SERVICE STATION MANUAL

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BELLAGIO

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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 setting off, 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.

The descriptions and illustrations given in this publication are not binding; While the basic features as described and illustrated in this booklet remain unchanged, Moto Guzzi reserves the right, at any time and without being required to update this publication beforehand, to make any changes to components, parts or accessory supplies, which it deems necessary to improve the product or which

are required for manufacturing or commercial reasons.
Not all versions shown in this publication are available in all Countries. The availability of individual versions should be checked with the official Moto Guzzi sales network.

SERVICE STATION MANUAL BELLAGIO

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 in order to carry out any procedure, please ensure that you do so in an open or very well ventilated area. Never let the engine run in an enclosed area. If you do work in an enclosed area, make sure to use a smoke-extraction system.

CAUTION

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

Fuel

CAUTION

FUEL USED TO POWER INTERNAL COMBUSTION ENGINES IS HIGHLY FLAMMABLE AND CAN BECOME EXPLOSIVE UNDER SPECIFIC 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 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.

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 DAMAGE TO THE SKIN IF HANDLED FOR PROLONGED PERIODS OF TIME AND ON A REGULAR BASIS. IT IS RECOMMENDED TO WASH YOUR HANDS CAREFULLY AFTER HANDLING IT. HAND THE OIL OVER TO OR HAVE IT COLLECTED BY THE NEAREST USED OIL RECYCLING COMPANY OR THE SUPPLIER. IT IS ADVISABLE TO WEAR LATEX GLOVES WHEN SERVICING THE VEHICLE.
DO NOT DISPOSE OF OIL INTO 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 OR THE CLUTCH SYSTEMS PROTECT THESE COMPONENTS WITH A CLEAN CLOTH. ALWAYS WEAR PROTECTIVE GOGGLES WHEN SERVICING THE 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

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. IF THE ELECTROLYTIC FLUID COMES INTO CONTACT WITH THE SKIN, RINSE CAREFULLY WITH COLD WATER. IT IS PARTICULARLY IMPORTANT TO PROTECT YOUR EYES AS EVEN TINY AMOUNTS OF BATTERY ACID MAY CAUSE BLINDNESS. IF THE FLUID GETS INTO CONTACT WITH THE 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 reported below carefully.

BEFORE DISMANTLING COMPONENTS

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

DISMANTLING COMPONENTS

- Do not loosen and/or tighten screws and nuts using pliers or other tools than the especially designed wrench.
- Mark positions on all connection joints (pipes, cables etc.) before separating them, and identify them with distinctive symbols.
- Each component needs to be clearly marked in order to be identified during assembly.
- Clean and wash the dismantled components carefully using a low-flammability detergent.
- Keep coupled parts together since they have "adjusted" to each other due to normal wear and tear.
- Some components must be used together or replaced altogether.
- Keep away from heat sources.

REASSEMBLING COMPONENTS

CAUTION

THE BEARINGS MUST BE ABLE TO ROTATE FREELY, WITHOUT BINDING AND/OR NOISE, OTHERWISE THEY NEED REPLACING.

- Only use ORIGINAL Moto Guzzi SPARE PARTS.
- Comply with lubricant and consumables usage 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 thread 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 junction planes, oil guard rims and washers before refitting them. Smear a light layer of lithium-based grease on the oil guard rims. Reassembly the oil guard and the bearings with the brand or lot number facing outward (visible side).

ELECTRIC CONNECTORS

Electric connectors must be disconnected as described as follows as non-compliance with the procedure described below causes irreparable damages to both the connector and the cable harness:
Press the relevant safety hooks, if any.

- Grip the two connectors and disconnect them by pulling them in opposite directions.
- In presence of dirt, rust, humidity etc. clean the connector's internal parts carefully, using a pressurised air jet.
- Make sure that the cables are correctly linked to the connector's internal terminal ends.
- Then insert the two connectors making sure that they couple correctly (if the relevant hooks are provided, you will hear them "click" into place).

CAUTION

TO DISCONNECT THE TWO CONNECTORS, DO NOT PULL THE CABLES.

NOTE

THE TWO CONNECTORS CONNECT ONLY FROM ONE SIDE: CONNECT THEM THE RIGHT WAY ROUND.

TIGHTENING TORQUE

CAUTION

DO NOT FORGET THAT TIGHTENING TORQUE OF ALL FASTENING ELEMENTS ON WHEELS, BRAKES, WHEEL SPINDLES AND OTHER SUSPENSION COMPONENTS PLAY A KEY ROLE IN ENSURING THE VEHICLE'S SAFETY AND MUST COMPLY WITH SPECIFIED VALUES. CHECK THE TIGHTENING TORQUE OF FASTENING PARTS ON A REGULAR BASIS AND ALWAYS USE A TORQUE WRENCH TO REASSEMBLE THESE COMPONENTS. IF THESE RECOMMENDATIONS ARE NOT COMPLIED WITH, ONE OF THE COMPONENTS MAY BECOME LOOSE AND EVEN DETACHED, THUS BLOCKING A WHEEL, OR OTHERWISE COMPROMISING THE VEHICLE'S MANOEUVRABILITY. THIS CAN LEAD TO FALLS, WITH THE RISK OF SERIOUS IN-

JURY 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 driving speed during the run-in. In this way, you allow for the work of components to be "loaded" and then "unloaded", thus cooling the engine parts.

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

ONLY AFTER THE SERVICE AT THE END OF THE RUN-IN PERIOD, IT IS POSSIBLE TO ATTAIN THE BEST PERFORMANCE OF YOUR VEHICLE.

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) brake carefully to avoid rough and long 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" TABLE IN THE SCHEDULED MAINTENANCE SECTION TO AVOID INJURING YOURSELF, OTHERS AND /OR DAMAGING THE VEHICLE.

- Between 1000 km (625 miles) and 2000 km (1250 miles) travelled, ride more vigourously, vary speeds and twist throttle fully for some short periods for best coupling of the components; do not exceed 6000 rpm.
- After 2000 km (1250 miles) a better engine performance may be expected, but without exceeding the engine maximum rpm allowed (7600 rpm).

Vehicle identification

SERIAL NUMBER POSITION

These numbers are necessary for vehicle registration.

NOTE

ALTERING IDENTIFICATION NUMBERS CAN BE SERIOUSLY PUNISHED BY LAW, PARTICULARLY MODIFYING THE CHASSIS NUMBER WILL IMMEDIATELY INVALIDATE THE WARRANTY.

This number is composed by numbers and letters, as in the example shown below.

ZGULY0000YMXXXXXX

KEY:

ZGU: WMI (World manufacturer identifier) code;

LY: model;

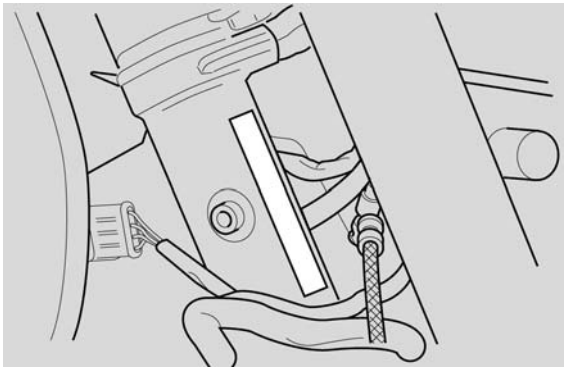
000: version variation;

0: digit free

Y year of manufacture

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

XXXXXX: progressive number (6 digits);

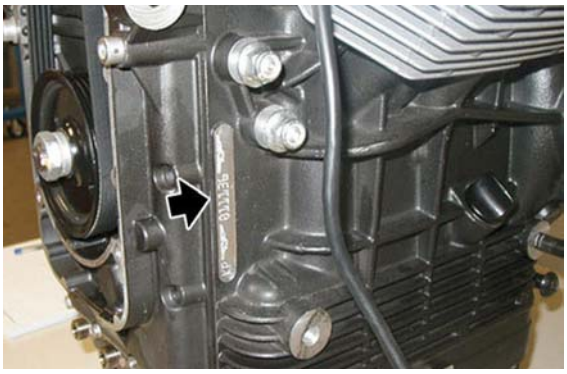


CHASSIS NUMBER

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
Length	2253 mm (88.70 in)
Width (to the brake / clutch levers)	820 mm (32.30 in)

Specification	Desc./Quantity
Height (to the brake pumps / clutch)	1130 mm (44.50 in)
Saddle height	780 mm (30.71 in)
Minimum ground clearance	150 mm (5.9 in)
Wheelbase	1560 mm (61.42 in)
Kerb weight	237 kg (522 lb)

Engine

ENGINE

Specification	Desc./Quantity
Type	90° transversal V-twin, four stroke
Cylinder quantity	2
Cylinders layout	90° V
Cubic capacity	935.6 cm³ (57.09 cu.in)
Bore / stroke	95 x 66 mm (3.74 x 2.66 cu.in)
Compression ratio	10:1
Start-up	electric
Engine revs at idle speed	1100 ± 100 rpm
Clutch	dry, twin disc with hydraulic control
Lubrication system	Pressure-fed lubrication system adjusted through valves and a trochoidal pump
Air filter	cartridge, dry
Cooling	air
Timing system diagram:	2 rod valves and rocking levers
Valid values with checking clearance between rocking levers and valve	inlet: 0.10 mm (0.0039 in) outlet: 0.15 mm (0.0059 in)

Transmission

TRANSMISSION

Specification	Desc./Quantity
Gear ratio	Primary gears 24/35
Gear	Mechanical, 6 speeds with foot lever on the left hand side of the engine
Gear ratios:	1st gear : 17/38 = 1 :2.2353 2nd gear : 20/34 = 1:1.7 3rd gear : 23/31 = 1:1.3478 4th gear : 26/29 = 1:1.1154

Specification	Desc./Quantity
	5th gear : 31/30 = 1:0.9677 6th gear : 29/25 = 1:0.8621
Final transmission	cardan shaft
Ratio	12/44 = 1:3.6667

Capacities

CAPACITY

Specification	Desc./Quantity
Engine oil sump	3000 cm³ (183 cu.in)
Gearbox oil	500 cm³ (30.5 cu.in)
Transmission oil	380 cm³ (23.2 cu.in)
Fuel (reserve included)	19 +/- 0.5 l (5.02 +/- 0.13 US gal)
Fuel reserve	4 l (1.056 US gal)
Adjustable telescopic fork oil (per fork leg)	0.485 l (0.128 US gal)
Seats	2
Vehicle maximum load	210 kg (463 lb) (rider + passenger + luggage)

Electrical system

ELECTRICAL SYSTEM

Specification	Desc./Quantity
Spark plugs - inner	long life, NGK PMR8B
Outer spark plug	NGK BPR6ES
Electrode gap	0.6 - 0.7 mm (0.024 - 0.028 in)
Battery	12 V - 18 Ampere/hour
Generator - alternator	Output power: 350 W at 5000 rpm (12V - 25A)
Main fuses	30 A
Secondary fuses	3 A - 15 A
Tail light	12V - 5 W
Low-/ High-beam light bulb (halogen)	12 V - 55 W/ 60 W H4
Turn indicators	12V - 10 W
Rear tail light /stop light	12 V - 5 / 21 W
Instrument panel lighting	LED
License plate light	12V - 5 W
Turn indicator warning light	LED

Specification	Desc./Quantity
Gear in neutral warning light	LED
Side stand down warning light	LED
Low fuel warning light	LED
High-beam warning light	LED
Oil pressure warning light	LED
General alarm warning light	LED

Frame and suspensions

CHASSIS - SUSPENSIONS

Specification	Desc./Quantity
CHASSIS	Double cradle, high strength steel tube chassis
Headstock angle	28°
Trail	92 mm (3.62 in)
Front suspension	MARZOCCHI hydraulic telescopic fork, □ 45 mm (1.77 in) with separate adjustment for rebound and compression damping.
Front wheel travel	140 mm (5.5 in)
Rear suspension - type	single arm suspension with progressive rising-rate leverage, single shock absorber with adjustable rebound and with ergonomic knob for preloading adjustment.
Rear wheel travel	120 mm (4.7 in)

Brakes

BRAKES

Specification	Desc./Quantity
Front	stainless steel Ø 320 mm (12.6 in) twin floating disc, Brembo floating callipers with 2 parallel plungers
Rear	stainless steel Ø 282 mm (11.1 in) fixed disc, Brembo floating calliper with 2 parallel pistons

Wheels and tyres

WHEELS AND TYRES

Specification	Desc./Quantity
Wheel rims	with spokes

Specification	Desc./Quantity
Front wheel rim	3.5" x 18"
Rear wheel rim	5.50 x 17
Tyres - Front size	120/70 - ZR 18" M/C 59 W
Tyres - Rear size	180/55 - ZR 17" M/C 73 W
Tyres - type	METZELER Roadtec Z6
Inflation pressure (front)	230 kPa (33.4 PSI)
Inflation pressure with passenger (front)	230 kPa (33.4 PSI)
Inflation pressure (rear)	250 kPa (36.3 PSI)
Inflation pressure with passenger (rear)	270 kPa (39.1 PSI)

Supply

SUPPLY

Specification	Desc./Quantity
Supply	MAGNETI MARELLI IAW MULTIPOINT electronic phased sequential fuel injection, ALFA-N System.
Diffuser	diameter: 40 mm (1.57 in)
Fuel	Premium unleaded petrol, minimum octane rating of 95 (NORM) and 85 (NOMM)

Tightening Torques

HEADS

Name	Torque in Nm
Oil cap (2)	25 Nm (18.44 lbf ft)
Exhaust system stud bolt (4)	10 Nm (7.38 lbf ft) - Loctite 648
Rocking lever support nut - M10x1.5 (8)	15 Nm (11.06 lbf ft) + 90º + 90º
Rocking lever nut (4)	10 Nm (7.38 lbf ft)
Set screw - TE M6x16 (4)	10 Nm (7.38 lbf ft)
Head cover screw - M6x25 (16)	10 Nm (7.38 lbf ft)
Head fixing screw (4)	15 Nm (11.06 lbf ft) + 90º
Oil temperature sensor	11 Nm (8.11 lbf ft) - Loctite 243
Oil temperature sensor container	11 Nm (8.11 lbf ft) - Loctite 601
Outer Spark plugs	30 Nm (22.13 lbf ft) - Molikote
Inner spark plugs	15 Nm (11.06 lbf ft) - Molikote

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)
Crankshaft flange screw - TE M8x25 (14)	25 Nm (18.44 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 joint screw - TCEI M6x20 (2)	10 Nm (7.38 lbf ft)
Timing system outer cover screw - TCEI M6x16 (4)	10 Nm (7.38 lbf ft)
Screw TSPEI M4x8 (2)	5 Nm (3.69 lbf ft) - Loctite 243
Screw TCEI M6x40 (2)	10 Nm (7.38 lbf ft)
Timing sensor - TCEI M5x12 (2)	6 Nm (4.42 lbf ft)
Crankcase stud bolts - chassis (4)	40 Nm (29.5 lbf ft) - Loctite 601

OIL SUMP

Name	Torque in Nm
Oil sump centre lower screws - TE M6x90 (4)	10 Nm (7.38 lbf ft)
Oil sump screw - TCEI M6x25 (14)	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
Overpressure plug	40 Nm (29.5 lbf ft)
Oil intake filter fixing screw - TCEI M6x16 (1)	10 Nm (7.38 lbf ft) - Loctite 648

OIL PUMP

Name	Torque in Nm
Oil pump fixing screw - TBEI M6x30 (3)	10 Nm (7.38 lbf ft) - Loctite 243
Oil pump gear nut - M10x1.25 (1)	20 Nm (14.75 lbf ft)
Oil delivery pipe screw (1)	17 Nm (12.54 lbf ft)
Oil pressure sensor	45 Nm (33.19 lbf ft)

TIMING SYSTEM

Name	Torque in Nm
Camshaft flange screw - TE M6x20 (3)	10 Nm (7.38 lbf ft)
Timing system gear nut on camshaft - M18 (1)	150 Nm (110.63 lbf ft)
Alternator locking nut - M16x1.5 (1)	80 Nm (59 lbf ft) - Loctite 243
Camshaft support screw on timing system cover -	5 Nm (3.69 lbf ft) - Loctite 243

Name	Torque in Nm
TCEI M4x10 (4)	

CRANKSHAFT - FLYWHEEL

Name	Torque in Nm
Start-up crown fixing screw on flywheel (8)	18 Nm (13.28 lbf ft) - Loctite 243
Connecting rod screw (4) - pretightening	40 Nm (29.5 lbf ft)
Connecting rod screw (4) - final tightening	80 Nm (59 lbf ft)
Flywheel fixing screw on crankshaft - M8x25 (6)	42 Nm (30.98 lbf ft) - Loctite 243

GEAR

Name	Torque in Nm
Gear shift cable lever nut	10 Nm (7.38 lbf ft)
Gear shift tie rod lever nut on transmission preselector	10 Nm (7.38 lbf ft)
Gearbox to crankcase fixing nut - M8 (5)	20 Nm (14.75 lbf ft)
Gearbox to crankcase fixing screw - TE flanged M8x45 (1)	20 Nm (14.75 lbf ft)
Oil cap M18x1.5 (1)	28 Nm (20.65 lbf ft)
Bleed 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)
Secondary shaft ring nut (1)	100 Nm (73.76 lbf ft)

CHASSIS

Name	Torque in Nm
Electronic control unit lower retainer - M6x20 (2)	10 Nm (7.38 lbf ft)
Electronic control unit upper retainer - M6x35 (2)	10 Nm (7.38 lbf ft) - Loctite 243
Tank to chassis support rubber rings retainer - M8x18 (2)	25 Nm (18.44 lbf ft)
Gearbox to chassis retainer - M12 (1+1)	50 Nm (36.88 lbf ft)
Engine support front plate retainer - M12x50 (2)	80 Nm (59 lbf ft)
Rider left and right footrest to chassis support retainer - M8x65 (4)	25 Nm (18.44 lbf ft)
Passenger left and right footrest to chassis support retainer - M8x25 (4)	25 Nm (18.44 lbf ft)
Filter box holding rear bracket to chassis retainer - M8x16 (2)	15 Nm (11.06 lbf ft)
Rider heel rest to footrest support plate retainer - M5x15 (6)	6 Nm (4.42 lbf ft)

Name	Torque in Nm
Stud bolt for fixing front bulkheads on the steering sleeve - M6x1 (2)	10 Nm (7.38 lbf ft)

FOOTRESTS AND LEVERS

Name	Torque in Nm
Footrest rubber retainer - M6x12 (8)	10 Nm (7.38 lbf ft)
Gear shift lever cable retainer (nut) - M6x1 (2)	10 Nm (7.38 lbf ft)
Gear shift lever / brake pin retainer - M6x16 (1+1)	10 Nm (7.38 lbf ft)
Gear shift lever pin retainer - M8 (1)	15 Nm (11.06 lbf ft) - Loctite 243
Preselector lever retainer - M6x20 (1)	10 Nm (7.38 lbf ft)

SIDE STAND

Name	Torque in Nm
Stand plate to engine retainer - M12x35 (2)	80 Nm (59 lbf ft)
Side stand retainer bolt - M10x1.25 (1)	10 Nm (7.38 lbf ft)
Switch retainer - M5x16 (2)	6 Nm (4.42 lbf ft)
Pin lock nut - M10x1.25 (1)	30 Nm (22.13 lbf ft)

SWING ARM

Name	Torque in Nm
Swingarm clamp on bushing retainer - M6x25 (2)	10 Nm (7.38 lbf ft)
Fork on cardan shaft housing retainer - M10x35 (4)	50 Nm (36.88 lbf ft)
Torque arm to cardan shaft housing retainer - M10x55 (1)	50 Nm (36.88 lbf ft)
Brake torque arm to chassis retainer - M10x55 (1)	50 Nm (36.88 lbf ft)
Fork pin to fork retainer - M20x1.5 (1)	60 Nm (44.25 lbf ft)
Preloading bushing to fork pin retainer - M25x1.5 (1)	10 Nm (7.38 lbf ft)

FRONT SUSPENSION

Name	Torque in Nm
Fork stem on lower/upper plate retainer - M8x30 (6)	25 Nm (18.44 lbf ft)
Headstock nut - M23x1 (1)	50 Nm (36.88 lbf ft)
Headstock ring nut - M25x1 (1)	7 Nm (5.16 lbf ft) - the headstock should turn freely
Fork stem cap (2)	25 Nm (18.44 lbf ft)
Fork hub closing - M6x40 (2+2)	10 Nm (7.38 lbf ft)

REAR SUSPENSION

Name	Torque in Nm
Shock absorber to chassis retainer - 8.8 M10x80 (1)	50 Nm (36.88 lbf ft)
Double connecting rod / shock absorber retainer 10.9 M10x47 (1)	40 Nm (29.5 lbf ft)
Single connecting rod / double connecting rod retainer 10.9 M10x95 (1)	50 Nm (36.88 lbf ft)
Single connecting rod to chassis retainer - 8.8 M10x85 (1)	50 Nm (36.88 lbf ft)
Double connecting rod / fork retainer 10.9 M10x82 (1)	50 Nm (36.88 lbf ft)

FILTER CASING

Name	Torque in Nm
Filter casing cover retainer - M5x30 (3)	6 Nm (4.42 lbf ft)
Filter casing to chassis bracket retainer - M6x12 (1)	10 Nm (7.38 lbf ft)

EXHAUST

Name	Torque in Nm
Exhaust pipe to engine retainer - M8x1.25 (4)	25 Nm (18.44 lbf ft)
Exhaust pipe to compensator retainer (clamp) - M6 (2)	10 Nm (7.38 lbf ft)
Compensator to plate retainer - M10 (2)	25 Nm (18.44 lbf ft)
Compensator to muffler retainer (clamp) - M6 (2)	10 Nm (7.38 lbf ft)
Lambda probe retainer - M18x1.5 (1)	38 Nm (28.03 lbf ft)
Mufflers to support retainer - M8x25 (4)	25 Nm (18.44 lbf ft) - Loctite 601
Muffler support to chassis retainer - M8 (1)	25 Nm (18.44 lbf ft)

FRONT WHEEL

Name	Torque in Nm
Brake disc retainer - M8x20 (12)	30 Nm (22.13 lbf ft) - Loctite 243
Wheel pin - M18x1.5 (1)	80 Nm (59 lbf ft)

REAR WHEEL

Name	Torque in Nm
Brake disc retainer - M8x20 (6)	30 Nm (22.13 lbf ft) - Loctite 243
Rear wheel retainer - 10.9 M12x65 (4)	110 Nm (81.13 lbf ft)

FRONT BRAKING SYSTEM

Name	Torque in Nm
Front brake right and left calliper retainer - M10x30 (2+2)	50 Nm (36.88 lbf ft)

REAR BRAKING SYSTEM

Name	Torque in Nm
Rear calliper retainer - M10x30 (2)	50 Nm (36.88 lbf ft)
Rear brake lever pin - M8 (1)	15 Nm (11.06 lbf ft) - Loctite 243
Rear brake fluid reservoir retainer - SWP 5x20 (1)	3 Nm (2.21 lbf ft)
Rear brake fluid reservoir on plate support retainer - M6x16 (1)	10 Nm (7.38 lbf ft)
Rear brake rod lock nut - M6 (1)	manual
Brake pump retainer - M6x20 (2)	10 Nm (7.38 lbf ft) - Loctite 243

HANDLEBAR AND CONTROLS

Name	Torque in Nm
Handlebar on steering plate retainer - M10x60 (2)	50 Nm (36.88 lbf ft)
Clutch and brake pump u-bolt retainer - M6 (2+2)	10 Nm (7.38 lbf ft)
Right and left light switch retainer - M5 (2)	1.5 Nm (1.11 lbf ft)
Clutch pump to transmission retainer - M6 (3)	10 Nm (7.38 lbf ft)
Mirror - M10 (1+1)	Manual

ELECTRICAL SYSTEM

Name	Torque in Nm
Horn retainer screw + nut - M8x20 (1)	15 Nm (11.06 lbf ft)
Coil retainer - AT M4x25 (4)	3 Nm (2.21 lbf ft)
Odometer sensor on cardan shaft housing retainer - M4x10 (2)	3 Nm (2.21 lbf ft)

INSTRUMENT PANEL AND LIGHTS

Name	Torque in Nm
Instrument panel support to light support retainer - M6x20 (4)	10 Nm (7.38 lbf ft)
Front light supports to fork plate retainer - M6x18 (4)	10 Nm (7.38 lbf ft)
Headlamp retainer - M8x30 (2)	15 Nm (11.06 lbf ft)
Front and rear turn indicator retainer (screw + nut) - M6 (2+2)	5 Nm (3.69 lbf ft)
Rear light to tail retainer - M5x18 (3)	4 Nm (2.95 lbf ft)

FUEL PUMP FLANGE

Name	Torque in Nm
Pump support to tank retainer - M5x16 (6)	6 Nm (4.42 lbf ft)

FUEL TANK

Name	Torque in Nm
Filler to tank retainer - M4x16 (5)	3 Nm (2.21 lbf ft)
Tank rear retainer - M8x45 (1)	25 Nm (18.44 lbf ft)

CHASSIS/ FAIRINGS (FRONT)

Name	Torque in Nm
Stabilisation plate to fork retainer - M8x35 (4)	15 Nm (11.06 lbf ft) - Loctite 243
Front mudguard to stabilisation plate retainer - M6x22 (4)	10 Nm (7.38 lbf ft) - Loctite 243
Engine closing plate to chassis front retainer - M5x12 (2)	4 Nm (2.95 lbf ft)
Engine closing plate to chassis rear retainer - M5x20 (2)	4 Nm (2.95 lbf ft)

CHASSIS / FAIRINGS (CENTRE)

Name	Torque in Nm
Right and left throttle body cover upper retainer - M5x20 (2)	4 Nm (2.95 lbf ft) - Loctite 243
Right and left throttle body cover lower retainer - M5x20 (2)	manual
Right and left side fairing retainer - M5x9 (4)	4 Nm (2.95 lbf ft)

CHASSIS/ FAIRINGS (REAR)

Name	Torque in Nm
Tail section / battery holder mudflap / license plate holder retainer - M5x9 (12)	4 Nm (2.95 lbf ft)
Retroreflector to support retainer - M5 (1)	4 Nm (2.95 lbf ft)
Retroreflector support on license plate holder retainer - M5x12 (1)	4 Nm (2.95 lbf ft)
License plate lamp, license plate holder, retroreflector support retainer - M5x22 (1)	4 Nm (2.95 lbf ft)

FINISHING

Name	Torque in Nm
Ignition lock retainer - shear head screw - M8x15 (1)	at the point of failure
Ignition lock retainer - M8x16 (1)	25 Nm (18.44 lbf ft)

Overhaul data

Assembly clearances

Cylinder - piston assy.

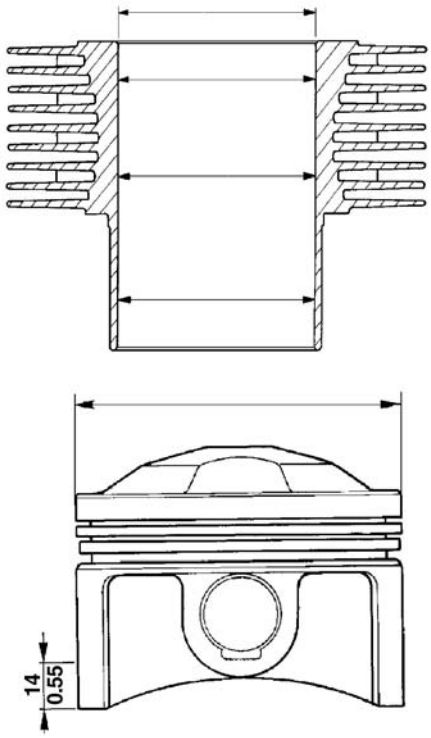
Measurement of the cylinder diameter must be done at three heights, turning the dial gauge 90°.

Check the clearance between the cylinders and pistons; if it is larger than indicated, it is necessary to replace cylinders and pistons.

The pistons of an engine must be balanced; a weight difference of up to 1.5 grams (0.0033 pounds) is admitted between them.

ADMITTED MEASUREMENTS

Specification	Desc./Quantity
cylinder diameter	95.000 - 95.020 mm (3.7401 - 3.7409 in)
piston diameter	94.942 - 94.972 mm (3.7379 - 3.7390 in)
fitting clearance	0.048 - 0.068 mm (0.00189 - 0.00268 in)



Piston rings

Check the sealing piston rings and the oil scraper.

On each piston there are:

1 upper piston ring;

1 middle stepped piston ring;

1 oil scraper piston ring.

The ends of the fitted piston rings are out of phase.

Fitting backlash detected between the ring thickness and seats on the piston:

Sealing rings and oil scraper 0.030 - 0.065 mm (0.00118 - 0.00256 in)

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

Upper sealing ring and stepped ring 0.40 - 0.65 mm (0.00158 - 0.00255 in)

Oil scraper ring 0.30 - 0.60 mm (0.00118 - 0.00236 in).

Turn the rings so that the junction ends are 120 degrees between them.

Crankcase - crankshaft - connecting rod

CAMSHAFT (CAM) SUPPORT DIAMETER AND THEIR SEATS ON THE CRANKCASE (TIMING SYSTEM SIDE)

Specification	Desc./Quantity
Shaft support diameter	47.000 - 46.984 mm (1.85039 ÷ 1.84976 inch)
Seat diameter on crankcase	47.025 - 47.050 mm (1.85137 ÷ 1.85236 inch)
fitting clearance	0.025 - 0.066 mm (0.00098 ÷ 0.00260 inch)

CAMSHAFT (CAM) SUPPORT DIAMETER AND THEIR SEATS ON THE CRANKCASE (FLYWHEEL SIDE)

Specification	Desc./Quantity
Shaft support diameter	32.000 - 31.984 mm (1.25984 ÷ 1.25921 inch)
Seat diameter on crankcase	32.025 - 32.050 mm (1.26082 ÷ 1.26181 inch)
fitting clearance	0.025 - 0.066 mm (0.00098 ÷ 0.00260 inch)

TAPPET-SEAT COUPLING ON CRANKCASE DATA (PRODUCTION)

Specification	Desc./Quantity
Seats diameter	22.021 - 22.000 mm (0.86697 ÷ 0.86614 inch)
Tappet external diameter	21.996 - 21.978 mm (0.86598 ÷ 0.86527 inch)
Fitting clearances	0.004 - 0.043 mm (0.00016 ÷ 0.00169 in.)

Specification	Desc./Quantity

Recommended products chart

RECOMMENDED PRODUCTS

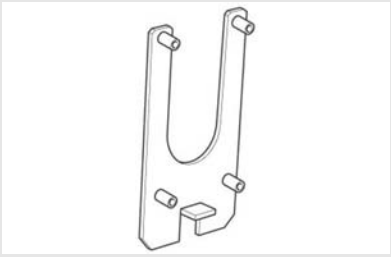
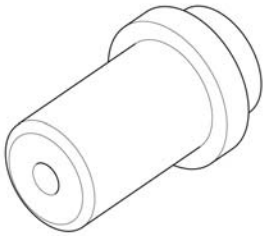
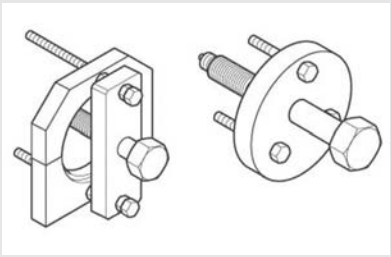
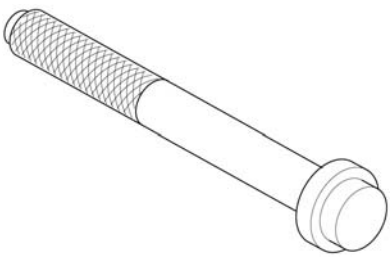
Product	Description	Specifications
AGIP RACING 4T 10W-60	Engine oil	SAE 10W - 60. Top branded oils that meet or exceed the requirements of CCMC G-4 API SG specifications can be used as an alternative for recommended oils.
AGIP GEAR SAE 80 W 90	Transmission oil	-
AGIP GEAR MG/S SAE 85 W 90	Gearbox oil	-
AGIP FORK 7.5W	Fork oil	SAE 5W / SAE 20W
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	Top branded fluids that meet or exceed the requirements of SAE J1703, NHTSA 116 DOT 4, ISO 4925 Synthetic fluid specifications can be used as an alternative for recommended fluids.
AGIP BRAKE 4 / BRAKE 5.1	Clutch fluid	Top branded fluids that meet or exceed the requirements of SAE J1703, NHTSA 116 DOT 4, ISO 4925 Synthetic fluid specifications can be used as an alternative for recommended fluids.

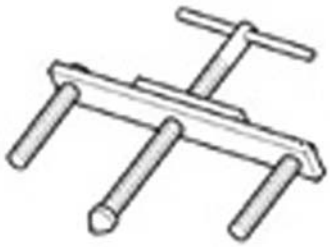
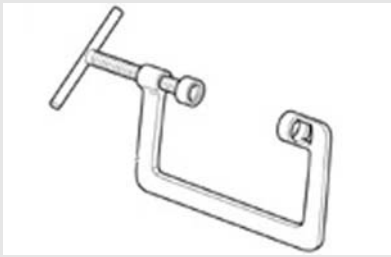
NOTE

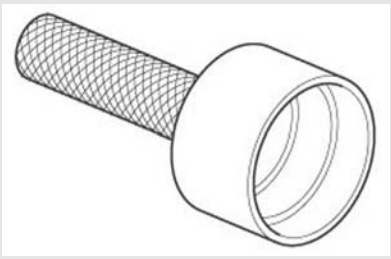
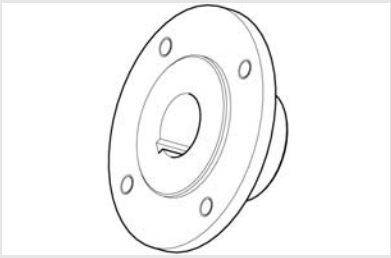
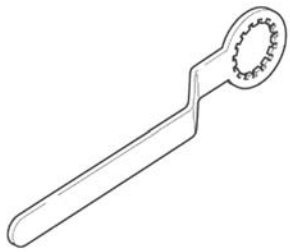
USE ONLY NEW BRAKE FLUID. DO NOT MIX DIFFERENT BRANDS OR TYPES OF OIL WITHOUT CHECKING THEIR BASE COMPATIBILITY.

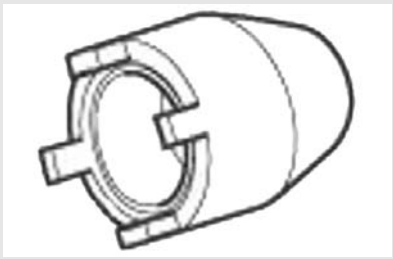
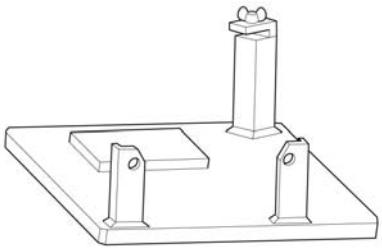
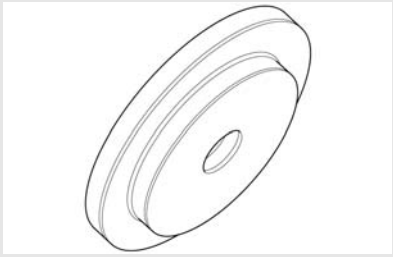
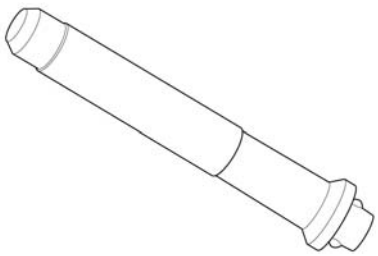
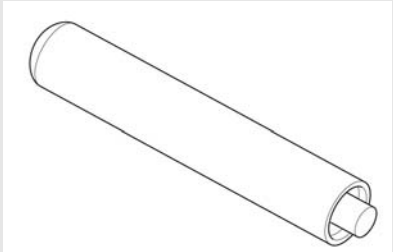
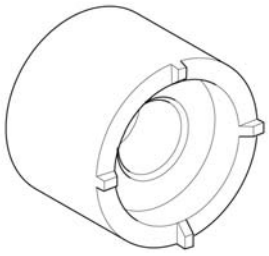
INDEX OF TOPICS

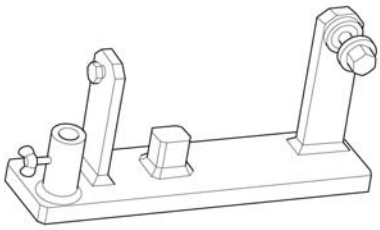
SPECIAL TOOLS

Stores code	Description	
05.90.25.30	Gearbox support	
14.92.72.00	Tool for fitting the sealing ring on the timing system cover	
05.91.25.30	Gearbox opening	
05.90.19.30	Inner spark plug removal	
05.92.80.30	Piston ring clamp	
14.92.91.00	Punch for pressing the sealing ring on the front fork sleeve and sealing ring inside the gearbox.	

Stores code	Description	
19.92.96.00	Graduated dial to control ignition timing	
17.94.75.60	Arrow to control ignition timing	
12.91.18.01	Tool to lock the flywheel and start-up crown	
12.91.36.00	Tool to remove the flywheel side flange	
10.90.72.00	Tool for valve removal and refitting	
30.90.65.10	Tool for clutch fitting	

Stores code	Description	
14.92.71.00	Tool to fit the sealing ring on the flywheel side flange	
12.91.20.00	Tool to fit the flywheel side flange together with sealing ring on the crankshaft	
19.92.71.00	Tool to fit the sealing ring on the flywheel side flange	
14.92.73.00	Tool for camshaft gear sealing	
981001	Graduated dial hub	
30.91.28.10	Clutch body locking	

Stores code	Description	
05.91.26.30	Tool for tightening the fork pin ring nut - clutch hub	
05.90.27.30	Gearbox support	
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	

Stores code	Description	
05.90.27.35	Pinion oil seal buffer	
05.90.27.36	Bevel gear pair support	

INDEX OF TOPICS

Maintenance chart

NOTE

CARRY OUT THE MAINTENANCE OPERATIONS AT HALF THE INTERVALS SHOWN IF THE VEHICLE IS USED IN WET OR DUSTY AREAS, OFF ROAD OR FOR SPORTS APPLICATIONS.

AT EVERY START-UP

Action
Engine oil pressure warning light - check and clean, adjust, grease or replace if necessary

BEFORE EACH RIDE AND EVERY 2000 KM (1250 MI)

Action
Brake pad wear - Check and clean, adjust, grease or replace if necessary

AFTER 1000 KM (625 MILES) RUN-IN

Action
Exhaust pipe flange fixing bolts - Check and clean, adjust, grease or replace if necessary
Transmission cables and controls - Check and clean, adjust, grease or replace if necessary
Steering and steering clearance bearings - Check and clean, adjust, grease or replace if necessary
Brake discs - Check and clean, adjust, grease or replace if necessary
Engine oil filter - Replace
Fork - Check and clean, adjust and lubricate
General vehicle operation - Check and clean, adjust, grease or replace if necessary
Braking systems - Check and clean, adjust, grease or replace if necessary
Light circuit - Check and clean, adjust or replace if necessary
Safety switches - Check and clean, adjust, grease or replace if necessary
Gearbox oil - change
Engine oil - Replace
Final transmission oil - Change
Tyres - Check and clean, adjust or replace if necessary
Tyre pressure - Adjust
Engine revs at idle speed - Adjust
Valve clearance adjustment - Adjust
Wheels - Check and clean, adjust, grease or replace if necessary
Bolt, nut and screw tightening - Check and clean, adjust, grease or replace if necessary
Battery terminal tightening - Check and clean, adjust, grease or replace if necessary
Cylinder synchronisation - Check and clean, adjust, grease or replace if necessary
Suspensions and trim - Check and clean, adjust, grease or replace if necessary

Action
Brake pad wear - Check and clean, adjust, grease or replace if necessary

EVERY 4 YEARS

Action
Fuel pipes - Replace
Brake pipes - Replace

EVERY 5000 KM (3125 MI) - IF THE VEHICLE IS USED FOR RACING

Action
Outer spark plugs - Replace
Engine oil filter - Replace
Purge fluid present in oil drainage pipe from the filter casing - Clean
Clutch wear - Check and clean, adjust, grease or replace if necessary

EVERY 10,000 KM (6250 MI) OR 12 MONTHS

Action
Outer spark plugs - Replace
Gearbox oil - change
Idle mixture (CO) - Check and clean, adjust, grease or replace if necessary
Transmission cables and controls - Check and clean, adjust, grease or replace if necessary
Steering and steering clearance bearings - Check and clean, adjust, grease or replace if necessary
Wheel bearings - Check and clean, adjust, grease or replace if necessary
Brake discs - Check and clean, adjust, grease or replace if necessary
Air filter - Check and clean, adjust, grease or replace if necessary
Engine oil filter - Replace
General vehicle operation - Check and clean, adjust, grease or replace if necessary
Braking systems - Check and clean, adjust, grease or replace if necessary
Valve clearance adjustment - Adjust
Wheels - Check and clean, adjust, grease or replace if necessary
Bolt, nut and screw tightening - Check and clean, adjust, grease or replace if necessary
Cylinder synchronisation - Check and clean, adjust, grease or replace if necessary
Purge fluid present in oil drainage pipe from the filter casing - Clean
Final transmission oil - Change
Fuel pipes - Check and clean, adjust, grease or replace if necessary
Brake pipes - Check and clean, adjust, grease or replace if necessary
Clutch wear - Check and clean, adjust, grease or replace if necessary

AFTER THE FIRST 10,000 KM (6,250 MILES) AND THEN AFTER EVERY 20,000 KM (12,500 MILES)

Action
Fork oil - Change
Fork oil seals - Replace

EVERY 20,000 KM (12,500 MI) OR 24 MONTHS

Action
Inner spark plugs - Replace
Alternator belt - Adjust; replace every 50,000 km
Air filter - Replace
Fork - Check and clean, adjust and lubricate
Brake fluid - change
Final transmission oil - Change
Gearbox oil - change
Suspensions and trim - Check and clean, adjust, grease or replace if necessary
Brake pad wear - Check and clean, adjust, grease or replace if necessary

Transmission fluid

Check

• Keep the vehicle upright with both wheels on the ground.

• Unscrew and remove the level plug (1).

• The level is correct if the oil is close to the hole of the level plug (1).

• If the oil is lower than specified, top-up until it reaches the level plug hole (1).

CAUTION

DO NOT ADD ADDITIVES OR OTHER SUB-STANCES 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 over 400 cm³ (25 in³) 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 replace, if necessary, the drainage plug sealing washer (3).
- Remove any metal scrap attached to the drainage plug magnet (3).
- Screw and tighten the drainage plug (3).
- Pour new oil through the filler (1) until it reaches the level plug hole (1).

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.

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

Engine oil

Check

CAUTION

THE 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 ABOUT 15 KM (10 MILES).

• Stop the engine.

• Keep the vehicle upright with both wheels on the ground.

• Unscrew and remove the dipstick (1).

• Clean the dipstick (1).

• Reinsert the dipstick (1) into its tube but do not screw it.

• Remove the dipstick (1).

• Check the oil level on the dipstick (1).

• Oil level is correct when it is close to the "**MAX**" mark.

MAX = maximum level

MIN = minimum level

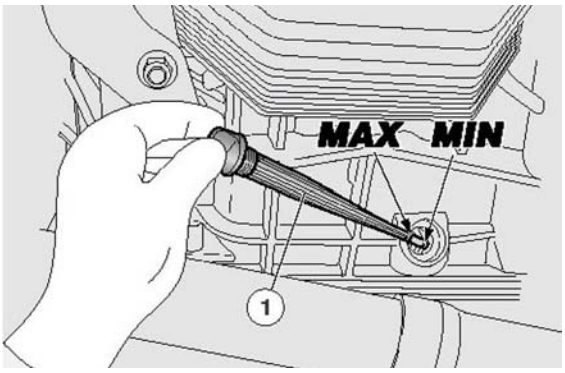
Add engine oil if required:

• Unscrew and remove the dipstick (1).

• Top-up with engine oil getting over the minimum level marked "**MIN**".

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.



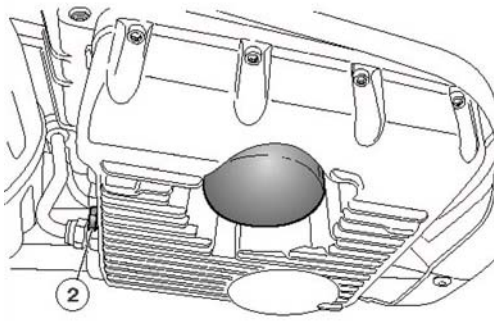
Replacement

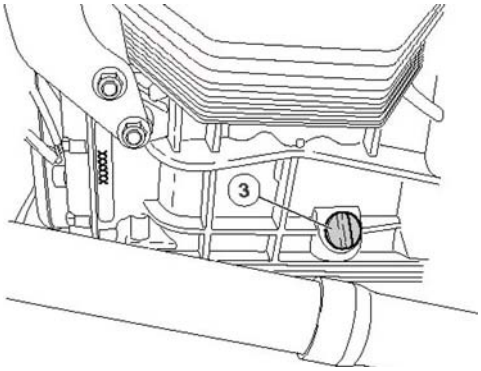
NOTE

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

• Place a container with +4000 cm³ capacity under the drainage plug (2).

• Unscrew and remove the drainage plug (2).





• Unscrew and remove the filler cap (3).

• Drain the oil into the container; allow several minutes for oil to drain out completely.

• Check and replace, if necessary, the drainage plug (2) sealing washers.

• Remove any metal scrap attached to the drainage plug (2) magnet.

• Screw and tighten the drainage plug (2).

• Pour new oil until getting over the minimum level marked "MIN".

Gearbox Oil

Inspection

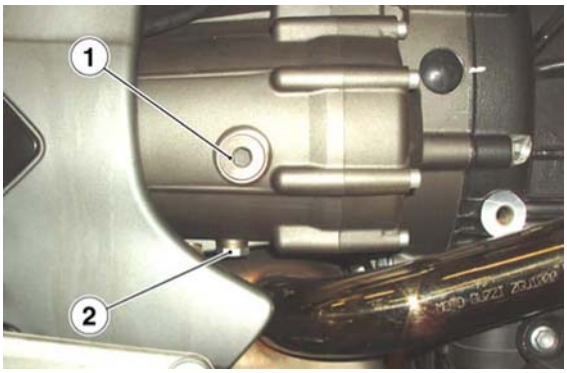
CHECKING AND TOPPING UP

CAUTION

THE 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).



- Stop 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 level plug (1).

If necessary:

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

CAUTION

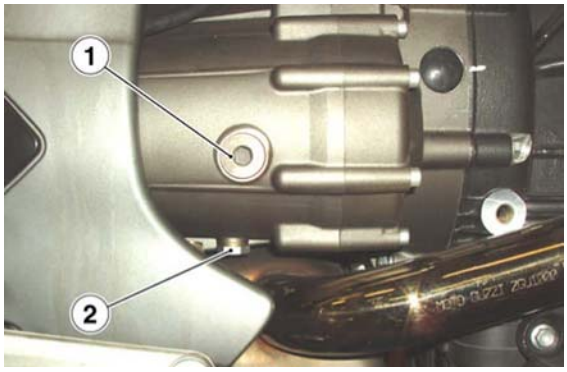
DO NOT ADD ADDITIVES OR OTHER SUB-

STANCES TO THE OIL. 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.



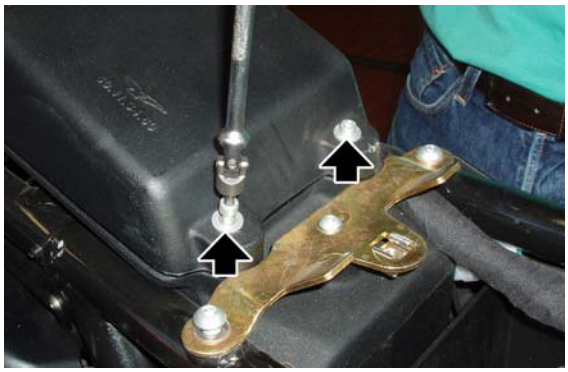
• Place a container with suitable capacity under the drainage plug (2).
• Unscrew and remove the drainage plug (2).
• Unscrew and remove the filler cap (1).
• Drain the oil into the container; allow several minutes for oil to drain out completely.
• Check and replace, if necessary, the drainage plug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

CAUTION

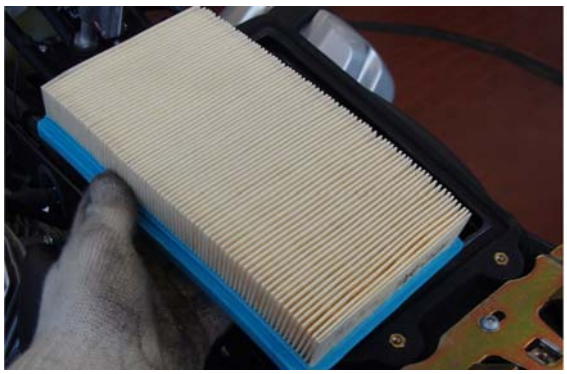
DO NOT ADD ADDITIVES OR OTHER SUBSTANCES TO THE OIL. WHEN USING A FUNNEL OR ANY OTHER ELEMENT, MAKE SURE IT IS PERFECTLY CLEAN.

Air filter

- Remove the fuel tank.
- Undo and remove the three screws from the filter casing cover.



- Remove the filter casing cover from the clamps.
- Remove the air filter.



NOTE

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

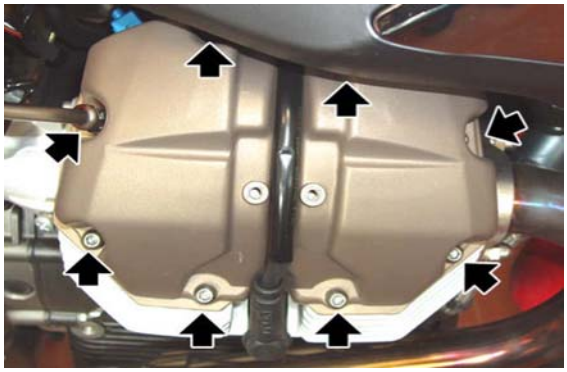
If the timing system is very noisy, check the clearance between valves and rockers.

NOTE

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

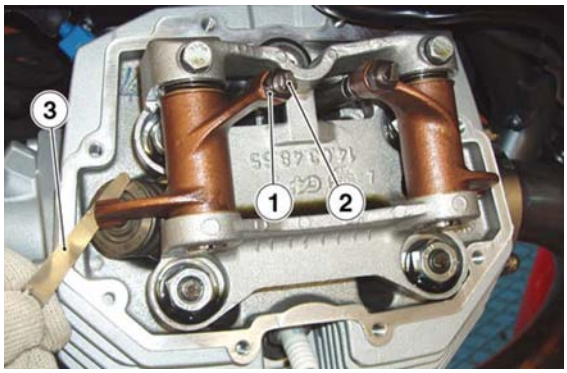
- Remove the fuel tank.
- Unscrew and remove the two screws.
- Remove the spark plugs protection.
- Disconnect both spark plug tubes.

- Unscrew and remove the eight screws.
- Remove the head cover.



- loosen the nut (1);
- use a screwdriver on the 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 done using a thickness gauge (3).

CAUTION

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

- PRESSURE DROP;
- ENGINE OVERHEAT;
- VALVE BURNOUT, ETC.

Braking system

Level check

Brake fluid check

- Place the vehicle on the service 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

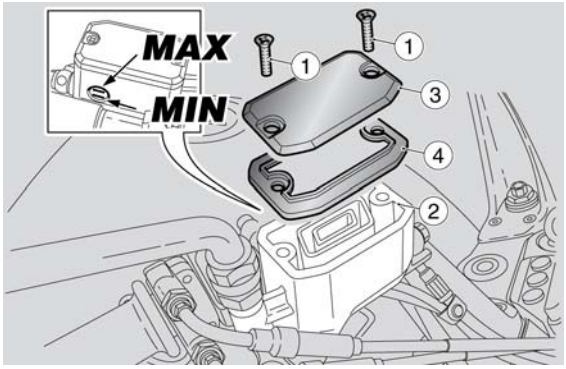
If the fluid does not reach at least the "**MIN**" reference mark:

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

Top-up

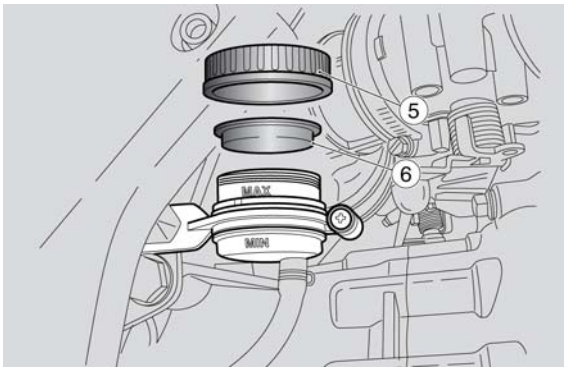
Front brake:

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



Rear brake:

- Unscrew and remove the cover (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 SPILLS. DO NOT OPERATE THE BRAKE LEVER WITH BRAKE FLUID RESERVOIR CAP LOOSENED OR REMOVED.

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.

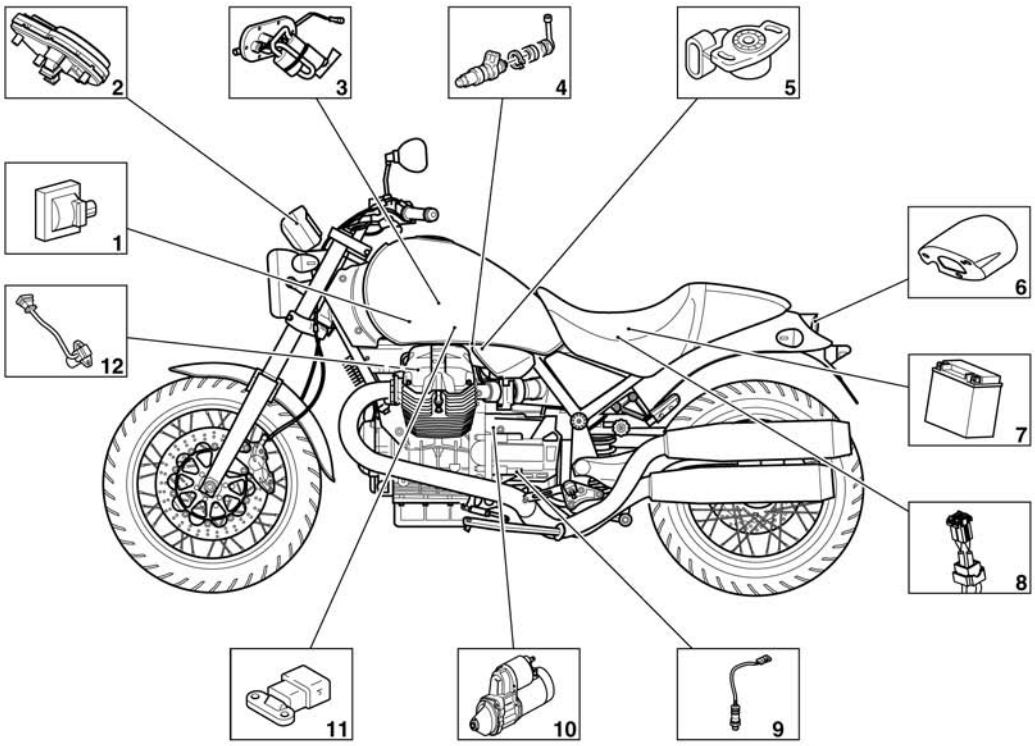
TO AVOID SPILLING FLUID WHILE TOPPING-UP, KEEP THE TANK PARALLEL TO THE RESERVOIR EDGE (IN HORIZONTAL POSITION).
DO NOT ADD ADDITIVES OR OTHER SUBSTANCES TO THE LIQUID.
WHEN USING A FUNNEL OR ANY OTHER ELEMENT, MAKE SURE IT IS PERFECTLY CLEAN.

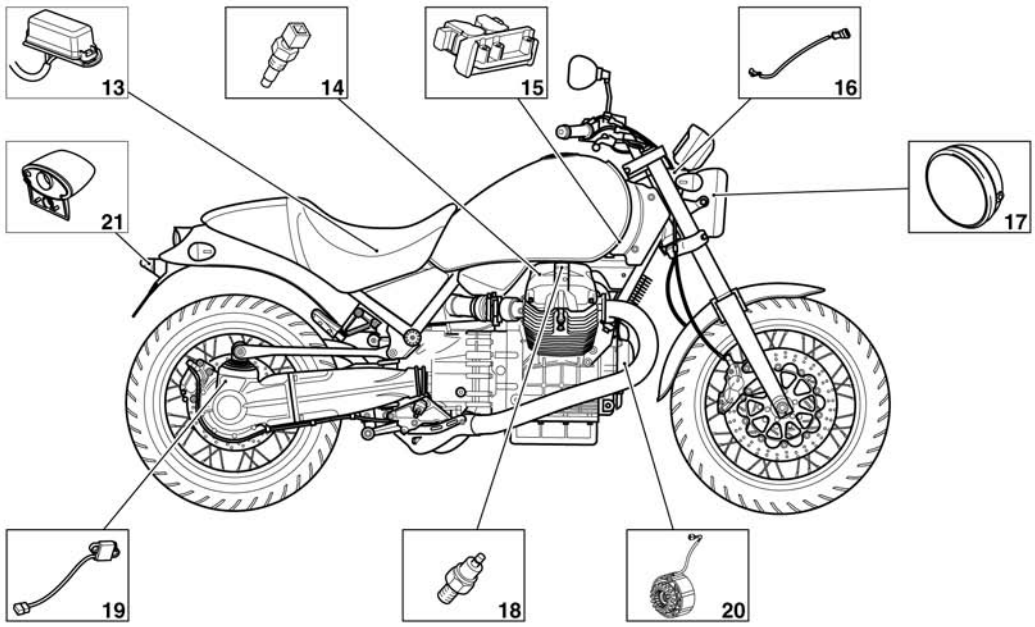
DO NOT EXCEED THE "MAX" LEVEL MARK WHEN TOPPING UP.
TOP-UP TO "MAX" LEVEL MARK ONLY WHEN BRAKE PADS ARE NEW. WHEN TOPPING UP DO NOT EXCEED THE "MAX" LEVEL MARK WHEN BRAKE PADS ARE WORN AS YOU RISK SPILLING FLUID WHEN CHANGING THE BRAKE PADS.
CHECK BRAKING EFFICIENCY. IN CASE OF EXCESSIVE TRAVEL OF THE BRAKE LEVER OR POOR PERFORMANCE OF THE BRAKING CIRCUIT, TAKE YOUR VEHICLE TO AN OFFICIAL MOTO GUZZI DEALER, AS IT MAY BE NECESSARY TO PURGE THE AIR IN THE CIR-

CUIT.

INDEX OF TOPICS

Components arrangement





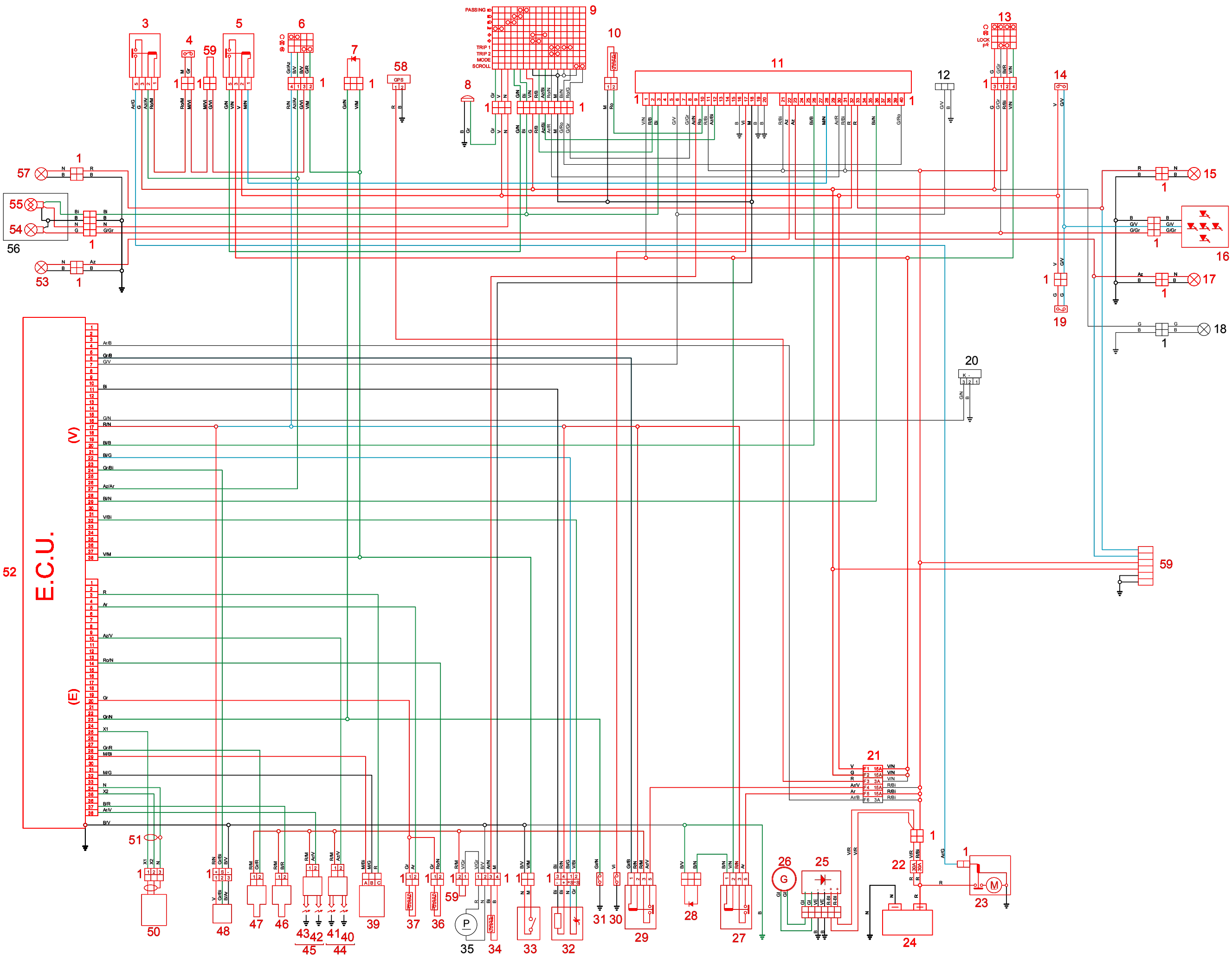
Key:

1. Coil
2. Instrument panel
3. Fuel pump

4. Injector
5. Throttle valve potentiometer
6. Rear light
7. Battery
8. Main fuses
9. Lambda Probe
10. Starter motor
11. Intake air temperature sensor
12. Engine revolution sensor
13. Secondary fuses
14. Head temperature sensor
15. Engine control unit
16. Instrument panel air temperature sensor
17. Front headlamp
18. Oil pressure sensor
19. Speed sensor
20. Alternator
21. License plate light

Electrical system installation

General wiring diagram



Bellagio 940

KEY

01 MULTIPLE CONNECTORS
02 -
03 START-UP RELAY
04 CLUTCH SWITCH
05 LIGHT LOGIC RELAY
06 RIGHT LIGHT SWITCH
07 SAFETY DIODE
08 HORN
09 LEFT LIGHT SWITCH
10 AMBIENT AIR TEMPERATURE SENSOR
11 INSTRUMENT PANEL
12 INSTRUMENT PANEL DIAGNOSIS
13 KEY SWITCH
14 FRONT STOP SWITCH
15 REAR RIGHT TURN INDICATOR
16 REAR LIGHT ASSEMBLY
17 LEFT RIGHT TURN INDICATOR
18 LICENSE PLATE LIGHT BULB
19 REAR STOP SWITCH
20 ECU DIAGNOSIS
21 AUXILIARY FUSES
22 MAIN FUSES
23 STARTER MOTOR
24 BATTERY
25 VOLTAGE REGULATOR
26 FLYWHEEL
27 MAIN INJECTION RELAY
28 INJECTION DIODE
29 SECONDARY INJECTION RELAY
30 OIL PRESSURE SENSOR
31 NEUTRAL SENSOR
32 LAMBDA PROBE
33 SIDE STAND SWITCH
34 FUEL LEVEL SENSOR
35 FUEL PUMP
36 INTAKE AIR TEMPERATURE SENSOR
37 ENGINE TEMPERATURE SENSOR
38 -
39 THROTTLE POSITION SENSOR
40 RIGHT CYLINDER INNER SPARK PLUG
41 RIGHT CYLINDER OUTER SPARK PLUG
42 LEFT CYLINDER INNER SPARK PLUG
43 LEFT CYLINDER OUTER SPARK PLUG
44 RIGHT CYLINDER DOUBLE COIL
45 LEFT CYLINDER DOUBLE COIL
46 RIGHT CYLINDER INJECTOR
47 LEFT CYLINDER INJECTOR
48 VEHICLE SPEED SENSOR
49 -
50 PICK UP
51 PICK UP CABLE SHIELDING
52 ECU
53 FRONT LEFT TURN INDICATOR
54 TAIL LIGHT BULB
55 LOW-BEAM/HIGH-BEAM BULB
56 HEAD LIGHT ASSEMBLY
57 FRONT RIGHT TURN INDICATOR
58 GPS COUPLING
59 ANTI-THEFT COUPLING

COLOUR KEY

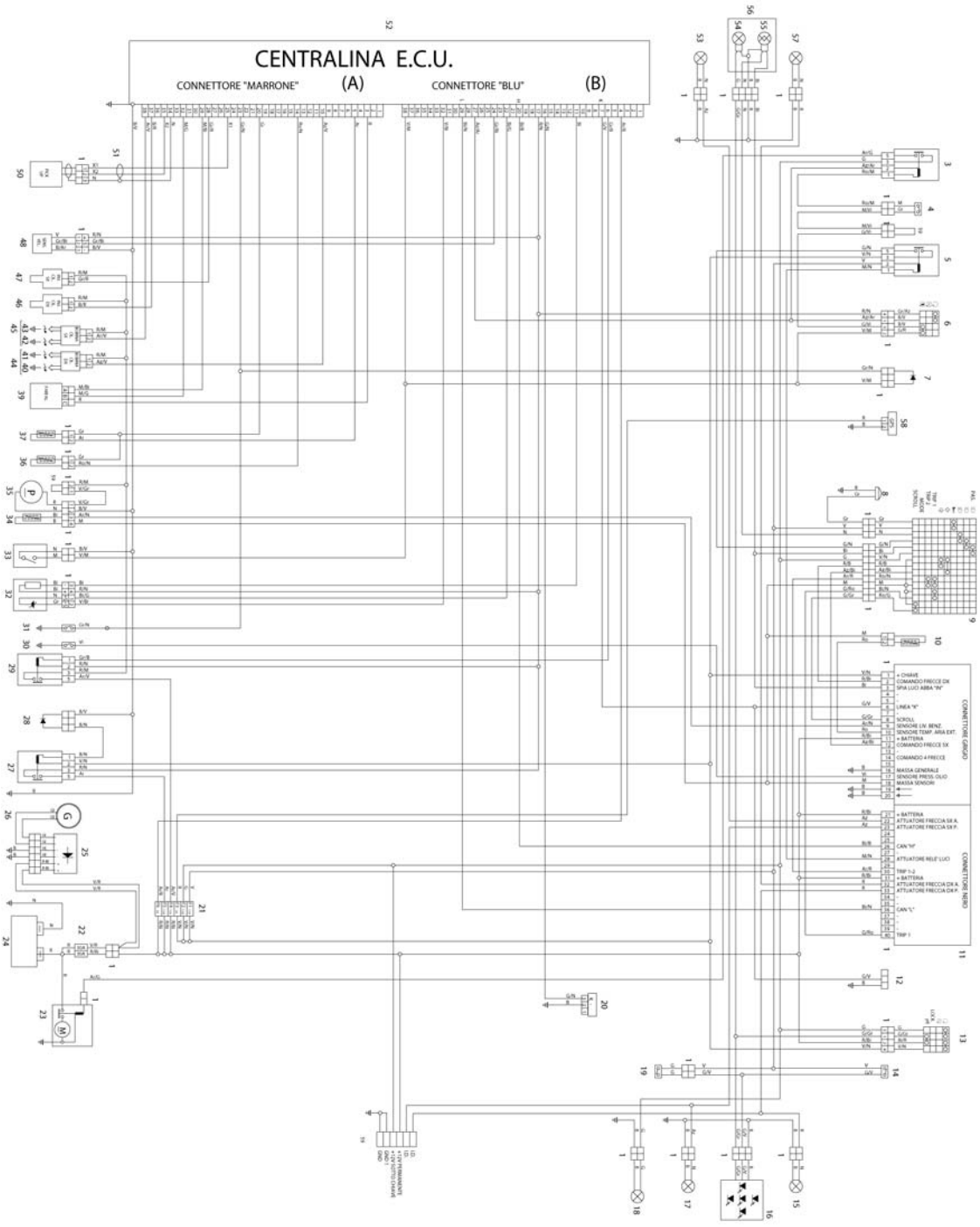
Ar Orange
Az Sky blue
B Blue
Bi White
G Yellow
Gr Grey
M Brown
N Black
R Red
Ro Pink
V Green
Vi Purple

DIAGRAM COLOURS - KEY

POWER SUPPLY
GROUND
ENABLING/ SIGNAL
ENABLING/ SIGNAL

ECU CONNECTORS - KEY

A Brown
B Blue



Key:

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

6. Right light switch
7. Safety diode
8. Horn
9. Left light switch
10. Instrument panel air temperature thermistor
11. Instrument panel
12. Instrument panel diagnosis
13. Key switch
14. Front stop switch
15. Right rear turn indicator
16. Rear light (LED)
17. Left rear turn indicator
18. License plate light
19. Rear stop switch
20. (ECU) Diagnosis connector
21. Secondary fuses
22. Main fuses
23. Starter motor
24. Battery
25. Voltage regulator
26. 350 W alternator
27. Main injection relay
28. Injection diode
29. Secondary injection relay
30. Oil pressure sensor
31. Gear in neutral switch
32. Lambda Probe
33. Side stand switch
34. Fuel reserve sensor
35. Fuel pump
36. Intake air temperature thermistor
37. Head temperature sensor
38. -
39. Throttle sensor
40. Right cylinder inner spark plug

41.Right cylinder outer spark plug

42.Left cylinder inner spark plug

43.Left cylinder outer spark plug

44.Right cylinder double coil

45.Left cylinder double coil

46.Right injector

47.Left injector

48.Speed sensor

49.Fall sensor

50.Flywheel pick up

51.Pick-up wire shielding

52.ECU

53.Left front turn indicator

54.Tail light bulb

55.High - low-beam bulb

56.Front headlamp

57.Right front turn indicator

58.GPS coupling

59.Antitheft coupling

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 violet

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 SERVICE CODE

For this vehicle the SERVICE CODE is: **21959**

The functions in this menu are

- Exit
- ECU errors
- Instrument Panel Errors
- Delete errors
- Reset Service
- Update
- Change Keys

ECU ERRORS

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

Description - Error code

Throttle Valve Error DC Vdc - ECU 10

Throttle Valve Error DC Gnd - ECU 11

Engine Temperature Error DC Vdc - ECU 14

Engine Temperature Error DC Gnd - ECU 15

Air Temperature Error DC Vdc - ECU 16

Air Temperature Error DC Gnd - ECU 17

Low Battery Error - ECU 20

Lambda Probe Error - ECU 21

Coil 1 Error DC Vdc - ECU 22

Coil 1 Error DC Gnd - ECU 23

Coil 2 Error DC Vdc - ECU 24

Coil 2 Error DC Gnd - ECU 25

Injector 1 Error DC Vdc - ECU 26

Injector 1 Error DC Gnd - ECU 27

Injector 2 Error DC Vdc - ECU 30

Pump Relay Error - ECU 36

Local Loop-back Error - ECU 37

DC Start-up Remote control Error Vdc - ECU 44

Remo. Error DC Start-up Gnd - ECU 45

Canister Error DC Vdc - 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

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 - Error code

Fuel sensor failure - DSB 05 Air temperature sensor failure - DSB 06 Oil sensor failure - DSB 07 Oil pressure failure - DSB 08

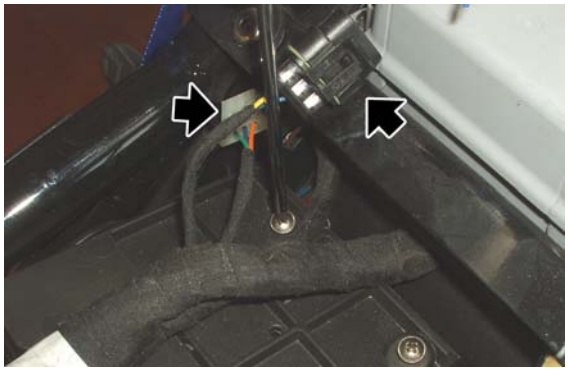
The instrument panel keeps all previous errors stored in its **memory**.

DELETE ERRORS

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

INSTRUMENT PANEL SOFTWARE UPGRADE

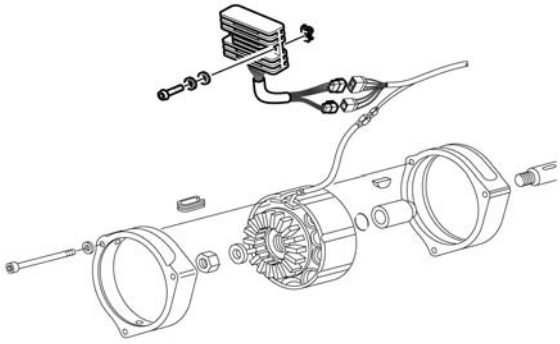
This function is used to program the instrument panel again with a new software through Axone. The Display reads: "Instrument panel disconnected. Now connect the diagnosis instrument"; the instrument panel will connect normally after the key is extracted-inserted.
The white connector is placed under the saddle, beside the fuse box, close to the diagnosis connector for the injection system.
Use the Ditech connector in the Axone 2000 **Aprilia-Moto Guzzi** package to connect to the Axone cable.



Battery recharge circuit

Checking the stator

INVERTED CONNECTION WILL CAUSE IRREPARABLE DAMAGE TO THE REGULATOR. MAKE SURE THAT THE REGULATOR HAS A CORRECT GROUND CONNECTION. POSSIBLE CHECKS TO BE CARRIED OUT ON THE ALTERNATOR AND ON THE REGULATOR IN CASE THAT THE BATTERY IS RECHARGED OR THAT VOLTAGE IS NO LONGER REGULATED.



With engine off disconnect the two generator yellow cables from the rest of the system and, with an Ohm meter, carry out the following checks:
WINDING TOWARD THE GROUND INSULATION CHECK
Connect an Ohm meter lead to one of the two yellow cables and the other lead to the ground connection (reed valve). The Ohm meter should indicate a value above 10 MOhm.
WINDING CONTINUITY CHECK
Connect the Ohm meter to the ends of the two yellow cables.

The Ohm meter should indicate a value between 0.2 and 0.3 Ohm.

OUTPUT VOLTAGE CHECK

Connect a voltmeter set to 200 V alternating current capacity to the ends of the two yellow cables.

Start up the engine and check that the output voltages are within the values indicated in the table.

ALTERNATOR CHECK

	Specification	Desc./Quantity
1	Alternating current voltage at 1000 rpm	15V or above
2	Alternating current voltage at 3000 rpm	40V or above
3	Alternating current voltage at 6000 rpm	80V or above
4	Direct current intensity at 1000 rpm	9.50 Amp
5	Direct current intensity at 1200 rpm	13.0 Amp
6	Direct current intensity at 1500 rpm	16.50 Amp
7	Direct current intensity at 2000 rpm	20.0 Amp
8	Direct current intensity at 3000 rpm	23.50 Amp
9	Direct current intensity at 4000 rpm	25.0 Amp
10	Direct current intensity at 6000 rpm	26.50 Amp
11	Direct current intensity at 10000 rpm	27.50 Amp

Voltage regulator check

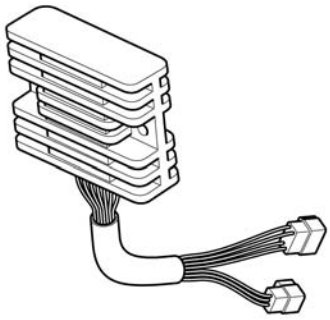
The regulator is calibrated to keep battery voltage between 14 and 14.6 V.

Regulator checks

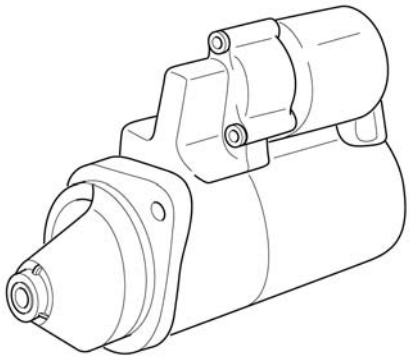
Regular tools in the shop are not enough to carry out the regulator check, therefore, there follow some indications for effectively detecting a faulty regulator.

A regulator is faulty if:

After being disconnected from the rest of the system, it has a short circuit between the ground connection (aluminium sheath) and any output cable.



Start-up system check



GENERAL CHARACTERISTICS

	Specification	Desc./Quantity
1	Voltage	12 V
2	Power	1.2 kW
3	Torque at idle speed	11 Nm
4	Torque when loading	4.5 Nm
5	Pinion	z = 9 module 2.5
6	Rotation (pinion side)	Anticlockwise
7	Speed	1750 rpm
8	Current at idle speed	600 A
9	Current when loading	230 A
10	Weight	2.8 kg (61.73 lb)

level indicators

Petrol pump:

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

Fuel level sensor:

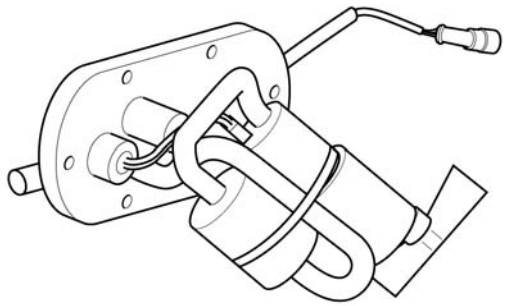
Resistance (to be measured between pins 3 and 4)

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)

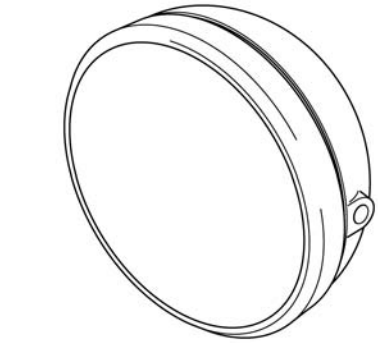
The low fuel warning light turns on with values over 230 Ohm.

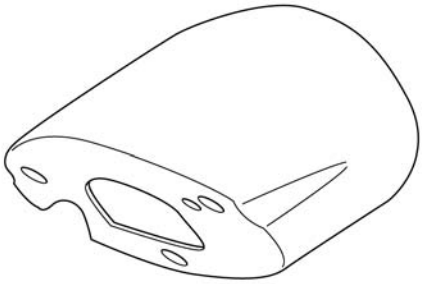


Lights list

ELECTRICAL SYSTEM

Specification	Desc./Quantity
Tail light	12V - 5 W
Low-/ High-beam light bulb (halogen)	12 V - 55 W/ 60 W H4
Rear tail light /stop light	12 V - 5 / 21 W
License plate light	12V - 5 W





Fuses

SECONDARY FUSES

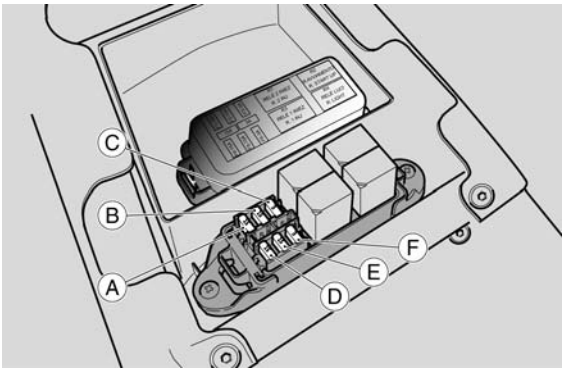
A - Stop, horn, coil, light relay (15 A).

B - Tail lights, license plate light, passing, ignition relay (15 A).

C - Positive live lead, "Tom - Tom" GPS (3A)

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

D - Lambda burner, secondary injection relay coil, ignition relay coil, speed sensor power supply, engine kill, ECU power supply (15 A).



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

NOTE

THERE ARE TWO SPARE FUSES.

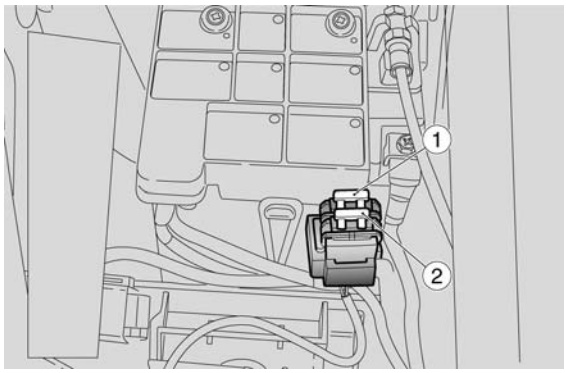
MAIN FUSES

1 - From battery to voltage regulator (30 A).

2 - From battery to key and secondary fuses C - D (30 A).

NOTE

THERE IS ONE SPARE FUSE.



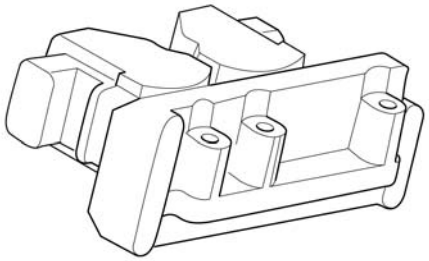
Control unit

Model: Magneti Marelli IAW 5 AM

The control unit structure has ground connection

The connectors on the control unit are both black.

For the following pin explanation, the cable harness connectors are the reference:



Engine connector pins (brown)

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 Not used

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 Not used

18 Not used

19 Not used

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 power supply

30 Not used

31 Not used

32 Ignition potentiometer negative

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

Vehicle connector pins (blue)

Pin Use

1 Not used

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 Not used

29 CAN - L line (ccm/instrument panel)

30 Not used

31 Not used

32 Oxygen probe power supply

33 Not used

34 Not used

35 Not used

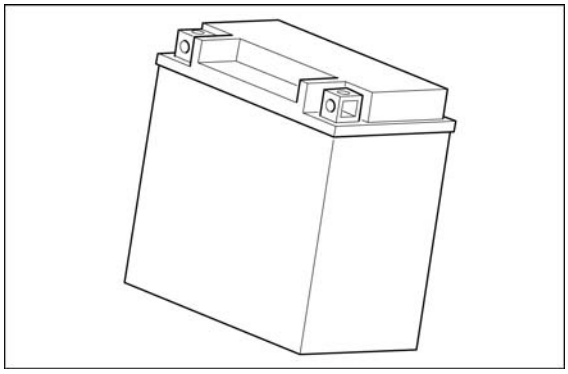
36 Not used

37 Not used

38 Side stand sensor signal

Battery

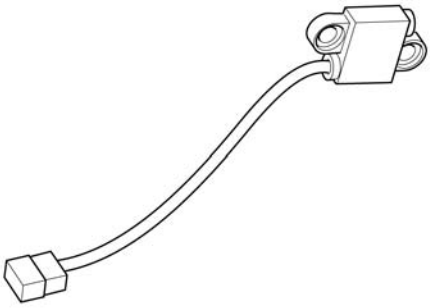
12 V - 18 Ampere/hour



Speed sensor

Active inductive sensor

3-pin connector (Power supply - Signal-Earth connection).

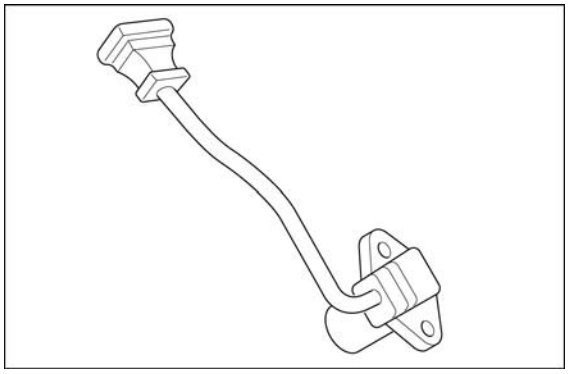


Engine rpm sensor

Measures the engine revolution speed and each cylinder timing in relation to the TDC

Inductive type sensor, with three-way connector:

- positive voltage pin;
- negative voltage pin: resistance from 650 to 720 Ohm (to be measured between pins 1 and 2);
- shielding pin.

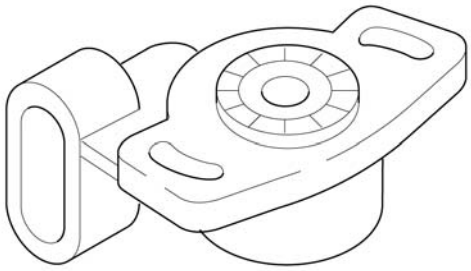


Air gap value (measure the sensor length with a depth gauge): **0.7 - 0.9 mm (0.0276 - 0.0354 in)**.

Throttle position sensor

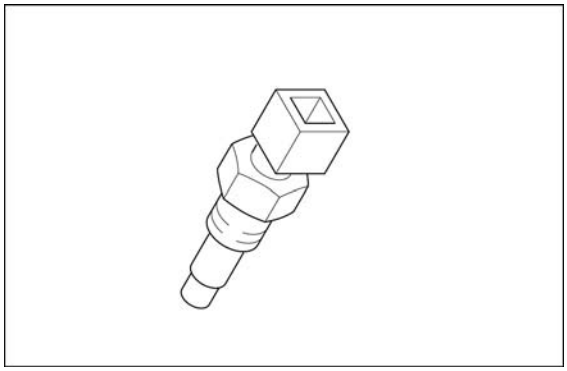
Output voltage 0.45 - 4.85 V (variable depending on the position of the throttle valve, to be meas-

ured between pins C and A)



Engine temperature sensor

This sensor, 5V powered, features NTC specifications and sends the control unit a signal which varies depending on temperature to help manage the stoichiometric ratios during engine speed adjustment.



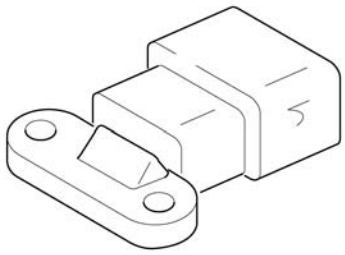
ENGINE TEMPERATURE SENSOR RESISTANCE

	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

	Specification	Desc./Quantity
16	Resistance at +110 °C (230 °F)	0.153 kOhm
17	Resistance at +120 °C (257 °F)	0.102 kOhm

Air temperature sensor

NTC type sensor



AIR TEMPERATURE SENSOR RESISTANCE

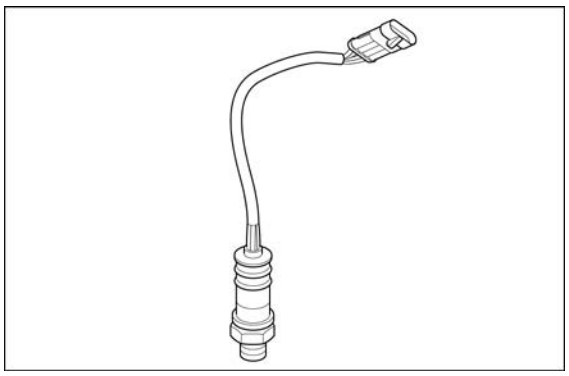
	Specification	Desc./Quantity
1	Resistance at -40 °C (-40 °F)	100.950 kOhm
2	Resistance at 0 °C (32 °F)	9.750 kOhm
3	Resistance at 10 °C (50 °F)	5.970 kOhm
4	Resistance at 20 °C (68 °F)	3.750 kOhm
5	Resistance at 30 °C (86 °F)	2.420 kOhm
6	Resistance at 40 °C (104 °F)	1.600 kOhm
7	Resistance at 90 °C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

Lambda sensor

Oxygen sensor with heater.

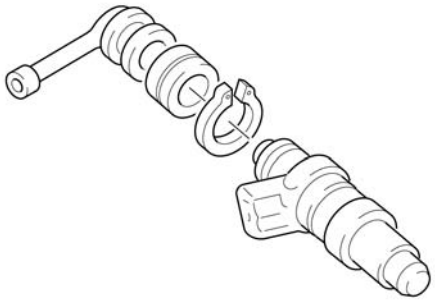
Sensor voltage between 0 and 0.9 V (to be measured between pins 1 and 2).

Heater resistance 12.8 Ohm (to be measured between pins 3 and 4 at 20°C - 68°F).



Injector

Resistance 14 Ohm ± 2 Ohm measured at 20 °C (68 °F)



Coil

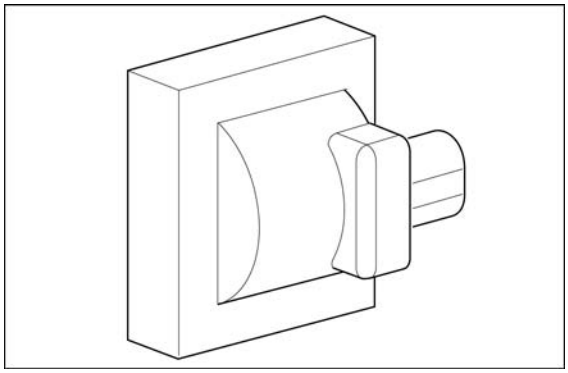
Characteristic

Primary resistance:

0.52 - 0.62 Ω (measured between pins 1 and 2)

Secondary resistance:

6.85 - 7.5 KΩ.

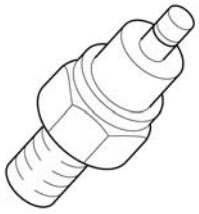


Engine oil pressure sensor

There is a failure in the oil pressure sensor when it is detected as not conducting (open) with the engine off and the key set to ON. This problem is signalled by the lighting of the "service" warning light, which should remain lit also when the engine is on.

There is an oil pressure failure indication when, with engine on and over 2000 rpm, the sensor is detected as conducting (closed). In this case, the error is indicated by the lighting of the "bulb" icon.

In both cases, the instrument panel diagnosis memory is stored.



Air temperature sensor - instrument panel

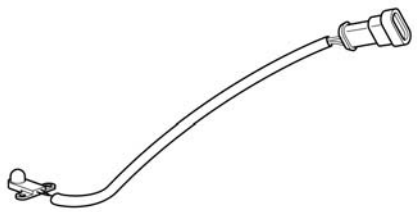
Characteristic

Resistance

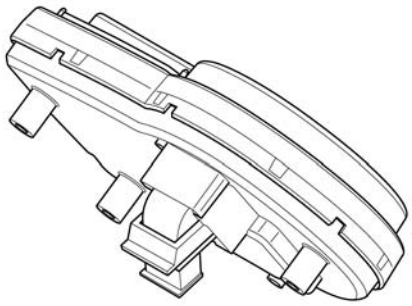
10 kOhm (at 25°C - 77°F)

Resistance

32.5 kOhm (at 0°C - 32°F)



Dashboard



PIN USE

1 + KEY

2 RIGHT TURN INDICATOR CONTROL

3 HIGH-BEAM LIGHT INPUT

4 -

5 -

6 K LINE

7 -

8 SCROLL

9 FUEL LEVEL SENSOR

10 EXTERNAL AIR TEMPERATURE SENSOR

11 + BATTERY

12 LEFT TURN INDICATOR CONTROL

13 -

14 HAZARD

15 -

16 GENERAL EARTH CONNECTION

17 OIL PRESSURE SENSOR

18 SENSORS EARTH CONNECTION

19 GENERAL EARTH CONNECTION

20 GENERAL EARTH CONNECTION

21 + BATTERY

22 FRONT LEFT TURN INDICATOR ACTUAT-

OR

23 REAR LEFT TURN INDICATOR ACTUATOR

24 -

25 -

26 CAN H LINE

27 -

28 LIGHT RELAY ACTUATOR

29 -

30 TRIP 1 - 2

31 + BATTERY

32 FRONT RIGHT TURN INDICATOR ACTUAT-

OR

33 REAR RIGHT TURN INDICATOR ACTUAT-

OR

34 -

35 -

36 CAN L LINE

37 -

38 -

39 -

40 TRIP 1

INDEX OF TOPICS

Vehicle preparation

- Drain off the engine oil.
- Remove the tank.
- Remove the exhaust system.
- Remove the fork.
- Remove the shock absorber.
- Remove the air filter casing.
- Remove the battery.

- Operating from both sides, undo and remove the lower screw.

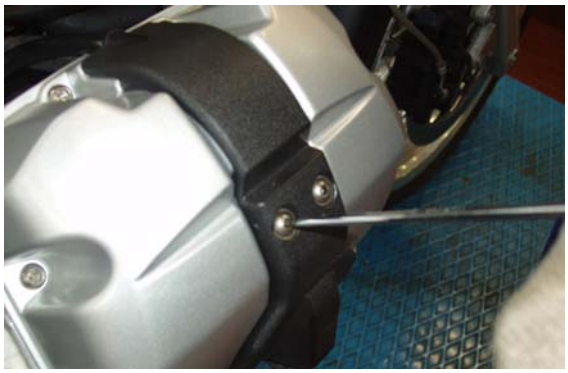
- Operating from both sides, remove the throttle body covers by sliding them off from above.

- Operating from both sides, undo and remove the two screws.

- Operating from both sides, remove the side plate.
- Remove the throttle body.

Removing the engine from the vehicle

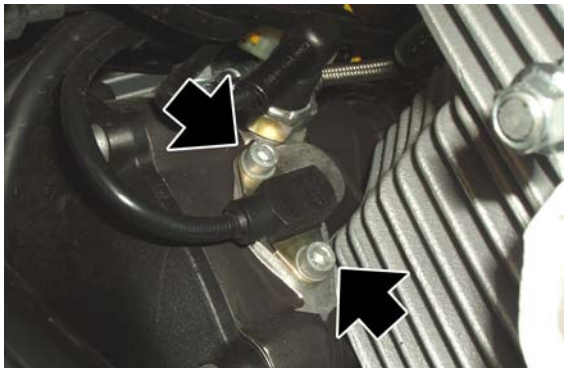
- Operating from both sides, undo and remove the two screws.



- Disconnect the spark plug tubes.

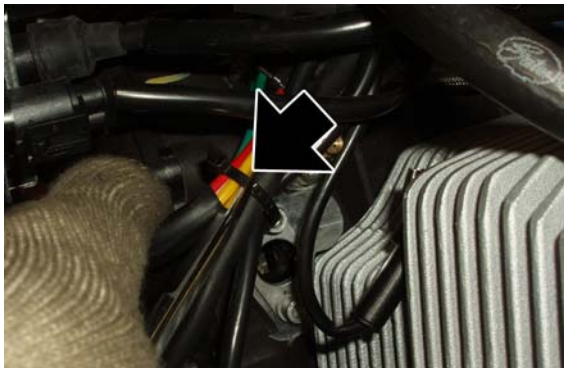
- Disconnect the engine temperature sensor connector.

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



- Disconnect the oil pressure sensor.

- Remove the clamp.



- Disconnect the generator connector.

- Operating on both sides, release the clamp.
- Disconnect the oil vapour recovery pipe.

NOTE

UPON REFITTING, ALWAYS REPLACE WITH A NEW CLAMP.

- Release the clamp and disconnect the crankcase / timing system vapour recovery pipe.

- Slide off the transmission oil breather pipe.

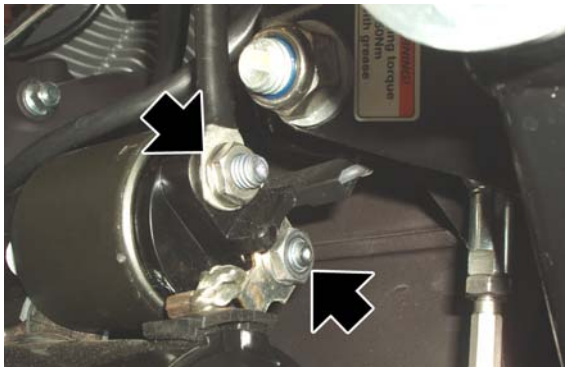
- Disconnect the neutral sensor connector.

- Unscrew and remove the two screws.
- Remove the starter motor protection.

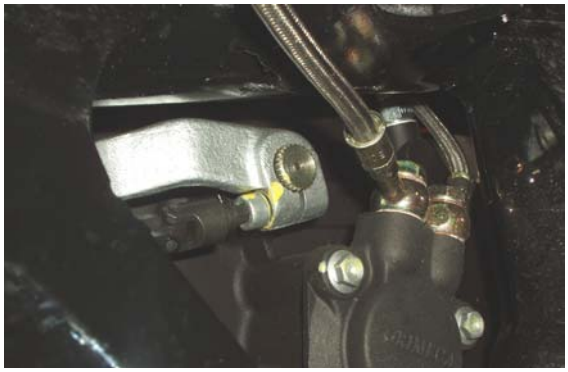
- Disconnect the side stand sensor connector.

- Unscrew and remove the screw.
- Disconnect the earth leads.

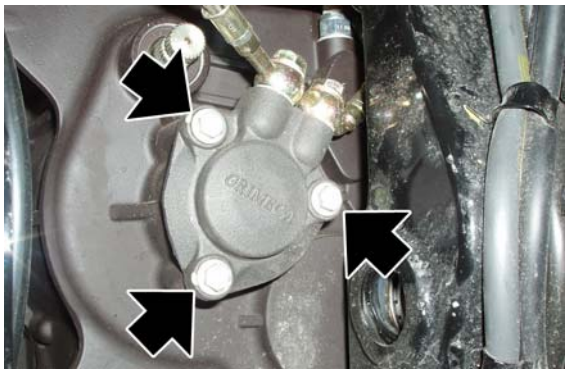
- Disconnect the starter motor connectors.



- Undo and remove the screw.
- Remove the gear transmission lever.

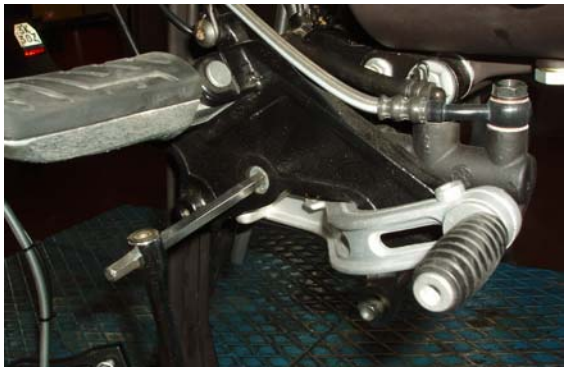


- Undo and remove the three screws.
- Remove the clutch control cylinder.
- Lock the plunger using a clamp.



- Undo and remove the brake control fixing screw.
- Turn the footrest to operate on the en-

gine pin.



- Undo and remove the lower rear pin.
- Slide off the pin from the right side.

- Undo and remove the two rear brake control screws.

- Working from both sides, undo and remove the engine front fixing screw.

- Unscrew and remove the upper rear pin nut.

- Remove the pin from the opposite side.

- Lift the chassis.

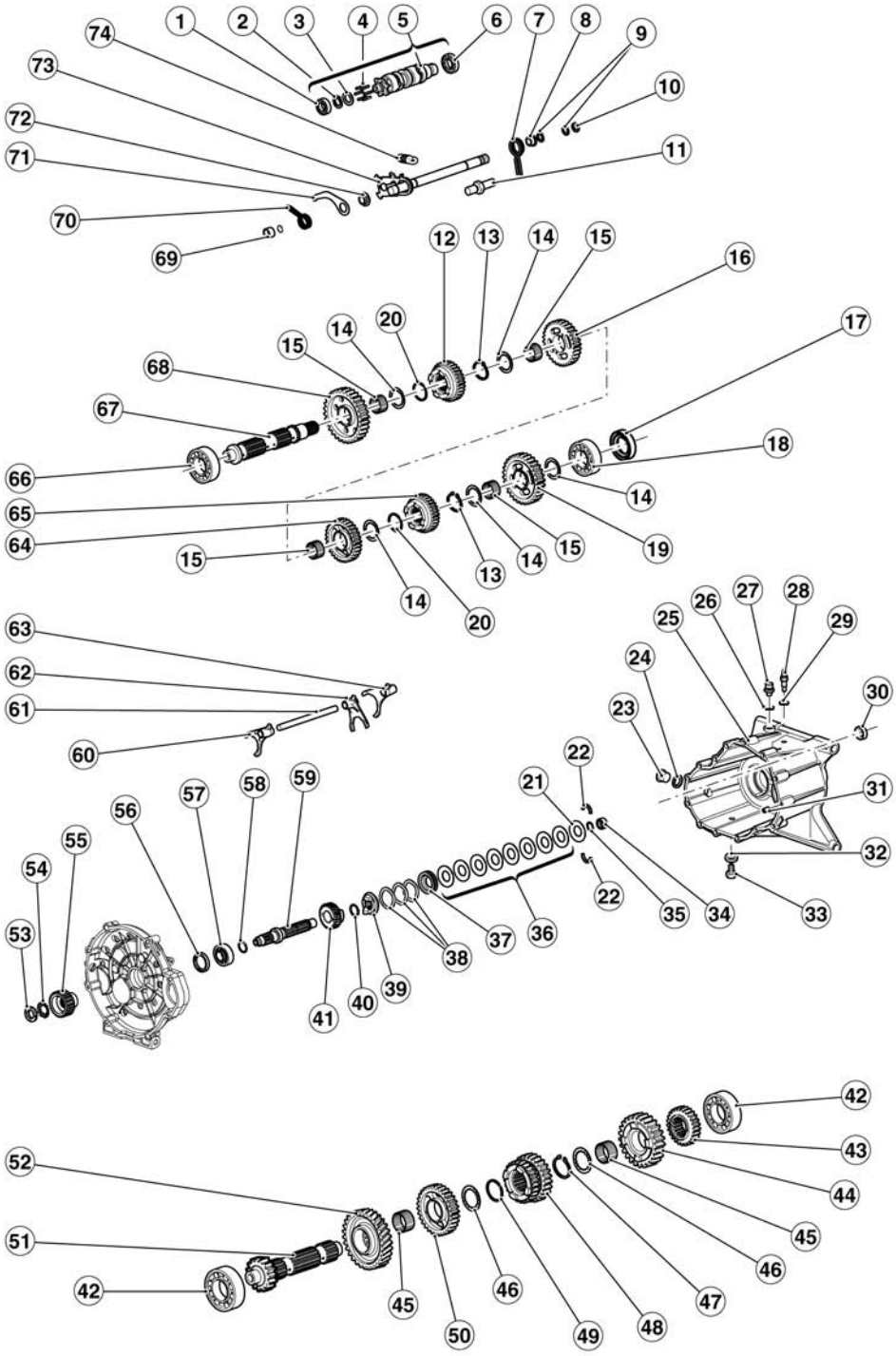
Installing the engine to the vehicle

For refitting, follow the operations in reverse order observing the tightening torque.

INDEX OF TOPICS

Gearbox

Diagram



KEY:

1. Ball bearing

2. Circlip
3. Shim washer
4. Pin
5. Desmodromic compl.
6. Ball bearing
7. Spring
8. Spacer
9. Circlip
10. Fifth wheel
11. Linking pin
12. Gear
13. Circlip
14. Shoulder washer
15. Ball bearing cage
16. Gear
17. Sealing ring
18. Ball bearing
19. Gear
20. Circlip
21. Washer
22. Half ring
23. Oil cap
24. Washer
25. Gearbox
26. Aluminium gasket
27. Bleed cap
28. Neutral sensor
29. Gasket
30. Sealing ring
31. Bushing
32. Gasket
33. Oil drainage cap
34. Roller bearing
35. Circlip
36. Belleville spring

37. Pressure plate

38. Shaped washers

39. Sleeve

40. Circlip

41. Transmission gear

42. Ball bearing

43. Gear

44. Gear

45. Ball bearing cage

46. Shoulder washer

47. Circlip

48. Gear

49. Circlip

50. Gear

51. Main shaft

52. Transmission gear

53. Ring nut

54. Washer

55. Clutch internal body

56. Sealing ring

57. Ball bearing

58. O-Ring

59. Clutch shaft

60. Fork

61. Fork shaft

62. Fork

63. Fork

64. Gear

65. Gear

66. Ball bearing

67. Secondary shaft

68. Gear

69. Spacer

70. Spring

71. Index lever

72. Bushing

73. Pre-selector compl.

74. Spring

Gearbox

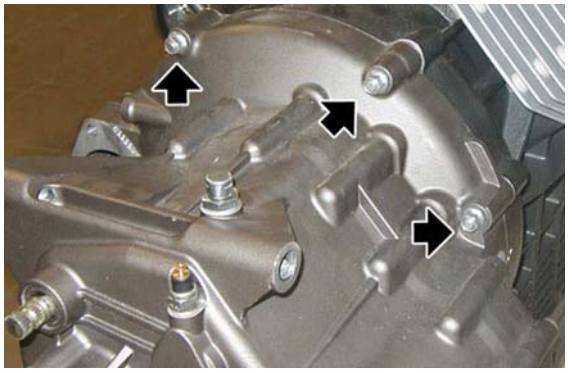
Removing the gearbox

- Remove the starter motor.
- Make sure the transmission is in idle.

- Unscrew and remove the breather pipe.

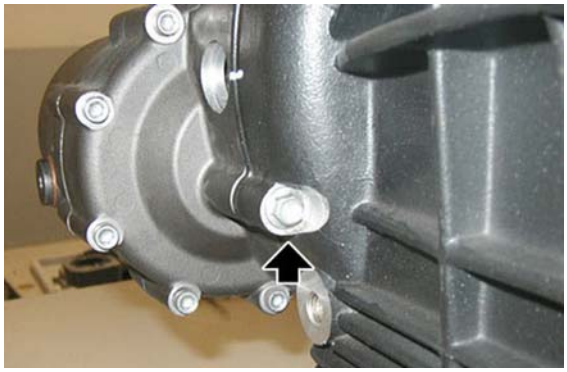
- Place a container of suitable capacity under it, unscrew and remove the cap and then bleed all gearbox oil.

- Unscrew and remove the three screws.



- Unscrew and remove the two screws.

- Unscrew and remove the screw.



- Remove the gearbox.

Gearbox shafts

Disassembling the gearbox

- Remove the gearbox.

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

Specific tooling

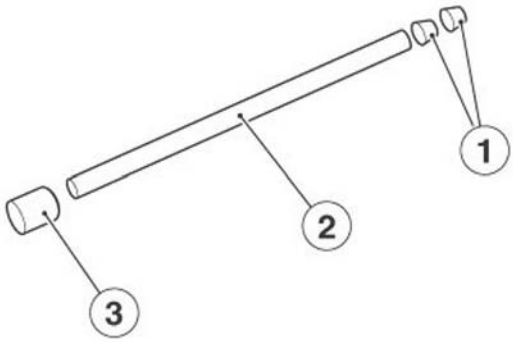
05.90.25.30 Gearbox support

- 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 two bushings (1) and remove the rod (2), collecting the bushing (3).



- Fold the washer fins.

- Using the adequate ring nut spanner and the clutch body locking tool, unscrew and remove the ring nut, collecting the clutch internal body.

Specific tooling

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

30.91.28.10 Clutch body locking

- Open the gearbox using the specific tool.

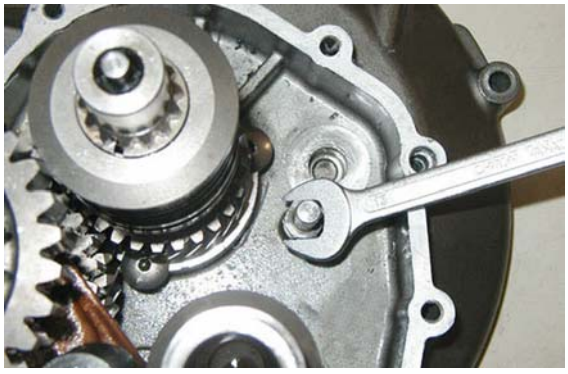
Specific tooling

05.91.25.30 Gearbox opening

- Release the spring.

- Pressing the selector, slide off the whole transmission lever.

- Unscrew and remove the threaded reference pin.



- Use rubber bands to tie down the transmission shaft unit and extract it.

- Remove the bearings from the gear-box if necessary.

- 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.

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 helicoidal transmission gear.

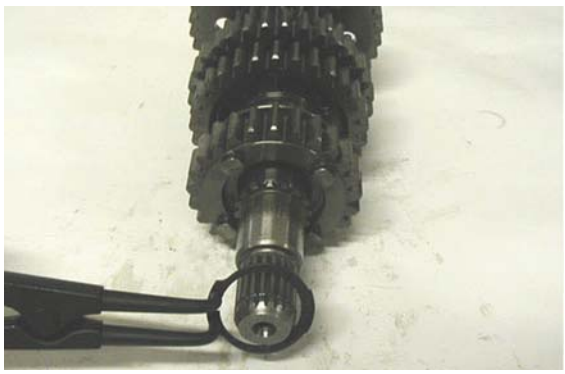
Removing the secondary shaft

- Remove the secondary 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.

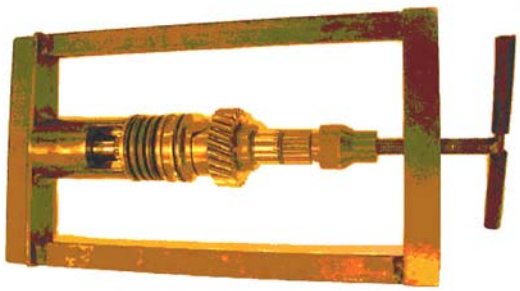
- Remove the circlip.

- Remove the gear of the fifth gear.

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

Disassembling the clutch shaft

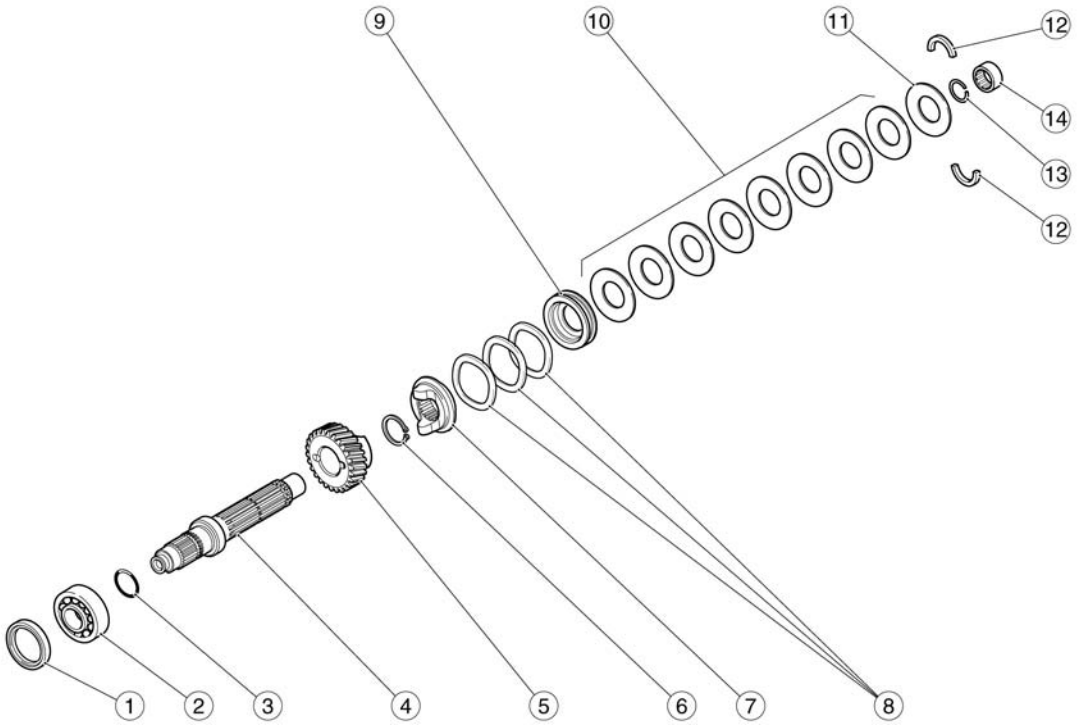
- Remove the gearbox from the engine block.
- Remove the gearbox.
- Insert the clutch shaft in the special tool for removal.



Specific tooling

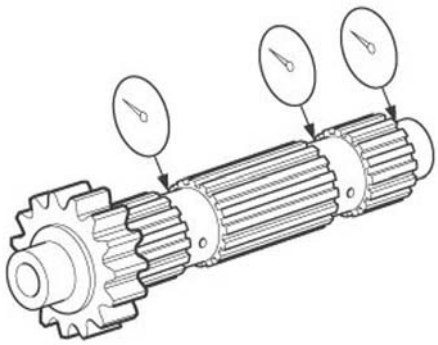
000019663300 Tool for clutch shaft removal

- Compress the Belleville springs (10) until releasing the two half-rings (12).
- Remove the Belleville springs (10).
- Remove the washer (11).
- Remove the shaped washers (8).
- Remove the sleeve (7).
- Remove the circlip (6).
- Remove the transmission gear (5).
- Collect the clutch shaft (4).



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

Secondary shaft coaxiality limit

0.08 mm (0.0031 in)

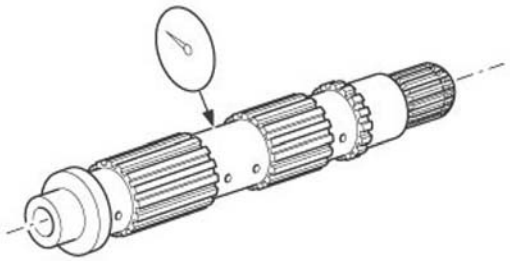
Check transmission gears for signs of pitting and wear and replace damaged gears if necessary.

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 secondary shaft with a dial gauge and a centring device and replace it if not complying with specifications.



Characteristic

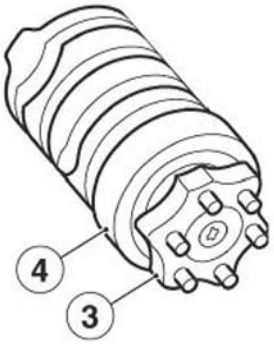
Secondary shaft coaxiality limit

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.

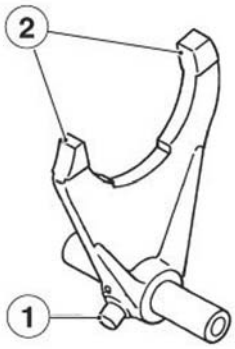


Checking the forks

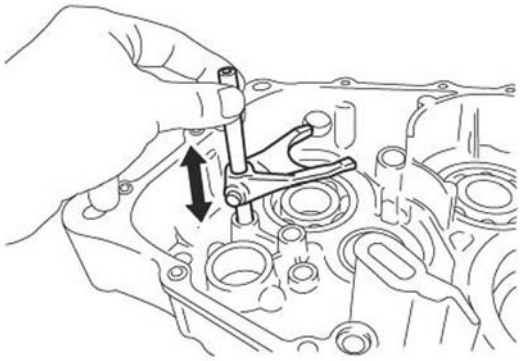
NOTE

THE FOLLOWING PROCEDURE IS VALID FOR ALL TRANSMISSION 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.



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.

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.

Assembling the clutch 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.

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.

Flywheel

Removing the flywheel

- Remove the clutch.
- Place the locking tool on the flywheel and unscrew the six sealing screws of the flywheel, operating diagonally and in stages.
- Remove the locking tool.

Specific tooling

12.91.18.01 Tool to lock the flywheel and start-up crown

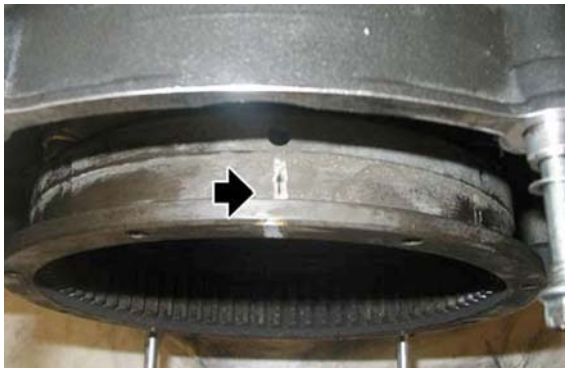
- Remove the flywheel.

Checking

- Check that the flywheel shows no scorings on the disc faying surface.
- Check that the support surfaces on the crankshaft are not deformed; if they are, replace the flywheel.

Installing the flywheel

- Position the flywheel.



NOTE

RESPECT THE FLYWHEEL POSITIONING REFERENCES.

CAUTION

THE SCREWS MUST BE REPLACED WITH NEW ONES AT THE FOLLOWING REFITTING AS THEY ARE SUBJECT TO HIGH LOADS AND STRESS.

- Position the locking tool on the flywheel and tighten the six flywheel sealing screws operating diagonally and in stages.
- Fit the clutch.

Specific tooling

12.91.18.01 Tool to lock the flywheel and start-up crown

Generator

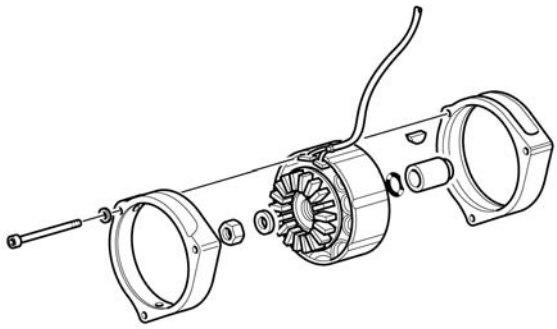
Removing the generator

The alternator is made of two elements:
The stator that is fixed on the timing system cover and the rotor that is fitted on the crankshaft.

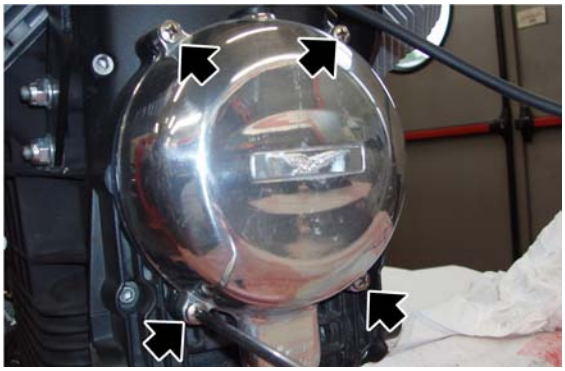
Characteristic

Generator - alternator

Output power: 350 W at 5000 rpm (12V - 25A)



- Unscrew the four screws and remove the alternator cover.



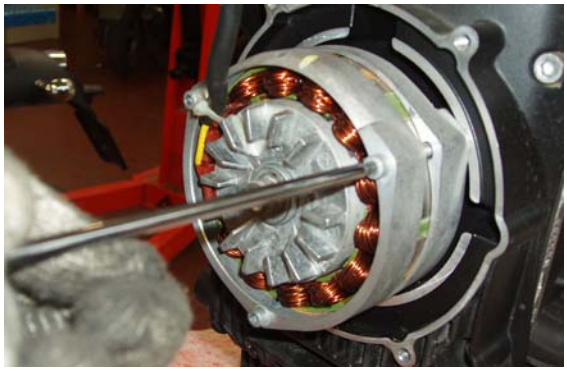
- Remove the gearbox.
- Lock the rotation of the engine fly-wheel using the appropriate locking tool.

Specific tooling

12.91.18.01 Tool to lock the flywheel and start-up crown

- Remove the rotor centre sealing nut.

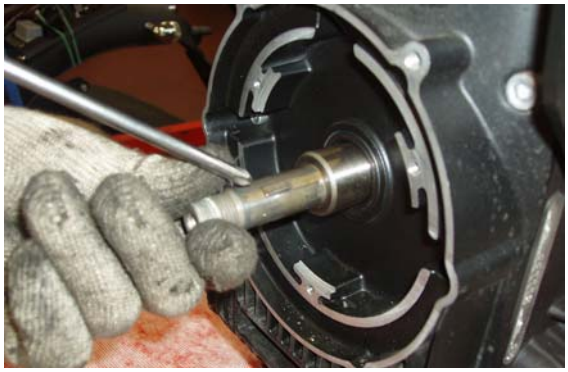
- Remove the stator unscrewing the three fixing screws.



- Remove the washer and take out the rotor.

IN ORDER TO PREVENT DEMAGNETISATION INTRODUCE THE ROTOR AGAIN ON THE STATOR PREVIOUSLY REMOVED.

- Remove the cotter.



Starter motor

Removing the starter motor

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

- Slide off the starter motor.

Clutch side

Disassembling the clutch

- Remove the gearbox from the engine.
- Remove the pressure plate disc cover.

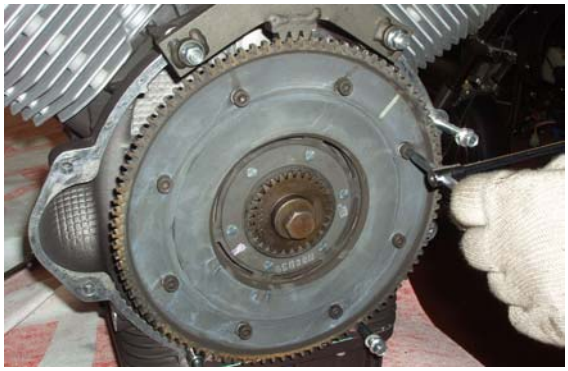
- Use the locking tool and the clutch spring compression tool on the fly-wheel.

Specific tooling

30.90.65.10 Tool for clutch fitting

12.91.18.01 Tool to lock the flywheel and start-up crown

- Undo and remove the eight sealing screws from the crown gear fitted on the engine flywheel, collecting the washers.



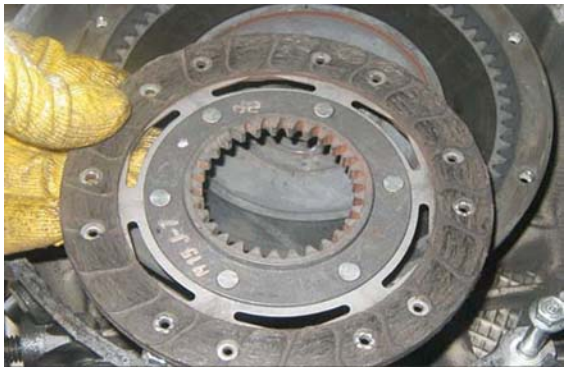
- Remove the start-up crown gear.

Extract from the inside of the engine flywheel:

- the clutch disc.

- The intermediate disc.

- The second clutch disc.



- Remove the tool used to compress the clutch springs.

Specific tooling

30.90.65.10 Tool for clutch fitting

- The pressure plate disc with springs.

Checking the clutch plates

Driven plates

Check that the supporting surfaces with the driven plates are perfectly smooth and even and that the external toothing that works inside the flywheel is not damaged, otherwise, replace the plate.

Crown gear for start-up

Check that the supporting surface with the driven plate is perfectly smooth and even.

Also check that the toothing where the starter motor pinion works is not chipped or scratched; otherwise, replace it.

Checking the clutch housing

Check that the teeth do not show any marks on the plate faying areas and that the toothing inside the clutch bell is in good conditions.

Checking the pusher plate

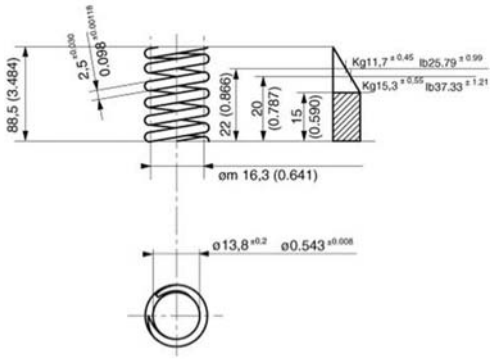
Pressure plate

Check that the plate does not show signs of wear on the opening where the control cap works, and that the supporting surfaces with the driven plate are perfectly even.

Checking the springs

Check that the springs are still flexible and are not deformed:

- Springs compressed at 22 mm (0.8661 in) must bear a load of 11.25 ÷ 11.70 kg (24.80 ÷ 25.79 pounds);
- Springs compressed at 20 mm (0.7874 in) must bear a load of 14.75 ÷ 15.30 kg (32.52 ÷ 33.73 pounds).

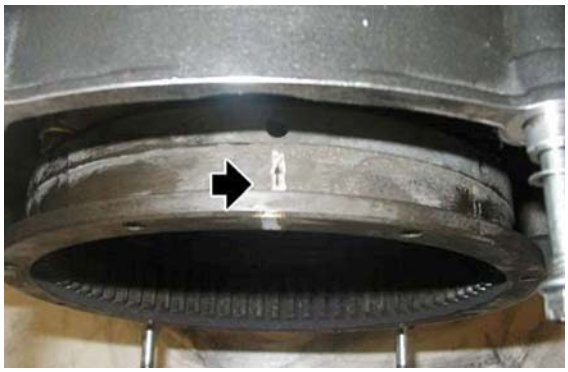


Assembling the clutch

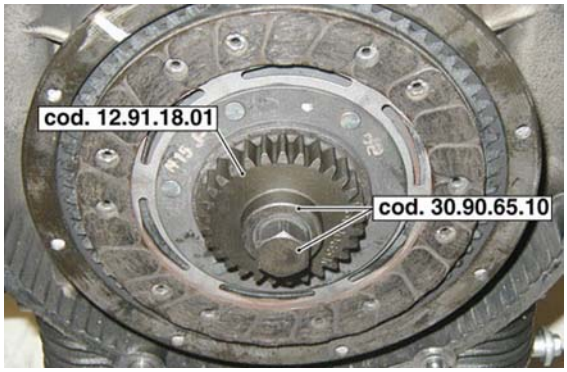
Insert the components in the clutch bell in the following order:

- the pressure plate with springs.

- Make sure that the reference marked on the pressure plate tooth is aligned with the reference on the flywheel.



- Use the locking tool and the clutch spring compression tool on the fly-wheel.



Specific tooling

30.90.65.10 Tool for clutch fitting

12.91.18.01 Tool to lock the flywheel and start-up crown

- Remove the locking tool.
- Fit the clutch disc.

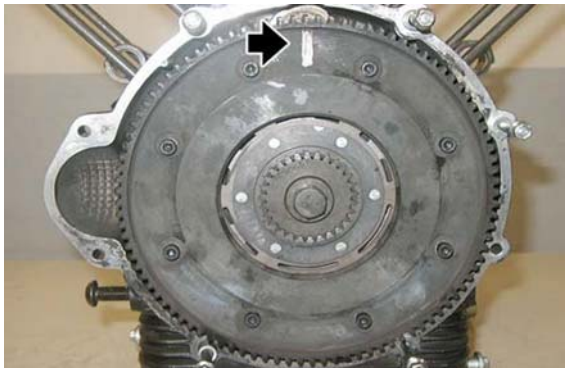
Specific tooling

12.91.18.01 Tool to lock the flywheel and start-up crown

- The intermediate disc.

- The clutch disc.

- Place the crown gear aligning its reference with that on the flywheel.



- Tighten the eight screws sealing the crown gear to the flywheel to the prescribed torque
- Remove the special tool for clutch spring compression.

Specific tooling

30.90.65.10 Tool for clutch fitting

- Insert the pressure plate disc cover.
- Install the gearbox unit.

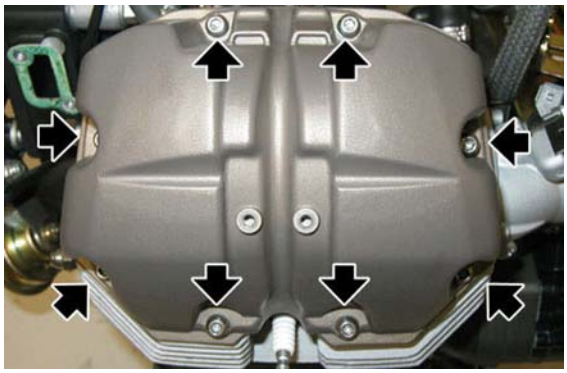
Head and timing

Removing the head cover

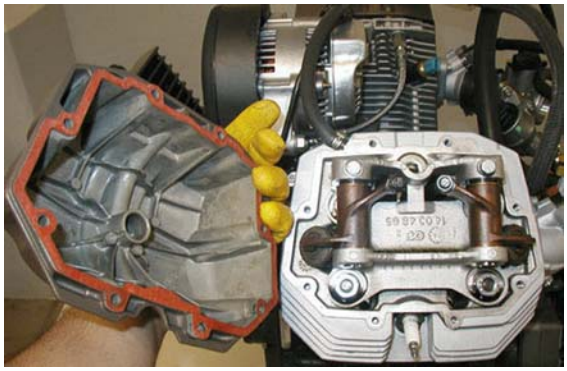
NOTE

THE FOLLOWING OPERATIONS REFER TO REMOVING ONLY ONE COVER BUT APPLY TO BOTH COVERS.

- Unscrew and remove the eight screws and collect the bushings.

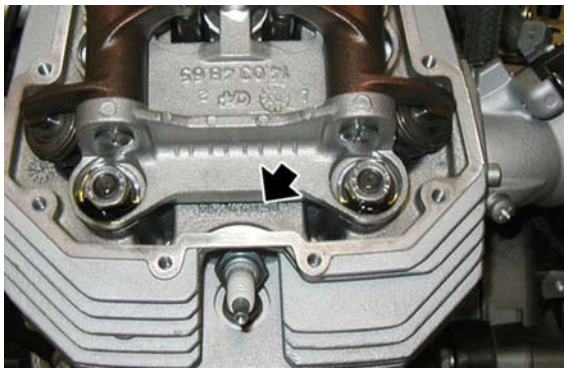


- Remove the head cover and collect the gasket.



Removing the cylinder head

- Remove the rocking arm rods.
- Unscrew and remove the outer spark plug.



- Loosen the nut and disconnect the pipes that deliver oil to the head.

- Unscrew and remove the threaded cap.

- Unscrew and remove the joint of the pipe that delivers oil to the head and collect the washer.

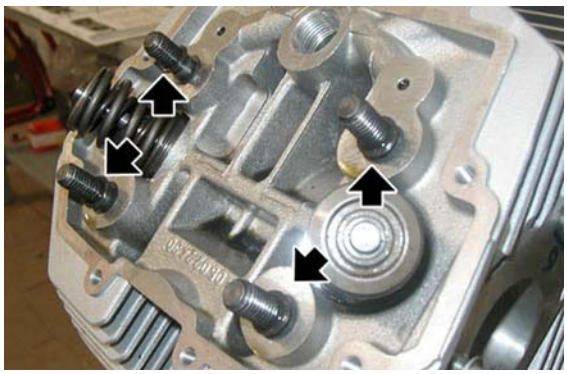
- Using the suitable special tool, unscrew and remove the inner spark plug.

Specific tooling

05.90.19.30 Inner spark plug removal

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

- Slightly detach the cylinder head and remove the four O-rings.



- Remove the head and collect the gasket.

Cylinder head

Removing the rocker arms

NOTE

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

• Remove the head cover.

• Rotate the crankshaft to TDC position in combustion phase (closed valves) for the left cylinder.
• Unscrew and remove the two screws.

• Remove the rockers shafts.

• Remove the rockers and collect the three washers.

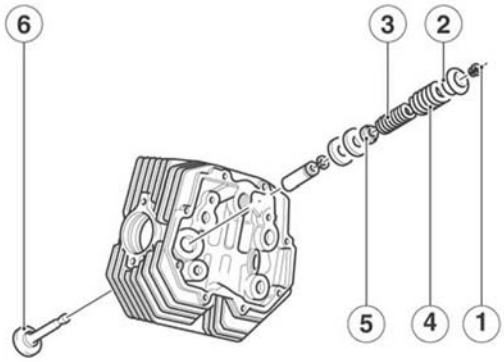
Removing the valves

- 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

- Tighten the tool screw until fitted, and then hit the tool head (where the upper retainer works) with a mallet so that the two cotters (1) get detached from the upper retainer (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.
- Remove the upper retainer (2).
- Remove the internal spring (3).
- Remove the external spring (4).
- Remove the lower retainer (5) and the shimming washers if necessary.
- Remove the valve (6) from inside the head.



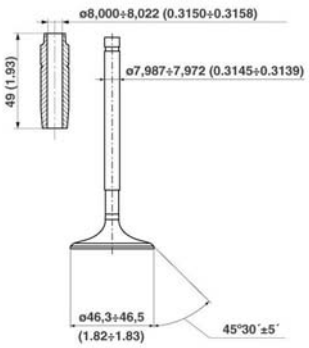
Checking the valve guides

Use a punch to extract the valve guide 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.

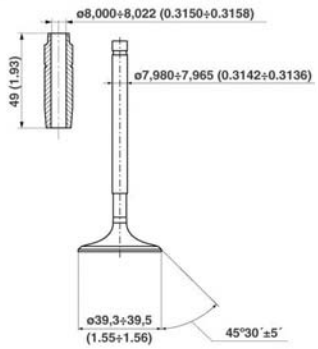
To refit the valve guides on the head, follow this procedure:

- 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 AND GUIDES COUPLING DATA CHART (INLET)

Specification	Desc./Quantity
Valve guide inside diameter mm (in)	8.000 ÷ 8.022 (0.3150 ÷ 0.3158)
Valve stem diameter	7.972 ÷ 7.987 (0.3139 ÷ 0.3145)
Fitting clearance mm (in)	0.013 ÷ 0.050 (0.0005 ÷ 0.0020)

VALVE AND GUIDES COUPLING DATA CHART (OUTLET)

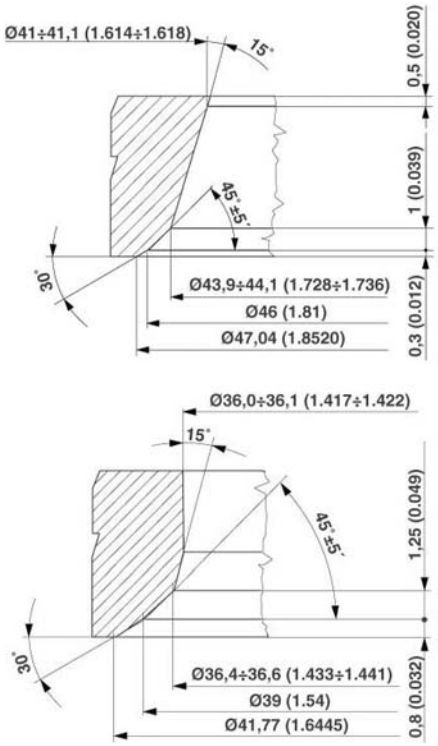
Specification	Desc./Quantity
Valve guide inside diameter mm (in)	8.005 ÷ 8.022 (0.3152 ÷ 0.3158)
Valve stem diameter mm (in)	7.965 ÷ 7.980 (0.3136 ÷ 0.3142)
Fitting clearance mm (in)	0.025 ÷ 0.057 (0.0010 ÷ 0.0022)

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.

The valve seats should be reamed with a mill. The seat inclination angle is 45° +/- 5. After milling, it is necessary to grind them to ensure a good coupling and a perfect sealing between the ring nuts and the valve heads.

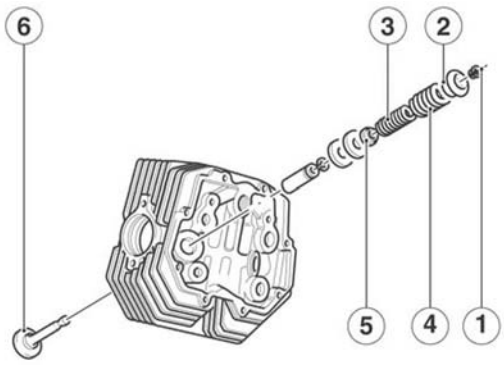


Installing the valves

NOTE

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

- Place the valve (6) inside the head.
- Place the lower retainer (5) and the shimming washers.
- Place the external spring (4).
- Place the internal spring (3).
- Insert the upper retainer (2).
- Place the two cotters (1) on the seats on the valves.
- Compressing the spring with the special valve tool, install the valve cotters.



Specific tooling

10.90.72.00 Tool for valve removal and refitting

NOTE

UPON REFITTING, PLACE THE O-RING CORRECTLY ON THE VALVE.

- Remove the special tool

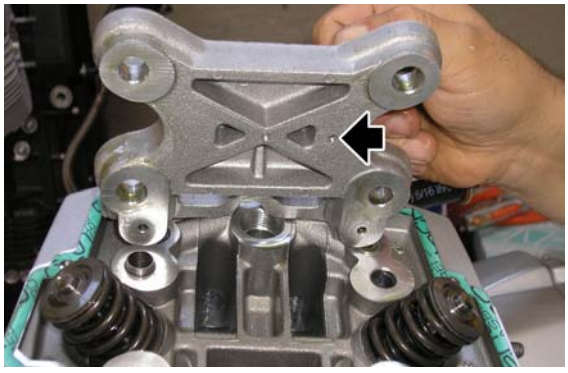
Installing the rocker arms

CAUTION

UPON REFITTING, ALWAYS REPLACE THE O-RINGS

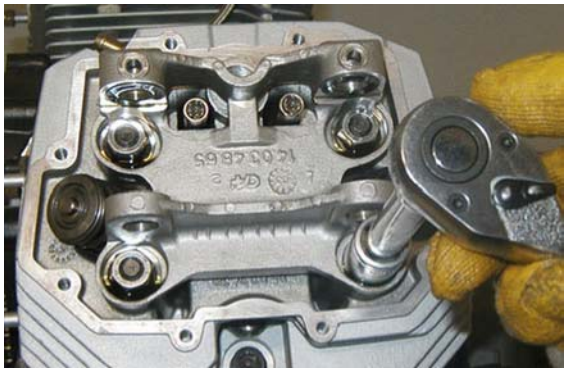
CAUTION

UPON REFITTING, DO NOT INVERT THE POSITION OF THE ROCKER SUPPORTS SO AS NOT TO COMPROMISE LUBRICATION.



- Install the rocker rods if they have been previously removed.
- Install the rocker support and replace the four O-rings.

- Place the four washers and screw the four nuts.



- Place the six washers and install the rockers.

- Insert the rocker shafts.

- Rotate the crankshaft to TDC position in combustion phase (closed valves)

for the left cylinder.

- Tighten the two screws.

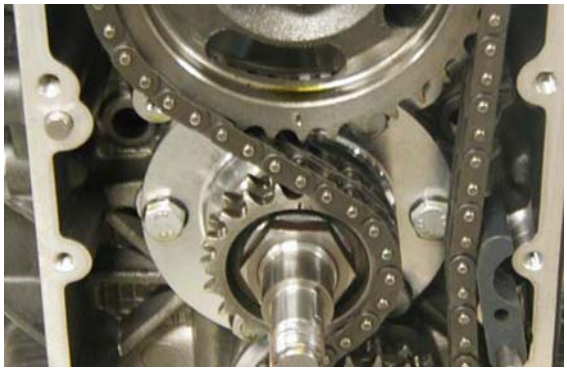
Timing

Chain removal

- Remove the engine assembly.
- Remove the alternator.
- Unscrew the fourteen screws (1 - 2 - 3).

- Remove the timing system cover.
- Collect the gasket.

- Clearly indicate the distribution timing marks that should be restored at the next refitting (left cylinder TDC).

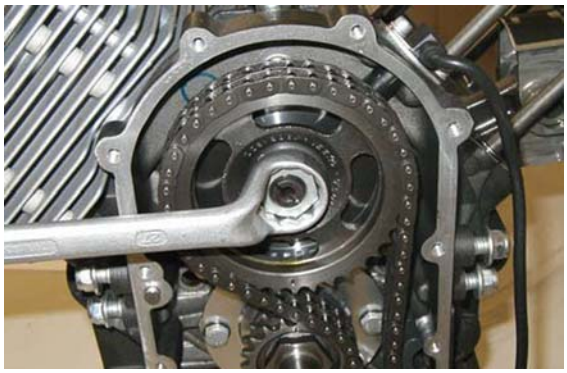


- Using the adequate tool, lock the ignition crown.

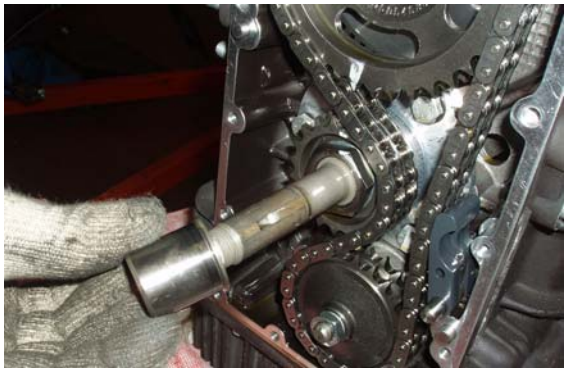
Specific tooling

12.91.18.01 Tool to lock the flywheel and start-up crown

- Unscrew the central sealing nut of the camshaft gear and collect the washer.



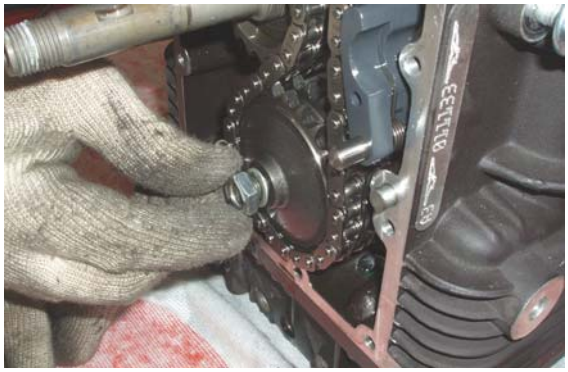
- Slide off the spacer from the crankshaft.



- Unscrew and remove the central sealing nut of the timing system control

gear on the crankshaft and collect the washer.

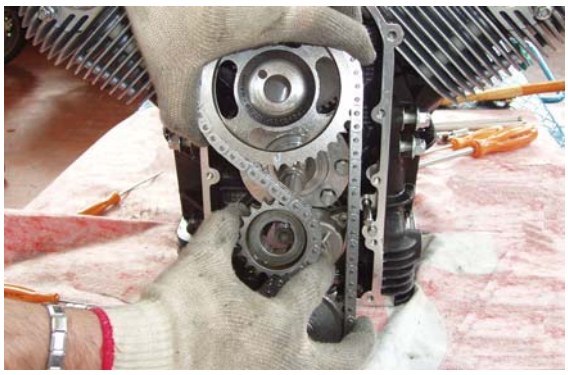
- Unscrew and remove the oil pump gear nut and collect the washer.



- Remove the chain tensioner and collect the spring.
- Slide off the three gears together with the chain.

CAUTION

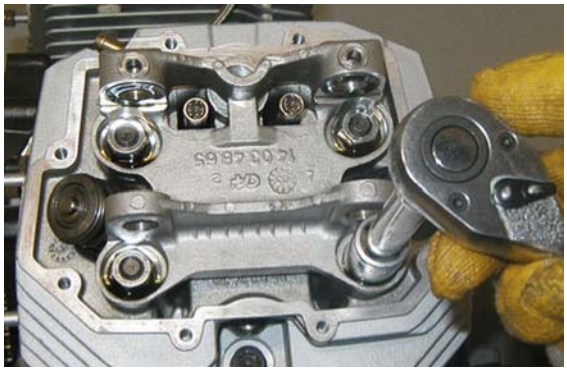
BE CAREFUL WITH THE OIL PUMP PULLING COTTER.



Removing the rods

- Remove the rockers.

- Unscrew and remove the four nuts and collect their washers.



- Remove the rocker support.

- Remove the two rocker rods

Removing the tappets

- Remove the engine assembly.
- Remove both heads.
- Slide off and remove the tappets from their seat on both sides.

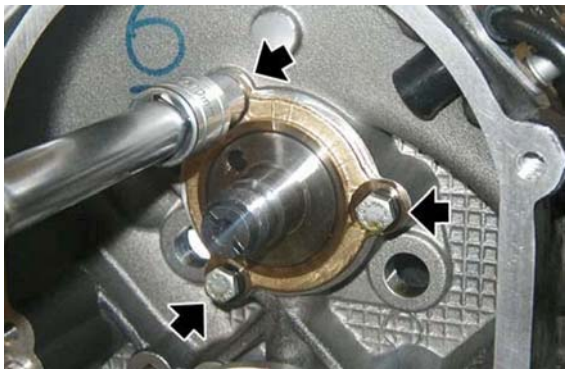
Removing the phonic wheel

- Remove the timing chain.
- Slide off the tone wheel and collect the plug.

Removing the camshaft

- Remove the timing chain.
- Remove the tone wheel.
- Remove the tappets.
- Remove the rods.

- Unscrew and remove the three screws and collect the washers.



- Remove the flange.

- Remove the camshaft.

Installing the camshaft

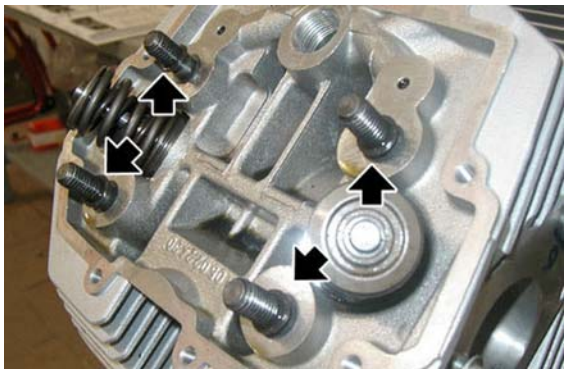
NOTE

FOR TIMING SYSTEM REFITTING, IT IS NECESSARY TO HEAT THE ENGINE WITH A SUITABLE HEATER IN ORDER TO INSERT THE CAMSHAFT CORRECTLY AND WITHOUT DAMAGING IT.

Follow the camshaft removal instructions but in reverse order.

Installing the rods

- Install the head if it has been previously removed.
- Replace the four O-rings.



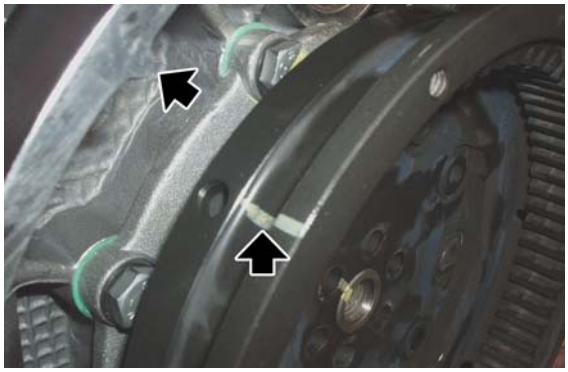
- Install the two rocker rods.

Installing the chain

For the installation of the three gears and of the timing chain carry out the operations indicated in section "Timing".

Cam timing

- On the crankcase, fit the crankshaft and the camshaft.
- Fit the cylinders and the heads.
- Fit the rods.
- Do not fit the rockers before carrying out engine timing so as not to damage the valves during the rotation of the camshaft.
- Turn the crankshaft until the left cylinder piston reaches the top dead centre (TDC).
- Fit the flywheel on the crankshaft aligning the stamp arrow on the flywheel with the fixed reference on the crankcase.



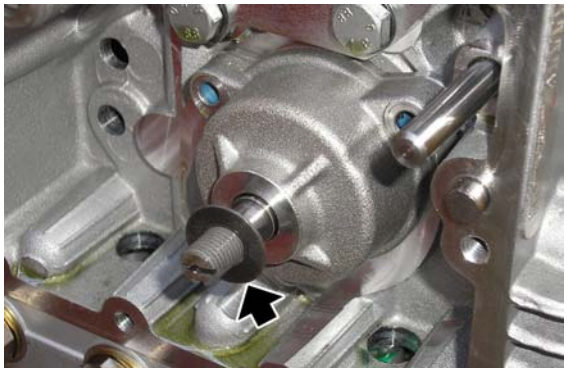
- Position the locking tool on the flywheel and tighten the six flywheel sealing screws operating diagonally and in stages.
- Fit the clutch.

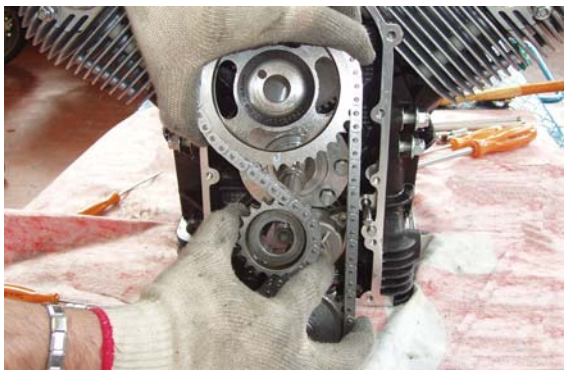
Specific tooling

12.91.18.01 Tool to lock the flywheel and start-up crown

- Fit the plug on the camshaft.
- Introduce the tone wheel with the smooth side facing outward.

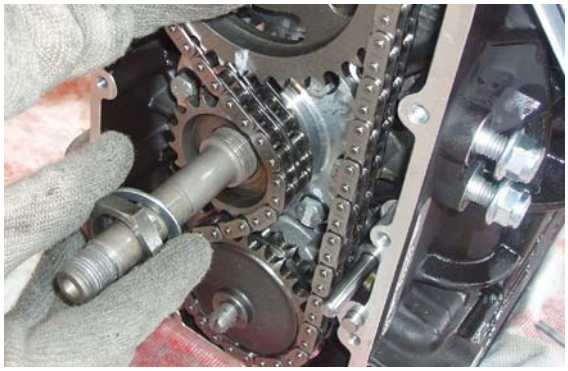
- Place the shim washer adequately so that the timing chain do not wear out the crankcase.
- Fit the three timing system gears and the chain aligning the references on the camshaft and crankshaft gears.



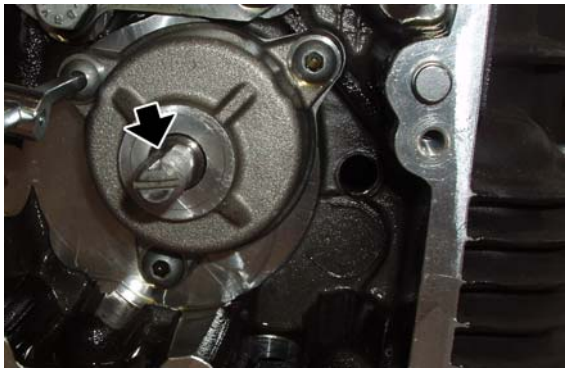


- Introduce the belleville spring and the nut to fasten the camshaft gear.

- Introduce the washer and the nut to fasten the crankshaft gear.



- Turn the oil pump shaft and introduce the gear pulling woodruff key.



- Introduce the chain tensioner.

- Remove the flywheel locking tool.
- Check the crankshaft rotation.
- Fit the rockers.

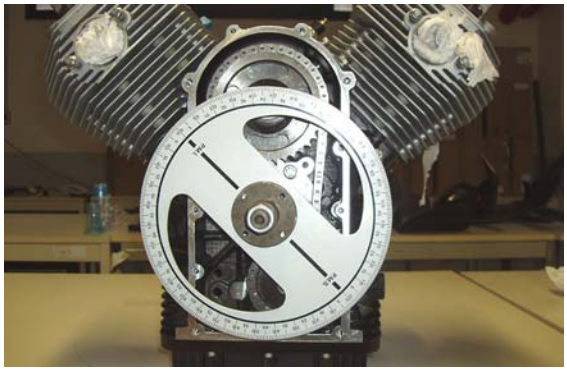
Specific tooling

12.91.18.01 Tool to lock the flywheel and start-up crown

Timing

To check distribution timing, follow these instructions:

- Obtain a clearance between rockers and valves of 1.5 mm (0.059 in);
- Place the hub for graduated dial and the relative graduated dial on the crankshaft slot, inserting the spacer and fixing it to the shaft with the nut.

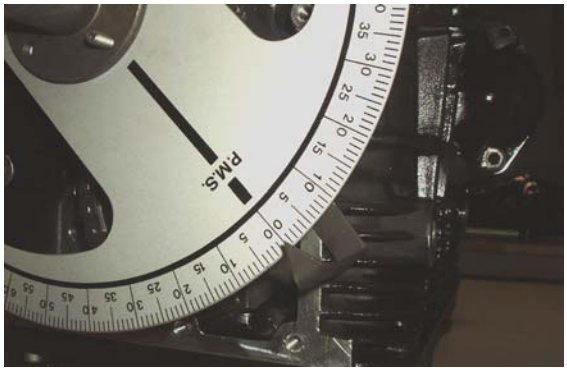


Specific tooling

981001 Graduated dial hub

19.92.96.00 Graduated dial to control ignition timing

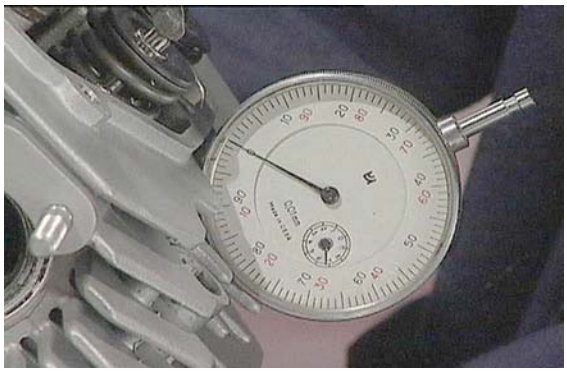
- With a screw, fasten the specific arrow to the threaded hole to the left of the crankcase.



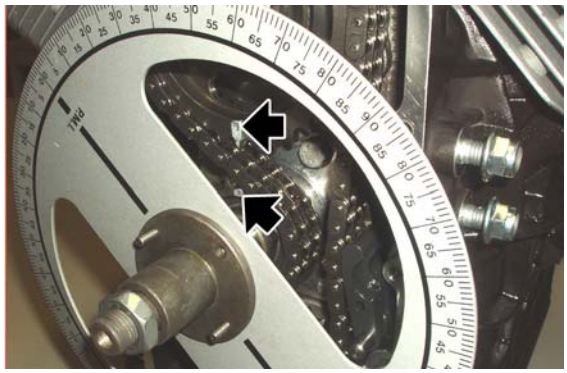
Specific tooling

17.94.75.60 Arrow to control ignition timing

- Fit the dial gauge support and then the gauge itself on the left outer spark plug hole.

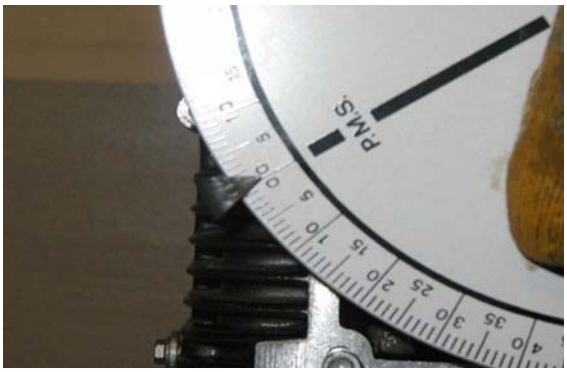


- Rotate the crankshaft until the left cylinder piston is actually at the top dead centre (with valves closed).
- Reset the dial gauge and make sure the references (on the timing system gears and the engine pinion) are perfectly aligned, so that looking through



the checking hole on the gearbox, the reference line marked 'S' is perfectly aligned with the reference marked at the centre of the hole.

- Align the arrow point with the TDC zero on the graduated dial.



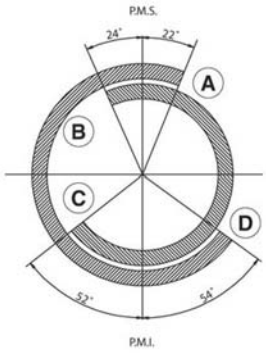
- Observing the timing system diagram, check timing considering that:

A - intake start opens 22° before TDC

B - outlet end closes 24° after TDC

C - outlet start opens 52° before BDC

D - intake end closes 54° after BDC



- Screw the dial gauge support and then the gauge itself on the right cylinder outer spark plug hole.
- With a screw, fix the arrow to the threaded hole to the right of the crank-case.
- Turn the disc clockwise until the reference marked with letter 'D' is aligned with the reference at the centre of the checking hole on the gearbox (valves closed).

- Repeat the operations described above for the left cylinder.

- After the check and if everything is correct, operate as follows to restore the operation clearance between rocking levers and valves (intake 0.10 mm (0.0039 in), outlet 0.15 mm (0.0059 in).
- Remove the graduated dial hub, the graduated dial, the arrow, the dial gauge support and the gauge itself.
- Refit the spark plugs and finish the refit.

Specific tooling

981001 Graduated dial hub

19.92.96.00 Graduated dial to control ignition timing

17.94.75.60 Arrow to control ignition timing

Measuring air gap

• Unscrew 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 timing system cover and cause it to make contact with the tone wheel.

• Measure the clearance between the fixing plate and the cover 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 insert the sensor after applying adequate sealing paste on the fixing plate, then tighten the screws to the torque.

Cylinder-piston assembly

Removing the cylinder

NOTE

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

- Remove the head.
- Remove the gasket.

- Slide off the cylinder from the stud bolts, paying attention not to damage the piston.

Disassembling the piston

NOTE

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

- Remove the cylinder.
- Cover the crankcase opening with a clean cloth.
- Disengage the pin clip.

- Remove the pin.

- Mark the piston crown on the outlet side to remember its position when re-fitting.
- Remove the piston.

Fitting the piston

NOTE

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

- 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 pin clip.

Installing the cylinder

- Fit the piston.
- Remove the cloth used to prevent foreign bodies coming into the crankcase.
- Turn the rings so that the junction ends are 120 degrees from each other.
- Lubricate piston and cylinder.
- Using a specific tool for piston ring clamps, place the cylinder.

CAUTION

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

Specific tooling

05.92.80.30 Piston ring clamp

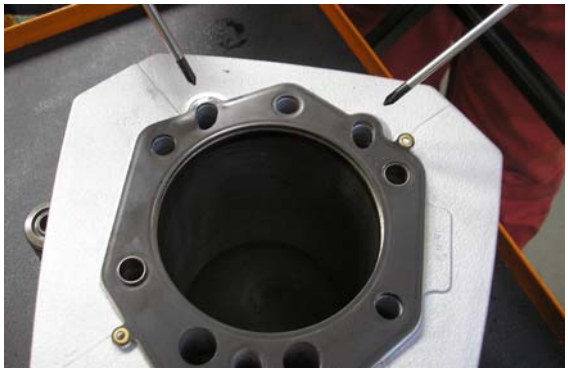
- Remove the tool for piston ring clamps
  and finish positioning the cylinder.

Specific tooling

05.92.80.30 Piston ring clamp

CAUTION

UPON REFITTING DO NOT INVERT THE POSITION OF THE CYLINDER GASKET SO AS NOT TO COMPROMISE LUBRICATION.

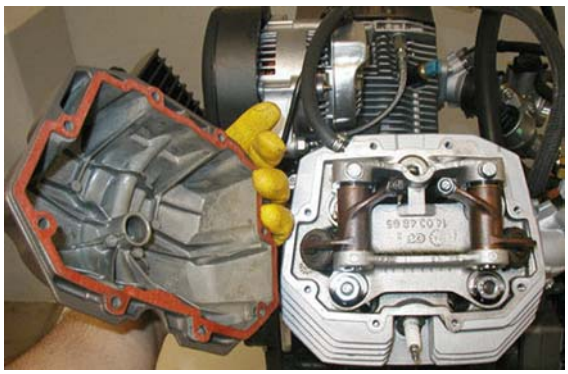


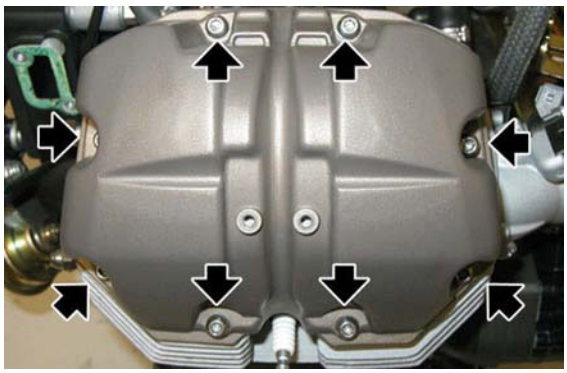
- Place the gasket on the cylinder base.

- Fit the head.

Installing the head cover

- Replace the gasket and fit the head cover.
- Place the bushings and cross tighten the eight screws.





Installing the cylinder head

- Fit the valves if they have been previously removed.
- Replace the gasket between head and cylinder.
- Fit the head.

- Place the two washers and tighten the two screws.

- Using the suitable special tool, screw

the inner spark plug.

Specific tooling

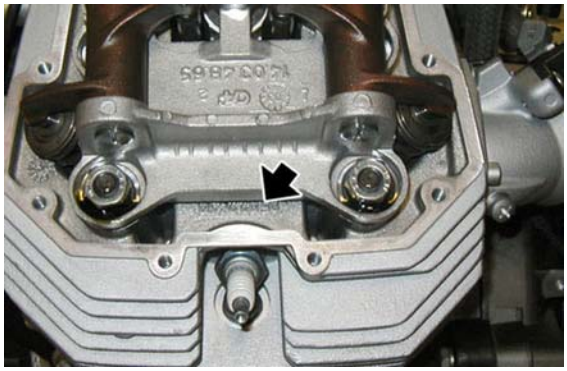
05.90.19.30 Inner spark plug removal

- Insert the washer and screw the joint of the pipe that delivers oil to the head .

- Screw the threaded cap.

- Connect the pipes that deliver oil to the head and screw the nut.

- Install the outer spark plug.



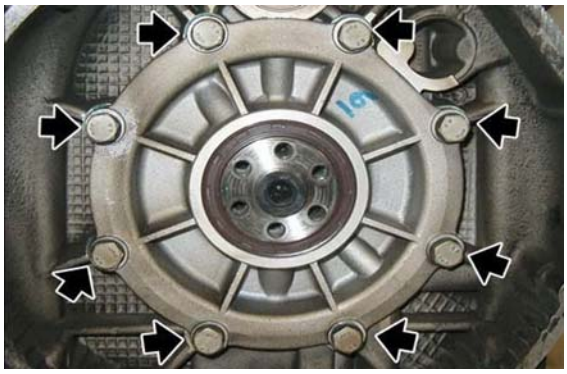
- Replace the gasket and install the head cover.

Crankcase - crankshaft

Removing the crankshaft

- Remove the connecting rods.

- Loosen and remove the eight fixing screws and collect the washers.

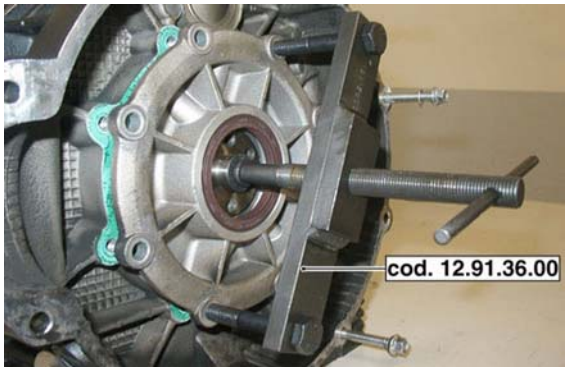


- Hold the crankshaft during flange removal.
- Using the suitable special tool, remove the crankshaft flange.
- Remove the sealing ring from the

flange, if necessary.

Specific tooling

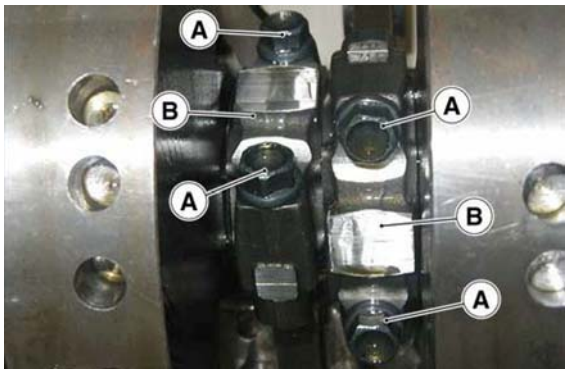
12.91.36.00 Tool to remove the flywheel side flange



- Remove the crankshaft afterwards.

Disassembling the connecting rod

- Remove the heads.
- Remove the cylinders and the pistons.
- Remove the clutch.
- Remove the flywheel.
- Remove the timing system.
- Remove the oil sump.
- Loosen the coupling screws 'A' from inside the crankcase and remove the connecting rods 'B'.



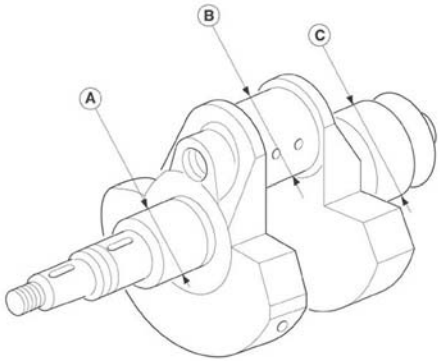
Inspecting the crankshaft components

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

FITTING CLEARANCES

Specification	Desc./Quantity
Between the bearing and the main journal on the	0.028 ÷ 0.060 mm (0.00110 ÷ 0.00236 in);

Specification	Desc./Quantity
timing system side	
Between the bearing and the main journal on the flywheel side	0.040 ÷ 0.075 mm (0.00157 ÷ 0.00295 in)
Between the bearing and the connecting rod pin	0.022 ÷ 0.064 mm (0.00087 ÷ 0.00252 in)



MAIN JOURNAL DIAMETER ON THE TIMING SYSTEM SIDE (A)

Specification	Desc./Quantity
Regular production	37.975 mm (1.49507 inch) 37.959 mm (1.49444 inch)

CRANKPIN DIAMETER (B)

Specification	Desc./Quantity
Regular production	44.008 ÷ 44.020 mm - (1.73259 ÷ 1.73307 in)
'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)

FLYWHEEL MAIN JOURNAL DIAMETER (C)

Specification	Desc./Quantity
Regular production	52.970 mm (2.08542 inch) 53.951 mm (2.12405 inch)

Checking the connecting rod

CONNECTING RODS

When examining the connecting rods, check that:

- Bushings are in good conditions, their clearance and the pins;
- Shaft parallelism;
- Connecting rod bearings.

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

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

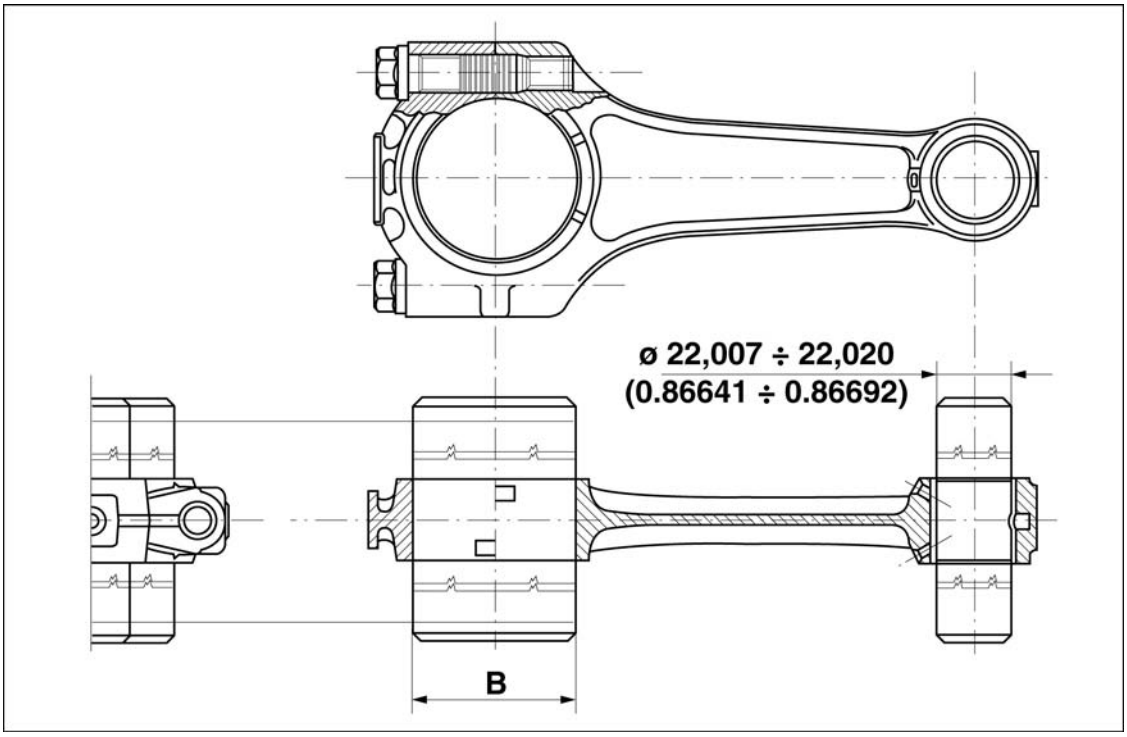
Before reaming the crankpin, measure the pin diameter comparing it with the maximum wear allowed, as indicated in the figure; this defines what kind of undersizing the bearing should have and to which diameter the pin should be reamed.

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 shafts of the head and rod small end, measured at 200 mm (7.873 inch) should be +/- 0.10 mm (0.00393 inch).



CONNECTING ROD BEARING THICKNESS

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

CRANKPIN DIAMETER (B)

Specification	Desc./Quantity
Regular production	44.008 ÷ 44.020 mm - (1.73259 ÷ 1.73307 in)
'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)

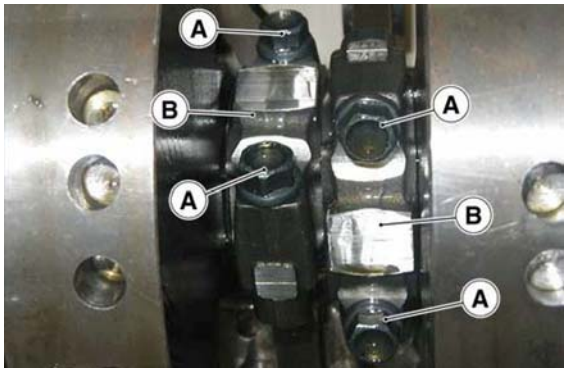
PIN AND BUSHING COUPLING DATA

Specification	Desc./Quantity
fitted and machined bushing inside Ø mm (inch)	22.007 mm (0.86641 inch) - 22.020 mm (0.86692 inch)
pin Ø mm (inch)	21.994 mm (0.86590 inch) - 21.998 mm (0.86606 inch)
Clearance between pin and bushing mm (inch)	0.009 ÷ 0.026 mm (0.000354 ÷ 0.001024 inch)

Assembling the connecting rod

- The references on the connecting rods should be facing the flywheel.
- Do not interchange left and right connecting rods.

- 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.

Installing the crankshaft

- 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 sealing ring on the flywheel side flange

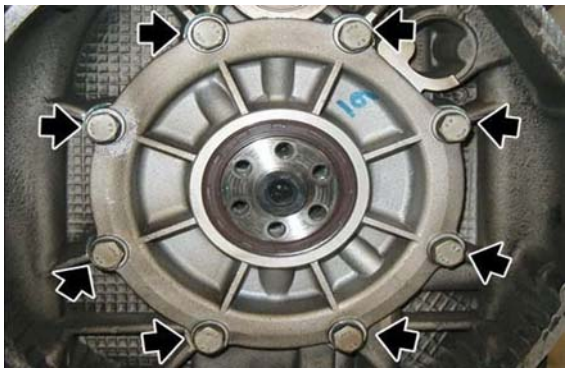
- Fit a new gasket between the crankcase and the crankshaft flange, on the flywheel side.

- Introduce the crankshaft.
- Place the flywheel side crankshaft support flange, taking into account the fitting order indicated by the holes.

Specific tooling

19.92.71.00 Tool to fit the sealing ring on the flywheel side flange

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

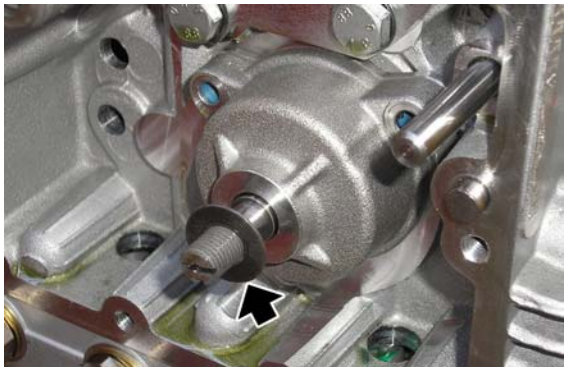


Lubrication

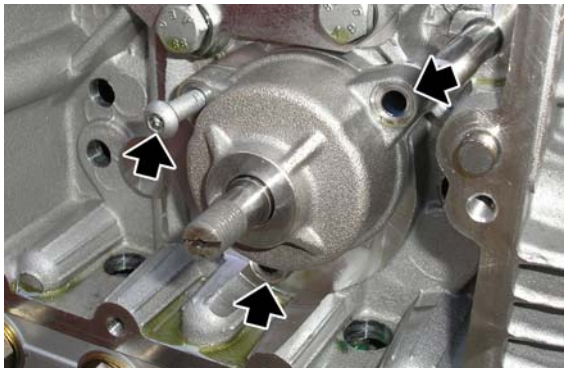
Oil pump

Removing

- Drain all the engine oil.
- Remove the alternator.
- Remove the timing system.
- Remove the shim washer.

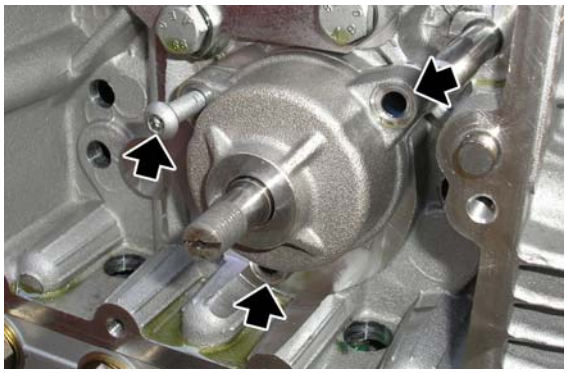


- Unscrew and remove the three screws fixing the oil pump.
- Remove the oil pump.

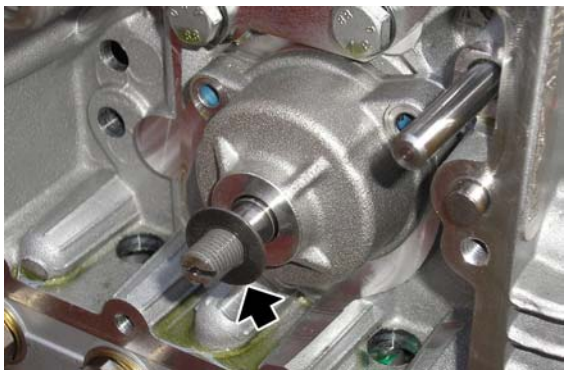


Installing

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



- Place the shim washer adequately so that the timing chain do not wear out the crankcase.
- Fit the timing system.
- Fit the alternator.
- Top-up with engine oil.



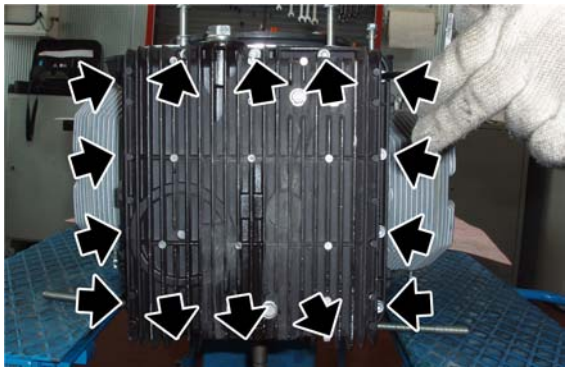
Removing the oil sump

NOTE

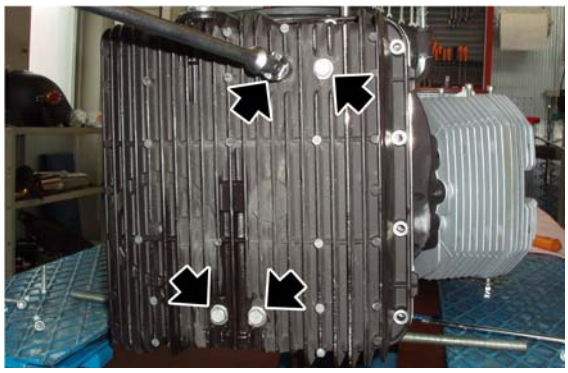
TO REMOVE THE OIL SUMP, PLACE A SUITABLE CONTAINER UNDER IT TO COLLECT THE USED OIL AND DRAIN OUT ALL OIL.

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

- Unscrew and remove the fourteen screws fixing the oil sump to the engine crankcase.

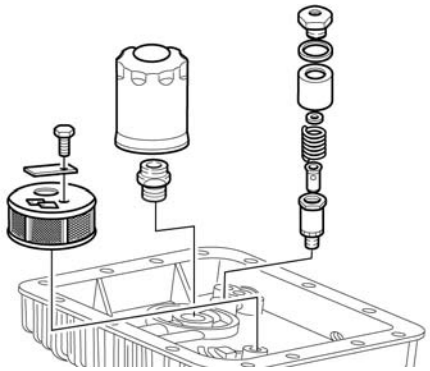


- Unscrew and remove the four screws and remove the engine oil sump.
- Collect the gasket.



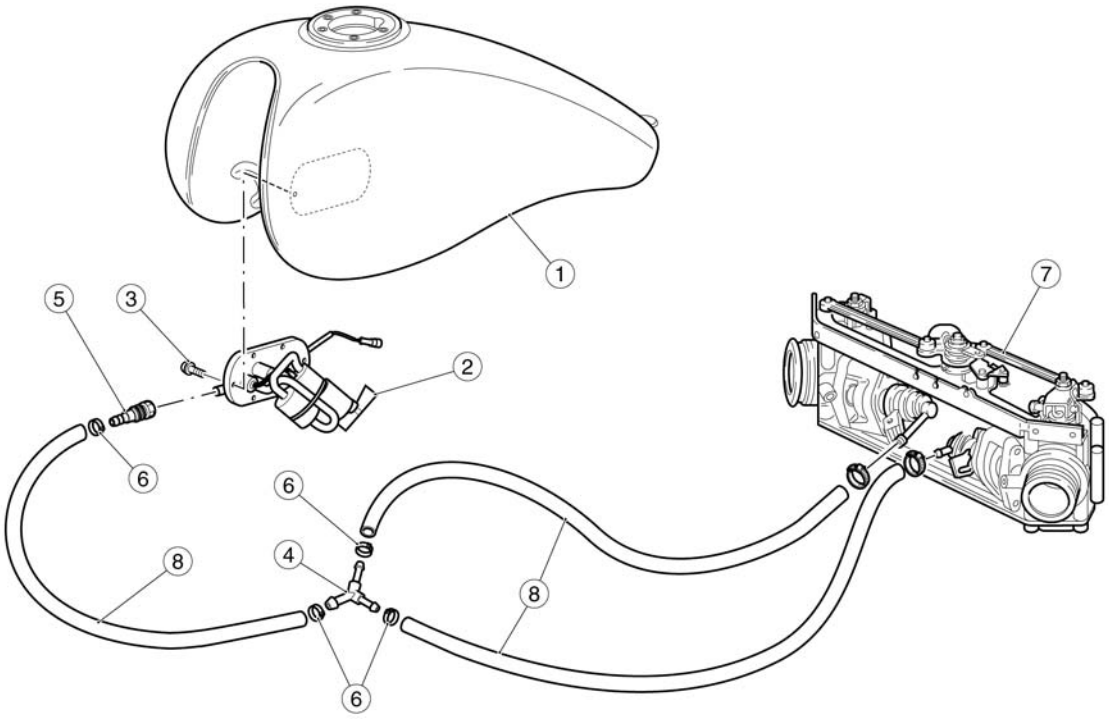
DURING REFITTING REPLACE THE GASKET WITH A NEW ONE OF THE SAME TYPE.

- If necessary, it is possible to remove the components shown on the figure.



INDEX OF TOPICS

Circuit diagram



Key:

1. Fuel tank
2. Complete fuel pump
3. Flanged screw
4. Three-way joint
5. Joint
6. Clamp
7. Throttle body
8. Fuel pipe

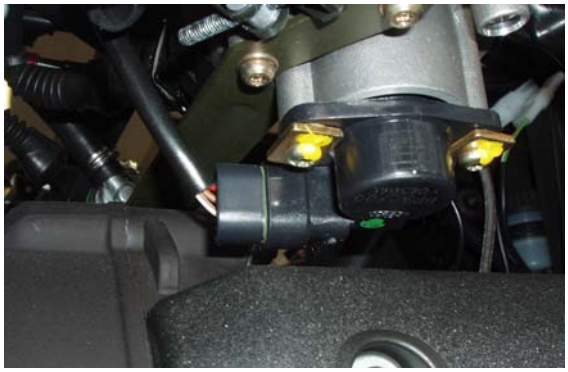
Injection

Removing the throttle body

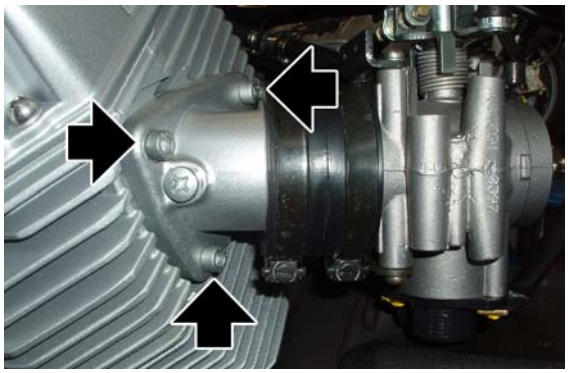
- Remove the air filter casing.

- Remove the injector connectors.

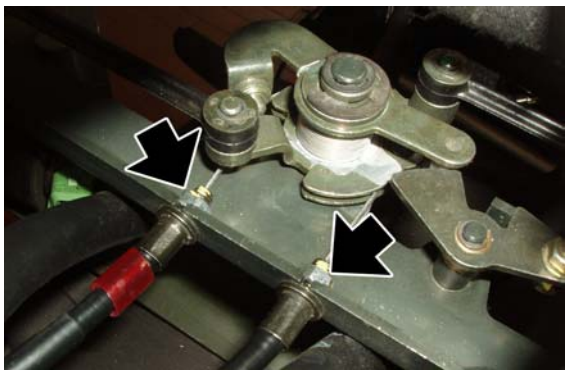
- Remove the TPS connector from the left throttle body.



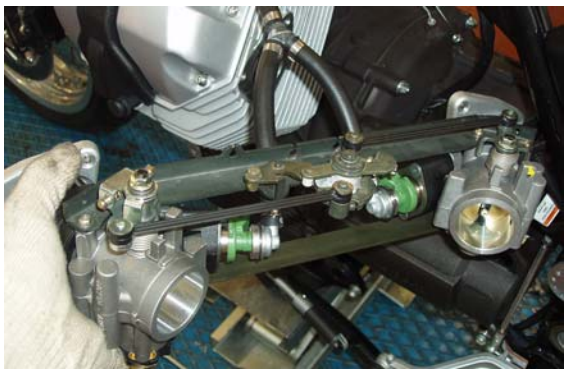
- Operating on both sides, undo and remove the three screws form the intake manifold.



- Remove the throttle grip cables moving the throttle body.

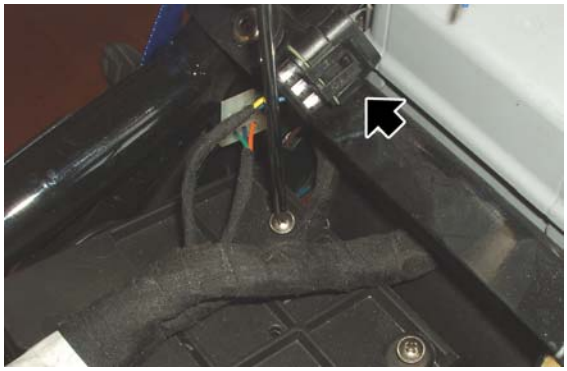


- Remove the throttle body from one side of the vehicle.

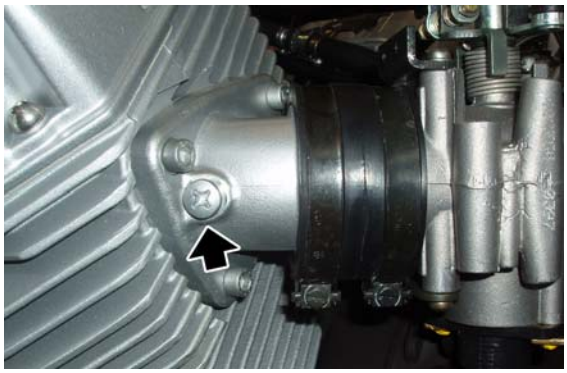


Cylinders synchronisation

- With engine off, connect the Axone 2000 tool to the diagnosis connector and to the vehicle battery.



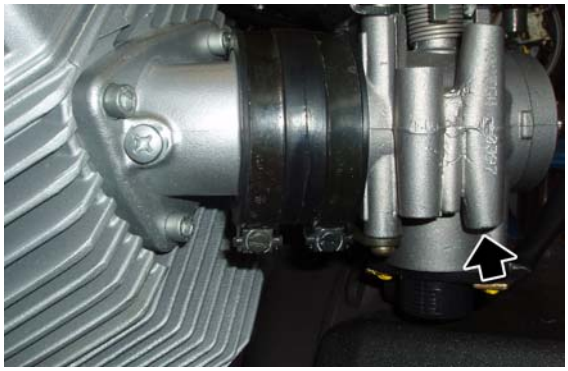
- Turn on the scanner.
- Screw the joints connecting the vacuometer pipes on the inlet pipe holes.
- Connect the vacuometer pipes to the relative joints.
- Set the key to ON.
- Make sure there are no errors in the control unit; otherwise, solve them and repeat the procedure.



- Make sure the left throttle is fully in.
- The Axone should display the adjustable parameters screen.
- 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 Axone session.
- Check that the "Throttle" value reading is 4.7 +/- 0.2°. 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 prescribe temperature: 60 °C (140 °F).
- Make the engine rev at 2000/3000 rpm and with the vacuometer check that the difference between the two pressures is maximum 1 cm Hg (1.33 kPa).

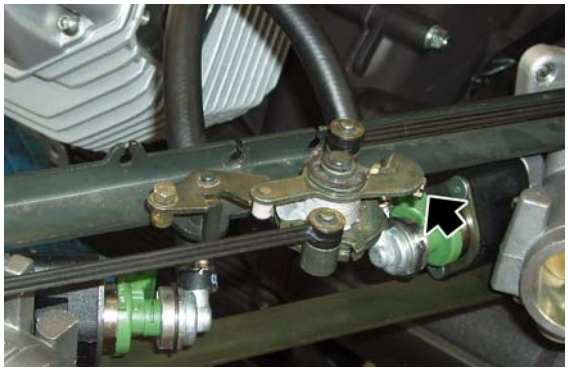


If this condition is detected:

- 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:

- work on the set screw of the throttle body connecting rod to reduce the pressure difference in the two pipes.
- Repeat the procedure "Throttle position autodetection" as explained above.
- Bring the engine back to idle and check the depression values so that they are aligned between the two cylinders.



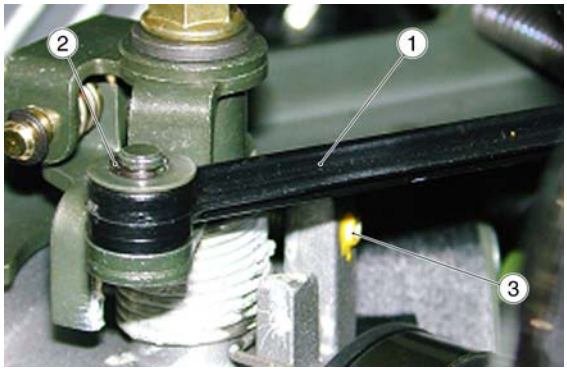
- Otherwise, open only the screw with higher depression, using the by-pass screws, to compensate.

Co rate adjustment

- Remove the saddle.
- Connect a vacuometer to the sockets on the intake manifolds.
- Using the appropriate cables, connect the AXONE diagnosis instrument to the diagnosis socket and to the vehicle battery (not to another battery).
- Always connect the positive clamp first and then the negative one.
- Turn on the AXONE pushing the button 'ON/OFF'
- Using the side arrows select the menu 'Self-diagnosis'.

CAUTION

IN ORDER TO ACCESS THE 'SELF-DIAGNOSIS' FUNCTIONS THE OBD MODULE MUST BE FITTED ON THE BACK OF THE AXONE.



- On the next screens select: vehicle brand (MOTOGUZZI), model (if the model Bellagio is not available, choose Breva V1100 avoiding throttle position autodetection), engine, system type (injection system software), chassis initial numbers, type of electronic control unit fitted.
- Turn the ignition to "ON", AXONE is connected to the control unit.
- Select the throttle potentiometer parameter.
- Disconnect the stem (1) from the left side throttle body releasing the snap ring (2).
- On the left throttle body, using the throttle adjustment dowel (3), adjust the throttle potentiometer to 3.6° (+/-

0.1°) visible on AXONE.

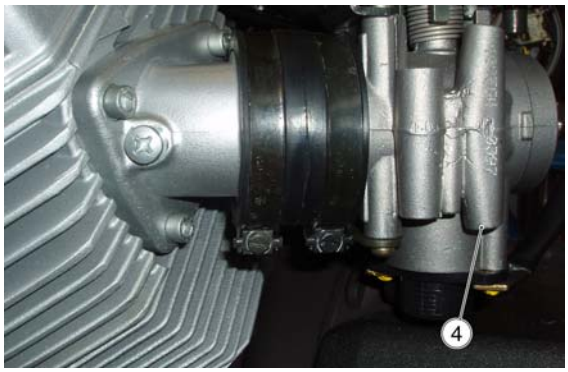
This value corresponds to a reading of 536 mV (+/- 20 mV)

USE AN ALLEN WRENCH TO WORK ON THE ADJUSTMENT DOWEL (3).

CAUTION

BEFORE DISCONNECTING THE POTENTIOMETER, TURN THE KEY TO "OFF".

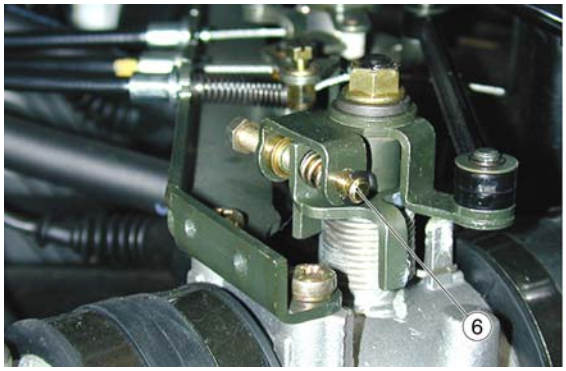
- Connect the stem (1) of the left side throttle body.
- Start the engine and let the temperature reach 50 °C (122 °F) (visible on AXONE) after selecting the engine temperature parameter.
- Close by-passes (4) completely on both sides.
- Disconnect the stem (1) from the left side throttle body.



- Balance the depression on the right cylinder using the throttle adjustment dowel (5).
- Connect the stem (1) of the left side throttle body.

- Check the depression balance between the two cylinders twisting the throttle grip a little (approximately 2000/3000 RPM). In case of imbalance, use the adjustment screw (6) to

level the depression.

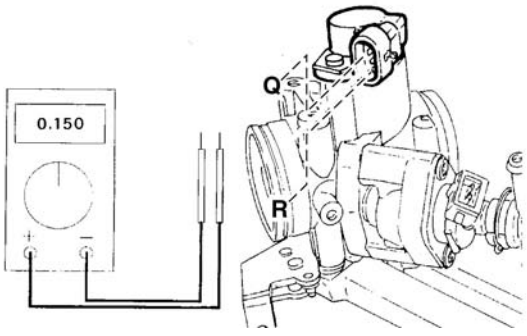


- Disconnect the vacuometer.
- Engine temperature should range between 70 °C (158 °F) and 80 °C (176 °F).
- Open both by-passes (4) gradually so as to take the minimum idle rpm to 1100 +/- 80, visible on AXONE after selecting the engine revs parameter, keeping depression balanced.
- Check upstream of the two outlet terminals that the CO value of the two cylinders is between 0.7 and 1.2%. If one of the two values is slightly off the range, it is possible to carry out small adjustments using the relative cylinder by-pass, keeping the minimum idle rpm at the prescribed value.
- Turn off and disconnect Axone.

CAUTION

AXONE MAY GET LOCKED DURING OPERATION.
IN THIS CASE TURN THE IGNITION KEY TO 'OFF', TURN OFF AXONE PUSHING 'ON/OFF', DISCONNECT THE UPPER CONNECTOR AND WAIT SOME SECONDS BEFORE CONNECTING IT TO THE CONTROL UNIT AGAIN.

If after this procedure the idle value is not within the indicated range, check the potentiometer using a tester proceeding as follows:
- set the throttle completely closed on the duct (throttle angle 0°);
- turn the ignition key to "ON";
- place the tester leads on the potentiometer connector between the poles (Q) and (R) and check that the voltage value measured is 150mV +/- 15mV.
- In case the potentiometer reading does not match the above mentioned value, loosen the two



potentiometer fixing screws and place it again correctly.

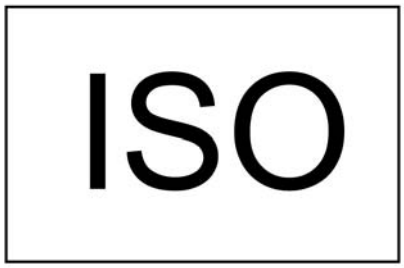
Using axone for injection system

Injection

Iso screen page

ISO

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



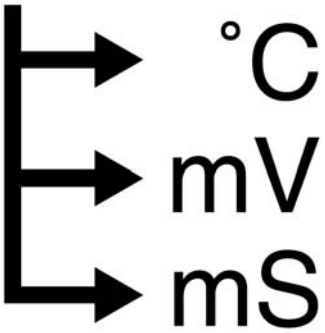
ISO SCREEN PAGE

Specification	Desc./Quantity
Mapping	-

Engine parameter reading screen page

ENGINE PARAMETER READING

This display 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.)



ENGINE PARAMETER READING SCREEN PAGE

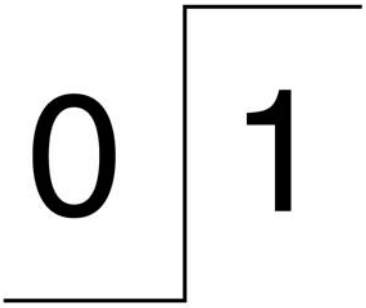
Specification	Desc./Quantity
Engine rpm	Engine revolutions per minute: the minimum value is set by the control unit cannot be adjusted
Injection time	- ms
Ignition advance	- °

Specification	Desc./Quantity
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 'Device status' display) this value should be close to 0%
Vehicle speed	- km/h
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

Device status screen page

DEVICE STATUS

This display show the status (ON/OFF only) of the vehicle devices or the operation condition of some vehicle systems (for example, lambda probe functioning)



DEVICE STATUS

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 / expanded 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

Devices activation screen page

DEVICES ACTIVATION

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

DEVICE 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 Axone and the control unit, the historical errors (STO) are no longer shown
Fuel pump	Operation for 30''
Stepper control	For 4'', advancement control of 32 steps; for the next 4'', retrocession control of 32 steps and so on for 30''

Errors display screen page

ERRORS DISPLAY

This displays shows potential errors detected in the vehicle (ATT) or stored in the control unit (MEM) and it is possible to check error deletion (STO)

ERROR DISPLAY

Specification	Desc./Quantity
Pressure sensor	Possible short circuit in the earth lead, battery or open circuit: recovery function noticeable for cus-

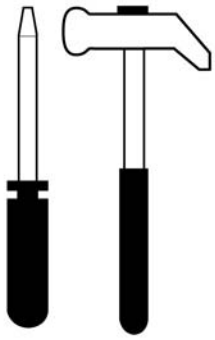
Specification	Desc./Quantity
	tomer. Careful with the air pressure sensor in the instrument panel
Air temperature	Possible short circuit in the earth lead, battery or open circuit: recovery function hardly noticeable for customer.
Engine temperature	Possible short circuit in the earth lead, battery or open circuit: recovery function.
Throttle actuator position sensor	Possible short circuit in the earth lead, battery or open circuit: recovery function noticeable for customer.
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	Possible short circuit in the earth lead, battery or speed sensor circuit open: also possible lack of supply from the control unit
CAN line diagnosis	Possible error on the CAN line: short circuit or line break or no signal or plausibility error detected.

Specification	Desc./Quantity
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

Adjustable parameters screen page

ADJUSTABLE PARAMETERS

This display is used to adjust some control unit parameters



ADJUSTABLE PARAMETERS

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

INDEX OF TOPICS

Front

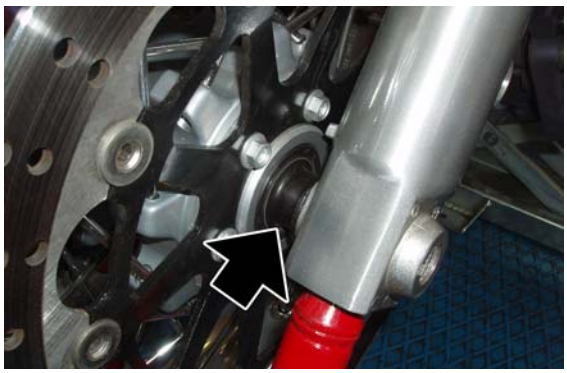
Removing the front wheel

- Remove the front brake calliper.

- Loosen the screws on the wheel pin clamps.

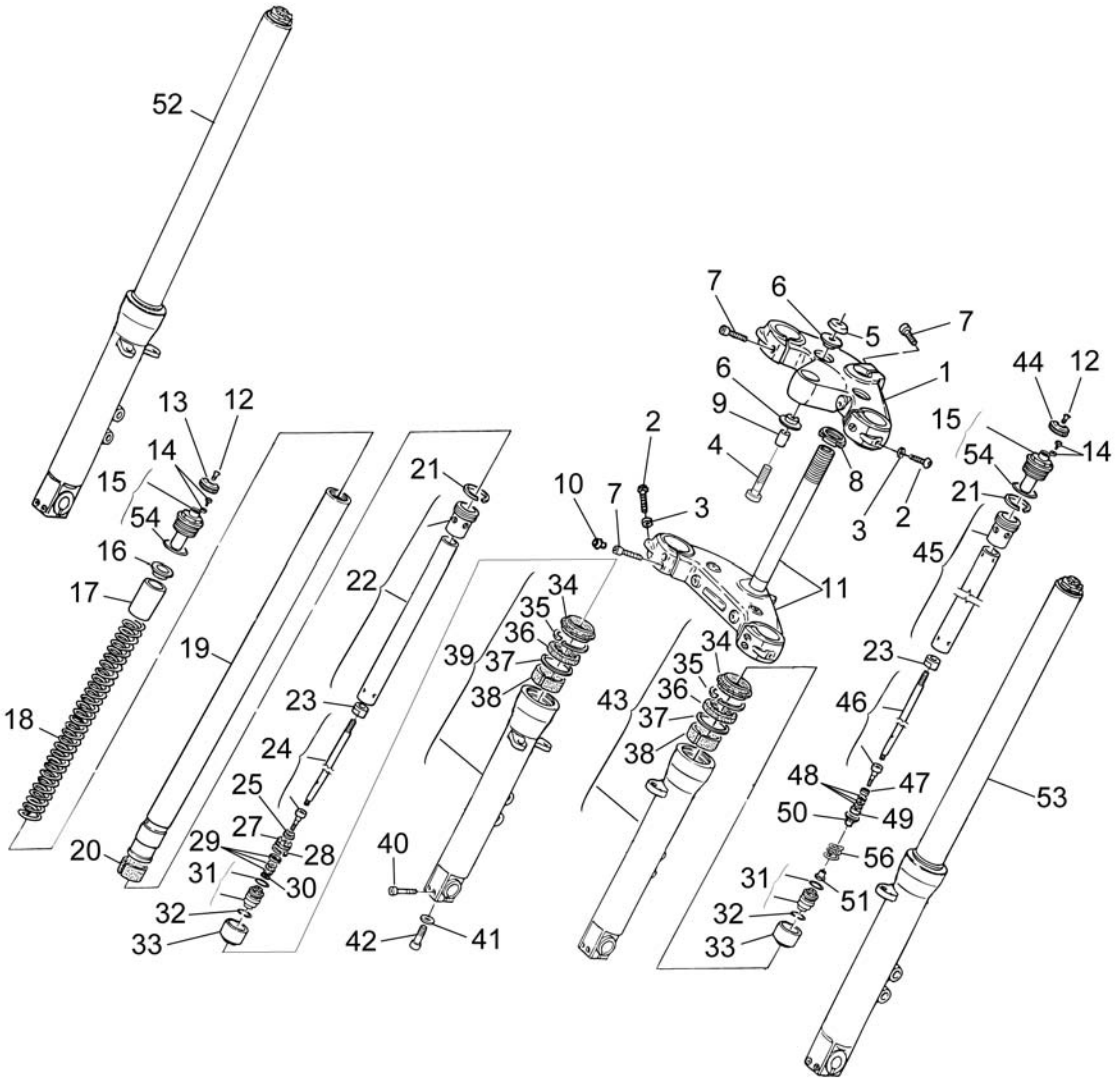
- Unscrew and remove the pin.

- Collect the spacer from the front wheel left side.



Front fork

Diagram



Key:

1. Fork upper plate
2. TBEI screw
3. Washer
4. Screw
5. Cap
6. Rubber ring
7. Screw
8. Ring nut
9. Spacer
10. Chrome-plated cap
11. Base with headstock
12. Screw

13.Right adjustment ring nut
14.Screw with OR
15.Complete cap
16.Cap
17.Preload tube
18.Spring
19.Stem
20.Lower bushing
21.Ring
22.Right tube (extension)
23.Lock nut
24.Right pumping member rod (extension)
25.Counter spring
26.Right piston (extension)
27.Right piston ring (extension)
28.Right pin (extension)
29.Calibration tab
30.Nut
31.Bottom valve unit
32.O-ring
33.Adaptor
34.Dust guard
35.Snap ring
36.Sealing ring
37.Cap
38.Upper bushing
39.Right sleeve
40.Screw
41.Washer
42.Screw
43.Left sleeve
44.Left adjustment ring nut (compression)
45.Left pipe (compression)
46.Left pumping member rod (compression)
47.Cap

48. Calibration tab
49. Left pin (compression)
50. Left piston (compression)
51. Nut
52. Complete right stem
53. Complete left stem
54. O-ring
55. Spring

Removing the fork legs

- Hold the front part of the vehicle with a belt and a hoist.
- Remove the front wheel.

- Undo the screws fixing the front mudguard and remove it.

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

- Remove the fork stem.

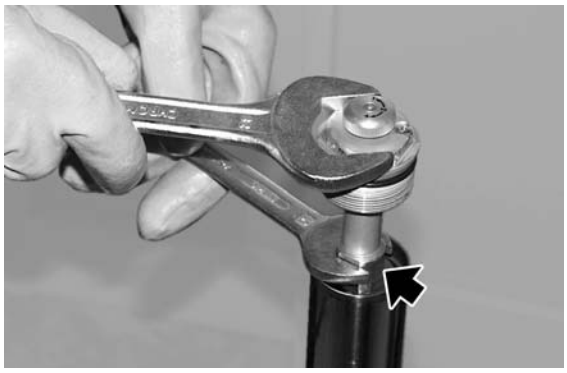
Draining oil

The vehicle is equipped with a hydraulic telescopic fork with separated shock absorber damping adjustment in extension and compression:
The left stem works in extension while the right one in compression.
Although the two stems work in a different mode, their internal components are similar; therefore, oil drainage and topping up are carried out following the same operations; that is why the following operations apply to both stems.

CAUTION

DURING OIL DRAINAGE AND REFILLING OPERATIONS, THE STEM AND ITS INNER PARTS SHOULD BE LOCKED IN A VICE; BE VERY CAREFUL NOT TO DAMAGE THEM BY EXERTING AN EXCESSIVE FORCE; ALWAYS USE ALUMINIUM JAW CAPS.

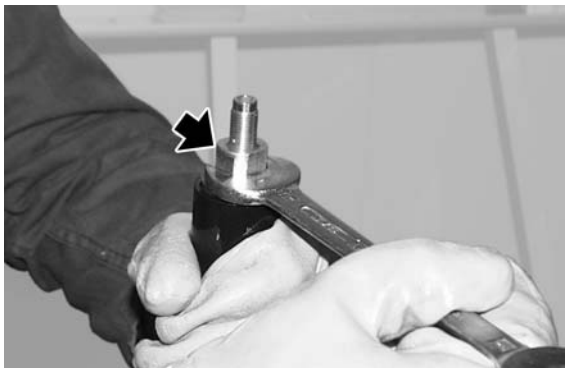
Outlet:



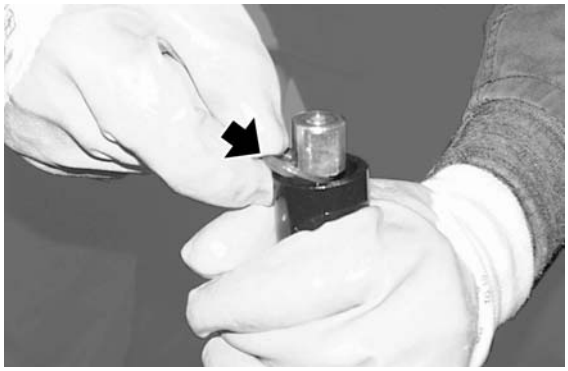
- Remove the stem from the fork.
- Place the stem in a vice equipped with jaws covered in aluminium so as not to damage the stem.
- With an hexagonal spanner, unscrew the upper closing cap. Be careful not to damage the O-ring during removal. Push the carrying tube inside the wheel carrier.
- Holding the upper cap with the spanner used before, loosen the lock nut, using an hexagonal spanner. Unscrew

the upper cap completely and remove it from the shock absorber rod end.

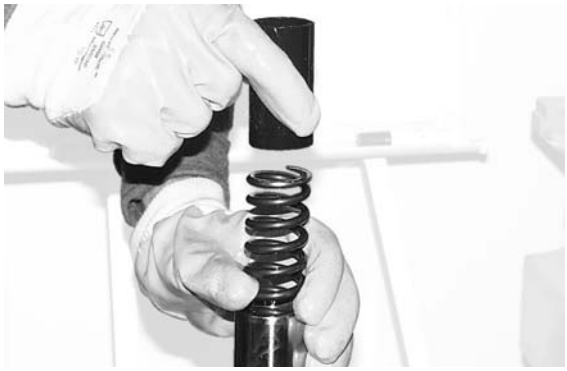
- Using an appropriate container, drain as much as possible the oil contained in the stem.
- Hold the stem in the vice again and, holding the preloading tube, loosen the lock nut partially for discharging the internal spring.



- Remove the open washer for releasing the preloading tube and the spring.



- Remove the preload tube and the spring.



- Drain the oil from the stem again and for easy drainage of the oil inside the shock absorber unit more easily, push the shock absorber rod to pump oil out.

BY PUMPING OIL OUT OF THE SHOCK AB-

SORBER USING THE ROD, AN OIL JET WILL FLOW FROM THE ROD END DUE TO THE PRESSURE. THEREFORE, IN ORDER TO AVOID DAMAGE OR INJURIES, POINT THE ROD END TO AN APPROPRIATE CONTAINER.

• Carefully check each part of the stem and make sure that there are no damaged elements.

• If there are no damaged or worn elements, refill the stem; otherwise, replace the damaged elements.

Disassembling the fork

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

- Remove the dust scraper using a screwdriver as a lever.

CAUTION

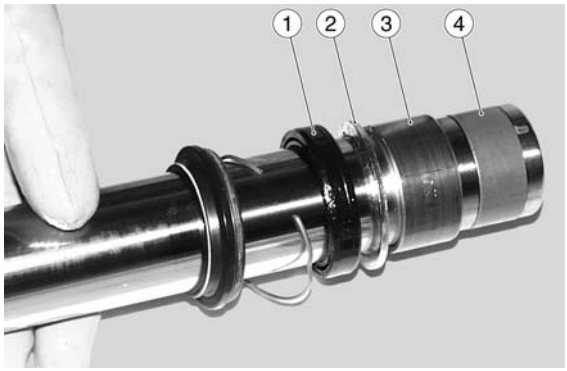
BE CAREFUL NOT TO DAMAGE THE SLEEVE RIM AND THE DUST SCRAPER.

- Remove the locking ring inside the sleeve using a thin screwdriver.

CAUTION

BE CAREFUL NOT TO DAMAGE THE SLEEVE RIM.

- Slide the stem from the wheel holder sleeve together with the sealing ring (1), the cap (2), the upper bushing on the fork leg (3), the lower bushing (4) on the pipe.



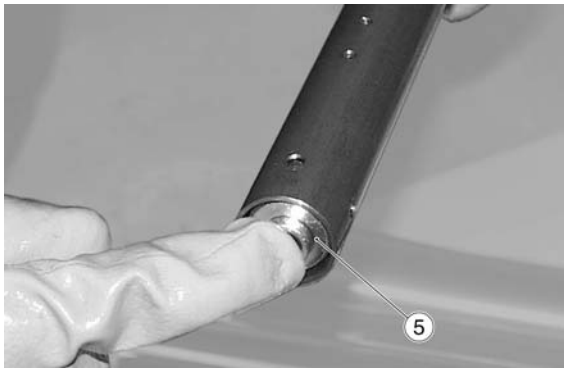
NOTE

WHEN REMOVING THE STEM FROM THE WHEEL HOLDER SLEEVE SOME PARTS MAY REMAIN INSIDE THE SLEEVE. IF THIS OCCURS, THESE PARTS MUST BE REMOVED AFTERWARDS, BEING CAREFUL NOT TO DAMAGE THE SLEEVE RIM AND THE UPPER BUSHING SEAT

- Slide off the pumping member unit from the holding tube.

- Remove the bottom buffer; this could remain fitted on the wheel holder fork leg; in this case remove it from inside.

- With the fingers, push the bottom valve inside the shock absorber sleeve.

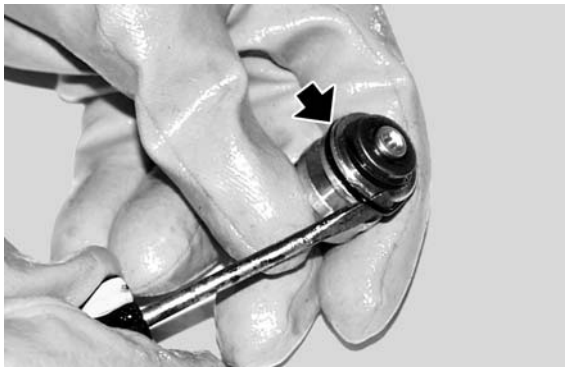


- Using a screwdriver, remove the snap ring.

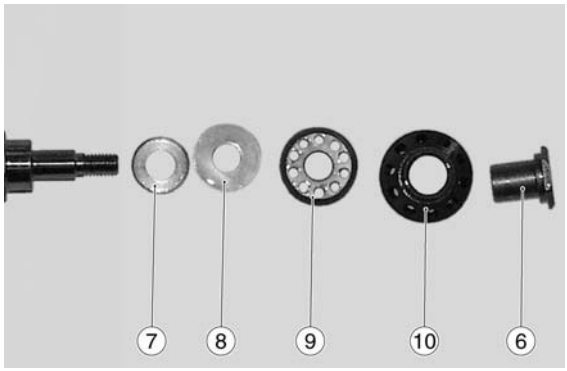
- With the shock absorber rod outside the sleeve, push the bottom valve.

- Check the bottom valve and its O-Ring, replace them if they are dam-

aged.



- Slide off the shock absorber rod together with the pumping member unit from the sleeve after unscrewing the lock nut on the rod end.
- Unscrew the nut (6) fixing the adjustment unit and slide off all the components. Carry out the appropriate checks and/or replacements, and refit according to order:



- cap (7);
- reed valve (8);
- cap (9);
- piston (10);
- fixing nut (6).

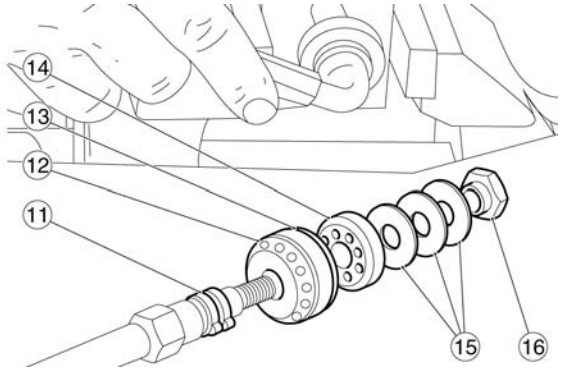
DURING SEALING UNIT REMOVAL, TAKE NOTE OF THE EXACT POSITION OF THE REEDS (8)

HOLDING THE SHOCK ABSORBER ROD IN A VICE WITHOUT ANY SUPPORTS, IT IS POSSIBLE TO CRUSH IT SINCE IT IS HOLLOW.

The removal procedure is similar to that of shock absorber "COMPRESSION" but the components

of the pumping member unit fixed to the shock absorber rod are different:

- pos. 11, counter spring;
- pos. 12, piston;
- pos. 13, ring for piston;
- pos. 14, right pin;
- pos. 15, calibration tabs;
- pos. 16, fixing nut.



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.

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

CAUTION

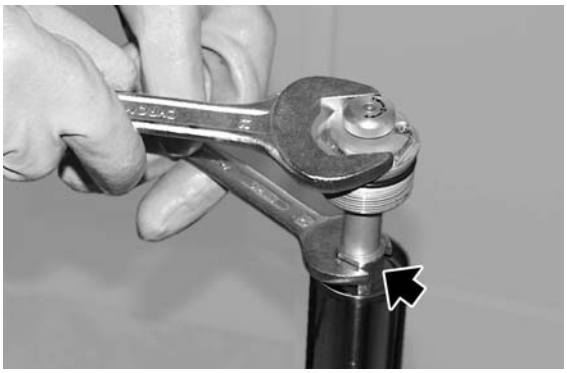
REMOVE ANY IMPURITY IN THE BUSHINGS, TAKING CARE NOT TO SCRATCH THEIR SURFACE.

Replace the following components with new ones:

- sealing ring;

- dust guard;

- O-Ring on the cap.



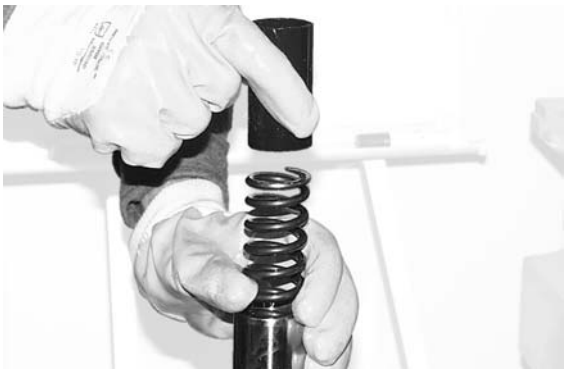
Filling oil

• Block the wheel holder sleeve in a vice.

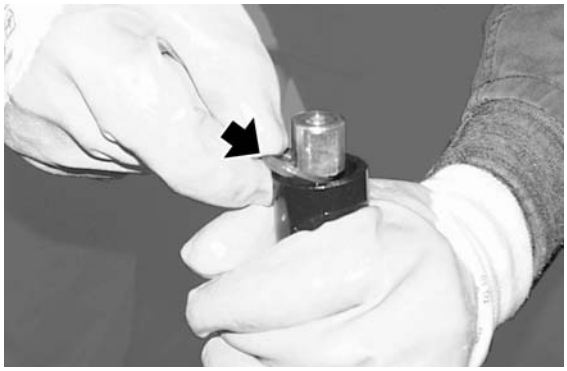
• Pour oil into the stem.

• Pump the stem, making sure the oil has completely filled the pumping member rod.

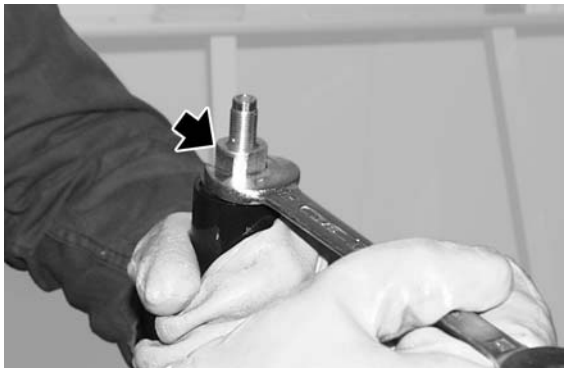
- Introduce the spring and the preload tube.



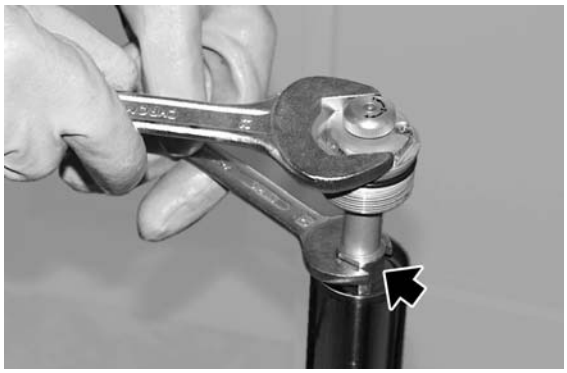
- Place the open washer locking the preloading tube and the spring.



- Screw the lock nut on the pumping member rod. So as to compress the spring.



- Fix the fork upper cap to the pumping member rod.
- Place the upper cap on the holding tube being careful not to damage the OR.
- Screw the upper cap to the prescribed torque.



Steering bearing

Adjusting play

- Operating from both sides, remove the screw fixing the fork stems to the upper plate.

- Loosen the upper plate back screw.

- Remove the chrome-plated cap.

- Unscrew and remove the head fixing nut.

- Unscrew and remove the two screws fixing the light support to the steering

upper plate.

- Undo and remove the two handlebar fixing screws.

- Collect the two chrome-plate washers.

- Slide off the fork upper plate moving it towards the instrument panel.

- Screw the ring nut to the prescribed torque.

Locking torques (N*m)

Headstock ring nut - M25x1 (1) 7 Nm (5.16 lbf ft) - the headstock should turn freely

Rear

Removing the rear wheel

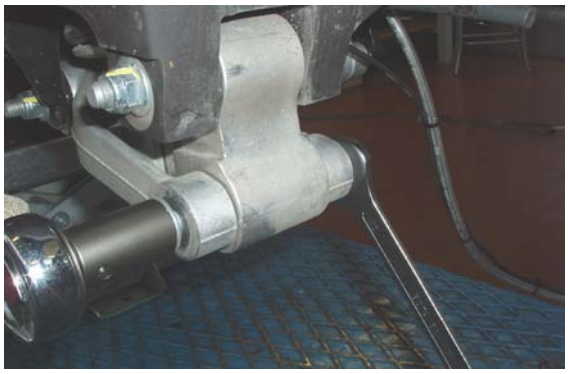
- Remove the exhaust terminals.
- Slide off the rear calliper from the disc.
- Lift the rear part of the vehicle with a belt and a hoist.

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

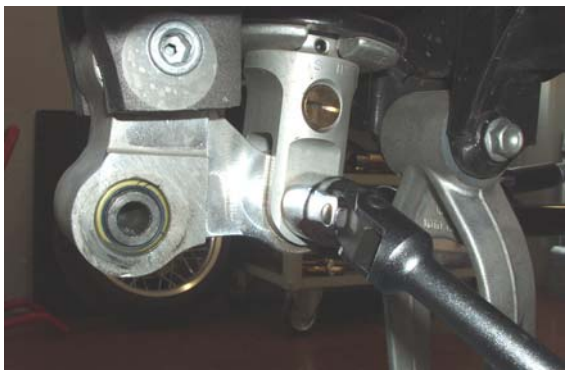
Shock absorbers

Removing

- Remove the exhaust terminals.
- Unscrew and remove the single connecting rod fixing bolt.



- Operating from the right side, unscrew and remove the shock absorber lower screw.



- Place a shim washer between the

chassis and the rear wheel.

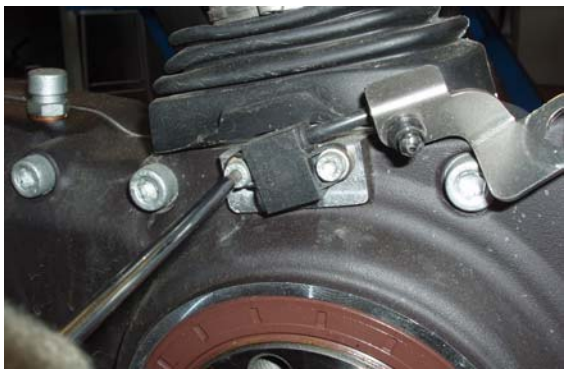
- Operating from the right side, unscrew and remove the shock absorber upper screw.
- Turn and remove the shock absorber from the left side of the vehicle.

INDEX OF TOPICS

Swinging arm

Removing

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

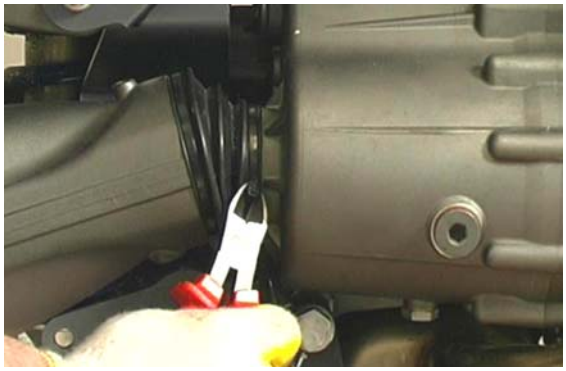


- Unscrew and remove the fixing nut of the connecting rod assembly and collect the screw.

- Undo and remove the two screws.
- Remove the rider left footrest protection.

- Unscrew and remove the fixing nut of the reinforcing bar.
- Remove the screw.
- Fix the reinforcing bar to the chassis with a clamp.

- Remove the clamp from the dust guard cap.



- Loosen the two fork terminal screws.

- Loosen the ring nut.

Specific tooling

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

- Helped by a second operator, remove the pin and remove the fork with

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 fork pin.
- Fit the ring nut in the fork 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 fork, insert the universal joint, align the holes and, at the same time, helped by a second operator, insert the pin completely.
- Tighten the fork pin.

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

Specific tooling

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

- Tighten the two fork terminal screws.

- Place the rider left footrest protection.
- Tighten the two screws.

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

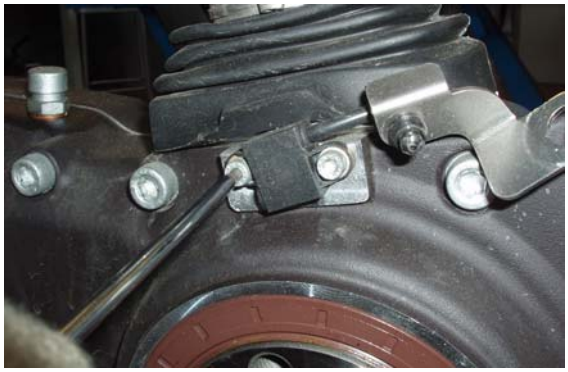
- Place the reinforcing bar in its seat.
- Insert the screw.
- Screw the fixing nut of the reinforcing.

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

- Place the anti-dust ring between the rim and the cardan shaft taking care to

mount it with the collar facing the transmission unit.

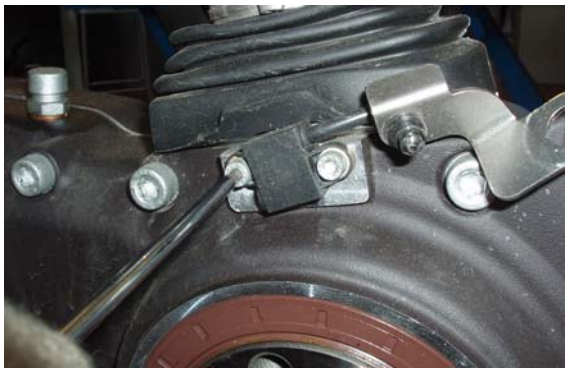
- Place the speed sensor on the fork and screw the two screws.
- Fit the rear wheel.
- Place the rear brake calliper on the disc and the brake pipe on the fork.



Bevel gears

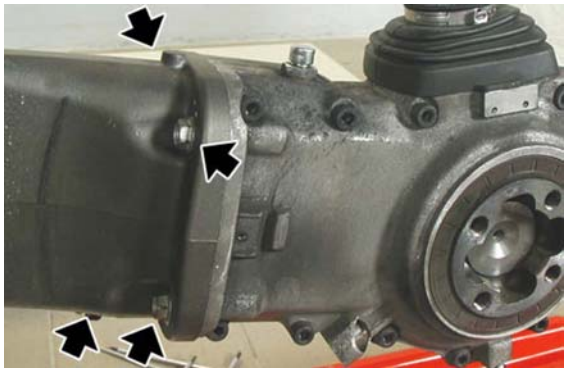
Removing

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



- Unscrew and remove the fixing nut of the reinforcing bar.
- Remove the screw.
- Fix the reinforcing bar to the chassis with a clamp.

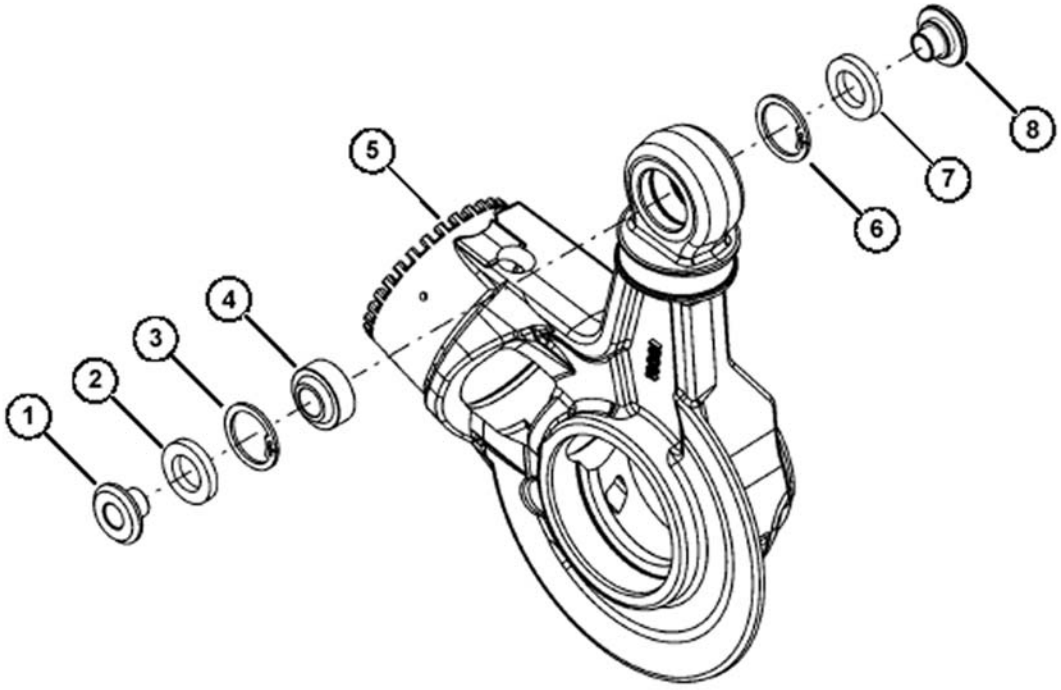
- Unscrew and remove the four screws.



- Remove the transmission casing sliding off the universal joint.

Checking

Support unit



REMOVAL

Remove the bushing (1) with a punch.

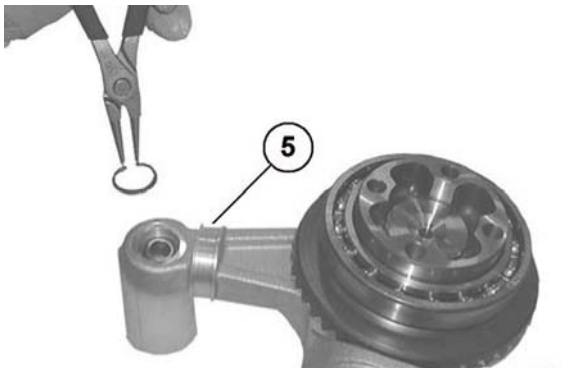
Turn the support (5) over and remove the other bushing (8).

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

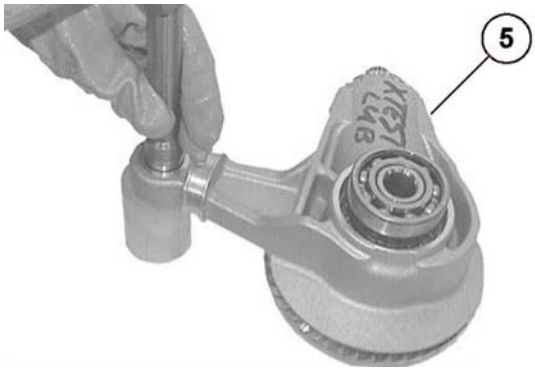
Remove the stop rings (3) and (6) from the support (5) with suitable pliers.

NOTE

THIS OPERATION DESTROYS THE SEALING RING.

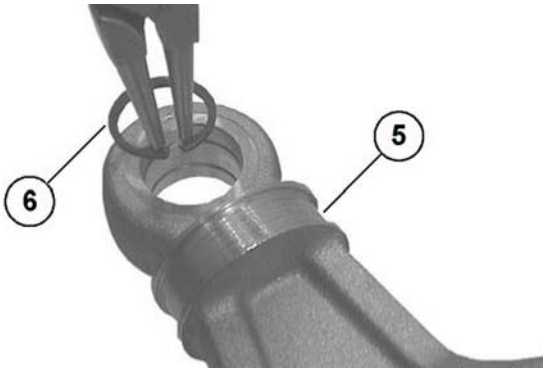


Remove the ball joint (4) with a suitable buffer and a rubber hammer.



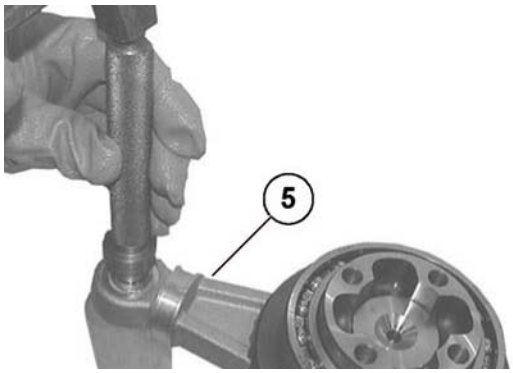
FITTING

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

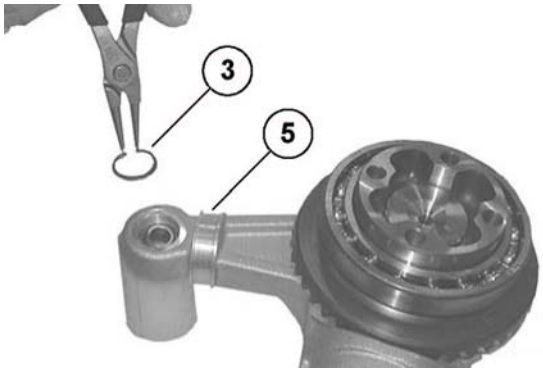


Turn the support (5) over.

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).

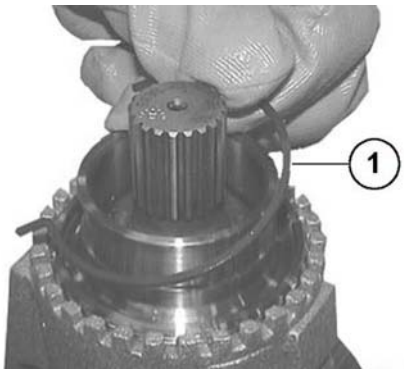
Drive the bushing (1) in with a plastic hammer.

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

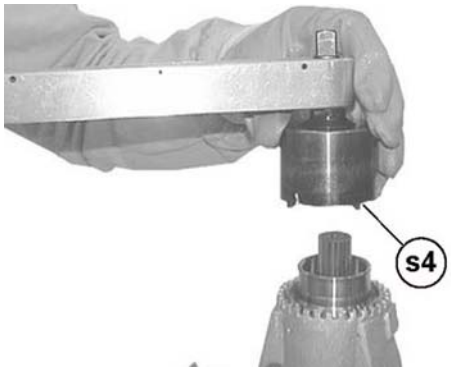
Pinion unit

REMOVAL

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



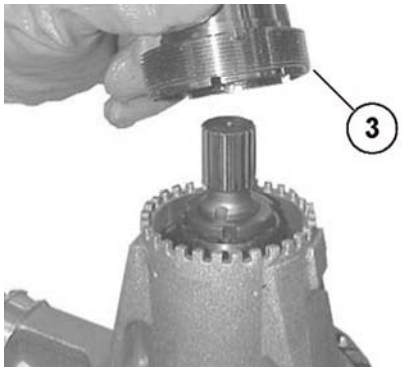
Unscrew the ring nut (2) with the special spanner (s4).



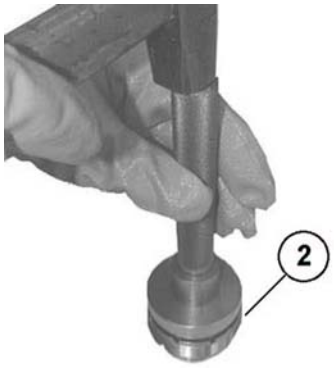
Remove the ring nut (2) and remove the sealing ring from the ring nut.

NOTE

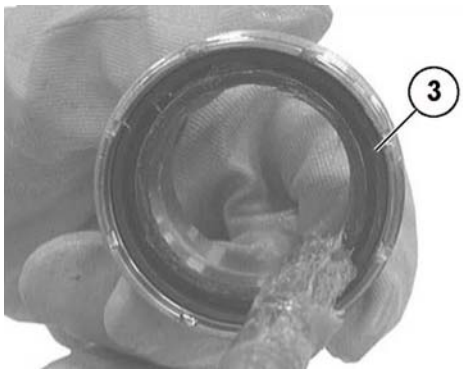
THIS OPERATION DESTROYS THE SEALING RING.



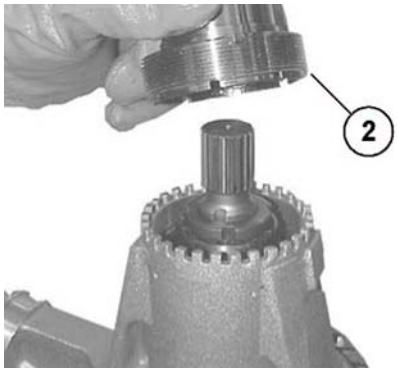
Assemble the sealing ring (3) to the ring nut (2) with the buffer CA715855 (see Fig.1) and a hammer.



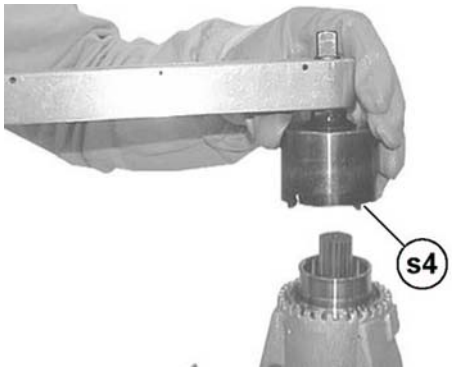
Lubricate the sealing ring (3).



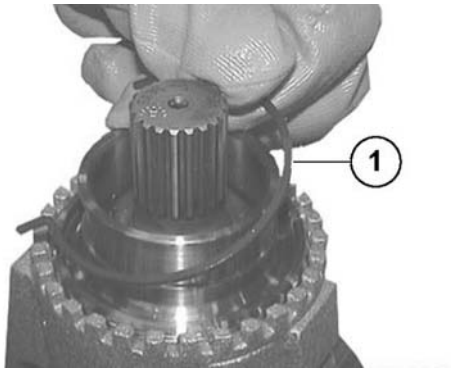
Assemble the ring nut (2).



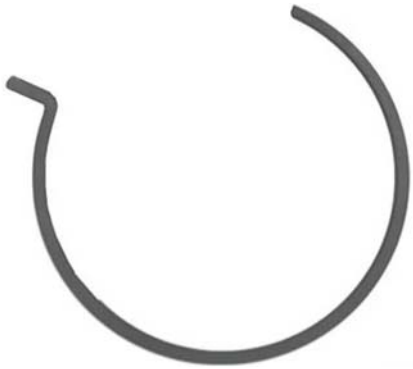
Tighten the ring nut (2) with the special spanner (s4) to the prescribe torque.



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

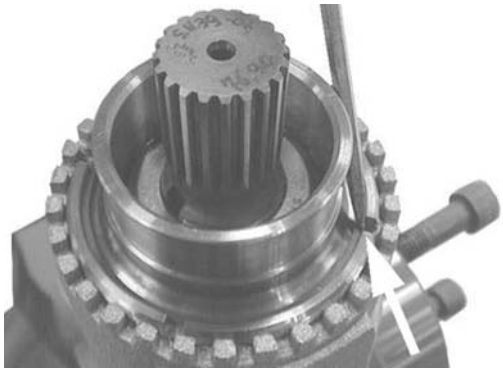


Assembly position of the stop ring (1).



CAUTION

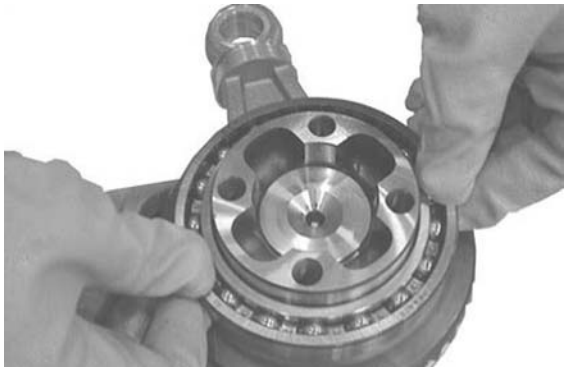
MAKE SURE THE STOP RING IS IN ITS SEAT.



Wheel axle unit

REMOVAL

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



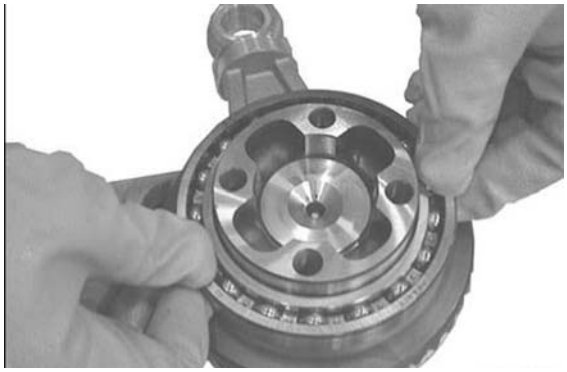
Turn the unit over.

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

FITTING

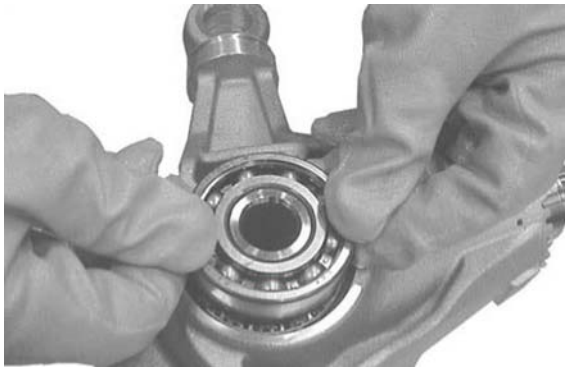
Heat the bearings to 100°C (212 °F).

Assemble the bearings to the wheel axle.



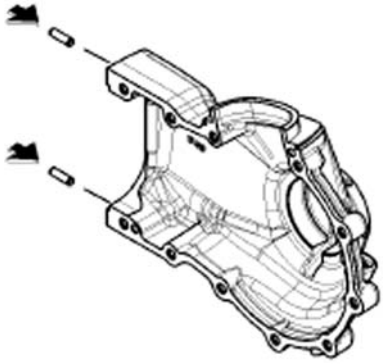
Turn the unit over.

Assemble the bearings to the wheel axle.



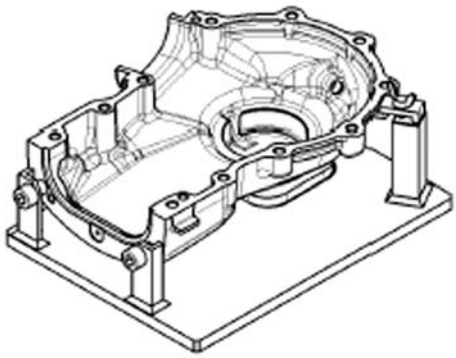
Casing unit fitting

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



Assemble the casing to the special fastening tool.

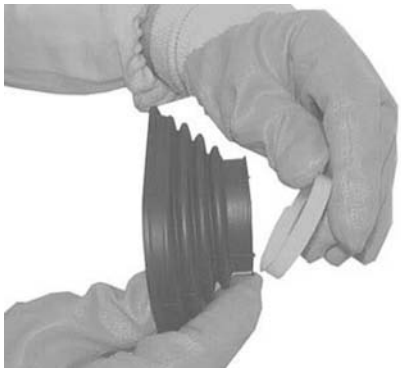
Clean the casing faying surfaces carefully.



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.

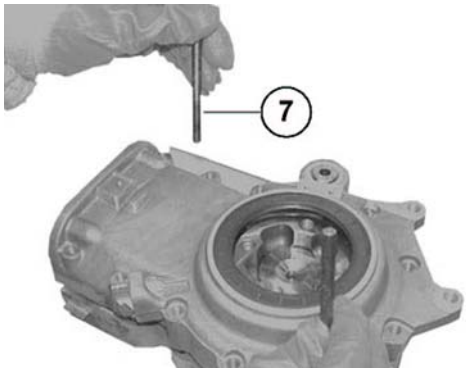
Fit a new sealing ring using the buffer.

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.

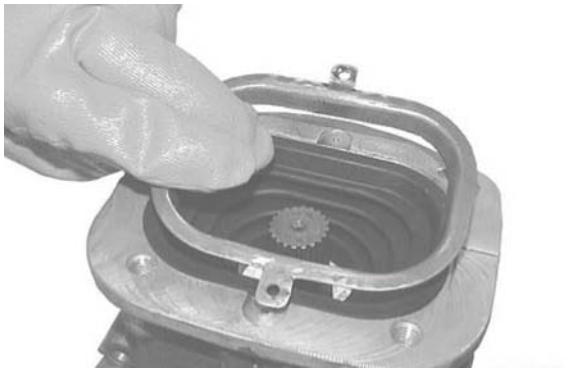


Assemble the fixing screws (7).

Tighten the screws (7) to the prescribed torque.

Remove excessive sealant.

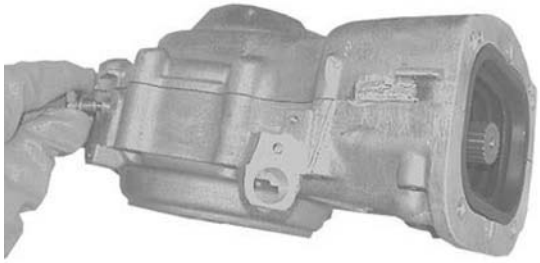
Assemble the ring to the casing.



Tighten the fixing screws to the prescribed torque.

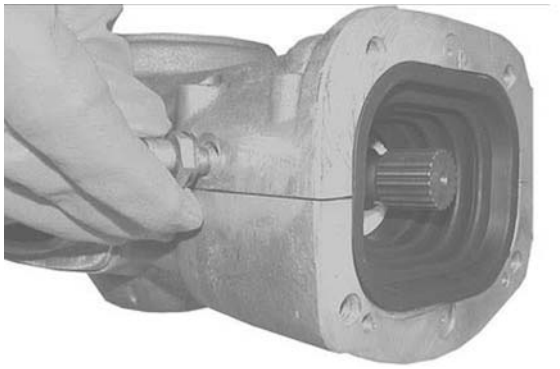
Fit the cap with the washer.

Screw the cap to the prescribed torque.



Fit the breather with the washer.

Screw the breather to the prescribed torque.

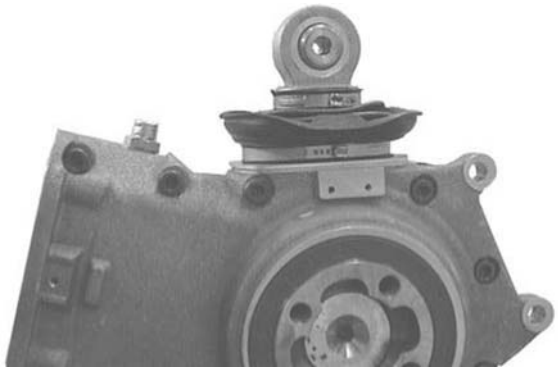


Fill the transmission with the prescribed oil.

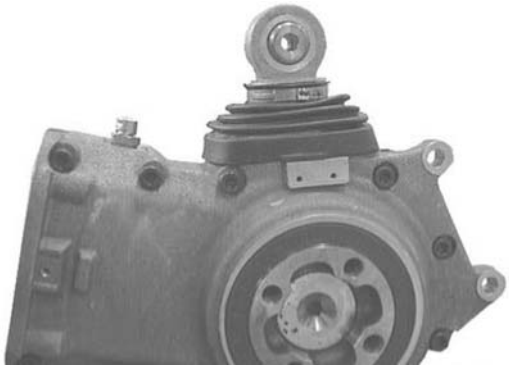
Fit the cap with the washer.

Screw the cap to the prescribed torque.

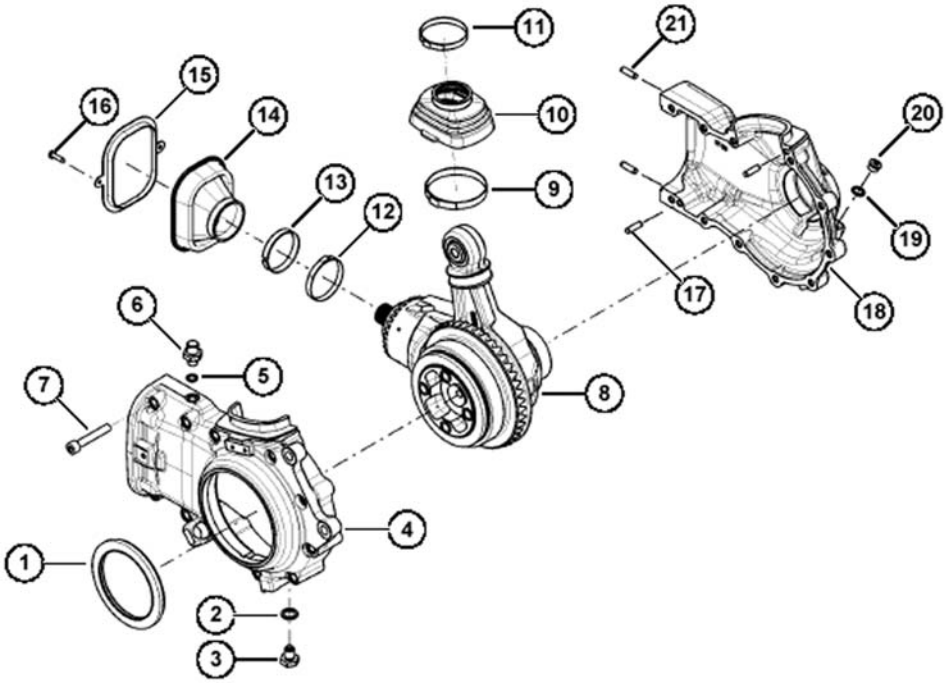
Assemble the cap with the clamps.



Fit the cap in its seat.



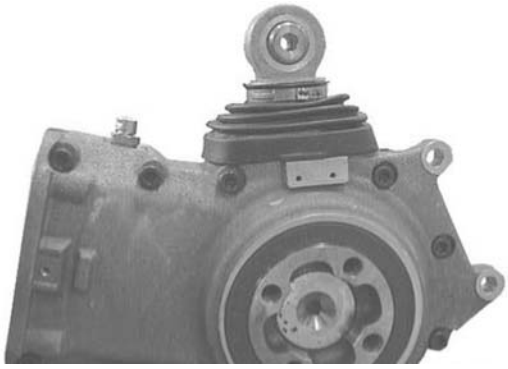
Casing unit removal



Remove the cover (20).

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

Lift the cap (10).



Remove the clamps (9) and (11).

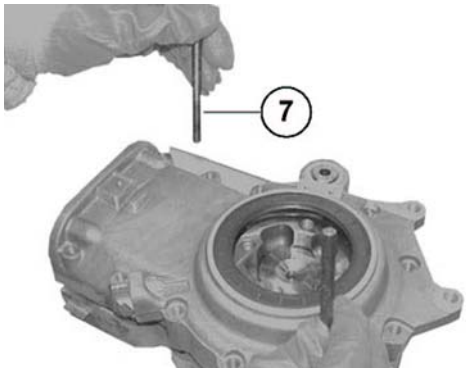
Remove the cap (14).

Remove the screws (16).

Collect the ring (15).

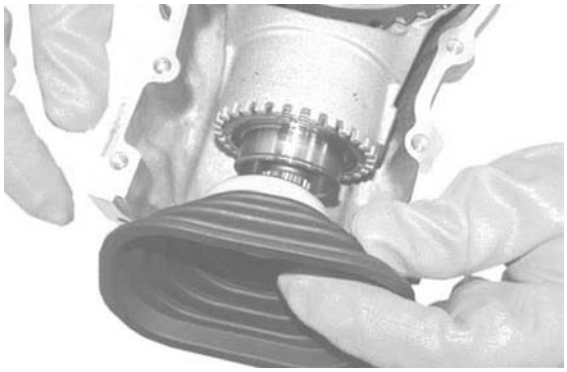
Remove the screws (7).

Remove the casing (4).

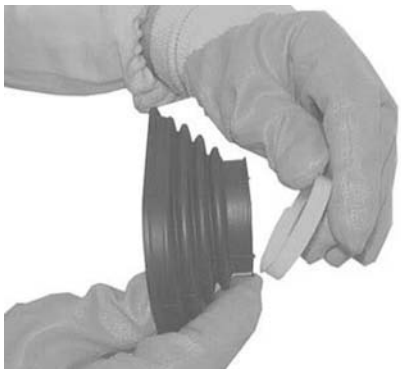


Remove the clamp (12).

Remove the cap (14).



Collect the ring (13).



Remove the support unit (8).

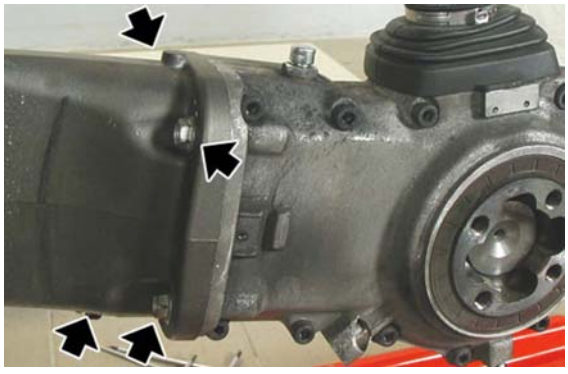
TROUBLESHOOTING

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 it and reassemble the casing 2. Tighten the closing screws to the correct torque
1. Dirt between sealing ring and casing 2. Worn sealing ring 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. Damaged cap 2. Retaining clamps or closing cover slacken 3. Fitting error of the radial seal or seal damaged 4. Sliding surface of the wheel spacer seal 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 fork making sure that the universal joint engages correctly.

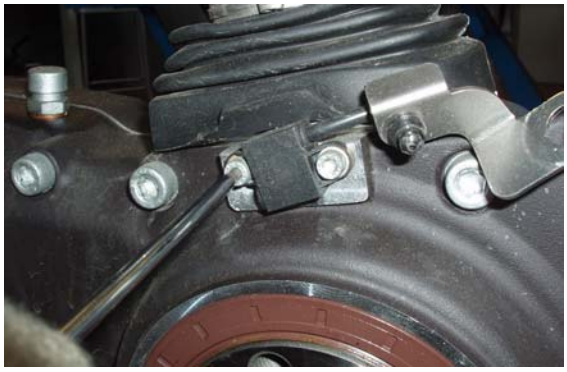
- Tighten the four screws to the prescribed torque operating diagonally.



- Place the reinforcing bar in its seat.
- Insert the screw.
- Tighten the reinforcing bar fixing nut.

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

- 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.



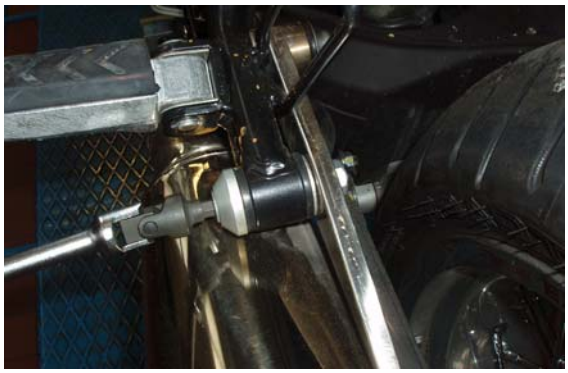
Exhaust

Removing the tail pipe

- Loosen the fixing clamps.

- Undo and remove the internal screw collecting the two washers.

- Undo and remove the external screw collecting the nut and the washer.



Removing the exhaust manifold

OPERATIONS VALID FOR BOTH MANIFOLDS

- Loosen the fixing clamps.

- Unscrew and remove the nuts from the head stud bolts.

- Disconnect the lambda probe connector.

- Remove the exhaust manifolds.

- Cut the clamp.

- Remove the manifold - end coupling.

INDEX OF TOPICS

Removal

OPERATIONS VALID FOR BOTH CALLIPERS

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

- Remove the front brake calliper.

Front brake pads

Removal

- Remove the front brake calliper.

- Remove the split pin.

- Slide off 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 LEAKAGE.

Rear brake pads

Removal

- Remove the rear brake calliper.

- Remove the lock.

- Remove the pin.

- Extract one pad at a time.

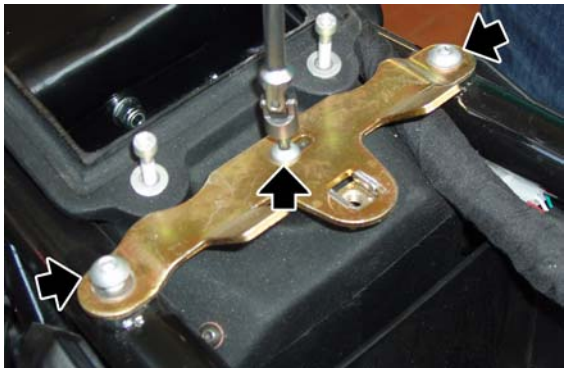
CAUTION

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 LEAKAGE.

INDEX OF TOPICS

Air box

- Remove the air filter.
- Undo and remove the three lower screws from the bracket.



- Slide off the oil vapour recovery pipe from the blow-by tank.

- Loosen the clamps on the throttle bodies and slide off the manifolds.

- Slide off the filter casing breather pipe.

- Lift the filter casing slightly.
- Operating inside the filter slightly, unscrew and remove the oil vapour recovery joint.
- Collect the gasket.
- Remove the filter casing by lifting it.

Fuel tank

- Unscrew and remove the rear screw.

- Disconnect the fuel pipe.

- Lift the fuel tank partially.
- Disconnect the two connectors.

- Slide off the fuel breather pipe.

- Remove the fuel tank.

Battery

REMOVAL

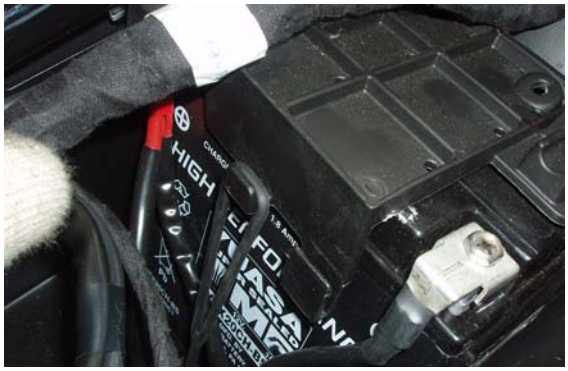
- Remove the saddle.

- Disconnect the connector.

- Slide off the fuse boxes.

- Undo and remove the two screws.

- Disconnect the elastic and remove the battery cover.



- Undo and remove the screws fixing the terminals.

- Remove the battery.