



SERVICE STATION MANUAL

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Stelvio 1200 NTX



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THE VALUE OF SERVICE

Only the mechanics of the Official Moto Guzzi Service Network know this vehicle well, thanks to constant technical professional development and Moto Guzzi specific training programmes, and have the tools needed to carry out maintenance and repair operations correctly.

The reliability of the vehicle also depends on its mechanical conditions. Checking the vehicle before riding it, carrying out routine maintenance and using only Moto Guzzi Original Spare parts is fundamental!

For information about the nearest Official Dealer and/or Service Centre, consult the Yellow Pages or search directly on the inset map in our Official Website:

www.motoguzzi.it

Only by purchasing Moto Guzzi Original Spare Parts will you get a product designed and tested during the bike designing phase. Moto Guzzi Original Spare Parts are subject to systematic quality control procedures so that their reliability and performance over time is guaranteed.

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SERVICE STATION MANUAL

Stelvio 1200 NTX

This manual provides the main information to carry out regular maintenance operations on your vehicle. This manual is intended to **Moto Guzzi Dealers** and their qualified mechanics; several concepts have been deliberately omitted as they are considered unnecessary. As it is not possible to include complete mechanical notions in this manual, users should have basic mechanical knowledge or minimum knowledge about the procedures involved when repairing scooters. Without this knowledge, repairing or checking the vehicle may be inefficient or even dangerous. As the vehicle repair and check procedures are not described in detail, be extremely cautious so as not to damage components or injure individuals. In order to optimise customer satisfaction when using our vehicles, **Moto Guzzi s.p.a.** commits itself to continually improve its products and the relative documentation. The main technical modifications and changes in repair procedures are communicated to all **Moto Guzzi Sales Outlets and its International Subsidiaries**. These changes will be introduced in the subsequent editions of the manual. In case of need or further queries on repair and check procedures, consult **Moto Guzzi CUSTOMER DEPARTMENT**, which will be prepared to provide any information on the subject and any further communications on updates and technical changes related to the vehicle.

NOTE Provides key information to make the procedure easier to understand and carry out.

CAUTION Refers to specific procedures to carry out for preventing damages to the vehicle.

WARNING Refers to specific procedures to carry out to prevent injuries to the repairer.



Personal safety Failure to completely observe these instructions will result in serious risk of personal injury.



Safeguarding the environment Sections marked with this symbol indicate the correct use of the vehicle to prevent damaging the environment.



Vehicle intactness The incomplete or non-observance of these regulations leads to the risk of serious damage to the vehicle and sometimes even the invalidity of the guarantee.



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Rules

Safety rules

Carbon monoxide

If you need to keep the engine running while working on the vehicle, please ensure that you do so in an open or very well ventilated area. Never run the engine in an enclosed area. If you do work in an enclosed area, make sure to use a fume extraction system.

CAUTION



EXHAUST EMISSIONS CONTAIN CARBON MONOXIDE, A POISONOUS GAS WHICH CAN CAUSE LOSS OF CONSCIOUSNESS AND EVEN DEATH.

Fuel

CAUTION



THE FUEL USED TO POWER INTERNAL COMBUSTION ENGINES IS HIGHLY FLAMMABLE AND MAY BE EXPLOSIVE UNDER CERTAIN CONDITIONS. IT IS THEREFORE RECOMMENDED TO CARRY OUT REFUELLING AND MAINTENANCE PROCEDURES IN A VENTILATED AREA WITH THE ENGINE SWITCHED OFF. DO NOT SMOKE DURING REFUELLING AND NEAR FUEL VAPOURS, AVOIDING ANY CONTACT WITH NAKED FLAMES, SPARKS OR OTHER SOURCES WHICH MAY CAUSE THEM TO IGNITE OR EXPLODE.

DO NOT DISPERSE FUEL IN THE ENVIRONMENT.

KEEP OUT OF THE REACH OF CHILDREN

Hot components

The engine and the exhaust system components become very hot and remain hot for some time after the engine has been switched off. When handling these components, wear insulating gloves or wait until the engine and the exhaust system have cooled down.

Used engine oil and transmission oil

CAUTION



IT IS ADVISABLE TO WEAR LATEX GLOVES WHEN SERVICING THE VEHICLE.

THE ENGINE OR GEARBOX OIL MAY CAUSE SERIOUS INJURIES TO THE SKIN IF HANDLED FOR PROLONGED PERIODS OF TIME AND ON A REGULAR BASIS.

WASH YOUR HANDS CAREFULLY AFTER HANDLING OIL.

HAND THE OIL OVER TO OR HAVE IT COLLECTED BY THE NEAREST USED OIL RECYCLING COMPANY OR THE SUPPLIER.

DO NOT DISPOSE OF OIL IN THE ENVIRONMENT

KEEP OUT OF THE REACH OF CHILDREN

Brake and clutch fluid



BRAKE AND CLUTCH FLUIDS CAN DAMAGE THE PLASTIC OR RUBBER PAINTED SURFACES. WHEN SERVICING THE BRAKING SYSTEM OR THE CLUTCH SYSTEM PROTECT THESE COMPONENTS WITH A CLEAN CLOTH. ALWAYS WEAR PROTECTIVE GOGGLES WHEN SERVICING THESE SYSTEMS. BRAKE AND CLUTCH FLUIDS ARE EXTREMELY HARMFUL FOR YOUR EYES. IN THE EVENT OF ACCIDENTAL CONTACT WITH YOUR EYES, RINSE THEM IMMEDIATELY WITH ABUNDANT COLD, CLEAN WATER AND SEEK MEDICAL ADVICE. KEEP OUT OF THE REACH OF CHILDREN

Battery electrolyte and hydrogen gas

CAUTION



THE BATTERY ELECTROLYTE IS TOXIC, CORROSIVE AND AS IT CONTAINS SULPHURIC ACID, IT CAN CAUSE BURNS WHEN IN CONTACT WITH THE SKIN. WHEN HANDLING BATTERY ELECTROLYTE, WEAR TIGHT-FITTING GLOVES AND PROTECTIVE APPAREL. IN THE EVENT OF SKIN CONTACT WITH THE ELECTROLYTIC FLUID, RINSE WELL WITH PLENTY OF CLEAN WATER. IT IS PARTICULARLY IMPORTANT TO PROTECT YOUR EYES BECAUSE EVEN TINY AMOUNTS OF BATTERY ACID MAY CAUSE BLINDNESS. IF THE FLUID GETS IN CONTACT WITH YOUR EYES, WASH WITH ABUNDANT WATER FOR FIFTEEN MINUTES AND CONSULT AN EYE SPECIALIST IMMEDIATELY. IF THE FLUID IS ACCIDENTALLY SWALLOWED, DRINK LARGE QUANTITIES OF WATER OR MILK, FOLLOWED BY MILK OF MAGNESIA OR VEGETABLE OIL AND SEEK MEDICAL ADVICE IMMEDIATELY. THE BATTERY RELEASES EXPLOSIVE GASES; KEEP IT AWAY FROM FLAMES, SPARKS, CIGARETTES OR ANY OTHER HEAT SOURCES. ENSURE ADEQUATE VENTILATION WHEN SERVICING OR RECHARGING THE BATTERY.

KEEP OUT OF THE REACH OF CHILDREN

BATTERY LIQUID IS CORROSIVE. DO NOT POUR IT OR SPILL IT, PARTICULARLY ON PLASTIC COMPONENTS. ENSURE THAT THE ELECTROLYTIC ACID IS COMPATIBLE WITH THE BATTERY TO BE ACTIVATED.

Maintenance rules

GENERAL PRECAUTIONS AND INFORMATION

When repairing, dismantling and reassembling the vehicle, follow the recommendations given below carefully.

BEFORE DISASSEMBLING COMPONENTS

- Before dismantling components, remove dirt, mud, dust and foreign bodies from the vehicle. Use the special tools designed for this bike, as required.

COMPONENTS REMOVAL

- Do not loosen and/or tighten screws and nuts using pliers or any other tools than the specific wrench.
- Mark the positions on all connection joints (pipes, cables, etc.) before separating them, and identify them with different distinctive symbols.
- Each component needs to be clearly marked to enable identification during reassembly.
- Clean and wash the dismantled components carefully using a low-flammability detergent.
- Keep mated parts together since they have "adjusted" to each other due to normal wear.

- Some components must be used together or replaced altogether.
- Keep away from heat sources.

REASSEMBLING COMPONENTS

CAUTION

BEARINGS MUST ROTATE FREELY, WITHOUT JAMMING AND/OR NOISE, OTHERWISE, THEY NEED TO BE REPLACED.

- Only use ORIGINAL Moto Guzzi SPARE PARTS.
- Comply with lubricant and consumables use guidelines.
- Lubricate parts (whenever possible) before reassembling them.
- When tightening nuts and screws, start from the ones with the largest section or from the internal ones, moving diagonally. Tighten nuts and screws in successive steps before applying the tightening torque.
- Always replace self-locking nuts, washers, sealing rings, circlips, O-rings (OR), split pins and screws with new ones if their tread is damaged.
- When assembling the bearings, make sure to lubricate them well.
- Check that each component is assembled correctly.
- After a repair or routine maintenance procedure, carry out pre-ride checks and test the vehicle on private grounds or in an area with low traffic density.
- Clean all coupling surfaces, oil guard rims and gaskets before refitting them. Smear a light layer of lithium-based grease on the oil guard rims. Reassemble oil guards and bearings with the brand or lot number facing outward (visible side).

ELECTRIC CONNECTORS

Electric connectors must be disconnected as described below; failure to comply with this procedure causes irreparable damage to both the connector and the wiring harness:

Press the relative safety clips, if applicable.

- Grip the two connectors and disconnect them by pulling them in opposite directions.
- If any signs of dirt, rust, moisture, etc. are noted, clean the inside of the connector carefully with a jet of compressed air.
- Ensure that the cables are correctly fastened to the internal connector terminals.
- Then connect the two connectors, ensuring that they couple correctly (if fitted with clips, you will hear them "click" into place).

CAUTION

DO NOT DISCONNECT CONNECTORS BY PULLING THE CABLES.

NOTE

THE TWO CONNECTORS CAN ONLY BE CONNECTED IN ONE DIRECTION: CONNECT THEM THE RIGHT WAY ROUND.

TIGHTENING TORQUES

CAUTION

REMEMBER THAT THE TIGHTENING TORQUES FOR ALL FASTENING ELEMENTS ON WHEELS, BRAKES, WHEEL AXLES AND ANY OTHER SUSPENSION COMPONENTS PLAY A KEY ROLE IN ENSURING VEHICLE SAFETY AND MUST COMPLY WITH SPECIFIED VALUES. CHECK THE

TIGHTENING TORQUES OF FASTENING ELEMENTS ON A REGULAR BASIS AND ALWAYS USE A TORQUE WRENCH TO REASSEMBLE THESE COMPONENTS. FAILURE TO COMPLY WITH THESE RECOMMENDATIONS MAY CAUSE ONE OF THESE COMPONENTS TO LOOSEN OR EVEN DETACH, CAUSING A WHEEL TO LOCK OR COMPROMISING VEHICLE HANDLING. THIS MAY LEAD TO FALLS, WITH THE RISK OF SERIOUS INJURY OR DEATH.

Running-in

Engine run-in is essential to ensure engine long life and correct operation. Twisty roads and gradients are ideal to run in engine, brakes and suspensions effectively. Vary your riding speed during the run-in. This ensures that components operate under both "loaded" and "unloaded" conditions, allowing the engine components to cool.

CAUTION

THE CLUTCH MAY EMIT A SLIGHT BURNING SMELL WHEN FIRST USED. THIS PHENOMENON SHOULD BE CONSIDERED NORMAL AND WILL DISAPPEAR AS SOON AS THE CLUTCH DISCS GET ADAPTED.

IT IS IMPORTANT TO STRAIN ENGINE COMPONENTS DURING RUN-IN, HOWEVER, MAKE SURE NOT TO OVERDO THIS.

CAUTION

THE FULL PERFORMANCE OF THE VEHICLE IS ONLY AVAILABLE AFTER THE SERVICE AT THE END OF THE RUN-IN PERIOD.

Follow the guidelines detailed below:

- Do not twist the throttle grip abruptly and completely when the engine is working at a low revs, either during or after run-in.
- During the first 100 Km (62 miles) use the brakes gently, avoiding sudden or prolonged braking. That is to permit the adequate adjustment of the pad friction material to the brake discs.



AFTER THE SPECIFIED MILEAGE, TAKE THE VEHICLE TO AN OFFICIAL Moto Guzzi DEALER FOR THE CHECKS INDICATED IN THE "AFTER RUN-IN" TABLE IN THE SCHEDULED MAINTENANCE SECTION TO AVOID INJURING YOURSELF, OTHERS AND /OR DAMAGING THE VEHICLE.

Vehicle identification

SERIAL NUMBER LOCATION

These numbers are necessary for vehicle registration.

NOTE

ALTERING IDENTIFICATION NUMBERS MAY BE SERIOUSLY PUNISHABLE BY LAW. IN PARTICULAR, MODIFYING THE CHASSIS NUMBER IMMEDIATELY VOIDS THE WARRANTY.

This number consists of numbers and letters, as in the example shown below.

ZGULZB000YMXXXXXX

KEY:

ZGU: WMI (World manufacturer identifier) code;

LZ: model;

B00: version variation;

0: digit free

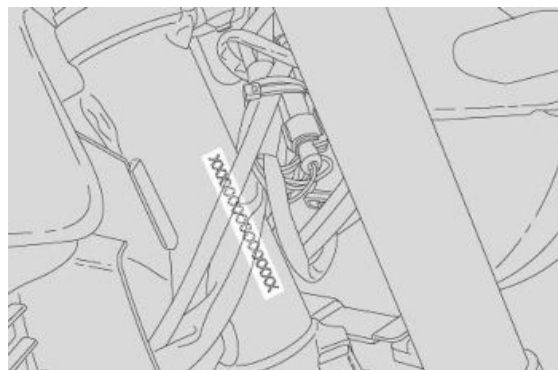
Y year of manufacture

M: production plant (M= Mandello del Lario);

XXXXXX: progressive number (6 digits);

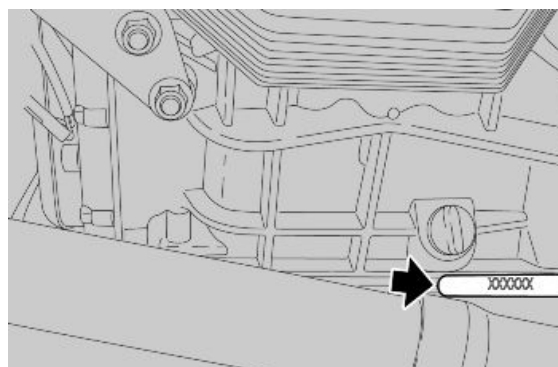
CHASSIS NUMBER

The chassis number is stamped on the right side of the headstock.



ENGINE NUMBER

The engine number is stamped on the left side, close to the engine oil level check cap.



Dimensions and mass

WEIGHT AND DIMENSIONS

Specification	Desc./Quantity
Maximum width (without accessories)	2305 mm (90.75 in)
Maximum width at handlebar	910 mm (35.83 in)
Maximum width of vehicle with accessories	1080 mm (42.52 in)
Minimum / maximum height (adjustable windshield)	1395 / 1440 mm (54.92 / 56.69 in)
Saddle height	800 mm (31.5 in)
Minimum ground clearance	185 mm (7.3 in)
Wheelbase	1535 mm (60.43 in)
Kerb weight	251 kg (553 lb)
Kerb weight of full house vehicle	278 kg (613 lb)

Engine

ENGINE

Specification	Desc./Quantity
Type	four stroke 90° transverse V-twin
Number of cylinders	2
Cylinder layout	90° V

Specification	Desc./Quantity
Bore / stroke	95 x 81.2 mm (3.74 x 3.20 in)
Engine capacity	1151 cm ³ (70 cu.in)
Compression ratio	11: 1
Ignition	electric
Idle speed	1100 ± 100 rpm
Clutch	hydraulic single plate dry clutch with integrated flexible coupling
Lubrication system	Pressurised circuit with regulator valves and trochoidal pump
Air filter	dry cartridge air filter
Cooling	air/oil system with independent trochoidal pump and pressure regulator valve for oil cooling circuit
Timing system diagram	Single overhead camshaft with bucket tappets and rockers
Values valid with control clearance between rocker and valve	inlet: 0.10 mm (0.0039 in) exhaust: 0.20 mm (0.0079 in)

Transmission

TRANSMISSION

Specification	Desc./Quantity
Primary drive	Helical gear, ratio 26/35 = 1:1.346
Gearbox	6 speed mechanical gearbox with foot gearshift lever on left hand side of engine
1st gear ratio	17/38 = 1:2.2353
2nd gear ratio	20/34 = 1:1.7
3rd gear ratio	23/31 = 1:1.3478
4th gear ratio	26/29 = 1:1.1154
5th gear ratio	31/30 = 1:0.9677
6th gear ratio	29/25 = 1:0.8621
Final drive	cardan shaft
Ratio	12/44 = 1:3.6667

Capacities

CAPACITY

Specification	Desc./Quantity
Engine oil	Oil change and oil filter replacement: 3,500 cm ³ (214 cu.in)
Gearbox oil	500 cm ³ (30.5 cu.in)
Transmission oil	380 cm ³ (23.2 cu.in)
Fuel (reserve included)	18 ± 1.5 l (3.96 ± 0.33 UK gal)
Fuel reserve	4 l (0.88 UK gal)
Seats	2
Maximum weight limit	495 kg (1091 lb)

Electrical system

ELECTRICAL SYSTEM

Specification	Desc./Quantity
Spark plug	NGK PMR8B (long life)
Alternatively:	
Spark plug	NGK CR8EKB (long life)
Electrode gap	0.6 - 0.7 mm (0.024 - 0.028 in)
Battery	12 V - 18 Ampere/hour
Alternator (permanent magnet type)	12 V - 550 W
Main fuses	30A - 40A
Secondary fuses	3 - 15 A (10A for ABS only)
Front daylight running light	12V - 5W
Low/high beam headlight (halogen)	12 V - 55 W / 60 W H4
Turn indicators	12V - 10 W
Tail light /stop light	LED

Specification	Desc./Quantity
Supplementary headlamps	12V/55W - H3
Instrument panel lighting	LED
License plate light	12V - 5 W
Turn indicator warning light	LED
Neutral gear warning light	LED
Alarm warning light - Shift indicator	LED
Side stand down warning light	LED
Low fuel warning light	LED
High beam warning light	LED
ABS warning light	LED

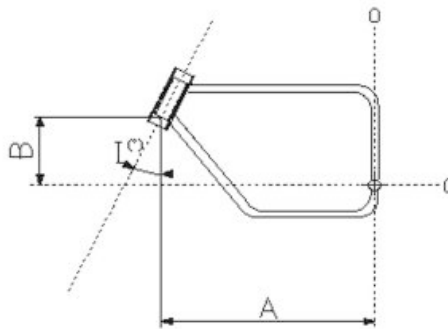
Frame and suspensions

CHASSIS

Specification	Desc./Quantity
Type	high strength tubular steel frame with engine as stressed element
Trail	125 mm (4.92 in)
Headstock	27°
Front	Upside down telescopic hydraulic fork, with 45mm (1.77 in) diam., stanchions and radial calliper mounting bracket with adjustable spring preload and hydraulic compression and rebound damping.
Front wheel travel	170 mm (6.69 in)
Rear	single sided swingarm with progressive linkage and mono-shock with adjustable hydraulic rebound and compression damping and spring preloading adjustment.
Unloaded shock absorber spring length	180 mm (7.09 in)
Rear wheel travel	155 mm (6.10 in)

SIZES A AND B

Specification	Desc./Quantity
Size A	745.0 mm (29.33 in)
Size B	403.16 mm (15.87 in)



Brakes

BRAKES

Specification	Desc./Quantity
Front	Dual 320 mm (12.6 in) diam. stainless steel floating wavy disc with radial callipers with 4 differentiated, horizontally opposed pistons.
Rear	282 mm (11.1 in) diam. stainless steel disc

Wheels and tyres

WHEELS AND TYRES - STELVIO NTX

Wheel	Model	Rim	Size	Tyre pressure with rider only	Tyre pressure, rider + passenger
Front (standard)	Metzeler Tourance	2.50 x 19"	110/80 R19 - 59V	2.4 bar (240 kPa) (34.8 PSI)	2.5 bar (250 kPa) (36.3 PSI)
Front (alternatively)	Metzeler Karoo (*) (***)	2.50 x 19"	110/80 R19 - 59R M+S	2.5 bar (250 kPa) (36.3 PSI) (**)	2.5 bar (250 kPa) (36.3 PSI) (**)
Front (alternatively)	Pirelli Scorpion Sync	2.50 x 19"	110/80 R19 - 59V	2.5 bar (250 kPa) (36.3 PSI)	2.5 bar (250 kPa) (36.3 PSI)
Rear (standard)	Metzeler Tourance	4.25 x 17"	150/70 R17 - 69V	2.7 bar (270 kPa) (36.1 PSI)	2.9 bar (290 kPa) (42.1 PSI)
Rear (alternatively)	Metzeler Karoo (*) (***)	4.25 x 17"	150/70 R17 - 69R M+S	2.7 bar (270 kPa) (36.1 PSI) (**)	2.9 bar (290 kPa) (42.1 PSI) (**)
Rear (alternatively)	Pirelli Scorpion Sync	5.50 x 17"	180/55 R17 - 73V	2.9 bar (290 kPa) (42.1 PSI)	2.9 bar (290 kPa) (42.1 PSI)

(*) Maximum speed allowed = 170 km/h (105 mi/h).

(**) Tyre pressure must be adjusted to suit terrain conditions for off road use.

(***) Do not install on vehicles equipped with ABS



WHEN FITTING Metzeler Karoo TYRES, THE MAXIMUM SPEED WARNING LABEL (INCLUDED WITH TYRES) MUST BE APPLIED TO THE SPEEDOMETER. USE EXTREME CAUTION WHEN RIDING ON TARMAC ROADS WITH "OFF-ROAD / ALLROUND" TYRES AS THESE TYRES OFFER POOR GRIP AND STABILITY ON TARMAC.



DO NOT INSTALL M+S TYPE TYRES ON VEHICLES EQUIPPED WITH ABS SYSTEM.

Supply

FUEL SYSTEM

Specification	Desc./Quantity
Fuel system	Electronic injection (Weber. Marelli) with Stepper motor
Diffuser	diameter: 50 mm (1.97 in)
Fuel	Premium unleaded petrol, minimum octane rating 95 (NORM) and 85 (NOMM)

Tightening Torques

HEADS

Name	Torque in Nm
Oil cap (2)	25 Nm (18.44 lbf ft)
Rocking lever support nut - M10x1.5 (8)	15 Nm (11.06 lbf ft) + 42 Nm (30.98 lbf ft)
Camshaft - rocking levers support fixing screws (12)	17 Nm (12.54 lbf ft)
Head fixing screw (4) - pre-tightening	15 Nm (11.06 lbf ft)
Head fixing screw (4) - final tightening	42 Nm (31 lbf ft)
Screw fixing head to chain compartment - M6x120 (4)	10 Nm (7.38 lbf ft)
Oil temperature sensor	11 Nm (8.11 lbf ft) - Loctite 243
Oil temperature sensor container	11 Nm (8.11 lbf ft) - Loctite 601
Head covers fixing screws (8)	8 Nm (5.9 lbf ft)
Spark plug (2)	15 Nm (11.06 lbf ft) - Molykote

CRANKCASE

Name	Torque in Nm
Crankcase stud bolt - cylinder (8)	25 Nm (18.44 lbf ft)
Transmission side flange stud bolt - M8x66 (3)	35 Nm (25.81 lbf ft)
Transmission side flange stud bolt - M8x75 (2)	35 Nm (25.81 lbf ft)
Gear side crankshaft flange screw - TE M8x25 (8)	26 Nm (19.18 lbf ft)
Timing system cover screw - TCEI M8x55 (4)	25 Nm (18.44 lbf ft)
Timing system cover screw - TCEI M6x30 (10)	10 Nm (7.38 lbf ft)
Oil vapour union screw - TCEI M6x20 (2)	10 Nm (7.38 lbf ft)
TCEI M6x40 Screw (2)	10 Nm (7.38 lbf ft)
Timing sensor - TCEI M5x12 (2)	6 Nm (4.42 lbf ft)
Service shaft bearing locking screw (2)	10 Nm (7.38 lbf ft)
Oil pressure sensor (1)	25 Nm (18.44 lbf ft)
Screw fixing oil pressure sensor support - TCEI M10x20 (1)	18 Nm (13.28 lbf ft)
Oil cap (2)	25 Nm (18.44 lbf ft)

OIL SUMP

Name	Torque in Nm
Oil pipe on sump reduction (1)	20 Nm (14.75 lbf ft)
Oil pipe on sump	20 Nm (14.75 lbf ft)
Oil sump lower screw - TCEI M6x30 (4)	10 Nm (7.38 lbf ft)
Oil sump screw - TCEI M6x55 (14)	10 Nm (7.38 lbf ft)
Oil sump screw - TCEI M6x60 (2)	10 Nm (7.38 lbf ft)
Oil drainage plug - M10x1 (1)	20 Nm (14.75 lbf ft)
Oil filter (1)	15 Nm (11.06 lbf ft)
Oil filter fitting (1)	40 Nm (29.5 lbf ft) - Loctite 243
Oil pipe in sump	20 Nm (14.75 lbf ft) - Loctite 648
Pressure-relief plug	40 Nm (29.5 lbf ft)
Cap on oil sump flange (2)	20 Nm (14.75 lbf ft)
Cap (1)	40 Nm (29.5 lbf ft)

CRANKSHAFT - FLYWHEEL

Name	Torque in Nm
Connecting rod screw (4) - pre-tightening	40 Nm (29.5 lbf ft)
Connecting rod screw (4) - final tightening	80 Nm (59 lbf ft)
Screw fixing clutch disc on crankshaft - M8x25 (6)	42 Nm (30.98 lbf ft) - Loctite 243
Screw fixing clutch bell on disc - M7x16 (6)	20 Nm (14.75 lbf ft)
Start-up crown gear fixing screw (6)	10 Nm (7.38 lbf ft)

OIL PUMP

Name	Torque in Nm
Oil pump fixing screws - M6x45 (3)	10 Nm (7.38 lbf ft)
Oil pump gear nut - M10x1.25 (1)	20 Nm (14.75 lbf ft)
Pressure-relief plug	40 Nm (29.5 lbf ft)
Cooling oil intake filter fixing screw (5)	10 Nm (7.38 lbf ft)
Lubrication oil intake filter fixing screw (2)	10 Nm (7.38 lbf ft)

TIMING SYSTEM

Name	Torque in Nm
Service shaft flange screw - TBEI M6x14 (2)	8 Nm (5.9 lbf ft)
Timing system gear nut on service shaft - M18 (1)	150 Nm (110.6 lbf ft)
Timing system gear nut on crankshaft - M25 (1)	200 Nm (147.51 lbf ft)
Timing system upper gear TE screw (2)	30 Nm (22.13 lbf ft)
Screw fixing timing system upper gear closing cap - TBEI M5x10 (4)	7 Nm (5.16 lbf ft)
Cylinder chain tensioner cap (2)	30 Nm (22.13 lbf ft)
Screw fixing movable chain slider (2)	25 Nm (18.44 lbf ft)

ALTERNATOR

Name	Torque in Nm
Alternator fixing screw - TCEI M8x45 (1)	22 Nm (16.23 lbf ft)
Alternator fixing nut - M10x1.5 (1)	30 Nm (22.13 lbf ft)

Name	Torque in Nm
Alternator pulley nut on crankshaft - M16 (1)	80 Nm (59 lbf ft) - Loctite 243
Belt tension	50 Nm (36.88 lbf ft)
Alternator belt cover screw - TCEI M6x16 (4)	10 Nm (7.38 lbf ft)
Alternator belt cover screw (radiator bracket retainer) TCEI M6x40 (2)	10 Nm (7.38 lbf ft)

GEAR

Name	Torque in Nm
Gear shift cable lever nut	10 Nm (7.38 lbf ft)
Gear shift tie rod lever nut on gear pre-selector	10 Nm (7.38 lbf ft)
Gearbox to crankcase fixing nut - M8 (5)	20 Nm (14.75 lbf ft)
TE flanged screw fixing gearbox to crankcase - M8x45 (1)	20 Nm (14.75 lbf ft)
Oil cap M18x1.5 (1)	28 Nm (20.65 lbf ft)
Breather cap (1)	8 Nm (5.9 lbf ft)
Gear in neutral sensor (1)	10 Nm (7.38 lbf ft)
Oil drainage plug - M10x1 (1)	24 Nm (17.7 lbf ft)
Transmission shaft ring nut (1)	100 Nm (73.76 lbf ft)

OIL RADIATOR

Name	Torque in Nm
Radiator to chassis retainer M6x30 (3)	10 Nm (7.38 lbf ft)
Nipples to radiator retainer M16x1.5 (2)	20 Nm (14.75 lbf ft)
Oil pipes to radiator and engine retainer M16x1.5 (2 + 2)	20 Nm (14.75 lbf ft)

CHASSIS TO ENGINE UNIT

Name	Torque in Nm
M6x40 TCEI DA screw	8 -12 Nm
Reduction	20 Nm

FUEL SUPPLY CONTROL UNIT

Name	Torque in Nm
M5x12 TCEI screw	6 -7 Nm
Stainless M5x16 TBEI flanged screw	6 -7 Nm
M6x25 TCEI DA screw	8 -12 Nm

CHASSIS

Name	Torque in Nm
Front engine to chassis retainer	80 Nm
Transmission to chassis retainer (M12x250 + M12x230)	50 Nm
Right fixing plate - transmission retainer	25 Nm
Plate clamp - Blow-by retainer	10 Nm
Coil plate retainer	10 Nm
Electronic control unit retainer	10 Nm
Bushings to electronic control unit retainer - M6x35 (1)	10 Nm (7.38 lbf ft) - Loct 243
Tank support rubber rings to chassis retainer (2)	Manual - Loct 243
Filter casing fixing bolts	10 Nm
Left and right footrest plate to chassis upper retainer M8x30 (2 +2)	20 Nm (14.75 lbf ft)
Left and right footrest plate to chassis lower retainer M8x75 (2 +2)	20 Nm (14.75 lbf ft)
Brake switch on plate retainer	Manual
Chrome-plated ring to plate retainer M5x10 (6)	6 Nm (4.42 lbf ft)
Retainer for cable guide on right footrest plate	6 Nm
Support retainer for M6 top boxes with countersunk head (6)	9.6 Nm (7.08 lbf ft)
Support retainer for M6 top boxes (4)	9.6 Nm (7.08 lbf ft)
Screws retainer behind the M6 bead protection (4)	9.6 Nm (7.08 lbf ft)
Screws retainer for M6 chassis supports (4)	23 Nm (16.96 lbf ft)
Cross-member retainer for M6 top boxes (2)	9.6 Nm (7.08 lbf ft)

FOOTRESTS AND LEVERS

Name	Torque in Nm
Footrest rubber retainer	10 Nm

Name	Torque in Nm
Rider footrest sliding pin - M8	25 Nm
Passenger footrest support to lateral plates retainer	38 Nm
Rider heelrest to plates retainer	6 Nm
Passenger heelrest retainer	3 Nm
Rod retainer (nut)	10 Nm
Gear shift lever / brake pin retainer	10 Nm
Gear shift lever / pre-selector retainer	10 Nm
Gear shift lever pin - brake retainer M8 (1+1)	15 Nm (11.06 lbf ft) - Loct 243

SIDE STAND

Name	Torque in Nm
Stand plate to engine upper retainer	50 Nm
Stand plate to engine lower retainer	25 Nm
Side stand retainer pin	10 Nm
Switch fixing screw - M6x20 (1)	10 Nm (7.38 lbf ft) - Loct 243
Lock nut	30 Nm
Stand cable guide to engine retainer M8 (1)	25 Nm (18.44 lbf ft)
Side lever arm retainer - M6x16 (2)	10 Nm (7.38 lbf ft) - Loct 243

SWINGARM

Name	Torque in Nm
Swingarm on bushing clamp retainer	10 Nm
Swingarm on bevel gear pair retainer	50 Nm
Reaction rod to bevel gear pair retainer	50 Nm
Reaction rod to chassis retainer	50 Nm
Swingarm bolt to swingarm retainer	60 Nm
Preloading bushing to swingarm bolt retainer	10 Nm

FRONT SUSPENSION

Name	Torque in Nm
Tube lock plate to steering base retainer	6 Nm
Fork stem on upper plate retainer - M8x30 (2)	20 Nm (14.75 lbf ft)
Fork stem on lower plate retainer - M8x30 (4)	20 Nm (14.75 lbf ft)
Headstock ring nut	40 Nm
Headstock counter ring nut	manual + 90 degrees
Upper yoke fixing cap	100 Nm
Fork hub closing - M6x30 (2+2)	10 Nm (7.38 lbf ft)

REAR SUSPENSION

Name	Torque in Nm
Shock absorber to chassis retainer - 8.8	50 Nm
Double connecting rod/shock absorber retainer - 10.9	40 Nm
Single connecting rod/double connecting rod retainer - 10.9	50 Nm
Single connecting rod to chassis retainer - 8.8	50 Nm
Double connecting rod/swingarm retainer - 10.9	50 Nm

AIR FILTER CASING - BLOW-BY

Name	Torque in Nm
Blow-by expansion tank spacer to engine retainer	10 Nm
Filter housing to chassis retainer	10 Nm

EXHAUST

Name	Torque in Nm
Exhaust pipe to engine retainer	25 Nm
Silencer to chassis connecting pipe retainer	25 Nm
Muffler to chassis retainer - M8x45 (1)	25 Nm (18.44 lbf ft)
Heat guard retainer - M6 (3)	10 Nm (7.38 lbf ft)
Lambda probe retainer	38 Nm
Clamps retainer - M8 (3)	20 Nm (14.75 lbf ft)

FRONT WHEEL

Name	Torque in Nm
Wheel pin nut	80 Nm

REAR WHEEL

Name	Torque in Nm
Disc retainer	25 Nm
Rear wheel retainer 10.9	110 Nm

FRONT BRAKING SYSTEM

Name	Torque in Nm
Front brake right and left calliper retainer	50 Nm

REAR BRAKING SYSTEM

Name	Torque in Nm
Rear brake calliper retainer	50 Nm
Rear brake fluid reservoir retainer	3 Nm
Rear brake fluid reservoir support to plate retainer	10 Nm
Rear brake rod lock nut	manual
Brake pump retainer - M6x20 (2)	10 Nm (7.38 lbf ft) - Loctite 243

HANDLEBAR AND CONTROLS

Name	Torque in Nm
Retainer for handlebar lower U-bolts on steering upper plate	50 Nm
Retainer for handlebar upper U-bolts	25 Nm
Anti-vibration counterweight fastener	10 Nm
Brake pump and clutch U-bolts retainer	10 Nm
Right and left light switch retainer	1.5 Nm
Clutch control cylinder to gear retainer	10 Nm
Rear-view mirror	Manual

ELECTRICAL SYSTEM

Name	Torque in Nm
Coil retainer	2 Nm
Horn retainer	15 Nm
Odometer sensor on bevel gear pair retainer	3 Nm

INSTRUMENT PANEL AND LIGHTS

Name	Torque in Nm
Instrument panel retainer	3 Nm
Front arrows retainer - M4 (2)	3 Nm (2.21 lbf ft)
Front headlamp retainer - M6x30 (6)	10 Nm (7.38 lbf ft)
Rear light to license plate retainer - M5x16 (4)	6 Nm (4.42 lbf ft)
Screws retainer for additional lights (2)	10 Nm (7.37 lbf ft)

FUEL PUMP FLANGE

Name	Torque in Nm
Pump support to tank retainer	6 Nm

FUEL TANK

Name	Torque in Nm
Filler to tank retainer	5 Nm
Screws on cap ring nut (aesthetic)	5 Nm
Tank to chassis front retainer	10 Nm

ENGINE COVER

Name	Torque in Nm
Right cover plate retainer - M10x20 (2)	40 Nm (29.5 lbf ft)
Left cover plate retainer - M10 (1)	40 Nm (29.5 lbf ft)

Name	Torque in Nm
Front engine guard retainer - M8x40 (4)	15 Nm (11.06 lbf ft)

FRONT BODYWORK

Name	Torque in Nm
Front mudguard retainer	6 Nm
Air deflector self-tapping retainer (4+4)	Manual
Fairing junction - M5 (2+2)	Manual
Glove-box - self-tapping (4)	Manual
Compartment lock - M6 (2)	Manual
Hinge locking bracket - self-tapping (2)	Manual
Rear tank cover - M5 (2)	4 Nm (2.95 lbf ft)
Rear tank cover - M6 (2)	10 Nm (7.38 lbf ft)
Left - right fairing - M5 (2)	4 Nm (2.95 lbf ft)
Left - right fairing - M6 (2)	10 Nm (7.38 lbf ft)

REAR BODYWORK

Name	Torque in Nm
Left - right fairings retainer - M6 (3+3)	10 Nm (7.38 lbf ft)
Retroreflector to support retainer	4 Nm
Retroreflector support to license plate holder retainer	4 Nm
License plate holder and light reinforcing retainer - M5 (1)	4 Nm (2.95 lbf ft)
Cases support retainer - M6 (2)	10 Nm (7.38 lbf ft)
Cases support retainer - M8 (2+2)	25 Nm (18.44 lbf ft)
Passenger grab handle to chassis retainer - M8 (2)	25 Nm (18.44 lbf ft)
Passenger grab handle to chassis retainer - M6 (4)	10 Nm (7.38 lbf ft)
License plate holder to chassis retainer - M5 (4)	4 Nm (2.95 lbf ft)
Luggage carrier brackets retainer - M8 (2+2)	25 Nm (18.44 lbf ft)

FINISHINGS

Name	Torque in Nm
Ignition lock retainer - shear head screw	- Nm

Overhaul data**Assembly clearances****Cylinder - piston assy.**

Measurement of the cylinder diameter must be done at three heights, turning the dial gauge 90°.

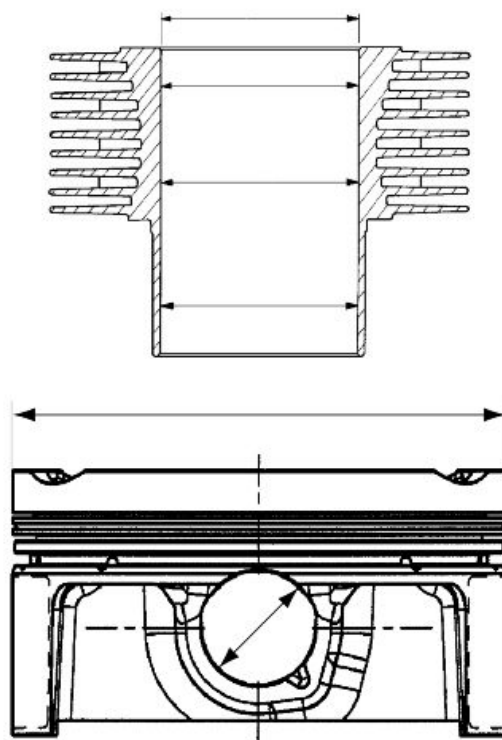
Check that cylinders and pistons are of the same selection types (D, E, F).

Check clearance between cylinders and pistons on the selected diameter; if it exceeds the value specified, it is necessary to replace cylinders and pistons.

The pistons of an engine must be balanced; a weight difference of up to 1.5 g (0.0033 lb) is allowed.

PISTON - CYLINDER SELECTION TYPES

Specification	Desc./Quantity
Piston diameter - selection D	94.935 - 94.945 mm (3.73759 - 3.73798 in)
Cylinder diameter - selection D	95.000 - 95.010 mm (3.74015 - 3.74054 in)
Piston diameter - selection E	94.945 - 94.955 mm (3.73798 - 3.73837 in)
Cylinder diameter - selection E	95.010 - 95.020 mm (3.74054 - 3.74093 in)
Piston diameter - selection F	94.955 - 94.965 mm (3.73837 - 3.73877 in)
Cylinder diameter - selection F	95.020 - 95.030 mm (3.74093 - 3.74133 in)



PIN - PISTON COUPLING

Specification	Desc./Quantity
Pin diameter	21.998 - 21.994 mm (0.86606 - 0.86590 in)
Pin hole diameter on piston	22.016 - 22.011 mm (0.86677 - 0.86657 in)
Clearance between pin and holes on piston	0.013 - 0.022 mm (0.00051 - 0.00087 in)

Piston rings

On each piston there are:

- 1 top piston ring;
- 1 middle piston ring;
- 1 oil scraper piston ring.

Turn the rings so that the coupling ends are 120 degrees from each other.

CLEARANCE BETWEEN PISTON RINGS AND SEATS ON PISTON

Specification	Desc./Quantity
Top ring	0.030 - 0.065 mm (0.00118 - 0.00256 in)
Middle ring	0.020 - 0.055 mm (0.00079 - 0.00216 in)
Oil scraper ring	0.010 - 0.045 mm (0.00039 - 0.00177 in)

Gap between the end of the piston rings inserted in the cylinder:

- Top and middle piston ring: 0.40 - 0.65 mm (0.00158 - 0.00255 in)
- Oil scraper piston ring: 0.30 - 0.60 mm (0.00118 - 0.00236 in).

Crankcase - crankshaft - connecting rod

CRANKSHAFT SEAT (TIMING SYSTEM SIDE)

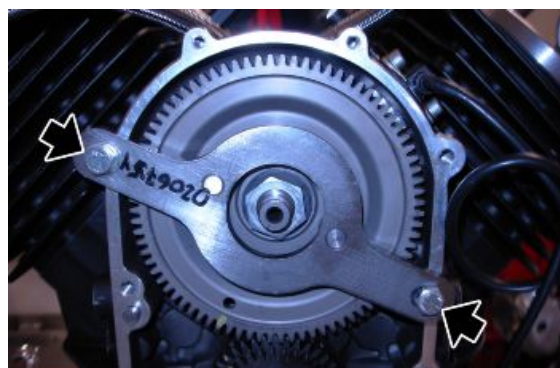
Specification	Desc./Quantity
Diameter of crankshaft main journal, timing system side	37.975 - 37.959 mm (1.49507 - 1.49444 in)
Inside diameter of crankshaft bushing, timing system side	38.016 - 38.0 mm (1.49669 - 1.49606 in)
Clearance between bushing and main journal (timing system side)	0.025 - 0.057 mm (0.00098 - 0.00224 in)

CRANKSHAFT SEAT (CLUTCH SIDE)

Specification	Desc./Quantity
Diameter of crankshaft main journal, clutch side	53.97 - 53.961 mm (2.12480 - 2.12444 in)
Inside diameter of crankshaft bushing on clutch-side flange	54.019 - 54.0 mm (2.12673 - 2.12598 in)
Clearance between bushing and main journal (clutch side)	0.030 - 0.058 mm (0.00118 - 0.00228 in)

Slot packing system

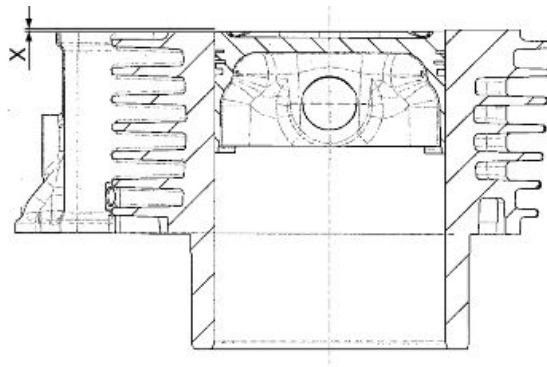
- Fit both pistons on the connecting rods.
- Working from both sides, fit the gasket between the crankcase and the cylinder on the crankcase.
- Fit both cylinders.
- Take the left cylinder piston to TDC and lock crankshaft rotation.



Specific tooling

020675Y Service shaft gear lock

- Thoroughly clean the upper surface of both cylinders.
- Place the tool on the left cylinder to determine the "squish" (X).
- Fasten the tool with the nuts of the stud bolts.



Specific tooling

020676Y Comparator support for piston position checking



- Reset the micrometer on the cylinder rim.
- Move the tool so that the micrometer feeler reaches the top point of the piston crown.
- Take note of the measurement and, according to the values found, consult the chart at the bottom of the page to decide the thickness of the gasket to be fitted between cylinder and head.
- Unlock crankshaft rotation.
- Rotate the crankshaft by 90° until the right cylinder piston reaches the TDC.
- Lock crankshaft rotation.
- Place the tool on the right cylinder stud bolts to determine the "squish" (X).

Specific tooling

020676Y Comparator support for piston position checking

- Repeat the same operations to determine the thickness of the left cylinder gasket between cylinder and head also for the right cylinder.

CYLINDER GASKET THICKNESS - HEAD

Specification	Desc./Quantity
Value (X) -0.56 / -0.37 mm (-0.022 / -0.0146 in)	gasket thickness: 0.65 mm (0.0256 in)
Value (X) -0.37 / -0.19 mm (-0.0146 / -0.0075 in)	gasket thickness: 0.85 mm (0.0335 in)
Value (X) -0.19 / 0 mm (-0.0075 / 0 in)	gasket thickness: 1.05 mm (0.0413 in)

Recommended products chart

RECOMMENDED PRODUCTS

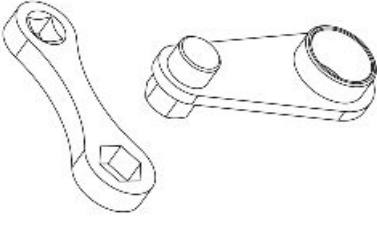
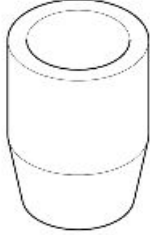
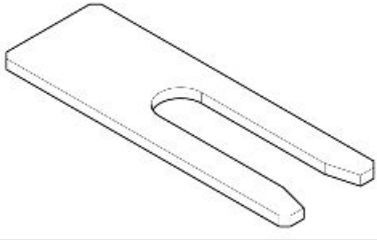


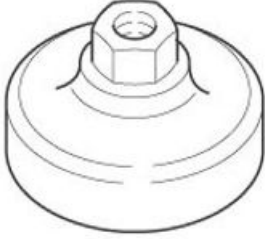
Product	Description	Specifications
AGIP RACING 4T 10W-60	Engine oil	SAE 10W - 60. As an alternative to the suggested oils, one may use brand name oils with performances matching or higher than CCMC G-<metricconverter productid="4 A" w:st="on" />4 A</metricconverter />.P.I. SG specifications.
AGIP GEAR SAE 80 W 90	Transmission oil	-
AGIP GEAR MG/S SAE 85 W 90	Gearbox oil	-
AGIP ARNICA SA 32	Fork oil	SAE 0W - ISO VG 32
AGIP GREASE SM2	Lithium grease with molybdenum for bearings and other points needing lubrication	NLGI 2
Neutral grease or petroleum jelly.	BATTERY POLES	
AGIP BRAKE 4 / BRAKE 5.1	Brake fluid	As an alternative for recommended fluids, use top branded fluids that meet or exceed the requirements of SAE J1703, NHTSA 116 DOT 4, ISO 4925 synthetic fluid specifications.
AGIP BRAKE 4 / BRAKE 5.1	Clutch fluid	As an alternative for recommended fluids use top-branded fluids that meet or exceed the requirements of SAE J1703, NHTSA 116 DOT 4, ISO 4925 Synthetic fluid specifications.

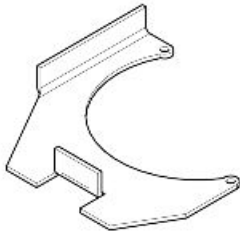

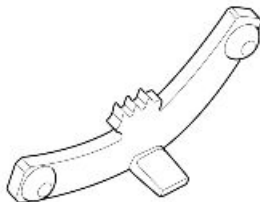
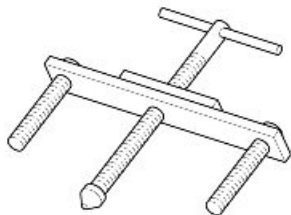

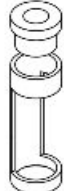
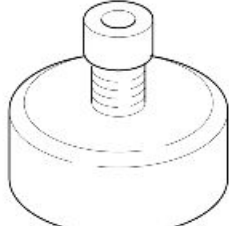
INDEX OF TOPICS

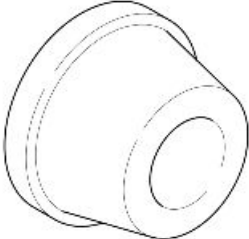
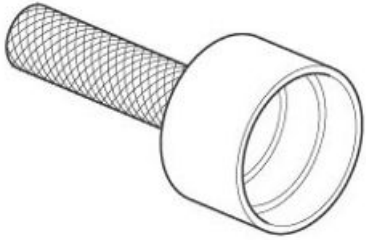
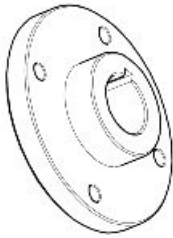
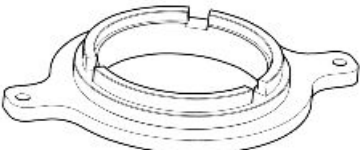
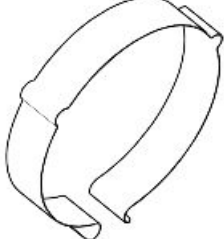
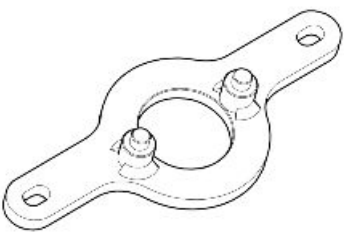
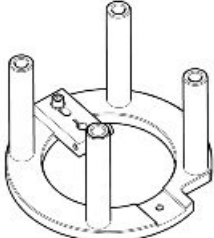
SSPECIAL TOOLS

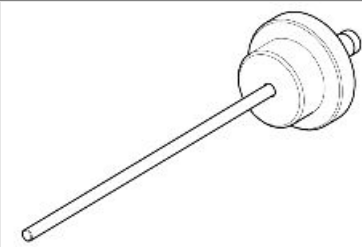
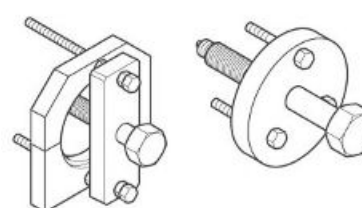
S-TOOLS

MOTORE

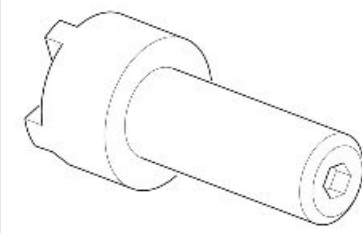
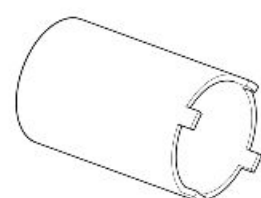
Stores code	Description	
020677Y	Alternator belt tensioner, Belt tensioning lever	
05.91.17.30	Front cover insertion cone	
020716Y	Connecting rod locking	
020470Y	Pin snap ring fitting tool	
05.92.72.30	Timing system cover sealing ring punch	
01.92.91.00	Wrench for removing the cover on sump and filter	

Stores code	Description	
05.90.25.30	Gearbox support	
19.92.96.00	Graduated dial to control ignition timing	
12.91.18.01	Tool to lock the flywheel and the starting ring gear	
12.91.36.00	Tool to remove the flywheel-side flange	
AP8140179	Support for valve fitting/removal	
AP9100838	Tool for valve pressure plate	
14.92.71.00	Tool to fit the sealing ring on the flywheel-side flange	

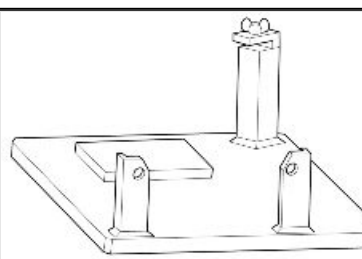
Stores code	Description	
12.91.20.00	Tool to fit the flywheel-side flange together with seal ring on the crankshaft	
19.92.71.00	Tool to fit the seal ring on the flywheel-side flange	
020673Y	Graduated dial hub	
020672Y	Clutch spring centre and pusher	
020674Y	Piston ring clamp	
020675Y	Service shaft gear lock	
020676Y	Comparator support for piston position checking	

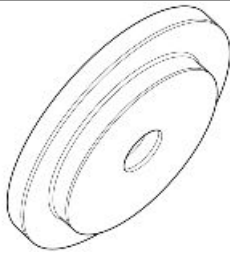
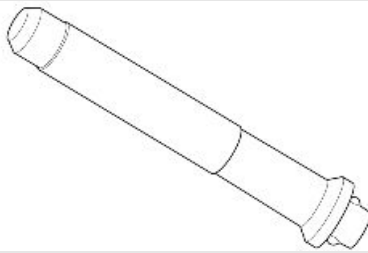
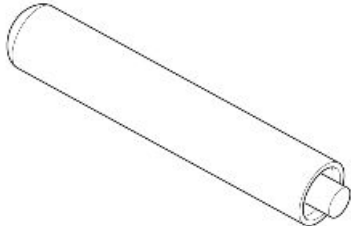
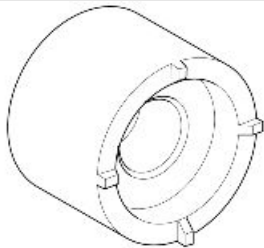
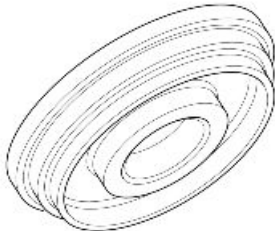
Stores code	Description	
020678Y	Tool for clutch rod checking	
05.91.25.30	Gearbox opening	

CHASSIS

Stores code	Description	
14.91.26.03	Hook spanner for fixing ring nut of the clutch shaft internal body	
AP8140190	Tool for steering tightening	

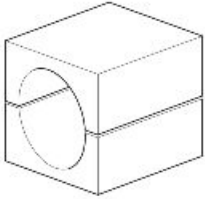
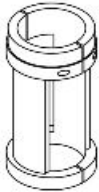
BEVEL GEAR SET

Stores code	Description	
05.90.27.30	Gearbox support	

Stores code	Description	
05.90.27.31	Gearbox oil seal buffer	
05.90.27.32	Buffer handgrip	
05.90.27.33	Ball joint sealing buffer	
05.90.27.34	Wrench for pinion ring nut	
05.90.27.35	Pinion oil seal buffer	

FRONT FORK

Stores code	Description	
AP8140146	Weight	

Stores code	Description	
AP8140149	Protection for fitting operations	
9100903	Marzocchi fork oil seal; ø 45 mm (1.77 in)	

INDEX OF TOPICS

MAINTENANCE

MAIN

Maintenance chart

NOTE

CARRY OUT MAINTENANCE OPERATIONS AT HALF THE INTERVALS SPECIFIED IF THE VEHICLE IS USED IN PARTICULAR RAINY OR DUSTY CONDITIONS, OFF ROAD OR FOR TRACK USE.

ROUTINE MAINTENANCE TABLE

I: INSPECT AND CLEAN, ADJUST, LUBRICATE OR REPLACE IF NECESSARY

C: CLEAN, R: REPLACE, A: ADJUST, L: LUBRICATE

* Check and clean, adjust or replace if necessary before every ride.

** Replace every 2 years or 20000 km (12427 miles).

*** Replace every 4 years

**** Check at every start-up.

***** It is recommended to lubricate stands and footrests periodically with spray grease after use in particularly hard conditions (dirty with salts, dust, etc.) or after long inactivity periods.

km x 1,000	1.5	10	20	30	40	50	60	70	80
Exhaust pipe flange fixing bolts	I		I		I		I		I
Spark plugs		R	R	R	R	R	R	R	R
Idle mixture (CO)		I	I	I	I	I	I	I	I
Throttle body			C		C		C		C
Stands*****		I	I	I	I	I	I	I	I
Transmission cables and controls	I	I	I	I	I	I	I	I	I
Generator belt			A		A	R	A		A
Steering bearings and steering clearance	I	I	I	I	I	I	I	I	I
Wheel bearings		I	I	I	I	I	I	I	I
Brake discs	I	I	I	I	I	I	I	I	I
Air filter		I	R	I	R	I	R	I	R
Engine oil filter	R	R	R	R	R	R	R	R	R
Fork	I		I		I		I		I
Vehicle general operation	I	I	I	I	I	I	I	I	I
Braking systems	I	I	I	I	I	I	I	I	I
Light circuit	I	I	I	I	I	I	I	I	I
Safety switches	I		I		I		I		I
Brake fluid **	I	I	R	I	R	I	R	I	R
Clutch fluid **	I	I	I	I	I	I	I	I	I
Gearbox oil	R	R	R	R	R	R	R	R	R
Engine oil	R	R	R	R	R	R	R	R	R
Fork oil / oil seals		R		R		R		R	
Final drive oil	R	R	R	R	R	R	R	R	R
Tyres - pressure / wear*	I	I	I	I	I	I	I	I	I
Engine revs at idle speed	A	A	A	A	A	A	A	A	A
Valve clearance adjustment	A	A	A	A	A	A	A	A	A
Wheels	I	I	I	I	I	I	I	I	I
Bolts and nuts tightening	I	I	I	I	I	I	I	I	I
Battery terminals - tightening	I		I		I		I		I
Tightening wheel nipples*	I	I	I	I	I	I	I	I	I
Cylinder synchronisation	I	I	I	I	I	I	I	I	I
Footrest joint *****		I	I	I	I	I	I	I	I
Suspensions and setting	I		I		I		I		I
Engine oil pressure warning light ****									
Empty oil drain pipe from the filter housing		C	C	C	C	C	C	C	C
Fuel pipes ***		I	I	I	I	I	I	I	I
Brake pipes ***		I	I	I	I	I	I	I	I
Clutch wear		I	I	I	I	I	I	I	I
Brake pad wear *	I	I	I	I	I	I	I	I	I

Transmission fluid

Check

- Keep the vehicle upright with both wheels on the ground.
- Unscrew and remove the cap/dipstick (1).
- The level is correct if the oil is close to the hole of the cap/dipstick (1).
- If the oil is lower than specified, top-up until it reaches the cap/dipstick hole (1).

CAUTION

DO NOT ADD ADDITIVES OR ANY OTHER SUBSTANCE TO THE FLUID. WHEN USING A FUNNEL OR ANY OTHER ELEMENT, MAKE SURE IT IS PERFECTLY CLEAN.



Replacement

CAUTION

THE UNIT MUST BE HOT WHEN THE OIL IS CHANGED AS UNDER SUCH CONDITIONS OIL IS FLUID AND THEREFORE EASY TO DRAIN.

NOTE

RIDE SOME km (miles) TO WARM UP ENGINE OIL

- Place a container with + 400 cm³ (25 cu in) capacity under the drainage plug (3).
- Unscrew and remove the drainage plug (3).
- Unscrew and remove the breather cap (2).
- Drain the oil into the container; allow several minutes for oil to drain out completely.
- Check and if necessary, replace the sealing washer of drainage plug (3).
- Remove any metal scrap attached to the drainage plug (3) magnet.
- Screw and tighten the drainage plug (3).
- Pour new oil through the fill opening (1) until it reaches the cap/dipstick hole (1).

CAUTION

DO NOT ADD ADDITIVES OR ANY OTHER SUBSTANCE TO THE FLUID. WHEN USING A FUNNEL OR ANY OTHER ELEMENT, MAKE SURE IT IS PERFECTLY CLEAN.

- Screw and tighten the caps (1 - 2).



Engine oil

Check

CAUTION

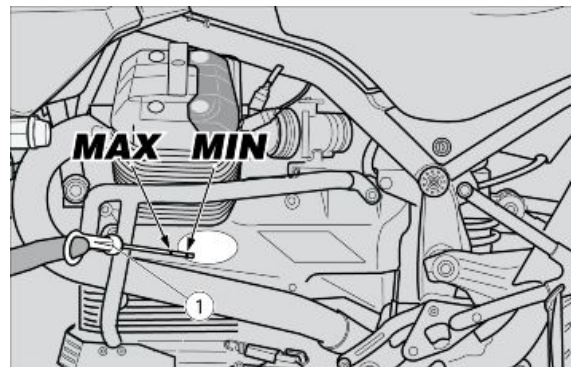
ENGINE MUST BE WARM TO CHECK ENGINE OIL LEVEL

NOTE

DO NOT LET THE ENGINE IDLE WITH THE VEHICLE AT STANDSTILL TO WARM UP THE ENGINE AND REACH THE OPERATING TEMPERATURE OF ENGINE OIL. OIL IS BEST CHECKED AFTER RUNNING FOR ABOUT 15 KM (10 miles).

- Stop the engine.
- Keep the vehicle upright with both wheels on the ground.

- Pull the filler plug / oil level dipstick (1) straight out.
- Wipe the oil level dipstick (1) clean and reinsert it.
- Pull it out again and check the oil level.
- The oil level is correct when it is close to the "MAX" mark. Otherwise, top-up with engine oil.

**CAUTION**

DO NOT ADD ADDITIVES OR OTHER SUBSTANCES TO THE OIL. WHEN USING A FUNNEL OR ANY OTHER ELEMENT, MAKE SURE IT IS PERFECTLY CLEAN.

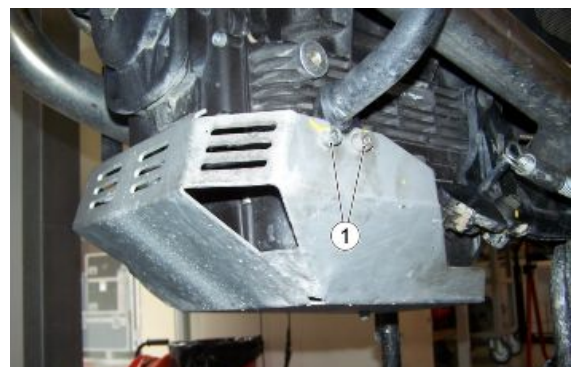
Replacement

NOTE

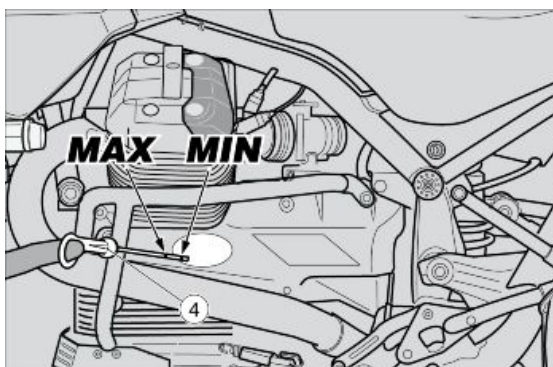
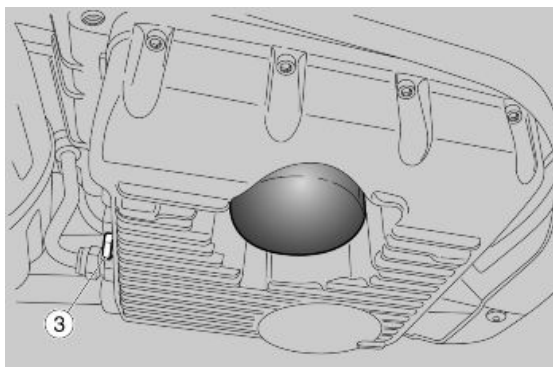
HOT OIL IS LESS VISCOUS AND WILL DRAIN OUT MORE EASILY AND COMPLETELY.

It is necessary to remove the metal oil sump guard in order to change the engine oil and replace the oil filter:

- Operating from both sides, unscrew and remove both screws (1).
- Remove the oil sump guard.



- Place a container with +4,000 cm³ (244 cu in) capacity under the drainage plug (3).
- Unscrew and remove the drainage plug (3).
- Pull out the oil filler plug / engine oil level dipstick (4).
- Drain the oil into the container; allow several minutes for oil to drain out completely.
- Insert the oil filler plug / engine oil level dipstick (4).
- Check and if necessary, replace the drainage plug (3) sealing washers.
- Remove any metal deposits attached to the drainage plug (3) magnet.
- Screw and tighten the drainage plug (3).



**DO NOT DISPOSE OF OIL INTO THE ENVIRONMENT.
DISPOSE OF ENGINE OIL IN A SEALED CONTAINER AND
TAKE IT TO YOUR SUPPLIER OR TO THE NEAREST USED
OIL COLLECTION CENTRE.**

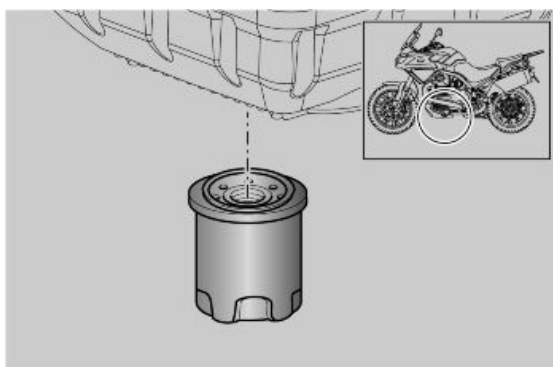
Engine oil filter

**Replace the engine oil filter each time you
change the engine oil.**

- Drain the engine oil completely.
- Unscrew and remove the engine oil filter from its seat.

NOTE

NEVER REUSE AN OLD FILTER.



- Spread a thin layer of oil on the sealing ring of the new engine oil filter.
- Fit and screw the new oil filter in its seat.

See also

[Replacement](#)

Gearbox Oil

Inspection

CHECKING AND TOPPING UP

CAUTION

ENGINE MUST BE WARM TO CHECK GEARBOX OIL LEVEL.

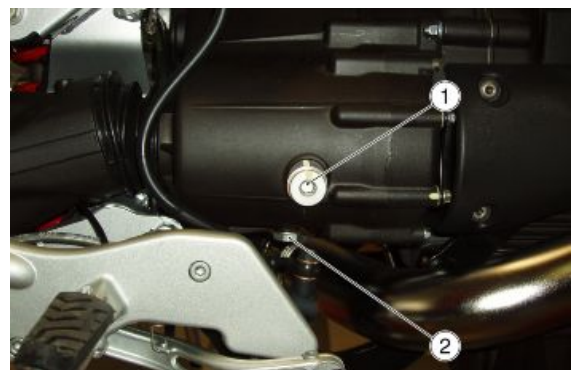
NOTE

DO NOT LET THE ENGINE IDLE WITH THE VEHICLE AT STANDSTILL TO WARM UP THE ENGINE AND REACH THE OPERATING TEMPERATURE OF ENGINE OIL. OIL IS BEST CHECKED AFTER RUNNING FOR ABOUT 15 KM (10 miles).

- Shut off the engine.
- Keep the vehicle upright with both wheels on the ground.
- Unscrew and remove the cap/dipstick (1) placed on the gearbox right side.
- The level is correct if the oil is on the rim of the hole of the cap/dipstick (1).

If necessary:

- Top-up with oil until it reaches the dipstick opening (1).



CAUTION

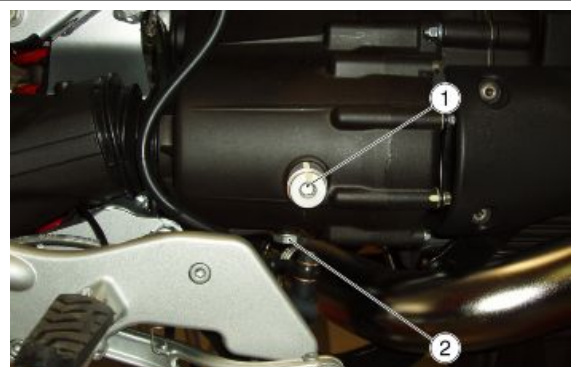
DO NOT ADD ADDITIVES OR ANY OTHER SUBSTANCE TO THE FLUID. WHEN USING A FUNNEL OR ANY OTHER ELEMENT, MAKE SURE IT IS PERFECTLY CLEAN.

Replacement

NOTE

HOT OIL IS MORE FLUID AND WILL DRAIN OUT MORE EASILY AND COMPLETELY.

- Place a container with suitable capacity under the drainage plug (2).
- Unscrew and remove the drainage plug (2).
- Unscrew and remove the filler cap (1).
- Drain the oil into the container; allow several minutes for oil to drain out completely.
- Check and replace, if necessary, the sealing washers of drainage plug (2).
- Remove any metal scrap attached to the drainage plug (2) magnet.
- Screw and tighten the drainage plug (2).



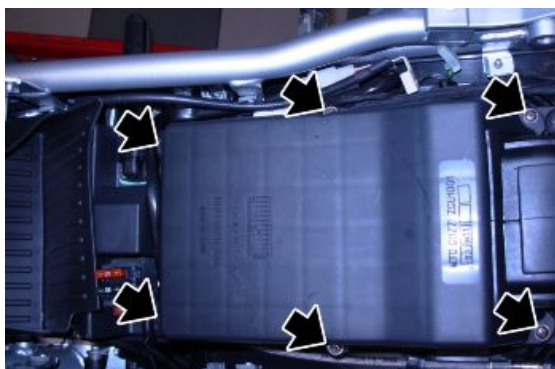
- Pour in new oil until it reaches the dipstick opening (1).
- Tighten the filler cap (1).

CAUTION

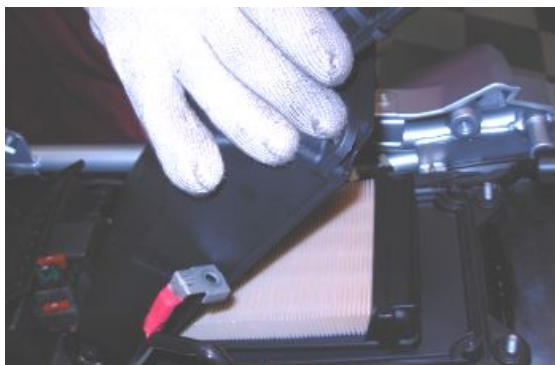
DO NOT ADD ADDITIVES OR ANY OTHER SUBSTANCE TO THE FLUID. WHEN USING A FUNNEL OR ANY OTHER ELEMENT, MAKE SURE IT IS PERFECTLY CLEAN.

Air filter

- Undo and remove the six screws.



- Lift the filter housing cover.



- Remove the air filter.
- Cover the inlet duct with a clean cloth so that no foreign bodies get into the inlet ducts.



**DO NOT START THE ENGINE WITHOUT THE AIR FILTER.
TO CLEAN THE FILTERING ELEMENT, USE A PRESSURE AIR JET FROM THE INSIDE TO THE OUTSIDE.**

Checking the valve clearance

If the timing system is very noisy, check the clearance between the valves and the rocking levers.

NOTE

ADJUST WITH COLD ENGINE, WITH PISTON AT TOP DEAD CENTRE (TDC) IN COMPRESSION STROKE (VALVES CLOSED).

- Disconnect both spark plug tubes.



- Unscrew and remove the four head cover fixing screws and collect the sealing O-rings.
- Remove the head cover together with the gasket.



- Loosen the nut (1).
- Use a screwdriver to act on set screw (2) until the following clearances are obtained:

Inlet valve: 0.10 mm (0.0039 in)

Outlet valve: 0.15 mm (0.0059 in)

- The measurement must be taken using a special thickness gauge.



CAUTION

IF CLEARANCE IS LARGER THAN RECOMMENDED, THE TAPPETS WILL BE NOISY. OTHERWISE, THE VALVES DO NOT CLOSE CORRECTLY, WHICH CAN LEAD TO PROBLEMS SUCH AS:

- PRESSURE DROP;
- ENGINE OVERHEAT;
- VALVE BURN OUT, ETC.

Braking system

Level check

Brake fluid check

- Rest the vehicle on its stand.
- For the front brake, turn the handlebar fully to the right.

- For the rear brake, keep the vehicle upright so that the fluid in the reservoir is at the same level with the plug.
- Make sure that the fluid level in the reservoir is above the "MIN" reference mark:

MIN = minimum level

MAX = maximum level

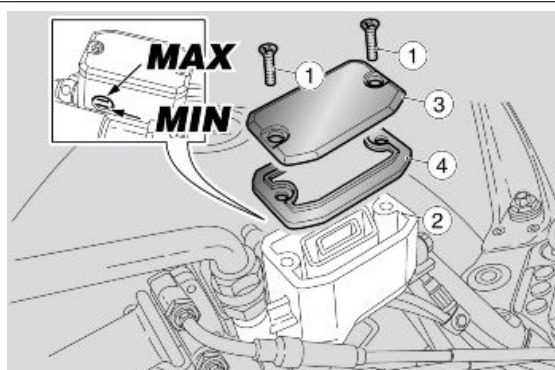
If the fluid does not reach at least the "**MIN**" reference mark:

- Check brake pads and disc for wear.
- If the pads and/or the disc do not need replacing, top-up the fluid.

Top-up

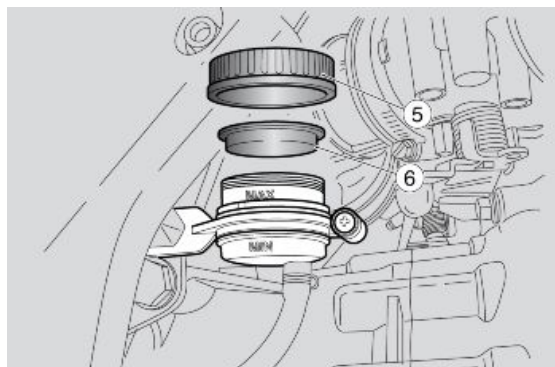
Front brake:

- Unscrew the two screws (1) of the brake fluid reservoir (2) using a Phillips screwdriver.
- Lift and remove the cover (3) and screws (1) as well.
- Remove the gasket (4).



Rear brake:

- Unscrew and remove the cap (5).
- Remove the gasket (6).
- Top-up the reservoir with brake fluid to the correct level, which is between the two "MIN" and "MAX" reference marks.



RISK OF BRAKE FLUID SPILLING. DO NOT OPERATE THE BRAKE LEVER IF THE BRAKE FLUID RESERVOIR CAP IS LOOSE OR HAS BEEN REMOVED.

CAUTION



AVOID PROLONGED AIR EXPOSURE OF THE BRAKE FLUID. BRAKE FLUID IS HYGROSCOPIC AND ABSORBS MOISTURE WHEN IN CONTACT WITH AIR. LEAVE THE BRAKE FLUID RESERVOIR OPEN ONLY FOR THE TIME NEEDED TO COMPLETE THE TOPPING-UP PROCEDURE.



TO AVOID SPILLING FLUID WHILE TOPPING-UP, KEEP THE TANK PARALLEL TO THE RESERVOIR EDGE (IN HORIZONTAL POSITION).

DO NOT ADD ADDITIVES OR OTHER SUBSTANCES TO THE FLUID.

**WHEN USING A FUNNEL OR ANY OTHER ELEMENT,
MAKE SURE IT IS PERFECTLY CLEAN.**



**DO NOT EXCEED THE "MAX" LEVEL MARK WHEN TOP-
PING UP.**

**TOP-UP TO "MAX" LEVEL MARK ONLY WHEN BRAKE
PADS ARE NEW. WHEN TOPPING UP DO NOT EXCEED
THE "MAX" LEVEL MARK WHEN BRAKE PADS ARE
WORN AS YOU RISK SPILLING FLUID WHEN CHANGING
THE BRAKE PADS.**

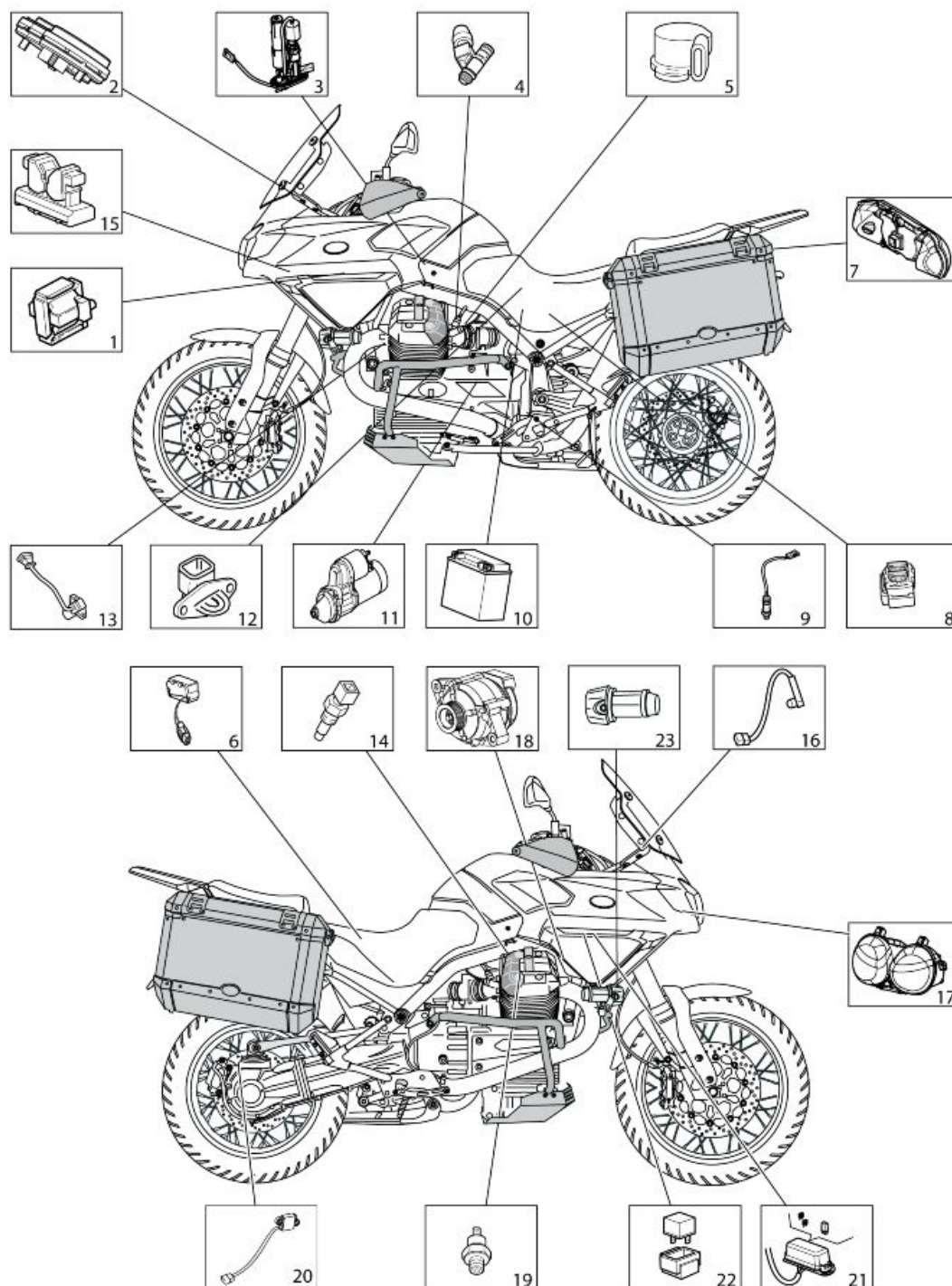
**CHECK BRAKING EFFICIENCY. IN CASE OF EXCESSIVE
TRAVEL OF THE BRAKE LEVER OR POOR PERFORM-
ANCE OF THE BRAKING SYSTEM, TAKE YOUR VEHICLE
TO AN Official Moto Guzzi Dealer, AS IT MAY BE NECES-
SARY TO PURGE THE AIR IN THE SYSTEM.**

INDEX OF TOPICS

ELECTRICAL SYSTEM

ELE SYS

Components arrangement



key:

- 1 Coil
- 2 Instrument panel
- 3 Fuel pump
- 4 Injector

- 5 Throttle valve potentiometer
- 6 Fall sensor
- 7 Rear light
- 8 Main fuses
- 9 Lambda probe
- 10 Battery
- 11 Starter motor
- 12 Intake air temperature sensor
- 13 Engine revolution sensor
- 14 Head temperature sensor
- 15 Engine control unit
- 16 Instrument panel air temperature sensor
- 17 Front headlamp
- 18 Alternator
- 19 Oil pressure sensor
- 20 Speed sensor
- 21 Auxiliary fuses
- 22 Relay
- 23 Additional headlamps

Electrical system installation

INTRODUCTION

Scope and applicability

The purpose of this document is to define cables laying, their fastening on the motorcycle and possible criticalities, special checks on connections and layouts, all this with the aim of obtaining vehicle reliability.

Special checks for the correct connection and laying of cables

The indicated connectors are considered critical in comparison with the others because the vehicle will stop if they are accidentally disconnected. Undoubtedly the connection of the rest of connectors is also important and essential for the correct operation of the vehicle.

Vehicle sections



The wiring distribution is subdivided in three essential sections, as indicated in the figure.

- 1. Front section
- 2. Central section
- 3. Rear section

Front side

TABLE A

1 - Check that the ground terminals are placed on the coils

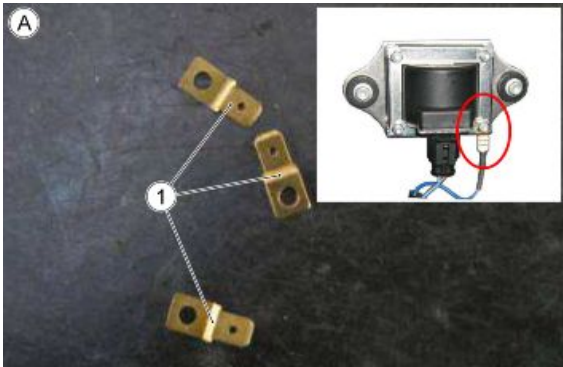


TABLE B

- 2 - Clamps.
- 3 - Auxiliary fuses.
- 4 - Instrument panel cable harness.
- 5 - Relays.
- 6 - Right coil.

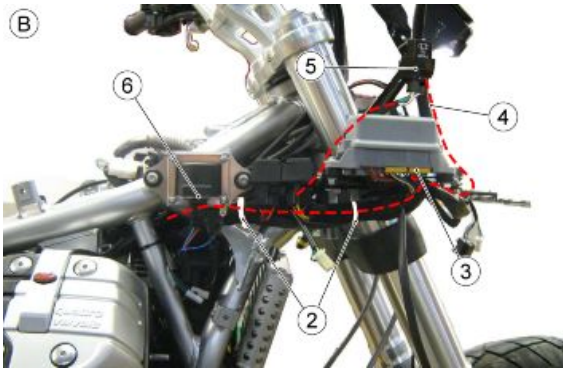


TABLE C

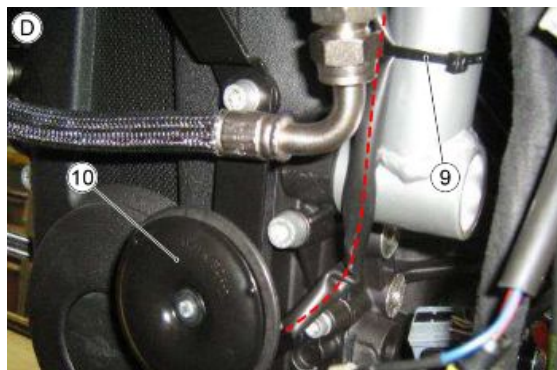
- 7 - Marelli control unit.
- 8 - Left coil.



TABLE D

9 - Clamp.

10 - Horn.

**TABLE E**

11 - Clamps.

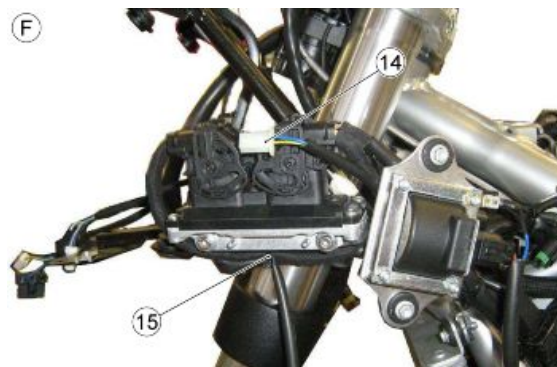
12 - Pick-Up.

13 - Antitheft.

**TABLE F**

14 - Left fog light.

15 - GPS Connector.

**TABLE G**

16 - Rubber clamps.

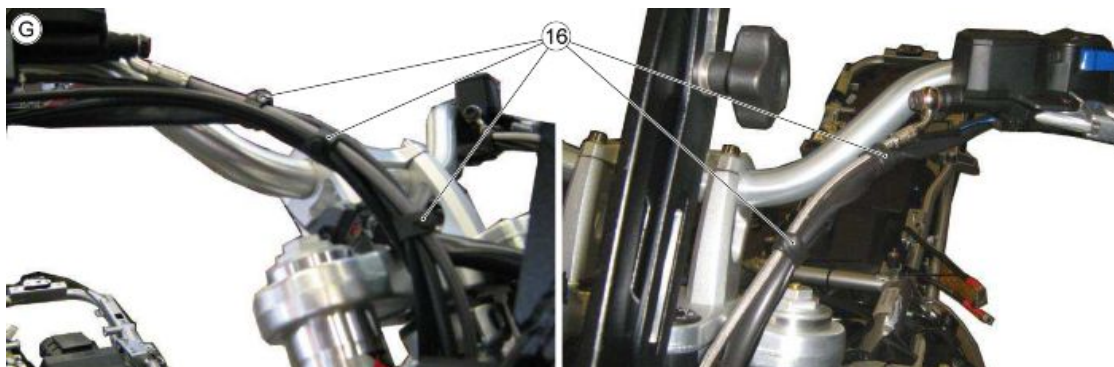


TABLE H

17 - Clamps.

18 - Instrument panel air temperature thermistor.



TABLE I

19 - Clamp not completely pulled.

20 - Left light switch cable harness.

21 - Key switch cable harness.

22 - Clutch switch cable harness.

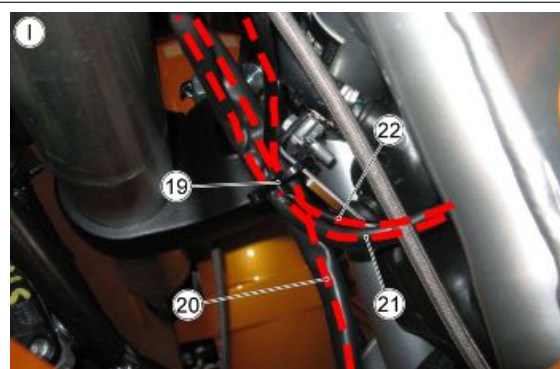
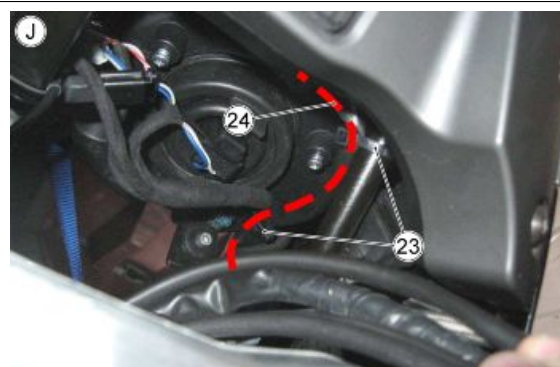


TABLE J

23 - Clamps.

24 - Instrument panel cable harness.

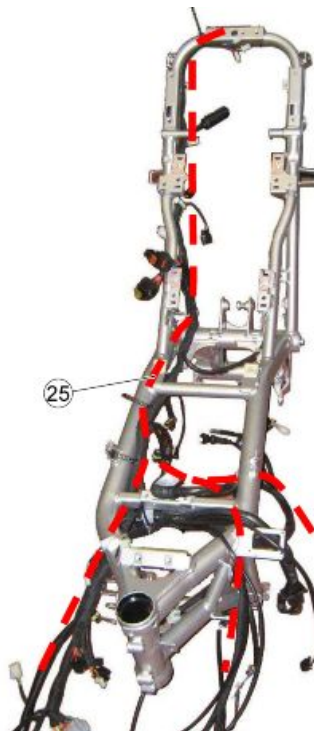


Central part

TABLE K

25 - Main cable harness.

(K)

**TABLE L**

Main cable harness passage with output: left coil, horn, pick up, antitheft, control unit, left turn indicator, GPS connector and compartment lock.

(L)

**TABLE M**

Main cable harness passage with output: right coil, key, right light switch, instrument panel, secondary fuses, relay, lights and right turn indicator.

(M)



TABLE N

26 - Clamp.

27 - Heated hand grips connectors.



TABLE O

28 - Clamps.



TABLE P

29 - Injectors.

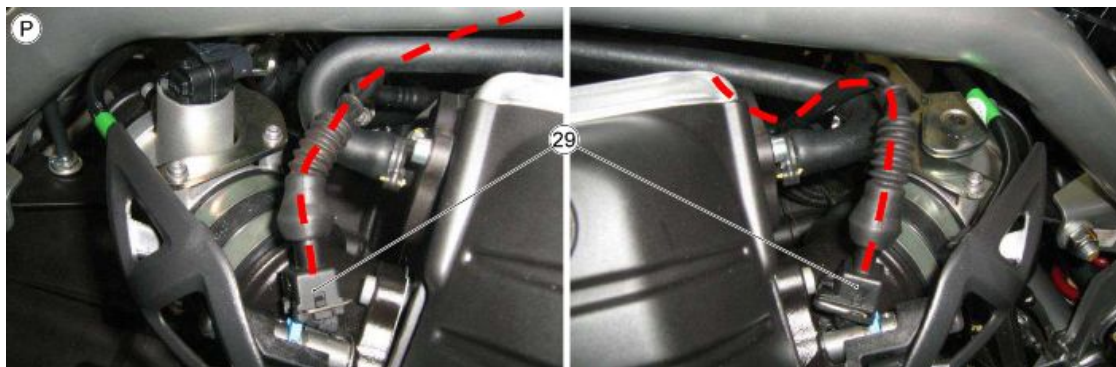


TABLE Q

30 - Clamp.

31 - Fall sensor.

32 - Main cable harness.

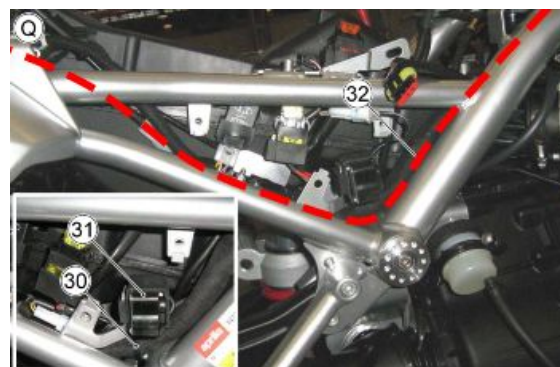
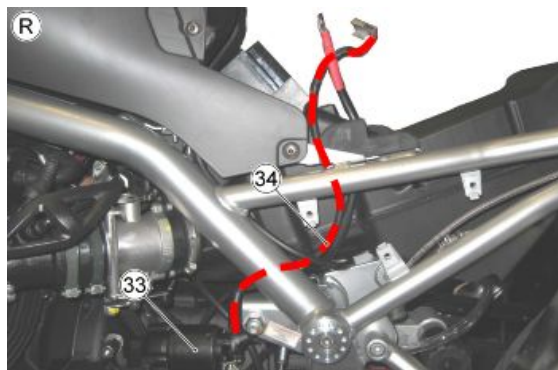


TABLE R

33 - Starter motor.

34 - Positive battery cable.

**Back side****TABLE S**

35 - Adhesive cable guides.

**TABLE T**

36 - Adhesive cable guides.

37 - U-bolt.

**TABLE U**

38 - Clamps.



TABLE V

39 - Negative battery cable.

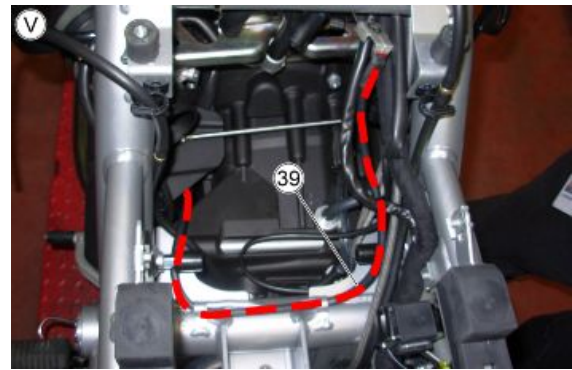
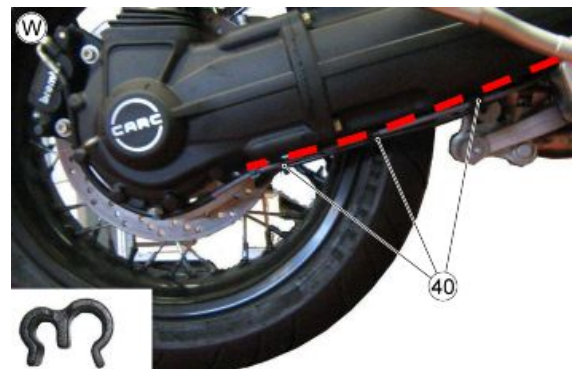
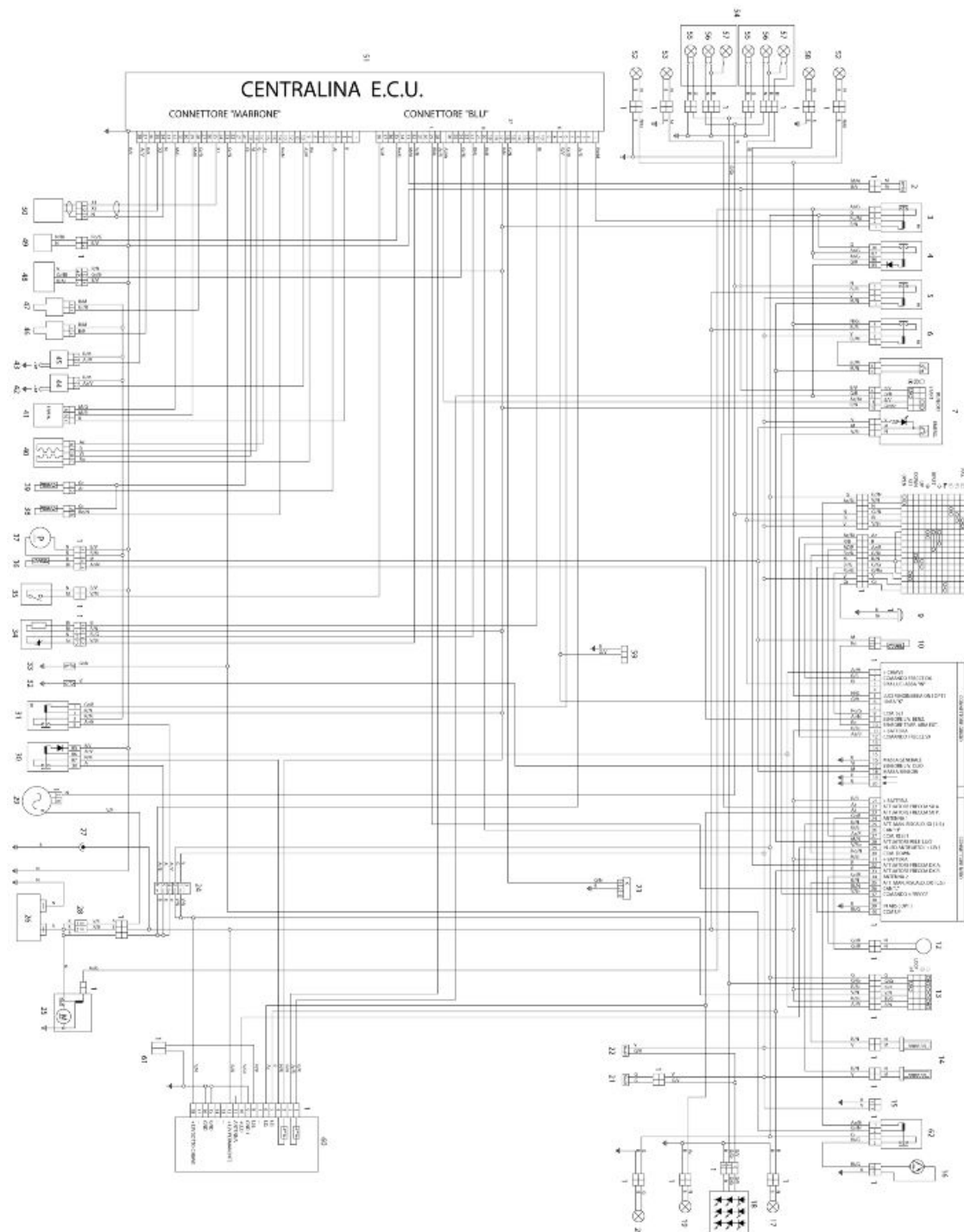


TABLE W

40 - Black cable grommet.



General wiring diagram



Key:

1. Multiple connectors
2. Clutch switch
3. Start-up relay
4. Start-up maintenance relay

5. Light relay
6. Fog lights relay
7. Right light switch
8. Left light switch
9. Horn
10. Instrument panel air temperature thermistor
11. Instrument panel
12. Immobilizer aerial
13. Key switch
14. Heated handgrips
15. GPS coupling
16. Glove-box compartment electric lock
17. Rear right turn indicator
18. Rear light (LED)
19. Left rear turn indicator
20. License plate light
21. Rear stop switch
22. Front stop switch
23. (ECU) Diagnosis connector
24. Auxiliary fuses
25. Starter motor
26. Battery
27. 12V socket
28. Main fuses
29. Alternator
30. Main injection relay
31. Secondary injection relay
32. Oil pressure bulb
33. Gear in neutral switch
34. Lambda Probe
35. Side stand switch
36. Fuel reserve sensor
37. Fuel pump
38. Intake air temperature thermistor
39. Head temperature thermistor
40. Automatic air
41. Throttle sensor
42. Right cylinder spark plug

- 43.Left cylinder spark plug
- 44.Right cylinder coil
- 45.Left cylinder coil
- 46.Right cylinder injector
- 47.Left cylinder injector
- 48.Speed sensor
- 49.Fall sensor
- 50.Flywheel pick up
- 51.ECU
- 52.Fog lights
- 53.Front left turn indicator
- 54.(Double) Front headlight
- 55.Tail light bulb
- 56.Low-beam bulb
- 57.High-beam bulb
- 58.Front right turn indicator
- 59.Instrument panel diagnosis
- 60.Antitheft control unit (optional equipment)
- 61.Under saddle switch
- 62.Glove-box compartment opening relay

Cable colour:

Ar orange

Az sky blue

B blue

Bi white

G yellow

Gr grey

M brown

N black

R red

Ro pink

V green

Vi purple

Checks and inspections

Dashboard

Diagnosis

Changing the CODE

If you know the code, just enter it and then a new code that will be automatically stored in the memory.

If the vehicle is new, the user code is: 00000

Resetting the CODE

This function is used to set a new code when the old one is not available; in this case, at least two of the programmed keys have to be inserted in the ignition lock.

After the first key has been inserted, the second one is requested with the following message:

INSERT KEY II

If the second key is not inserted within 20 seconds, the operation is finished.

After recognising the second key, the new code is required with the message:

ENTER NEW CODE

Once the operation is finished, the instrument panel goes back to the SET-UP menu.

DIAGNOSIS

Access to this menu (diagnosis functions), for the technical service only, after requesting a service code.

It will read: ENTER THE SERVICE CODE This vehicle code is: **10695**

The functions in this menu are:

- Exit
- ECU diagnosis
- Instrument Panel Errors
- Error Clearing
- Reset Service
- Update
- Change Keys
- km / Miles

ECU ERRORS

The instrument panel receives only the current errors from the control unit.

Description Error code

Throttle Valve Error DC V DC ECU 10

Throttle Valve Error DC Gnd ECU 11

Engine Temperature Error DC V DC ECU 14

Engine Temperature Error DC Gnd ECU 15

Air Temperature Error DC V DC ECU 16

Air Temperature Error DC Gnd ECU 17

Low Battery Error ECU 20

Lambda Probe Error ECU 21
Coil 1 Error DC V DC ECU 22
Coil 1 Error DC Gnd ECU 23
Coil 2 Error DC V DC ECU 24
Coil 2 Error DC Gnd ECU 25
Injector 1 Error DC V DC ECU 26
Injector 1 Error DC Gnd ECU 27
Injector 2 Error DC V DC ECU 30
Pump Relay Error ECU 36
Local Loopback Error ECU 37
Start-up Remote Error DC V DC ECU 44
Remote Error Start-up DC Gnd ECU 45
Canister Error DC V DC ECU 46
Canister Error DC Gnd ECU 47
Battery Error Hig ECU 50
Generic ECU Error ECU 51
Signal Panel Error ECU 54
Self-adaptability Value Error ECU 55
Vehicle Speed Error ECU 56
Stepper Error AC ECU 60
Stepper Error DC V DC ECU 61
Stepper Error DC Gnd ECU 62
Not recognised error ECU 00

INSTRUMENT PANEL ERRORS

In this mode a chart is displayed showing potential errors in the immobilizer and its sensors.

This is the error decoding chart:

Description: Immobilizer failure: Key code read but not recognised. Error code: DSB 01

Description: Immobilizer failure: Key code not read (Key not inserted or transponder broken) Error code: DSB 02

Description: Immobilizer failure: Aerial not working (Open or short-circuited). Error code: DSB 03

Description: Immobilizer failure: Internal controller failure. Error code: DSB 04

Description: - Error code: DSB 05

Description: Air temperature sensor failure. Error code: DSB 06

Description: Oil sensor failure. Error code: DSB 07

Description: Oil pressure failure. Error code: DSB 08

The instrument panel keeps all previous errors stored in its **memory**.

DELETE ERRORS

This option deletes instrument panel errors only, a further confirmation is requested.

INSTRUMENT PANEL SOFTWARE UPGRADE

This function is used to program the instrument panel again with a new software through Navigator.

The Display reads: "Instrument panel disconnected. Now connect the diagnosis instrument"; the instrument panel will connect normally after the key is extracted-inserted.

The white connector is placed under the saddle, beside the fuse box, close to the diagnosis connector for the injection system.

Use the Ditech connector in the Navigator **Aprilia-Moto Guzzi** package to connect to the Navigator cable.

**KEY CHANGE FUNCTION**

This function can be used:

- 1) if one key is lost; the dealer can disable this key;
- 2) to activate up to 4 keys;
- 3) should a new key lock be necessary and thus program the new set of keys.

In the first phase the user code must be entered and, after confirming the inserted key (key I) has been programmed, the other keys must be entered too.

The procedure finishes once the 4 keys have been programmed or after 20 seconds.

Should a new key lock be necessary, the procedure is: once the key is set to ON but the instrument panel does not recognise it, the user code is requested: enter the user code.

Now enter MENU, DIAGNOSIS (entering the service code), KEY CHANGE and program the new keys.

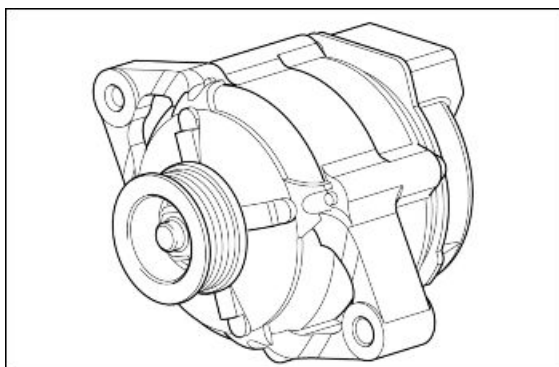
Battery recharge circuit

Checking the stator

Single-phase generator with regulated voltage

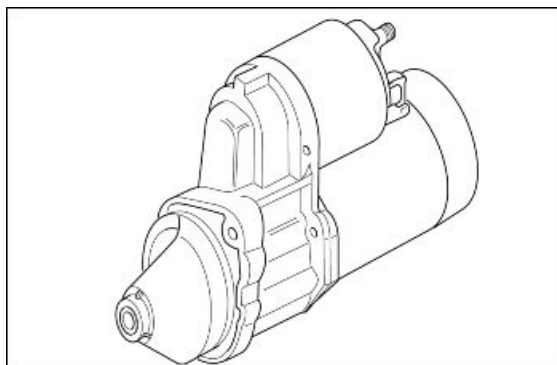
Maximum load 40A (550W)

Charging voltage 14.2 - 14.8 V (5000 rpm)



Start-up system check

pick-up input about 100 A



level indicators

Petrol pump:

Input: 3.5 A (to be measured between pins 1 and 2 with 12V voltage)

Fuel level sensor:

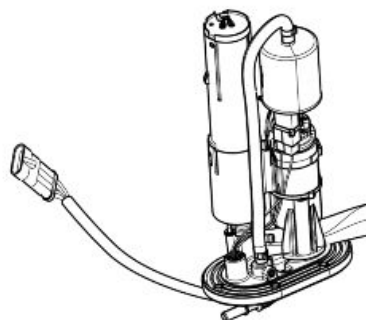
Resistance (to be measured between pins 3 and 4)

250-300 Ohm with fuel level equal to 0 litre

100 Ohm with fuel level equal to 11.25 litres (20.43 pt)

10-20 Ohm with fuel level equal to 22.5 litres (40.86 pt)

The low fuel warning light turns on with values over 230 Ohm.

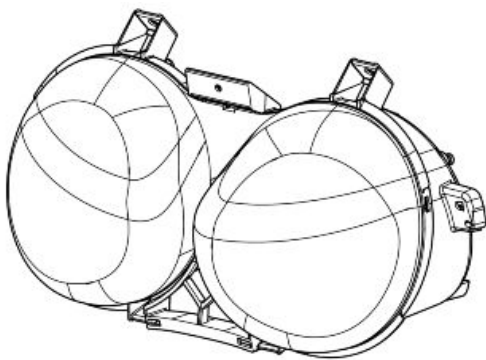


In case there is anomaly on the fuel probe, the low fuel warning light flashes on the instrument panel.
The alarm warning light on the instrument panel does not light up and the word Service is not displayed.

Lights list

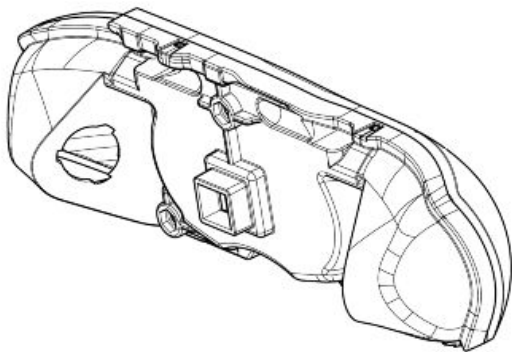
FRONT HEADLAMP

Specification	Desc./Quantity
Front daylight running light	12V - 5W
Low/high beam headlight (halogen)	12 V - 55 W / 60 W H4



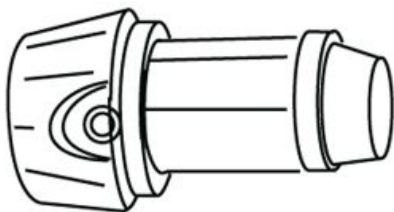
REAR LIGHT

Specification	Desc./Quantity
Tail light /stop light	LED
License plate light	12V - 5 W



ADDITIONAL HEADLAMPS

Specification	Desc./Quantity
Additional headlamp bulbs	12V/55W - H3



Fuses

AUXILIARY FUSES

A - Stop, horn, coil, GPS, hazard button lighting, coils, light relay, passing (15 A).

B - Tail lights, starter motor (15 A).

C - Free

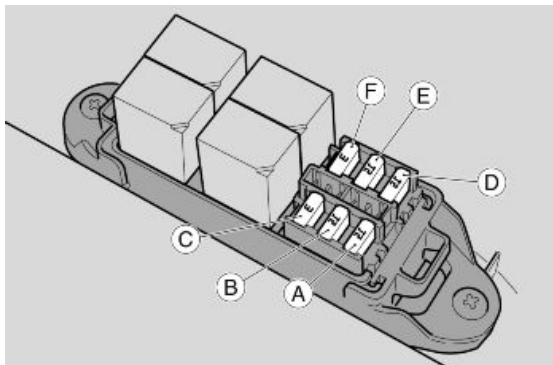
D - Fuel pump, coils, injectors (15 A).

D - Lambda burner, speed sensor, auxiliary injection relay coil, start-up relay coil (15 A).

F- Permanent positive, ECU power supply (3A).

NOTE

THERE ARE TWO SPARE FUSES.



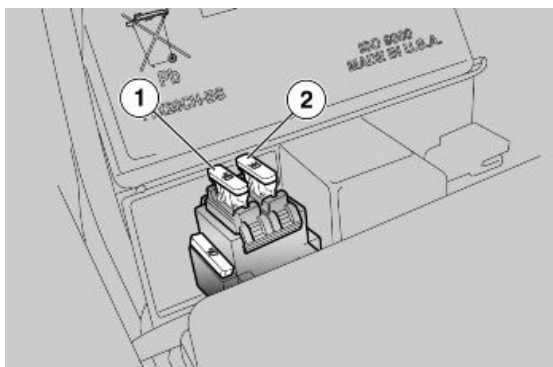
MAIN FUSES

1 - Battery recharge (40 A).

2 - Motion main fuse (30 A).

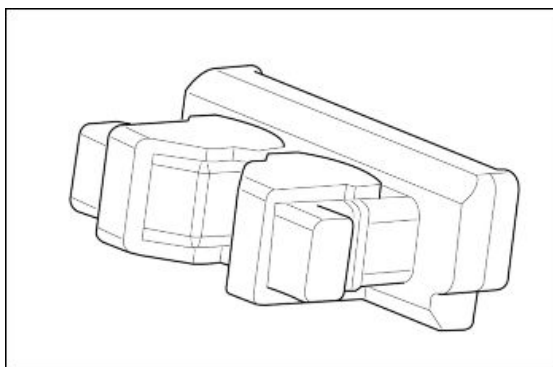
NOTE

THERE IS ONE SPARE FUSE.



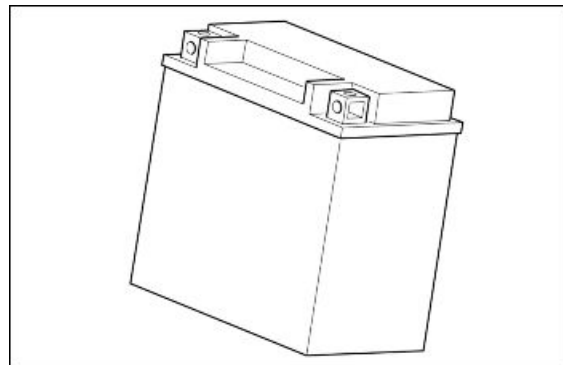
Control unit

Model: Magneti Marelli IAW 5 AM2



Battery

12 V - 18 Ampere/hour



Speed sensor

Function

To indicate the vehicle speed by reading the rear wheel turning speed.

Operation / Operating principle

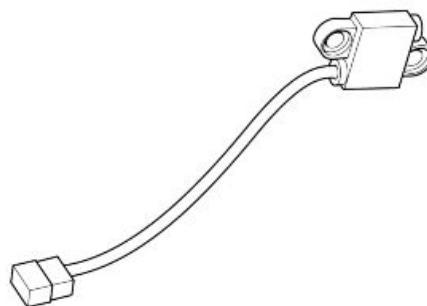
HALL effect sensor: a square-wave pulse is generated with voltage between 12 V and 0.3-0.4V approx.

Level in electrical circuit diagram:

Speed sensor

Location:

- Sensor: on swingarm, right side, near the rear brake calliper
- Connector: near the upper retainer of the rear shock absorber



Pin-out:

1. Supply voltage (green)
2. Output signal (grey/white)
3. Ground (blue/orange)

PIN:

- PINS 1-3 Voltage: approx. 12 V
- PINS 2-3 Voltage: variable 0.4V-12V (by turning the rear wheel)

NAVIGATOR: ELECTRICAL ERRORS

Speed sensor - invalid signal.

Error cause

- Error signal if a speed below the default value set by the manufacturer for the running vehicle is detected. Possibly shorted to ground, to battery or speed sensor circuit open: lack of supply from the control unit also possible.

Troubleshooting

CARRY OUT THE CASCADE OPERATIONS UNTIL THE FAILURE IS FOUND

- Check correct position of the sensor in its fitting.
- Check that the air gap thickness is correct ($0.6 \div 2.2 \text{ mm} - 0.024 - 0.087 \text{ in}$)
- Check voltage between PINS 1-3 of the sensor. In case of null voltage, check continuity between PIN 1 of the sensor and PIN 17 of the ECU BLUE connector.
- Check PIN 17 of the BLUE connector.
- Check continuity to ground of PIN 3 of the sensor.
- Check continuity of the grey/white cable harness from PIN 24 of the ECU BLUE connector.
- Check PIN 24 of the BLUE connector.
- If there is no failure after all these checks, replace the sensor.

Speed sensor - over the maximum limit.

Error cause

- Error signal if a speed above the default value set by the manufacturer for the running vehicle is detected.

Troubleshooting

- above the maximum threshold: replace the sensor.

Engine rpm sensor

Function

Informs crankshaft position and speed to the Mar-elli control unit.

Operation / Operating principle

Inductive sensor: sinusoidal-type generated voltage; two teeth are missing on the flywheel for the reference position.

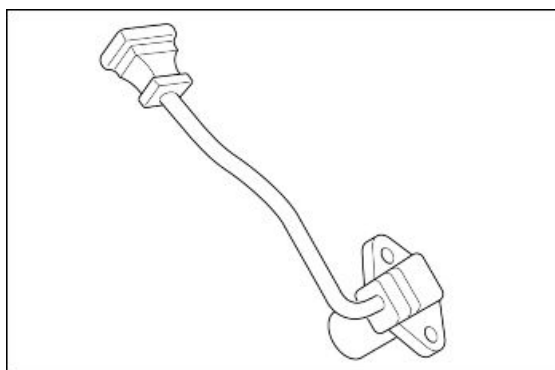
Level in electrical circuit diagram:

Engine speed sensor

Location:

- Sensor: Front left side of the engine, under the generator.
- Connector: Under the fuel tank.

Electrical characteristics:



- Winding resistance 650 Ohm +/- 15%
- Output alternating voltage, value
range: minimum: 0.5 V - maximum: 5 V

PIN:

1. Engine revolution sensor positive signal.
2. Engine revolution sensor negative signal.
3. Revolution sensor anti-jamming cable.

NAVIGATOR: PARAMETERS**Target engine revs**

Example value: 1100 +/- 100 rpm

Parameter valid at idle, setting depends especially on engine temperature: the ECU unit will try to keep the engine running at this revs, acting on the ignition advance.

NAVIGATOR: STATUSES**Synchronisation**

Example value: Synchronised / Not synchronised

Indicates if the control unit detects the revolution sensor signal correctly

DIAGNOSIS**Engine revolution sensor**

An interruption in the sensor circuit has been detected, from PIN 25 to PIN 35 of connector A (BROWN). Check the sensor connector and the injection control unit connector A (BROWN): if they are not OK, restore. If OK, check continuity of the two cables leading to PINS 25 and 35 of the control unit connector: if there is not continuity, restore the cable harness; if there is continuity, check the interruption on the sensor and replace it.

WARNING If the electric circuit is short-circuited, no error is displayed. Check the sensor electrical specifications: If they are not correct, replace the sensor. If correct, check supply insulation and ground connection insulation of both cables. Perform the tests from the sensor connector towards the sensor. If they are not OK, restore the cable harness or replace the sensor. If OK, perform the tests for pins 25 and 35 of the Marelli control unit connector A (BROWN) towards the cable harness.

Air gap value:

Place the sensor plus the corresponding spacers; the air gap should be between 0.7 and 0.9 mm.

Throttle position sensor

Function

In charge of telling the control unit the position of the throttle valves.

Operation / Operating principle

The throttle valve position sensor works as a variable resistance according to the throttle rotation.

Level in electrical circuit diagram: Throttle and idle motor

Location:

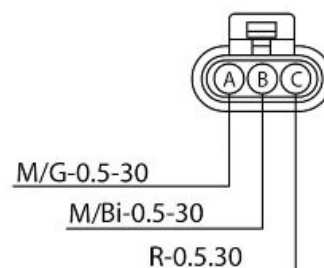
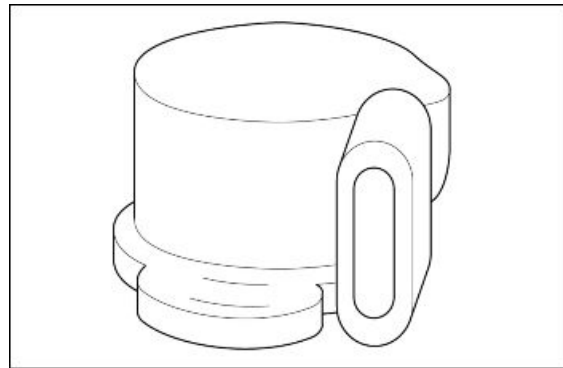
- sensor: on the right cylinder throttle body
- connector: on the potentiometer

Electrical characteristics:

- PINS A-C: throttle closed approx. 2.5 kOhm; throttle open approx. 1.5 kOhm.
- PINS A-B: approx. 1.1 kOhm

Pin-out:

- PIN A: ground connection
- PIN B: supply voltage +5V
- PIN C: potentiometer signal



THE CONNECTION DIAGRAMS ARE IN THE ELECTRICAL SYSTEM SECTIONS; PAY ATTENTION TO THESE DIAGRAMS AS THEY SHOW THE CONNECTOR/COMPONENT AS VIEWED FROM THE CABLE HARNESS SIDE, THAT IS LOOKING AT THE CABLES WHEN GOING OUT OF THE "MAIN" CABLE HARNESS AND INTO THE CONNECTOR/COMPONENT.

CAUTION

BEFORE CARRYING OUT ANY TROUBLESHOOTING, CAREFULLY READ THE GENERAL TROUBLESHOOTING CONCEPTS FOR ELECTRICAL DEVICES AT THE BEGINNING OF THE CHECK AND CONTROL SECTION IN THE ELECTRICAL SYSTEM CHAPTER.

NAVIGATOR: FUEL INJECTION SYSTEM

NAVIGATOR: PARAMETERS

Throttle

Example value: 4.9°

NAVIGATOR: STATUSES

Throttle position

Example value: Released/Pressed/Full load

Indicates if the throttle potentiometer is open or closed in the released position.

NAVIGATOR: ERRORS

Throttle actuator position sensor P0120

Example value: open circuit, shorted to positive / shorted to negative.

Error cause

- If the circuit is open, shorted to positive: excessive voltage has been detected at PIN 3 of connector A (BROWN).
- If shorted to negative: voltage equal to zero has been detected.

Troubleshooting

- Circuit is open, shorted to positive: check the injection control unit connector and the sensor connector: if they are not OK, restore; if they are OK, check continuity between PIN 3 of connector A (BROWN) and PIN C of the sensor (red cable): if there is not continuity, restore the cable harness; if there is continuity, check continuity of the sensor between PIN A and PIN C: if there is not continuity, replace the potentiometer; if there is continuity, check the resistance. If resistance is over 2.5 kOhm, it means the red cable is shorted to positive and the cable harness should be restored
- shorted to negative: disconnect the sensor connector and check the ground insulation of the red cable (from throttle sensor connector or control unit connector): if there is continuity to ground, restore the cable harness; if it is ground insulated, the resistance between PIN A and PIN C is below 1.3 kOhm; therefore, the throttle body should be replaced

NAVIGATOR: ADJUSTMENT

Throttle position autodetection: It allows the control unit to detect the closed throttle position; just press the Enter key.

Self-adjustable parameters reset: Lambda probe self-adaptability parameters reset: operation to be carried out after the throttle body is cleaned or in the case a new engine, a new lambda probe or a new injector is fitted, or the correct operation of the injection system or the valves is restored.

NAVIGATOR: RESET PROCEDURE

Once the throttle body or the injection control unit is replaced, it is necessary to connect to the diagnosis instrument selecting FUEL INJECTION and carry out the operation: Throttle position autodetection.

Engine temperature sensor

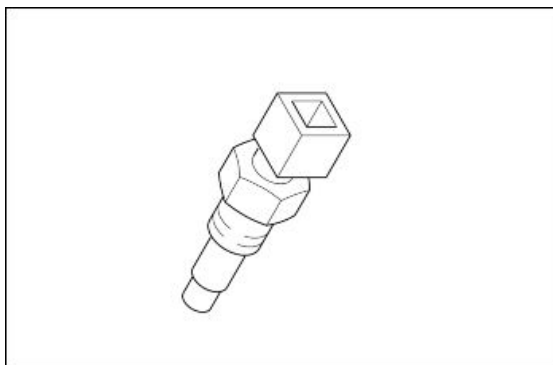
Function

tells the engine temperature to the control unit so as to optimise its operation.

Operation / Operating principle

NTC type sensor (resistance sensor, inversely variable with temperature).

Level in electrical circuit diagram: Temperature sensors



Location:

- sensor: inside the "V"
- Connector: on the sensor

Electrical characteristics:

ENGINE TEMPERATURE SENSOR RESISTANCE

	Specification	Desc./Quantity
1	Resistance at -40 °C (-40 °F)	100.950 kOhm
2	Resistance at -30 °C (-22 °F)	53.100 kOhm
3	Resistance at -20 °C (-4 °F)	29.120 kOhm
4	Resistance at -10 °C (14 °F)	16.600 kOhm
5	Resistance at 0 °C (32 °F)	9.750 kOhm
6	Resistance at +10 °C (50 °F)	5.970 kOhm
7	Resistance at +20 °C (68 °F)	3.750 kOhm
8	Resistance at +30 °C (86 °F)	2.420 kOhm
9	Resistance at +40 °C (104 °F)	1.600 kOhm
10	Resistance at +50 °C (122 °F)	1.080 kOhm
11	Resistance at +60 °C (140 °F)	0.750 kOhm
12	Resistance at +70 °C (158 °F)	0.530 kOhm
13	Resistance at +80 °C (176 °F)	0.380 kOhm
14	Resistance at +90 °C (194 °F)	0.280 kOhm
15	Resistance at +100 °C (212 °F)	0.204 kOhm
16	Resistance at +110 °C (230 °F)	0.153 kOhm
17	Resistance at +120 °C (257 °F)	0.102 kOhm

Pin-out:

- PIN 1: Ground connection
- PIN 2: 0-5 V signal

THE CONNECTION DIAGRAMS ARE IN THE ELECTRICAL SYSTEM SECTIONS; PAY ATTENTION TO THESE DIAGRAMS AS THEY SHOW THE CONNECTOR/COMPONENT AS VIEWED FROM THE CABLE HARNESS SIDE, THAT IS LOOKING AT THE CABLES WHEN GOING OUT OF THE "MAIN" CABLE HARNESS AND INTO THE CONNECTOR/COMPONENT.

CAUTION

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NAVIGATOR: FUEL INJECTION SYSTEM

NAVIGATOR: PARAMETERS

Engine temperature

In case of recovery, this value is set by the control unit.

NAVIGATOR: ERRORS

engine temperature sensor P0115 - open circuit, shorted to positive / shorted to negative.

Error cause

- If the circuit is open, shorted to positive: excessive voltage has been detected at PIN 5 of connector A (BROWN).
- If shorted to negative: voltage equal to zero has been detected at PIN 5 of the BROWN connector.

Troubleshooting

- If the circuit is open, shorted to positive: check the sensor connector and the Marelli control unit connector. If they are not OK, restore the cable harness; if OK, check the continuity of the sensor; if it is not OK, replace the sensor; if it is OK, check continuity between PIN 5 of the BROWN connector and PIN 2 of sensor: restore cable harness if there is not continuity; if it is OK, reconnect the control unit connector and, with key set to key ON, check the continuity between the sensor connector PIN 1 and the vehicle ground connection: if there is not continuity, restore the cable harness; if there is continuity, it means that the cause of the error is that the cable is shorted to positive and now the cable harness between the BROWN PIN 5 and PIN 2 of the sensor should be restored. If the air temperature sensor error is displayed at the same time, this means that the grey cable common for both sensors is shorted to positive.
- If shorted to negative, check sensor correct resistance: if resistance is null, replace the sensor; if resistance is correct, it means that the orange cable has ground connection: restore the cable harness.

NOTES No error is detected if the sensor does not work correctly or the control unit connector or sensor terminals are rusty: then check through Navigator if the temperature indicated is the same as the engine temperature. Check also that the sensor electrical characteristics are observed: replace the sensor if not OK; if it is OK, check the sensor connector and the Marelli control unit connector

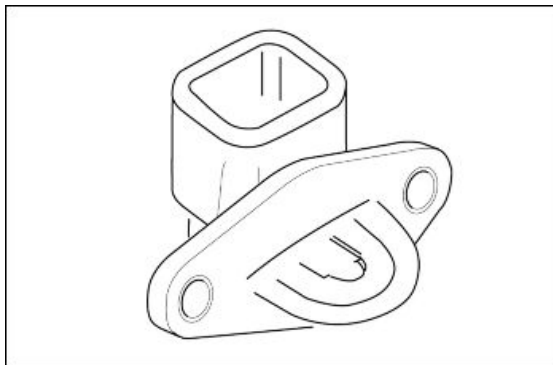
Air temperature sensor

Function

It tells the control unit the intake air temperature in order to calculate oxygen presence so as to optimise the petrol quantity necessary for correct combustion.

Operation / Operating principle

NTC type sensor (resistance sensor, inversely variable with temperature).



Level in electrical circuit diagram: Temperature sensors

Location:

- sensor: on filter casing
- connector: on the sensor

Electrical characteristics:

AIR TEMPERATURE SENSOR RESISTANCE

	Specification	Desc./Quantity
1	Resistance at -40 °C (-40 °F)	100.950 kOhm
2	Resistance at 0 °C (32 °F)	9.750 kOhm
3	Resistance at 10 °C (50 °F)	5.970 kOhm
4	Resistance at 20 °C (68 °F)	3.750 kOhm
5	Resistance at 30 °C (86 °F)	2.420 kOhm
6	Resistance at 40 °C (104 °F)	1.600 kOhm
7	Resistance at 90 °C (194 °F)	0.280 kOhm

Pin-out:

- PIN 1: Ground connection
- PIN 2: 0-5 V signal

NAVIGATOR: PARAMETERS

Air temperature

In case of failure, temperature is set at 25 °C (77 °F)

NAVIGATOR: ERRORS

air temperature sensor P0110 - open circuit, shorted to positive / shorted to negative.

Error cause

- If the circuit is open, shorted to positive: excessive voltage has been detected at PIN 14 of the BROWN connector. If shorted to negative: voltage equal to zero has been detected at PIN 14 of the BROWN connector

Troubleshooting

- If the circuit is open, shorted to positive: check the sensor connector and the Marelli control unit connector. If they are not OK, restore the cable harness; if OK, check the continuity of the sensor; if it is not OK, replace the sensor; if it is OK, check continuity between PIN 14

of the BROWN connector and PIN 2 of sensor: restore cable harness if there is not continuity; if it is OK, reconnect the control unit connector and, with key set to key ON, check the continuity between the sensor connector PIN 1 and the vehicle ground connection: if there is not continuity, restore the cable harness; if there is continuity, it means that the cause of the error is that the cable is shorted to positive and now the cable harness between the BROWN PIN 14 and PIN 2 of the sensor should be restored. If the engine temperature sensor error is displayed at the same time, this means that the grey cable common for both sensors is shorted to positive.

- If shorted to negative, check sensor correct resistance: if resistance = 0, replace the sensor; if resistance is correct, it means that the pink/black cable has ground connection: restore the cable harness

NOTES No error is detected if the sensor does not work correctly or the control unit connector or sensor terminals are rusty: then check through Navigator if the temperature indicated is plausible in relation to the ambient temperature. Check also that the sensor electrical characteristics are observed: replace the sensor if not OK; if it is OK, check the sensor connector and the Marelli control unit connector

Lambda sensor

Function

In charge of telling the control unit whether the mixture is lean or rich.

Operation / Operating principle

The Marelli injection control unit reads and interprets a voltage generated by the difference in oxygen content between the exhaust fumes and the ambient. It does not require an external supply source but, in order to work properly, it should reach a high operating temperature: that is why there is a heating circuit inside.

Level in electrical circuit diagram: Lambda probe

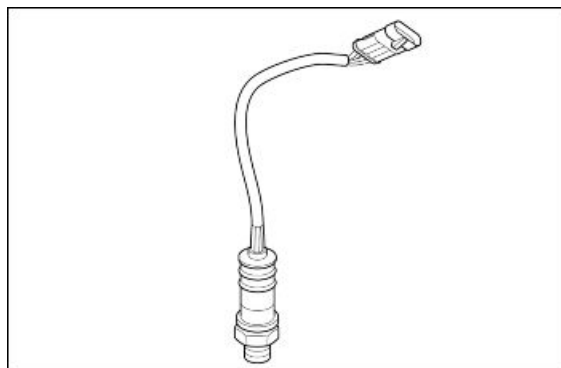
Location:

- sensor: exhaust pipe
- Connector: near the probe

Electrical characteristics:

Heater circuit: 12 -14 Ω at 20 °C (68 °F)

Pin-out:



1. Sensor signal + (black wire)
2. Sensor signal - (grey wire)
3. Heater ground connection (white)
4. Heater power supply (white)

NAVIGATOR: PARAMETERS**Lambda probe**

Example value: 0 - 1000 mV

If there is a short circuit at + 5 V or above, the value read is approx. 5,000 mV. If there is a short circuit to ground instead, the value read is equal to 0 mV and the Lambda Sensor Correction parameter shows 25%: no error is displayed, though.

Lambda sensor correction

example value: 1.00

In closed loop, the value must be close to 0 % (values not within the +10 % and -10 % range may indicate a fault): In an open circuit, the lambda probe signal is too low. Therefore, the control unit takes it as a lean mixture condition and will try to enrich it. The value read will be +25%.

NAVIGATOR: STATUSES**Lambda check**

Example value: Open loop / Closed loop

Closed loop indicates that the control unit is using the lambda probe signal to keep the combustion as close as possible to the stoichiometric value.

NAVIGATOR: ERRORS

Lambda probe P0130 - Shorted to positive.

Error cause

- Excessive voltage (battery voltage) has been detected at PINS 32 and 22 of the BLUE connector.

Troubleshooting

- shorted to positive: with the key set to ON, disconnect the sensor connector and measure voltage at PIN 1 on the cable harness side (white/yellow cable): if there is voltage (5 or 12 V), restore the cable harness; if there is no voltage, measure voltage at PIN 2, cable harness side, (green/white cable) and if there is voltage, restore the cable harness; if there is no voltage, replace the lambda probe

Lambda probe heating P0135 - shorted to positive / open circuit, shorted to negative.

Error cause

- If shorted to positive: excessive voltage has been detected at PIN 11 of the BLUE connector.
- If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 11 of the BLUE connector.

Troubleshooting

- shorted to positive: disconnect the probe connector and check the sensor correct resistance: replace the sensor if not OK; if it is OK, restore the cable harness.
- circuit is open, shorted to negative: check the continuity from probe connector (PIN 3 and 4) towards the probe: if not OK, replace the probe; if it is correct, check the sensor connector and the Marelli control unit connector. If not OK, restore. If OK, and with key set to ON and sensor connector disconnected, check if there is battery voltage at PIN 4: if not OK, check the red/black cable (cable harness side) between the probe connector and the auxiliary injection relay (No. 37 in the wiring diagram, placed on the front right side of the motorcycle, in the auxiliary fuses/relays box, first relay to the left starting from the front; CHECK, however, the identification of the relay with the colour of the cables). If there are also coil and injector errors, check that relay and its excitation and power line; if there is voltage at PIN 4, check the white cable ground insulation, cable harness side (PIN 3): if it is not OK, restore the cable harness. If OK, check continuity of the white cable, cable harness side (between PIN 3 of the sensor connector PIN 3 and PIN 11 of the BLUE connector) and restore the cable harness.

Injector

Function

To supply the correct amount of petrol at the right timing.

Operation / Operating principle

Injector coil is excited for the petrol passage to open.

Level in electrical circuit diagram: Coils and injectors

Location:

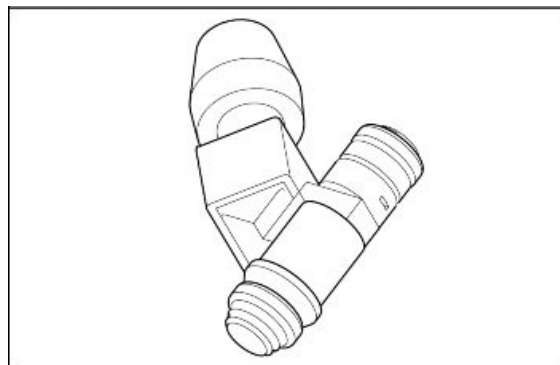
- on the intake manifold
- connector: on injector

Electrical characteristics: 14.8 Ohm +/- 5% (at 20 °C)

Pin-out:

"+": Supply:

"-": Ground connection



NAVIGATOR: FUEL INJECTION SYSTEM

NAVIGATOR: PARAMETERS

Injection time

NAVIGATOR: ACTIVATION

Left injector: operation for 4 ms, 5 times

The auxiliary injection relay (No. 37 in the electrical circuit diagram, placed on the front right side of the motorcycle, in the auxiliary fuses/relays box, first relay to the left starting from the front; CHECK, however, the identification of the relay with the colour of the cables) is energised for 5 seconds and the grey/red cable of the injector is closed to ground for 4 ms per second. Disconnect the 4-way connector of the fuel pump to be able to hear the relay and injector activation. The continuity of the cable harness is necessary for correct activation: no error indications are displayed in case of lack of activation.

NAVIGATOR: ERRORS

Left injector P0201 - shorted to positive / shorted to negative / open circuit.

Error cause

- If shorted to positive: excessive voltage has been detected at PIN 28 of the BROWN connector.
- If shorted to negative: no voltage has been detected.
- If the circuit is open: an interruption has been detected

Troubleshooting

- Shorted to positive: disconnect the injector connector, take the key to ON and check if there is voltage on the grey/red cable: if there is voltage, restore the cable harness. If there is no voltage, replace the injector.
- If shorted to negative: disconnect the injector connector, take the key to ON and check if the grey/red cable has continuity to the ground connection: if there is continuity to ground, restore the cable harness; if there is not continuity, replace the injector
- The circuit is open: check the component correct electrical characteristic: if it is not the correct one, replace the component; if it is correct, check the connector on the component and the Marelli control unit connector: If they are not OK, restore. If OK, check cable continuity between PIN 28 of the BROWN connector and the component PIN - and restore the cable harness.

NAVIGATOR: ACTIVATION

Right injector: Operation for 4 ms, 5 times

The auxiliary injection relay (No. 37 in the electrical circuit diagram, placed on the front right side of the motorcycle, in the auxiliary fuses/relays box, first relay to the left starting from the front; CHECK, however, the identification of the relay with the colour of the cables) is energised for 5 seconds and the blue/red cable of the injector is closed to ground for 4 ms per second. Disconnect the 4-way connector of the fuel pump to be able to hear the relay and injector activation. The continuity of the wiring is necessary for correct activation: no error indications are displayed in case of lack of activation.

NAVIGATOR: ERRORS

Right injector P0202 - shorted to positive / shorted to negative / open circuit.

Error cause

- If shorted to positive: excessive voltage has been detected at PIN 37 of the BROWN connector.
- If shorted to negative: no voltage has been detected.
- If the circuit is open: an interruption has been detected

Troubleshooting

- If shorted to positive: disconnect the injector connector, take the key to ON and check if there is voltage on the blue/red cable: if there is voltage, restore the cable harness. If there is no voltage, replace the injector.
- If shorted to negative: disconnect the injector connector, take the key to ON and check if the blue/red cable has continuity to the ground connection: if there is continuity to ground, restore the cable harness; if there is not continuity, replace the injector
- The circuit is open: check the component correct electrical characteristic: if it is not the correct one, replace the component; if it is correct, check the connector on the component and the Marelli control unit connector: If they are not OK, restore. If OK, check cable continuity between PIN 37 of the BROWN connector and the component PIN - and restore the cable harness

Coil

Function

It controls the ignition spark plug in order to generate the fuel ignition spark.

Operation / Operating principle

Inductive discharge system

Level in electrical circuit diagram: Coils and injectors

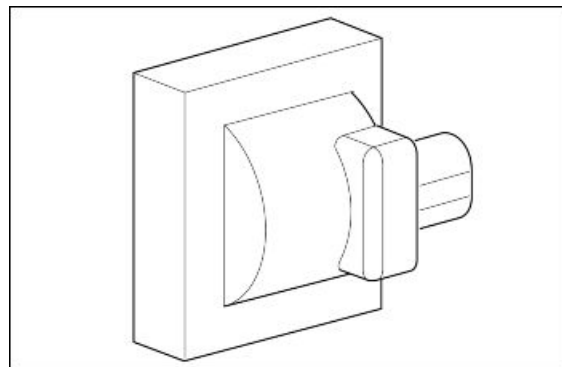
Location:

- In front of the fuel tank, left and right side
- Connector: on the coils

Electrical characteristics:

- Primary winding resistance: $550\text{ m}\Omega \pm 10\%$, at approx. $23\text{ }^{\circ}\text{C}$ ($73.4\text{ }^{\circ}\text{F}$).
- Secondary winding resistance: $3\text{ m}\Omega \pm 10\%$, at approx. $23\text{ }^{\circ}\text{C}$ ($73.4\text{ }^{\circ}\text{F}$).
- Tube resistance: $5\text{ k}\Omega$.

Pin-out:



1. Power supply + Vbatt
2. Circuit ground

NAVIGATOR: PARAMETERS

Left coil ignition advance.

NAVIGATOR: ACTIVATION**Left coil:**

The auxiliary injection relay (No. 37 in the electrical circuit diagram, placed on the front right side of the motorcycle, in the auxiliary fuses/relays box, first relay to the left starting from the front; CHECK, however, the identification of the relay with the colour of the cables) is energised for 5 seconds and the green/orange cable of the coil is closed to ground for 2 ms per second. Disconnect the 4-way connector of the fuel pump to be able to hear the relay and injector activation. The continuity of the wiring is necessary for correct activation: no error indications are displayed in case of lack of activation

NAVIGATOR: ERRORS

Left coil P0351- shorted to positive / open circuit, shorted to negative

Error cause

- If shorted to positive: excessive voltage has been detected at PIN 38 of the BROWN connector.
- If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 38 of the BROWN connector

Troubleshooting

- Shorted to positive: disconnect the coil connector, set the key to ON, activate the coil with Navigator and check voltage at connector PIN 2: if there is voltage, restore the cable harness; if voltage = 0, replace the coil.
- If the circuit is open, shorted to negative: check the coil connector and the Marelli control unit connector. If they are not OK, restore; if everything is OK, check cable continuity between PIN 2 of the coil connector and PIN 38 of the BROWN connector. If there is not continuity, restore the cable harness; if there is cable continuity, with the key set to KEY ON, check the cable ground insulation (from coil connector or control unit connector). If this is not OK, restore the cable harness.

NAVIGATOR: PARAMETERS

Right coil ignition advance.

NAVIGATOR: ACTIVATION**Right coil:**

The auxiliary injection relay (No. 37 in the electrical circuit diagram, placed on the front right side of the motorcycle, in the auxiliary fuses/relays box, first relay to the left starting from the front; CHECK, however, the identification of the relay with the colour of the cables) is energised for 5 seconds and the sky blue/green cable of the coil is closed to ground for 2 ms per second. Disconnect the 4-way connector

of the fuel pump to be able to hear the relay and injector activation. The continuity of the wiring is necessary for correct activation: no error indications are displayed in case of lack of activation

NAVIGATOR: ERRORS

Right coil P0352 - shorted to positive / open circuit, shorted to negative.

Error cause

- If shorted to positive: excessive voltage has been detected at PIN 10 of the BROWN connector.
- If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 10 of the BROWN connector

Troubleshooting

- shorted to positive: disconnect the coil connector, set the key to ON, activate the coil with Navigator and check voltage at connector PIN 2: if there is voltage, restore the cable harness; if voltage = 0, replace the coil
- if the circuit is open, shorted to negative: check the coil connector and the Marelli control unit connector. If they are not OK, restore; if everything is OK, check cable continuity between PIN 2 of the coil connector and PIN 10 of the BROWN connector. If there is not continuity, restore the cable harness; if there is cable continuity, with the key set to KEY ON, check the cable ground insulation (from coil connector or control unit connector). If this is not OK, restore the cable harness.

Engine oil pressure sensor

Function: Indicates the instrument panel if there is enough oil pressure (0.35 +/- 0.15 bar) (5.1 +/- 2.18 PSI) in the engine.

Operation / Operating principle: normally closed switch. With oil pressure above 0.35 +/- 0.15 bar (5.1 +/- 2.18 PSI), open circuit.

Level in wiring diagram: fuel reserve and oil pressure.

Location:

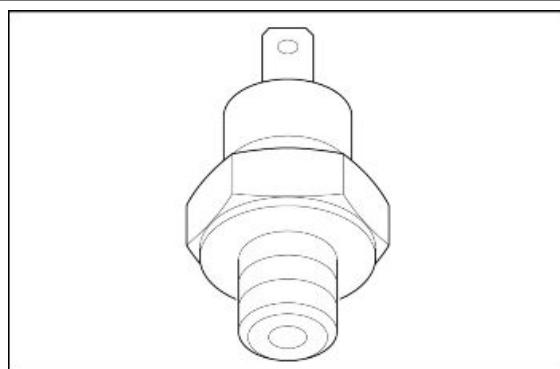
- Sensor: in between the engine "V", a little to the left, under the generator
- Connector: on the sensor.

Pin-out: Voltage 12V

Instrument panel

Oil sensor failure DSB 07

Error cause



- An oil sensor failure is signalled when, with engine off, it is detected that the sensor circuit is open. The test is performed only once when the key is set to ON. This error is signalled by the bulb icon and the general warning light turns on as well.

Troubleshooting

- Check the sensor connector and the instrument panel connector (PIN 17): If not OK, restore. If OK, check the continuity of the purple cable between the sensor connector and the instrument panel connector PIN 17: if not OK, restore the cable harness; if OK, replace the sensor.

Oil pressure failure DSB 08

Error cause

- An oil sensor failure is signalled when, with engine running, it is detected that the sensor circuit is closed. This error is signalled by the bulb icon and the general warning light turns on as well.

Troubleshooting

- Detach the sensor connector and check the purple cable is ground insulated: if there is continuity to ground, restore the cable harness; if it is ground insulated, replace the switch. If this error persists, use a pressure gauge to check the pressure of the oil in the engine circuit

Neutral sensor

Function

it tells the gear position to the control unit: in neutral or in gear.

Operation / Operating principle

for gear in neutral, the circuit is closed to ground connection: then, via CAN, the control unit sends the signal to the instrument panel which turns on the neutral speed warning light.

Level in electrical circuit diagram: start-up enabling switches

Location:

- Sensor: rear / upper side of the gearbox
- Connector: on the sensor

Electrical characteristics:

- Gear in neutral: closed circuit (0 V on wire from control unit to sensor / switch in continuity).
- Gearshift engaged: open circuit (12 V on wire from control unit to sensor / open switch, infinite resistance)

Pin-out:

- PIN 1: Voltage 12V

NAVIGATOR: STATUSES

Gear in neutral**Example value:**yes/no**DIAGNOSIS**

- Indication on the instrument panel always gear engaged: check the control unit connector and the sensor connector: if they are not OK, restore the cable harness; if OK, disconnect the connector and, with gear in neutral, check continuity to ground of the terminal, sensor side: if there is not continuity, replace the sensor (after checking cable harness continuity on the sensor side and the correct mechanical position); if there is, check cable continuity between the sensor connector and PIN 23 of the BROWN connector: if there is no continuity, restore the cable harness. If there is, replace the instrument panel if the vehicle performance is correct (the engine starts with gear in neutral but the neutral warning light is off) or replace the control unit if the vehicle performance is not correct (the engine does not start with gear in neutral).
- Indication on the instrument panel always gear in neutral: disconnect the terminals from the sensor and check if there is continuity with ground connection at PIN toward the sensor, with gear engaged: if there is continuity, replace the sensor. If it is ground insulated, it means that the grey/black cable from PIN 1 of the sensor to PIN 23 of the BROWN connector is shorted to ground: restore the cable harness.

Clutch lever sensor**Function**

It tells the clutch lever position to the control unit.

Operation / Operating principle

If the gear is engaged but the clutch is pulled, i.e. circuit closed to ground, vehicle start-up is enabled anyway.

Level in electrical circuit diagram:Start-up enabling switches.

Location:

- sensor: under clutch lever
- Connector: on the sensor

Electrical characteristics:

- Clutch pulled: closed circuit (continuity)
- Clutch released: open circuit (infinite resistance)

Pin-out:

1. Voltage 12V
2. Ground connection

NAVIGATOR: STATUSES**Clutch**

Example value: Yes/No

The statuses regularly viewed are YES / NO

DIAGNOSIS

Troubleshooting:

- Indication on Navigator always No: check the correct position of the cable terminals on the sensor and the correct connection of the cables on the terminals. If they are not correct, restore the cable harness; if correct, disconnect the two terminals from the sensor and check continuity to ground of PIN 2 (cable harness side): if there is no continuity, restore the cable harness; if there is, replace the sensor. Check continuity of the brown/purple cable between PIN 1 of the sensor and PIN 33 of the BLUE connector, cable harness side: if there is no continuity, restore the cable harness; if there is, replace the sensor. With the key set to ON, check that 12 Volt is fed to PIN 33 of the BLUE connector
- Indication on Navigator always Yes: disconnect the terminals from the sensor and check if there is continuity between the two PINS, with clutch released: if there is continuity, replace the sensor. If the circuit is open, it means that the brown/purple cable from PIN 1 of the sensor to PIN 33 of the BLUE connector is shorted to ground: restore the cable harness

Side stand sensor

Function

It tells the side stand position to the control unit.

Operation / Operating principle

If the gear is engaged and the side stand is unfolded, and therefore the circuit is open, the control unit does not enable vehicle start-up or shuts off the engine if it is rotating.

Level in electrical circuit diagram: Start-up enabling switches

Location:

- Sensor: on side stand supporting plate
- Connector: left side, near the starter motor

Electrical characteristics:

- Side Stand Up: closed circuit (continuity)
- Side Stand Down: open circuit (infinite resistance)

Pin-out:

1. Ground connection
2. Voltage 12 V (brown, sensor side)

NAVIGATOR: STATUSES

Side stand

Example value: retracted / extended

DIAGNOSIS

- Indication on Navigator always EXTENDED: check the side stand sensor connector and the ECU connector: if they are not OK, restore; if OK, disconnect both terminals from the sensor and check continuity to ground of PIN 1 (blue/green, cable harness side): if there is not continuity, restore the cable harness; if there is, check continuity of the green/brown cable: if it is not OK, restore; if OK, replace the sensor.
- Indication on Navigator always RETRACTED: disconnect the terminals from the sensor and check if there is continuity between the two PINS, with stand down: if there is continuity, replace the sensor; if the circuit is open, it means that the brown/green cable (cable harness side) from PIN 2 of the sensor to PIN 38 of the BLUE connector is shorted to ground: restore the cable harness.

Bank angle sensor

Function

it tells the vehicle position to the control unit.

Operation / Operating principle

When the sensor is inverted, the circuit is closed to ground: when the Marelli control unit detects this earthing, it disables the fuel pump circuit and the engine start-up circuit via the injection relay.

Level in electrical circuit diagram: Start-up enabling switches.

Location:

- Sensor: under the saddle, right side
- Connector: near the sensor

Electrical characteristics:

- Sensor in vertical position: open circuit (resistance: 62 kOhm)
- Sensor inverted: closed circuit (resistance below 0.5 kOhm)

Pin-out:

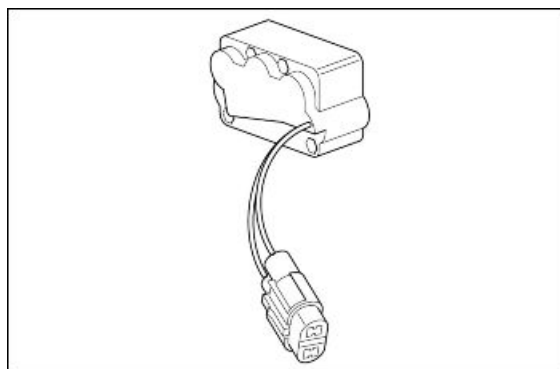
1. Voltage 12V
2. Ground connection

NAVIGATOR: STATUSES

Fall sensor

Example value: Normal / Tip over

DIAGNOSIS



- Indication on Navigator always Normal, even when the sensor is inverted: disconnect the connector and, with sensor inverted, check if there is continuity between the two PINS of the sensor: if there is no continuity, replace the sensor; if there is, check the connector. If not OK, restore the cable harness; if OK, check continuity to ground of PIN 2: if there is no continuity, restore the cable harness; if there is, with key set to KEY ON, check if there is 12V voltage at PIN 1. If there is not, check the Marelli control unit connector (PIN 35 of the BLUE connector)
- Indication on Navigator always Tip over: disconnect the connector and check if there is continuity between the two PINS when the sensor is in vertical position: if there is continuity, replace the sensor; if there is not, it means that, with key set to KEY ON, there is no 12V voltage at PIN 1: restore the cable harness whose pink/yellow cable will be shorted to ground

Air temperature sensor - instrument panel

Function

It tells the ambient air temperature to the instrument panel.

Operation / Operating principle

NTC type sensor (resistance sensor, inversely variable with temperature).

Level in electrical circuit diagram: Temperature sensors

Location:

- Sensor: under the instrument panel
- Connector: under the instrument panel

Electrical characteristics:

- Resistance at 0 °C (32 °F): 32.5 kOhm
+/- 5%
- Resistance at 25 °C (77 °F): 10.0
kOhm +/- 5%

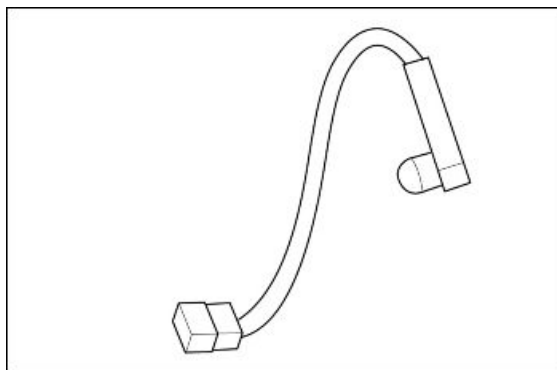
Pin-out:

1. Voltage 5V
2. Ground connection

Instrument panel

Air temperature sensor failure DSB 06

Error cause



- An oil sensor failure is signalled when it is detected that the sensor circuit is open or shorted to positive

Troubleshooting

- Check the sensor connector and the instrument panel connector (PINS 10 and 18): If they are not OK, restore. If OK, check continuity of the pink cable between the sensor connector and the instrument panel connector PIN 10: if it is not OK, restore the cable harness; if OK, check the correct sensor resistance: if it is not OK, replace the sensor; if it is OK, check continuity of the brown cable between the sensor connector and PIN 18 of the instrument panel connector: If not OK, restore the cable harness; if OK, with key set to ON, check if there is voltage at the sensor connector PIN 1: if there is no voltage, replace the instrument panel; if there is approximately 12V, restore the cable harness (there is a short circuit in the battery). If there is 5V voltage, connect a 10 kOhm resistance to PIN 1 of the sensor connector and to the vehicle ground connection: if, with key set to ON, the voltage measured upstream the resistance decreases, replace the instrument panel. If voltage continues to be approximately 5V, restore the pink cable (there is a short circuit at + 5V).

Notes

If a short circuit to ground is detected at PIN 10 of the instrument panel connector, the display will show a full scale air temperature indication of 60 °C (140 °F)

Check the ground insulation of the sensor connector pink cable: if there is a connection, restore the cable harness; if it is earth insulated, check that sensor resistance is correct: if it is not OK, replace the sensor; if it is OK, replace the instrument panel.

RUN/STOP switch

Function

It tells the control unit if the driver wishes to enable engine start-up or to keep the engine running.

Operation / Operating principle

If the driver wants to shut off the engine or to disable engine start-up, the switch should be open, i.e. the Marelli control unit should not detect voltage at PIN 27 of the BLUE connector.

Level in electrical circuit diagram:start-up enabling switches.

Location:

- right light switch.
- connector: right side, near the coil.

Electrical characteristics:

- STOP position: the circuit is open
- RUN position: closed circuit (continuity)

PIN:

- sky blue/orange cable: 0V if engine kill in STOP; 12V if engine kill in RUN
- red/black cable: Voltage 12V

NAVIGATOR: STATUSES

Run / stop switch

Example value:Run/Stop

DIAGNOSIS

- Indication on Navigator always STOP: disconnect the connector and, with the switch set to RUN, check if there is continuity towards the switch of both the green/orange and the grey/yellow cables (sensor side): if there is not continuity, replace the sensor; if there is, check the connector. If it is not OK, restore the cable harness; if it is OK, with the key set to ON, check if there is voltage on the red/black cable (cable harness side): if there is no voltage, restore the cable harness; if there is, check the ground insulation of the sky blue/orange cable (cable harness side): if there is continuity to ground, restore the cable harness; if it is OK, take the key to OFF and check that the BLUE connector is in good conditions and if there is continuity of the sky blue/orange cable between the connector in question and PIN 27 of the BLUE connector: if not OK, restore the cable harness; if OK, replace the Marelli control unit.
- Indication on Navigator always RUN: disconnect the connector and, with the switch set to STOP, check if there is continuity between the two cables of the switch (sensor side): if there is continuity, replace the switch; if there is not, it means that, with the key set to KEY ON, the sky blue/orange cable is shorted to positive: restore the cable harness.

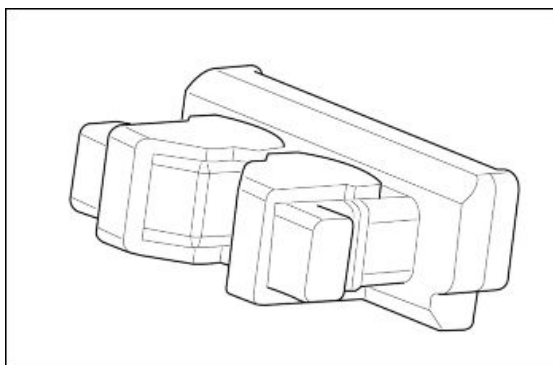
Connectors

ECU

BROWN connector pin configuration

Pin Use

- 1 Not used
- 2 Not used
- 3 Ignition potentiometer signal
- 4 Not used
- 5 Engine temperature signal
- 6 Not used
- 7 Not used
- 8 Not used
- 9 Stepper motor (+)
- 10 Right cylinder coil control



- 11 Not used
- 12 Not used
- 13 Not used
- 14 Air temperature signal
- 15 Not used
- 16 Not used
- 17 Stepper motor (+)
- 18 Stepper motor (-)
- 19 Stepper motor (-)
- 20 5V power supply (NTC sensors)
- 21 Not used
- 22 Not used
- 23 Neutral sensor signal
- 24 Not used
- 25 Engine revolution sensor signal
- 26 Not used
- 27 Not used
- 28 Left cylinder injector control
- 29 Ignition potentiometer negative
- 30 Not used
- 31 Not used
- 32 Ignition potentiometer power supply
- 33 Not used
- 34 Revolution sensor anti-jamming cable
- 35 Engine revolution sensor signal
- 36 Not used
- 37 Right cylinder injector control
- 38 Left cylinder coil control

BLUE connector pin configuration

Pin Use

- 1 Pin 85 ignition relay control
- 2 Not used
- 3 Not used
- 4 Power supply protected from instrument panel
- 5 Not used
- 6 Pin 86 auxiliary relay control
- 7 Immobilizer line
- 8 Not used

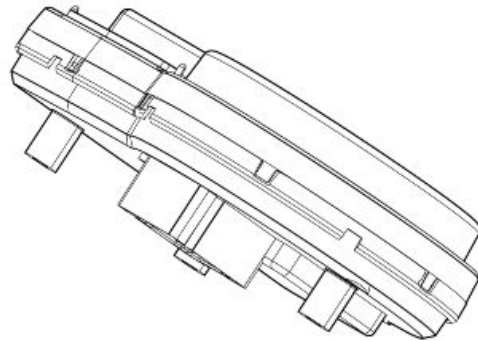
- 9 Not used
 - 10 Not used
 - 11 Oxygen probe negative control
 - 12 Not used
 - 13 Not used
 - 14 Not used
 - 15 Not used
 - 16 K line (diagnosis)
 - 17 Power supply from main relay
 - 18 Not used
 - 19 Not used
 - 20 CAN - H line (ccm/instrument panel)
 - 21 Not used
 - 22 Oxygen probe signal
 - 23 Not used
 - 24 Vehicle speed signal input
 - 25 Not used
 - 26 Not used
 - 27 "Engine stop" signal input
 - 28 Ignition signal input
 - 29 CAN - L line (ccm/instrument panel)
 - 30 Not used
 - 31 Not used
 - 32 Oxygen probe power supply
 - 33 Clutch sensor signal
 - 34 Not used
 - 35 Fall sensor signal
 - 36 Not used
 - 37 Not used
 - 38 Side stand sensor signal
-

Dashboard

The pin configuration of the GREY-bodied connector is as follows:

PIN USE

- 1 + KEY
- 2 RIGHT TURN INDICATOR CONTROL
- 3 HIGH-BEAM LIGHT INPUT
- 4 -
- 5 FOG LIGHTS ON (OPT)
- 6 K LINE
- 7 -
- 8 CONTROL - SET
- 9 FUEL LEVEL SENSOR
- 10 AIR TEMPERATURE SENSOR
- 11 + BATTERY
- 12 LEFT TURN INDICATOR CONTROL
- 13 -
- 14 -
- 15 -
- 16 GENERAL EARTH CONNECTION
- 17 OIL PRESSURE SENSOR INTAKE
- 18 SENSORS EARTH CONNECTION
- 19 GENERAL GROUND (OPTIONAL)
- 20 GENERAL GROUND (OPTIONAL)



The pin configuration of the BLACK-bodied connector is as follows:

PIN USE

- 21 + BATTERY
- 22 FRONT LEFT TURN INDICATOR ACTIVATION
- 23 REAR LEFT TURN INDICATOR ACTIVATION
- 24 AERIAL 1
- 25 LEFT HEATED HANDGRIPS ACTUATOR (OPT)
- 26 CAN H
- 27 CONTROL - RESET
- 28 LIGHTS RELAY ACTIVATION
- 29 ANTI-THEFT DEVICE LED (+12v)
- 30 CONTROL - DOWN
- 31 + BATTERY

32 FRONT RIGHT TURN INDICATOR ACTIVATION
33 REAR RIGHT TURN INDICATOR ACTIVATION
34 AERIAL 2
35 RIGHT HEATED HANDGRIPS ACTUATOR (OPT)
36 CAN L
37 HAZARD CONTROL
38 -
39 ABS (OPT)
40 CONTROL - UP

INDEX OF TOPICS

ENGINE FROM VEHICLE

ENG VE

Vehicle preparation

Before removing the engine block, proceed as follows:

- Rest the vehicle on its centre stand.
- From the back, secure the vehicle with belts attached to a hoist.
- From the front, secure the vehicle with belts attached to the handlebar and fixed to the work bench.
- Remove the exhaust system, the fork with cardan shaft, the fuel tank and the rear shock absorber.

See also

[Exhaust
Removing](#)

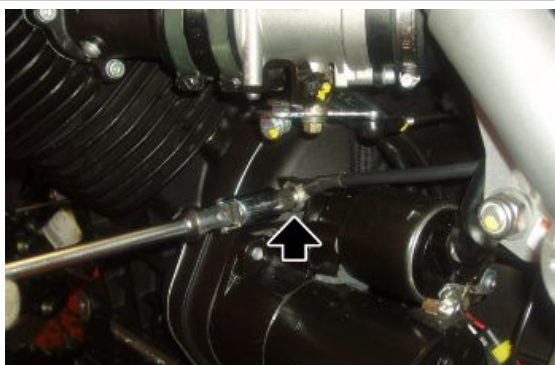
[Fuel tank
Removing](#)

Removing the engine from the vehicle

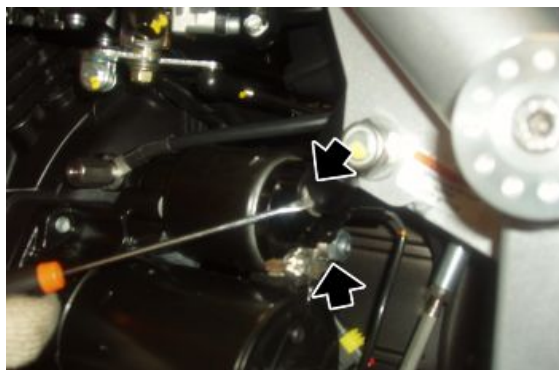
- Disconnect the spark plug tubes.
- Unscrew and remove the three screws and remove the clutch control cylinder.
- Lock the cylinder using a clamp to prevent oil leaks.



- Remove the starter motor cover.
- Unscrew and remove the stud bolt.
- Disconnect the ground leads.



- Disconnect the starter motor connectors.



- Disconnect the stand sensor connector and release it from the clamps.



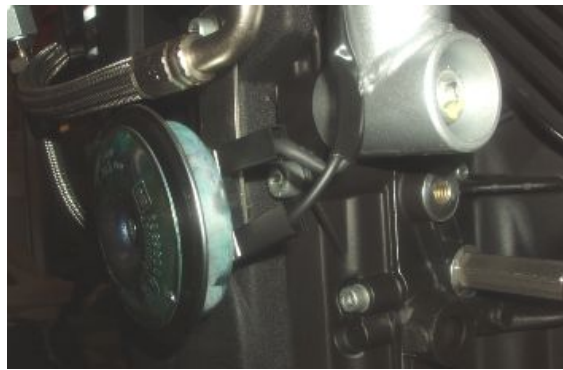
- Slide off the gearbox oil breather pipe.



- Disconnect the neutral sensor connector.



- Disconnect the horn connectors.



- Operating from both sides, undo and remove the screw fixing the oil radiator to the chassis.



- Loosen the clamp and slide off the oil pipe from the blow-by tank.

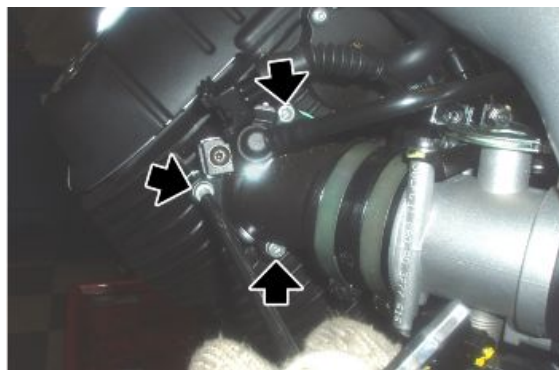
- Working on both sides, release the clamp and slide off the engine oil breather pipe.



- Working on both sides disconnect the injector connectors.



- Working from both sides, undo and remove the three inlet manifold screws.
- Collect the gasket.



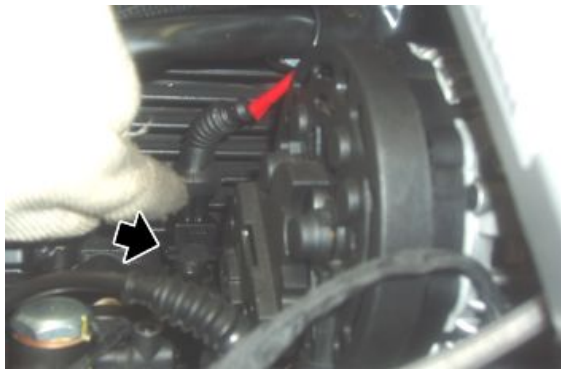
- Disconnect the alternator connectors.



- Disconnect the engine temperature sensor connector



- Disconnect the engine oil pressure sensor connector.



- Disconnect the revolution sensor connector.



- Remove the fairing under the oil sump.
- Support the vehicle with the engine service stand.
- Undo and remove the screws fixing the centre stand plates.
- Remove the centre stand.



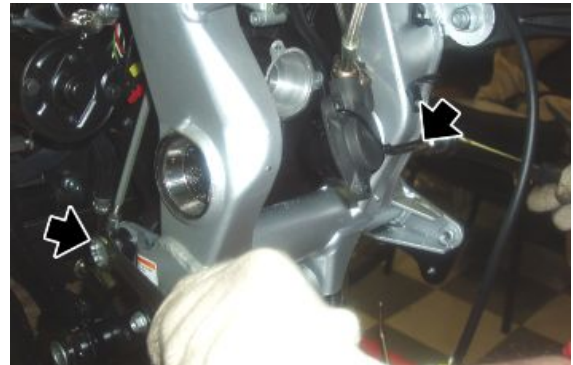
- Working on both sides, unscrew and remove the front screw and collect the washer.



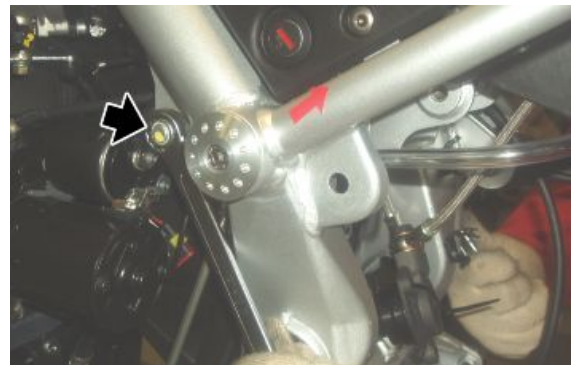
- Operating from both sides, undo and remove the upper engine fixing nut on the internal side of the chassis.



- Unscrew and remove the engine lower fixing nut and collect the washer.
- Remove the lower bolt and collect the washer.



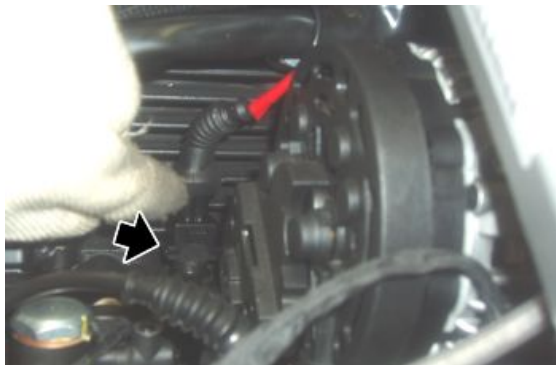
- Unscrew and remove the upper nut fixing the engine and collect the washer.
- Remove the upper pin and collect the washer.



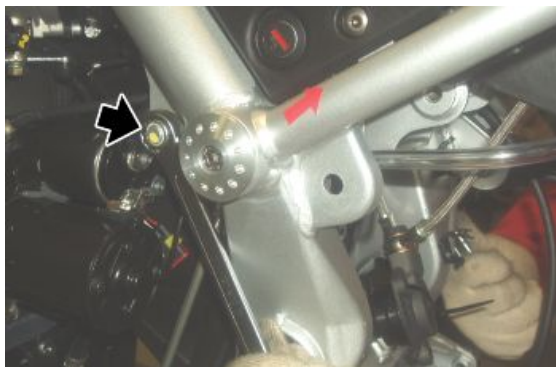
- Lower the engine completely.
- Lift the rear part of the vehicle.
- Release the front belts.
- Hold the rear part of the vehicle, remove the chassis from the engine.

Installing the engine to the vehicle

- Place the vehicle chassis over the engine with the gear.
- From the back, secure the chassis with belts attached to a hoist.
- From the front, secure the vehicle with belts attached to the handlebar and fixed to the work bench.
- Lift the engine placing it in position.
- Connect the oil pressure sensor connector.



- Working from the left side, fit the engine upper bolt with the washer.
- From the opposite side, fit the washer and screw the nut.



- Working on both sides, insert the washer and screw the screw without tightening it.



- Working from the left side, fit the engine lower bolt with the washer.
- From the opposite side, fit the washer and tighten the nut.



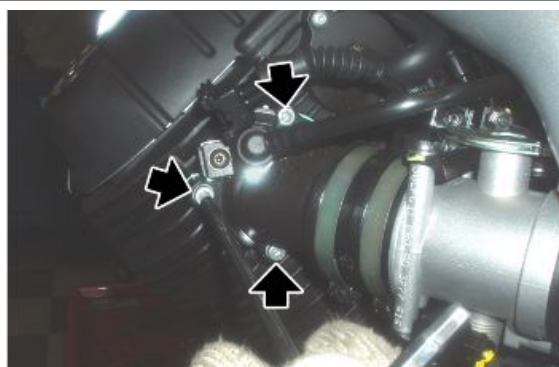
- Operating from both sides, tighten the upper engine fixing nut on the internal side of the chassis.



- Fit the centre stand.
- Operating from both sides, tighten the screws fixing the centre stand plates.
- Remove the engine service stand from under the oil sump.



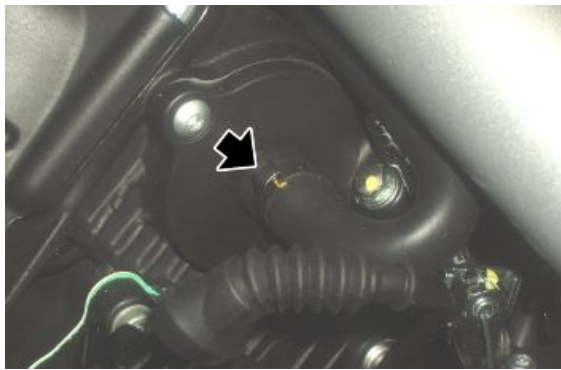
- Working from both sides, place the inlet manifold fitting a new gasket between the manifold and head.
- Fasten the inlet manifold with the three screws.



- Connect the stand sensor connector and fix it to the chassis with new clamps.



- Insert the oil breather pipe and fasten it with a new clamp.



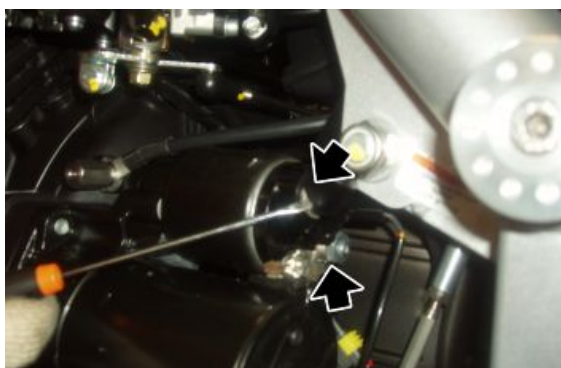
- Fit the gearbox oil breather pipe.



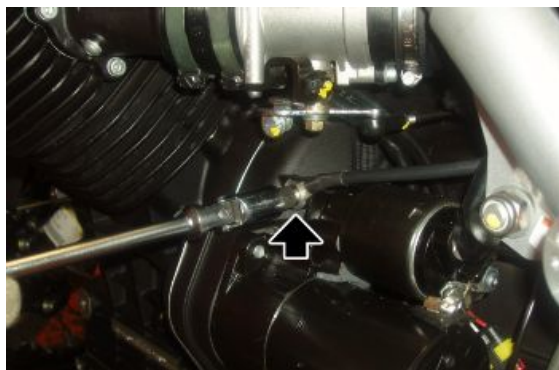
- Fit the clutch control cylinder.
- Tighten the three screws.



- Connect the starter motor connectors.



- Connect the ground leads and tighten the stud bolt.
- Fit the starter motor cover.
- Tighten the screws.



- Connect the neutral sensor connector.



- Connect the alternator connectors.



- Connect the revolution sensor connector.



- Connect the horn connectors.



- Connect the engine temperature sensor connector.



- Place the oil radiator.
- Tighten the two screws.



- Place the fork with cardan shaft and the rear wheel.
- Working on both sides, connect the injector connectors.
- Adjust the throttle grip cable clearance.
- Working from both sides, connect the spark plug tube.
- Install the fuel tank.
- Fit the saddle.
- Install the complete exhaust.



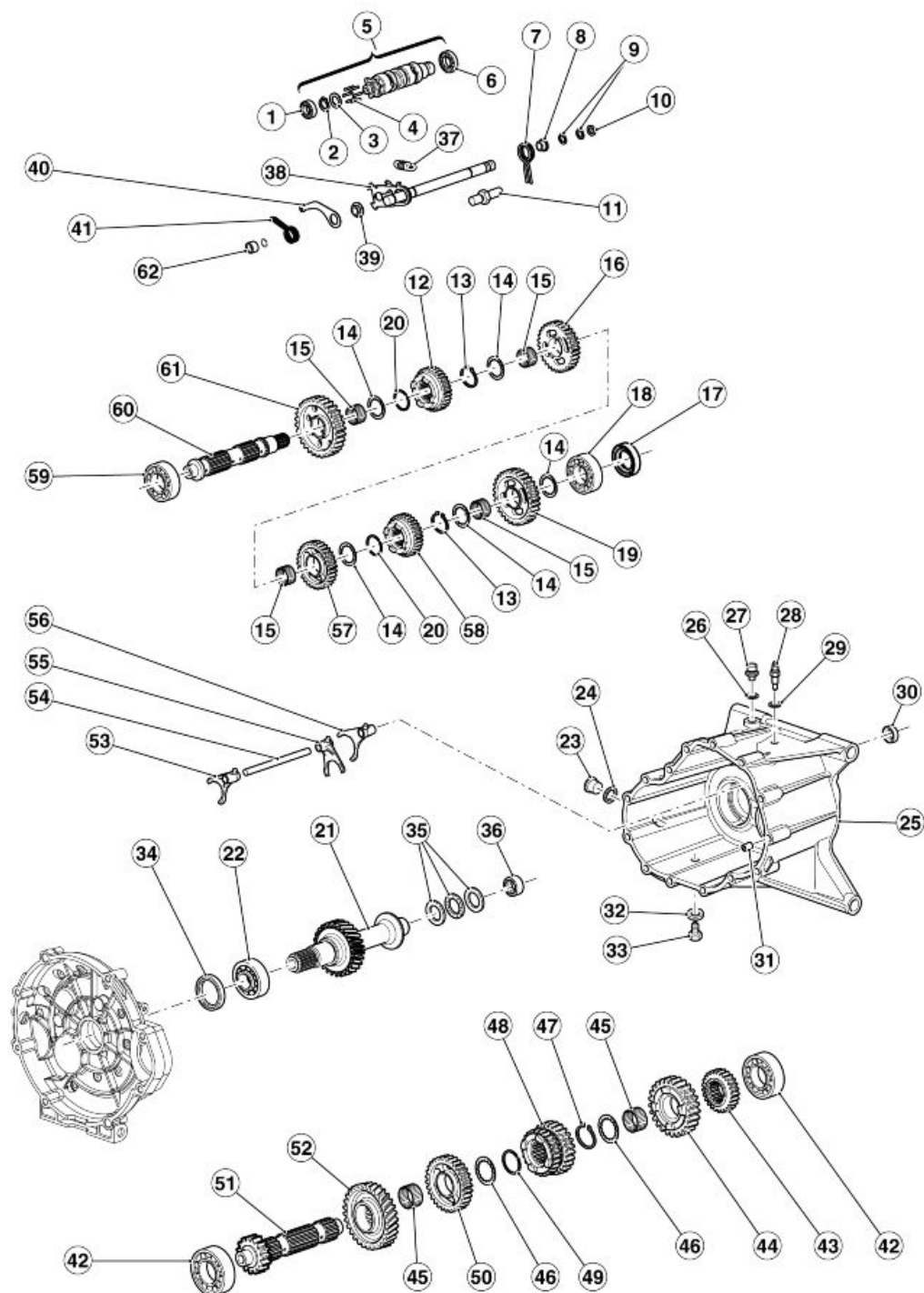
INDEX OF TOPICS

ENGINE

ENG

Gearbox

Diagram



Key:

- 1. Ball bearing

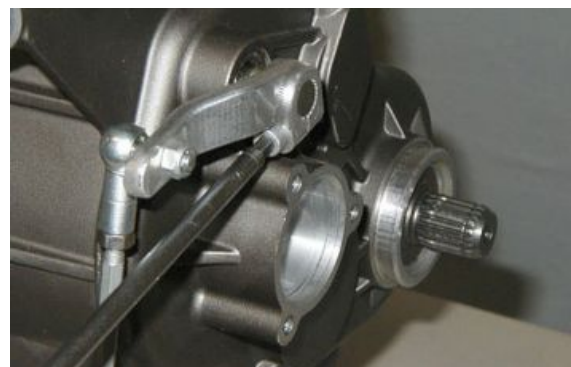
2. Circlip
3. Thickness
4. Pin
5. Complete desmodromic
6. Ball bearing
7. Spring
8. Spacer
9. Circlip
10. Fifth wheel
11. Linking pin
12. Gear
13. Circlip
14. Thrust washer
15. Ball bearing cage
16. Gear
17. Sealing ring
18. Ball bearing
19. Gear
20. Circlip
21. Clutch shaft
22. Ball bearing
23. Oil plug
24. Washer
25. Gearbox
26. Aluminium washer
27. Breather cap
28. Neutral sensor
29. Gasket
30. Sealing ring
31. Bushing
32. Gasket
33. Oil drainage plug
34. Sealing ring
35. Thrust bearing
36. Roller bearing
37. Spring
38. Complete pre-selector
39. Bushing

- 40.Index lever
- 41.Spring
- 42.Ball bearing
- 43.Gear
- 44.Gear
- 45.Ball bearing cage
- 46.Thrust washer
- 47.Circlip
- 48.Gear
- 49.Circlip
- 50.Gear
- 51.Main shaft
- 52.Transmission gear
- 53.Fork (5th - 1st)
- 54.Fork shaft
- 55.Fork (3rd - 4th)
- 56.Fork (2nd - 4th)
- 57.Gear
- 58.Gear
- 59.Ball bearing
- 60.Transmission shaft
- 61.Gear
- 62.Spacer

Gearbox

Removing the gearbox

- Remove the starter motor.
- Make sure the transmission is in idle.
- Undo and remove the screw and remove the gearbox lever.



- Unscrew and remove the gearbox oil filler cap.



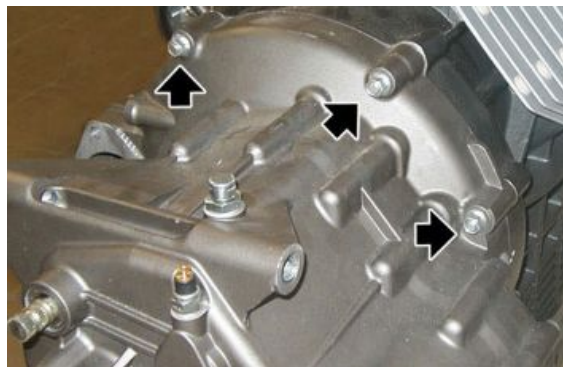
- Place a container of suitable capacity under it, unscrew and remove the cap and then bleed all gearbox oil.



- Loosen and turn the oil pipe fitting on the sump.



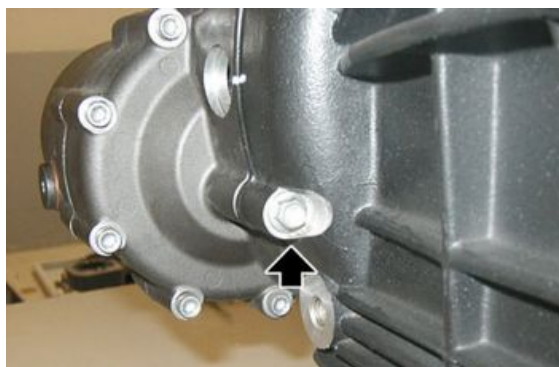
- Undo and remove the three screws.



- Undo and remove the two screws.



- Undo and remove the screw.



- Remove the gearbox.



See also

[Removing the starter motor](#)
[Replacement](#)

Gearbox shafts

Disassembling the gearbox

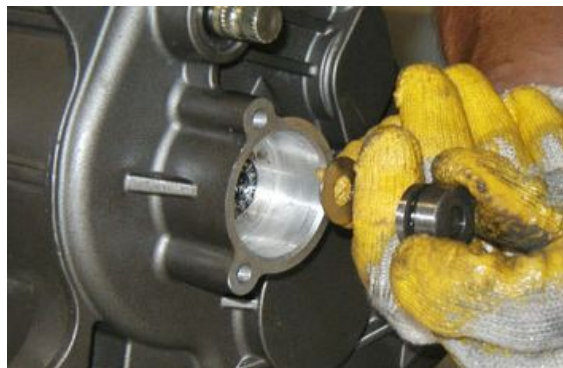
- Remove the gearbox.



- Unscrew and slide off the odometer gear and collect the abutment washer that is inside the gearbox.



- From the outside, slide off the thrust cylinder and collect the O-Ring and the washer.



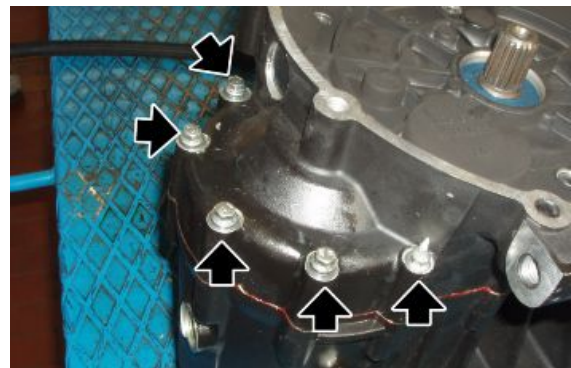
- Remove the thrust bearing and the washer.



- Slide off the rod with the two bushings.



- Undo and remove the five external screws.



- Place the gearbox on the specific gearbox support tool and on a vice.

Specific tooling

05.90.25.30 Gearbox support

- Undo and remove the nine internal screws.



- Open the gearbox using the specific tool.

Specific tooling

05.91.25.30 Gearbox opening





-
- Remove the bearings from the gearbox if necessary.



-
- Release the spring.



-
- Pressing the selector, slide off the whole transmission lever.
 - Use rubber bands to tie down the transmission shaft unit and extract it.



- Once the transmission shaft unit is in on a bench, remove the rubber bands, being careful with the group.
- Detach the shafts and label the forks before removal.



- Remove the forks and collect the shaft.





- Replace bearings if necessary and remove the clutch shaft.

**See also**

[Removing the gearbox](#)

Removing the primary shaft

- Remove the main shaft.
- Operate on the main shaft from the second gear side.



- Remove the gear of the second gear and collect the ball bearing cage.



- Remove the gear of the sixth gear and collect the shoulder washer.



- Remove the circlip.



- Remove the gear of the third and fourth gears.



- Remove the circlip and collect the shoulder washer.



- Remove the gear of the fifth gear and collect the ball bearing cage.



- Heat the shaft with a specific heater and remove the helical transmission gear.



Removing the secondary shaft

- Remove the transmission shaft.
- Operate on the shaft from the grooved side.



- Remove the shoulder washer.



- Remove the gear of the second gear and collect the ball bearing cage and the shoulder washer.



- Remove the circlip.



- Remove the gear of the sixth gear.



- Remove the circlip and collect the shoulder washer.



-
- Remove the gear of the fourth gear and collect the ball bearing cage.



-
- Remove the gear of the third gear and collect the ball bearing cage and the shoulder washer.



-
- Remove the circlip.



-
- Remove the gear of the fifth gear.



- Remove the circlip, the shoulder washer and remove the gear of the first gear, collect the ball bearing cage.
- Remove the bearing if necessary.

**See also**

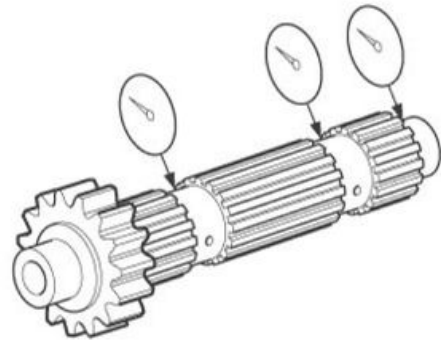
[Disassembling the gearbox](#)

Checking the primary shaft

Measure coaxiality of the main shaft with a dial gauge and a centring device and replace it if not complying with specifications.

Characteristic**Shaft coaxiality limit**

0.08 mm (0.0031 in)



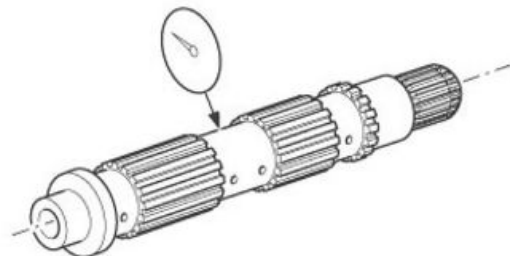
Check transmission gears for signs of pitting and wear and replace damaged gears if necessary.
Check the gear fitting teeth for cracks, damage and wear and replace those damaged if necessary.
Check the transmission gears movement and, if it is not regular, replace the damaged part.

Checking the secondary shaft

Measure the coaxiality of the transmission shaft with a dial gauge and a centring device and replace it if not complying with specifications.

Characteristic**Shaft coaxiality limit**

0.08 mm (0.0031 in)



Check transmission gears for signs of pitting and wear and replace damaged gears if necessary.
Check the gear fitting teeth for cracks, damage and wear and replace those damaged if necessary.
Check the transmission gears movement and, if it is not regular, replace the damaged part.

Checking the desmodromic drum

Check gear drum for damage, scratches and wear and replace the desmodromic if necessary.

Check the desmodromic segment «3» for damage and wear and replace it if necessary.

Check the desmodromic bearing «4» for damage and cracks and replace it if necessary.

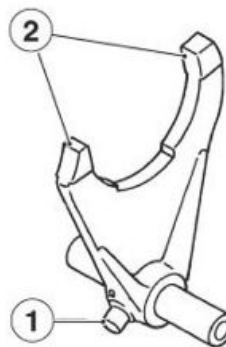


Checking the forks

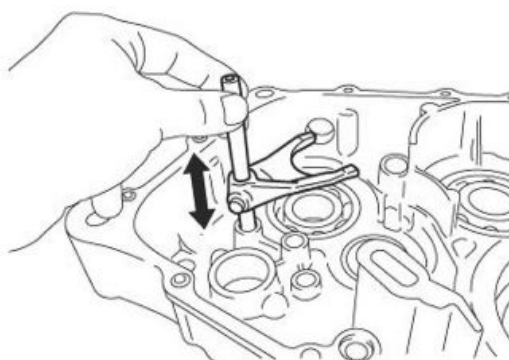
NOTE

THE FOLLOWING PROCEDURE IS VALID FOR ALL GEARBOX FORKS.

- Check the transmission fork cam roller «1» and the transmission fork tooth «2» for damage, deformation and wear.
- Replace the transmission fork if necessary.



- Check the transmission fork movement and if it is not regular, replace the transmission forks.



See also

[Disassembling the gearbox](#)

Fitting the primary shaft

NOTE

TO REFIT, FOLLOW THE SAME INSTRUCTIONS AS FOR REMOVAL BUT IN REVERSE ORDER. REMEMBER TO REPLACE ALL SEALING RINGS, CIRCLIPS AND SAFETY RINGS PREVIOUSLY REMOVED.

See also

[Removing the primary shaft](#)

Fitting the secondary shaft

NOTE
TO REFIT, FOLLOW THE SAME INSTRUCTIONS AS FOR REMOVAL BUT IN REVERSE ORDER. REMEMBER TO REPLACE ALL SEALING RINGS, CIRCLIPS AND SAFETY RINGS PREVIOUSLY REMOVED.

See also
[Removing the secondary shaft](#)

Assembling the gearbox

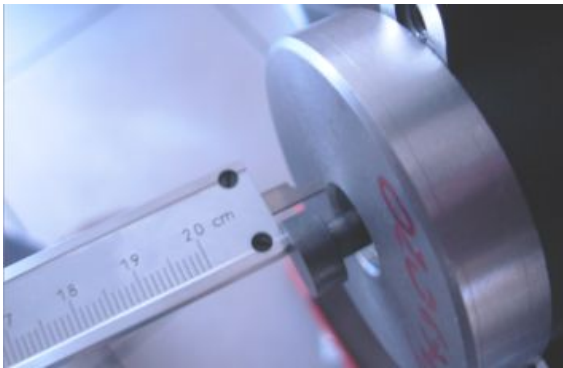
NOTE
TO REFIT, FOLLOW THE SAME INSTRUCTIONS AS FOR REMOVAL BUT IN REVERSE ORDER. REMEMBER TO REPLACE ALL SEALING RINGS, CIRCLIPS AND SAFETY RINGS PREVIOUSLY REMOVED.

If the clutch is replaced, measure the length of the clutch control rod in order to use the correct rod.
Measure as follows:

- Fit the new clutch on the crankshaft.
- Fit the clutch control bowl in the gearbox.



- Fit the gearbox on the engine block.
- Fit the tool in the gearbox to determine the clutch control rod length.
- Measure rod protrusion using a depth gauge (see picture).
- According to the value found, select the correct rod based on the following table:



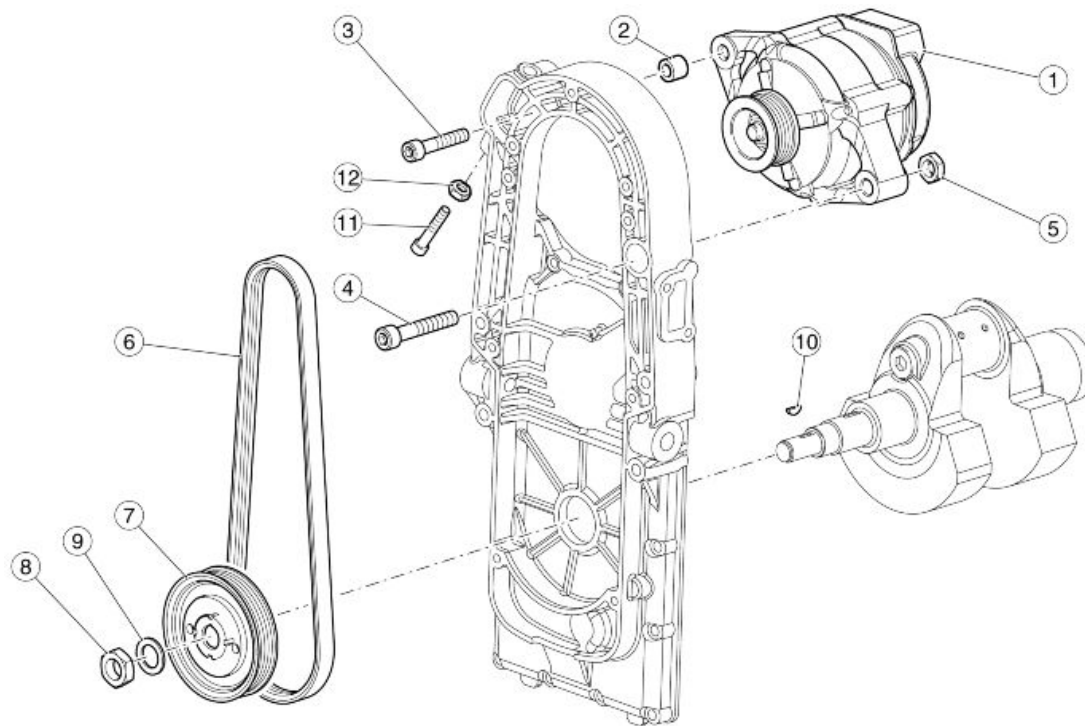
Specific tooling

020678Y Tool for clutch rod checking

CLUTCH CONTROL ROD SELECTION

Specification	Desc./Quantity
Protrusion: 9.8 - 11.2 mm (0.386 - 0.441 in)	Clutch control rod length (code 976593) = 183 mm (7.205 in)
Protrusion: 8.3 - 9.7 mm (0.327 - 0.382 in)	Clutch control rod length (code 976594) = 184.5 mm (7.264 in)
Protrusion: 6.8 - 8.2 mm (0.268 - 0.323 in)	Clutch control rod length (code 976595) = 186 mm (7.323 in)
Protrusion: 5.3 - 6.7 mm (0.209 - 0.264 in)	Clutch control rod length (code 976596) = 187.5 mm (7.382 in)

See also
[Disassembling the gearbox](#)

Generator**Key:**

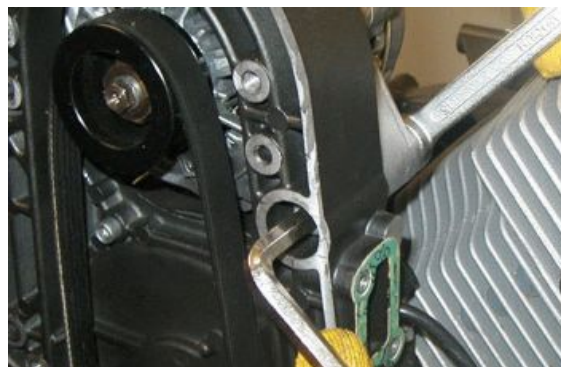
- 1. Alternator
 - 2. Spacer
 - 3. Screw
 - 4. Screw
 - 5. Nut
 - 6. Belt
 - 7. Generator control pulley
 - 8. Nut
 - 9. Washer
 - 10. Magneto flywheel cotter
 - 11. Screw
 - 12. Nut
-

Removing the generator

- Remove the fuel tank.
- Remove the control unit from its seat.
- Disconnect the alternator connectors.
- Undo and remove the five screws and collect the bushings.



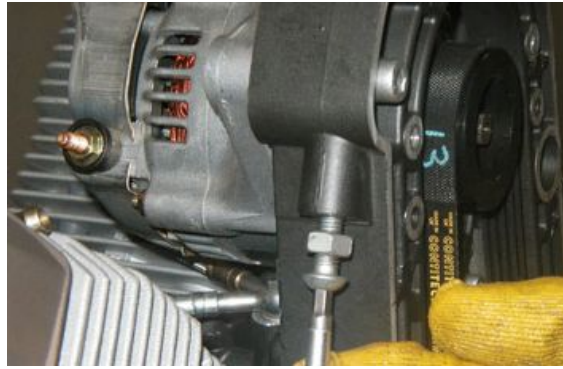
- Remove the cover.
- Unscrew the nut and collect the screw.



- Loosen the screw.



- Loosen the nut and undo the set screw so that the alternator slides down.



- Completely loosen and remove the screw.



- Remove the belt and the alternator with pulley.

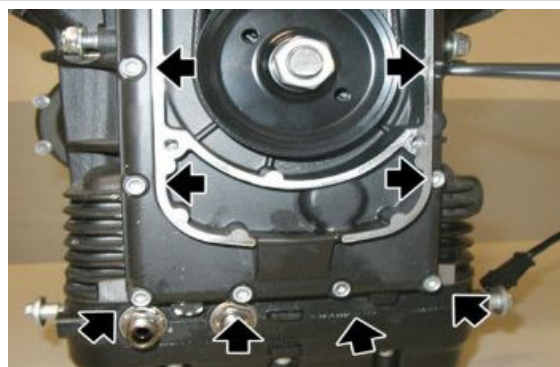


- Using a compressed air gun, unscrew and remove the nut and collect the spacer.
- Remove the lower pulley.





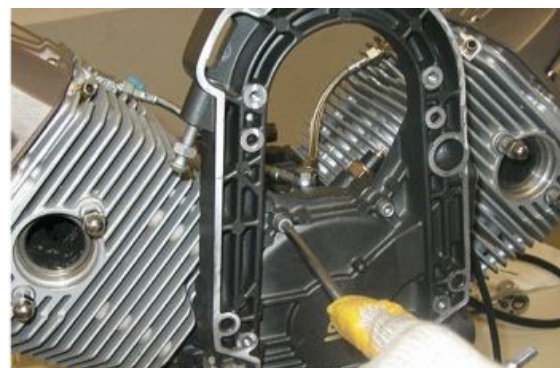
- Undo and remove the eight screws.



- Undo and remove the two screws.



- Undo and remove the two screws.



- Remove the alternator frame.
- Remove the sealing ring if necessary.



See also

Fuel tank

Tensioning the belt

- Operating from both sides, undo and remove the screw fixing the oil radiator to the chassis.



- Undo and remove the radiator lower screw and collect the washer.



- Undo and remove the horn fixing screw.



- Undo and remove the five screws fixing the alternator belt cover.
- Remove the oil radiator lower support bracket and the alternator belt cover.

Locking torques (N*m)

Alternator belt cover screw (radiator bracket retainer) TCEI M6x40 (2) 10 Nm (7.38 lbf ft) Alternator belt cover screw - TCEI M6x16 (4) 10 Nm (7.38 lbf ft)



- Loosen the screw.



- Loosen the nut and undo the set screw so that the alternator slides down.



- Using the belt tensioning tool, tension the belt to the prescribed torque.
- Tighten the set screw.
- Tighten the lock nut.

Specific tooling

020677Y Alternator belt tensioner, Belt tensioning lever

Locking torques (N*m)

Belt tension 50 Nm (36.88 lbf ft)



Installing the generator

- If the sealing ring has been previously removed, replace it using the punch of the timing system cover sealing ring.

Specific tooling

05.92.72.30 Timing system cover sealing ring punch



- Place the bolt and the pin in the generator cover.



- Replace the gasket and place the alternator frame using the front cover insertion cone.
- Remove the insertion cone afterwards.

Specific tooling

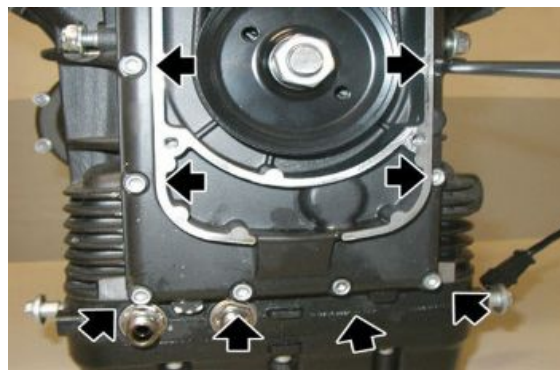
05.91.17.30 Front cover insertion cone



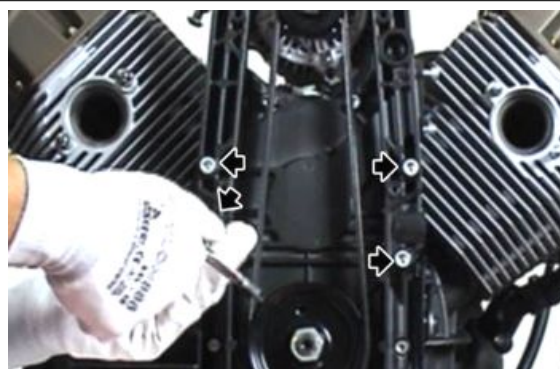
- Tighten the two screws.



- Tighten the eight lower screws.
- Operating diagonally and in stages, tighten the ten fixing screws on the alternator fitting.



- Tighten the four screws, operating diagonally and in stages.



- Position the lower pulley and the spacer.
- Tighten the nut to the prescribed torque.



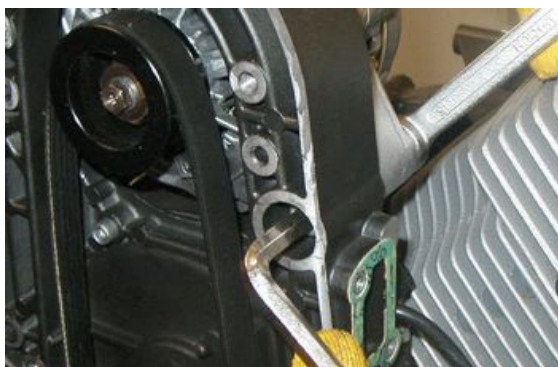
- Position the alternator and the timing system belt.



- Position the screw and pre-tighten it.



- Position the screw and tighten the nut.



- Using the belt tensioning tool, tension the belt to the prescribed torque and tighten the set screw.
- Remove the belt tensioning tool.
- Lock the set screw in position by screwing the lock nut.

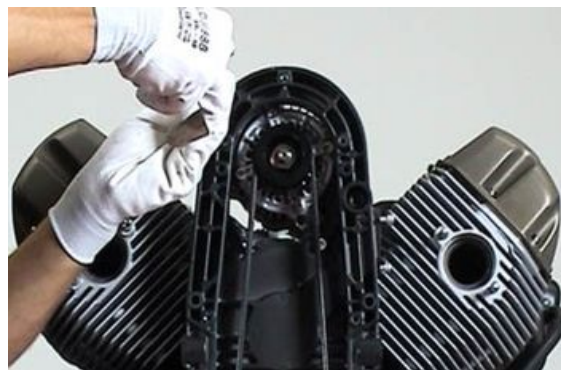


Specific tooling

020677Y Alternator belt tensioner, Belt tensioning lever



- Tighten the alternator fixing screws.



- Place the alternator belt cover.
- Tighten the five screws operating diagonally and in stages.



Starter motor

Removing the starter motor

- Undo and remove the two screws and collect the washers.



- Slide off the starter motor.



Clutch side

Disassembling the clutch

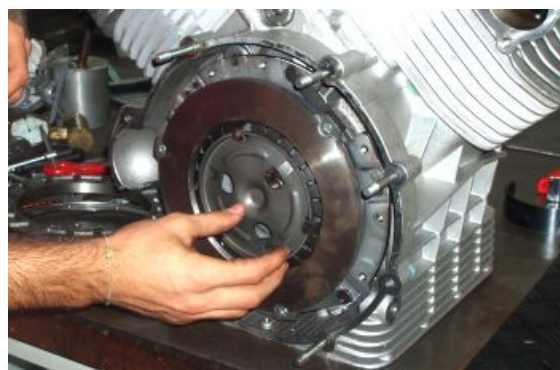
- Remove the complete gearbox.
- Undo and remove the six screws.
- Remove the start-up crown gear.



- Remove the clutch bell and the friction disc.



- Remove the Seeger ring.
- Remove the clutch pressure plate.

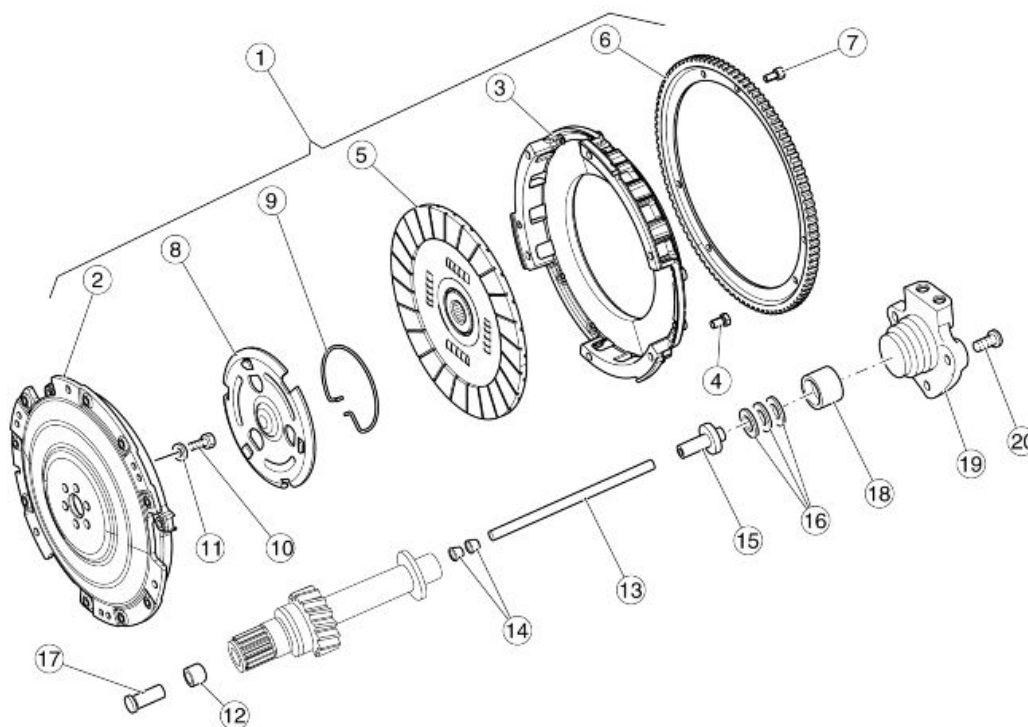


- Undo and remove the six screws and collect the belleville springs.
- Remove the clutch disc.



See also

[Removing the gearbox](#)

**Key:**

1. Complete clutch
2. Clutch
3. Clutch bell
4. TCEI screw
5. Clutch disc
6. Crown
7. TCEI screw
8. Clutch pressure plate
9. Ring
10. TE flanged screw
11. Conical washer
12. Bushing
13. Rod
14. Bushing
15. Intermediate body
16. Thrust bearing
17. Clutch control bowl
18. Thrust cylinder
19. Clutch control cylinder
20. TE flanged screw

Checking the clutch actuator

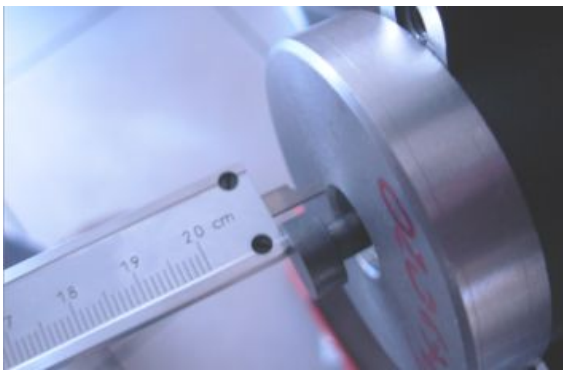
If the clutch is replaced, measure the length of the clutch control rod in order to use the correct rod.

Measure as follows:

- Fit the new clutch on the crankshaft.
- Fit the clutch control bowl in the gear-box.



- Fit the gearbox on the engine block.
- Fit the tool in the gearbox to determine the clutch control rod length.
- Measure rod protrusion using a depth gauge (see picture).
- According to the value found, select the correct rod based on the following table:



Specific tooling

020678Y Tool for clutch rod checking

CLUTCH CONTROL ROD SELECTION

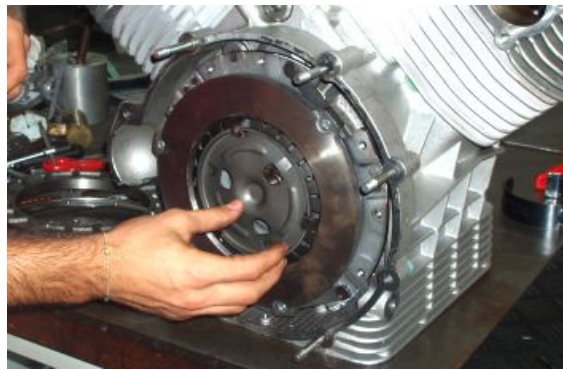
Specification	Desc./Quantity
Protrusion: 9.8 - 11.2 mm (0.386 - 0.441 in)	Clutch control rod length (code 976593) = 183 mm (7.205 in)
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Protrusion: 5.3 - 6.7 mm (0.209 - 0.264 in)	Clutch control rod length (code 976596) = 187.5 mm (7.382 in)

Assembling the clutch

- Lock crankshaft rotation with the crankpin facing upwards.
- Place the clutch disc with the reference facing upwards.
- Fasten the clutch disc on the crankshaft with the six screws, Loctite 243 and the belleville springs.



- Place the clutch pressure plate.
- Fit the tool to centre and compress the plate.
- Fully tighten the two centring tool screws.

Specific tooling**020672Y Clutch spring centre and pusher**

- Once the centring tool is fitted, lock the plate with the snap ring.
- Undo and remove the two screws fixing the tool.
- Remove the special tool.



- Place the friction disc; centre it.



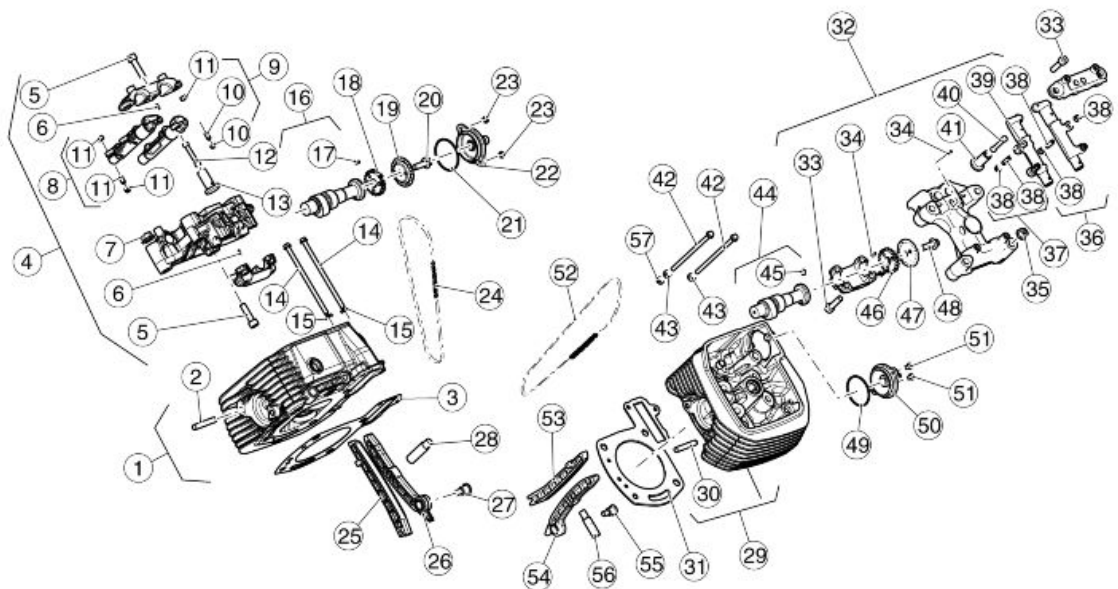
- Place the clutch bell with the reference facing upwards.



- Place the start-up crown gear with the reference facing upwards.
- Tighten the six screws to the prescribed torque operating diagonally and in stages.



Head and timing



Key:

- Right cylinder head

2. Stud bolt
3. Cylinder head gasket
4. Right rocking lever support
5. Screw
6. Pin
7. Nut
8. Right exhaust, left intake rocking lever
9. Left exhaust, right intake rocking lever
10. Set screw
11. Nut
12. Rocking lever rod
13. Tappet bowl
14. Flanged screw
15. Spacer
16. Camshaft
17. Pin
18. Timing system gear
19. Breather plate
20. TE flanged screw
21. O-ring
22. Complete breather cover
23. TBEI screw
24. Timing system chain
25. Chain guide slider
26. Chain tensioner pad
27. Chain tensioner screw
28. Right chain tensioner
29. Left cylinder head
30. Stud bolt
31. Cylinder head gasket
32. Left rocking lever support
33. Screw
34. Pin
35. Nut
36. Right exhaust, left intake rocking lever
37. Left exhaust, right intake rocking lever
38. Set screw
39. Nut

- 40. Rocking lever rod
- 41. Tappet bowl
- 42. Flanged screw
- 43. Spacer
- 44. Camshaft
- 45. Pin
- 46. Timing system gear
- 47. Breather plate
- 48. TE flanged screw
- 49. O-ring
- 50. Complete breather cover
- 51. TBEI screw
- 52. Timing system chain
- 53. Chain guide slider
- 54. Chain tensioner pad
- 55. Chain tensioner screw
- 56. Left chain tensioner
- 57. Spacer

Removing the head cover

NOTE

THE OPERATIONS DESCRIBED BELOW REFER TO ONE HEAD REMOVING ONLY BUT APPLY TO BOTH HEADS.

- Disconnect the spark plug tube.



- Unscrew and remove the four head cover fixing screws and collect the sealing O-rings.
- Remove the head cover together with the gasket.



Removing the cylinder head

CAUTION

WHEN REMOVING THE COMPONENTS, MARK THE POSITION OF EACH PART VERY CAREFULLY IN ORDER TO PLACE THEM IN THEIR ORIGINAL POSITION UPON FITTING.

- Remove the head cover.
- Unscrew and remove the two screws
- Remove the cap.



- Unscrew and remove the screw.
- Remove the timing system upper gear bulkhead.



For the right head:

- Unscrew and remove the chain tensioner cap.
- Remove the right chain tensioner.



For the left head:

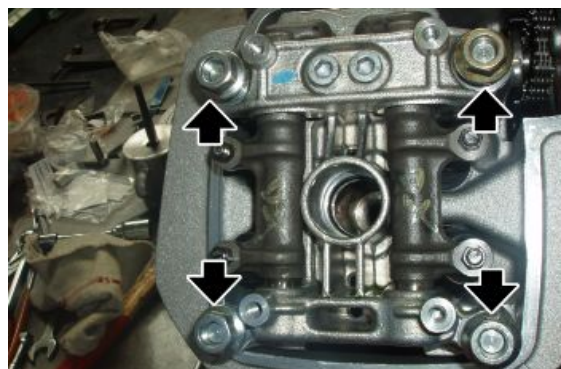
- Unscrew and remove the screw and the washer.
- Relief oil pressure from the left chain tensioner.



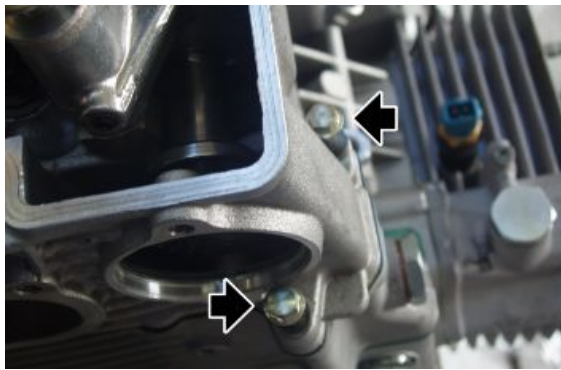
- Slide off the timing system gear from the chain to remove it from the camshaft.



- Unscrew and remove the four nuts on the stud bolts.
- Remove the complete cam cap.



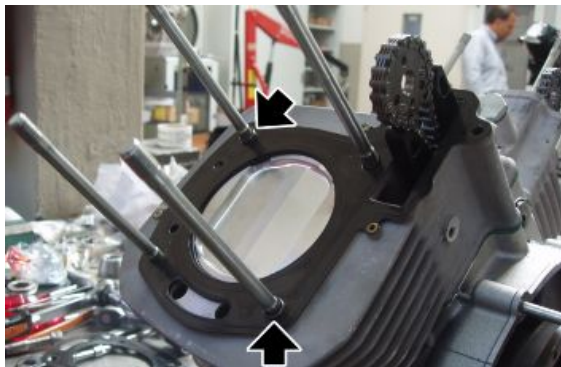
- Unscrew and remove the two screws.
- Remove the head.



- Fit the timing system upper gear back to the chain.
- Fit the chain tensioner cap temporarily and keep the chain taut on the service shaft.



- Collect the two head dowel pins.
- Collect the gasket between the head and the cylinder.



See also

[Removing the head cover](#)

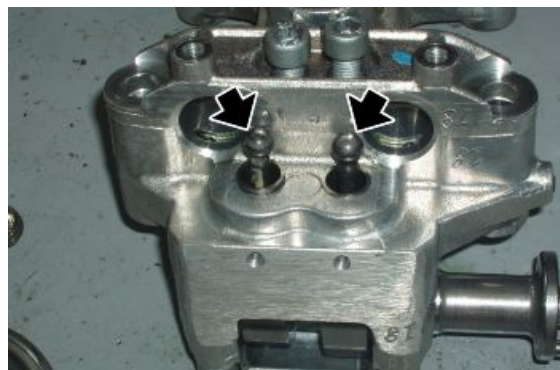
Cylinder head

Removing the overhead camshaft

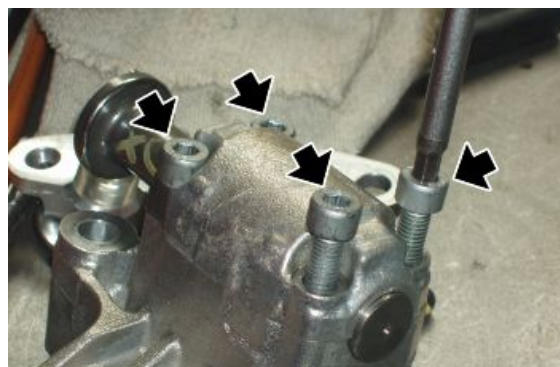
CAUTION

WHEN REMOVING THE COMPONENTS, MARK THE POSITION OF EACH PART VERY CAREFULLY IN ORDER TO PLACE THEM IN THEIR ORIGINAL POSITION UPON FITTING.

- Remove the two rocking levers from the cam cap.
- Remove the two rods.



- Undo and remove the four screws.
- Remove the U-bolt.



- Remove the camshaft.



- Remove the bowls from the cam cap, and mark their position so as not interchange them when refitting.



See also

[Removing the rocker arms](#)

Removing the rocker arms

CAUTION

WHEN REMOVING THE COMPONENTS, MARK THE POSITION OF EACH PART VERY CAREFULLY IN ORDER TO PLACE THEM IN THEIR ORIGINAL POSITION UPON FITTING.

- Remove the cam cap from the stud bolts.
- Undo and remove the two screws.
- Remove the U-bolt.



- Remove the two rocking levers from the cam cap.



See also

[Removing the cylinder head](#)

Removing the valves

- Remove the head.
- Place the special tool on the upper cap and at the centre of the head of the valve to be removed.

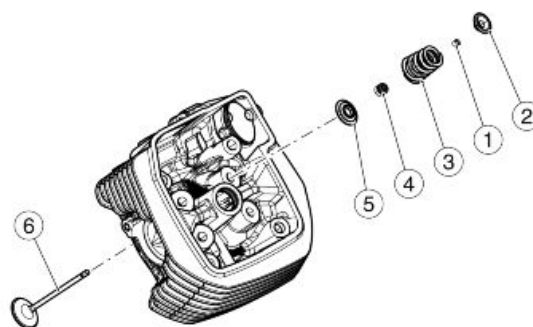
Specific tooling

10.90.72.00 Tool for valve removal and refitting

AP9100838 Tool for valve pressure plate



- Tighten the tool screw until fitted, and then hit the tool head (where the upper cap works) with a mallet so that the two cotters (1) get detached from the upper cap (2).
- Once the two cotters (1) are detached, screw these cotters until they can be slid off the valve seats; unscrew the tool and remove it from the head.
- Slide off the upper cap (2).
- Remove the spring (3).
- Remove the lower cap (5) and the valve guide oil seal (4), if necessary.
- Remove the valve (6) from inside the head.



Checking the valve guides

Use a punch to extract the valve guides from the heads.

The valve guides should be replaced only if the clearance between them and the stem cannot be eliminated by simply replacing the valves.

To refit the valve guides on the head, follow this procedure:

- Heat the head in an oven at about 60°C (140°F).
- Lubricate the valve guide.
- Fit the circlips.
- Press the valve guide with a punch.
- Use a reamer to bore the holes the valve stems slide through so that the inside diameter is at the prescribed value. The interference between the seat on the head and the valve guide must be 0.046 - 0.075 mm (0.0018 - 0.0030 in)

VALVE GUIDE COUPLING - VALVES (INLET)

Specification	Desc./Quantity
Valve guide inside diameter	5.0 ÷ 5.012 mm (0.19685 ÷ 0.19732 in)
Valve stem diameter	4.972 ÷ 4.987 mm (0.19574 ÷ 0.19633 in)
Fitting clearance	0.013 ÷ 0.040 mm (0.00051 ÷ 0.00157 in)

VALVE GUIDE COUPLING - VALVES (OUTLET)

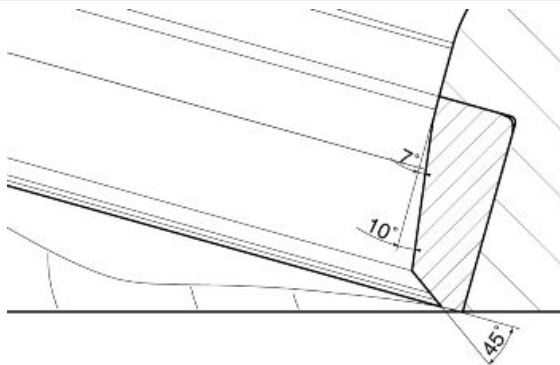
Specification	Desc./Quantity
Valve guide inside diameter	5.0 ÷ 5.012 mm (0.19685 ÷ 0.19732 in)
Valve stem diameter	4.960 ÷ 4.975 mm (0.19527 ÷ 0.19587 in)
Fitting clearance	0.025 ÷ 0.052 mm (0.00098 ÷ 0.00205 in)

Checking the cylinder head

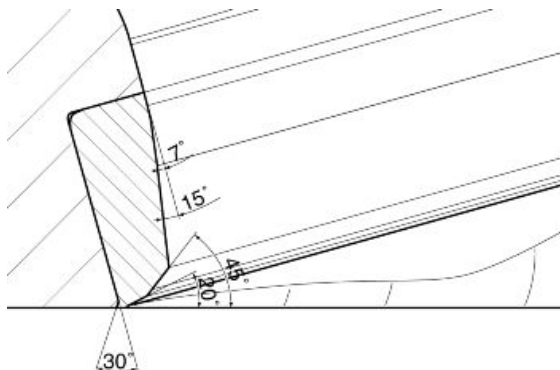
Check that:

- the faying surfaces with the cover and the cylinder are not scored or damaged, jeopardising a perfect sealing.
- Check that the tolerance between the valve guide holes and the valve stems is within the prescribed limits.
- Check the valve seats are in good conditions.

INLET VALVE SEAT DETAIL DRAWING



OUTLET VALVE SEAT DETAIL DRAWING



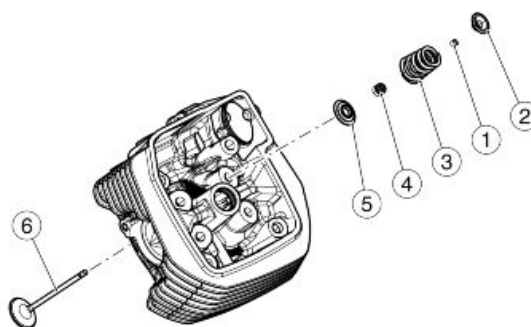
- If the width of the mark on the valve seat is larger than the prescribed limits, true the seats with a 45° milling cutter and then grind.
- Replace the head in case of excessive wear or damage.

Installing the valves

NOTE

THE FOLLOWING OPERATIONS REFER TO REMOVING ONLY ONE HEAD BUT APPLY TO BOTH HEADS.

- Place the valve guide oil seal (4) in the head.
- Place the lower cap (5).
- Place the valve (6) inside the head.
- Place the spring (3).
- Fit the upper cap (2).
- Place the two cotters (1) on the seats in the valves.
- By compressing the spring (3) with the special tool, fit the valve cotters.



Specific tooling

10.90.72.00 Tool for valve removal and refitting

AP9100838 Tool for valve pressure plate

- Remove the special tool



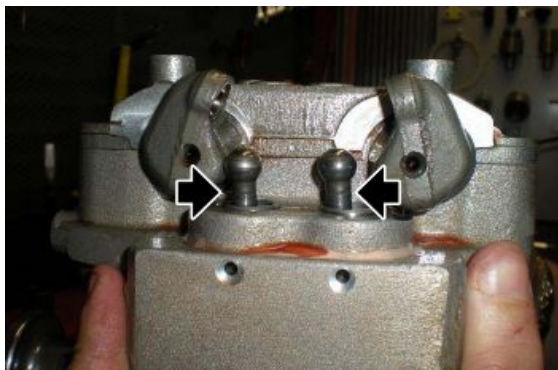
Installing the rocker arms

- Fit the camshaft.
- Fit the two rods.

WARNING

MAKE SURE THAT THE NOTCH ON THE DIPSTICK BODY FACES THE ROCKING LEVER.





- Place the two rocking levers in the cam tower seats.



- Place the U-bolt on the rocking levers making sure the two reference pins match the seats on the cam tower.
- Tighten the two screws operating diagonally and in stages.



See also

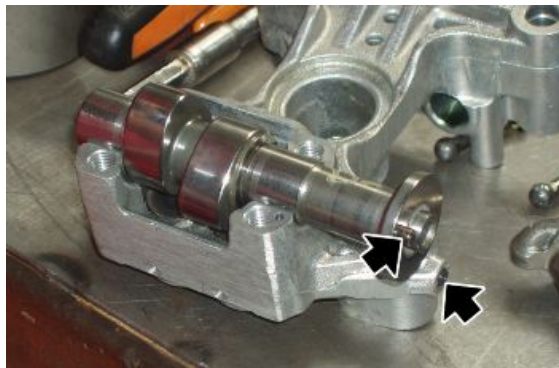
[Installing the overhead camshaft](#)

Installing the overhead camshaft

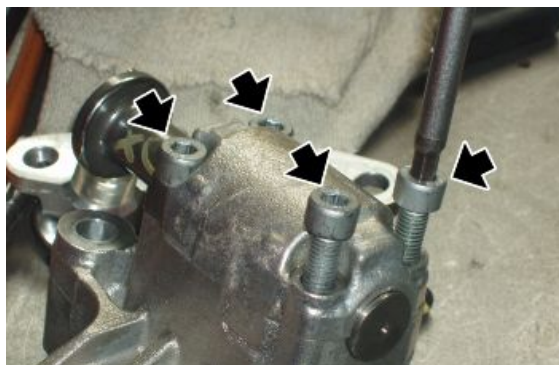
- Place the bowls in the cam tower, if those previously removed are refitted be careful not to interchange them.



- Place the camshaft with the gear seat on the dowel side.



- Place the U-bolt on the camshaft making sure the two reference pins match the seats on the cam tower.
- Tighten the four screws operating diagonally and in stages.



Timing

Removing the phonic wheel

- Remove the generator and the timing system cover.
- Unscrew and remove the nut and collect the washer.
- Remove the timing system gear on the service shaft.



- Remove the timing sensor and any shim washers.
- Remove the tone wheel.
- Remove the cotter and shim washer from the service shaft.

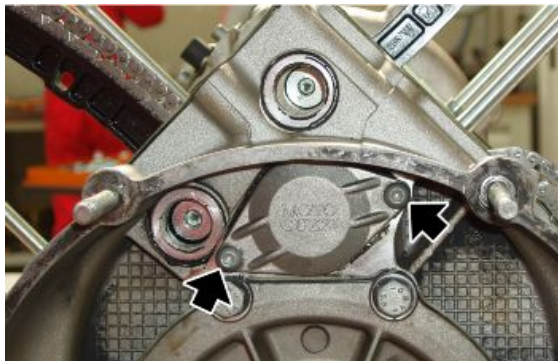


See also

[Removing the generator](#)

Service shaft removal

- Remove the tone wheel.
- Remove both cylinders.
- Undo and remove the two screws.
- Remove the service shaft closing cap.



- Mark the timing chains so as not to invert the direction of rotation upon fitting.
- Slide off the service shaft from the chains.
- Remove both chains.

**See also**[Removing the phonic wheel](#)

Installing the service shaft

- Place the service shaft bearing (if previously removed) on the crankcase.
- Fix it to the seat with the lock washer and screw.



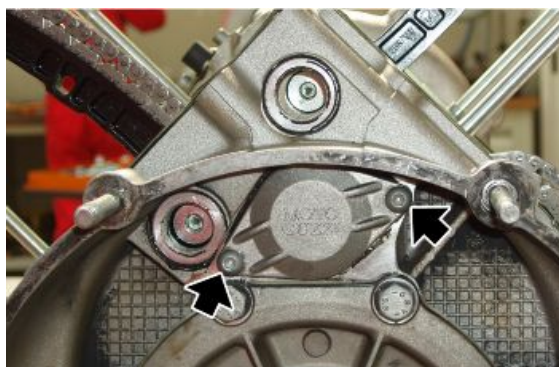
- Fit the timing chains according to the references marked at the removal phase.
- Lubricate the service shaft.
- Insert the service shaft in its crankcase seat by sliding it through the two chains.
- Fit each chain to the corresponding service shaft gear.



- Fit the roller cage and a new O-ring on the service shaft closing cap.



- Partially fit the service shaft closing cap.
- To screw the cap until it stops, use two M6 flanged screws larger than the original screws.
- Tighten the two M6 flanged screws operating in stages until the cap stops against the crankcase.
- Undo and remove the two M6 flanged screws.
- Tighten the cap with the two original TBEI screws.



Installing sliders

- Fit the crankshaft and the service shaft on the crankcase.
- Fit the fixed chain sliders and tighten the fixing screws.



- Tighten the chain caps with O-rings.
- The operations related to the movable chain sliders are described in the cylinder fitting section.



See also

[Installing the crankshaft](#)
[Installing the service shaft](#)

Cam timing

- Fit the crankshaft and the service shaft on the crankcase.
- Fit the cylinders.
- Turn the crankshaft until the left cylinder piston reaches the top dead centre (TDC).
- Fit the cotter and the shim washer on the service shaft.
- Fit the tone wheel with the chamfered side facing the crankcase on the service shaft.



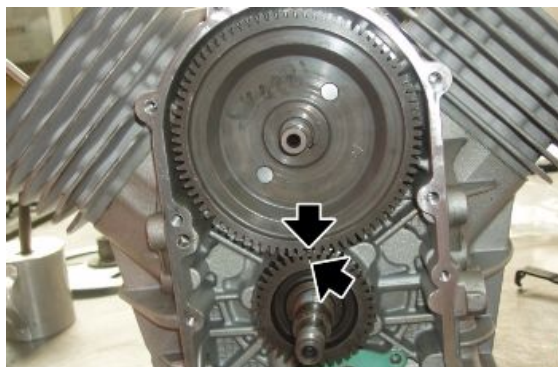
- Lock crankshaft rotation.
- Unscrew and remove the nut fixing the crankshaft gear.
- Remove the oil pump control gear.

Specific tooling

12.91.18.01 Tool to lock the flywheel and the starting ring gear



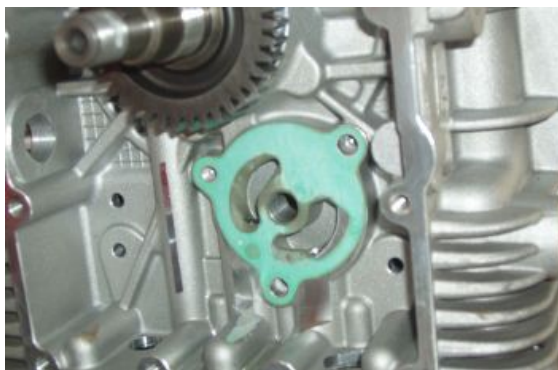
- Fit the timing system gear and align the reference with that on the crankshaft gear. Turn the crankshaft to align the two gears.



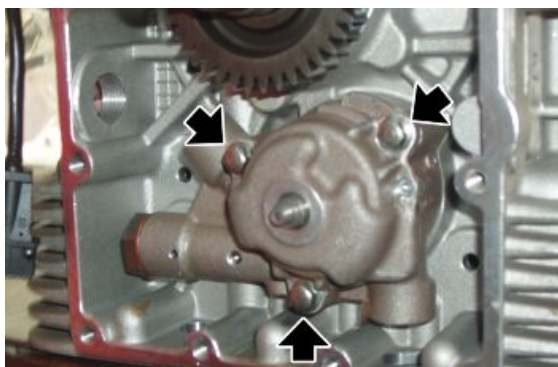
- After shimming the timing sensor properly, proceed to fit it.
- Fit the washer and tighten the timing system gear fixing nut of the service shaft.



- Place a new gasket between the crank-case and the oil pump.



- Place the oil pump.
- Tighten the three screws fixing the oil pump.



- Place the driving pin on the oil pump shaft.



- Place the gear on the oil pump shaft.



- Place the washer on the oil pump shaft.
- Tighten the nut to the specified torque.



- Place the oil pump control gear on the crankshaft and align its reference with that marked during the removal phase on the oil pump driven gear.
- Tighten the nut to the specified torque.



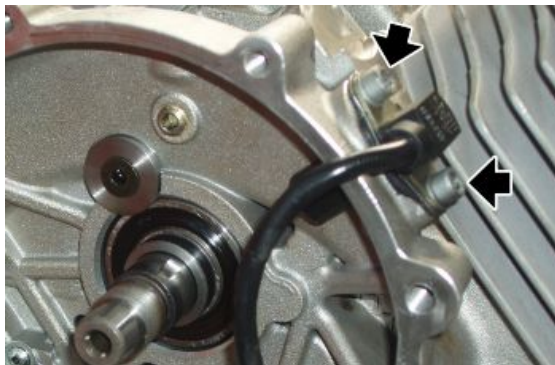
- Tighten the screw with the washer to the prescribed torque.

**See also**

[Installing the crankshaft](#)
[Installing the service shaft](#)
[Measuring air gap](#)

Measuring air gap

- Undo and remove the two screws and remove the sensor.

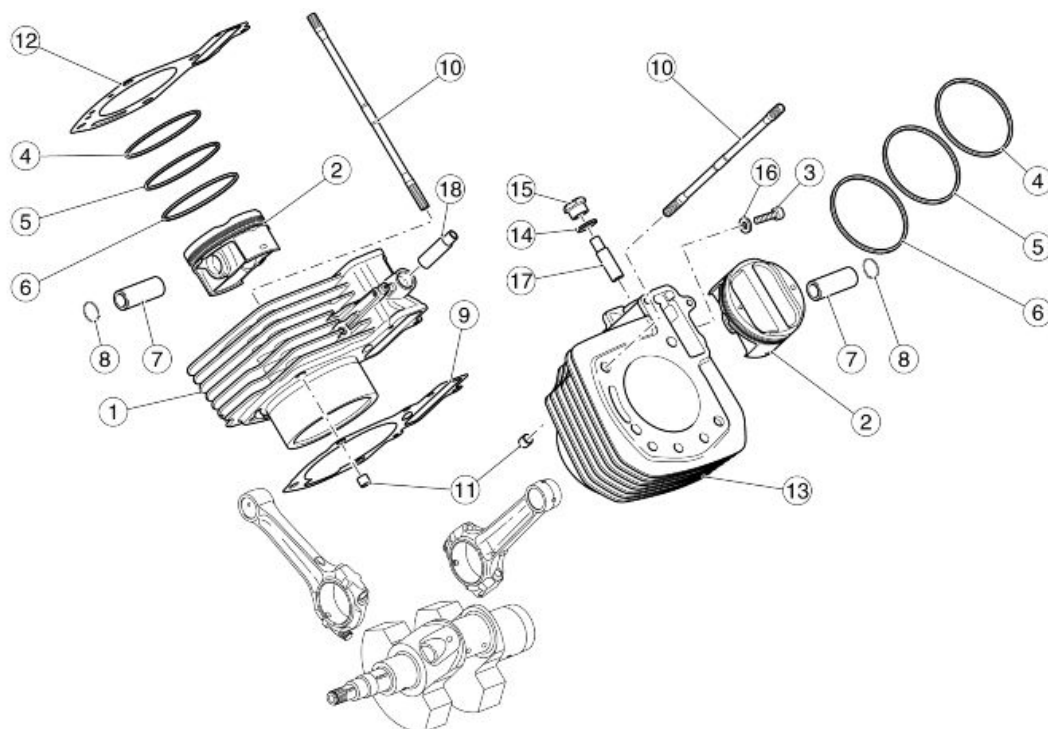


- Insert a suitable plain washer on the sensor and note its thickness.



- Place the sensor on the crankcase and move it until it makes contact with the tone wheel.
- Measure the clearance between the fixing plate and the crankcase with a thickness gauge. Subtract the plain washer value from this measurement to obtain the clearance between the sensor and the tone wheel.
- Remove the washer and fit the sensor after applying adequate sealing paste on the fixing plate, then tighten the screws to the prescribed torque.

Cylinder-piston assembly



Key:

1. Right cylinder
2. Piston
3. Screw
4. Top piston ring
5. Middle piston ring
6. Oil scraper piston ring
7. Pin
8. Snap ring
9. Cylinder base gasket
10. Stud bolt
11. Pin
12. Cylinder head gasket
13. Left cylinder
14. Washer
15. Chain tensioner cap
16. Washer
17. Left chain tensioner
18. Right chain tensioner

Removing the cylinder

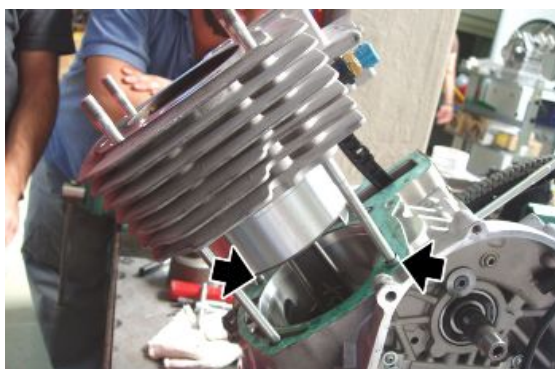
NOTE

THE OPERATIONS DESCRIBED BELOW REFER TO ONE HEAD REMOVING ONLY BUT APPLY TO BOTH HEADS.

- Remove the head, the gasket between the head and the cylinder and the two dowel pins.
- Slide off the movable chain slider.
- Remove the cylinder from the stud bolts.



- Remove the two dowel pins on the stud bolts.
- Remove the two gaskets between the crankcase and the cylinder.
- Cover the crankcase opening with a clean cloth.



See also

[Removing the cylinder head](#)

Disassembling the piston

NOTE

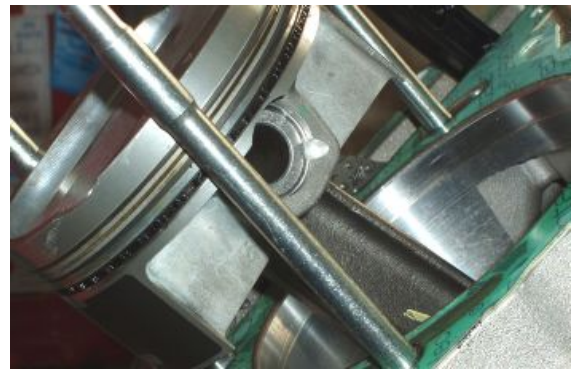
THE OPERATIONS DESCRIBED BELOW REFER TO ONE HEAD REMOVING ONLY BUT APPLY TO BOTH HEADS.

- Remove the cylinder.
- Cover the crankcase opening with a clean cloth.
- Release the snap ring.



- Remove the pin.

- Mark the piston crown on the exhaust side so as to remember the refitting position.
- Remove the piston.



Fitting the piston

NOTE

THE OPERATIONS DESCRIBED BELOW REFER TO REMOVING ONLY ONE HEAD BUT APPLY TO BOTH HEADS.

- The reference on the piston ring must be facing the piston crown.
- Fit the piston rings on the piston: - the oil scraper in the lower slot; - the thicker smooth ring in the intermediate slot; - the less thick smooth ring in the upper slot.
- The piston rings must be offset at 120° one from the other.
- Fit one of the two pin snap rings on the piston.
- Lock crankshaft rotation.



Specific tooling

12.91.18.01 Tool to lock the flywheel and the starting ring gear

- Fit the piston.

NOTE

CHECK THE PISTON DIRECTION ACCORDING TO THE REFERENCES MARKED ON THE PISTON CROWN. DO NOT ASSEMBLE PISTONS AND CYLINDERS OF DIFFERENT SELECTOR TYPES.

- Insert the pin.



- Insert the snap ring.

Specific tooling

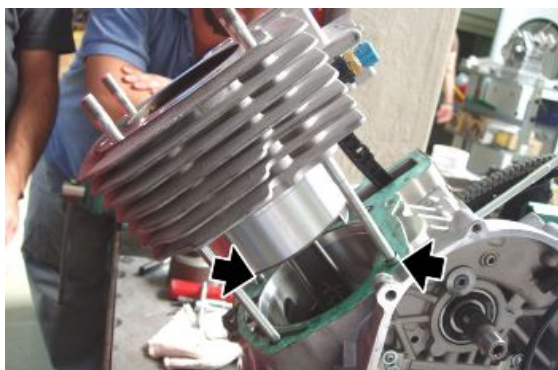
020470Y Pin snap ring fitting tool



Installing the cylinder

RIGHT CYLINDER

- Fit the piston.
- Remove the cloth used to prevent foreign bodies from getting into the crankcase.
- Turn the rings so that the coupling ends are 120 degrees from each other.
- Place a new metal gasket between the crankcase and the cylinder. Place the two dowel pins on the stud bolts. Lubricate the piston and the cylinder. Lock connecting rod motion with the fork tool. Using the suitable piston ring clamp tool, place the cylinder and fit the chain in the timing system plate.



CAUTION

DURING THIS OPERATION, PAY ATTENTION NOT TO DAMAGE THE PISTON.

Specific tooling

020674Y Piston ring clamp

020716Y Connecting rod locking

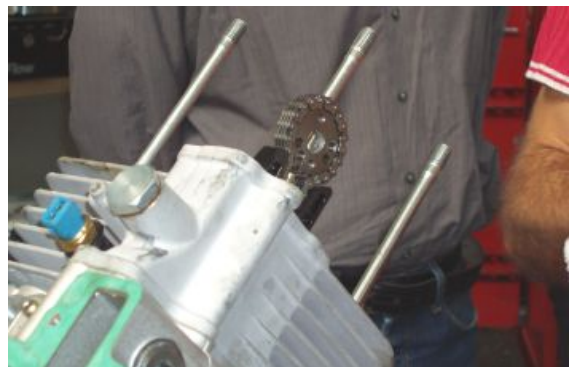
- Remove the piston ring clamp tool and finish positioning the cylinder.

Specific tooling

020674Y Piston ring clamp



- Fit the movable chain slider.
- Fit the upper gear.
- Fit the chain tensioner and the chain tensioner cap temporarily and keep the chain taut on the service shaft.



LEFT CYLINDER

- Fit the piston.
- Remove the cloth used to prevent foreign bodies from getting into the crankcase.
- Turn the rings so that the coupling ends are 120 degrees from each other.
- Place a new metal gasket between the crankcase and the cylinder.
- Place the two dowel pins on the stud bolts.
- Undo the screw which will be used to time the upper gear.



- Check that the oil in the left cylinder chain tensioner has been drained off by compressing it. If the operation is difficult, use a pin drive to push the central hole so that the oil is drained off from the circuit.



- Fit the chain tensioner in the cylinder.
- Lubricate the piston and the cylinder.
- Lock connecting rod motion with the fork tool.
- Using the suitable piston ring clamp tool, place the cylinder and fit the chain in the timing system plate.

CAUTION

DURING THIS OPERATION, PAY ATTENTION NOT TO DAMAGE THE PISTON.

Specific tooling

020674Y Piston ring clamp

020716Y Connecting rod locking

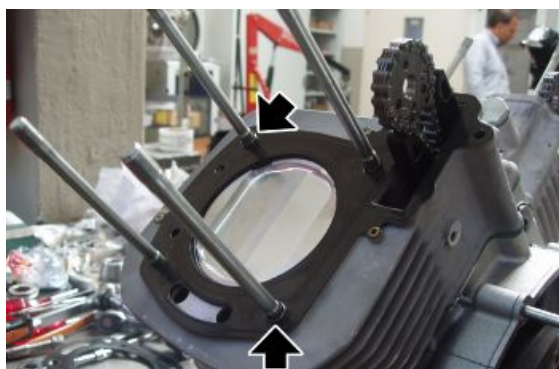
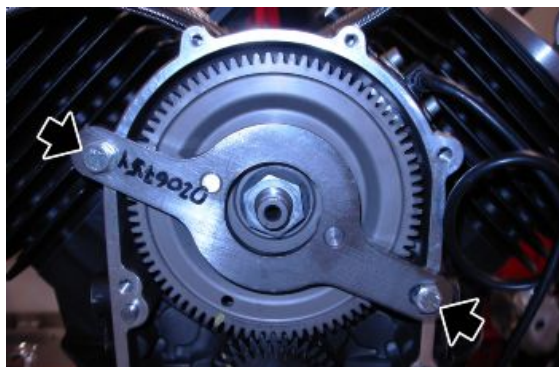


- Fit the movable chain slider.
- Fit the upper gear.
- Fit the chain tensioner cap temporarily and keep the chain taut on the service shaft.



Installing the cylinder head

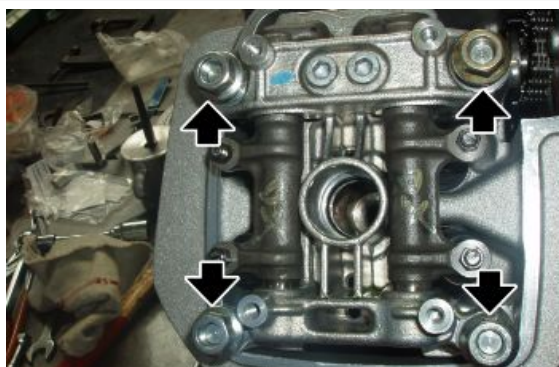
- Fit the valves in the head, if previously removed.
- Take the left cylinder piston to TDC and lock crankshaft rotation.
- Determine the thickness of the gasket to be fitted between the head and the cylinder as described in the section: Shimming system.
- Place the two dowel pins.
- Fit the gasket with the correct thickness between the head and the cylinder.
- Fit the left cylinder head.



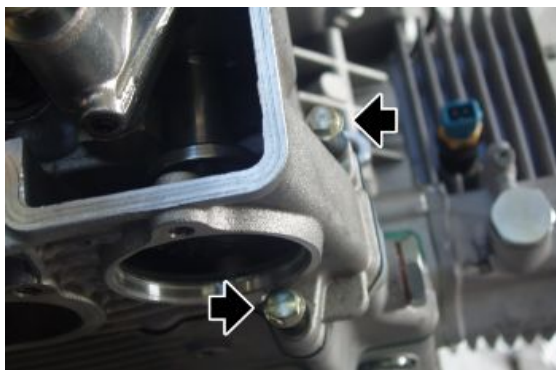
- Fit a new O-ring in the spark plug hole.
- Fit the complete cam cap.



- Fix the cam cap with the four nuts on the stud bolts.



- Fix the head with the two screws.
- Tighten nuts and screws to the prescribed torque operating diagonally and in stages.
- Loosen the valve set screws.



- Using a thin screwdriver relief oil pressure from the left cylinder chain tensioner.



- Screw two screws in the threaded holes of the timing system upper gear.
- Rotate the camshaft so that its pin is aimed towards the hole in the timing system chain.
- Place the gear in the chain.
- On the left camshaft pin, fit the hole marked with the letter "L" of the timing system gear.



- Block the left chain tensioner hole with screw and washer.
- Rotate the crankshaft by 90° so that the right cylinder piston reaches the TDC; lock crankshaft rotation.
- Also determine the thickness of the gasket for the right cylinder, to be fitted between the head and the cylinder as described in the section: Shimming system.
- Place the two dowel pins.



- Fit the gasket with the correct thickness between the head and the cylinder.
- Fit the right cylinder head.

- Unscrew and remove the right chain tensioner cap.



- Screw two screws in the threaded holes of the timing system upper gear.
- Rotate the camshaft so that its pin is aimed towards the hole in the timing system chain.
- Place the gear in the chain.
- On the right camshaft pin, fit the hole marked with the letter "R" of the timing system gear.



- Screw the cap of the right chain tensioner.
- Undo and remove the screws used to place the gear on the camshaft.
- Place the bulkhead and align the holes with the timing system gear.
- Fix the bulkhead on the timing system gear using a screw with Loctite on the thread.
- Tighten the screw to the prescribed torque.
- Also place the bulkhead of the other head.



- Place the cap.
- Tighten the two screws to the prescribed torque.
- Also place the cap of the other head.
- Adjust valve clearance.

**See also**

[Checking the valve clearance](#)

Installing the head cover

- Replace the gasket and install the head cover.



- Place the plastic half-cover.
- Replace the four rubber rings.
- Tighten the four screws to the prescribed torque.



- Place the spark plug tube.



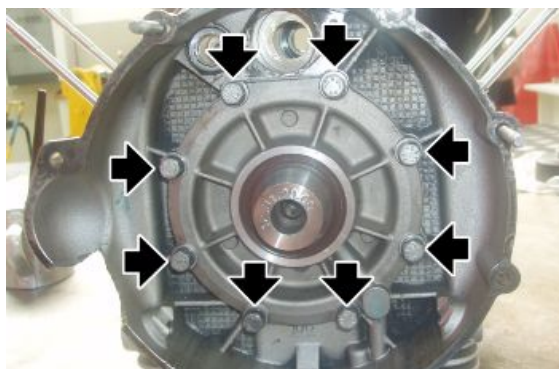
Crankcase - crankshaft

Removing the crankshaft

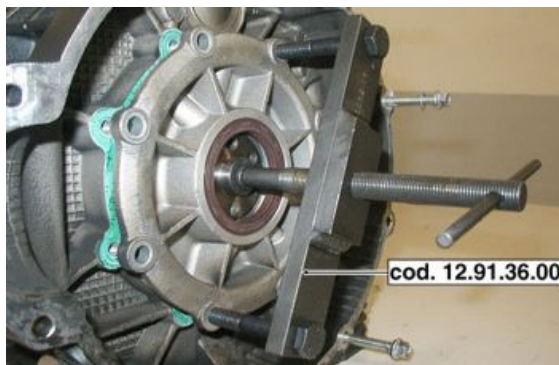
- Remove the clutch.
- Remove the tone wheel and the oil pump gear.
- Working from the generator side, unscrew and remove the nut.
- Remove both gears.



- Remove the connecting rods.
- Undo and remove the eight fixing screws and collect the washers.



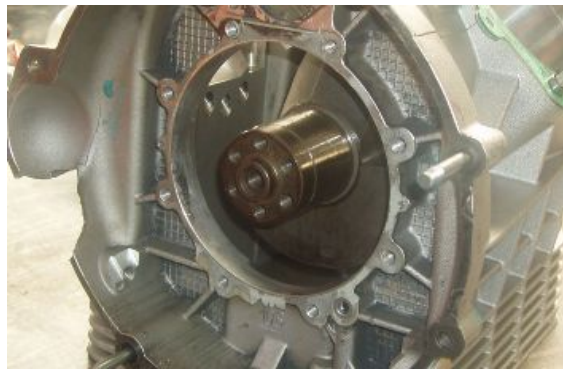
- Hold the crankshaft during flange removal.
- Using the suitable special tool, remove the crankshaft flange.
- Remove the sealing ring from the flange, if necessary.



Specific tooling

12.91.36.00 Tool to remove the flywheel-side flange

- Remove the crankshaft afterwards.



- Collect the shim washer from inside the crankcase.



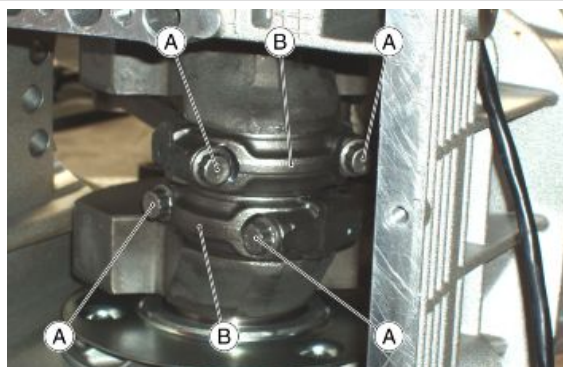
See also

[Disassembling the clutch](#)

[Removing the phonic wheel](#)

Disassembling the connecting rod

- Remove both heads.
- Remove the cylinders and the pistons.
- Remove the oil sump.
- Undo the coupling screws (A) inside the crankcase and remove the connecting rods (B).



See also

[Removing the flywheel](#)

[Disassembling the piston](#)

[Removing the cylinder](#)

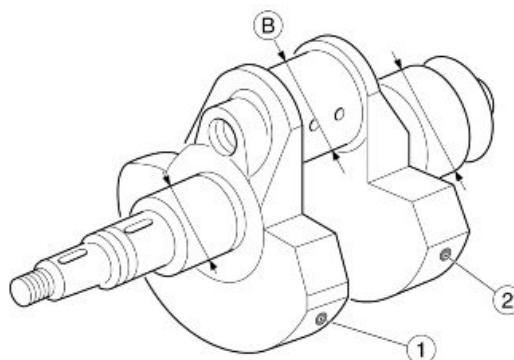
[Removing the cylinder head](#)

Inspecting the crankshaft components

Check the surfaces of the main journals; if they are scored or oval-shaped, reface them (observing the undersize charts), and replace the main bushing/s.

Reference (1) indicates the position where the coloured reference is applied to select diameter (B).

Reference (2) indicates the position where the coloured reference is applied to select balancing.



CRANKSHAFT SEAT (TIMING SYSTEM SIDE)

Specification	Desc./Quantity
Diameter of crankshaft main journal, timing system side	37.975 - 37.959 mm (1.49507 - 1.49444 in)
Inside diameter of crankshaft bushing, timing system side	38.016 - 38.0 mm (1.49669 - 1.49606 in)
Clearance between bushing and main journal (timing system side)	0.025 - 0.057 mm (0.00098 - 0.00224 in)

CRANKSHAFT SEAT (CLUTCH SIDE)

Specification	Desc./Quantity
Diameter of crankshaft main journal, clutch side	53.97 - 53.961 mm (2.12480 - 2.12444 in)
Inside diameter of crankshaft bushing on clutch-side flange	54.019 - 54.0 mm (2.12673 - 2.12598 in)
Clearance between bushing and main journal (clutch side)	0.030 - 0.058 mm (0.00118 - 0.00228 in)

CRANKPIN DIAMETER (B)

Specification	Desc./Quantity
'Blue' bushing half-shell regular production	44.008 ÷ 44.014 mm (1.73259 ÷ 1.73283 in)
'Red' bushing half-shell regular production	44.014 ÷ 44.020 mm (1.73283 ÷ 1.73307 in)

BALANCING SELECTION COLOURS (2)

Specification	Desc./Quantity
Crankshaft selection colour (2) brown	Type 1 to be used with brown connecting rods. Balance with a 1558 g (54.96 oz) +/- 0.25% weight fitted on the crankpin (B). Maximum imbalance allowed for each shoulder: 2 g (0.07 oz).
Crankshaft selection colour (2) green	Type 2 to be used with green connecting rods. Balance with a 1575 g (55.56 oz) +/- 0.25% weight fitted on the crankpin (B). Maximum imbalance allowed for each shoulder: 2 g (0.07 oz).
Crankshaft selection colour (2) black	Type 2 to be used with black connecting rods. Balance with a 1592 g (56.16 oz) +/- 0.25% weight fitted on the crankpin (B). Maximum imbalance allowed for each shoulder: 2 g (0.07 oz).

Checking the connecting rod

When examining the connecting rods, check that:

- Bushing conditions and bushings-pins clearance;
- Shaft parallelism;
- Connecting rod bearings.

These are thin shell bearings, anti-friction alloy that does not allow for any adaptation; replace them immediately if seizing or wear marks are found.

Upon replacing the bearings it may be necessary to ream the crankshaft pin.

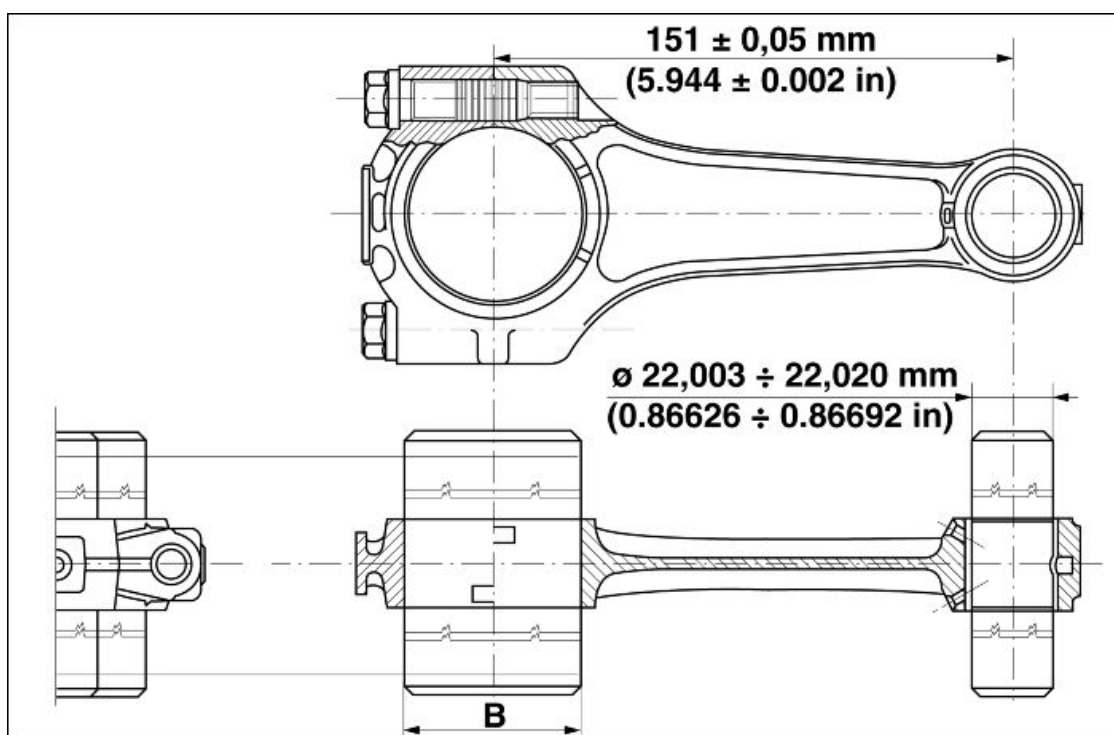
Before reaming the crankpin, measure the pin diameter (B) comparing it with the maximum wear allowed, as indicated in the figure; this defines what kind of undersizing the bearing should have and to which diameter the pin (B) should be reamed.

Checking shaft parallelism

Check shafts for squaring before fitting them.

It is therefore necessary to check that the head holes and the rod small end are parallel and on the same plane.

The maximum parallelism and plane error of the two head shafts and connecting rod small end should be ± 0.10 mm (0.00393 inch).



CONNECTING ROD BEARING THICKNESS

Specification	Desc./Quantity
Regular 'Blue' connecting rod bearing (production)	1.539 - 1.544 mm (0.06059 - 0.06079 in)
Regular 'Red' connecting rod bearing (production)	1.535 - 1.540 mm (0.06043 - 0.06063 in)

CRANKPIN DIAMETER (B)

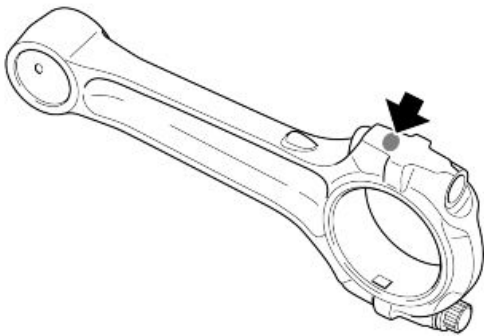
Specification	Desc./Quantity
'Blue' bushing half-shell regular production	44.008 ÷ 44.014 mm (1.73259 ÷ 1.73283 in)
'Red' bushing half-shell regular production	44.014 ÷ 44.020 mm (1.73283 ÷ 1.73307 in)

PIN-BUSHING COUPLING DATA

Specification	Desc./Quantity
Fitted and machined bushing - inside Ø	22.003 - 22.020 mm (0.86626 - 0.86692 in)
Pin diameter	21.998 - 21.994 mm (0.86606 - 0.86590 in)
Clearance between pin and bushing	0.005 - 0.026 mm (0.000197 - 0.001024 in)

The connecting rods have a marked area for weight selection.

The weight indicated in the chart includes screws, dowels and the bushing.



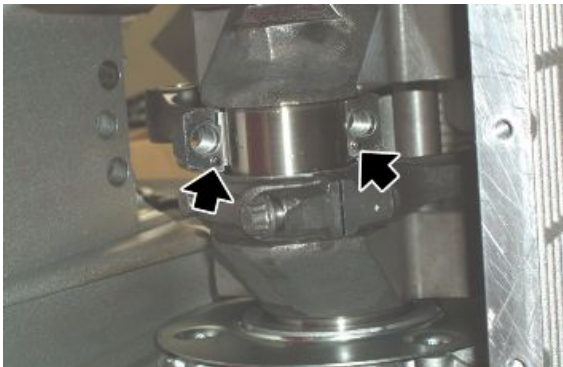
CONNECTING ROD WEIGHT SELECTION

Specification	Desc./Quantity
Connecting rod - brown	0.588 - 0.598 mm (0.02074 - 0.02109 in)
Connecting rod - green	0.598 - 0.608 mm (0.02109 - 0.02145 in)
Connecting rod - black	0.608 - 0.618 mm (0.02145 - 0.02180 in)

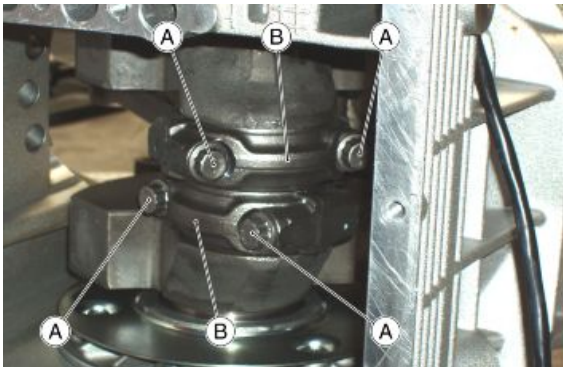
Assembling the connecting rod

- Lubricate the crankpin on which the connecting rods are to be fixed.
- If the connecting rods are not replaced, be careful not to interchange the right connecting rod with the left one and vice versa.

To place the connecting rods: the two pins must be facing the crankcase internal side.



- Place the connecting rods and the caps (B) on the crankshaft and fasten them with new screws (A).
- Remember these recommendations:



- The screws fixing the connecting rods to the crankshaft must be replaced with new ones at the following refitting as they are subject to high loads and stress;
- The fitting clearance between bearing and connecting rod pin is 0.028 mm (0.0011 inch) minimum and 0.052 mm (0.0020 inch) maximum;
- The clearance between the shim washers of the connecting rod and those of the crankshaft is comprised between 0.30 mm (0.01181 in) and 0.50 mm (0.01968 in);
- Lock the screws (A) on the caps (B) with a torque wrench at the prescribed torque.



PAY ATTENTION TO CRANKSHAFT ROTATION WHEN ONLY THE CONNECTING RODS ARE FITTED BECAUSE IT COULD HIT THE TWO LUBRICATION JETS INSIDE THE CRANKCASE.

Installing the crankshaft

- Fit the shim washer inside the crankcase with the chamfered side facing the generator side.



- Lubricate the crankshaft bushing on the crankcase, generator side.



- Use the sealing ring fitting tool on the flywheel-side flange to fit the sealing ring on the flange.

Specific tooling

19.92.71.00 Tool to fit the seal ring on the flywheel-side flange

- Fit a new gasket between the crankcase and the crankshaft flange, flywheel side.
- Fit the crankshaft on the crankcase, flywheel side.
- Mark the crankshaft on the flywheel side with the crankpin facing upwards.
- Place the suitable sealing ring centring tool on the crankshaft.



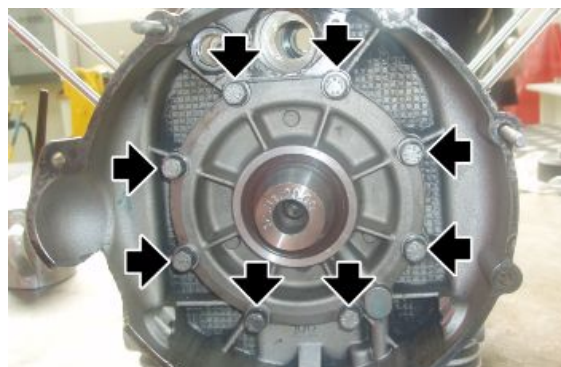
Specific tooling

12.91.20.00 Tool to fit the flywheel-side flange together with seal ring on the crankshaft

- Place the flywheel-side flange on the crankshaft and check if the dowel pin with the O-ring is correctly placed.
- When fitting the flange on the crankcase, make sure that the three dowel pins match the seats on the crankcase.



- Apply Teflon tape on the two lower fixing screws at the back in order to prevent oil leaks.
- Screw the eight flange screws on the flywheel side proceeding diagonally.



- Remove the sealing ring centring tool from the crankshaft.

Specific tooling

12.91.20.00 Tool to fit the flywheel-side flange together with seal ring on the crankshaft

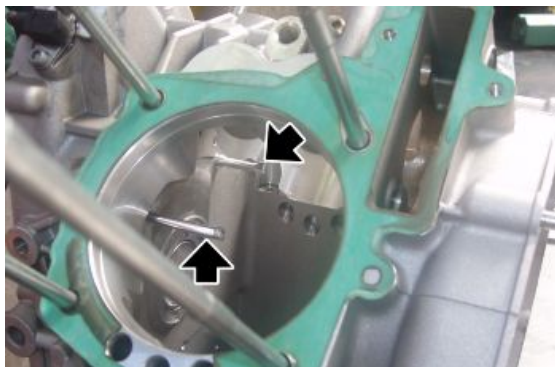
- To avoid that the shim washer inside the crankcase moves out of its seat, fit the two gears and the nut on the crankshaft on the generator side.



Refitting the crankcase halves

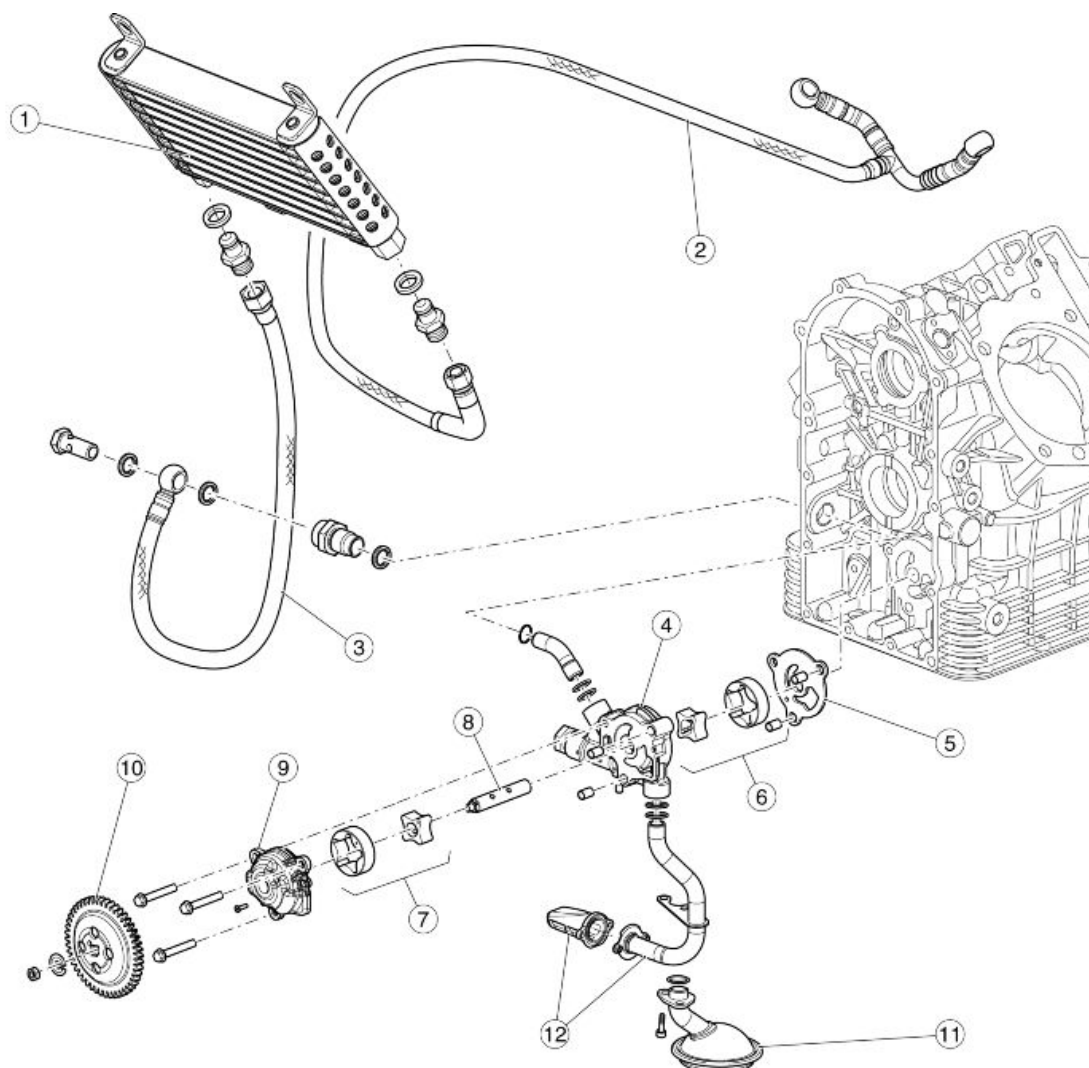
In case the lubrication jets are removed, replace them with two new of the same type. Check that the O-ring is fitted on the jets.

Do not interchange them upon refitting because they have a different length.



Lubrication

Conceptual diagrams



Key:

1. Oil cooling radiator
2. Oil delivery pipe to heads
3. Oil delivery pipe to radiator
4. Oil pump body
5. Oil pump gasket
6. Rotor for lubrication
7. Rotor for cooling
8. Rotor control shaft
9. Oil pump cover
10. Oil pump control gear
11. Lubrication oil intake filter
12. Cooling oil intake filter

The oil pump is operated by the gear (10) which receives the motion directly from the crankshaft. The gear (10) is mounted on the shaft (8), on which two rotors are fitted: one for engine cooling (7) and another for lubrication (6).

Cooling:

The rotor (7) takes in oil from the sump through the filter (12); the oil is sent to the radiator (1) through the hoses (3). Oil passes through the radiator (1) dispersing part of the heat and reaches the heads through the hoses (2). Oil goes down to the sump again and joins the oil used for lubrication.

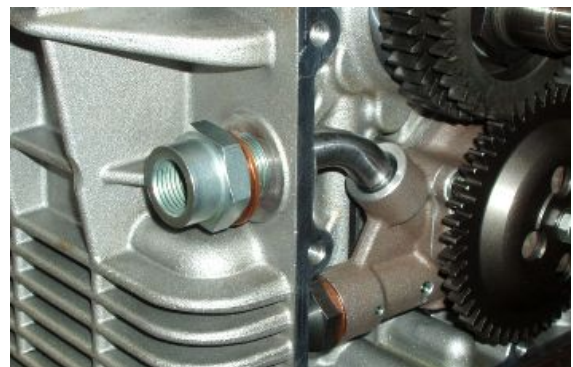
Lubrication:

The rotor (6) takes in oil from the sump through the filter (11); the oil is sent through special ducts in the crankcase to all the parts to be lubricated. Oil goes down to the sump again and joins the oil used for cooling.

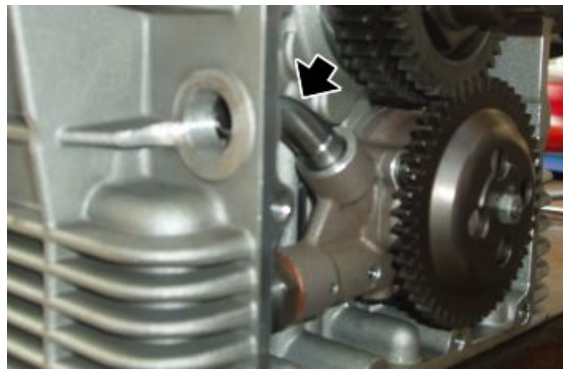
Oil pump

Removing

- Drain off the engine oil.
- Remove the generator and the timing system cover.
- Unscrew and remove the nipple.
- Collect the gasket.



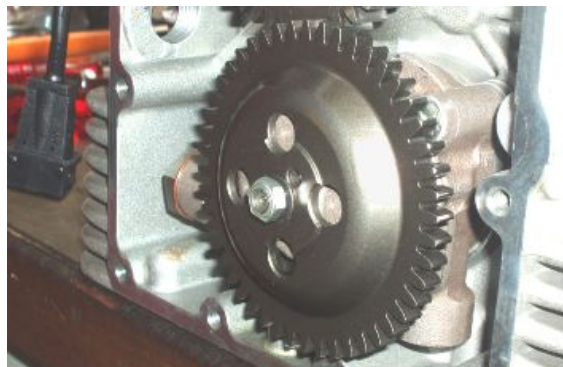
- Remove the nipple - oil pump fitting.



- Bring the left cylinder piston to the TDC in combustion phase.
- Mark a reference on the oil pump control gear and another on the driven gear so as to place them correctly again upon refitting.
- Unscrew and remove the nut on the crankshaft.
- Remove the oil pump control gear.
- Screw the nut again so that the internal shim washer does not fall in the crankshaft crankcase.



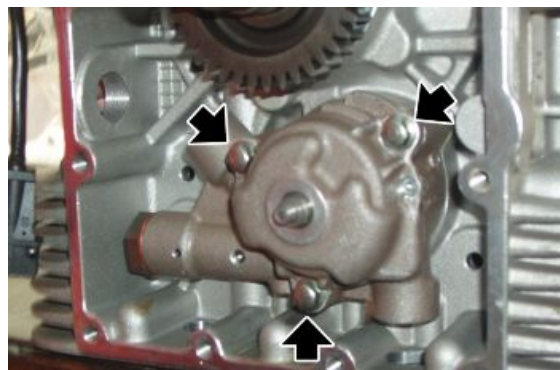
- Unscrew and remove the driven gear nut.
- Collect the washer.
- Remove the oil pump driven gear.



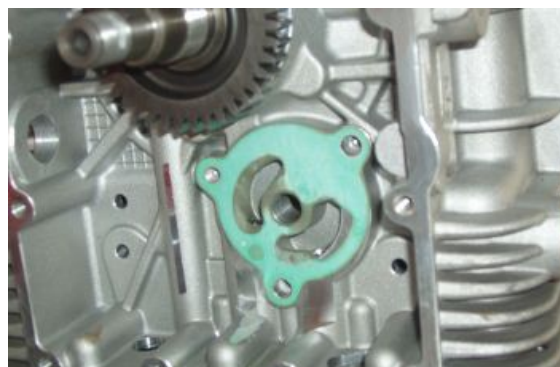
- Remove the driving pin.



- Undo and remove the three screws.
- Remove the oil pump.



- Remove the gasket between the crankcase and the oil pump.



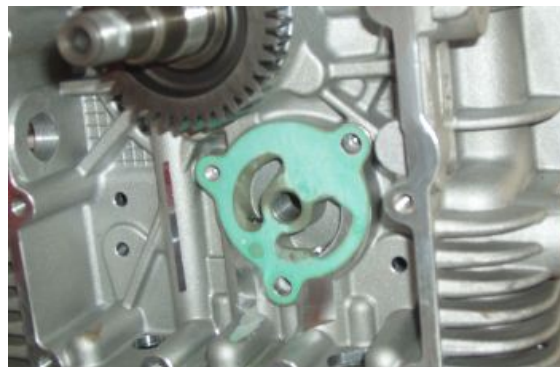
See also

[Replacement](#)

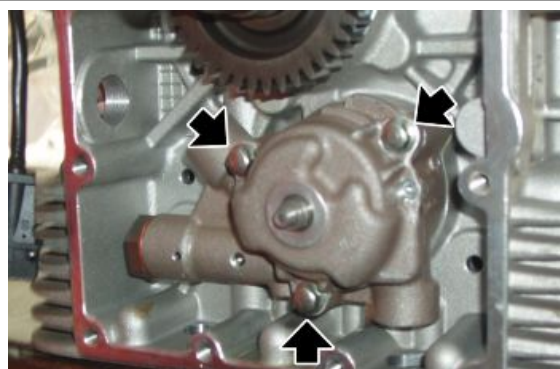
[Removing the generator](#)

Installing

- Place a new gasket between the crankcase and the oil pump.



- Place the oil pump.
- Tighten the three screws fixing the oil pump.



- Place the driving pin on the oil pump shaft.



- Place the gear on the oil pump shaft.



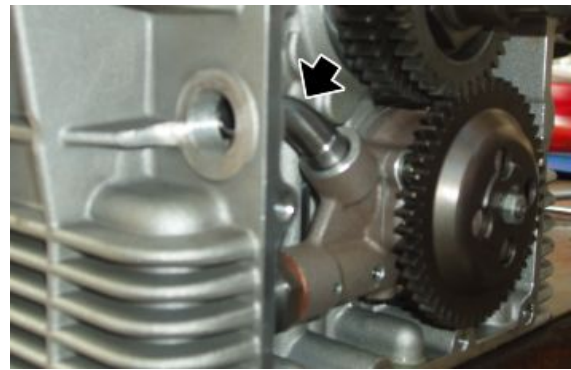
- Place the washer on the oil pump shaft.
- Tighten the nut to the specified torque.



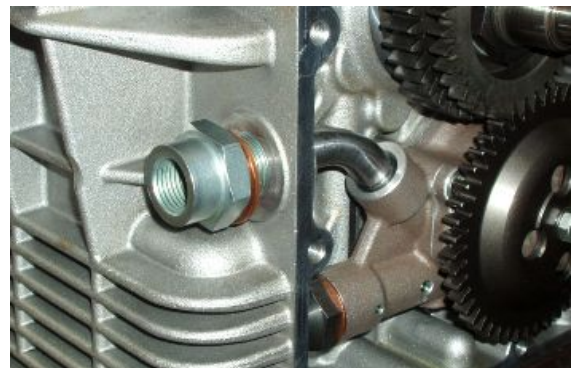
- Place the oil pump control gear on the crankshaft and align its reference with that marked during the removal phase on the oil pump driven gear.
- Tighten the nut to the specified torque.



- Insert the joint in the oil pump.



- Fit the nipple with the gasket on the crankcase.
- Tighten the nipple to the prescribed torque.



Removing the oil sump

NOTE

TO REMOVE THE OIL SUMP, PLACE A SUITABLE CONTAINER UNDER IT TO COLLECT THE USED OIL AND DRAIN OUT ALL OIL.

- If necessary, the filter can be removed with the suitable special tool.

Specific tooling

01.92.91.00 Wrench for removing the cover on sump and filter

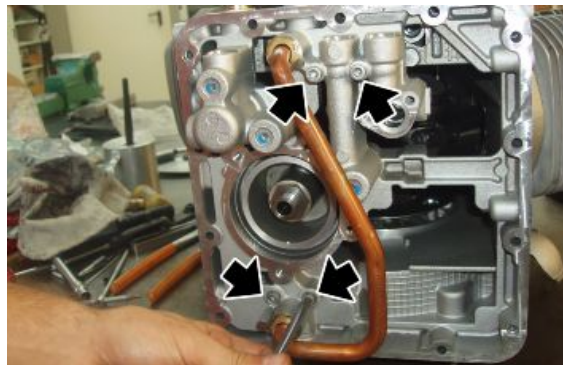
- Unscrew and remove the oil level plug and collect the O-Ring.



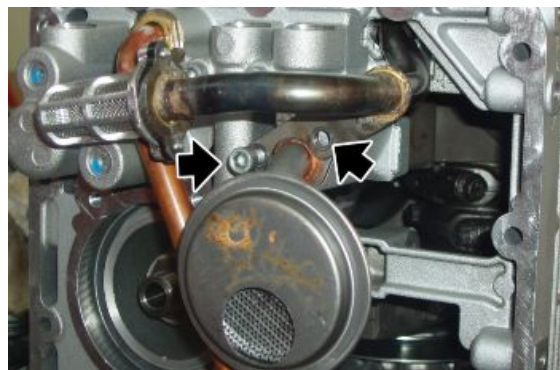
- Undo and remove the fourteen screws fixing the oil sump to the engine crank-case.



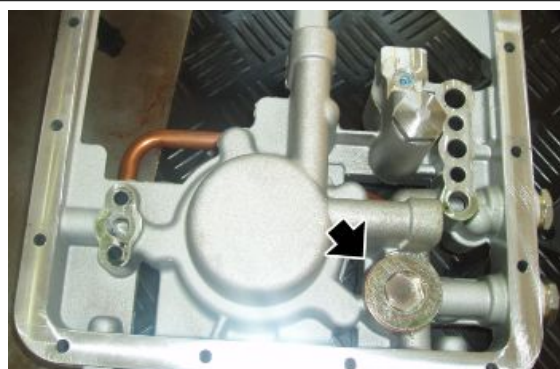
- Undo and remove the four screws.
- Remove the flange.



- Undo and remove the two screws.
- Remove both filters.



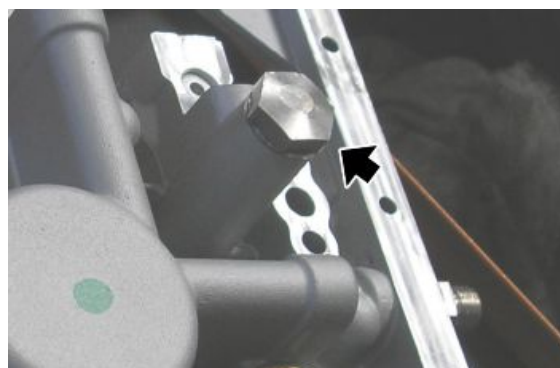
- Unscrew and remove the plug.



- Remove the thermostatic valve.



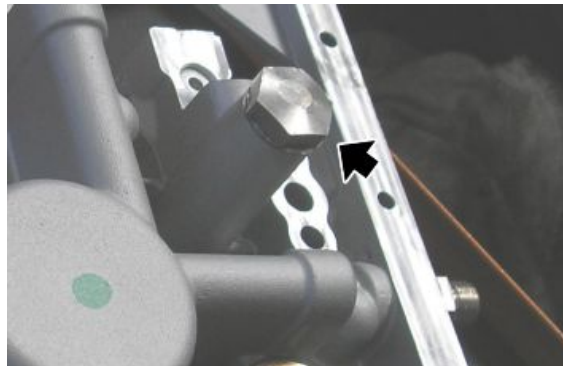
- Unscrew and remove the pressure relief valve plug.
- Remove the pressure relief valve components





Refitting the oil sump

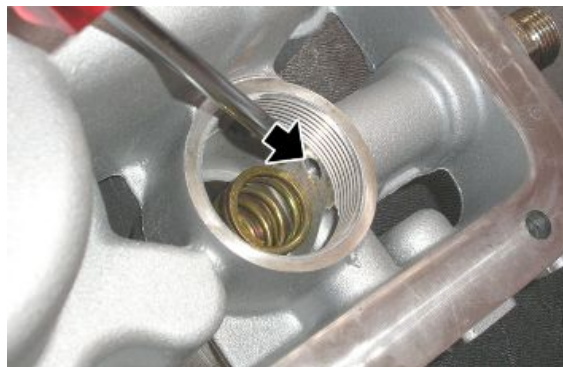
- Place the pressure relief valve components correctly.
- Screw the pressure relief valve plug.



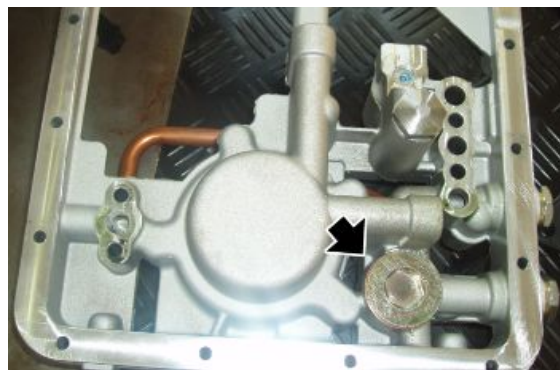
- Place the thermostatic valve.



CHECK THAT THE ENGINE OIL PASSAGE HOLE IS NOT CLOGGED.



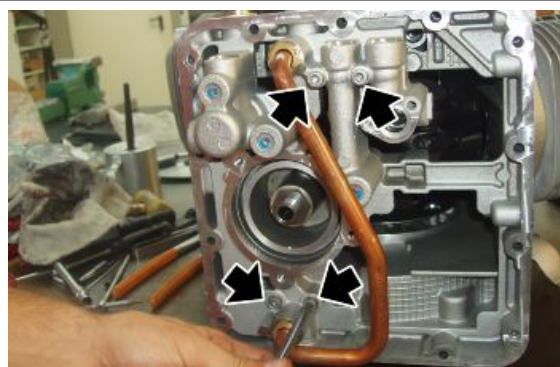
- Tighten the thermostatic valve plug.



- Place a new gasket between the crank-case and the flange.



- Fit the flange.
- Fix the flange with the four screws.



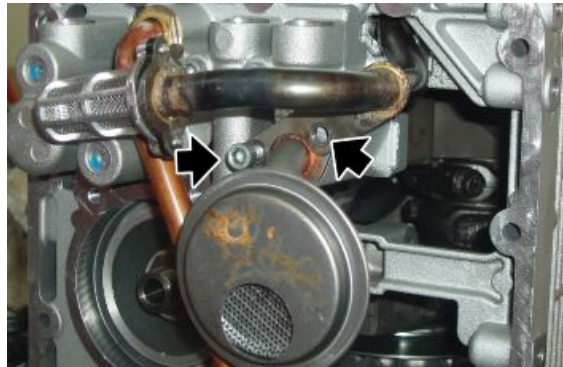
- Fit the lubrication oil intake filter.



- Check that the O-rings are fitted on the oil pump.
- Fit the cooling oil intake filter.



- Fix both filters and tighten the two screws to the prescribed torque.



- Fit a new oil filter and tighten it to the prescribed torque.



- Place a new gasket between the flange and the sump.



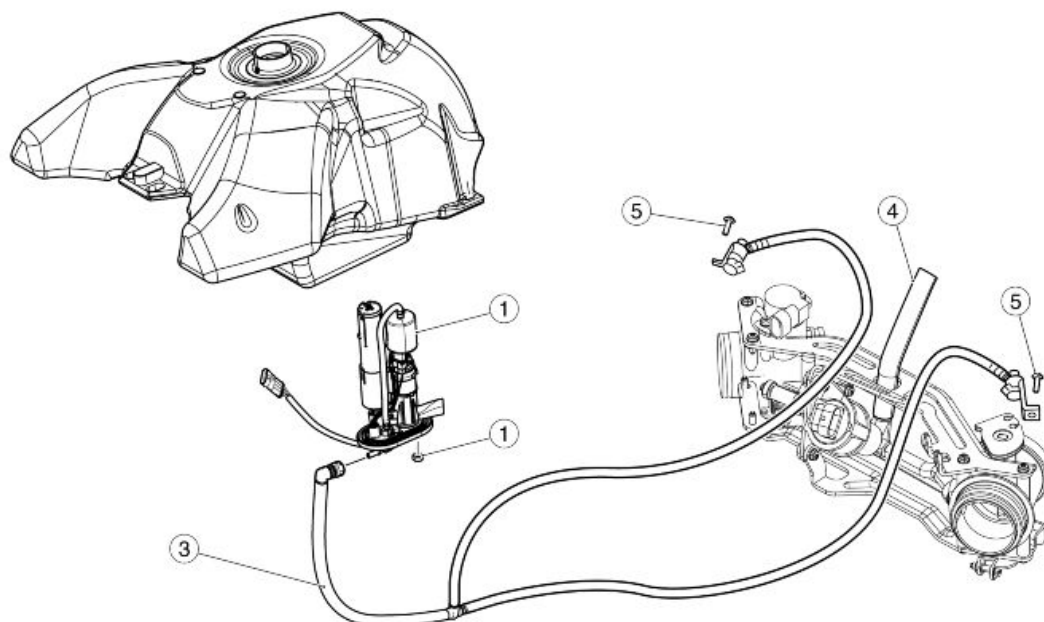
-
- Place the oil sump.
 - Tighten the fourteen screws to the prescribed torque.
 - Add engine oil up to the correct level.



INDEX OF TOPICS

POWER SUPPLY

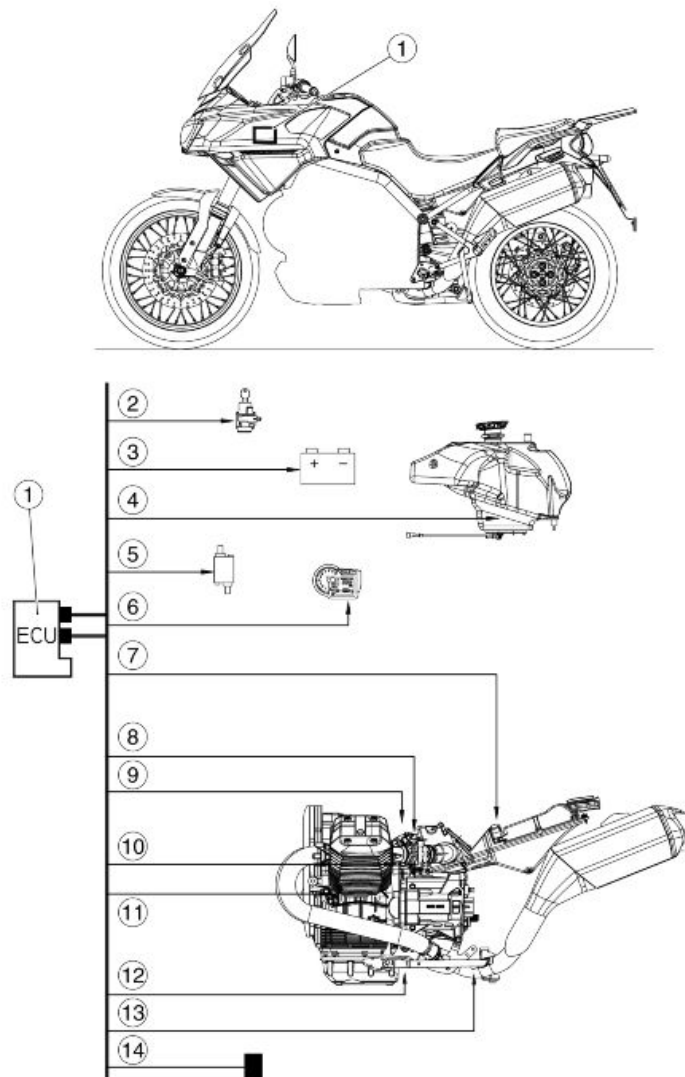
P SUPP

Circuit diagram**Key:**

- 1. Complete fuel pump unit
- 2. Nut
- 3. Fuel pipe
- 4. Pipe
- 5. Screw

Injection

Diagram

**Key:**

- 1 Control unit
- 2 Ignition switch
- 3 Battery
- 4 Fuel pump
- 5 Coils
- 6 Instrument panel
- 7 Air temperature sensor
- 8. Throttle valve position sensor
- 9 Injectors
- 10 Engine temperature sensor
- 11 Crankshaft position sensor
- 12. Side stand

13 Lambda probe

14 Fall sensor

THROTTLE BODY PIPES LAYING

Pipes from the throttle body to the idle motor should be laid so that the shaped part is inserted in the air filter casing.



The shortest part of the fuel pipe connected to the throttle bodies should be placed on the right.



Cylinders synchronisation

- With engine off, connect the Navigator tool to the diagnosis connector and to the vehicle battery.



- Turn on the scanner.
- Screw the joints connecting the vacuumeter pipes on the inlet pipe holes.
- Connect the vacuumeter pipes to the relative joints.
- Set the key to ON.



- Make sure there are no errors in the control unit; otherwise, solve them and repeat the procedure.

- Make sure the left throttle is fully in.

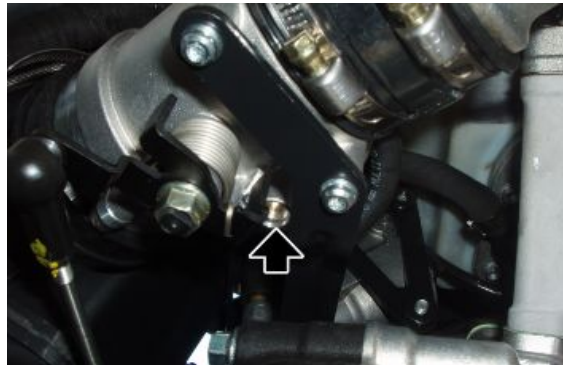


DO NOT TOUCH THE THROTTLE ABUTMENT SCREW OR THE THROTTLE BODY MUST BE REPLACED. CHECK THAT THE THROTTLE RETURN CABLE IS NOT TAUT.



- The instrument should display the adjustable parameters screen page.
- Autodetect the throttle position.

- Turn the key to "OFF" and leave it for at least 30 seconds.
- Turn the key back to "ON" and restore the instrument session.
- Check that the "Throttle" value reading is $4.7 \pm 0.2^\circ$. If the value is incorrect, replace the control unit and repeat the procedure from the start.
- Completely close the two by-pass screws on the throttle bodies.
- Start the engine.
- Take the engine to the prescribed temperature: 60°C (140°F).
- Make the engine rev at 2000/3000 rpm and with the vacuum gauge check that the difference between the two pressures is 1 cm Hg (1.33 kPa) maximum.



If this condition is detected:

- take the engine back to idle and check the depression values so that they are aligned between the two cylinders. Otherwise, open only the screw with higher depression, using the by-pass screws, to compensate.

If there is a larger difference:

- act on the set screw of the throttle body connecting rod to reduce the pressure difference in the two pipes.
- Repeat the procedure "Throttle position self-acquisition" as explained above.
- Take the engine back to idle and check the depression values so that they are aligned between the two cylinders.
- Otherwise, open only the screw with higher depression, using the by-pass screws, to compensate.



Recovery function

If the signal of the following sensors is interrupted, the control unit determines some values to keep the engine running or it uses a different parameter. The instrument panel and the Navigator also signal the problem.

RECOVERY FUNCTION	
Specification	Desc./Quantity
air temperature	25 °C (77 °F)
engine temperature	30 °C (86 °F) with linear increase from the air temperature at ignition
barometric pressure	1010 hPa
throttle valve potentiometer	2.9° at idle, otherwise variable.
idle motor	fixed value variable depending on the vehicle

Using Navigator for injection system

Injection system

ECU INFO screen page

This screen page shows general data regarding the control unit, for example software type, mapping, control unit programming date



INFO ECU SCREEN PAGE

Specification	Desc./Quantity
Mapping	-

PARAMETERS screen page

This screen page shows the parameters measured by the several sensors (engine revs, engine temperature, etc.) or values set by the control unit (injection time, ignition advance, etc.)



PARAMETERS SCREEN PAGE

Specification	Desc./Quantity
Engine rpm	Engine revolutions per minute: the minimum value is set by the control unit cannot be adjusted
Injection time	- ms
Ignition advance	- °
Air temperature	°C Temperature of the air taken in by the engine, measured by the sensor in the filter casing. This is not the temperature indicated by the instrument panel
Engine temperature	°C
Battery voltage	V
Throttle	Value corresponding to the throttle when closed (approximate value between 4.5 and 4.9°) (left throttle supported by the end of stroke screw). If a different value is read, it is necessary to activate the parameter "Throttle positioner autodetection" and obtain this value.
Atmospheric pressure	1015 mPa (approximate values) The sensor is inside the instrument panel
Lambda probe	100 - 900 mV (approximate values) Signal when energised that the control unit receives from the lambda probe: inversely proportional to the presence of oxygen
Lambda integrator	When the control unit uses the lambda probe signal (see the 'Lambda' parameter on the 'Statuses' screen page) this value should be close to 0%.
Vehicle speed	- km/h

Specification	Desc./Quantity
Target engine revs	1150 rpm (approximate values) Parameter valid at idle, setting depends especially on the engine temperature: the control unit will try to keep the engine running at this revs, acting on the ignition advance and the Stepper motor
Stepper base	70 - 100 (approximate values) Steps corresponding to the Stepper motor reference position
CL Stepper	70 - 150 (approximate values) Steps set by the control unit for the Stepper motor. At idle, steps so that the engine keeps the target engine revs set by the control unit
Stepper regulator	Difference between current steps of motor at idle and those at the reference position
Virtual throttle angle from Stepper	0° With engine not at idle speed, this value indicates the throttle degrees corresponding to the Stepper motor air flow

STATUS screen page

This screen page shows the status (usually ON/OFF) of the vehicle devices or the operation condition of some vehicle systems (for example, lambda probe functioning status).



STATUSES

Specification	Desc./Quantity
Engine status	ON/run/power-latch/stopped operation conditions
Throttle position	Released / pressed indicates if the throttle potentiometer is open or closed
Stand	Retracted / extended indicates the position of the side stand (only with gear engaged)
Ignition	Enabled / disabled indicates if the control unit consents engine start-up
RUN / STOP switch	Run / stop indicates the position of the safety switch
Clutch	No / Yes indicates the clutch sensor status
Gear engaged	No / Yes indicates the gear sensor status
fall sensor	Normal / Tip over indicates the vehicle fall sensor status
Lambda	Open loop / Closed loop Indicates if the control unit is using (CLOSED) the lambda probe signal to keep the stoichiometric combustion. At idle CLOSED only if: Air T over 20°C (68°F) and engine T over 30°C (86°F) and engine on for at least 2-3 minutes
Synchronisation	Synchronised / Not synchronised Indicates if the control unit detects the revolution sensor signal correctly

ACTIVATION screen page

This screen page is used to delete errors in the control unit memory and to activate some systems controlled by the control unit.



ACTIVATION

Specification	Desc./Quantity
Left coil	operation for 2.5 m, 5 times
Right coil	operation for 2.5 m, 5 times
Left injector	Operation for 4 m, 5 times
Right injector	Operation for 4 m, 5 times
Error clearing	By pressing the 'enter' button, the stored errors (MEM) become part of the historical data (STO). In the next connection between the Navigator and the control unit, the historical errors (STO) are no longer shown
Fuel pump	Operation for 30"
Stepper control	For 4" advancement command of 32 steps, for the next 4" retrocession command of 32 steps and so on for 30"

ERRORS screen page

This screen page shows potential errors detected in the vehicle (ATT) or stored in the control unit (MEM) and it allows to check error clearing (STO).



ERRORS

Specification	Desc./Quantity
Pressure sensor	Possible short circuit in the earth lead, battery or open circuit: recovery function noticeable for customer. Careful with the air pressure sensor in the instrument panel
Air temperature	Possible short circuit in the earth lead, battery or open circuit: recovery function hardly noticeable for customer.
Engine temperature	Possible short circuit in the earth lead, battery or open circuit: recovery function.
Throttle actuator position sensor	Possible short circuit in the earth lead, battery or open circuit: recovery function noticeable for customer.

Specification	Desc./Quantity
Lambda probe	Possible short circuit on the earth lead, battery or open circuit or plausibility: recovery function hardly noticeable for customer.
Left injector	Possible short circuit in the earth lead, battery or open circuit. If both injectors do not work, the engine does not work
Right injector	Possible short circuit in the earth lead, battery or open circuit. If both injectors do not work, the engine does not work
Fuel pump relay	Possible short circuit in the earth lead, battery or open circuit: the engine does not start.
Left coil	Possible short circuit in the earth lead, battery or open circuit. If both coils do not work, the engine does not work.
Right coil	Possible short circuit in the earth lead, battery or open circuit. If both coils do not work, the engine does not work.
Idle regulator	Possible short circuit in the earth lead, battery or open circuit: recovery function noticeable for the customer due to no idle management
Battery voltage	Battery voltage detected is too low (7V) or too high (16V) for a certain period
Starter diagnosis	Possible short circuit in the earth lead, battery or open circuit.
Engine revolution sensor	Possible open circuit.
Lambda heater	Possible short circuit in the earth lead, battery or lambda probe heating circuit open.
SPEED SENSOR	
CAN line diagnosis	Possible error on line CAN: short circuit or line break or no signal or plausibility error detected.
RAM memory	Possible internal control unit error. Also check the control unit supply and earth connections
ROM memory	Possible internal control unit error. Also check the control unit supply and earth connections
Microprocessor	Possible internal control unit error. Also check the control unit supply and earth connections
Checksum EPROM	Possible internal control unit error. Also check the control unit supply and earth connections

SETTINGS screen page

This screen page is used to adjust some control unit parameters.



ADJUSTMENTS

Specification	Desc./Quantity
Throttle positioner autodetection	Allows the control unit to detect the closed throttle position: just press the enter button

INDEX OF TOPICS

SSUSPENSIONS

SUSP

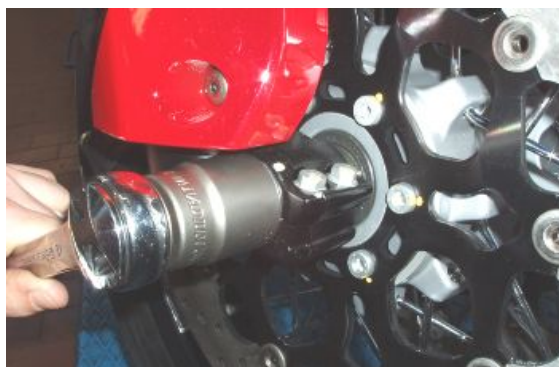
Front

Removing the front wheel

- Working from both sides, undo and remove the two fixing screws from the front brake callipers and remove them from their seats.



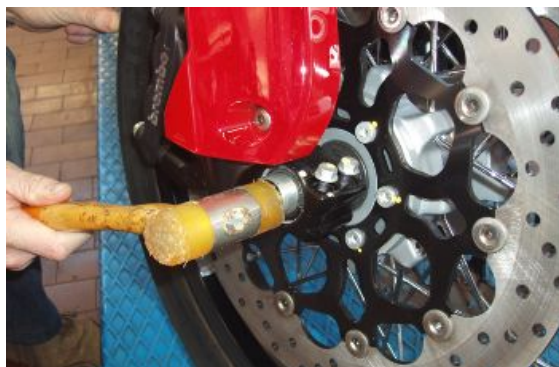
- Hold the vehicle front part.
- Unscrew and remove the wheel axle fixing nut and collect the sealing washer.



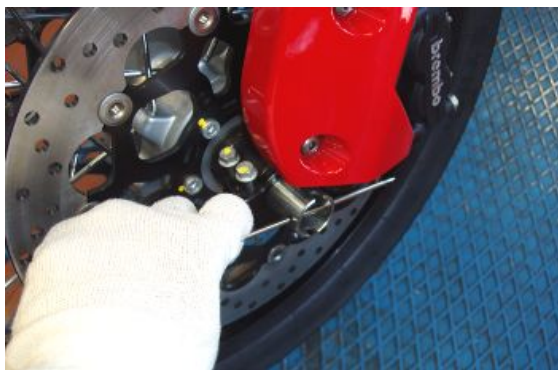
- Working from both sides, loosen the screws on the wheel bolt clamps.



- Tap the wheel axle slightly with a rubber mallet so that the hole on the opposite side is exposed.



- Remove the wheel axle by inserting a screwdriver in the holes on the pin.
- During extraction, support the wheel and then remove it.

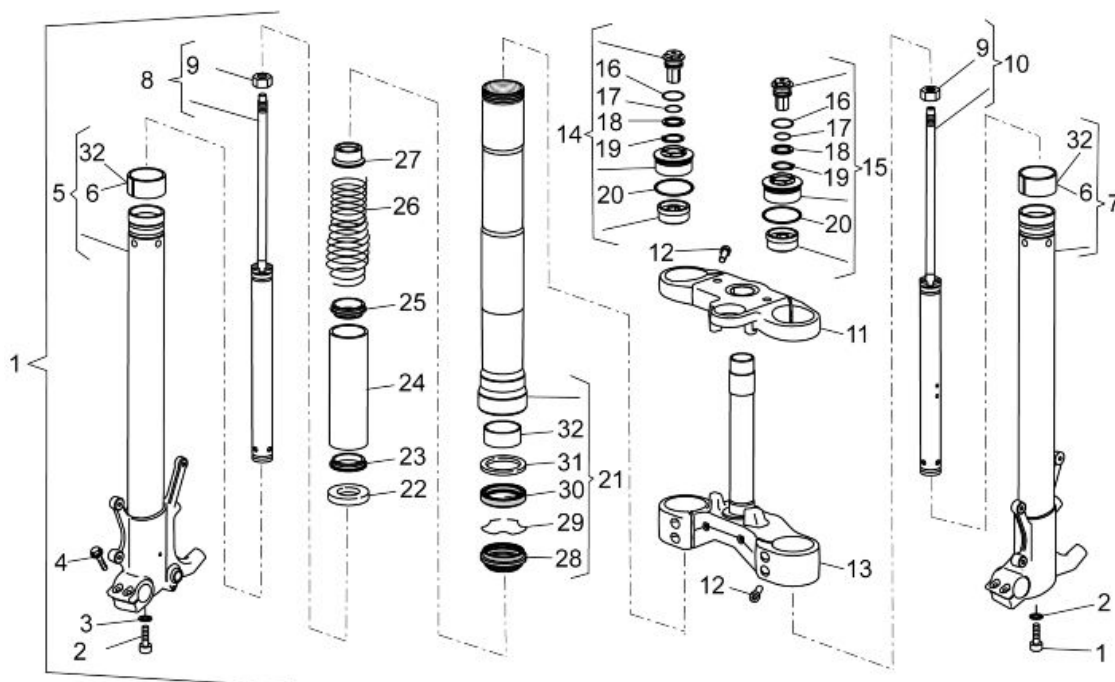


- Collect the spacer from the front wheel right side.



Front fork

Diagram



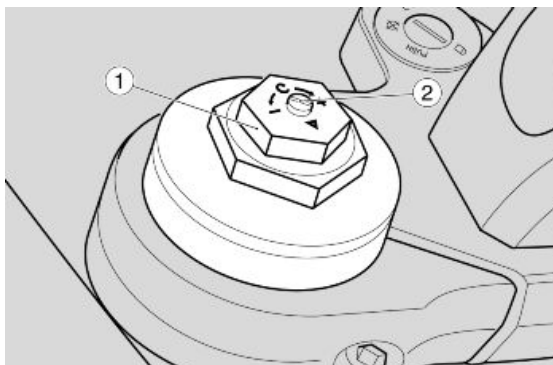
Key:

1. Complete front fork
 2. TCE screw
 3. Washer
 4. TE flanged screw
 5. Stem + right wheel holder
 6. Bushing
 7. Stem + left wheel holder
 8. Complete right pumping member
 9. Nut
 10. Complete left pumping member
 11. Fork upper plate
 12. TCE screw
 13. Base with headstock
 14. Right sleeve cap
 15. Left sleeve cap
 16. O-ring
 17. O-ring
 18. Washer
 19. Snap ring
 20. O-ring
 21. Complete sleeve
 22. Spring holder cap
 23. Spring guide
 24. Preloading pipe
 25. Spring guide
 26. Spring
 27. Bushing
 28. Dust guard
 29. Snap ring
 30. Sealing ring
 31. Cap
 32. Bushing
-

Adjustment

The front suspension consists of a hydraulic fork connected to the headstock by means of two plates.

To set the vehicle suspension, each fork stem features an upper nut (1), to adjust spring preloading, and an upper set screw (2):



- act on the right stem set screw to adjust hydraulic rebound damping;
- act on the left stem set screw to adjust hydraulic compression damping.

ADJUSTMENTS

Regular adjustment (standard):

- only rider.

Medium load setting:

- (for example, rider with passenger or with luggage).

Maximum load adjustment:

- (for example, rider, passenger and luggage).

FORK ADJUSTMENT

Specification	Desc./Quantity
Spring preloading, nut (1) - regular load conditions	tighten (clockwise) 6 turns from fully open
Spring preloading, nut (1) - half-load conditions	tighten (clockwise) 7 turns from fully open
Spring preloading, nut (1) - maximum load conditions	tighten (clockwise) 7 turns from fully open
Rebound damping, right stem set screw (2) - regular load conditions	unscrew (anticlockwise) 2 turns from fully closed
Rebound damping, right stem set screw (2) - half-load conditions	unscrew (anticlockwise) 2 turns from fully closed
Rebound damping, right stem set screw (2) - maximum load conditions	unscrew (anticlockwise) 2 turns from fully closed
Compression damping, left stem set screw (2) - regular load conditions	unscrew (anticlockwise) 2 turns from fully closed
Compression damping, left stem set screw (2) - half-load conditions	unscrew (anticlockwise) 2 turns from fully closed
Compression damping, left stem set screw (2) - maximum load conditions	unscrew (anticlockwise) 1.5 turns from fully closed



(1) THE SETTING SHOWN IN THE TABLE MAY NEED TO BE MODIFIED ACCORDING TO THE TYRE AND ROAD TYPE.

NOTE

(2) IF FITTED.

Removing the fork legs

- Rest the vehicle on its centre stand.

- Secure the rear part of the vehicle through belts in order to lift the front wheel.
- Remove the mudguard.
- Remove the front wheel.

- Support the fork stem and loosen the screws on the upper and then the lower plate.



- Remove the fork stem.

See also

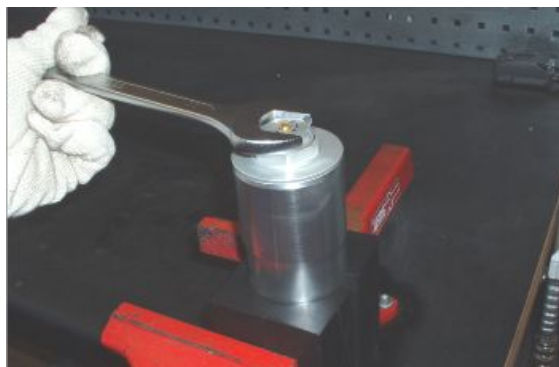
[Removing the front wheel](#)

Draining oil

- Lock the sleeve in a vice with the specific tool (code AP8140149).
- Set the minimum spring preloading.

Specific tooling

AP8140149 Protection for fitting operations



- Unscrew the sleeve top cap.



- Remove the complete cap.



- Remove the spring. Let the oil deposited on the spring turns fully drip into the sleeve.



- Pour the oil into the container.
- Remove in order:
 - upper spring guide;
 - preload pipe;
 - lower spring guide;
 - spring holder cap.



Disassembling the fork

- Drain out all the oil in the stem.
- Block the wheel holder sleeve with a vice.
- Unscrew the bottom screw and remove it together with its gasket.



- Remove the pumping member pin.



- Slide off the dust scraper from the sleeve using a screwdriver as a lever.
- During this operation, pay attention not to damage the sleeve rim.



- Remove the retainer ring.



- Take out the sleeve from the stem using the stem as a hammer puller.



- From the stem remove the fixed fitted bushing, the movable bushing, the ring and the oil seal.





- Remove the ring and the dust guard.

See also[Draining oil](#)

Checking the components**Stem**

Check the sliding surface for scorings and/or scratches.

These scorings can be eliminated by rubbing them with wet sandpaper (grain 1).

If the scorings are deep, replace the stem.

Use a dial gauge to check that the stem bending is below the limit value.

If over the value, replace the stem.

CAUTION

A BENT STEM SHOULD NEVER BE STRAIGHTENED BECAUSE ITS STRUCTURE WOULD BE WEAKENED AND USING THE VEHICLE MAY BECOME DANGEROUS.

Characteristic**Bending limit:**

0.2 mm (0.00787 in)

Sleeve

Check that there are no damages and/or cracks; otherwise, replace it.

Spring

Check the spring is in good conditions.

Check that the following components are in good conditions:

- upper bushing;



- lower bushing;



- pumping member pin.

If there are signs of excessive wear or damage, replace the affected component.

CAUTION

REMOVE ANY IMPURITY IN THE BUSHINGS, TAKING CARE NOT TO SCRATCH THEIR SURFACE.

Replace the following components with new ones:

- sealing ring;



- dust guard;

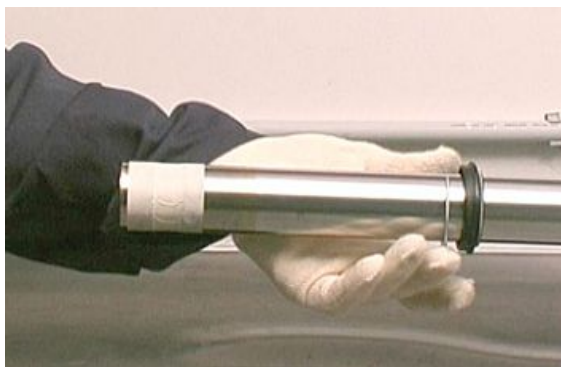


- O-Ring on the cap.



Reassembling the fork

- Lock the stem in a vice without damaging the surface.
- Protect the bearing tube end with adhesive tape.
- Lubricate the sliding edges with fork oil or sealing grease.
- Fit on the slider the dust scraper, the retainer ring and the seal ring.



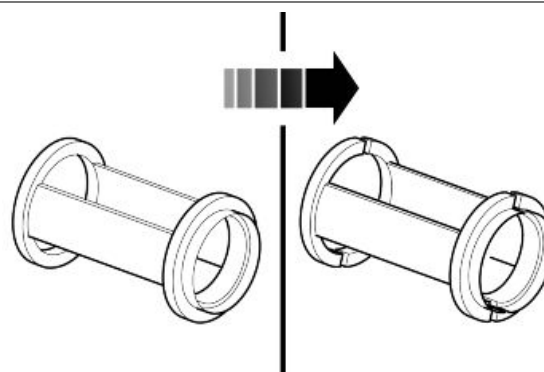
- The sealing ring must be placed with the stamped part facing the dust gaiter.



- Fit the ring, the movable bushing and, after removing the tape, fit the fixed bushing.



- Get the special tool code 8140758.
- Cut the tool along the longitudinal axle so as to obtain two similar half-shells to be used on forks with inverted stems.



- Fit the sleeve on the stem and with the specified tool fit the oil seal into position.

Specific tooling

AP8140758 tool to fit oil seals and dust guards for ø 50 mm (1.97 in) stems

AP8140146 Weight



- Insert the retainer ring in its position.

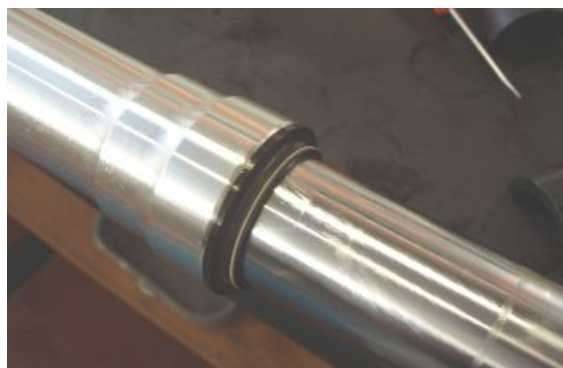


- Fit the dust guard with the specific tool.

Specific tooling

AP8140758 tool to fit oil seals and dust guards for ø 50 mm (1.97 in) stems

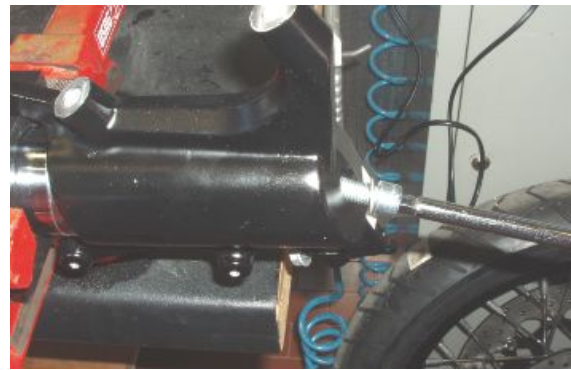
AP8140146 Weight



- Insert the pumping member in the sleeve.

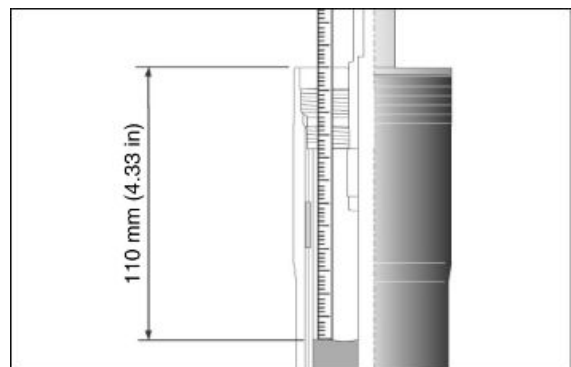


- Tighten the screw fixing the pumping member on the fork end to the prescribed torque.



Filling oil

- Place the sleeve upright in a vice fitted with protection shoes.
- Compress the sleeve in the stem.
Place a support under the stem in order to leave it compressed.
- Pour part of the fork oil into the sleeve.
- Wait some minutes until the oil fills all the ducts.
- Pour the remaining oil.
- Pump out oil a few times.
- Measure the air gap between the oil level and the rim.



THE SLEEVE MUST BE PERFECTLY UPRIGHT IN ORDER TO MEASURE THE CORRECT OIL LEVEL. THE OIL LEVEL MUST BE THE SAME IN BOTH STEMS.

Specific tooling

AP8140149 Protection for fitting operations

Characteristic

Oil level (from sleeve rim, without the spring and preloading pipe)

110 mm (4.33 in).

- Insert the spring holder cap in the sleeve.



- Insert the preloading pipe with the two spring guides in the sleeve.



- Fit the spring.



- Tighten the nut completely.
- Support the pumping member pin in order to screw the upper cover.



- Screw the upper cap on the pumping member pin.



- Place the sleeve in the vice using the specified tool.
- Screw the upper cover, tightening it to the prescribed torque.

Specific tooling

AP8140149 Protection for fitting operations



- Once the operations are completed, restore the spring preloading correct value.

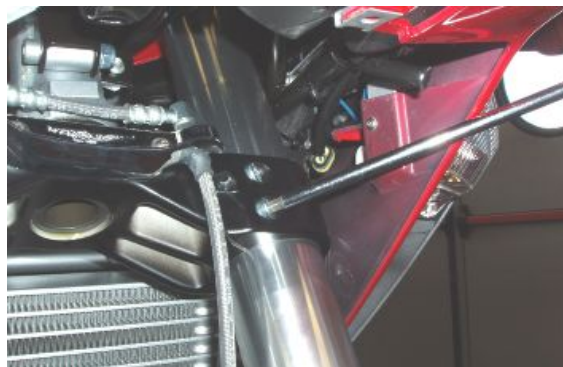


Installing the fork legs

- Insert the fork stem in position.
- Insert the wheel pin so that the stems are aligned.



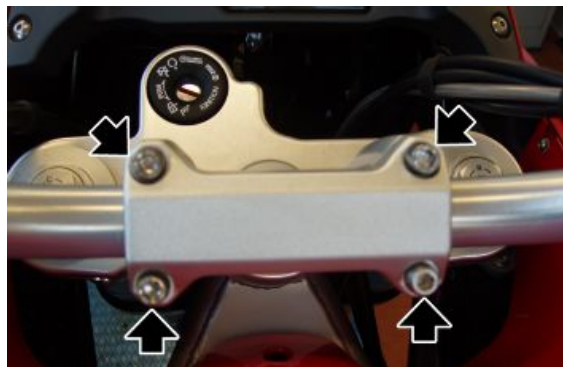
- Tighten the screws on the fork plates to the prescribed torque.



Steering bearing

Adjusting play

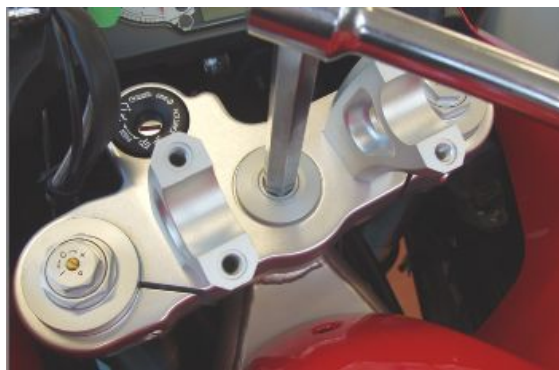
- Unscrew and remove the U-bolt four fixing screws.
- Remove the U-bolt.
- Remove the handlebar and place it paying attention that oil in the clutch and front brake tanks does not spill out.



- Working on both sides, unscrew and remove the upper plate fixing screw on the fork stems.



- Unscrew and remove the fork upper plate cover; collect the shim.



- Lift the fork upper plate sliding it off from the stems.



- Rivet the safety washer on the headstock.



UPON REFITTING, REPLACE THE SAFETY WASHER WITH A NEW ONE



- Using the suitable special tool, unscrew and remove the upper ring nut.

Specific tooling

AP8140190 Tool for steering tightening



- Remove the safety washer.



- Using the suitable special tool, set the preloading of the steering bearings.

Specific tooling

AP8140190 Tool for steering tightening



- Fit a new safety washer.



- Screw the upper ring nut manually and then slightly tighten the clamps on the plate so as to align notches on the ring nut.

Specific tooling

AP8140190 Tool for steering tightening

- Rivet the tongues of the new safety washer.
- Fit the fork upper plate on the stems.

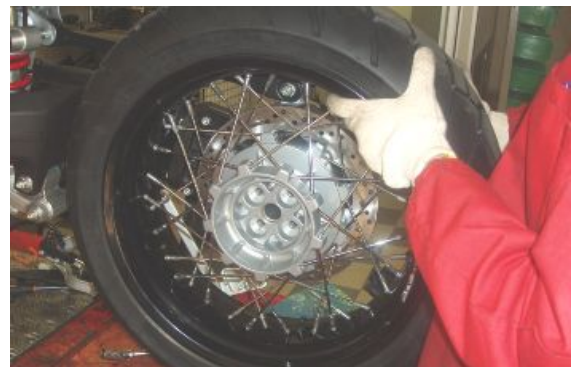
Rear

Removing the rear wheel

- Support the vehicle rear part using a suitable stand.



- Engage the first gear.
- Undo and remove the four screws, collect the spacers and the dust-protection ring.
- Remove rear wheel.



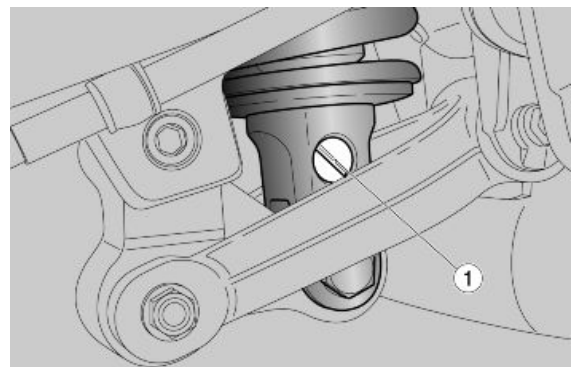
Shock absorbers

Adjusting

The rear suspension consists of a spring-shock absorber unit linked to the frame via Silent-block and to the rear fork via a linkage system.

To set vehicle suspension, the shock absorber has:

- a set screw (1) to adjust the hydraulic rebound damping;
- a set knob (2) to adjust spring (3) preloading.

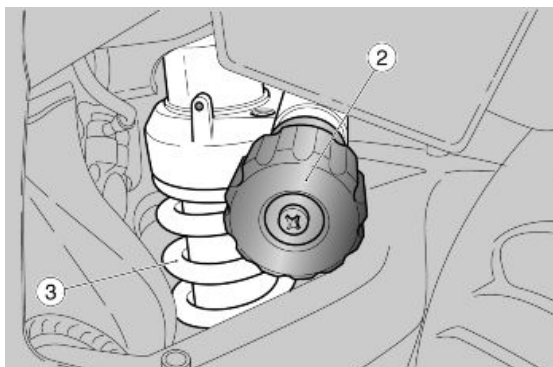


Standard rear shock absorber setting is adjusted to suit most high and low speed riding conditions, to transport the rider plus luggage.

However, this set can be modified for specific needs according to vehicle use.



ALLOW ENGINE AND EXHAUST SILENCER TO COOL OFF BEFORE OPERATING THE SET SCREWS.



ADJUSTMENTS

Regular adjustment (standard):

- only rider.

Half load adjustment:

- (for example, rider with passenger or with luggage).

Maximum load adjustment:

- (for example, rider, passenger and luggage).

CAUTION

SET SPRING PRELOADING AND SHOCK ABSORBER REBOUND DAMPING ACCORDING TO THE VEHICLE USE CONDITIONS. IF THE SPRING PRELOADING IS INCREASED, IT IS NECESSARY TO INCREASE THE REBOUND DAMPING ACCORDINGLY TO AVOID SUDDEN JERKS WHEN RIDING. IF NECESSARY, CONTACT AN Official Moto Guzzi Dealer. TRY RIDING THE VEHICLE ON THE STREET UNTIL THE OPTIMUM ADJUSTMENT IS OBTAINED.

SHOCK ABSORBER SETTING TABLE

Regular load adjustments are the standard settings by manufacturer

REAR SHOCK ABSORBER ADJUSTMENT

Specification	Desc./Quantity
Preload - regular load conditions	15 clicks starting from knob (2) fully loosened
Preload - half-load conditions	28 clicks starting from knob (2) fully loosened
Preload - maximum load conditions	33 clicks starting from knob (2) fully loosened
Rebound - regular load conditions	24 clicks starting from screw (1) fully tightened
Rebound - half -load conditions	20 clicks starting from screw (1) fully tightened
Rebound - maximum load conditions	18 clicks starting from screw (1) fully tightened



(1) THE SETTING SHOWN IN THE TABLE MAY NEED TO BE MODIFIED ACCORDING TO THE TYRE AND ROAD TYPE.

NOTE

(2) IF FITTED.

Removing

- Park the vehicle on its centre stand.
- Lock the vehicle handlebar so that the rear wheel is off the ground.
- Remove the fork.
- Undo and remove the shock absorber upper screw.
- Remove the shock absorber.



INDEX OF TOPICS

CHASSIS

CHAS

Swinging arm

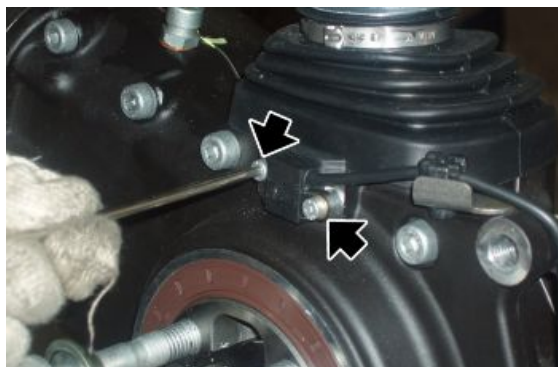
Removing

- To remove the fork, first remove the footrest holding plate and the exhaust silencer.
- Slide off the rear brake calliper from the disc and release the brake pipe.

- Engage the first gear.
- Unscrew and remove the four screws, collecting the spacers and the dust protection ring.



- Remove the rear wheel.
- Unscrew and remove the two screws.
- Remove the speed sensor from the fork.



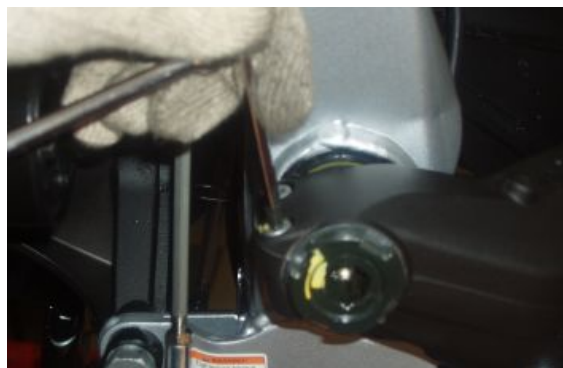
- Unscrew and remove the nut fixing the reaction rod.
- Remove the screw.
- Fix the reaction rod to the chassis with a clamp.



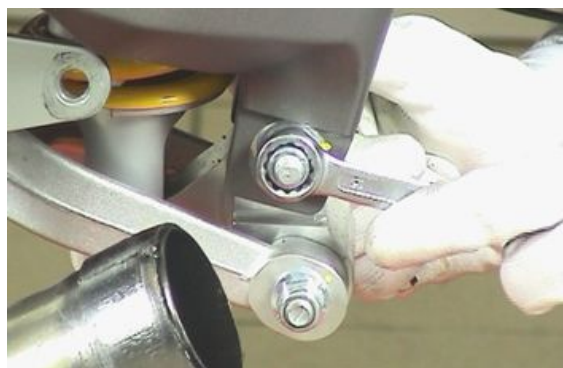
- Remove the clamp from the dust guard cap.



- Loosen the two swingarm terminal screws.



- Unscrew and remove the fixing nut of the connecting rod assembly and collect the screw.



- Loosen the ring nut.

Specific tooling

14.91.26.03 Hook spanner for fixing ring nut of the clutch shaft internal body



- Helped by a second operator, remove the pin and remove the swingarm together with the cardan shaft.



Checking

- Check that the universal joint is not damaged, the gear teeth inserting in the sleeve grooves and the grooves on the joint are not deformed or damaged; otherwise, replace the joint.
- Check that the rubber bellows are not cut or pierced; otherwise, replace it.
- Check that the fork pin threads and the fork fixing nuts are not damaged, deformed or flattened; otherwise, replace them.
- Check that the sleeve grooves are not damaged, deformed or deteriorated; otherwise, replace the sleeve.
- Check that the sleeve outer toothing and grooves are not damaged.



Installing

- Spread a thin layer of lubricating grease all along the swingarm pin.
- Fit the ring nut in the swingarm pin and screw it manually.



- Working from both sides, grease the cardan shaft cables with the recommended product from the recommended products table.
- Block the swingarm, insert the universal joint, align the holes and, at the same time, helped by a second operator, insert the pin completely.
- Tighten the swingarm pin.



- Use the suitable box-spanner to tighten the ring nut.



Specific tooling

05.91.26.30 Tool for tightening the swingarm pin ring nut - clutch hub

- Tighten the two swingarm terminal screws.



- Fit the dust guard cap in the gearbox.
- Lock the dust guard cap with a new clamp.



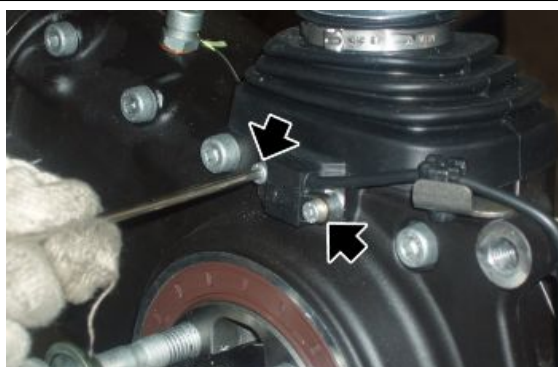
- Place the reaction rod into its seat.
- Insert the screw.
- Screw the nut fixing the reaction rod.



- Place the connecting rod assembly on the swingarm.
- Insert the screw.
- Tighten the fixing nut of the connecting rod assembly.



- Place the speed sensor on the fork and screw the two screws.
- Fit the rear wheel.
- Place the rear brake calliper on the disc and the brake pipe on the fork.



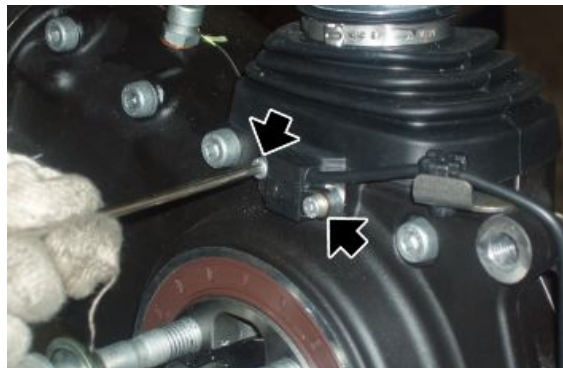
See also

Recommended products chart

Bevel gears

Removing

- Remove the rear wheel.
- Unscrew and remove the two screws.
- Remove the speed sensor from the fork.



- Unscrew and remove the nut fixing the reaction rod.
- Remove the screw.
- Fasten the reaction rod to the chassis with a clamp.



- Undo and remove the four screws.

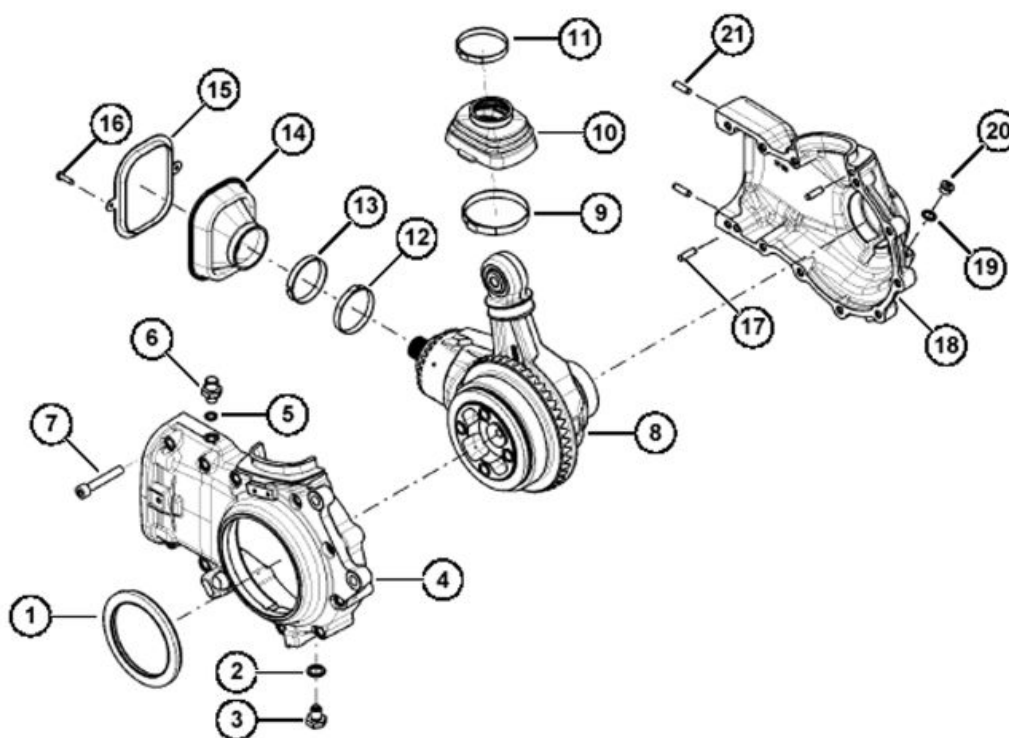


- Remove the transmission casing sliding off the universal joint.



Checking

Casing unit removal



Remove the cover (20).

Remove the plug (3) to drain out the oil.



Lift the cap (10).



Remove the clamps (9) and (11).

Remove the cap (14).



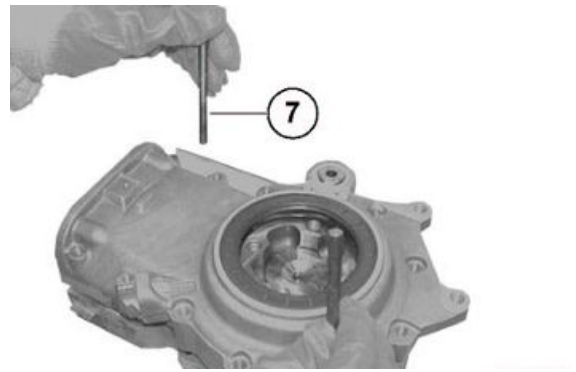
Remove the screws (16).



Collect the ring (15).



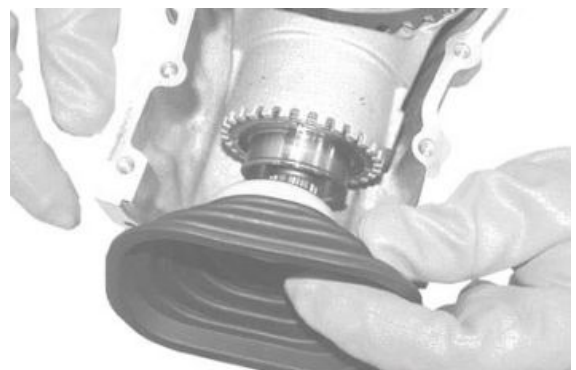
Remove the screws (7).
Remove the casing (4).



Remove the clamp (12).



Remove the cap (14).



Collect the ring (13).

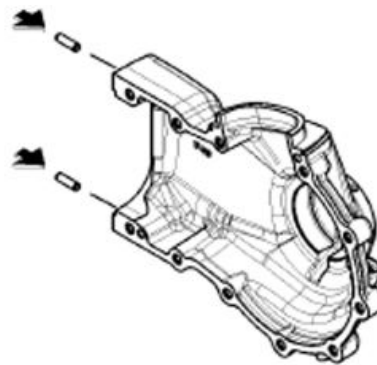


Remove the support unit (8).

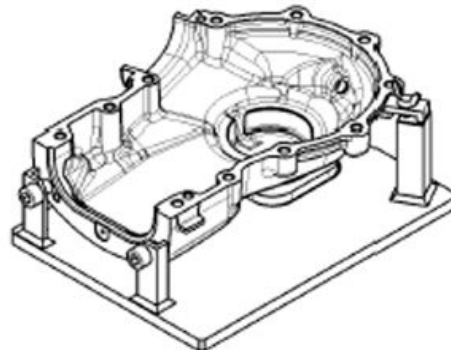


Casing unit fitting

Assemble the dowel pins to the casing with the buffer and a hammer.



Assemble the casing to the special fastening tool.
Clean the casing faying surfaces carefully.



Heat the casing.



Insert the support group in the casing.



Assemble the cap and the ring.



Fit the cap on the support.

Fit the clamp.



Screw the clamp with the specific pliers.



Apply the prescribed sealant to the casing.



Fit a new sealing ring using the buffer.
Lubricate the sealing ring.



Assemble two centring stud bolts with M8 thread
in the threaded holes of the casing as shown in the
picture.



Fit the casing.
Remove the two dowel pins.



Assemble the fixing screws (7).

Tighten the screws (7) to the prescribed torque.

Remove excessive sealant.



Assemble the ring to the casing.



Tighten the fixing screws to the prescribed torque.



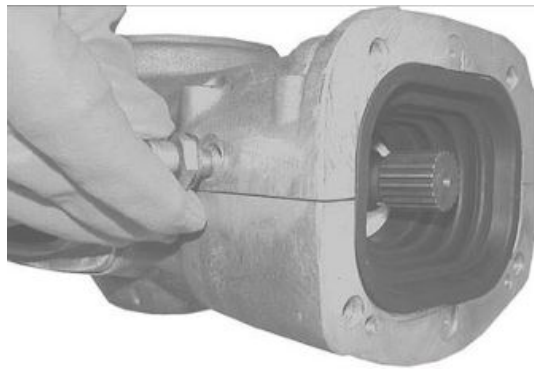
Fit the cap with the washer.

Screw the cap to the prescribed torque.



Fit the breather with the washer.

Screw the breather to the prescribed torque.



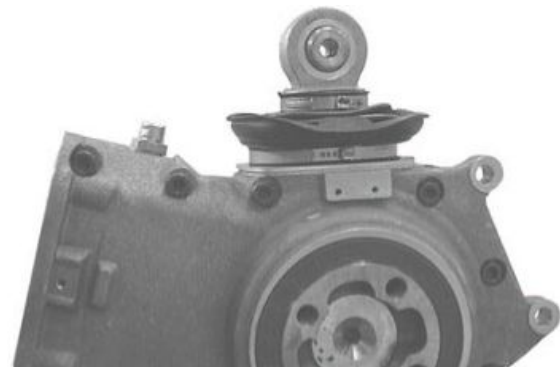
Fill the transmission with the prescribed oil.

Fit the cap with the washer.

Screw the cap to the prescribed torque.



Assemble the cap with the clamps.



Fit the cap in its seat.



Wheel axle unit

REMOVAL

Remove the bearing from the wheel axle with a suitable extractor.



Turn the unit over.

Remove the bearing from the wheel axle with a suitable extractor.

**FITTING**

Heat the bearings to 100°C (212 °F).

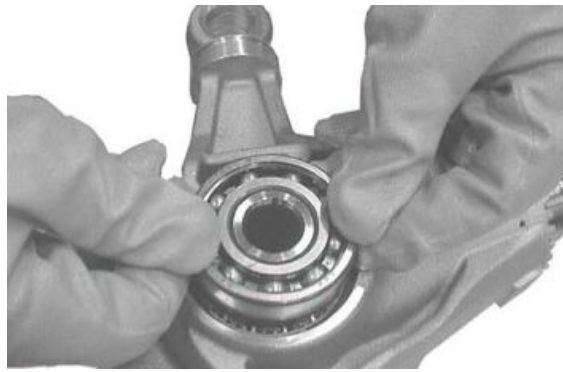


Assemble the bearings to the wheel axle.



Turn the unit over.

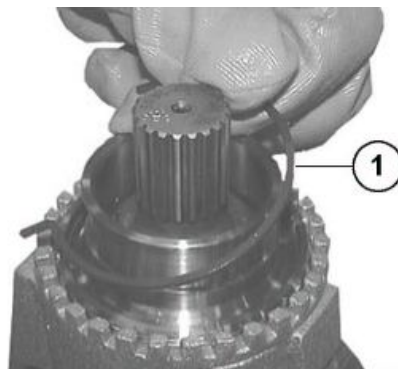
Assemble the bearings to the wheel axle.



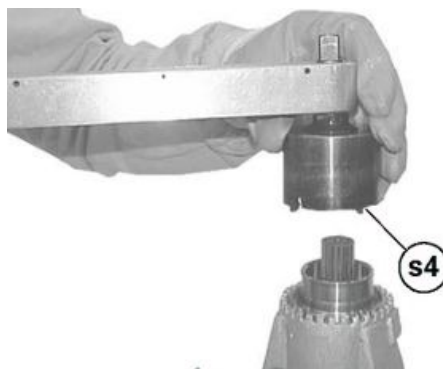
Pinion unit

REMOVAL

Remove the stop ring (1) from the ring nut.



Unscrew the ring nut (2) with the special spanner (s4).



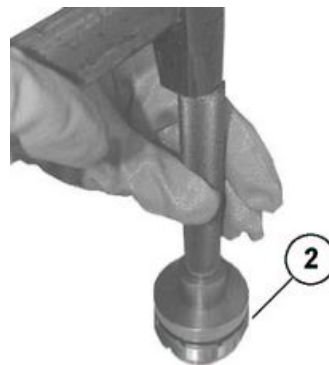
Remove the ring nut (2) and remove the sealing ring from the ring nut.

NOTE

THIS OPERATION DESTROYS THE SEALING RING.



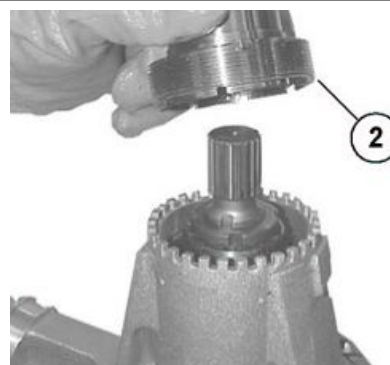
Assemble the sealing ring (3) to the ring nut (2) with the buffer CA715855 (see Fig.1) and a hammer.



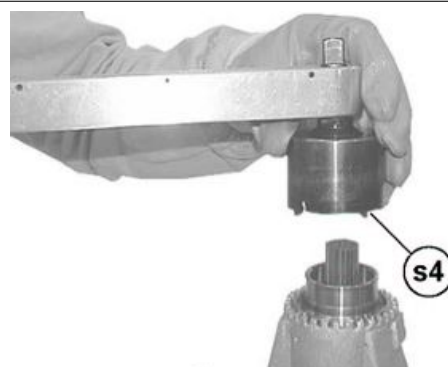
Lubricate the sealing ring (3).



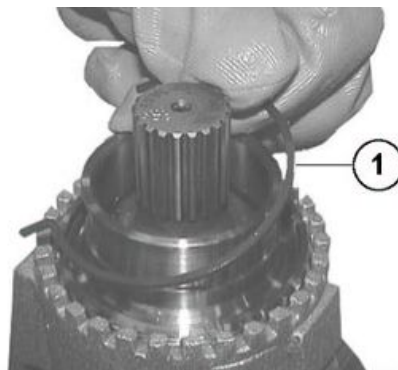
Assemble the ring nut (2).



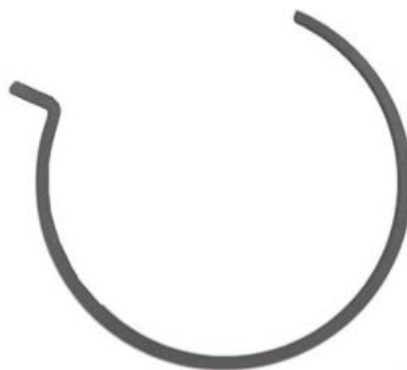
Tighten the ring nut (2) with the special spanner (s4) to the prescribe torque.



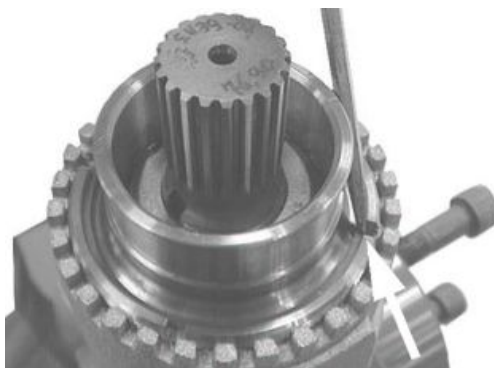
Insert the stop ring (1) in the ring nut (2) in the indicated direction.



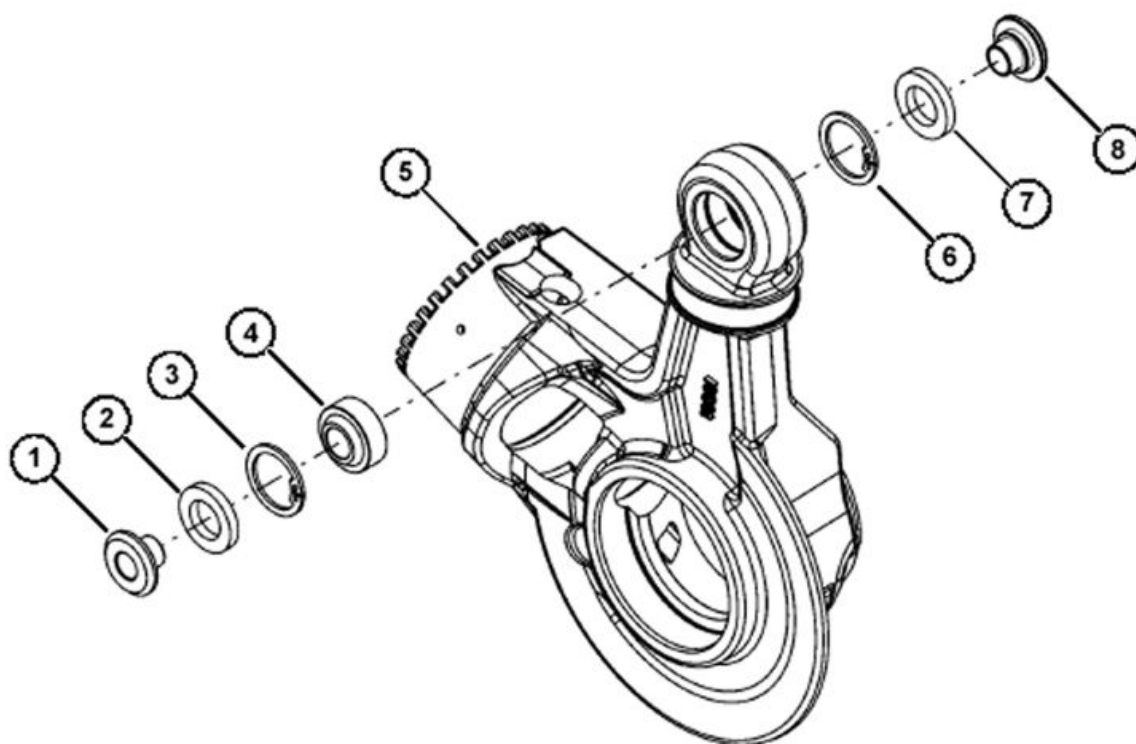
Assembly position of the stop ring (1).

**CAUTION**

MAKE SURE THE STOP RING IS IN ITS SEAT.



Support unit

**REMOVAL**

Remove the bushing (1) with a punch.

Turn the support (5) over and remove the other bushing (8).

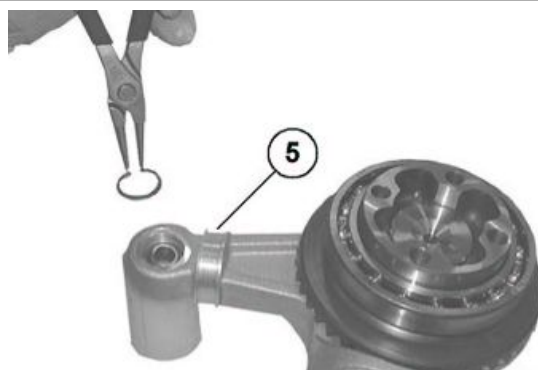


Remove the sealing rings (2) and (7) with a screwdriver.

Remove the stop rings (3) and (6) from the support (5) with suitable pliers.

NOTE

THIS OPERATION DESTROYS THE SEALING RING.

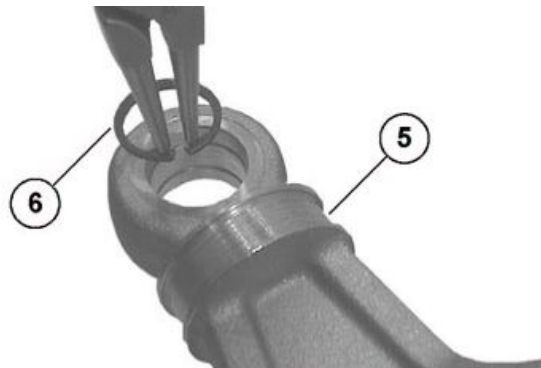


Remove the ball joint (4) with a suitable buffer and a rubber hammer.



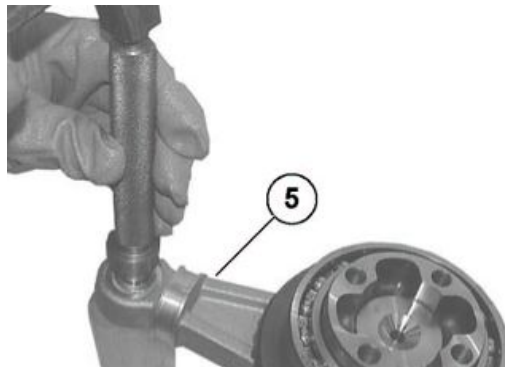
FITTING

Fit the stop ring (6) in the support (5) with suitable pliers.

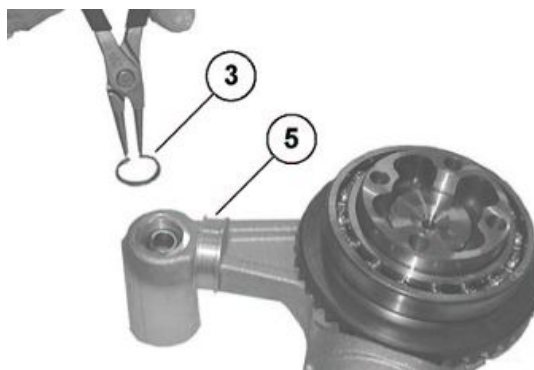


Turn the support (5) over.

Assemble the ball joint (4) with the buffer and a rubber hammer.



Fit the stop ring (3) in the support (5) with suitable pliers.



Manually assemble the new sealing rings (2) and (7).

Assemble the bushing (1).



Drive the bushing (1) in with a plastic hammer.

Turn the support (5) over and assemble the other bushing (8).



TROUBLESHOOTING

Possible Cause	Operation
1. Fitting error of the radial seal or seal damaged 2. Sliding surface of the wheel axle seal spoiled or damaged	1. Replace the sealing ring and fit it correctly with the suitable tool 2. Replace the wheel axle
1. Casing not sealed 2. Closing screws of the casing shells not tightened to the prescribed torque	1. Open the casing shells, clean the surfaces, seal and reassemble the casing shells 2. Tighten the closing screws to the correct torque
1. Dirt between the sealing ring and the casing 2. A used sealing ring has been fitted 3. Plug not tightened to the prescribed torque	1. Clean and tighten to the correct torque 2. Replace the sealing ring 3. Tighten the plug to the correct torque
1. Cap damaged 2. Retaining clamp or closing cover loose 3. Fitting error of the radial seal or seal damaged 4. Sliding surface of the wheel spacer spoiled or damaged	1. Replace the cap 2. Screw the clamp with suitable pliers 3. Replace the sealing ring and fit it correctly with the suitable tool 4. Replace the spacer
1. Cap damaged 2. Internal retaining clamp or external closing clamp loose	1. Replace the cap 2. Screw the internal or external clamp with suitable pliers
1. Bevel gear pair fitting error 2. Bevel gear pair toothing spoiled or damaged	1. Replace the bevel gear pair
1. Ball bearings on the wheel axle damaged	1. Replace the wheel bearings

Installing

- Insert the transmission casing on the swingarm making sure that the universal joint engages correctly.



- Tighten the four screws to the prescribed torque operating diagonally.



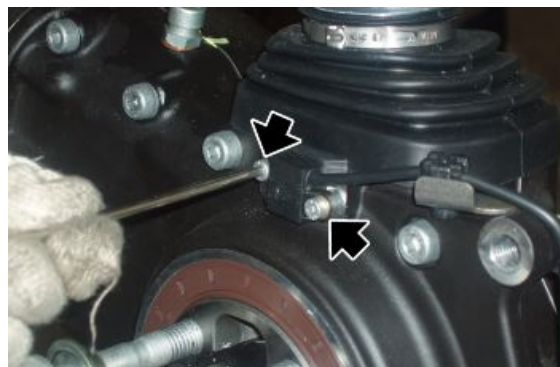
- Place the reaction rod into its seat.
- Insert the screw.
- Screw the nut fixing the reaction rod.



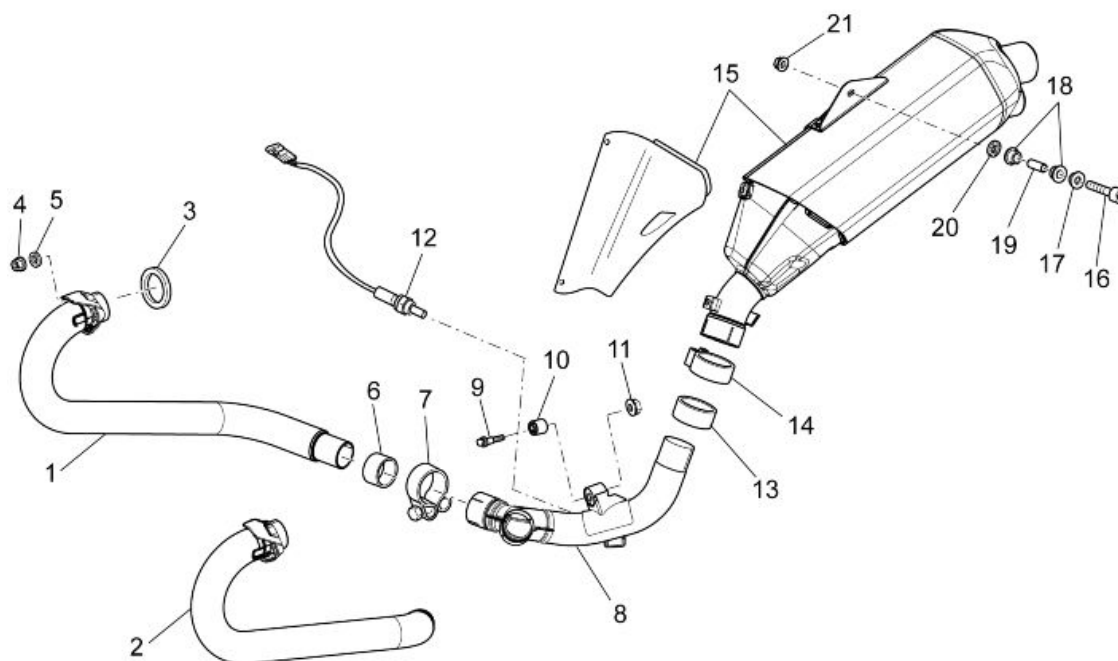
- Place the dust-protection ring between the rim and the cardan shaft taking care to mount it with the collar facing the transmission unit.



- Place the speed sensor and fasten the cable harness with the clamps.
- Place the rear wheel on the fork.
- Tighten the four screws with their spacers and the dust-protection ring.
- Place the rear brake calliper on the disc and the brake pipe on the fork.



Exhaust



key:

1. Right exhaust pipe
2. Left exhaust pipe

3. Gasket
4. Flanged nut
5. Washer
6. Gasket
7. Clamp
8. Central exhaust pipe
9. TE flanged screw
10. Silent-block
11. Flanged self-locking nut
12. Lambda probe
13. Gasket
14. Clamp
15. Silencer
16. TCEI screw
17. Silencer fixing bushing
18. Muffler rubber ring
19. Spacer
20. Washer
21. Nut

Removing the tail pipe

- Loosen the sealing clamp between the exhaust and the central manifold.



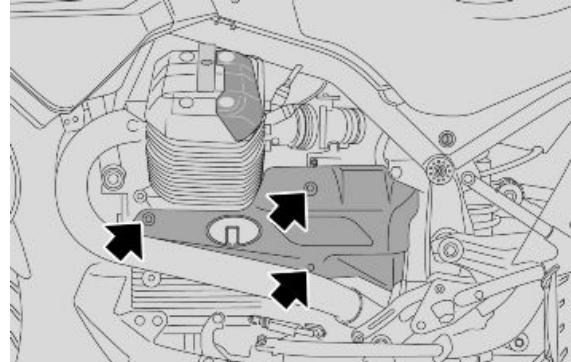
- Undo and remove the screw and collect the nut and the washer.



- Remove the exhaust end.

Removing the manifold - tail pipe

- Remove the exhaust end and the exhaust manifolds.
- Remove the starter motor protection in order to disconnect the lambda probe connector.



- Unscrew and remove the nut and remove the fixing screw.
- Remove the manifold - exhaust end coupling together with the lambda probe.



See also

[Removing the exhaust manifold](#)
[Removing the tail pipe](#)

Removing the exhaust manifold

The engine and the exhaust system components get very hot and remain in this condition for a certain time interval after the engine has been switched off. Before handling these components, make sure that you are wearing insulating gloves or wait until the engine and the exhaust system have cooled down.

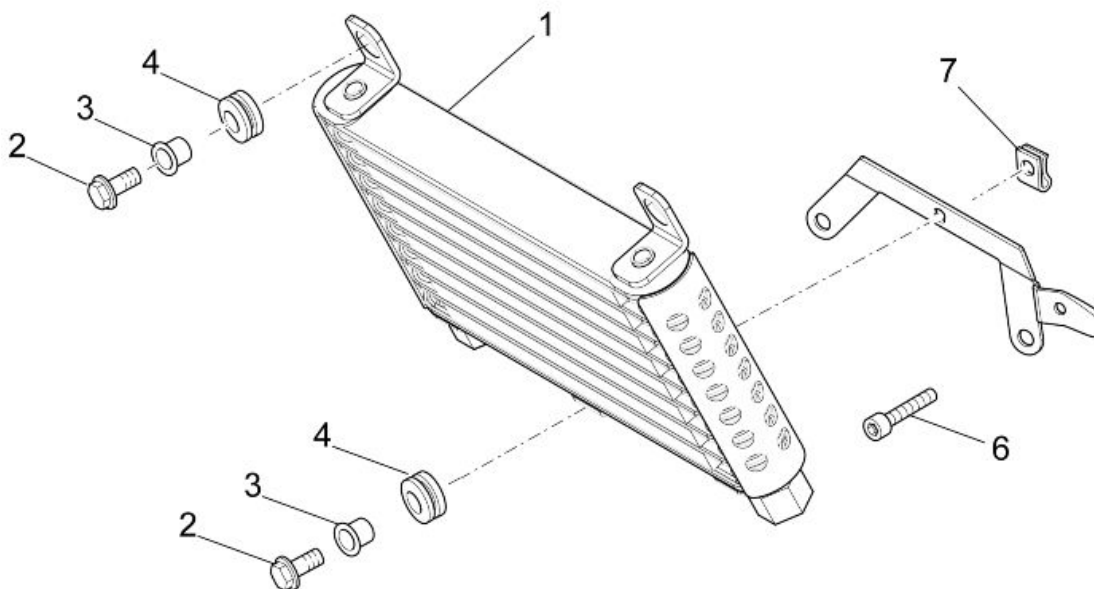
- Unscrew and remove the two nuts on the head exhaust stud bolts.
- Retrieve the washers.



- Loosen the clamp.
- Remove the exhaust manifold.



Engine oil cooler



Key:

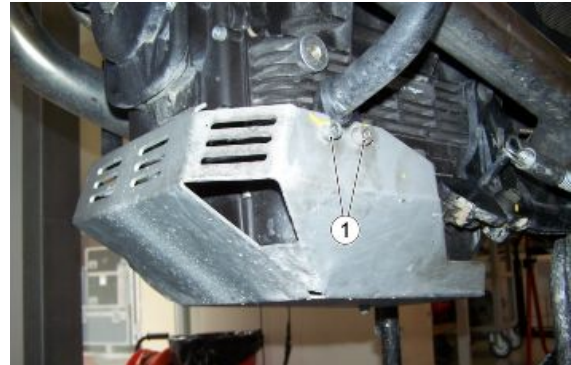
1. Complete oil radiator
2. TE flanged screw

3. T-shaped bushing
4. Rubber ring
5. Radiator support
6. TCEI screw
7. Clip

Removing

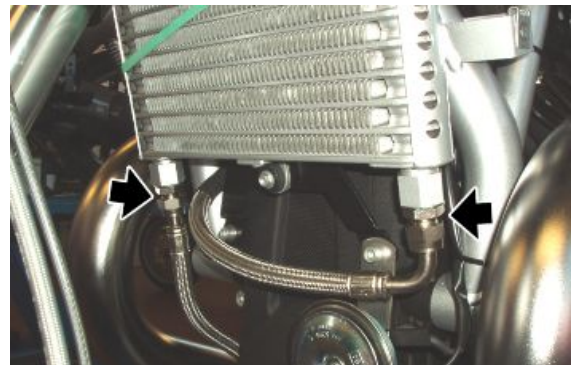
It is necessary to remove the metal oil sump guard in order to change the engine oil and replace the oil filter:

- Operating from both sides, unscrew and remove both screws (1).
- Remove the oil sump guard.



- Place a collecting container and empty the lubrication system.

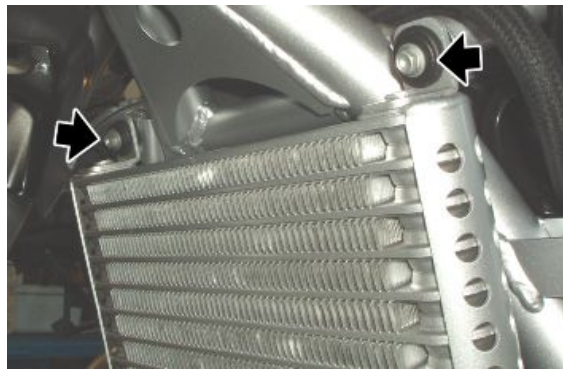
- Unscrew and remove the two oil pipes on the radiator.



- Undo and remove the radiator lower screw and collect the washer.



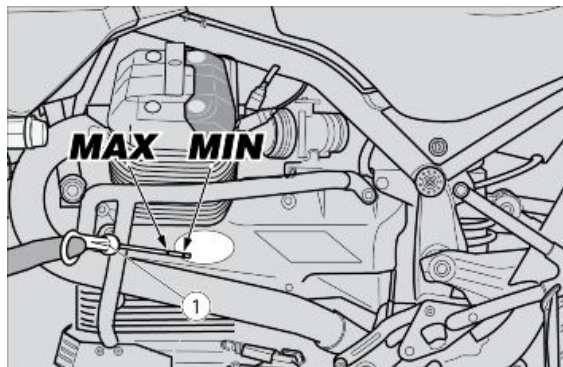
- Undo and remove the two radiator upper screws and collect the washer.



- Remove the oil cooling radiator.

Installing

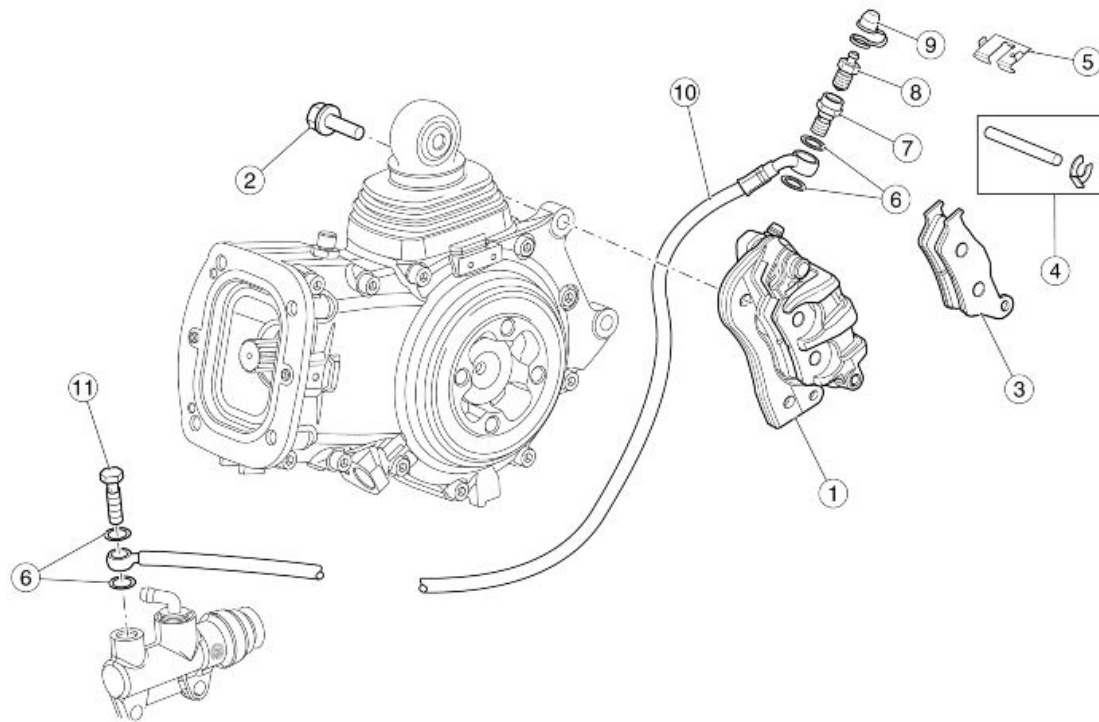
- Fit the oil cooling radiator on the vehicle following the operations described in the removal chapter but in reverse order.
- Pull out the oil filler plug / oil level dipstick (1).
- Pour new oil until it goes over the minimum level marked "MIN" on the dipstick (1).
- Insert the oil filler plug / oil level dipstick (1).
- Start the vehicle and let the engine run for a few minutes so that the oil circulates and fills the radiator internal ducts.
- Stop the engine and check the oil level with the dipstick (1).
- Fill with engine oil as required.



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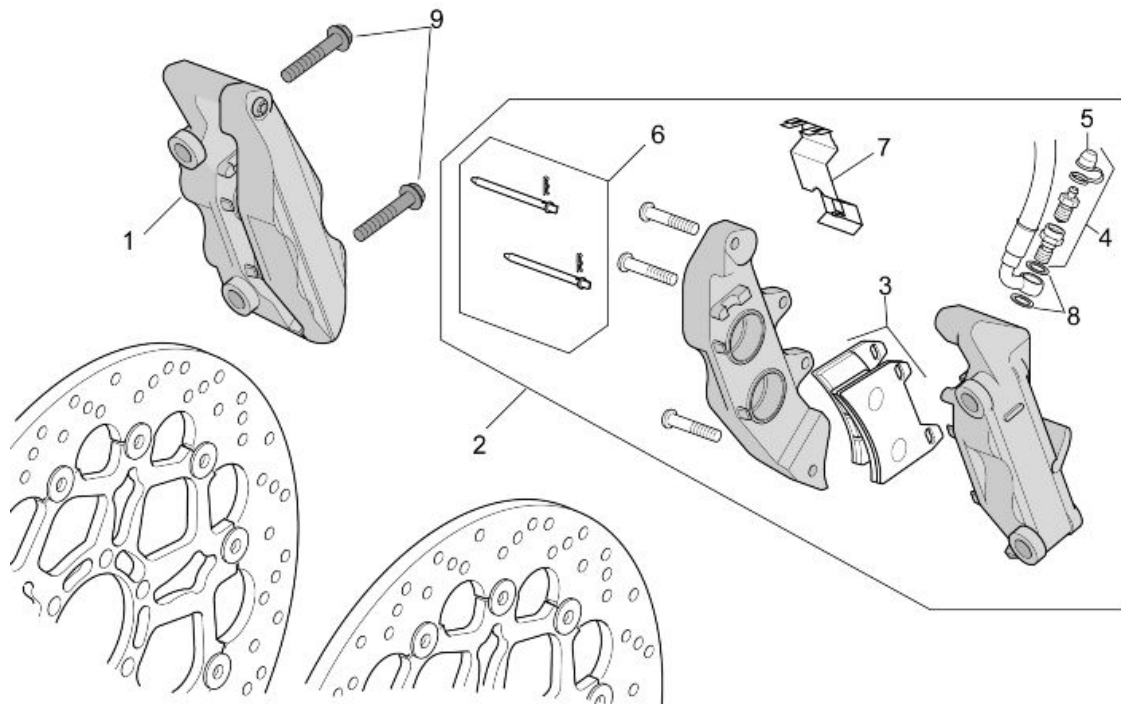
BRAKING SYSTEM

BRAK SYS

Rear brake calliper**Key:**

1. Rear brake calliper
 2. Screw
 3. Pads
 4. Pin + calliper split pin
 5. Spring
 6. Gasket
 7. Screw
 8. Air bleed
 9. Air bleed cap
 10. Rear brake pipe
 11. Oil pipe screw
-

Front brake calliper



Key:

1. Front right brake calliper
2. Front left brake calliper
3. Pads
4. Air bleed
5. Air bleed cap
6. Pins + Calliper springs
7. Spring
8. Aluminium gasket
9. Screw

Front brake pads

Removal

- Unscrew and remove the two screws.
- Slide off the brake calliper from the disc.



- Turn the pins and remove both split pins.



- Remove both pins.



- Remove the vibration-damping plate.



- Extract one pad at a time.

CAUTION

AFTER REMOVING THE PADS, DO NOT OPERATE THE BRAKE LEVER OR THE CALLIPER PLUNGERS COULD GO OUT OF THEIR SEATS RESULTING IN BRAKE FLUID LEAKS.



Installing

- Insert two new pads, placing them so that the holes are aligned with the caliper holes.

CAUTION

ALWAYS REPLACE BOTH PADS AND MAKE SURE THEY ARE CORRECTLY POSITIONED INSIDE THE CALLIPER.



- Position the anti-vibration plate.
- Insert both pins.
- Position both split pins.
- Abut the plungers against the pads, acting on the brake pump lever several times.
- Check the brake fluid level in the reservoir.





Rear brake pads

Removal

- Undo and remove the two screws.
- Remove the brake calliper from the disc.
- Turn the pin and pull out the split pin.
- Remove the split pin.



-
- Remove the pin.



- Extract one pad at a time.

CAUTION

AFTER REMOVING THE PADS, DO NOT OPERATE THE BRAKE CONTROL LEVER OR THE CALLIPER PLUNGERS COULD GO OUT OF THEIR SEATS RESULTING IN BRAKE FLUID LEAKS.



Installing

- Insert two new pads, placing them so that the holes are aligned with the caliper holes.

CAUTION

ALWAYS REPLACE BOTH PADS AND MAKE SURE THEY ARE CORRECTLY POSITIONED INSIDE THE CALLIPER.



- Insert the pin.
- Position the split pin.
- Abut the plungers against the pads, acting on the brake pump pedal several times.
- Check the brake fluid level in the reservoir.





Bleeding the braking system

Front

Any air trapped in the hydraulic circuit acts as a cushion, absorbing much of the pressure applied by the brake pump and minimising the braking power of the calliper.

The presence of air is signalled by the "sponginess" of the brake control and by poor braking efficiency.

CAUTION

CONSIDERING THE DANGER FOR VEHICLE AND RIDER, IT IS STRICTLY NECESSARY, AFTER REFITTING BRAKES AND RESTORING THE BRAKING SYSTEM TO THE REGULAR USE CONDITIONS, THAT THE HYDRAULIC CIRCUIT BE AIR PURGED.

NOTE

THE FOLLOWING OPERATIONS REFER TO ONLY ONE FRONT BRAKE CALLIPER BUT APPLY TO BOTH CALLIPERS. THE VEHICLE MUST BE ON LEVEL GROUND TO BE PURGED. WHILE PURGING THE HYDRAULIC SYSTEM, FILL THE RESERVOIR WITH THE NECESSARY QUANTITY OF BRAKE FLUID. CHECK THAT, DURING THE OPERATION, THERE IS ALWAYS BRAKE FLUID IN THE RESERVOIR.

- Remove the rubber protection cover from the bleed valve.
- Insert the transparent plastic pipe in the front brake calliper bleed valve and slide the other end of this pipe in a container to collect the fluid.
- Remove the front brake fluid reservoir cap.
- Operate the brake lever and then open the bleed valve on the calliper by a 1/4 turn to let the air escape.
- Close the bleed valve before reaching the end of travel of the brake lever, then repeat the operation until air no longer escapes.



- Repeat the procedure for both callipers.



- Screw the bleed valve and remove the pipe.
- Top-up the reservoir until the right brake fluid level is obtained.
- Refit and block the front brake fluid reservoir cap.
- Refit the protective rubber cap.

Rear

Any air trapped in the hydraulic circuit acts as a cushion, absorbing much of the pressure applied by the brake pump and minimising the braking power of the calliper.

The presence of air is signalled by the "sponginess" of the brake control and by poor braking efficiency.

CAUTION

CONSIDERING THE DANGER FOR VEHICLE AND RIDER, IT IS STRICTLY NECESSARY, AFTER REFITTING BRAKES AND RESTORING THE BRAKING SYSTEM TO THE REGULAR USE CONDITIONS, THAT THE HYDRAULIC CIRCUIT BE AIR PURGED.

NOTE

THE VEHICLE MUST BE ON LEVEL GROUND TO BE PURGED. WHILE PURGING THE HYDRAULIC SYSTEM, FILL THE RESERVOIR WITH THE NECESSARY QUANTITY OF BRAKE FLUID. CHECK THAT, DURING THE OPERATION, THERE IS ALWAYS BRAKE FLUID IN THE RESERVOIR.

- Remove the rubber protection cover from the bleed valve.
- Insert the transparent plastic pipe in the rear brake calliper bleed valve and insert the other end of this pipe into a container to collect the fluid.
- Remove the rear brake fluid reservoir cap.
- Operate the brake lever and then open the bleed valve on the calliper by a 1/4 turn to let the air escape.
- Close the bleed valve before reaching the end of travel of the brake lever,



then repeat the operation until air no longer escapes.



- Screw the bleed valve and remove the pipe.
 - Top-up the reservoir until the right brake fluid level is obtained.
 - Refit and lock the rear brake fluid reservoir cap.
 - Refit the protective rubber cap.
-

INDEX OF TOPICS

BODYWORK

BODYW

Seat

- Rest the vehicle on its stand.
- Insert the key in the saddle lock.
- Turn the key clockwise and slightly press the centre of the passenger seat rear part to facilitate releasing the pin.
- Lift the passenger seat and slide it off from behind.
- Unscrew and remove the knobs fixing the rider saddle.
- Remove the rider saddle.



CAUTION

BEFORE LOWERING AND LOCKING THE SADDLE, CHECK THAT THE KEY HAS NOT BEEN LEFT INSIDE THE GLOVE-BOX / TOOLKIT COMPARTMENT.

Engine guard



ENSURE THAT THE ENGINE AND THE THERMAL PARTS OF THE VEHICLE ARE COLD BEFORE OPERATING ACCORDING TO THE FOLLOWING INSTRUCTIONS. PARK THE VEHICLE ON STAND ON FIRM AND LEVEL GROUND.

- Undo the screw and remove the rear brake oil reservoir.

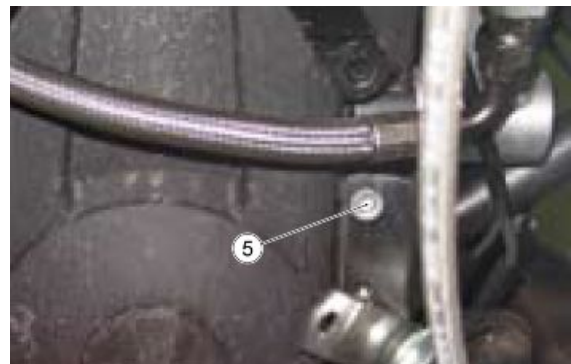
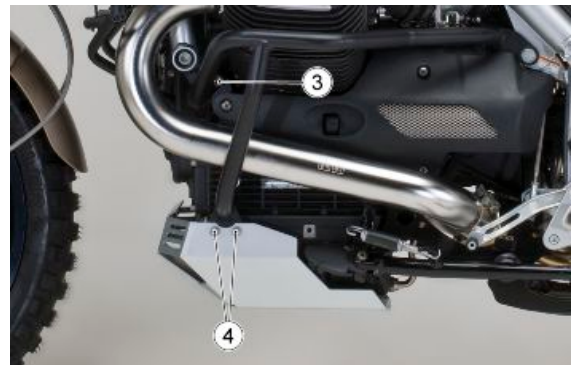


- From the left side of the vehicle, remove the nut (1) and the corresponding washer.
- Slide off the frame pin (2) from the right side with the corresponding washer.

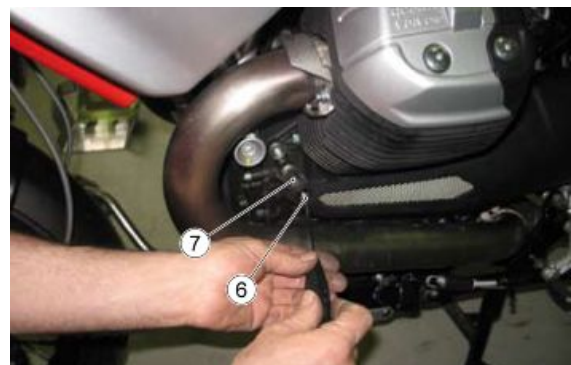




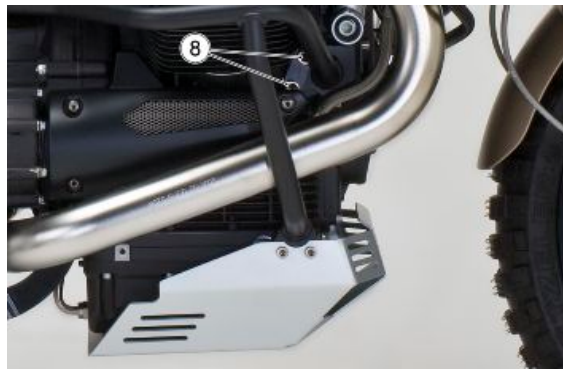
- Remove the TCEI screw (3) (M10x35) on the upper side.
- Remove both TCEI screws (4) (M8x40) in the lower part of the engine guard.
- Remove the TCEI screw (5) (M8x60) in the engine guard front section with the corresponding washer.



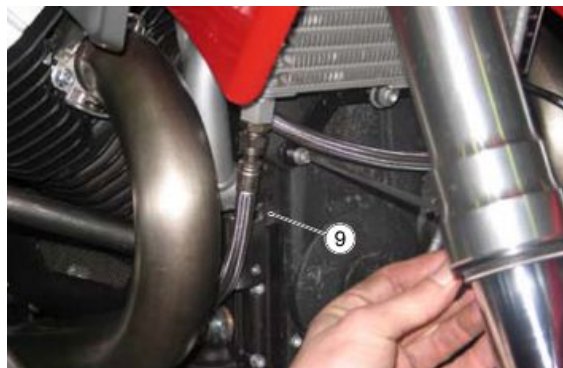
- Remove the screw (6).
- Remove the hexagonal stud bolt (7) with the corresponding washer.
- Remove the left engine guard.



- Remove the TCEI screws (8) (M10x35) on the upper side.



- Remove the TCEI screw (9) (M8x60) and the corresponding washer.



- Remove the TCEI screws (10) (M8x40) in the lower part of the engine guard.



- Remove the right engine guard.

Instrument panel

- Undo and remove the four screws.



- Disconnect the instrument panel connector.



Supplementary light mount



ENSURE THAT THE ENGINE AND THE THERMAL PARTS OF THE VEHICLE ARE COLD BEFORE OPERATING ACCORDING TO THE FOLLOWING INSTRUCTIONS. PARK THE VEHICLE ON STAND ON FIRM AND LEVEL GROUND.

- Remove the screws (1).



- Remove the screws (2).
- Remove the complete support (3).



NOTE

FOR REFITTING, FOLLOW THE PROCEDURE IN THE REVERSE ORDER

Additional lights

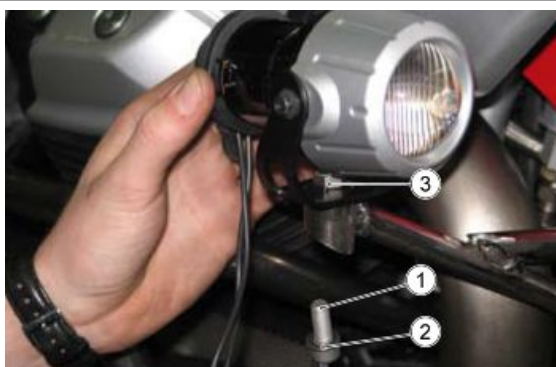
- Disconnect the additional headlamps connectors.



- Slide off the cables from the opening near the arrows between the side fairings and fairings.



- Remove the screw (M8x20) and be careful to collect the washer and the nut.



NOTE

FOR REFITTING, FOLLOW THE PROCEDURE IN THE REVERSE ORDER

Rider footrest plate

LEFT SIDE

- Undo and remove the upper screw and collect the washer and the nut.



- Undo and remove the lower screw and collect the two washers and the spacer.



- Undo and remove the lower screw and collect the washer and the spacer.



- Disconnect the gearbox rod and release the spring.
- Remove the left footrest holding plate.

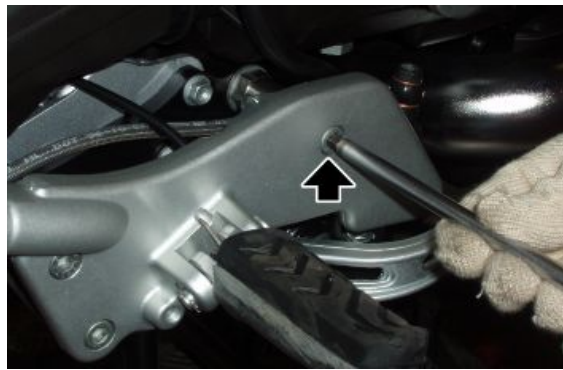


RIGHT SIDE

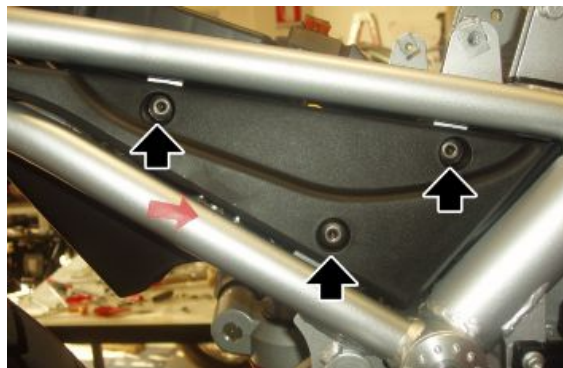
- Undo and remove the upper screw and collect the washer and the nut.



- Undo and remove the front lower screw.



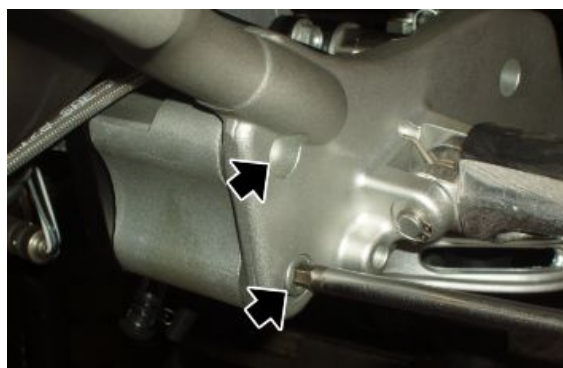
- Undo and remove the three screws.
- Remove the right under seat fairing.



- Disconnect the connectors of the rear brake lever switch and the speed sensor.
- Release the cable harness from the clamps.



- Undo and remove the two rear lower screws; collect the washers and the spacer.



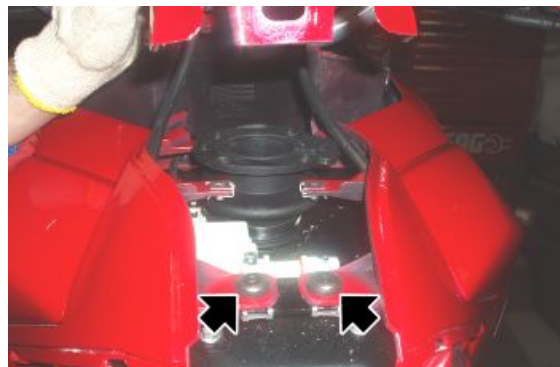
- Unscrew and remove the screw.
- Detach the rear brake fluid reservoir but keep it connected to the pipe.



- Remove the right footrest plate, keeping the brake fluid reservoir in vertical position.

Side fairings

- Remove the fuel tank upper fairing.
- Unscrew and remove the two screws.



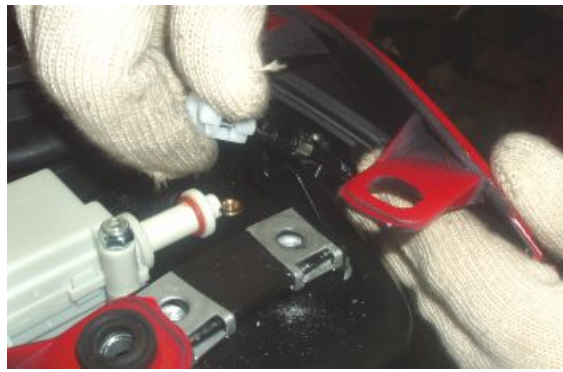
- Working from both sides, undo and remove the screw.



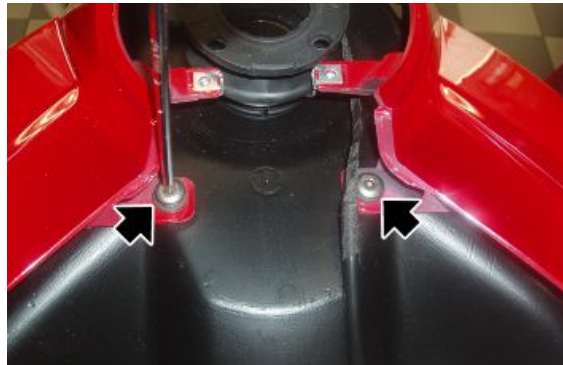
- Working from both sides, undo and remove the screw.



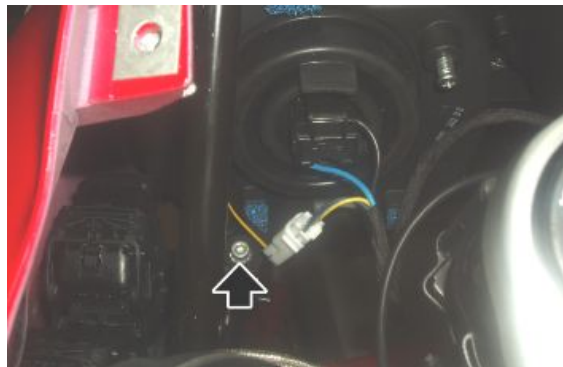
- Detach the fairing.
- Disconnect the glove-box compartment opening cable.



- Undo and remove the two front screws.



- Operating from both sides, undo and remove the internal screw and collect the washer and the nut.



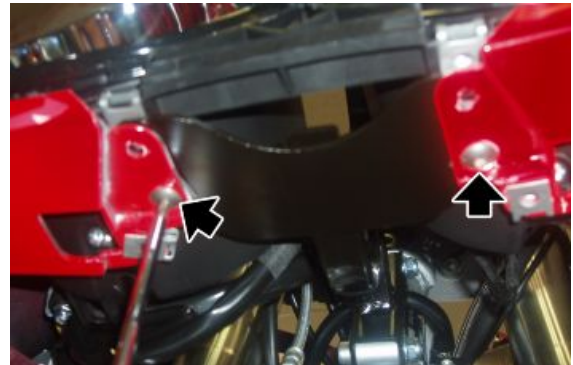
- Unscrew and remove the two screws.



- Undo and remove the four screws.
- Remove the headlight lower cover.



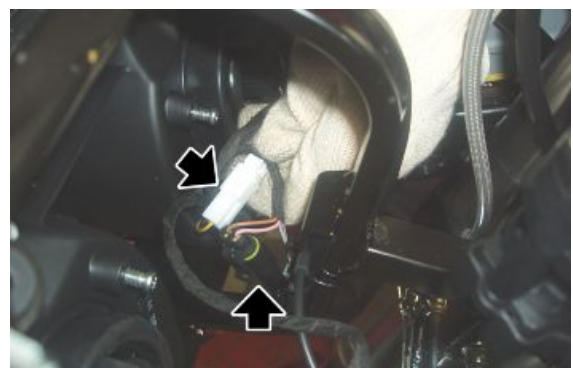
- Unscrew and remove the two screws.

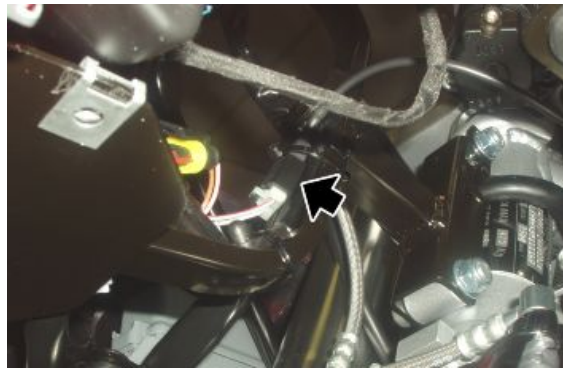


- Operating from both sides, disconnect the turn indicator connector.



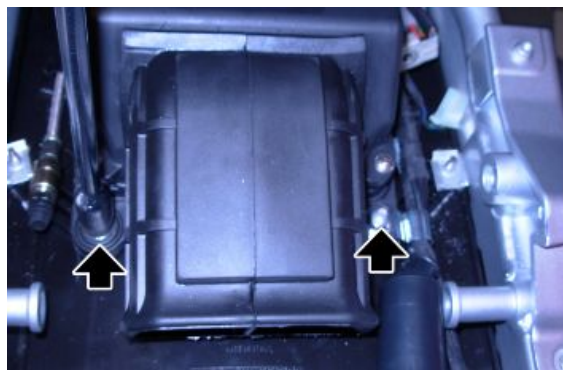
- Slightly detach the fairing.
- Disconnect the front headlight connectors releasing the cable harness from the clamps.
- Remove the fairing together with the front headlight.





Air box

- Remove the saddle.
- Remove the passenger grab handle.
- Undo and remove the two screws and collect the cable guide.



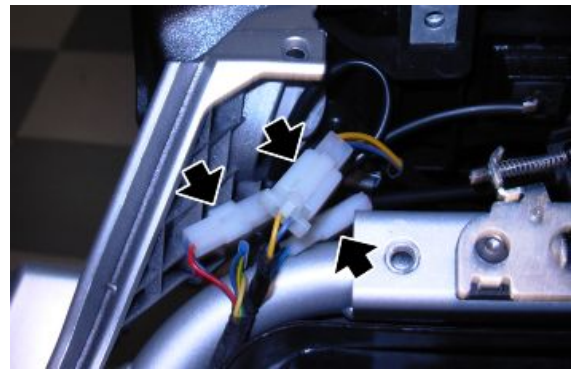
- Disconnect the air temperature sensor connector.



- Slide off and remove the main fuse box from its holder.



- Disconnect the rear light connectors



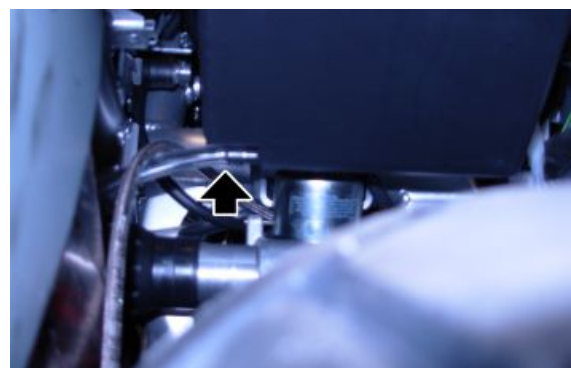
- Release the clutch bleeding pipe from the cable guide.



- Operating from both sides, undo and remove the three screws.
- Remove the mudflap.



- Release from its and remove the breather pipe placed on the right side of the filter casing.
- Operating on both sides, loosen the clamp.

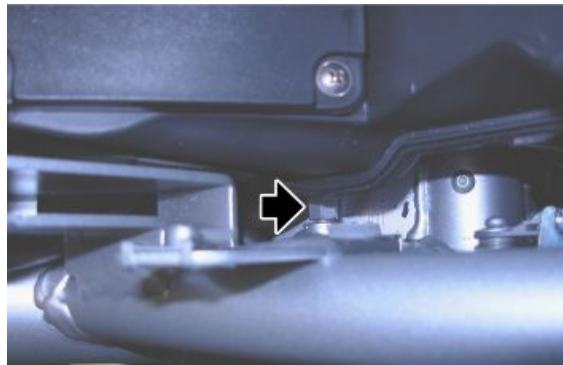




- Remove the two breather pipes.



- Operating from both sides, undo and remove the stud bolt.
- Remove the filter casing.



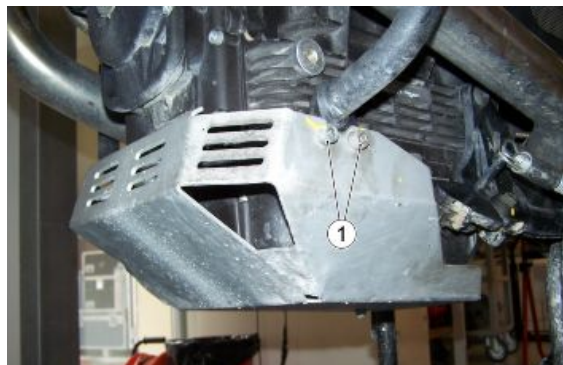
See also

[Seat](#)

Sump guard



ENSURE THAT THE ENGINE AND THE THERMAL PARTS OF THE VEHICLE ARE COLD BEFORE OPERATING ACCORDING TO THE FOLLOWING INSTRUCTIONS. PARK THE VEHICLE ON STAND ON FIRM AND LEVEL GROUND.



- Remove the four TCEI 8x40 screws (1) (two on each side)
- Be careful to collect the four spacer bushings inside the sump guard.



NOTE

FOR REFITTING, FOLLOW THE PROCEDURE IN THE REVERSE ORDER

Fuel tank

FUEL TANK CAP REMOVAL

- Open the fuel tank cap.
- Cover the tank fill opening with a clean cloth so that no foreign bodies can come in.
- Undo and remove the four screws.
- Remove the cap.



FUEL TANK COVER

- Remove the rider saddle.
- Operating from both sides, undo and remove the three screws.
- Collect the rubber rings of the rear screws.
- Remove the fuel tank cover.



See also

[Seat](#)

FUEL TANK UPPER FAIRING

- Remove the fuel tank cap.
- Undo and remove the four screws.



- Remove the fuel tank cover.
- Working from both sides, undo and remove the screw.



- Unscrew and remove the front screw fixing the tank.



- Operating from both sides, undo and remove the two screws.



- Lift the rear part of the fuel tank fairing.
- Disconnect the pipes.
- Remove the fuel tank fairing.

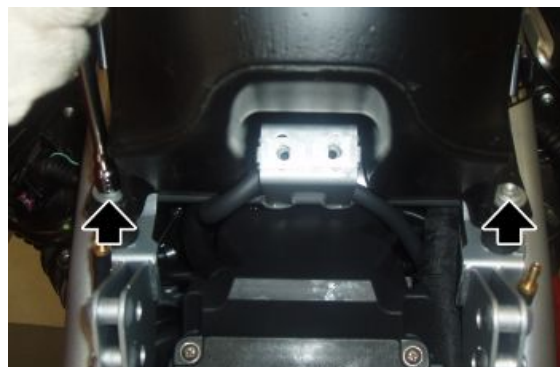
**See also**[Seat](#)

FUEL TANK

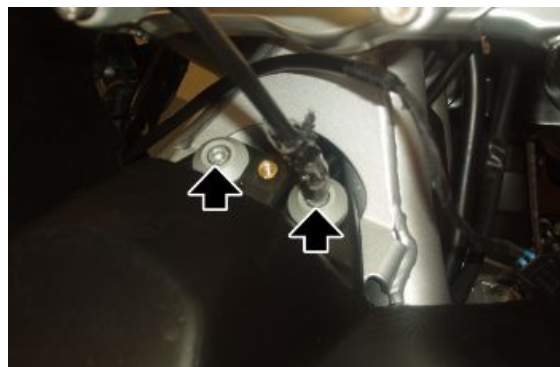
- Remove the tank side fairings.
- Disconnect the glove-box opening control connector.



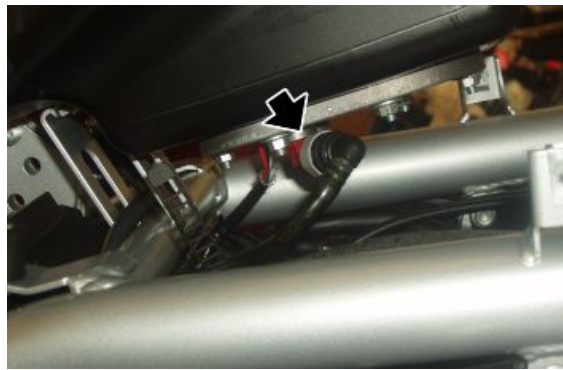
- Undo and remove the two rear screws and collect the washers.



- Undo and remove the two front screws.



- Lift the tank and disconnect the fuel pipe.



- Disconnect the fuel pump connector.
- Remove the fuel tank.

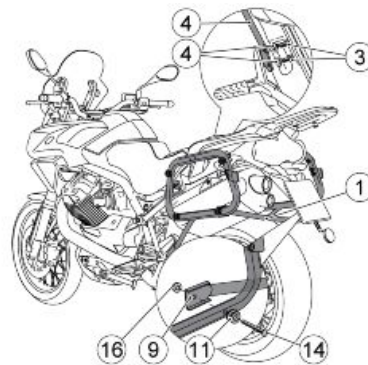


See also

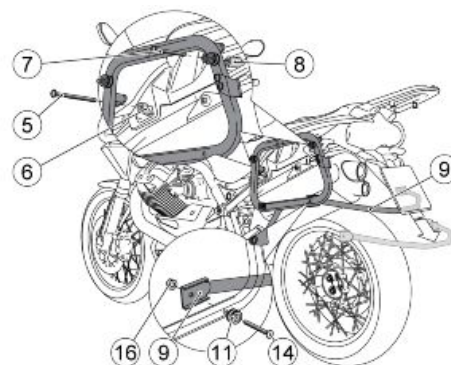
[Side fairings](#)

Pannier mounting

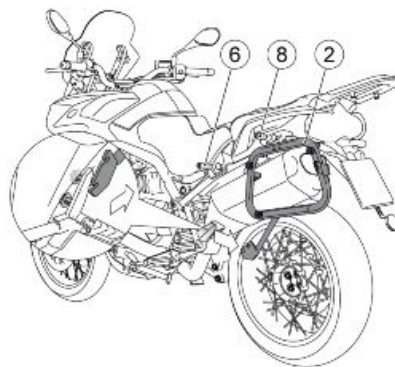
- Remove the countersunk-head screw (14) and collect the bushings (11) and nuts (16).
- Remove the cross-member (9).
- Remove the hexagonal-head screw (3) and collect the washers (4).



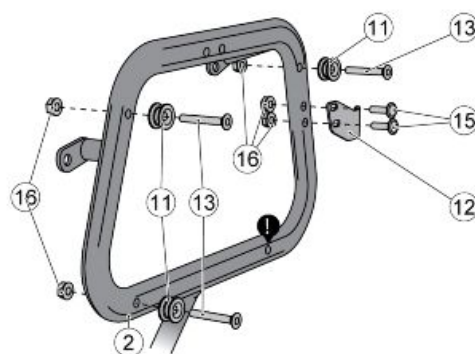
- Remove the Allen screws (5) and (7).
- Remove the support for the left top box (2).



- Remove the spacers (6) and (8).



- Remove the components (11) to (16) from both supports.



Adjustable windscreen

- Remove the windscreen glass.
- Working from both sides, undo and remove the windscreen top set screw and remove the knob.



- Working from both sides, unscrew and remove the lower screw.

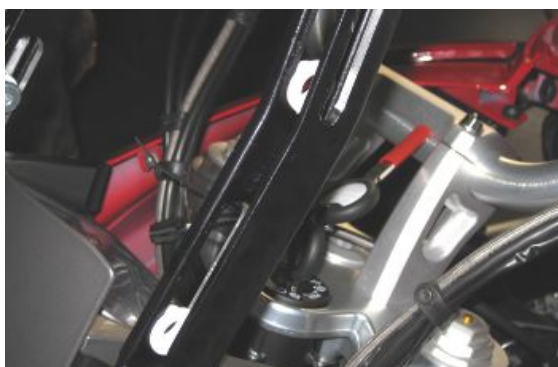


- Working from both sides, remove the windscreen support from the bracket.



- Remove the four bushings from the brackets

If replacing the bushings remember to place them with the larger diameter inside the brackets.



INDEX OF TOPICS

PRE-DELIVERY

PRE DE

Carry out the listed checks before delivering the motorcycle.

WARNING

HANDLE FUEL WITH CARE.

Aesthetic inspection

- Paintwork
 - Fitting of Plastic Parts
 - Scratches
 - Dirt
-

Tightening torques inspection

- Safety fasteners:
 - front and rear suspension unit
 - front and rear brake calliper retainer unit
 - front and rear wheel unit
 - engine - chassis retainers
 - steering assembly
 - Plastic parts fixing screws
-

Electrical system

- Main switch
 - Headlamps: high-beam lights, low-beam lights, tail lights (front and rear) and their warning lights
 - Headlight adjustment according to regulations in force
 - Front and rear stop light switches and their bulbs
 - Turn indicators and their warning lights
 - Instrument panel lights
 - Instrument panel: fuel and temperature indicator (if present)
 - Instrument panel warning lights
 - Horn
 - Electric start-up
 - Engine stop via emergency stop switch and side stand
 - Helmet compartment electrical opening switch (if present)
-

- Through the diagnosis tool, check that the last mapping version is present in the control unit/s and, if required, program the control unit/s again: consult the technical service website to know about available upgrades and details regarding the operation.

CAUTION

TO ENSURE MAXIMUM PERFORMANCE, THE BATTERY MUST BE CHARGED BEFORE USE. INADEQUATE CHARGING OF THE BATTERY WITH A LOW LEVEL OF ELECTROLYTE BEFORE IT IS FIRST USED SHORTENS BATTERY LIFE.

CAUTION

UPON INSTALLING THE BATTERY, ATTACH THE POSITIVE LEAD FIRST AND THEN THE NEGATIVE ONE, AND PERFORM THE REVERSE OPERATION UPON REMOVAL.

WARNING

THE BATTERY ELECTROLYTE IS POISONOUS AS IT MAY CAUSE SERIOUS BURNS. IT CONTAINS SULPHURIC ACID. AVOID CONTACT WITH YOUR EYES, SKIN AND CLOTHING. IN CASE OF CONTACT WITH YOUR EYES OR SKIN, WASH WITH ABUNDANT WATER FOR APPROX. 15 MIN. AND SEEK MEDICAL ATTENTION IMMEDIATELY. IF ACCIDENTALLY SWALLOWED, IMMEDIATELY DRINK LARGE QUANTITIES OF WATER OR VEGETABLE OIL. SEEK MEDICAL ATTENTION IMMEDIATELY. BATTERIES PRODUCE EXPLOSIVE GASES; KEEP CLEAR OF NAKED FLAMES, SPARKS OR CIGARETTES. VENTILATE THE AREA WHEN RECHARGING INDOORS. ALWAYS WEAR EYE PROTECTION WHEN WORKING IN THE PROXIMITY OF BATTERIES. KEEP OUT OF THE REACH OF CHILDREN

CAUTION

NEVER USE FUSES WITH A CAPACITY HIGHER THAN THE RECOMMENDED CAPACITY. USING A FUSE OF UNSUITABLE RATING MAY SERIOUSLY DAMAGE THE VEHICLE OR EVEN CAUSE A FIRE.

Levels check

- Hydraulic braking system fluid level
- Clutch system fluid level (if present)
- Gearbox oil level (if present)
- Transmission oil level (if present)
- Engine coolant level (if present)
- Engine oil level
- Mixer oil level (if present)

Road test

- Cold start
- Instrument panel operation

- Response to throttle control
 - Stability when accelerating and braking
 - Front and rear brake efficiency
 - Front and rear suspension efficiency
 - Abnormal noise
-

Static test

Static check after test drive:

- Restarting when warmed up
 - Starter operation (if present)
 - Minimum holding (turning the handlebar)
 - Uniform turning of the steering
 - Possible leaks
 - Radiator electric fan operation (if present)
-

Functional inspection

- Hydraulic braking system
- Stroke of brake and clutch levers (if present)
- Clutch - Check for correct operation
- Engine - Check for correct general operation and absence of abnormal noise
- Other
- Documentation check:
- Chassis and engine numbers check
- Supplied tools check
- License plate fitting
- Locks checking
- Tyre pressure check
- Installation of mirrors and any possible accessories



NEVER EXCEED THE RECOMMENDED INFLATION PRESSURES AS TYRES MAY BURST.

CAUTION



CHECK AND ADJUST TYRE PRESSURE WITH TYRES AT AMBIENT TEMPERATURE.

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