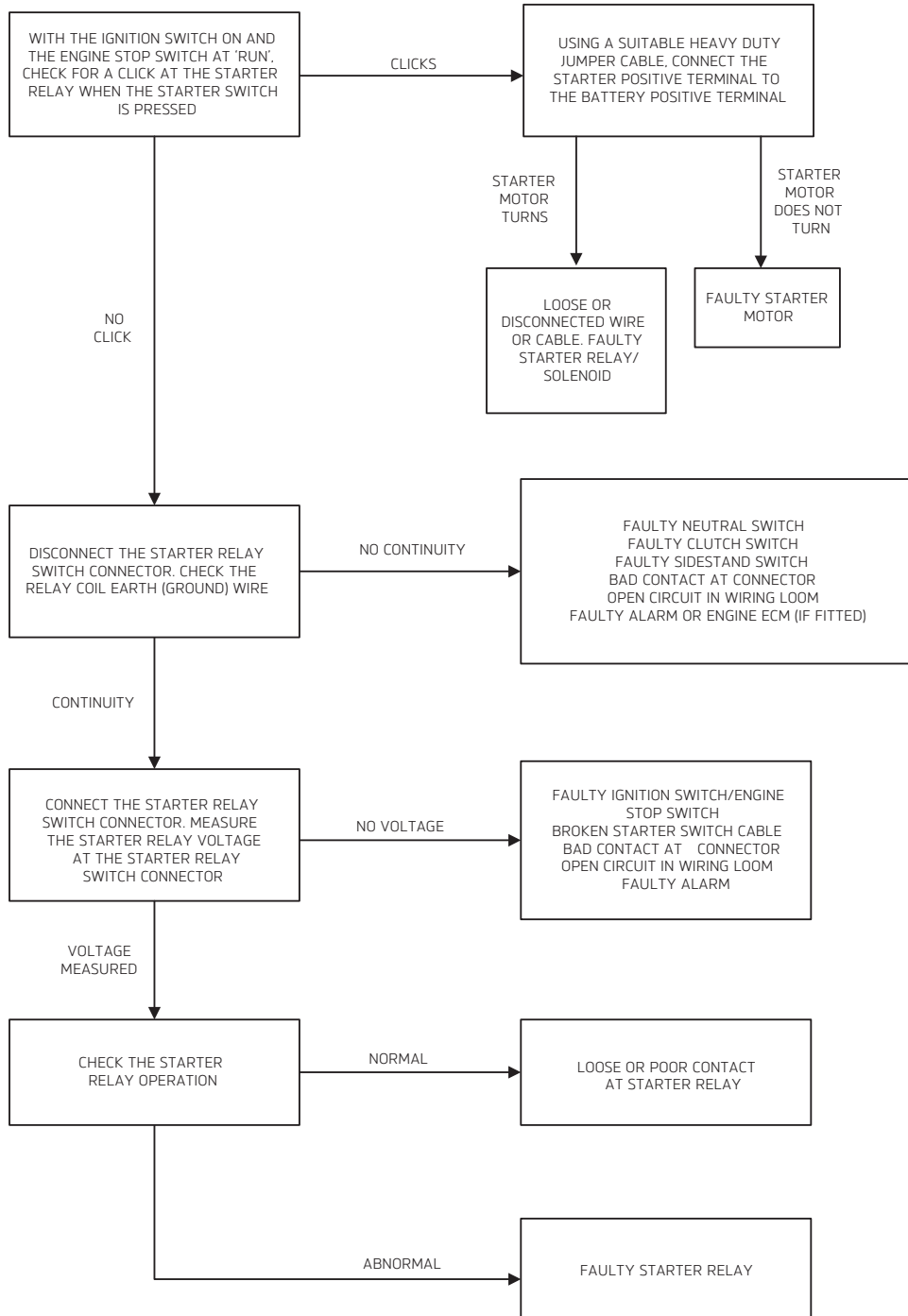
Symptom	Possible cause(s)
Starter relay does not click, starter motor does not turn	Battery discharged or defective
	Blown main or starter relay fuse
	Defective starter relay wiring or starter switch
	Check that the side stand, transmission and clutch lever are positioned for engine starting i.e. transmission in neutral, clutch lever pulled in and the side stand 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 not 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	Starter motor or starter ring gear

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Diagnosis – Starter Circuit

Note:

- Prior to carrying out the diagnosis, ensure the battery voltage is 12 - 13.5 V, the immobiliser system (if fitted) is functioning correctly, the transmission is in neutral and the clutch lever is pulled fully to the handlebar.



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Alternator/Charging System

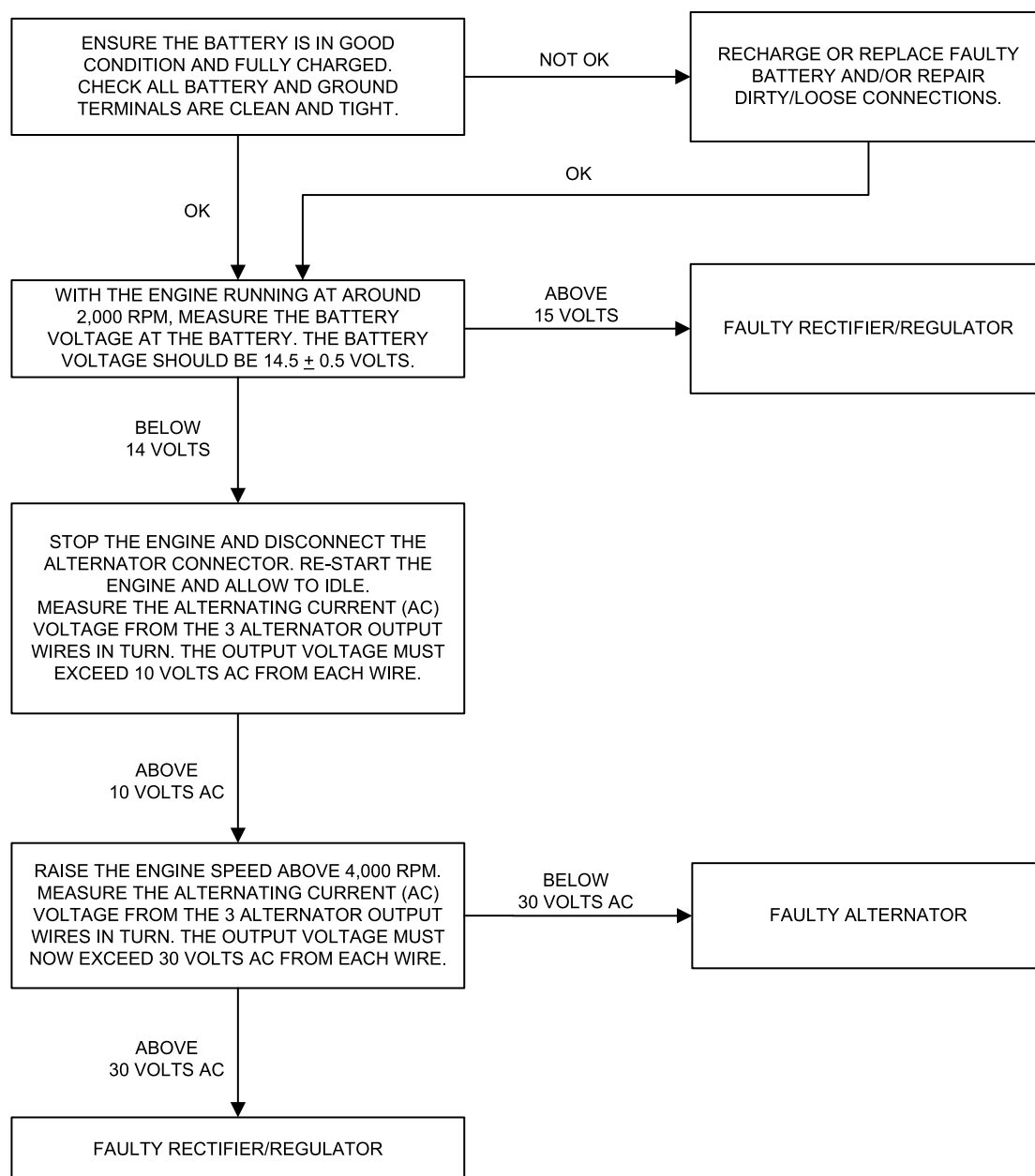
The charging system consists of an alternator, a rectifier/regulator assembly and the battery. The alternator is made up of two parts, the stator, which is mounted to the crankcase or the engine cover, and the rotor, mounted to the end of the crankshaft. The stator is an assembly of 18 coils, arranged 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 4,000 - 5,000 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 limits 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.

Rectify any defects as necessary.

Diagnosis – Charging Circuit



Headlight

Warning

Adjust road speed to suit the visibility and weather conditions in which the motorcycle is being operated.

Make sure that the beam is adjusted to illuminate the road surface sufficiently far ahead without dazzling oncoming traffic. An incorrectly adjusted headlight may impair visibility causing an accident.

Warning

Never attempt to adjust a headlamp beam when the motorcycle is in motion.

Any attempt to adjust a headlamp beam when the motorcycle is in motion may result in loss of control and an accident.

Caution

Do not cover the headlight or lens with any item likely to obstruct air flow to, or prevent heat escaping from, the headlight lens.

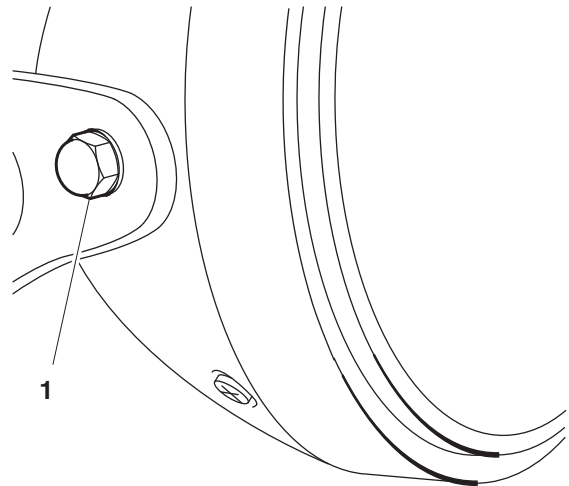
Covering the headlight lens during operation with items of clothing, luggage, adhesive tape, devices intended to alter or adjust the headlight beam or non genuine headlight lens covers will cause the headlight lens to overheat and distort, causing irreparable damage to the headlight assembly.

Damage caused by overheating is not considered a manufacturing defect and will not be covered under warranty.

If the headlight must be covered during use - such as taping of the headlight lens required during closed-course conditions - the headlight must be disconnected.

Headlight Vertical Adjustment

1. Switch the headlight dipped beam on.
2. Loosen the headlight assembly mounting fixings sufficiently to allow restricted movement of the headlight.
3. Adjust the position of the headlight to give the required beam setting.
4. Tighten the mounting fixings to 10 Nm.
5. Recheck the headlight beam setting.
6. Switch the headlight off when the beam setting is satisfactorily set.



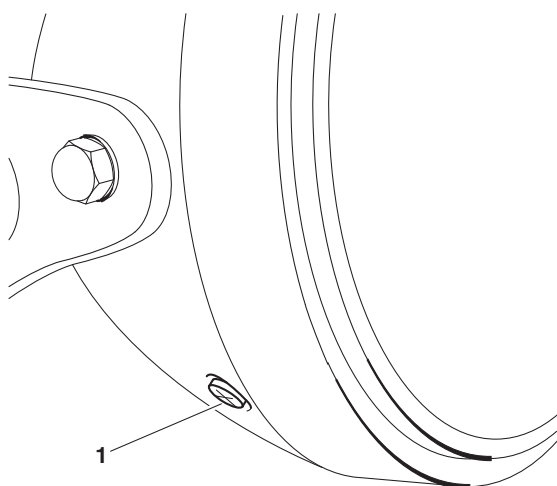
1. **Headlight mounting fixings**

Headlight - 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.

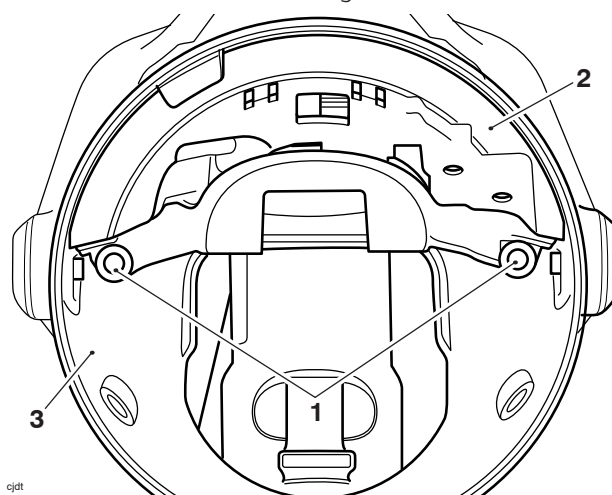
- Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
1. Release the two fixings and detach the headlight from the headlight bowl.



1. Headlight fixing (one of two)

2. Disconnect the electrical connector from the headlight bulb, detach the position light and remove the headlight.

3. Release the fixings and detach the harness bracket from the headlight bowl.



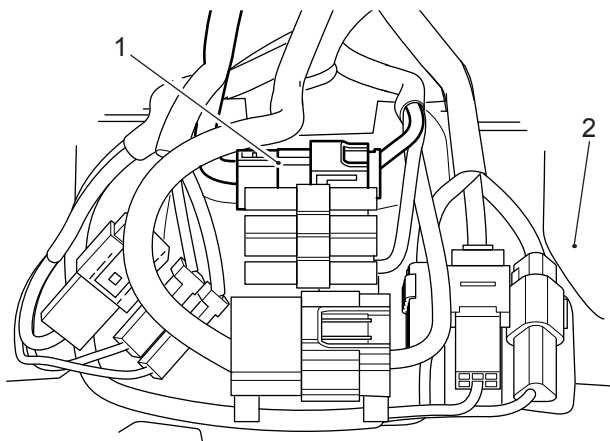
cjdt

1. Fixings
2. Harness bracket
3. Headlight bowl

Note:

- Note the position of the electrical connectors on the back of the harness bracket for installation.

4. On the back of the harness bracket, detach all the electrical connectors and remove the harness bracket.

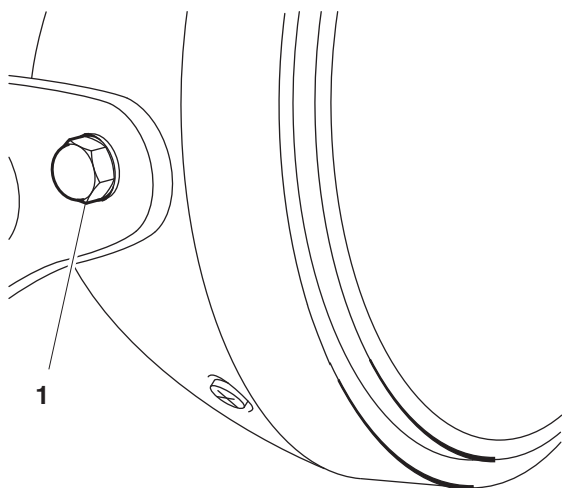


cjcz

1. Electrical connectors

2. Harness bracket

5. Remove the headlight mounting fixings and remove the headlight bowl while feeding the harnesses out of the headlight bowl.



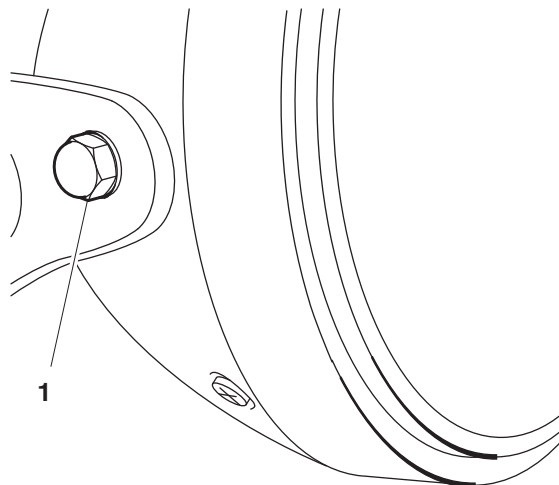
1. Headlight mounting fixings

Headlight - Installation

Warning

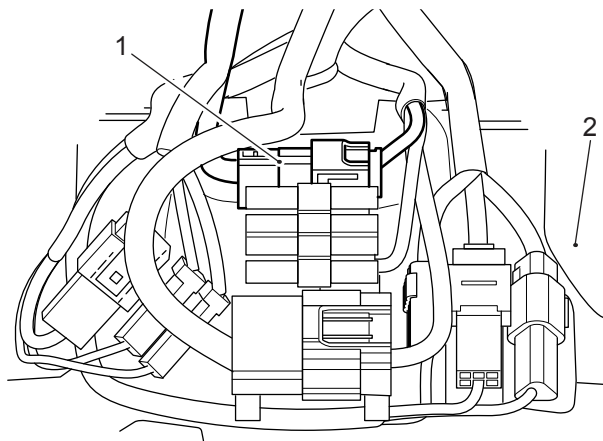
Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

1. Refit the headlight bowl while feeding the harnesses into the headlight bowl. Do not fully tighten the fixings at this stage.



1. Headlight mounting fixings

2. Fit the wiring harness electrical connectors to the back of the harness bracket as noted during removal.

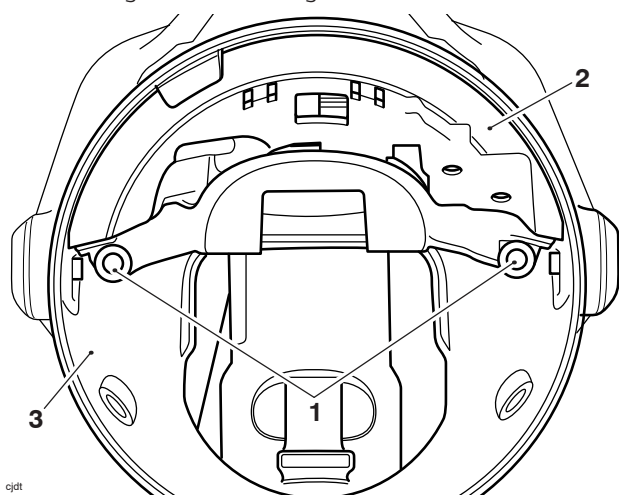


cjcz

1. Electrical connectors

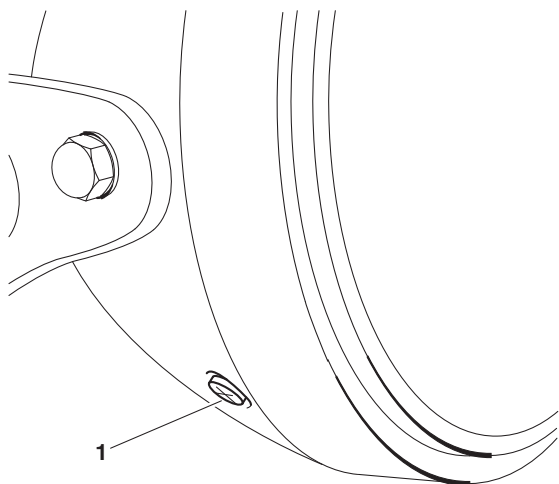
2. Harness bracket

3. Fit the harness bracket to the headlight bowl and tighten the fixings to 1.5 Nm.



1. **Fixings**
2. **Harness bracket**
3. **Headlight bowl**

4. Reconnect the headlight electrical connector and refit the position light.
5. Refit the headlight, tightening the fixings to 4 Nm.



1. Headlight fixing (one of two)

- Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
- Refit the seat (see Seat - Installation, page 645).
- Check the headlight operation and the beam setting, rectify as necessary.

Headlight and Daytime Running Light Bulb Replacement

! Warning

The bulbs become hot during use. Always allow sufficient time for the bulbs to cool before handling. Avoid touching the glass part of the bulb. If the glass is touched or gets dirty, clean with alcohol before reuse.

! Caution

The use of non-approved headlight bulbs may result in damage to the headlight lens.

Use a genuine Triumph supplied headlight bulb as specified in the Triumph Parts Catalogue.

Always have replacement headlight bulbs installed by an authorised Triumph dealer.

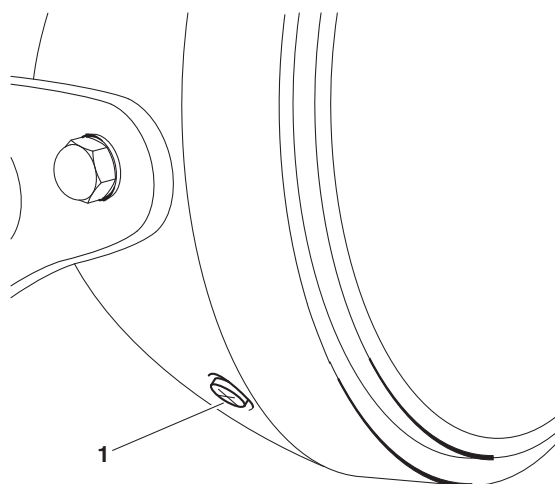
- Remove the seat (see Seat - Removal, page 645).
- Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).

Daytime Running Lights

The daytime running lights (DRL) are situated within the headlight assembly and are sealed, maintenance free LED units.

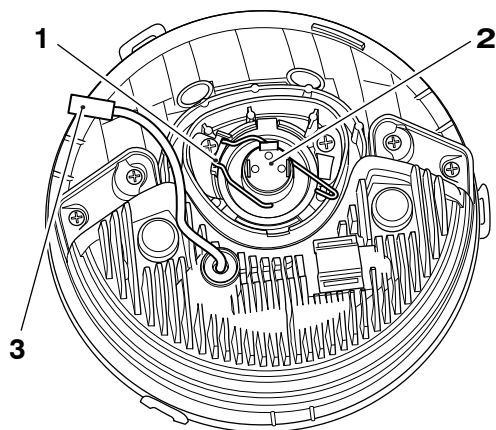
Headlight Bulb

1. Release the two fixings and detach the headlight from the headlight bowl.



1. Headlight fixing (one of two)

2. While supporting the light unit, disconnect the multipin electrical connector from the headlight bulb and the electrical connector for the daytime running light from the main harness.
3. Remove the rubber dust cover.
4. Unhook the headlight bulb's wire retainer.
5. The headlight bulb can now be removed.



cizx_2

1. Wire retainer
2. Headlight bulb
3. DRL harness

6. Installation is the reversal of removal.

Headlight and Position Light Bulb Replacement

Warning

The bulbs become hot during use. Always allow sufficient time for the bulbs to cool before handling. Avoid touching the glass part of the bulb. If the glass is touched or gets dirty, clean with alcohol before reuse.

Caution

The use of non-approved headlight bulbs may result in damage to the headlight lens.

Use a genuine Triumph supplied headlight bulb as specified in the Triumph Parts Catalogue.

Always have replacement headlight bulbs installed by an authorised Triumph dealer.

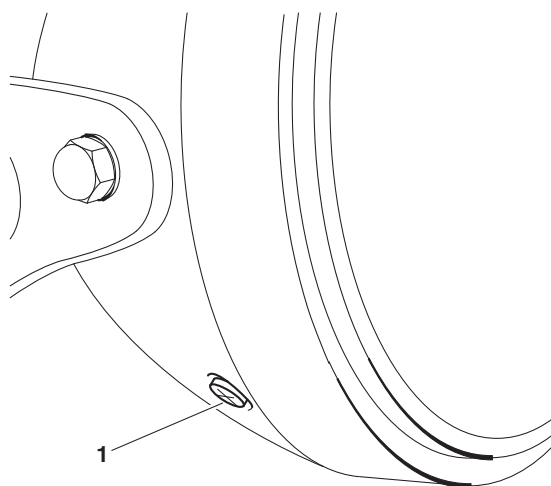
- Remove the seat (see Seat - Removal, page 645).
- Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).

Position Lights

The position lights are situated within the headlight assembly and are sealed, maintenance free LED units.

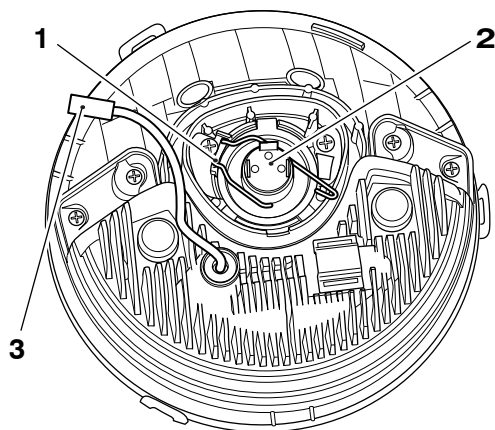
Headlight Bulb

1. Release the two fixings and detach the headlight from the headlight bowl.



1. Headlight fixing (one of two)

2. While supporting the light unit, disconnect the multipin electrical connector from the headlight bulb and the electrical connector for the daytime running light from the main harness.
3. Remove the rubber dust cover.
4. Unhook the headlight bulb's wire retainer.
5. The headlight bulb can now be removed.



cizx_2

1. **Wire retainer**
2. **Headlight bulb**
3. **DRL harness**
6. Installation is the reversal of removal.

Headlight Bracket - Removal

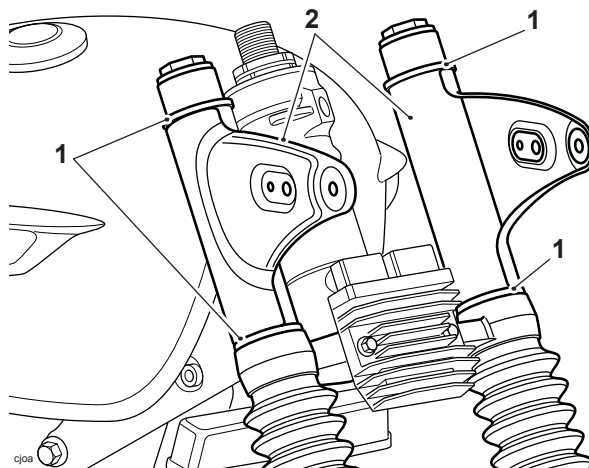
Warning

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.

- Remove the seat (see Seat - Removal, page 645).
- Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
- Remove the headlight (see Headlight - Removal, page 679).
- Remove the instruments (see Instruments - Removal, page 691).
- Remove the front direction indicators (see Front Direction Indicators - Removal, page 688).
- Remove the upper yoke (see Upper Yoke - Removal, page 498).

Note:

- **Note the position of the rubber bushes in the headlight brackets for installation.**
1. Slide the headlight brackets off the front forks for removal.



1. **Rubber bushes**
2. **Headlight mounting brackets**

Headlight Bracket - Installation

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.

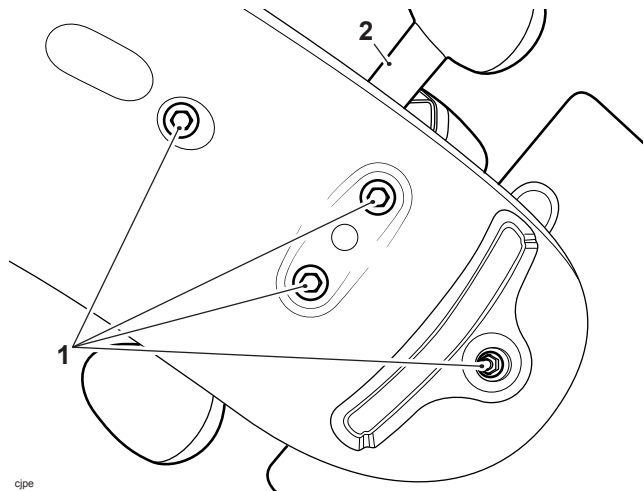
1. Check the rubber grommets for the headlight brackets for cracks and wear, replace if necessary.
2. Position the headlight brackets over the front forks as noted for removal.
 - Refit the upper yoke (see Upper Yoke - Installation, page 499).
 - Refit the front indicators (see Front Direction Indicators - Installation, page 689).
 - Refit the instruments (see Instruments - Installation, page 692).
 - Refit the headlight (see Headlight Bracket - Installation, page 684).
 - Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
 - Refit the seat (see Seat - Installation, page 645).
 - check and, if necessary, adjust the headlight (see Headlight Vertical Adjustment, page 678).

Rear Light - Removal

Warning

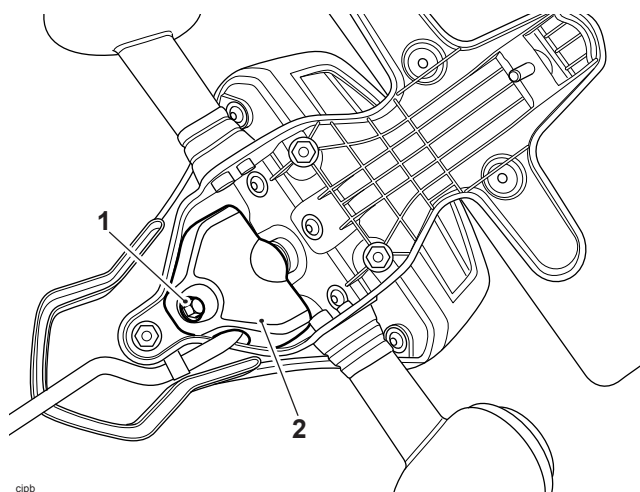
Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

- Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
 - Remove the rear mudguard (see Rear Mudguard - Removal, page 647).
1. Remove the license plate from the rear light bracket.
 2. Release the fixings and remove the rear light assembly from the rear mudguard. Discard the fixings.



1. **Fixings**
2. **Rear light assembly**

3. Release the fixing and remove the harness cover.

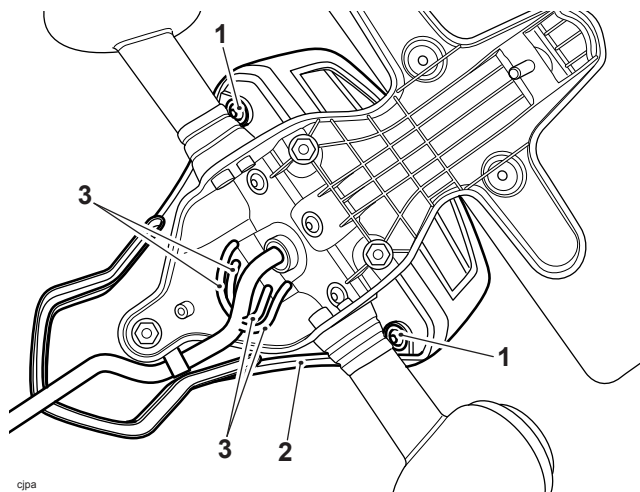


cjbpb

1. Fixings
2. Harness cover

Note:

- Note the routing of the direction indicator harnesses for installation.
 - The right hand direction indicator harness can be identified by the red tape on it.
4. Disconnect the direction indicators from the rear light harness.
 5. Release the two fixings and remove the rear light cover.



cjbpa

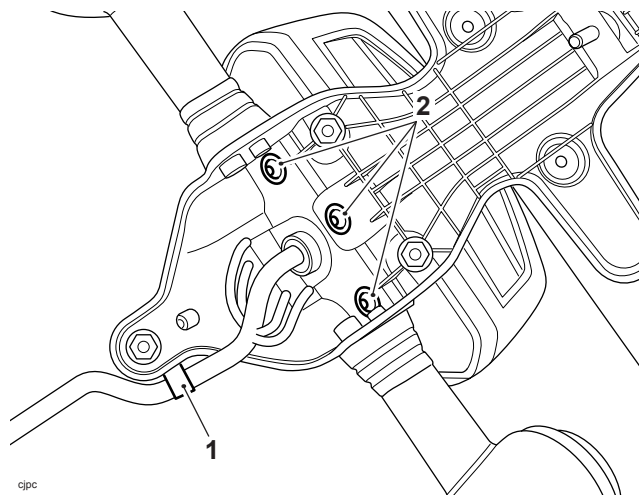
1. Fixings
2. Rear light cover
3. Direction indicator harnesses

6. Detach the rear light harness from the rear light bracket.

Note:

- Note the routing of the rear light harness for installation.

7. Release the three fixings and remove the rear light.



cjbpc

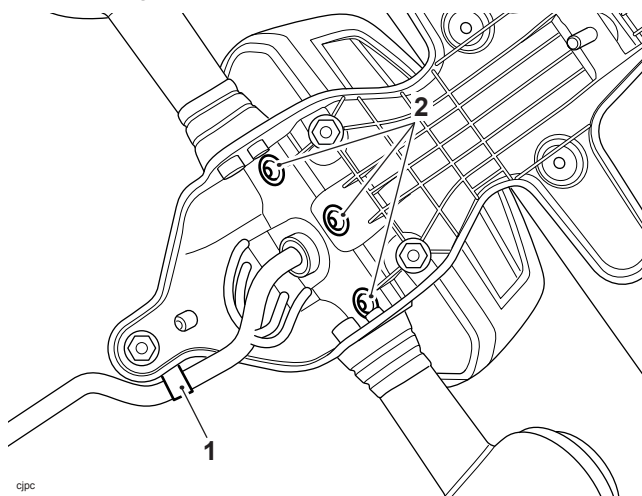
1. Harness clip
2. Fixings

Rear Light - Installation

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. Fit the rear light to the rear light bracket and tighten the three fixings to 2 Nm.
2. Route the harness as noted for removal and attach the rear light harness to its clip on the rear light bracket.



1. Harness clip

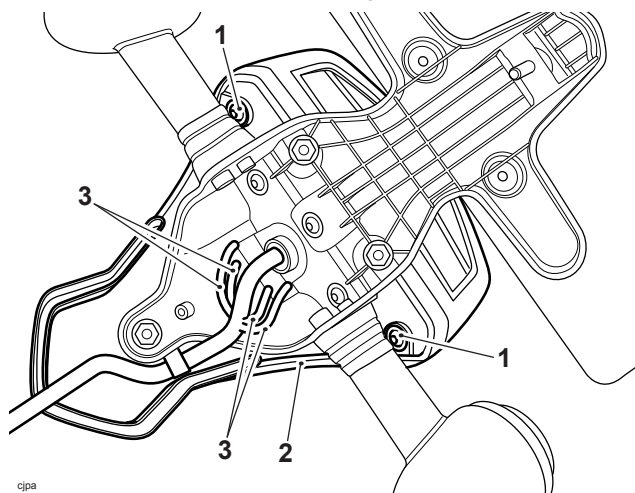
2. Fixings

3. Refit the rear light cover and tighten its two fixings to 2 Nm.

Note:

- The harness for the right hand direction indicator can be identified by the red tape on it.

4. Route the direction indicator harness as noted for removal and connect the electrical connectors to the rear light harness.

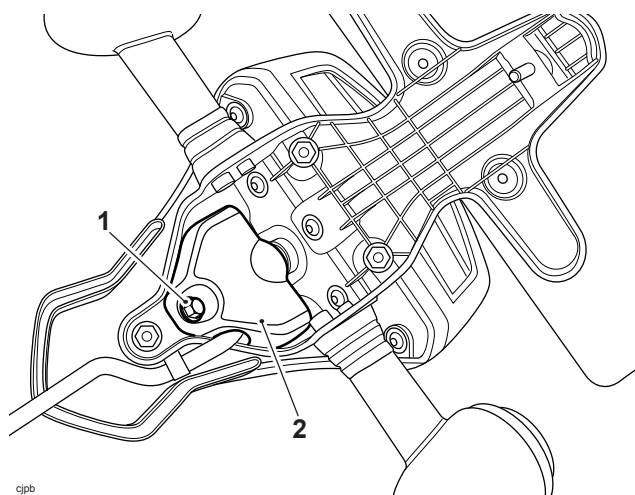


1. Fixings

2. Rear light cover

3. Direction indicator harnesses

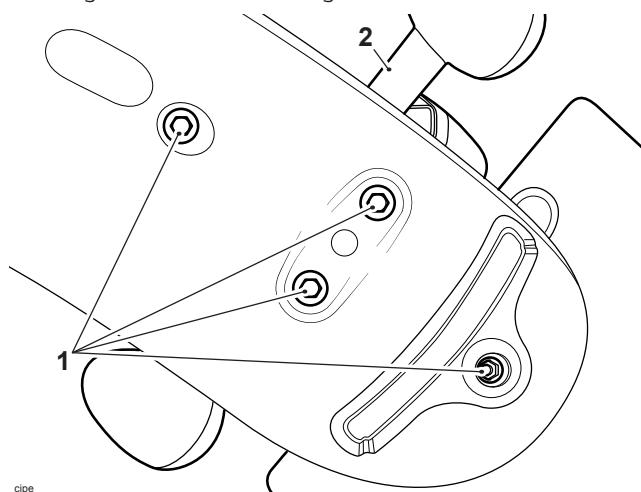
5. Fit the harness cover and tighten its fixings to 4 Nm.



1. Fixings

2. Harness cover

6. Refit the rear light to the rear mudguard and tighten the new fixings to 5 Nm.



1. Fixings

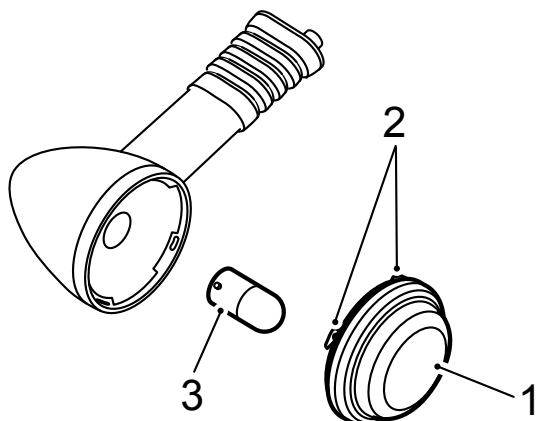
2. Rear light assembly

7. Refit the rear mudguard (see Rear Mudguard - Installation, page 648)
- Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
 - Refit the seat (see Seat - Installation, page 645).
 - Check the rear light operation, rectify as necessary.

Bulb Replacement LED

The rear light unit is a sealed, maintenance free LED unit.

Direction Indicator Lights - Bulb Replacement



1. Lens
2. Locating tangs
3. Bulb

Carefully twist the lens clockwise and remove from the indicator to gain access to the bulb for replacement.

To remove the bulb, gently press inwards and twist anti-clockwise. Replace the bulb.

Installation for the bulb is the reverse of the removal procedure.

Caution

When installing the lens, make sure that the locating tangs are correctly aligned to the indicator body.

Front Direction Indicators - Removal

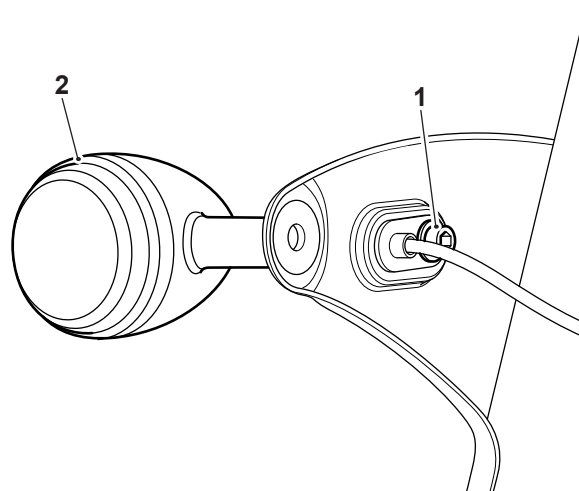
Warning

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.

- Remove the seat (see Seat - Removal, page 645).
- Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
- Remove the headlight (see Headlight - Removal, page 679).

Note:

- Note the routing of the front direction indicator harness for installation.
1. Disconnect the front direction indicators from the main harness.
 2. Release the fixing and remove the front direction indicator from the headlight bracket.

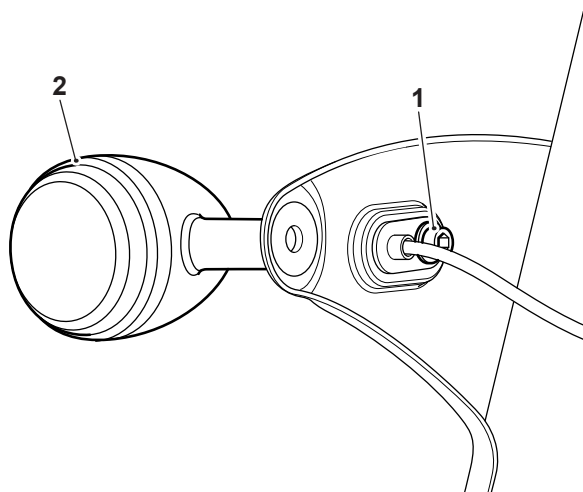


cjpd

1. Fixing
2. Front direction indicator (right hand side)

Front Direction Indicators - Installation

1. Route the direction indicator harness as noted for removal and connect it to the main harness. The main harness for the right hand direction indicator is marked with red tape to aid correct connection.
2. Fit the front direction indicator to the headlight bracket and tighten the fixing to 3 Nm.

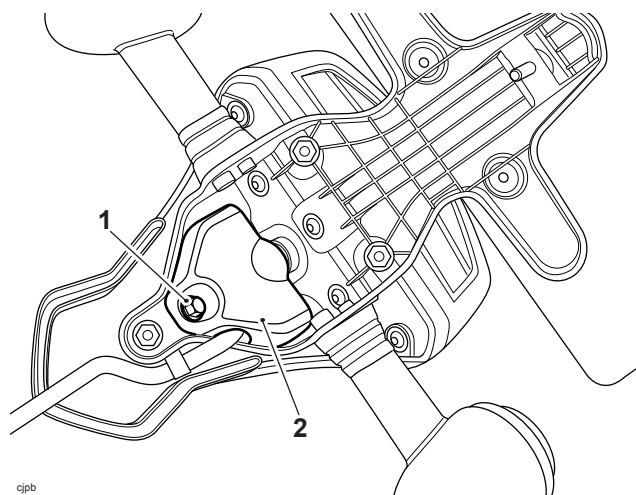


cjp/d

1. **Fixing**
2. **Front direction indicator (right hand side)**
 - Fit the headlight (see Headlight - Installation, page 680).
 - Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
 - Refit the seat (see Seat - Installation, page 645).
 - Check the operation of the direction indicators, rectify as necessary.

Rear Direction Indicators - Removal

- Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
 - Remove the rear light (see Rear Light - Removal, page 684).
1. Release the fixing and remove the harness cover.



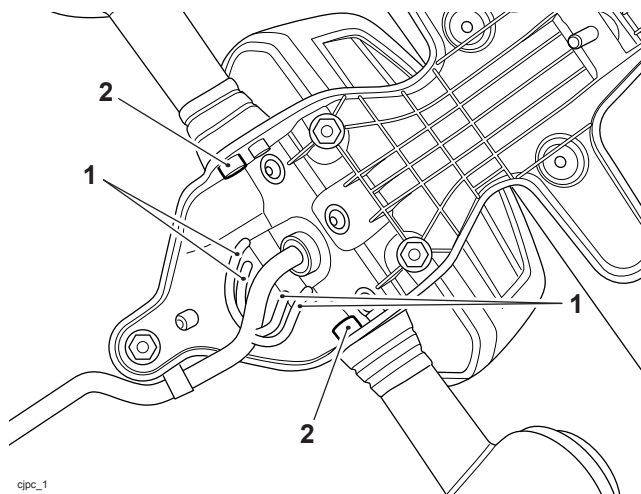
cjp/b

1. **Fixings**
2. **Harness cover**

Note:

- **Note the routing of the direction indicator harnesses for installation.**
- **The harness for the right hand direction indicator can be identified by the red tape on it.**

2. Disconnect the direction indicator electrical connectors from the rear light harness.
3. Release the fixing and remove the direction indicator.



1. Direction indicator connectors
2. Fixings

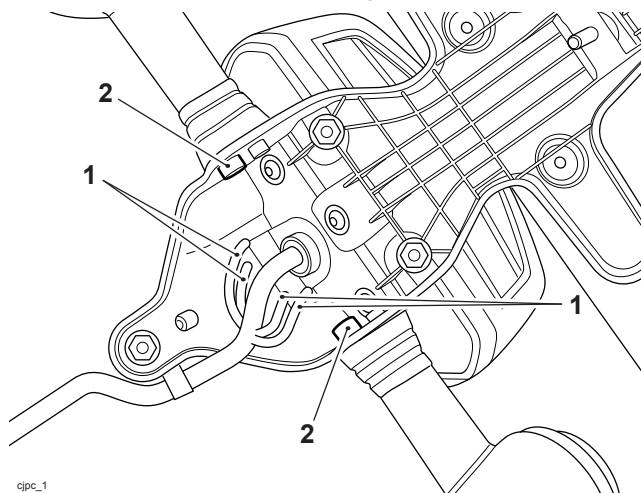
Rear Direction Indicators - Installation

1. Fit the direction indicator to the rear light assembly and tighten the fixing to 3 Nm.

Note:

- The harness for the right hand direction indicator can be identified by the red tape on it.

2. Route the direction indicator harness as noted for removal and connect the electrical connectors to the rear light harness.

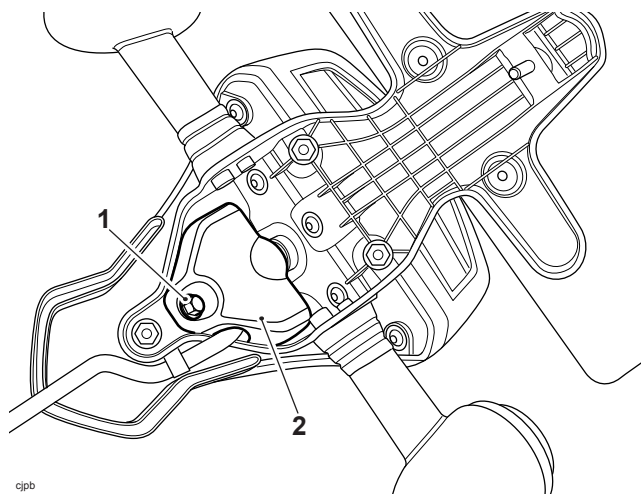


cipc_1

1. Direction indicator connectors

2. Fixings

3. Fit the harness cover and tighten its fixings to 4 Nm.



cjp6

1. Fixings

2. Harness cover

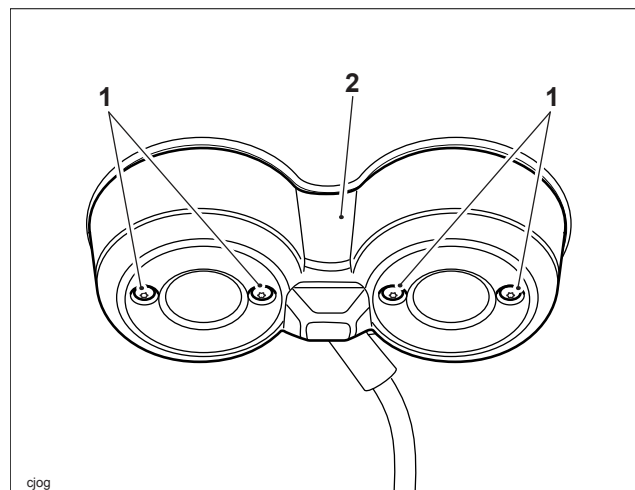
- Refit the rear light to the rear mudguard (see Rear Light - Installation, page 686).
- Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
- Refit the seat (see Seat - Installation, page 645).
- Check the direction indicators operation, rectify as necessary.

Instruments - 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.

- Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
 - Remove the headlight (see Headlight - Removal, page 679).
1. Remove the four fixings and remove the instrument cover.

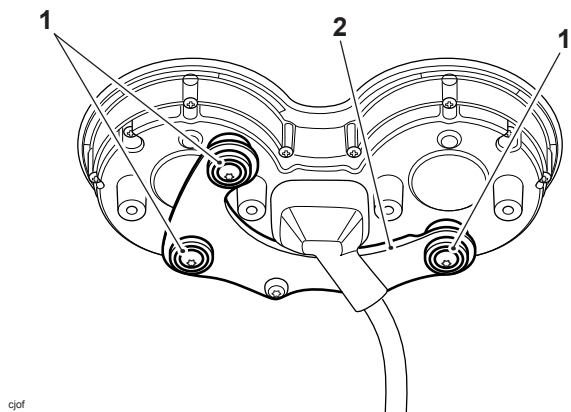


cjog

1. Fixings

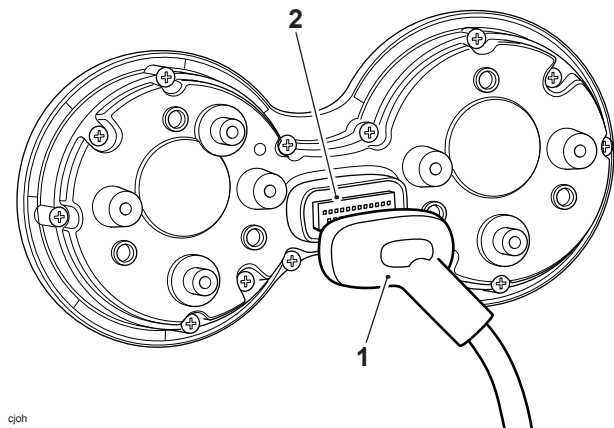
2. Instruments cover

2. Remove the three fixings and detach the instruments from its bracket.



cjoh

- 1. Fixings**
2. Instruments bracket
3. Slide the cover off the electrical connector, disconnect the electrical connector and remove the instruments.



cjoh

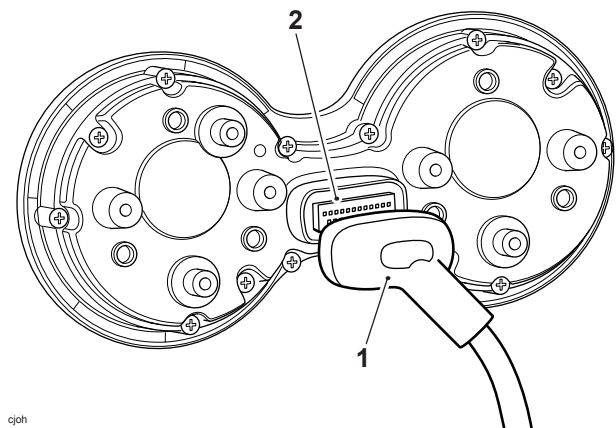
- 1. Cover**
2. Electrical connector

Instruments - Installation

⚠ 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.

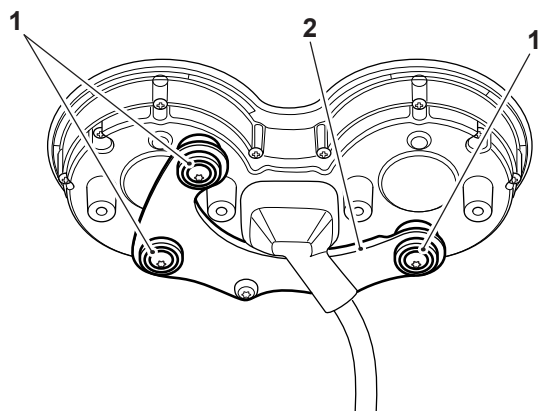
1. Connect the electrical connector to the instruments, slide the cover over the electrical connector.



cjoh

- 1. Cover**
2. Electrical connector

2. Position the instruments to the headlight bracket, secure with the three fixings and tighten to 3 Nm.

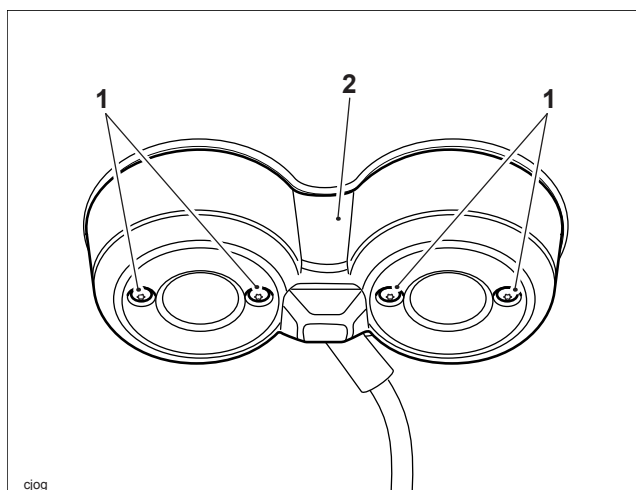


cjof

1. Fixings

2. Headlight bracket

3. Refit the instrument cover and tighten the fixings to 3 Nm.



cjog

1. Fixings

2. Instruments cover

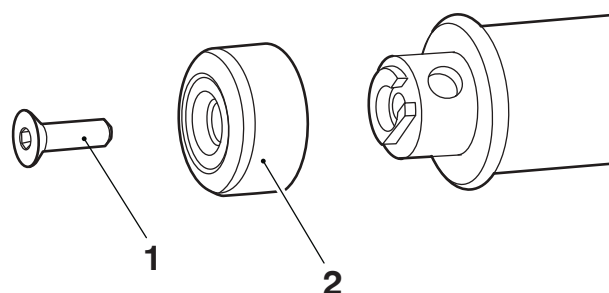
- Refit the headlight (see Headlight - Installation, page 680).
- Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
- Refit the seat (see Seat - Installation, page 645).

Heated Grips - 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.

- Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
 - For the removal of the heated twist grip see Twist Grip - Removal, page 408.
1. Remove the left hand handlebar end weight. Discard the fixing.

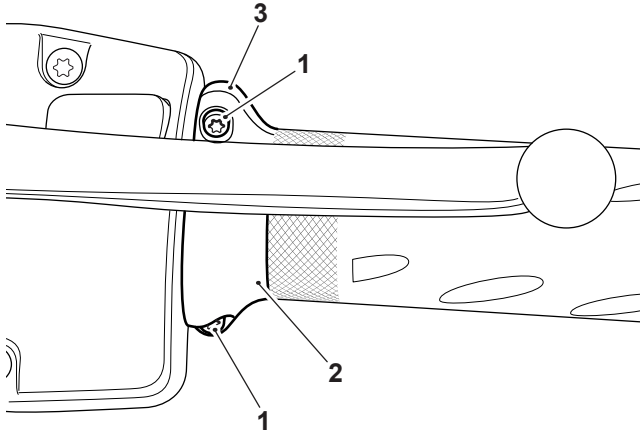


ccow_5

1. Fixing

2. End weight

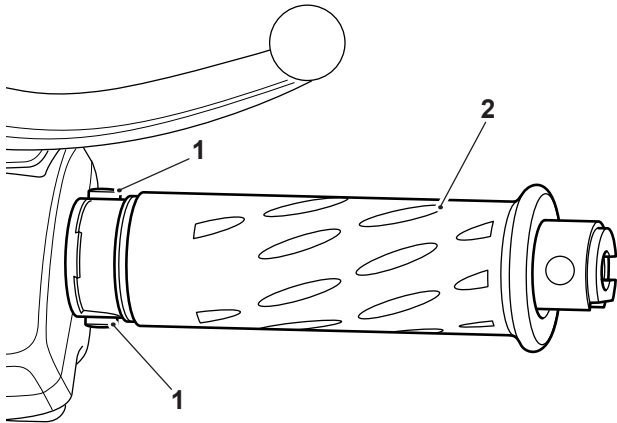
- Remove the two fixings and remove the upper and lower heated grip switch housings.



cjob

- Fixing**
- Lower heated grip switch housing**
- Upper heated grip switch housing**

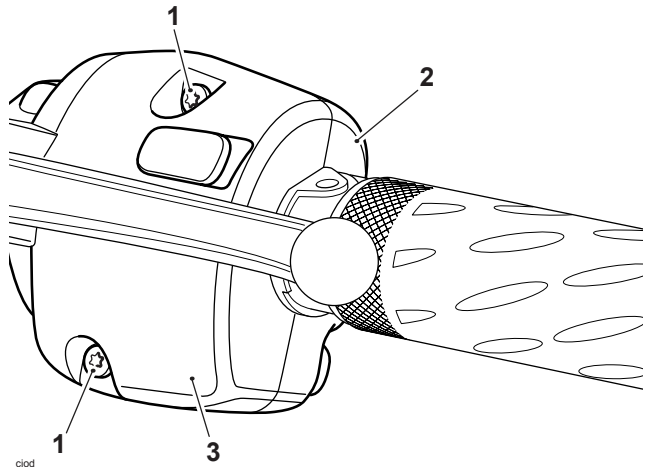
- Remove the two fixings securing the heated grip to the handlebar.



cjac

- Fixing**
- Heated grip**

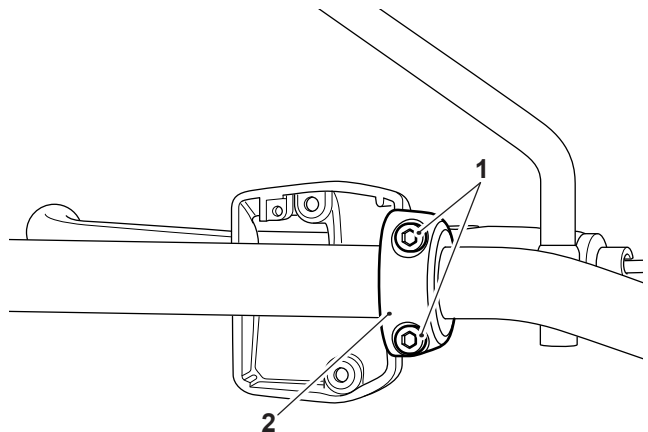
- Remove the two fixings and detach the left hand switch housing from the clutch lever housing.



cjod

- Fixing**
- Left hand switch housing**
- Clutch lever housing**

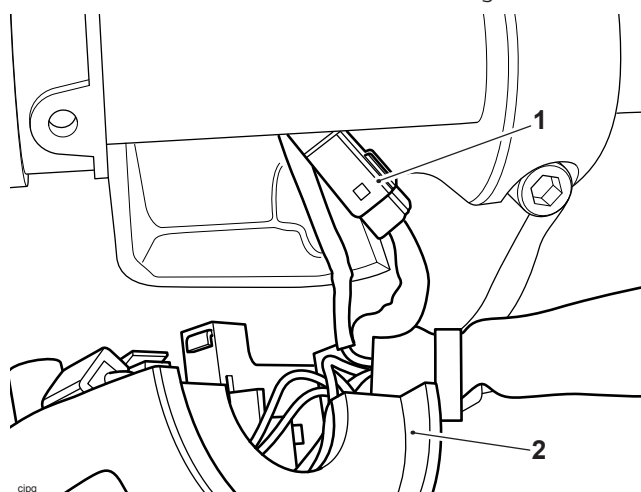
- Loosen the fixings and move the clutch lever housing to access the hole in the handlebar for the heated grip electrical connector.



cjmg

- Fixings**
- Clamp**

6. Disconnect the heated grip electrical connector from the switch housing.



1. Heated grip electrical connector.
2. Left hand switch housing

Note:

- Note the orientation of the heated grip for installation.
7. Slide the twist grip off the handlebar while carefully feeding the harness into the handlebar.

Heated Grips - Installation

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.

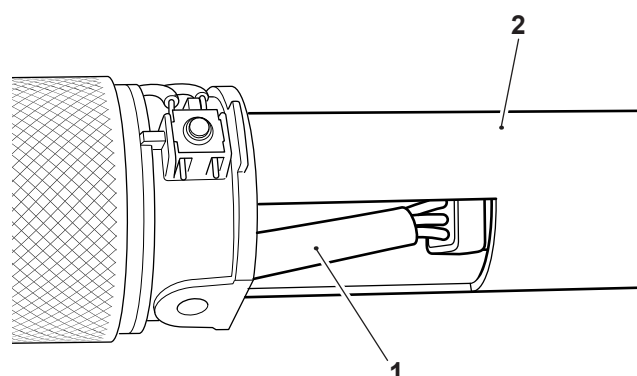
- For the installation of the heated twist grip see Twist Grip - Installation, page 410.

When fitting the heated grips, ensure the heated grip harness is held in position and is positioned by the flat edge of the handlebar.

Caution

When fitting the heated grips, do not excessively twist the grip forward or rearward. Excessive twisting of the grip may damage the heated grip harness.

1. With the heated grip aligned as noted for removal, guide the heated grip harness under the flat edge of the handlebar, through the first hole and into the handlebar.



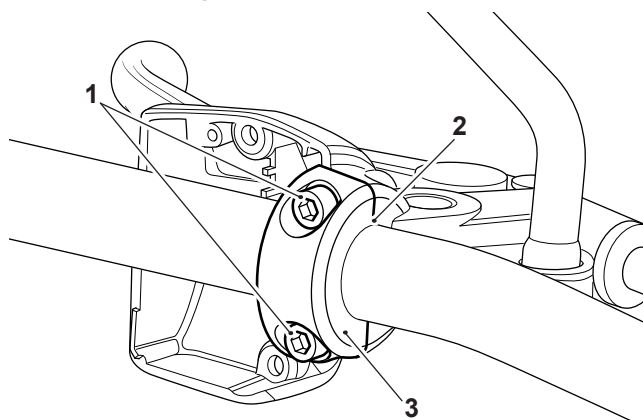
cjoe_1

1. Heated grip harness

2. Handlebar

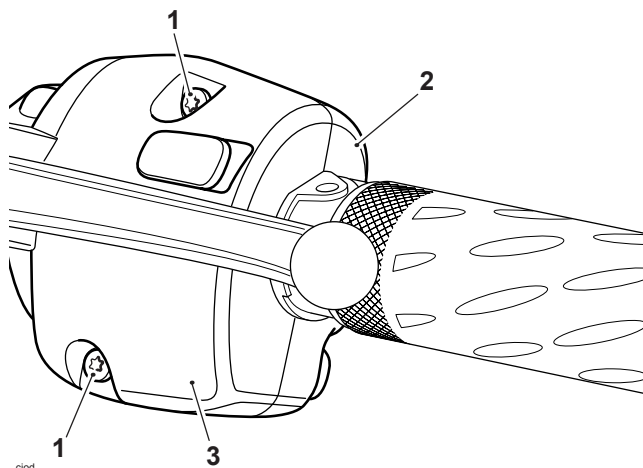
2. While holding the harness inside the heated grip in position, slide the grip onto the handle until its electrical connector is visible at the second hole.
3. Pull the electrical connector out of the handlebar and connect it to the left hand switch housing.
4. Slide the heated grip back until its fixings holes align with their holes in the handlebar.

5. Align the clutch lever split line with the alignment mark on the handlebar. Tighten the clamp fixings, upper one first, to 12 Nm.



cjmf

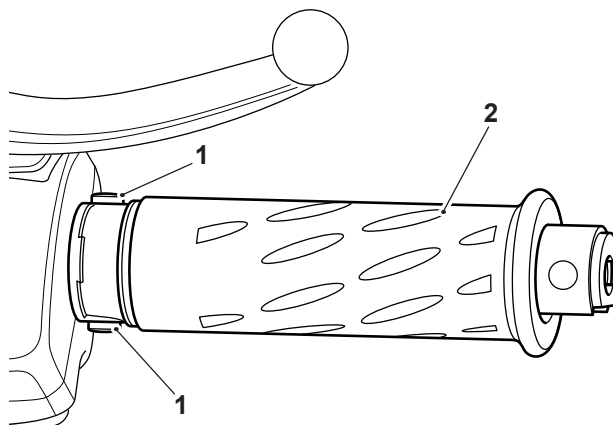
6. Fit the left hand switch housing to the handlebar and tighten its fixings to 1 Nm.



cjod

- 1. Fixing**
2. Left hand switch housing

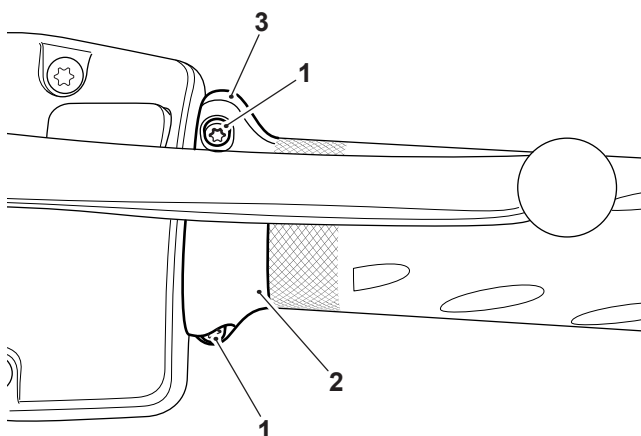
7. Secure the heated grip to the handlebar with two new fixings and tighten to 2 Nm.



cjoc

- 1. Fixing**
2. Heated grip

8. Refit the upper and lower heated grip switch housings and tighten the fixings to 0.5 Nm.



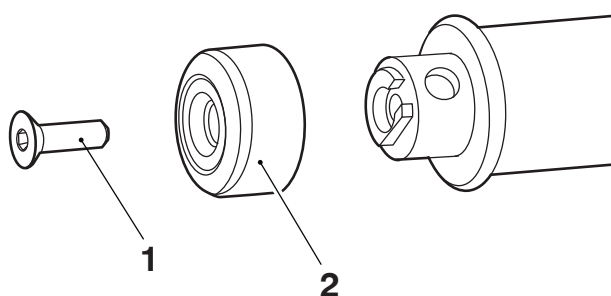
cjob

1. Fixing

2. Lower heated grip switch housing

3. Upper heated grip switch housing

9. Refit the left hand handlebar end weight and tighten its new fixing to 5 Nm.



ocow_5

1. Fixing

2. End weight

- Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
- Refit the seat (see Seat - Installation, page 645).

Side Stand Switch - Removal

Warning

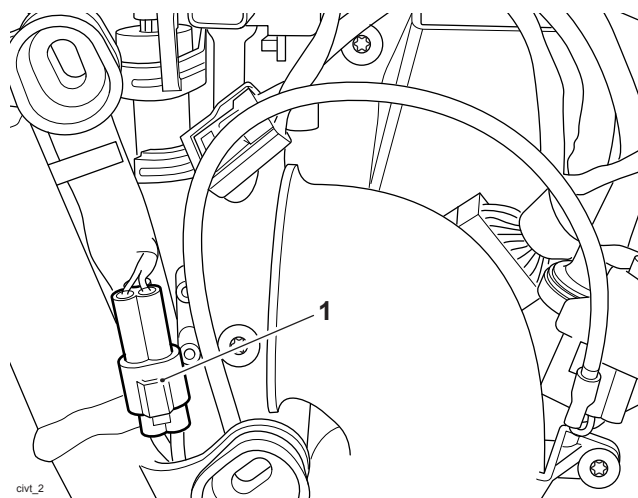
Before starting work, ensure the motorcycle is stabilised and adequately supported. This will help prevent it from falling and causing injury to the operator or damage to the motorcycle.

- Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
1. Remove the left hand side panel (see Side Panels, page 646).

Caution

Note the routing and the retaining clips of the side stand switch harness for installation.

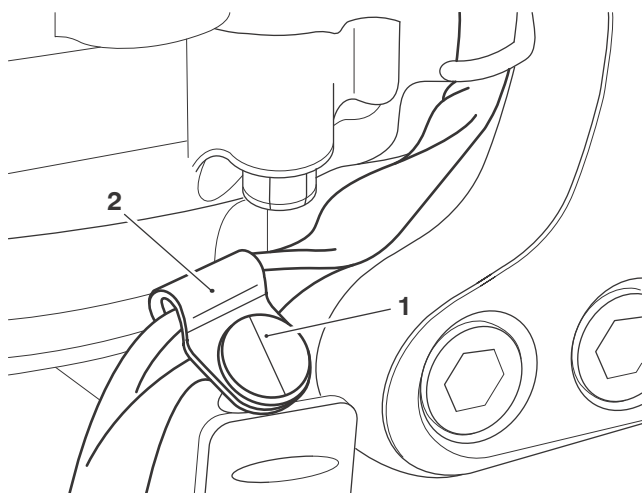
2. Disconnect the side stand switch electrical connector from the main harness and feed it down to the side stand switch.



civt_2

1. Side stand switch electrical connector

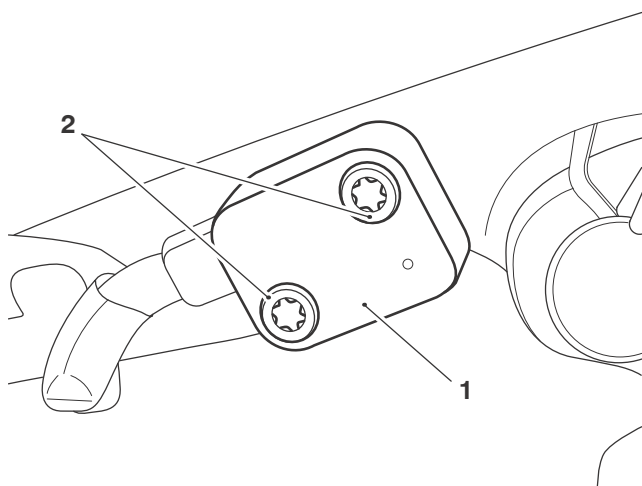
3. Remove and discard the fir tree clip from the frame cradle and retain the P clip.



1. Fir tree clip

2. P clip

4. Remove the side stand switch and discard the fixings.



1. Side stand switch

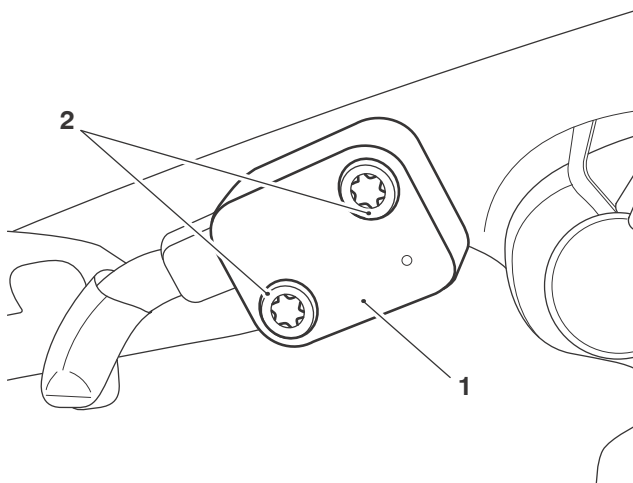
2. Fixings

Side Stand Switch - Installation

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.

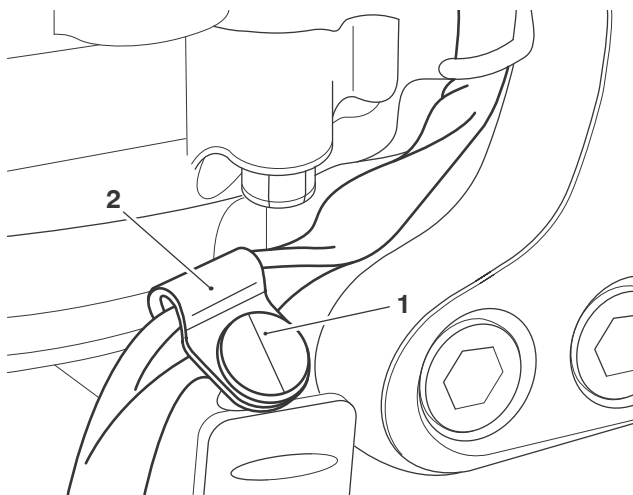
1. Refit the side stand switch, tighten the new fixings to 3 Nm.



1. Side stand switch

2. Fixings

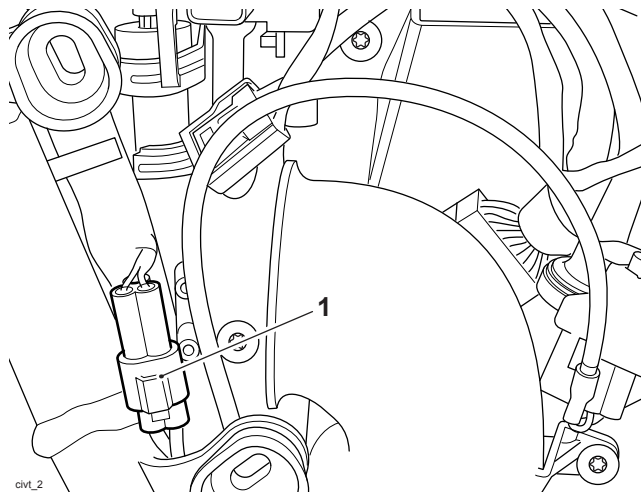
2. Secure the harness using a new fir tree clip and the original P clip.



1. Fir tree clip

2. P clip

3. Route the side stand switch harness to the left hand side of the airbox as noted for removal. Connect the electrical connector to the main harness.



1. Side stand switch electrical connector

4. Fit the left hand side panel (see Side Panels, page 646).
 - Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
 - Refit the seat (see Seat - Installation, page 645).

Ignition Coils - Removal

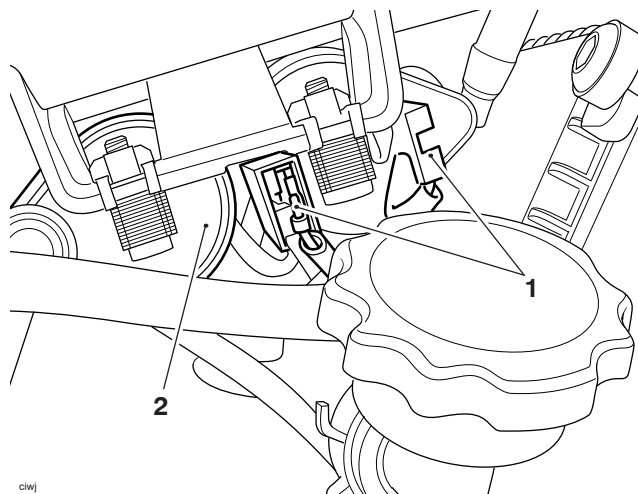
Warning

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.

- Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
 - Remove the fuel tank (see).
1. Disconnect the high tension cables from the spark plugs.

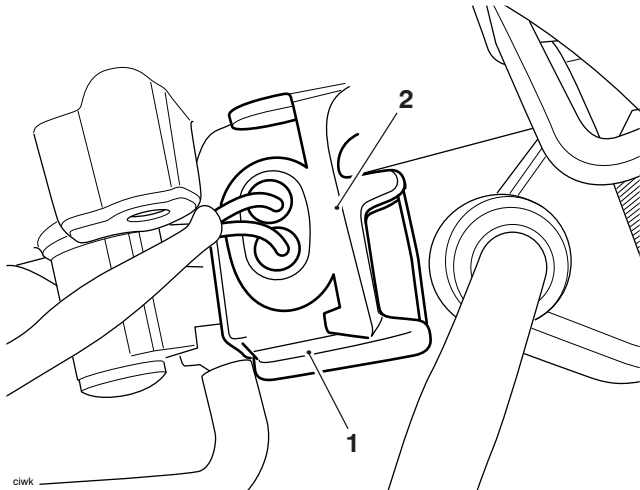
Note:

- The ignition coil wires identified with the red tape are fitted to the right hand side of the ignition coils.
 - Note the position of the four wires connected to the ignition coils for installation.
2. Disconnect the four wires from the ignition coils (two either side of the ignition coils).



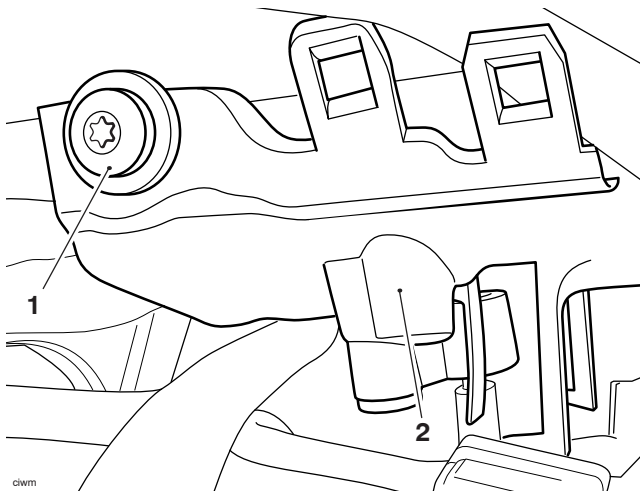
1. Ignition coil connections (right hand side shown)
2. Ignition coils

3. Detach the coolant temperature connector from the ignition coils bracket.



1. Coolant temperature sensor connector

4. Remove the three fixings and detach the ignition coil bracket from the motorcycle frame.

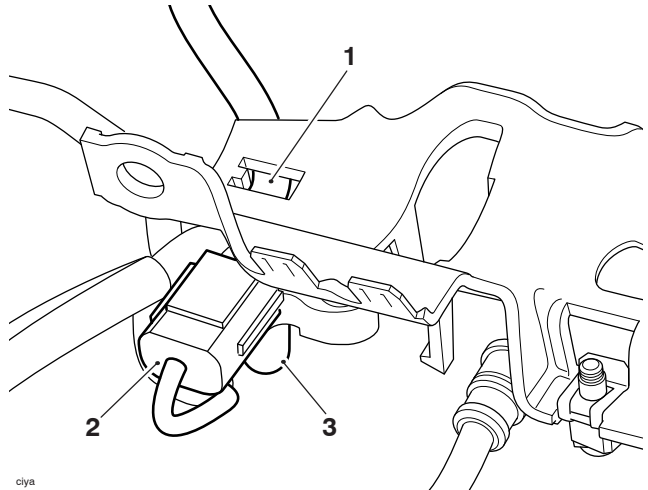


1. Fixing (left hand side shown)
2. Ignition coil bracket

Note:

- Note the routing of the fuel pump harness on the ignition coil bracket for installation.
5. Detach the fuel pump harness from the ignition coils bracket.

6. Disconnect the MAP sensor hose and the electrical connector from the MAP sensor.



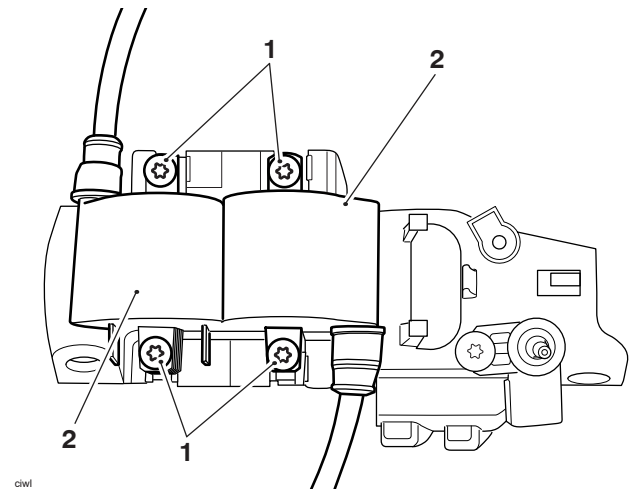
1. Fuel pump harness

2. MAP sensor electrical connector

3. MAP sensor hose

Note:

- The front ignition coil has the longer HT lead.
7. Remove and discard the four fixings and remove the ignition coils from their bracket.



1. Fixings

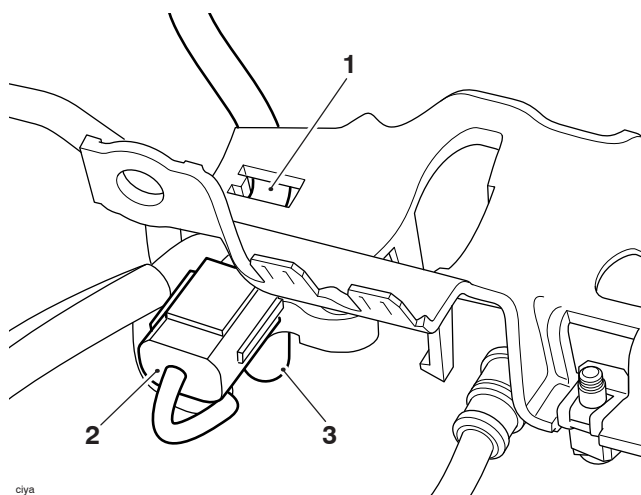
2. Ignition coils

Ignition Coils - Installation

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 ignition coils onto their bracket, secure with new fixings and tighten to 3 Nm.
2. Connect the MAP sensor hose and the electrical connector to the MAP sensor.
3. Attach the fuel pump harness to the ignition coil bracket, as noted for removal.



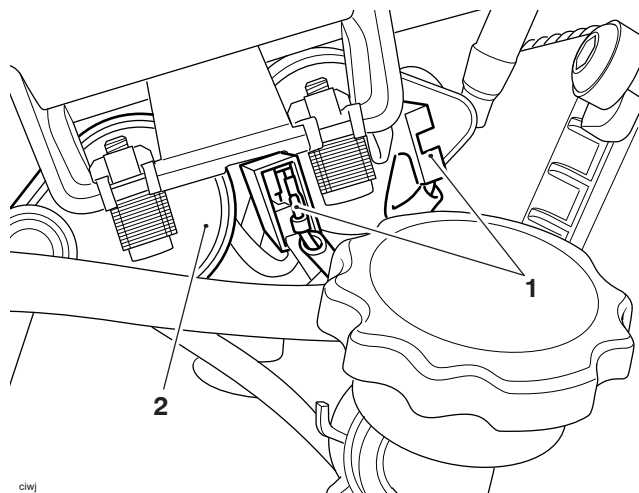
1. Fuel pump harness
2. MAP sensor electrical connector
3. MAP sensor hose

4. Position the ignition coils and bracket assembly to the motorcycle frame, secure with the fixings and tighten to 3 Nm.
5. Attach the coolant temperature sensor connector onto the ignition coil bracket.

Note:

- The wires for the right hand side of the ignition coils are identified with the red tape.

6. Connect the four wires from the ignition coils as noted for removal (two either side of the ignition coils).



1. Ignition coil connections (right hand side shown)

2. Ignition coils

7. Connect the high tension cables to the spark plugs.
 - Refit the fuel tank (see Fuel Tank - Installation, page 385).
 - Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
 - Refit the seat (see Seat - Installation, page 645).

Alternator Stator - 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.

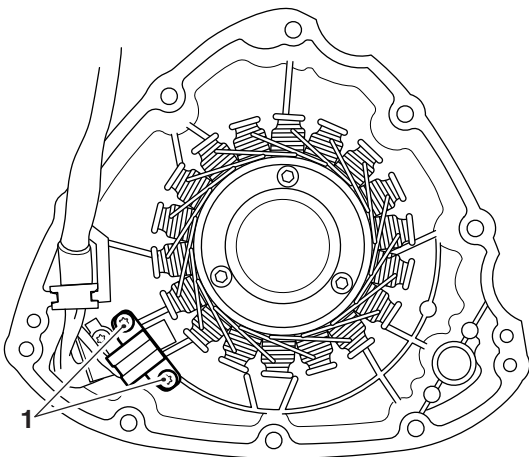
Note:

- If the alternator stator needs to be replaced, the crankshaft position sensor will also be replaced as they are one assembly.
- Remove the seat (see Seat - Removal, page 645).
- Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
- Remove the alternator cover (see Alternator Cover - Removal, page 99).

Note:

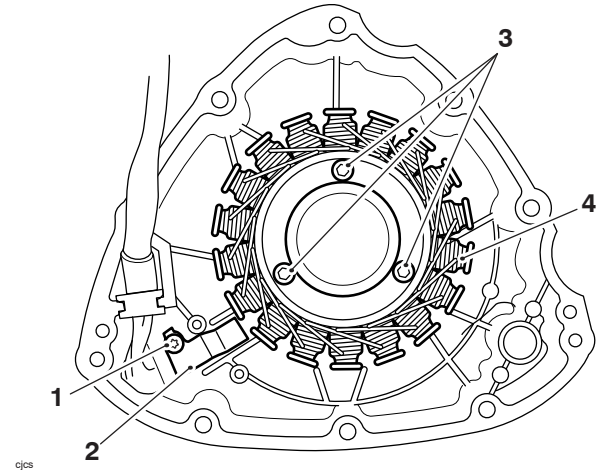
- Note the routing of the stator harness for installation.

1. Remove and discard the fixings securing the crankshaft position sensor to the alternator cover.



1. Fixings

2. Remove and discard the fixing securing the cable bracket to the alternator cover.
3. Remove and discard the fixings securing the stator to the alternator cover and remove the stator.



1. Cable bracket fixing
2. Cable bracket
3. Stator fixing
4. Stator

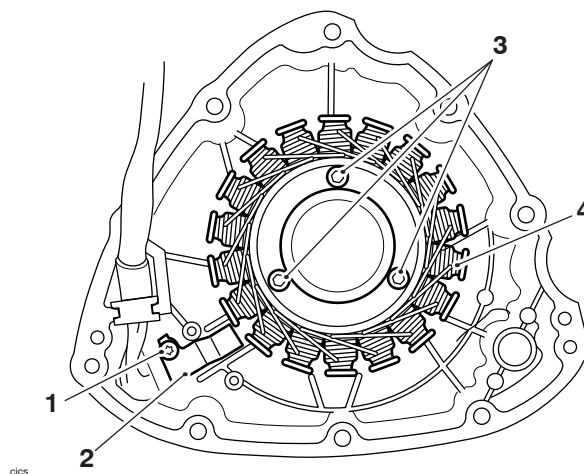
Alternator Stator - Installation

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.

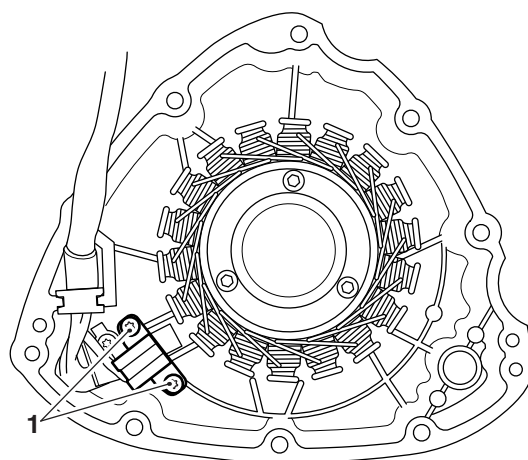
1. Fit the stator to the alternator cover and tighten its new fixings to 12 Nm.

2. Route the harness as noted for removal, fit the harness retainer and tighten its new fixing to 9 Nm.



1. Cable bracket fixing
2. Cable bracket
3. Stator fixing
4. Stator

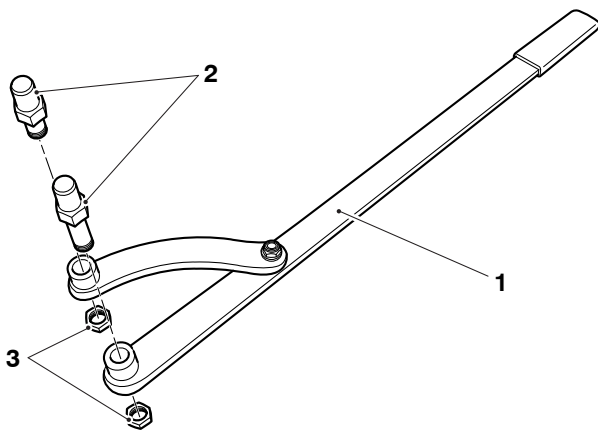
3. Fit the crankshaft position sensor to the alternator cover and tighten its new fixings to 9 Nm.



1. Fixings
 - Refit the alternator cover to the engine (see Alternator Cover - Installation, page 101).
 - Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
 - Refit the seat (see Seat - Installation, page 645).

Alternator Rotor - Removal

- Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
 - Remove the alternator cover (see Alternator Cover - Removal, page 99).
1. Assemble the service tool T3880656 to the service tool T3880606, ensuring the shorter pin is fitted to the short arm of service tool T3880606. Fit the nuts and tighten to 10 Nm.



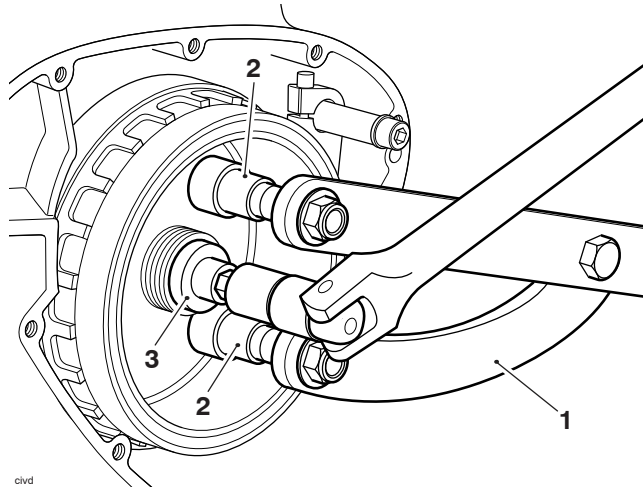
1. **T3880606 - Flywheel Restraint Handle**
2. **Pins (T3880656 - Pulley Wrench Pin Set)**
3. **Nuts (T3880656 - Pulley Wrench Pin Set)**



Warning

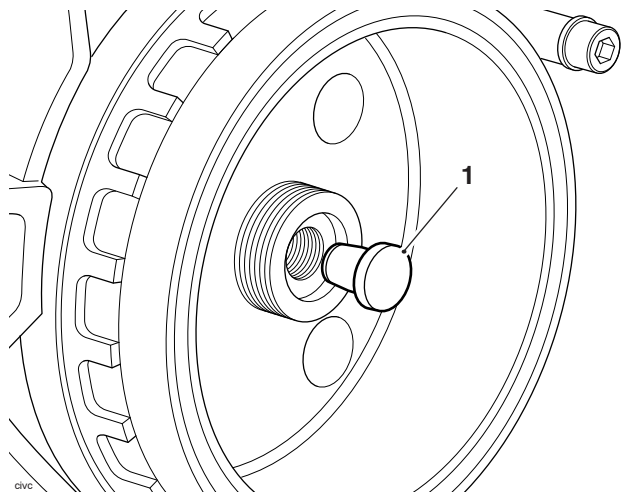
The rotor magnets are very strong. When fitting the service tools to the rotor the magnets may 'grab' the service tool, causing injury to the hands or fingers. When installing the service tools, wear suitable gloves to protect hands and fingers.

2. Using the service tool T3880606 and service tool T3880656, prevent the rotor from turning and remove the rotor fixing and washer from the end of the crankshaft.



1. **T3880606 - Flywheel Restraint Handle**
2. **T3880656 - Pulley Wrench Pin Set**
3. **Rotor fixing**

3. Locate the spigot from the larger of the two thrust pads supplied with service tool T3880365 to the crankshaft.

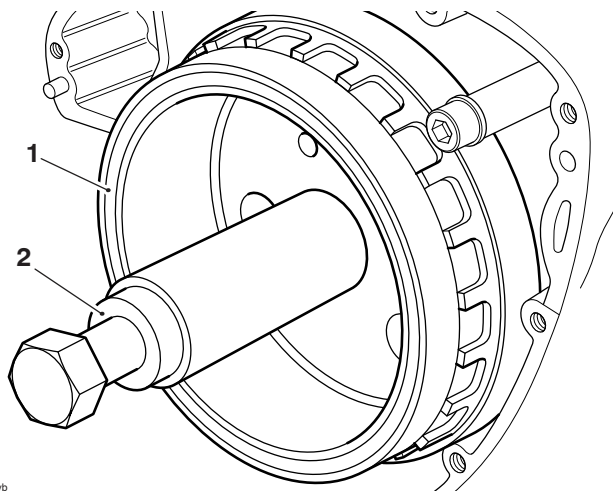


1. **Thrust pad**
4. Assemble service tool T3880365 to the threaded centre section of the rotor.

Note:

- Ensure that the thrust pad does not fall out during assembly of the tool.

5. Hold the outer of the tool to prevent rotation then tighten the draw-bolt in the centre of the tool to release the taper seating of the rotor from the crankshaft.



civb

1. Rotor

2. T3880365 - Alternator Housing Puller

6. Withdraw the rotor and tool as an assembly and then separate the tool from the rotor. Collect the Woodruff Key and the tool thrust pad from the crankshaft.

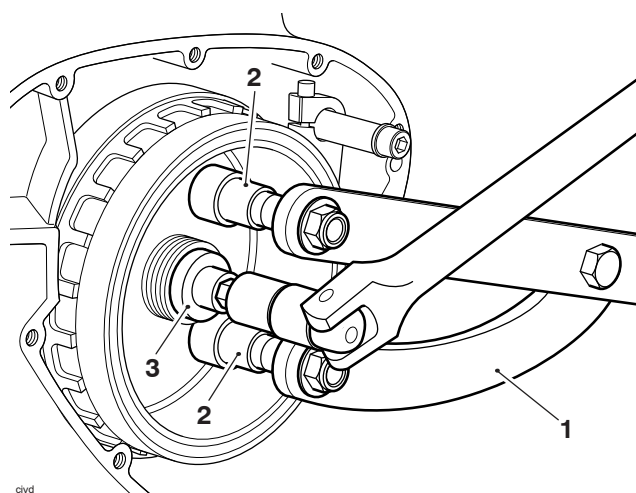
Alternator Rotor - Installation

1. Refit the Woodruff key to the crankshaft.
2. Assemble the rotor to the key way on the crankshaft, ensuring the Woodruff key remains in position.

Warning

The rotor magnets are very strong. When fitting the service tools to the rotor the magnets may 'grab' the service tool, causing injury to the hands or fingers. When installing the service tools, wear suitable gloves to protect hands and fingers.

3. Refit the service tool T3880606 and service tool T3880656 to prevent the crankshaft from rotating.
4. Tighten the rotor retaining fixing in the following stages:
 - **Stage 1.** Tighten the rotor retaining fixing to 85 Nm.
 - **Stage 2.** Tighten the rotor retaining fixing to 120 Nm.



civd

1. T3880606 - Flywheel Restraint Handle

2. T3880656 - Pulley Wrench Pin Set

3. Rotor fixing

5. Remove the service tool T3880606 and service tool T3880656 from the rotor.
 - Refit the alternator cover to the engine (see Alternator Cover - Installation, page 101).
 - Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
 - Refit the seat (see Seat - Installation, page 645).

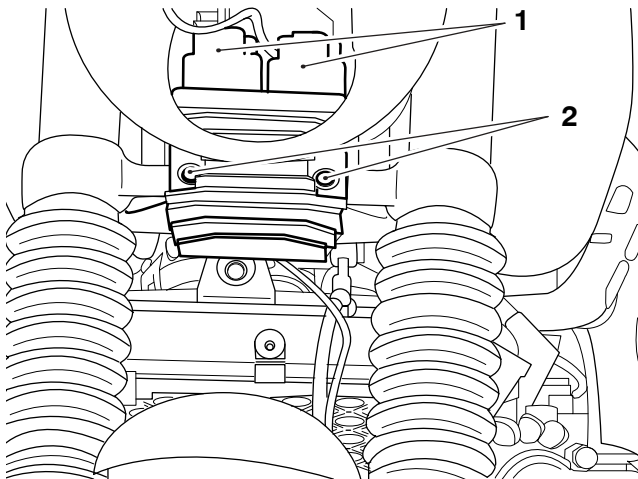
Alternator Regulator/Rectifier - Removal

Note:

- The alternator rectifier is attached to the front of the lower yoke. The rectifier does not contain any serviceable parts and must be replaced if faulty.
- Remove the seat (see Seat - Removal, page 645).
- Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).

Note:

- Note the position of the electrical connectors for installation.
1. Disconnect both electrical connectors from the alternator rectifier.
 2. Release the two fixings securing the rectifier to lower yoke and remove the alternator rectifier.



1. Electrical connectors
2. Fixings

Alternator Regulator/Rectifier - Installation

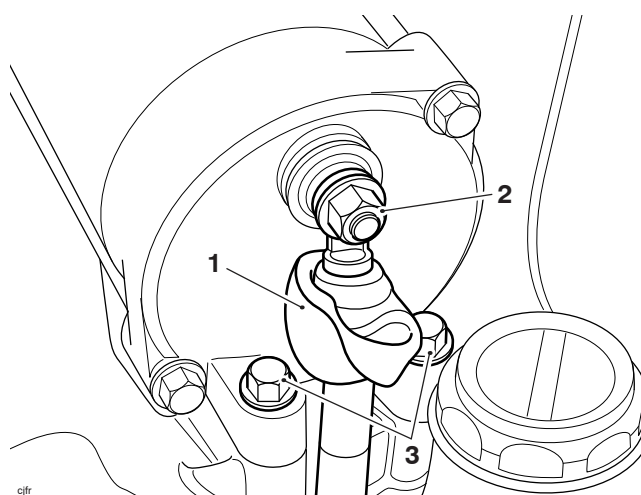
1. Position the alternator rectifier to the lower yoke, secure with the two fixings and tighten to 4 Nm.
2. Reconnect the two electrical connectors to the alternator rectifier as noted for removal.
 - Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
 - Refit the seat (see Seat - Installation, page 645).

Starter Motor - 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.

- Remove the seat (see Seat - Removal, page 645).
 - Disconnect the battery, negative (black) lead first (see Battery - Removal, page 668).
1. Ease the rubber boot from the starter cable, release the nut and disconnect the cable.
 2. Protect the crankcase painted surfaces from damage, using a suitable self-adhesive tape such as masking tape.
 3. Release the two bolts securing the starter motor to the crankcase.



1. Rubber boot
2. Nut
3. Bolts

Caution

Damage to painted surfaces could result from inadequate care during removal or installation of the starter motor. Always protect the crankcase from damage during removal or installation.

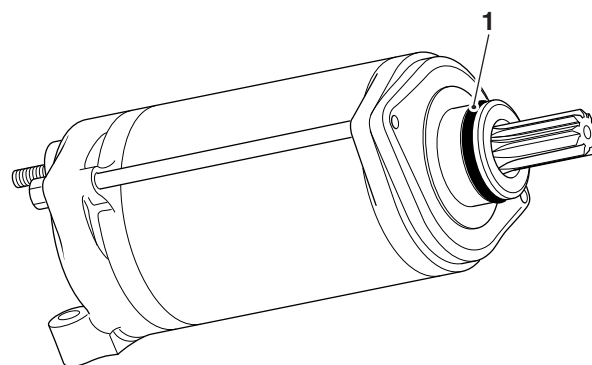
4. Carefully manoeuvre the starter motor out to the right hand side of the motorcycle.

Starter Motor - Installation

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. Fit a new O-ring to the starter motor.



cifs

1. O-ring

Caution

Damage to painted surfaces could result from inadequate care during removal or installation of the starter motor. Always protect the crankcase from damage during removal or installation.

2. Carefully position the starter to the crankcase and retain with the two bolts and tighten to 10 Nm.
3. Remove any self-adhesive tape used to protect the crankcase.
4. Locate the starter cable to its connection pole. Fit the nut and tighten it to 5 Nm.
5. Refit the rubber boot.
 - Reconnect the battery, positive (red) lead first (see Battery - Installation, page 668) and tighten the terminals to 4.5 Nm.
 - Refit the seat (see Seat - Installation, page 645).

Alternator Stator

The stator is an assembly of 18 coils, arranged into three phases. It is possible to check for continuity and short circuits through the coils and to earth.

Note:

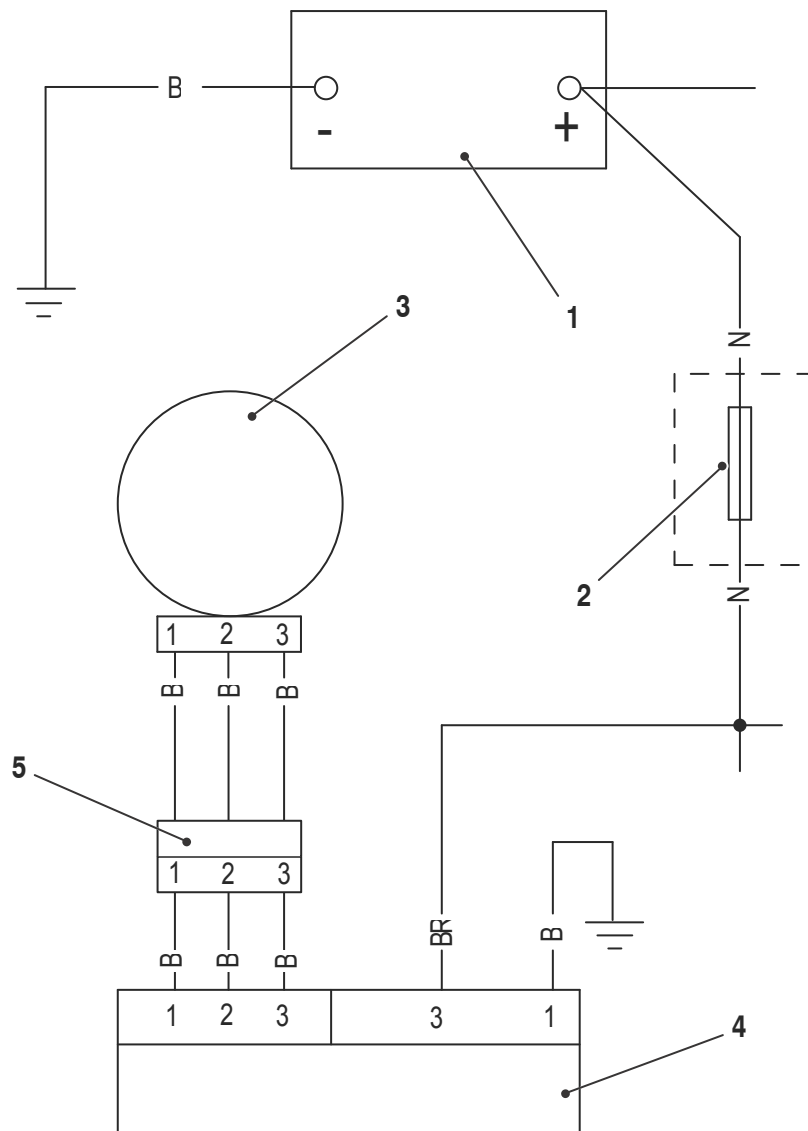
- Only repair the stator harness between the rectifier and where the harness goes into the crankcase.
- Do not attempt to repair the stator coils.
- If the battery is not fully charged, the charging voltage may be lower than specified when checking at 2,000 rpm.
- Ensure all additional accessories (auxiliary lights, heated grips etc.) are switched off.

Fault	Possible cause	Action
Battery not charging	Main fuse	Check the condition of the main 30A fuse:
	Battery	Check the condition of the battery. Test the battery using the BatteryMate 150-9. Refer to the instructions supplied with the BatteryMate 150-9. Ensure the battery is serviceable:
	Alternator	Proceed to pinpoint test 1:
	Regulator/Rectifier	Test the regulator/rectifier (see Regulator/Rectifier, page 712)

Pinpoint Tests

Test	Result	Action
1 Check cable and terminal integrity: - Battery positive (+) - Battery negative (-) - Regulator/rectifier black connector pin 1 - Regulator/rectifier black connector pin 3 - Regulator/rectifier grey connector pin 1 - Regulator/rectifier grey connector pin 2 - Regulator/rectifier grey connector pin 3 - Alternator harness connector pin 1 - Alternator harness connector pin 2 - Alternator harness connector pin 3	OK	Disconnect the battery leads, negative (black) lead first. Disconnect regulator/rectifier black connector and proceed to test 2
	Faulty	Rectify fault, proceed to test 4
2 Check cable continuity: - Regulator/rectifier black connector pin 1 to battery lead negative connector - Regulator/rectifier black connector pin 3 to battery lead positive connector	OK	Reconnect the battery leads, positive (red) lead first. Reconnect the regulator/rectifier black connector. Disconnect the rectifier/regulator grey connector and proceed to test 3
	Open circuit	Locate and rectify wiring fault, proceed to test 4
3 Check resistance through the coils: - Alternator pin 1 to pin 2 - Alternator pin 2 to pin 3 - Alternator pin 3 to pin 1	0.14 to 0.18 Ohms	Proceed to test 4
	Open circuit or short circuit	If the fault is between the rectifier and the crankcase, repair the harness. Proceed to test 4 If the fault is after the crankcase, replace the unit. Proceed to test 5
4 Reconnect the harness and run the engine. Check the charging voltage at 2,000 rpm:	13.5 V - 15 V	Action complete - quit test
	Fault still present	Disconnect the regulator/rectifier grey connector and proceed to test 5
5 Check the alternator AC output voltage at 850 rpm by probing the 3-pin stator connector as follows: - Positive (+) probe to pin 1 negative (-) probe to pin 2 - Positive (+) probe to pin 2 negative (-) probe to pin 3 - Positive (+) probe to pin 3 negative (-) probe to pin 1	15 V AC to 25 V AC	Test regulator/rectifier (see Regulator/Rectifier, page 712)
	Less than 15 V AC	Replace unit. Proceed to pinpoint test 6
6 Reconnect the harness and run the engine. Check the charging voltage at 2,000 rpm:	13.5 V - 15 V	Action complete - quit test
	Fault still present	Contact Triumph service

Circuit Diagram



1. Battery
2. Starter solenoid main fuse
3. Alternator
4. Rectifier/Regulator
5. Alternator harness connector

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Regulator/Rectifier

Internally the rectifier/regulator consists of three diodes, one between each input and the positive terminal, and three Field Effect Transistors (FETs), one between each input and the ground terminal.

As the voltage of the AC signal from the alternator rises, the voltage controller switches the FETs to avoid over voltage on the output.

The diodes and FETs can be checked using a multimeter on DIODE setting. Disconnect the two electrical connectors from the rectifier/regulator and check the readings as indicated below.

Note:

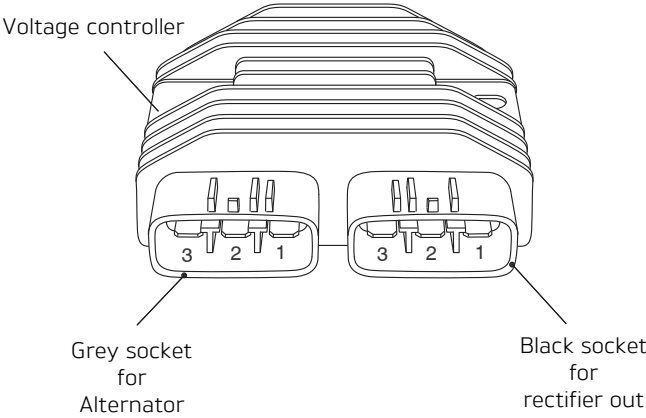
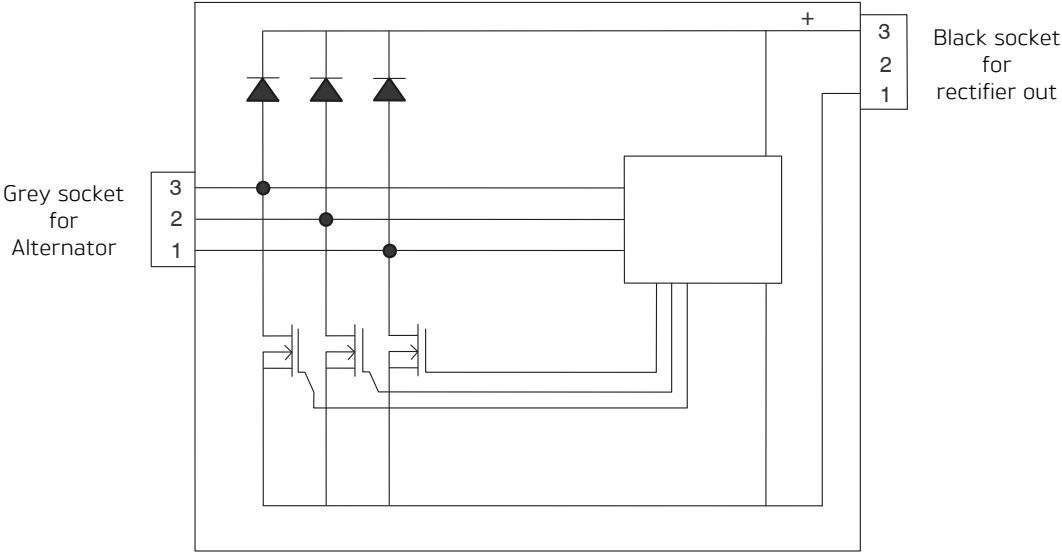
- **This test does not check for voltage regulation.**

Fault	Possible cause	Action
Battery not charging	Main Fuse	Check the condition of the main 30A fuse:
	Battery	Check the condition of the battery. Test the battery using the BatteryMate 150-9. Refer to the instructions supplied with the BatteryMate 150-9. Ensure the battery is serviceable.
	Regulator/Rectifier	Disconnect the black and the grey connectors from the rectifier/regulator and proceed to pinpoint test 1:
	Alternator	Test the alternator stator (see Alternator Stator, page 708).

Pinpoint Tests

Test	Result	Action
1 Check FET forward bias: Positive (+) probe to rectifier black socket pin 1 to: - Negative (-) probe to rectifier grey socket pin 1 - Negative (-) probe to rectifier grey socket pin 2 - Negative (-) probe to rectifier grey socket pin 3	0.4 V to 0.7 V	Proceed to test 2
	Open circuit or short circuit	Replace the unit. Proceed to test 4
2 Check diodes function forward bias: Negative (-) probe to rectifier black socket pin 3 to: - Positive (+) probe to rectifier grey socket pin 1 - Positive (+) probe to rectifier grey socket pin 2 - Positive (+) probe to rectifier grey socket pin 3	0.1 V to 0.3 V	Proceed to test 3
	Open circuit or short circuit	Replace the unit. Proceed to test 4
3 Check diodes reverse bias: Negative (-) probe to rectifier black socket pin 1 to: - Positive (+) probe to rectifier grey socket pin 1 - Positive (+) probe to rectifier grey socket pin 2 - Positive (+) probe to rectifier grey socket pin 3 Positive (+) probe to rectifier black socket pin 3 to: - Negative (-) probe to rectifier grey socket pin 1 - Negative (-) probe to rectifier grey socket pin 2 - Negative (-) probe to rectifier grey socket pin 3	More than 1.4 V or OL on meter	Proceed to test 4
	Less than 1.4 V or short circuit	Replace the unit. Proceed to test 4
4 Reconnect the harness and run the engine. Check the charging voltage at 2,000 rpm:	13 V - 15 V	Action complete - quit test
	Fault still present	Test alternator stator (see Alternator Stator, page 708)
		If alternator stator is serviceable, contact Triumph service

Circuit Diagram



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Lighting Circuit tables

Key to Circuit Diagram

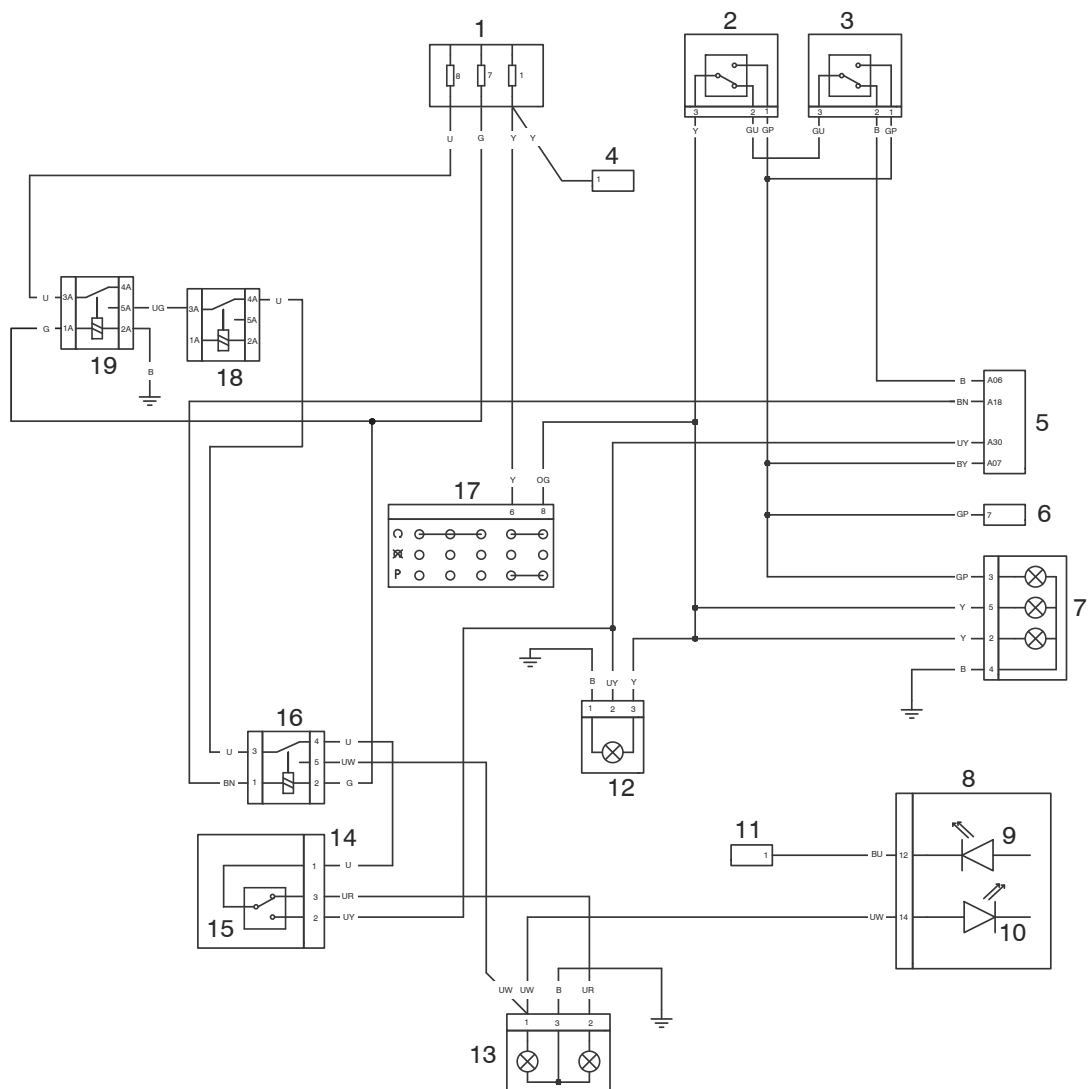
Key	Item Description
1	Fuse Box (Fuses 1, 7and 8)
2	Front Brake Switch
3	Rear Brake Switch
4	Bluetooth Module Connector
5	Engine Control Module - Connector A
6	ABS Modulator
7	Rear Light Sub-Harness Connector
8	Instrument Assembly Connector
9	Oil Pressure Instruments Light
10	High Beam Warning Light
11	Engine Oil Pressure Switch
12	Daytime Running Light (DRL) Unit
13	Headlamp Bulb
14	Left Hand Switch Housing - 3 Way Connector
15	Left Hand Switch Cube - DIP/DRL Switch
16	Main/DIP Beam Relay
17	Ignition Switch Connector
18	Starter Motor Solenoid Relay
19	Headlamp Relay

Code	Wiring Colour
LU	Light Blue

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

Lighting Circuit Diagram



Starting and Charging Circuit Tables

Key to Circuit Diagram

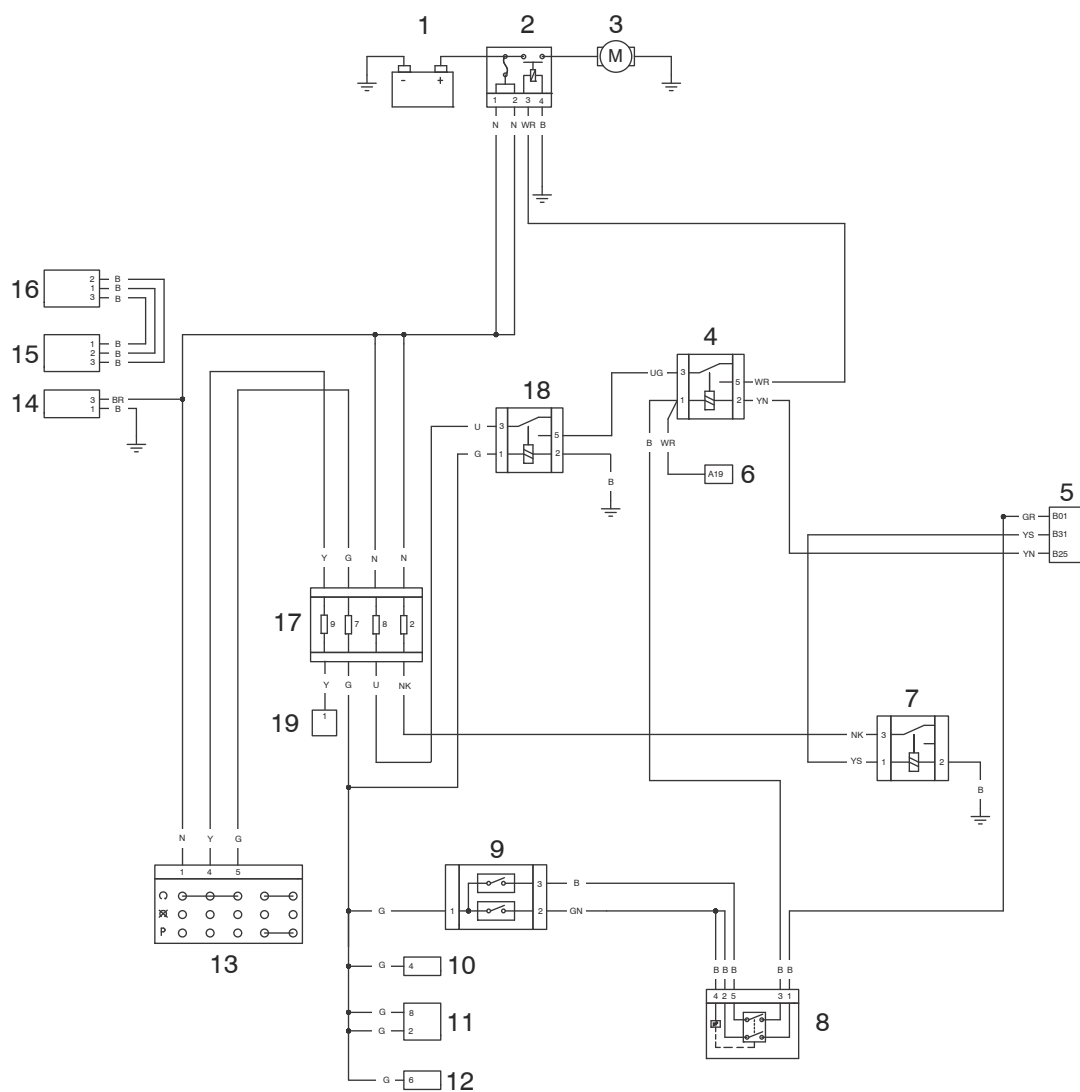
Key	Item Description
1	Battery
2	Starter Solenoid
3	Starter Motor
4	Starter Solenoid Relay
5	Engine Electronic Control Module - Connector B
6	Engine Electric Control Module - Connector A
7	EMS Relay
8	Alarm Connector
9	Right Hand Switch Housing - 8 Way Connector
10	Instrument Assembly Connector
11	Immobiliser
12	Bluetooth® Module Connector
13	Ignition Switch
14	Regulator Rectifier - DC Connector
15	Regulator Rectifier - AC Connector
16	AC Generator
17	Fuse Box
18	Headlamp Relay
19	USB Socket

Code	Wiring Colour
LG	Light Green
LU	Light Blue

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

Starting and Charging Circuit Diagram



Auxiliary and Accessory Circuit Tables

Key to Circuit Diagram

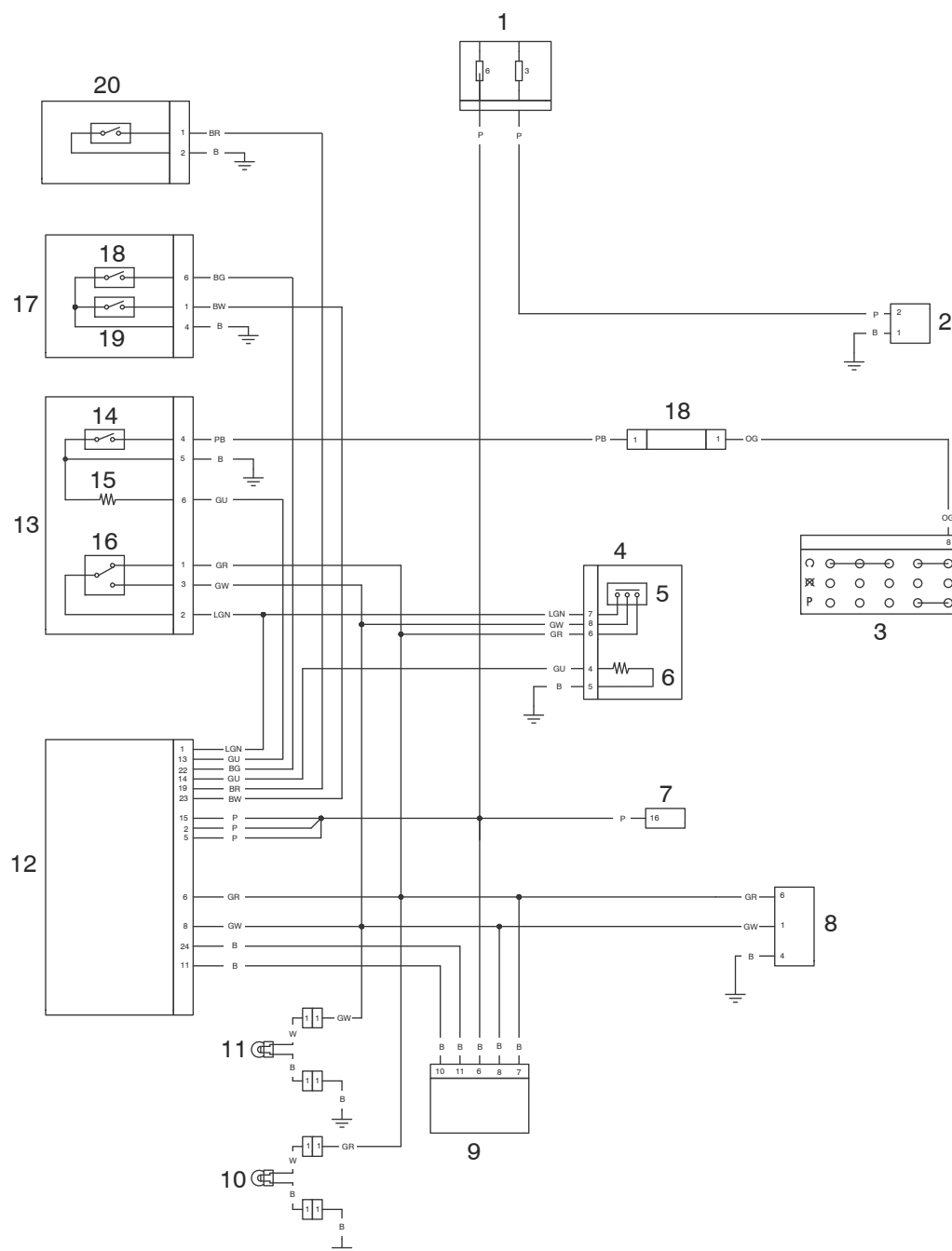
Key	Item Description
1	Fuse Box
2	Accessory Socket - Rider
3	Ignition Switch
4	Right Hand Switch Housing - 8 Way Connector
5	Hazard Light Switch
6	Right Hand Heated Grip (Internal connector)
7	Diagnostic Connector
8	Rear Light Sub-Harness Connector
9	Alarm
10	Left Hand Front Direction Indicator
11	Right Hand Front Direction Indicator
12	Instrument Assembly Connector
13	Left Hand Switch Housing - 6 Way Connector
14	Horn Switch
15	Left Hand Heated Grip (Internal connector)
16	Direction Indicator Switch
17	Left Hand Switch Housing - 8 Way Connector
18	Heated Grips Switch
19	Scroll Switch
20	Mode Switch

Code	Wiring Colour
P	Purple
W	White
Y	Yellow
LG	Light Green
LU	Light Blue

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

Auxiliary and Accessory Circuit Diagram



Engine Management Circuit Tables

Key to Circuit Diagram

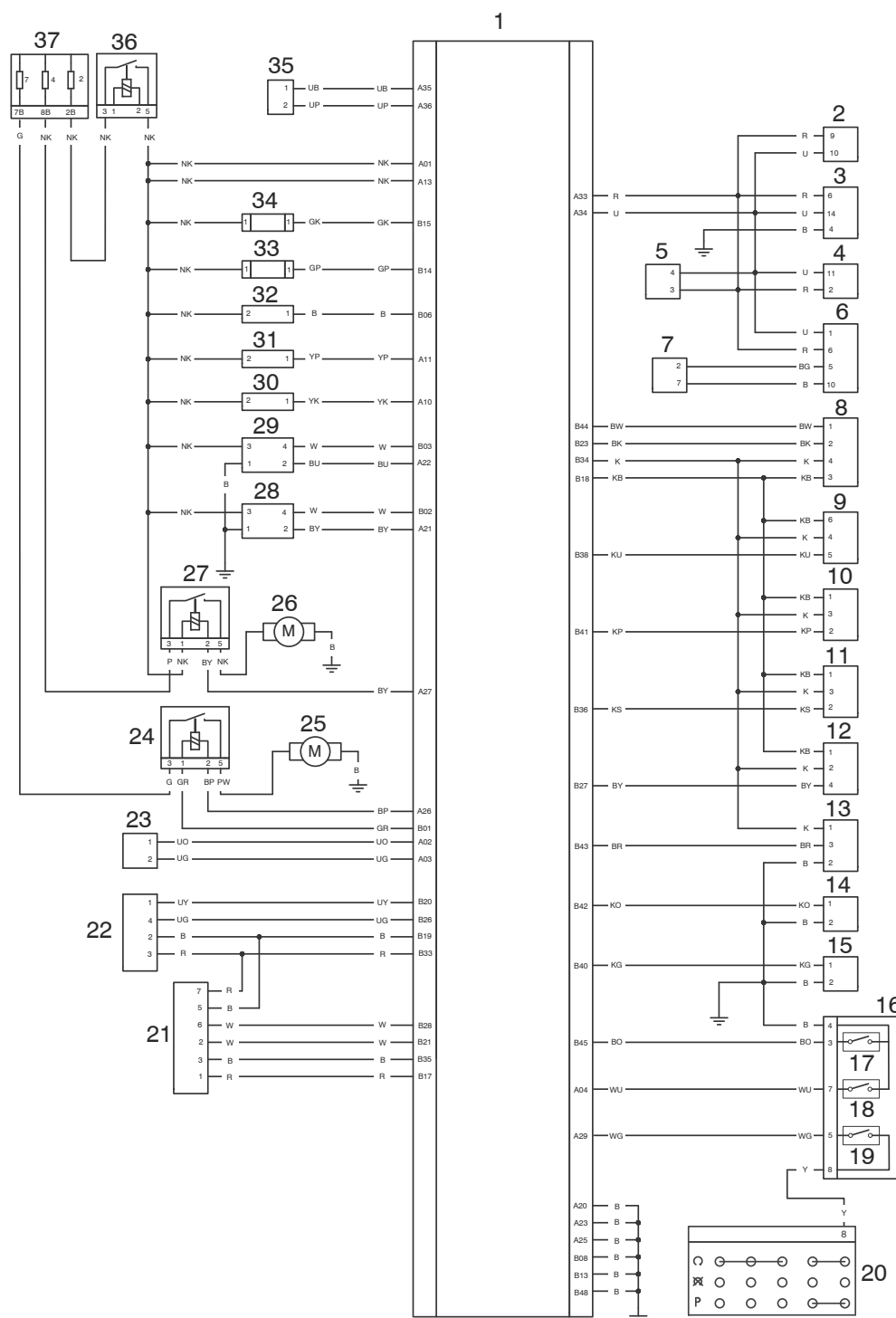
Key	Item Description
1	Engine Electronic Control Module
2	Instrument Assembly Connector
3	Diagnostic Connector
4	ABS Module Connector
5	Bluetooth® Module
6	Immobiliser
7	Ignition Switch
8	Gear Position Sensor
9	Fall Detection Switch
10	Ambient Air Pressure Sensor
11	MAP Sensor
12	Fuel Level Sender
13	Side Stand Switch
14	Intake Air Temperature Sensor
15	Coolant Temperature Sensor
16	Left Hand Switch Housing - 8 Way Connector
17	Clutch Switch
18	Main Beam Switch
19	Cruise Control Switch (if fitted)
20	Ignition Switch
21	Twist Grip Position Sensor
22	Throttle Position sensor
23	Throttle Drive Motor
24	Fuel Pump Relay
25	Fuel Pump
26	Cooling Fan
27	Cooling Fan Relay
28	Oxygen Sensor - Cylinder 1
29	Oxygen Sensor - Cylinder 2
30	Fuel Injector - Cylinder 1
31	Fuel Injector - Cylinder 2
32	Purge Valve
33	Ignition Coil - Cylinder 1
34	Ignition Coil - Cylinder 2

Key	Item Description
35	Crankshaft Position Sensor
36	EMS Relay
37	Fuse Box

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

Engine Management Circuit Diagram



ABS System Circuit Tables

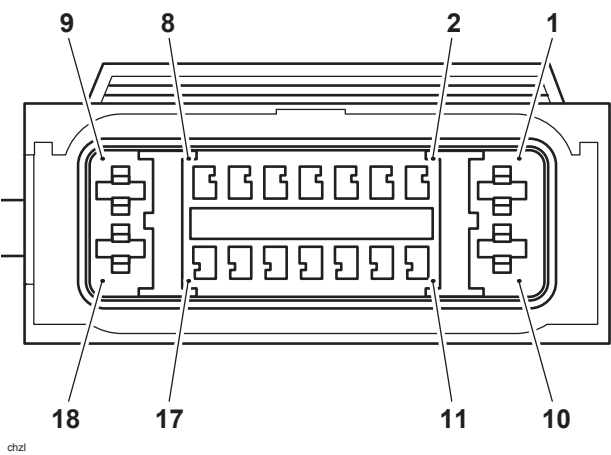
Key To Wiring Circuit Diagram

Key	Item Description
1	ABS Modulator
2	Fuse Box
3	Front Brake Switch
4	Rear Brake Switch
5	Engine Electronic Control Module - Connector A
6	Rear Light Sub-harness Connector
7	Front Wheel Speed Sensor
8	Rear Wheel Speed Sensor
9	Instruments Connector
10	Diagnostic Connector

Key To Wiring Colour Codes

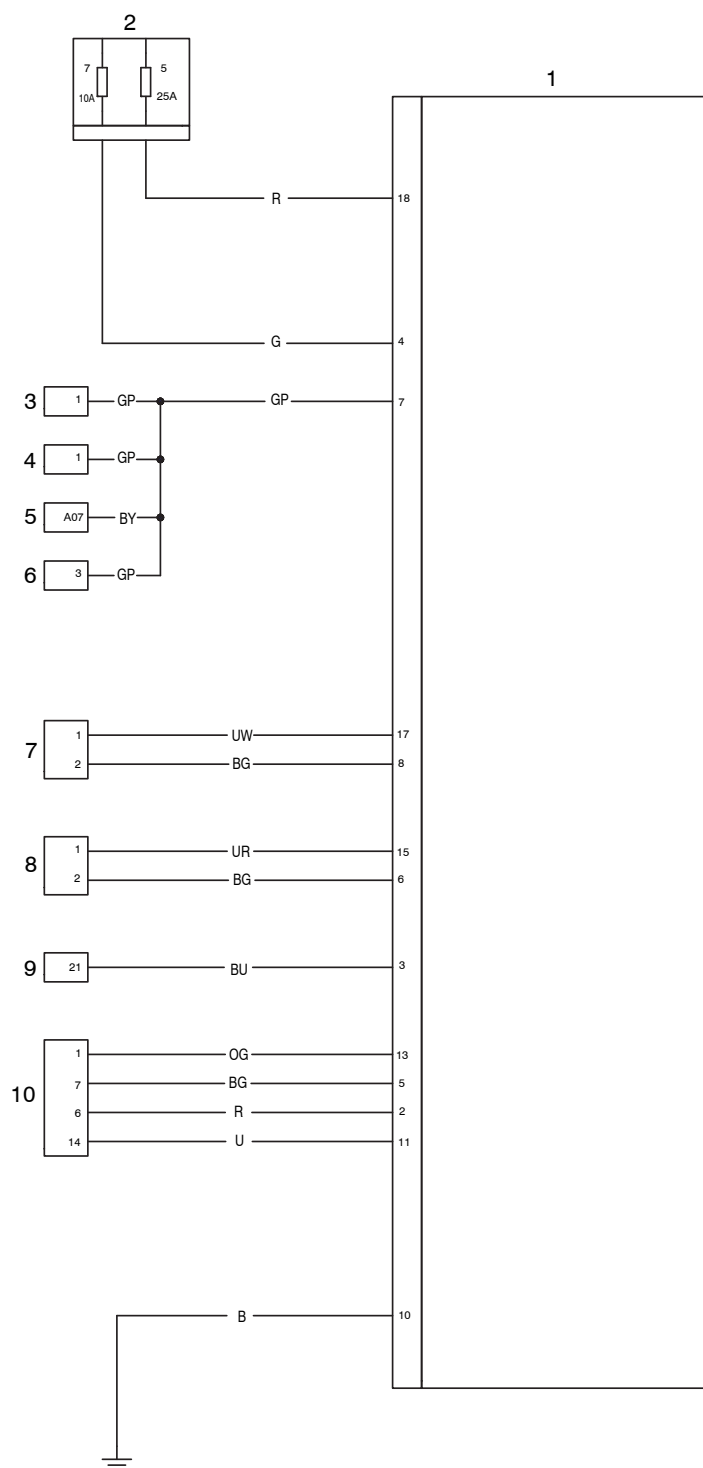
Code	Wiring Colour
B	Black
U	Blue
N	Brown
G	Green
S	Slate/Grey
O	Orange
K	Pink
R	Red
P	Purple
W	White
Y	Yellow
LG	Light Green
LU	Light Blue

ABS ECM Connector Pin Numbering



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 right to left with number one in the top right hand corner.

ABS System Circuit Diagram



Complete Main Harness Table

Key to Circuit Diagram

Key	Item Description
1	Engine Electronic Control Module
2	Intake Air Temperature Sensor
3	Engine Coolant Temperature Sensor
4	Cooling Fan
5	Cooling Fan Relay
6	Engine ECM Main Relay
7	Fuel Pump
8	Fuel Pump Relay
9	Rear Brake Switch
10	Brake Light
11	Rear Light
12	Licence Plate Light
13	Left Hand Rear Direction Indicator
14	Right Hand Rear Direction Indicator
15	Rear Light Sub-Harness Electrical Connector
16	Dip/Main Headlamp Relay
17	Alarm Connector
18	Regulator Rectifier DC Connector
19	Starter Motor Solenoid Relay
20	Regulator Rectifier AC Connector
21	Engine Alternator Connector
22	Starter Motor Solenoid
23	Harness Battery Negative Connection
24	Battery
25	Starter Motor
26	Fuse Box

Key	Item Description
27	Headlamp Main Relay
28	Ignition Switch Connector
29	Immobiliser Antenna
30	Rider Accessory Socket
31	Immobiliser
32	Front Brake Switch
33	Engine OFF Switch
34	Engine Start Switch
35	Hazard Light Switch
36	Right Hand Heated Grip (if fitted)
37	Direction Indicator Switch
38	Horn Switch
39	Left Hand Heated Grip (if fitted)
40	Dip/Main Switch
41	Clutch Switch
42	Instrument Scroll Switch
43	Heated Grips Switch (if fitted)
44	Cruise Control
45	Mode Switch
46	Bluetooth® Module Connector
47	USB Charging Point Connector
48	Rear Wheel Speed Sensor
49	Front Wheel Speed Sensor
50	ABS Modulator
51	Diagnostic Connector
52	Headlamp Bulb
53	Front Position Light/ Daytime running Lights (DRL)
54	Right Hand Front Direction Indicator
55	Left Hand Front Direction Indicator

Key	Item Description
56	Horn
57	Dip/Daytime Running Lights (DRL) Switch
58	Instruments
59	Oil Pressure Switch
60	MAP Sensor
61	Ambient Air Pressure Sensor
62	Roll Over Switch
63	Side Stand Switch
64	Fuel Level Sender
65	Gear Position Sensor
66	Ignition Coil 2
67	Ignition Coil 1
68	Oxygen Sensor 2
69	Oxygen Sensor 1
70	Injector 2
71	Injector 1
72	Purge Valve
73	Drive By Wire Throttle Motor
74	Throttle Position Sensor
75	Twist Grip Position Sensor
76	Crankshaft Position sensor

Key To Wiring Colour Codes

Code	Wiring Colour
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S	Slate/Grey
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K	Pink
R	Red
P	Purple
W	White

Code	Wiring Colour
Y	Yellow
LG	Light Green
LU	Light Blue

Complete Main Harness Diagram

