PIAGGIO

WORKSHOP MANUAL

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MP3 530 hpe

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WORKSHOP MANUAL

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This workshop manual has been produced for consultation by the technical staff of Dealerships, Service Centres, Authorised Service Network Workshops.
This manual is addressed to service mechanics who are supposed to have a basic knowledge of mechanics principles and of vehicle mounting techniques and procedures.
Any technical changes made to the vehicles or to specific mounting operations will be promptly reported by updates to this manual.
In order to achieve satisfactory operations, it is necessary to have adequate work areas and the necessary specific equipment or hierarchies.

N.B.
Indicates a note that provides information to make the process easier and clearer.

IMPORTANT
Indicates the specific processes that must be followed in order to prevent possible injury to the person repairing the vehicle.

WARNING
Indicates the specific processes that must be followed in order to prevent damage to the vehicle.

Personal Safety
The total or partial failure to follow these instructions may lead to serious personal injury.

Environmental Protection
Indicates the correct behaviour to adopt for an environmentally-friendly use of the vehicle.

Vehicle Integrity
The total or partial failure to follow these instructions may lead to serious damage to the vehicle and may even invalidate the warranty.

LIST OF TOPICS

Electrical system.....

Engine from the vehicle.....

Power supply system.....

Suspension.....

LIST OF TOPICS

General mandatory requirements

1.1 General mandatory requirements

General Information

This section contains general information regarding the vehicle and the use of the manual, as well as important notes regarding safety.

WARNINGS AND IMPORTANT NOTES Each symbol has a precise meaning, as illustrated below.

- **IMPORTANT:** - This symbol indicates risks for the health of the operator and of the nearby persons if the described procedures are performed incorrectly.
- **WARNING:** - This symbol indicates that the component on which works are being performed may be damaged if the described procedures are performed incorrectly.
- **NOTE:** - This paragraph provides additional instructions for the ongoing procedure, so that the operation may be performed in an efficient manner.

REACH REGULATION WARNINGS :

To protect the health and safety of the PROFESSIONAL CLIENT, as provided by the:

- (EC) Regulation No. 1907/2006 (REACh);
- 2000/53/EC (END of LIFE VEHICLES);
- SCIP Database Directive (art.9, par.1 lett.i) of the framework directive regarding waste, as modified by the Directive 2018/851

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1 . chemical protection gloves if the specific type is not explicitly indicated, or, if required, special gloves according to the substance used;

2 . mask, possibly a chemically active one, if specifically required;

3 . protective goggles.

The above indications represent an alternative for the prescriptions of other regulations and of the legislation in force in the specific countries. Regarding the use of other PPE, governed by the laws regarding the safety at work, the relevant legislation in force apply.

GENERAL SAFETY WARNINGS :

1 . Always wear protective goggles and proper clothing.
2 . Always use a safety support to operate under the vehicle.
3 . Check that the ignition switch is always OFF, unless the procedure indicates otherwise.
4 . Pull the hand brake (if applicable) before starting working on the vehicle.
5 . Start the engine only in well ventilated places, to avoid the risks related to the carbon oxide.
6 . Keep a safe distance from the mobile parts during the operation of the engine, especially from the fans and belts.
7 . To avoid burns, avoid contact with the hot metallic parts, such as the radiator, exhaust manifold, exhaust pipe, catalytic converter and silencer.
8 . Do not smoke during maintenance operations.
9 . To avoid any injuries, do not wear rings, watches, jewellery and loose clothing before starting to work on the vehicle.
10 . Keep your hands and other objects away from the blades of the radiator's fan (if present)!
11 . The cooling fan (if present) is fitted on the radiator and may start any time due to a temperature increase of the cooling fluid. It is important to check that the cooling fan's starter motor is disconnected from the wiring harness before starting the works.

The units of measurement used in this manual are indicated as SI UNITS (International System of Units). Example: 24,5 ÷ 34,3 Nm

LIST OF TOPICS

Pre-delivery

2.1 General section - Predelivery

The ASR system is a driving aid that assists the driver in acceleration manoeuvres, particularly on low-grip surfaces or under conditions that can cause sudden back-wheel slippage. The ASR in these situations automatically intervenes by reducing engine output within the limit imposed by the grip conditions, contributing significantly to the maintenance of stability the vehicle.

WARNING

THE ASR SYSTEM IS BASED ON THE RECOGNITION OF SPEED DIFFERENCES BETWEEN FRONT AND REAR WHEEL. IN ORDER FOR THE SYSTEM TO MAINTAIN MAXIMUM EFFICIENCY IN ALL CONDITIONS, THE CALIBRATION PROCEDURE MUST BE PERFORMED EVERY TIME, EVEN IN CASE OF REPLACEMENT OF JUST ONE TYRE.

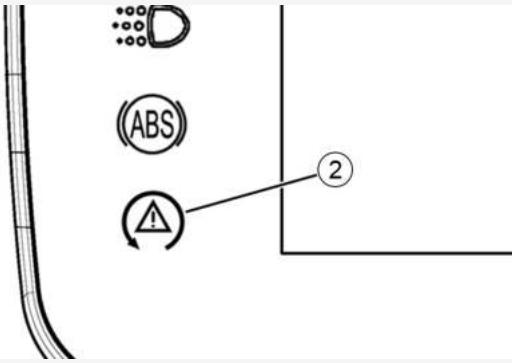
FOR THE CALIBRATION OF THE ASR SYSTEM PERFORM THE PROCEDURE BELOW.

- **ASR BUTTON 1:** activation / deactivation.
- **ASR INDICATOR LIGHT «2»:** operating indication warning light.

Warning light flashing mode:

- Off with the vehicle in gear:: the system is working, but is not active (normal condition).

- Flashing quickly with moving vehicle: The system is functioning correctly and is active (poor grip conditions, engine power limiting in effect); ride with extreme care, as the grip limit has been exceeded; restore the vehicle to safety conditions by gently reducing the throttle opening.



- Lit with moving vehicle: the system is disabled and will not intervene in case of loss of grip.

- If the deactivation was voluntary (by pressing the appropriate button **"1"** for 1 second) it is recommended to reactivate the system as soon as possible.
- If the deactivation was NOT voluntary, there is an ASR failure: In this case, proceed with the system diagnosis and reactivation.

To ensure maximum safety of the vehicle it is advisable to keep the system active. Deactivation may be necessary only in case of starting with very low grip surfaces (mud, snow) on which the operation of the ASR could actually prevent the movement of the vehicle.

N.B.

AT VEHICLE START-UP THE ASR WARNING LIGHT FLASHES AT THE SAME FREQUENCY AS THE ABS WARNING LIGHT, INDICATING A DIAGNOSTIC PHASE OF THE SYSTEM. IN THE ABSENCE OF ERRORS, BOTH WARNING LIGHTS TURN OFF AT THE SAME TIME WHEN EXCEEDING 5 km/h.

WARNING

THE ASR SYSTEM IS ACTIVATED EVERY TIME, THE STARTER SWITCH IS TURNED TO THE "ON" POSITION.

IF DISABLED BY THE USER, THE ASR SYSTEM KEEPS THE STATE OF INACTIVITY ONLY IF THE VEHICLE IS OFF, BY USING THE ENGINE STOP SWITCH; THE ASR SYSTEM IS AUTOMATICALLY ENABLED THE NEXT TIME THE IGNITION SWITCH IS TURNED TO THE "ON" POSITION.

ATTENTION

IT IS EMPHASISED THAT THE RIDING AUXILIARY SYSTEM CANNOT CHANGE THE PHYSICAL LIMITS OF GRIP AND IS NOT A SUBSTITUTE FOR PROPER MANAGEMENT OF POWER, BOTH ON STRAIGHT STRETCHES AND IN TURNS. THEREFORE, IT IS RECOMMENDED TO ALWAYS USE THE VEHICLE WITH THE UTMOST CARE AND IN ACCORDANCE WITH THE REGULATIONS IN FORCE.

CAUTION

AT LOW SPEED, LESS THAN 5 Km/h (3 mph), THE ASR SYSTEM IS NOT OPERATIONAL.

IT IS RECOMMENDED TO PAY PARTICULAR ATTENTION IN THE EVENT OF ACCELERATION FROM STANDSTILL IN CONDITIONS OF LOW GRIP, ESPECIALLY IN THE FIRST METRES.

N.B.:

IN CASE OF ROADS FULL OF HOLES BRIEF ACTIVATION OF THE ASR SYSTEM MAY OCCUR. SUCH EVENT APPEARS UNDER NORMAL OPERATION CONDITIONS OF THE VEHICLE.

CAUTION

THE ASR SYSTEM PREVENTS THE APPLICATION OF HIGH SPEED ROTATION ON THE REAR WHEEL WITH THE VEHICLE ON THE CENTRE STAND.

IT IS RECOMMENDED TO NOT INSIST WITH THE THROTTLE GRIP IN THIS SPECIFIC SITUATION, BECAUSE THIS MAY CAUSE ABNORMAL STOPS AND/OR DAMAGE TO THE CATALYSTS.

ATTENTION

IN THE EVENT OF MALFUNCTION OF THE BATTERY, THE ABS - ASR SYSTEM TURNS OFF.

WARNING

A POOR STATE OF MAINTENANCE OF THE TYRES CAN RESULT IN ABNORMAL OPERATION OF THE ASR SYSTEM.

IF THE ASR SYSTEM IS TRIGGERED REPEATEDLY EVEN IN ADEQUATE GRIP CONDITIONS AND AT SMALL THROTTLE APERTURES, CHECK THE STATE OF WEAR AND INFLATION PRESSURE OF THE TYRES. IF THE PROBLEM PERSISTS, CONTACT A DEALERSHIP OR AN AUTHORISED SERVICE CENTRE.

The status of the ASR system (on / off) is also shown on the digital display by selecting the vehicle CONFIGURATION menu (see paragraph "**Digital display**").

ASR INDICATOR LIGHT OPERATING MODE

ASR SYSTEM STATUS	ASR INDICATOR LIGHT WITH THE ENGINE SWITCHED OFF OR THE KEY TO "ON"	ASR INDICATOR LIGHT WITH THE ENGINE SWITCHED ON AND THE VEHICLE RUNNING	ASR RUNNING WHILE DRIVING (LOW GRIP CONDITIONS)
ASR ACTIVE and calibrated	"ASR" icon: 1 Hz slow flashing	"ASR" icon: Off	"ASR" icon: 5 Hz fast flashing
ASR ACTIVE not calibrated	-	"ASR" icon: on steady	"ASR" icon: 5 Hz fast flashing
ASR voluntarily deactivated	"ASR" icon: on steady	"ASR" icon: on steady	-
ASR system not working (fault)	"ASR" icon: on steady	"ASR" icon: on steady	-
ASR programming phase (successful)	-	"ASR" icon: 1 Hz slow flashing; at the next engine start, the icon is off if the programming failed	-
ASR programming phase (failed)	-	"ASR" icon: switched on steady at the next engine start if the programming has failed	-

ASR SYSTEM CALIBRATION PROCEDURE

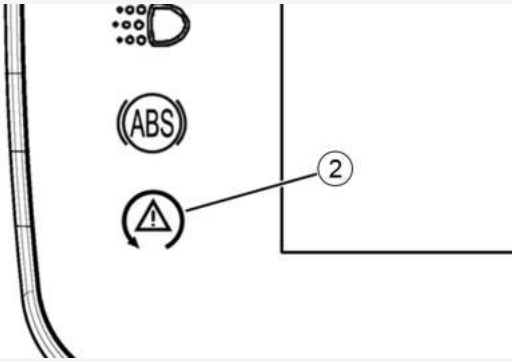
Calibrate the ASR system before the vehicle is delivered to the customer. **It is advisable to carry out the procedure also after replacing one or more tires.**

- Wait until the diagnostic phase of the ASR and ABS systems is complete.

- **Start the engine and drive a short straight stretch of flat road above 5 km / h (3.1 mph)** and wait for the ABS indicator light to stop flashing. If replacing the tires, wait until the ASR indicator light stops flashing.
- **Stop** and allow the engine to run in idle for at least **5 seconds**;

- **Press the ASR button "1" and keep one of the brake levers pulled for at least 7 seconds.**

- • **The activation of the wheel radius learning procedure** or of the ASR calibration procedure **will be confirmed by the ASR indicator light "2" with slow flashing.**
- **Accelerate to a constant speed of** 30-40 km/h (18.6-**24.8 mph)** and maintain it for **at least 8 seconds**. The permanence of the vehicle speed in the correct range for the completion of the procedure is confirmed by the fast flashing of the ASR warning light «**2**».



- **The completion of the procedure** will be indicated when the **ASR indicator light "2" switches off** and now the **ASR system is functional**.
- **To memorize** the procedure, **switch off the engine** , turn the ignition switch **to "OFF" and wait for at least 60 seconds** before turning again to "**ON**" and engaging a gear.
- **Complete the procedure within 5 minutes;** if the **ASR indicator light "2" stays on steady,** it means that the **ASR procedure has failed**.

Therefore, it is necessary to repeat the ASR calibration procedure until it is successfully completed.

- **Procedure OK**: **ASR indicator light OFF** and the system active. The next time the ignition switch is turned "**ON**", the new wheel radius will be stored.
- **Procedure failed**: **The ASR indicator light STEADILY ON** and the system active (for safety purposes) with the previously memorized or the default wheel radius (if it has never been programmed).

N.B.:

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HOWEVER, THE SYSTEM CAN PERFORM AUTOMATIC CALIBRATION AFTER TIRE REPLACEMENT.

2.2 Appearance check

Appearance check:

- Paintwork
- Fitting of Plastics
- Scratches
- Dirt

2.3 Locking check

Safety locks check

- Safety fasteners
- Fastening screws

Safety fasteners:

- Rear shock absorber upper fixing
- Rear shock absorber lower fixing
- Front shock absorber upper fixing
- Front shock absorber lower fixing
- Sliding shafts fixing
- Brake calliper fixing
- Front wheels fastening screws
- Front wheels axle nut
- Rear wheel axle nut
- Engine - frame oscillating arm fastening
- Handlebar lock nut
- Lateral steering tube lower ring nut
- Lateral steering tube upper ring nut
- Central steering tube lower ring nut
- Central steering tubes upper ring nut
- Constant-velocity universal joints

2.4 Electrical system

- Battery
- Main switch
- Headlamps: high beam lights, low beam lights, tail-lights (front and rear) and relevant warning lights
- Headlight adjustment according to prevailing regulations
- Front and rear stop light switches and their bulbs
- Turn indicators and their warning lights
- Instrument cluster lights
- Instrument cluster: fuel and temperature indicator
- Instrument panel warning lights
- Horn
- Electric Starter
- Engine stop with emergency stop switch
- Saddle electrical opening with remote control
- Roll lock-unlock switch

WARNING

TO ENSURE MAXIMUM PERFORMANCE, THE BATTERY MUST BE CHARGED BEFORE USE. INADEQUATELY CHARGING THE BATTERY WITH A LOW ELECTROLYTE LEVEL BEFORE IT IS USED FOR THE FIRST TIME WILL SHORTEN THE LIFE OF THE BATTERY.

WARNING

WHEN INSTALLING THE BATTERY, ATTACH THE POSITIVE LEAD FIRST AND THEN THE NEGATIVE ONE, AND PERFORM THE REVERSE OPERATION DURING REMOVAL.

CAUTION

BATTERY ELECTROLYTE IS TOXIC AND IT MAY CAUSE SERIOUS BURNS. IT CONTAINS SULPHURIC ACID. AVOID CONTACT WITH EYES, SKIN AND CLOTHING.

IF IT ACCIDENTALLY COMES INTO CONTACT WITH YOUR EYES OR SKIN, WASH WITH ABUNDANT WATER FOR APPROX. 15 MIN. AND SEEK IMMEDIATE MEDICAL ATTENTION.

IF IT ACCIDENTALLY SWALLOWED, IMMEDIATELY DRINK LARGE QUANTITIES OF WATER OR VEGETABLE OIL. SEEK IMMEDIATE MEDICAL ATTENTION.

BATTERIES PRODUCE EXPLOSIVE GAS; KEEP CLEAR OF NAKED FLAMES, SPARKS OR CIGARETTES. VENTILATE THE AREA WHEN RECHARGING INDOORS. ALWAYS WEAR EYE PROTECTION WHEN WORKING IN THE PROXIMITY OF BATTERIES.

ALWAYS WEAR EYE PROTECTION WHEN WORKING IN THE PROXIMITY OF BATTERIES.

KEEP OUT OF THE REACH OF CHILDREN.

CAUTION

NEVER USE FUSES WITH A CAPACITY HIGHER THAN THAT RECOMMENDED. THE USE OF A FUSE OF UNSUITABLE CAPACITY MAY RESULT IN SERIOUS DAMAGES TO THE WHOLE VEHICLE OR EVEN CAUSE A FIRE.

2.5 Level check

Checking levels:

- Hydraulic braking system fluid level
- Roll lock system fluid level
- Rear hub oil level
- Engine coolant level
- Engine oil level

2.6 Test drive

Test drive:

- Cold start
- Instrument operations
- Response to the gas command
- Stability on acceleration and braking

- Front and rear brake efficiency
- Parking brake efficiency
- Front and rear suspension efficiency
- Abnormal noise
- Tilting system locking - unlocking efficiency

2.7 Static check

Static control after the test drive:

- Restarting when warmed up
- Minimum holding (turning the handlebar)
- Uniform turning of the steering
- Any leaks
- Operation of the radiator electric fan

WARNING

CHECK AND ADJUST TYRE PRESSURE WITH TYRES AT AMBIENT TEMPERATURE.

CAUTION

NEVER EXCEED THE RECOMMENDED INFLATION PRESSURES OR TYRES MAY BURST.

2.8 Functional checks

Functional Checks:

- Hydraulic braking system: lever travel
- Clutch: proper functioning check
- Engine: proper general functioning and no abnormal noise check
- Other: papers check, chassis and engine number check, tools and equipment, licence plate fitting, lock check, tyre pressure check, rear-view mirror and any accessory fitting

2.9 Specific operations for vehicle

TOOLKIT

The toolkit comprises:

- a shock absorber pre-load adjusting wrench;
- One fuse puller.

The tools are stored in the helmet compartment.

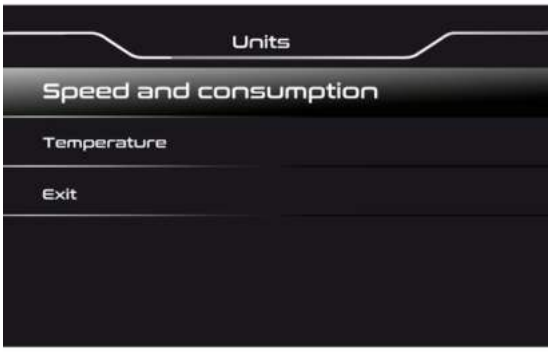
LICENCE PLATE HOLDER

CAUTION

ONLY FIT THE LICENCE PLATE HOLDER SUPPLIED AS STANDARD WITH THE VEHICLE, SINCE IT HAS TYPE-APPROVED AND OBLIGATORY SIDE REFLECTORS.

Measurement unit change

Once the **SETTINGS** function has been entered, briefly press the "**UP**" or "**DOWN**" keys to scroll through and enter the **CONFIGURATION** menu by briefly pressing the "**SET**" key.



Shortly press the "**UP**" or "**DOWN**" keys to select the parameter:

- Speed: select the required unit of measurement, choosing from the following options: Km/h, mph mpg ENG / mph mpg USA / ON, OFF.
- Temperature: select the required unit of measurement, choosing from the following options: degrees°C, °F / ON, OFF.

Change the desired parameter by briefly pressing the "**SET**" key.

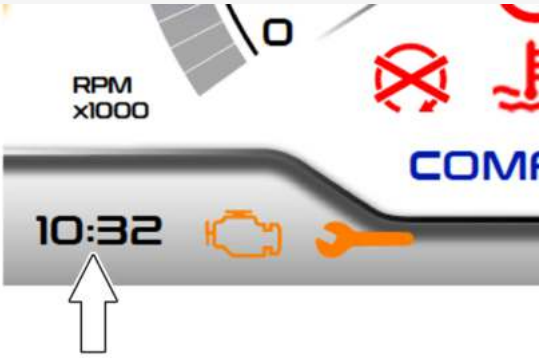
Setting the clock

Once the **SETTINGS** function has been entered, briefly press the "**UP**" or "**DOWN**" keys to scroll through and enter the **CONFIGURATION** menu by briefly pressing the "**SET**" key.

Press the "**UP**" or "**DOWN**" keys briefly to select the desired parameter:

- Set time (hours, minutes, exit)
- 12h
- 24h
- Exit

Change the desired parameter by briefly pressing the "**SET**" key.



2.10 Rear-view mirrors

- Lock the locking nut of the mirror on the lower part of the handlebar.

- Keeping the nut locked, unscrew the mirror and remove it, collecting the washers.

LIST OF TOPICS

Technical specifications

3.1 Regulations

This section describes general safety rules for any maintenance operations performed on the vehicle.

3.2 Safety specifications

- Should it be necessary to keep the engine running while servicing, make sure that the area or room is well ventilated, and use special exhaust fans, if required. never let the engine run in an enclosed area. Exhaust gasses are toxic.
- The battery electrolyte contains sulphuric acid. Protect your eyes, clothes and skin. Sulphuric acid is highly corrosive; in the event of contact with your eyes or skin, rinse thoroughly with abundant water and seek immediate medical attention.
- The battery produces hydrogen, a gas that can be highly explosive. Do not smoke and avoid sparks or flames near the battery, especially when charging it.
- Fuel is highly flammable and it can be explosive given some conditions. Do not smoke in the working area, and avoid naked flames or sparks.
- Clean the brake pads in a well-ventilated area, directing the jet of compressed air carefully to avoid the risk of inhaling dust produced by worn friction material. Even though the latter contains no asbestos, inhaling dust is harmful.

3.3 maintenance instructions

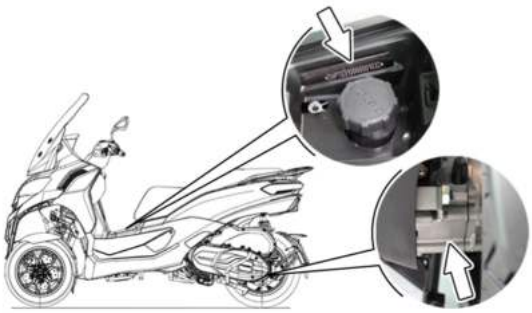
- Use original PIAGGIO spare parts and lubricants recommended by the Manufacturer. Non-original or non-conforming spare parts may damage the vehicle.
- Use only the special tools designed for this vehicle.
- Always use new gaskets, seal rings and cotter pins when reassembling.
- After removal, clean the components using non-flammable or low flash point solvent. Lubricate all the work surfaces, except tapered couplings, before refitting these parts.
- After reassembly, check that all components have been installed properly and that they are in good working order.
- For removal, overhaul and reassembly operations use only tools provided with metric measures. Metric bolts, nuts and screws are not interchangeable with coupling members with English measurement. Using unsuitable coupling members and tools may damage the vehicle.
- Should any interventions to the vehicle electrical system be required, check that the electrical connections – especially earth and battery connections – have been implemented properly.

3.4 vehicle identification

The identification registration number consists of a prefix followed by a number stamped on both the chassis and the engine.

These numbers must always be quoted in the spare parts requests.

We recommend checking that the frame registration number stamped on the vehicle corresponds with that on the vehicle documentation.

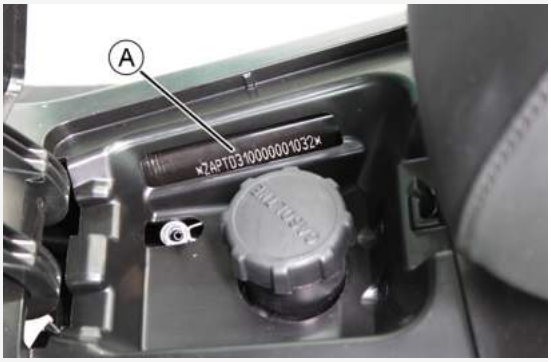


ATTENTION

NOTE THAT ALTERING SERIAL NUMBERS MAY BE PUNISHABLE WITH SEVERE LEGAL PENALTIES (IMPOUNDING OF VEHICLE, ETC.).

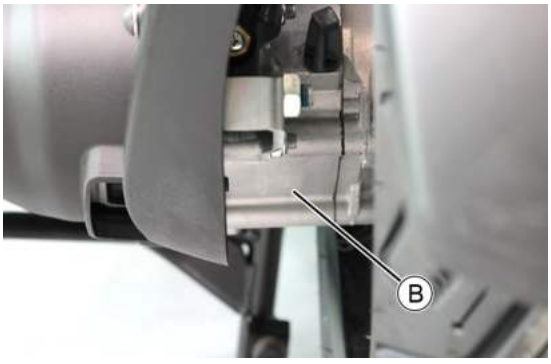
Frame number

To read the frame number "**A**", open the fuel tank cap access door and lift the flap of the fuel tank.



Engine number

The engine number «**B**» is stamped near the rear left shock absorber lower support.

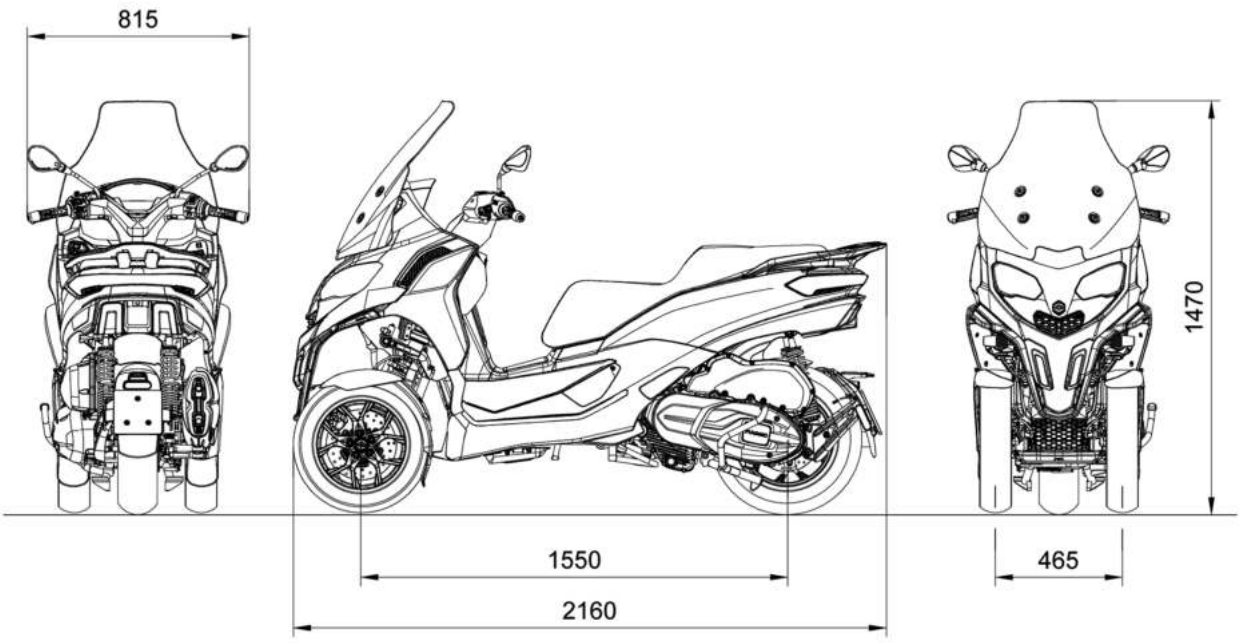


VEHICLE IDENTIFICATION

CHARACTERISTIC	DESCRIPTION / VALUE
Chassis prefix	ZAPTD3101

CHARACTERISTIC	DESCRIPTION / VALUE
Engine prefix	TD31M

3.5 Vehicle Information



CHARACTERISTIC	DESCRIPTION / VALUE
Chassis	In tubes and steel sheet metal
Front suspension	Rolling system composed of a universal joint composed of aluminium rods and of two side tubes and shock absorbers with a hydraulic lock system
Rear suspension	Two gas shock absorbers with pre-load adjustment.
Front brake	Dual 258 mm hydraulically operated disc brakes controlled from RH handlebar lever; braking assisted by ABS system.
Rear brake	Ø 240 mm hydraulically operated disc brake controlled from LH handlebar lever; braking assisted by ABS system.

CHARACTERISTIC	DESCRIPTION / VALUE
Integral braking system	A hydraulic system allowing the rider to operate all three brake discs simultaneously from the pedal on the foot board; braking assisted by ABS system.
Wheel type	Light alloy.
Front wheel rims	13" x 3.00
Rear rim	14” x 4.50
Front tyres	Tubeless 110/70 - 13" 48S
Rear tyre	Tubeless 140/70 - 14" 68S
Front tyre pressure	2 bar
Rear tire pressure (with passenger)	2.4 (2.6) bar
Kerb mass	280 kg
Maximum technically permissible weight at full load	460 kg
Battery	12V - 12Ah

3.6 Engine data

CHARACTERISTIC	DESCRIPTION / VALUE
Type	Single cylinder 4-stroke
Engine capacity	530 cm³
Bore x Stroke	97.5 x 71 mm
Compression ratio	11,5 ± 0,5 : 1
Idle engine speed	1,600 ± 100 rpm
Timing	Four valves, single overhead camshaft, chain-driven.
Valve clearance (cold)	Intake: 0.15 mm Exhaust: 0.15 mm
Max. power	33.0 kW at 7,250 rpm
MAX. torque	51.0 Nm at 5,250 rpm

CHARACTERISTIC	DESCRIPTION / VALUE
Transmission	CVT expandable pulley continuously variable transmission with torque server, V-belt, self-ventilating dry automatic centrifugal clutch and transmission housing with forced-circulation air cooling. Electrically operated reverse gear.
Final drive reduction gear	Gear reduction unit in oil bath.
Lubrication	Engine lubrication with lobe pump (inside crankcase), chain-driven, with double filter: mesh and paper.
Cooling	Forced coolant circulation system.
Ignition	Electric
Ignition	High efficiency inductive electronics integrated with injection, variable advance, separate H.V. coil and double spark plug.
Ignition advance	Three-dimensional map managed by control unit
Spark plug	NGK MR7BI-8 / MR8BI-8
Electrode gap	0.7-0.9 mm
Power feed	Electronic injection with electric fuel pump.
Fuel	Unleaded gasoline E10 (95 R.O.N.)
Exhaust silencer	Absorption type with catalytic converter and lambda probe.
Emissions compliance	EURO 5+

3.7 Capacity

CAPACITY

CHARACTERISTIC	DESCRIPTION / VALUE
Engine oil	1.7 l
Transmission oil	250 cm³
Cooling system liquid - replacement	~ 1.8 l

CHARACTERISTIC	DESCRIPTION / VALUE
Fuel tank	13.7 ± 0.5 l

3.8 Tightening torques

FRONT BRAKE

DESCRIPTION	TORQUE
Brake calliper pipe fitting on side steering pipe	25 - 28 Nm
Calliper-pipe fitting	20 to 25 Nm
Brake pump - pipe fitting	20 to 25 Nm
Callipers fitting screw	22 ÷ 27 Nm
Screw tightening calliper to support	20 to 25 Nm
Oil bleed screw	8 to 12 Nm
Front brake disc screws	9 ± 1 Nm
Front brake calliper fixing screw	22.5 ± 2.5 Nm
Front brake calliper-Shock absorber support	22.5 ± 2.5 Nm

REAR BRAKE

DESCRIPTION	TORQUE
Parking brake transmission adjustment nut	10 Nm
Rear brake calliper-pipe fitting	20 to 25 Nm
Brake pump - pipe fitting	20 to 25 Nm
Rigid / flexible pipe fitting	13 - 18 Nm
Rear brake disc screws	5 - 6.5 Nm
Rear brake calliper fixing screws	41.5 to 51.5 Nm
Pipe support bracket fastening screws	6 to 8 Nm
Rear brake calliper tube fixing screws	6 - 10 Nm
Parking brake - Screw used to fasten callipers to the support	24 - 27 Nm
Rear brake calliper fixing screw	42.5 ± 2.5 Nm

INTEGRAL BRAKE PEDAL

DESCRIPTION	TORQUE
Brake pump - pipe fitting	20 to 25 Nm

DESCRIPTION	TORQUE
Screw fastening the brake pedal to the chassis	20 to 25 Nm
Screw fastening the integral brake fluid tank	1 - 1.7 Nm

ABS SYSTEM

DESCRIPTION	TORQUE
Pipe fittings - ABS control unit	19 - 21 Nm
Pipe fittings - ABS electronic brake force distribution	20 to 25 Nm
Screws used to fasten the ABS control unit to the support	6 - 10 Nm
ABS stiff piping support plate fastening screws	4 - 6 Nm
ABS control unit support fastening screws	6 - 10 Nm
ABS sensors fastening screws	6 - 10 Nm

FRONT SUSPENSION

DESCRIPTION	TORQUE
Fixing nuts for constant-velocity universal joints	18 ÷ 20 Nm
Roll lock calliper - Bracket	10 ± 2 Nm
Steering arm pin nut	20 to 25 Nm
Lower shock absorber clamp	19 - 26 Nm
Shock absorber upper clamp	19 - 29 Nm
Clamp for sliding stem locking device	6.5 ÷ 10.5 Nm
Electric motor - roll lock device	12 ± 1 Nm
Pump pin - Roll lock device	12 ± 1 Nm
Pump - roll lock device	12 ± 1 Nm
Fastening that secures the potentiometer to the anti-roll device	8 to 10 Nm
Fastening that secures the sensor to the anti-roll device	2,5 ÷ 2,9 Nm
Side headstock lower ring nut	4.5 ÷ 5.5 Nm
Side headstock upper ring nut	31,5 ÷ 38,5 Nm
Pressure switch to the distributor	18 ÷ 20 Nm
Anti-roll device pump fitting	20 to 25 Nm

DESCRIPTION	TORQUE
Suspension lock calliper pipe fitting on side steering pipe	25 - 28 Nm
Slew rings retaining bracket tube terminals	7 to 11 Nm
Screw fixing sliding stem to shock absorber	45 - 50 Nm
Arm coupling screws	47.5 ± 2.5 Nm
Screws used to fasten the arms to the side columns	47.5 ± 2.5 Nm
Screws used to fasten the arms to the central column	47.5 ± 2.5 Nm
Linkage arms coupling flange fastening screws	20 to 25 Nm
Front wheel fastening screws	19 to 24 Nm
Roll brake disc sector fastening screws	22.5 ± 2.5 Nm
Gear motor crankcase halves coupling screws	12 ± 1 Nm

REAR SUSPENSION

DESCRIPTION	TORQUE
Rear shock absorber - Chassis	42.5 ± 2.5 Nm
Rear shock absorber - Engine	42.5 ± 2.5 Nm
Shock-absorber/guard coupling bracket	20 to 27 Nm
Rear wheel axis	104 - 126 Nm
Silencer arm fastening screw	27 ÷ 30 Nm

STEERING

DESCRIPTION	TORQUE
Steering lower ring nut (central headstock)	10 - 12 Nm
Steering upper ring nut (central headstock)	22,5 ÷ 25 Nm
Handlebar fixing screw	50 - 55 Nm
Screws used to fasten the control unit jumper cables to the handlebars	7 - 10 Nm

CHASSIS

DESCRIPTION	TORQUE
Swing arm regulator bushing	5 - 7 Nm
Engine arm - chassis arm pin	32.5 ÷ 40 Nm

DESCRIPTION	TORQUE
Swing arm regulator bushing nut	54 - 60 Nm
Engine-swinging arm bolt	98 ÷ 118 Nm
Frame-swinging arm bolt	54 - 60 Nm
Central stand bolt	31 ÷ 39 Nm

SILENCER

DESCRIPTION	TORQUE
Silencer heat shield fastening screw	4 to 5 Nm
Screw used to fasten silencer to supporting arm	27 ÷ 30 Nm
Lambda probe tightening on exhaust manifold	20 ÷ 30 Nm
Manifold/silencer joint tightening torque	12 - 14 Nm
Manifold - silencer diaphragm tightening clamp	15.5 ÷ 18.5 Nm

THROTTLE CONTROL TRANSMISSIONS

DESCRIPTION	TORQUE
Transmission adjustment nuts	5 - 6 Nm
Throttle body cover fastening screw	6 - 10 Nm

BRAKE DISC

DESCRIPTION	TORQUE
New rear disc thickness	5 mm
Disc thickness at wear limit (rear)	3.5 mm

CHARACTERISTIC	DESCRIPTION / VALUE
Max. axial run-out	0.1 mm
Friction material minimum thickness	1.5 mm
Brake pad pin	17.5 ± 2.5 Nm
Parking brake calliper screw	25.5 ± 1.5 Nm

CHARACTERISTIC	DESCRIPTION / VALUE
Thickness of a new front disc	4.0 mm
Disc thickness at wear limit (front)	3.5 mm

CHARACTERISTIC	DESCRIPTION / VALUE
Cooling system	~ 1.8 l

DESCRIPTION	TORQUE
Lower tank fastening - Chassis	6.0 ± 1.0 Nm
Upper tank fastening- Chassis	6.0 ± 1.0 Nm
Rdiator upper crosspiece - Frame	5.5 ± 1.5 Nm
Radiator - Radiator upper crosspiece	9.5 ± 1.5 Nm

ENGINE

DESCRIPTION	TORQUE
Tank lower crosspiece - Frame	25.0 ± 5.0 Nm
Rear hub cover screws	24 - 27 Nm
Hub oil drain screw	15 - 17 Nm
Support screws with bulkhead	0.3 ÷ 0.4 Nm
Pump cover fixing screws	3 - 4 Nm
Starter screws	11 to 13 Nm
Counterweight screw	7 ÷ 8.5 Nm
Valve lifter weight stop washer fastening screws	12 ± 1 Nm
Valve Register	8 ± 1 Nm

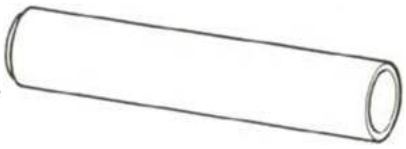
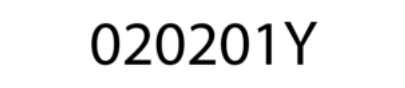
LIST OF TOPICS

Specific tools

4.1 Tools

CODE	DESCRIPTION	IMAGE
001330Y	Tool for fitting steering seats	
001467Y002	Driver for OD 73 mm bearing	
001467Y006	Pliers to extract 20 mm bearings	
001467Y007	Bearing housing, external ø 54 mm	
001467Y008	Calliper to extract ø 17-mm bearings	

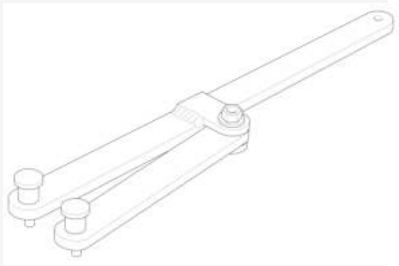
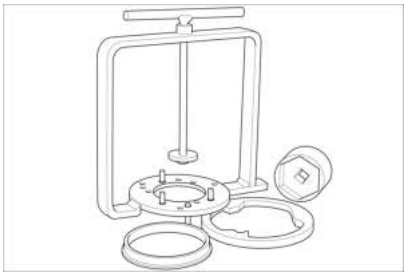
CODE	DESCRIPTION	IMAGE
001467Y014	Calliper to extract ø 15-mm bearings	
001467Y017	Bearing housing, external ø 39 mm	
001467Y031	Bell	
001467Y034	Calliper to extract ø 15-mm bearings	
001467Y035	Bearing housing, external ø 47 mm	

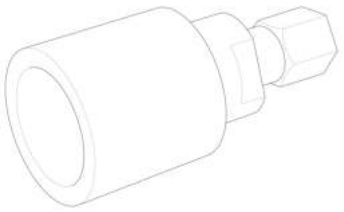
CODE	DESCRIPTION	IMAGE
006029Y	Punch for fitting steering bearing on the steering tube	
020004Y	Punch for removing steering bearings from headstock	
020055Y	Wrench for steering tube ring nut	
020193Y	Oil pressure gauge	
020201Y	Spacer bushing driving tube	

CODE	DESCRIPTION	IMAGE
020306Y	Punch valve seal rings fitting	
020335Y	Magnetic mounting for dial gauge	
020357Y	32 x 35-mm Adaptor	
020358Y	37 x 40 mm Adaptor	

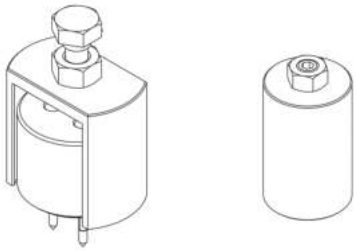
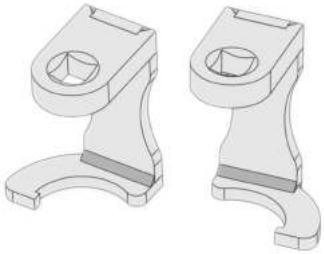
CODE	DESCRIPTION	IMAGE
020359Y	42 x 47 mm Adaptor	
020360Y	52 x 55 mm adaptor	
020364Y	25-mm guide	
020376Y	Adaptor handle	
020382Y012	bush (valve removing tool)	

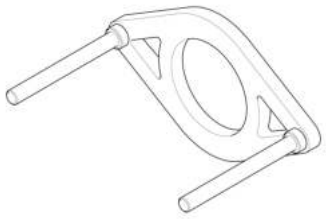
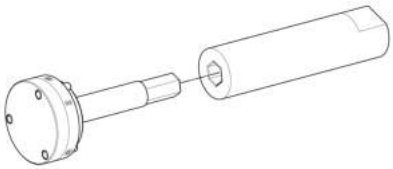
CODE	DESCRIPTION	IMAGE
020412Y	15-mm guide	
020424Y	Driven pulley roller casing fitting punch	
020431Y	Valve oil seal extractor	
020434Y	Union for oil pressure measurement	
020439Y	17-mm guide	

CODE	DESCRIPTION	IMAGE
020442Y	Engine pulley lock wrench 125 cc	
020444Y	Tool for FITTING/removing clutch on/from driven pulley	
020456Y	Adapter 24 mm	
020458Y	Puller for lower bearing on steering tube	
020459Y	Punch for fitting the bearing on the steering tube	

CODE	DESCRIPTION	IMAGE
020467Y	Flywheel puller tool	
020470Y	Tool for fitting the pin locking stops	
020472Y	Flywheel lock tool	
020475Y	Piston position checking tool	
020476Y	Stud bolt set	

CODE	DESCRIPTION	IMAGE
020479Y	Countershaft lock wrench	
020480Y	Fuel pressure measurement kit	
020483Y	30-mm guide	
020512Y	Piston fitting fork	
020604Y011	Fitting adapter	-
020648Y	Single battery charger	

CODE	DESCRIPTION	IMAGE
020565Y	Flywheel lock calliper spanner	
020661Y	Water pump overall seal replacement kit	
020674Y	Piston mounting ring Ø 95 mm	
020892Y	Steering side headstock ring nut key	
021017Y	PADS EOBD E5 diagnostics cable	

CODE	DESCRIPTION	IMAGE
021022Y	Driven pulley stop	
021023Y	Reverse lock ring spanner	
021024Y	Control bushing stopper wrench	
021999Y	PADS 4.0	

LIST OF TOPICS

Maintenance

5.1 General section - Maintenance

ADJUSTING THE REAR GAS SHOCK ABSORBERS

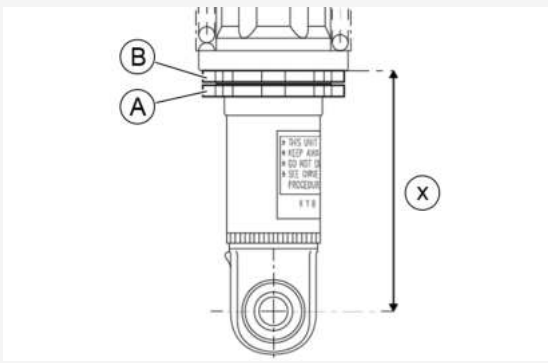
To adjust the rear gas shock absorbers pre-load proceed as follows:

1. Use the specific wrench for adjusting shock absorbers, inserting it from the bottom and connecting two teeth of the ring nut.
2. Unscrew the lower ring nut «**A**» spacing it a few millimetres from the top ring nut.
3. Turn the adjusting ring nut «**B**» until reaching the specified values.
4. Tighten the lower ring nut «**A**» bringing it in contact with the top ring nut and tighten it.

Specified values«x»

Position 1 minimum pre-load; rider only: **100 - 105 mm**

Position 2 maximum pre-load; rider, passenger and luggage: **119 mm**



CAUTION

RIDING THE VEHICLE WHEN THE SPRING PRE-LOAD HAS NOT BEEN SET-UP CORRECTLY FOR THE RIDER, AND THE POTENTIAL LOAD, COULD REDUCE THE COMFORT OF THE RIDE AND THE PRECISION OF THE STEERING.

CAUTION

WE RECOMMEND WEARING GLOVES WHILE CARRYING OUT THIS OPERATION IN ORDER TO AVOID INJURIES.

CAUTION

IT IS ABSOLUTELY FORBIDDEN TO ADJUST THE PRE-LOAD DIFFERENTLY ON THE TWO SHOCK ABSORBERS.

CAUTION

CARRY OUT THE ADJUSTMENT WITH THE SILENCER COLD AND USING SUITABLE GLOVES AND PROTECTIVE CLOTHING.

N.B.:

THE TWO TEETH ON THE WRENCH ALLOW YOU TO USE IT FOR EACH POSITION INDICATED IN THE FIGURE, IN BOTH DIRECTIONS.

MAINTENANCE ICON RESET

For each time the ignition key is turned to "**ON**", once the instrument panel has performed the initial check, if the value of the remaining kilometres until the next intervention is less than 300 Km (186.41 mi), the indicated icon will flash for 5 seconds.

Once the scheduled service mileage is reached, each time the key is turned to "**ON**", the icon remains solidly lit until the scheduled service is carried out.

Follow these steps to reset the service icon:

- select the "**BATTERY**" function.

- Press the **"SET"** key for more than 10 seconds.
- When the button is released, the corresponding maintenance step is reset and the icon disappears.

ADJUSTMENT PROCEDURE OF THE RING NUTS OF THE SIDE HEADSTOCKS

To adjust the tightening of the side headstock ring nuts proceed as follows:

- Remove the windscreen and the top fairing.

- - Remove the front shield.

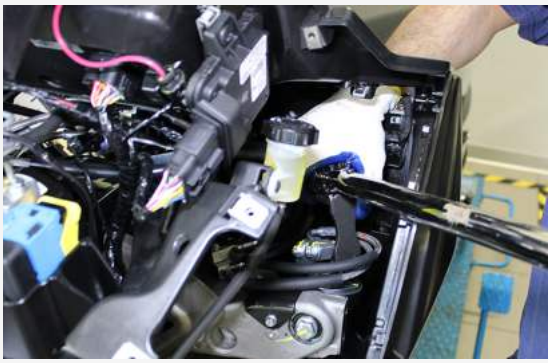
Using the special tool, proceed as follows:

- Loosen the ring nut.
- Tighten the lower ring nut to the prescribed torque.

DESCRIPTION	TORQUE
Side headstock lower ring nut	4.5 ÷ 5.5 Nm

- Manually screw the upper ring nut until it stops.
- Tighten the upper ring nut to the prescribed torque.

DESCRIPTION	TORQUE
Side headstock upper ring nut	31,5 ÷ 38,5 Nm



- Restore the body of the vehicle.

5.2 Maintenance Table

SCHEDULED MAINTENANCE TABLE

Km x 1.000 (mi x 1.000)	1 (0.6)	10 (6.2)	20 (12.4)	30 (18.6)	40 (24.8)	50 (31)	AT 12 MONTHS	AT 24 MONTHS	AT 36 MONTHS	AT 48 MONTHS
Safety fasteners	I	I		I		I				
Spark plugs		R	R	R	R	R				
Centre stand		L	L	L	L	L	L	L	L	L
Roll lock calliper control cable		A	A	A	A	A				
Drive belt		R	R	R	R	R				
Diagnos by tool	I	I	I	I	I	I	I	I	I	I
Air filter and gaskets		R	R	R	R	R				
Engine oil filter	R	R	R	R	R	R	R	R	R	R
Valve clearance			A		A					
Clutch unit		I	I	I	I	I				

Km x 1.000 (mi x 1.000)	1 (0.6)	10 (6.2)	20 (12.4)	30 (18.6)	40 (24.8)	50 (31)	AT 12 MONTHS	AT 24 MONTHS	AT 36 MONTHS	AT 48 MONTHS
Sliding shoes / CVT rollers		R	R	R	R	R				
Driven pulley - roller casings		I	I	I	I	I				
Electrical system and Battery	I	I	I	I	I	I				
Brake system	I	I	I	I	I	I	I	I	I	I
Coolant	I	I	I	I	I	I	I	R	I	R
Brake fluid (1)	I	I	I	I	I	I	R	I	R	I
Engine oil	R	R	R	R	R	R	R	R	R	R
Hub oil	R	I	R	I	R	I	I	I	I	I
Headlight direction adjustment		I		I		I				
Brake pads	I	I	I	I	I	I	I	I	I	I
Tire pressure and wear	I	I	I	I	I	I	I	I	I	I
Test drive	I	I	I	I	I	I	I	I	I	I
Suspension		I	I	I	I	I	I	I	I	I
Central and side steering bearings	A	A	A	A	A	A	I	I	I	I
Steering linkage		I	I	I	I	I	I	I	I	I

Km x 1.000 (mi x 1.000)	1 (0.6)	10 (6.2)	20 (12.4)	30 (18.6)	40 (24.8)	50 (31)	AT 12 MONTHS	AT 24 MONTHS	AT 36 MONTHS	AT 48 MONTHS
Transmi		I	I	I	I	I	I	I	I	I
Labour time (minutes)	110	165	270	165	270	165	80	50	80	50

- (**I**): CHECK AND CLEAN, ADJUST, LUBRICATE OR REPLACE, IF NECESSARY
- (**C**): CLEAN
- (**R**): REPLACE
- (**A**): ADJUST
- (**L**): LUBRICATE
- **(1) CAUTION: failure to do so may result in a complete loss of the brake system functionality.**

N.B.:

☞

AT EACH SCHEDULED SERVICE, USE THE DIAGNOSTIC TOOL TO CHECK FOR ERRORS AND CHECK THAT ALL PARAMETERS ARE CORRECT.

ENSURE THAT THE VEHICLE CALIBRATION IS UP TO DATE AFTER UPDATING THE DIAGNOSTIC TOOL.

5.3 Recommended Products

Piaggio Group recommends the use of products from its Castrol official partner for the scheduled maintenance of its vehicles.

Only use lubricants and fluids which meet or exceed the performance characteristics specified. This also applies when topping up only.

TABLE OF RECOMMENDED PRODUCTS

PRODUCT	DESCRIPTION	SPECIFICATIONS
5W-40 engine oil	Synthetic-based lubricant for four-stroke engines.	SAE 5W-40; JASO MA, MA2; API SL; ACEA A3
75W-140 transmission oil	Synthetic lubricant for gearboxes and transmissions.	SAE 75W-140, API GL-5

PRODUCT	DESCRIPTION	SPECIFICATIONS
DOT 4 brake fluid	Synthetic brake fluid.	SAE J 1703; FMVSS 116; ISO 4925; CUNA NC 956 DOT4
Anti-freeze liquid, ready to use, colour red	Glycol ethylene based antifreeze liquid with organic additive technology corrosion inhibitor. Colour red, ready to use.	ASTM D 3306 - ASTM D 4656 - ASTM D 4985 - CUNA NC 956-16
Lubricating grease	Yellow-brown lithium-based, medium-fibre grease suitable for a variety of uses.	ISO L-X-BCHA 3 - DIN 51 825 K3K -20
Water-repellent spray grease	Water repellent stringy calcium spray grease.	White spray grease based on NLGI 2 calcium complex soap; ISO-L-XBCIB2

5.4 Spark plug

This engine has two spark plugs.

- Remove the hatch located on the left-hand side fairing of the vehicle by unscrewing the fixing screw "**A**" and using a small screwdriver on the rear notch.

Proceed as follows:

1. Disconnect the caps «**B**» of the HV cables of the spark plugs;
2. Undo the spark plugs with the specific spark plug spanner;
3. When reassembling, place the spark plugs in their hole with the correct inclination and screw it in completely by hand;
4. Use a wrench only to secure it;
5. Insert the caps «**B**» on the spark plugs all the way to the bottom;
6. Insert the caps «**B**» on the spark plugs all the way to the bottom;

WARNING

THE SPARK PLUGS MUST BE DISMANTLED WHEN THE ENGINE IS COLD. SPARK PLUG MAINTENANCE IS DESCRIBED IN THE SCHEDULED MAINTENANCE TABLE. THE USE OF ELECTRONIC CENTRAL UNITS AND OF NON-COMPLIANT ELECTRONIC IGNITIONS OR SPARK PLUGS OTHER THAN THOSE PRESCRIBED MAY SERIOUSLY DAMAGE THE ENGINE.

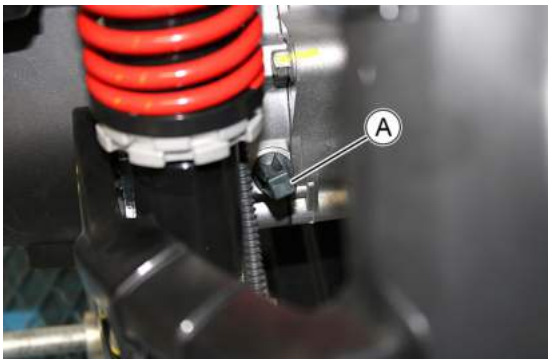
N.B.:

USING SPARK PLUGS OTHER THAN THE INDICATED TYPE OR SHIELD-LESS SPARK PLUG CAPS CAN CAUSE ELECTRICAL SYSTEM FAILURES.

5.5 Hub oil check

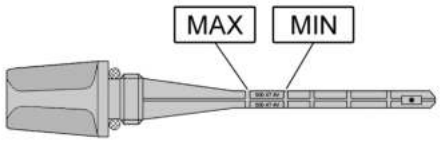
- Rest the vehicle on its centre stand on level ground.

- Unscrew the dipstick «**A**», dry it with a clean rag and then reinsert it, **screwing it tightly into place**.



- Extract the dipstick checking that the oil level is between the **MAX** and **MIN** index marks; if the level is below the **MIN** mark, it needs to be filled up with the right amount of hub oil.

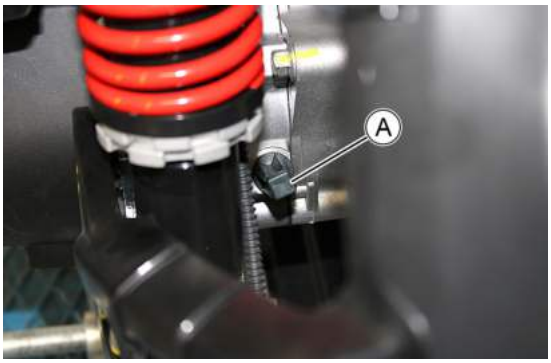
-Screw up the oil dipstick again and make sure it is locked properly into place.



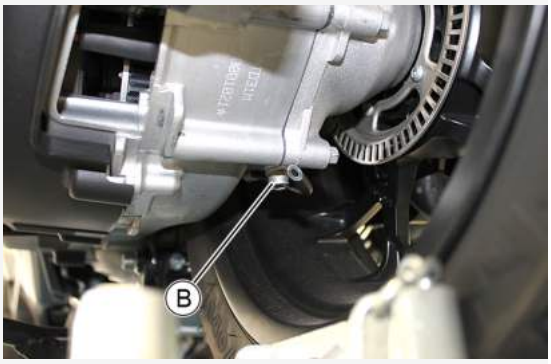
PRODUCT	DESCRIPTION	SPECIFICATIONS
75W-140 transmission oil	Synthetic lubricant for gearboxes and transmissions.	SAE 75W-140, API GL-5

5.6 Hub oil change

- Remove the oil filler cap "**A**".
- Unscrew the oil drainage cap «**B**» and drain out all the oil.



- Screw the drainage cap back on and fill the hub with the prescribed oil.



PRODUCT	DESCRIPTION	SPECIFICATIONS
75W-140 transmission oil	Synthetic lubricant for gearboxes and transmissions.	SAE 75W-140, API GL-5

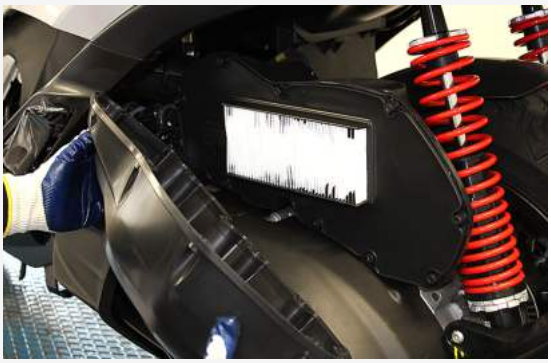
CHARACTERISTIC	DESCRIPTION / VALUE
Transmission oil	250 cm³

5.7 Air filter

To remove the air filter, proceed as follows:

- Unscrew and remove the air filter cover fixing screws.

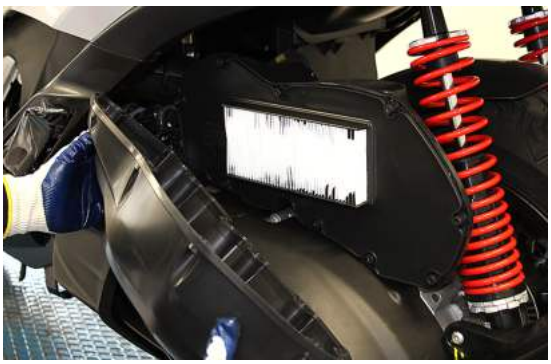
- Remove the filter box cover.



- Remove the filter element.

- Check the condition of the rubber gaskets on the profile of the filter box and the cover.
- Replace the gaskets if it shows cuts and/or cracked.

- Insert a new filter element in its seat.



- Fit the cover.
- Tighten the fastening screws of the air filter box cover.

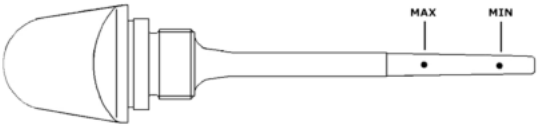
5.8 Engine oil

In four-stroke engines, the engine oil is used to lubricate the timing elements, the bench bearings and the head-engine block-piston assembly.

An insufficient quantity of oil can seriously damage the engine.

In all four stroke engines, the deterioration of the oil characteristics, or a certain consumption should be considered normal, especially if during the run-in period.

Consumption levels in particular can be influenced by the conditions of use (e.g.: oil consumption increases when driving at "full throttle".



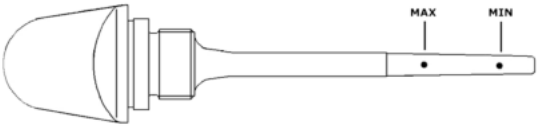
5.9 Engine oil change

Change oil and replace filter as indicated in the scheduled maintenance table.

- Empty the engine by draining the oil through drainage plug «**B**».

- To facilitate oil drainage, loosen the cap/ dipstick «**A**».

- Once all the oil has drained through the drainage hole, unscrew the oil cartridge filter and remove it.
- Make sure the pre-filter and drainage plug O-rings are in good conditions.
- Lubricate them and refit the mesh filter and the oil drainage plug, screwing them up to the prescribed torque.
- Refit the new cartridge filter being careful to lubricate the O-ring before fitting it.
- Change the engine oil. Since a certain quantity of oil still remains in the circuit, engine oil must be added through plug «**A**».
- Then start up the vehicle, leave it running for a few minutes and switch it off: after about five minutes check the level and if necessary top up without exceeding the MAX level.
- The cartridge filter must be replaced every time the oil is changed.



Use new oil of the recommended type for topping up and changing purposes.

PRODUCT	DESCRIPTION	SPECIFICATIONS
5W-40 engine oil	Synthetic-based lubricant for four-stroke engines.	SAE 5W-40; JASO MA, MA2; API SL; ACEA A3

5.10 Engine oil check

This operation must be carried out with the engine cold and following the procedure below:

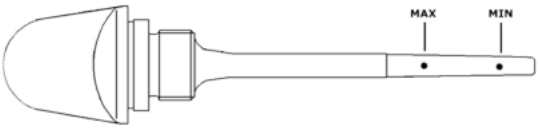
- Place the vehicle on its centre stand and on flat ground.
- Unscrew the cap/dipstick «**A**», dry it with a clean cloth and reinsert it, **screwing it all the way down**.
- Unscrew the cap/dipstick «**A**», dry it with a clean cloth and reinsert it, **screwing it all the way down**.
- Remove the cap/dipstick again and check that the level is between the min and max marks; top-up, if required.

If the check is carried out after the vehicle has been used, and therefore with a hot engine, the level will be lower; in order to carry out a correct check, wait at least 10 minutes after the engine has been stopped so as to get the correct level.

Engine oil top-up

The oil should be topped up after having checked the level and should **never exceed the MAX. level**.

Restoration of the level from **MIN** to **MAX** requires approximately **400 cc**.



PRODUCT	DESCRIPTION	SPECIFICATIONS
5W-40 engine oil	Synthetic-based lubricant for four-stroke engines.	SAE 5W-40; JASO MA, MA2; API SL; ACEA A3

5.11 Engine oil filter

Change oil and replace filter as indicated in the scheduled maintenance table.

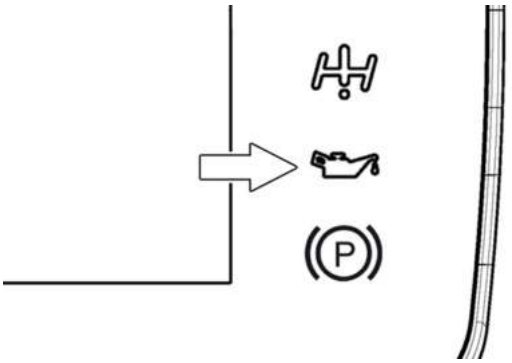
- Use new oil of the recommended type for topping up and changing purposes.
- Make sure the pre-filter and drainage plug O-rings are in good conditions.
- Lubricate them and refit the mesh filter and the oil drainage plug, screwing them up to the prescribed torque.
- Refit the new cartridge filter being careful to lubricate the O-ring before fitting it.
- Change the engine oil.

5.12 Oil pressure warning light

The vehicle is equipped with a tell-tale light on the instrument cluster that lights up when the key is turned to the «**ON**» position.

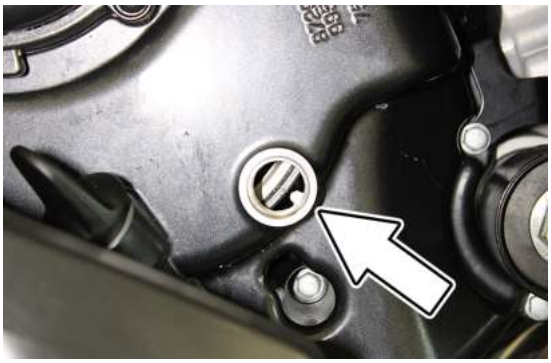
However, this light should come off once the engine has been started.

If the light turns on during braking, at idling speed or while turning a corner, it is necessary to check the oil level and the lubrication system.



5.13 Distribution timing check

- Remove the plastic cap from the flywheel cover.



- Turn the flywheel until the reference mark on the rotor corresponds with the reference mark on the flywheel cover as shown in the figure (PMS).
- Make sure that the 4V reference point on the camshaft control pulley is aligned with the reference mark on the big end. If the reference is opposite the indicator on the head, turn the crankshaft once more.

5.14 Valve clearance check

Checking the valve clearance should be carried out according to the scheduled maintenance table.

- Place the vehicle on a suitable axle so that the rear wheel can be locked.
- Disconnect the battery cables.
- Remove the luggage racks, the rear side fairings and the footrests.
- Place a pantograph lift under the vehicle.

- Unscrew the fixing screws of the transmission compartment cooling cover.

- Remove the transmission compartment cooling cover.

- Unscrew the inspection cap on the flywheel side cover.

- Loosen the ignition spark plug and turn the crankshaft so as to align the reference marks on the flywheel with the crankcase.

- Unscrew the fixing screw of both rear shock absorbers.

- Unscrew and remove the fixing screw of the rear brake pipe.

- Using the lifting device, lift the body of the vehicle, the engine rotates slightly between the rear wheel and the swingarm.
- The head rises upward, thus increasing the space between the tappet cover and the canister.
- Unscrew and remove the tappet cover fixing screws.

- Remove the tappet cover.

- Check the alignment of the reference on the big end with the one on the timing sprocket.

- Using a feeler gauge, check the clearance between the adjuster and the valve.

CHARACTERISTIC	DESCRIPTION / VALUE
Intake valve clearance (cold)	0.15 mm
Exhaust valve clearance (cold)	0.15 mm

- If an incorrect value is found, adjust it back to the prescribed value.

- Fit the tappet cover.
- Insert the special screws complete with the damper pad.
- Tighten the fixing bolts to the specified locking torque in order 1-2-3-4.

- Insert and tighten the rear brake pipe fixing screw.

- Using the lifting device, lower the vehicle until the lower coupling of the rear shock absorbers is aligned with the relative couplings on the engine.
- Insert and secure the mounting bolts of both shock absorbers to the specified locking torque.

- Insert and tighten the inspection cap on the flywheel side cover.

- Fit the transmission compartment cooling cover.
- Refit the footrests, the rear side fairings and the luggage racks.
- Connect the battery cables.

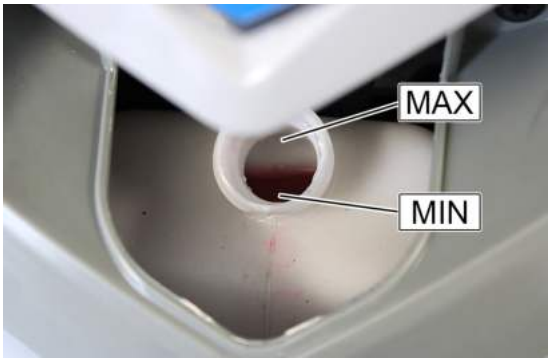
5.15 Cooling system

Check coolant level when the engine is cold as indicated in the scheduled maintenance table, following the steps below:

- Place the vehicle on its centre stand and on flat ground.
- Unscrew the screw shown in the figure and remove the expansion tank cover.

- Unscrew and remove the plug.

- - If the fluid level is near or below the MIN level edge. The liquid level must always be between the MIN and MAX levels.
- The coolant consists of an ethylene glycol and corrosion inhibitor based demineralised water- antifreeze solution mix.



CAUTION

DO NOT EXCEED THE MAX. LEVEL WHEN FILLING SO AS TO AVOID THE COOLANT ESCAPING FROM THE EXPANSION TANK WHEN THE VEHICLE IS IN USE.

Recommended products

PRODUCT	DESCRIPTION	SPECIFICATIONS
Anti-freeze liquid, ready to use, colour red	Glycol ethylene based antifreeze liquid with organic additive technology corrosion inhibitor. Colour red, ready to use.	ASTM D 3306 - ASTM D 4656 - ASTM D 4985 - CUNA NC 956-16

5.16 Level check

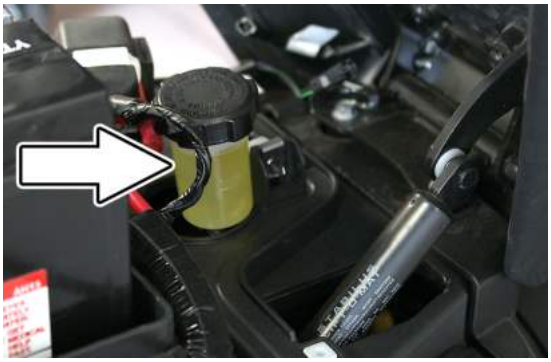
FRONT AND REAR BRAKING SYSTEM LEVEL CHECK

The front and rear brake fluid reservoirs are both positioned on the handlebar. Proceed as follows:

- Rest the vehicle onto its centre stand, with the handlebar centred.
- Check the fluid level through the sight glass. A drop in the brake fluid level may be caused by pad wear.

INTEGRAL BRAKING SYSTEM LEVEL CHECK

- Rest the vehicle on its centre stand on level ground.
- Remove the inspection cover and check that the brake fluid inside the reservoir is not below the recommended level.



5.17 Top-up

FRONT AND REAR BRAKING SYSTEM TOPPING UP

For both brake pumps, proceed as follows:

- Loosen the two fixing screws and remove the reservoir cover; top-up with the recommended fluid and without exceeding the maximum mark.

Under standard climatic conditions, replace fluid as indicated in the scheduled maintenance table.

WARNING

ONLY USE DOT 4-CLASSIFIED BRAKE FLUID. BRAKE CIRCUIT FLUID IS HIGHLY CORROSIVE: DO NOT LET IT COME INTO CONTACT WITH PAINTED PARTS.

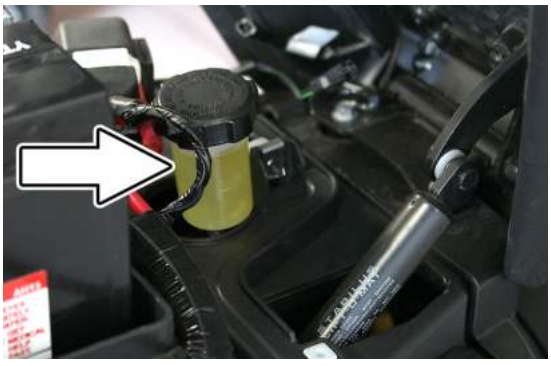
CAUTION

AVOID CONTACT OF BRAKE FLUID WITH EYES, SKIN, AND CLOTHING. IN CASE OF ACCIDENTAL CONTACT, RINSE WITH WATER.

PRODUCT	DESCRIPTION	SPECIFICATIONS
DOT 4 brake fluid	Synthetic brake fluid.	SAE J 1703; FMVSS 116; ISO 4925; CUNA NC 956 DOT4

INTEGRAL BRAKING SYSTEM LEVEL TOPPING UP

- Remove the inspection cover, unscrew the tank cap and top up using the recommended product.
- If there is air in the circuit, bleed the system.



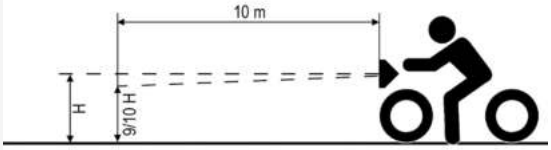
PRODUCT	DESCRIPTION	SPECIFICATIONS
DOT 4 brake fluid	Synthetic brake fluid.	SAE J 1703; FMVSS 116; ISO 4925; CUNA NC 956 DOT4

5.18 Headlight adjustment

Proceed as follows:

- Position the unloaded vehicle, in running order and with the tyres inflated to the prescribed pressure, onto a flat surface 10 m away from a half-lit white screen; make sure the vehicle axis is perpendicular to the screen.
- Remove the upper cover from the leg shield.

- Turn on the headlight and check that the limit of the projected light beam is not higher than 9/10 or lower than 7/10 of the height of the centre of the headlight from the ground.



N.B.:

IN COMPLIANCE WITH LOCAL LEGAL REQUIREMENTS, SPECIFIC PROCEDURES MUST BE FOLLOWED WHEN CHECKING LIGHT BEAM ADJUSTMENT.

- To adjust the height of the light beam, use the screws indicated.

- The headlamp light beam toe-in/toe-out can be adjusted.

- To proceed with the adjustment, use the two screws indicated.

5.19 Anti-evaporating system

The vehicle is equipped with the "Canister", main component of the system for the control of evaporative emissions, compliant with the current standards.

A. Fuel pump

B. Fuel tank

C. Two-way fuel vapour breather valve

D. Canister

E. Air purge pipe into atmosphere

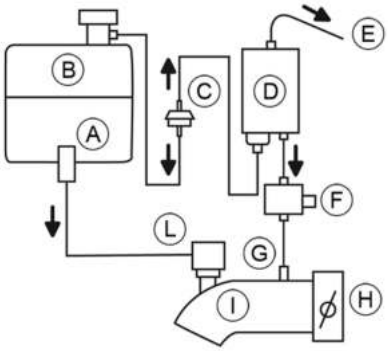
F. One-way electronic fuel vapour purge control valve (controlled by ECU)

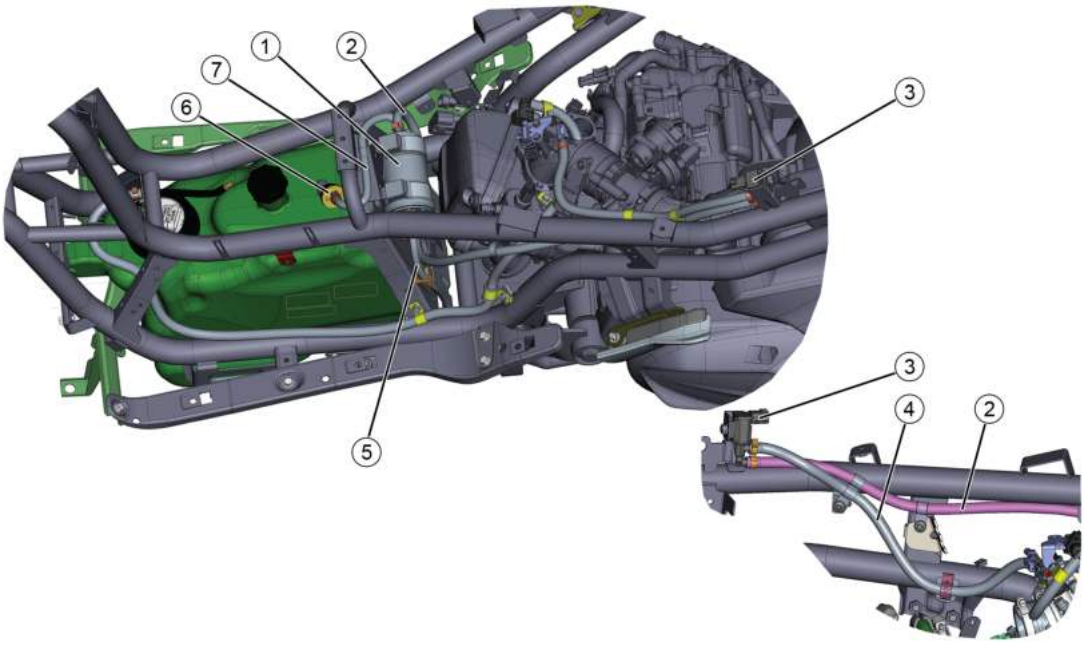
G. Vacuum connection

H. Throttle body

I. Air induction fitting

L. Injector





Key:

1.Canister

2. Pipe for connecting the solenoid valve to the canister

3. Canister solenoid valve

4. Pipe for connecting the solenoid valve to the insertion coupling

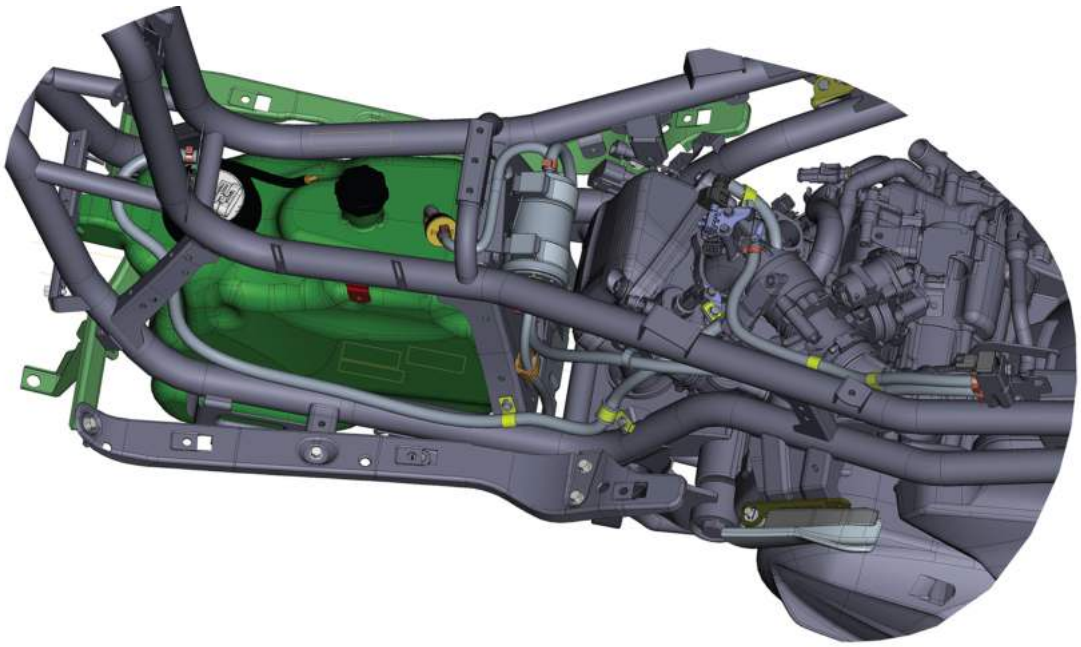
5. Purge pipe

6. Breather valve

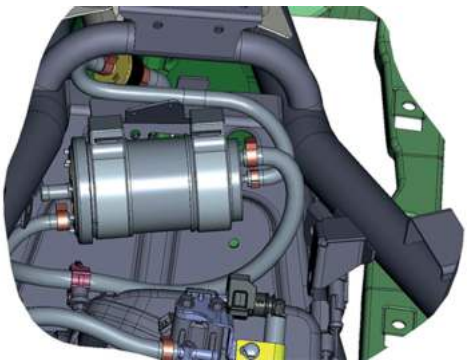
7. Pipe for connecting the fuel tank to the canister

5.20 removal of components of the evaporative emissions control system

Remove the helmet compartment and the side fairings to gain access to the components of the evaporative emissions control system.

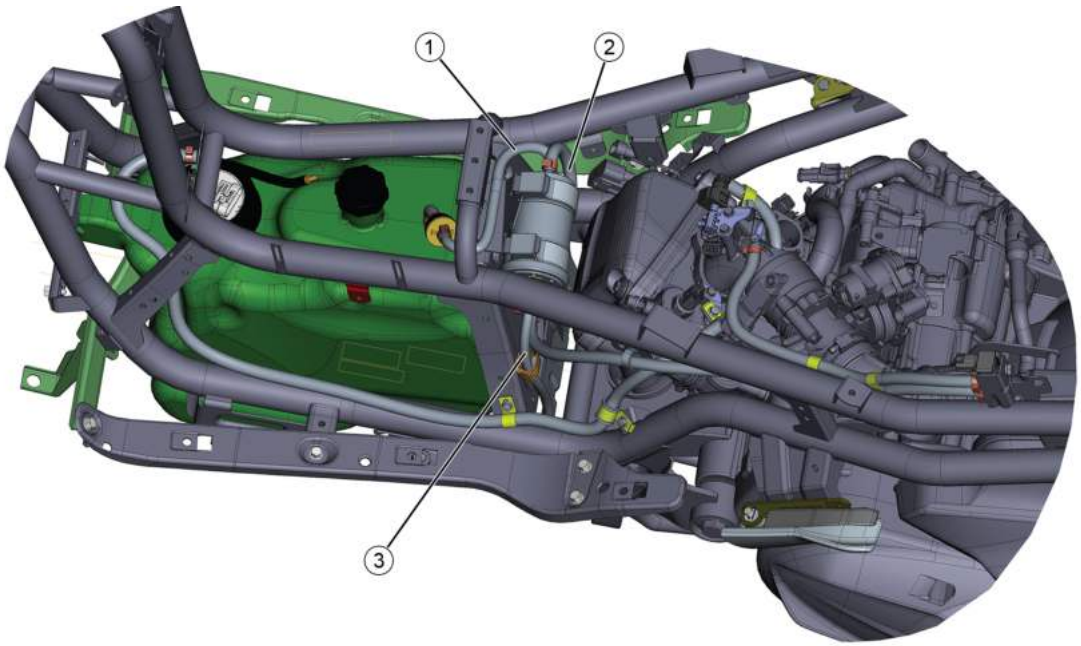


After removing the pipe fixing clamps, remove the canister from its support.



5.21 Installation of components of the evaporative emissions control system

Upon reassembling the components, use caution when connecting the pipes to the canister.



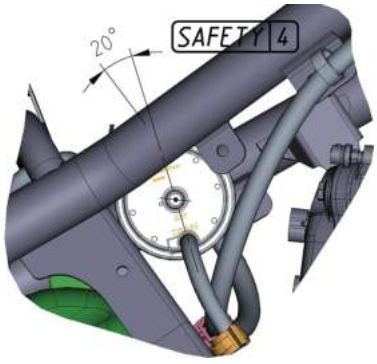
Key:

1. Pipe for connecting the fuel tank to the canister

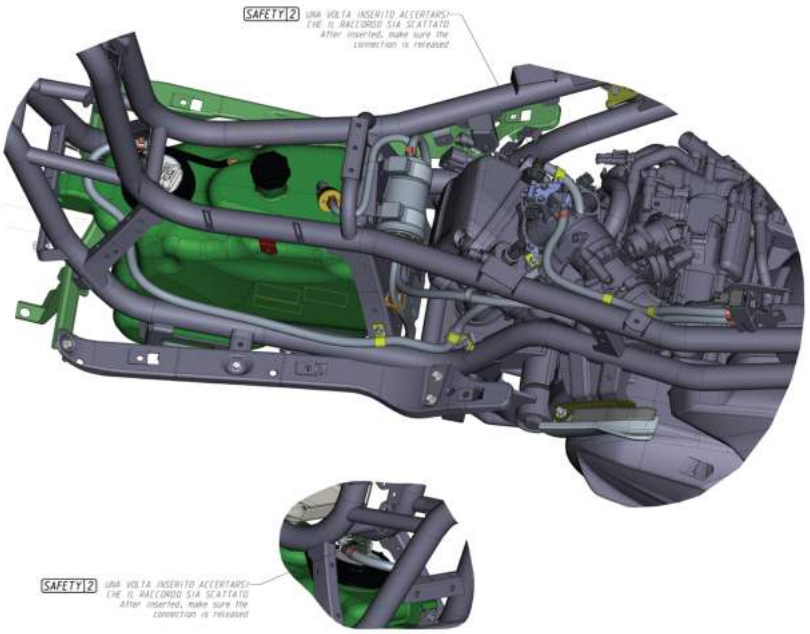
2. Pipe for connecting the solenoid valve to the canister

3. Purge pipe

- Ensure correct alignment of the canister.
- Take care of the fitting of the pipe to ensure that the fuel pipe is fitted correctly to the tank.

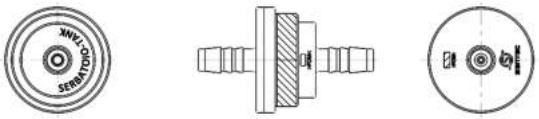


When reassembling, observe the valve alignment.

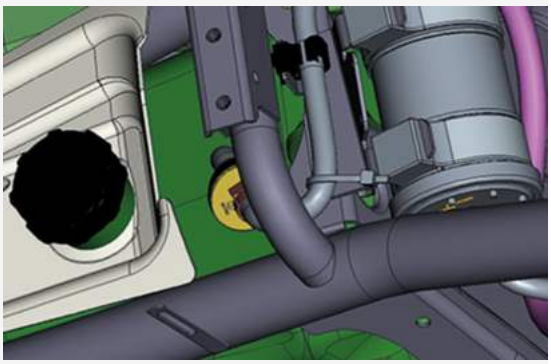


- Make sure that the orientation of the breather valve is correct.
- In the event of a malfunction, the opening pressures of the valve can be checked.
- If you detect different pressures, replace the valve.

CHARACTERISTIC	DESCRIPTION / VALUE
Colour of the valve on the tank side	BLACK
Colour of the valve on the canister side	YELLOW
Opening pressure on the tank side	110 mBar
Opening vacuum on the tank side	-10 mBar



After having installed the components, secure the pipes with new ties.



CAUTION

TAKE CARE TO ENSURE THE PROPER DIRECTION OF THE COMPONENTS' INSTALLATION: IF INSTALLED IN REVERSE, THEY COULD COMPROMISE THE FUNCTIONALITY OF THE ENTIRE EVAPORATING SYSTEM.

5.22 canister check

The canister is essential to treat the hydrocarbons present in the volume of gas that escapes from the tank when there is an increase in internal pressure (tank heating induced by the cooling radiator, by the motor or by the external environment).

Although the amount of hydrocarbons coming from the tank is small enough to avoid the saturation of the canister, it is necessary to regenerate the activated carbon by means of a reversed flow of ambient air sucked by the engine.

These vacuums of pollution and carbon regeneration take place at each cycle of use of the vehicle.

To control the canister, it is necessary to proceed with its removal while keeping the 2 pipes connected.

- Shake the Canister and make sure there is no noise.
- Using a compressed air gun, blow alternately in 3 ducts and make sure that pressure does not build inside the canister.
- Check that the air flow is kept free and that no carbon residues escape out of any pipe.

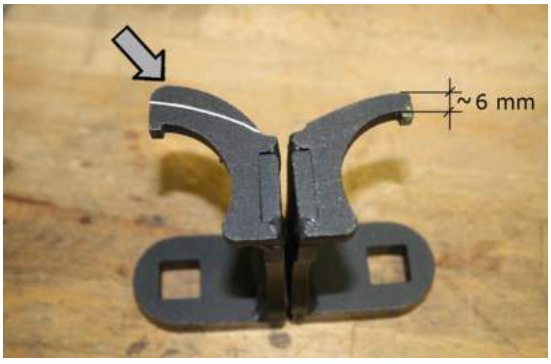
If you detect noise, clogging or loss of carbon, replace the canister.

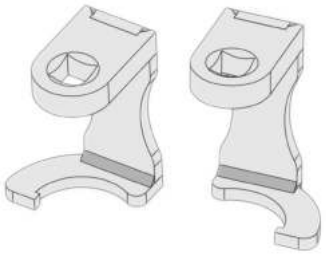
5.23 Adjustment of lateral headstock ringnuts

ADJUSTMENT OF LATERAL HEADSTOCK RINGNUTS

OPERATION TO CHANGE TOOL 020892Y

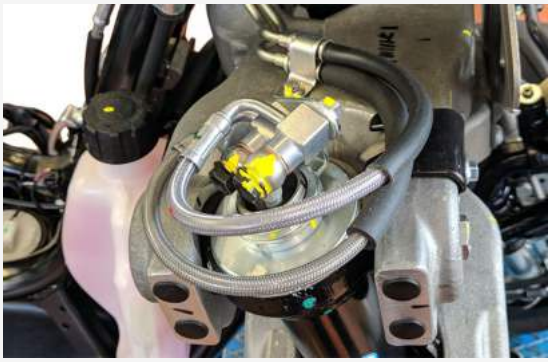
To carry out the operation described below, you must change the existing tool 020892Y, removing material as described in the photo. This operation will make the tool usable on this vehicle as well



CODE	DESCRIPTION	IMAGE
020892Y	Steering side headstock ring nut key	

Remove the leg shield back plate as described in the «Bodywork» Chapter.

Once the plastics have been remove the ring nuts of the side headstock of the front suspension can be reached.



Undo the upper ring nut.

Bring the upper ring nut to the end of the headstock thread of the side suspension

Tighten the lower ring nut to the specified torque with the appropriate key.

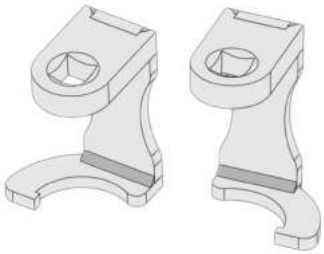
DESCRIPTION	TORQUE
Side headstock lower ring nut	5 ± 0.5 Nm

Screw the upper ring nut until it stops

Tighten upper ring nut to the specified torque with the appropriate key.

Carry out the assembly of the plastic covers in reverse order to the disassembly.

DESCRIPTION	TORQUE
Side headstock upper ring nut	35 ± 3.5 Nm

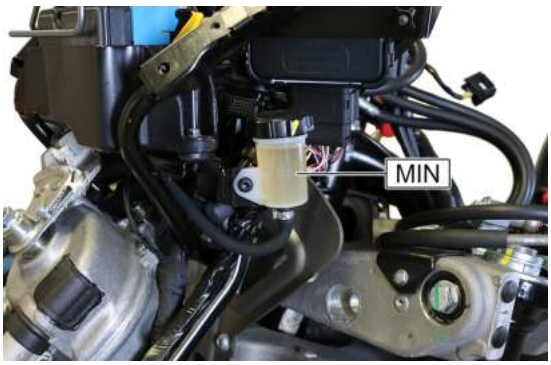
CODE	DESCRIPTION	IMAGE
020892Y	Steering side headstock ring nut key	

Check the level and top up

- To access the system tank it's necessary to remove the front shield.

- Check that the liquid level inside the tank is not below the indicated minimum level.

- If necessary, top up with the recommended product.



PRODUCT	DESCRIPTION	SPECIFICATIONS
DOT 4 brake fluid	Synthetic brake fluid.	SAE J 1703; FMVSS 116; ISO 4925; CUNA NC 956 DOT4

LIST OF TOPICS

Electrical system

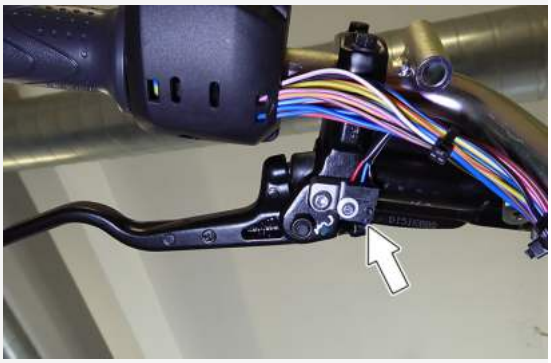
6.1 Component layout

1. Right brake lever stop switch

To access it, remove the handlebar covers.

2. Left brake lever stop switch.

To access it, remove the handlebar covers.



3. Brake pedal stop switch.

Remove the right footrest to reach it.

4. Pre-installation for heated accessories

To access it, remove the handlebar covers.

5. Ambient temperature sensor.

Located in the lower handlebar cover.

6. Key-less switch contacts

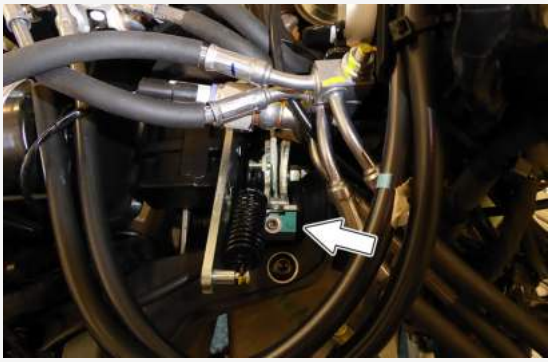
Remove the leg shield back plate to reach it.

7. PMP3

To reach it, remove the upper part of the shield.

8. Roll lock mechanical brake calliper sensor

remove the front shield to reach it.

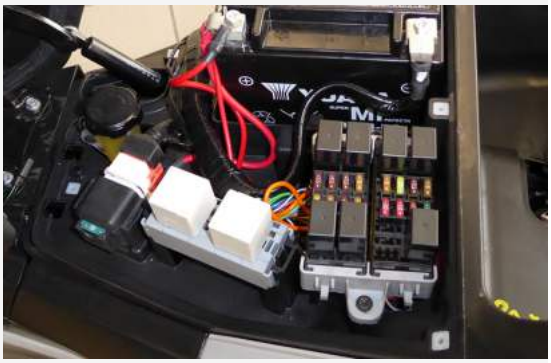


9. Roll lock hydraulic pressure sensor

remove the front shield to reach it.

10. Relays and fuses terminal block

Located under the seat, remove the battery cover to reach them.

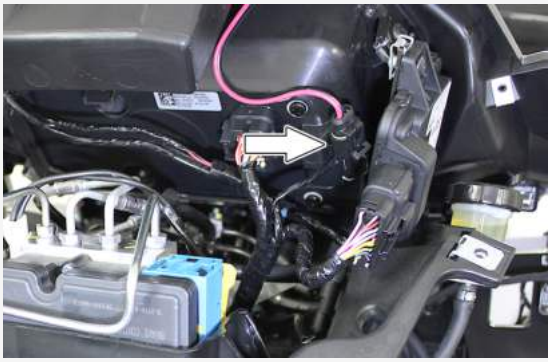


11. Turn indicators device

Located on the left side of the vehicle, remove the rear fairing to gain access.

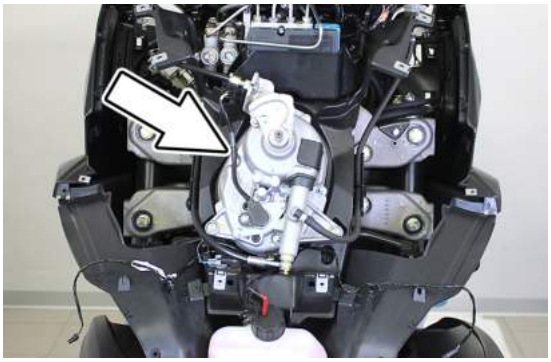
12. USB port connector

remove the front shield to reach it.



13. Roll lock gear motor

remove the front shield to reach it.



14. End-of-stroke rotary sensor

remove the front shield to reach it.

15. Parking control ECU

Remove the leg shield back plate to reach it.

16. Hand brake switch

Remove the leg shield back plate to reach it.

17. Fuel pump

Remove the central chassis cover to reach it.

18. Voltage regulator

to reach it, remove the right rear fairing.

19. Oil pressure sensor

Located on the right side of the engine.

20. H.V. coil

Located on the left side of the vehicle, to access it remove the left side fairing.

21. Tank cap opening actuator

Remove the leg shield back plate to reach it.

22. Buzzer

Remove the helmet compartment to reach it.

23. 11MP injection control unit

Located on the right side of the vehicle.

Remove the helmet compartment to reach it.

24. Rider present sensor connector

The rider presence sensor is integrated in the seat, the connector is located in the seat hinge area.

To access, lift the saddle.

25. Heated saddle pre-installation connector

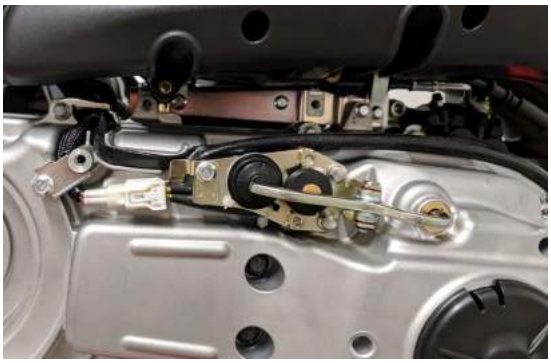
The connector is located in the seat hinge area. To access, lift the saddle.

26. ABS control unit

remove the front shield to reach it.

27. Reverse gear actuator unit

Remove the transmission protection cover to reach it.



28. Reverse gear motor

The contact box of the reverse gear motor positive cable is fastened on the left side of the vehicle, above the transmission cover.

To reach the component it is necessary however to remove the transmission cover, according to the description in chapter "Engine".

29. Electric fan

Remove the leg shield back plate to reach the connector.

30. Speed sensors.

The sensors are located on the inside of the front suspension.

31. Pre-cat lambda probe

The lambda probe is located on the exhaust manifold. Remove the right rear side fairing to access the connector.

32. Rear wheel ABS sensor

The rear wheel ABS sensor is located on the engine, between the wheel and the left rear shock absorber.

To get access to the connector, remove the helmet compartment.

33. Starter motor

Remove the helmet compartment to reach it.

34. Saddle opening actuator

Remove the side fairings to reach the component.

35. Injector

To access it, remove the inspection cover located in the helmet compartment.

36. Engine temperature sensor

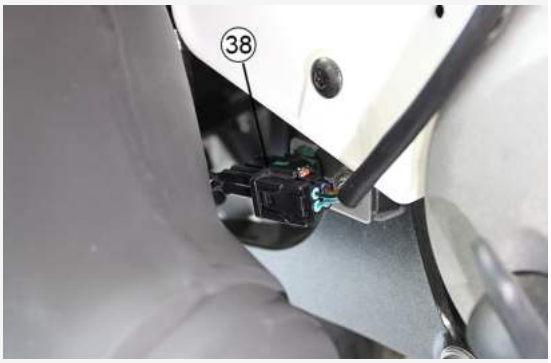
Remove the helmet compartment to reach it.

37. Demand sensor

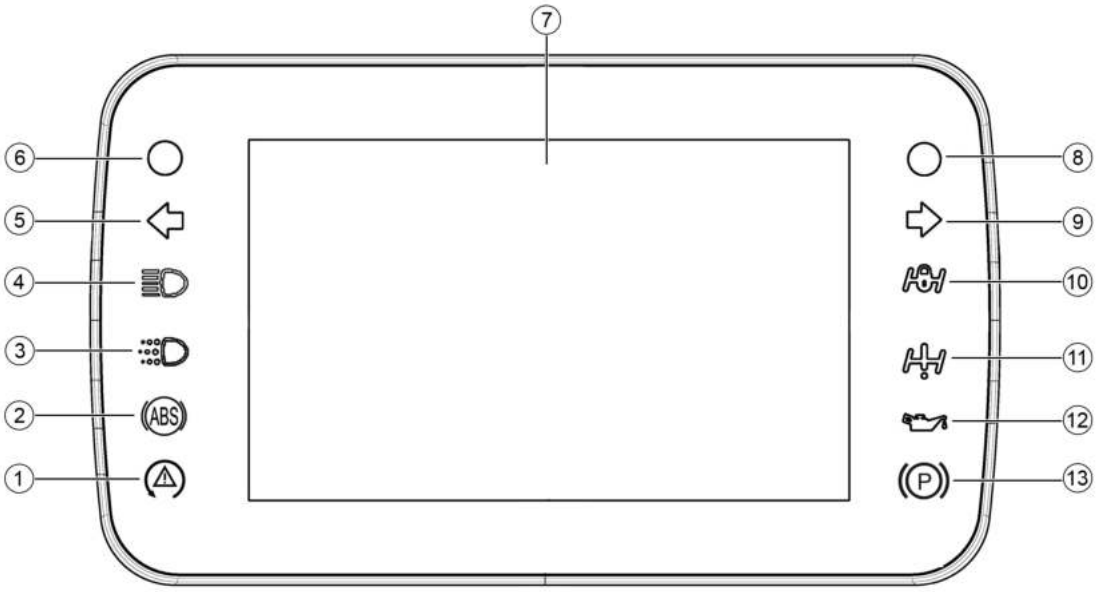
Located on the right side of the handlebar

38. Post-cat lambda probe

The lambda probe is located on the exhaust terminal. The connector is located in the area between the terminal and the engine.



6.2 Instrument cluster



Key:

1 = ASR indicator light

2 = ABS indicator light

3 = D.R.L. (Daytime Running Lights) indicator light on

4 = High beam indicator light on

5 = Left turn signal indicator light

6 = Digital display brightness sensor

7 = Digital display

8 = Immobilizer LED

9 = Right turn signal indicator light

10 = Active front suspension lock system indicator light

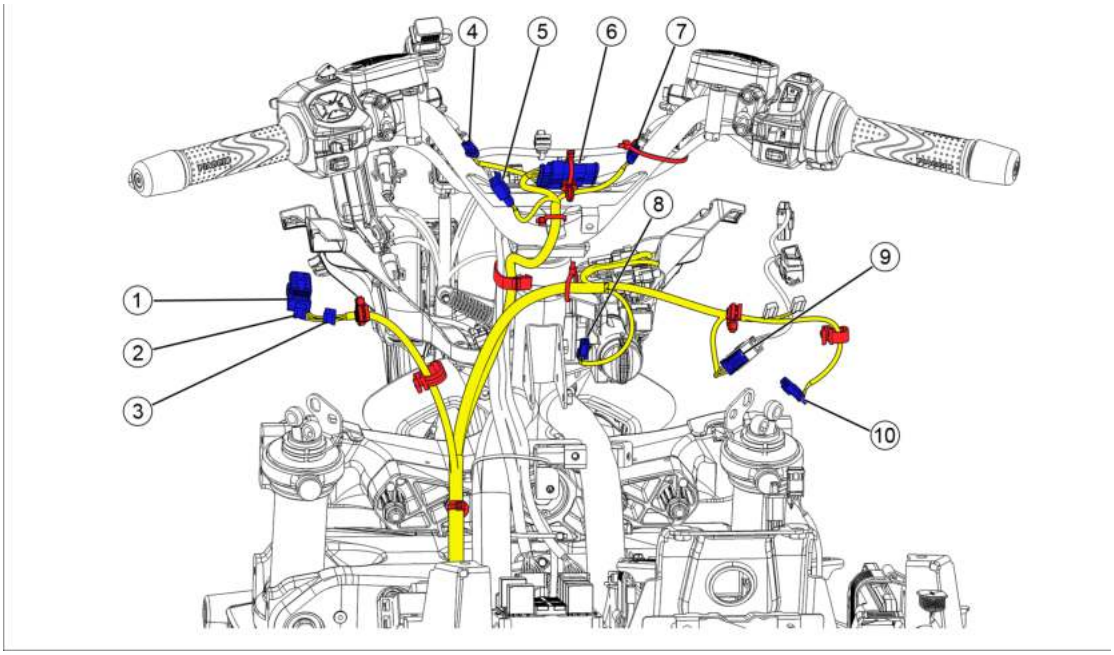
11 = Front suspension lock system malfunction indicator light

12 = Low engine oil pressure indicator light

13 = Parking brake indicator light

6.3 Electrical system installation

FRONT



1. Reverse gear selector connector

2. Saddle release switch

3. Fuel door opening button

4. Connector of the left brake pump stop switch

5. Air temperature sensor connector

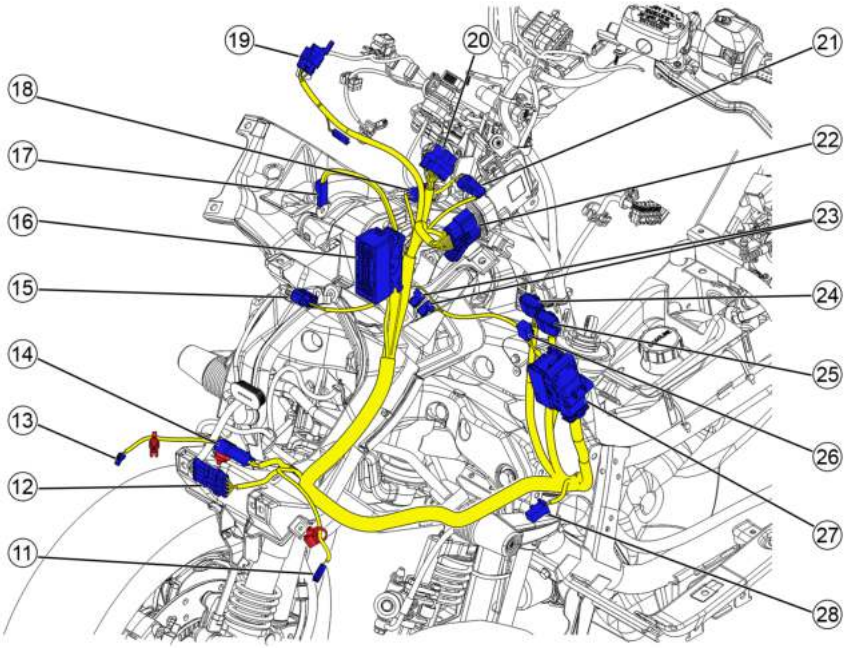
6. Heated accessories provision connector

7. Right brake pump stop switch connector

8. Parking brake sensor connector

9. Connector for DRL switch wiring harness

10. Fuel door actuator connector



11. Front left turn indicator connector

12. Front headlamp connector

13. Front left turn indicator connector

14. Gear motor connector

15. Rotary sensor connector

16. ABS control unit connector

17. ABS control unit ground connector

18. Pressure sensor connector

19. Anti-theft device pre-installation connector

20. Instrument panel connector

21. USB port connector

22. PMP3 connector

23. Horn connectors

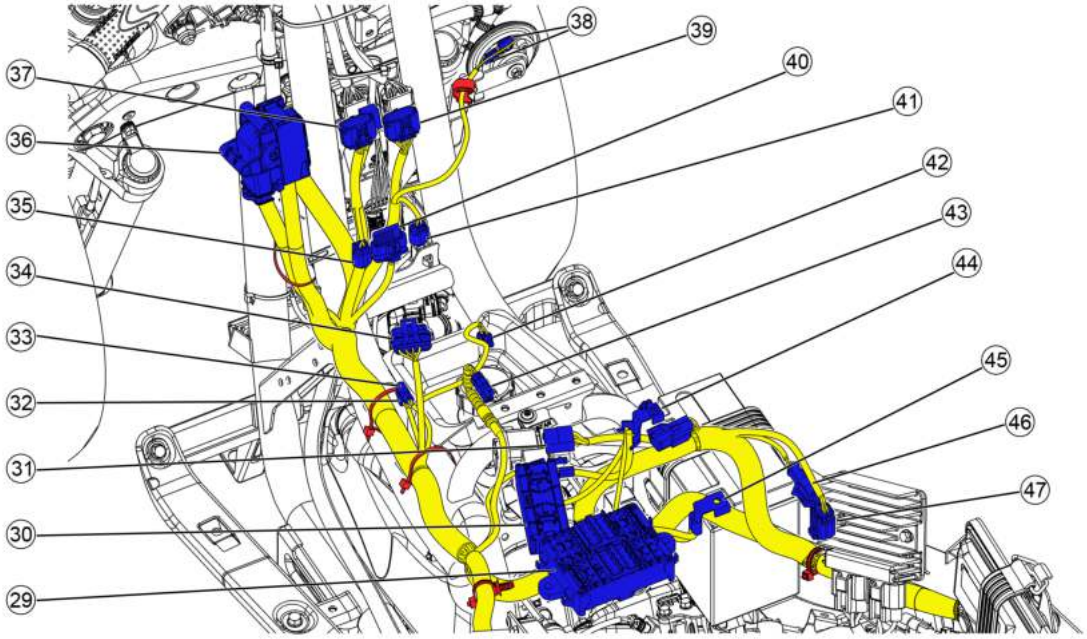
24. Right side electric device connector (BLACK)

25. Left hand electric device connector (GREY)

26. ABS sensor cable assembly connector

27. CECA control unit connector

28. Electric fan connector



29. Fuse box and micro-relay terminal block

30. Relay terminal block

31. Starter relay connector

32. Speed sensor cable connector (BLACK)

33. Speed sensor cable connector (GREY)

34. fuel pump connector

35. Left ABS sensor cable assembly connector

36. CECA control unit connector

37. Left hand electric device connector (GREY)

38. Horn connectors

39. Right side electric device connector (BLACK)

40. Demand sensor connector

41. Right ABS sensor cable assembly connector

42. Brake pedal stop switch cable connector

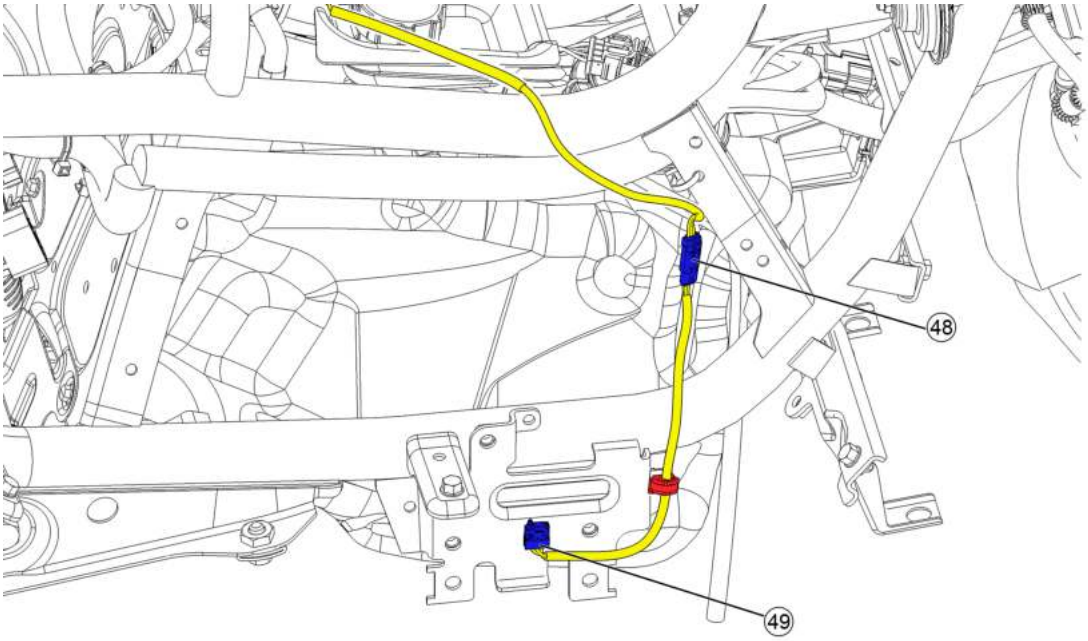
43. Rider detector sensor connector and connector for heated saddle provision

44. Battery positive connector (+)

45. Battery negative connector (-)

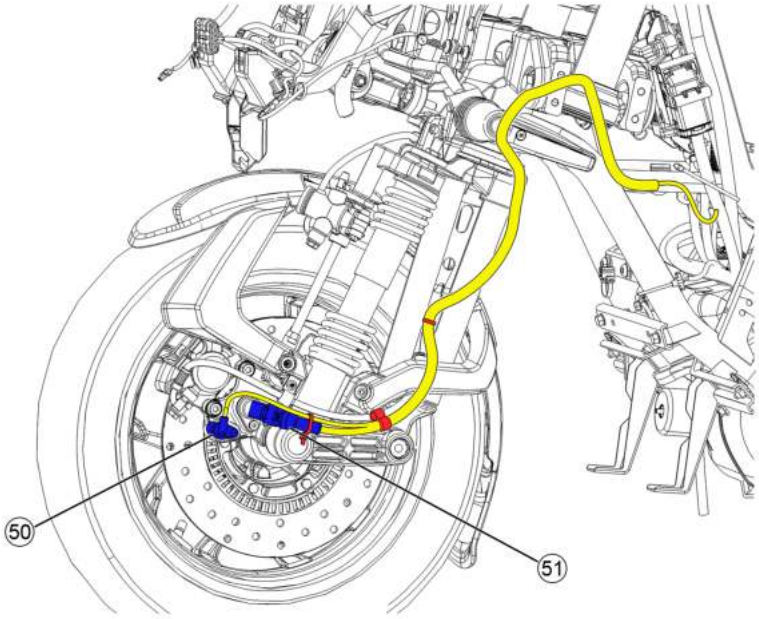
46. Diagnostics connector (CAN line)

47. OBD diagnostic socket



48. Connector between the main wiring harness and the brake pedal stop switch

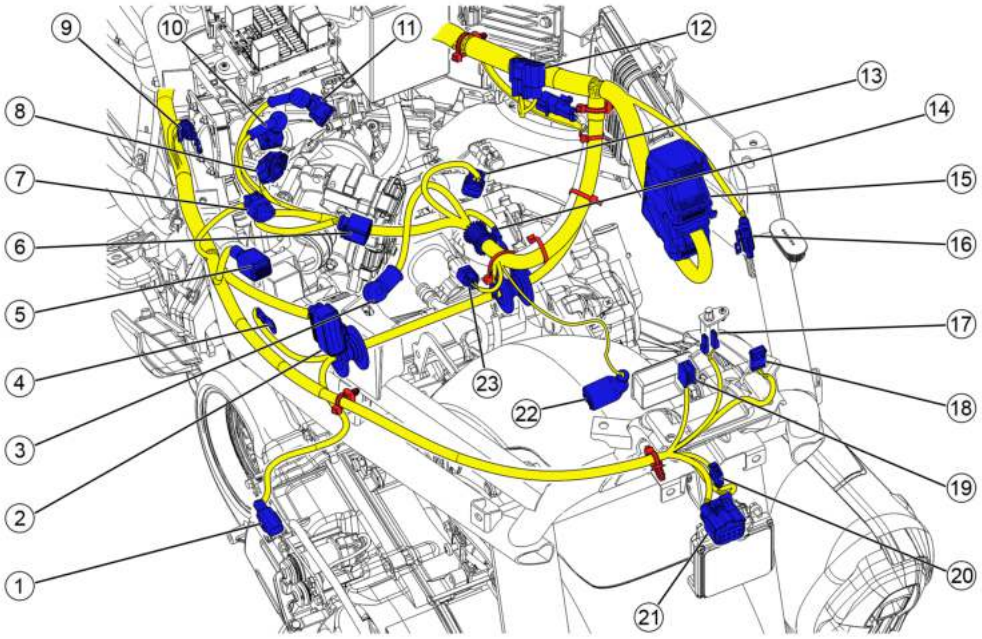
49. brake pedal stop switch



50. ABS tone wheel sensor

51. Engine speed sensor

REAR



1. reverse gear solenoid connector

2. Keyless control unit connector

3. Starter motor connector

4. Engine ground connection

5. Turn indicators device connector

6. Throttle body connector

7. Canister valve connector

8. T-Map sensor connector

9. Coil connector

10. Engine temperature sensor connector

11. Injector connector

12. Voltage regulator connector

13. Pre-catalytic converter lambda probe connector

14. Engine ground connector

15. 11MP injection ECU connector

16. Rear headlight assembly connector

17. Helmet compartment lighting switch connectors

18. Saddle opening actuator connector

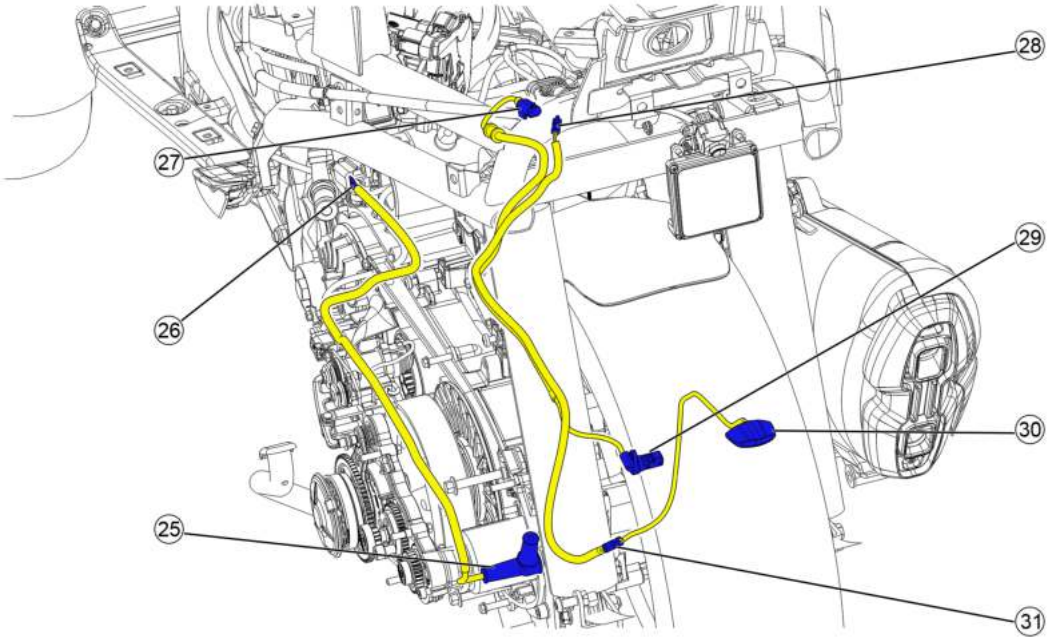
19. Helmet compartment internal light connector

20. Rear camera connector

21. Rear radar connector

22. Engine oil pressure sensor connector

23. Rear wheel ABS sensor connector



25. Reverse gear motor connector

26. Reverse gear motor wiring harness connector to the main wiring harness of the vehicle

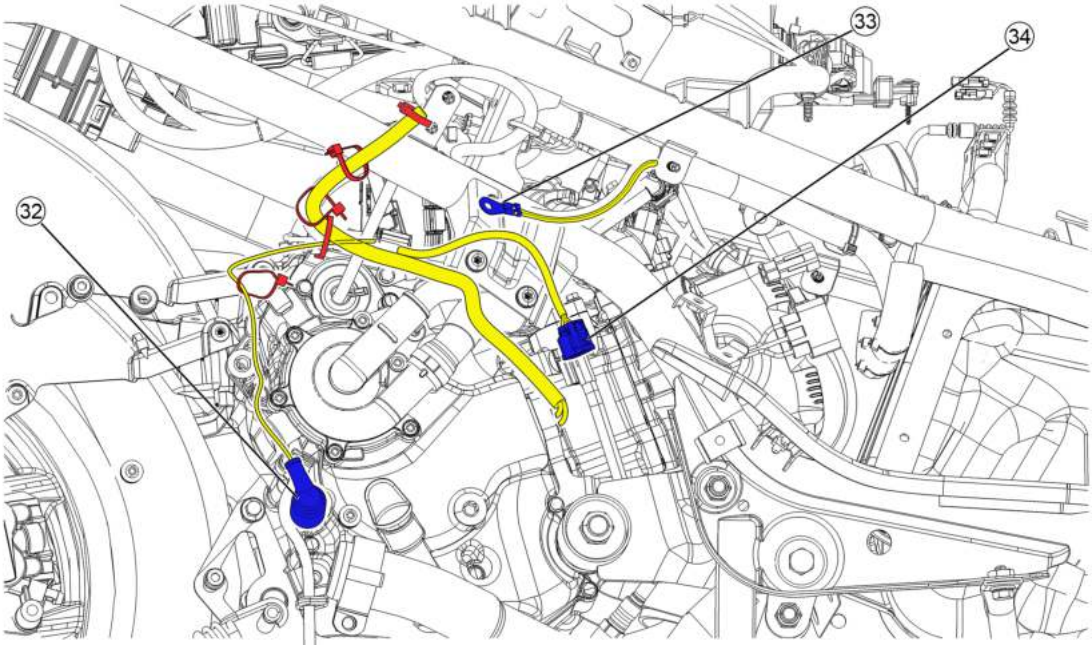
27. Rear wheel ABS sensor connector

28. Connection wiring harness connector between the licence plate light and the main wiring harness of the vehicle

29. Rear wheel ABS sensor

30. License plate light

31. Connection wiring harness connector between the licence plate light and the licence plate light



32. Engine oil pressure sensor

33. Frame ground

34. Pre-catalytic converter lambda probe connector

35. Post-cat lambda probe connector

36. Post-cat lambda probe

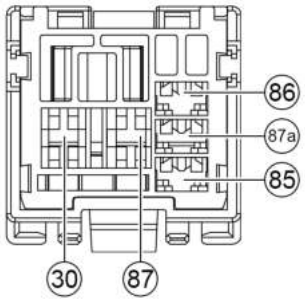
6.4 Checks and controls

This section is dedicated to the checks on the electrical system components.

6.5 remote control check

To check the operation of a relay:

1. Check that, given regular conditions, there is no continuity between terminals 87 and 30.
2. Apply a 12V voltage to power terminals 86 and 85 of the relay.
3. With the relay fed, check that there is continuity between terminals 87 and 30.
4. If these conditions are not met, the relay is surely damaged and, therefore, it should be replaced.



6.6 Battery recharge circuit

The charging circuit consists of three-phase alternator and a permanent magneto flywheel.

The alternator is directly connected to the voltage regulator.

This, in its turn, is connected directly to the ground and the battery positive terminal passing through the 30A protective fuse.

The three-phase alternator provides good recharge power and at low revs a good compromise is achieved between generated power and idle stability.

6.7 Recharge system output check

Look for any leakage

1. Access the battery by removing its cover under the saddle.
2. Check that the battery does not show signs of losing fluid before checking the output voltage.
3. Turn the ignition key to the OFF position, connect the terminals of the tester between the negative pole (-) of the battery and the black cable and only then disconnect the black cable from the negative pole (-) of the battery.
4. With the ignition switch to OFF, the reading indicated by the ammeter must be ≤ 0.5 mA.

Charging current check

1. Rest the vehicle on its centre stand.
2. With the battery correctly connected to the circuit, place the tester's leads between the battery terminals.
3. Turn on the engine, increase the engine rpm and, at the same time, measure the voltage.

Maximum current output check

- With the engine off and the panel at «ON» with the lights on, allow the battery voltage to stop at 12V.
- Connect ammeter clamp to the 2 recharge positive poles in output from the regulator.
- Start the engine and rev it up to a high engine speed while reading the value on the pincer.

CHARACTERISTIC	DESCRIPTION / VALUE
Type	Non-adjustable three-phase transistor
Voltage	14 to 15V at 5,000 rpm with lights off

6.8 Lighting system

This section lists the bulb types required for the vehicle's equipment.

BULB TABLE

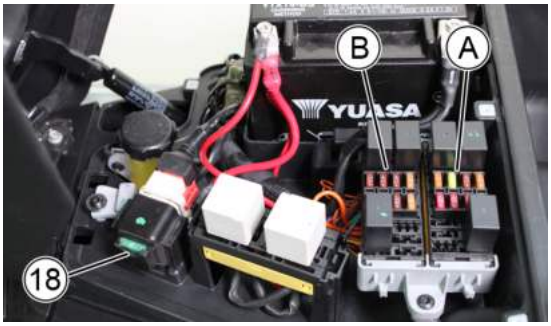
CHARACTERISTIC	DESCRIPTION / VALUE
Low beam bulb	**Type**: LED **Quantity**: 1 RH - 1 LH
High beam light bulb	**Type**: LED **Quantity**: 1 RH - 1 LH
front position lights / DRL lights bulb.	**Type**: LED **Quantity**: 1 RH - 1 LH
Front indicator light bulb	**Type**: LED **Quantity**: 1 RH - 1 LH
Rear tail light bulb	**Type**: LED **Quantity** : 1 RH - 1 LH
Rear indicator light bulb	**Type**: LED **Quantity**: 1 RH - 1 LH
Stop light bulb	**Type**: LED **Quantity** : 1 RH - 1 LH

CHARACTERISTIC	DESCRIPTION / VALUE
Licence plate light bulb	**Type**: LED **Quantity**: 1
Helmet compartment light bulb	**Type:** TORPEDO TYPE **Power:** 12V - 5W **Quantity:** 1

6.9 Fuses

The electrical system is equipped with 16 main protection fuses, divided into two fuse boxes "**A**" and "**B**", and a general fuse "**18**", located near the battery.

To access the fuses, it is necessary to lift the saddle and remove the battery cover as described in the section "**Battery**".



WARNING

BEFORE REPLACING THE BLOWN FUSE, SEARCH AND SOLVE THE PROBLEM THAT CAUSED IT TO BLOW.

NEVER TRY TO REPLACE A BLOWN FUSE WITH A FUSE OF A DIFFERENT RATING THAN THAT SPECIFIED OR USING OTHER MATERIAL (FOR EXAMPLE, A PIECE OF ELECTRICAL WIRE).

WARNING

IN ORDER TO AVOID DAMAGING THE ELECTRICAL SYSTEM, NEVER DISCONNECT THE BATTERY CABLE WHILE THE ENGINE IS RUNNING.

WARNING

IN ORDER TO AVOID DAMAGING THE ELECTRICAL SYSTEM, NEVER DISCONNECT THE BATTERY CABLE WHILE THE ENGINE IS RUNNING.

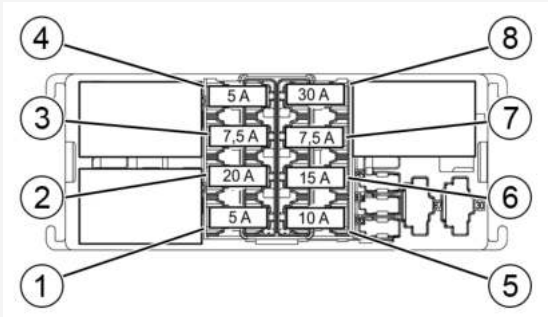
MAIN FUSE

The location and characteristics of the main fuses on the vehicle are indicated in the table.

CHARACTERISTIC	DESCRIPTION / VALUE
Fuse No. 18	**Capacity**: 30 A **Power feed**: from battery **Protected circuits (under starter switch):** fuses no 1, 2, 3, 4, 5, 6, 7 and 8 (fuse box "**B**") voltage regulator.

FUSE BOX "A"

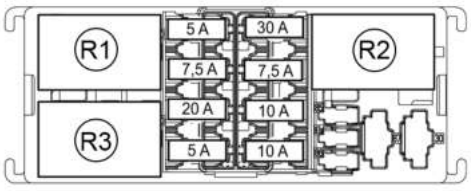
The locations and positions of the main fuses on the vehicle, situated in the fuse box "**A**", are indicated in the table.



CHARACTERISTIC	DESCRIPTION / VALUE
Fuse No. 1	**Capacity**: 5 A **Protected circuits**: power from fuse no. 1 (fuse box "**B**"); Low/high beam light switch.

CHARACTERISTIC	DESCRIPTION / VALUE
Fuse No. 2	**Capacity**: 20 A **Protected circuits**: Battery-powered; Parking electronic control unit.
Fuse No. 3	**Capacity**: 7.5 A **Protected circuits**: Battery-powered; provision for anti-theft system, provision for heated grips/saddle, diagnostic socket.
Fuse No. 4	**Capacity**: 5 A **Protected circuits**: Battery-powered; instrument panel.
Fuse No. 5	**Capacity**: 10 A **Protected circuits**: Battery-powered; Electric fan relay, electric fan.
Fuse No. 6	**Capacity**: 15 A **Protected circuits**: Battery-powered; injection load relay, engine control unit.
Fuse No. 7	**Capacity**: 7.5 A **Protected circuits**: Battery-powered; helmet compartment lighting, provision for anti-theft system, turn indicators control device (blinker), PMP3 (Piaggio Multimedia Platform) control unit, "Keyless" control unit, provision for electric case.
Fuse No 8	**Capacity**: 30 A **Protected circuits**: Battery-powered; ABS control unit.

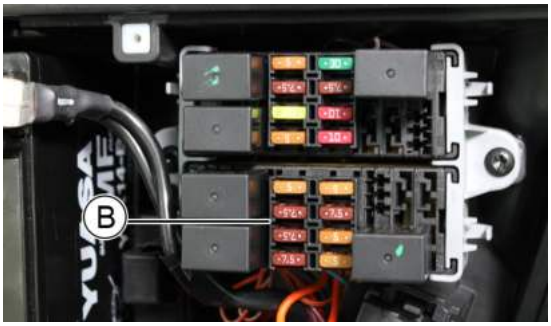
The locations and positions of the fuses situated in the fuse box "**A**", are indicated in the table.

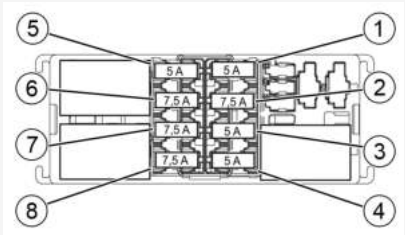


CHARACTERISTIC	DESCRIPTION / VALUE
Relay no. 1	**Circuits**: main.
Relay no. 2	**Circuits**: electric fan.
Relay no. 3	**Circuits**: Fuel pump.

FUSE BOX "B"

The locations and positions of the main fuses on the vehicle, situated in the fuse box "**B**", are indicated in the table.

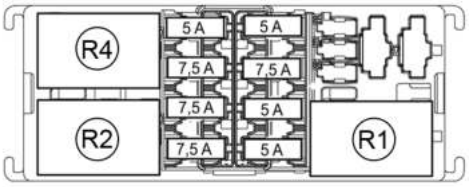




CHARACTERISTIC	DESCRIPTION / VALUE
Fuse No. 1	**Capacity**: 5 A **Protected circuits**: powered from starter switch; USB port.
Fuse No. 2	**Capacity**: 7.5 A **Protected circuits**: powered from starter switch; provision for anti-theft system, provision for heated grips/saddle, diagnostic socket.
Fuse No. 3	**Capacity**: 5 A **Protected circuits**: powered from starter switch; turn indicators (blinker) control device, hazard warning light button, turn indicator switch, PMP3 (Piaggio Multimedia Platform) control unit, provision for electric top box.

CHARACTERISTIC	DESCRIPTION / VALUE
Fuse No. 4	**Capacity**: 5 A **Protected circuits**: powered from starter switch; D.R.L. daylight running lights switch, D.R.L. daylight running lights relay, instrument cluster.
Fuse No. 5	**Capacity**: 5 A **Protected circuits**: powered from starter switch; relay for brake light, rear brake light, starter relay coil.
Fuse No. 6	**Capacity**: 7.5 A **Protected circuits**: powered from starter switch; Parking electronic control unit.
Fuse No. 7	**Capacity**: 7.5 A **Protected circuits**: powered from starter switch; “Keyless” control unit, ABS control unit, engine control unit.
Fuse No 8	**Capacity**: 7.5 A **Protected circuits**: powered from starter switch; horn button, horn, rear radar, front position lights and daylight running lights D.R.L., rear position lights, licence plate light, rear camera, instrument cluster.

The locations and positions of the fuses situated in the fuse box "**B**", are indicated in the table.



CHARACTERISTIC	DESCRIPTION / VALUE
Relay no. 1	**Circuits**: D.R.L.. daylight running lights switch.
Relay no. 2	**Circuits**: Reverse gear enable.
Relay no. 3	**Circuits**: stop lights.

6.10 Sealed battery

If the vehicle is provided with a sealed battery, the only maintenance required is the check of its charge and recharging, if necessary.

These operations should be carried out before delivering the vehicle, and on a six-month basis while the vehicle is stored in open circuit.

Besides upon pre-delivery it is therefore necessary to check the battery charge and recharge it, if required, before storing the vehicle and afterwards every six months.

INSTRUCTIONS FOR THE RENEWAL RECHARGE AFTER OPEN-CIRCUIT STORAGE

1) Voltage check

Before FITTING the battery on the vehicle, perform an open-circuit voltage check using a conventional tester.

- If voltage exceeds 12.60 V, the battery may be installed without any renewal recharge.
- If voltage is below 12.60 V, a renewal recharge is required as explained in 2).

2) Constant voltage battery charge mode

- Constant voltage charge equal to 14.40-14.70V
- Initial charge current equal to 0.3-0.5 x rated capacity

Charge time:

- 10 - 12 h recommended
- Minimum 6 h
- Maximum 24 h

3) Constant current battery charge mode

- Initial charge current equal to 1/10 of the rated capacity
- Charge time: Maximum 5 h

6.11 Battery installation

Where provided

VRLA battery (valve-regulated lead-acid battery) Maintenance Free (MF)

CAUTION

BATTERY ELECTROLYTE IS TOXIC AND IT MAY CAUSE SERIOUS BURNS. IT CONTAINS SULPHURIC ACID. AVOID CONTACT WITH EYES, SKIN AND CLOTHING. IF IT ACCIDENTALLY COMES INTO CONTACT WITH YOUR EYES OR SKIN, WASH WITH ABUNDANT WATER FOR APPROX. 15 MIN. AND SEEK IMMEDIATE MEDICAL ATTENTION.

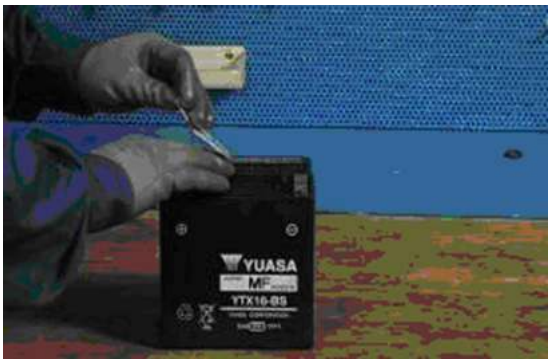
IN THE EVENT OF ACCIDENTAL INGESTION OF THE LIQUID, IMMEDIATELY DRINK LARGE QUANTITIES OF WATER OR MILK. FOLLOWED BY MAGNESIUM MILK, BEATEN EGG OR VEGETABLE OIL. SEEK IMMEDIATE MEDICAL ATTENTION. BATTERIES

PRODUCE EXPLOSIVE GAS; KEEP CLEAR OF NAKED FLAMES, SPARKS OR CIGARETTES; VENTILATE THE AREA WHEN RECHARGING INDOORS.

ALWAYS WEAR EYE PROTECTION WHEN WORKING IN THE PROXIMITY OF BATTERIES. KEEP OUT OF THE REACH OF CHILDREN.

1) Battery preparation

Position the battery on a flat surface. Remove the adhesive sheet closing cells and proceed as quickly as possible to run the subsequent activation phases.



2) Electrolyte preparation.

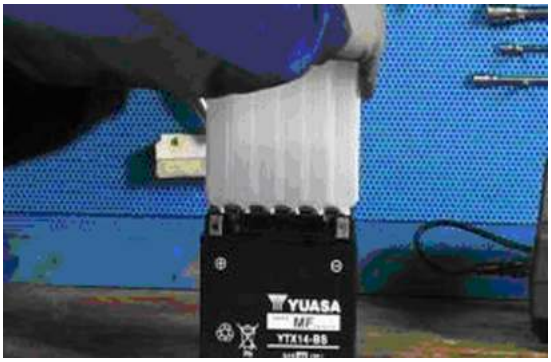
Remove the container of the electrolyte from the pack. Remove and preserve cover strips from the container, in fact, the strip will later be used as a closing cover.

Note: Do not pierce the sealing of the container or the container itself because inside there is sulphuric acid.

3) Procedure for filling the battery with acid.

Position the electrolyte container upside down with the six areas sealed in line with the six battery filler holes. Push the container down with enough force to break the seals. The electrolyte should start to flow inside the battery.

Note: Do not tilt the container to prevent the flow of electrolyte from pausing or stopping.



4) Control the flow of electrolyte

Make sure air bubbles are rising from all six filling holes. Leave the container in this position for 20 minutes or more.

Note: If there are no air bubbles coming out of the filling holes, lightly tap the bottom of the container two or three times. Do not remove the container from the battery.

5) Take out the container

Make sure all the electrolyte in the battery is drained. Gently tap the bottom of the container if electrolyte remains in the container. Only once the container is completely empty, gently remove the container itself from the battery. Leave the battery to rest, without sealing the six cells, for at least 1 hour before charging.

6) Battery closing.

- Insert the airtight cover strips into the filling holes.
- Press horizontally with both hands and make sure that the strip is levelled with the top part of the battery.

Note: To do this, do not use sharp objects that could damage the closing strip, use gloves to protect your hands and do not bring your face close to the battery.

7) Recharging the new battery

With the above-mentioned procedure, the battery will have gained around 70% - 75% of its total electrical capacity. Before FITTING the battery on the vehicle, it must be fully charged and then must be recharged.

If the battery is to be installed on the vehicle prior to this pre-charged one, the battery will not be able to exceed 75% charge without jeopardising its useful life on vehicle.

The dry charge battery MF like the completely loaded YTX, must have a zero load voltage between 12.8 to 13.15 V Bring the battery to full charge, using the 020648Y battery charger:

a - select the type of battery with the red switch on the left of the panel battery charger panel

b - select NEW on the yellow timer

c - connect the clamps of the battery charger to the battery poles (black clamp to negative pole (-) and red clamp to positive pole (+)).

d - Press the red button, as shown in figure.

e - Press the “MF” black button to activate the battery recharge **Maintenance Free** as shown in figure.

f - Check the ignition of the green LED indicated with a red arrow in figure.

g - The activation cycle of the new battery lasts for 30 minutes after the ignition of the recharge LED has taken place

h - Disconnect the clamps from the battery and check the voltage. If voltages are detected of less than 12.8 V, proceed with a new recharge of the battery starting from point **c** of the **New battery charging** procedure, otherwise go to point **i**.

i – The battery is now properly activated, disconnect the battery charger from the power supply and unplug the terminals from the battery.

6.12 ECSC control unit

REMOVAL

To remove the ECSC control unit follow these steps:

- Support the vehicle adequately.
- Remove the upper shield cover.

- Remove the leg shield back plate and side shields.

- Disconnect the connector of the ECSC control unit.

- Unscrew and remove the fixing screws of the ECSC control unit.

FITTING

- Position the ECSC control unit in its seat.
- Insert and tighten the fixing screws of the control unit.

- Connect the ECSC control unit connector, taking care to hear the click of the connector's safety button.

- Connect the ECSC control unit connector, taking care to hear the click of the connector's safety button.

- Refit the leg shield back plate and side shields.

- Refit the upper shield cover.

6.13 Tone wheel

It is a magneto-resistive sensor with an integrated circuit inside. It sends a current signal with two levels according to the position of the tone wheel to the control unit. The continuity test or measuring the electric resistance is not possible, as if this type of sensor is not connected to the control unit and so an open circuit is supplied.

Operation check: Connect the oscilloscope and turn the wheel by hand; an electric signal with a voltage square wave appears, as the one in the figure, after having selected the correct scale for the horizontal and vertical axes.

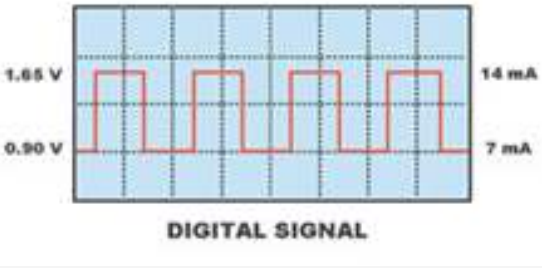


Table 1: Technical Characteristics

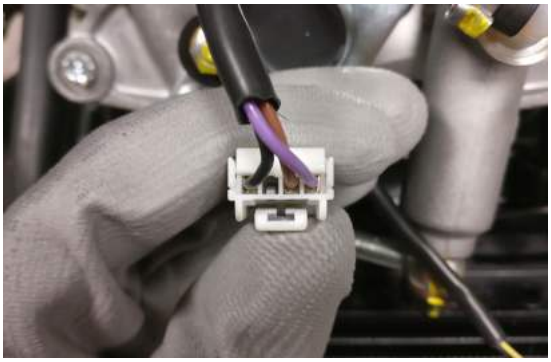
CHARACTERISTIC	DESCRIPTION / VALUE
Vibration 0.3 V	11.25 to 11.55 V approximately

6.14 Connectors

CAUTION

☞

THE DIAGRAM SHOWS THE LAYOUT OF THE CONNECTORS VIEWED FROM THE CABLE INLET SIDE, AS INDICATED IN THE EXAMPLE.



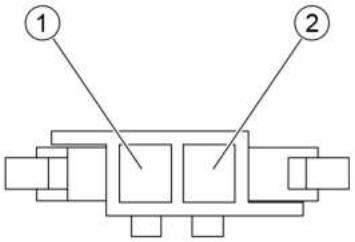
The electrical components of the vehicle are as follows:

- Saddle opening actuator
- Tank actuator
- H.V. coil.
- Earth braid
- Development CAN
- ABS control unit
- Parking control ECU
- Injection ECU
- Horn
- Key switch
- Light switch
- Ignition actuator contact
- Starter relay contact
- Throttle body
- Turn indicator control device
- RH / LH electronic device
- Diode
- Electric fan
- Rear light
- Solenoid unit
- Instrument panel
- License plate light
- Injector
- Helmet compartment light switch
- Keyless
- Front right indicator
- Front left indicator
- Alarm LED
- Key on fuses / battery terminal block.
- H.V. coil ground
- Frame ground
- Gear motor
- Battery negative
- Starter motor negative
- Pick-up
- Light unit
- PMP3
- Fuel pump
- Battery positive
- Battery positive reverse gear
- Starter motor positive
- Reverse gear motor positive
- Pre-installation for anti-theft device
- Top-box provision
- Installation-ready for heated hand grips, leg warmer and heated seat

- Provision for heated saddle
- Diagnostic socket
- USB port
- Headlight
- Heating ignition button
- Saddle release switch
- Tank opening button
- ASR Button
- End-of-stroke button
- Hand brake button
- Brake pedal button
- Right stop button
- Left stop button
- Radar
- Voltage regulator
- Drive / Reverse mode selector
- Right front ABS sensor
- Left front ABS sensor
- Rear ABS sensor
- Inclination sensor
- Throttle position sensor
- Rider detection sensor
- Pressure sensor
- Oil pressure sensor
- Rotation sensor
- External temperature sensor
- Engine temperature sensor
- T_MAP sensor
- Right speed sensor
- Left speed sensor
- Ignition actuator solenoid
- Lambda probe 1 with heater
- Lambda probe 2 with heater
- Buzzer
- Rear camera
- Starter relay
- Reverse gear relays
- Canister valve

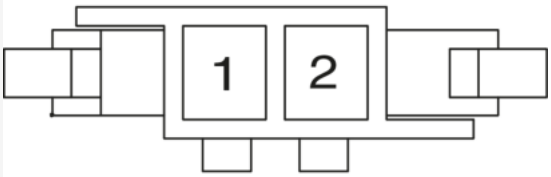
SADDLE OPENING ACTUATOR CONNECTOR

1 . Ground lead (Black)
2 . Signal from keyless device (Yellow-Grey)



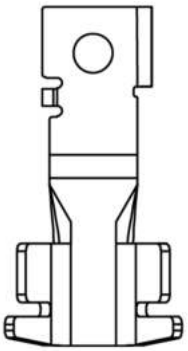
TANK ACTUATOR

1 . Ground lead (Black)
2 . Keyless tank release command input (Yellow-Red)



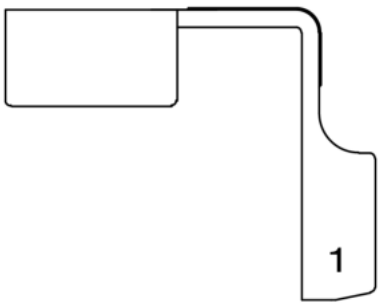
BATTERY POSITIVE

1 . Power supply (Red)



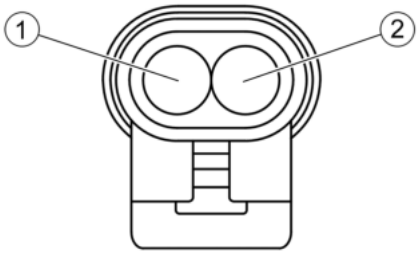
BATTERY NEGATIVE

1 . Ground lead (Black)



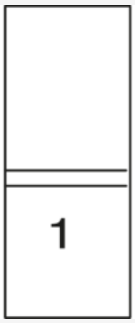
H.V. COIL CONNECTOR

1 . Injection load relay (Black-Green)
2 . Injection ECU (Pink-Black)



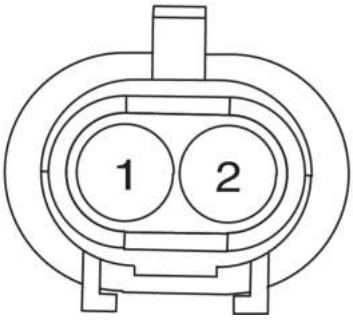
EARTH BRAID

1 . Ground lead (Black)



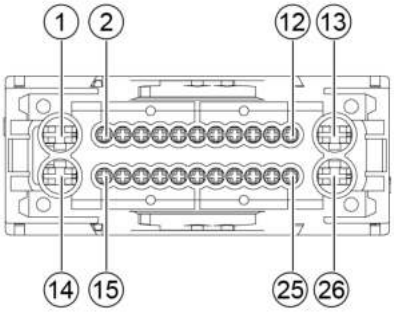
DEVELOPMENT CAN CONNECTOR

1 . CAN H Line (Orange-Grey)
2 . CAN L line (Orange-Light Blue)



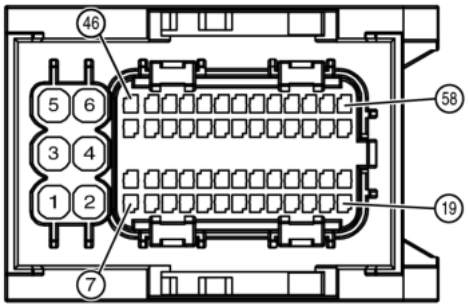
ABS CONTROL UNIT CONNECTOR

1 . Battery-powered (Red)
2 . Rear ABS sensor ground (Brown-Black)
3 . Rear ABS sensor signal (Brown-Red)
4 . Not connected
5 . Front right ABS sensor signal (Purple-Red)
6 . Front right ABS sensor ground (Purple-Black)
7 . Not connected
8 . Front left ABS sensor ground (Sky blue-Black)
9 . Front left ABS sensor signal (Sky blue-Red)
10 . Not connected
11 . Not connected



12 . Not connected
13 . Not connected
14 . Not connected
15 . Not connected
16 . Not connected
17 . Not connected
18 . Line K (Orange-Black)
19 . Not connected
20 . Live supply (Orange-Blue)
21 . CAN L Line (Pink-White)
22 . Ground lead (Black)
23 . CAN H line (Pink-Red)
24 . Not connected
25 . Not connected
26 . Ground lead (Black)

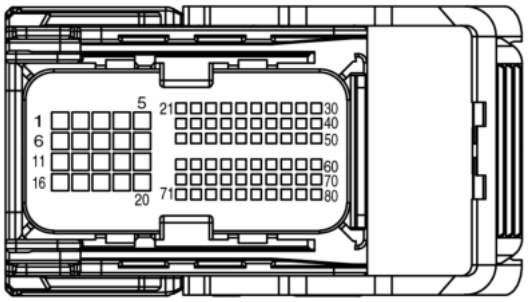
PARKING CONTROL ECU CONNECTOR



1 . Battery powered (Blue-Red)
2 . Battery powered (Blue-Red)
3 . Ground lead (Black)
4 . Ground lead (Black)
5 . Gear motor (Yellow)
6 . Gear motor (Blue)
7 . Not connected
8 . Not connected
9 . Not connected
10 . Not connected
11 . Not connected
12 . Not connected
13 . Not connected
14 . Not connected
15 . Not connected
16 . Not connected
17 . Not connected
18 . Not connected
19 . CAN H line (Pink-Red)
20 . Suspension locking/unlocking button (Blue-Yellow)
21 . Suspension locking/unlocking button (Purple-Black)
22 . Not connected
23 . Not connected
24 . Not connected
25 . Not connected
26 . Rider detection sensor (Purple)
27 . Rotation sensor (Green-Blue)

28 . End-of-stroke button (Brown)
29 . End-of-stroke button (Brown-White)
30 . Pressure sensor (White)
31 . Not connected
32 . CAN L Line (Pink-White)
33 . Suspension locking/unlocking button (Green-Grey)
34 . Not connected
35 . Right-side speed sensor ground (Black-Red)
36 . Left-side speed sensor ground (Green-Black)
37 . Sensors ground (Green-Black)
38 . Not connected
39 . Not connected
40 . Not connected
41 . Not connected
42 . Not connected
43 . Not connected
44 . Not connected
45 . Right side speed sensor (Red)
46 . Ignition switched live (Yellow-Black)
47 . Ignition switched live (Yellow-Black)
48 . Not connected
49 . Rotation sensor power supply (Orange-Blue)
50 . Not connected
51 . Not connected
52 . Not connected
53 . Not connected
54 . Not connected
55 . Horn (Yellow-Pink)
56 . Not connected
57 . Buzzer (Grey)
58 . Left side speed sensor (Green)

INJECTION ECU

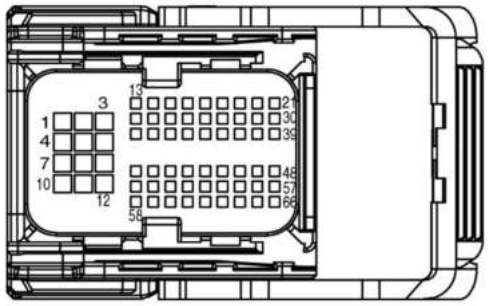


1 . Throttle body DC M - signal (Grey-Black)
2 . Not connected
3 . Not connected
4 . Not connected
5 . Canister Valve (White-Black)
6 . Throttle body DC M + signal (Red-Blue)
7 . Not connected
8 . Not connected
9 . Not connected
10 . Lambda probe heater (White-Blue)

11 . Not connected
12 . Not connected
13 . Not connected
14 . Not connected
15 . injector (red-yellow)
16 . Not connected
17 . H.V. coil (Pink-Black)
18 . Not connected
19 . Not connected
20 . Not connected
21 . Not connected
22 . Throttle body TPS1 signal (Orange-White)
23 . Lambda signal (-) (Light blue-Black)
24 . Lambda signal (+) (Green-Blue)
25 . Not connected
26 . Not connected
27 . Not connected
28 . Not connected
29 . Signal for solenoid coil (Blue-Red)
30 . Not connected
31 . Not connected
32 . Cruise Control Speed Increment Signal (Yellow/Grey)
33 . Cruise Control speed decrease signal (Yellow/Red)
34 . Cruise Control on/off signal (Yellow/White)
35 . Not connected
36 . Not connected
37 . Not connected
38 . Not connected
39 . Not connected
40 . Not connected
41 . Not connected
42 . Not connected
43 . Not connected
44 . Sensor ground (Purple-Black)
45 . ground sensors (grey-green)
46 . Sensors ground (Black-Yellow)
47 . Not connected
48 . Not connected
49 . Signal for reverse gear motor coil (White-Violet)
50 . Not connected
51 . Throttle body TPS2 signal (Green-Orange)
52 . Not connected

53 . Not connected
54 . Power supply for solenoid unit (Brown-Red)
55 . Not connected
56 . Not connected
57 . Power supply for T-MAP sensor (Green-Red)
58 . Not connected
59 . Brake pedal button (White-Grey)
60 . Pick-up (+) signal (Red)
61 . Not connected
62 . Not connected
63 . T-MAP sensor air temperature signal (Yellow-Blue)
64 . Not connected
65 . Not connected
66 . Not connected
67 . Throttle body power supply (Red-Black)
68 . Brake pedal button (White-Pink)
69 . Not connected
70 . Pick-up (-) signal (Brown)
71 . T-MAP sensor air pressure signal (Yellow-Green)
72 . Not connected
73 . engine temperature sensor (light blue-green)
74 . Not connected
75 . Ground sensors (Grey-Brown)
76 . Not connected
77 . Not connected
78 . ASR button (Light Blue-White)
79 . Not connected
80 . Not connected

INJECTION CONTROL UNIT CONNECTOR (66 ways)



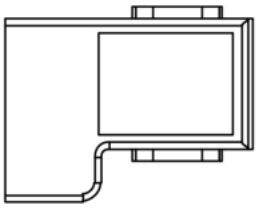
1 . Power supply from injection load relay (Black-Green)
2 . Power supply from injection load relay (Black-Green)
3 . Battery powered (Red-Green)
4 . Not connected
5 . Ground lead (Black)
6 . Ground lead (Black)
7 . Lambda probe 2 with heater (Red-White)
8 . Ground lead (Black)

9 . Not connected
10 . Signal for reverse gear enable relay coil (Blue)
11 . Signal for brake lights relay coil (Green-White)
12 . Not connected
13 . Live supply (Orange-Blue)
14 . Signal right stop button (White-Black)
15 . Starter button (Purple)
16 . Starter relay contact power supply input (Red)
17 . Signal engine stop (Grey)
18 . Signal for injection loads relay coil (Black-Purple)
19 . Not connected
20 . Signal for electric fan coil (White)
21 . Not connected
22 . Not connected
23 . Signal right stop button (White-Grey)
24 . Not connected
25 . Reverse gear selector (Light blue)
26 . Signal engine stop (Yellow-Blue)
27 . Not connected
28 . Not connected
29 . Not connected
30 . Development CAN L (Orange-Light blue)
31 . Reverse gear selector (Grey-Black)
32 . Signal left stop button (Pink-Green)
33 . Not connected
34 . Not connected
35 . Not connected
36 . Not connected
37 . Not connected
38 . Signal for fuel pump relay coil (Purple-Black)
39 . Development CAN H (Orange-Grey)
40 . Signal left stop button (Pink-Brown)
41 . Not connected
42 . Sensors ground (Light Blue-Black)
43 . Sensors ground (Brown-Black)
44 . Sensors ground (Black-Yellow)
45 . Not connected
46 . Not connected
47 . Not connected
48 . CAN H line (Pink-Red)
49 . Signal solenoid unit (Brown)

50 . Power for throttle grip position sensor (Light blue-Red)
51 . Power for throttle grip position sensor (Brown-Red)
52 . Power for tilt sensor (Light blue-Green)
53 . ground sensors (grey-green)
54 . Not connected
55 . Not connected
56 . Not connected
57 . CAN L Line (Pink-White)
58 . Not connected
59 . Not connected
60 . Signal from throttle grip position sensor (Light blue-Yellow)
61 . Signal from throttle grip position sensor (Brown-White)
62 . Signal from tilt sensor (Orange-Green)
63 . Lambda 2 signal (-) (Green-Blue)
64 . Lambda 2 signal (+) (White-Blue)
65 . Signal for starter relay coil (Purple-White)
66 . Ground lead (Black)

HORN CONNECTORS

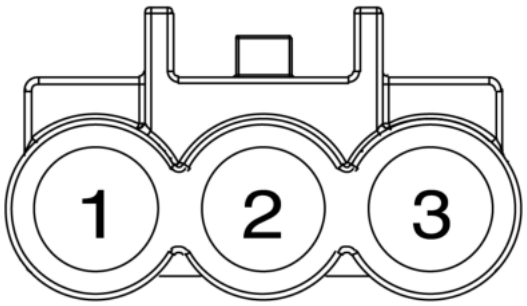
1 . Ground lead (Black)
2 . Power supply (Yellow-Pink)



1

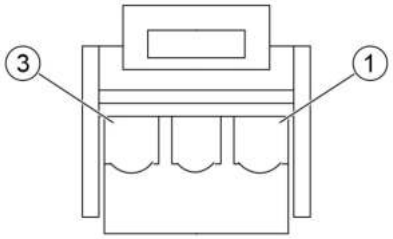
IGNITION SWITCH CONNECTOR

1 . Fuse F18 Power Input (Red-Black)
2 . Output ignition switched live (Orange)
3 . Not connected



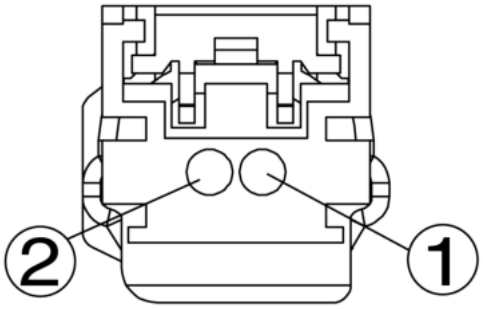
LIGHT SWITCH CONNECTOR

1 . DRL relay command (Yellow-Pink)
2 . DRL light (Yellow-Brown)
3 . Headlamp (Yellow-Red)



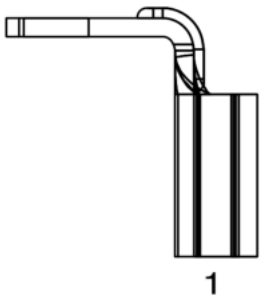
IGNITION ACTUATOR CONTACT CONNECTOR

1 . Signal from ignition actuator contact (Purple-White)
2 . Ground (Brown-Black)



STARTER RELAY CONTACT CONNECTOR

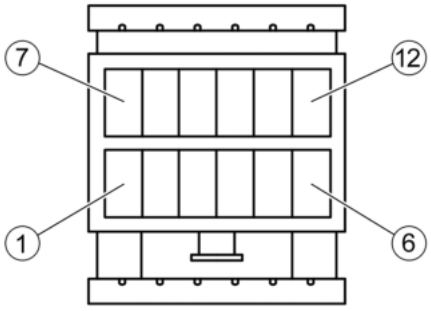
1 . Battery-powered (Red)



THROTTLE BODY CONNECTOR

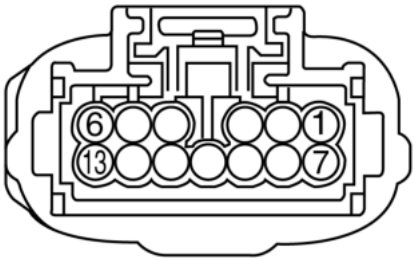
1 . Injection ECU TPS1 signal (Orange-White)
2 . Power supply from injection ECU (Red-Black)
3 . Injection ECU DC M + Signal (Red-Blue)
4 . Injection ECU TPS2 signal (Green-Orange)
5 . Injection ECU DC M - Signal (Grey-Black)
6 . Ground reference from injection electronic control unit (Black-Yellow)

TURN INDICATOR CONTROL DEVICE CONNECTOR



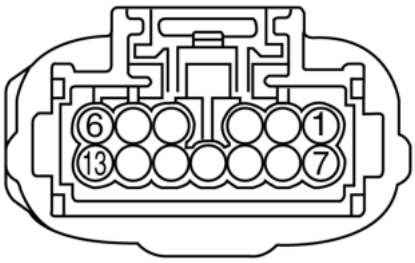
1 . HAZARD button (Brown-Purple)
2 . Left turn indicator light activation command signal input (Red-Grey)
3 . Right turn indicator light activation command signal input (Light blue)
4 . Left turn indicator lights activation command signal output (Pink)
5 . Right turn indicator activation command signal output (White-Blue)
6 . Battery-powered (Red-Blue)
7 . Not connected
8 . Ignition switched live (Brown-Red)
9 . Ground lead (Black)
10 . Not connected
11 . Turn indicator deactivation signal (Blue-White)
12 . Not connected

ELECTRONIC DEVICE CONNECTOR RH



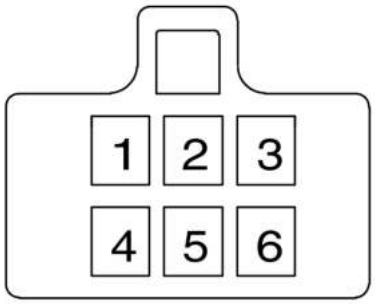
1 . Engine stop signal for injection ECU (Grey)
2 . RH engine stop button ground (Black-Yellow)
3 . Engine stop signal for injection ECU (Yellow-Blue)
4 . LH engine stop button ground (Grey-Green)
5 . Starter button power supply (Orange-Blue)
6 . Signal output from starter button (Purple)
7 . Hazard button power supply (Brown-Red)
8 . Signal output from Hazard button (Brown-Purple)
9 . Suspension unlock signal (Blue-Yellow)
10 . Parking electronic control unit (Green-Grey)
11 . Suspension lock signal (Purple-Black)
12 . Ground suspension management button (Black-Green)
13 . Not connected

ELECTRONIC DEVICE CONNECTOR LH



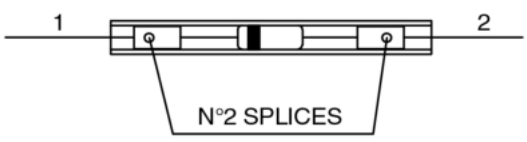
1 . Blinker switch power supply (Brown-Red)
2 . Joystick ground (Black-Yellow)
3 . Signal for instrument cluster from upper joystick button (Pink-Yellow)
4 . Signal for instrument cluster from lower joystick button (Pink-Grey)
5 . Signal for instrument cluster from left joystick button (White-Pink)
6 . Signal for instrument cluster from right joystick button (Pink-Brown)
7 . Left-side direction indicators (Red-Grey)
8 . Turn indicator deactivation button (Blue-White)
9 . Right hand direction indicators (Light blue)
10 . Cruise Control speed increase signal for injection ECU (Yellow-Grey)
11 . Cruise Control on/off signal (Yellow-White)
12 . Cruise Control speed decrease signal for injection ECU (Yellow-Red)
13 . Cruise Control ground (Grey-Brown)

LEFT ELECTRONIC DEVICE CONNECTOR



1 . Horn button power supply (Light blue)
2 . Horn (Yellow-Pink)
3 . High beam lights signal (Pink)
4 . Light switch control power input (Brown)
5 . Not connected
6 . Light switch ignition switched live input (White-Purple)

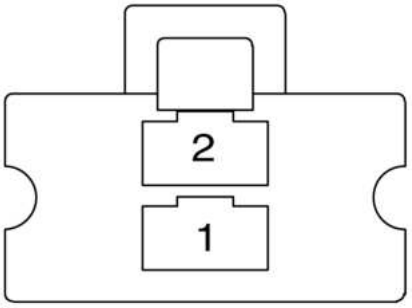
DIODE



1 . Power supply inlet from DRL relay (Yellow)
2 . Signal output for DRL lights (Yellow-Green)

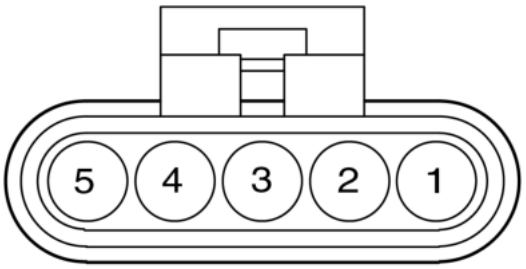
ELECTRIC FAN CONNECTOR

1 . Power supply input from electric fan relay (Red-Grey)
2 . Ground lead (Black)



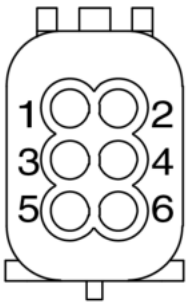
TAILLIGHT CONNECTOR

1 . BRAKE light (White-Black)
2 . Rear daylight running light (Light blue)
3 . Right side turn indicator (White-Blue)
4 . Left side turn indicator (Pink)
5 . Ground lead (Black)



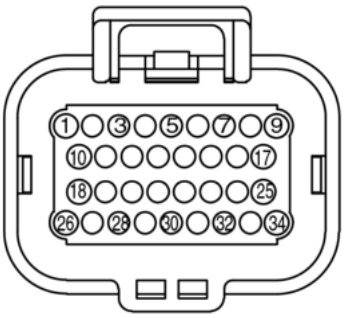
SOLENOID UNIT CONNECTOR

1 . Power supply from solenoid relay (Green)
2 . Signal from injection ECU (Brown-Red)
3 . Ground lead (Black)
4 . Ground reference from injection ECU (Purple-Black)
5 . Not connected
6 . Signal for injection ECU (Brown)



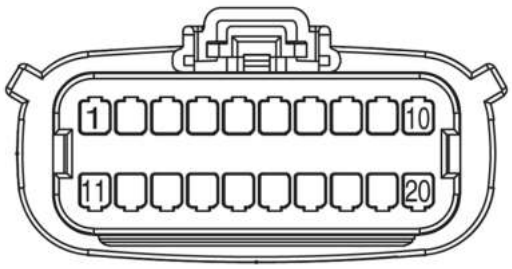
INSTRUMENT PANEL CONNECTOR

1. Not connected
2. Rear camera (-) signal (Orange-Blue)
3. Rear telecamera signal (+) (Blue)
4. Fuel level indicator (White-Green)
5. Air temperature sensor (Yellow-Blue)
6. Upper joystick button (Pink-Yellow)
7. Not connected
8. Not connected
9. battery power (red-white)



10. Hand brake switch (Yellow-Black)
11. Lower joystick button (Pink-Grey)
12. Not connected
13. Engine oil low pressure signal (Pink-Black)
14. high beam warning light (purple)
15. Keyless courtesy LED (Grey)
16. Ignition switched live (Yellow-Red)
17. battery power (red-white)
18. Not connected
19. Right turn indicator warning light (White-Blue)
20. Left turn indicator warning light (Pink)
21. Immobilizer led (Yellow-Orange)
22. Right joystick button (Pink-Brown)
23. Left joystick button (White-Pink)
24. Ground lead (Black)
25. Sensors ground (Black-Yellow)
26. Not connected
28. Daylight running light (Light blue)
27. DRL indicator light (Yellow)
29. Not connected
30. Not connected
31. Not connected
32. CAN L Line (Pink-White)
33. CAN H line (Pink-Red)
34. Not connected

KEYLESS CONNECTOR

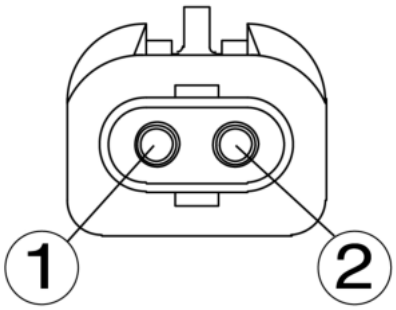


1 . Battery-powered (Red-Blue)
2 . Ignition actuator solenoid signal (+) (Green-White)
3 . Ground lead (Black)
4 . Ignition actuator solenoid signal (-) (Green-Black)
5 . CAN H line (Pink-Red)
6 . CAN L Line (Pink-White)
7 . Top-box electrical provision (Light blue-Yellow)
8 . Saddle opening actuator (Yellow-Grey)

9 . Tank cap actuator (Yellow-Red)
10 . Left side turn indicator signal (Pink)
11 . Signal input from ignition actuator contact (Purple-White)
12 . Ignition switched live (Orange-Blue)
13 . Not connected
14 . Saddle opening button command input (Brown-Yellow)
15 . Tank opening button command input (Brown-Red)
16 . Ground (Brown-Black)
17 . LED immobilizer light on command (Yellow-Orange)
18 . Ground for courtesy LED (Grey)
19 . Not connected
20 . Right side turn indicator signal (White-Blue)

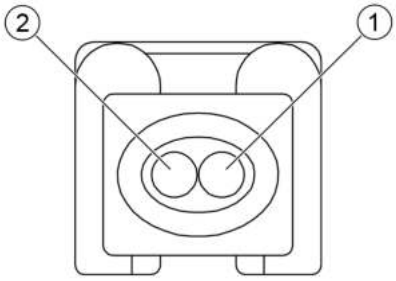
NUMBER PLATE LIGHTING CONNECTOR

1 . Ignition switched live (Light blue)
2 . Ground lead (Black)



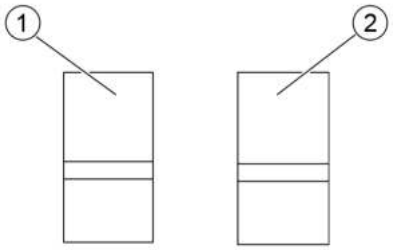
INJECTOR CONNECTOR

1 . Power supply from injection load relay (Black-Green)
2 . Negative from control unit (Red-Yellow)



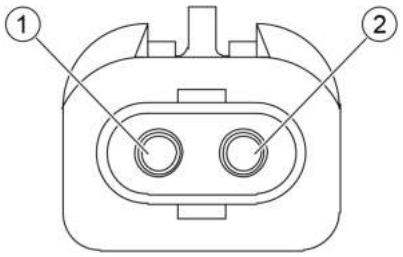
HELMET COMPARTMENT LIGHT CONNECTOR

1 . Battery power supply (Red-Blue)
2 . Saddle compartment light (Blue-Black)



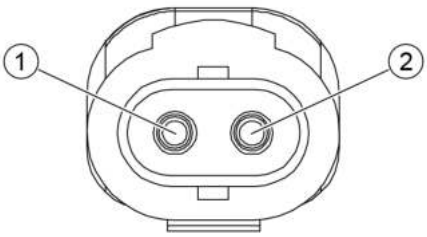
RH FRONT DIRECTION INDICATOR CONNECTOR

1 . Power supply (White-Blue)
2 . Ground lead (Black)



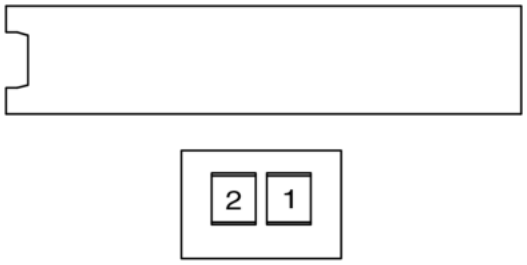
LH FRONT DIRECTION INDICATOR CONNECTOR

1 . Power supply (Pink)
2 . Ground lead (Black)



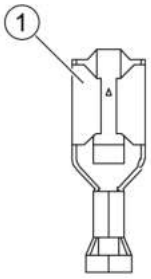
ALARM LED CONNECTOR

1 . Ground lead (Black)
2 . Pre-installation for anti-theft device (Red)



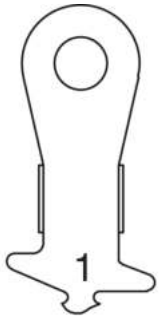
H.V. COIL GROUND

1 . Ground lead (Black)



FRAME GROUND

1 . Ground lead (Black)



BATTERY FUSE/RELAY TERMINAL BLOCK CONNECTOR

1. Battery power supply output from fuse F05 (Grey-Red)

2. Battery power output from fuse F06 (Red-Green)

3. Battery power output from fuse F07 (Red-Blue)

4. Ignition key-controlled power supply output from F08 (Red)

5. Battery power supply input for fuse F05 (Red)

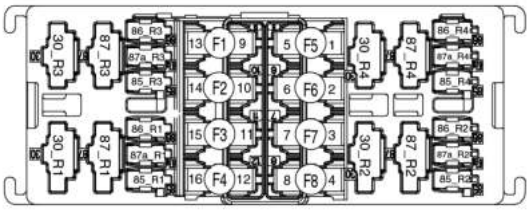
6. Battery power supply input for fuse F06 (Red)

7. Battery power supply input for fuse F07 (Red)

8. Battery power supply input for fuse F08 (Red)

9. Ignition switched live input for fuse F01 (Orange)

10. Battery power supply input for fuse F02 (Red)



11. Battery power supply input for fuse F03 (Red)

12. Battery power supply input for fuse F04 (Red)

13. Ignition switched live output from fuse F01 (White-Purple)

14. Battery power output from fuse F02 (Blue-Red)

15. Battery power output from fuse F03 (Red-Black)

16. Battery power supply output from fuse F04 (Red-White)

30R1. Battery power input for injection load relay (Red-Green)

87R1. Power supply output from injection load relay (Black-Green)

85R1. Signal input from injection ECU for injection load relay coil (Black-Purple)

87aR1. Relay contact

86R1. Battery power input for injection load relay (Red-Green)

30R2. Power supply input from battery for electric fan relay (Grey-Red)

87R2. Power supply output from electric fan relay (Red-Grey)

85R2. Signal input from injection ECU for electric fan relay coil (White)

87aR2. Relay contact

86R2. Power supply input from injection loads relay for electric fan relay (Black-Green)

30R3. Power supply input from injection loads for fuel pump relay (Black-Green)

87R3. Power outlet from fuel pump relay (Green)

85R3. Ground

87aR3. Relay contact

86R3. Signal input from injection electronic control unit for fuel pump relay coil (Purple-Black)

30R4. Not connected

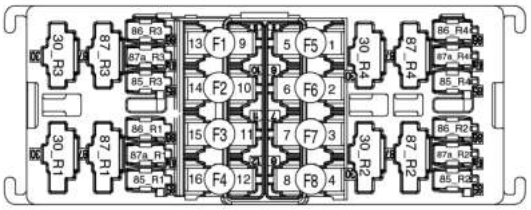
87R4. Not connected

85R4. Not connected

87aR4. Not connected

86R4. Not connected

SWITCHED LIVE FUSE/RELAY TERMINAL BLOCK CONNECTOR



1. Ignition switched live output from fuse F05 (Orange-White)

2. Ignition switched live output from fuse F06 (Yellow-Black)

3. Ignition switched live output from fuse F01 (Orange-Blue)

4. Ignition switched live output from fuse F08 (Light blue)

5. Ignition switched live input for fuse F05 (Orange)

6. Ignition switched live input for fuse F06 (Orange)

7. Ignition switched live input for fuse F07 (Orange)

8. Ignition switched live input for fuse F08 (Orange)

9. Ignition switched live input for fuse F01 (Orange)

10. Ignition switched live input for fuse F02 (Orange)

11. Ignition switched live input for fuse F03 (Orange)

12. Ignition switched live input for fuse F04 (Orange)

13. Ignition switched live output from fuse F01 (Red-Black)

14. Ignition switched live output from fuse F02 (Red-Green)

15. Ignition switched live output from fuse F03 (Brown-Red)

16. Ignition switched live output from fuse F03 (Yellow-Red)

30R1. Battery power supply input for DRL relay (Yellow-Red)

87R1. Power output from DRL relay (Brown)

85R1. Ground lead (Black)

87aR1. Power output from DRL relay (Yellow-Green)

86R1. Signal input from light switch for DRL (Yellow-Pink)

30R2. Battery power supply input from injection load relay (Black-Green)

87R2. Power supply output from solenoid relay (Green)

85R2. Signal input from injection electronic control unit for coil solenoid (Light blue-Red)

87aR2. Relay contact

86R2. Signal input from injection electronic control unit for coil solenoid (Purple)

30R3. Not connected

87R3. Not connected

85R3. Not connected

87aR3. Not connected

86R3. Not connected

30R4. Ignition switched live input for brake lights relay (Orange-White)

87R4. Power supply output from brake lights relay (White-Black)

85R4. Signal input from injection electronic control unit for brake lights relay coil (Green-White)

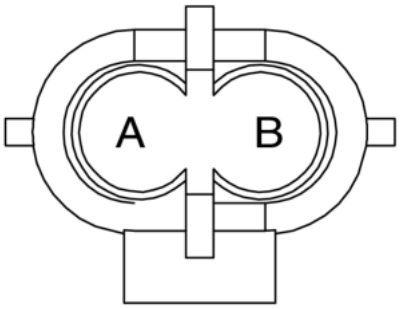
87aR4. Relay contact

86R4. Ignition switched live input for brake lights relay (Orange-White)

GEAR MOTOR CONNECTOR

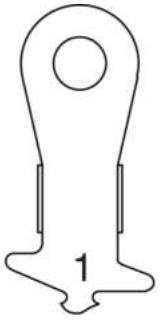
A. Parking electronic control unit (Yellow)

B. Parking electronic control unit (Blue)



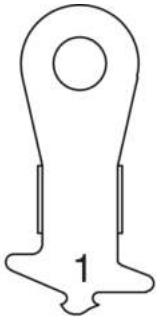
STARTER MOTOR POSITIVE

1 . Power supply (Red)



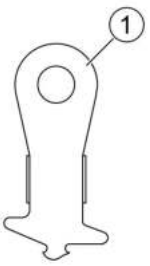
STARTER MOTOR NEGATIVE

1 . Ground lead (Black)



REVERSE GEAR MOTOR POSITIVE

1 . Reverse gear motor (Red)

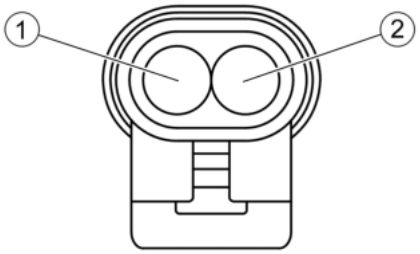


BATTERY POSITIVE REVERSE GEAR

1 . Reverse gear battery positive (Red)

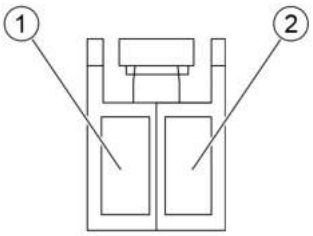
PICK-UP CONNECTOR

1 . Injection ECU (Red)
2 . Injection ECU (Brown)



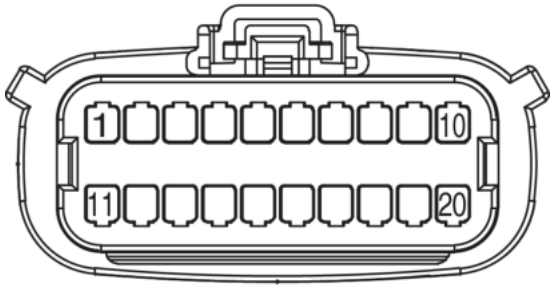
SADDLE COMPARTMENT LIGHT CONNECTOR

1 . Power supply (Blue-Black)
2 . Ground lead (Black)



PMP3

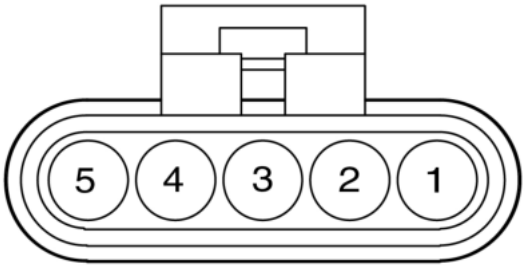
1 . CAN H line (Pink-Red)
2 . Ignition switched live (Brown-Red)
3 . Right side turn indicator signal output (White-Blue)
4 . Left side turn indicator signal output (Pink)
5 . Follow me activation command (Yellow)
6 . Turn indicators control device (Brown-Purple)
7 . DRL (Yellow-Brown)
8 . Saddle compartment light (Blue-Black)
9 . Battery-powered (Red-Blue)
10 . Not connected
11 . CAN L Line (Pink-White)
12 . Ground lead (Black)
13 . Heating activation button (Green)
14 . Left-side direction indicators signal input (Red-Grey)
15 . Right-side turn indicators signal input (Light blue)
16 . Turn indicators control device (Brown-Purple)



17 . Turn indicator deactivation button (Blue-White)
18 . Saddle opening actuator (Yellow-Grey)
19 . Ground lead (Black-Green)
20 . Not connected

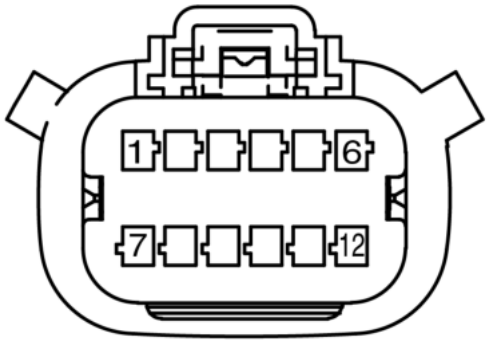
FUEL PUMP CONNECTOR

1 . Not connected
2 . Ground lead (Black)
3 . Sensors ground (Black-Yellow)
4 . Instrument cluster fuel level indicator light signal (White-Green)
5 . Fuel pump power from relay (Green)



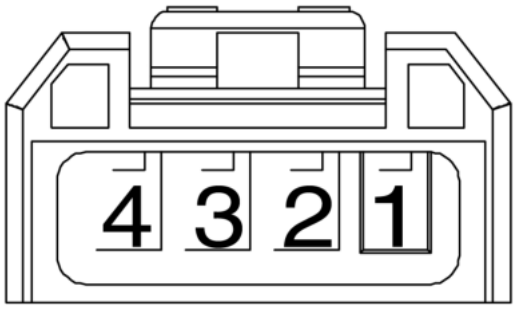
Pre-installation for anti-theft device

1 . Battery power supply (Red-Black)
2 . Live (Red-Green)
3 . Not connected
4 . Alarm LED (Red)
5 . Right side turn indicator (White-Blue)
6 . Left side turn indicator (Pink)
7 . Ground lead (Black)
8 . Helmet compartment lighting (Blue-Black)
9 . Not connected
10 . Not connected
11 . Not connected
12 . Not connected



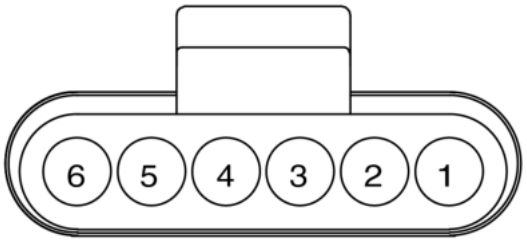
TOP-BOX ELECTRICAL PROVISION

1 . Ignition switched live (Brown-Red)
2 . Signal from Keyless control unit (Light blue-Yellow)
3 . Ground lead (Black)
4 . Battery-powered (Red-Blue)



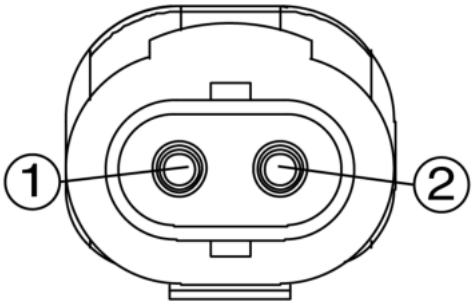
CONNECTOR FOR PRE-INSTALLATION OF HEATED GRIPS/LEG WARMER/SEAT

1 . Live (Red-Green)
2 . Ground lead (Black)
3 . Battery-powered (Red-Black)
4 . Pre-installation of heated saddle (Black-Green)
5 . CAN H line (Pink-Red)
6 . CAN L Line (Pink-White)



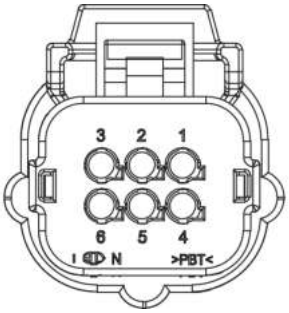
HEATED SADDLE PRE-INSTALLATION CONNECTOR

1 . Power supply (Black-Green)
2 . Ground lead (Black)



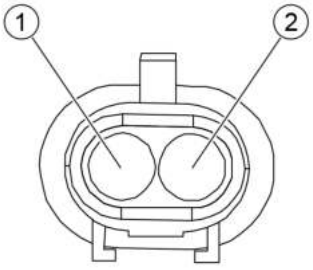
DIAGNOSTICS SOCKET CONNECTOR

1 . Live (Red-Green)
2 . CAN H line (Pink-Red)
3 . Ground lead (Black)
4 . Battery-powered (Red-Black)
5 . CAN L Line (Pink-White)
6 . Line K (Orange-Black)



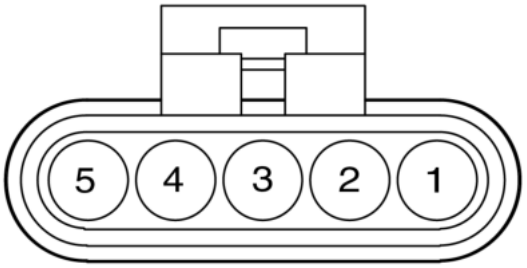
USB PORT CONNECTOR

1 . Ignition switched live (Red-Black)
2 . Ground lead (Black)



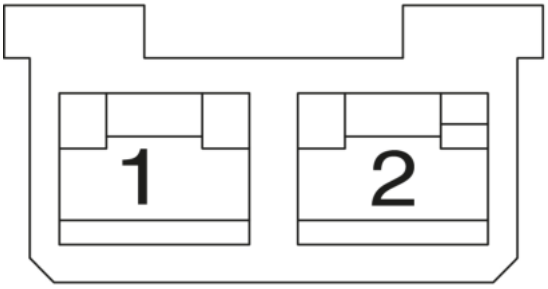
HEADLIGHT CONNECTOR

1. Daytime running lights (DRL) (Yellow)
2. Daylight running light (Light blue)
3. Ground lead (Black)
4. High-beam light (Purple)
5. Low beam light (Brown)



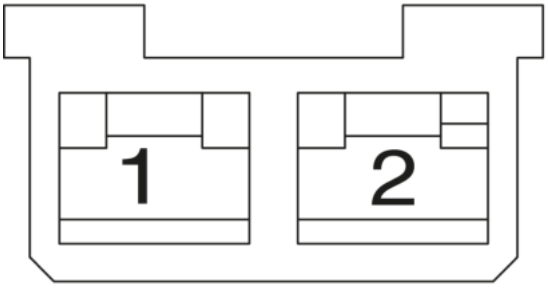
HEATING ACTIVATION BUTTON CONNECTOR

1. Ground from PMP3 control unit (Black-Green)
2. PMP3 control unit signal (Green)



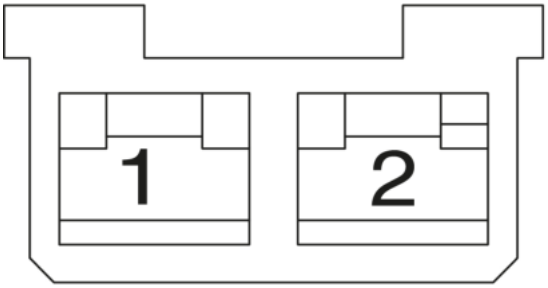
SADDLE OPENING BUTTON CONNECTOR

1. Saddle opening signal for Keyless (Brown-Yellow)
2. Ground (Brown-Black)



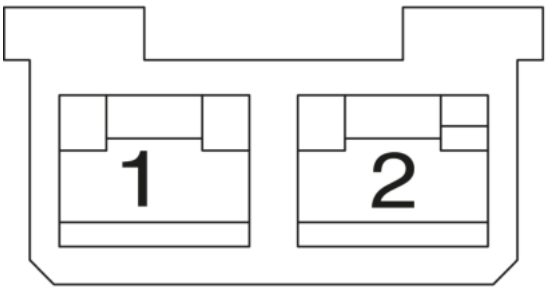
TANK OPENING BUTTON CONNECTOR

1. Tank opening button signal for Keyless (Brown-Red)
2. Ground (Brown-Black)



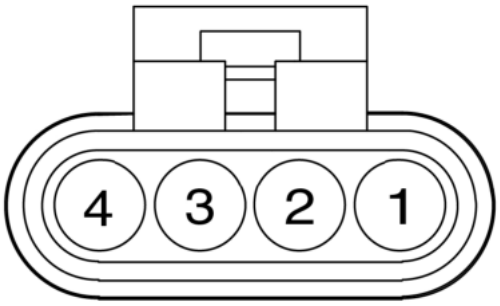
ASR BUTTON CONNECTOR

1 . Signal (Sky blue-White)
2 . Negative from the Injection control unit (Grey-Brown)



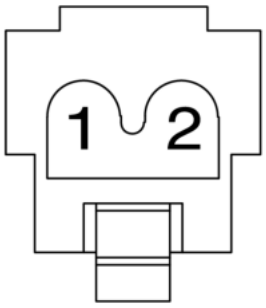
END-OF-STROKE BUTTON CONNECTOR

1 . Parking electronic control unit signal (Brown)
2 . Sensors ground (Black-Green)
3 . Parking electronic control unit signal (Brown-White)
4 . Sensors ground (Black-Green)



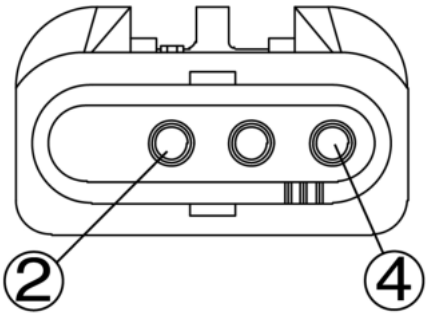
HAND BRAKE SWITCH CONNECTOR

1 . Instrument panel signal (Yellow-Black)
2 . Sensors ground (Black-Yellow)



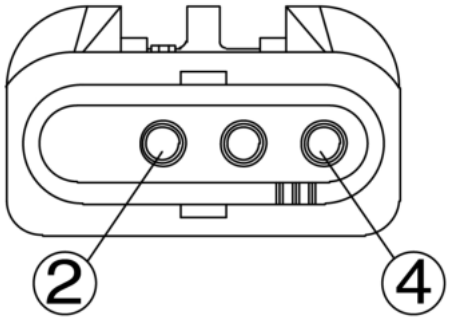
BRAKE PEDAL SENSOR CONNECTOR

2. Ground sensors (Grey-Brown)
3. Injection control unit signal (White-Grey)
4. Injection control unit signal (White-Pink)



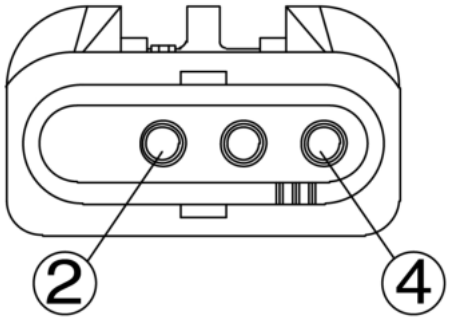
RH STOP BUTTON CONNECTOR

2. Sensors ground (Black-Yellow)
3. Injection control unit (White-Grey)
4. Injection control unit (White-Black)



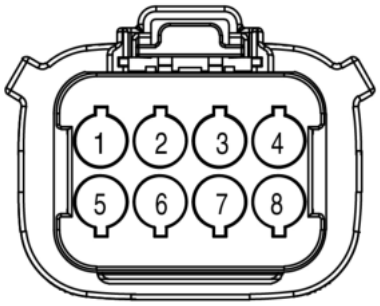
LH STOP BUTTON CONNECTOR

2. ground sensors (grey-green)
3. Injection control unit (Pink-Green)
4. Injection control unit (Pink-Brown)



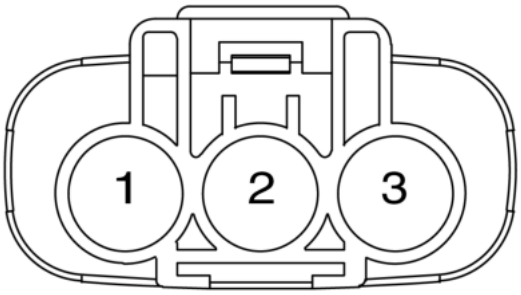
RADAR CONNECTOR

1 . Left side turn indicator (Pink)
2 . Right side turn indicator (White-Blue)
3 . Not connected
4 . Not connected
5 . Ignition switched live (Light blue)
6 . CAN H line (Pink-Red)
7 . CAN L Line (Pink-White)
8 . Ground lead (Black)

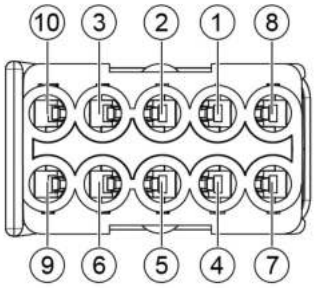


VOLTAGE REGULATOR CONNECTOR

1 . Battery Positive (Red-Black)
2 . Not connected
3 . Ground lead (Black)

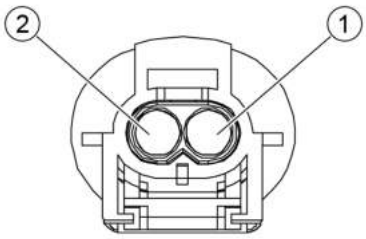


DRIVE/REVERSE MODE SELECTOR CONNECTOR



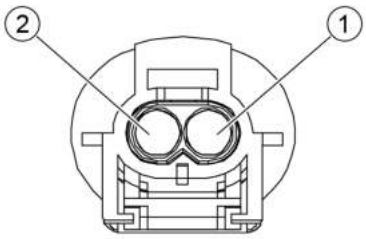
1 . Injection ECU (Light blue)
2 . Ground lead (Grey-Green)
3 . Injection ECU (Grey-Black)
4 . Not connected
5 . Not connected
6 . Not connected
7 . Not connected
8 . Not connected
9 . Not connected
10 . Not connected

RH FRONT ABS SENSOR CONNECTOR



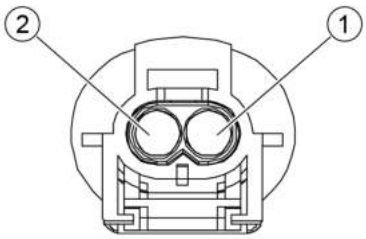
1 . Negative from ABS control unit (Purple-Black)
2 . Signal (Purple-Red)

LH FRONT ABS SENSOR CONNECTOR



1 . Negative from ABS control unit (Light blue-Black)
2 . Signal (Sky blue-Red)

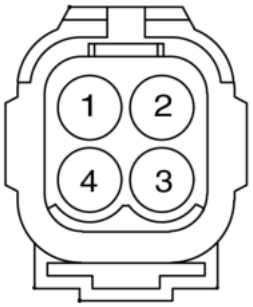
REAR ABS SENSOR CONNECTOR



1 . Negative from ABS control unit (Brown-Black)
2 . Signal (Brown-Red)

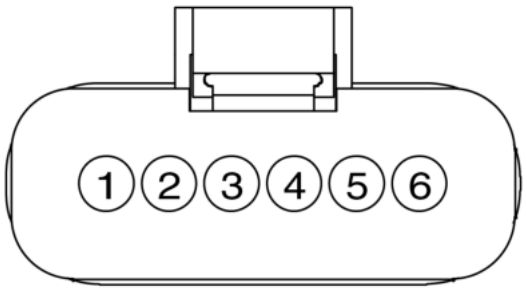
TILT SENSOR CONNECTOR

1 . Not connected
2 . ground sensors (grey-green)
3 . Power supply from the injection control unit (Light blue-Green)
4 . Signal for injection control unit (Orange-Green)



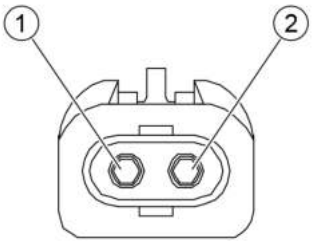
1 . THROTTLE GRIP POSITION SENSOR CONNECTOR

1 . Power supply (1) from the injection control unit (Light blue-Red)
2 . Sensors ground (Light Blue-Black)
3 . Injection control unit signal (1) (Light blue-Yellow)
4 . Power supply (2) from the injection control unit (Brown-Red)
5 . Sensors ground (Brown-Black)
6 . Injection control unit signal (2) (Brown-White)



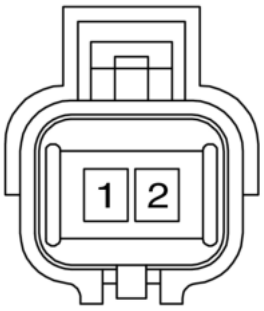
RIDER DETECTOR SENSOR CONNECTOR

1 . Rider present sensor (Purple)
2 . Negative from parking control unit (Black-Green)



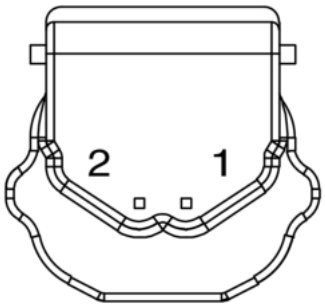
PRESSURE SENSOR CONNECTOR

1 . Parking electronic control unit (White)
2 . Sensors ground (Black-Green)



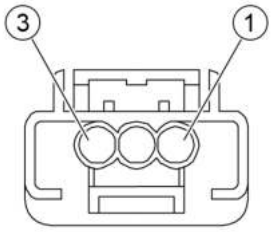
OIL PRESSURE SENSOR CONNECTOR

1 . Instrument panel (Pink-Black)
2 . Not connected



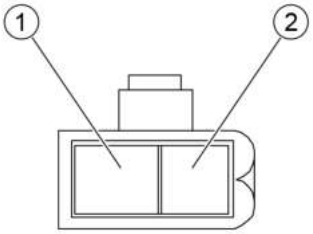
ROTATION SENSOR CONNECTOR

1 . Power supply from parking command control unit (Orange-Blue)
2 . Signal (Green-Blue)
3 . Negative from parking control unit (Black-Green)



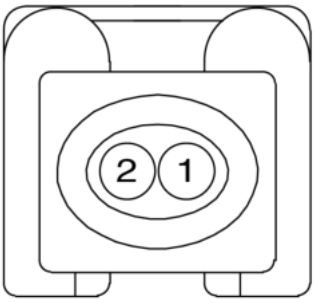
EXTERNAL TEMPERATURE SENSOR CONNECTOR

1 . Ground (Black-Yellow)
2 . Signal (Yellow-Blue)

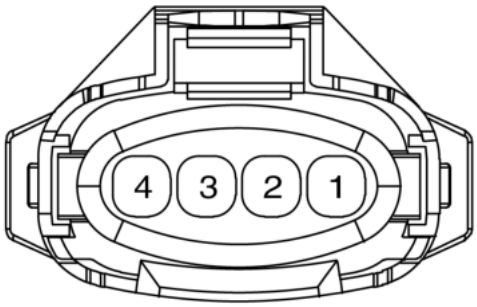


ENGINE TEMPERATURE SENSOR CONNECTOR

1 . Signal for injection control unit (Light blue-Green)
2 . Ground reference from injection ECU (Purple-Black)

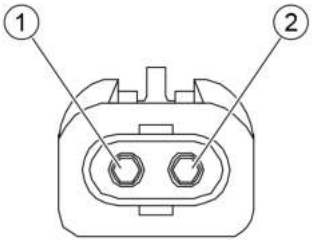


T-MAP SENSOR CONNECTOR



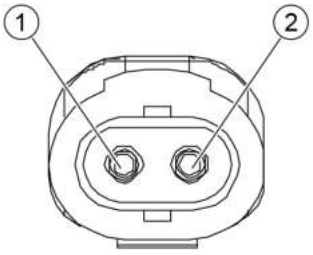
1. Ground reference from injection electronic control unit (Grey-Green)
2. Air temperature signal output for injection ECU (Yellow-Blue)
3. Power supply from injection ECU (Green-Red)
4. Air pressure signal output for injection ECU (Yellow-Green)

RH SPEED SENSOR CONNECTOR



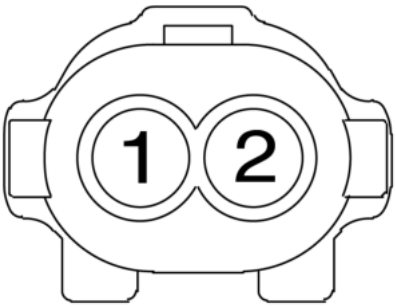
1. Negative from parking control unit (Black-Red)
2. Speed sensor (Red)

LH SPEED SENSOR CONNECTOR



1. Negative from parking control unit (Green-Black)
2. Speed sensor (Green)

IGNITION ACTUATOR SOLENOID CONNECTOR



1. Ignition actuator solenoid + signal (Green-White)
2. Ignition actuator solenoid - signal (Green-Black)

CONNECTOR LAMBDA PROBE 1 WITH HEATER

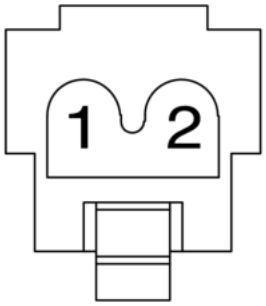
1 . Lambda signal (+) from the injection electronic control unit (Green-Blue)
2 . Lambda signal (-) from injection electronic control unit (Light blue-Black)
3 . Power supply from injection load relay (Black-Green)
4 . Ground from heater for injection electronic control unit (White-Blue)

CONNECTOR LAMBDA PROBE 2 WITH HEATER

1 . Injection control unit signal (+) (Green-Blue)
2 . Injection control unit signal (-) (White-Blue)
3 . Power supply from injection loads for the heater (Black-Green)
4 . Ground from the injection control unit for the heater (Red-White)

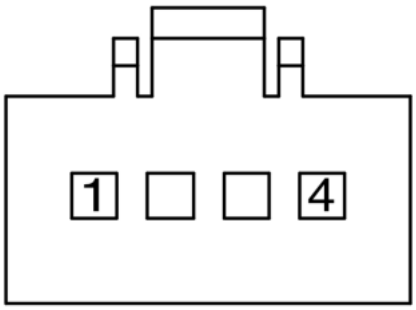
BUZZER CONNECTOR

1 . Ground lead (Black)
2 . Parking electronic control unit signal (Grey)



REAR CAMERA CONNECTOR

1 . Ignition switched live (Light blue)
2 . Ground lead (Black)
3 . (+) video signal from instrument cluster (Blue)
4 . (-) video signal from instrument cluster (Orange-Blue)



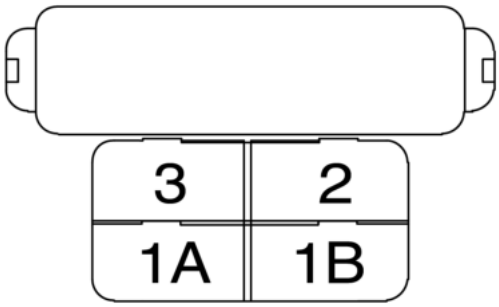
STARTER RELAY CONNECTOR

1A. Battery power supply output (Red-Black)

1B. Battery power supply output (Red-Black)

2. Key-on power supply input for the starter relay coil (Orange-White)

3. Signal input for starter relay coil from injection electronic control unit (Purple-White)



REVERSE CONTACTOR CONNECTOR

30R1. Power supply from reverse enable relay (Red)

87R1. Power supply output from reverse gear motor relay (Red)

85R1. Signal from injection ECU for reverse gear motor coil (White-Violet)

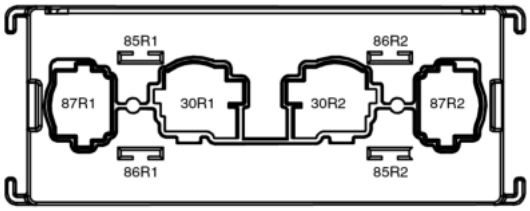
86R1. Power supply from injection load relay (Black-Green)

30R2. Power supply output from reverse enable relay (Red)

87R2. Reverse enable relay power supply input (Red)

85R2. Signal from injection ECU for reverse enable coil (Blue)

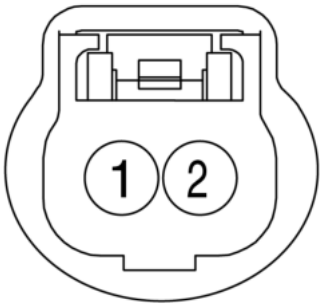
86R2. Power supply from injection load relay (Black-Green)



CANISTER VALVE CONNECTOR

1 . Signal for injection ECU (Black-White)

2 . Power supply from injection load relay (Black-Green)



6.15 Copying keys/remote controls

Procedure for the duplication of the remote control for "Piaggio KeyLess" system.

A= Remote control

B= Master-Key

1. Check the initial conditions:

1.1 Battery voltage higher > 12V

1.2 It is necessary to have the Master-Key available

1.3 It is necessary to have all remote controls to be coded (including those already coded before the procedure),

1.4 It is necessary to connect the PADS diagnosis tool to the OBD connector of the vehicle, using a specific tool.

Table 2: Specific tools

CODE	DESCRIPTION	IMAGE
021999Y	PADS 4.0	
021017Y	PADS EOBD E5 diagnostics cable	

2. Start duplication procedure before entering Keyless Self-diagnosis using PADS:

2.1 Ignition key on **"OFF"**.

2.2 Deactivate the remote control by pressing the first and the second button.

2.3 Press the ignition key and at the same time approach the master key (mechanical key) to the Keyless control unit. **(*)**

2.4 Following the flashing of the hazard warning lights, the ignition key can be turned to **"ON" (**)**

(*) The master key is equipped with an integrated transponder and must be brought into contact with the housing on the outside of the underseat compartment by means of the guide ribs, on the left side of the vehicle, near the 'Keyless' system control unit.

(**) From the moment the selector is turned to the "ON" position, the Remote Control Programming procedure must be started within 120 seconds (description in step 3. Otherwise, the procedure must be started from step 2.

3. Start procedure in Self-diagnosis & Keyless remote controls programming using PADS:

3.1 With ignition key on "ON".

3.2 Access the Keyless control unit self-diagnosis.

3.3 Eliminate any faults stored in the "MEM" status, and/or proceed with the resolution of any anomaly.

3.4 Access the "Adjustments" section and start Adjustment> Remote Control Programming following the guided procedure proposed by PADS.

3.5 At the end of each remote control programming, PADS shows a message "Programming successful"; with subsequent message for request of programming a new remote control, up to a maximum of 4 remote controls. **(***)**

(***) The Keyless control unit gives 5 seconds between programming one remote control and the other.

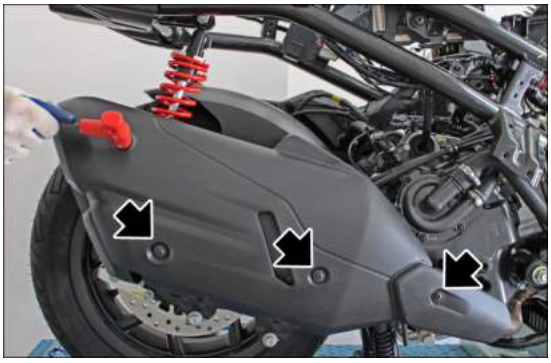
End of remote controls programming procedure.

LIST OF TOPICS

Engine from the vehicle

7.1 Removing the complete silencer

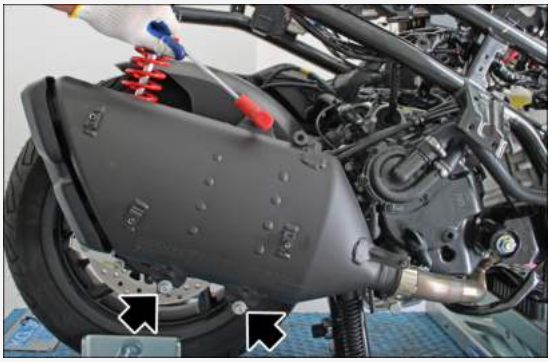
- Remove the right-hand and left-hand footrests.
- Remove the heat shield by unscrewing the four fixing screws.



- Disconnect the connector of the post-catalytic converter lambda probe.

- Loosen the clamp between the exhaust terminal and the manifold.

- Remove the three screws that fasten the exhaust terminal.



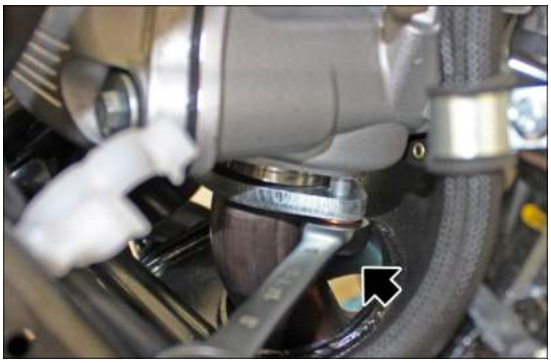
- Remove the exhaust en by sliding it off the manifold.

- Release the pre-catalytic converter lambda probe connector and disconnect it.

- Remove the screw rear that secures the rear brake pipe to the frame.

- Remove the right-hand nut of the exhaust manifold.

- Remove the left-hand nut of the exhaust manifold.



- Remove the exhaust manifold paying attention to slide off the wiring harness of the lambda probe.

FITTING THE COMPLETE SILENCER

- If necessary, install the lambda probe on the exhaust manifold.

DESCRIPTION	TORQUE
Lambda probe fastener	25 ± 5 Nm

- Install the exhaust manifold to the vehicle, taking care not to damage the lambda probe during installation.
- Partially screw in the two exhaust flange nuts.

- Connect the pre-catalytic converter lambda probe connector and fasten it to the respective support.

- Restore the rear brake pipe into position and tighten the screw that secures it to the frame.

- Install the terminal on the exhaust manifold.

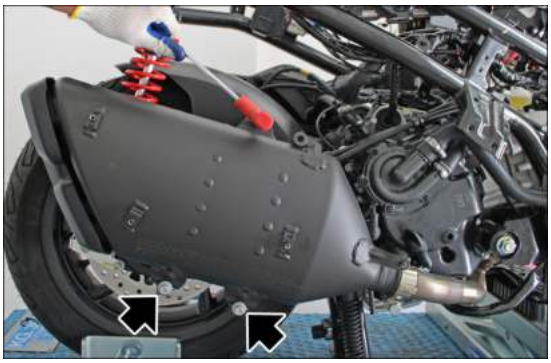
WARNING

ALWAYS REPLACE THE GRAPHITE GASKET BETWEEN THE TERMINAL AND THE EXHAUST MANIFOLD.

- Connect the post-catalytic converter lambda sensor connector and engage it in its seat.

- Install the three fixing screws and tighten them to the specified torque.

DESCRIPTION	TORQUE
Exhaust muffler fixing screw	28.5 ± 1.5 Nm



- Tighten the two exhaust flange fixing nuts to the specified torque.

DESCRIPTION	TORQUE
Exhaust flange fixing nut	17 ± 1 Nm

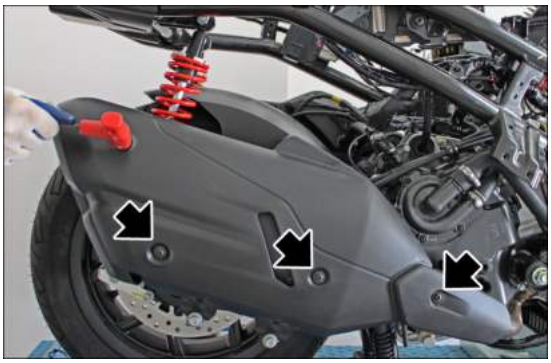
- Tighten the metal clamp between the terminal and the exhaust manifold.

DESCRIPTION	TORQUE
Metallic clamp	13 ± 1 Nm

- Install the heat shield on the exhaust muffler, making sure to insert the pin into the rubber bushing on the terminal.

- Tighten the four heat shield fixing screws to the specified torque.

DESCRIPTION	TORQUE
Heat shield fixing screw	4.5 ± 0.5 Nm



7.2 Removing the engine from the vehicle

Proceed as follows:

- Use a jack to support the vehicle properly.
- Disconnect the battery.
- Remove the side fairings.
- Remove the footrests.
- Remove the helmet compartment.
- Remove the complete silencer.

WARNING

CARRY OUT THESE OPERATIONS WHEN THE ENGINE IS COLD.

- Unscrew and remove the fuel pipe fixing.

- Remove the safety lock.
- Disconnect the fuel pipe connector from the injector.

- Disconnect the injector connector.

- Disconnect the throttle body connector.

- Turn the safety lock anticlockwise and disconnect the engine temperature sensor connector.

- Remove the clamp and disconnect the canister piping from the intake coupling.

- Disconnect the tubes from the spark plugs.

- Disconnect the lambda probe electric connector.

- Open the cable ties clamp located above the engine to release the main wiring harness.

- Disconnect the tone wheel sensor connector of the rear wheel.

- Disconnect the oil pressure sensor connector.

- Unscrew and remove the fixing screws of the rear brake calliper.

- Release the cable of the connector from the retaining clip.

- Unscrew and remove the fixing screws of the rear brake calliper.

- Remove the rear brake calliper.

- Unscrew and remove the fixing screws of the parking brake calliper.

- Remove the parking brake calliper.

- Unscrew and remove the screw fixing the rear brake cable retaining clamp.

- Remove the hose clamp of the line connecting the radiator to the pump.

- Disconnect the pipe from the pump.

- Unscrew and remove the hose clamp of the line connecting thermostat to the radiator.

- Disconnect the pipe from the thermostat.

- Open the joint cover, unscrew and remove the nuts connecting the electric motor wiring harness of the reverse gear.

- Unscrew and remove the screw fixing the cable retaining plate.

- Disconnect the connector of the reverse gear system.

- Remove the license plate light wiring harness with its relative cable glands from its compartment in the engine.

- Disconnect the connector of the flow meter.

- Disconnect the starter motor positive connector.

- Disconnect the starter motor negative connector.

- Disconnect the connector from the voltage regulator.

- Disconnect the Lambda sensor connector.

- Unscrew and remove the fixing screw of the engine ground cable to the LH footplate.

- Unscrew and remove the upper fastening pins on the rear shock absorbers.

- Unscrew and remove the fixing nuts of the exhaust manifold to the big end.

- Remove the exhaust manifold pulling first the fixing flange.

- Unscrew and remove the fixing nut of the engine pivot.

- Slide off the engine pivot.

- The engine is now disconnected from the vehicle and it is possible to remove it from the vehicle.

7.3 Fitting the engine on the vehicle

- Properly support the engine and the chassis.
- Place the engine in the frame and align the holes of the engine with the ones of the swinging arm.

- Insert from the left side of the vehicle the pin that fastens the engine to the swinging arm.

- Insert from the right side of the vehicle the nut and tighten it to the prescribed torque.

Table 3: Tightening torques

DESCRIPTION	TORQUE
Engine - swinging arm pin	67 - 75 Nm

- Insert the exhaust manifold in the hole into the swinging arm and then pass the relative fixing flange.

- Insert and tighten the fixing nuts of the exhaust manifold flange.

- Insert and tighten to the recommended torque the upper fixing pins of the shock absorbers.

Table 4: Tightening torques

DESCRIPTION	TORQUE
Shock absorber upper clamp	33 - 41 Nm

- Insert and tighten the fixing screw of the engine ground cable to the LH footplate.

- Connect the lambda probe connector.

- Connect the connector from the voltage regulator.

- Connect the starter motor negative connector.

- Connect the starter motor positive connector.

- Connect the electrical connector of the flow meter.

- Insert the license plate lighting harness through the passages on the engine taking care to correctly insert the plastic grommets.

- Connect the connector of the reverse gear system.

- Insert and tighten the fastening screw of the cable retaining plate.

- Place the plate, insert and tighten the nuts connecting the electric motor wiring harness of the reverse gear.
- Close the plastic cover of the electric joint.

- Connect the pipe to the thermostat.

- Tighten the hose clamp of the line connecting thermostat to the radiator.

- Connect the line from the coolant pump.

- Tighten the radiator-to-pump line hose clamp.

- Insert and tighten the screw used to fasten the rear brake cable retaining clamp.

- Place the parking brake calliper.

- Insert and tighten to the recommended torque the screws fixing the parking brake calliper.

Table 5: Tightening torques

DESCRIPTION	TORQUE
Parking brake calliper screw	25.5 ± 1.5 Nm

- Position the rear brake calliper.

- Insert and tighten the rear brake calliper fixing screws, applying the recommended torque.

Table 6: Tightening torques

DESCRIPTION	TORQUE
Rear brake calliper fixing screw	42.5 ± 2.5 Nm

- Connect the oil pressure sensor connector.

- Disconnect the tone wheel sensor connector of the rear wheel.

- Lock the main harness in the snap clip located above the engine.

- Connect the tubes to the spark plugs.

- Connect the canister line from the inlet fitting.
- Lock the pipe by installing a new pipe clamp.

- Connect the engine temperature sensor connector.

- Connect the throttle body connector.

- Connect the injector connector.

- Insert the injector electric connector.

- Connect the fuel pipe connector.
- Make sure the fitting has clicked.
- Lower the safety lock.

- Mount the silencer.
- Mount the helmet compartment.
- Mount the footrests.

- Mount the side fairings.
- Fit the battery.
- Fill and bleed the cooling system.
- Connect the P.A.D. S. and reset the self-adjustable parameters and any updates.

LIST OF TOPICS

Power supply system

8.1 General section - Injection

KEY

1 . Injection ECU
2 . Injector
3 . Engine speed sensor
4 . Lambda probe
5 . Fuel pump
6 . Battery
7 . Diagnostic / OBD port
8 . H.V. coil.
9 . Engine temperature sensor

Injection system

This vehicle is fitted with an integrated injection and ignition system.

Injection is indirect in the manifold through an electro-injector.

The injection and ignition are timed on the four-stroke cycle by means of a tone wheel keyed on the crankshaft and of a pick-up sensor.

Mixture and ignition are managed on the basis of engine revs and throttle valve opening. Further corrections are made according to the following parameters:

- Coolant temperature
- Intake air temperature
- Lambda probe

The system implements cold engine idle fuel/air mixture correction with a stepper motor on a by-pass circuit of the throttle valve. The control unit manages the Stepper motor and the injector opening time, thereby ensuring the idle steadiness and the proper mixture.

In all conditions of use, mixture preparation is managed by modifying the injector opening time.

The fuel system pressure is kept constant in relation to ambient pressure.

The **fuel system circuit** consists of:

- Fuel pump
- Fuel filter
- Injector
- Pressure regulator

The pump, the filter and the regulator are placed inside the fuel tank on a single support.

The injector is connected by a pipe with fast-release fittings. The pressure regulator is located at the beginning of the circuit.

The fuel pump is controlled by the control unit; this ensures safety of the vehicle.

The **ignition circuit** consists of:

- H.V. coil.
- H.V. cable.
- Shielded cap
- ECU
- Spark plug

The ECU manages ignition at the optimum advance while ensuring timing on the four-stroke cycle (ignition only in compression).

The injection/ignition system manages the engine function according to a pre-set program.

Should any input signals fail, an acceptable working order of the engine is ensured to allow the user to reach a service station.

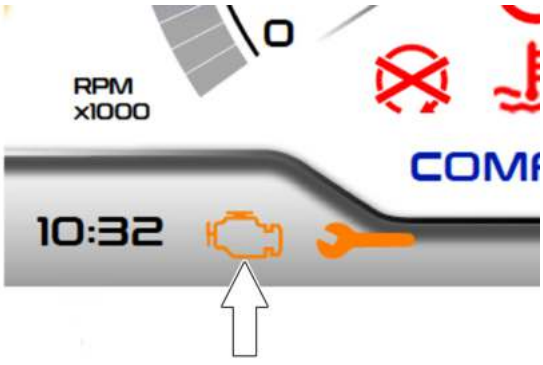
Of course, this cannot happen when the rpm-timing signal is missing, or when the failure involves the control circuits:

- Fuel pump
- H.V. coil.
- Injector

The control unit is fitted with a self-diagnosis system connected to a warning light on the instrument panel.

Failures are detected and restored by the diagnostic tester.

The diagnostic tester is also required to adjust the idle mixture.



CODE	DESCRIPTION	IMAGE
021999Y	PADS 4.0	

8.2 Precautions

1. Before repairing any part of the injection system, check if any faults have been stored. Do not disconnect the battery before checking for faults.

2. The fuel supply system is pressurised. Before disconnecting the fast-release fitting of the fuel supply pipe, check that there are no naked flames. Do not smoke. Act with caution to avoid spraying fuel to your eyes.

3. When repairing electric components, the battery must always be disconnected unless it is strictly necessary for the battery to be connected.

4. When functional checks are performed, make sure that the battery voltage exceeds 12V.

5. Before attempting to start the vehicle, ensure that there are at least two litres of fuel in the tank. Failure to respect this norm will damage the fuel pump.

6. If a long period is envisaged with the vehicle not in use, fill the tank to at least the halfway mark. This will ensure the pump will be covered by fuel.

7. When washing the vehicle, do not spray excessive water on electric components and wiring harnesses.

8. In the event of ignition problems, begin troubleshooting from the battery and the injection system connections.

9. Before disconnecting the ECU connector, perform the following steps in the order shown:

- Set the switch to «**OFF**»
- Disconnect the battery

Failure to respect this norm may damage the control unit.

10. Do not invert the poles when fitting the battery.

11. To avoid causing any damage, disconnect and reconnect the system connectors only if required. Before reconnecting, check that the connectors are dry.

12. When carrying out electric inspections, do not force the tester probes into the connectors. Do not take measurements not specifically foreseen by the manual.

13. At the end of every check performed with the diagnostic tester, remember to protect the system connector with its cap. Failure to observe this precaution may damage the control unit.

14. Before reconnecting the quick couplers of the power supply system, check that the terminals are perfectly clean.

Troubleshooting hints

1. An injection-ignition system failure is more likely to be due to the connections rather than to the components.

Before troubleshooting the system, carry out the following checks:

A: Power supply

a. Battery voltage

b. Blown fuse

c. Relays

d. Connectors

B: Frame ground connection

C: Fuel system

a. Faulty fuel pump

b. Dirty fuel filter

D: Ignition system

a. Faulty park plug/s

b. Faulty coil

c. Faulty shielded cap

E: Intake circuit

a. Air filter dirty

b. Faulty stepper motor

F: Others

a. Wrong timing system

b. Wrong idle mixture

c. Wrong reset of the throttle valve position sensor

2. Failures in the system may be caused by loose connectors. Make sure that all connections are properly implemented.

Check the connectors taking into consideration the following point:

A: check that the terminals are not bent.

B: check that the connectors have been properly connected.

C: check whether the failure changes if the connector is slightly vibrating.

3. Check thoroughly the entire system before replacing the control unit. If the fault is fixed even by replacing the control unit, install the original control unit again and check if the fault occurs again.

4. For troubleshooting, use a multimeter with an internal resistance of more than 10KW / V. Inappropriate tools may damage the control unit. The instruments to be preferred have a definition over 0.1V and 0.5W and an accuracy over 2%.

8.3 Fuel system

The fuel supply circuit includes the electric pump, the filter, the pressure regulator, the electro-injector and the fuel delivery pipes.

The electrical pump is located in the tank from which the fuel is pumped and sent to the injector through the filter.

The pressure is controlled by the pressure regulator situated in the pump assembly in the tank.

8.4 Fuel pump removal

FUEL PUMP REMOVAL

To remove the fuel pump from the vehicle, proceed as follows:

- Remove the tank from the vehicle.

- Rotate the connector of the fuel pipe by 90 ° on its axis and disconnect it from the pump.

- Place the fuel tank on the bench.

- Before proceeding with disassembly, mark the position of the fuel pump connector with a marker pen, in order to realign it correctly during assembly.

- Unscrew and remove the locking ring nut of the fuel pump with fuel level indicator.

- Remove the fuel pump complete with gasket for the necessary checks or for replacement.

8.5 Fuel pump fitting

FUEL PUMP FITTING

- Lubricate the surface between the gasket and the tank collar with soapy water.

- Insert the fuel pump into the tank, taking care to realign the connector with the original position.

- Screw and lock the fuel pump nut.

- Fit the tank in the frame and reconnect the fuel pipe and the electrical connector of the fuel pump.

8.6 Removing injector

To remove the fuel injector, proceed as follows:

- Remove the helmet compartment.
- Undo the fixing screw of the fuel pipe retainer clamp.

- Remove the screw.

- Remove the safety retainer and disconnect the fuel hose coupling from the injector support.

- Disconnect the electrical connector.

- Unscrew and remove the fixing screws of the injector support.

- Remove the fixing screws and the fuel pipe support bracket.

- Remove the injector with its support.

- Remove the clip.

- Disconnect the injector from the support.

8.7 FITTING injector

- Assemble the injector with the corresponding support.

- Place the injector retaining spring on the support.

- Place the injector with its support in its seat.

- Place the fuel pipe support bracket.
- Insert the fastening screws.

- Tighten the injector fixing screws and the bracket.

- Insert the injector electric connector.

- Connect the fuel pipe connector.
- Make sure the fitting has clicked.
- Lower the safety lock.

- Place the fuel pipe fixing clamp.
- Insert the fastening screw.

- Tighten the pipe fixing screw.

8.8 Throttle body removal

To remove the throttle body, proceed as follows:

- Disconnect the battery.
- Remove the helmet compartment.
- Disconnect the throttle body connector.

- Loosen the clamp of the connection sleeve to the inlet coupling.

- Loosen the clamp on the connection sleeve to the air filter box.

- Disconnect the sleeve on the air filter box side.

- Disconnect the throttle body from the sleeve on the engine side and remove it from the vehicle.

8.9 Throttle body fitting

To install the throttle body on the vehicle, proceed as follows:

- Place the throttle body in the sleeve connecting with the intake coupling.

- Connect the throttle body with the sleeve on the air filter side.

- Tighten the clamp on the sleeve on the air filter side

- Tighten the clamp on the engine side.

- Connect the electric connector.
- Restore the vehicle
- Connect the device P.A.D. S. and reset the throttle body and the self-adjustable parameters.

8.10 Hydraulic check of the system

Install the specific tool for checking the fuel pressure, with the pipe fitted with the gauge.

Check during regular operation by placing the appropriate tool between the pump and the injector.

- With the battery voltage 12 V, check the pump flow rate by disconnecting from the injector the pipe equipped with the pressure gauge of the appropriate tool. Prepare a graded burette with flow rate of approximately 1 L.
- Turn the pump with active diagnosis of the PDA.
- Using a pair of long flat needle-nose pliers, choke the fuel pipe making the pressure stabilise at approx. 3,5 bar.
- Pay attention not to choke the pipe too much, as the pressure remains unchanged while the flow diminishes.
- Check that within 15 seconds the pump has a flow rate of approx. 230 cc.

CODE	DESCRIPTION	IMAGE
020480Y	Fuel pressure measurement kit	

8.11 Hydraulic check of the injector

Remove the injector.

- Install the specific tool to check the fuel pressure and position the manifold on a graduated container of at least 100 cc.
- Connect the injector with the cable as part of the kit for the injection tester.
- Connect the clamps of the cable to an auxiliary battery.
- Activate the fuel pump with the active diagnosis.
- Check that, within fifteen seconds, approximately 40 cc of fuel is dispensed with an adjustment pressure of approximately 3.5 BAR.

CODE	DESCRIPTION	IMAGE
020480Y	Fuel pressure measurement kit	

8.12 Shielded cap check

Measure the shielded cap resistance.

Table 7: Electrical specifications

CHARACTERISTIC	DESCRIPTION / VALUE
Resistance	5 KΩ

If different values are measured (<1; >20KΩ), replace the shielded cap.

LIST OF TOPICS

Suspension

9.1 front wheel removal

- Remove the five screws that fix the wheel.

- Remove the wheel from the hub.

9.2 Front wheel hub service

- Remove the wheel.
- Remove the brake calliper.

- Remove the cotter pin.

- Remove the cap.

- Unscrew the fixing nut.

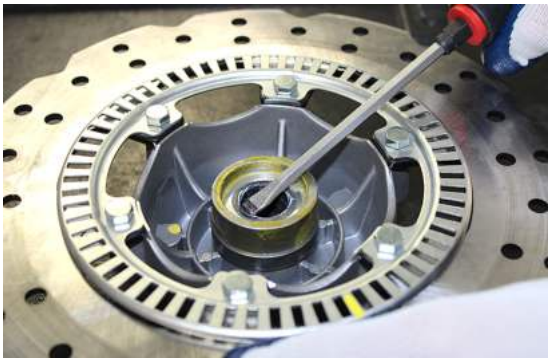
- Remove the wheel hub.

- Remove the ball bearing check Seeger ring indicated in the picture

- Extract the ball bearing using the specific tool

CODE	DESCRIPTION	IMAGE
001467Y014	Calliper to extract ø 15-mm bearings	
001467Y017	Bearing housing, external ø 39 mm	

- Remove the oil seal on the roller bearing side using a screwdriver

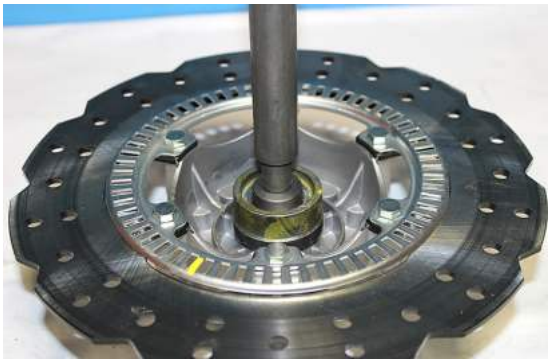


- Remove the roller bearing using the specific tool

CODE	DESCRIPTION	IMAGE
020376Y	Adaptor handle	
020456Y	Adapter 24 mm	

CODE	DESCRIPTION	IMAGE
020363Y	20-mm guide	

- Heat the roller bearing seat with a heat gun
- Use the specific tool to introduce and push the bearing until it stops, with the shielded side facing out
- Refit the ball bearing check Seeger ring



CODE	DESCRIPTION	IMAGE
020151Y	Air heater	
020376Y	Adaptor handle	

CODE	DESCRIPTION	IMAGE
020359Y	42 x 47 mm Adaptor	
020412Y	15-mm guide	

- Use the specific tool to fit and push the roller casing until it stops
- Refit the oil seal on the roller bearing side
- Lubricate the area between the roller bearing and the ball bearing

CODE	DESCRIPTION	IMAGE
020038Y	Punch	

PRODUCT	DESCRIPTION	SPECIFICATIONS
Lithium based grease	Yellow-brown lithium-based, medium-fibre grease suitable for a variety of uses.	ISO L-X-BCHA 3 - DIN 51 825 K3K -20

9.3 Fitting the front wheel

- Refit the hub and tighten the five screws of the wheel to the specified torque.

Table 8: Tightening torques

DESCRIPTION	TORQUE
Front wheel fastening screws	19 to 24 Nm

9.4 Removing the handlebar

- Remove the two handlebar covers as explained in the Bodywork Chapter.
- Remove the handlebar wiring retaining straps and disconnect the electric connectors.
- Unscrew the fittings, then remove the front and rear brake pump piping.
- Remove the demand sensor.
- Loosen the clamp fixing the handlebar to the steering tube and pulling upwards, remove the handlebar, then remove the lower plastic cover.

N.B.:

☞

IF THE HANDLEBAR IS BEING REMOVED TO REMOVE THE STEERING, TILT THE HANDLEBAR FORWARD TO AVOIDING DAMAGING THE TRANSMISSIONS.

9.5 Fitting the handlebar

Carry out the above operations by working in the reverse order from that used for removal.

DESCRIPTION	TORQUE
Handlebar fixing screw	50 - 55 Nm

9.6 Front shock absorber removal

To remove the front shock absorber, proceed as follows:

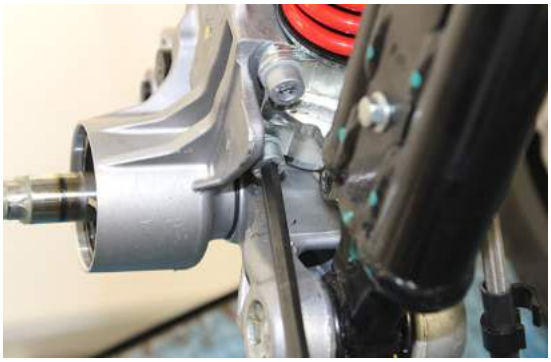
- Remove the mudguard of the side front suspension in question.
- Slide off the stanchion of the suspension block device.

- Unscrew and remove the fixing screws of the suspension block device calliper.

- Unscrew and remove the upper shock absorber fastening nut.

- Remove the nut, the washer, the ring and the upper buffer.

- Unscrew and remove the lower fixing screws of the shock absorber.



- Remove the shock absorber from the suspension.

9.7 Front shock absorber fitting

- Put the shock absorber in its seat.

- Insert in the following order:
  - the upper buffer
  - the washer
  - the ring
  - the fixing nut

- Tighten the nut by hand without tightening to the prescribed torque.

- Insert the lower fixing screws of the shock absorber.

- Tighten to the specified torque the lower fixing screws of the shock absorber.

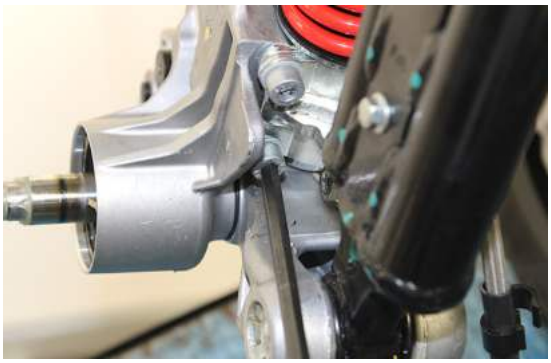


Table 9: Tightening torques

DESCRIPTION	TORQUE
Front shock absorber lower fixing	23.5 ± 3.5 Nm

- Position the calliper of the suspension locking system.

- Insert and tighten the screws fastening the calliper to the shock absorber.

- Insert the suspension lock device rod.

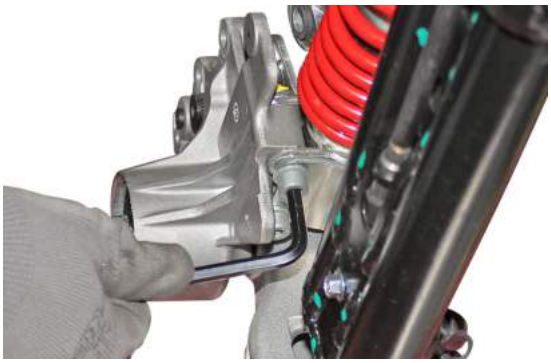
- Install the front mudguard.

9.8 Shock absorber brake calliper support

- Remove the wheel hub.
- Unscrew the fixing bolt of the ABS sensor to remove it from the support.

- Disconnect the speed sensor connector.

- Unscrew the two fixing of the shock absorber to the support.



- Remove the seeger stop ring of the support.

- Remove the shock absorber-brake calliper support and collect the washer and the O-ring.

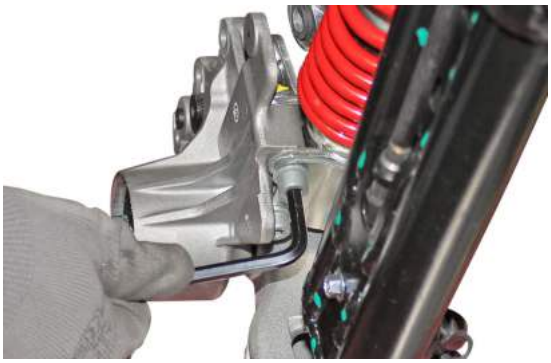
9.9 Shock absorber-brake calliper support mounting

position the shock absorber-brake calliper support, taking care to insert the washer and o-ring correctly

Insert the seeger stop ring of the support.

Insert and tighten to the prescribed torque the two shock absorber fasteners to the support.

DESCRIPTION	TORQUE
Lower shock absorber clamp	19 - 26 Nm



Connect the speed sensor connector.

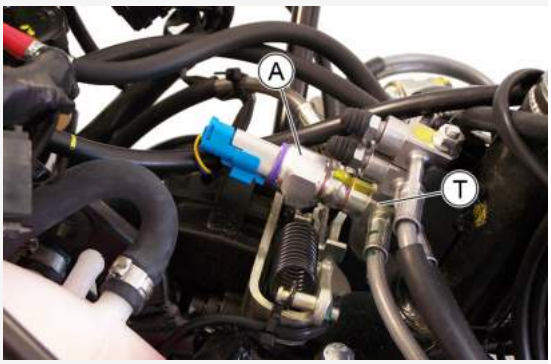
Position the ABS sensor in its housing. Insert and tighten the ABS sensor fixing screws. Refit the wheel hub.

9.10 Roll system - Hydraulic system layout

When roll is locked, the gear motor activates the hydraulic pump indicated in the picture and pressurises the circuit.

The pressurised oil reaches the distribution frame «**T**» and the pressure sensor «**A**».

Then, the pipes branch out to reach the upper joints on the side steering tubes.



Through the rigid-flexible pipes inside the side steering tubes, the oil reaches the stem sliding locking device placed parallel to the shock absorber.

9.11 Steering tubes

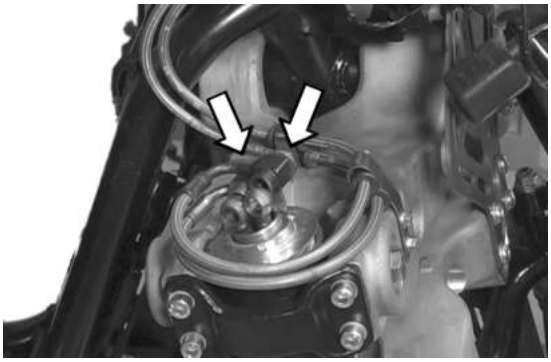
- Remove the brake calliper pipe retainers and the hydraulic pipe fitting from the brake calliper making sure there is a container to collect the brake fluid.

- Disconnect the tone wheel connector indicated in the picture.

- Undo the fixing screw of the ABS sensor and remove it.

- Remove the upper fittings, on the parallelogram, of the brake hydraulic pipes and the suspension lock indicated in the picture.

- Remove the hydraulic pipe fitting fixing nuts indicated in the figure from the support bracket.

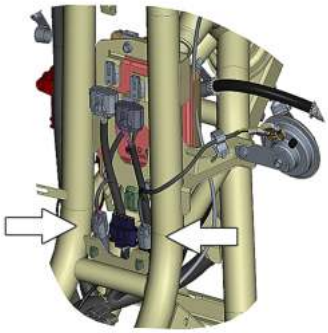


- Remove the suspension roll lock device pipes from the headstock.

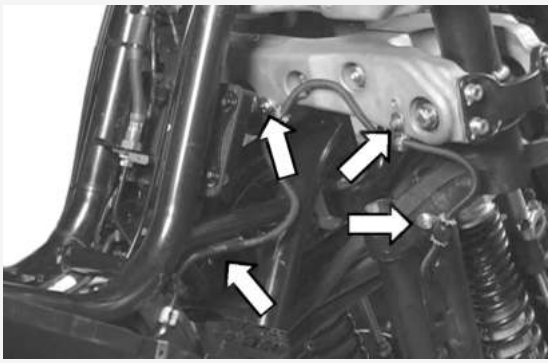
- Remove first the flexible part of the brake calliper from the steering tube as shown in the picture, and then remove the rigid part.

- Remove the clamps shown in the figure.

- Disconnect the front right and left speed sensor connectors.

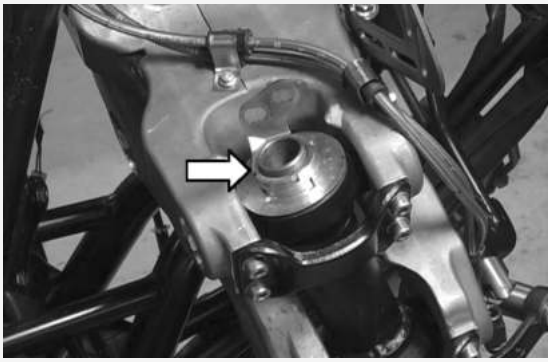


- Remove the clamps shown in the figure.



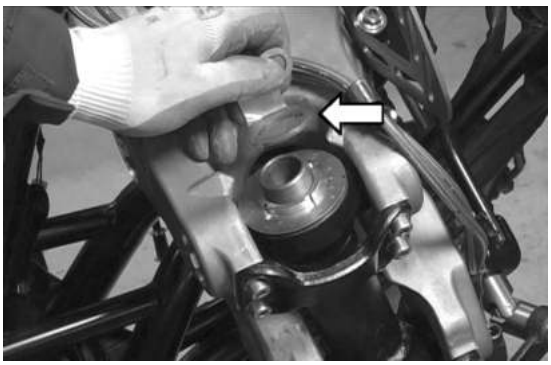
- Remove the constant-velocity universal joint from the steering bar by undoing the nut indicated in the picture.

- Use a specific tool to remove the upper tightening ring nut of the steering tube.

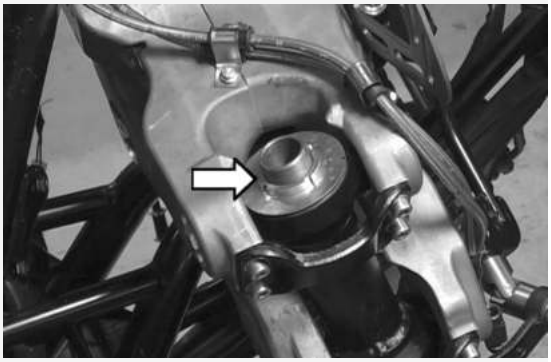


CODE	DESCRIPTION	IMAGE
020055Y	Wrench for steering tube ring nut	

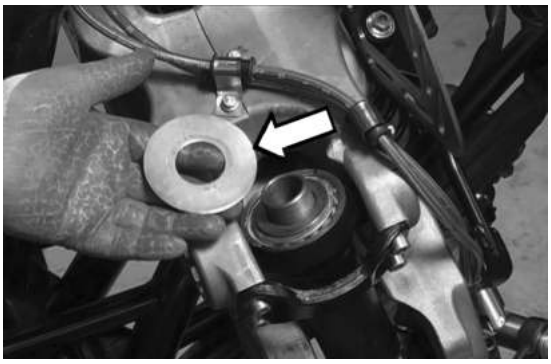
- Remove the hydraulic pipe support bracket.



- Remove the steering tube lower ring nut.



- Remove the protective cap.



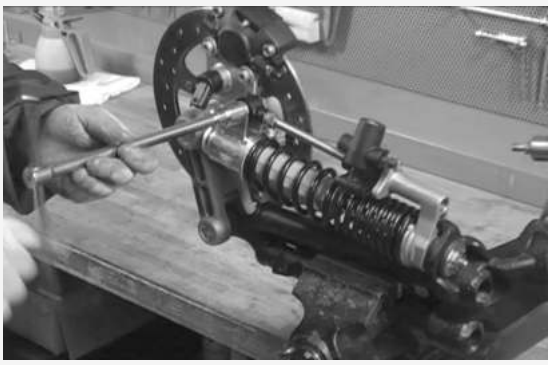
- Now the steering tube can be removed.

Check that the roller tapered bearing does not show signs of abnormal wear.

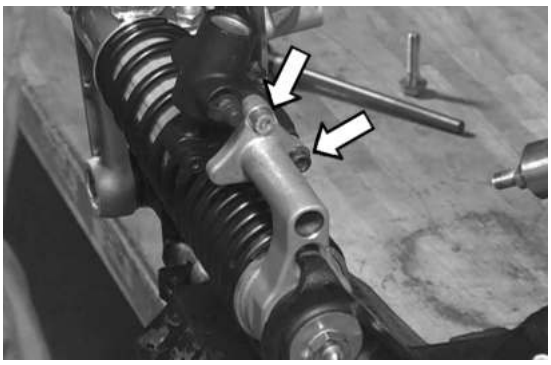
Otherwise, proceed with replacement.

THE OPERATIONS DESCRIBED BELOW CAN ALSO BE CARRIED OUT EVEN WHEN THE SUSPENSION IS FITTED

Remove the lower retainer of the sliding stem shown in the picture.

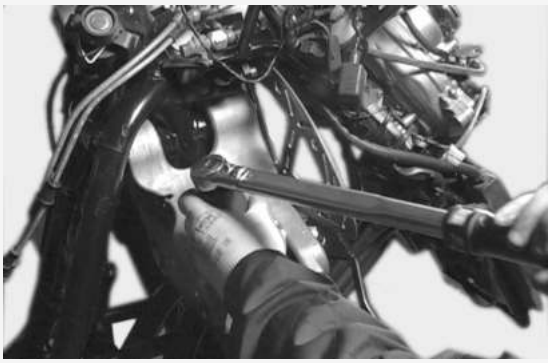


Remove the sliding stem locking device retainers indicated in the picture.



- Check that the sliding stem locking device does not show signs of abnormal wear.

- For refitting, follow the operations for removal but in reverse order, observing the prescribed torque and greasing the bearings and their seats.



DESCRIPTION	TORQUE
Side headstock upper ring nut	31,5 ÷ 38,5 Nm
Side headstock lower ring nut	4.5 ÷ 5.5 Nm
Screw fixing sliding stem to shock absorber	45 - 50 Nm
Fixing nuts for constant-velocity universal joints	18 ÷ 20 Nm
Suspension lock calliper pipe fitting on side steering pipe	25 - 28 Nm
Brake calliper pipe fitting on side steering pipe	25 - 28 Nm

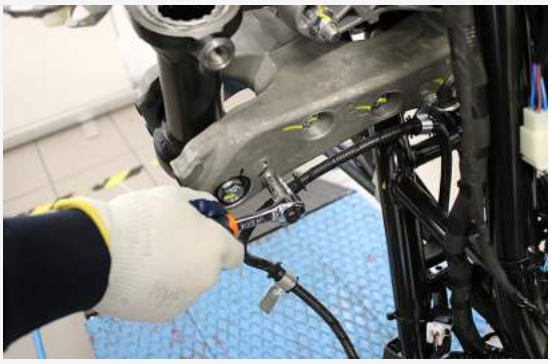
9.12 tension regulator

REMOVAL

To remove the tension regulator, proceed as follows:

- Remove the steering pipes.

- Remove the fastenings that secure the hydraulic tubes to the four-bar linkage.



- To facilitate the following operations, remove the roll lock control unit.

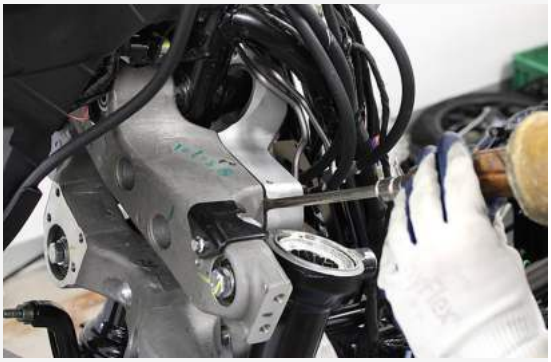
- Remove the 4 screws fastening the roll brake disc sector.

- Remove the roll brake disc sector.

- Unscrew the arm coupling fastenings of the tension regulator.

- Remove all screws.
- In order to simplify the re-assembly procedure, make a note of the position of the various components before removing them.

- Proceed with the separation of the two upper linkage arms using two wedges to be inserted into the slots on both sides of the vehicle as shown in the photo.
- Insert the wedges progressively and to the same extent on the right as on the left in order to separate the front from the rear of the rocker arm in parallel.



- Remove the plastic plugs at the ends of the lower arms.

- Using a suitable tool, separate the two lower linkage arms as shown in the photo, working progressively and equally on the right and left so that the front is separated from the rear in parallel.

- Remove the steering columns.

- remove the steering bearings.

- Visually check the bearings of the linkage arms. If any unusual wear is observed, replace the affected parts.

- Visually inspect the upper and lower bearing housings on the steering columns, and the respective bearings. If any unusual wear is observed, replace the affected parts.

- Check the internal tracks of the four-bar linkage bearings on the chassis.

REVISION

The procedure for replacing the bearings on the arms of the front suspension system is described below.

- Bring the linkage arms to the workbench.
- Remove the Seeger ring

- Tilt the arm.
- Using a hot air gun, heat the area surrounding to the bearing, that should be replaced.

- Tilt the arm.
- Using the appropriate tool, remove the bearing.
- Insert the new bearing working from the opposite side.

FITTING

- Place the linkage arms and the side headstocks in their seat on the frame.
- Insert and hand tighten wherever possible all the fastener screws.

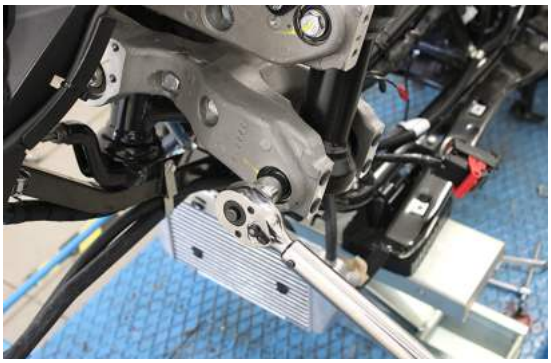
- Gradually tighten the screws joining the linkage arms a few turns at a time, starting with the central fulcrum screw.

- Then proceeding in a crossed sequence alternating the two sides of the vehicle.

- Finish the sequence by tightening the screws to the prescribed torque.

Table 10: Tightening torques

DESCRIPTION	TORQUE
Screws used to fasten the arms to the side columns	47.5 ± 2.5 Nm



- Position the roll brake disc sector.

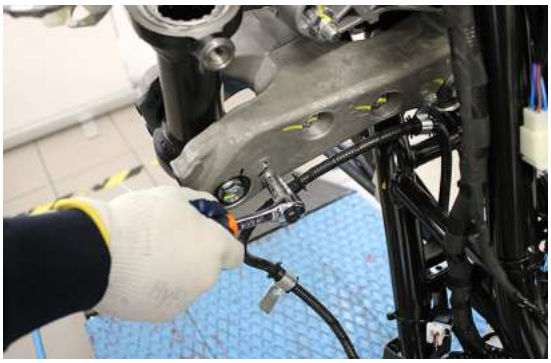
- Insert the screws fixing the brake disc sector and tighten them to the specified torque.

Table 11: Tightening torques

DESCRIPTION	TORQUE
Roll brake disc sector fastening screws	22.5 ± 2.5 Nm

- Reposition the roll block control unit.

- Insert and tighten the fixing screws of the hydraulic hoses clamps to tension regulator.

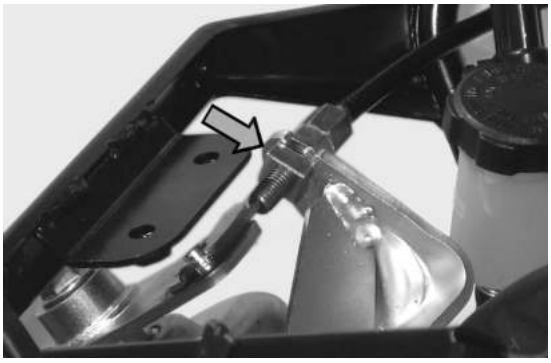


- Refit the steering tubes.

9.13 gear motor and suspension lock devices

Before removing the gear motor:

- Disable the suspension lock.
- - Remove the front shield.
- With the set nut indicated in the picture, remove the tensioning cable of the suspension locking mechanical calliper.
- Remove the electrical connection of the gear motor electric motor.



- Disconnect the hydraulic pipes between the pump and the sliding stem locking clamps.
- Empty the system and use a container to collect the brake fluid.

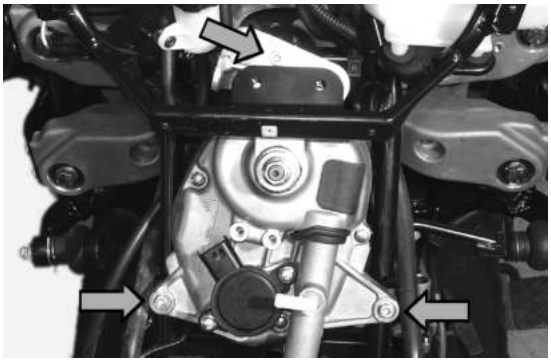
CAUTION

ELIMINATE ANY REMAINING BRAKE FLUID SPILLS.

CAUTION

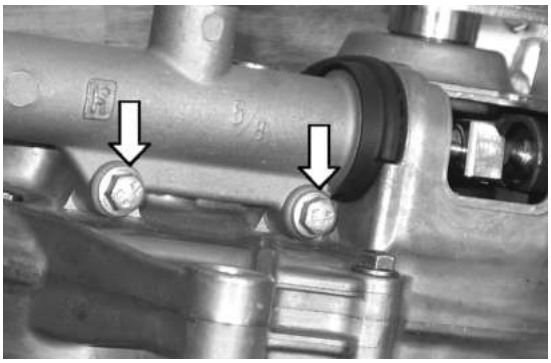
BRAKE FLUID IS EXTREMELY POISONOUS. NEVER ALLOW BRAKE FLUID TO BE INGESTED OR SWALLOWED. IF ACCIDENTALLY SWALLOWED, DRINK LARGE QUANTITIES OF MILK OR WATER AND SEEK MEDICAL ADVICE IMMEDIATELY. BRAKE FLUID IS HIGHLY DESTRUCTIVE TO SKIN AND EYE TISSUE. IF YOU ACCIDENTALLY SPILL BRAKE FLUID ON YOURSELF, TAKE OFF YOUR CLOTHES, WASH WITH HOT WATER AND SOAP AND SEEK MEDICAL ADVICE IMMEDIATELY. IF BRAKE FLUID GETS ACCIDENTALLY IN CONTACT WITH YOUR EYES, RINSE WITH ABUNDANT FRESH WATER AND SEEK MEDICAL ADVICE IMMEDIATELY. KEEP BRAKE FLUID OUT OF THE REACH OF CHILDREN.

- Remove the 3 fixing screws indicated and remove the whole gear motor.

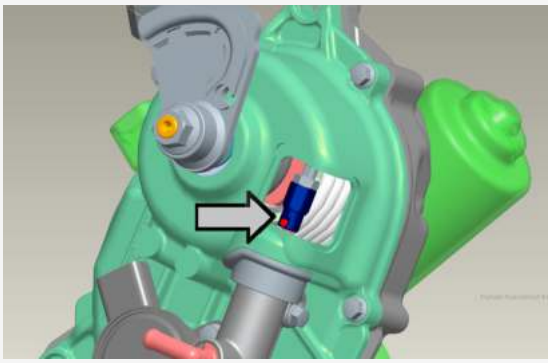


- Use a screwdriver to remove the plastic access cover to the pump joint/gear motor
- Undo the pump joint screw.

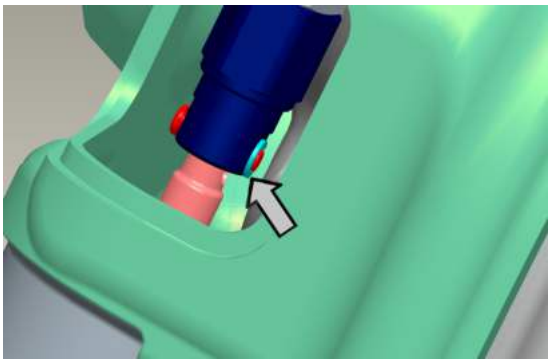
- Undo the two gear motor pump locking screws.



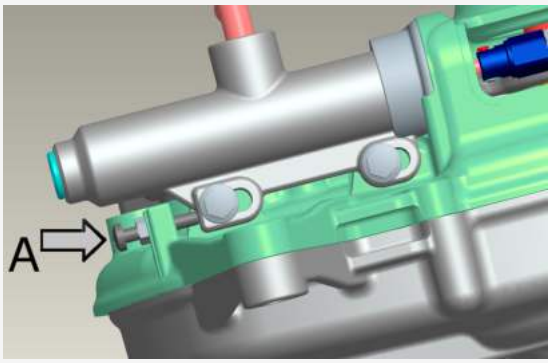
- The following points have been changed in the new solution for attaching the pump to the suspension block assembly:
- The connections of the pump body to the unit.



- the fixing of the pump coupling.

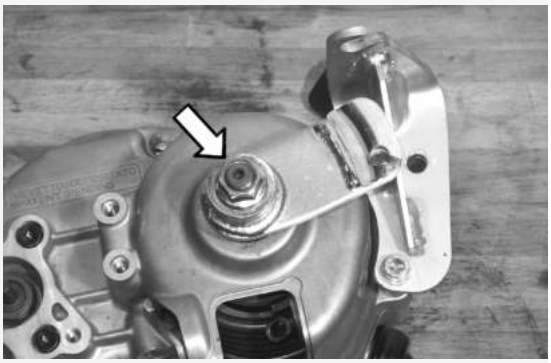


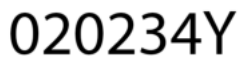
- A safety screw **"A"** on the lower part of the pump been also added to be tightened after the main locking have been carried out.



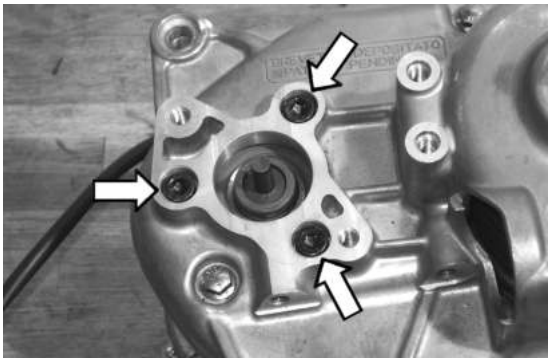
- Undo the two potentiometer screws.
- Upon refitting, plug the potentiometer in D-type connector, afterwards place it with its electric connection directed to the opposite side of the pump.

- Remove the nut indicated in the figure, if necessary lock the lever with a vice making sure not to spoil the surface.
- In case of difficulties when removing the lever, use the specific tool.
- Remove the tongue and then, the moulded washer.

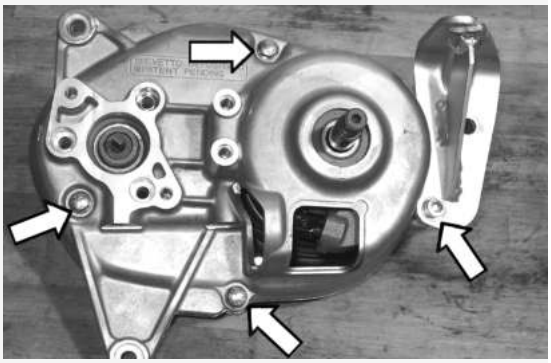


CODE	DESCRIPTION	IMAGE
020234Y	extractor	

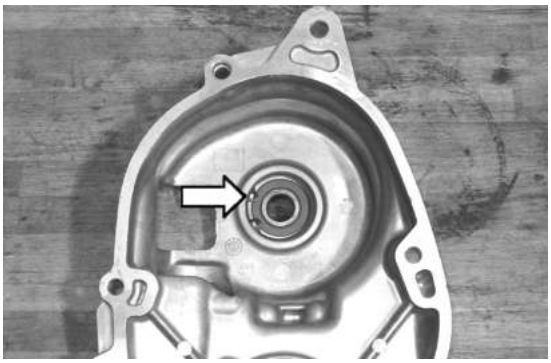
- Remove the three fixing screws of the electric motor.
- It is important to mark the direction of the electric motor position in order to refit it correctly.



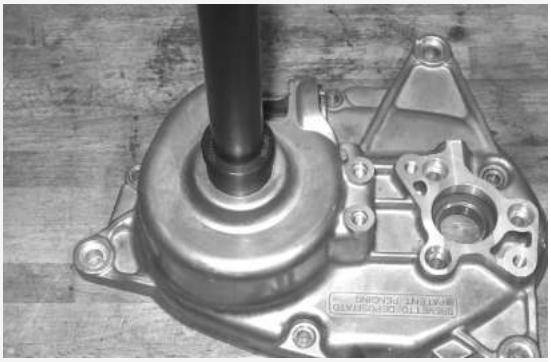
- Remove the four screws indicated in the figure, remove the flexible transmission supporting bracket, separate the two crankcase halves, if necessary, use a rubber mallet to hit the flexible transmission lever in order to separate the two crankcases.



- Remove the retaining Seeger ring of the bearing of the flexible transmission lever control shaft bearing.



- Remove the bearing with the specific tool.



CODE	DESCRIPTION	IMAGE
020376Y	Adaptor handle	
020441Y	26 x 28 mm adaptor	
020362Y	12 mm guide	

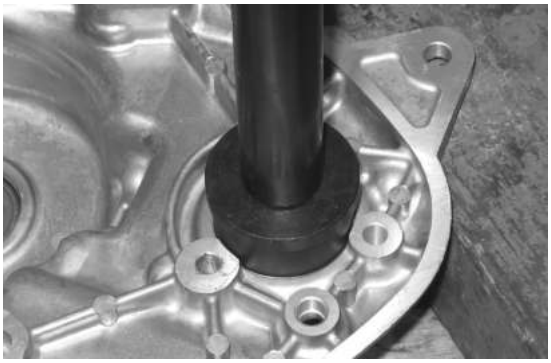
- Extract the electric motor bearing with the specific tool.

CODE	DESCRIPTION	IMAGE
020376Y	Adaptor handle	
020375Y	28 x 30 mm adaptor	
020363Y	20-mm guide	

- Hold the crankcase in a perfectly horizontal position, heat it with a specific heat gun at about 120 °C, use the specific tool to fit the bearing of the flexible transmission lever control shaft. Hit slightly with a mallet if necessary.
- Refit the bearing check Seeger ring.

CODE	DESCRIPTION	IMAGE
020151Y	Air heater	
020376Y	Adaptor handle	
020362Y	12 mm guide	
020357Y	32 x 35-mm Adaptor	

- Hold the crankcase in a perfectly horizontal position, heat it with a specific heat gun at about 120 °C, use the specific tool to fit the bearing of the electric motor. Hit slightly with a mallet if necessary.



CODE	DESCRIPTION	IMAGE
020363Y	20-mm guide	
020358Y	37 x 40 mm Adaptor	
020151Y	Air heater	
020376Y	Adaptor handle	

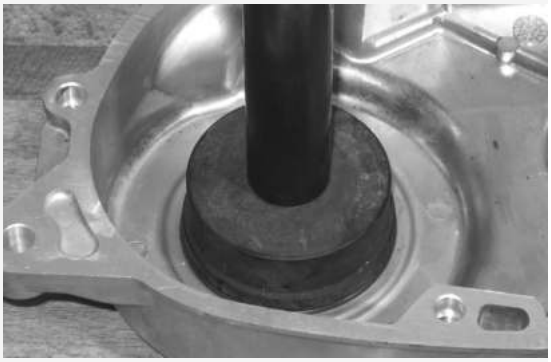
- Remove the spring/toothed sector unit from its fitting, slightly hit with a mallet if necessary to release the unit.

- Extract the bearing of the spring/toothed sector unit with the specific tool.

CODE	DESCRIPTION	IMAGE
001467Y002	Driver for OD 73 mm bearing	

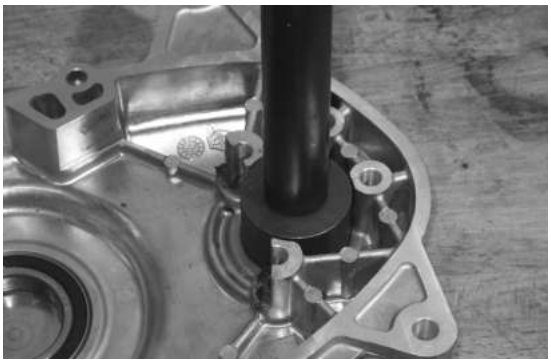
- Extract the bearing of the electric motor with the specific tool.

- Hold the crankcase in a perfectly horizontal position, heat it with a specific heat gun at about 120 °C, use the specific tool to fit the bearing of the spring/toothed sector unit. Hit slightly with a mallet if necessary.



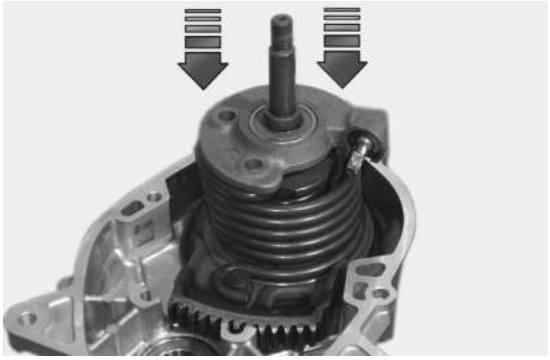
CODE	DESCRIPTION	IMAGE
020360Y	52 x 55 mm adaptor	
020151Y	Air heater	
020376Y	Adaptor handle	

- Hold the crankcase in a perfectly horizontal position, heat it with a specific heat gun at about 120 °C, use the specific tool to fit the bearing of the electric motor. Hit slightly with a mallet if necessary.

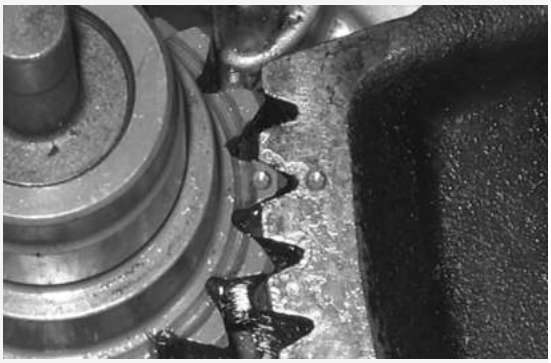


CODE	DESCRIPTION	IMAGE
020363Y	20-mm guide	
020151Y	Air heater	
020376Y	Adaptor handle	
020477Y	Adapter 37 mm	

- Refit the spring/toothed sector unit, hold the crankcase in a perfectly horizontal and stable position, place the spring/ toothed sector unit keeping it perfectly perpendicular to the bearing already fitted on the crankcase; if necessary, slightly hit the unit shaft end with a mallet and protect the thread by screwing in a nut.



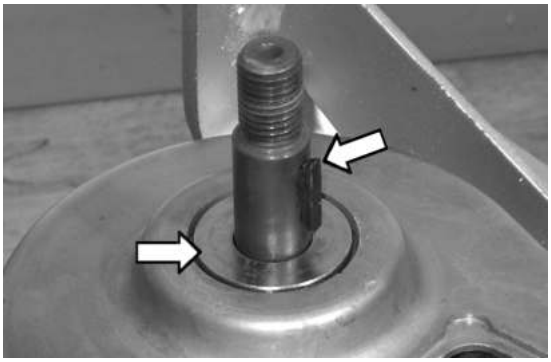
- Fit the pinion and align the reference on the pinion teeth with the reference indicated on the second slot of the toothed sector.
- Grease the pinion and the toothed sector with specific grease.



- Refit the toothed sector spacer.

PRODUCT	DESCRIPTION	SPECIFICATIONS
Molybdenum disulphide grease	Oily lithium grease containing molybdenum disulphide.	Grey-black grease

- Lubricate the interference areas, match the crankcase halves with slight hits of a mallet to get them into contact.
- Place the flexible transmission supporting bracket, refit the four screws, screw them to the prescribed torque.



DESCRIPTION	TORQUE
Gear motor crankcase halves coupling screws	12 ± 1 Nm

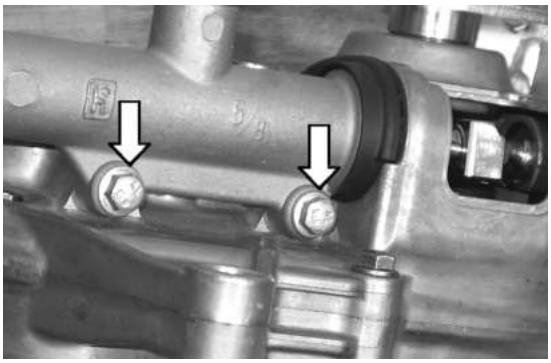
- Refit the electric motor; check the position is correct by means of the reference indicated during removal.
- The motor should be so positioned that it does not protrude from the reduction unit mould, see figure.
- Tighten the screws to the prescribed torque.

DESCRIPTION	TORQUE
Electric motor - roll lock device	12 ± 1 Nm

- Place the moulded washer of the flexible transmission control lever shaft and the tongue.
- Refit the flexible transmission control lever as shown in the figure.

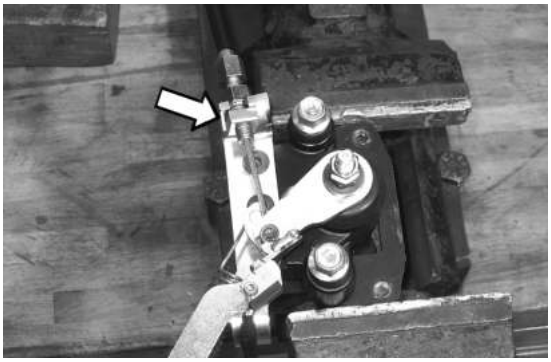
- Refit the potentiometer (not forcing in the D-type connector ensures a sole position) with the connector directed to the opposite side of the hydraulic pump.

- Refit the hydraulic pump on the gear motor body and tighten the screws to the prescribed torque.
- Fit but not tighten the pump stem coupling screw and refit the plastic protection cap.
- The synchronisation procedure should be complete when the installation is finished.

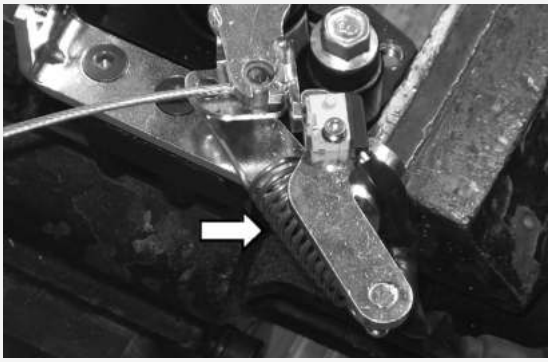


DESCRIPTION	TORQUE
Pump - roll lock device	12 ± 1 Nm

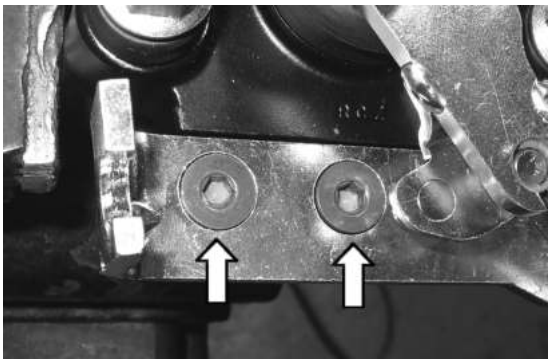
- Remove the two bracket screws after releasing the spring and freeing the flexible transmission adjustment.



- It is very important to remove the flexible transmission from its fitting only for replacement.

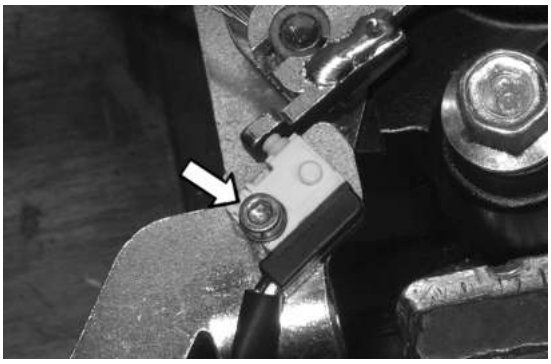


- When refitting, tighten the two bracket screws and the flexible transmission lever nut to the prescribed torque.



DESCRIPTION	TORQUE
Roll lock calliper - Bracket	10 ± 2 Nm

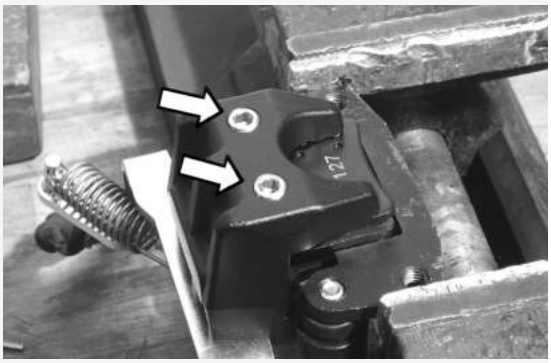
- Undo the Allen screw and remove the switch.

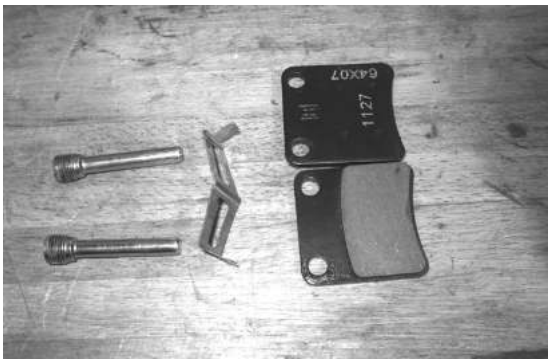


- Upon refitting, place the switch with the button oriented to the stop indicated on the calliper lever, observing the reference indicated on the switch supporting bracket.

- After refitting, check in detail that the switch is regularly activated by the stop on the lever.

- Undo the two pad pin screws; remove the pads with the spring.
- Upon refitting, tighten the two screws to the prescribed torque and use threadlock.
- Upon refitting, adjust the cable properly so that the switch is pushed when the system is unlocked.



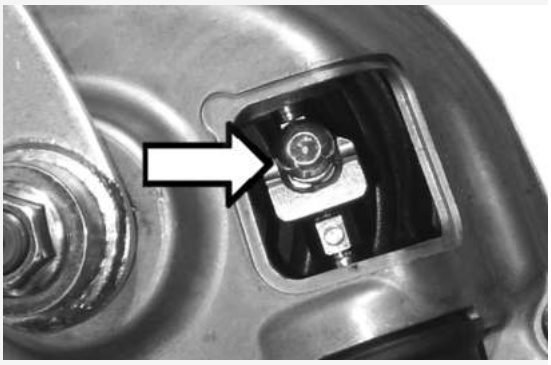


- Connect the diagnostic tool.

- Perform the troubleshooting of the lower stop and follow the indications given by the diagnostic tool.

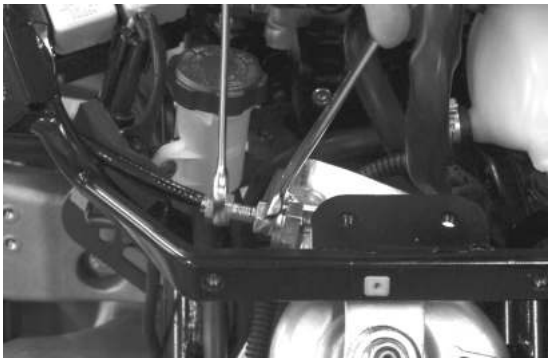
- The parameter adjustment of the relative angle must be performed by acting on the screw indicated in the picture, after having removed the lower protection cap.

- Remove the upper protection cap, align the pump control and lock the screw to the prescribed torque.



DESCRIPTION	TORQUE
Pump pin - Roll lock device	12 ± 1 Nm

- Proceed with the reset of the potentiometer following the indications given by the diagnostic tool.
- The adjustment of the flexible transmission must be performed so that a small clearance is left to guarantee switch activation on the roll lock calliper.



9.14 Rear wheel removal

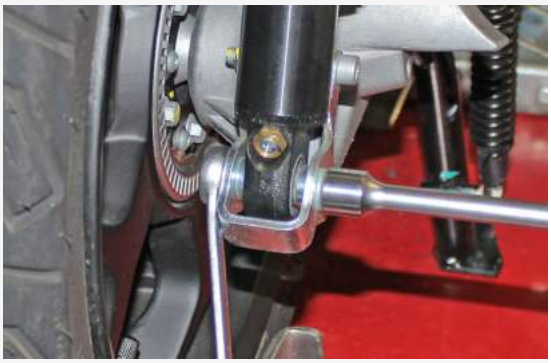
Before removing the rear wheel, support the vehicle properly and engage the parking brake so as to facilitate the removal of the wheel fixing screws.

- Remove the exhaust silencer.
- Remove the two upper screws of the bracket cover.

- Remove the two nuts fastening the cover and the bracket to the engine.

- Remove the bracket cover.

- Remove the rear mudguard.
- Undo the screw fixing the right shock absorber to the clamp.



- Remove the cotter pin and collect the cap.
- Unscrew the wheel fixing nut and collect the spacer.

- Unscrew the three screws fixing the bracket to the central stand.

- Undo the two fixing screws of the ABS sensor support and remove it.

- Unscrew the clamp.

- Retrieve the conical spacer.
- Unscrew the five screws that fix the wheel.

- Unscrew the upper fastener of the right shock absorber and remove it completely.

- Remove the wheel.

9.15 Fitting the rear wheel

- Put the wheel on the axle and put it all the way on with the hub.

- Align the holes between the wheel and the hub, then screw on the five fixing bolts of the wheel.

1 . Insert the spacer.

- Place the bracket all the way onto the wheel axle.

- Fit the ABS sensor on the bracket.

- Fix the two screws of the sensor support.

- Screw in the three fasteners of the bracket to the stand.

- Insert the spacer on the wheel hub.

- Insert the wheel axle nut and tighten, applying the recommended torque.

Table 12: Tightening torques

DESCRIPTION	TORQUE
Rear wheel axis	104 - 126 Nm

- Fit the cap and insert a new cotter pin.

- Fit the mudguard.
- Put the bracket cover.

- Screw the nuts used to fasten to the engine, tightening to the specified torque.

Table 13: Tightening torques

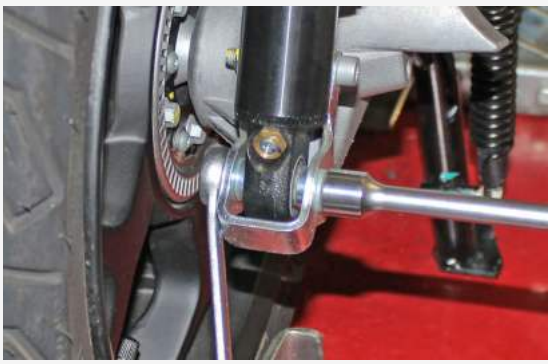
DESCRIPTION	TORQUE
Silencer arm fastening screw	27 ÷ 30 Nm

- Screw the two upper screws of the cover.
- Refit the exhaust silencer.

- Put back the right shock absorber and tighten the fastening to the recommended torque.

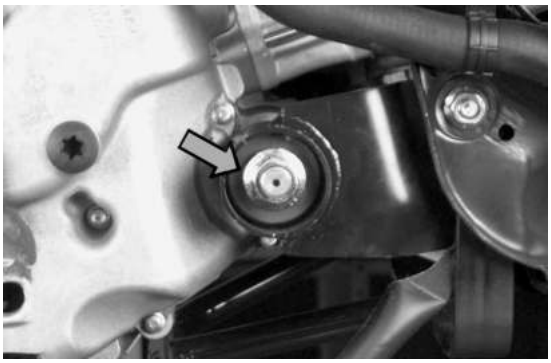
Table 14: Tightening torques

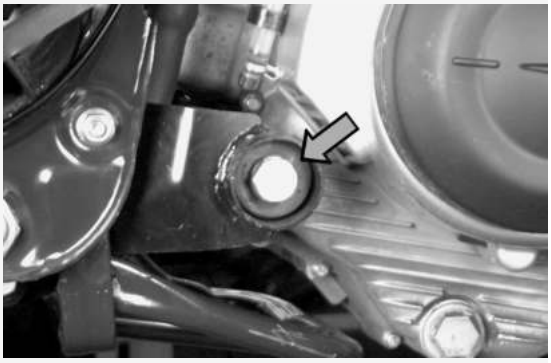
DESCRIPTION	TORQUE
Lower shock absorber clamp	19 - 26 Nm
Shock absorber upper clamp	19 - 29 Nm



9.16 Removing the swingarm

- Place the vehicle on its centre stand;
- Remove the retainer fixing the swinging arm to the engine, unscrew the nut and remove the bolt.



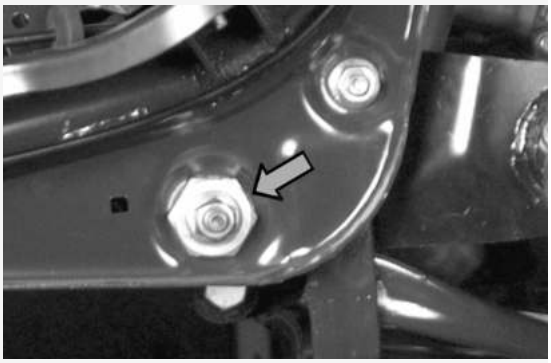


- Remove the silent-blocks.

- Remove the retainer fixing the swinging arm to the frame: undo the screw.

- Remove the pivot.

- Unscrew the nut of the set screw bushing.



- From the inside loosen the set screw bushing until the swinging arm is free.
- Remove the swinging arm.

- Check the entire swinging arm assembly.
- Check all the components- Teflon bushings, silent-blocks, roller bushings, spacers.
- Replace the work components that cause excessive clearance on the rear suspension.

9.17 Swinging arm service

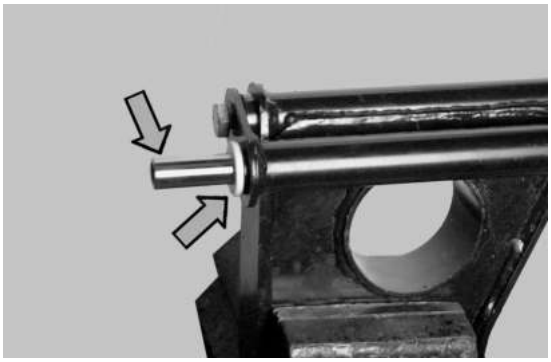
- Properly support the swinging arm in the vice

- Check there is no sticking in the movement of the connection of the swinging arm on the engine side to the swinging arm on the chassis side.
- In order to check the clearance of the swinging arm on the frame side, prepare a retainer using the fixing pin of the swinging arm on the frame and two rings from the special tool 020229Y. Alternatively, use two washers with 12-mm inside diameter for pins, minimum 30-mm outside diameter and 4-mm thick at least.

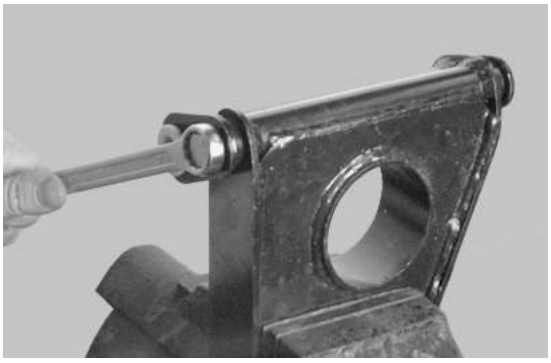
- Check there is no sticking in the rotation.
- Check the axial clearance of the swinging arm on the chassis side.

DESCRIPTION	TORQUE
Standard clearance	0.40 - 0.60 mm
Allowable limit after use:	1.5 mm

- Separate the swinging arm on the engine side from the vehicle side arm.
- Remove the plastic bushings and the internal spacer shown in the picture.



- Remove the pin connecting the engine swinging arm - frame swinging arm.



The operations below are described once but apply to both sides of the swinging arm.

- Remove the inner spacer.
- Using a suitable pin remove the roller casings as shown in the pictures.

- Using an appropriate tool plant new roller casings, being careful to position the bearings with the seal rings facing outwards

CODE	DESCRIPTION	IMAGE
020244Y	15 mm Ø punch	

DESCRIPTION	TORQUE
Length of the swinging arm tube on the engine side	L 140.5 ± 0.7 mm
Chassis side swinging arm plastic bushing shim	3.5 ± 0.05 mm
Length of the internal swinging arm spacer on the frame side	L 182.5 ± 0.3 mm
Length of the swinging arm tube on the frame side	L 222.5 ± 0.2 mm

- Lubricate roller casings and the plastic bushings with grease.
- Insert the spacers.
- Assembly both arms with the appropriate bolt.
- Adjust the bolt as shown in the picture.
- Place the swinging arm, frame side, with the protruding part facing the transmission side.
- Lubricate roller casings and the plastic bushings with grease.

PRODUCT	DESCRIPTION	SPECIFICATIONS
Calcium based grease	Calcium grease.	Ivory-coloured calcium grease; TL 9150 066; NATO G 460

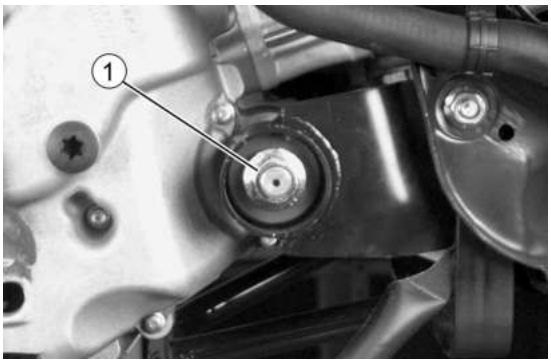
- Check that the silent block is not broken. Otherwise, replace it.

- Unscrew the retainer to the frame in order to remove the silent block supporting clamp.

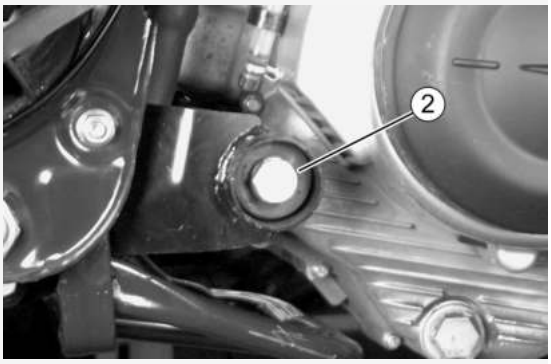
9.18 Swinging arm fitting

For correct installation of the swinging arm on the vehicle, proceed as follows:

- Position the silent bloc support bracket with part **3** inserted and lightly tighten part **1**



Position the swinging arm, inserting part **2**



Tighten part **3** to the prescribed torque

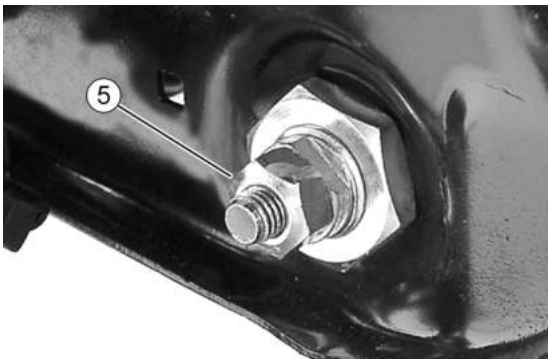
DESCRIPTION	TORQUE
Frame-swinging arm bolt	54 - 60 Nm

Screw on and tighten part **4** to the prescribed torque

DESCRIPTION	TORQUE
Swing arm regulator bushing nut	54 - 60 Nm

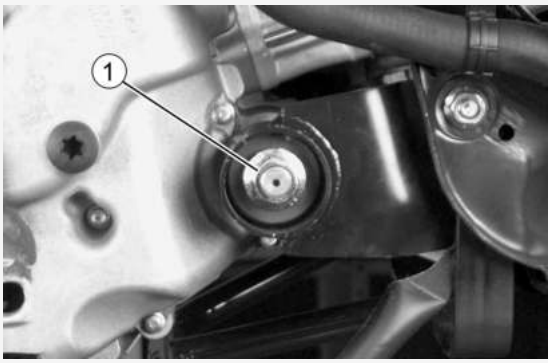
Screw on and tighten part **5** to the prescribed torque

DESCRIPTION	TORQUE
Engine-swinging arm bolt	98 ÷ 118 Nm



Tighten part **1** to the prescribed torque

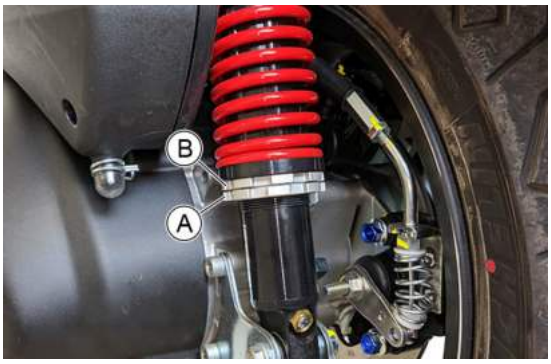
DESCRIPTION	TORQUE
Engine-swinging arm bolt	98 ÷ 118 Nm



9.19 Rear shock absorbers

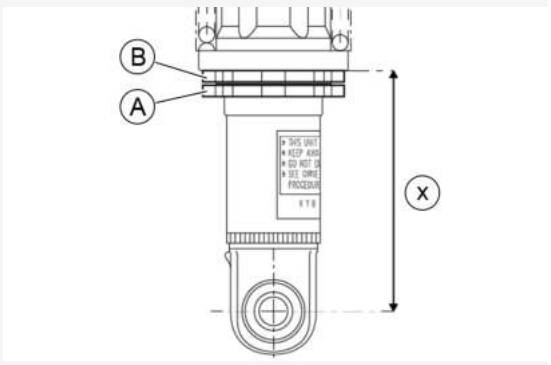
To adjust the rear gas shock absorbers pre-load proceed as follows:

1. Use the specific wrench for adjusting shock absorbers, inserting it from the bottom and connecting two teeth of the ring nut.
2. Unscrew the lower ring nut «**A**» spacing it a few millimetres from the top ring nut.
3. Turn the adjusting ring nut «**B**» until reaching the specified values.
4. Tighten the lower ring nut «**A**» bringing it in contact with the top ring nut and tighten it.



Specified values«x»

CHARACTERISTIC	DESCRIPTION / VALUE
Position 1 - minimum pre-load	rider only: 100 - 105 mm
Position 2 - maximum pre-load	rider, passenger and luggage: 119 mm



N.B.:

THE TWO TEETH ON THE WRENCH ALLOW YOU TO USE IT FOR EACH POSITION INDICATED IN THE FIGURE, IN BOTH DIRECTIONS.

CAUTION

CARRY OUT THE ADJUSTMENT WITH THE SILENCER COLD AND USING SUITABLE GLOVES AND PROTECTIVE CLOTHING.

9.20 Rear shock absorber removal

To remove the shock absorbers, proceed as follows:

- Remove the rear fairings.
- Remove the transmission cover.
- Unscrew and remove the fixing screws of the license plate holder.

- Disconnect the connector of the license plate light and remove the splash guard.

- Unscrew and remove the lower fixing screw of the shock absorber.

- Unscrew and remove the upper fixing screw of the shock absorber.

- Remove the shock absorber.

9.21 Fitting the rear shock absorbers

- Insert the shock absorber in its seat.

- Insert and tighten the upper shock absorber fastening screw to the specific torque.

DESCRIPTION	TORQUE
Rear shock absorber - Chassis	42.5 ± 2.5 Nm

- Insert and tighten to the recommended torque the lower fixing screw of the shock absorber.

DESCRIPTION	TORQUE
Rear shock absorber - Engine	42.5 ± 2.5 Nm

- Prepare the licence plate holder.
- Connect the licence plate light connector.

- Assemble the licence plate holder.

9.22 Centre stand

- Remove the exhaust terminal.
- Undo the two bolts fixing the centre stand support bracket to the silencer support bracket.

CAUTION

SUPPORT THE VEHICLE ADEQUATELY.

- Remove the two screws fixing the centre stand support bracket to the engine.
- Remove the centre stand complete with support bracket.
- At the workbench, release the two return springs, unscrew the relative fixing bolts and separate the centre stand from the support bracket, paying attention to the bushings.
- Before refitting, check the integrity of the components.
- During re-fitting, tighten the fixings of the centre stand support bracket at the prescribed torque.

CAUTION

IN ORDER TO PREVENT INJURY AND DAMAGE, THE SPRING MUST BE REMOVED WITH THE CENTRE STAND RAISED.

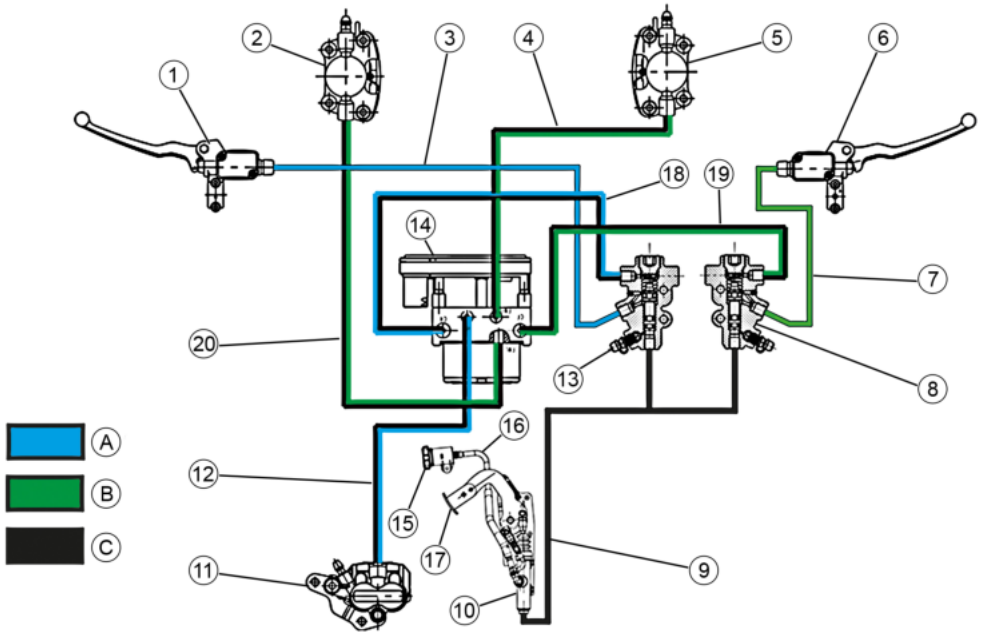
DESCRIPTION	TORQUE
Central stand bolt	31 ÷ 39 Nm

LIST OF TOPICS

Braking system

10.1 Circuit diagram of brake system

This section is dedicated to the description of the brake system components.



A = Rear brake circuit

B = Front brake circuit

C = Integral brake circuit

KEY

1 . Rear brake master cylinder

2 . LH front brake calliper

3 . Rear brake pipes (rear brake pump - rear valve)

4 . Front right brake calliper pipes (ABS modulator - wheel brake calliper)

5 . RH front brake calliper

6. Front brake master cylinder

7. Front brake pipes (front brake pump - front valve)

8 . Front valve

9 . Brake pipes (integral brake pump - valves)

10 . Integral brake master cylinder

11 . Rear brake calliper

12 . Rear brake pipes (ABS modulator - wheel brake calliper)

13 . Rear valve

14 . ABS Modulator

15 . Integral brake fluid reservoir

16 . Integral brake fluid pipe fitting

17 . Brake pedal

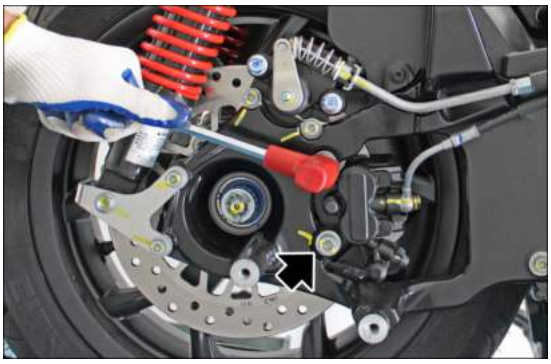
18 . Rear valve brake pipes (rear valve - ABS modulator)

19 . Front valve brake pipes (front valve - ABS modulator)

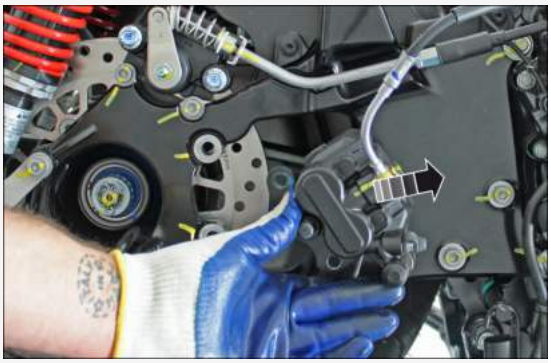
20. Front left brake calliper pipes (ABS modulator - wheel brake calliper)

10.2 Rear brake calliper removal

- Remove the silencer terminal first.
- Remove the two fastener screws of the rear brake calliper.



- Remove the brake calliper from its seat on the support bracket.



N.B.:

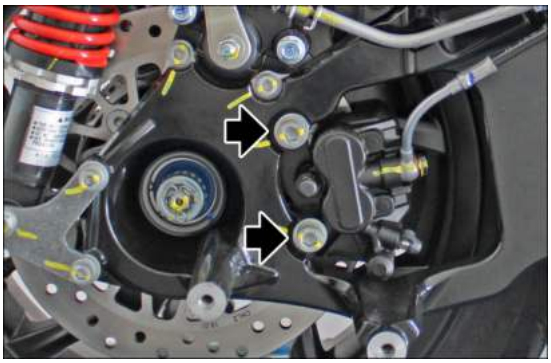
☞

IF IT IS NECESSARY TO REPLACE OR SERVICE THE BRAKE CALLIPER, BEFORE REMOVING THE FITTINGS FIXING THE CALLIPER TO THE SUPPORT BRACKET, FIRST LOOSEN THE OIL HOSE FITTING AFTER HAVING EMPTIED THE SYSTEM OF THE CIRCUIT BEING EXAMINED.

10.3 Rear brake calliper fitting

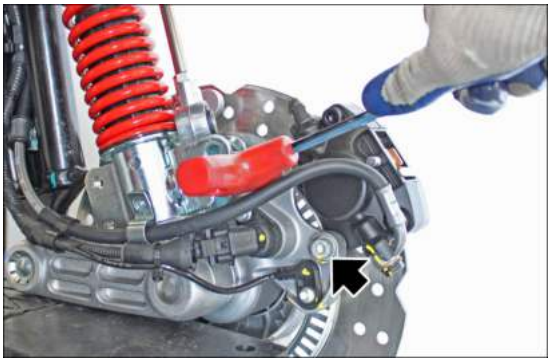
- Install the brake calliper in its seat on the support bracket.
- Clean the threads of the fixing screws and apply **medium thread locking compound "LOCTITE 243"** to them and tighten them to the specified torque.
- Install the silencer terminal.

DESCRIPTION	TORQUE
Rear brake calliper fixing screws	41.5 to 51.5 Nm



10.4 Front brake calliper removal

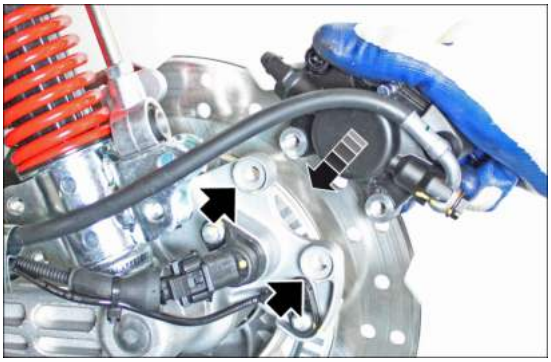
- The operations described refer to only one calliper but apply to both.
- Remove the wheel.
- Undo the two fixing screws to the plate and remove the calliper.



10.5 Front brake calliper fitting

- To fit front brake callipers, carry out the removal operations in reverse order.
- Clean the threads of the fixing screws and apply medium thread locking compound "**LOCTITE 243**" to them and tighten them to the specified torque.

DESCRIPTION	TORQUE
Front brake calliper-Shock absorber support	22.5 ± 2.5 Nm



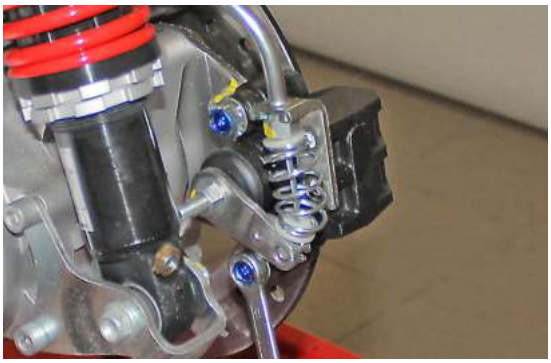
PRODUCT	DESCRIPTION	SPECIFICATIONS
Loctite 243	Medium strength thread-locking sealant.	Blue

10.6 Rear brake disc removal

- First remove the rear wheel.
- Unscrew the screws used to fasten the filter box and mudguard to the crankcase.
- Slightly raise the filter box so that you have access to the fastenings of the clamps.

- Remove the rear brake calliper.

- Remove the parking brake calliper.



- Take off the hub complete with brake disc from the wheel axle.

- Unscrew the five screws fastening the disc to the wheel hub.
- Remove the disc.

10.7 Installation of the rear brake disc

- Install the brake disc on the wheel's hub and align the fastening holes.
- Tighten the five screws to the specified torque.

DESCRIPTION	TORQUE
Rear brake disc screws	5 - 6.5 Nm

PRODUCT	DESCRIPTION	SPECIFICATIONS
Loctite 243	Medium strength thread-locking sealant.	Blue

- Install the hub on the wheel's axle and set it flush.
- Refit the rear brake calliper.

- Refit the parking brake calliper.

- Reposition the filter box, aligning the fixing holes.
- Screw in the two screws used to fasten the filter box and mudguard to the crankcase.
- Refit the wheel.

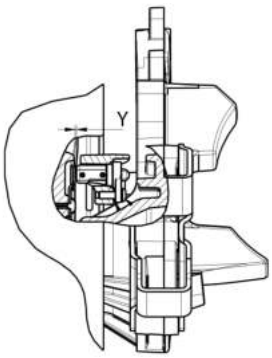
AIR GAP CHECK

Fit the ABS sensor with No.2 washers 669282.

Check the distance "**Y**" between the ABS sensor and the tone wheel:

- for 0.6mm values < = **Y** <2.0mm, leave n°2 washers;
- for values **Y** < 0.6mm, add n°1 washer 669282;
- for values **Y** > = 2.0 mm remove n°1 washer 669282.

Make sure the distance value "**Y**" is 0.6mm < = **Y** < = 2.0mm.

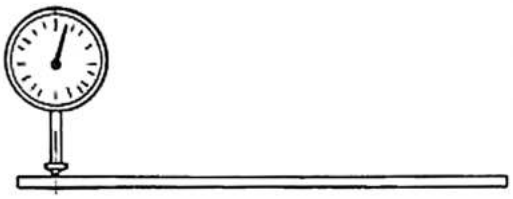


10.8 Checking the rear disc

Checking the disc is important; it must be perfectly clean, with no sign of rust, oil or grease or any other dirt, and must show no signs of deep scoring.

CHARACTERISTIC	DESCRIPTION / VALUE
New rear disc thickness	5 mm
Disc thickness at wear limit (rear)	3.5 mm

- Dismantle the brake disc and place it on a flat reference surface, check that the axial offset of the braking surface is within the prescribed parameters.
- - If this is not the case, replace the disc and repeat the test.



CHARACTERISTIC	DESCRIPTION / VALUE
Max. axial run-out	0.1 mm

N.B.:

☞

WHEN INSTALLING, THOROUGHLY CLEAN THE DISC AND ITS SEAT ON THE HUB.

10.9 Front brake disc removal

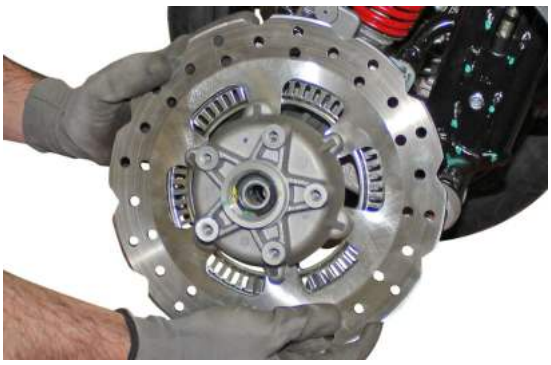
- Remove the wheel.
- Remove the brake calliper.

- Remove the cotter pin.

- Remove the cap.

- Unscrew the fixing nut.

- Remove the wheel hub.



- Unscrew the six bolts securing the disc to the wheel hub.
- Remove the disc.

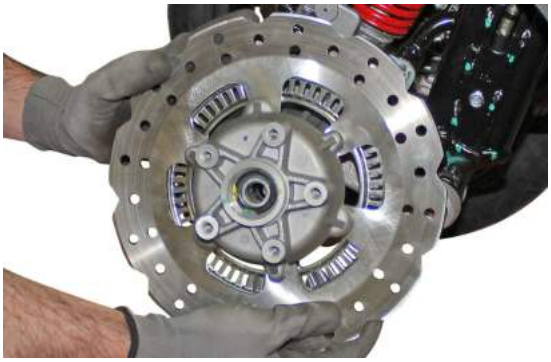
10.10 Fitting the Front brake disc

- Install the brake disc on the wheel's hub and align the fastening holes.
- Tighten the six bolts to the specified torque.

DESCRIPTION	TORQUE
Front brake disc screws	9 ± 1 Nm

PRODUCT	DESCRIPTION	SPECIFICATIONS
Loctite 243	Medium strength thread-locking sealant.	Blue

- Install the hub on the wheel's axle and set it flush.



- Screw and fasten the wheel axle's nut.

- Fit the cap.

- Insert a new cotter pin.

- Reassemble the brake calliper and the wheel.

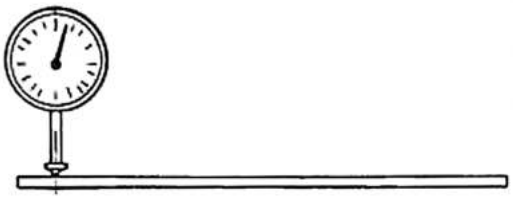
10.11 Front disc check

Checking the disc is important; it must be perfectly clean, with no sign of rust, oil or grease or any other dirt, and must show no signs of deep scoring.

CHARACTERISTIC	DESCRIPTION / VALUE
Thickness of a new front disc	4.0 mm
Disc thickness at wear limit (front)	3.5 mm

- Dismantle the brake disc and place it on a flat reference surface, check that the axial offset of the braking surface is within the prescribed parameters.
- - If this is not the case, replace the disc and repeat the test.

DESCRIPTION	TORQUE
Max. axial run-out	0.1 mm



N.B.:

☞

WHEN INSTALLING, THOROUGHLY CLEAN THE DISC AND ITS SEAT ON THE HUB.

10.12 Front pad removal

- Remove the brake calliper.
- Remove the R cotter pin from the pad pin.

- Slide off the pin paying attention to collect the retaining spring of the pads.

- Remove the brake pads from the calliper.

Check that the residual pad thickness is not less than the prescribed value.

- Check that the residual pad thickness is not less than the prescribed value.
- Check that the residual pad thickness is not less than the prescribed value.

CHARACTERISTIC	DESCRIPTION / VALUE
Friction material minimum thickness	1.5 mm

10.13 front brake pad removal

- Insert the brake pads.

- Fit the brake pads retaining spring and insert the pin in the calliper.

- Insert the R cotter pin onto the pad pin.
- Reassemble the calliper.

10.14 Rear pad removal

Proceed as follows:

- Remove the rear brake calliper.
- Remove the two pins holding the brake pads.
- Remove the pads, being careful with the pad spring clamp.
- Check the thickness of the pads.

If the thickness is less than the minimum value, replace the pads with new pads.

CHARACTERISTIC	DESCRIPTION / VALUE
Minimum value	1.5 mm

10.15 Rear pads fitting

- To refit the brake pads, carry out the removal operations in reverse order.
- Clean the threads of the pad pins and apply medium thread locking compound "**LOCTITE 243**" to them and tighten them to the specified torque.

DESCRIPTION	TORQUE
Brake pad pin	17.5 ± 2.5 Nm

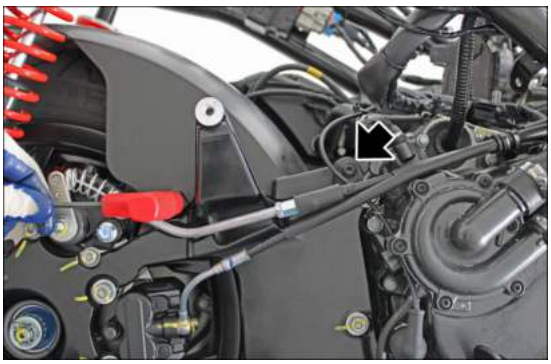
10.16 Filling and bleeding the rear - rear integral braking system

For this procedure, see section «**Misc. documents**».

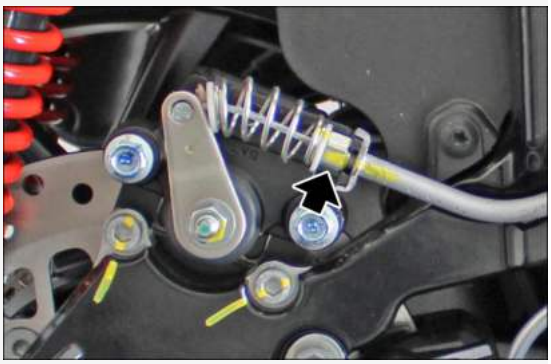
10.17 Parking brake

REMOVAL

- Remove the silencer terminal first.
- Remove the two right-hand fixing screws of the rear mudguard.



- Loosen the adjusting nut of the brake operating cable and then pull out the cable of its control lever.

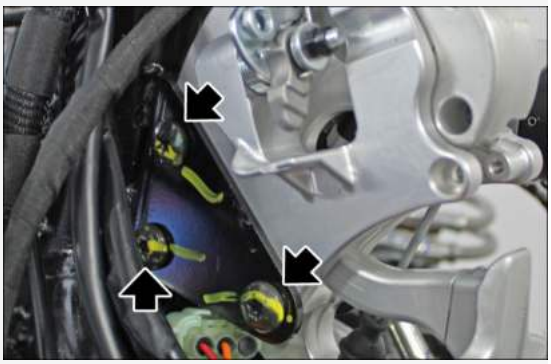


- Remove the two fixing screws of the mechanical brake calliper.
- Lift the rear mudguard slightly and remove the brake calliper from its housing on the support bracket.

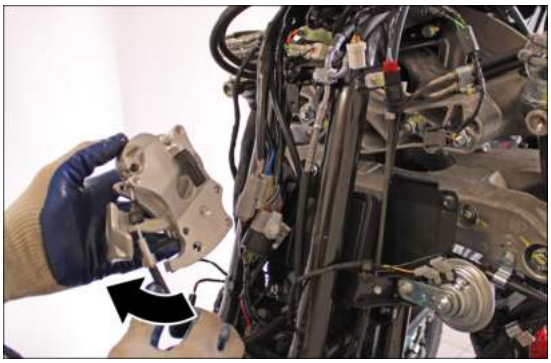
- After removing the leg shield back plate, remove the engaging cable for the safety mechanism removing it from its fitting.
- During refitting pay special attention to the correct insertion of the metallic drum in its seat, as shown in the picture.

- Disconnect the parking brake indicator light button connector.

- Remove the three screws that secure the operating lever to the frame.



- Disconnect the brake operating cable of the control lever.



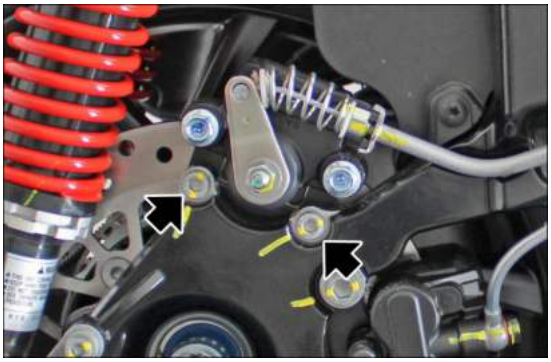
N.B.:

☞

IF THE OPERATING LEVER MUST BE REMOVED WITHOUT REMOVING THE CALLIPER, DISCONNECT THE OPERATING CABLE FROM THE CALLIPER TO ALLOW THE LEVER TO BE REMOVED.

FITTING

- For fitting the parking brake components, carry out the removal operations in reverse order.
- Clean the threads of the fixing screws of the brake calliper and apply medium thread locking compound "**LOCTITE 243**" to them and tighten them to the specified torque.



DESCRIPTION	TORQUE
Parking brake calliper screw	25.5 ± 1.5 Nm

BRAKE PAD REPLACEMENT

- Remove the mechanical brake calliper.
- Remove the two retaining pins and remove the brake pads from the calliper, taking care to retrieve the retaining spring.
- Check that the thickness of the friction material is greater than the minimum value; if not, proceed with the replacement of the brake pads.

CHARACTERISTIC	DESCRIPTION / VALUE
Friction material minimum thickness	1.5 mm

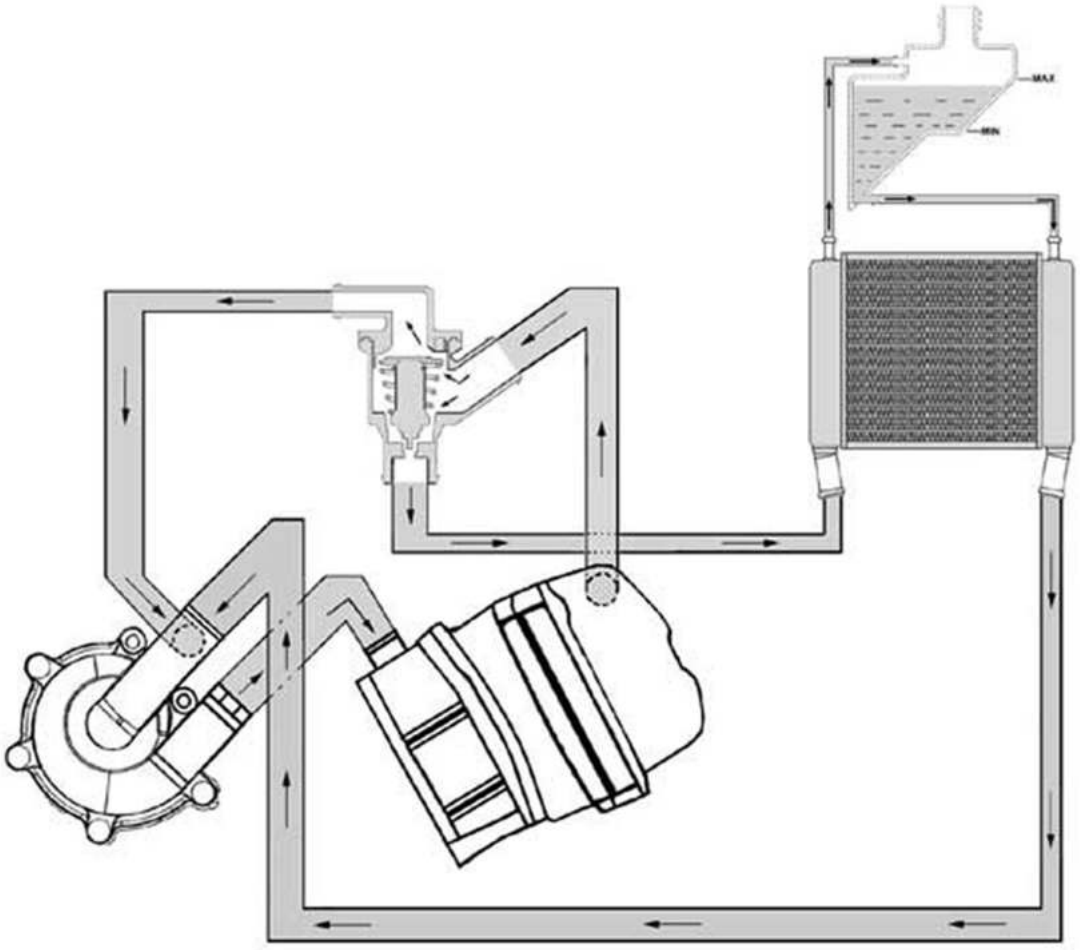
- To refit the brake pads, carry out the removal operations in reverse order.
- Clean the threads of the pad pins and apply medium thread locking compound "**LOCTITE 243**" to them and tighten them to the specified torque.

DESCRIPTION	TORQUE
Brake pad pin	17.5 ± 2.5 Nm

LIST OF TOPICS

Cooling system

11.1 Circuit diagram



This is a forced circulation cooling system, with continuous venting and air pressurisation.

Circulation takes places by a centrifugal pump driven by the countershaft.

The pump delivers the coolant to the thermal group.

The two-way thermostat support is connected in output to the head. One way is connected to the pump and the other to the radiator (of the horizontal circulation type).

The radiator output is directly connected to the pump.

The expansion tank is connected in parallel to the radiator.

The radiator hot box is connected to the upper side of the expansion tank (in air).

The radiator cold box is connected to the lower side of the expansion tank (in the fluid).

When the engine is cold, the thermostat output to the radiator is closed, even though there is still a little flow for de-aeration obtained by a hole into the closing plate.

In this case, the circulation into the thermal group is active to ensure an even heating.

Once the working temperature has been reached, the main circulation on radiator and expansion tank starts.

With the small openings in the thermostat there is a flow overlapping (recirculation and main one).

When the temperature is higher, the thermostat allows excluding the recirculation to favour the main circulation.

In this case, the flow is consistent in the expansion tank as well, and this ensures a continuous automatic venting.

For the system venting during the circuit filling step, there is a special union at the top of the head (see filling rules).

To ensure cooling in case of poor dynamic ventilation, there is an electric fan controlled by the injection system.

TECHNICAL SPECIFICATIONS

CHARACTERISTIC	DESCRIPTION / VALUE
Cooling system capacity	1.8 l
Recommended fluid	Mixture of 50% water and 50% fluid for sealed circuits
Sealing pressure	Cap calibrated at 0.9 bar

THERMOSTAT

CHARACTERISTIC	DESCRIPTION / VALUE
Type	Wax-type, with deviator
Starts opening at	95 ± 2°C

ELECTRIC VENTILATION

CHARACTERISTIC	DESCRIPTION / VALUE
Electric ventilation starts at	105° C
Electric ventilation stops at	98° C

WATER PUMP

CHARACTERISTIC	DESCRIPTION / VALUE
Type	Centrifugal
Control	Coaxial at the countershaft

RADIATOR

CHARACTERISTIC	DESCRIPTION / VALUE
Type	Aluminium, with horizontal circulation

EXPANSION TANK

CHARACTERISTIC	DESCRIPTION / VALUE
Calibration	Automatic bleeding, in parallel with the radiator

11.2 electric fan check

- Connect the injection diagnostic tester and select the «ERRORS» function in this menu.
- Check for anomalies in the electric fan command circuit (See Chapter "injection").

CODE	DESCRIPTION	IMAGE
021999Y	PADS 4.0	

- Select the menu on the "ACTIVE DIAGNOSIS" function and start the electric fan operation simulation (see "Injection" chapter).

- If the electric fan is certainly efficient, check the ventilation start and stop temperatures.
- Select the «PARAMETERS» function in this menu to display the coolant temperature.
- Electric fan start: 105°C
- Electric fan stops: 98°C

- If non-compliant values are found, replace the injection control unit.

If the temperature indication of the analogue instrument approaches the red zone, but the signalling in degrees of the diagnostic tester is below the electric ventilation temperature, proceed with the temperature sensor check on the head and relative injection circuit;

N.B.:

☞

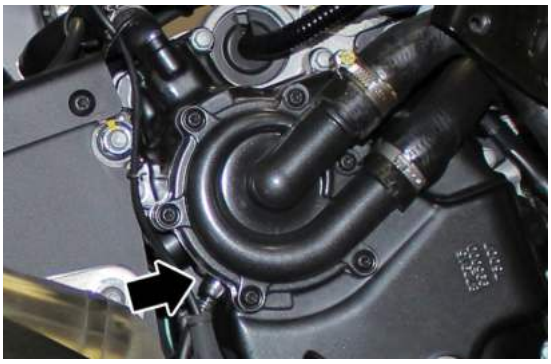
THE ELECTRIC FAN TEMPERATURE AT 105° C CAN ONLY BE MANAGED BY A SYSTEM SUPPLIED WITH A 50% MIXTURE AND PRESSURISED AT 0.9 BAR. AVOID STARTING THE ENGINE WITHOUT PRESSURISATION SINCE IT MAY REACH THE BOILING TEMPERATURE BEFORE THE ELECTRIC FAN STARTS WORKING.

IN CASE OF AN INCREASE OF THE ELECTRIC FAN START TIME, CHECK THE THERMOSTAT OPENING TEMPERATURE AND CHECK THAT THE COOLANT DENSITY IS CORRECT.

THE OPTIMUM DENSITY IS OBTAINED WITH A 50% WATER AND 50% COOLING CIRCUIT FLUID MIXTURE.

11.3 check system for leaks

- Check the proper circuit sealing when it is under pressure and at the temperature.
- For a more accurate check, wait until the system has cooled down since small leaks may not be visible due to evaporation.
- The water pump is provided with a drainage hole in case of leaks from the cooling system mechanical seal, or from the shaft sealing oil guard.
- If coolant or oil leaks are detected, replace the pump (see «Flywheel Cover» Chapter).



N.B.:

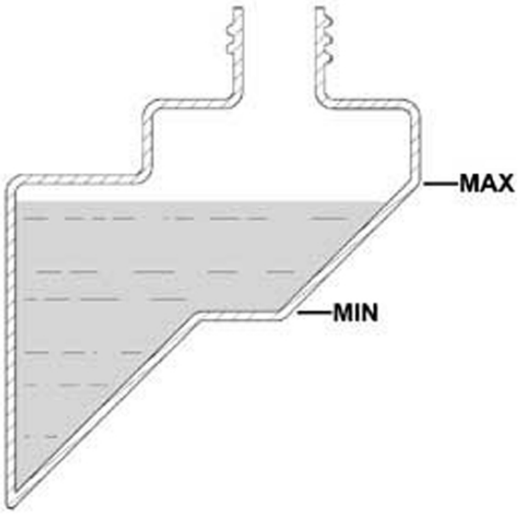
☞

DO NOT USE OILS OR GREASES WHILE MOUNTING THE COOLING SYSTEM. FAILURE TO OBSERVE THIS PRECAUTION WILL IRRETRIEVABLY DEFORM THE SEALING GASKETS.

11.4 Coolant change

System filling instructions

- Prepare the mixture of 50% water and 50% coolant.
- Fill the system to reach a level ranging between the MIX and MAX levels indicated in the expansion tank filler.
- Do not close the expansion tank with the cap.



- Use a transparent hose to connect the venting union with the expansion tank filler.
- Loosen the vent and start the engine.

- Keep it open until the air has been fully vented.
- Tighten the bleed screw.
- Switch off the engine.
- Restore the level into the expansion tank and tighten the cap.
- Start the engine and leave it running to warm up until the electric fan triggering temperature is reached.
- Shut off the engine.
- Restore level when the engine is cold.

WARNING

ELECTRIC VENTILATION IS CONTROLLED BY THE TEMPERATURE MEASURED AT THE HEAD.

THE ELECTRIC VENTILATION START DOES NOT MEAN THAT THE VENTING HAS BEEN COMPLETED.

VENTING IS COMPLETE WHEN THE EXPANSION TANK TEMPERATURE RISES.

11.5 Water pump

Water pump

If noise or loss of liquid at the drain hole of the water pump is discovered, replace the flywheel cover and the water pump as described in the "Flywheel Cover" Chapter.

Proceed to carry out a few preliminary operations as described below:

- Place the vehicle on its centre stand and on flat ground.
- Remove the bodywork components as described in the "Bodywork" Chapter.
- Remove the muffler to access the flywheel cover as described in the "Removing the Engine from the Vehicle" Chapter.
- Empty the cooling system, removing the hoses located on the water pump cover and the loading cap located on the expansion tank.

WARNING

CARRY OUT THESE OPERATIONS WHEN THE ENGINE IS COLD.

- Remove the water pump cover shown in the figure by loosening the 6 fastening screws.
- Proceed to partially drain the circuit as described in the "Engine" Chapter.
- Once the fault has been fixed and all components have been replaced, fill and purge the system again.

N.B.:

FOR CHANGING THE COOLANT AND BLEEDING THE SYSTEM, SEE THE "COOLANT CHANGE" SECTION.

CHARACTERISTIC	DESCRIPTION / VALUE
Cooling system liquid - replacement	~ 1.8 l

Removing the water pump cover:

- Check that the water pump cover is not deformed or dented.
- Check that the sealing O-ring is in good working order.
- otherwise, replace the component.
- Correctly fit a new O-ring, do not allow it to come into contact with grease or oil.

- Refit the water pump cover and tighten the 6 fixing screws to the prescribed torque.

DESCRIPTION	TORQUE
Pump cover fixing screws	3 - 4 Nm

WARNING

FAILURE TO OBSERVE THIS PRECAUTION WILL IRRETRIEVABLY DEFORM THE O-RING.

11.7 failure diagnosis

excessive system pressure

1 - Check the expansion tank cap efficiency.

N.B.:

THE CAP IS EQUIPPED WITH A PRESSURE-RELIEF VALVE CALIBRATED AT 0.9 BAR.

There is also a valve that must allow air inlet during the cooling step.

YES go to 2 NO go to 3

2 - Check the head gasket seal (see «Thermal group and timing system» chapter)

3 - Replace the cap.

Coolant consumption

1 - Check the system outer seals as described above.

YES go to 2 NO go to 3

2 - Check the head gasket seal (see «Thermal group and timing system» chapter)

- If water leaks are detected in the engine oil, inspect the pad on the head cooling circuit.

3 - Fix any damaged seals.

presence of oil in the coolant

1 - Presence of oil in the coolant.

YES go to 2

2 - Check the head gasket seal (see «Thermal group and timing system» chapter)

LIST OF TOPICS

Bodywork

12.1 Saddle

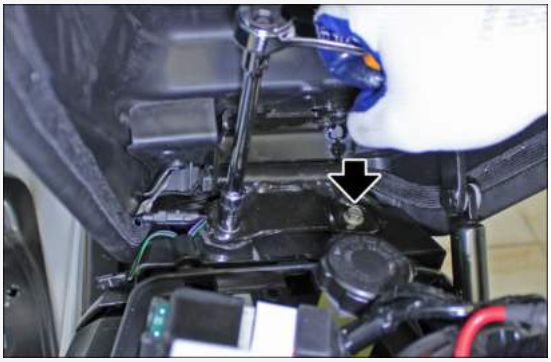
REMOVAL

- Lift the saddle.
- Disconnect the rider detection sensor connector.

- Remove the benzing ring from the pneumatic cylinder pin.

- Retrieve the plastic washer and release the pneumatic cylinder from its pin.

- Remove the two fixing screws of the saddle hinge.

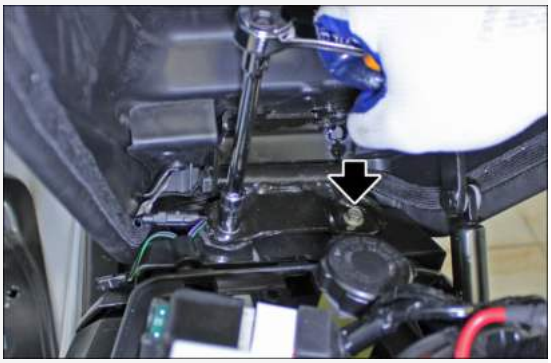


- Remove the saddle from the vehicle.

FITTING

- Place the saddle on the vehicle.

- Support the saddle, keeping its rear part raised and install the two fixing screws of the hinge.



- Insert the pneumatic cylinder onto the relative pin and install the plastic washer.

- Install the benzing ring on the cylinder pin.

- Connect the presence sensor connector.

12.2 Rear-view mirrors

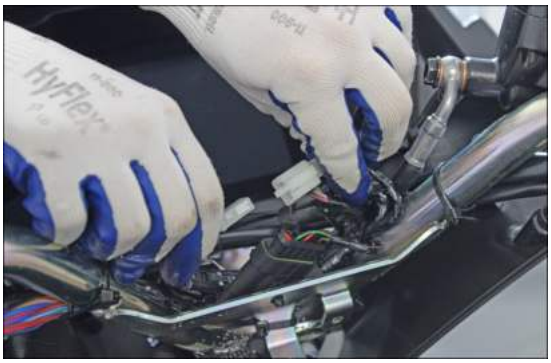
- Lock the locking nut of the mirror on the lower part of the handlebar.

- Keeping the nut locked, unscrew the mirror and remove it, collecting the washers.

12.3 Rear handlebar cover

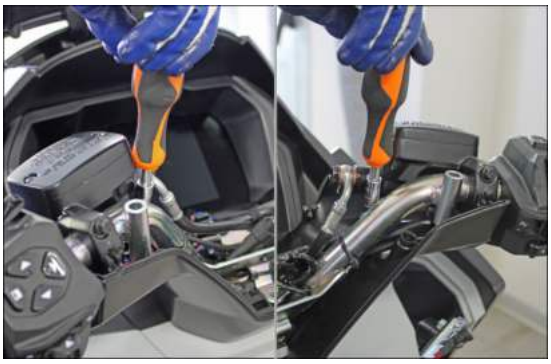
REMOVAL

- Remove the upper handlebar cover
- Disconnect the connector indicated in the figure.



- Remove the rear fixing screw.

- Remove the two side fixing screws.



- Remove the handlebar cover from the vehicle, taking care not to tension the wiring harness during the operation.

FITTING

- Install the handlebar cover on the vehicle.

N.B.:

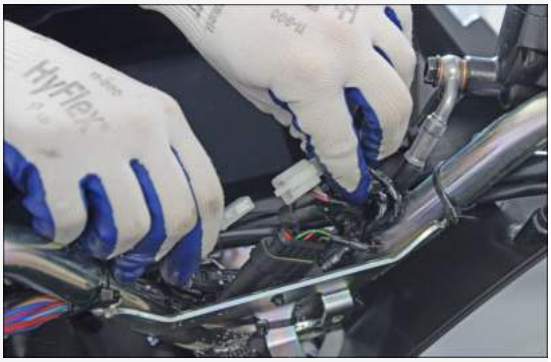
☞

ROUTE THE WIRING HARNESS FROM THE FRONT SIDE OF THE HANDLEBAR.

- Install the rear fixing screw.

- Install the two side fixing screws.

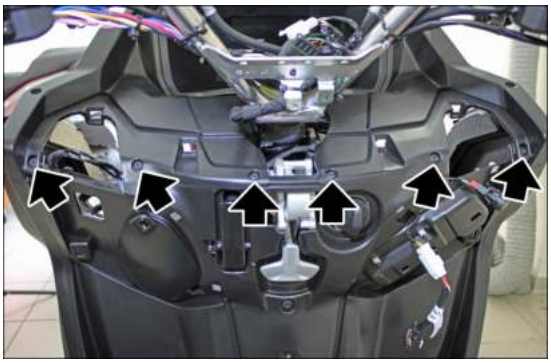
- Connect the connector indicated in the figure.



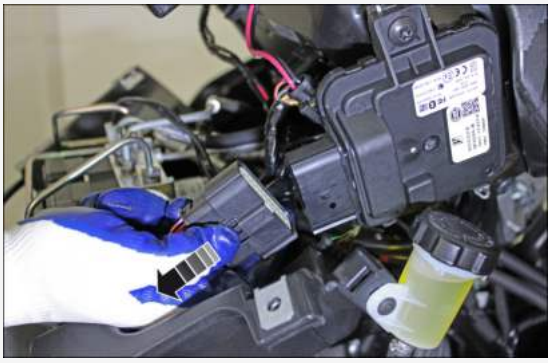
12.4 Instrument panel

REMOVAL

- - Remove the front shield.
- Remove the handlebar covers.
- Remove the leg shield back plate cover.
- Remove the six screws that fasten the dashboard to the leg shield back plate.



- Disconnect the connector of the PMP3 control unit.



- Disconnect the connector indicated in the figure.

- Disconnect the instrument assembly connector.

- Cut the plastic clamp and release the wiring harness.

- Remove from the vehicle the dashboard together with the instrument panel and the PMP3 control unit.

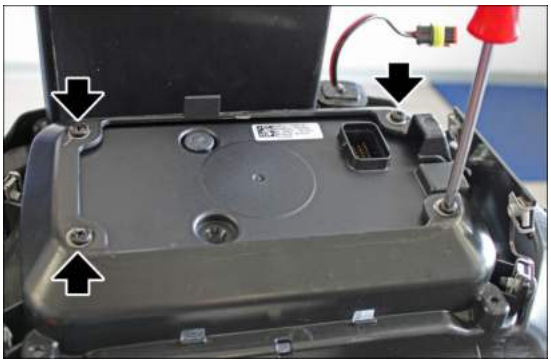
- Place the dashboard on a suitable work surface.
- Undo the two fixing screws and remove the PMP3 from the dashboard.

- Operating the inside of the dashboard, unscrew the two screws securing the instrument panel frame.

- Press the bezel retaining tabs one by one to release it from the dashboard.

- Remove the instrument panel bezel from the dashboard.

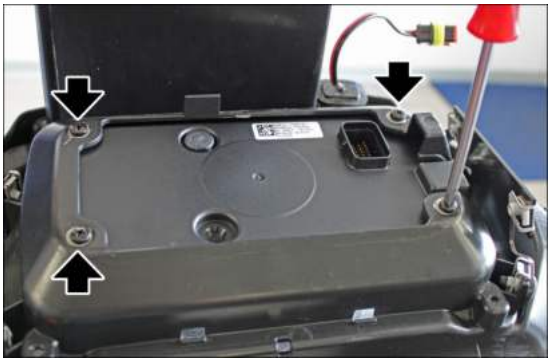
- Unscrew the four fixing screws of the instrument panel.



- Remove the instrument panel from the dashboard.

FITTING

- Insert the instrument panel in the dashboard and secure it from the inside using the four screws.



- Install the instrument panel bezel in the dashboard. Make sure that the securing tabs are seated correctly.

- Tighten the two screws fastening the instrument panel bezel.

- Place the PMP3 control unit on the dedicated support brackets and tighten the relevant fixing screws.

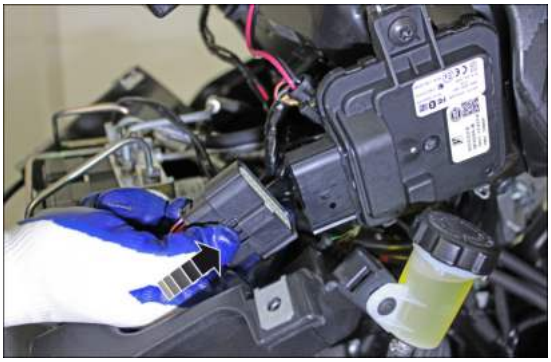
- Fit on the vehicle the dashboard together with the instrument panel and the PMP3 control unit.

- Secure the wiring harness to the dashboard using a plastic clamp, as shown in the figure.

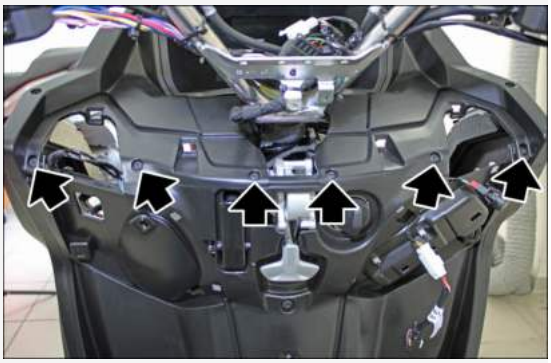
- Connect to instrument panel connector.

- Connect the connector shown in the figure.

- Connect the connector of the PMP3 control unit.



- Install and tighten the six screws that fasten the dashboard to the leg shield back plate.
- Fit the leg shield back plate cover
- Fit the handlebar covers.
- Fit the front shield.



12.5 Front handlebar cover

REMOVAL

- Remove both rear-view mirrors.
- Remove the two fixing screws indicated in the figure.

- Lift the handlebar cover upward and remove it from the vehicle.

FITTING

- Position the upper handlebar cover in its housing, taking care to couple it correctly with the lower handlebar cover.

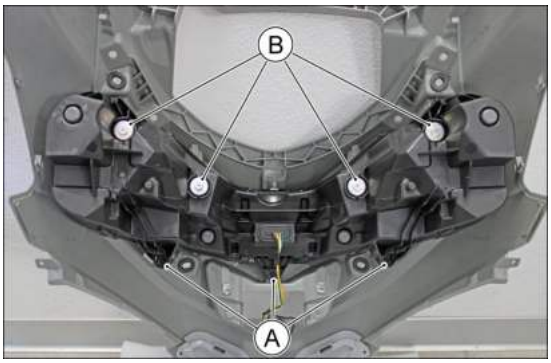
- Insert and tighten the two fixing screws illustrated in the figure.
- Install the rear-view mirrors.

12.6 Front light cluster

HEADLIGHT

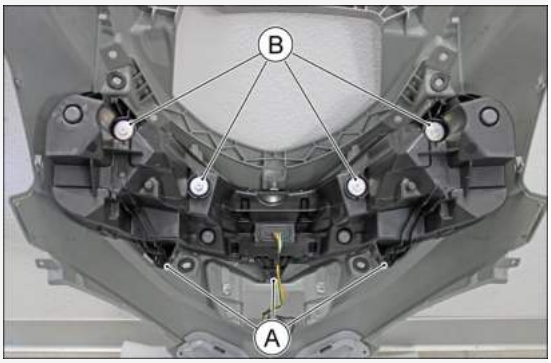
REMOVAL

- Unscrew the three fastening screws "**A**".
- Unscrew the four fixing screws "**B**" and remove the headlamp from the front shield.



FITTING

- Install the headlamp into the headlamp housing on the front shield.
- Install the fixing screws "**B**".
- Install the fixing screws "**A**".



TURN INDICATORS

REMOVAL

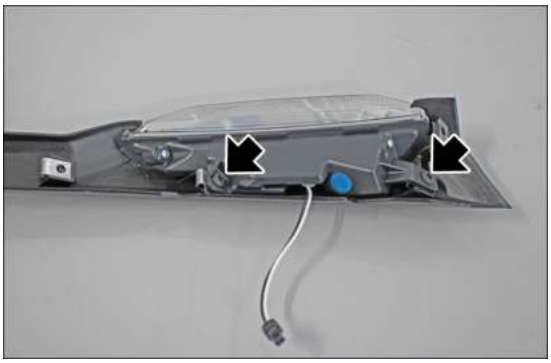
- Unscrew the two lower fixing screws of the turn indicator.

- Unscrew the intermediate fixing screw of the turn indicator.

- Unscrew the upper fixing screw of the turn indicator.

- Move the turn indicator away from the vehicle and disconnect its connector.
- Repeat on the opposite side the operations for the removal of the turn indicator.

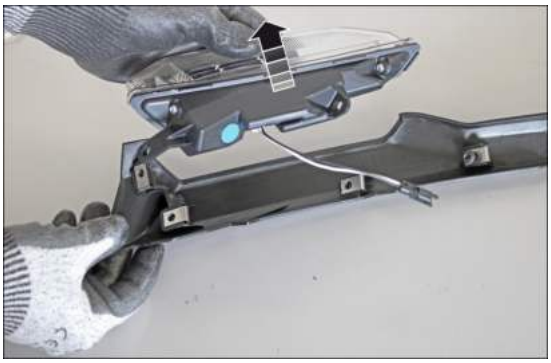
- Remove the two fixing screws of the turn indicator.



- Remove the turn indicator from its plastic holder.

CAUTION

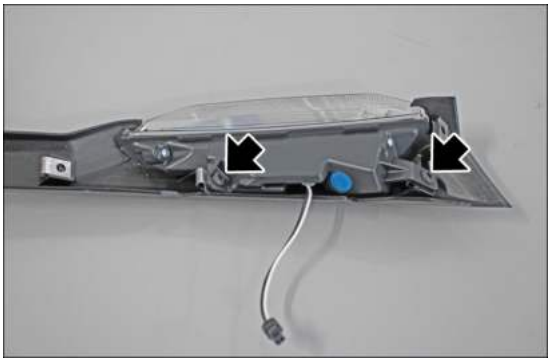
THE TURN INDICATORS ARE LED TYPE, THEREFORE MAINTENANCE-FREE. IN THE EVENT OF A FAULT, REPLACE THE ENTIRE COMPONENT.



ASSEMBLY

- Insert the turn indicator into its plastic holder.

- Tighten the two fixing screws of the turn indicator



- Connect the direction indicator connector.
- Repeat the operations for the fitting of the turn indicator on the opposite side.

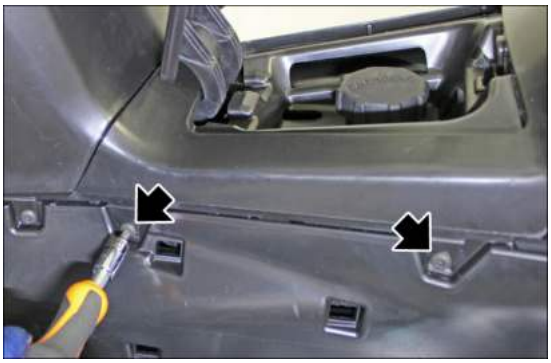
- Tighten the upper fixing screw of the turn indicator.

- Tighten the two lower fixing screws of the turn indicator.

12.7 Central frame cover

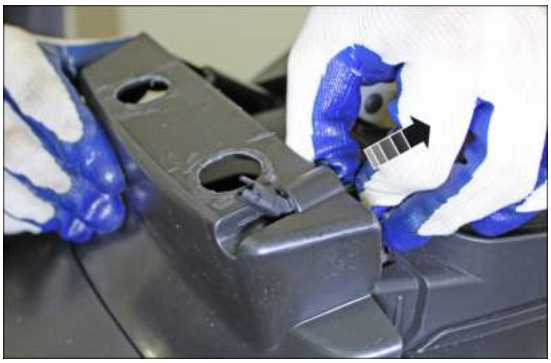
REMOVAL

- Remove the side fairings.
- Remove the seat.
- Remove the leg shield back plate.
- Remove the two fixing screws shown in the figure, from both sides.



- Temporarily unscrew the tank plug and remove the rubber mat of the tank compartment.

- Slide off the rider detection sensor wiring harness from the central cover.



- Lift the cover from the frame.
- Detach the cable sheath from its housing.

- Disconnect the cable from the door opening control and remove the central cover from the vehicle.

ASSEMBLY

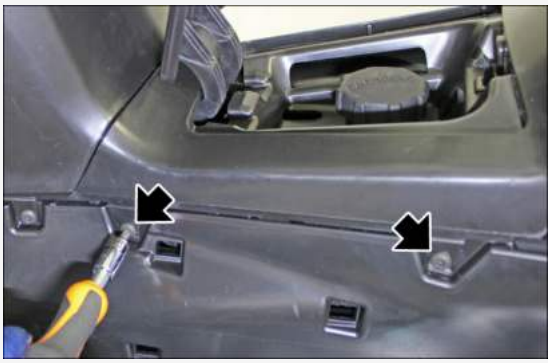
- Connect the cable from the door opening control and remove the central cover from the vehicle.

- Position the cable sheath from its housing.
- Lower the cover from the frame.

- Insert the rider detection sensor wiring harness from the central cover.

- Position the rubber mat from the tank compartment and screw on the fuel filler cap.

- Screw the two fixing screws shown in the figure, on both sides.
- Proceed with fitting the leg shield back plate, saddle, and side panels.



12.8 Front shield

REMOVAL

- Remove the two fixing screws of the front bezel.

- Remove the bezel from the front shield.

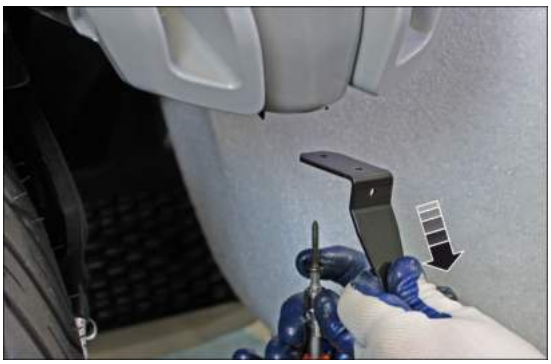
- Disconnect the front headlamp connector.

- Remove both side screws that fasten the front spoiler.

- Remove the central fixing screw of the front spoiler.

- Remove the front spoiler from the vehicle.

- Unscrew the two fixing screws and remove the bracket from the vehicle.



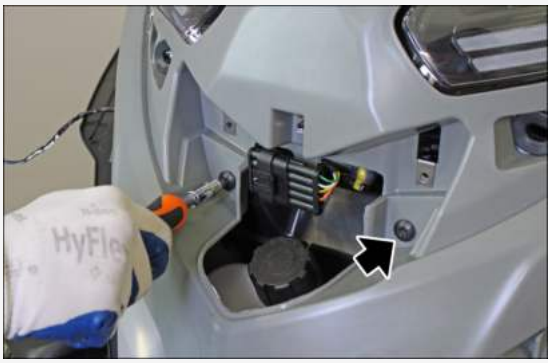
- Unscrew the two lower fixing screws of the turn indicator.

- Unscrew the intermediate fixing screw of the turn indicator.

- Unscrew the upper fixing screw of the turn indicator.

- Move the turn indicator away from the vehicle and disconnect its connector.
- Repeat on the opposite side the operations for the removal of the turn indicator.

- Remove the two central fixing screws.

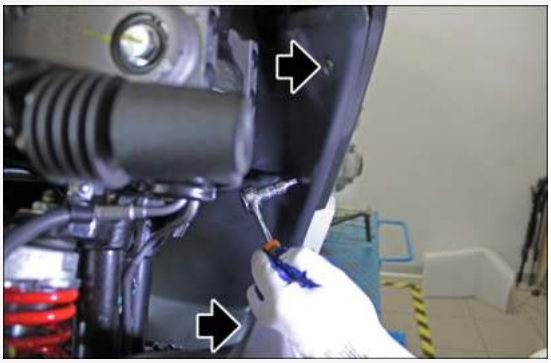


- Operating from both sides, remove the lower side fixing screw.

- Operating from both sides, remove the upper side fixing screw.

- Remove from the vehicle the front section of the shield.

- Operating on the inside of the wheel arch, remove the three screws that secure the side section of the shield.

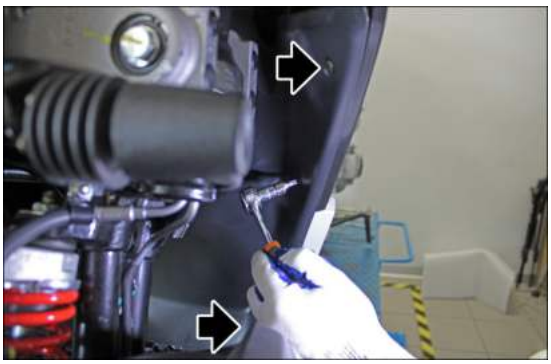


- Lift the side section to release the three retaining tabs from the leg shield back plate and then remove the component from the vehicle.
- Repeat the operation for the side section on the opposite side.

FITTING

- Install the side section of the front shield on the vehicle, inserting from the top the three fixing tabs to the leg shield back plate. Make sure that the coupling between the two components is correct.

- Operating on the inside of the wheel arch, fit the three screws that secure the side section of the shield.
- Repeat the operations for the section on the opposite side.

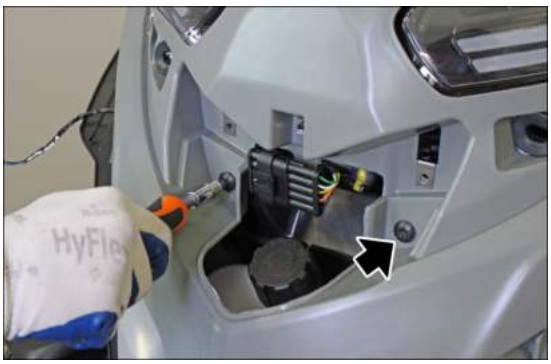


- Install the front section of the front shield on the vehicle.

- Operating from both sides, fit the upper side fixing screw.

- Operating from both sides, install the lower side fixing screw.

- Install the central fixing screws.



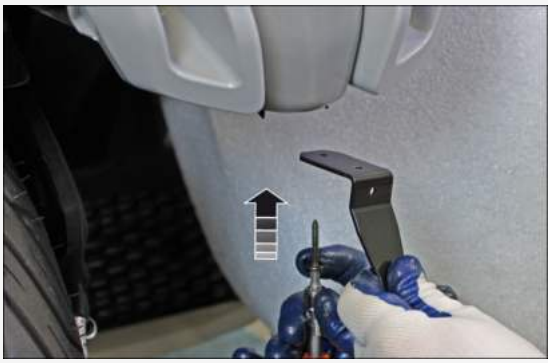
- Connect the connector and install the turn indicator on the vehicle.

- Install the upper fixing screw of the turn indicator.

- Install the intermediate fixing screw of the turn indicator.

- Install the two lower fixing screws.
- Repeat the operations concerning the installation of the turn indicator on the opposite side.

- Fit the bracket fastening the front spoiler and tighten the relative fixing screws.



N.B.:

THE LONG SCREW MUST BE FACING THE FRONT OF THE VEHICLE, THE SHORT SCREW MUST BE FACING TOWARDS THE REAR.

Install the front spoiler on the relative retainer bracket.

- Install the central fixing screw of the front spoiler.

- Install the side fixing screws of the front spoiler.

- Connect the connector of the front headlamp.

- Install the front shield grille in its housing.

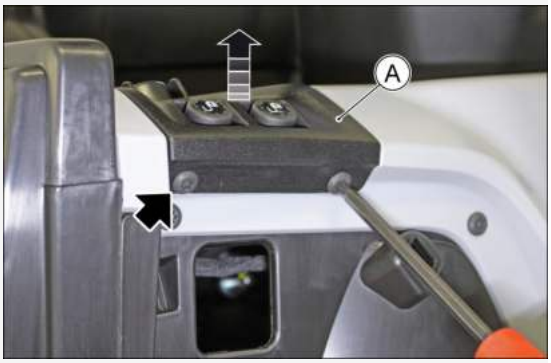
- Install the two fixing screws of the front grille.
-

12.9 Leg shield back plate

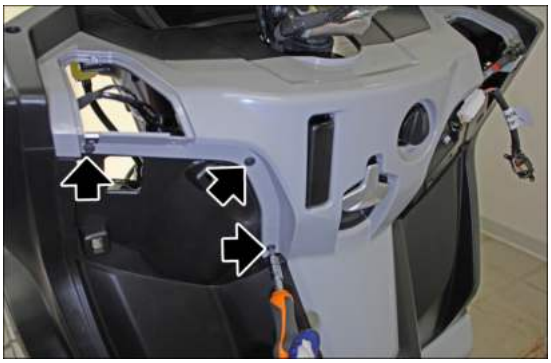
REMOVAL

- - Remove the front shield.
- Remove the handlebar covers.
- Remove both cushions from the leg shield back plate by pulling them out.

- Unscrew the two screws that fasten the panel "**A**".
- Lift the panel "**A**", disconnect the wiring harness connectors and remove it from the vehicle.
- Repeat the operations for the panel on the opposite side.

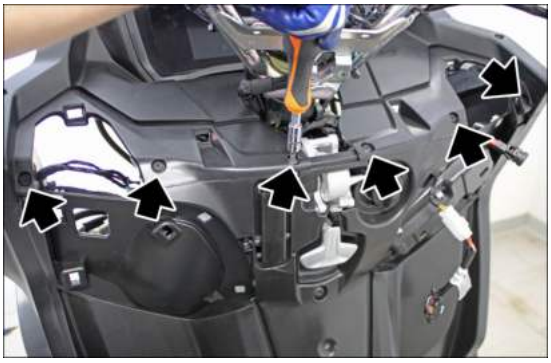


- Unscrew the three fixing screws shown in the figure, from both sides.



- Remove from the vehicle the cover of the leg shield back plate.

- Remove the six screws that fasten the dashboard to the leg shield back plate.
- Then remove the instrument panel dashboard from the vehicle.



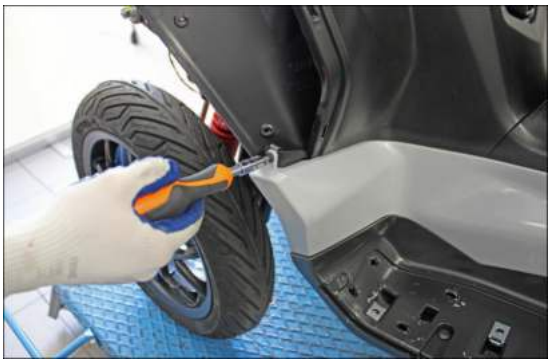
N.B.:

☞

REFER TO THE RELEVANT SECTION OF THE MANUAL FOR THE INSTRUMENT PANEL REMOVAL PROCEDURES.

- Remove the inspection footrest inspection hatch.
- Remove the fixing screw indicated in the figure.

- Remove the fixing screw indicated in the figure.



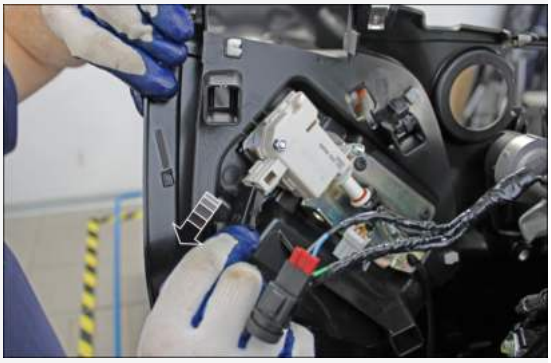
- Remove the side cover from the footrest.
- Repeat the operations for the cover on the opposite side.

- Remove the two lower fixing screws of the leg shield back plate.

- Operating from the inside of the front wheel housing, remove the screw shown on both sides.

- Remove the leg shield back plate central fixing screw.

- Disconnect the saddle opening actuator connector.



- Disconnect the transmission cable from the saddle opening actuator.

- Release the wiring harness from the grommet on the inside of the leg shield back plate.

- Remove the leg shield back plate from the vehicle.

FITTING

- Install the leg shield back plate on the vehicle.

- Secure the wiring harness to the wiring harness grommet on the inner side of the leg shield back plate.

- Connect the transmission cable to the saddle opening actuator.

- Connect the saddle opening actuator connector.

- Install the leg shield back plate central fixing screw.

- Operating from the inside of the front wheel housing, install on both sides the screw shown in the figure.

- Install the two lower fixing screws of the leg shield back plate.

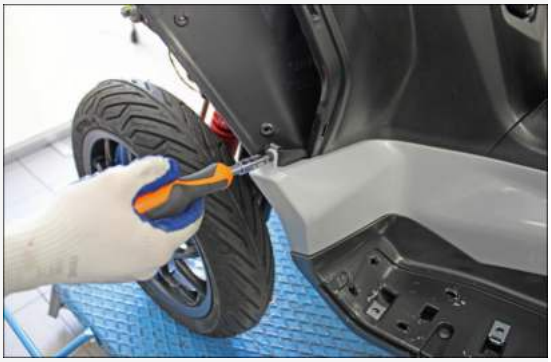
- Install the footrest side cover on the vehicle.

N.B.:

☞

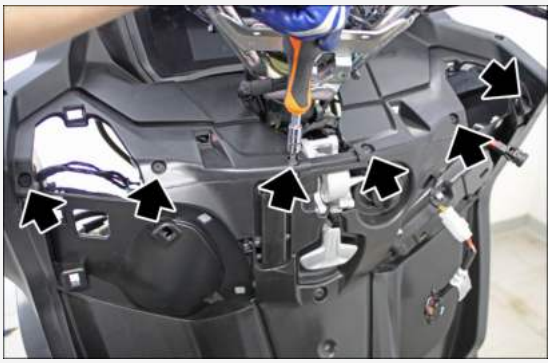
MAKE SURE THAT THE RETAINING PINS ARE CORRECTLY INSERTED AND COUPLED IN THEIR SEATS.

- Install the fixing screw indicated in the figure.



- Install the fixing screw indicated in the figure.
- Install the inspection compartment hatch on the footrest.
- Repeat the fitting operations for the footrest cover on the opposite side.

- Install the instrument panel dashboard on the vehicle.
- Install the six screws that fasten the dashboard to the leg shield back plate.

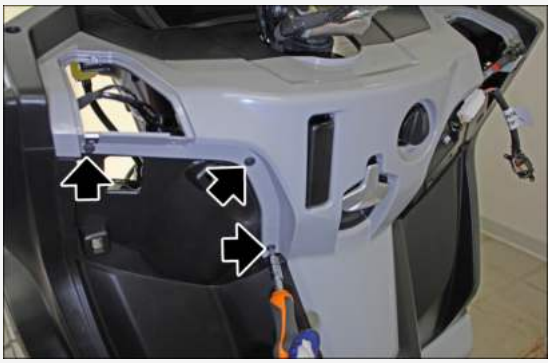


N.B.:

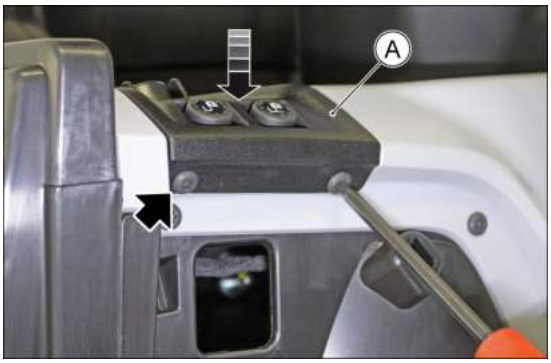
REFER TO THE RELEVANT SECTION OF THE MANUAL FOR THE INSTRUMENT PANEL REMOVAL PROCEDURES.

- Install the leg shield back plate cover on the vehicle.

- Install the three fixing screws shown in the figure, on both sides.



- Connect the wiring harness connectors and install the panel "**A**" on the leg shield back plate.
- Tighten the two fixing screws and repeat the operations for the panel on the opposite side.

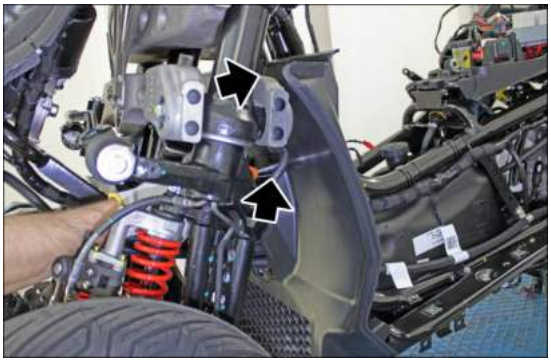


- Install both cushions on the leg shield back plate, making sure that the retaining pins are properly seated.
- Fit the handlebar covers.
- Fit the front shield.

12.10 Front wheel housing

REMOVAL

- - Remove the front shield.
- Working on both sides of the vehicle, remove the two upper screws that secure the wheel housing to the frame.



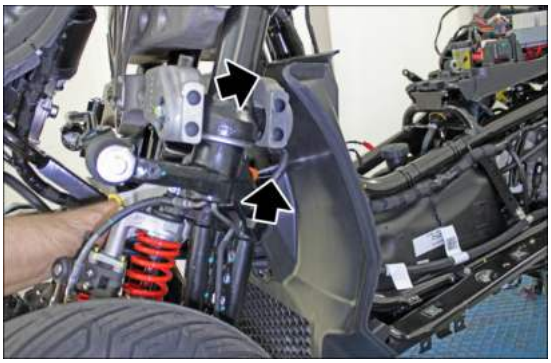
- Working on both sides of the vehicle, remove the two upper screws that secure the wheel housing to the frame.

- Remove the wheel housing from the vehicle.

FITTING

- Install the wheel housing on the vehicle, making sure it is correctly mated with adjacent plastic parts.

- Working on both sides of the vehicle, install the two upper screws that secure the wheel housing to the frame.



- Operating from both sides, install the lower fixing screw.

12.11 Side fairing

REMOVAL

To remove the side fairing, proceed as follows:

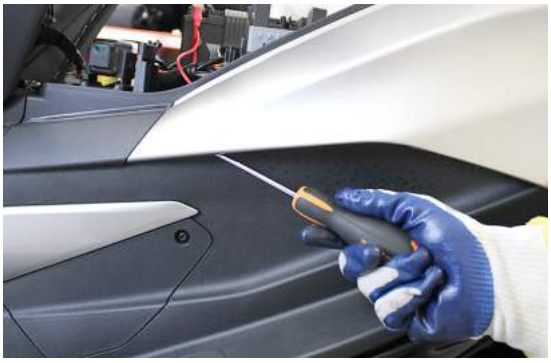
- Remove the upper rear cover.

- Remove the lower rear cover.

- Unscrew and remove the screw located in the lower part of the side fairing.

- Unscrew and remove the screw located in the middle of the side fairing.

- Unscrew and remove the screw located in the front part of the side fairing.



- Unscrew and remove the screw located at the rear of the side fairing below the taillight cluster.

- Unscrew and remove the screw located in the upper part of the side fairing.

- Remove the side fairing.

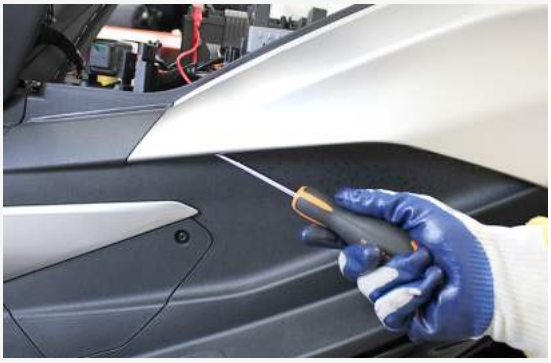
FITTING

- Position the side fairing.

- Insert and tighten the screw located in the upper part of the side fairing.

- Insert and tighten the screw located at the rear of the side fairing below the taillight cluster.

- Insert and tighten the screw located in the front part of the side fairing.



- Insert and tighten the screw located in the middle of the side fairing.

- Insert and tighten the screw located in the lower part of the side fairing.

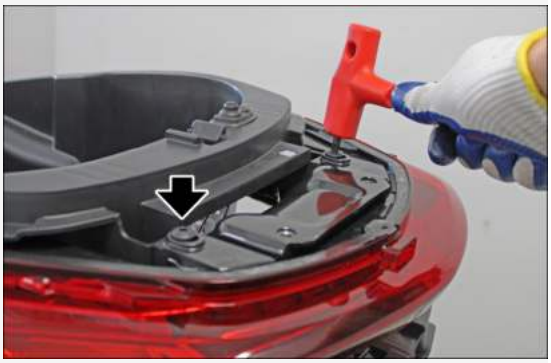
- Refit the lower rear cover.

- Refit the upper rear cover and restore the vehicle.

12.12 Rear light assembly

- Remove both side fairings.
- Disconnect the wiring harness connector and remove the light cluster connector from the support bracket.

- Remove the two fixing screws.

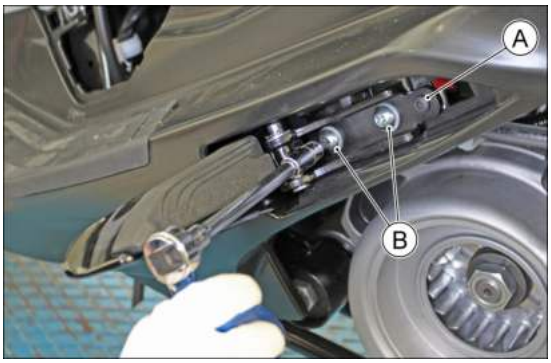


- Remove the light cluster from the vehicle.

12.13 Footrest

REMOVAL

- Remove the chassis central cover.
- Open the passenger footrest and unscrew the screw "**A**".
- Unscrew the screws "**B**", retrieve the washers and remove the passenger footrest from the vehicle.



N.B.:

THE OPERATIONS DESCRIBED REFER TO ONE SIDE OF THE VEHICLE, BUT ARE TO BE CONSIDERED VALID FOR BOTH, TO INSTALL THE FOOTREST ON THE VEHICLE.

Working on the right-hand footrest:

- lift the rubber bellows,
- undo the two brake pedal fixing screws,
- remove the pedal itself from the vehicle.

- Remove the cover retaining rubber plugs.

- Remove the rubber cover from the footrest.

- Remove the lower fastening screw.

- Remove the upper fixing screw.

- Remove the fixing screws indicated in the figure.

- Remove the footrest from the vehicle.

FITTING

- Install the footrest on the vehicle.

N.B.:

☞

THE OPERATIONS DESCRIBED REFER TO ONE SIDE OF THE VEHICLE, BUT ARE TO BE CONSIDERED VALID FOR BOTH, TO INSTALL THE FOOTREST ON THE VEHICLE.

- Install the four fixing screws shown in the figure.

- Install the upper fixing screw.

- Install the lower fixing screw.

- Install the rubber footrest on the footrest, taking care to correctly insert the centring "pins" into their seats.

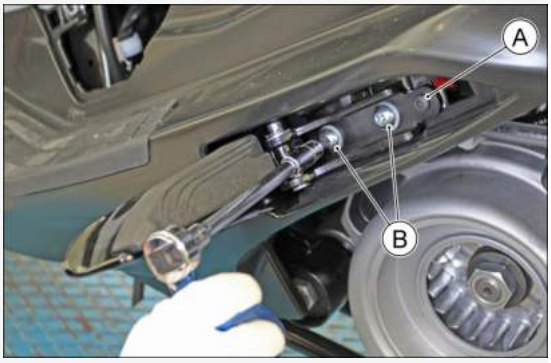
- Install the rubber cover retaining caps.

Working on the right-hand footrest:

- Install the pedal on the brake lever,
- then tighten the relative fixing screws.

Once installation is complete, refit the rubber bellow over the brake lever.

- Install the passenger footrest on the vehicle and partially tighten the screws "**B**", together with washers.
- Install the fixing screw "**A**" and then tighten screws "**B**" permanently.
- Reinstall the central frame cover and all previously removed components.



12.14 Rear mudguard

- Remove the exhaust silencer.
- Remove the two upper screws of the bracket cover.

- Remove the two nuts fastening the cover and the bracket to the engine.

- Remove the bracket cover.

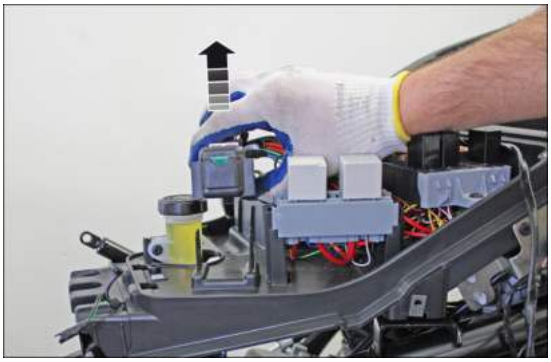
- On the left side remove the two screws fastening the filter box and the mudguard.

- Release the ABS sensor wiring harness from its fitting on the mudguard.

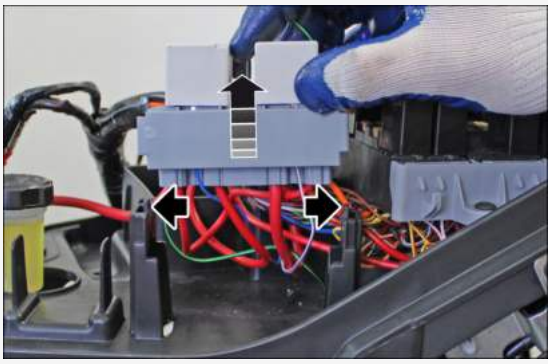
- Slide the mudguard off from the left hand side.

12.15 Helmet compartment

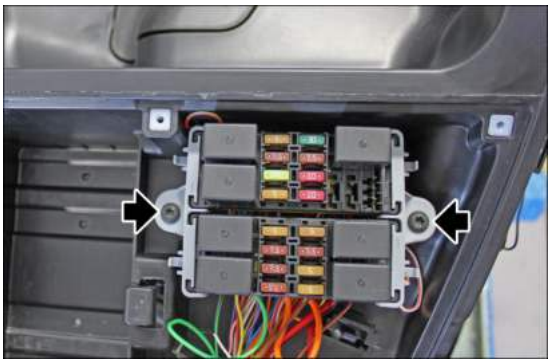
- Remove the seat.
- Disconnect and remove the battery.
- Remove both the footrests.
- Remove the starter contactor from its housing.



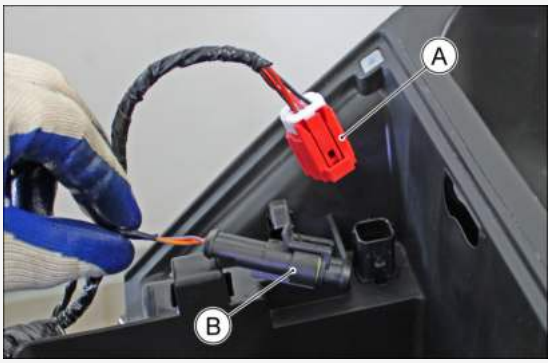
- Open the two safety tabs and remove the relay base from its housing.



- Remove the two screws that secure the fuse holder and remove the fuse holder from its housing.

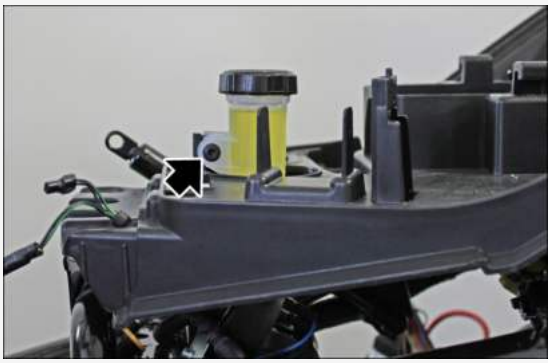


- Remove OBD2 socket "**A**" and the auxiliary socket "**B**" from their housings.

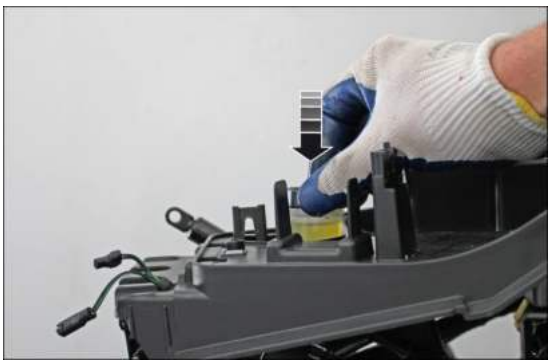


- Place the wiring harness and components just removed on the right-hand side of the vehicle, taking care not to damage any components.

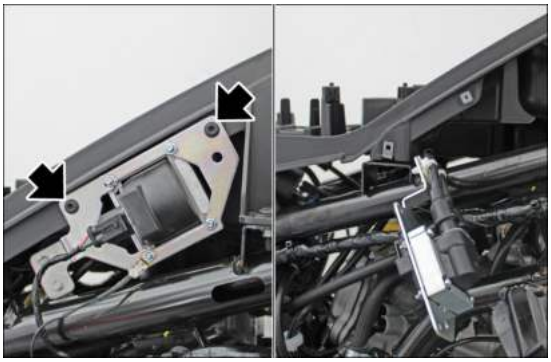
- Remove the fixing screw of the rear brake oil tank.



- Lower the rear brake oil tank into the rear brake oil tank opening in the helmet storage compartment.



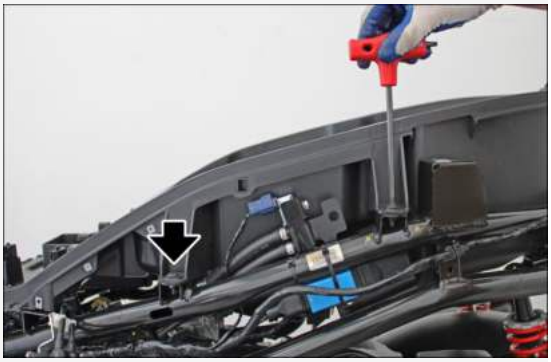
- Remove the two fixing screws and place the ignition coil on the frame tube.



- Operating at the rear of the vehicle, remove the courtesy light connector.

- Remove the two cables from the saddle closing switch.

- Remove the two side fixing screws of the helmet storage compartment.
- Repeat this operation on the opposite side as well.

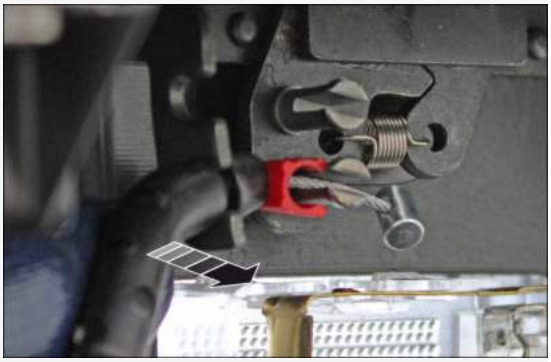


- Remove the front fixing screw.

- - Remove the two rear fixing screws.

- Lift the rear section of the helmet storage compartment to allow work on the saddle lock cables.
- Remove the cable clip using a screwdriver.

- Press the cable sheath outward to release it from its support and release the cable from the cable drum located on the saddle opening control.
- Repeat the operations for the second cable.



- Remove the helmet storage compartment from the vehicle.

12.16 Fuel tank

FUEL TANK REMOVAL

To remove the fuel tank, proceed as follows:

- Disconnect the battery to proceed in safety.
- Remove the footrests.
- Remove the chassis central cover.
- Remove the front wheel housing.

- Disconnect the fuel pump electrical connector.

- Unscrew and remove the screws fixing the tank lower crosspiece.

- Remove the tank lower crosspiece.

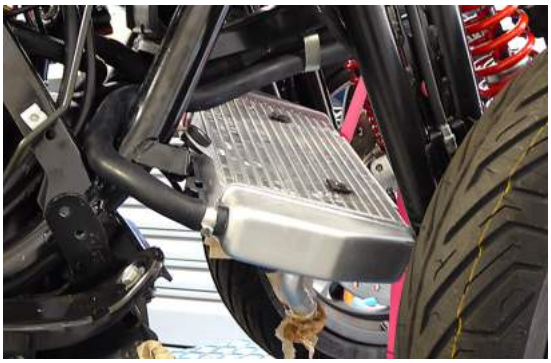
- Adequately support the fuel tank by placing lifting device below it.
- Unscrew and remove the screws fixing the radiator.

- Unscrew and remove the fixing screws of the radiator fixing upper crosspiece.

- Prepare a suitable recipient for the collection of the cooling circuit fluid.
- Remove the pipe clamps of the pipes connecting the radiator to the engine.

- Disconnect the pipes and drain the cooling system.

- Rotate the radiator upward and lock it in position using a belt.



- Unscrew and remove the nut fixing the air duct.

- Unscrew and remove the screws fixing the radiator support bracket to the footrests.

- Remove the crosspiece and the air duct of the radiator.

- Remove the hose clamp on the line connecting the tank to the canister.
- Disconnect the pipe.

- Unscrew and remove the upper screw fixing the tank to the frame.

- Unscrew and remove the lower screw fixing the tank to the frame.

- Lower the lift to extract the tank from the frame.

- Rotate the connector of the fuel pipe by 90 ° on its axis and disconnect it from the pump.

FUEL TANK FITTING

- Place the tank in its seat on the frame with a suitable lifting device.

- Connect the connector of the fuel pipe to the pump.

- Put the tank in its their final position.

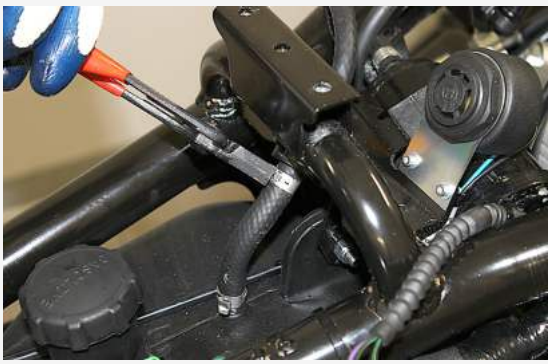
- Insert the lower fixing bolt of the tank to the frame.
- Tighten the fastener to the prescribed torque.

DESCRIPTION	TORQUE
Lower tank fastening - Chassis	6.0 ± 1.0 Nm

- Insert the upper fixing bolt of the tank to the frame.
- Tighten the fastener to the prescribed torque.

DESCRIPTION	TORQUE
Upper tank fastening- Chassis	6.0 ± 1.0 Nm

- Place a new hose clamp on the line connecting the tank to the canister.
- Using an adequate pliers to tighten the clamp.



- Place the crosspiece and the air duct of the radiator.

Insert and tighten the screws fixing the radiator support bracket to the footrests.

- Insert and tighten the nut fixing the air duct and the relative support bracket to the frame.

- Refit the radiator in its seat.
- Insert the new pipe clamps on the connection pipe between the radiator and the engine.
- Use the suitable pliers to tighten the clamps.

- Insert and tighten to the recommended torque the screws fixing the radiator upper crosspiece.

DESCRIPTION	TORQUE
Rdiator upper crosspiece - Frame	5.5 ± 1.5 Nm

- Insert and tighten the fixing screws of the radiator.

DESCRIPTION	TORQUE
Radiator - Radiator upper crosspiece	9.5 ± 1.5 Nm

- Fit the tank lower crosspiece.

- Insert and tighten to the recommended torque the screws fixing the lower crosspiece of the tank.

DESCRIPTION	TORQUE
Tank lower crosspiece - Frame	25.0 ± 5.0 Nm

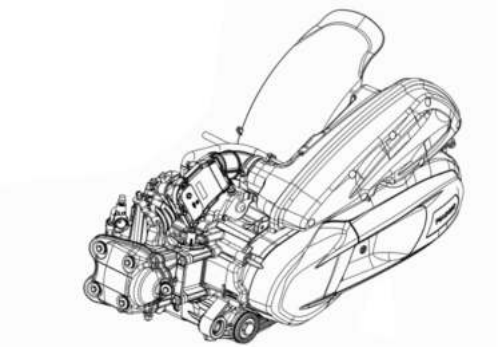
- Connect the electrical connector on the fuel pump.

- Refit the side panels of the vehicle.
- Connect the battery.
- Fill and bleed the cooling circuit.

PIAGGIO GROUP

WORKSHOP MANUAL

1Q001077 Ed: 03-07_2025



Engine 530 HPE

Engine 530 HPE

Piaggio & C. S.p.A. Viale Rinaldo Piaggio, 25 - 56025 PONTEDERA (PI), Italy

WORKSHOP MANUAL

Engine 530 HPE

This workshop manual has been produced for consultation by the technical staff of Dealerships, Service Centres, Authorised Service Network Workshops.
This manual is addressed to service mechanics who are supposed to have a basic knowledge of mechanics principles and of vehicle mounting techniques and procedures.
Any technical changes made to the vehicles or to specific mounting operations will be promptly reported by updates to this manual.
In order to achieve satisfactory operations, it is necessary to have adequate work areas and the necessary specific equipment or hierarchies.

N.B.
Indicates a note that provides information to make the process easier and clearer.

IMPORTANT
Indicates the specific processes that must be followed in order to prevent possible injury to the person repairing the vehicle.

WARNING
Indicates the specific processes that must be followed in order to prevent damage to the vehicle.

Personal Safety
avvertenze-sicurezza

Environmental Protection
Indicates the correct behaviour to adopt for an environmentally-friendly use of the vehicle.

Vehicle Integrity
The total or partial failure to follow these instructions may lead to serious damage to the vehicle and may even invalidate the warranty.

LIST OF TOPICS

LIST OF TOPICS

Regulations

This section describes general safety rules for any maintenance operations performed on the vehicle.

1.1 Safety specifications

- Should it be necessary to keep the engine running while servicing, make sure that the area or room is well ventilated, and use special exhaust fans, if required. never let the engine run in an enclosed area. Exhaust gasses are toxic.
- The battery electrolyte contains sulphuric acid. Protect your eyes, clothes and skin. Sulphuric acid is highly corrosive; in the event of contact with your eyes or skin, rinse thoroughly with abundant water and seek immediate medical attention.
- The battery produces hydrogen, a gas that can be highly explosive. Do not smoke and avoid sparks or flames near the battery, especially when charging it.
- Fuel is highly flammable and it can be explosive given some conditions. Do not smoke in the working area, and avoid naked flames or sparks.
- Clean the brake pads in a well-ventilated area, directing the jet of compressed air carefully to avoid the risk of inhaling dust produced by worn friction material. Even though the latter contains no asbestos, inhaling dust is harmful.

1.2 maintenance instructions

- Use original PIAGGIO spare parts and lubricants recommended by the Manufacturer. Non-original or non-conforming spare parts may damage the vehicle.
- Use only the special tools designed for this vehicle.
- Always use new gaskets, seal rings and cotter pins when reassembling.
- After removal, clean the components using non-flammable or low flash point solvent. Lubricate all the work surfaces, except tapered couplings, before refitting these parts.
- After reassembly, check that all components have been installed properly and that they are in good working order.
- For removal, overhaul and reassembly operations use only tools provided with metric measures. Metric bolts, nuts and screws are not interchangeable with coupling members with English measurement. Using unsuitable coupling members and tools may damage the vehicle.
- Should any interventions to the vehicle electrical system be required, check that the electrical connections – especially earth and battery connections – have been implemented properly.

LIST OF TOPICS

Technical specifications

2.1 Engine specifications

CHARACTERISTIC	DESCRIPTION / VALUE
Type	Single cylinder 4-stroke
Engine capacity	530 cm³
Bore x Stroke	97.5 x 71 mm
Compression ratio	11,5 ± 0,5 : 1
Idle engine speed	1,600 ± 100 rpm
Timing	Four valves, single overhead camshaft, chain-driven.
Valve clearance (cold)	Intake: 0.15 mm Exhaust: 0.15 mm
Transmission	CVT expandable pulley continuously variable transmission with torque server, V-belt, self-ventilating dry automatic centrifugal clutch and transmission housing with forced-circulation air cooling. Electrically operated reverse gear.
Final drive reduction gear	Gear reduction unit in oil bath.
Lubrication	Engine lubrication with lobe pump (inside crankcase), chain-driven, with double filter: mesh and paper.
Cooling	Forced coolant circulation system.
Ignition	Electric
Ignition	High efficiency inductive electronics integrated with injection, variable advance, separate H.V. coil and double spark plug.
Ignition advance	Three-dimensional map managed by control unit
Spark plug	NGK MR7BI-8 / MR8BI-8
Electrode gap	0.7-0.9 mm
Power feed	Electronic injection with electric fuel pump.

CHARACTERISTIC	DESCRIPTION / VALUE
Fuel	Unleaded gasoline E10 (95 R.O.N.)
Exhaust silencer	Absorption type with catalytic converter and lambda probe.

2.2 Tightening torques

SILENCER

DESCRIPTION	TORQUE
Silencer heat shield fastening screw	4.5 ± 0.5 Nm
Screw used to fasten silencer to supporting arm	28.5 ± 1.5 Nm
Lambda probe tightening on exhaust manifold	25 ± 5 Nm
Manifold/silencer joint tightening torque	13 ± 1 Nm

LUBRICATION SYSTEM

DESCRIPTION	TORQUE
Oil pump cover screws	0.8 ± 0.1 Nm
Screws fixing oil pump to the crankcase	5.5 ± 0.5 Nm

HEAD-ENGINE BLOCK-PISTON ASSEMBLY AND TIMING SYSTEM

DESCRIPTION	TORQUE
Spark plug	11.0 ± 1.0 Nm
Head screws - Cylinder	11.0 ± 1.0 Nm
Head-cylinder fixing nuts	13 Nm + 90° + 90°
Exhaust/intake head fastening nuts	11 ± 1 Nm
Cylinder head lubrication nozzle	6 ± 1Nm
Coolant temperature sensor - Cylinder head	22.0 ± 1.0 Nm
Injector fastening screw.	3.5 ± 0.5 Nm
Decompression screw	7.75 ± 0.75 Nm
Tensioner show fastening screw	12 ± 2 Nm
Pick-up - Crankcase	3.5 ± 0.5 Nm
Inlet manifold screws	12 ± 1 Nm
Tappet cover fastening screws	8 ± 1 Nm
Throttle body fastening screws	12 ± 1 Nm

DESCRIPTION	TORQUE
Cylinder head fastening screws	11 ± 1 Nm
Camshaft retaining bracket screws	5 ± 1Nm
Tensioner screw	4.5 ± 0.5 Nm
Tensioner fastening screws	12 ± 1 Nm

TRANSMISSION COVER

DESCRIPTION	TORQUE
Driven pulley nut	96 ± 4 Nm
Driver pulley nut	167.5 ± 7.5 Nm
M8 transmission cover fastenings	24.5 ± 1.5 Nm
M6 transmission cover fastenings	12 ± 1 Nm
Clutch ferrule	60 ± 5 Nm
Air duct screws	7.0 ± 1.0 Nm
Water pump cover screws	3.5 ± 0.5 Nm
Soundproof cover - Transmission cover	7.0 ± 1.0 Nm
Flywheel cover screws	12 ± 1 Nm
Hub cover - Crankcase	25.5 ± 1.5 Nm
Hub oil outlet	16 ± 1 Nm

FLYWHEEL COVER

DESCRIPTION	TORQUE
Integral chain guide shoe - Crankcase	3.5 ± 0.5 Nm
Flywheel fixing nut	120 ± 5 Nm
Stator fastenings	9 ± 1 Nm
Blow-by recovery duct fastening screws	3.5 ± 0.5 Nm
Freewheel to flywheel fixing screws	14 ± 1 Nm
Stator wiring guide bracket screws	3.5 ± 0.5 Nm
Bulkhead mounting screws	6.0 ± 1.0 Nm
Minimum oil pressure sensor	13 ± 1 Nm
Water pump impeller	5.0 ± 1.0 Nm
Starter motor - Crankcase	12 ± 1 Nm

CRANKSHAFT AND CASE

DESCRIPTION	TORQUE
Counter-shaft fastening nut	27 ± 2 Nm
Engine oil filter	14 ± 2 Nm
Engine oil drainage plug	27 ± 3 Nm
Engine-crankcase coupling screws	12 ± 1 Nm
Oil pump screws	5.5 ± 0.5 Nm
Crankshaft gearwheel screws	12.0 ± 1.0 Nm
Oil pump compartment closing bulkhead screw	3.5 ± 0.5 Nm

COOLING

DESCRIPTION	TORQUE
Water pump impeller	5.0 ± 1.0 Nm
Water pump cover screws	3.5 ± 0.5 Nm
Bleeder screw	3.5 ± 0.5 Nm

REVERSE GEAR SYSTEM

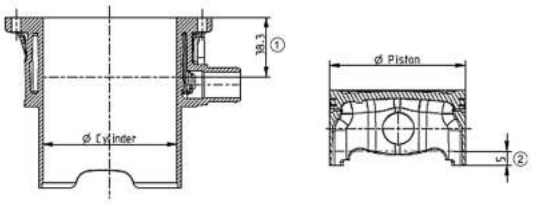
DESCRIPTION	TORQUE
Reverse gear control bushing ring nut	70 ± 4 Nm
Reverse gear system oil relief screw	16 ±1 Nm
Reverse gear system cover screws	12 ± 1 Nm
Reverse gear motor fastening screws	12 ± 1 Nm

2.3 Piston - cylinder fitting clearance

Measure the cylinder at distance "1" and the piston at distance "2".

N.B.:

THE PISTON MUST BE INSTALLED WITH THE ARROW FACING TOWARDS THE EXHAUST SIDE, THE PISTON RINGS MUST BE INSTALLED WITH THE WORD «TOP» OR THE STAMPED MARK FACING UPWARDS.

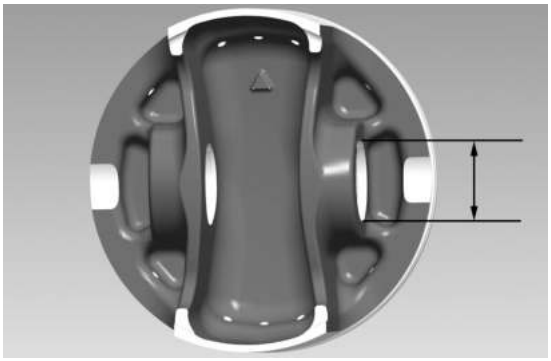


	Class A	Class B	Class C	Class D
Cylinder	97.490 to 97.497	97.497 to 97.504	97.504 to 97.511	97.511 to 97.518
Piston	97.457 to 97.464	97.464 to 97.471	97.471 to 97.478	97.478 to 97.485

Flow rates to the piston

- The bearing diameter on the piston must within the limits specified below.

CHARACTERISTIC	DESCRIPTION / VALUE
Standard diameter	22 +0.010 +0.004 mm



N.B.:

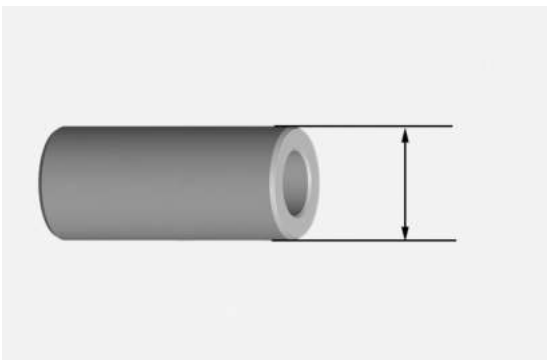
☞

THE PIN HOUSINGS HAVE 2 LUBRICATION CHANNELS. FOR THIS REASON, MEASUREMENT MUST BE MADE ACCORDING TO THE PISTON AXIS

Piston pin

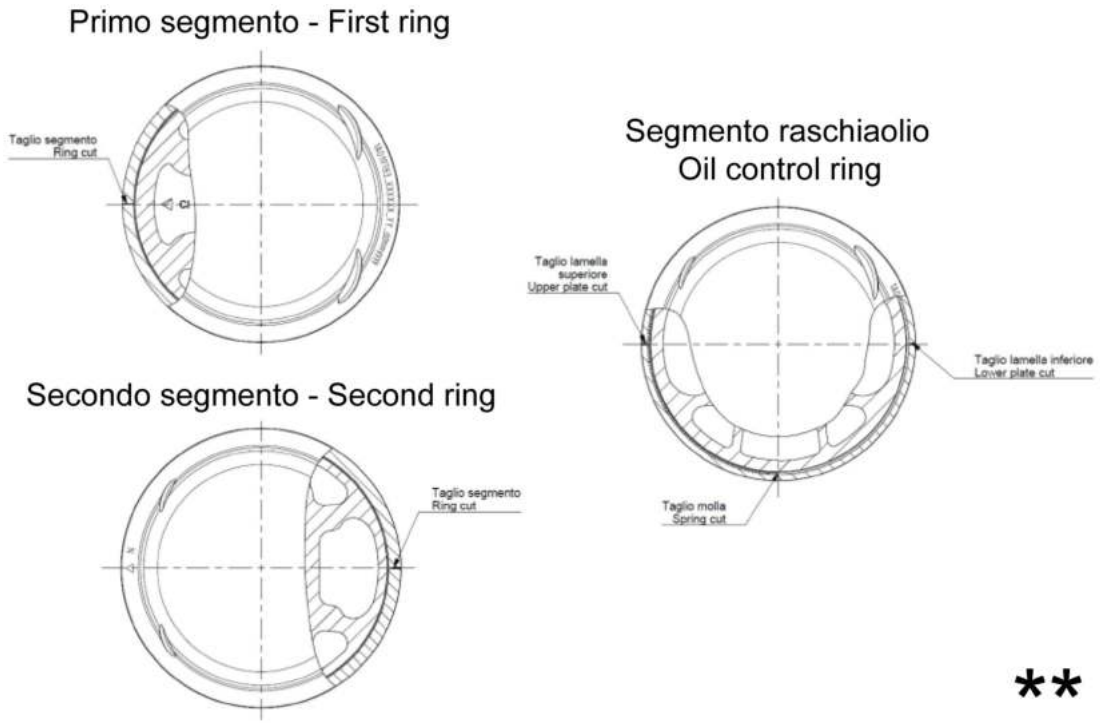
- The pin diameter must fall within the limits specified below.

CHARACTERISTIC	DESCRIPTION / VALUE
Standard diameter	22 -0.004 mm



2.4 Sealing rings assembly clearance

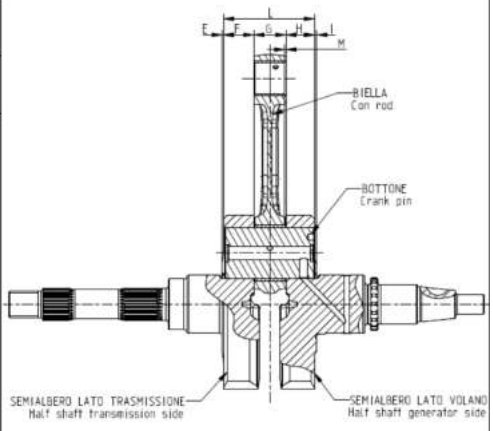
***Compression ring tolerances**



	Dimensions
First compression ring	0,150 ÷ 0,350 mm
Second compression ring	0,250 ÷ 0,500 mm
Oil scraper ring	0,250 ÷ 0,500 mm

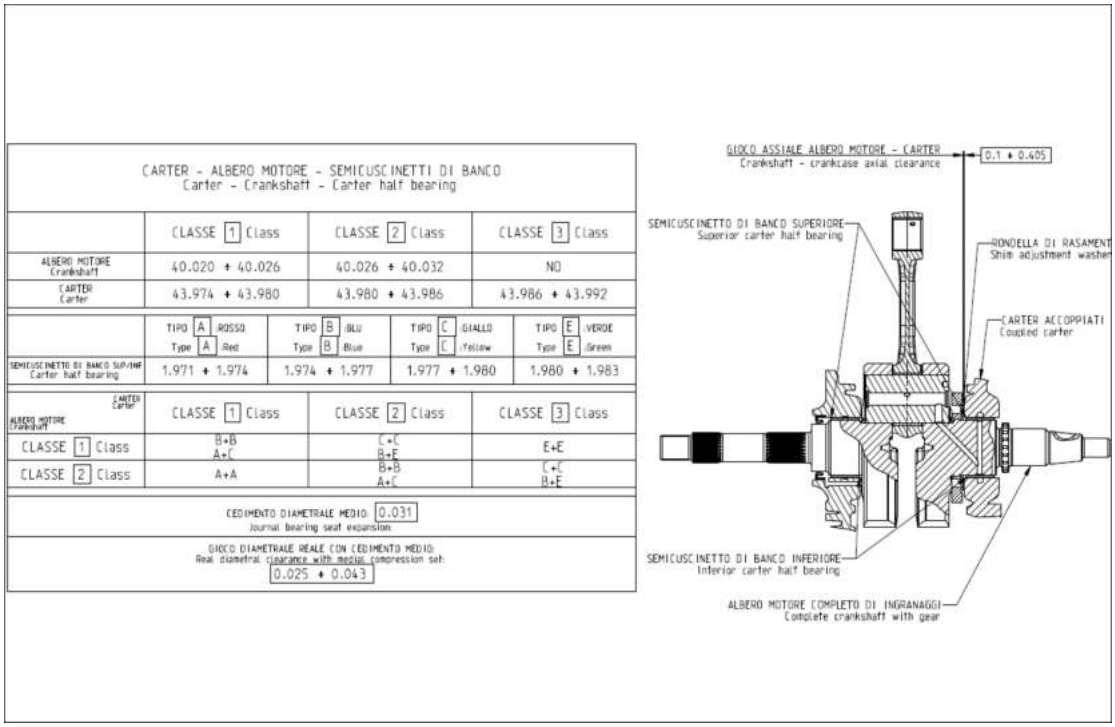
2.5 Crankcase - crankshaft - connecting rod

GIOCO ASSIALE TRA ALBERO MOTORE E BIELLA Axial clearance between crankshaft and con rod		
DENOMINAZIONE Denomination	DIMENSIONI Dimensions	GIOCO DI MONTAGGIO Assembly clearance
SPALLA LATO TRASMISSIONE Shoulder transmission side	E= 1 ± 0.025	M= 0.20 ÷ 0.50
SEMIALBERO LATO TRASMISSIONE Half shaft transmission side	F= $20.9^{0}_{-0.05}$	
BIELLA Connecting rod	G= $22^{-0.10}_{-0.15}$	
SEMIALBERO LATO VOLANO Half shaft generator side	H= $19.6^{0}_{-0.05}$	
SPALLA LATO VOLANO Shoulder generator side	I= 1.8 ± 0.025	
ALBERO MOTORE COMPLETO Complete crank shaft	L= $65.5^{+0.10}_{-0.05}$	



AXIAL CLEARANCE BETWEEN CRANKSHAFT AND CONNECTING ROD

	Dimensions	Assembly clearance
Transmission-side shoulder	E = 1 ± 0,025	M = 0.20 to 0.50
Transmissionside half-shaft	F = 20,9 (0 / -0,05)	M = 0.20 to 0.50
Connecting rod	G = 22 (-0,10 / -0,15)	M = 0.20 to 0.50
Flywheel-side halfshaft	H = 19,6 (0 / -0,05)	M = 0.20 to 0.50
Flywheel-side shoulder	I = 1,8 ± 0,025	M = 0.20 to 0.50
Complete crankshaft	L = 65,5 (+0,10 / - 0,05)	M = 0.20 to 0.50



CLASSIFICATION OF CRANKSHAFT - CASING

	Class 1	Class 2	Class 3
Crankshaft	40.020÷40.026	40.026÷40.032	NO
Crankcase	43.974 ÷ 43.980	43.980 ÷ 43.986	43.986 ÷ 43.992

CLASSIFICATION OF CRANKSHAFT HALF-BEARING

	Type A (red)	Type B (blue)	Type C (yellow)	Type E (green)
Upper/Lower crankshaft half-bearing	1.971 ÷ 1.974	1.974 ÷ 1.977	1.977 ÷ 1.980	1.980 ÷ 1.983

CLASS MATCHING

	Crankcase - class 1	Crankcase - class 2	Crankcase - class 3
Crankshaft - class 1	B+B / A+C	C+C / B+E	E+E
Crankshaft - class 2	A+A	B+B / A+C	C+C / B+E

BIELLA - BOTTONE - SEMICUSCINETTI DI BIELLA
Con rod - Crank pin - Connecting rod half bearing

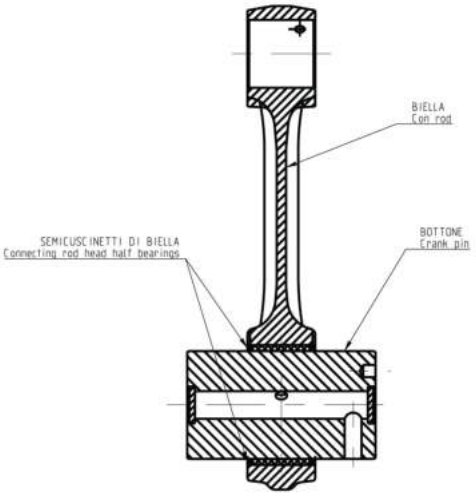
	CLASSE 1 Class	CLASSE 2 Class
BIELLA Con rod	39.000 ÷ 39.006	39.006 ÷ 39.012
BOTTONE Crank pin	34.988 ÷ 34.994	34.994 ÷ 35.000

	TIPO A/D ROSSO/NERO Type A/D Red/Black	TIPO B/D BLU/NERO Type B/D Blue/Black	TIPO C/D GIALLO/NERO Type C/D Yellow/Black
SEMICUSCINETTO DI BIELLA Connecting rod half bearing	1.986 ÷ 1.989	1.989 ÷ 1.992	1.992 ÷ 1.995

BOTTONE Crank pin / BIELLA Con rod	CLASSE 1 Class	CLASSE 2 Class
CLASSE 1 Class	BD + BD AD + CD	CD + CD
CLASSE 2 Class	AD + AD	BD + BD AD + CD

CEDIMENTO DIAMETRALE MEDIO: 0.018
Journal bearing seat expansion:

GIOCO OLIO DIAMETRALE CON CEDIMENTO MEDIO:
Diametral oil clearance with medial compression set:
0.040 ÷ 0.058



CLASSIFICATION OF CONNECTING ROD - BUTTON

	Class 1	Class 2
Connecting rod	39,000 ÷ 39,006	39,006 ÷ 39,012
Button	34,988 ÷ 34,994	34,994 ÷ 35,000

CLASSIFICATION OF CONNECTING ROD HALF-BEARING

	Type A/D (red/black)	Type B/D (blue/ black)	Type C/D (yellow/ black)
Connecting rod half-bearing	1,986 ÷ 1,989	1,989 ÷ 1,992	1,992 ÷ 1,995

CLASS MATCHING

Average diametrical failure: 0,018

Diametrical oil clearance with average failure: 0,040 ÷ 0,058

	Connecting rod - class 1	Connecting rod - class 2
Button - class 1	BD+BD / AD+CD	CD+CD
Button - class 2	AD+AD	BD+BD / AD+CD

2.6 Head assembly clearance

Valve service limits

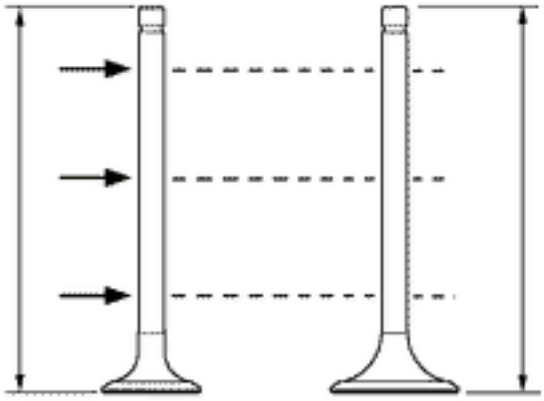
Measure the diameter of the valve stems in the three positions indicated in the diagram.

STANDARD DIAMETER

STANDARD DIAMETER	
Intake:	4.987 - 4.972 mm
Exhaust:	4.975 - 4.960 mm

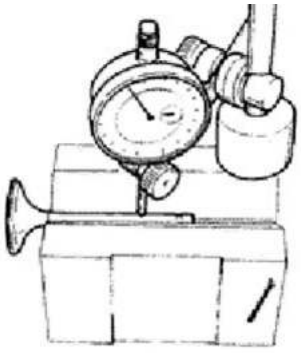
MINIMUM DIAMETER PERMITTED

MINIMUM DIAMETER PERMITTED	
Intake:	4.96 mm
Exhaust:	4.945 mm

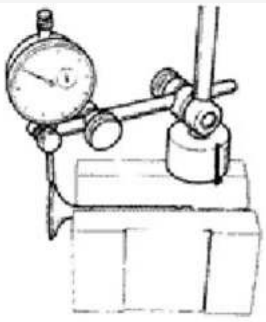


- Check the deviation of the valve stem by resting it on a «**V**» shaped abutment and measuring the extent of the deformation with a dial gauge.

CHARACTERISTIC	DESCRIPTION / VALUE
Limit value admitted: 0,01 mm	



- Check the concentricity of the valve head by placing a dial gauge at right angles to the valve head and rotating it on the «**V**» shaped support.



CHARACTERISTIC	DESCRIPTION / VALUE
Admissible limit:	0.03 mm

Guide - valve clearance

- The clearance between the guide and the stanchion can be obtained after measuring the valve guide diameter and the valve stanchion diameter.

INTAKE	
Standard clearance:	0.013 - 0.04 mm
Admissible limit:	0.08 mm

EXHAUST	
Standard clearance:	0.025 - 0.052 mm
Admissible limit:	0.09 mm

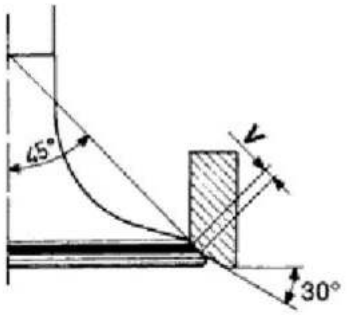
STANDARD VALVE LENGTH

STANDARD VALVE LENGTH	
Intake:	95.0 ± 0.3 mm
Exhaust:	94.2 ± 0.3 mm

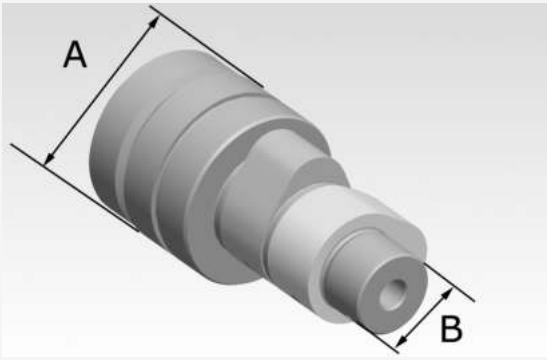
Seat - valve coupling

Standard value: 1 - 1.3 mm

Admissible limit: 1.6 mm



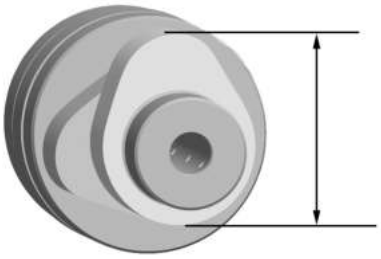
Camshaft capacities



STANDARD DIAMETER	
Bearing A Ø:	42 - 0.060 -0.085 mm
Bearing B diameter:	20 - 0.020 -0.041 mm

MINIMUM DIAMETER PERMITTED	
Bearing A Ø:	41.910 mm
Bearing B diameter:	19.940 mm

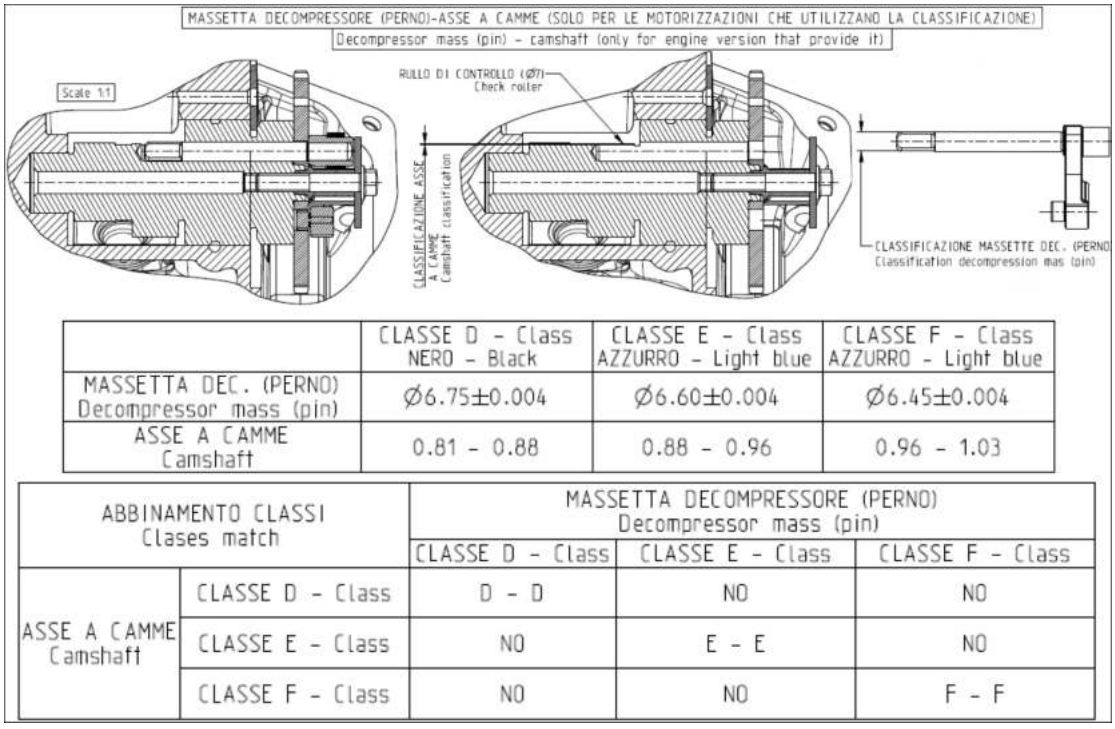
Cam height



STANDARD HEIGHT	
intake	31,982 mm
exhaust	31,297 mm

LIMITS ALLOWED	
intake	31,747 mm
exhaust	31,064 mm
Standard axial clearance:	0 - 0.22 mm
Maximum admissible axial clearance:	0.3 mm

CLASSIFICATION OF DECOMPRESSION PIN/SCREW KNOB - CAMSHAFT



	CLASSE D - Class NERO - Black	CLASSE E - Class AZZURRO - Light blue	CLASSE F - Class AZZURRO - Light blue
MASSETTA DEC. (PERNO) Decompressor mass (pin)	Ø6.75±0.004	Ø6.60±0.004	Ø6.45±0.004
ASSE A CAMME Camshaft	0.81 - 0.88	0.88 - 0.96	0.96 - 1.03

ABBINAMENTO CLASSI Clases match		MASSETTA DECOMPRESSORE (PERNO) Decompressor mass (pin)		
		CLASSE D - Class	CLASSE E - Class	CLASSE F - Class
ASSE A CAMME Camshaft	CLASSE D - Class	D - D	NO	NO
	CLASSE E - Class	NO	E - E	NO
	CLASSE F - Class	NO	NO	F - F

CLASSIFICATION OF DECOMPRESSION SCREW KNOB (PIN) - CAMSHAFT

	Class D (black)	Class E (light blue)	Class F (light blue)
Decompression screw knob (pin)	Ø 6.75 ± 0.004	Ø 6.60 ± 0.004	Ø 6.45 ± 0.004
Camshaft	0.81 - 0.88	0.88 - 0.96	0.96 - 1.03

CLASS MATCHING

	Decompression screw knob (pin) - Class D	Decompression screw knob (pin) - Class E	Decompression screw knob (pin) - Class F
Camshaft - Class D	D - D	NO	NO
Camshaft - Class E	NO	E - E	NO
Camshaft - Class F	NO	NO	F - F

Decompression pin/screw knob

- Class identification sign: D - E - F
- Stamp of the class identification sign: pin end

Camshaft

- Class identification sign: D - E - F
- Stamp of the class identification sign: camshaft - sprocket timing view

N.B.:

THE CLASSES OF THE TWO COMPONENTS MUST BE IDENTICAL.

Check the combustion chamber's pressure during the ignition so that it ranges between the accepted values listed below and also check the engine's revolutions.

Perform the check when the battery is loaded, at room temperature and use a pressure gauge to detect the (relative) pressure during the ignition and the corresponding engine revolutions.

	Drive motor revolutions (rpm)	Relative pressure (bar)
MIN	415	5.2
MAX	550	7.2

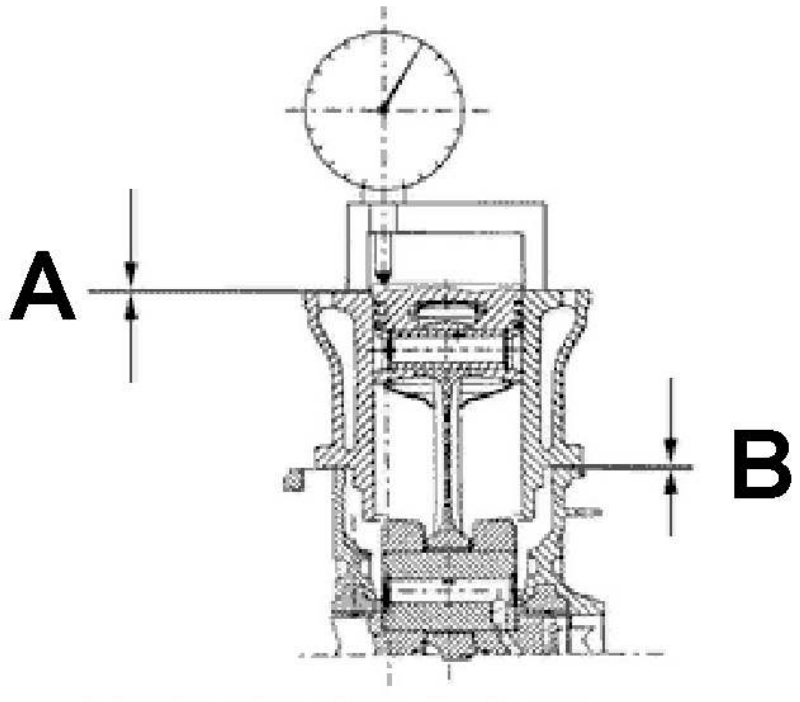
2.7 Shimming system

Shimming system to control compression ratio.

DISTANCE «A» IS A PROTRUSION OR RECESS VALUE OF THE PISTON CROWN WITH RESPECT TO THE CYLINDER PLANE.

DISTANCE «A» HELPS DETERMINE THE THICKNESS OF GASKET «B» THAT HAS TO BE FITTED TO THE CYLINDER HEAD IN ORDER TO RESTORE COMPRESSION RATIO. BASE GASKET «B» MUST BE THICKER THE MORE THE PLANE FORMED BY THE PISTON CROWN PROTRUDES FROM THE PLANE FORMED BY THE CYLINDER HEAD. ON THE OTHER HAND, THE MORE THE PISTON CROWN IS RECESSED INTO THE CYLINDER TOP PLANE, THE SMALLER THE GASKET THICKNESS.

Compression ratio11.5 ± 0.5 :1



BASE GASKET THICKNESS

	Measurement A	BASE GASKET THICKNESS
«A» MEASURE TAKEN	- 0.185 - - 0.10	0.4
«A» MEASURE TAKEN	- 0.10 - + 0.10	0.6
«A» MEASURE TAKEN	+ 0.10 - + 0.185	0.8

N.B.:

☞

MEASUREMENT "A" MUST BE TAKEN WITHOUT ANY GASKET FITTED BETWEEN THE CRANKCASE AND CYLINDER AND AFTER RESETTING THE DIAL GAUGE, EQUIPPED WITH A SUPPORT, ON A GROUND PLANE.

2.8 Maintenance

Please refer to the vehicle-specific Service Station Manual for the maintenance schedule and related operations.

LIST OF TOPICS

Specific tools

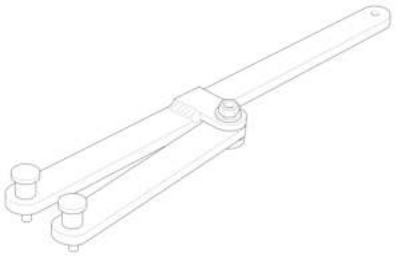
3.1 Tools

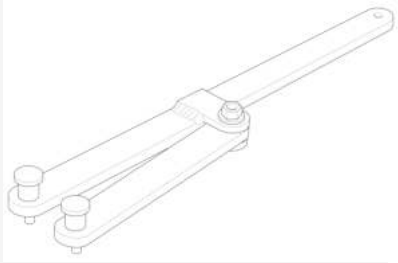
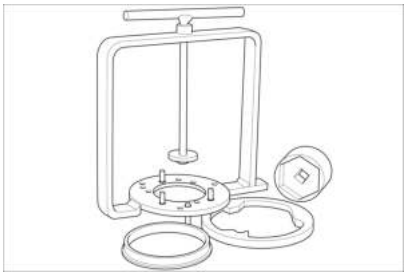
CODE	DESCRIPTION	IMAGE
001467Y002	Driver for OD 73 mm bearing	
001467Y006	Pliers to extract 20 mm bearings	
001467Y007	Bearing housing, external ø 54 mm	
001467Y008	Calliper to extract ø 17-mm bearings	
001467Y014	Calliper to extract ø 15-mm bearings	

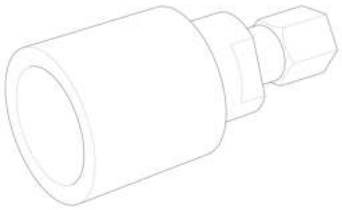
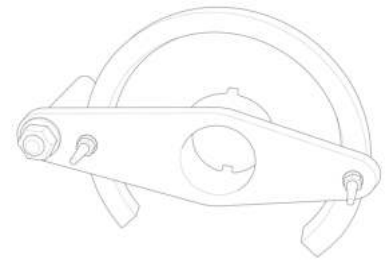
CODE	DESCRIPTION	IMAGE
001467Y017	Bearing housing, external ø 39 mm	
001467Y031	Bell	
001467Y034	Calliper to extract ø 15-mm bearings	
001467Y035	Bearing housing, external ø 47 mm	
020151Y	Air heater	

CODE	DESCRIPTION	IMAGE
020193Y	Oil pressure gauge	
020201Y	Spacer bushing driving tube	
020306Y	Punch valve seal rings fitting	
020335Y	Magnetic mounting for dial gauge	

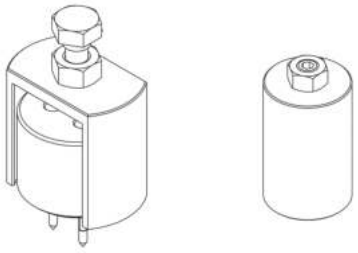
CODE	DESCRIPTION	IMAGE
020357Y	32 x 35-mm Adaptor	
020358Y	37 x 40 mm Adaptor	
020359Y	42 x 47 mm Adaptor	
020360Y	52 x 55 mm adaptor	
020364Y	25-mm guide	

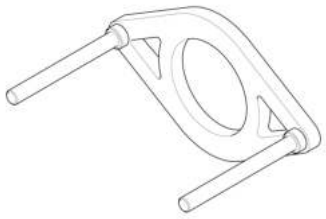
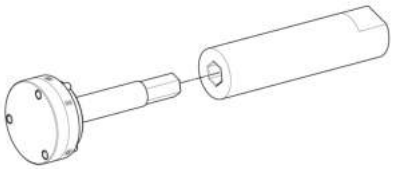
CODE	DESCRIPTION	IMAGE
020376Y	Adaptor handle	
020382Y012	adapter for valve removal too	
020412Y	15-mm guide	
020442Y	Engine pulley lock wrench 125 cc	
020424Y	Driven pulley roller casing fitting punch	

CODE	DESCRIPTION	IMAGE
020431Y	Valve oil seal extractor	
020434Y	Union for oil pressure measurement	
020439Y	17-mm guide	
020442Y	Engine pulley lock wrench 125 cc	
020444Y	Tool for FITTING/removing clutch on/from driven pulley	

CODE	DESCRIPTION	IMAGE
020456Y	Adapter 24 mm	
020467Y	Flywheel puller tool	
020470Y	Tool for fitting the pin locking stops	
020472Y	Flywheel lock tool	
020474Y	Driving pulley immobiliser tool	

CODE	DESCRIPTION	IMAGE
020475Y	Piston position checking tool	
020476Y	Stud bolt set	
020479Y	Countershaft lock wrench	
020480Y	Fuel pressure measurement kit	
020483Y	30-mm guide	

CODE	DESCRIPTION	IMAGE
020512Y	Piston fitting fork	
020565Y	Flywheel lock calliper spanner	
020661Y	Water pump overall seal replacement kit	
020674Y	Piston mounting ring Ø 95 mm	
021017Y	PADS EOBD E5 diagnostics cable	

CODE	DESCRIPTION	IMAGE
021022Y	Driven pulley stop	
021023Y	Reverse lock ring spanner	
021024Y	Control bushing stopper wrench	
021999Y	PADS 4.0	

LIST OF TOPICS

Engine

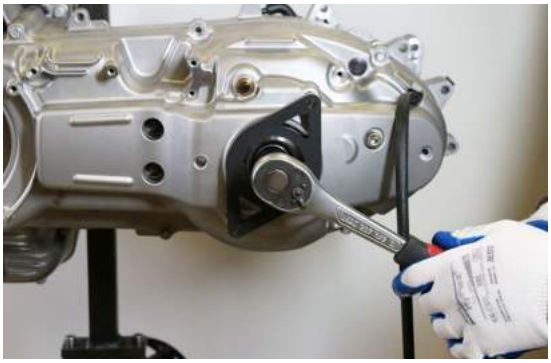
4.1 Automatic transmission

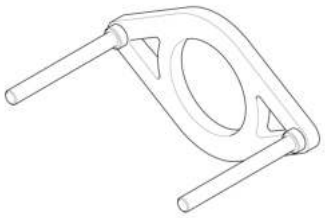
4.1.1 Transmission cover

- Loosen the 4 fastening screws.
- Extract the outside plastic transmission cover.

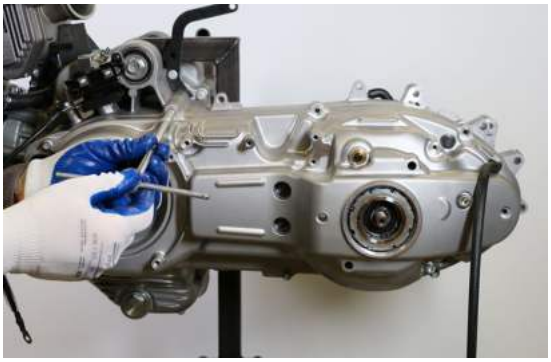
- Use a screwdriver to remove the driven pulley axle cover.

- Install the specific tool in the appropriate slots and unscrew the driven pulley axle nut.
- Remove the nut and the two washers.
- Remove the specific tool.

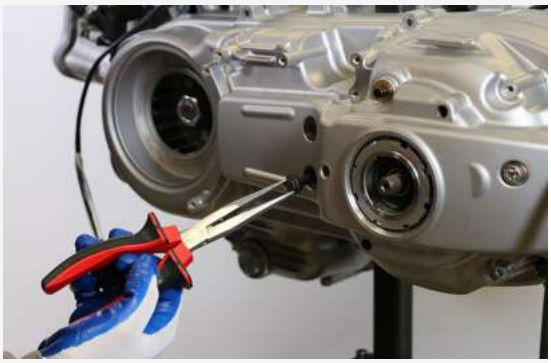


CODE	DESCRIPTION	IMAGE
021022Y	Driven pulley stop	

- Remove the transmission cover screws.



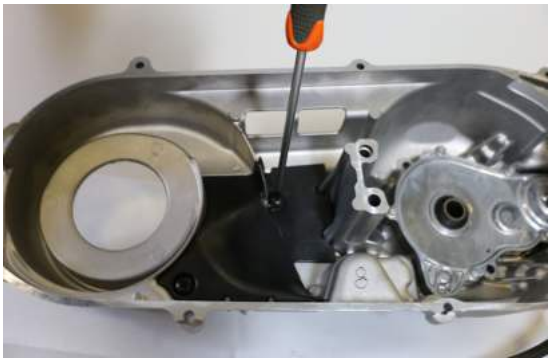
- Remove the screws from the right side of the cover.
- Remove the screws from the central part.



- Remove the transmission cover.
- Check that the bearing rotates freely, otherwise replace the bearing.

4.1.2 Air duct

- Remove the transmission cover.
- Unscrew the two screws shown in the figure to remove the air conveyor.



4.1.3 Removing the driven pulley shaft mounting bearing

- Remove the transmission cover.
- Remove the seeger ring.

- Place the transmission cover on a wooden surface and use the special tool so that it is adequately supported.
- Extract the bearing with the specific tool.

N.B.:

☞

THE BELL MUST BE PLACED INTO THE TRANSMISSION COVER, CLOSE TO THE BEARING SEAT AND THE WOODEN SURFACE, SINCE WITHOUT BELL THE ENTIRE COVER STRUCTURE WOULD BEND.; NOT ONLY IN THE AREA OF MAXIMUM STURDINESS.

CODE	DESCRIPTION	IMAGE
001467Y002	Driver for OD 73 mm bearing	

CODE	DESCRIPTION	IMAGE
020376Y	Adaptor handle	
020375Y	28 x 30 mm adaptor	
020439Y	17-mm guide	

4.1.4 Fitting the driven pulley shaft mounting bearing

- Heat the transmission cover inside with a heat gun.

N.B.:

☞

BE CAREFUL NOT TO OVERHEAT THE COVER AS THIS WOULD DAMAGE THE OUTSIDE PAINTED SURFACE.

CODE	DESCRIPTION	IMAGE
020151Y	Air heater	

- Fit the bearing onto the special tool with a little grease to prevent it from coming out.
- Refit the new bearing with the specific tool.

N.B.:

☞

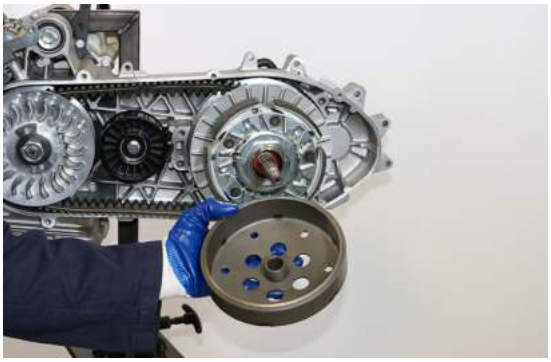
PROPERLY SUPPORT THE OUTSIDE COVER TO PREVENT DAMAGING THE PAINTED SURFACE.

CODE	DESCRIPTION	IMAGE
020376Y	Adaptor handle	

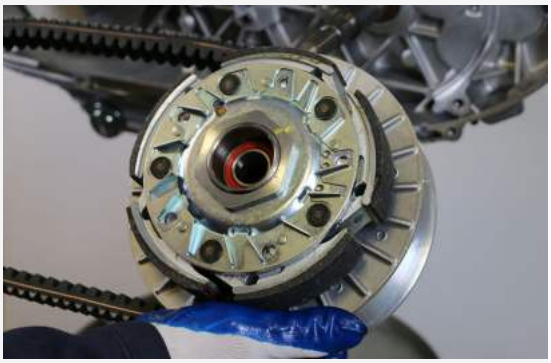
CODE	DESCRIPTION	IMAGE
020358Y	37 x 40 mm Adaptor	
020439Y	17-mm guide	

4.1.5 Driven pulley removal

- Remove the housing clutch, if necessary levering with a screwdriver and using a plastic mallet.



- Remove the fixed driving half-pulley.
- Remove the driven pulley assembly with the belt.



4.1.6 clutch housing check

- Make sure that the clutch housing is not worn or damaged.
- Measure the clutch housing inside diameter.

N.B.:

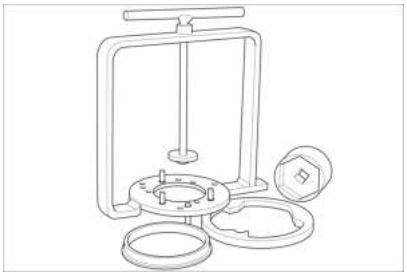
☞

CHECK THE ECCENTRICITY MEASURED, 0.2 MM MAX.

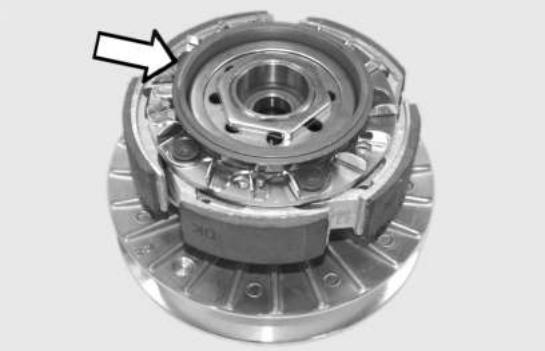
CHARACTERISTIC	DESCRIPTION / VALUE
Max. value.	160.5 mm
Standard value	160.2 mm

4.1.7 Removing the clutch

- To remove the clutch with the driven pulley it is necessary to use the special tool.
- Arrange the tool with the mean pins screwed in position "**E**" on the inside.

CODE	DESCRIPTION	IMAGE
020444Y	Tool for FITTING/removing clutch on/from driven pulley	

- Fit the adapter ring to the clutch assembly as shown in the photograph.



- Install the driven pulley unit onto the tool inserting the pins into the ventilation holes.
- Move the rear stop screw in abutment against the fixed driven pulley as shown in the figure.

WARNING

THE TOOL SHOULD BE FIRMLY SECURED IN A VICE USING THE SPECIAL TOOL. DO NOT TIGHTEN THE REAR SCREW TOO MUCH AS THIS COULD IRRETRIEVABLY DEFORM THE TOOL.

USING THE SPECIAL 55-MM WRENCH, REMOVE THE FASTENING RING NUT.

LOOSEN THE TOOL SCREW AND DISASSEMBLE THE DRIVEN PULLEY UNIT, CLUTCH, SPRING WITH SHEATH.

4.1.8 Clutch Check

- Check the thickness of the clutch mass friction material.

CHARACTERISTIC	DESCRIPTION / VALUE
Minimum thickness allowed	1 mm

- The masses must not show traces of lubricants. Otherwise, check the driven pulley unit seals.

- Do not use tools to open the masses to avoid variation in the return spring load.

N.B.:

☞

UPON RUNNING-IN, THE MASSES MUST EXHIBIT A CENTRAL FACING SURFACE AND MUST NOT BE DIFFERENT FROM ONE ANOTHER.

VARIOUS CONDITIONS CAN CAUSE THE CLUTCH TO TEAR.

4.1.9 Pin retaining collar

- Extract the collar using 2 screwdrivers.

- Remove the 4 guide pins.
- Extract the moving driven half-pulley.

4.1.10 Stationary driven half-pulley check

- Check that the belt contact surface is free from wear.
- Measure the outside diameter of the pulley bushing.

CHARACTERISTIC	DESCRIPTION / VALUE
Minimum diameter permitted	49.91 mm
Standard diameter	50.00 - 0.015-0.035 mm

4.1.11 Removing the driven half-pulley bearings

- Check there are no signs of wear or damage on the bushing; otherwise replace the fixed driven half-pulley.
- Remove the snap ring with pliers.

- With the special tool inserted through the roller bearing, pull out the ball bearing.

WARNING

ADEQUATELY SUPPORT THE HALF PULLEY SO AS NOT TO DAMAGE THE THREADED END WHILE FITTING THE BEARINGS.

CODE	DESCRIPTION	IMAGE
020376Y	Adaptor handle	
020456Y	Adapter 24 mm	
020363Y	20-mm guide	

N.B.:

☞

IF YOU NEED TO OVERHAUL THE BEARINGS ON AN ASSEMBLED DRIVEN PULLEY UNIT, IT IS NECESSARY TO SUPPORT THE UNIT BY THE BELL.

CODE	DESCRIPTION	IMAGE
001467Y002	Driver for OD 73 mm bearing	

- Remove the roller bearing with the specific tool, supporting the fixed half-pulley with the bell.

CODE	DESCRIPTION	IMAGE
020376Y	Adaptor handle	
020375Y	28 x 30 mm adaptor	
020364Y	25-mm guide	

CODE	DESCRIPTION	IMAGE
001467Y002	Driver for OD 73 mm bearing	

4.1.12 Movable driven half-pulley check

- Check that the belt contact surface is free from wear.
- Remove the 2 inside sealing rings and the 2 outside O-rings.
- Measure the movable half-pulley bushing inside diameter.

CHARACTERISTIC	DESCRIPTION / VALUE
Maximum diameter allowed	50.05 mm
Standard diameter	50.00 +0.035 0.00 mm

4.1.13 FITTING the driven half-pulley bearings

- Fit a new roller bearing with the specific tool.

N.B.:

☞

PLACE THE BEARING WITH THE WRITINGS AND THE EMBEDDED OIL GUARD FACING OUTWARDS.

- Properly support the half-pulley to prevent damaging the threading.
- If you are working on the driven pulley unit fully assembled, use the special tool.

CODE	DESCRIPTION	IMAGE
020478Y	Punch for roller casing	
001467Y002	Driver for OD 73 mm bearing	

- Fit a new ball bearing with the specific tool.
- Insert the Seeger lock ring.

CODE	DESCRIPTION	IMAGE
020376Y	Adaptor handle	

CODE	DESCRIPTION	IMAGE
020477Y	Adapter 37 mm	
020363Y	20-mm guide	

4.1.14 Assembly of the driven pulley

- Fit the new oil seals.
- Fit the new O-rings.
- Fit the half-pulley on the bushing being careful not to damage the top sealing ring during the fitting.
- Make sure the pins and collar are not worn, refit the pins and the collar.
- Using a curved-spout grease gun, lubricate the driven pulley assembly with approximately 10 g of grease. Apply the grease through one of the holes in the bushing until it comes out through the hole on the opposite side. This operation is necessary to avoid the presence of grease beyond the O-rings.

N.B.:

☞

O-RINGS ARE OF TWO SIZES. THE LARGE ONE IS INSTALLED ON THE MACHINING END RADIUS, AT THE BASE OF THE HALF-PULLEY.

PRODUCT	DESCRIPTION	SPECIFICATIONS
Molybdenum disulphide grease	Oily lithium grease containing molybdenum disulphide.	Grey-black grease

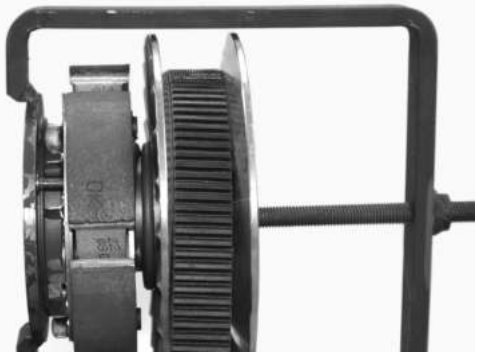
4.1.15 Return spring check

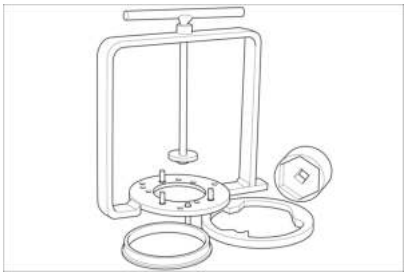
- Measure the free length of the return spring between the clutch and the driven half-pulley.

CHARACTERISTIC	DESCRIPTION / VALUE
Standard length	146,5 mm
Limit length allowed after use	137,0 mm

4.1.16 Fitting the clutch

- Prepare the special tool as for removal;
- Preassemble the driven pulley unit with the drive belt according to its direction of rotation;
- Insert the driven pulley unit, the spring with sheath and clutch into the tool.



CODE	DESCRIPTION	IMAGE
020444Y	Tool for FITTING/removing clutch on/from driven pulley	

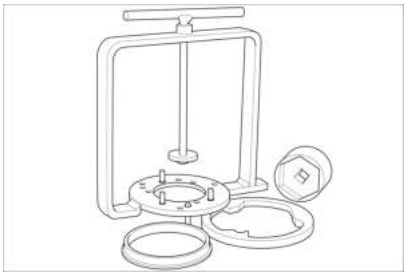
WARNING

DURING THE SPRING PRE-LOADING PHASE, BE CAREFUL NOT TO DAMAGE THE PLASTIC SPRING STOP AND THE BUSHING THREADING.

- Compress the spring and insert the clutch on the driven pulley bushing.
- Tighten the ring nut by hand and complete the tightening using the special wrench to the foreseen torque.

DESCRIPTION	TORQUE
Clutch ferrule	60 ± 5 Nm

- To facilitate reassembly on the engine, turn the moving driven pulley and insert the belt onto the smaller diameter.

CODE	DESCRIPTION	IMAGE
020444Y	Tool for FITTING/removing clutch on/from driven pulley	

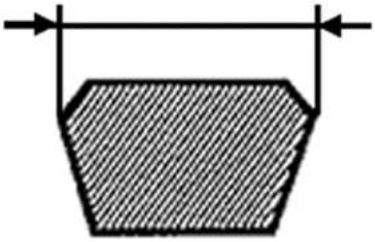
4.1.17 Driven pulley fitting

- Install the driven pulley assembly with belt.

4.1.18 Drive belt

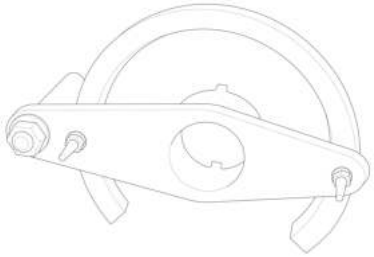
- Check that the drive belt is not damaged.
- Check belt for correct width.

CHARACTERISTIC	DESCRIPTION / VALUE
Minimum width	27.5 mm
Maximum width	28.7 mm

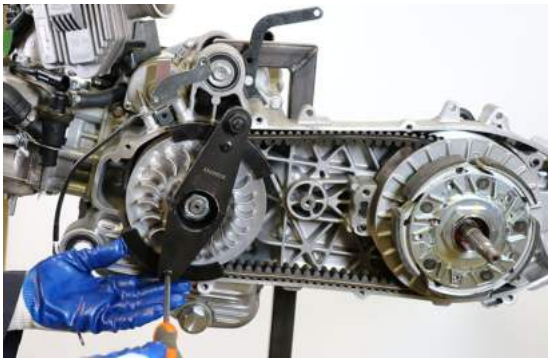


4.1.19 Driving pulley removal

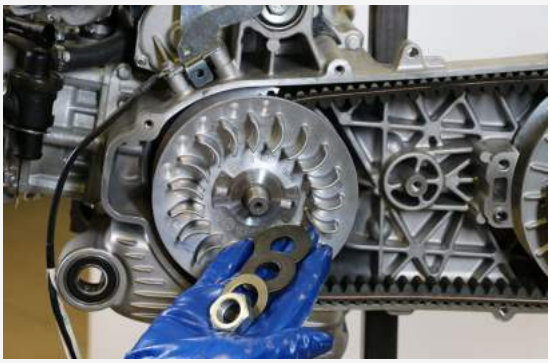
- Fit the specific tool, first inserting the two retainer clamps onto the pulley so that the splines are completely engaged.

CODE	DESCRIPTION	IMAGE
020474Y	Driving pulley immobiliser tool	

- Screw, also manually, the 2 fixing screws on the main tool.



- Using a 27 mm wrench, unscrew the central nut of the pulley drive.
- Remove the washers.
- Remove the fixed driving half-pulley.



- Remove the driven pulley assembly with the belt.

- Remove the bushing connection washer.

- Remove the mobile driving half-pulley with the relevant bushing, being careful not to let the rollers to come out.

- Remove the rear washer.

- The transmission side casing is now free.

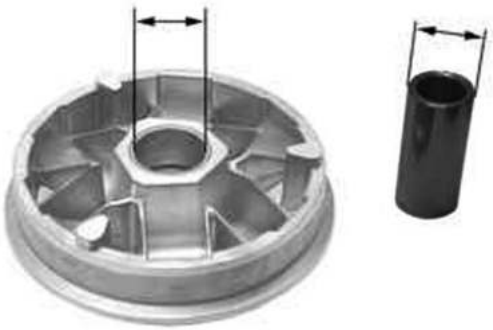
4.1.20 Roller housing check

WARNING

DO NOT LUBRICATE OR CLEAN THE BUSHINGS.

- Verify that the bushings shown in the figure do not show abnormal wear and measure the internal diameter.

CHARACTERISTIC	DESCRIPTION / VALUE
Maximum allowable diameter	Ø 30.12 mm
Standard diameter	Ø 30.021 mm



- Measure the outside diameter of the pulley sliding bushing shown in the figure.

CHARACTERISTIC	DESCRIPTION / VALUE
Minimum diameter permitted	Ø 29.95 mm
Standard diameter	Ø 29.959 mm

- Check that the rollers are not damaged or worn.

CHARACTERISTIC	DESCRIPTION / VALUE
Minimum diameter permitted	Ø 24.5 mm
Standard diameter	Ø 24.9 mm

- Check that the guide sliders for the roller contrast plate are not worn.
- Check that the roller housings or the surfaces in contact with the belt on both half-pulleys are not worn.

4.1.21 fitting the drive pulley

Installing the roller container

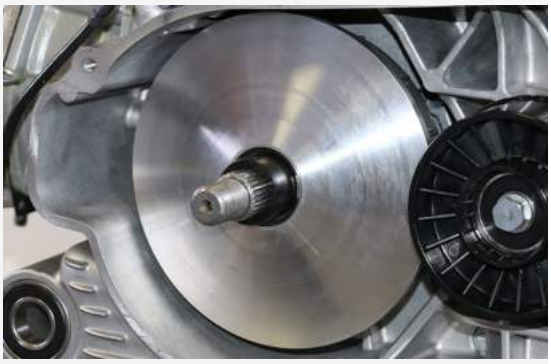
- Install the spacer with the internal chamfer facing towards the inside.

- Check that the guide sliders for the roller contrast plate are not worn.
- Check that the roller housings or the surfaces in contact with the belt on both half-pulleys are not worn.
- Check the weight of the variator rollers.
- Replace in the event of worn rollers or with weight lower than that specified
- Position the rollers on the half-pulley as shown in the figure.
- The closed side must rest on the inside thrust face of the roller container.

Vehicle	WEIGHT (grams)
MP3 530	22.4

- Assemble the half-pulley with the ramp plate and the sliders.

- Insert the bushing and driving half-pulley .

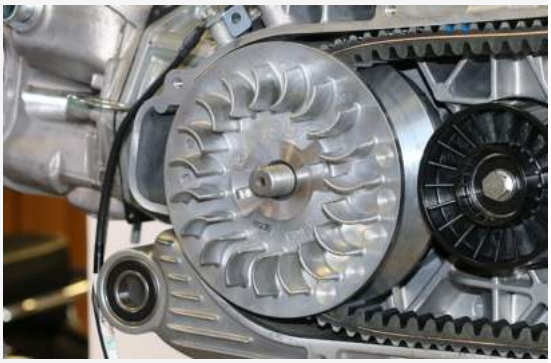


- Fit the transmission belt on the driven pulley.

Installing the fixed driving half-pulley

- Insert the spacer.

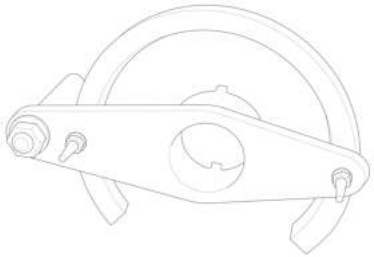
- Install the fixed driving half-pulley and check that it is in contact with the spacer and with the guide bushing of the movable driving pulley.



- Remove the flat washer and the spring washer as shown in the figure.

- Insert the nut in the original position (nut side in contact with the belleville washer).

- Fit the specific tool, first inserting the two retainer clamps onto the pulley so that the splines are completely engaged.
- Screw, also manually, the 2 fixing screws on the main tool.

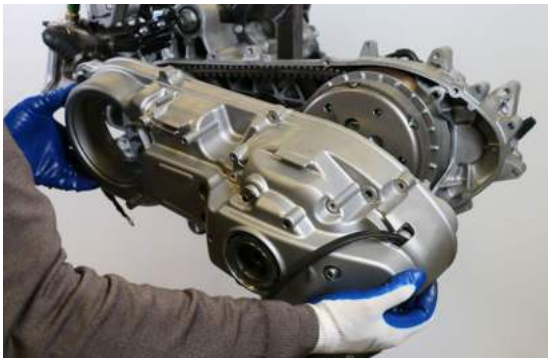
CODE	DESCRIPTION	IMAGE
020474Y	Driving pulley immobiliser tool	

- Using a 27 mm wrench, fasten the driving pulley fastening nut to the foreseen torque.
- Remove the specific tool.

DESCRIPTION	TORQUE
Driver pulley nut	167.5 ± 7.5 Nm

4.1.22 Fitting the transmission cover

- Put the transmission cover.



CAUTION

THE FOUR M8 SCREWS OF THE TRANSMISSION COVER HAVE DIFFERENT LENGTHS: THE TWO LONG SCREWS MUST BE FITTED ON THE CENTRAL PART, THE TWO SHORT SCREWS ON THE RIGHT SIDE.

- Tighten the screws on the central part.

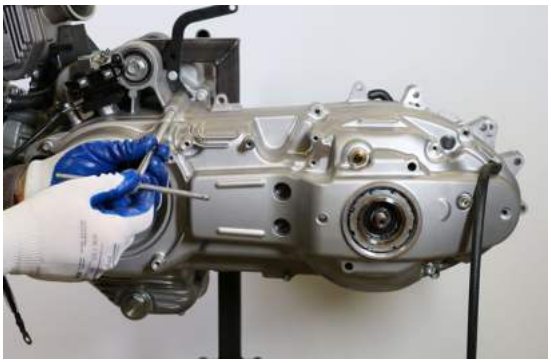
DESCRIPTION	TORQUE
M8 transmission cover fastenings	24.5 ± 1.5 Nm

- Tighten the screws on the right part.

DESCRIPTION	TORQUE
M8 transmission cover fastenings	24.5 ± 1.5 Nm

- Tighten the transmission cover screws.

DESCRIPTION	TORQUE
M6 transmission cover fastenings	12 ± 1 Nm

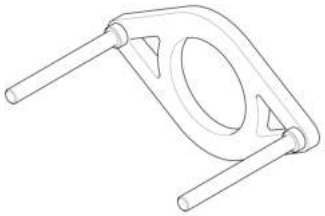


- Insert the washers on the driven pulley shaft.

N.B.:

INSERT THE SMALLER WASHER FIRST, THEN THE LARGER ONE.

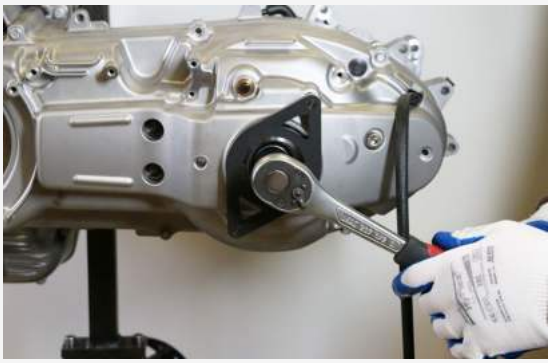
- Insert the specific tool in the appropriate slots, if necessary rotate the shaft to engage it fully.

CODE	DESCRIPTION	IMAGE
021022Y	Driven pulley stop	

- Fit the driven pulley axle nut.

- Tighten the nut to the foreseen torque.

DESCRIPTION	TORQUE
Driven pulley nut	96 ± 4 Nm



- Remove the specific tool.

- Fit the driven pulley axle plug.

N.B.:

ENSURE THAT THE AIR INTAKE AND EXHAUST OPENINGS ARE COMPLETELY FREE.

- Install the outside plastic transmission cover.
- Tighten the 4 fastening screws to the foreseen torque.

DESCRIPTION	TORQUE
Soundproof cover - Transmission cover	7.0 ± 1.0 Nm

4.2 Final drive reduction gear

4.2.1 Hub cover removal

- Drain the rear hub oil via the drain screw at the bottom of the engine.

- Remove the fixing screws of the hub cover.

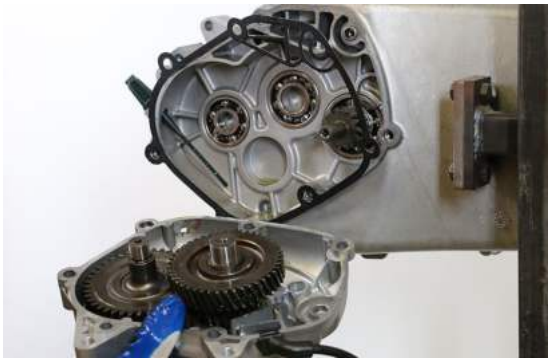
4 long screws

3 short screws

N.B.:

THE FIXING SCREWS ARE OF DIFFERENT LENGTHS, TAKE NOTE OF THEIR RESPECTIVE POSITIONS.

- Remove the hub cover and the relevant gasket.



4.2.2 Wheel axle removal

- Remove the countershaft.
- Remove the wheel axle with the gear.

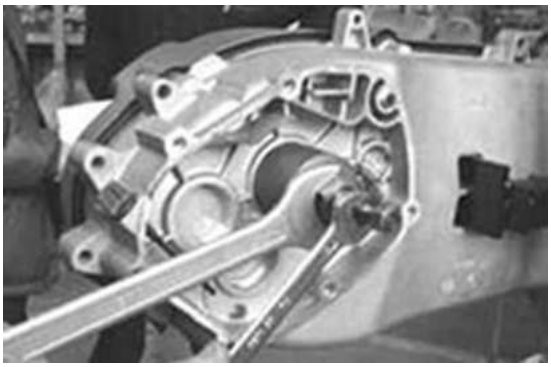
4.2.3 Removing the hub box bearings

- Check all bearings (wear, clearance and noise).
- In case of anomalies, proceed as follows.
- To remove the gear shaft bearing on the engine crankcase, use the following parts.

CODE	DESCRIPTION	IMAGE
001467Y014	Calliper to extract ø 15-mm bearings	
001467Y034	Calliper to extract ø 15-mm bearings	

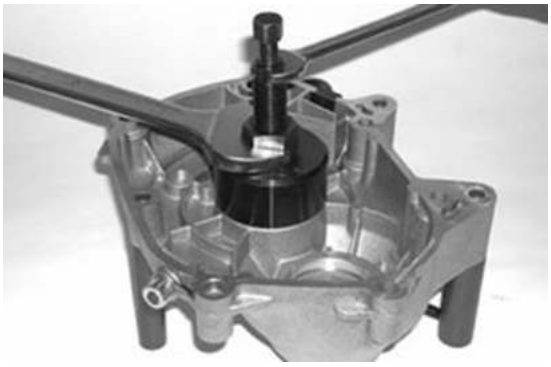
CODE	DESCRIPTION	IMAGE
001467Y031	Bell	

- Use the special extractor to disassemble the bearing on the engine chassis of the countershaft.



CODE	DESCRIPTION	IMAGE
001467Y006	Pliers to extract 20 mm bearings	
001467Y035	Bearing housing, external ø 47 mm	

- Support the hub cover using the stud bolt set.
- Pull out the bearing using the special tool.



CODE	DESCRIPTION	IMAGE
020476Y	Stud bolt set	
001467Y006	Pliers to extract 20 mm bearings	
001467Y007	Bearing housing, external ø 54 mm	

4.2.4 Wheel axle bearing removal

- Take out the clip on the outside of the hub cover.

- Support the hub cover using the stud bolt set.
- Extract the bearing with the specific tool.

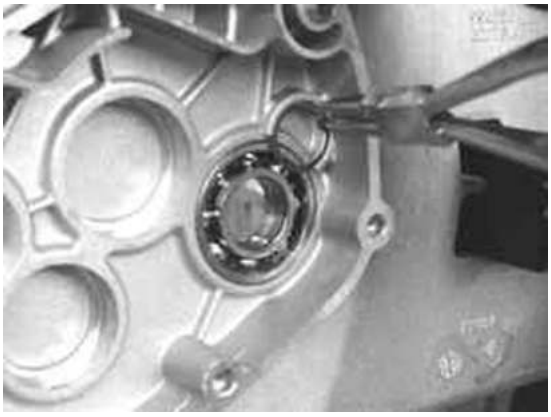
CODE	DESCRIPTION	IMAGE
020476Y	Stud bolt set	
020376Y	Adaptor handle	

CODE	DESCRIPTION	IMAGE
020477Y	Adapter 37 mm	
020483Y	30-mm guide	

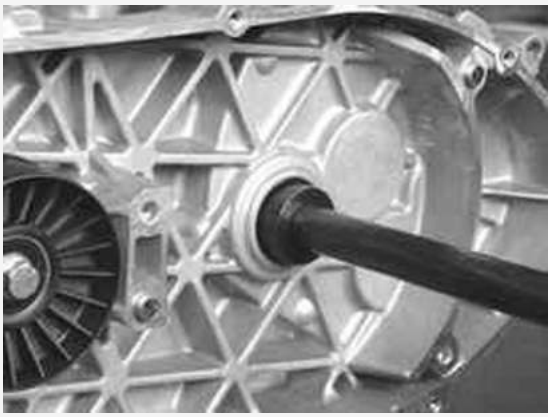
- Remove the oil guard using a screwdriver.

4.2.5 Removal of the driven pulley shaft bearing

- If you have to remove the driven pulley shaft, the relevant bearing and the oil guard, remove the transmission cover and the clutch unit as described in the « Automatic transmission» chapter.
- Extract the driven pulley shaft from the bearing.
- Remove the oil guard using a screwdriver into the hub gear box.
- Remove the Seeger ring shown in the figure.



- Pull out the driven pulley shaft bearing from the engine crankcase using the special tool.

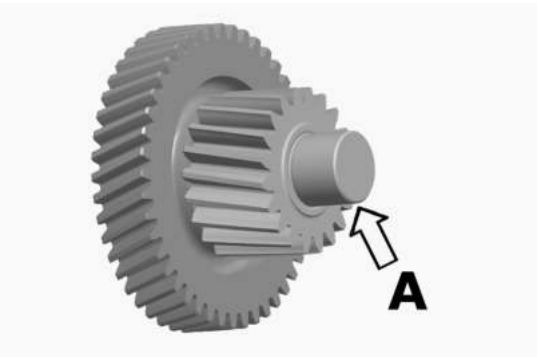


CODE	DESCRIPTION	IMAGE
020376Y	Adaptor handle	
020358Y	37 x 40 mm Adaptor	
020364Y	25-mm guide	

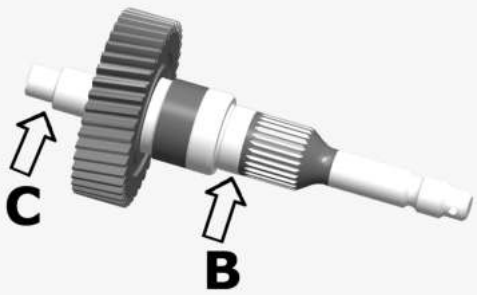
4.2.6 Hub shaft check

- Check that the 3 shafts exhibit no wear or deformation on the grooved surfaces, at the bearings and at the oil seals.
- In case of faults, replace the damaged parts.

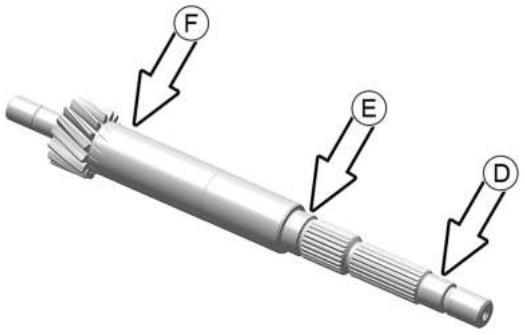
CHARACTERISTIC	DESCRIPTION / VALUE
Connection diameter for countershaft	A = diameter 20 - 0.01 -0.02 mm



CHARACTERISTIC	DESCRIPTION / VALUE
Connection diameter for wheel shaft	B = Ø 30 - 0.010 -0.023 mm
	C = diameter 15 - 0.01 -0.02 mm



CHARACTERISTIC	DESCRIPTION / VALUE
Bearing diameter for shaft driven pulley	D = Ø 15 - 0.01 -0.02 mm
	E = Ø 20 - 0.01-0.02 mm
	F = Ø 25 - 0.01-0.02 mm



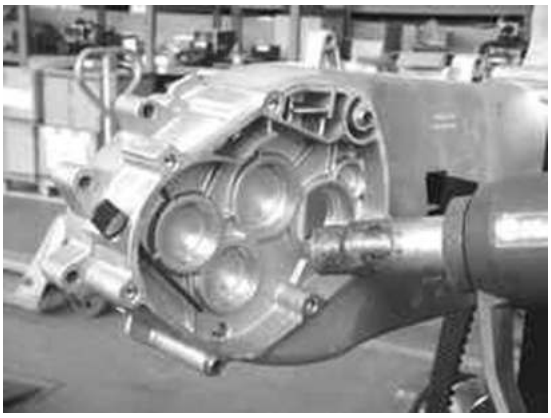
4.2.7 Hub cap check

- Check that the mounting surface is not damaged or deformed.
- Check the bearing bearings.

In case of faults, replace the hub cover.

4.2.8 Fitting the driven pulley shaft bearing

- Heat the crankcase using the heat gun.



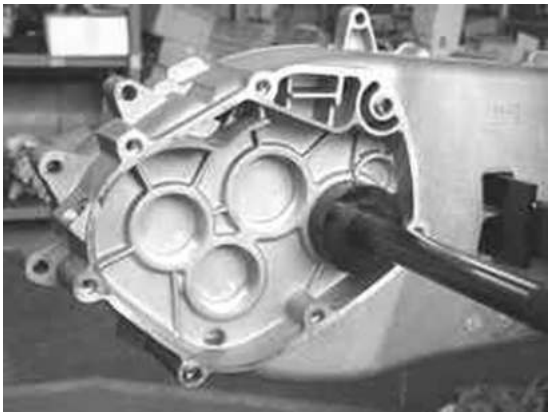
CODE	DESCRIPTION	IMAGE
020151Y	Air heater	

- Insert the driven pulley shaft bearing until it stops against the bottom of the seat using the specific tool.

N.B.:

☞

PLACE IT WITH THE BALLS FACING THE HUB (THIS APPLIES TO BEARINGS WITH PLASTIC CAGE).



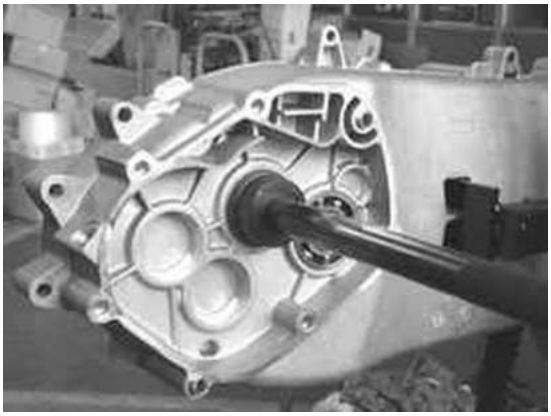
CODE	DESCRIPTION	IMAGE
020376Y	Adaptor handle	
020360Y	52 x 55 mm adaptor	
020364Y	25-mm guide	

- Heat the intermediate gear bearing seat.
- Insert the intermediate shaft bearing using the special tool.

N.B.:

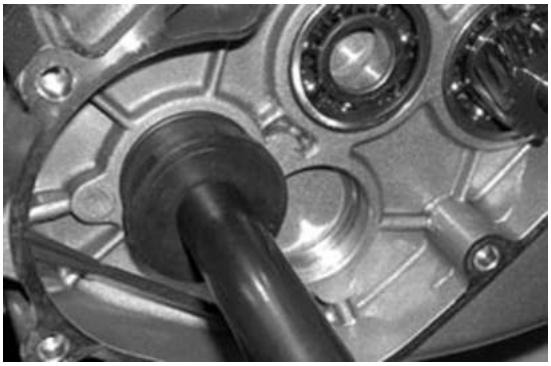
☞

PLACE IT WITH THE BALLS FACING THE HUB (THIS APPLIES TO BEARINGS WITH PLASTIC CAGE).



CODE	DESCRIPTION	IMAGE
020376Y	Adaptor handle	
020359Y	42 x 47 mm Adaptor	
020363Y	20-mm guide	

- Heat the gear shaft bearing seat on the crankcase.
- Insert the gear shaft bearing in the upper crankcase seat using the special tool.



N.B.:

☞

PLACE IT WITH THE BALLS FACING THE HUB (THIS APPLIES TO BEARINGS WITH PLASTIC CAGE).

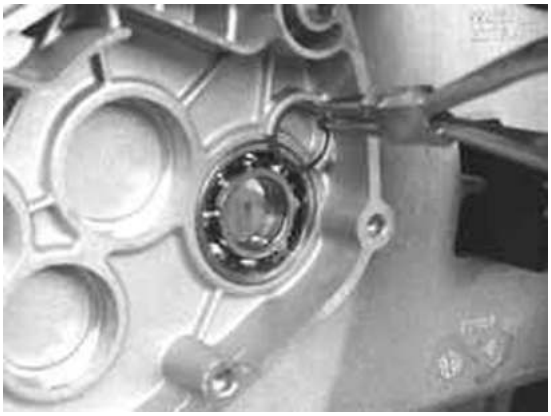
CODE	DESCRIPTION	IMAGE
020376Y	Adaptor handle	
020359Y	42 x 47 mm Adaptor	
020412Y	15-mm guide	

- Place the safety lock Seeger ring of the driven pulley shaft bearing.

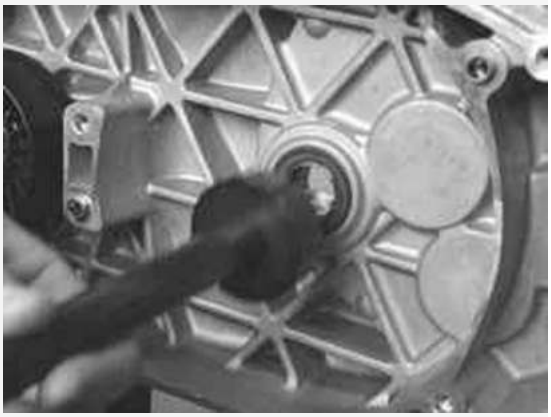
N.B.:

☞

PLACE IT IN THE POSITION SHOWN IN THE FIGURE.



- Insert the pulley shaft oil guard on the transmission side.

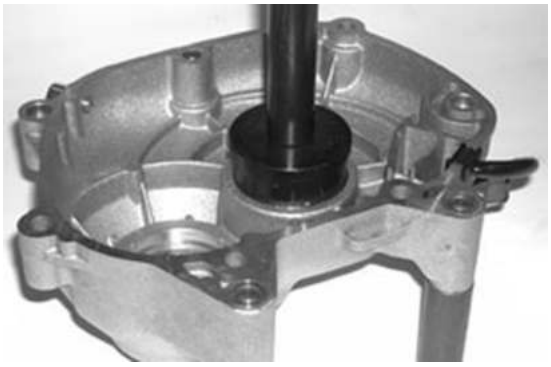


4.2.9 Fitting bearings on hub cover

- Heat the bearing seats on the cover using the heat gun.
- Support the hub cover using the stud bolt set.

CODE	DESCRIPTION	IMAGE
020151Y	Air heater	
020476Y	Stud bolt set	

- Insert the intermediate shaft bearing on the cover using the special tool.



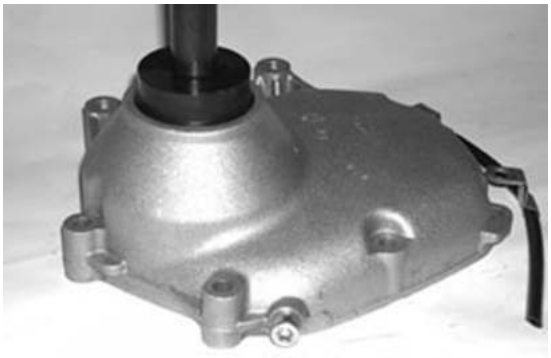
N.B.:

☞

PLACE IT WITH THE BALLS FACING THE HUB (THIS APPLIES TO BEARINGS WITH PLASTIC CAGE).

CODE	DESCRIPTION	IMAGE
020376Y	Adaptor handle	
020360Y	52 x 55 mm adaptor	
020363Y	20-mm guide	

- Heat the gear shaft bearing seat from the cover outside.
- Insert the gear shaft bearing on the cover using the special punch until abutment.



CODE	DESCRIPTION	IMAGE
020376Y	Adaptor handle	
020360Y	52 x 55 mm adaptor	
020483Y	30-mm guide	

- Replace the snap ring.

- Support the hub cover using the stud bolt set.
- Insert the wheel shaft oil guard with the sealing lip facing the inside of the cover.
- Place the oil guard flush with the crankcase.

CODE	DESCRIPTION	IMAGE
020376Y	Adaptor handle	
020360Y	52 x 55 mm adaptor	
020476Y	Stud bolt set	

4.2.10 Fitting the Gear hub

- Place the 3 shafts as shown in the figure.

4.2.11 Hub cover fitting

- Check the proper position of the centring dowels.
- Fit a new gasket.
- Fit the gearbox cover, making sure the breather pipe is in the correct position.

- Position the fixing screws according to the position noted during disassembly.

4 long screws

3 short screws

- Tighten the screws to the specified torque, paying attention to the positioning of the clamps of the breather pipe , as shown in the figure.

DESCRIPTION	TORQUE
Hub cover - Crankcase	25.5 ± 1.5 Nm

- Position the hub oil drain screw and tighten it to the specified torque.
- Refill with the prescribed oil to the Max. level.

DESCRIPTION	TORQUE
Hub oil outlet	16 ± 1 Nm

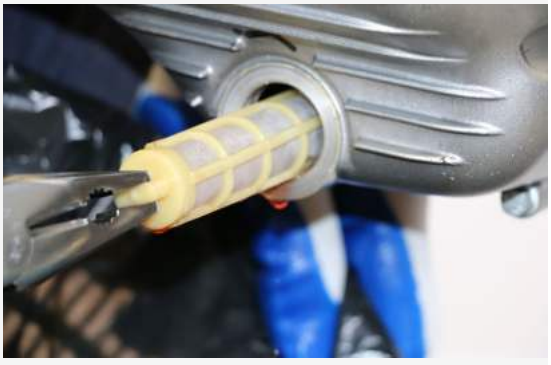
PRODUCT	DESCRIPTION	SPECIFICATIONS
80W-90 transmission oil	Lubricant for gearboxes and transmissions.	SAE 80W-90; API GL-4

4.3 Flywheel cover

4.3.1 Removing the Flywheel cover

- Drain the engine oil by removing the drainage cap.
- Prepare a suitable container to collect the oil.

- Remove the pre-filter.



- Remove the oil filter using a filter tape or shaped cup wrench.

- Unscrew the 13 fixing screws of the flywheel cover, paying attention to the different lengths:

1 central screw 75 mm

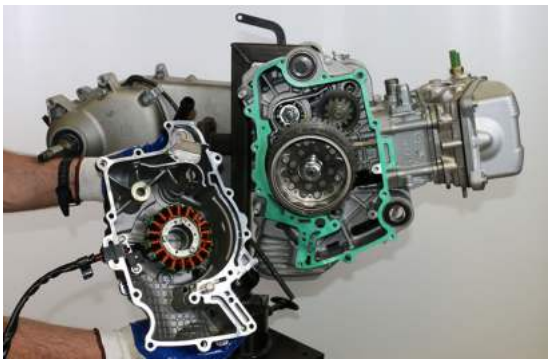
9 medium screws 40 mm

3 short screws 31 mm

N.B.:

THE FIXING SCREWS ARE OF DIFFERENT LENGTHS, TAKE NOTE OF THEIR RESPECTIVE POSITIONS.

- Remove the flywheel cover with the relevant gasket and the cooling system sleeve support.



CAUTION

REMOVE THE COVER AVOIDING ANY POSSIBLE INTERFERENCE BETWEEN STATOR AND ROTOR.

CAUTION

BE CAREFUL TO PREVENT SLIPPAGE OF THE BY-PASS VALVE AND OF THE RELEVANT SPRING.

4.3.2 Removing flywheel cover components

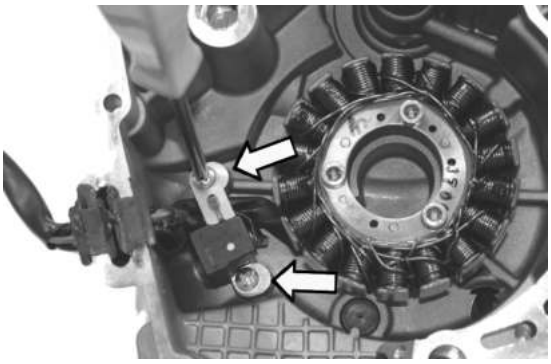
- Unscrew the fastening screws and remove the water pump cover.

6 Torx T25 screws

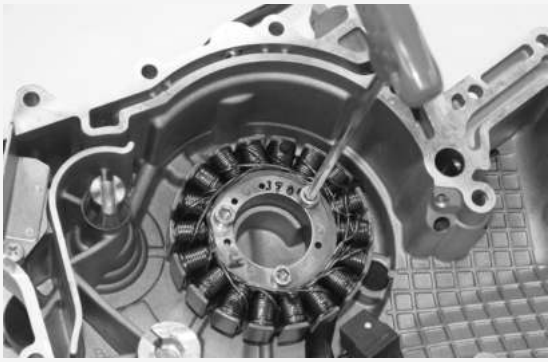
- Remove the by-pass and the relevant spring.
- Remove the sealing gasket.

4.3.3 Stator removal

- Remove the two retaining screws and the cable guide bracket.

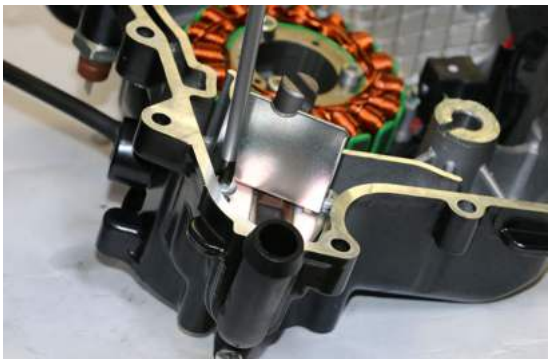


- Unscrew the 3 fastening screws and remove stator and its wiring.



4.3.4 Cover components check

- Loosen the two retaining screws and remove the reed valve support with bulkhead.

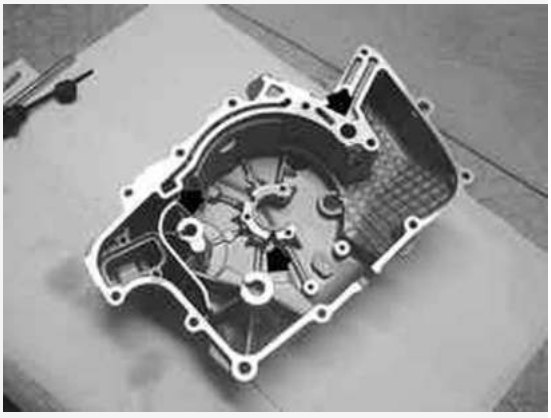


- Remove the blow-by reed valve with the relevant sealing gasket.

- Unscrew the fastening screw and remove the gas outlet union with the relevant O-ring.

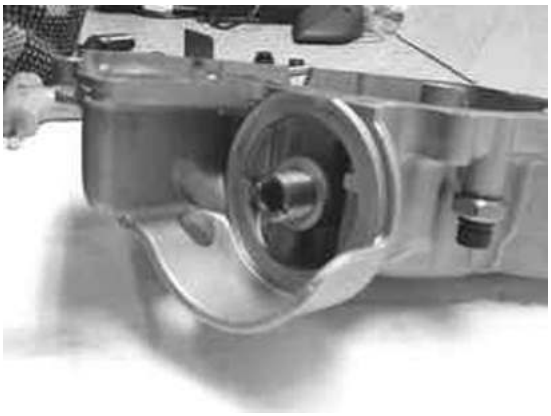
- Check that the mounting surface of the crankcase is not worn or deformed.
- Check that the by-pass valve seat, the torque limiter and the water pump shaft are free from wear.

CHARACTERISTIC	DESCRIPTION / VALUE
By-pass housing hole diameter	13.9 mm
Connection diameter for start-up gear shaft	12 mm



CHARACTERISTIC	DESCRIPTION / VALUE
Connection diameter for pump shaft	8 mm

- Check that the oil filter union and matching surface exhibit no deformations or wear.



- Check the condition of the stator and the relevant cable harness.

- Check the continuity between the 3 phases.

N.B.:

☞

VALUES ARE STATED AT AMBIENT TEMPERATURE. A CHECK WITH THE STATOR AT OPERATING TEMPERATURE LEADS TO VALUES HIGHER THAN THOSE STATED.

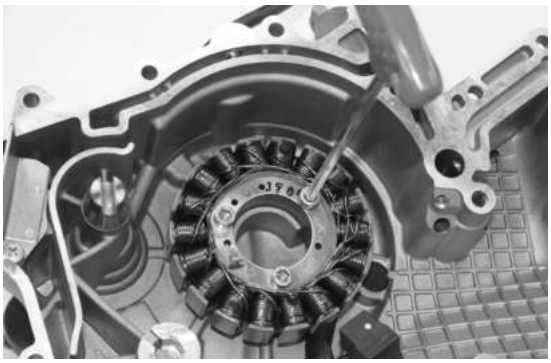
CHARACTERISTIC	DESCRIPTION / VALUE
Resistance	0.2 ÷ 1 Ω

- Check the ground insulation of each phase.
- If a fault is found, carry out a thorough check of the cable harness that contains two types of cable: Rigid cables close to the stator and flexible cables close to the connector.

- Check that the winding is positioned so as not to interfere with the heads of the retaining screws.

4.3.5 Fitting the Stator

- Install the stator assembly together with the wiring harness, tightening the 3 screws to the foreseen torque.



N.B.:

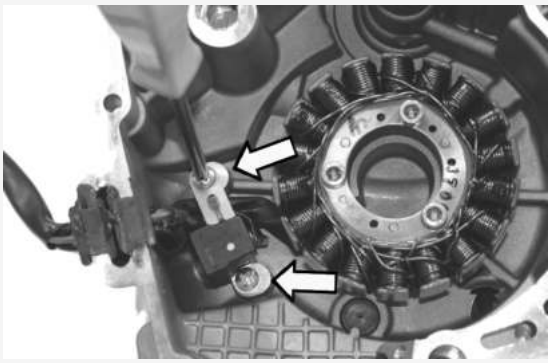
☞

INSERT THE RUBBER WIRING SEALING GASKET INTO THE SPECIAL SEAT ON THE CRANKCASE.

DESCRIPTION	TORQUE
Stator fastenings	9 ± 1 Nm

- Install the wiring guide bracket tightening the 2 screws to the foreseen torque.

DESCRIPTION	TORQUE
Stator wiring guide bracket screws	3.5 ± 0.5 Nm



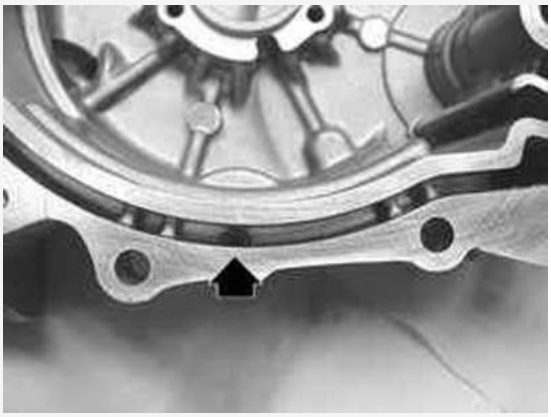
4.3.6 Installing components on the flywheel cover

Before reassembling, check that all components are perfectly clean.

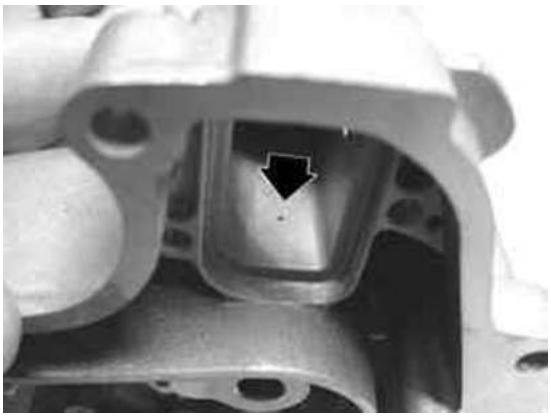
For the cover, carefully check all lubrication channels, in particular:

- The 3 by-pass channels.

- Oil pressure sensor feeding duct.



- Oil vapour decantation chamber.



- Temporarily install the distribution timing check hole cover and the engine oil filling cap/bar.
- Insert the blow-by recovery duct using a new O-ring.
- Tighten the screw to the foreseen torque.

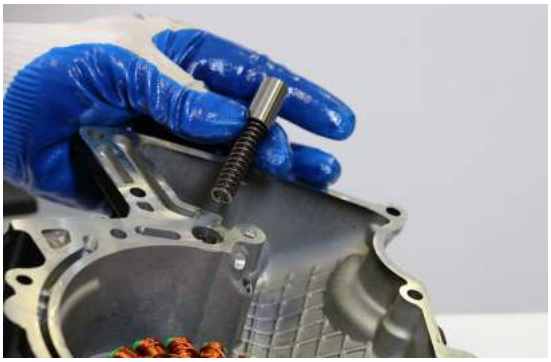
DESCRIPTION	TORQUE
Blow-by recovery duct fastening screws	3.5 ± 0.5 Nm

- Insert the spring and the by-pass piston on the flywheel cover.

N.B.:

☞

LUBRICATE THE BY-PASS VALVE.



- Reinstall the blow-by reed valve using a new sealing gasket.
- Reinstall the support with head and tighten the screws to the foreseen torque.

DESCRIPTION	TORQUE
Bulkhead mounting screws	6.0 ± 1.0 Nm

- Correctly fit a new O-ring, do not allow it to come into contact with grease or oil.

WARNING

FAILURE TO OBSERVE THIS PRECAUTION WILL IRRETRIEVABLY DEFORM THE O-RING.

- Refit the water pump cover and tighten the 6 fixing screws to the foreseen torque.

DESCRIPTION	TORQUE
Water pump cover screws	3.5 ± 0.5 Nm

4.3.7 Fitting the flywheel cover

- Install a new oil filter, lubricate the gasket, screw on and finally tighten to the foreseen torque.

DESCRIPTION	TORQUE
Engine oil filter	14 ± 2 Nm

- Install the supply hose to the cylinder and connect the return hose to the pump cover using new clamps.

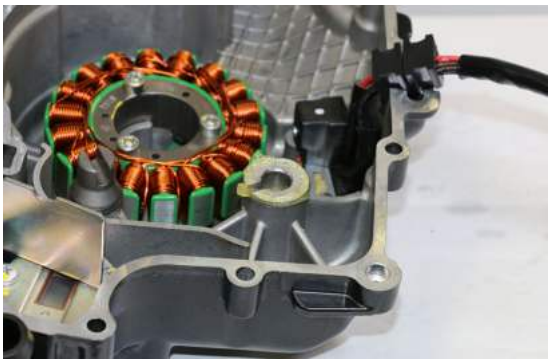
- Install the pre-filter again and insert the engine oil drain plug, tightening to the foreseen torque.
- Refill the engine with the prescribed type of oil.

DESCRIPTION	TORQUE
Engine oil drainage plug	27 ± 3 Nm

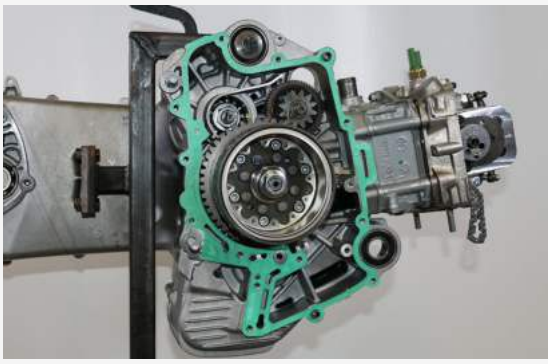
NOTETIGHTEN THE CLAMPS USING APPROPRIATE PLIERS, PAYING ATTENTION NOT TO CONSTRICT THE HOSES BUT ALSO TAKING CARE TO TIGHTEN THE CLAMPS SUFFICIENTLY.

PRODUCT	DESCRIPTION	SPECIFICATIONS
5W-40 engine oil	Synthetic-based lubricant for four-stroke engines.	SAE 5W-40; JASO MA, MA2; API SL; ACEA A3

- Lubricate the intermediate gear seat with torque limiter on the flywheel cover.
- Align the water pump movement sensor with a reference and install the flywheel cover as described in the **Flywheel cover** chapter.



- Install a new gasket on the engine crankcase.
- Check the presence of the three centring dowels.

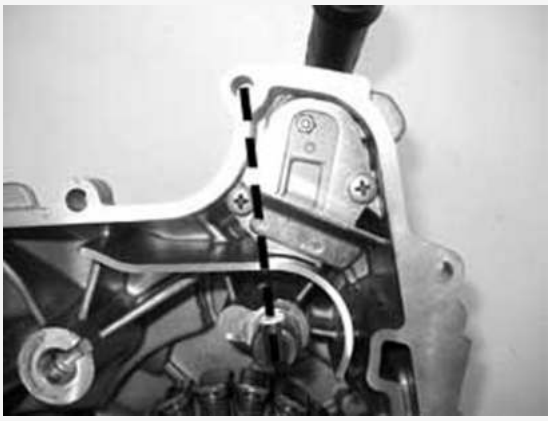


- Turn the crankshaft in order to align the countershaft movement sensor with a reference point on the crankcase (see figure).

- Repeat the alignment for the water pump crankshaft using the same reference point on the engine.

N.B.:

THIS PREPARATION IS USEFUL PARTICULARLY IN THE EVENT OF REPAIRS WITH THE WATER PUMP COVER INSTALLED.

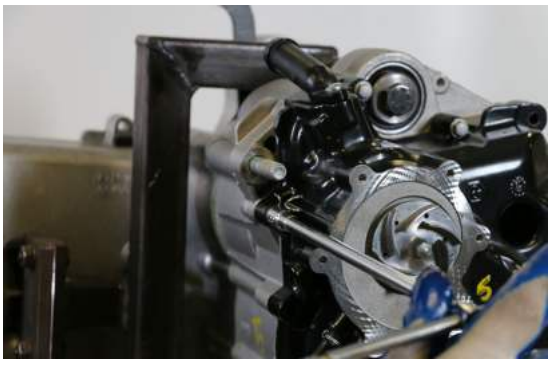


- Install the flywheel cover on the engine, paying attention to avoid interference between the stator and rotor.
- Fix the flywheel cover fixing screws according to the position noted during disassembly, paying attention to the correct assembly of the oil pressure sensor cable gland and the sleeve support.

1 central screw 75 mm

9 medium screws 40 mm

3 short screws 31 mm

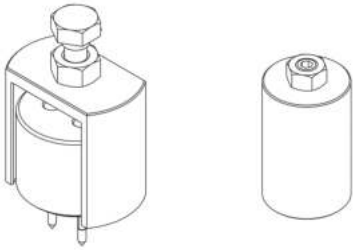


DESCRIPTION	TORQUE
Flywheel cover screws	12 ± 1 Nm

WARNING

FAILURE TO OBSERVE THIS PRECAUTION MAY RESULT IN DESTRUCTION OF THE CERAMIC MAGNETS.

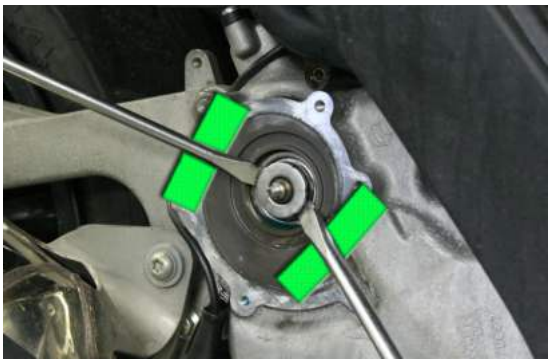
4.3.8 Water pump removal

CODE	DESCRIPTION	IMAGE
020661Y	Water pump overall seal replacement kit	

- Remove the six screws and the pump cover with a screwdriver.

- Unscrew the water pump rotor with an 8-mm wrench.

- Place two flat blade screwdrivers as shown in the figure so as to lever on the marked crankcase edge and disassemble the overall seal, pressure-fitted on the rotor shaft.



WARNING

USE TEFLON AS SHOWN IN THE FIGURE SO AS NOT TO DAMAGE THE WATER

PUMP COVER SEALING SURFACE. SMALL SCRATCHES ON THE SEAT EDGE DO NOT POSE FUNCTIONAL PROBLEMS.

- Change the position of the screwdrivers if necessary.
- During seal disassembly, the ceramic may split.

- Clean all the parts thoroughly before removing them.

- Place the extractor together with the pin on the fixed part of the ceramic seal.
- Without modifying the extractor position, make three holes on the fixed part of the seal using the pin supplied and a hammer.

N.B.:

MAKE THE HOLES WITH A STRONG HIT. MULTIPLE LIGHT BLOWS COULD DEFORM THE PART WITHOUT PASSING THROUGH.

- Fix the extractor to the fixed part of the sealing using the screws supplied with the tool.

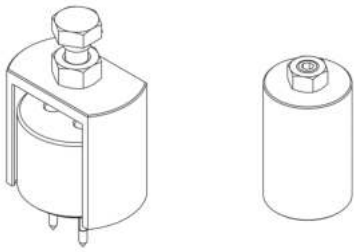
WARNING

FIX IT PROPERLY WITHOUT "TEARING" THE PLATE

- Complete the tool by fitting the bracket, the screw and the nut.

- Hold the screw in position and operate the nut until the fixed part of the sealing is completely removed.
- Remove the extractor with the fixed part of the overall seal.

4.3.9 Water pump assembly

CODE	DESCRIPTION	IMAGE
020661Y	Water pump overall seal replacement kit	

OVERALL SEAL FITTING

WARNING

CLEAN ALL THE COMPONENTS THOROUGHLY.

WARNING

LUBRICATE THE ROTOR SHAFT WITH ENGINE OIL.

- Fit the tie rod by screwing it to the rotor shaft.

WARNING

TIGHTEN MANUALLY UNTIL IT STOPS.

- Place the overall seal on the shaft.

- Place the calibrated punch (at preloading value).
- Fit the nut to the tie rod.
- Keep the tie rod in position and screw the nut up to the end of stroke.
- The tool will drive the fixed part seat on the crankcase and the movable part seat on the shaft, thus obtaining the correct ceramic seal preloading.

- Screw the rotor.

DESCRIPTION	TORQUE
Water pump impeller	5.0 ± 1.0 Nm

- Tighten the six cover screws to the prescribed torque.

DESCRIPTION	TORQUE
Water pump cover screws	3.5 ± 0.5 Nm

N.B.:

TO AVOID DEFORMATION, DO NOT LUBRICATE THE O-RING WITH PETROLEUM GREASE.

4.4 Flywheel and starter

4.4.1 Starter motor removal

N.B.:

☞

THIS OPERATION MAY ALSO BE CARRIED OUT WITH FLYWHEEL COVER ASSEMBLED.

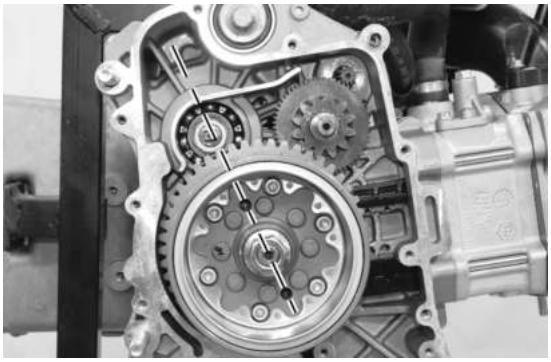
- Undo the fastening screws.

2 screws

- Remove the ground cable and the pipe support bracket, then remove the complete starter motor.

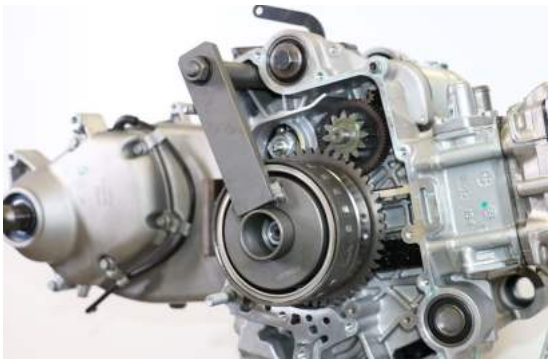
4.4.2 Removing the magneto flywheel

- Align the holes obtained on the flywheel with the crankcase housing to allow the introduction of the special tool.



- Tighten the bushing of the flywheel lock tool on the removing tool threading.

- Insert the special tool as shown in the figure, making sure that the pins are perfectly inserted into the previously aligned holes and that it is perfectly abutted and almost flush with the flywheel.



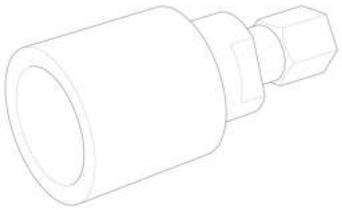
CODE	DESCRIPTION	IMAGE
020472Y	Flywheel lock tool	

- Loosen the magneto flywheel fastening nut.
- Remove the specific tool, the fixing nut and the washer below.
- Insert the nut again so as to slightly uncover the shaft and free the space that was occupied by the washer.

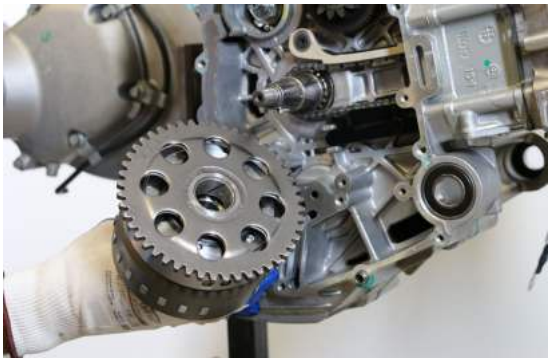
WARNING

THIS OPERATION IS REQUIRED AS THE FLYWHEEL IS STRONGLY LOCKED; THE CONE DETACHMENT MAY THEREFORE CAUSE THE ROTOR SLIPPAGE, WITH THE CONSEQUENT BREAKAGE OF THE MAGNETS.

- Insert the special removing tool.
- Using a 27-mm wrench and a 19-mm bushing, release the flywheel.

CODE	DESCRIPTION	IMAGE
020467Y	Flywheel puller tool	

- Remove the extractor.
- Remove the nut and extract the flywheel with the start-up rim.
- Remove the crankshaft key.



- To remove the start-up rim from the freewheel it is necessary to turn it clockwise and pull it out.

- Remove the freewheel from the flywheel by loosening the 6 fastening screws.

WARNING

SINCE THE FREEWHEEL MUST BE REMOVED, IT IS ADVISABLE TO LOOSEN THE 6 FASTENING SCREWS IN ADVANCE WITH THE FLYWHEEL STILL INSTALLED ON THE CRANKSHAFT.

- The freewheel is coupled to the flywheel with high precision; if removal is difficult, use 2 screws as gripping points and as removing tools, if required.

- Extract the intermediate gear provided with torque limiter.

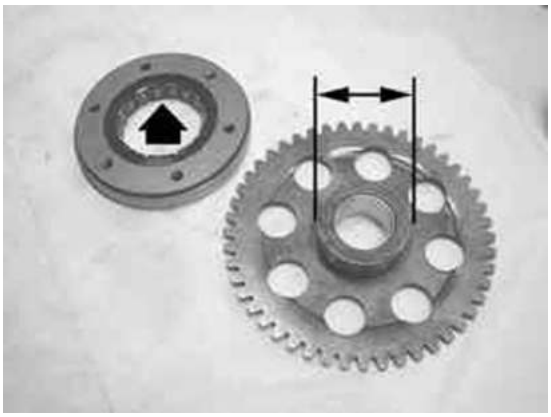
4.4.3 Checking the flywheel components

- Check the integrity of the magnets.
- Check that the magnet support cage is free from deformation or cracks.
- Check that the flywheel splines exhibit no loosening.

4.4.4 Starter crown

- Check that there is no wear or abnormal impressions on the "rollers" of the freewheel and on the surface of the starter ring gear hub.
- Check the hub outside diameter.

CHARACTERISTIC	DESCRIPTION / VALUE
Hub outside diameter	Diameter 45.665 + 0.008 +0.005 mm



- Check the inside diameter of the bushing of the starter gearing.
- Check that the toothing is not worn.

CHARACTERISTIC	DESCRIPTION / VALUE
Inside diameter of the bushing	Diameter 27 + 0.020 +0.041 mm

N.B.:

☞

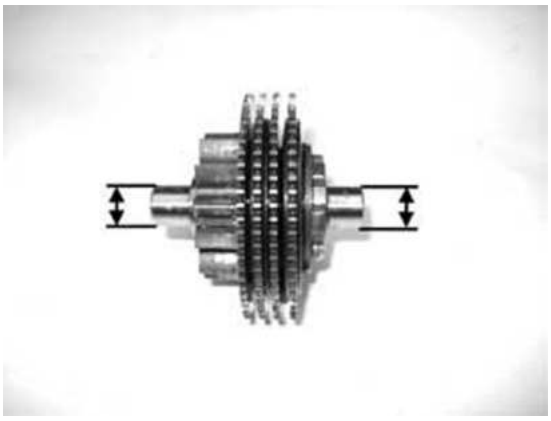
IF THE FAULTS DISCOVERED AFFECT THE HUB, REPLACE THE STARTER RING GEAR AND FREEWHEEL.

IF ONLY THE BUSHING IS WORN, IT IS POSSIBLE TO REPLACE ONLY THE COMPLETE STARTING RING GEAR. IN THAT CASE, CHECK ALSO THE DIAMETER AND THE SURFACE OF THE CONNECTION ON THE CRANKSHAFT. IN CASE OR IRREGULARITIES, REPLACE THE CRANKSHAFT.

4.4.5 Intermediate gear

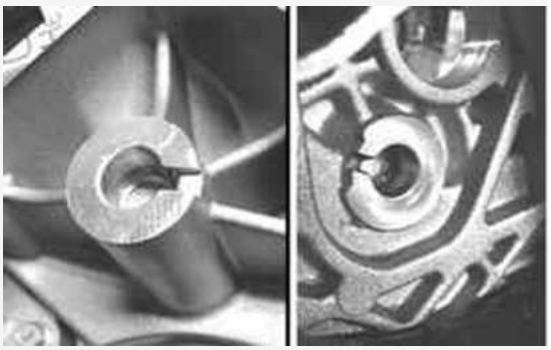
- Check that the toothing is not worn.
- Check the diameter of the two bearings.

CHARACTERISTIC	DESCRIPTION / VALUE
Gear bearing diameter	Ø 12- 0 - 0,011 mm



- Also check the shaft diameter on the flywheel cover and on the engine crankcase.

CHARACTERISTIC	DESCRIPTION / VALUE
Bearing diameter on the flywheel cover	Diameter 12 + 0.034 -0.016 mm
Bearing diameter on the engine crankcase	Diameter 12 + 0.034 -0.016 mm



N.B.:

THE TORQUE LIMITER IS PROVIDED WITH 4 GEARS THAT HAVE THE FUNCTION OF CLUTCH DRIVE PLATES.

Driven plates consist of 4 Belleville springs provided with grooved profiles; this assembly allows transmitting torque lower than 10 kg.

In case of incorrect start-up manoeuvres, the limiter prevents any kicks, with consequent reversal of direction of the crankshaft which would impair the engine structure.

The limiter assembly cannot be overhauled. In case of irregularities on the toothed discs, replace the assembly.

4.4.6 Freewheel fitting

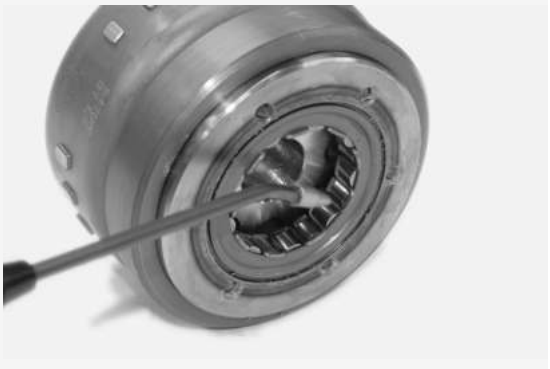
- Make sure the freewheel contact surfaces are in good condition.
- Thoroughly clean the free wheel to remove LOCTITE residue.
- Degrease the threading of the holes in the free wheel and the clamping screws.
- Apply the recommended product to the end of the screws.

PRODUCT	DESCRIPTION	SPECIFICATIONS
Loctite 243	Medium strength thread-locking sealant.	Blue

- Fit the freewheel on the magneto flywheel making sure that the ground side is in contact with the flywheel itself, i.e. with wheel Seeger ring visible.
- Lock the six clamping screws in criss-cross fashion to the foreseen torque.

DESCRIPTION	TORQUE
Freewheel to flywheel fixing screws	14 ± 1 Nm

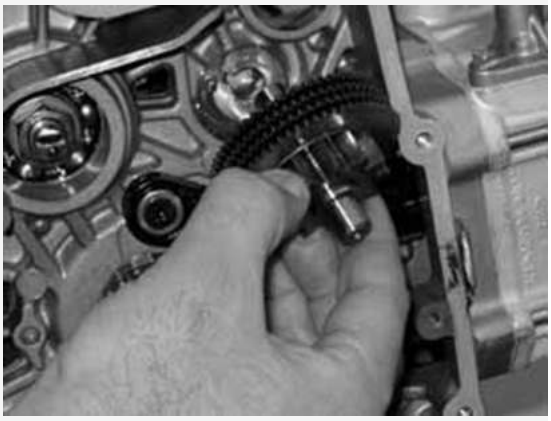
- Oil the free wheel "rollers".



4.4.7 Intermediate gear fitting

- Grease the gear housing on the engine crankcase.

- Fit the intermediate gear with torque limiter.



- Lubricate the inside bushing and the starter ring gear hub surface.

- Install the start-up rim on the flywheel turning it clockwise and inserting at the same time.

4.4.8 Fitting the Magneto flywheel

- Apply the wrench to the crankshaft.
- Install the flywheel checking the proper insertion of the key and engaging the torque limiter gear with the start-up rim.

- Insert washer and nut on the crankshaft.

- Tighten thoroughly the guide bushing of the flywheel lock tool and loosen by 1/4 turn.

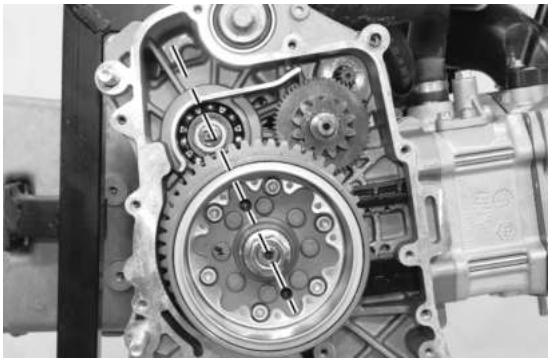
N.B.:

☞

FAILURE TO OBSERVE THIS PRECAUTION CAUSES THE LOCKING OF THE GUIDE ON THE FLYWHEEL.

CODE	DESCRIPTION	IMAGE
020472Y	Flywheel lock tool	

- Align the 2 holes of the flywheel with the case housing to allow the introduction of the special tool.

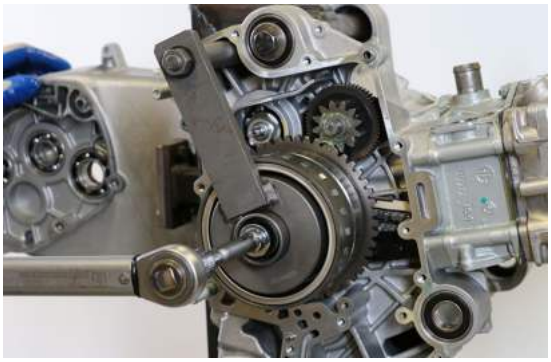


- Insert the special tool checking that the pins are perfectly introduced into the seat.

CODE	DESCRIPTION	IMAGE
020472Y	Flywheel lock tool	

- Tighten the flywheel lock nut to the foreseen torque.

DESCRIPTION	TORQUE
Flywheel fixing nut	120 ± 5 Nm



4.4.9 Fitting the starter motor

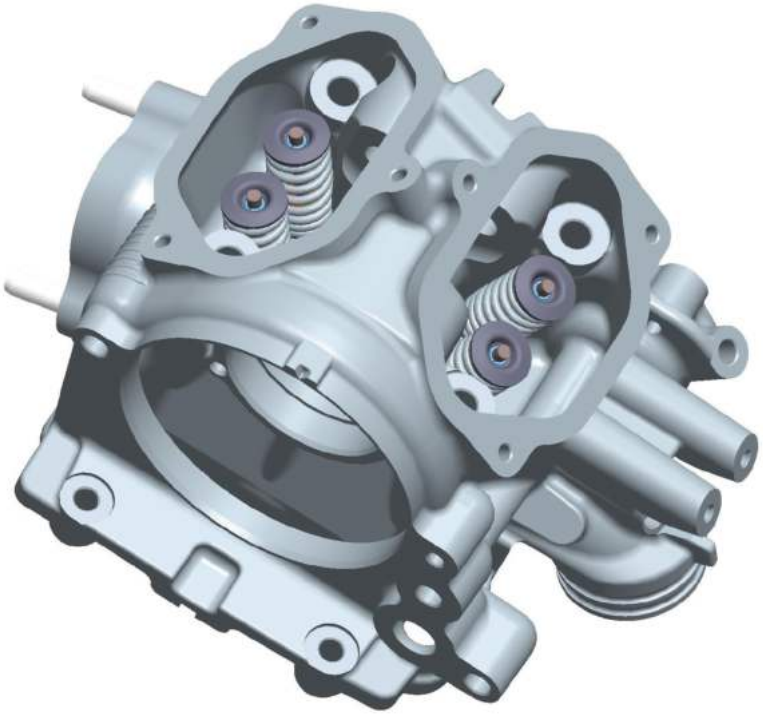
- Check that the O-ring is in good working order and lubricate it.
- Insert the starter motor.
- Fit the fixing screws with the ground cable and the pipe support bracket, as shown in the photo.

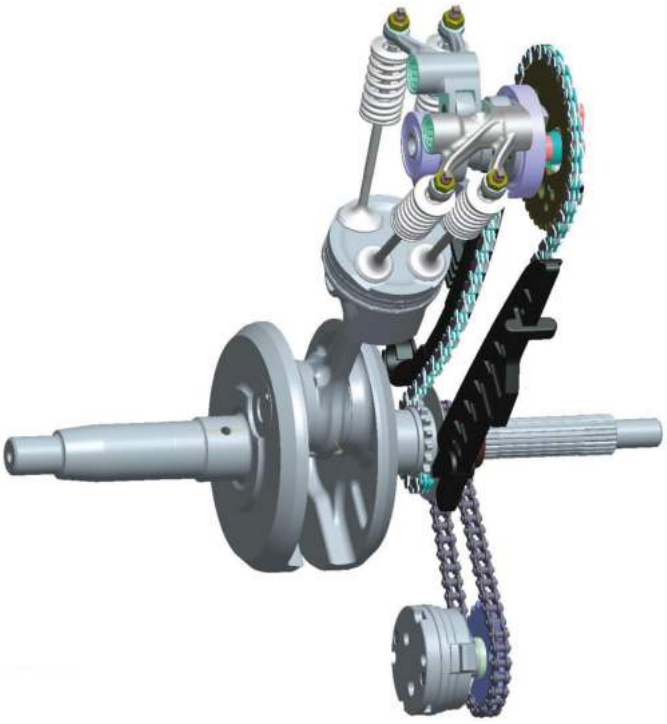
2 screws

- - Tighten the screws to the prescribed torque.

DESCRIPTION	TORQUE
Starter motor - Crankcase	12 ± 1 Nm

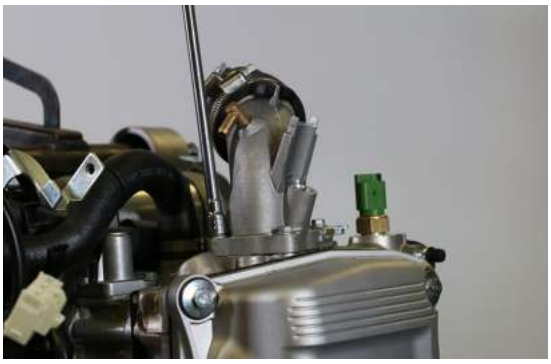
4.5 Head-engine block-piston assembly and timing system





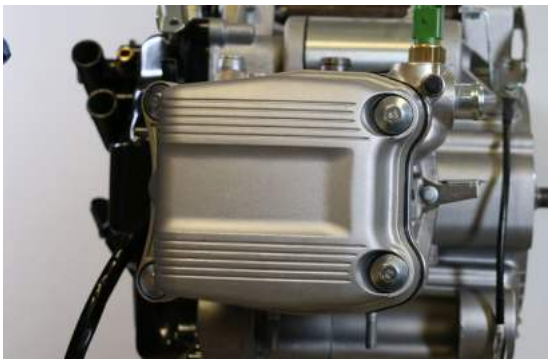
4.5.1 removing the intake manifold

- Loosen the 3 fastening screws.
- Remove the intake manifold unit.

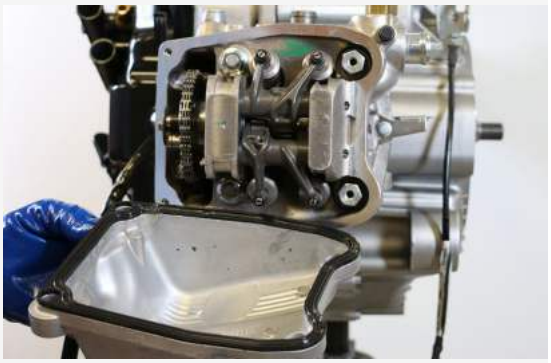


4.5.2 Removing the Tappet cover

- Unscrew and remove the 4 flanged screws to remove the tappet cover.

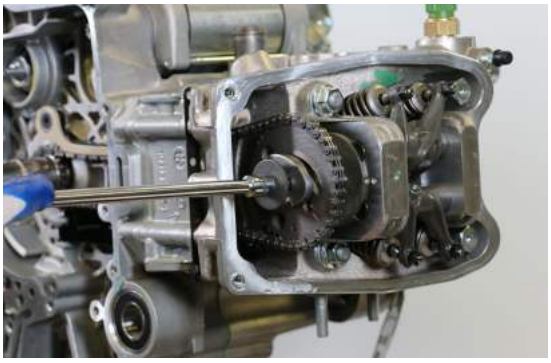


- Lift the tappet cover and pay attention to the gasket.

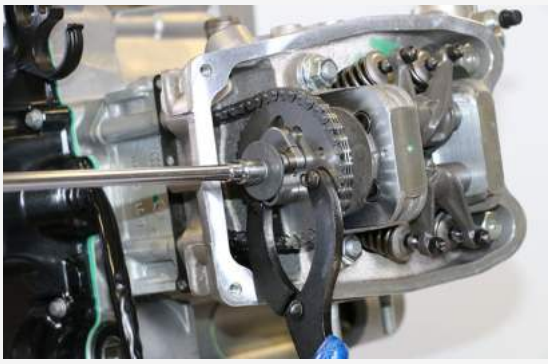


4.5.3 Removing the timing system control

- Turn the engine to close the intake valves.

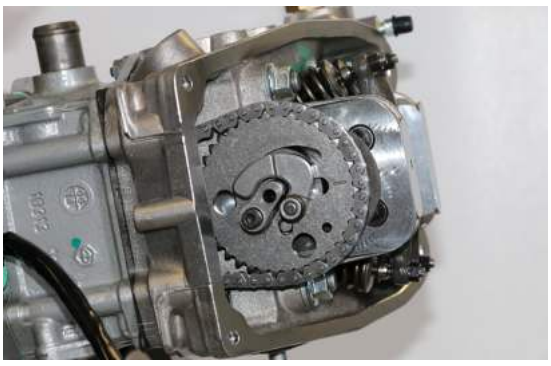


- Remove the central screw and the valve lifting device mass stop washer using the special tool.



CODE	DESCRIPTION	IMAGE
020565Y	Flywheel lock calliper spanner	

- Remove the return spring and the valve lifting mass with relevant travel end washer.
- Align the reference marks on the timing chain rim with those on the head, as shown in the photo.



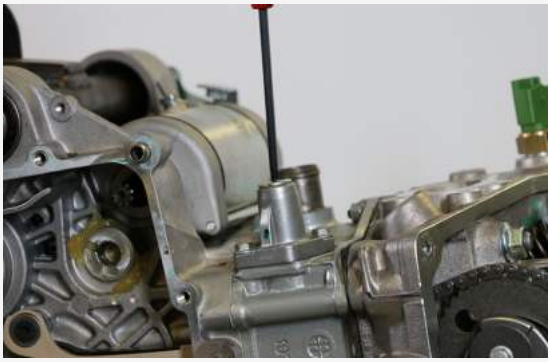
N.B.:

☞

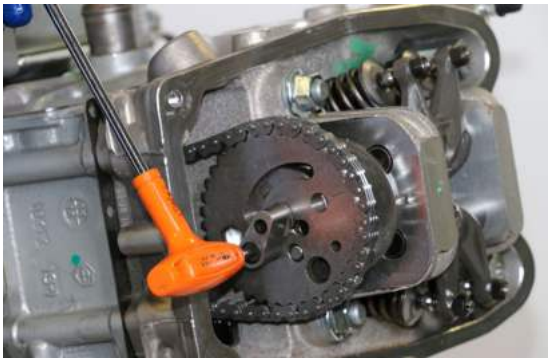
BE CAREFUL NOT TO ALLOW THE WASHER AND SPRING TO FALL INTO

THE ENGINE THROUGH THE CHAIN COMPARTMENT.

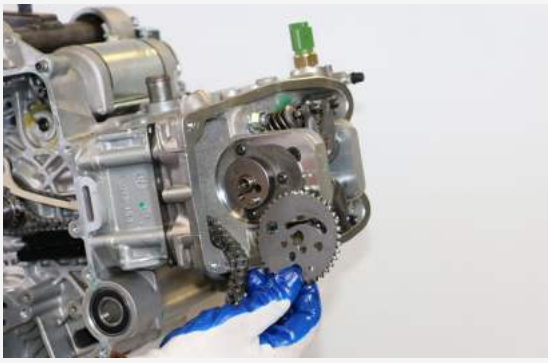
- Loosen the central screw on the tensioner first.
- Unscrew the 2 fastening screws and remove the tensioner with relevant gasket.



- Remove the inside hexagon screw and the counterweight as shown in the figure.



- Remove the timing belt rim from the camshaft.
- Remove the timing belt rim.



4.5.4 Removing the Camshaft

- Unscrew the 3 fastening screws and remove camshaft retaining bracket.

N.B.:

☞

REMOVING THE FASTENING SCREWS MAY BE DIFFICULT. BE CAREFUL NOT TO DAMAGE THE INSIDE HEXAGON. IF NECESSARY, SEPARATE THE THREADS IN ADVANCE.

- Remove the camshaft.

- Remove pins and rocking levers by the transmission side holes.

4.5.5 Head removal

- remove the spark plugs.
- Remove the cooling system outlet sleeve with thermostat.

- Remove the 2 fastening nuts on the head, on the exhaust and on the intake side.

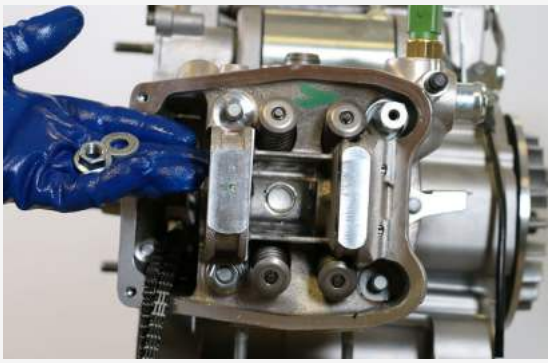
- Remove the two side screws inside the distribution channel and the spark plug side complete with thermostat support.

N.B.:

☞

IF NEEDED, THE HEAD MAY BE REMOVED WITH THE CAMSHAFT, ROCKER PINS AND FIXING BRACKET. THE HEAD CAN ALSO BE REMOVED WITHOUT REMOVING THE CHAIN AND THE CRANKSHAFT CHAIN TENSIONER.

- Loosen the 4 head-cylinder fastening nuts in 2 or 3 times and in a crossed sequence.
- Remove the head, the 2 centring dowels, the gasket and the lower chain guide sliding block.



N.B.:

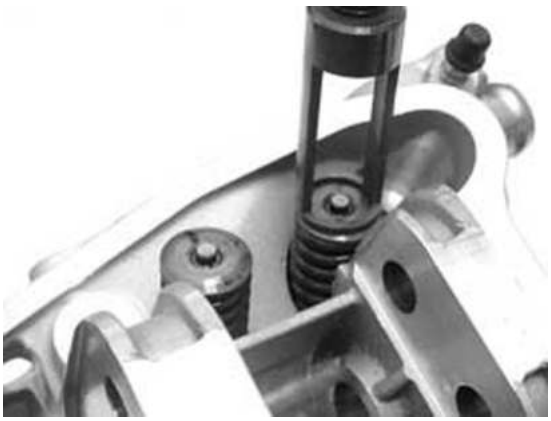
DO NOT REMOVE THE DOWELS IF THEY ARE FORCED INTO THEIR SEAT.

WARNING

WHEN YOU HAVE TO REMOVE THE HEAD, PREPARE A SUITABLE CONTAINER SINCE THE THERMAL GROUP CONTAINS COOLANT.

4.5.6 Removing the Valves

- Using the appropriate tool fitted with an adaptor, remove the cotters, caps, springs and valves.



CODE	DESCRIPTION	IMAGE
020382Y	Valve semi-cone extractor tool	

CODE	DESCRIPTION	IMAGE
020382Y012	adapter for valve removal too	

WARNING

ARRANGE THE VALVES SO AS TO RECOGNISE THE ORIGINAL POSITION ON THE HEAD (FLYWHEEL SIDE AND TRANSMISSION SIDE).

- Remove the oil seals with the specific tool.

CODE	DESCRIPTION	IMAGE
020431Y	Valve oil seal extractor	

- Remove the spring supports.

N.B.:

☞

BLOW THE SEATS WITH COMPRESSED AIR TO FACILITATE THE SPRING SUPPORT REMOVAL.

4.5.7 Removing the Cylinder piston

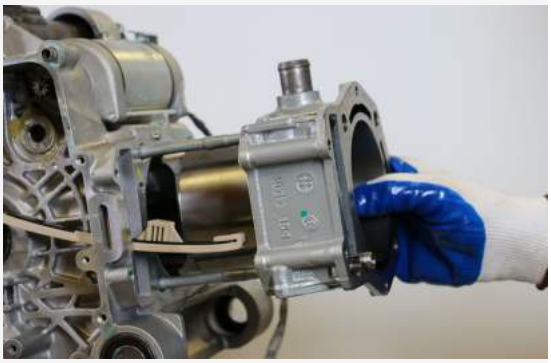
- Remove the timing chain.
- Loosen the fastening screw and remove the spacer and the tightening sliding block.

N.B.:

☞

IT IS ADVISABLE TO MARK THE CHAIN IN ORDER TO ENSURE THAT THE INITIAL DIRECTION OF ROTATION IS MAINTAINED.

- Extract the cylinder with the relevant gasket and the centring dowel.



N.B.:

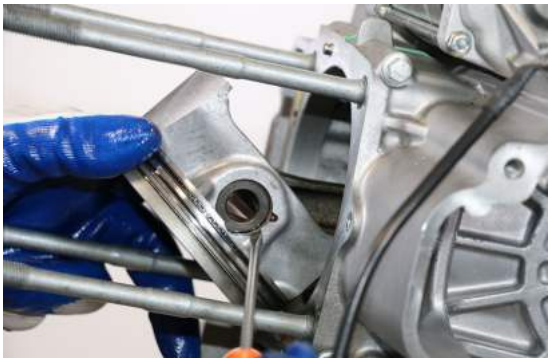
☞

THE SECOND CENTRING IS ENSURED BY A PIN SET INTO THE CYLINDER.

WARNING

TO PREVENT DAMAGING THE PISTON, SUPPORT IT WHILE REMOVING THE CYLINDER.

- Remove the 2 piston pin locking rings by the specific housings.
- Slide the pin and remove the piston.



N.B.:

USE PAPER OR A CLOTH TO CLOSE THE CYLINDER HOUSING MOUTH ON THE CRANKCASE TO PREVENT SLIPPAGE OF ONE OF THE PIN LOCKING RINGS INTO THE CASE.

- Remove the piston sealing rings and the oil scraper.

WARNING

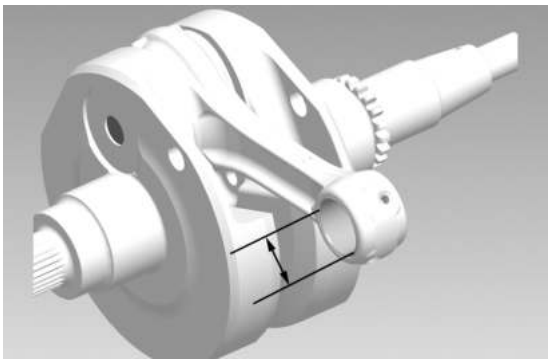
NOTE THE ASSEMBLY POSITIONS OF THE LININGS TO PREVENT INVERTING THE POSITION IN CASE OF REUSE.

WARNING

BE CAREFUL NOT TO DAMAGE THE SEALING RINGS DURING REMOVAL.

4.5.8 Connecting rod small end check-up

- Using an internal bore gauge, measure the diameter of the connecting rod small end and check that the value is within the limits provided in the "**Technical data**" section.
- If the value indicated is incorrect, replace the crankshaft as shown in the "**Crankshaft assembly**" section.



4.5.9 Pin check

Check that the service limits of the pin are within the values provided in the "**Technical data**" section.

If the readings are not correct, replace the pin.

4.5.10 Piston check

- Check that the service limits of the piston and the cylinder coupling values are within the values provided in the "**Technical data**" section. If the readings are not correct, replace the piston and/or cylinder.
- Check that the cylinder liner is not deformed or sheared.
- Check that the head surface is not worn or distorted.

N.B.:

☞

THE PISTON AND CYLINDER MUST BE COUPLED IN ACCORDANCE WITH THE CLASSES. IT IS NOT POSSIBLE TO MOUNT COMPONENTS OF DIFFERENT CLASSES.

4.5.11 Check the sealing rings

- Alternately insert the three sealing rings into the cylinder, in the area where it retains its original diameter. Using the piston, insert the rings perpendicularly to the cylinder axis.
- Make sure that each single sealing ring evenly adheres to the cylinder liner. If it does not, this means the ring is worn. Replace it.
- Measure the opening (see figure) of the sealing rings using a feeler gauge.
- When reading values higher than those provided in the "**Technical data**" section,

proceed with the replacement of the segments.

4.5.12 Fitting the piston

- Install the piston and the piston pin on the connecting rod, orienting the piston with the arrow facing towards the exhaust side.

- Insert the locking ring into the special tool, with the opening in the position indicated on the tool.

S = left

D = right

- Place the wrist pin retainer ring into position using a punch.

- Install the pin lock using the key shown in the figure.

CODE	DESCRIPTION	IMAGE
020470Y	Tool for fitting the pin locking stops	

N.B.

THE TOOL FOR INSTALLING THE RETAINER RINGS MUST BE USED MANUALLY.

WARNING

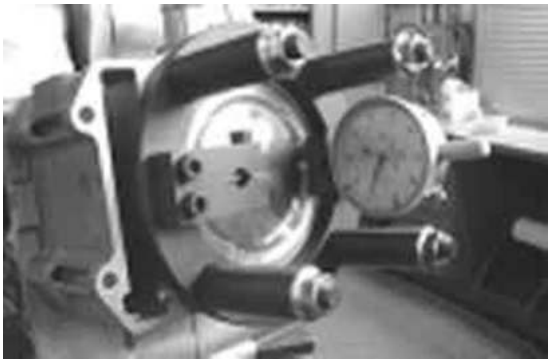
USING A HAMMER MIGHT DAMAGE THE STOPS' HOUSING.

4.5.13 Gasket selection

- Provisionally fit the piston into the cylinder, without any base gasket.
- Install a dial gauge on the special tool using the short union, as shown in the figure.

CODE	DESCRIPTION	IMAGE
020475Y	Piston position checking tool	

- Using an abutment plane, reset the dial gauge with a pre-load of a few millimetres.
- Finally fix the dial gauge.
- Check the perfect sliding of the feeler pin.
- Install the tool on the cylinder without changing the dial gauge position.
- Lock the tool using the original head fixing nuts.
- Turn the crankshaft to TDC (the reversal point of the dial gauge's rotation).
- Measure the deviation from the reset value.
- Identify the thickness of the cylinder base gasket to be used for reassembly by using the table in the "**Technical data**" section. Correctly identify the cylinder base gasket thickness to keep the correct compression ratio.
- Remove the special tool and the cylinder.



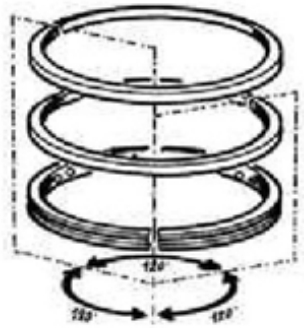
N.B.:

☞

IF DEVIATIONS (OR RECESSES OR PROJECTIONS) CLOSE TO THE CHANGE OF CATEGORY ARE MEASURED, REPEAT THE MEASUREMENT AT THE OPPOSED SIDE. TO DO SO, REPEAT THE TOOL INSTALLATION BY INVERTING ITS POSITION.

4.5.14 Fitting the sealing rings

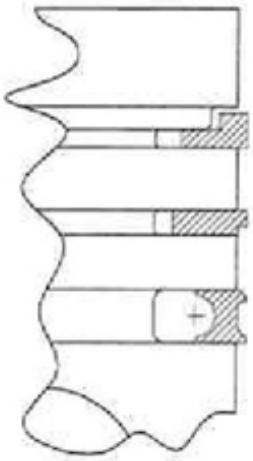
- Place the scraper ring spring on the piston.
- Install the scraper ring keeping the opening opposed to the spring junction and with the writing “top” facing the piston crown. The chamfered side of the oil scraper ring should always be facing the piston crown.
- Fit the second lining with the identification letter or the writing “top” facing the piston crown. In any case, the step must be facing opposite the piston crown.
- Install the first compression ring in the direction imposed by the housing.
- It is advisable to use a fitter to facilitate the installation of the linings.



N.B.

☞

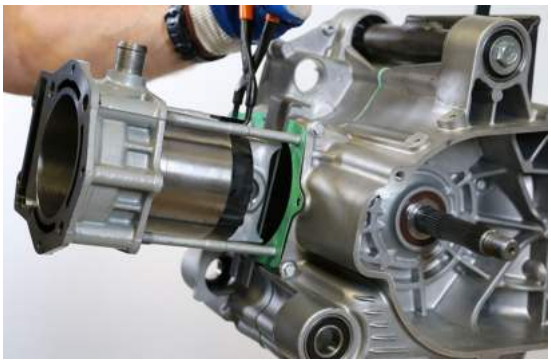
THE TWO PISTON RINGS ARE MADE WITH A TAPERED CYLINDRICAL CONTACT CROSS-SECTION. THIS IS TO ACHIEVE A BETTER BEDDING.



- Misalign the lining openings at 120° as shown in the figure.
- Lubricate the components with engine oil.
- The engine uses the first compression lining with an L section.

4.5.15 Cylinder fitting

- Insert the cylinder base gasket with the thickness determined above.
- Using the fork and the ring clamp, fit the cylinder as shown in the figure.



N.B.

☞

BEFORE FITTING THE CYLINDER, CAREFULLY BLOW OUT THE LUBRICATION DUCT AND OIL THE CYLINDER BARREL.

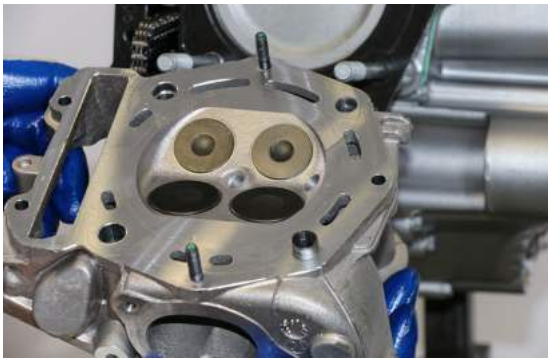
CODE	DESCRIPTION	IMAGE
020674Y	Piston mounting ring Ø 95 mm	
020512Y	Piston fitting fork	

4.5.16 Cylinder head check

- Using a trued bar and a feeler gauge, check that the cylinder head surface is not worn or distorted.

CHARACTERISTIC	DESCRIPTION / VALUE
Maximum allowable run-out	0.1 mm

- In case of faults, replace the head.

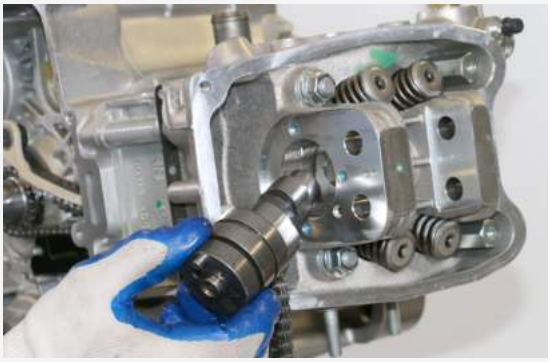


- Check the sealing surfaces for the intake and exhaust manifold.
- Check that the camshaft and the rocker pin capacities exhibit no wear.
- Check that the head cover shows no signs of wear.
- Check that the coolant seal plug exhibits no oxidation.

4.5.17 Timing system component check-up

- Check that the guide slider and the tensioner pad are not excessively worn.
- Check that the crankshaft pinion and the camshaft timing gear and crankshaft pinion exhibit no wear.

- In case of wear of the sliding blocks, replace them. In case of wear of the chain or rim, replace the entire unit.



N.B.:

☞

IF THE CHAIN HAS DAMAGED THE PINION, REPLACE THE CRANKSHAFT AS DESCRIBED IN CHAPTER CRANKCASE AND CRANKSHAFT.

Chain tensioner

- Remove the central screw and check the integrity of the gasket.

Chain tensioner

- Make sure that there is no wear on the mechanism and that turning with a slotted screwdriver the chain tensioner can be arm or disarm correctly.
- In case of wear or malfunction, replace the chain tensioner.

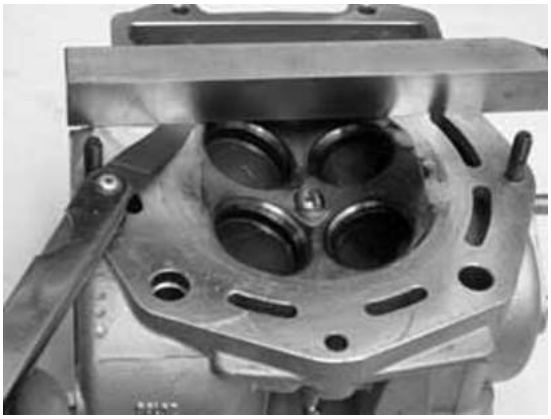
4.5.18 Valve seal test

WARNING

DO NOT REVERSE THE FITTING POSITIONS OF THE VALVES (RIGHT - LEFT).

- Visually inspect the valve sealing surface.

- If the sealing surface of the valve is found to be interrupted at one or more points or is not flat, replace the valve.



- Insert the valves into the cylinder head.
- Alternatively check the intake and exhaust valves.
- The test is carried out by filling the manifold with petrol and checking that the head does not ooze through the valves when these are just pressed with the fingers.

4.5.19 Valve seat wear check

- Clean the seats and the valves of any carbon residues.
- Check that the service limits are within the values provided in the "**Technical data**" section.
- If the impression width on the valve seat is larger than the prescribed limits, true the seats with a 45° mill and then grind.
- In case of excessive wear or damage, replace the head.

4.5.20 Valve check

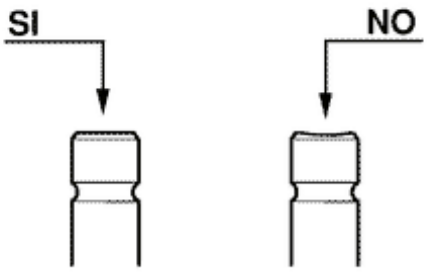
Check that the service limits of the valves are within the values provided in the "**Technical data**" section.

If the readings are not correct, replace the component.

4.5.21 Checking the valve guide clearance

Check that the service limits of the valve guides are within the values provided in the "**Technical data**" section. If the readings are not correct, replace the component.

- Check that there are no signs of wear on the mating surface with the set screw articulated terminal.



- If no anomalies are found during the above checks, you can use the same valves. To obtain better sealing performance, grind the valve seats.
- Grind the valves gently with a fine-grained lapping compound.
- During the grinding, keep the cylinder head with the valve axes in a horizontal position. This will prevent the lapping compound residues from penetrating between the valve stem and the guide (see figure).

WARNING

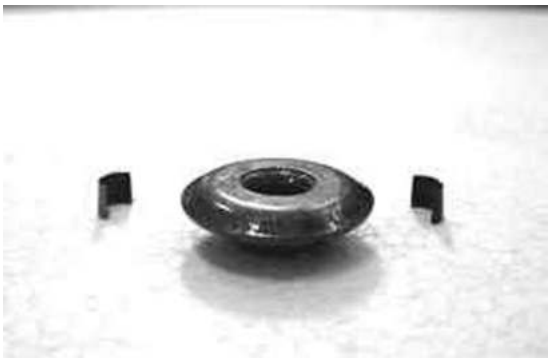
TO AVOID SCORING THE MATING SURFACE, DO NOT ROTATE THE VALVE WHEN NO LAPPING COMPOUND IS LEFT. CAREFULLY WASH THE CYLINDER HEAD AND THE VALVES WITH A SUITABLE PRODUCT FOR THE TYPE OF LAPPING COMPOUND BEING USED.

WARNING

DO NOT REVERSE THE FITTING POSITIONS OF THE VALVES (RIGHT - LEFT).

4.5.22 Springs and cotters check

- Check that the upper and lower supporting spring washers, the cotters and the oil seal show exhibit no signs of abnormal wear. Replace a component when worn.



- Measure the unloaded spring length.

CHARACTERISTIC	DESCRIPTION / VALUE
Standard length	44.4 mm
Allowable limit after use:	42.4 mm

4.5.23 Valve fitting

- Place the valve spring supporting plates on the head.
- Alternately insert the 4 oil guards using the special tool.
- Lubricate the oil seals and the valve guides.

CODE	DESCRIPTION	IMAGE
020306Y	Punch valve seal rings fitting	

- Fit the valves, the springs and the caps.
- Using the appropriate tool with adapter, compress the springs and insert the cotters in their seats.

CODE	DESCRIPTION	IMAGE
020382Y	Valve semi-cone extractor tool	
020382Y012	adapter for valve removal too	

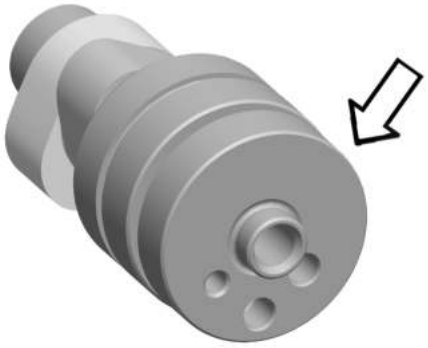
N.B.

☞

DO NOT CHANGE THE VALVE FITTING POSITION. FIT THE VALVE SPRINGS WITH THE REFERENCE COLOUR ON COTTER SIDE (TURNS WITH GREATER PITCH).

4.5.24 Camshaft check

- Using a micrometer, measure the camshaft bearings.
- Using a gauge, measure the cam height.
- When abnormal wear or values other than those provided in the "**Technical data**" section are found, replace the camshaft.
- Check that the groove, the retaining plate seat shown in the figure exhibits no wear.



- Check that there is no wear at the automatic valve lifter cam and at the end stop roller.
- Check that the valve lifter spring has not yielded.
- Replace any defective or worn components.

- Check that the rocker pins exhibit no scores or wear.

CHARACTERISTIC	DESCRIPTION / VALUE
Standard diameter	Diameter 13 - 0.010 -0.018 mm

- Measure the inside diameter of each rocker.

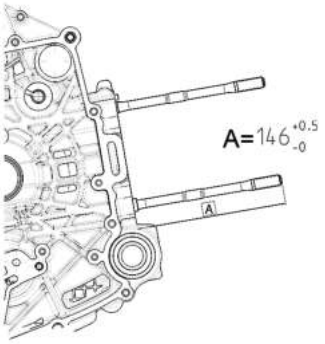
CHARACTERISTIC	DESCRIPTION / VALUE
Standard diameter	Diameter 13 + 0.026 +0.015 mm

- Check that the cam contact sliding block and the articulated register cap is free from wear.
- In case of wear, replace the component.

4.5.25 Fitting the cylinder head and timing system components

WARNING

AT EACH REMOVAL OF THE CYLINDER HEAD IT IS NECESSARY TO REPLACE THE STUD BOLTS. FOR FITTING QUOTA SEE THE SECTION "MOTOR/STUD BOLT SHAFT CRANKCASE.".



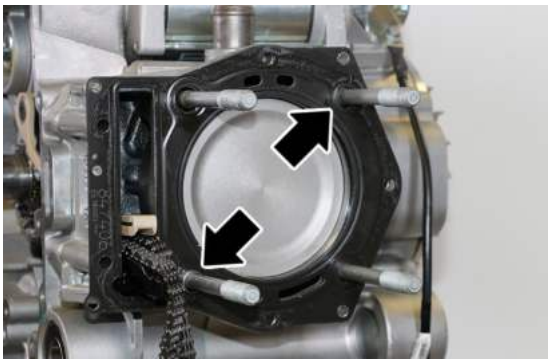
- Insert the chain guide sliding block.
- Insert the two centring dowels between head and cylinder.
- Install the head gasket.

- The head gasket is made of steel and has a standard thickness.

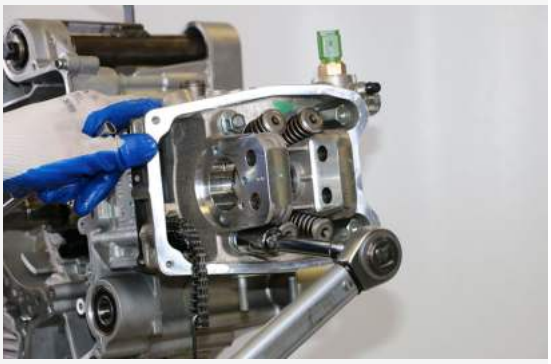
N.B.:

☞

THE FIGURE SHOWS THE INSERTION POSITION OF THE TWO CENTRING DOWELS BETWEEN HEAD AND CYLINDER. THE DIRECTION OF INSTALLATION FOR THE GASKET IS FORCED BY THE DOWELS.



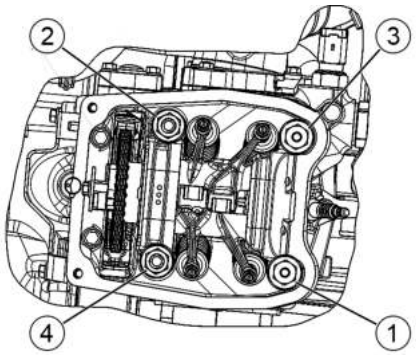
- Check that the head lubrication channel is perfectly clean.
- Clean with compressed air jets, if required.
- Fit the head.
- Lubricate the stud bolts and the 4 fixing stud bolts.



- Tighten the fixing nuts crosswise to the foreseen torque as shown in the figure.

DESCRIPTION	TORQUE
Head-cylinder fixing nuts	13 Nm + 90° + 90°

- Apply a preliminary torque of 13 Nm in a crossed sequence.
- Tighten by 90° in a crossed sequence.
- Tighten again by 90° in a criss-crossed sequence.



- Tighten the fastening nuts on the exhaust and on the intake side to the foreseen torque.

CHARACTERISTIC	DESCRIPTION / VALUE
Head screws - Cylinder	11.0 ± 1.0 Nm

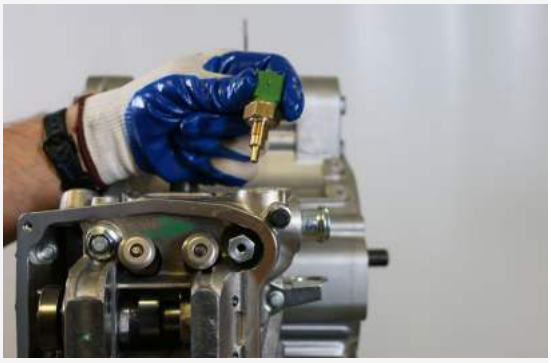
- Tighten the 3 side screws to the foreseen torque.

CHARACTERISTIC	DESCRIPTION / VALUE
Cylinder head fastening screws	11 ± 1 Nm

- Using a 22 mm wrench, install the coolant temperature sensor with relative washer and tighten to the prescribed torque.

N.B.:

FAILURE TO OBSERVE THE TIGHTENING TORQUE CAN DAMAGE THE SENSOR.



CHARACTERISTIC	DESCRIPTION / VALUE
Coolant temperature sensor - Cylinder head	22.0 ± 1.0 Nm

- Fit the spark plugs and tighten them to the prescribed torque.

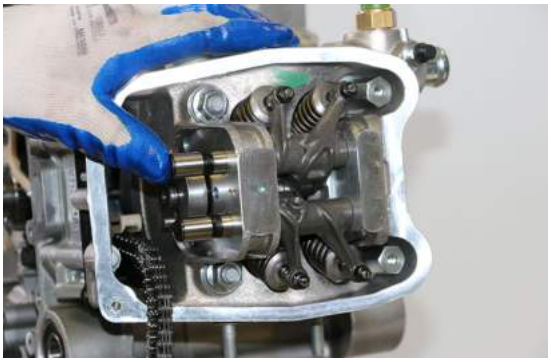
CHARACTERISTIC	DESCRIPTION / VALUE
Spark plug	11.0 ± 1.0 Nm

- Insert the timing control belt on the crankshaft according to the initial direction of rotation.
- Install the tensioner shoe with its spacer, tightening the bolt to the prescribed torque, using the recommended product.

CHARACTERISTIC	DESCRIPTION / VALUE
Tensioner show fastening screw	12 ± 2 Nm

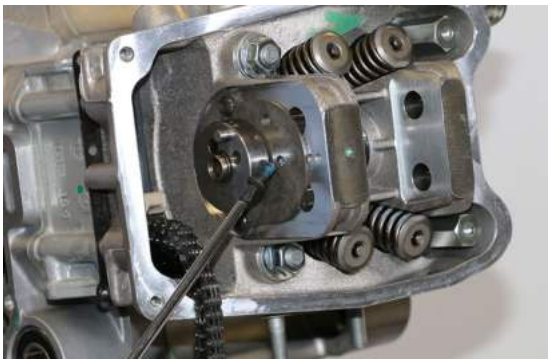
PRODUCT	DESCRIPTION	SPECIFICATIONS
Loctite 243	Medium strength thread-locking sealant.	Blue

- Insert pins and rocking levers on the flywheel side.
- Lubricate the two rocking levers through the holes at the top.



- Clean the camshaft by blowing with little compressed air jets, especially the retaining plate housing.
- Lubricate the 2 shafts.
- Insert the camshaft into the head with the cams opposite the rocking levers.

- Remove any LOCTITE residues from the screws fixing the camshaft retaining bracket using a brush.



PRODUCT	DESCRIPTION	SPECIFICATIONS
Loctite 243	Medium strength thread-locking sealant.	Blue

- Apply the recommended product to the fixing screws and tighten to the prescribed torque.
- Insert the camshaft retain bracket with visible countersinks and tighten the 3 fastening screws to the prescribed torque, being careful not to damage the inside hexagon.

CHARACTERISTIC	DESCRIPTION / VALUE
Camshaft retaining bracket screws	5 ± 1Nm

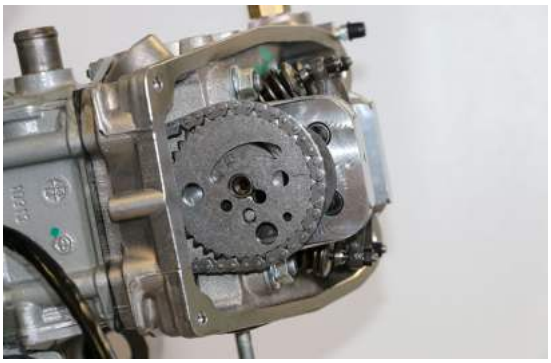
- Install the intermediate gear with torque limiter, the flywheel and its cover, as described in Chapter "**Flywheel and start-up system**", and in Chapter "**Flywheel cover**".

N.B.:

☞

FOR MORE CONVENIENCE, INSTALL THE FLYWHEEL COVER WITHOUT THE COOLING SYSTEM SLEEVES.

- Insert the belt on the camshaft control timing rim.
- Insert the timing rim on the camshaft checking that the references are aligned.



N.B.:

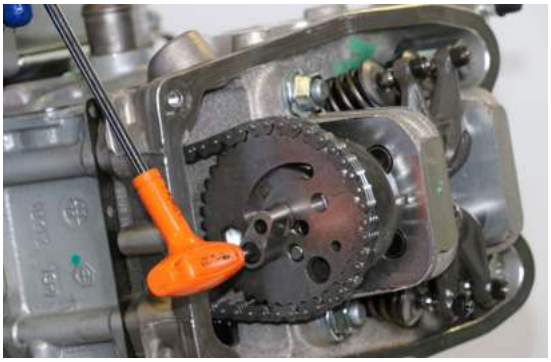
☞

DURING THE STROKE CHECK, KEEP THE BELT TENSIONED BY PRESSING ON THE TIGHTENER COMPARTMENT SIDE.

- Using a TORX type wrench, remove the timing check cap.
- Keeping the belt slightly pulled, turn the crankshaft using the driving pulley to make the reference on the magnet support collimate with that on the flywheel cover.

- Install the counterweight mass.
- Centre using the washer fastening screw.
- Lock the mass fixing screws to the prescribed torque, using the recommended product.

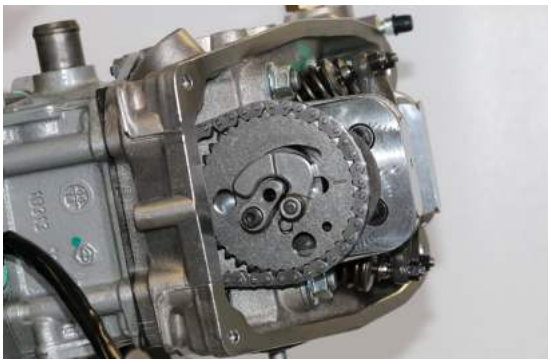
CHARACTERISTIC	DESCRIPTION / VALUE
Counterweight screw	7 ÷ 8.5 Nm



- Remove the central screw.
- Install the valve lifting mass being careful to the proper positioning of the travel end ring.
- Lubricate the mass and de-compressor control pin.

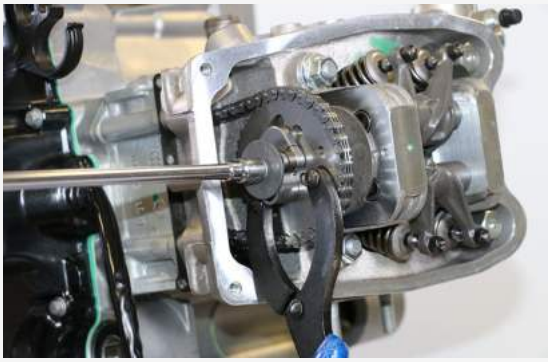
PRODUCT	DESCRIPTION	SPECIFICATIONS
Loctite 243	Medium strength thread-locking sealant.	Blue

- Install the return spring and load it by about 3/4 turn.



- Turn the engine to move the references to the top as shown in the figure (intake end).
- Insert the valve lifting device mass stop washer.
- Tighten the retaining screw to the prescribed torque, using the recommended product.
- Check that the decompression mass is free and that it is pulled by the spring.

DESCRIPTION	TORQUE
Valve lifter weight stop washer fastening screws	12 ± 1 Nm



CODE	DESCRIPTION	IMAGE
020565Y	Flywheel lock calliper spanner	

PRODUCT	DESCRIPTION	SPECIFICATIONS
Loctite 243	Medium strength thread-locking sealant.	Blue

- Place the tightener cursor in the rest position, keeping the retain tab pressed.

- Install a new tightener on the cylinder using a new gasket.
- Tighten the two fastening screws to the prescribed torque.

DESCRIPTION	TORQUE
Tensioner fastening screws	12 ± 1 Nm

- Insert the spring with the central screw and the washer.
- Tighten the central screw to the prescribed torque.

DESCRIPTION	TORQUE
Tensioner screw	4.5 ± 0.5 Nm

- Place the engine with the valve clearance adjustment timing references aligned with the head.
- Check, with a feeler gauge, the play between valve and rocker.

Table 1: PRESCRIBED CLEARANCE

CHARACTERISTIC	DESCRIPTION / VALUE
Intake	0.15 mm (engine cold)
Exhaust	0.15 mm (engine cold)

- In case different values are found, adjust by loosening the lock nut and use a screwdriver for the set screw as shown in the figure.

DESCRIPTION	TORQUE
Valve Register	8 ± 1 Nm

4.5.26 Chain fitting and distribution timing

Ignition advance is determined electronically on the basis of parameters known by the control unit. For this reason it is not possible to interpret the reference values based on the engine rpm.

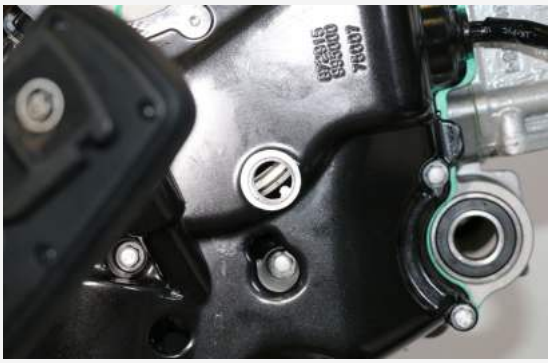
The ignition advance value is detectable at any time using the diagnostic tester.

CODE	DESCRIPTION	IMAGE
021999Y	PADS 4.0	

Proceed as follows:

- Remove the outside transmission cover as described in the automatic "transmission chapter".
- Remove the TDC reference inspection cap between flywheel and crankcase cover. See the "flywheel cover" chapter

- By the driving pulley, turn the engine to find the alignment of the references to identify the TDC.



- Repeat for the reference between driving pulley and transmission housing
- Refit the inspection cap on the flywheel side
- Connect the diagnostic tester.
- Start the engine.
- Select the «Parameters» function in this menu.

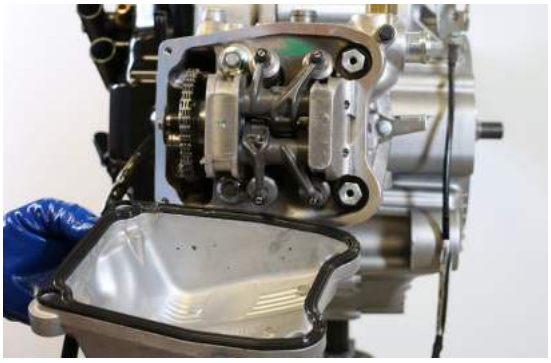
CODE	DESCRIPTION	IMAGE
021999Y	PADS 4.0	

If the values do not match, check:

- valve timing
- speed/phase sensor
- injection ECU

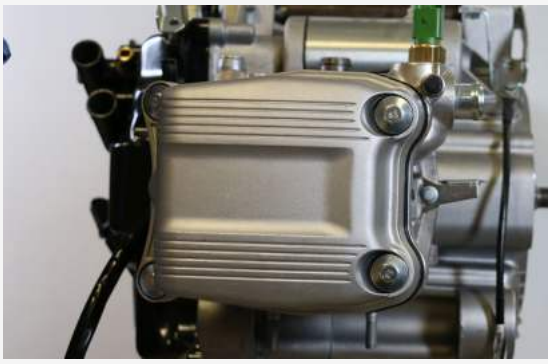
4.5.27 Tappet cover fitting

- Check that the gasket is in good condition.



- Tighten the tappet cover to the specified torque.

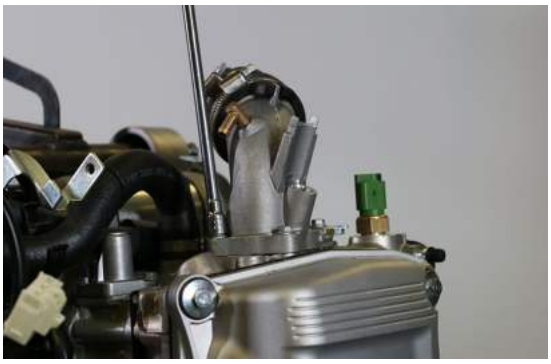
DESCRIPTION	TORQUE
Tappet cover fastening screws	8 ± 1 Nm



4.5.28 Intake manifold fitting

- Install the intake manifold on the engine.
- Insert the 3 fastening screws, one of which with a support band for the cooling system sleeve, and tighten to the prescribed torque.

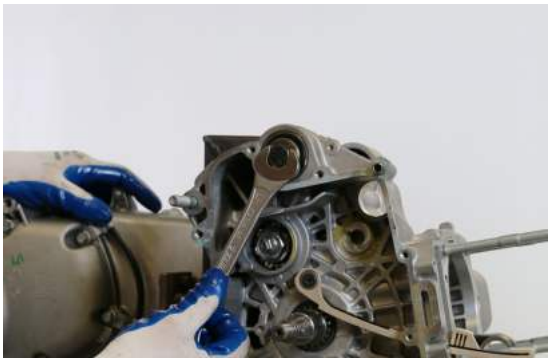
DESCRIPTION	TORQUE
Inlet manifold screws	12 ± 1 Nm



4.6 Crankshaft crankcase

4.6.1 Crankcase opening

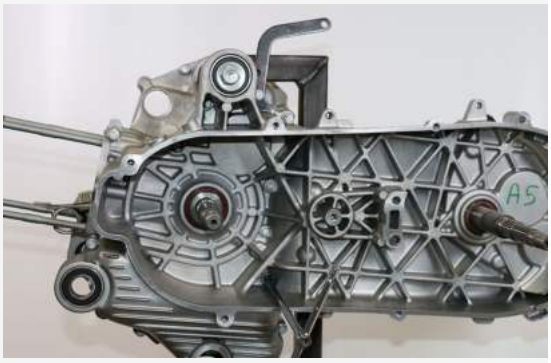
- Remove the engine support retain screw on the flywheel side half-crankcase.



- Remove the 14 coupling screws from the crankcase.

N.B.:

THE FIXING SCREWS ARE OF DIFFERENT LENGTHS, TAKE NOTE OF THEIR RESPECTIVE POSITIONS.



- Split the crankcases while keeping the crankshaft inserted on the flywheel side half-crankcase.
- Remove the coupling gasket.

N.B.:

THE BUSHING SUPPORT CAN BE LEFT IN THE FLYWHEEL SIDE HALF-CRANKCASE.

4.6.2 crankshaft removal

- Before removing the crankshaft, check the timing with the countershaft. To carry out this check, turn the crankshaft to align the two holes obtained on the crankshaft with the hole on the countershaft control gear.

This is an optimal position also to remove the crankshaft.

- Remove the crankshaft with the shim adjustment washer on the flywheel side.

WARNING

WHILE OPENING THE CRANKCASE AND REMOVING THE CRANKSHAFT, CHECK THAT THE SHAFT THREADED ENDS DO NOT INTERFERE WITH THE MAIN BEARINGS.

FAILURE TO OBSERVE THIS PRECAUTION CAN DAMAGE THE MAIN BEARING.

Removing the oil pump and countershaft control gear.

- To remove the control gear, loosen the 4 fastening screws.

Remove the gear only if actually required.

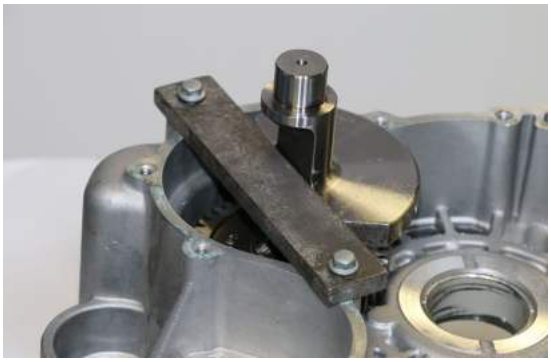
WARNING

THE SCREWS HAVE A COUNTERSUNK HEAD AND THEIR THREADING IS LOCKED BY LOCTITE. BE CAREFUL NOT TO

DAMAGE THE CONTROL HEXAGON. TO OBTAIN BETTER RESULTS IT IS PREFERABLE TO USE AN INSIDE HEXAGON SOCKET WRENCH.

4.6.3 Removing the countershaft

- Place the special tool as shown in the figure.



CODE	DESCRIPTION	IMAGE
020479Y	Countershaft lock wrench	

- Remove the fastening nut with relevant washer.

- Remove the special tool and extract the countershaft with the control gear.

4.6.4 Replacing the countershaft bearings

- Check that the bearings are free from irregular noise or clearance. Otherwise, proceed with replacement.

Flywheel-side half-crankcase

- Remove the inside Seeger ring.

- Upturn the half-crankcase.
- Remove the bearing from the flywheel side half-crankcase using the special tool and a mallet.

CODE	DESCRIPTION	IMAGE
020376Y	Adaptor handle	

CODE	DESCRIPTION	IMAGE
020358Y	37 x 40 mm Adaptor	
020439Y	17-mm guide	

- Remove the bearing from the transmission side half-crankcase using the special tool.

CODE	DESCRIPTION	IMAGE
001467Y008	Calliper to extract ø 17-mm bearings	
001467Y007	Bearing housing, external ø 54 mm	

- Before installing a new bearing, heat the flywheel side half-crankcase using the special tool.
- Place the half-crankcase on a wooden base.

CODE	DESCRIPTION	IMAGE
020151Y	Air heater	

- Insert a new bearing on the special tool after greasing the guide seat.
- Install the new bearing on the half-crankcase using the special tool.

N.B.:

☞

IF A BEARING WITH PLASTIC CAGE IS USED, KEEP THE BALLS VISIBLE FROM THE CRANKCASE INTERNAL SIDE.

CODE	DESCRIPTION	IMAGE
020376Y	Adaptor handle	

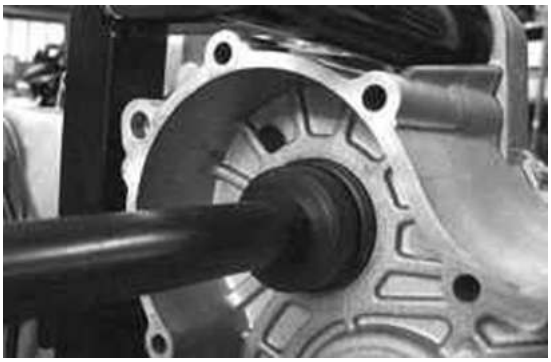
CODE	DESCRIPTION	IMAGE
020359Y	42 x 47 mm Adaptor	
020439Y	17-mm guide	

- Assemble the seeger ring.

- Before installing the new bearing on the transmission side crankcase, heat the seat using the special tool.

CODE	DESCRIPTION	IMAGE
020151Y	Air heater	

- Insert a new bearing on the special tool after greasing the guide seat.
- Install the new bearing on the engine crankcase using the special tool.



N.B.:

☞

IF A BEARING WITH PLASTIC CAGE IS USED, KEEP THE BALLS VISIBLE FROM THE CRANKCASE INTERNAL SIDE.

CODE	DESCRIPTION	IMAGE
020376Y	Adaptor handle	
020359Y	42 x 47 mm Adaptor	

CODE	DESCRIPTION	IMAGE
020439Y	17-mm guide	

4.6.5 Crankshaft components check

- Check that the axial and diametral clearances of the connecting rod are within the values given in the "**Technical Data**" section.
- Check that the inner surfaces of the crankshaft shoulders have no scores. Using a gauge, check the overall width of the crankshaft shoulders.

N.B.:

☞

WHEN MEASURING THE WIDTH OF THE CRANKSHAFT, MAKE SURE THAT THE MEASUREMENTS ARE NOT MODIFIED BY THE RADII OF FITTINGS WITH THE CRANKSHAFT BEARINGS.

CHARACTERISTIC	DESCRIPTION / VALUE
Crankshaft width	65.45 to 65.6 mm

N.B.:

☞

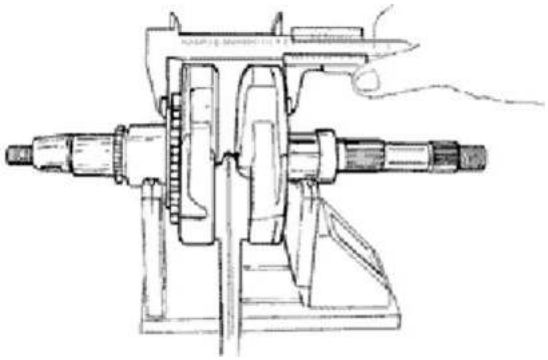
THE CRANKSHAFT CAN BE REUSED WHEN THE WIDTH IS WITHIN THE STANDARD VALUES AND THE SURFACES SHOW NO SIGNS OF SCORING.

Shimming

- Check the overall height of the crankshaft - shimming - gear assembly.

CHARACTERISTIC	DESCRIPTION / VALUE
Standard measure	76.135 to 76.4 mm

- Check that shim adjustment is free from scratches.



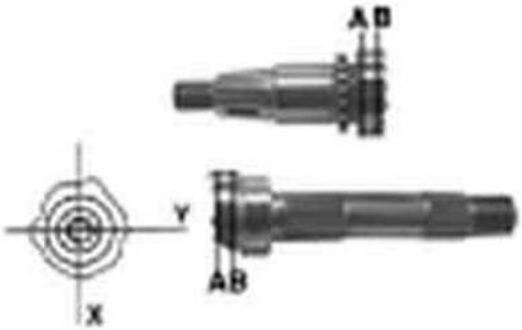
WARNING

NOTE THE ASSEMBLY POSITIONS OF THE LININGS TO PREVENT INVERTING THE POSITION IN CASE OF REUSE.

CODE	DESCRIPTION	IMAGE
020074Y	Support base for checking crankshaft alignment	

- If the crankshaft - crankcase axial clearance is higher than the standard value and the crankshaft exhibits no irregularity, the problem is caused by wear or by a wrong machining on the engine crankcase.

- Check, according to the axes and planes shown in the figure, that both bearing diameters of the crankshaft are within the values given in the "**Technical Data**" section.
- Half shafts are classified into two categories: "Class 1" and "Class 2" and the bearing diameters are indicated in the table coupling Crankcase - Crankshaft - Crankshaft half-bearings



WARNING

IF ABNORMALITIES OR VALUES NOT CONFORMING TO THOSE SPECIFIED ARE FOUND, PROCEED WITH REPLACING THE COMPLETE CRANKSHAFT.

4.6.6 Crankshaft alignment check

- Install the crankshaft on the specific support and check that the eccentricity values are within the values provided in the "**Technical data**" section.

CODE	DESCRIPTION	IMAGE
020074Y	Support base for checking crankshaft alignment	

- Check that the crankshaft cone, the tab fitting, the oil seal flow, the knurling and the threaded tangs are in good working order.
- In case of failure, replace the crankshaft.

N.B.:

☞

THE MAIN BEARINGS ARE NOT GRINDABLE.

The connecting rod cannot be replaced. To check the connecting rod small end diameter, see chapter "**Thermal group and timing system**".

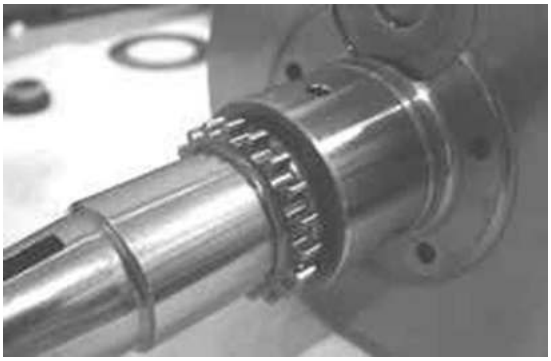
- When cleaning the crankshaft, be very careful that no impurities get in through the shaft lubrication hole.

N.B.:

☞

IN CASE OF REPLACEMENT OF A CRANKSHAFT CONSISTING OF TWO HALF-SHAFTS OF DIFFERENT CATEGORY, REPLACE THE TWO HALF-CRANKCASES AS WELL, COUPLING THE TWO COMPONENTS (SHAFT AND CRANKCASE) WITH THE SAME CATEGORY.

- To check the gearing of the crankshaft, see section "**Thermal group and timing system**".



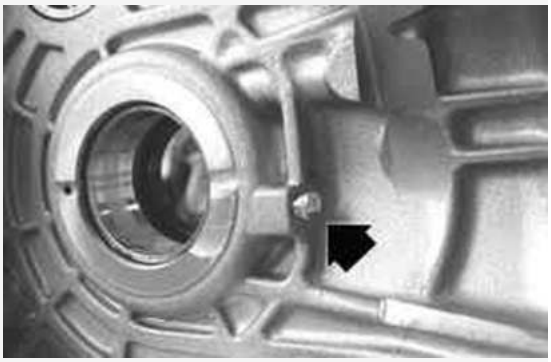
4.6.7 Crankcase half check

- Before proceeding to check the crankcase halves, thoroughly clean all surfaces and oil ducts.
- For the transmission-side half-crankcase, special attention should be given to the bushings, to the cooling jet on the transmission side (see figure) and to the lubrication duct.

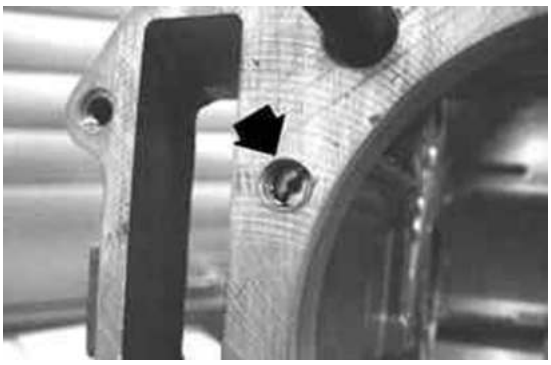
N.B.:

☞

THE JET IS FED THROUGH THE MAIN BUSHINGS. PROPER OPERATION OF THIS COMPONENT IMPROVES PISTON CROWN COOLING. CLOGGING HAS EFFECTS THAT ARE DIFFICULT TO DETECT (PISTON TEMPERATURE INCREASE). FAILURE OR LEAKS CAN CAUSE A CONSIDERABLE DROP IN THE LUBRICATION PRESSURE FOR MAIN BUSHINGS AND CONNECTING ROD.



- For the flywheel side half-crankcase, special attention should be given to the lubrication channels for the main bearings and to the compartment and the channels for the oil pump, as well as to the duct for the by-pass located on the flywheel cover.



N.B.:

☞

AS ALREADY DESCRIBED IN THE “LUBRICATION” CHAPTER, IT IS ESPECIALLY IMPORTANT THAT THE BY-PASS HOUSING ON THE FLYWHEEL COVER IS FREE FROM WEAR THAT MAY IMPAIR THE PROPER SEALING OF THE LUBRICATION PRESSURE ADJUSTMENT PISTON.

THE HEAD LUBRICATION CHANNEL IS EQUIPPED WITH A SHUTTER JET; THIS GIVES A "LOW PRESSURE" HEAD LUBRICATION. THIS CHOICE WAS MADE TO REDUCE THE OIL TEMPERATURE IN THE SUMP.

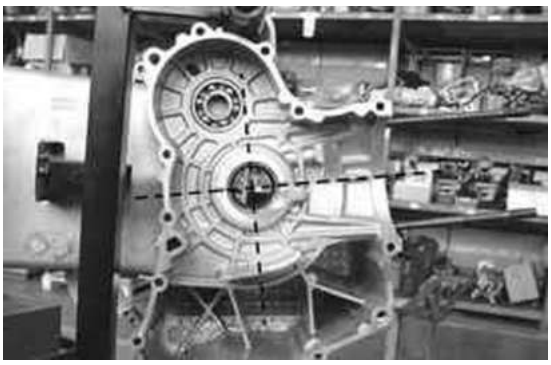
Jet clogging impairs the head lubrication and the timing mechanisms.

A jet failure causes a decrease in the main bearing and connecting rod lubrication pressure.

- Check that the surfaces are not dented or deformed and pay special attention to the crankcase coupling and the crankcase-cylinder surfaces.
- Any defects in the crankcase gasket or matching surfaces (see Flywheel cover coupling) can cause pressurised oil leaks, thereby affecting the connecting rod and main bearing lubrication pressure.
- Check that the surfaces that limit axial clearance of the crankshaft show no signs of wear. For the dimensional check, refer to the instructions about checking the axial clearance and the dimensions on the crankshaft

4.6.8 Main bushing check

- To obtain a good bushing lubrication it is necessary to have both an optimal lubricating pressure (4 bar) and a good oil flow rate; the bushings must be correctly positioned so as not to obstruct the oil supply channels.
- The main bushings are comprised of two half-bearings, one with holes and channels for lubrication whereas the other is solid.



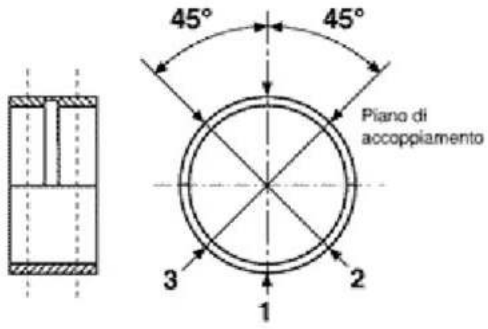
- The solid half-bearing is intended to stand the thrusts caused by combustion, and for this reason it is arranged opposite the cylinder.
- To prevent shutters in the oil feeding channels, the matching surface of the two half-bearings must be perfectly orthogonal to the cylinder axis, as shown in the figure.
- The oil feeding channel section is also affected by the bushings driving depth compared with the crankshaft axial clearance of the limiting surface.

N.B.:

TO KEEP THE BUSHINGS ON THE CRANKCASE IN SUCH POSITION, DRIVING IS FORCED ON CAST-IRON

RINGS INSERTED IN THE CASTING OF BOTH CRANKCASE HALVES.

- Measure the bushings diameter at the 3 positions indicated in the figure.
- Repeat the measurements for the other bushing half. see diagram.



N.B.:

☞

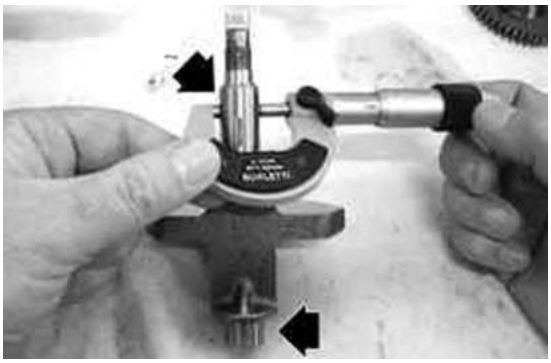
DO NOT TAKE THE MEASUREMENT ON THE TWO HALF-SHELL COUPLING SURFACE SINCE THE ENDS ARE RELIEVED TO ALLOW BENDING DURING THE DRIVING OPERATION.

- Before fitting, check that the clearance between the bushings and the crankshaft is within the values provided in the "**Technical data**" section.
- The standard bushing diameter after driving is variable on the basis of a coupling selection.
- The crankcase bushing seats are classified into 3 categories while the crankshaft ones, into 2 categories.
- The bushings, in turn, are divided into 4 categories according to their thickness (see the table in section "**Technical data**").

4.6.9 Countershaft

- Using a micrometer, measure the 2 bearings of the countershaft as shown in the figure.

CHARACTERISTIC	DESCRIPTION / VALUE
Standard diameter	17 - 0.01- 0.02 mm



- Check that the water pump drive is not worn.

4.6.10 Crankshaft fitting

- Check that the oil pump and countershaft control gear are free from deformations or dents. Replace, if required.

N.B.:

☞

IF YOU HAVE TO REPLACE THE OIL PUMP AND COUNTERSHAFT CONTROL GEAR IT IS NECESSARY TO REPLACE THE COUNTERSHAFT GEAR AS WELL.

- Before installing the gear on the crankshaft, carefully clean the two matching surfaces removing any residues of LOCTITE from the holes using a brush.
- Blow with compressed air and degrease the mounting holes on both surfaces to make the new LOCTITE grip.
- Apply the recommended product to the holes again.

PRODUCT	DESCRIPTION	SPECIFICATIONS
Loctite 243	Medium strength thread-locking sealant.	Blue

- Repeat the same procedure for the 4 fastening screws.
- Insert the control gear on the crankshaft with the hole countersink visible.
- Tighten the 4 fastening screws to the prescribed torque.

WARNING

THE SCREWS HAVE A COUNTERSUNK HEAD AND THEIR THREADING IS LOCKED BY LOCTITE. BE CAREFUL NOT TO DAMAGE THE CONTROL HEXAGON. TO OBTAIN BETTER RESULTS IT IS PREFERABLE TO USE AN INSIDE HEXAGON SOCKET WRENCH.

DESCRIPTION	TORQUE
Crankshaft gearwheel screws	12.0 ± 1.0 Nm

- Lubricate the main bearing on the flywheel side half-crankcase.
- Lubricate the shim adjustment washer.
- Insert the shim adjustment washer on the crankshaft in its original position.
- Insert an 8 mm diameter pin into the hole on the countershaft.

- Insert the crankshaft on the pin and into the bushing.
- Before inserting thoroughly, make the oil pump gear align with the control gear.
- Complete the insertion and remove the pin.

N.B.:

☞

WHEN INSERTING THE SHAFT ON THE HALF-CRANKCASE, BE CAREFUL NOT TO DAMAGE THE MAIN BEARING WITH THE THREADED TANG OF THE CRANKSHAFT AND WITH THE TIMING CONTROL TOOTHED PINION.

- Install the oil pump closing plate.
- Tighten the 2 flanged fastening screws to the prescribed torque.

DESCRIPTION	TORQUE
Oil pump compartment closing bulkhead screw	3.5 ± 0.5 Nm

4.6.11 Crankcase coupling

- Remove the oil guard from the transmission side half-crankcase using a screwdriver.

- Install a new oil guard after lubricating it, using the special tool, arranging it at a 0.5 mm recess from the crankcase plane.

WARNING

INSERT THE OIL SEAL ONLY WITH THE SPECIFIC TOOL TO RESPECT THE EXACT DEPTH OF THE PRESS-FITTING.

NON-COMPLIANCE WITH THIS WARNING MAY CAUSE THE OBSTRUCTION OF THE LUBRICATION CHANNEL WITH RESULTING SERIOUS DAMAGE TO THE ENGINE.

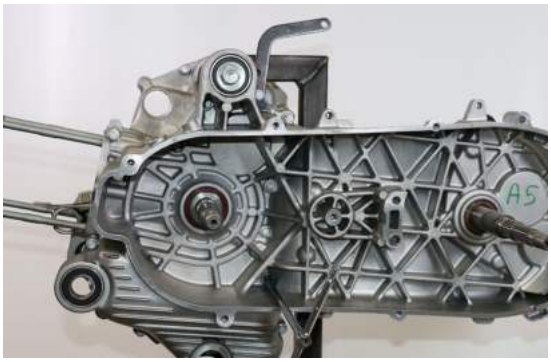
CODE	DESCRIPTION	IMAGE
020360Y	52 x 55 mm adaptor	

CODE	DESCRIPTION	IMAGE
020376Y	Adaptor handle	

- Insert the gasket on the flywheel side half-crankcase.

- Lubricate the main bearing on the transmission side half-crankcase.
- **Couple the 2 half-crankcases being careful not to damage the bushing on the transmission side half-crankcase with the threaded tang of the crankshaft.**
- Insert the engine support retain screw on the flywheel side half-crankcase without tightening.

- Insert the 14 fixing screws according to the position noted during disassembly.
- Tighten the screws thoroughly and tighten to the prescribed torque.
- Check that the crankshaft rotates freely.



N.B.:

☞

REMOVE ANY EXCESS FROM THE CRANKCASE COUPLING GASKET ON THE CYLINDER PLANE, TO ENSURE BETTER SEALING PERFORMANCE.

DESCRIPTION	TORQUE
Engine-crankcase coupling screws	12 ± 1 Nm

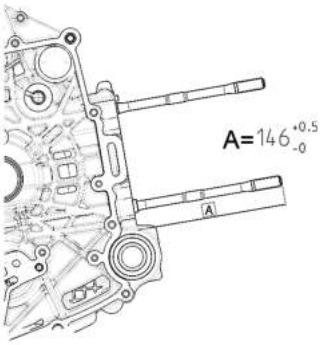
- Install the thermal group (cylinder, head, piston) as described in section «**Thermal group and timing system**».
- Install the flywheel with start-up control as described in the "**Flywheel and start-up**" chapter.
- Install the flywheel cover with the cooling system sleeves, as described in the "**Flywheel cover** " chapter.
- Install the complete driving pulley, the transmission cover and the relevant mesh filter and the outside transmission cover as described in the «**Automatic transmission**» chapter.

4.6.12 Stud bolts

- Using two nuts, fitted as nut and lock nut type, remove and then drive from the seat.
- Clean the threaded seat on the carter thoroughly.
- Refit a new stud bolt and apply the special product on the threading crankcase side.

- Tighten up to the press-fitting depth indicated

CHARACTERISTIC	DESCRIPTION / VALUE
Stud bolt projection	146 +0.5 -0 mm



PRODUCT	DESCRIPTION	SPECIFICATIONS
Loctite 270	High strength thread-locking green sealant.	

WARNING

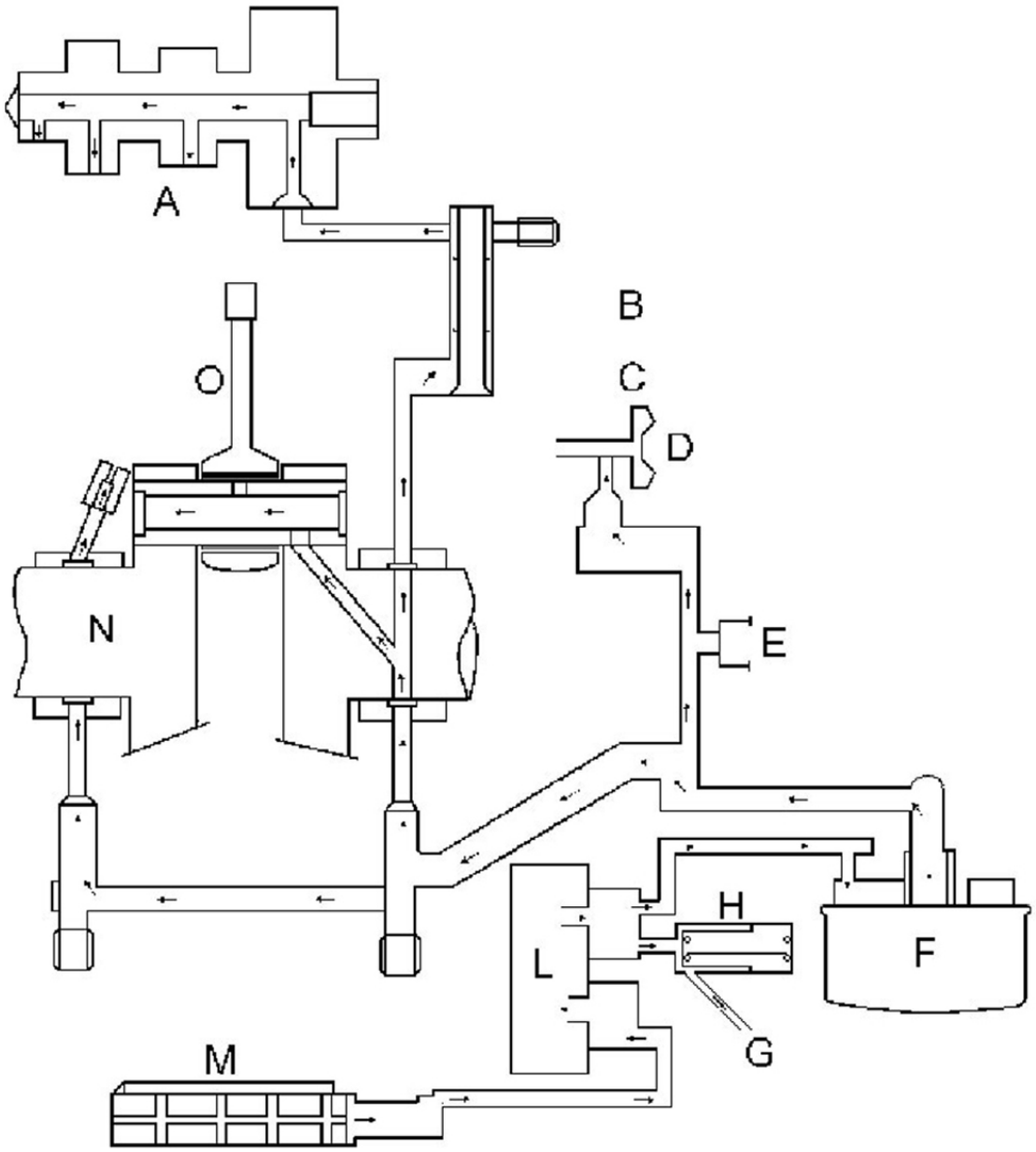
AT EACH REMOVAL OF THE CYLINDER HEAD IT IS NECESSARY TO REPLACE THE STUD BOLTS. FOR FITTING QUOTA SEE THE SECTION "MOTOR/STUD BOLT SHAFT CRANKCASE.".

N.B.:

NEW STUD BOLTS DO NOT NEED THREADLOCK, AS THEY COME EQUIPPED WITH SCOTCH-GRIP.

4.7 Lubrication

4.7.1 Basic circuit diagram



CHARACTERISTIC	DESCRIPTION / VALUE
A	Camshaft
B	Cylinder-head plane
C	Cylinder-crankcase plane
D	Water pump impeller
E	Minimum oil pressure sensor
F	Oil filter cartridge
G	To the oil sump

CHARACTERISTIC	DESCRIPTION / VALUE
H	By-pass valve
I	Oil pump
L	Mesh pre-filter
M	Crankshaft
N	Connecting rod

4.7.2 General specifications

The lubrication system is divided into two sections:

- high pressure
- low pressure.

The high pressure section includes all components located on the engine crankcase whereas the low pressure section only refers to the thermal group. The trochoidal pump is installed in the sump and is controlled by a pair of gears. To guarantee the integrity of the pump, a pre-filter is fitted. This is a screw-in type pre-filter and the relevant plug serves at the same time as an engine oil drain plug.

The pump is controlled by means of a piston by-pass calibrated to 4 bar. This is located before the cartridge filter and both are installed on the flywheel cover, so that the seal of the filter is subject to the pressure of the circuit.

The by-pass located before the cartridge filter improves the operating conditions for the filter, particularly with cold oil. The filter is equipped with an anti-drain back valve and a pressure regulator valve; the latter intervenes when the filtering mass causes a pressure drop above 1 ± 0.2 bar. These conditions naturally occur only with cold oil and at high engine revs or if the filter is clogged.

The filtered oil is used to lubricate the water pump shaft and once at the engine crankcase, to lubricate the main bearings, the connecting rod head and the piston cooling nozzle, on the transmission-side bearing. The main bearing on the transmission side is fitted with an oil seal and the respective drain line.

The supply line for the timing system comes from the flywheel-side bearing; the supply to the head is controlled by the respective spray jets in the engine crankcase. The components of the timing system function with low-pressure oil lubrication. The camshaft bearings are installed directly on the aluminium of the head; the camshaft axial clearance is partially compensated by the oil supplied to the smaller diameter bearing.

The camshaft supplies the lubricant to the rocking levers via the holes provided; these are installed in a position to ensure that the lubrication is maintained even after the vehicle has stopped. This is achieved when the camshaft reaches its most usual and likely position when the engine is shut off. The oil used to lubricate the head returns to the sump via the chain casing channel and therefore it also provides lubrication for the chain.

A one-way valve and a decantation chamber are used so that gases from the crankcase do not carry any oil. The one-way valve is a metal reed valve; the decantation chamber has a drainage hole.

A failure in these components implies oil getting into the line supplying air to the engine. Excessive oil vapours may result in clogged ducts on the throttle body.

In order to signal low oil pressure in the system, a pressure switch is used, located immediately after the oil filter outlet. The lubrication circuit does not include the countershaft. The countershaft is lubricated by the oil transported by the gears or by the centrifugal effect of the crankshaft.

The same applies to the piston or the pin, but in this case the cooling nozzle is particularly important.

4.7.3 Oil pressure check

1 - In case of oil leaks from the oil filter or from the flywheel cover coupling gasket, check the lubrication pressure.

NEXT go to 2

2 - Install the special tool.

CODE	DESCRIPTION	IMAGE
020193Y	Oil pressure gauge	
020434Y	Union for oil pressure measurement	

NEXT go to 3

3 - Check the system pressure with cold engine and medium – high speed.

Standard pressure < 6 bar

YES go to 4 NO go to 5

4 - Replace the damaged components.

5 - Check the working order of the adjustment by-pass (see "flywheel cover" chapter) and restore proper sliding.

N.B.:

☞

STANDARD PRESSURES ARE OBTAINED USING OIL WITH THE PRESCRIBED VISCOSITY. A HIGHER VISCOSITY CAUSES AN INCREASE OF THE SYSTEM PRESSURE.

1 - If oil consumption is above 250 g/1000 km on a run-in engine, proceed as follows.

NEXT go to 2

2 - Check the presence of oil in the scavenge duct on the filter box.

YES go to 3 NO go to 4

3 - Check the one-way reed valve and the decantation chamber drainage hole.

YES go to 5 NO go to 4

4 - Check the thermal group seals (piston rings, valve guides and oil guards), see "Thermal group and Timing system" chapter.

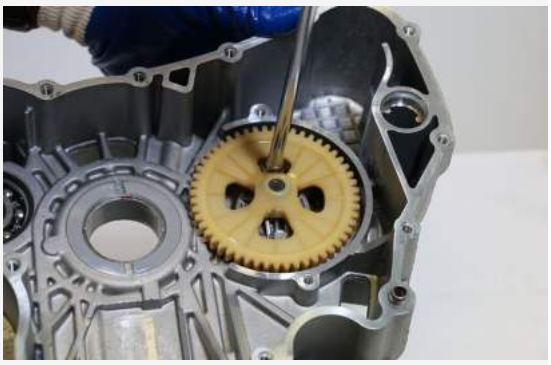
5 - Restore the valve or the drainage hole efficiency.

4.7.4 Removing the oil pump

- Remove the closing plate of the oil pump housing by loosening the 2 retaining screws with their washers.

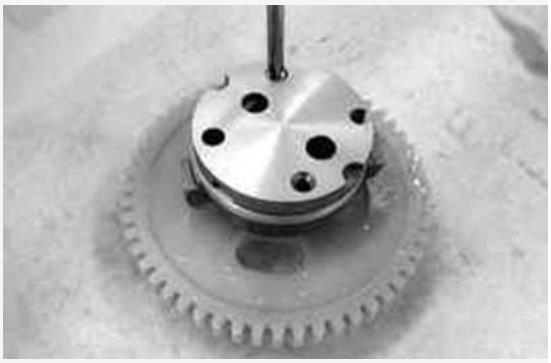
- Unscrew the oil pump fixing screws, through the slots on the gear.

2 screws



- Remove the oil pump including the gear and gasket.

- Remove the two screws and the oil pump cover.



- Remove the inside rotor retaining snap ring turning it to move the opening at the shaft face.

- Remove and wash the rotors thoroughly with petrol and compressed air.
- Extract the shaft with its gear and check that it is in good working order and free from wear.

- Reassemble the rotors in the pump body, keeping the two reference marks visible.
- Insert the shaft with the gear and install the lock ring; then, turn it with the opening opposed to the shaft face.
- Check any irregular clearance between shaft and pump body.

- Using a feeler gauge, check the distance between the rotors in the position shown in the figure.

CHARACTERISTIC	DESCRIPTION / VALUE
Maximum clearance admitted	0.012 mm

Measure the distance between the outer rotor and the pump body (see figure).

CHARACTERISTIC	DESCRIPTION / VALUE
Maximum clearance admitted	0.25 mm

- Check the axial clearance of the rotors with a trued bar as reference, as shown in the figure.

CHARACTERISTIC	DESCRIPTION / VALUE
Limit value allowed	0,01 mm

4.7.5 Fitting the oil pump

- Make sure the gasket is in the correct position.

N.B.:

☞

THE TOOTH OF THE GASKET MUST BE IN ITS SEAT.

- Lubricate the internal rotors.
- Check there are no signs of scoring or wear on the oil pump cover.
- If non-conforming values or signs of wear are found, replace the pump.
- Fit the pump cover in the position that permits the crankcase clamping screws to be aligned.
- Tighten the two fastening screws to the prescribed torque.

DESCRIPTION	TORQUE
Oil pump cover screws	0.8 ± 0.1 Nm

- Insert the oil pump with gear
- Insert the 2 retaining screws through the slots on the gear and tighten to the prescribed torque.

N.B.:

☞

THE ASSEMBLY POSITION OF THE PUMP IS FIXED BY INSTALLATION OF THE SCREWS.

Failure to observe the tightening torque may alter the coupling clearance of the rotors with the pump body.

DESCRIPTION	TORQUE
Screws fixing oil pump to the crankcase	5.5 ± 0.5 Nm

- Insert the countershaft with gearing into the flywheel-side half-crankcase.
- Install the special tool in the position shown in the figure

CODE	DESCRIPTION	IMAGE
020479Y	Countershaft lock wrench	

- Keep the countershaft in position and insert the washer with the nut.
- Tighten the nut to the prescribed torque, using the recommended product.
- Remove the specific tool.

DESCRIPTION	TORQUE
Counter-shaft fastening nut	27 ± 2 Nm

PRODUCT	DESCRIPTION	SPECIFICATIONS
Loctite 243	Medium strength thread-locking sealant.	Blue

4.8 Reverse gear

REVERSE GEAR ACTUATOR UNIT

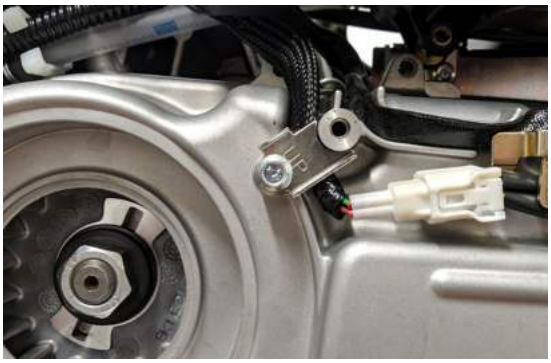
- To disassemble the reverse gear actuator unit, remove the transmission protection cover screws.

- Remove the transmission protection cover.

- To facilitate access to the components, if necessary remove the filter box fittings and lift it slightly.

- A solenoid is mounted on the central part of the transmission cover, used to manage the engagement of the reverse gear.
- There is also a linear sensor, which detects the position of the engagement lever and enables the reverse gear.

- Unscrew the screw of the wiring harness retaining plate and remove it.



- Remove the fasteners of the reverse gear actuator unit (3 screws).

- Disconnect the connector and remove the unit.

CAUTION

TO RELEASE THE FASTENING PIN OF THE CONNECTOR, PRESS AS SHOWN IN THE IMAGE.

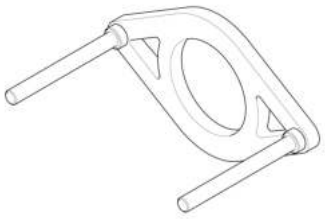
- The contact box of the reverse gear motor positive cable contacts is fastened on the left side, at the top.

REVERSE GEAR MOTOR AND GEARS REMOVAL

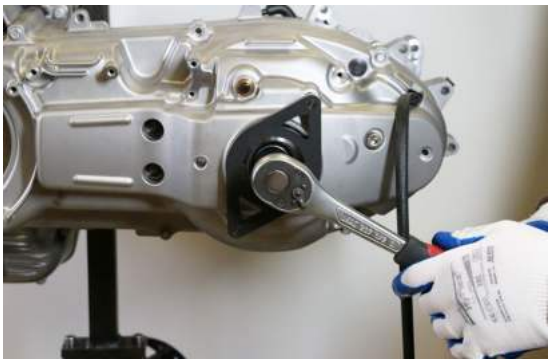
- Unscrew the plate nuts, remove it and disconnect the positive cable of the reverse gear motor.

- - Use a screwdriver to remove the driven pulley axle plug.

- Insert the specific tool in the appropriate slots.

CODE	DESCRIPTION	IMAGE
021022Y	Driven pulley stop	

- Unscrew the driven pulley shaft nut

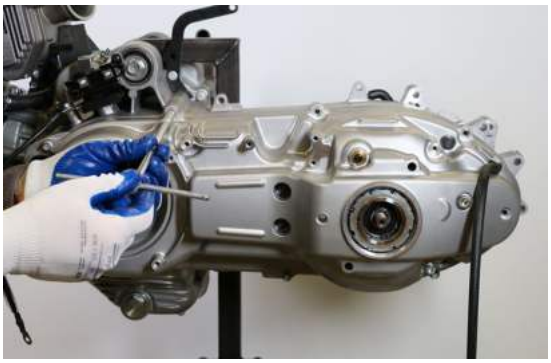


- Remove the nut.

- Remove the specific tool.

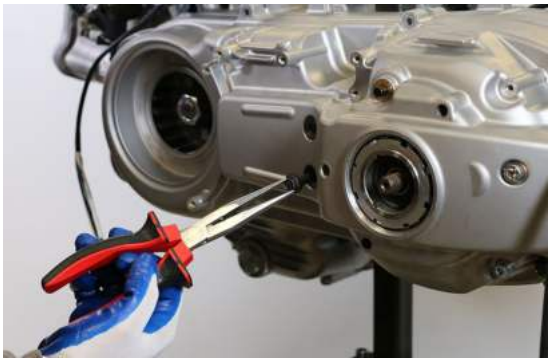
- Remove the two washers.

- Remove the transmission cover screws.



- Remove the screws from the right side of the cover.

- Remove the screws from the central part.

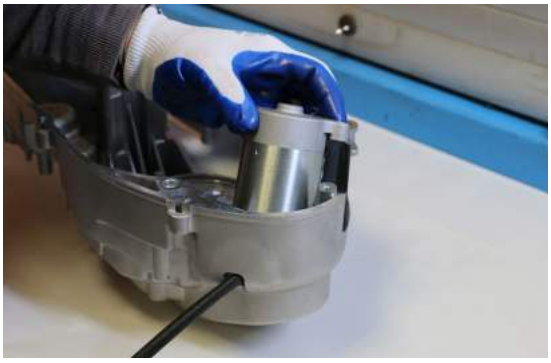


- Remove the transmission cover.

- Remove the fixing screws of the reverse gear motor.

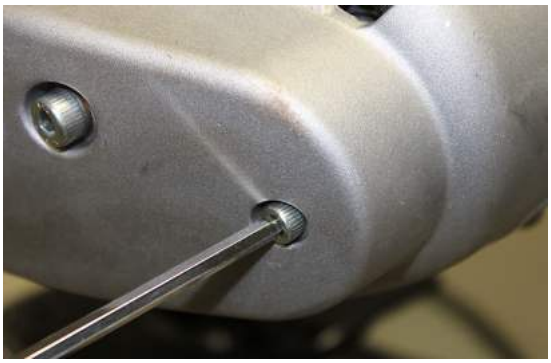
- Remove the spacers.

- Prepare a suitable container for draining the oil.
- Remove the motor by taking out the cable from the crankcase slot.
- Rotate the entire crankcase cover to drain the oil contained in the reverse gear system.

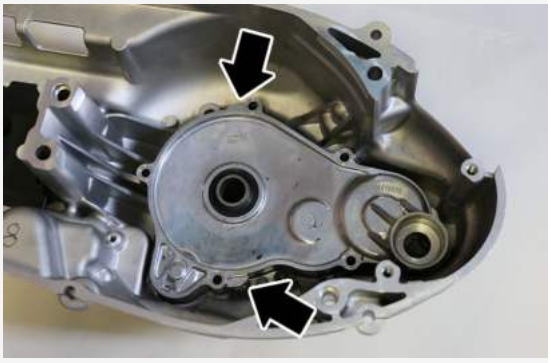


- Remove the reverse gears cover internal screws.

- Remove the external screw.



- To remove the cover, apply force on the two protrusions shown in the image.
- Only if high resistance is encountered, heat the area to facilitate the operation.



- Remove the reverse gears cover.

- Remove the spring.

- Remove the first gear.

- Remove the second gear.

- Remove the shaft.

- Remove the transmission bushing.

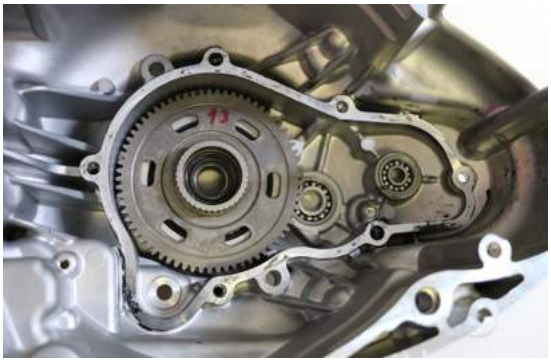
N.B.:

☞

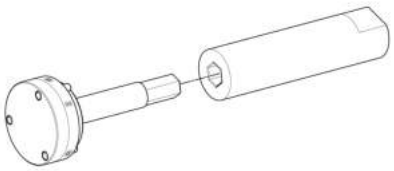
THE TRANSMISSION BUSHING IS EQUIPPED WITH A SAFETY SYSTEM THAT MECHANICALLY PREVENTS THE ENGAGEMENT OF THE REVERSE GEAR WHEN THE DRIVEN PULLEY SHAFT EXCEEDS A CERTAIN ROTATION SPEED.

- Remove the gear control fork unit and the selector by raising it evenly.

- Remove the control bushing.



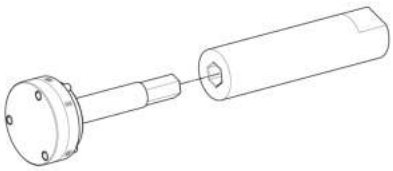
- Insert the specific tool from the outside of the transmission cover.

CODE	DESCRIPTION	IMAGE
021024Y	Control bushing stopper wrench	

- Pay attention to the tool protrusion, which must be inserted into the internal cavity, as shown in the image.

- The tool has two functions: to keep the control bushing blocked and to act as support for the transmission cover during removal.

- Fasten the other part of the specific tool to a vice.

CODE	DESCRIPTION	IMAGE
021024Y	Control bushing stopper wrench	

- Place the transmission cover on the vice, inserting the two parts of the tool one inside the other.

- Using a pin punch, bend the locking washer sear downwards.

- Place the specific tool on the ring nut, inserting the teeth of the tool into the ring nut slots.

CODE	DESCRIPTION	IMAGE
021023Y	Reverse lock ring spanner	

- Loosen the ring nut.

- Remove the transmission cover from the vice and remove the specific tools.

- Support the control bushing from the inside of the cover, unscrew the ring nut and remove the lock washer.

- Remove the control bushing.

REVERSE GEAR MOTOR AND GEARS FITTING

N.B.

☞

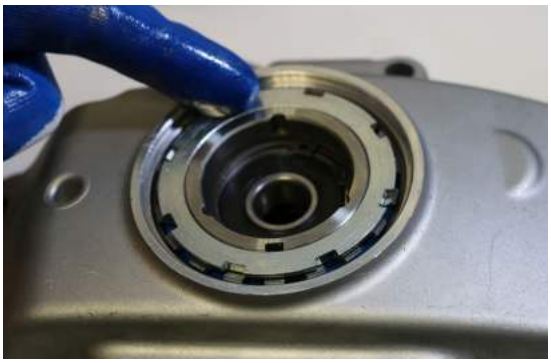
BEFORE MOUNTING THE CONTROL BUSHING, LUBRICATE THE SEAL RING LOCATED ON THE TRANSMISSION COVER AND THE MATING SURFACE OF THE BUSHING.

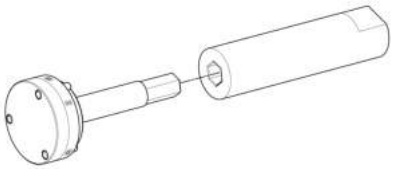
PRODUCT	DESCRIPTION	SPECIFICATIONS
80W-90 transmission oil	Lubricant for gearboxes and transmissions.	SAE 80W-90; API GL-4

- Insert the control bushing from the inner side of the transmission cover and the lock washer from the opposite side.

- Tighten the ring nut manually.

- Insert the specific tool from the outside of the transmission cover.

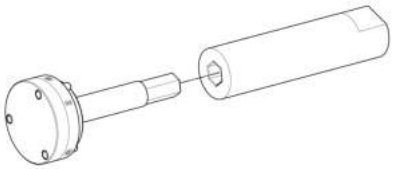


CODE	DESCRIPTION	IMAGE
021024Y	Control bushing stopper wrench	

- Pay attention to the tool protrusion, which must be inserted into the internal cavity, as shown in the image.

- The tool has two functions: to keep the control bushing blocked and to act as support for the transmission cover during removal.

- Fasten the other part of the specific tool to a vice.

CODE	DESCRIPTION	IMAGE
021024Y	Control bushing stopper wrench	

- Place the transmission cover on the vice, inserting the two parts of the tool one inside the other.

- Place the specific tool on the ring nut, inserting the teeth of the tool into the ring nut slots.

CODE	DESCRIPTION	IMAGE
021023Y	Reverse lock ring spanner	

- Tighten the ring nut, applying the recommended torque.

CAUTION

AFTER TIGHTENING, BEND A TOOTH OF THE STOP WASHER IN ONE OF THE EXTERNAL CAVITIES OF THE RING.

DESCRIPTION	TORQUE
Reverse gear control bushing ring nut	70 ± 4 Nm

- Remove the transmission cover from the vice and remove the specific tools.

- Fit the gear control fork unit and the selector.

N.B.

☞

LUBRICATE THE AREA OF THE GEAR CONTROL FORK PIN.

PRODUCT	DESCRIPTION	SPECIFICATIONS
80W-90 transmission oil	Lubricant for gearboxes and transmissions.	SAE 80W-90; API GL-4

- Fit the unit on the control bushing.

N.B.

☞

BEFORE FITTING, APPLY THE RECOMMENDED OIL BETWEEN THE TEETH (SPLINES) OF THE CONTROL BUSHING AND THE GEAR SELECTOR.

PRODUCT	DESCRIPTION	SPECIFICATIONS
80W-90 transmission oil	Lubricant for gearboxes and transmissions.	SAE 80W-90; API GL-4

- Fit the transmission bushing.

- Fit the spindle.

- Mount the first gear with the flexible coupling side facing down, as shown in the figure.

- Fit the second gear.

- Insert the spring.

CAUTION

BE CAREFUL THAT THERE IS NO SEALANT APPLIED ON THE EXTERNAL PART OF THE CONTROL GUIDE HOLE.

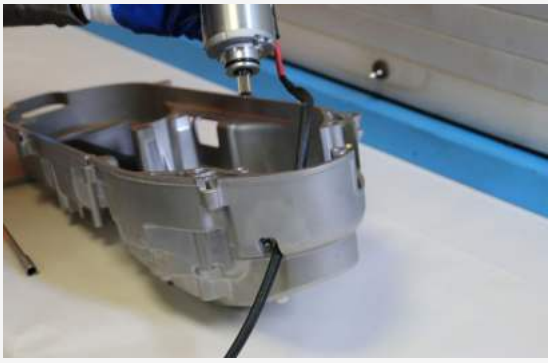
- Clean the mating surface, apply the specific sealing product and place the reverse gear cover.

PRODUCT	DESCRIPTION	SPECIFICATIONS
THREE BOND TB1207B	Engine sealing paste	Liquid sealant

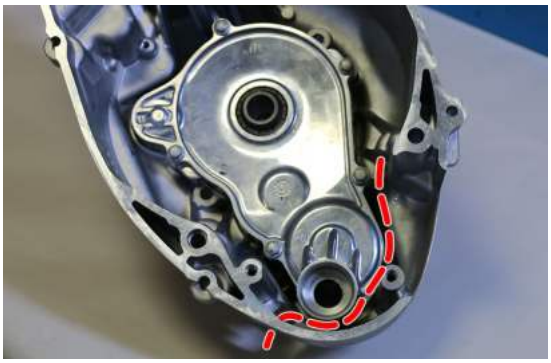
- Tighten the internal screws of the cover.

DESCRIPTION	TORQUE
Reverse gear system cover screws	12 ± 1 Nm

- Place the motor and pass the cable through the specific slot.



- Place the motor cable and the cap as shown in the figure.

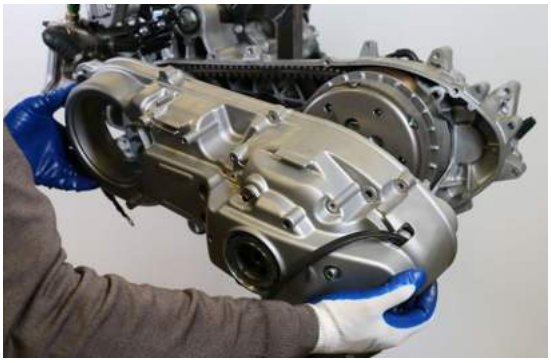


- Insert the spacers.

- Screw the screws fastening the motor.

DESCRIPTION	TORQUE
Reverse gear motor fastening screws	12 ± 1 Nm

- Put the transmission cover.



CAUTION

THE FOUR M8 SCREWS OF THE TRANSMISSION COVER HAVE DIFFERENT LENGTHS: THE TWO LONG SCREWS MUST BE FITTED ON THE CENTRAL PART, THE TWO SHORT SCREWS ON THE RIGHT SIDE.

- Tighten the screws on the central part.

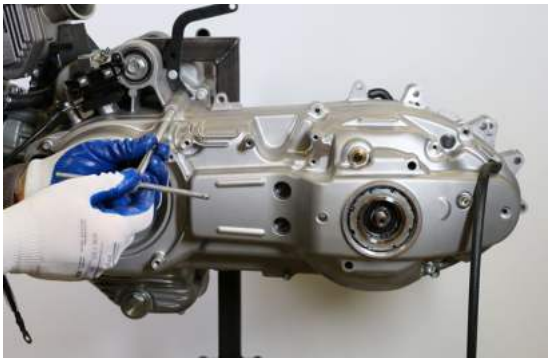
DESCRIPTION	TORQUE
M8 transmission cover fastenings	24.5 ± 1.5 Nm

- Tighten the screws on the right part.

DESCRIPTION	TORQUE
M8 transmission cover fastenings	24.5 ± 1.5 Nm

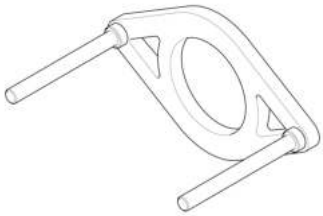
- Tighten the transmission cover screws.

DESCRIPTION	TORQUE
M6 transmission cover fastenings	12 ± 1 Nm



- Fit the two washers as shown in the image; first the one with the smaller diameter, then the one with the larger diameter.

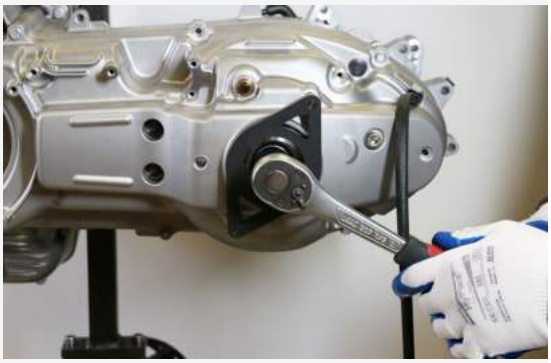
- Insert the specific tool in the appropriate slots, if necessary rotate the shaft to engage it fully.

CODE	DESCRIPTION	IMAGE
021022Y	Driven pulley stop	

- Fit the driven pulley axle nut.

- Tighten the nut to the prescribed torque.

DESCRIPTION	TORQUE
Driven pulley nut	96 ± 4 Nm



- Remove the specific tool.

- Fit the driven pulley axle plug.

- Connect the positive cable of the reverse gear motor, place the plate and fasten it with the specific nuts.

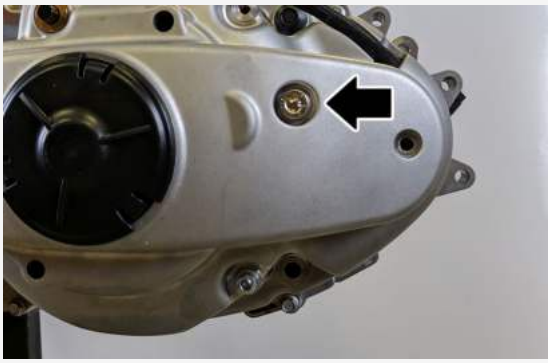
WARNING!

CHECK AND CLEAN THE CONTACTS: IMPROPER MAINTENANCE STATE MAY CAUSE MALFUNCTIONS WHICH CAN ENTAIL FIRE RISKS.

- Fill the installation through the filler hole.

DESCRIPTION	TORQUE
Reverse gear system oil relief screw	16 ±1 Nm

CHARACTERISTIC	DESCRIPTION / VALUE
Reverse gear system oil	90 cm³



PRODUCT	DESCRIPTION	SPECIFICATIONS
80W-90 transmission oil	Lubricant for gearboxes and transmissions.	SAE 80W-90; API GL-4