PIAGGIO

SERVICE STATION MANUAL

1Q000267 EN

MP3 500 i.e. SPORT Business_LT_ ABS-ASR_EU_USA (2015)

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SERVICE STATION MANUAL
MP3 500 i.e. SPORT Business_LT_ ABS-ASR_EU_USA (2015)

This service station manual has been drawn up by Piaggio & C. Spa to be used by the workshops of Piaggio dealers. It is assumed that the user of this manual for maintaining and repairing Piaggio vehicles has a basic knowledge of mechanical principles and vehicle repair technique procedures. Any significant changes to vehicle characteristics or to specific repair operations will be communicated by updates to this manual. Nevertheless, no mounting work can be satisfactory if the necessary equipment and tools are unavailable. It is therefore advisable to read the sections of this manual concerning special tools, along with the special tool catalogue.

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

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

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

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

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

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

INDEX OF TOPICS

INDEX OF TOPICS

This section describes the general specifications of the vehicle.

Rules

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

Safety rules

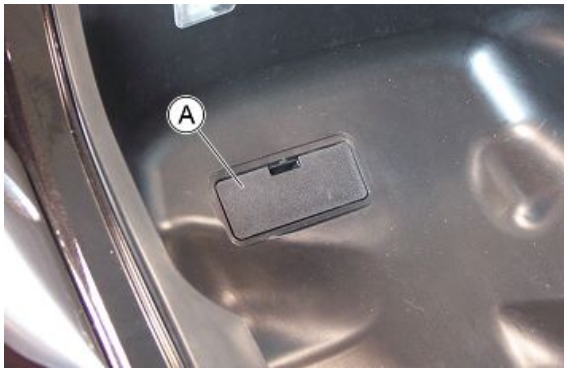
- If work can only be done on the vehicle with the engine running, make sure that the premises are well ventilated, using special extractors if necessary; never let the engine run in an enclosed area. Exhaust fumes are toxic.
- The battery electrolyte contains sulphuric acid. Protect your eyes, clothes 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 in such a way that you do not breathe in the dust produced by the wear of the friction material. Even though the latter contains no asbestos, inhaling dust is harmful.

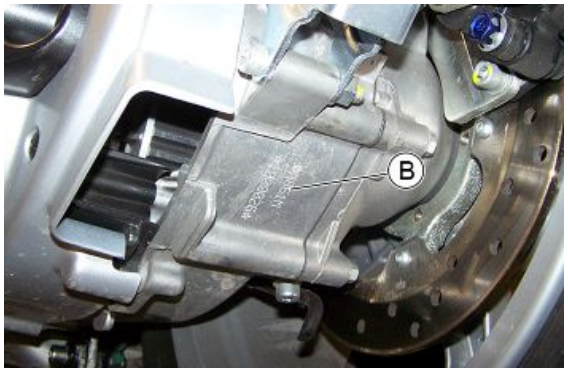
Maintenance rules

- Use original PIAGGIO spare parts and lubricants recommended by the Manufacturer. Non-original or non-conforming spares may damage the vehicle.
- Use only the appropriate tools designed for this vehicle.
- Always use new gaskets, sealing rings and split pins upon refitting.
- After removal, clean the components using non-flammable or low flash-point solvents. Lubricate all the work surfaces, except tapered couplings, before refitting these parts.
- After refitting, make sure that all the components have been installed correctly and work properly.
- Use only equipment with metric sizes for removal, service and reassembly operations. Metric bolts, nuts and screws are not interchangeable with coupling members using English measurements. Using unsuitable coupling members and tools may damage the vehicle.
- When carrying out maintenance operations on the vehicle that involve the electrical system, make sure the electrical connections have been made properly, particularly the ground and battery connections.

Vehicle identification

The identification registration numbers consist of a prefix stamped on the chassis and engine "**B**" respectively, followed by a number. These numbers must always be indicated on spare parts requests. To read the chassis number, remove the relevant port "**A**" in the helmet compartment. We recommend checking that the chassis registration number stamped on the vehicle corresponds with that on the vehicle documentation.





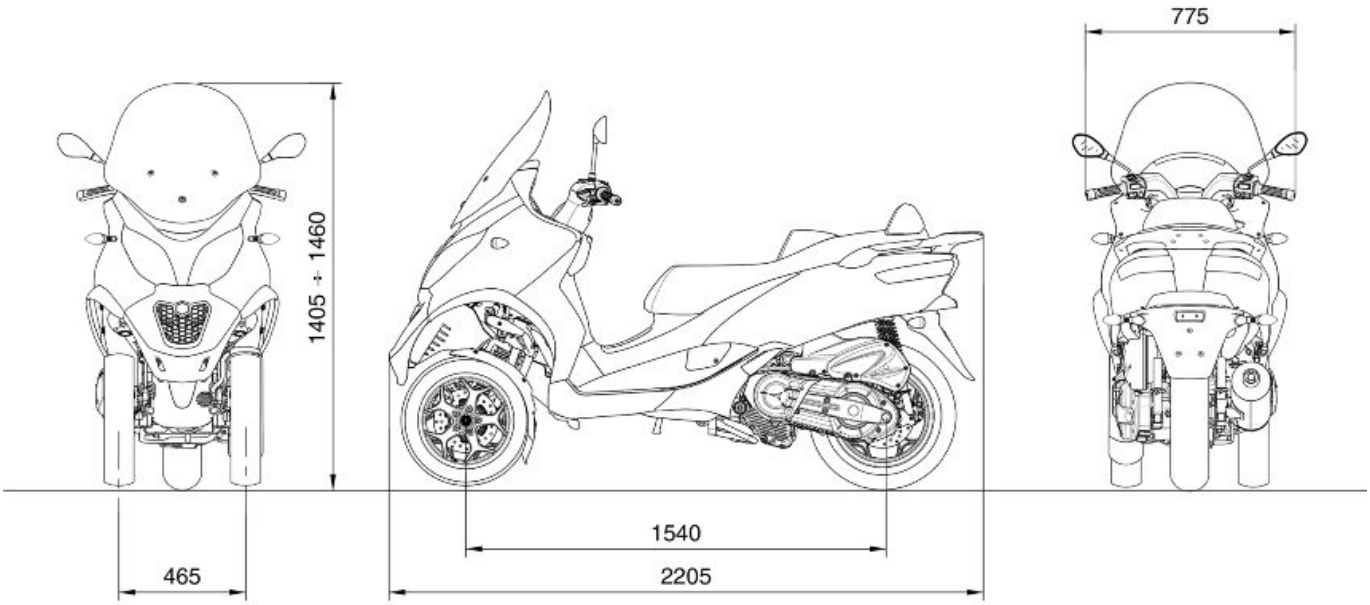
CAUTION

PLEASE REMIND THAT ALTERING IDENTIFICATION REGISTRATION NUMBERS CAN LEAD TO SERIOUS PENAL SANCTIONS (IMPOUNDING OF THE VEHICLE, ETC.).

VEHICLE IDENTIFICATION

Specification	Desc./Quantity
Frame prefix (VERSION EQUIPPED WITH ABS - ASR SYSTEM)	ZAPM86100
Frame prefix (VERSION NOT EQUIPPED WITH ABS - ASR SYSTEM)	ZAPM86101
Frame prefix USA/CND	ZAPM860X
Engine prefix	M861M
Engine prefix USA/CND	M863M

Dimensions and mass



WEIGHTS AND DIMENSIONS

Specification	Desc./Quantity
Length	2205 mm (86.8 in)
Width	775 mm (30.5 in)
Maximum height	1460 mm (57.5 in)
Wheelbase	1540 mm (60.6 in)
Track	465 mm (18.3 in)
Kerb weight	266 kg (586 lb)
Maximum weight limit	460 kg (1014 lb)

Engine

ENGINE TECHNICAL DATA

Specification	Desc./Quantity
Type	Single-cylinder, 4-stroke
Engine capacity	493 cm³
Bore x Stroke	94 x 71 mm
Compression ratio	10.5 ± 0.5 : 1
Engine idle speed	1,600 ± 100 rpm
Timing system	Four valves, single overhead camshaft, chain-driven.
Valve clearance	Inlet: 0.15 mm Outlet: 0.15 mm
MAX. power	29.5 kW at 7,250 rpm
MAX. torque	45.5 Nm at 5,250 rpm
Transmission	CVT expandable pulley variator with torque server, V-belt, self-ventilating dry automatic centrifugal clutch and transmission housing with forced-circulation air cooling.
Final reduction	with gear reduction unit in oil bath.
Lubrication	Engine lubrication with lobe pump (inside crankcase), chain-driven, with double filter: mesh and paper.

Specification	Desc./Quantity
Cooling	Forced coolant circulation system.
Electric	Electric starter
Ignition	Highly efficient electronic inductive ignition, integrated with the injection system, with variable advance, separate HV coil and double spark plug.
Ignition advance	Three-dimensional map managed by control unit
Spark plug	NGK CR7EKB
Electrode gap	0.7 ÷ 0.9 mm
Fuel system	By electronic injection with electric fuel pump.
Fuel	Unleaded petrol (95 RON)
Exhaust silencer	Absorption-type exhaust muffler with catalytic converter and lambda probe.
Emissions compliance	EURO 2

Transmission

TRANSMISSION

Specification	Desc./Quantity
TRANSMISSION	Automatic expandable pulley variator with torque server, V-belt, automatic clutch.
Final reduction	with gear reduction unit in oil bath.

Capacities

CAPACITY

Specification	Desc./Quantity
Engine oil	0.44 gal (1.7 l)
Transmission oil	15.3 in³ (250 cm³)
Cooling system fluid	~ 0.47 gal (~ 1.8 l)
Fuel tank	3.2 gal ± 0.1 (12.0 ± 0.5 l)

Electrical system

ELECTRICAL SYSTEM

Specification	Desc./Quantity
Electric	Electric starter
Ignition	Electronic, inductive, high efficiency, integrated with the injection system, with variable advance separate HV coil.
Ignition advance	Three-dimensional map managed by control unit
Spark plug	NGK CR7EKB
Alternative spark plug	-
Battery	12V-12Ah
Alternator	alternating current

Frame and suspensions

CHASSIS AND SUSPENSIONS

Specification	Desc./Quantity
Chassis	Tubular and sheet steel
Front suspension	The roll system is composed of an articulated parallelogram suspension with die-cast aluminium control arms and two side headstocks plus shock absorbers with hydraulic locking system
Front suspension travel	85 mm
Rear suspension	Two double-acting shock absorbers, adjustable to four positions at preloading.

Specification	Desc./Quantity
Rear suspension travel	110 mm

Brakes

BRAKES

Specification	Desc./Quantity
Front brake	Double disc Ø 258 with hydraulic control activated by handlebar right lever; Braking assisted by ABS system (where available).
Rear brake	Ø 240-mm disc brake with hydraulic control operated by the handlebar left-hand lever; Braking assisted by ABS system (where available).
Integral braking system	The system operates all three discs simultaneously and is controlled hydraulically via the pedal on the footrest.

Wheels and tyres

WHEELS AND TYRES

Specification	Desc./Quantity
Wheel rim type	Light alloy.
Front wheel rims	13" x 3.00"
Rear wheel rim	14" x 4.50
Front tyres	Tubeless 110/70 - 13" 48S
Rear tyre	Tubeless 140/70 - 14" 68S
Front tyres pressure	2 bar
Rear tyre pressure (with passenger)	2.4 (2.6) bar

Tightening Torques

STEERING

Name	Torque in Nm
Steering lower ring nut (central headstock)	10 - 12 Nm (7 - 9 lb*ft)
Steering upper ring nut (central headstock)	32.5 - 40 Nm (24 - 30 lb*ft)
Handlebar fixing screw	50 - 55 Nm (37 - 41 lb*ft)
Fixing screws for the control unit U-bolts to the handlebar	7 - 10 Nm (5.2 - 7 lb*ft)

FRAME

Name	Torque in Nm
Swinging arm adjuster bushing	5 - 7 Nm (3.7 - 5.2 lb*ft)
Engine arm bolt - frame arm	32.5 - 40 Nm (24 - 30 lb*ft)
Swinging arm adjuster bushing nut	54 - 60 Nm (40 - 44 lb*ft)
Engine-swinging arm bolt	98 - 118 Nm (72 - 87 lb*ft)
Frame-swinging arm bolt	54 - 60 Nm (40 - 44 lb*ft)
Centre stand bolt	31 - 39 Nm (23 - 29 lb*ft)

FRONT SUSPENSION

Name	Torque in Nm
Lower shock absorber clamp	19 - 26 Nm (14 - 19 lb*ft)
Upper shock absorber retainer	19 - 29 Nm (14 - 21 lb*ft)
Front wheel fixing screws	19 - 24 Nm (14 - 18 lb*ft)
Tilt gripper fixing screws	20 - 25 Nm (15 - 18 lb*ft)
Steering arm bolt nut	20 - 25 Nm (15 - 18 lb*ft)
Arm coupling screws	45 - 50 Nm (33 - 37 lb*ft)
Screws fixing arms to lateral headstocks	45 - 50 Nm (33 - 37 lb*ft)
Screws fixing arms to central headstock	45 - 50 Nm (33 - 37 lb*ft)
Screws fixing the half-arm coupling flange	20 - 25 Nm (15 - 18 lb*ft)
Screws fixing roll lock disc section	20 - 25 Nm (15 - 18 lb*ft)

Name	Torque in Nm
Side headstock upper ring nut	20 - 24 Nm (15 - 18 lb*ft)
Side headstock lower ring nut	12 - 15 Nm (9 - 11 lb*ft)
Screw fixing sliding stem to shock absorber	45 - 50 Nm (33 - 37 lb*ft)
Clamp for sliding stem locking device	6.5 - 10.5 Nm (4.8 - 8 lb*ft)
Fixing nuts for constant-velocity universal joints	18 - 20 Nm (13 - 15 lb*ft)
Potentiometer to anti-tilting device clamp	8 - 10 Nm (5.9 - 7 lb*ft)
Electric motor to anti-tilting device clamp	11 - 13 Nm (8 - 10 lb*ft)
Clamp fixing pump spindle to anti-tilting device	11 - 13 Nm (8 - 10 lb*ft)
Pump to anti-tilting device clamp	11 - 13 Nm (8 - 10 lb*ft)
Pressure switch to distribution frame	18 - 20 Nm (13 - 15 lb*ft)
Sensor to tilt gripper clamp	2.5 - 2.9 Nm (1.8 - 2.1 lb*ft)
Pipe terminals to fifth wheel check spring	7 - 11 Nm (5.2 - 8 lb*ft)
Joint to anti-tilting device pump	20 - 25 Nm (15 - 18 lb*ft)
Suspension lock calliper pipe fitting on side steering pipe	25 - 28 Nm (18 - 21 lb*ft)

REAR SUSPENSION

Name	Torque in Nm
Upper shock absorber retainer	33 - 41 Nm (24 - 30 lb*ft)
Lower shock absorber clamp	33 - 41 Nm (24 - 30 lb*ft)
Shock absorber-crankcase attachment bracket	20 - 27 Nm (15 - 18 lb*ft)
Rear wheel axle	104 - 126 Nm (77 - 93 lb*ft)
Silencer arm fixing screw	27 - 30 Nm (20 - 22 lb*ft)

FRONT BRAKE

Name	Torque in Nm
Calliper coupling screw	22 - 27 Nm (16 - 20 lb*ft)
Oil bleed screw	8 - 12 Nm (5.9 - 9 lb*ft)
Front brake disc screws	8 - 10 Nm (5.9 - 7 lb*ft)
Front brake pump-pipe fitting	16 - 20 Nm (12 - 15 lb*ft)
Joint pipe-calliper	20 - 25 Nm (15 - 18 lb*ft)
Screw tightening calliper to support	20 - 25 Nm (15 - 18 lb*ft)
Brake calliper pipe fitting on side steering pipe	25 - 28 Nm (18 - 21 lb*ft)

REAR BRAKE

Name	Torque in Nm
Rear brake disc screws(°)	5 - 6.5 Nm (3.7 - 4.8 lb*ft)
Rear brake calliper-pipe fitting	20 - 25 Nm (15 - 18 lb*ft)
Rigid - flexible pipe fitting	13 - 18 Nm (10 - 13 lb*ft)
Rear brake pump-pipe fitting	16 - 20 Nm (12 - 15 lb*ft)
Rear brake calliper fixing screws	41.5 - 51.5 Nm (31 - 38 lb*ft)
Parking brake - Screw tightening calliper to support (°)	24 - 27 Nm (18 - 20 lb*ft)

(°) Apply LOCTITE 243 medium-strength threadlock.

ABS SYSTEM (IF FITTED)

Name	Torque in Nm
ABS sensors tightening screws	6 - 10 Nm (4.4 - 7 lb*ft)
Screw fixing ABS control unit to support	10 - 12 Nm (7 - 9 lb*ft)
Pipe fittings - ABS control unit	13 - 18 Nm (10 - 13 lb*ft)
ABS control unit supporting bracket fixing screw	8 - 10 Nm (5.9 - 7 lb*ft)

SILENCER

Name	Torque in Nm
Silencer heat guard fixing screw	4 - 5 Nm (3 - 3.7 lb*ft)
Screw for fixing silencer to supporting arm	20 - 25 Nm (15 - 18 lb*ft)
Oxygen sensor tightening on exhaust manifold	40 - 50 Nm (30 - 37 lb*ft)
Exhaust manifold-silencer joint tightening	12 - 13 Nm (9 - 10 lb*ft)
Manifold-silencer clamp tightening	16 - 18 Nm (12 - 13 lb*ft)

LUBRICATION

Name	Torque in Nm
Oil pump cover screws	0.7 - 0.9 Nm (0.52 - 0.66 lb*ft)
Screws fixing oil pump to the crankcase	5 - 6 Nm (3.7 - 4.4 lb*ft)

HEAD-ENGINE BLOCK-PISTON ASSEMBLY

Name	Torque in Nm
Spark plug	12 - 14 Nm (9 - 10 lb*ft)
Head fixing stud bolts	7 Nm + 90° + 90° (5.2 lb*ft + 90° + 90°)
Head fixing nuts	10 - 12 Nm (7 - 9 lb*ft)
Exhaust / intake head fixing nuts	10 - 12 Nm (7 - 9 lb*ft)
Head lubrication control jet	5 - 7 Nm (3.7 - 5.2 lb*ft)
Coolant temperature sensor	10 - 12 Nm (7 - 9 lb*ft)
Lambda probe on exhaust manifold	10 - 12 Nm (7 - 9 lb*ft)
injector fixing screw	3 - 4 Nm (2.2 - 3 lb*ft)
Counterweight screw	7 - 8.5 Nm (5.2 - 6.3 lb*ft)
Tensioner pad fixing screw	10 - 14 Nm (7 - 10 lb*ft)
Speed/phase sensor fixing screw	3 - 4 Nm (2.2 - 3 lb*ft)
Valve lifter mass stop bell fixing screws	30 - 35 Nm (22 - 26 lb*ft)
Intake manifold screws	11 - 13 Nm (8 - 10 lb*ft)
Tappet cover fixing screws	7 - 9 Nm (5.2 - 6.6 lb*ft)
Throttle body fixing screws	11 - 13 Nm (8 - 10 lb*ft)
Head fixing screws	10 - 12 Nm (7 - 9 lb*ft)
Camshaft retaining bracket screws:	4 - 6 Nm (3 - 4.4 lb*ft)
Tightener screw:	5 - 6 Nm (3.7 - 4.4 lb*ft)
Tensioner fastening screws:	11 - 13 Nm (8 - 10 lb*ft)

TRANSMISSION COVER

Name	Torque in Nm
Driven pulley nut	92 - 100 Nm (68 - 74 lb*ft)
Driving pulley nut	160 - 175 Nm (118 - 129 lb*ft)
Anti-vibration roller screw	16.7 - 19.6 Nm (12 - 14 lb*ft)
M8 retainers for transmission cover	23 - 26 Nm (17 - 19 lb*ft)
M6 retainer	11 - 13 Nm (8 - 10 lb*ft)
Anti-vibration roller retainer	17 - 19 Nm (13 - 14 lb*ft)
Clutch ring nut	65 - 75 Nm (48 - 55 lb*ft)
Air duct screws	11 - 12 Nm (8 - 9 lb*ft)
Water pump cover screws	3 - 4 Nm (2.2 - 3 lb*ft)
External transmission cover screws	7 - 9 Nm (5.2 - 6.6 lb*ft)
Flywheel cover screws	11 - 13 Nm (8 - 10 lb*ft)

FLYWHEEL COVER

Name	Torque in Nm
Chain guide sliding block fastening screws	3 - 4 Nm (2.2 - 3 lb*ft)
Flywheel fixing nut	115 - 125 Nm (85 - 92 lb*ft)
Stator clamps	8 - 10 Nm (5.9 - 7 lb*ft)
Blow-by recovery duct fixing screws	3 - 4 Nm (2.2 - 3 lb*ft)
Screws fixing freewheel to flywheel	13 - 15 Nm (10 - 11 lb*ft)
Stator wiring harness guide bracket screws	3 - 4 Nm (2.2 - 3 lb*ft)
Supporting screws with bulkhead	0.3 - 0.4 Nm (0.22 - 0.30 lb*ft)
Minimum oil pressure sensor	12 - 14 Nm (9 - 10 lb*ft)
Water pump rotor	4 - 5 Nm (3 - 3.7 lb*ft)

CRANKCASE AND CRANKSHAFT

Name	Torque in Nm
Countershaft fixing nut	25 - 29 Nm (18 - 21 lb*ft)
Engine oil filter	12 - 16 Nm (9 - 12 lb*ft)
Engine oil drainage plug	24 - 30 Nm (18 - 22 lb*ft)
Engine-crankcase coupling screws	11 - 13 Nm (8 - 10 lb*ft)
Oil pump screws	5 - 6 Nm (3.7 - 4.4 lb*ft)
Gear mounting on crankshaft screws	10 - 12 Nm (7 - 9 lb*ft)
Oil pump compartment cover bulkhead screws	8 - 10 Nm (5.9 - 7 lb*ft)

COOLING

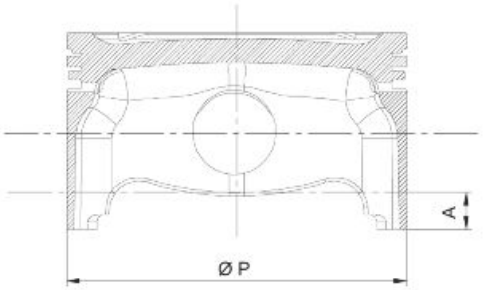
Name	Torque in Nm
Water pump rotor	4 - 5 Nm (3 - 3.7 lb*ft)
Water pump cover screws	3 - 4 Nm (2.2 - 3 lb*ft)
Thermostat cover screws	3 - 4 Nm (2.2 - 3 lb*ft)

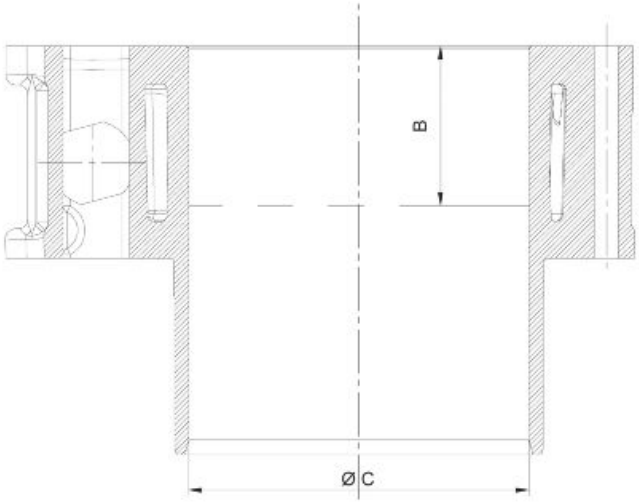
Name	Torque in Nm
Bleed screw	3 Nm (2.2 lb*ft)

Overhaul data

Assembly clearances

Cylinder - piston assy.





HEIGHT TO MEASURE THE PISTON

Specification	Desc./Quantity
A	10 mm
B	43 mm

CYLINDER - PISTON

Specification	Desc./Quantity
Cylinder diameter C	94 +0.018-0.01mm
Piston diameter P	93.968 - ±0.014 mm

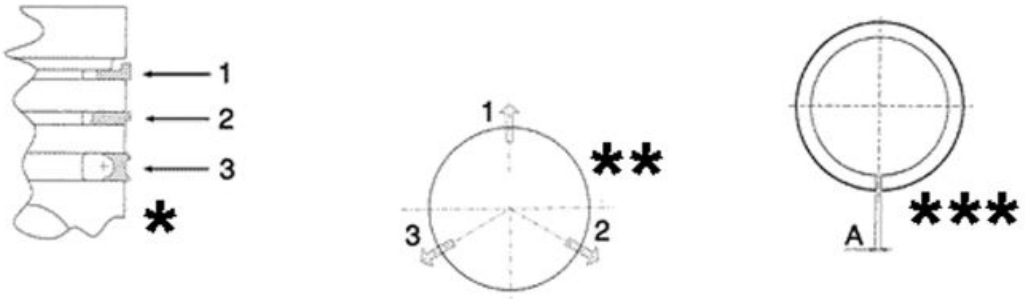
COUPLING CATEGORIES

Name	Initials	Cylinder	Piston	Play on fitting
Cylinder- Piston	A	93.990÷93.997	93.954÷93.961	0.029÷0.043
Cylinder- Piston	B	93.997÷93.004	93.961÷93.968	0.029÷0.043
Cylinder- Piston	C	94.004÷94.011	93.968÷93.975	0.029÷0.043
Cylinder- Piston	D	94.011÷94.018	93.975÷93.982	0.029÷0.043

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.

Piston rings



***** Fit piston rings «**2**» and «**3**» with the mark «**TOP**» facing up.

****** Position the opening in the rings as shown in this figure.

******* Value «**A**» of the sealing ring inside the cylinder.

Check the size of the sealing ring opening:

Compression ring: 0.15 ÷ 0.35 mm. Max. value: 0.5 mm

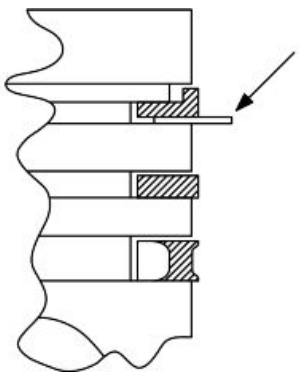
Scraper ring: 0.25 ÷ 0.50 mm. Max. value: 0.65 mm

Scraper ring: 0.25 ÷ 0.50 mm. Max. value: 0.65 mm

Rings/slots coupling clearances:

Carefully clean the sealing rings housings.

Check coupling clearances by placing a thickness gauge between the ring and the slot as shown in the figure.



Top ring: Standard coupling clearance:

0.01÷0.06 mm

Maximum clearances allowed after use: 0.10 mm

Middle ring: Standard coupling clearance:

0.02÷0.07 mm

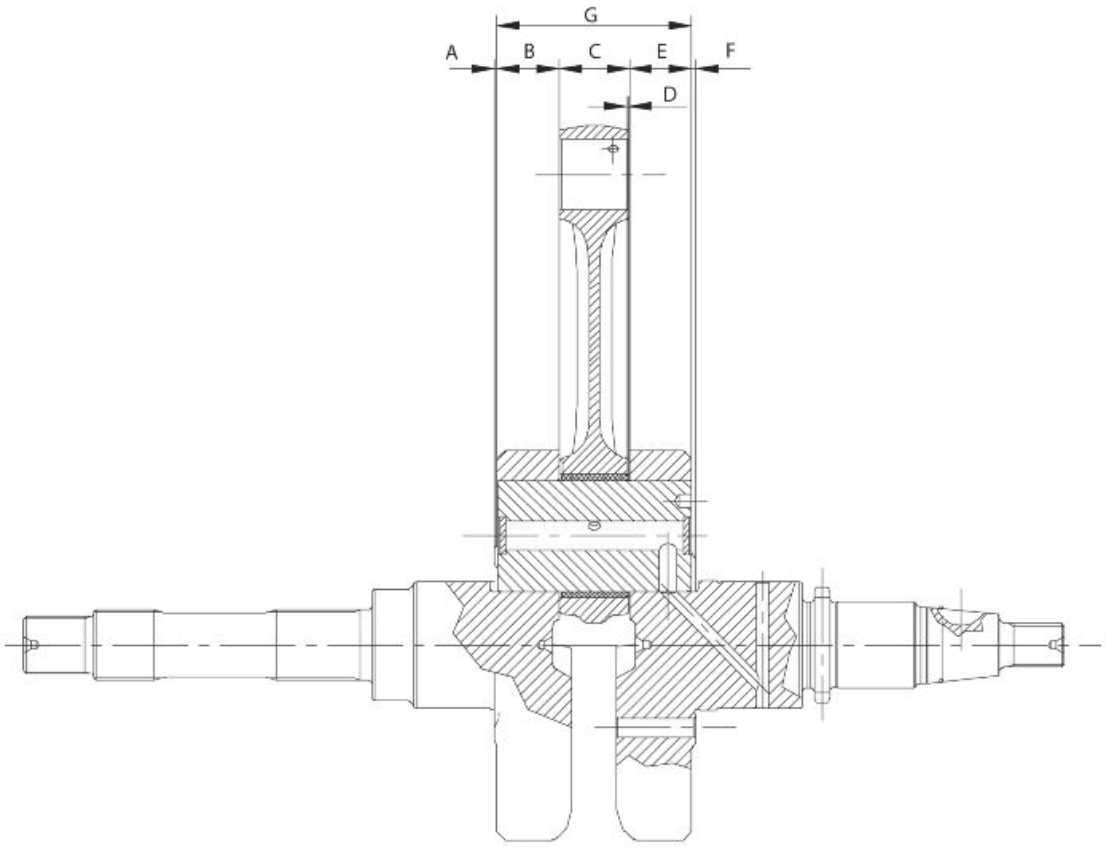
Maximum clearances allowed after use: 0.10 mm

Oil scraper ring: Standard coupling clearance: 0.01÷0.06 mm

Maximum clearances allowed after use: 0.10 mm

If clearances measured exceed the maximum values specified in the table, the piston should be replaced by a new one.

Crankcase - crankshaft - connecting rod



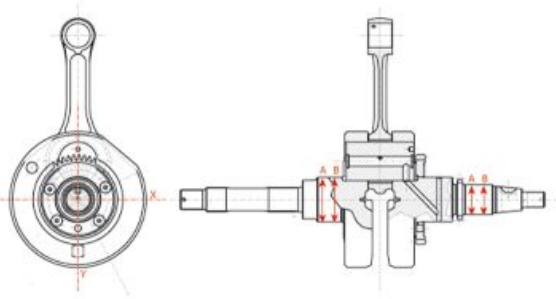
AXIAL CLEARANCE BETWEEN CRANKSHAFT AND CONNECTING ROD

Name	Description	Dimensions	Initials	Quantity
Transmission-side shoulder		1 ± 0.025	A	D = 0.20 ÷ 0.50
Half-shaft, transmission side		20.9 - 0.05	B	D = 0.20 ÷ 0.50
Connecting rod		22 0.10 - 0.15	C	D = 0.20 ÷ 0.50

Name	Description	Dimensions	Initials	Quantity
Flywheel-side shoulder		1.8 ± 0.025	F	D = 0.20 ÷ 0.50
Flywheel side half-shaft		19.6 + 0.05	E	D = 0.20 ÷ 0.50
Complete crankshaft		65.5 +0.1 -0.05	G	D = 0.20 ÷ 0.50

Diameter of crankshaft bearings.

Measure the bearings on both axes x-y.



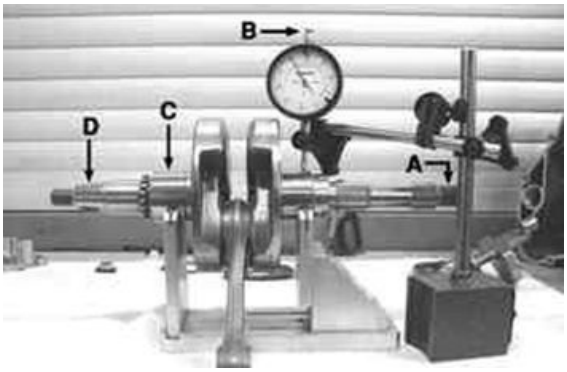
CRANKSHAFT

Specification	Desc./Quantity
Cat. 1	Standard diameter: 40.010 ÷ 40.016
Cat. 2	Standard diameter: 40.016 ÷ 40.022

Crankshaft alignment

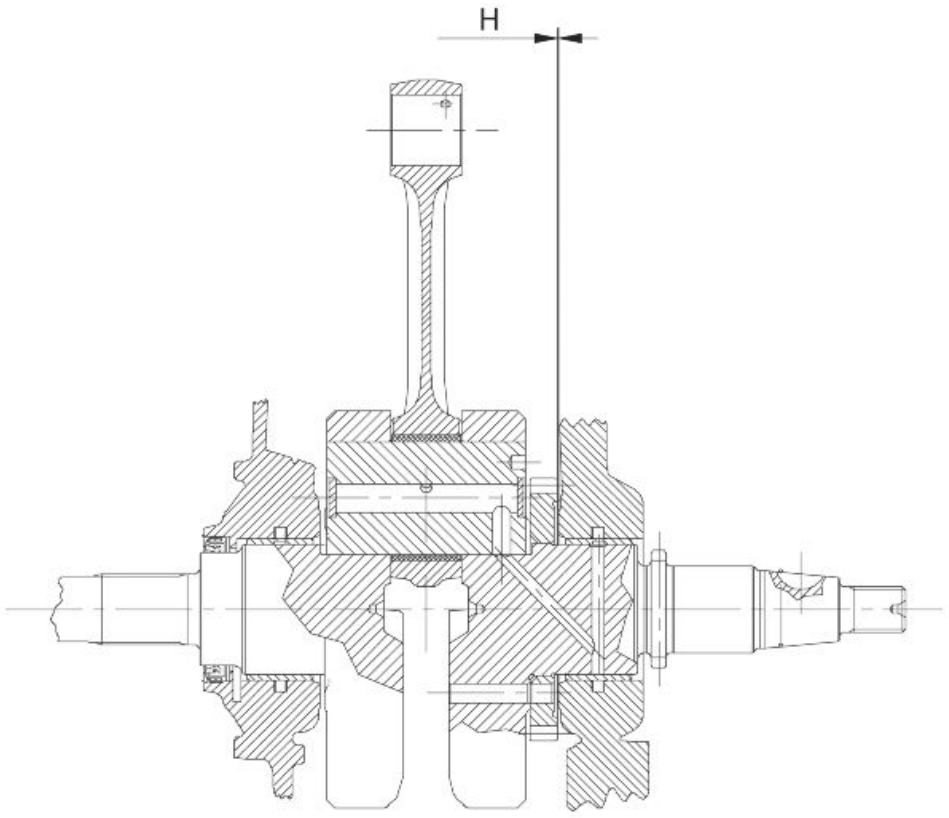
Specific tooling

020335Y Dial gauge magnetic support



MAXIMUM OFF-LINE ALLOWED

Specification	Desc./Quantity
A =	0.15 mm
B =	0.010 mm
C =	0.010 mm
D =	0.10 mm



Characteristic

Crankshaft-crankcase axial clearance (H)

0.1 ÷ 0.405 mm (when cold)

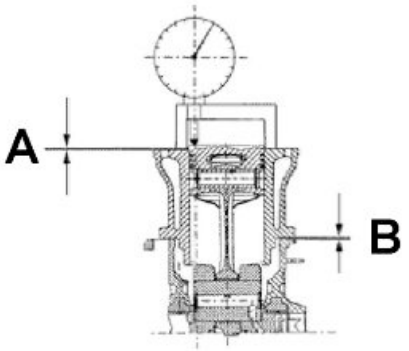
Compression ratio

10.5: 1

Slot packing system

Shimming system to control compression ratio

MEASUREMENT «A» IS A PROTRUSION OR RECESS VALUE OF THE PISTON CROWN COMPARED WITH THE CYLINDER PLANE.
MEASUREMENT «A» ALLOWS TO DETERMINE THE THICKNESS OF THE GASKET «B» THAT HAS TO BE FITTED INTO THE CYLINDER BASE IN ORDER TO RESTORE THE COMPRESSION RATIO. THE MORE THE PLANE FORMED BY THE PISTON CROWN PROTRUDES BEYOND THE PLANE FORMED BY THE CYLINDER UPPER END, THE THICKER THE GASKET TO BE USED AT THE CYLINDER BASE «B» SHOULD BE. ON THE OTHER HAND, THE MORE THE PISTON CROWN IS RECESSED INTO THE CYLINDER TOP PLANE, THE SMALLER THE GASKET THICKNESS.



Characteristic

Compression ratio

10.5: 1

BASE GASKET THICKNESS

Name	Measure A	Thickness
MEASURE TAKEN «A»	- 0.185 ÷ - 0.10	0.4 ± 0.05
MEASURE TAKEN «A»	- 0.10 ÷ + 0.10	0.6 ± 0.05
MEASURE TAKEN «A»	+ 0.10 ÷ + 0.185	0.8 ± 0.05

N.B.

VALUES INDICATED WITH «-» REFER TO RECESSES OF THE PISTON CROWN FROM THE CYLINDER PLANE.

N.B.

SIZE «A» MUST BE MEASURED WITHOUT ANY GASKET FITTED AT «B»

Products

RECOMMENDED PRODUCTS TABLE

Product	Description	Specifications
AGIP GEAR SAE 80W-90	Lubricant for gearboxes and transmissions.	API GL-4
eni i-Ride PG 5W-40	Synthetic based lubricant for high-performance four-stroke engines.	JASO MA, MA2 - API SL - ACEA A3
AGIP FILTER OIL	Special product for the treatment of foam filters.	-
AGIP GP 330	Water repellent stringy calcium spray grease.	R.I.D./A.D.R. 2 10°b) 2 R.I.Na. 2.42 - I.A.T.A. 2 - I.M.D.G. class 2 UN 1950 Page 9022 EM 25-89
AGIP BRAKE 4	Brake fluid.	SAE J 1703 -FMVSS 116 - DOT 3/4 - ISO 4925 - CUNA NC 956 DOT 4 synthetic fluid
AGIP PERMANENT SPECIAL	Ethylene glycol-based antifreeze fluid with organic inhibition additives. Red, ready to use.	ASTM D 3306 - ASTM D 4656 - ASTM D 4985 - CUNA NC 956-16

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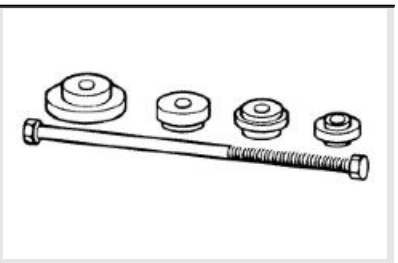
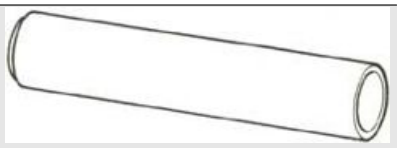
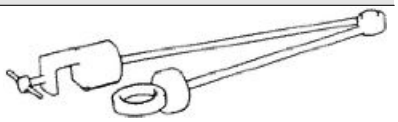
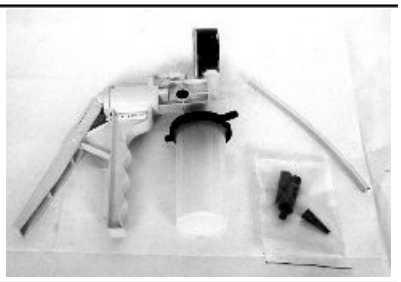
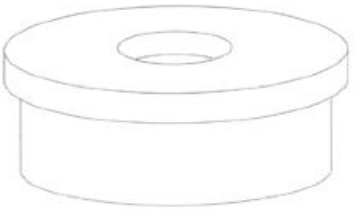
SPECIFIC TOOLS

Stores code	Description	
001330Y	Tool for fitting steering seats	
001467Y002	Driver for OD 73 mm bearing	
001467Y006	Pliers to extract 20 mm bearings	
001467Y007	Bell for OD 54-mm bearings	
001467Y008	Calliper to extract 17-mm diameter bearings	
001467Y014	Calliper to extract 15-mm diameter bearings	

Stores code	Description	
001467Y031	Bell	
001467Y034	Calliper to extract 15-mm diameter bearings	
001467Y035	Bell for 47-mm outside diameter bearings	
002465Y	Calliper for circlips	
006029Y	Punch for fitting steering bearing seat on steering tube	
020004Y	Punch to remove steering bearings from headstock	

Stores code	Description	
020055Y	Wrench for steering tube ring nut	
020150Y	Air heater support	
020151Y	Air heater	
020193Y	Gauge for oil pressure check	
020201Y	Spacer bushing driving tube	
020262Y	Crankcase splitting strip	
020306Y	Punch for fitting the valve seal rings	

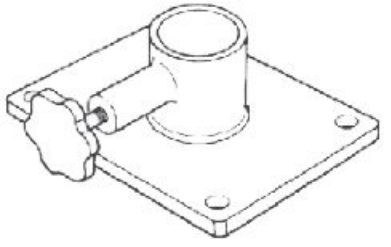
Stores code	Description	
020329Y	Vacuum pump Mity-Vac	
020330Y	Stroboscopic light for timing checking	
020331Y	Digital multimeter	
020648Y	Single battery charger	
020335Y	Dial gauge magnetic support	
020357Y	32 x 35 mm adaptor	
020358Y	37 x 40 mm adaptor	

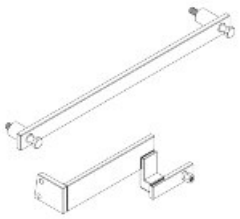
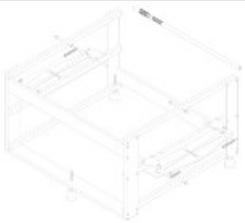
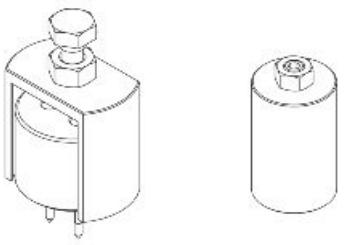
Stores code	Description	
020359Y	42 x 47-mm adaptor	
020360Y	52 x 55-mm adaptor	
020364Y	25-mm Guide	
020376Y	Adapter handle	
020382Y012	bush (valve removing tool)	
020412Y	15 mm guide	
020424Y	Punch for fitting driven pulley roller casing	

Stores code	Description	
020431Y	Valve oil seal extractor	
020434Y	Fitting for oil pressure check	
020439Y	17 mm guide	
020444Y	Tool for fitting/removing the clutch on the driven pulley	
020456Y	Ø24 mm adaptor	

Stores code	Description	
020458Y	Puller for lower bearing on steering tube	
020459Y	Punch for fitting bearing on steering tube	
020922Y	Diagnosis Tool	
020467Y	Flywheel extractor	
020468Y	Piston fitting ring	
020470Y	Pin snap ring fitting tool	

Stores code	Description	
020471Y	Pin for countershaft timing	
020472Y	Flywheel lock wrench	
020474Y	Driving pulley lock wrench	
020475Y	Piston position checking tool	
020476Y	Stud bolt set	
020478Y	Punch for roller casing	

Stores code	Description	
020479Y	Countershaft lock wrench	
020480Y	Fuel pressure check set	
020482Y	Engine support	
020483Y	30 mm guide	
020512Y	Piston fitting fork	
020527Y	Engine support base	
020604Y011	Fitting adapter	

Stores code	Description	
020565Y	Flywheel lock calliper spanner	
020481Y004	Parking control unit interface wiring	
020646Y	Parallelogram and steering positioning tool	
020647Y	Toe-in checking tool	
020647Y028	MP3 LT Toe-in tool (tricycle)	
020661Y	Water pump overall seal replacement kit	

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N.B.

THE UNITS OF MEASUREMENT CONTAINED IN THIS CHAPTER ARE EXPRESSED IN TERMS OF THE DECIMAL METRIC SYSTEM. TO REFER TO THE UNIT OF MEASUREMENT EXPRESSED IN TERMS OF THE ANGLO-SAXON SYSTEM, SEE THE «CHARACTERISTICS» CHAPTER.

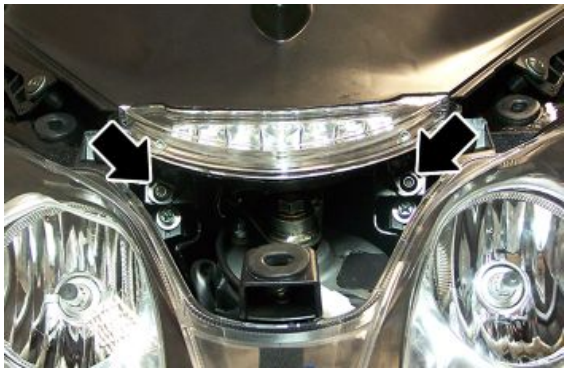
SERVICE ICON RESET

When switching to «**ON**», immediately after the ignition check, if there are less than 300 km (187.5 miles) to the next scheduled service, the corresponding icon flashes for 5 seconds. Once the service mileage has been reached, the icon remains steadily on until it is reset. The icon reset is carried out by pressing the button «**SET**» for more than 10 seconds when switching to «**ON**»: the icon with the key, after the ignition check, must flash with a frequency of 1 Hz and then turn off after 10 seconds to indicate the performed reset. If the button is released before the 10 seconds, the icon is not reset.

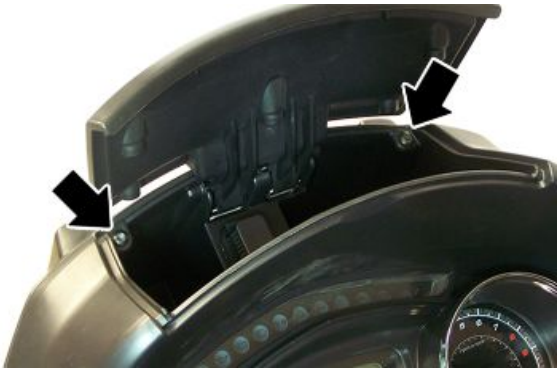
ADJUSTMENT PROCEDURE OF THE RING NUTS OF THE SIDE HEADSTOCKS

- Remove the windshield.
- Remove the central cover fixed to the joints on the legshield.

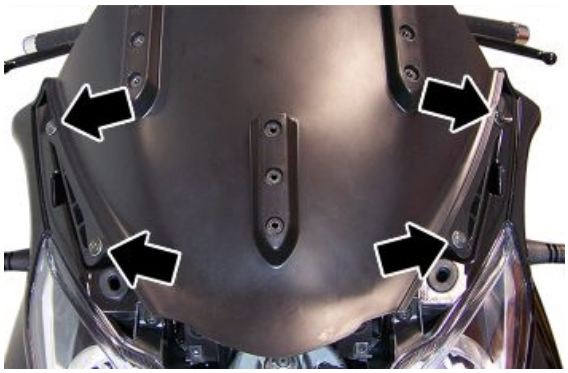
- Remove the two indicated daylight running light fixing screws.
- Remove the daylight running light by disconnecting the connector.



- Remove the two screws located inside the glove-box on the dashboard.



- Remove the four screws indicated and recover the related spacers.



- Undo the two screws indicated, then remove the spoiler.

- Remove the two headlight upper fixing screws.

- Remove the Piaggio clip-on badge, fixed to the joint, by acting on the indicated slot.

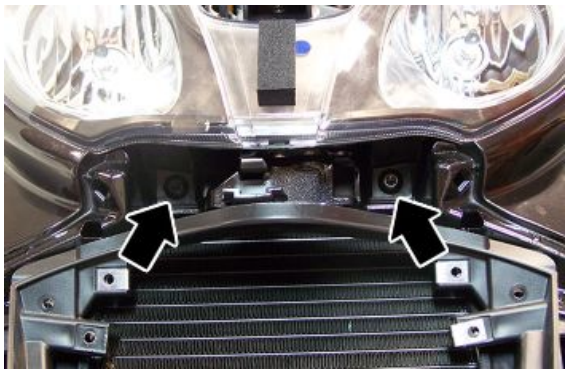
- Remove the indicated screw and remove the radiator grille frame.

- Unscrew the four indicated screws and remove the radiator grille.

- Working on both sides of the vehicle, remove the two screws in the wheel housing.

- Unscrew the four indicated screws and remove the front radiator cover.

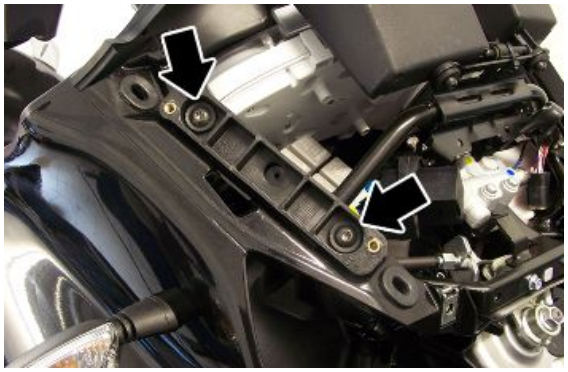
- Remove the two lower fastening screws.



- Disconnect the connector and remove the head-light.

- Undo the four indicated screws on the leg shield back plate.

- Working on both sides of the vehicle, unscrew the two indicated screws and remove the spoiler support plastic.



- Remove the two indicated screws from both sides of the vehicle, located inside the wheel housing.
- Detach the shield from the vehicle, complete with side bumpers and turn indicators and disconnect the connectors of the turn indicators.

WARNING

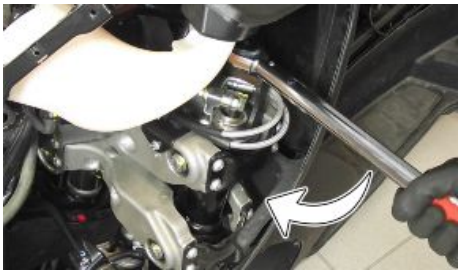
DURING THE REFITTING, PAY PARTICULAR ATTENTION TO THE CORRECT POSITION OF THE TWO SPOILER SUPPORT PLASTICS, REFERRING TO THE INDICATIONS ON THE PLASTIC.

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

Unscrew 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.



Locking torques (N*m)

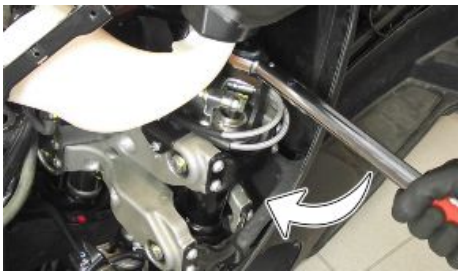
Side headstock lower ring nut **12 - 15**

Screw the upper ring nut until it stops

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

Specified torque: 20 to 24 Nm.

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



Specific tooling

020892y Steering side headstock ring nut key

Locking torques (N*m)

Side headstock upper ring nut **20 to 24**

Maintenance chart

SCHEDULED MAINTENANCE TABLE

***I**: CHECK AND CLEAN, ADJUST, LUBRICATE OR REPLACE IF NECESSARY.*
***C**: CLEAN, **R**: REPLACE, **A**: ADJUST, **L**: LUBRICATE*
** Replace every 2 years*

Km x 1,000	1	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80
Safety fasteners	I		I				I				I				I		
Throttle control	A		A		A		A		A		A		A		A		A
Engine oil filter	R		R		R		R		R		R		R		R		R
Electrical system	I		I		I		I		I		I		I		I		I
Coolant level *	I		I		I		I		I		I		I		I		I
Brake oil level*	I		I		I		I		I		I		I		I		I
Engine oil	R	I	R	I	R	I	R	I	R	I	R	I	R	I	R	I	R
Brake pads	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Tyre pressure and wear	I		I		I		I		I		I		I		I		I
Vehicle and brake test - test drive	I		I		I		I		I		I		I		I		I
Hub oil	R		I		R		I		R		I		R		I		R
Centre and side steering	A		A		A		A		A		A		A		A		A
Parking control unit software upgrading (if available)	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Centre stand		L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Drive belt			R		R		R		R		R		R		R		R
Air filter			C		I		C		I		C		I		C		I

Km x 1,000	1	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80
Sliding shoes / CVT rollers			R		R		R		R		R		R		R		R
Suspension			I		I		I		I		I		I		I		I
Spark plugs			R		R		R		R		R		R		R		R
Roll lock calliper control cable			A		A		A		A		A		A		A		A
Valve clearance					I				I				I				I
Operation time	105'	10'	190'	10'	220'	10'	190'	10'	220'	10'	190'	10'	220'	10'	190'	10'	220'

Versions for market USA-CND

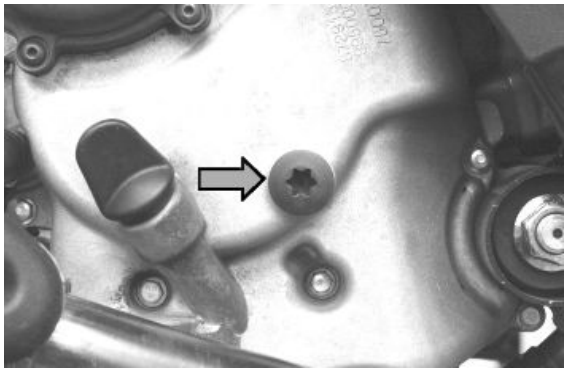
SCHEDULED MAINTENANCE TABLE

***I**: CHECK AND CLEAN, ADJUST, LUBRICATE OR REPLACE IF NECESSARY.*
***C**: CLEAN, **R**: REPLACE, **A**: ADJUST, **L**: LUBRICATE*
** Replace every 2 years*

km x 1,000 (mi x 1000)	1 (0.6)	5 (3.1)	10 (6.2)	15 (9.3)	20 (12.4)	25 (15.5)	30 (18.6)	35 (21.7)	40 (24.9)	45 (28.0)	50 (31.1)	55 (34.2)	60 (37.3)	65 (40.4)	70 (43.5)	75 (46.6)	80 (49.7)
Safety fasteners	I		I				I				I				I		
Throttle control	A		A		A		A		A		A		A		A		A
Engine oil filter	R		R		R		R		R		R		R		R		R
Electrical system	I		I		I		I		I		I		I		I		I
Coolant level *	I		I		I		I		I		I		I		I		I
Brake oil level*	I		I		I		I		I		I		I		I		I
Engine oil	R	I	R	I	R	I	R	I	R	I	R	I	R	I	R	I	R
Brake pads	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Tyre pressure and wear	I		I		I		I		I		I		I		I		I
Vehicle and brake test - test drive	I		I		I		I		I		I		I		I		I
Hub oil	R		I		R		I		R		I		R		I		R
Centre and side steering	A		A		A		A		A		A		A		A		A
Parking control unit software upgrading (if available)	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
Centre stand		L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
Drive belt			R		R		R		R		R		R		R		R
Air filter			C		I		C		I		C		I		C		I
Sliding shoes / CVT rollers			R		R		R		R		R		R		R		R
Suspension			I		I		I		I		I		I		I		I
Spark plugs			R		R		R		R		R		R		R		R
Roll lock calliper control cable			A		A		A		A		A		A		A		A
Valve clearance					I				I				I				I
Operation time	105'	10'	190'	10'	220'	10'	190'	10'	220'	10'	190'	10'	220'	10'	190'	10'	220'

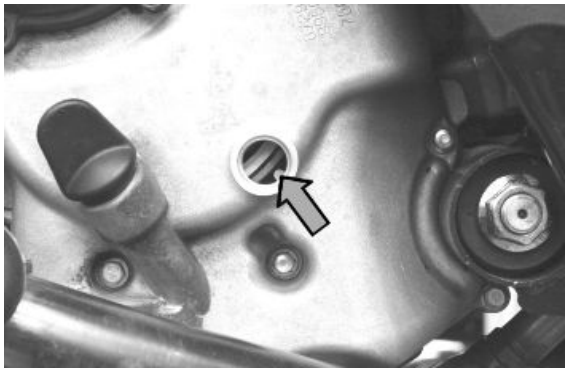
Checking the spark advance

The ignition advance is electronically determined based on the parameters known by the control unit. This is why it is not possible to measure the reference values based on the engine rpm. The ignition advance value is detectable at any time using the diagnostic tester. It is possible to check whether the ignition advance determined by the injection system matches the value actually activated on the engine, by means of the stroboscopic light.



Proceed as follows:

- Remove the spark plugs.
- Remove the transmission crankcase.
- Rotate the driving pulley fan until the reference marks between the flywheel and flywheel cover meet as shown in the photograph.



- Bring the reference mark onto the transmission side between the fan and the transmission cover as shown in the photograph.

- Refit the spark plugs.
- Refit the plastic cap on the flywheel cover.
- Adjust the spark gap to the contact position (no reference mark visible) and install it on the engine between the spark plugs and spark plug caps.
- Connect the induction clamp to the spark gap cable respecting the proper polarity (the arrow on the clamp must be pointing at the spark plug).

- Connect the diagnostic tool.
- Start the engine.
- On the diagnostic tool, select the function «**PARAMETERS**».
- Set the stroboscopic light control to the traditional four-stroke engine position (1 spark, 2 revs).
- Check that the real values of rpm and ignition advance match those measured using the diagnostic tool.

If the values do not correspond, check:

- distribution timing
- rpm timing sensor
- injection control unit

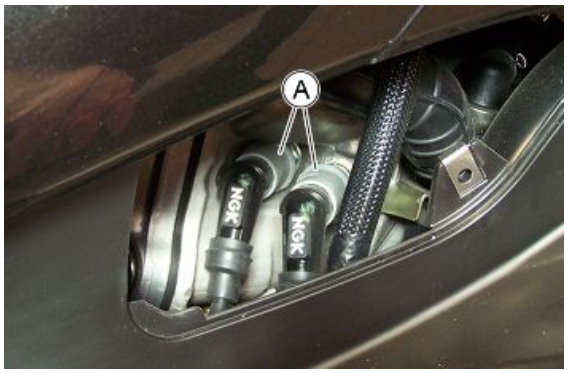
Specific tooling

020922Y Diagnosis Tool

020330Y Stroboscopic light for timing checking

020621Y HV cable extraction adaptor

Spark plug



Remove the port on the left-hand side panel of the vehicle by undoing the fixing screw and using a small screwdriver in the rear recess shown in the figure, then do the following:

- Disconnect the HV wire caps «**A**» of the spark plugs;

- Unscrew the spark plugs using the wrench supplied;

- Upon refitting, place the spark plugs at the required angle and tighten by hand until it is finger tight;

- Use the wrench only for final tightening of the spark plug;

- Place cap «**A**» fully over the spark plugs

- Refit the port making sure the rear hook is inserted.

WARNING

THE SPARK PLUG MUST BE REMOVED WHEN THE ENGINE IS COLD. REPLACE THE SPARK PLUG AS INDICATED 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 SHIELDLESS SPARK PLUG CAPS CAN CAUSE ELECTRICAL SYSTEM FAILURES.

Characteristic

Spark plug

NGK CR7EKB

Electric characteristic

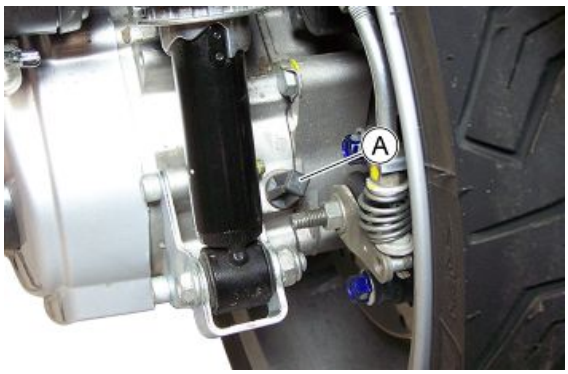
Electrode gap

0.7 - 0.8 mm

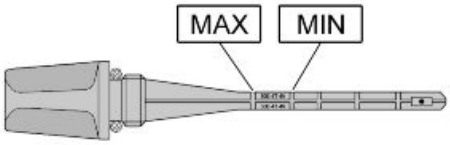
Hub oil

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**.

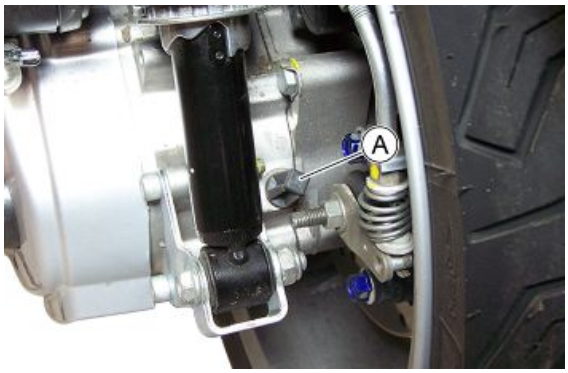


- Extract the dipstick checking that the oil level is between the **MAX** and **MIN** index marks; if the level is below the **MIN** mark, it needs to be filled up with the right amount of hub oil.
-Screw up the oil dipstick again and make sure it is locked properly into place.



Replacement

- Remove the oil filler plug «**A**».
- Unscrew the oil drainage cap «**B**» and drain out all the oil.
- Screw in the drainage cap again and fill the hub with the prescribed oil.



Recommended products

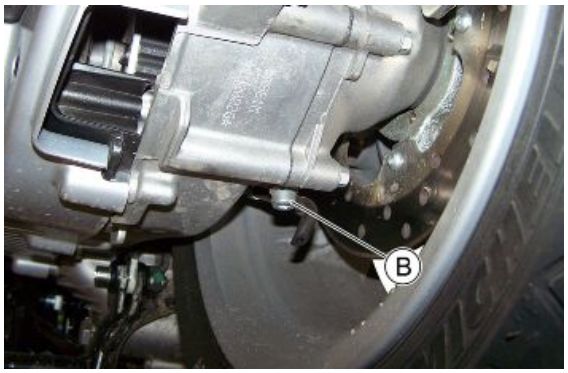
AGIP GEAR SAE 80W-90 Lubricant for gear-boxes and transmissions.

API GL-4

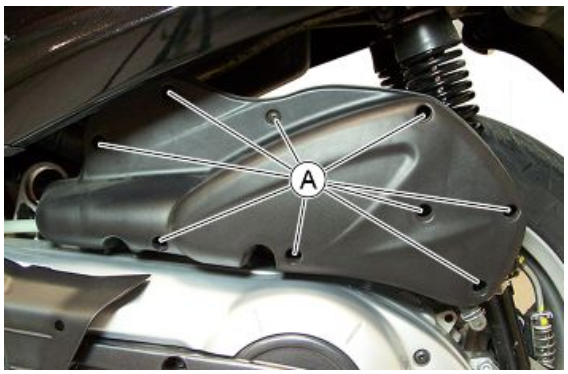
Characteristic

Rear hub oil

Capacity approximately 250 cc



Air filter



- Unscrew the nine fixing screws «**A**» and remove the air filter cover.
- Wash the sponge with water and mild soap.
- Dry it with a clean cloth and short blasts of compressed air.
- Gently squeeze the filtering element with your hands but do not wring it; allow it to drip dry and then refit.

CAUTION

IF THE VEHICLE IS USED ON DUSTY ROADS IT IS NECESSARY TO CARRY OUT MAINTENANCE CHECKS OF THE AIR FILTER MORE OFTEN TO AVOID DAMAGING THE ENGINE.

Recommended products

AGIP FILTER OIL Special product for the treatment of foam filters.

-

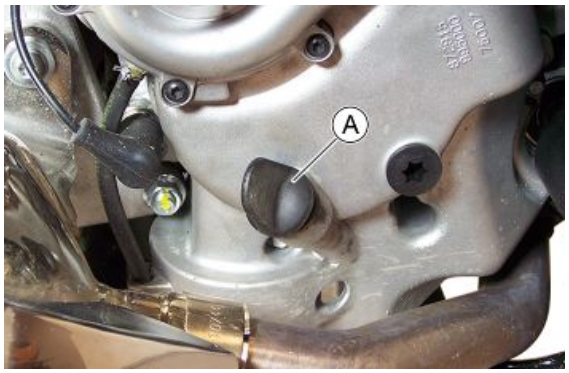
Engine oil

In four stroke engines, the engine oil is used to lubricate the timing elements, the bench bearings and the thermal group. **An insufficient quantity of oil can cause serious damage to 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".

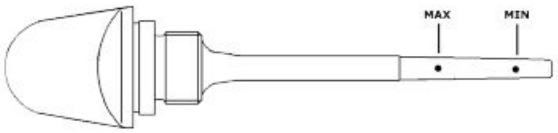
Replacement

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 but never exceeding the **MAX** level reference mark.
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.



N.B.

THE ENGINE MUST BE HOT WHEN THE OIL IS CHANGED.

Recommended products

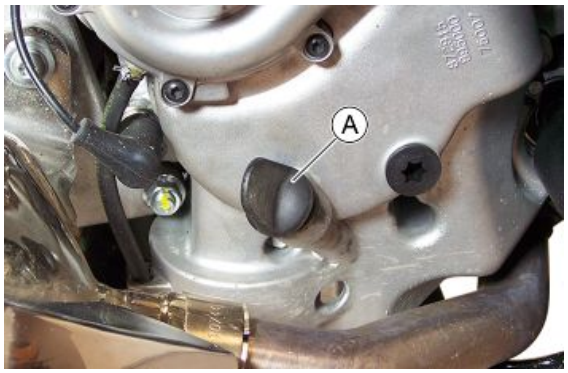
eni i-Ride PG 5W-40 Synthetic based lubricant for high-performance four-stroke engines.

JASO MA, MA2 - API SL - ACEA A3

Locking torques (N*m)

Engine oil filter **12 - 16** **Engine oil drainage plug** **24 to 30**

Check

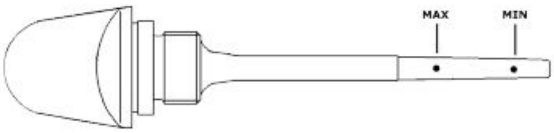


This operation must be carried out with the engine cold and following the procedure below:

- 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**.
- Remove the cap/dipstick again and check that the level is between the min and max reference 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 in any case by adding oil **without ever exceeding the MAX. level**.

Restoring the level from the **MIN** to the **MAX** marks requires approx. **400 m³** of oil.

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.

Recommended products

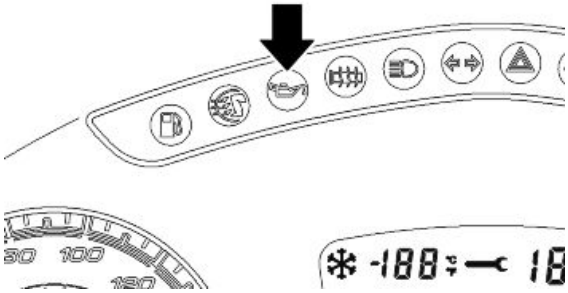
eni i-Ride PG 5W-40 Synthetic based lubricant for high-performance four-stroke engines.

JASO MA, MA2 - API SL - ACEA A3

Oil pressure warning light

The vehicle is equipped with a telltale light on the dashboard that lights up when the key is turned to the «**ON**» position. However, this light should switch 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.

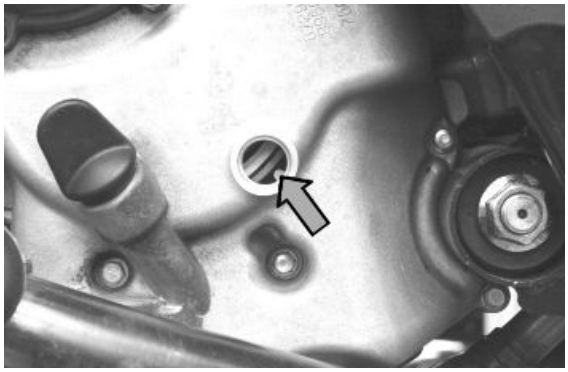


Checking the ignition timing

- Remove the plastic cap on the flywheel cover

-Turn the flywheel until the reference mark «**T**» on the rotor matches the reference mark on the flywheel cover as shown in the figure (TDC). Make sure that the 4V reference point on the camshaft control pulley is aligned with the reference point on the head as shown in the second figure. If the reference is opposite the indicator on the head, turn the crankshaft once more.

For the use of this reference mark, remove the spark plug and turn the engine in the direction that is the reverse of the normal direction using a calliper spanner applied to the camshaft command pulley casing.

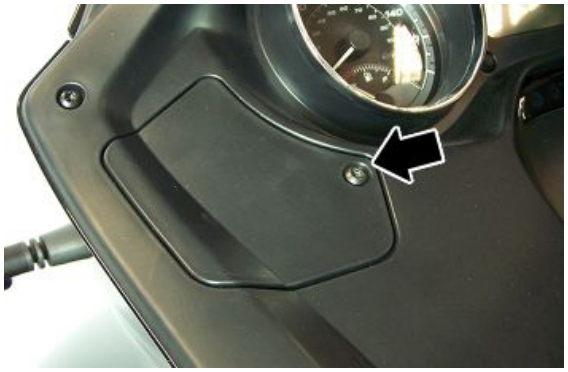


Cooling system

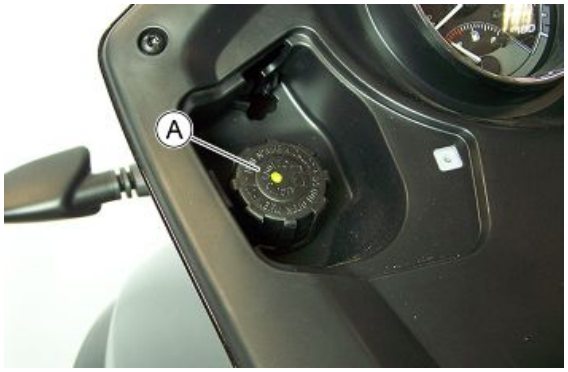
Check coolant level when the engine is cold as indicated in the scheduled maintenance table, following the steps below:

Place the vehicle on its centre stand and on flat ground.

- Unscrew the screw shown in the figure and remove the expansion tank cover.



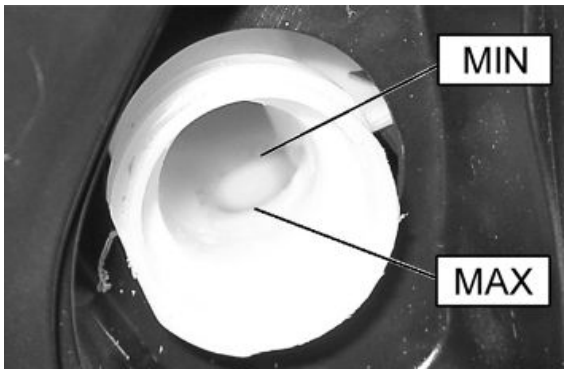
- Top up if the coolant level by undoing the plug «**A**», if the coolant level is near or below the level edge **MIN**. The coolant level should always be between the **MIN** and **MAX** levels.



-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

AGIP PERMANENT SPEZIAL Ethylene glycol-based antifreeze fluid with organic inhibition additives. Red, ready to use.

ASTM D 3306 - ASTM D 4656 - ASTM D 4985 - CUNA NC 956-16

Braking system

Level check

FRONT AND REAR BRAKING SYSTEM LEVEL CHECK

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

- Rest the vehicle onto the 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.
- A drop in the brake fluid level may be caused by pad wear.

Top-up

FRONT AND REAR BRAKING SYSTEM TOP-PING 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 VERY CORROSIVE; MAKE SURE THAT IT DOES NOT COME INTO CONTACT WITH THE PAINT-WORK.

CAUTION

MAKE SURE THE BRAKE FLUID DOES NOT GET INTO YOUR EYES OR ON YOUR SKIN OR CLOTHES. IF THIS HAPPENS ACCIDENTALLY, WASH WITH WATER.

Recommended products

AGIP BRAKE 4 Brake fluid.

SAE J 1703 -FMVSS 116 - DOT 3/4 - ISO 4925 - CUNA NC 956 DOT 4 synthetic fluid

INTEGRAL BRAKING SYSTEM LEVEL TOP-PING 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.

CAUTION

AIR INSIDE THE INTEGRAL CIRCUIT IS SPECIALLY DANGEROUS: THIS SPECIFIC BRAKING SYSTEM CAN PUMP AIR INTO THE REAR AND/OR FRONT CIRCUITS THUS COMPROMISING THE CORRECT OPERATION OF EACH SYSTEM WHEN USED INDIVIDUALLY.

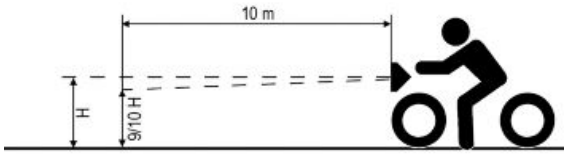
Recommended products

AGIP BRAKE 4 Brake fluid.

SAE J 1703 -FMVSS 116 - DOT 3/4 - ISO 4925 - CUNA NC 956 DOT 4 synthetic fluid

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 scooter axis is perpendicular to the screen;
- Remove the headlight assembly central cover.
- Turn on the headlight and check that the border of the projected light beam on the screen is not higher than 9/10 or lower than 7/10 f the height from the ground to the centre of vehicle headlamp;
- Otherwise, adjust the headlight with the screws « **A**» indicated in the figure

N.B.

THE ABOVE PROCEDURE COMPLIES WITH THE EUROPEAN STANDARDS REGARDING MAXIMUM AND MINIMUM HEIGHT OF LIGHT BEAMS. REFER TO THE STATUTORY REGULATIONS IN FORCE IN EVERY COUNTRY WHERE THE VEHICLE IS USED.

Anti-evaporation system

Removing system components

To access the canister system components:

- Open the saddle.
- Undo the fixing screws of the system components cover.

- Remove the components from their seat acting on the rubber supports.

Refitting system components

To refit, proceed in reverse order, taking care to use new metal clamps to fix the pipes.

Canister inspection

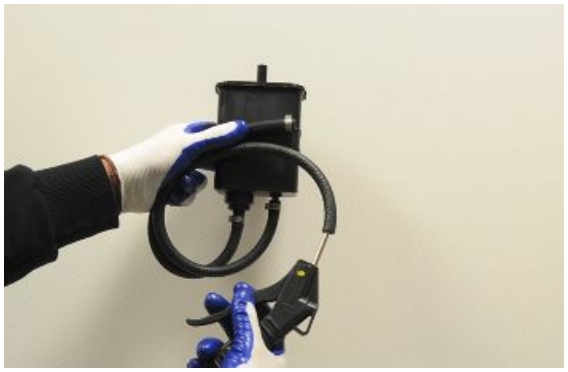
The canister is essential to treat the hydrocarbons present in the volume of gas that escapes from the tank when there is an increase in internal pressure (tank heating induced by the cooling radiator, by the motor or by the external environment).

The volume of air is limited by the operation of the ventilation valve (Roll-over).

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.

Safety valve check

The cleaning of the canister is achieved via a controlled flow of air from the vacuum socket in the intake manifold.

To ensure that the engine works properly, it is necessary that the flow of air is not too intense, this is achieved by means of a restricted section 0.0354in (0.9 mm) formed in the socket on the intake manifold.

The relative connecting pipe with the canister, includes the installation of the safety valve.

This is a one-way valve which ensures the passage of air in the direction of the manifold when the control vacuum is greater than 2.9PSI (20kPa) (200mbar).

The vacuum of the engine at idle, causes a slight flow of air easily compensated by the idle speed adjustment parameters.

When the vehicle is stopped, the safety valve will be closed due to the lack of control vacuum therefore, any expansion of the fuel tank, will not cause pollution of the intake manifold, and then cause flooding of the engine.

To control the valve, it is preferable to it, alternatively just access the manifold side pipe.

- Connect the MITY-VAC pump on the engine side duct.
- Select the pump command on the "vacuum" position, then slowly apply vacuum up to the valve threshold check opening.

If you detect different pressures, replace the valve.

Note: An opening vacuum that is too high, causes a lack of regeneration of the activated carbon; vice versa, an opening vacuum that is too low, increases the flow of air to the engine causing the thinning of idle.

Characteristic

Standard opening vacuum

(2.90-3.77)PSI (20-26)kPa (200-260)mbar

Roll-over valve check

The valve must enable the following results:

- Aeration of the tank while riding (the ambient air enters the tank in relation to the volume of fuel used).
- Pressurisation of the tank (while riding or during a break, you may experience increases in the temperature inside the tank. The valve must pressurize the tank to limit the escape of fuel vapour to the canister).
- Prevent pollution of the canister with the liquid fuel (in case of fall of the vehicle, the valve must block the connection with the canister).

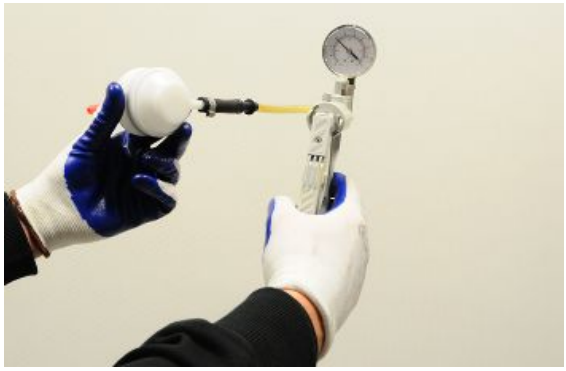
To control the valve, it is necessary to remove it from the vehicle.

For the check, it is planned to use a MITY-VAC pump and a piece of tube, then proceed as follows:

- Connect the MITY-VAC pump to the lower joint of the safety valve (white).
- Select the "vacuum" control position and keeping the valve in the vertical axis, check that it is possible to intake

air without movements of the gauge needle.

- Switch the control of the pump to "pressure" and, keeping the valve in the vertical axis, check that it is possible to pressurise the valve up to values slightly below 1.45PSI(~0.87PSI) 10kPa(~6kPa) 100mbar(~60mbar).



Note: The setting pressure is easily recognisable in that, when it is reached, the valve discharges the air emitting a little noise.

- Position the valve in the horizontal axis and check that you can pressurise it to values well above the setting pressure (eg. 7.25PSI (50 kPa) (0.5bar) without guaranteeing the maintenance).

If you detect abnormal behaviour, replace the valve.

Note: Any malfunction of the valve can cause deformation of the fuel tank or aggravate the working conditions of the canister.

INDEX OF TOPICS

This section makes it possible to find what solutions to apply when troubleshooting.

For each failure, a list of the possible causes and pertaining operations is given.

Engine

Excessive oil consumption/Exhaust smoke

EXCESSIVE CONSUMPTION

Possible Cause	Operation
Wrong valve adjustment	Adjust the valve clearance properly
Overheated valves	Remove the head and the valves, grind or replace the valves
Misshapen/worn valve seats	Replace the head unit
Worn cylinder, Worn or broken piston rings	Replace the piston cylinder assembly or piston rings
Worn or broken piston rings or piston rings that have not been fitted properly	Replace the piston cylinder unit or just the piston rings
Oil leaks from the couplings or from the gaskets	Check and replace the gaskets or restore the coupling seal
Worn valve oil seal	Replace the valve oil seal
Worn valve guides	Check and replace the head unit if required

Insufficient lubrication pressure

POOR LUBRICATION PRESSURE

Possible Cause	Operation
By-Pass remains open	Check the By-Pass and replace if required. Carefully clean the By-Pass area.
Oil pump with excessive clearance	Perform the dimensional checks on the oil pump components
Oil filter too dirty	Replace the cartridge filter
Oil level too low	Restore the level adding the recommended oil type

Transmission and brakes

Clutch grabbing or performing inadequately

IRREGULAR CLUTCH PERFORMANCE OR SLIPPAGE

Possible Cause	Operation
Faulty clutch	Check that there is no grease on the masses. Check that the clutch mass faying surface with the bell is mainly in the centre with equivalent characteristics on the three masses. Check that the clutch housing is not scored or worn in an anomalous way

Insufficient braking

INEFFICIENT BRAKING SYSTEM

Possible Cause	Operation
Inefficient braking system	Check the pad wear (1.5 min). Check that the brake discs are not worn, scored or warped. Check the correct level of fluid in the pumps and replace brake fluid if necessary. Check there is no air in the circuits; if necessary, bleed the air. Check that the front brake calliper moves in axis with the disc.
Fluid leakage in hydraulic braking system	Failing elastic fittings, plunger or brake pump seals, replace

Possible Cause	Operation
Brake disc slack or distorted	Check the brake disc screws are locked; measure the axial shift of the disc with a dial gauge and with wheel mounted on the vehicle.

Brakes overheating

BRAKE OVERHEAT

Possible Cause	Operation
Defective plunger sliding	Check calliper and replace any damaged part.
Brake disc slack or distorted	Check the brake disc screws are locked; use a dial gauge and a wheel mounted on the vehicle to measure the axial shift of the disc.
Clogged compensation holes on the pump	Clean carefully and blast with compressed air.
Swollen or stuck rubber gaskets	Replace gaskets.

Steering and suspensions

Heavy steering

STEERING HARDENING

Possible Cause	Operation
Steering hardening	Check the tightening of the top and bottom ring nuts. If irregularities continue in turning the steering even after making the above adjustments, check the seats in which the ball bearings rotate: replace them if they are recessed or if the balls are flattened.

Excessive steering play

EXCESSIVE STEERING CLEARANCE

Possible Cause	Operation
Torque not conforming	Check the tightening of the top and bottom ring nuts. If irregularities continue in turning the steering even after making the above adjustments, check the seats in which the ball bearings rotate: replace them if they are recessed or if the balls are flattened.

Noisy suspension

NOISY SUSPENSION

Possible Cause	Operation
Faults in the suspension system	If the front suspension is noisy, check: the efficiency of the front shock absorber; the condition of the ball bearings and relevant lock-nuts, the limit switch rubber buffers; and the movement bushings. In conclusion, check the tightening torque of the wheel hub, the brake calliper, the shock absorber disc in the attachment to the hub and the steering tube.

Suspension oil leakage

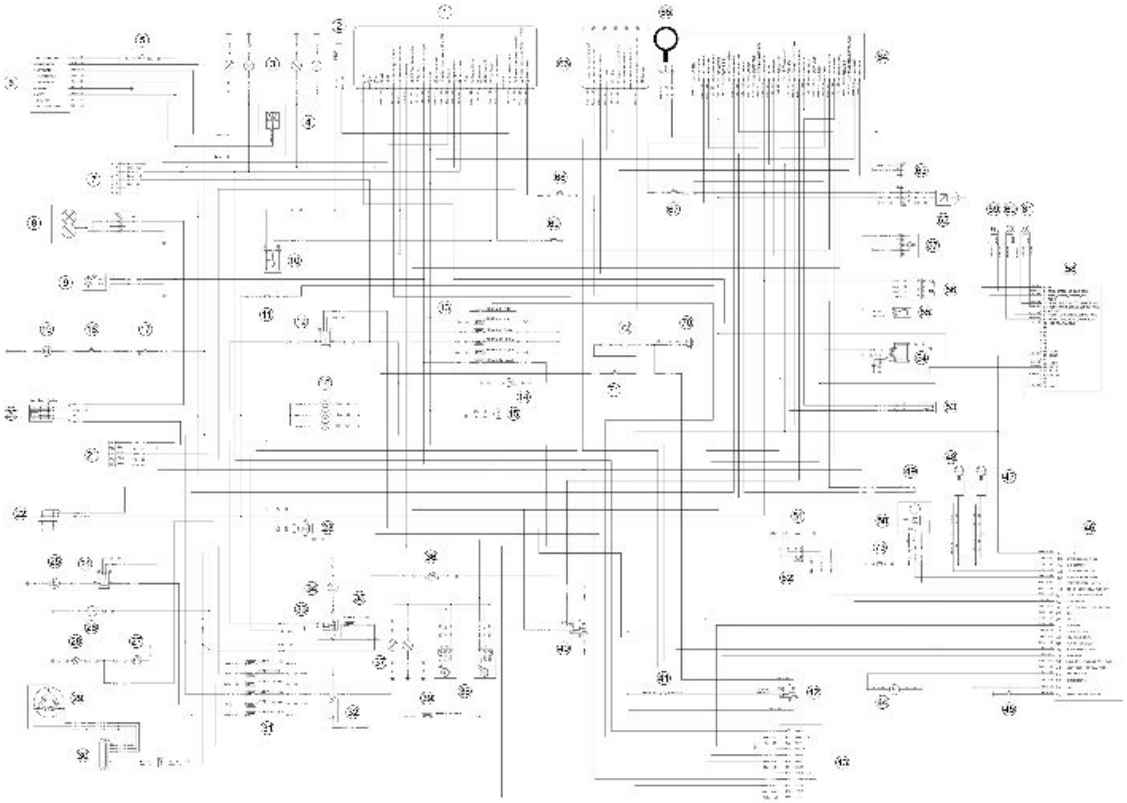
OIL LEAKAGE FROM SUSPENSION

Possible Cause	Operation
Faulty or broken seals	Replace the shock absorber Check the condition of wear of the steering covers and the adjustments.

INDEX OF TOPICS

CAUTION

THE FOLLOWING INSTRUCTIONS REFER TO THE VEHICLE VERSION EQUIPPED WITH ABS - ASR SYSTEM.



KEY

1. Instrument panel

2. Ambient temperature sensor

3. Turn indicator bulbs

4. Turn indicator switch

5. Emergency turn indicator switch

6. Turn indicators control device

7. Pre-installation for anti-theft device

8. Headlight

9. Front daylight running light bulb

10. Fuel level transmitter

11. Starter button

12. Headlight relay

13. Secondary fuses

14. ignition key contacts

15. USB socket

16. Stop buttons lever and brake pedals

17. Ignition switch contacts

18. Saddle opening switch
19. Saddle opening actuator
20. Light switch
21. Pre-installation heated handgrips control device and leg warmer
22. engine stop switch
23. Stop light relay
24. Electric fan relay
25. Electric fan
26. Plug socket
27. Helmet compartment light switch
28. Helmet compartment light bulb
29. Magneto flywheel
30. Voltage regulator
31. Main fuses
32. Battery
33. Start-up relay
34. Starter motor
35. Fuse No. 13
36. ignition key contacts
37. License plate bulbs
38. Rear headlight assembly
39. Fuse No. 14
40. Injection load relay
41. Pressure sensor
42. Horn relay
43. PMP connection
44. Geared motor
45. Brake calliper sensor
46. Parking control ECU
47. Right speed sensor
48. Left speed sensor
49. Lambda sensor
50. Rotation sensor
51. Hand brake switch
52. Suspension locking/unlocking switches
53. Engine speed sensor
54. HV coil
55. Injector

56. Engine temperature sensor

57. Fuel pump

58. ABS control unit

59. Rear ABS sensor

60. Left front ABS sensor

61. Right front ABS sensor

62. Tip over sensor

63. Diagnostic socket

64. Injection ECU

65. Immobilizer aerial

66. Warning light unit

67. ASR Button

68. MODE button

69. Oil pressure sensor

70. Horn

71. horn button

72. Horn connection for anti-theft device

73. Rider presence sensor

Cable colour:

Az = Sky blue

Bi = White

Ar = Orange

Gi = Yellow

BL = Blue

Ma = Brown

Ne = Black

Rs = Red

Ro = Pink

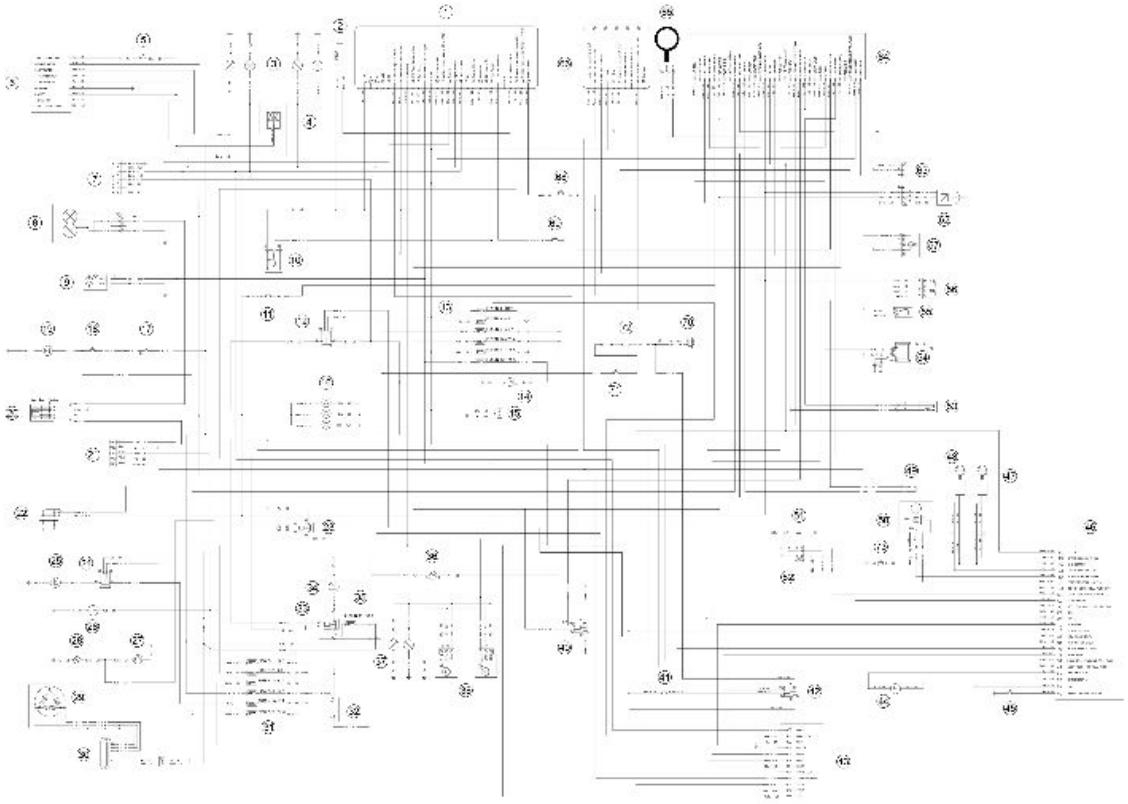
Ve = Green

Vi = Violet

Gr = Grey

CAUTION

THE FOLLOWING INSTRUCTIONS REFER TO THE VEHICLE VERSION NOT EQUIPPED WITH ABS - ASR SYSTEM.



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58. -

59. -

60. -

61. -

62. Tip over sensor

63. Diagnostic socket

64. Injection ECU

65. Immobilizer aerial

66. Warning light unit

67. -

68. MODE button

69. Oil pressure sensor

70. Horn

71. horn button

72. Horn connection for anti-theft device

73. Rider presence sensor

Cable colour:

Az = Sky blue

Bi = White

Ar = Orange

Gi = Yellow

BL = Blue

Ma = Brown

Ne = Black

Rs = Red

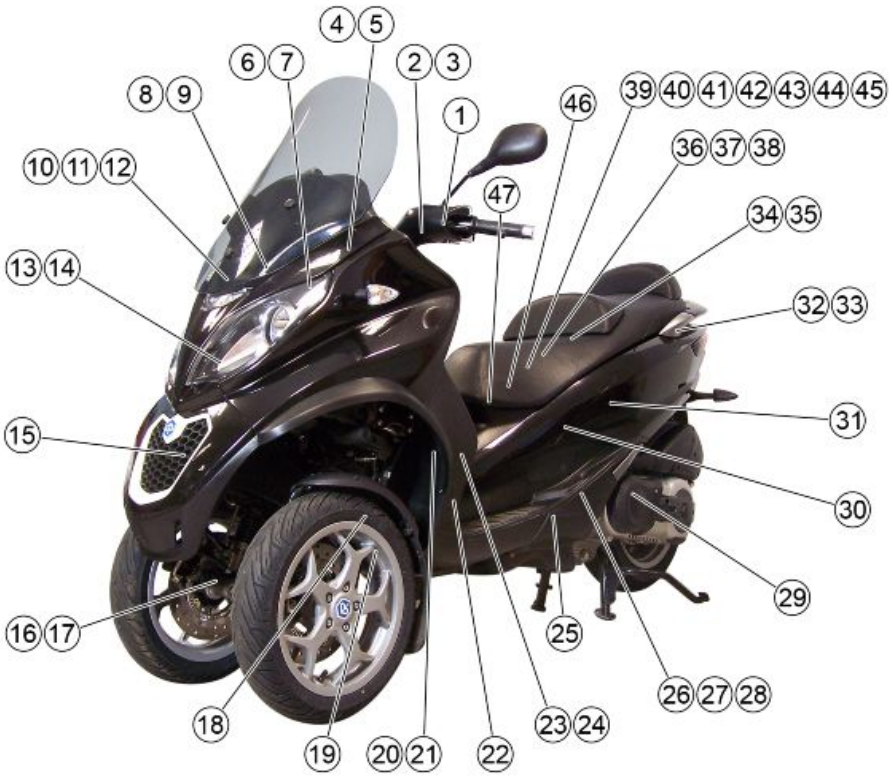
Ro = Pink

Ve = Green

Vi = Violet

Gr = Grey

Components arrangement

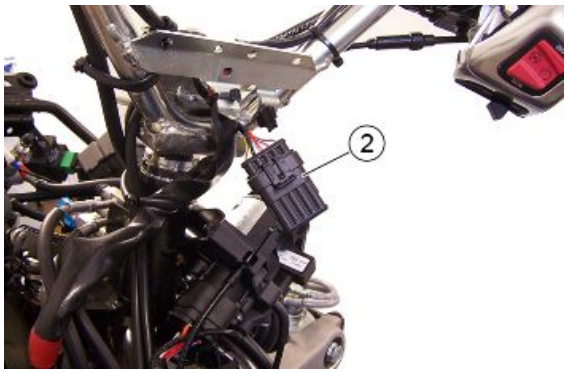


1. BRAKE LEVER STOP BUTTONS

Remove the upper handlebar cover to reach it.

2. PRE-INSTALLATION HEATED HANDGRIPS CONTROL DEVICE AND LEG WARMER

Remove the upper handlebar cover to reach it.



3. AMBIENT TEMPERATURE SENSOR

Remove the upper handlebar cover to reach it.

4. IMMOBILIZER AERIAL

Remove the shield back plate upper side to reach it.

5. IGNITION KEY CONTACTS

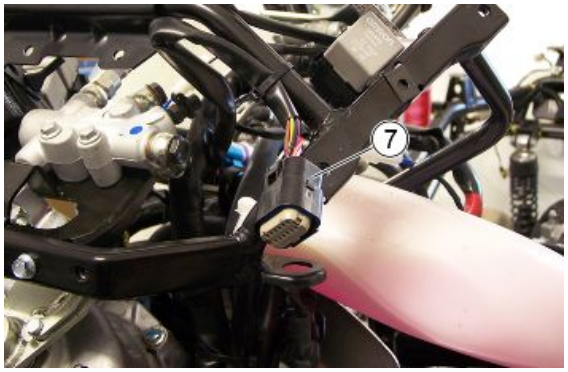
Remove the shield back plate upper side to reach it.

6. STOP LIGHTS RELAY

Remove the leg shield to reach it.

7. PMP CONNECTION

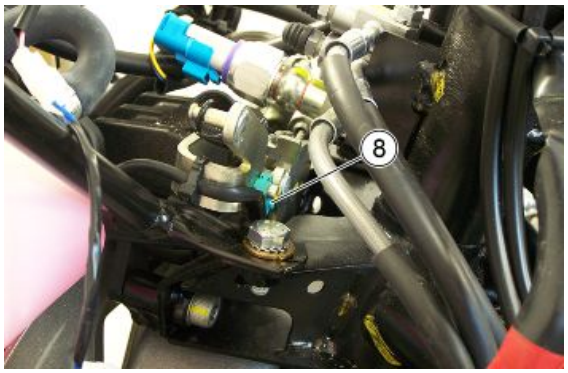
Remove the leg shield to reach it.

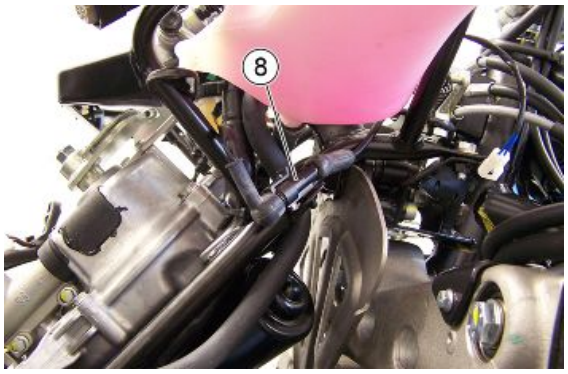


8. BRAKE CALLIPER SENSOR

Remove the leg shield to reach it.

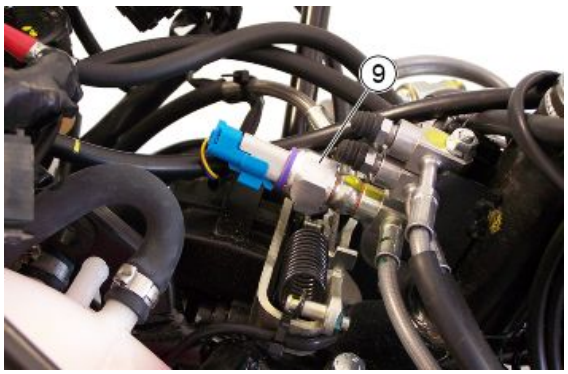
The sensor connector is fixed to the frame under the expansion tank.





9. PRESSURE SENSOR

Remove the leg shield to reach it.



10. RELAY UNIT

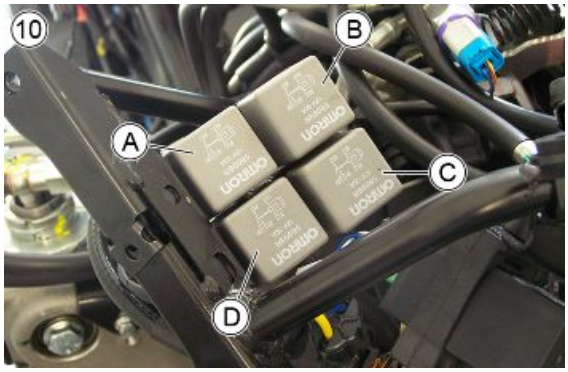
Remove the leg shield to reach it.

A. HORN RELAY

B. INJECTION LOAD RELAY

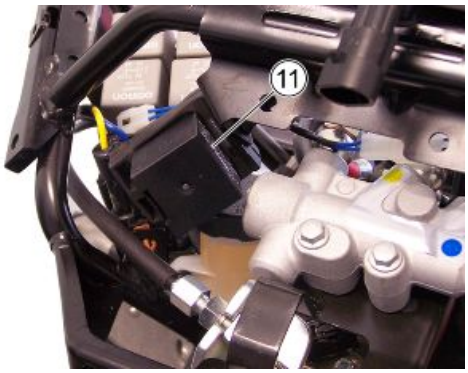
C. ELECTRIC FAN RELAY

D. HEADLIGHT RELAY



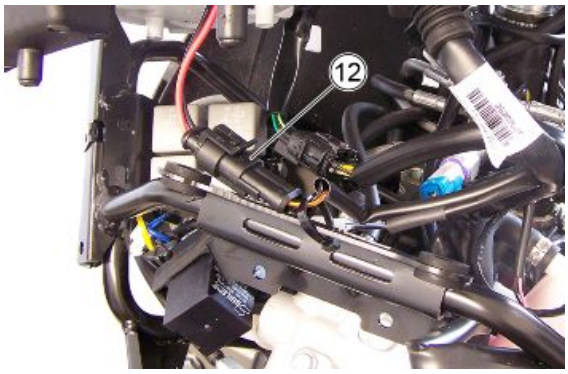
11. TURN INDICATORS CONTROL DEVICE

Remove the leg shield to reach it.



12. USB SOCKET CONNECTOR

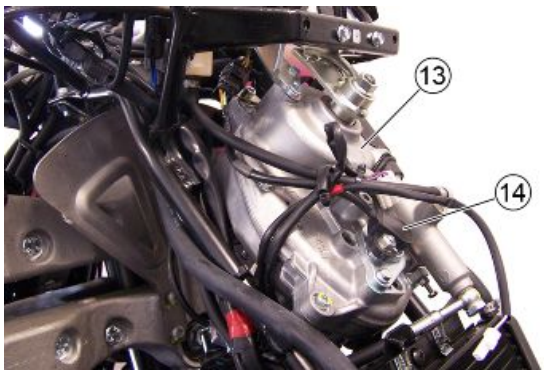
Remove the leg shield to reach it.



13. GEAR MOTOR

14. ROTATION SENSOR

Remove the leg shield to reach it.



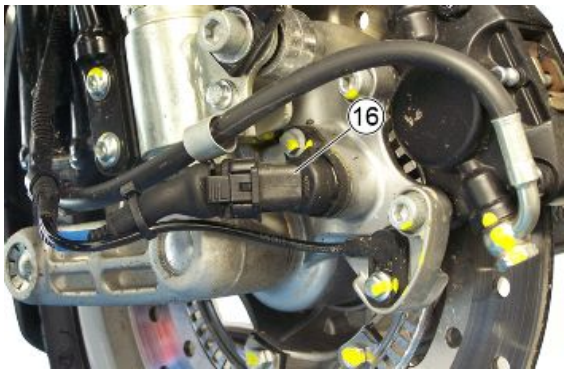
15. ELECTRIC FAN

Remove the radiator cover to reach it.

16. SPEED SENSOR

The sensors are located in the internal section of the front wheels.

To access the connectors, the central chassis cover must be removed.



17. FRONT ABS SENSORS (IF APPLICABLE)

The sensors are located in the internal section of the front wheels.

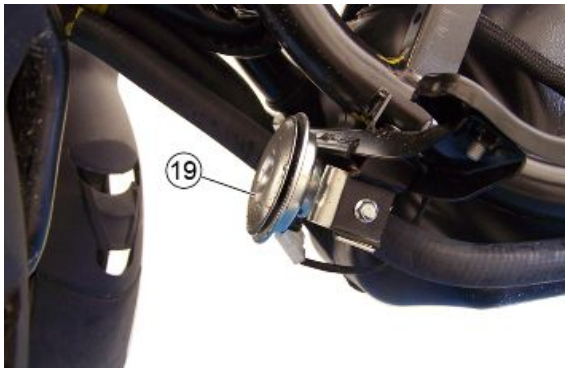
Remove the leg shield back plate to reach the connectors.

18. STOP PEDAL BRAKES BUTTON

To reach them, remove the right footrest.

19. HORN

Remove the left footrest to reach them.

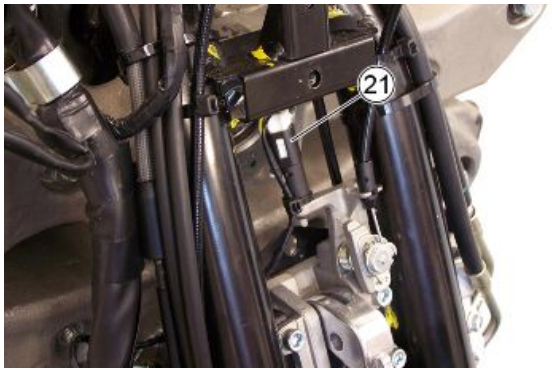


20. PARKING CONTROL ECU

Remove the leg shield back plate to reach it.

21. HAND BRAKE SWITCH

Remove the leg shield back plate to reach it.



22. AUXILIARY FUSES

To reach them, remove the cover on the left foot-rest.

23. FUEL PUMP

24. FUEL LEVEL TRANSMITTER

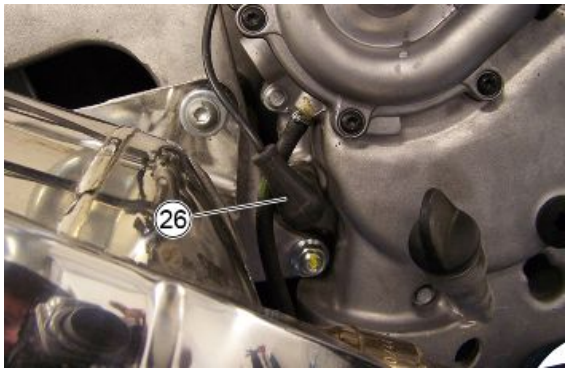
Remove the central chassis cover to reach it.

25. LAMBDA SENSOR

To reach the connector of the probe, positioned on the exhaust manifold, remove the inspection cover located in the helmet compartment.

26. OIL PRESSURE SENSOR

The sensor is positioned on the right side of the engine, near the exhaust muffler.

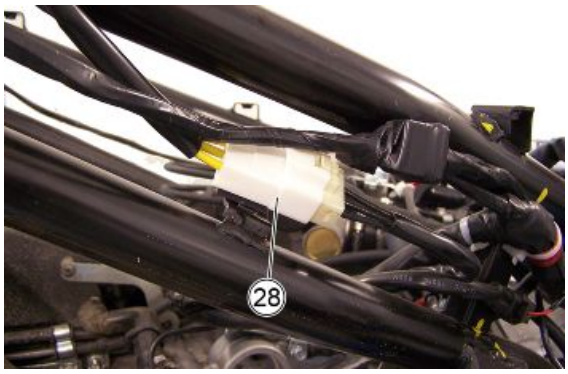


27. ENGINE SPEED SENSOR

To reach the sensor connector, remove the right side fairing.

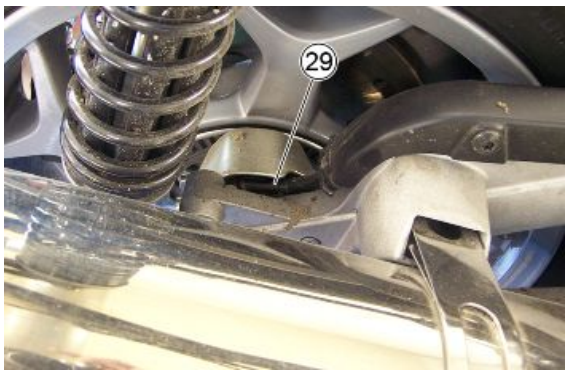
28. MAGNETO FLYWHEEL

To reach the flywheel connector, remove the right side fairing.



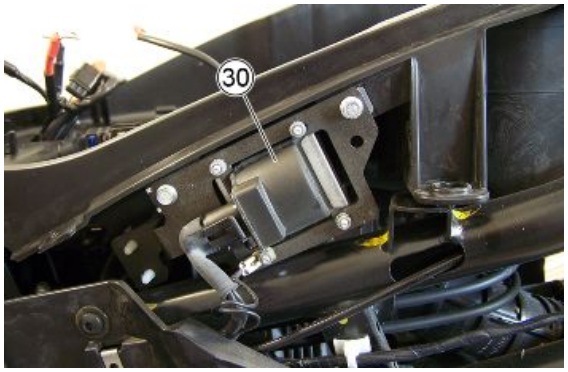
29. REAR ABS SENSOR (IF APPLICABLE)

Remove the helmet compartment in order to reach the connector.



30. H.V. COIL

Remove the left side fairing to reach it.

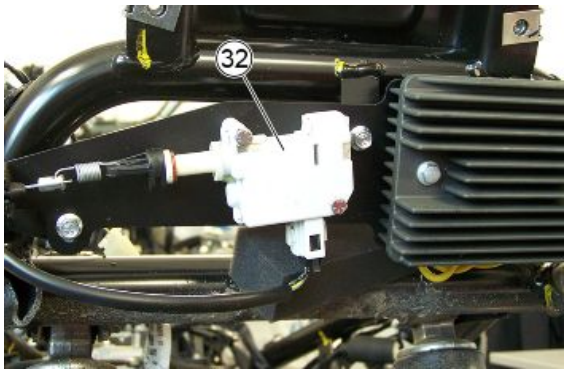


31. STARTER MOTOR

Remove the helmet compartment to reach it.

32. SADDLE OPENING ACTUATOR

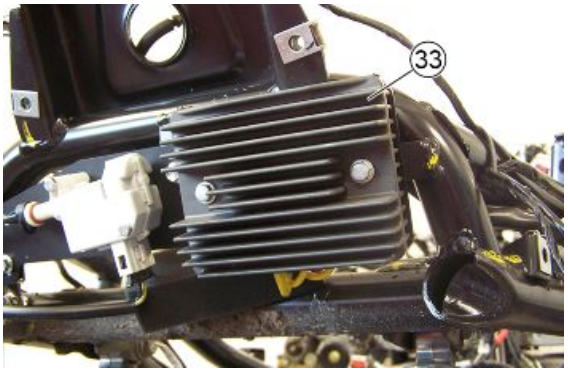
Remove the license plate support to reach it.

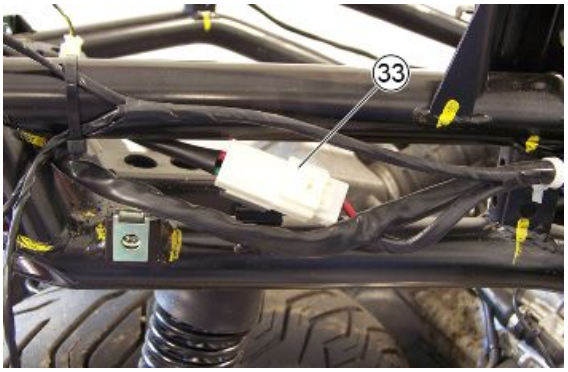


33. VOLTAGE REGULATOR

Remove the license plate support to reach it.

To reach the connector, remove the right side fairing.

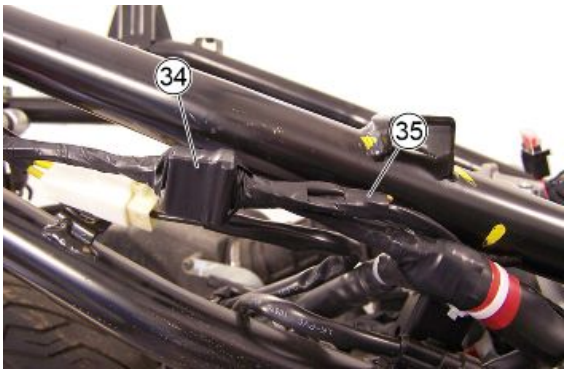




34. PRE-INSTALLATION FOR ANTI-THEFT DEVICE

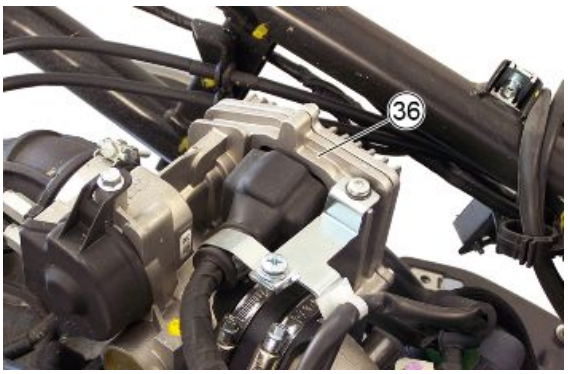
35. HORN CONNECTION FOR ANTI-THEFT DEVICE

Remove the right side fairing to reach it.



36. INJECTION ECU

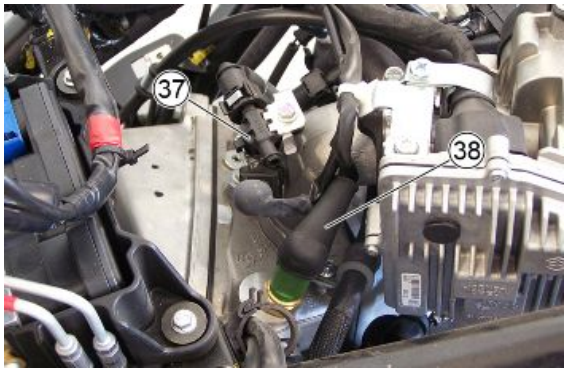
Remove the inspection cover located in the helmet compartment to reach it.



37. INJECTOR

38. ENGINE TEMPERATURE SENSOR

Remove the inspection cover located in the helmet compartment to reach it.



39. START-UP RELAY

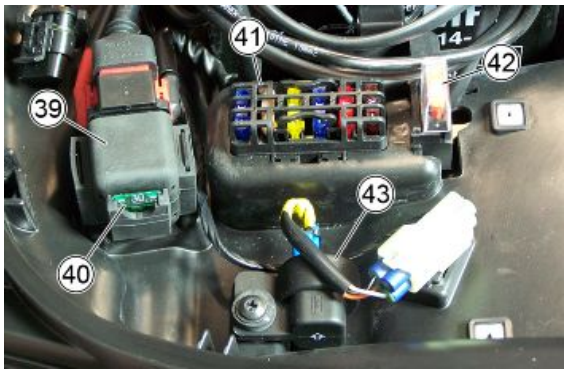
40. FUSE No. 13

41. MAIN FUSES

42. FUSE No. 14 (IF APPLICABLE)

43. TIP OVER SENSOR

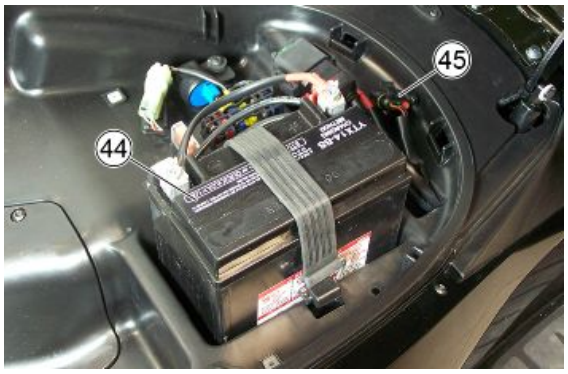
These components are found in the helmet compartment.



44. BATTERY

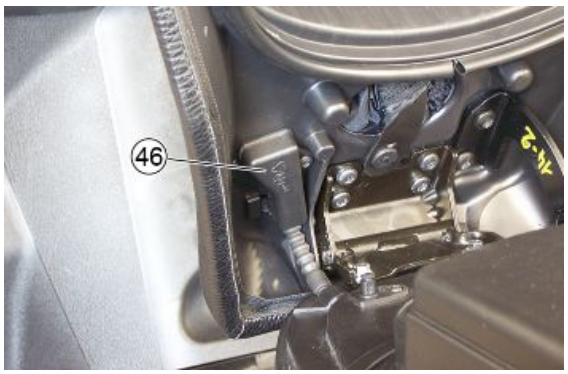
45. DIAGNOSIS SOCKET

These components are found in the helmet compartment.



46. RIDER DETECTION SENSOR

The sensor is located under the saddle, undo the screw and remove the cover to reach it.

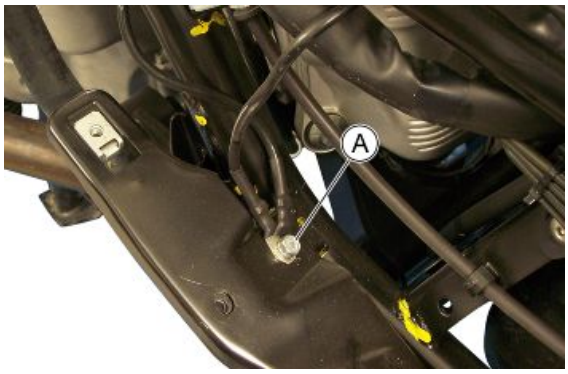


47. ABS CONTROL UNIT (IF APPLICABLE)

Remove the helmet compartment to reach it.

Ground points

On the vehicle there is a chassis ground point **"A"**, remove the footrest to access it.

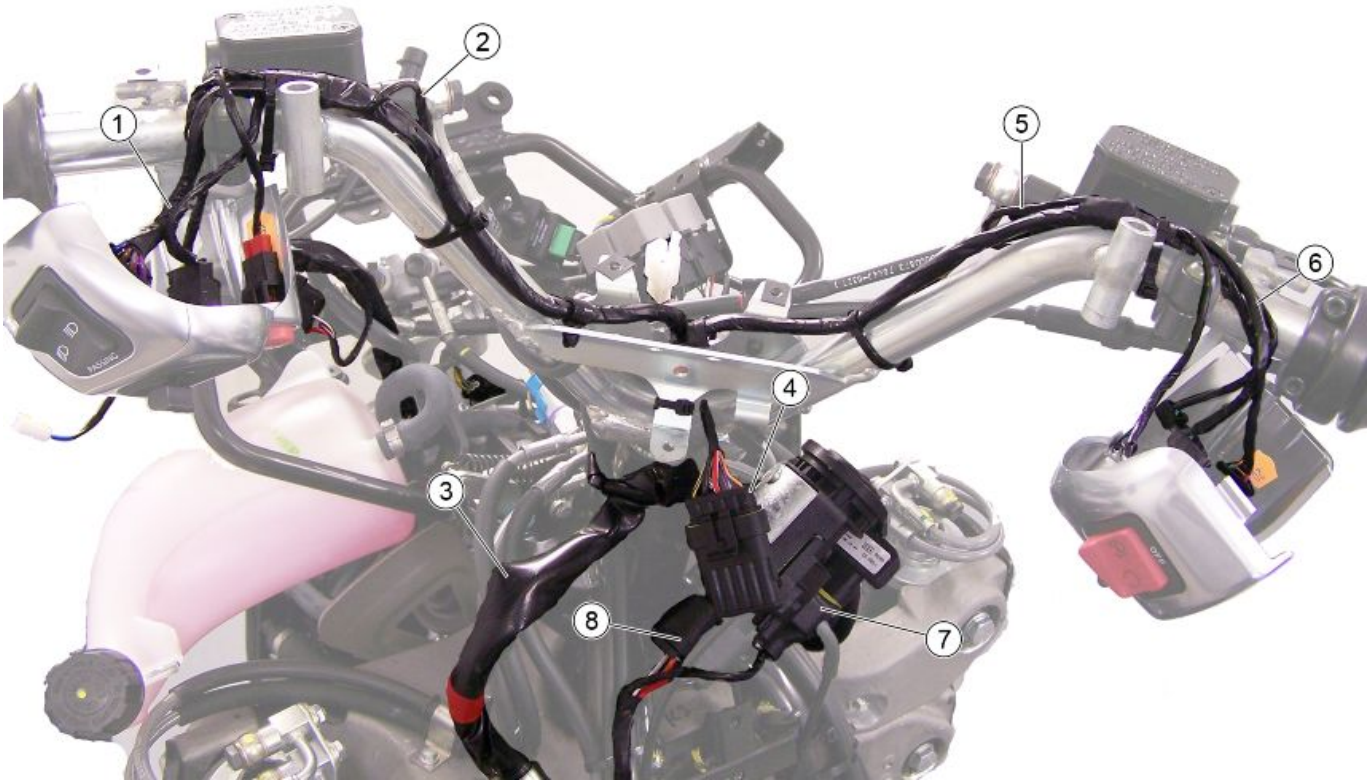


There is another ground point **"B"** on the starter motor, remove the helmet compartment to reach it.

On the left side of the vehicle is an engine-chassis ground cable «**C**» fixed, remove the footrest and the side fairing to reach it.

Electrical system installation

Front side



1. Control connections on the left side of the handlebar

2. At left stop button

3. Main cable harness

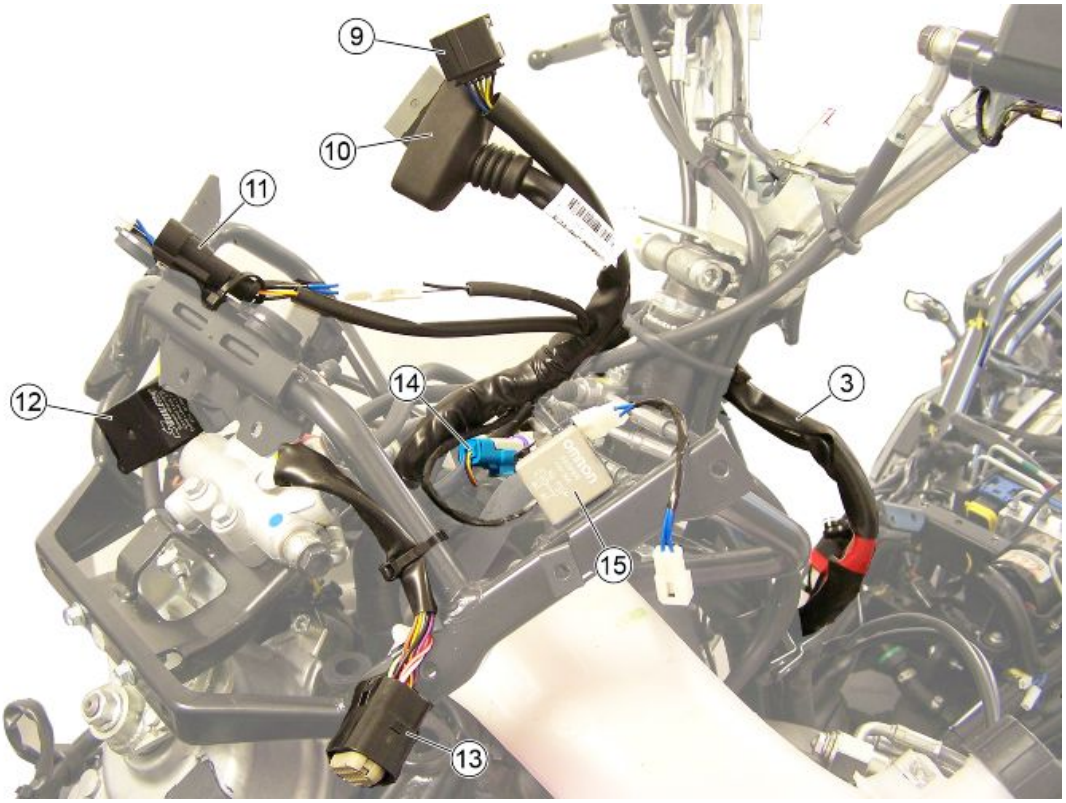
4. Pre-installation heated handgrips control device and leg warmer connector

5. At right stop button

6. Control connections on the right side of the handlebar

7. Immobilizer aerial

8. Ignition switch contacts



9. Warning light unit connector

10. Instrument panel connector

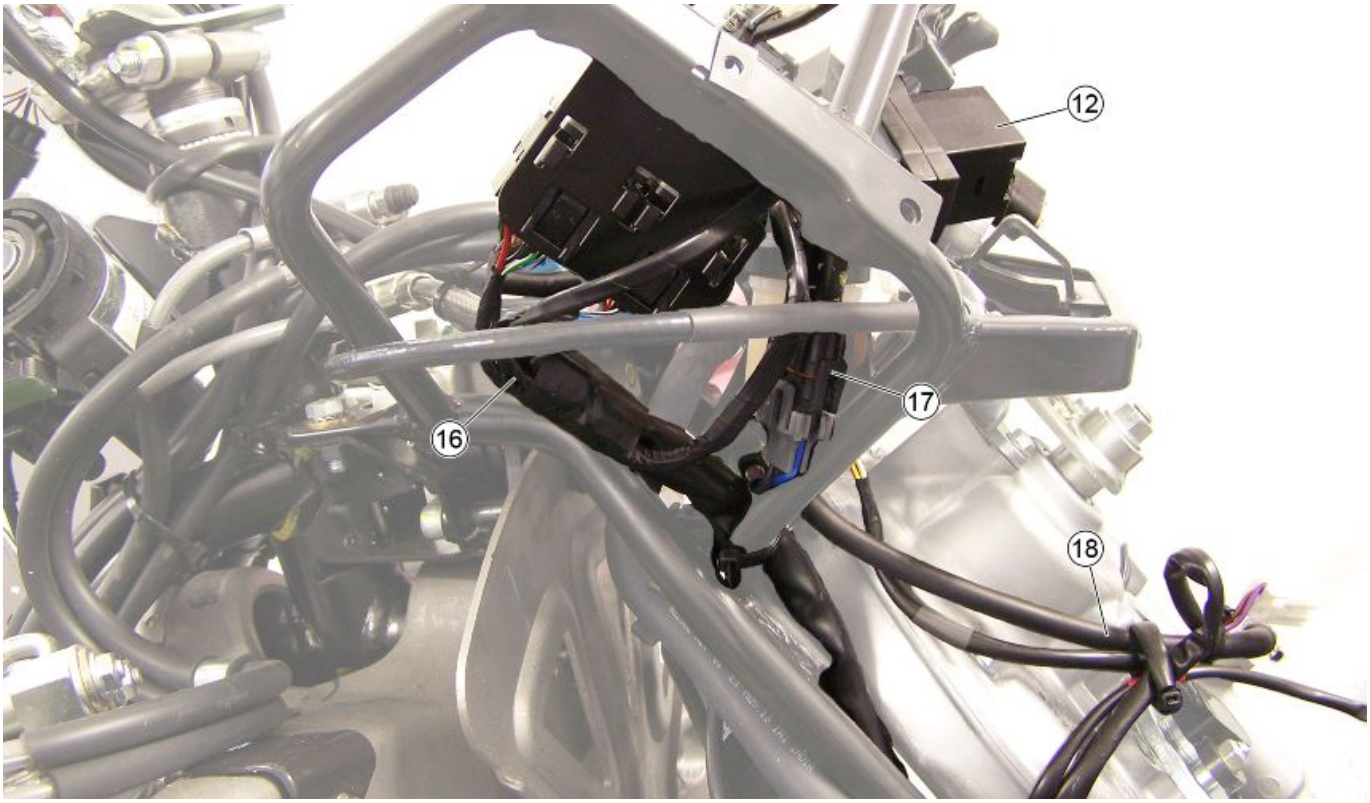
11. USB socket connector

12. Turn indicators control device

13. PMP connection

14. Pressure sensor

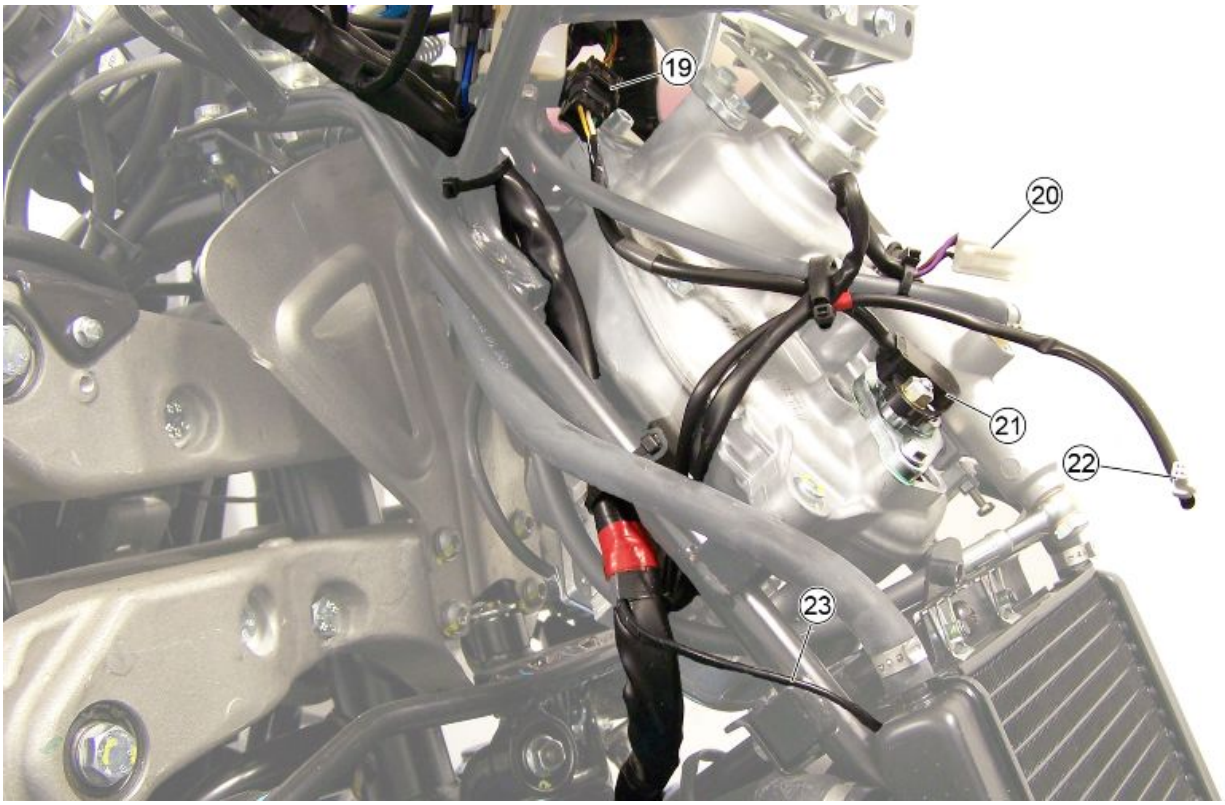
15. Stop light relay



16. Relay unit connections

17. Gear motor connector

18. Rotation sensor and headlamp wiring



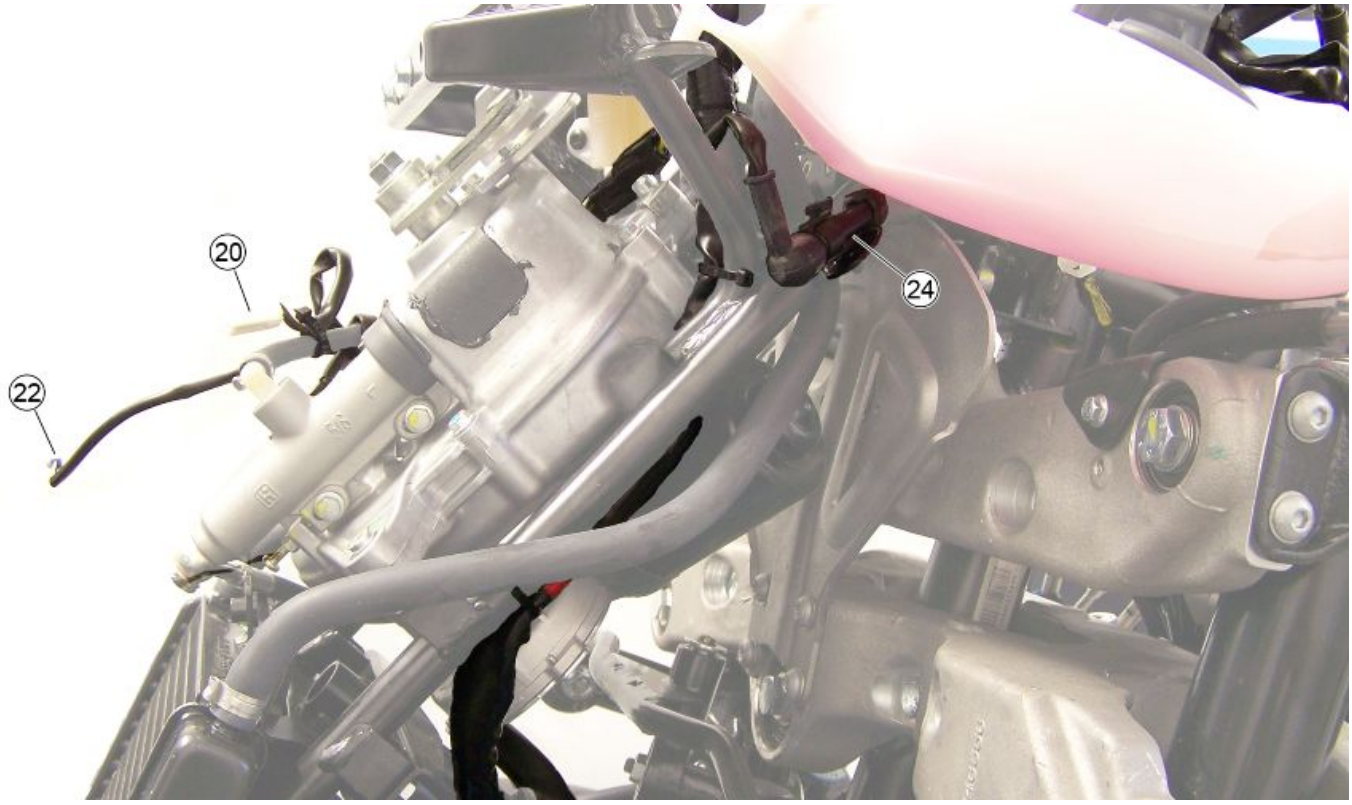
19. Rotation sensor connector

20. Headlight connector

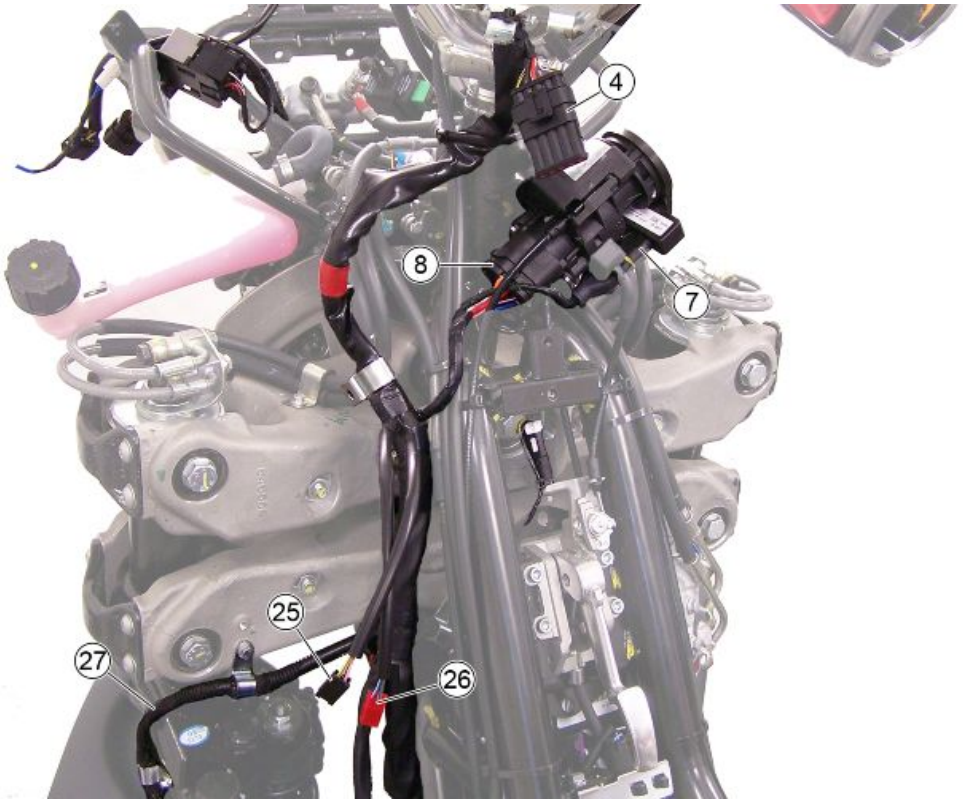
21. Rotation sensor

22. Front daylight running light connector

23. To electric fan



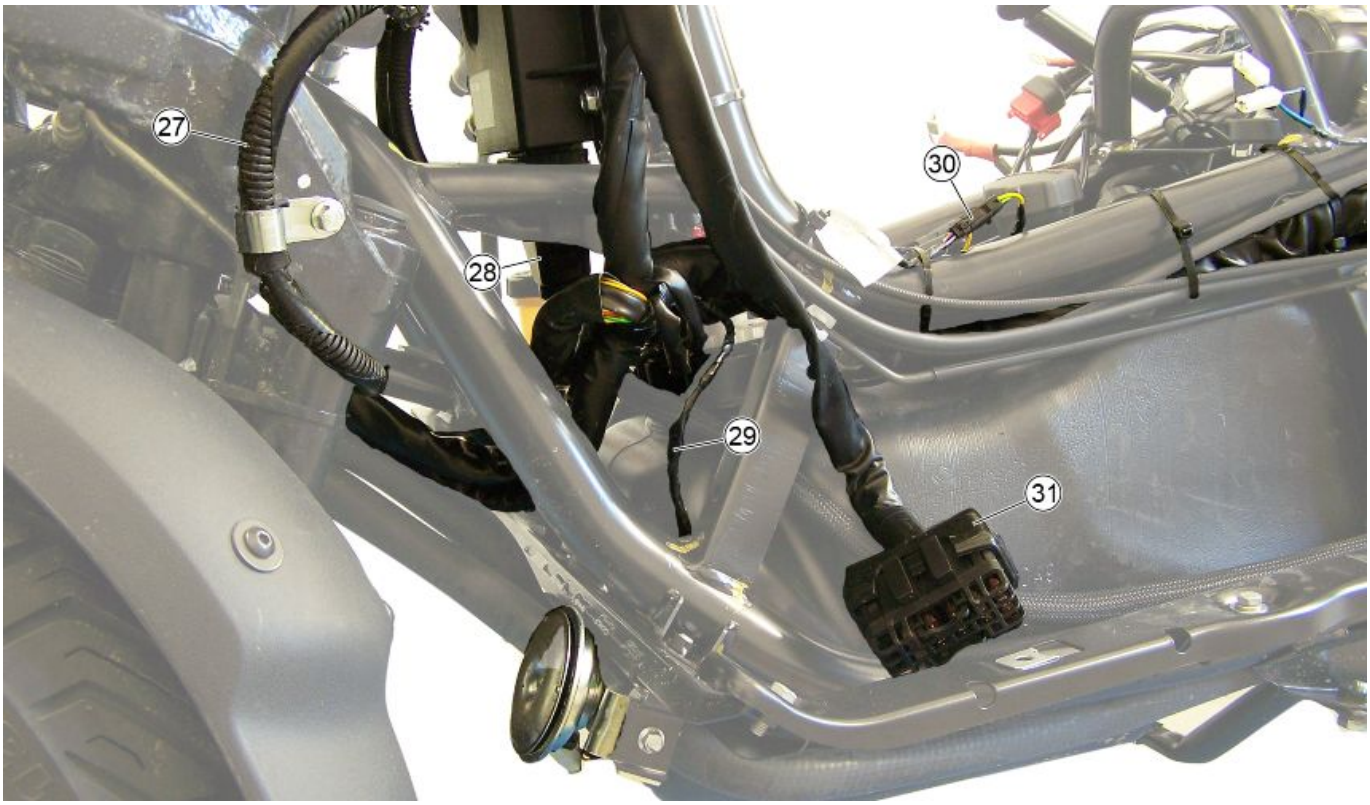
24. Pressure sensor connector



25. Saddle opening switch connector

26. ASR Button connector

27. Wheel sensors wiring

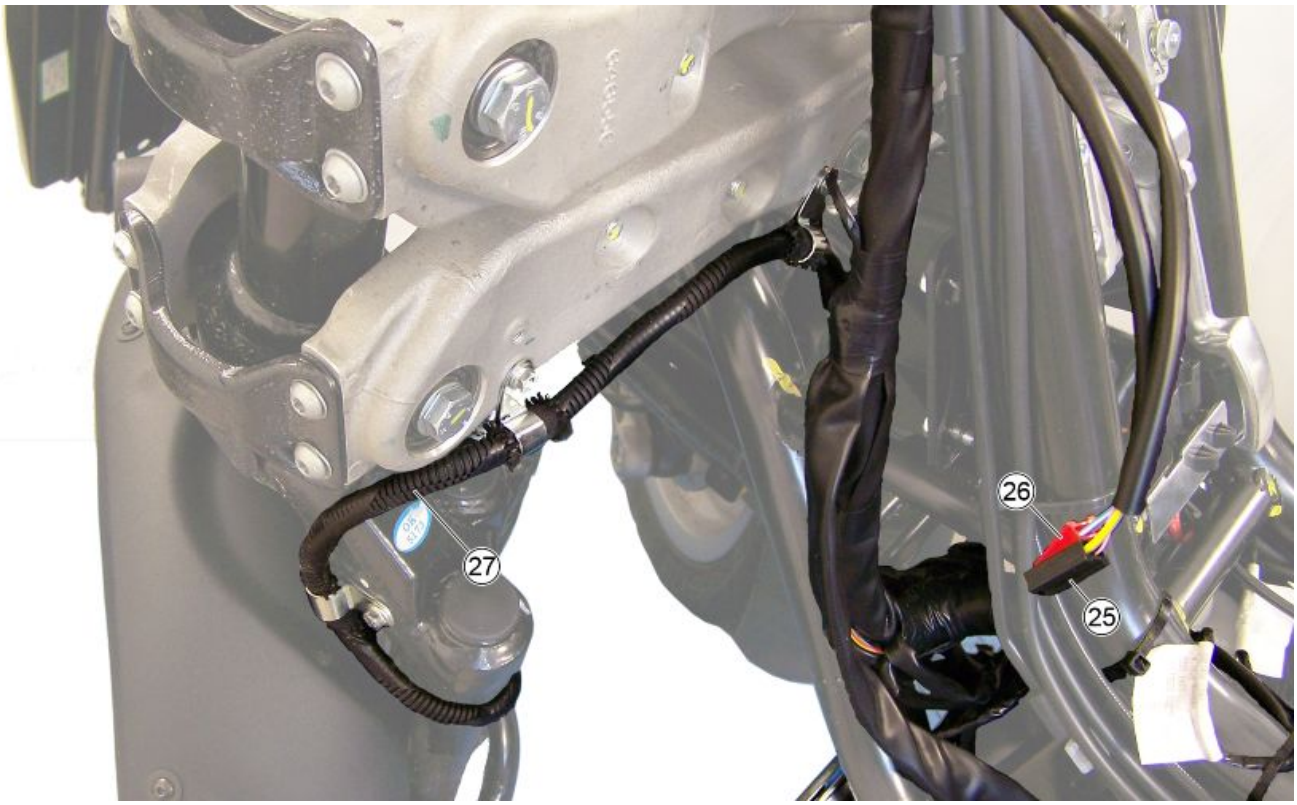


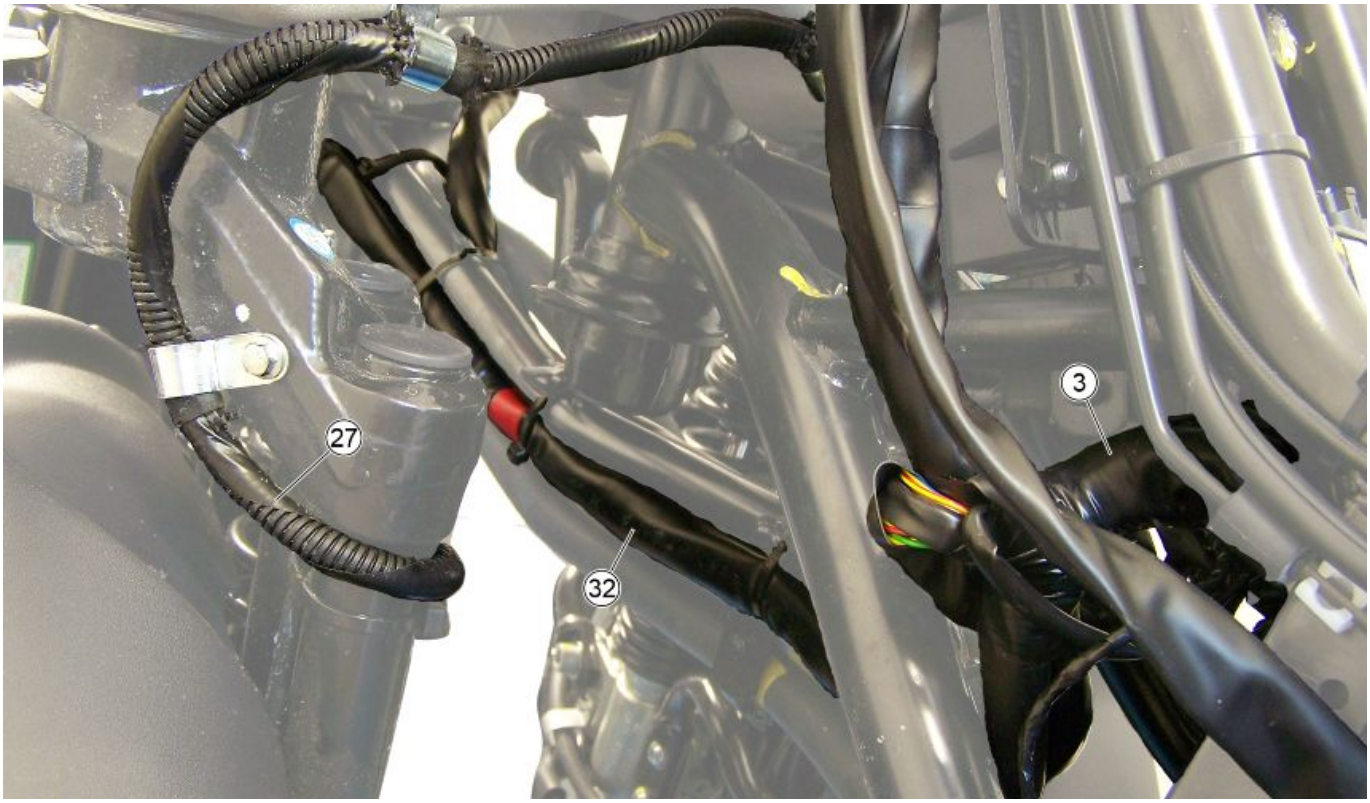
28. Parking control ECU connector

29. To horn

30. Speed sensors connectors

31. Secondary fuses

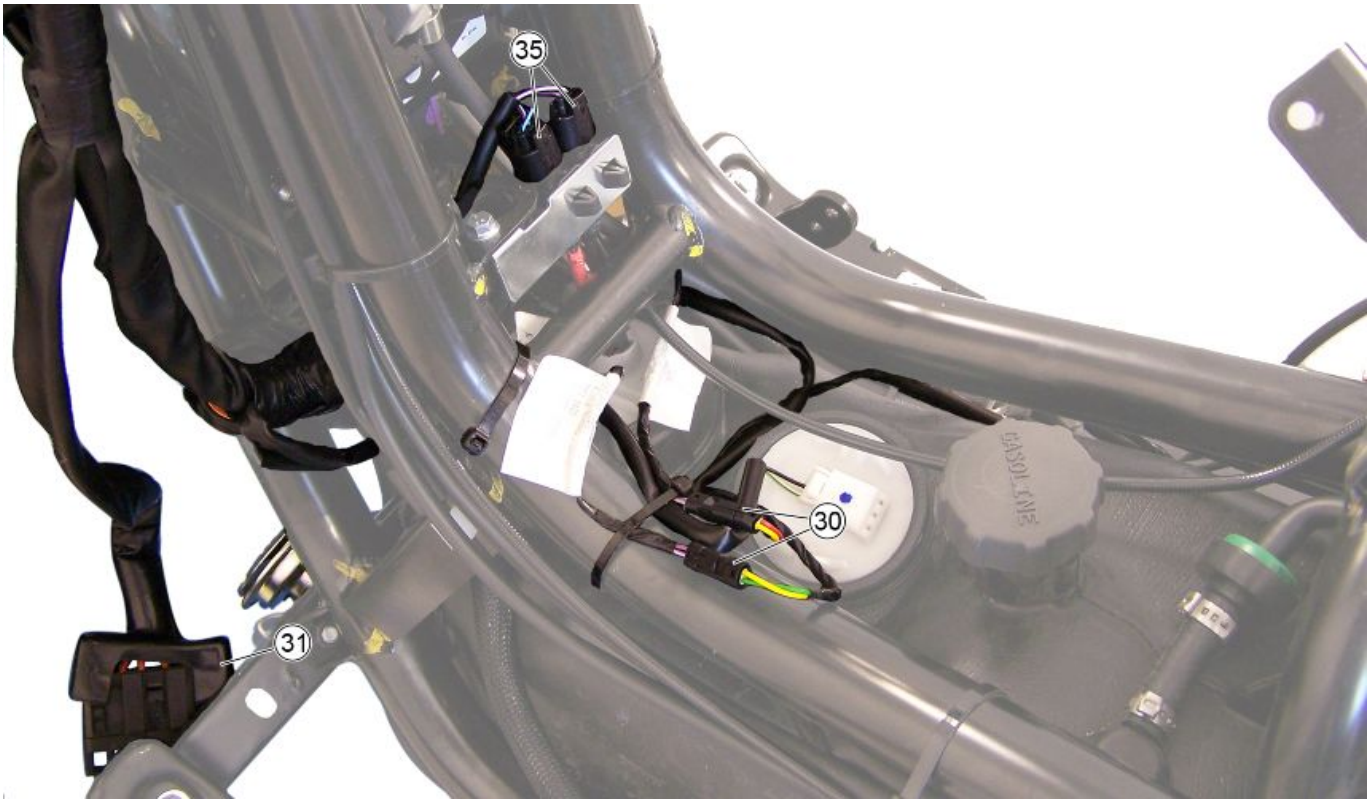




32. Front wiring branch

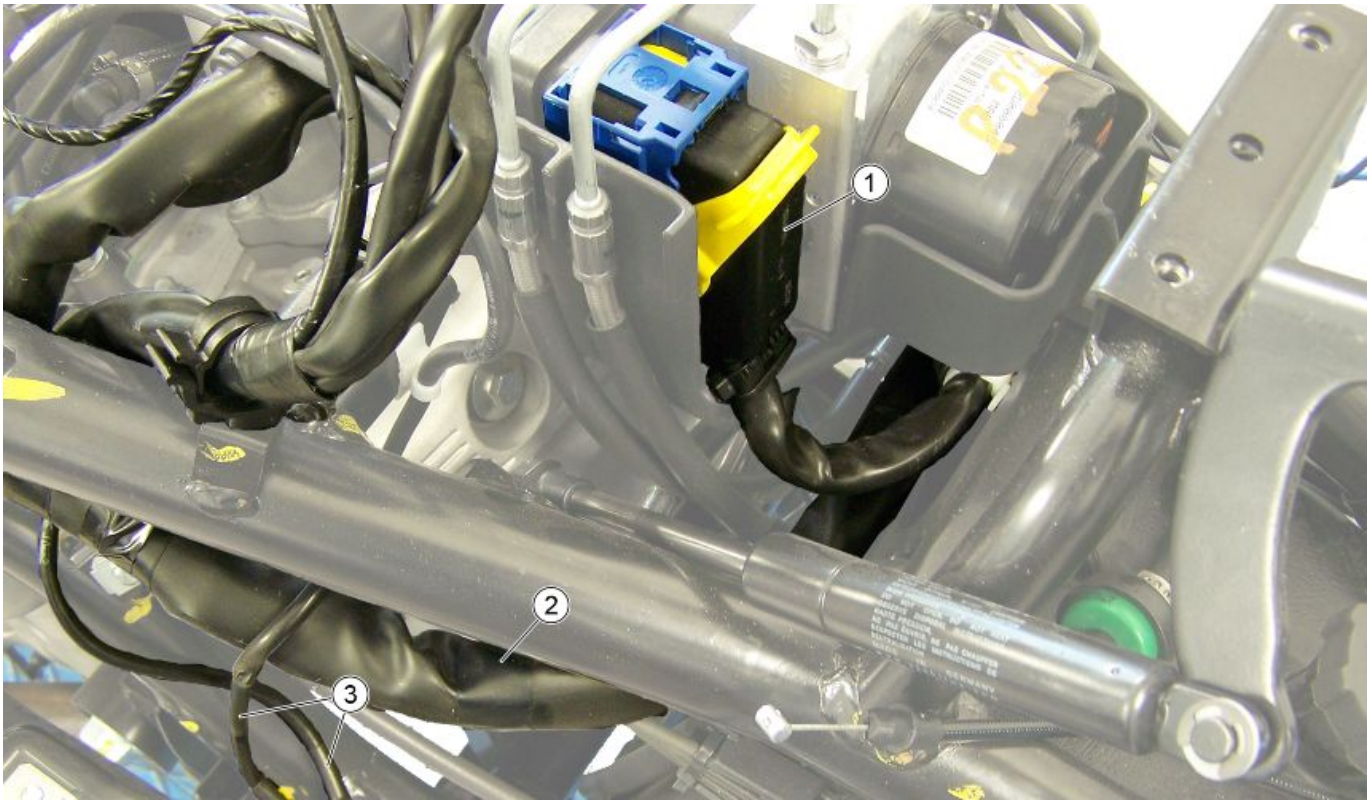
33. Speed sensor

34. Front ABS sensor



35. Front ABS sensors connectors

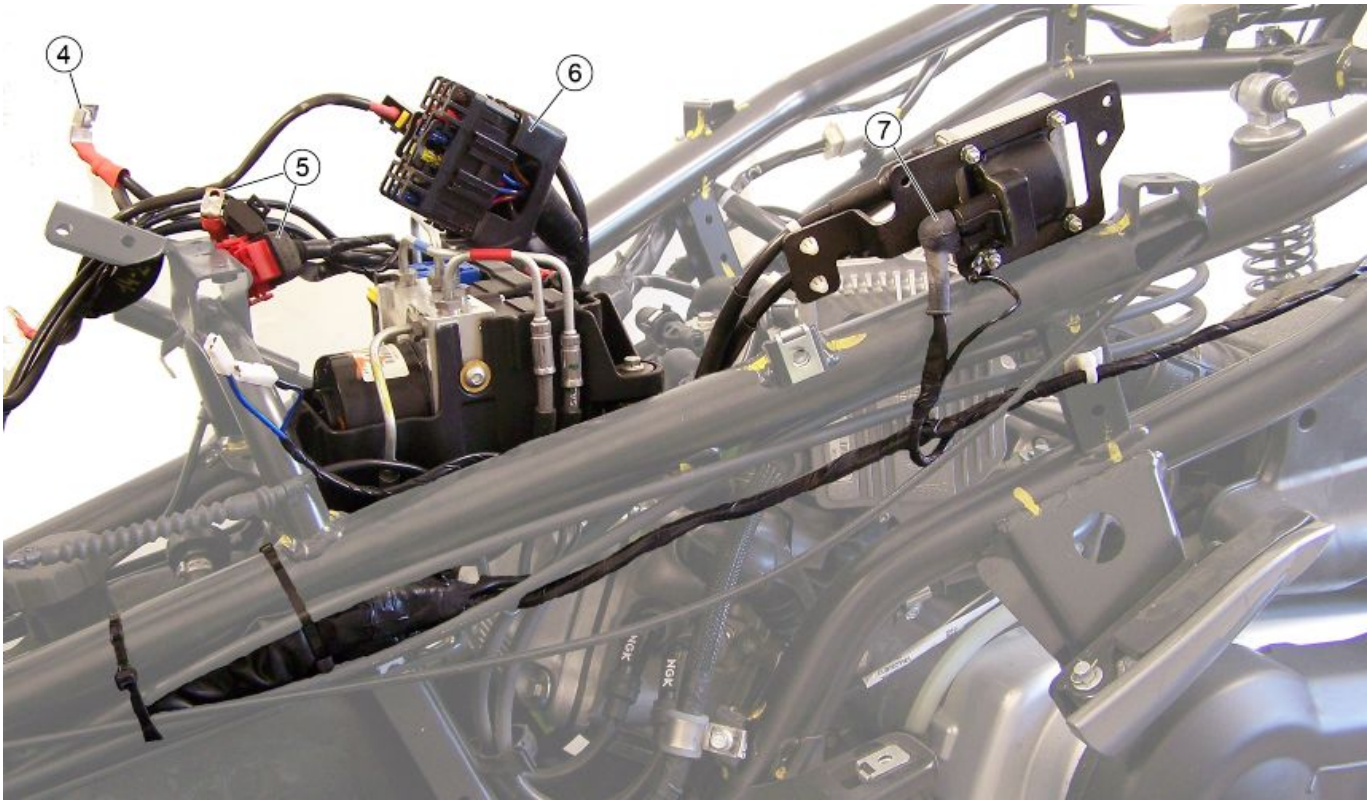
Back side



1. ABS control unit connector

2. Main cable harness

3. To ground point on chassis

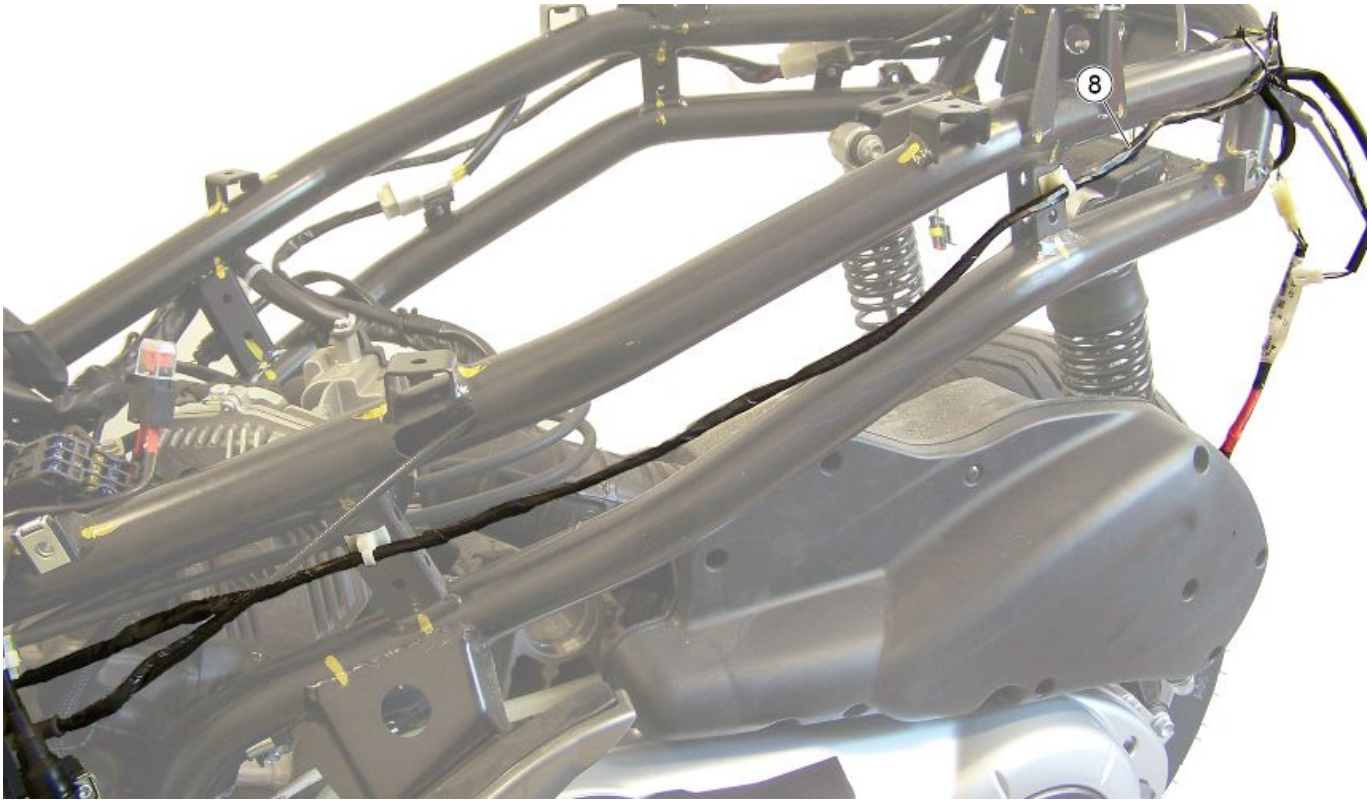


4. Positive battery pole

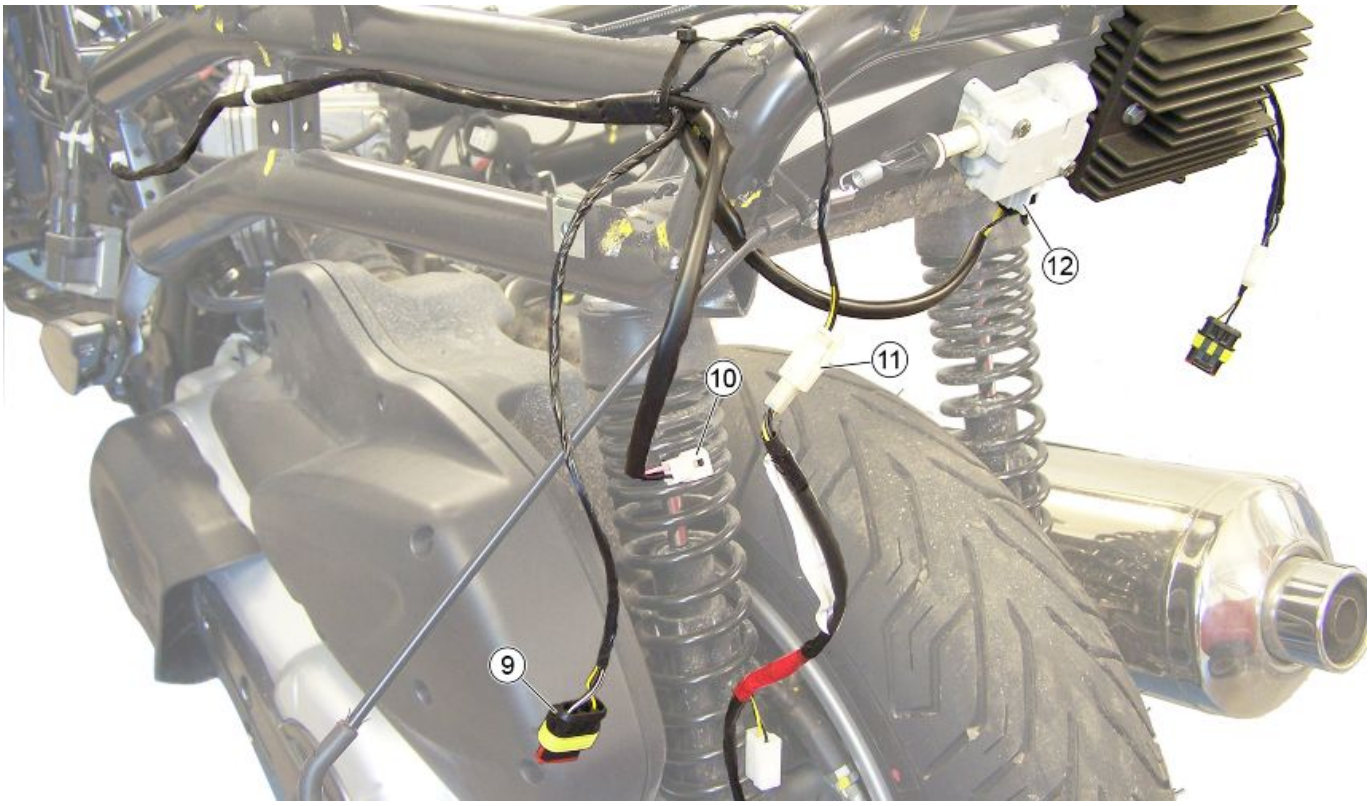
5. Start-up relay connections

6. Main fuses

7. HV coil



8. Left taillight, license plate lights and saddle opening switch actuator wiring

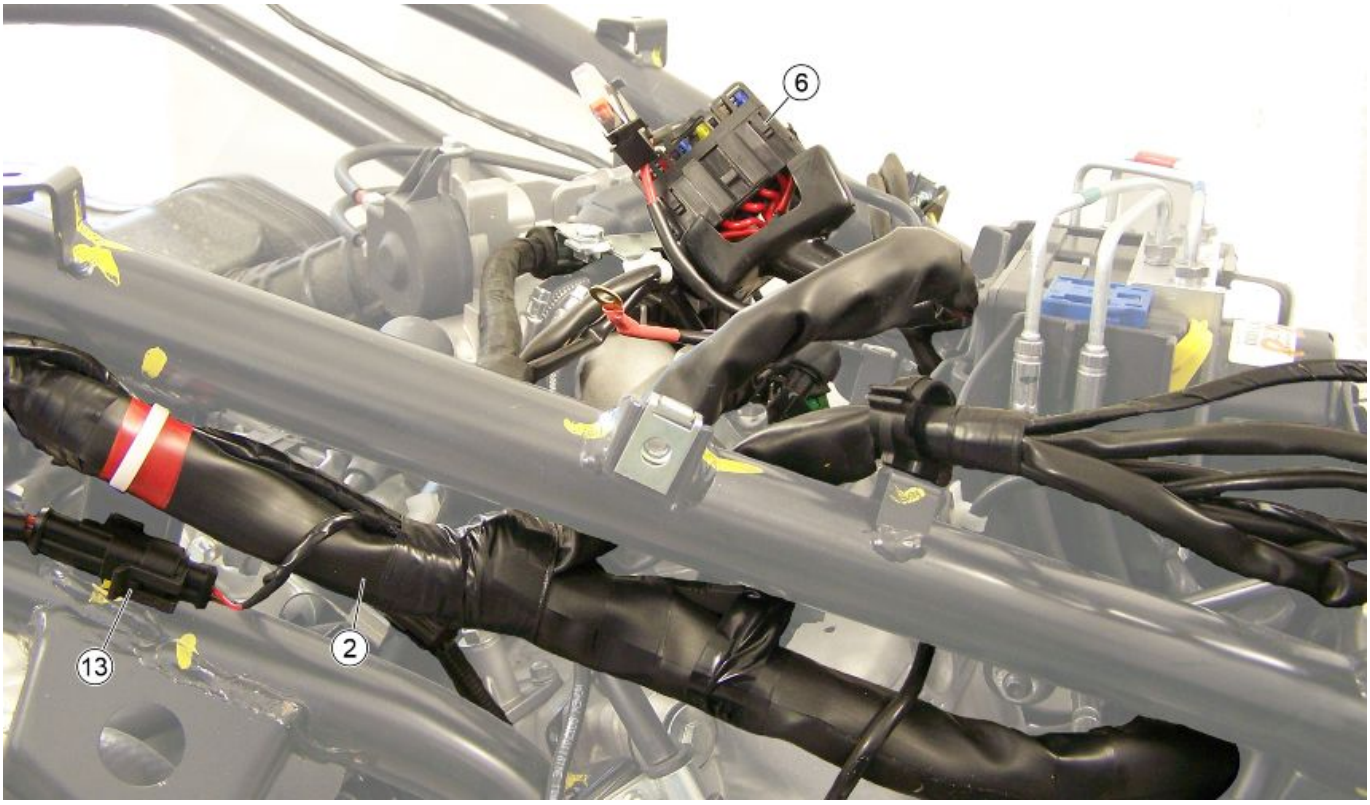


9. Left taillight connector

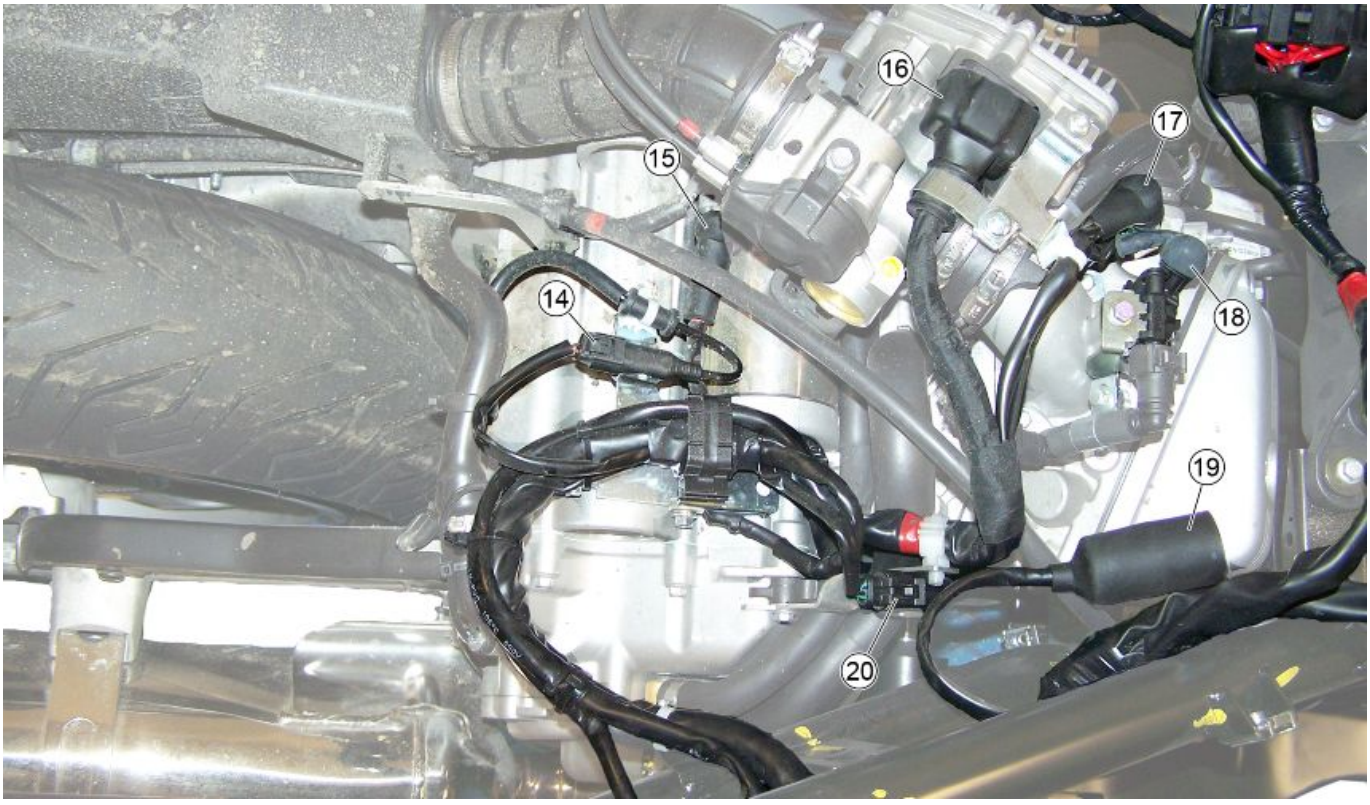
10. Rear left turn indicator connector

11. License plate lights connector

12. Saddle opening actuator



13. Engine speed sensor connector



14. Rear ABS sensor connector

15. Starter motor positive

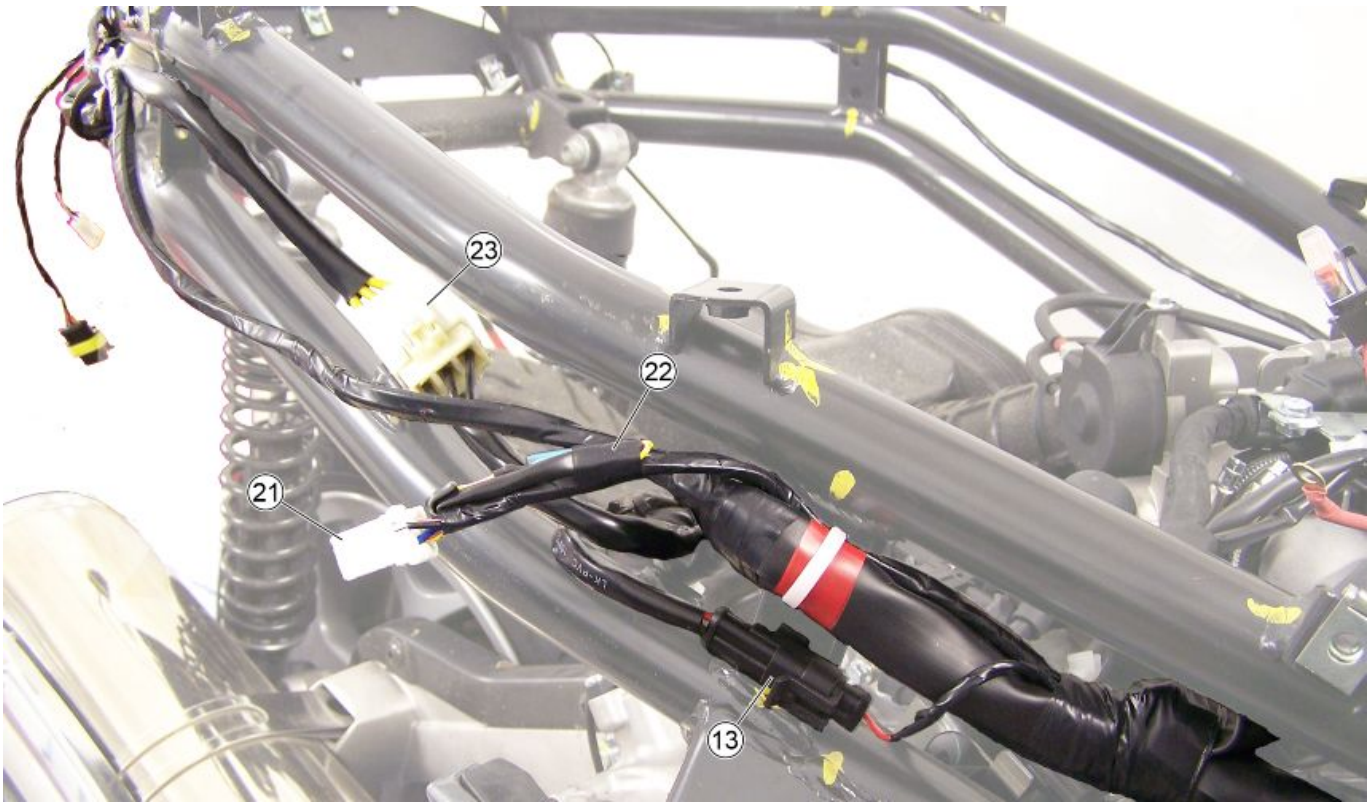
16. Injection ECU connector

17. Engine temperature sensor

18. Injector

19. Plug socket

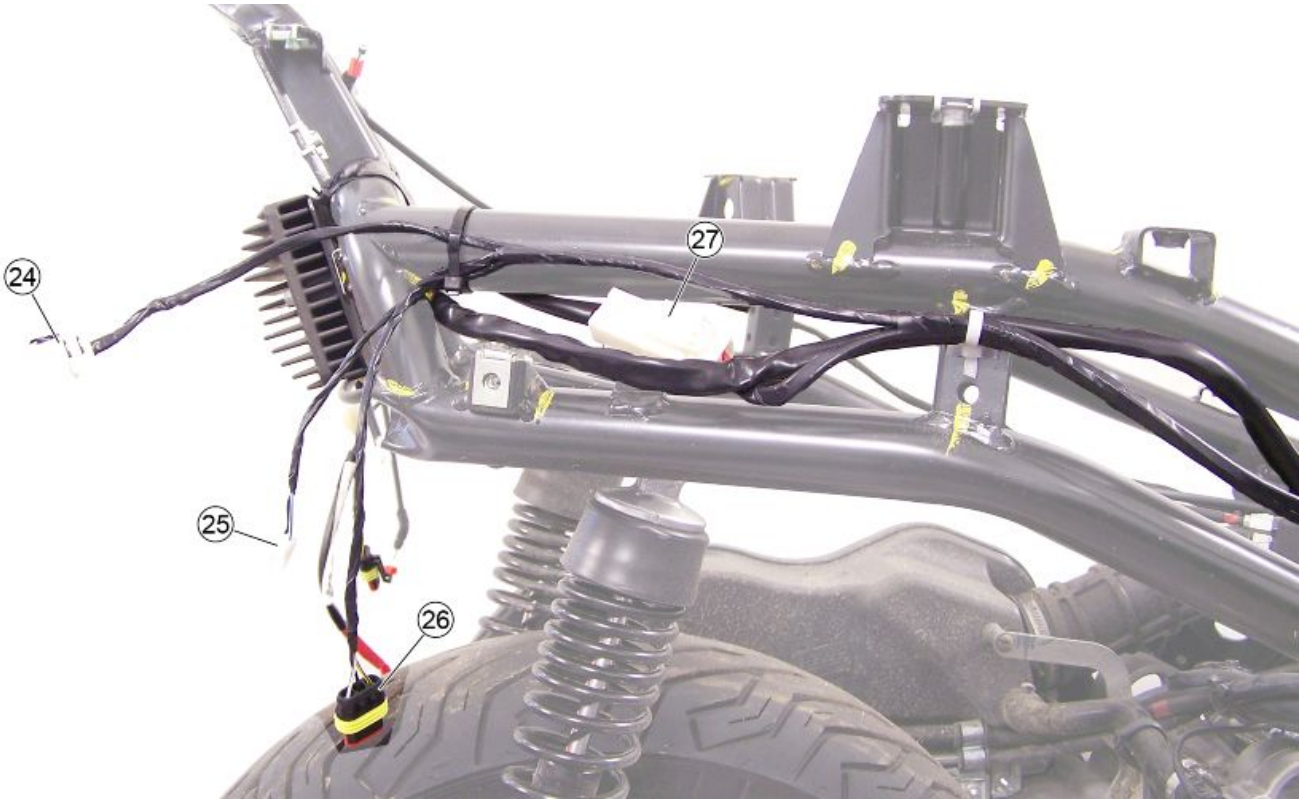
20. Oxygen sensor connector



21. Pre-installation for anti-theft device

22. Horn connection for anti-theft device

23. Magneto flywheel connector

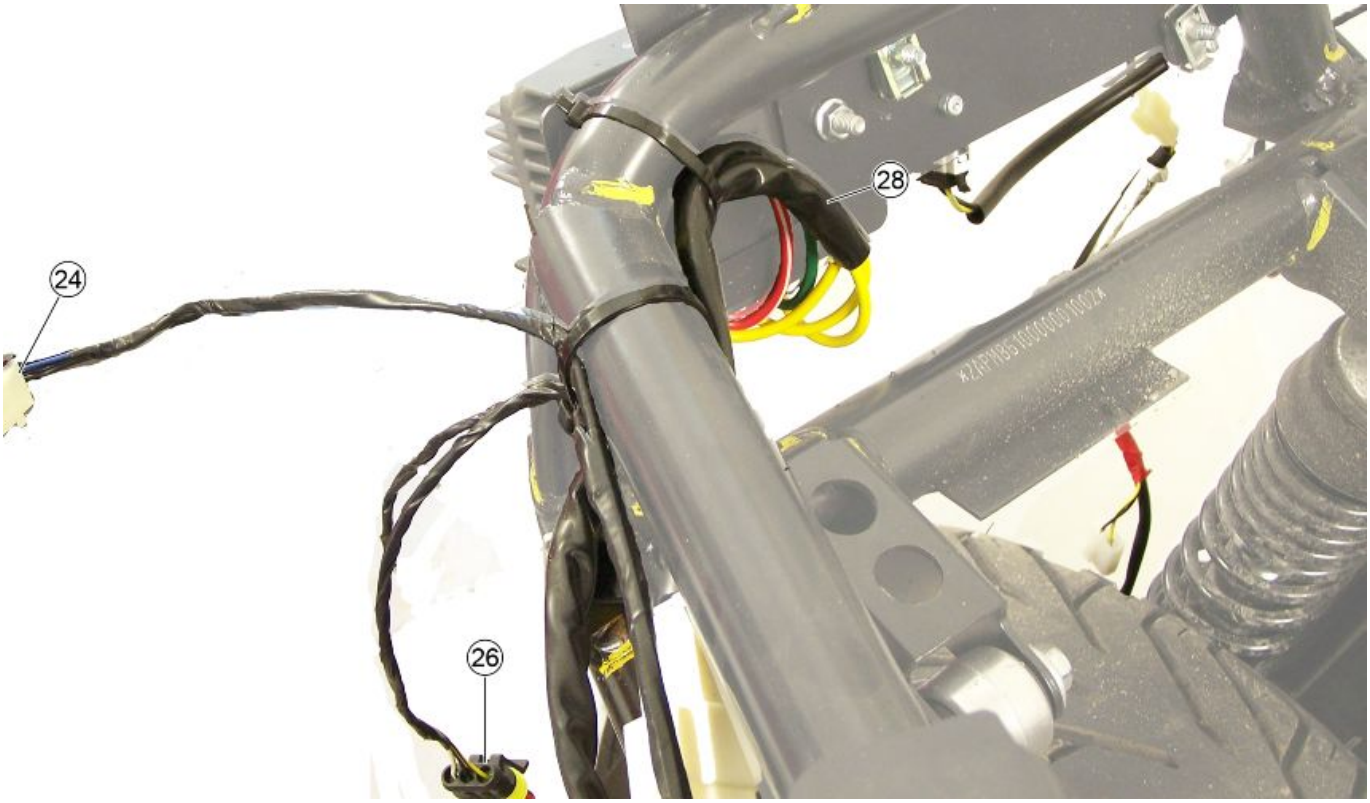


24. Helmet compartment light connector

25. Rear right turn indicator connector

26. Right taillight connector

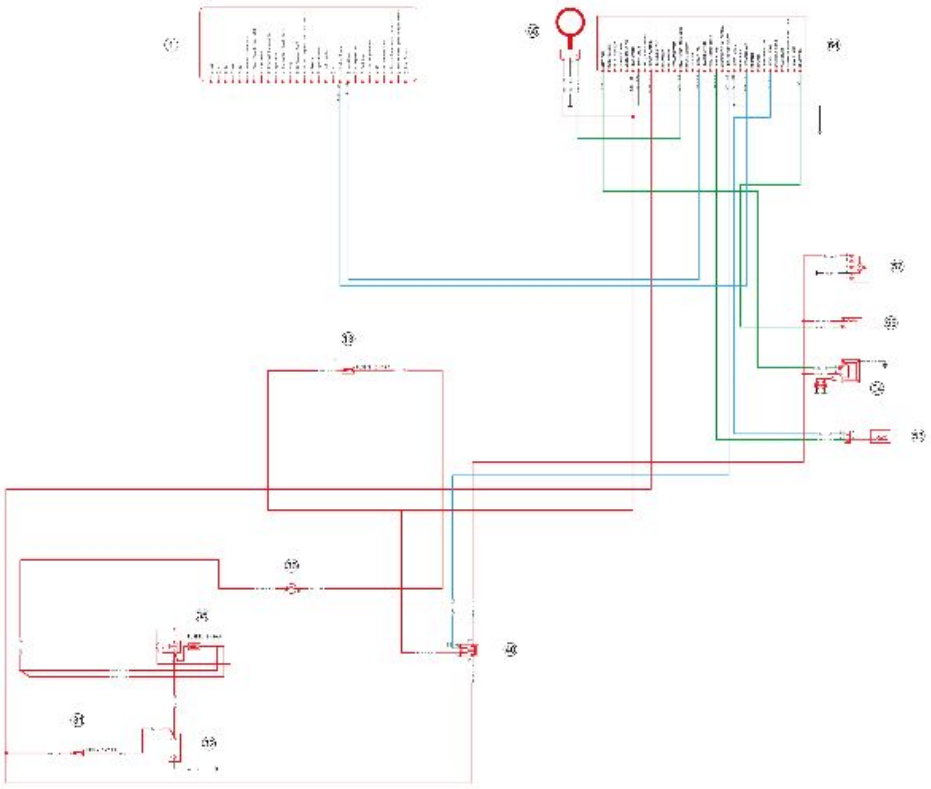
27. Voltage regulator connector



28. To voltage regulator

Conceptual diagrams

Ignition



KEY

1. Instrument panel

13. Secondary fuses

31. Main fuses

32. Battery

35. Fuse No. 13

36. ignition key contacts

40. Injection load relay

53. Engine speed sensor

54. HV coil

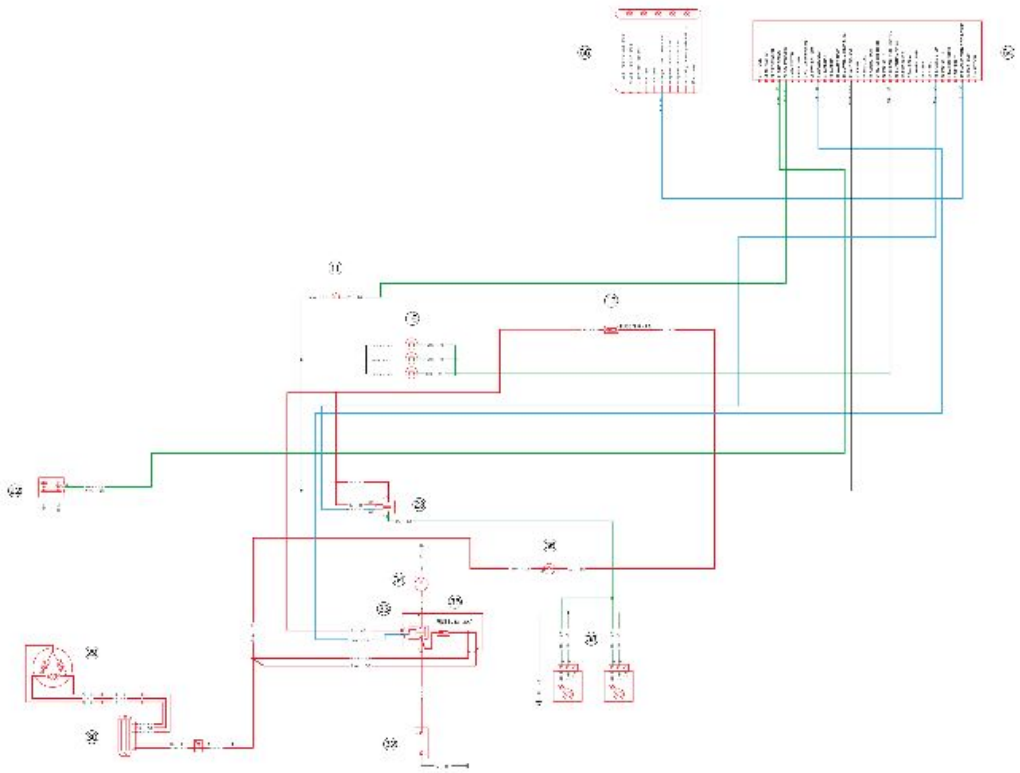
55. Injector

57. Fuel pump

64. Injection ECU

65. Immobilizer aerial

Battery recharge and starting



KEY

11. Starter button

13. Secondary fuses

16. Stop buttons lever and brake pedals

22. engine stop switch

23. Stop light relay

29. Magneto flywheel

30. Voltage regulator

32. Battery

33. Start-up relay

34. Starter motor

35. Fuse No. 13

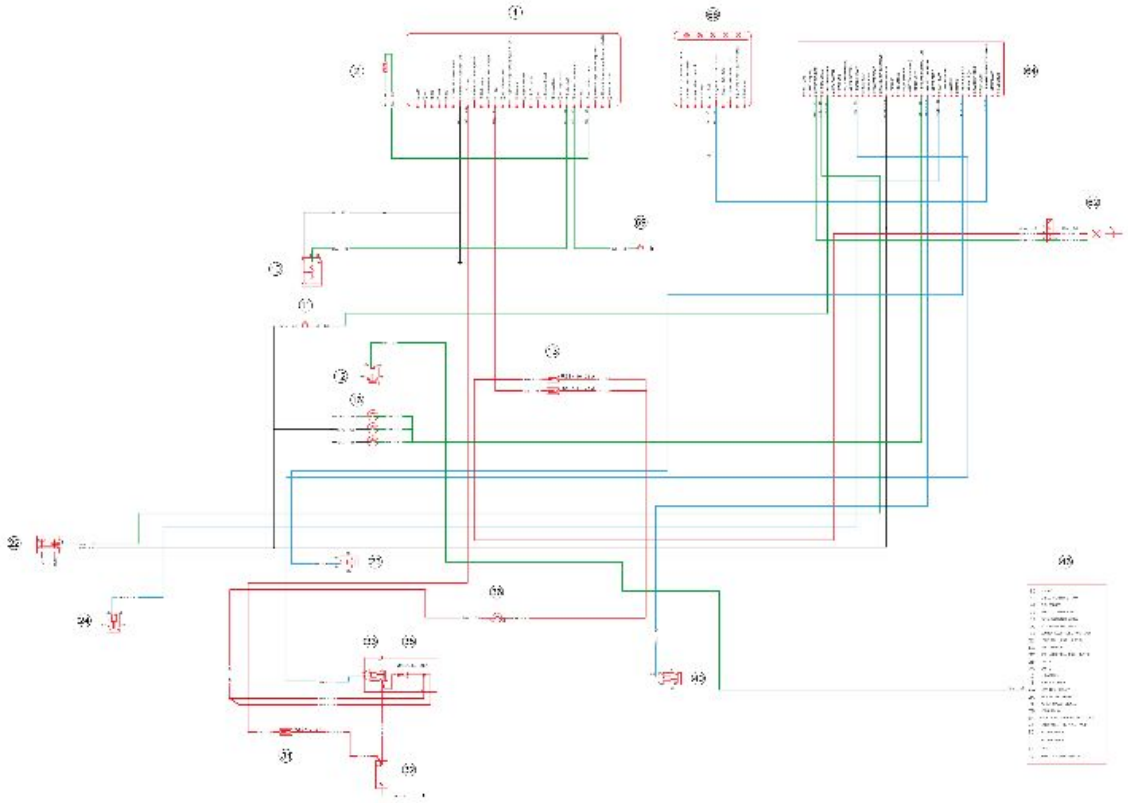
36. ignition key contacts

38. Rear headlight assembly

64. Injection ECU

66. Warning light unit

Level indicators and enable signals section



KEY

1. Instrument panel

2. Ambient temperature sensor

10. Fuel level transmitter

11. Starter button

12. Headlight relay

13. Secondary fuses

16. Stop buttons lever and brake pedals

22. engine stop switch

23. Stop light relay

24. Electric fan relay

31. Main fuses

32. Battery

33. Start-up relay

35. Fuse No. 13

36. ignition key contacts

40. Injection load relay

46. Parking control ECU

62. Tip over sensor

64. Injection ECU

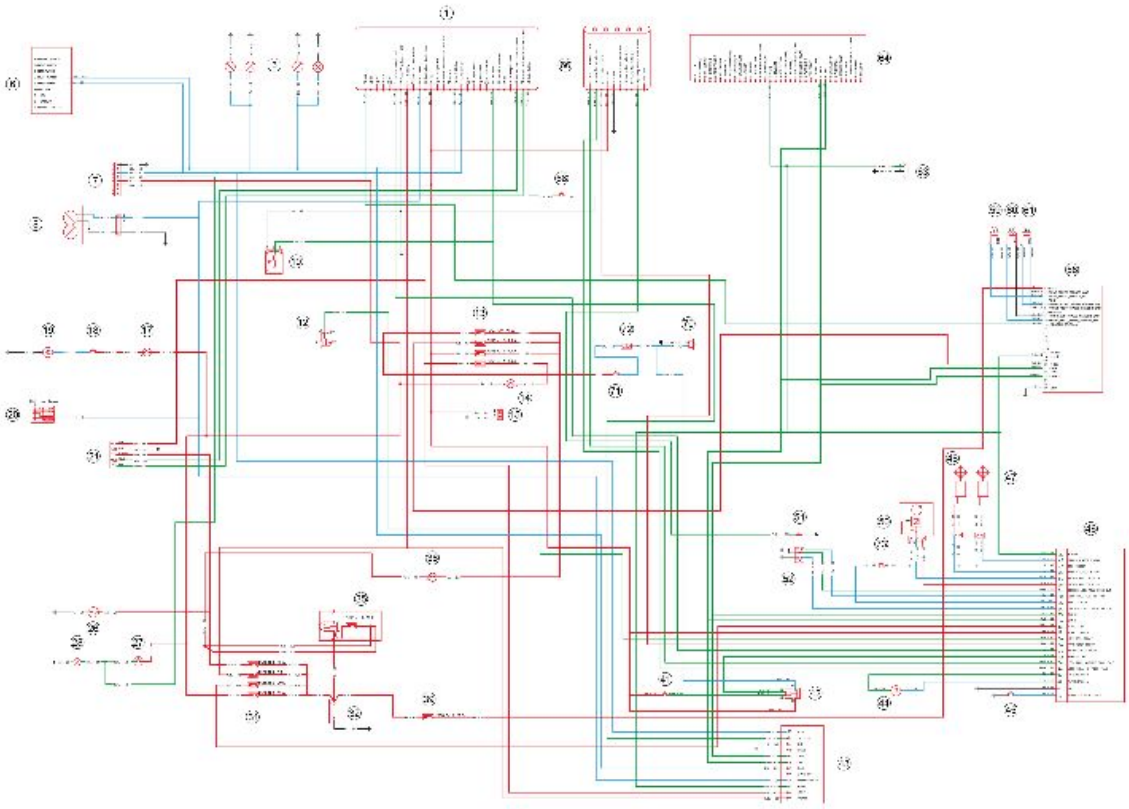
66. Warning light unit

69. Oil pressure sensor

Devices and accessories

CAUTION

THE FOLLOWING INSTRUCTIONS REFER TO THE VEHICLE VERSION EQUIPPED WITH ABS - ASR SYSTEM.



KEY

1. Instrument panel

3. Turn indicator bulbs

6. Turn indicators control device

7. Pre-installation for anti-theft device

8. Headlight

10. Fuel level transmitter

12. Headlight relay

13. Secondary fuses

14. ignition key contacts

15. USB socket

17. Ignition switch contacts

18. Saddle opening switch

19. Saddle opening actuator

20. Light switch

21. Pre-installation heated handgrips control device and leg warmer

26. Plug socket

27. Helmet compartment light switch

28. Helmet compartment light bulb

31. Main fuses

32. Battery

35. Fuse No. 13

36. ignition key contacts

39. Fuse No. 14

41. Pressure sensor

42. Horn relay

43. PMP connection

44. Geared motor

45. Brake calliper sensor

46. Parking control ECU

47. Right speed sensor

48. Left speed sensor

50. Rotation sensor

51. Hand brake switch

52. Suspension locking/unlocking switches

58. ABS control unit

59. Rear ABS sensor

60. Left front ABS sensor

61. Right front ABS sensor

63. Diagnostic socket

64. Injection ECU

66. Warning light unit

68. MODE button

70. Horn

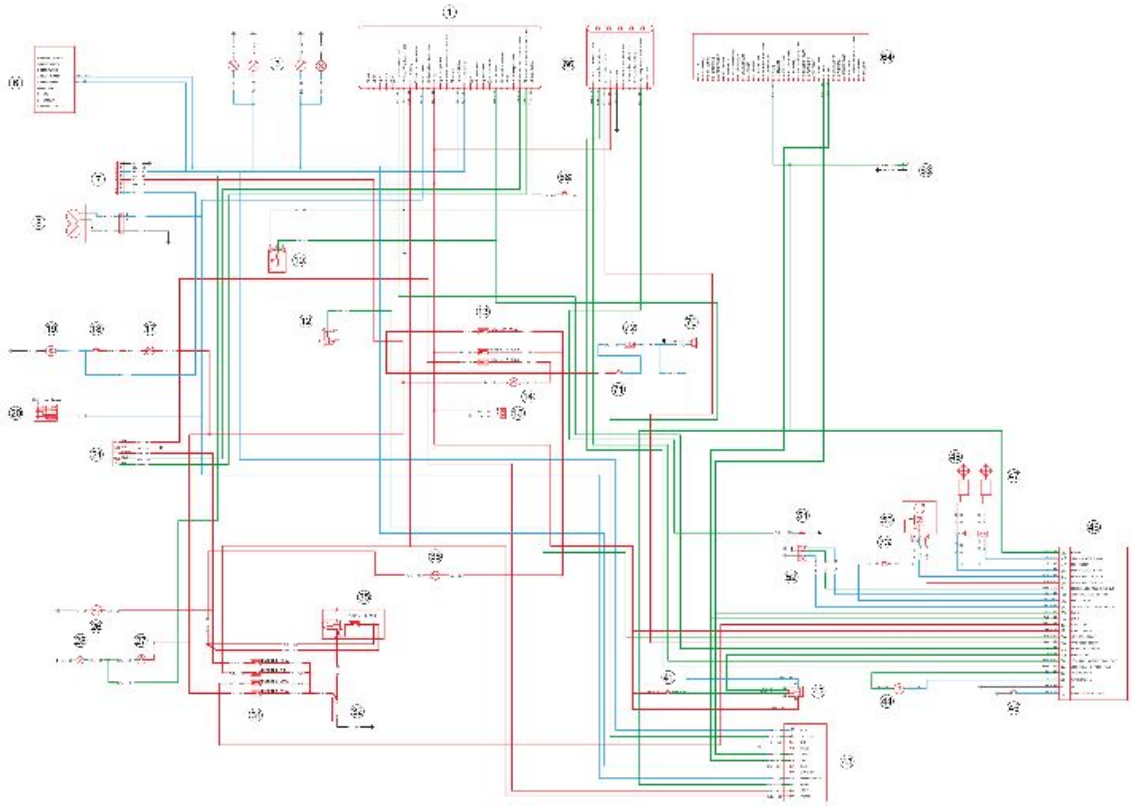
71. horn button

72. Horn connection for anti-theft device

73. Rider presence sensor

CAUTION

THE FOLLOWING INSTRUCTIONS REFER TO THE VEHICLE VERSION NOT EQUIPPED WITH ABS - ASR SYSTEM.



KEY

1. Instrument panel

3. Turn indicator bulbs

6. Turn indicators control device

7. Pre-installation for anti-theft device

8. Headlight

10. Fuel level transmitter

12. Headlight relay

13. Secondary fuses

14. ignition key contacts

15. USB socket

17. Ignition switch contacts

18. Saddle opening switch

19. Saddle opening actuator

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21. Pre-installation heated handgrips control device and leg warmer

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41. Pressure sensor
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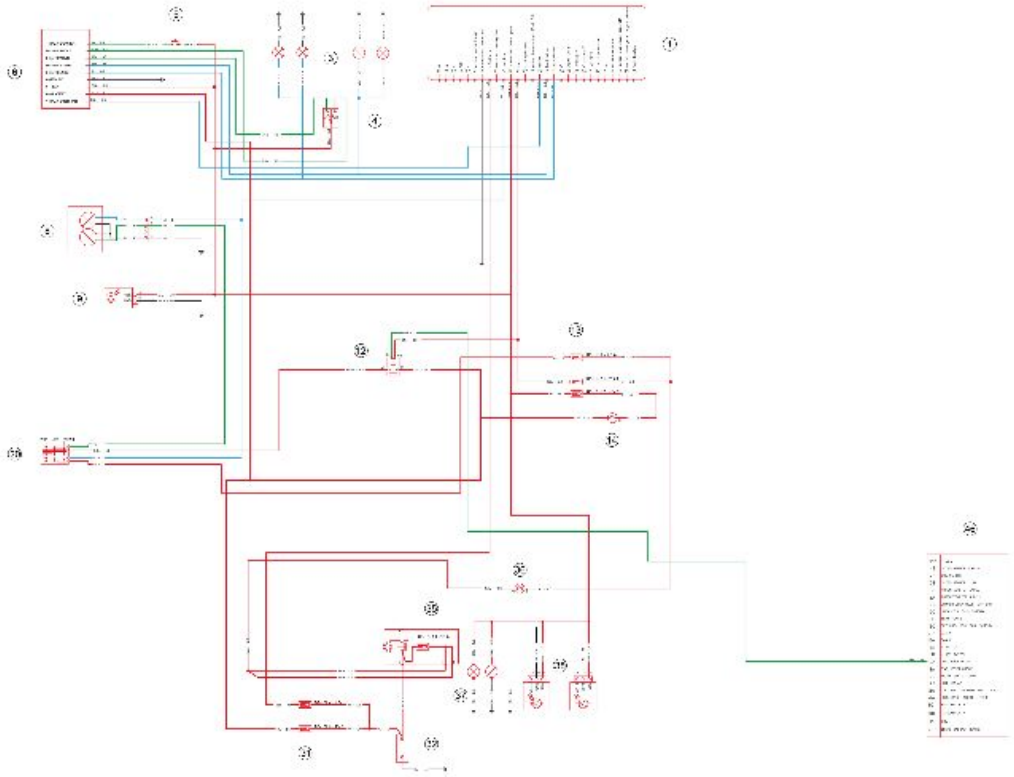
43. PMP connection
44. Geared motor
45. Brake calliper sensor
46. Parking control ECU
47. Right speed sensor
48. Left speed sensor
50. Rotation sensor
51. Hand brake switch
52. Suspension locking/unlocking switches
63. Diagnostic socket
64. Injection ECU
66. Warning light unit
68. MODE button
70. Horn
71. horn button
72. Horn connection for anti-theft device
73. Rider presence sensor

Lights and turn indicators



KEY

1. Instrument panel

3. Turn indicator bulbs

4. Turn indicator switch

5. Emergency turn indicator switch

6. Turn indicators control device

8. Headlight

9. Front daylight running light bulb

12. Headlight relay

13. Secondary fuses

14. ignition key contacts

20. Light switch

31. Main fuses

32. Battery

35. Fuse No. 13

36. ignition key contacts

37. License plate bulbs

38. Rear headlight assembly

46. Parking control ECU

Checks and inspections

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

Immobiliser

The electronic ignition system is controlled by the control unit with the integrated Immobilizer system. The immobilizer is an anti-theft system that allows the operation of the vehicle only if it is started with the keys encoded and recognized by the control unit. The code is integrated in a transponder in the key body. This allows transparent operation to the driver who does not have to carry out any other operation than to normally turn the key.
The immobilizer system contains the following components:
- an electronic control unit
- immobilizer aerial
- master key with built-in transponder
- service key with built-in transponder
- HV coil
- diagnosis LED

The diagnosis LED also works as a theft-deterrent blinker. This function is activated every time the ignition switch is set to «**OFF**» or the emergency stop switch is set to «**OFF**». It remains activated for 48 hours in order not to affect the battery charge. When the ignition switch is turned to «**ON**», the deterring blinker function is deactivated and a flash confirms the switching to « **ON**». The duration of the flash depends on the programming of the electronic control unit. If the LED is off regardless of the position of the ignition switch and/or the instrument panel is not initiated, check if:

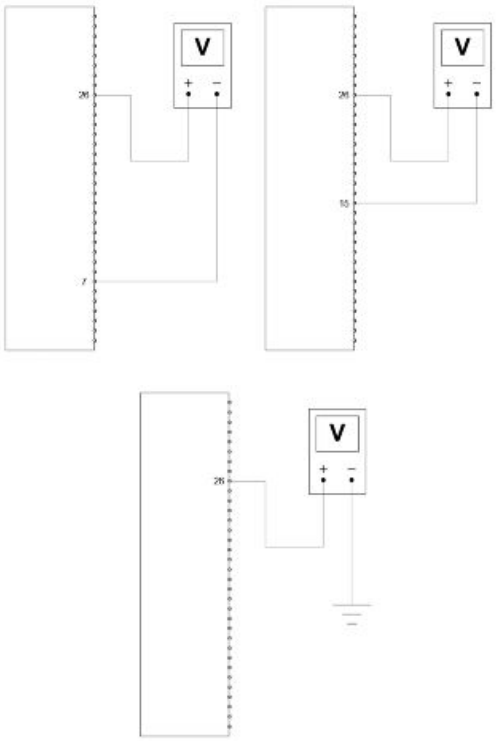
- there is battery voltage

- fuses 2, 11, 13 are in working order
- there is power to the control unit as specified below

Remove the connector mounting bracket shown in the photograph and disconnect the connector from the control unit. Check the following conditions:

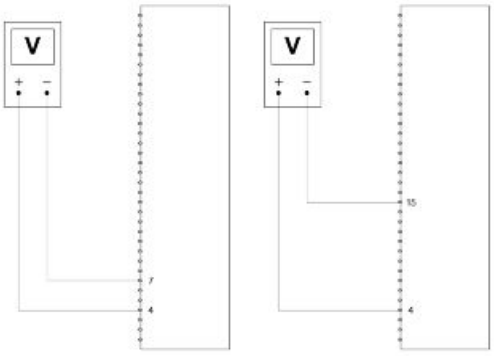
With the key switch set to OFF:

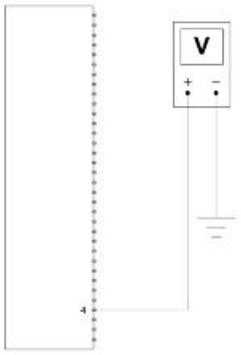
- if there is battery voltage between terminals 7-26, 15-26 and terminal 26-chassis ground (fixed power supply). If there is no voltage, check that fuse 6 and its cable harness are in working order.



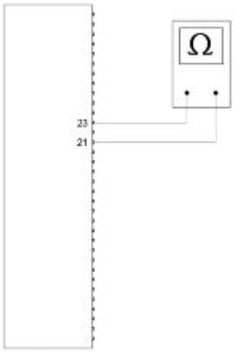
With the key switch in the ON position:

- if there is battery voltage between terminals 7-4, 15-4 and terminal 4-chassis ground (fixed power supply). If there is no voltage, check the ignition switch contacts and that fuses No. 10, 13 and their cables are in working order.

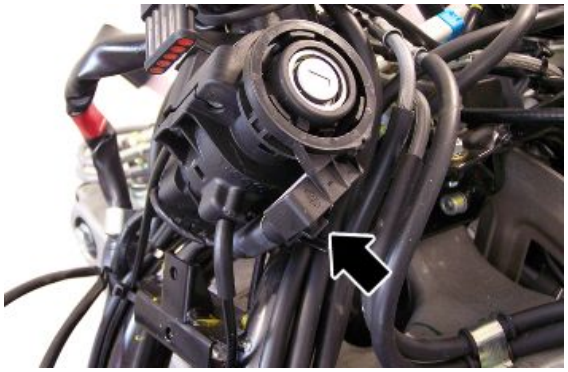




- There is continuity between terminals 21-23 with the emergency cut-off switch set to «RUN». If there is no continuity check the contacts of the switch.

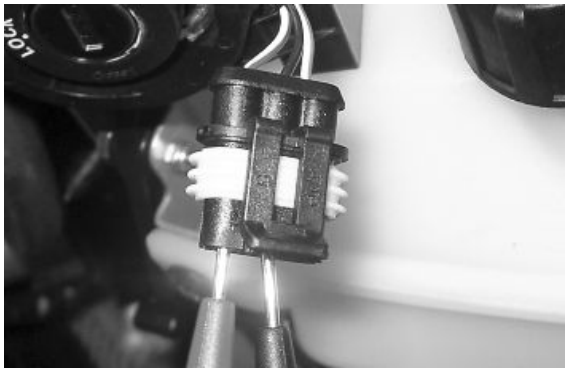


After removing the leg shield back plate, remove the electrical connection from the aerial as shown in the picture.



Remove the protective base from the connector.

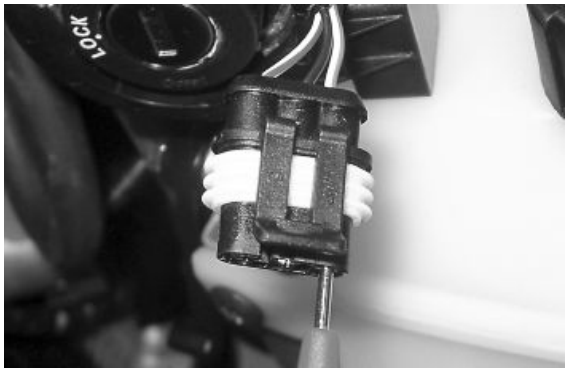
With the ignition key switch at «**ON**» check if there is battery voltage between the Red-White and Black cables.



Disconnect the control unit connector and check the continuity between pin 29 and the aerial Orange-White cable.

Specific tooling

020331Y Digital multimeter



Virgin circuit

When the ignition system is not encrypted, any key will start the engine but limited to 2000 rpm. The keys can only be recognised if the control unit has been programmed properly. The data storage procedure for a previously not programmed control unit provides for the recognition of the Master as the first key to be stored to memory: this becomes particularly important because it is the only key that enables the control unit to be wiped clean and reprogrammed for the memorisation of the service keys. The Master and service keys must be used to code the system as follows:

- Insert the Master key, turn it to «**ON**» and keep this position for 2 seconds (limit values 1-3 seconds).
- Insert the service key and turn it to «**ON**» for 2 seconds.
- If you have copies of the key, repeat the operation with each key.
- Insert the Master key again and turn it to «**ON** » for 2 seconds.

The maximum time to change keys is 10 seconds.

A maximum of 5 service keys can be programmed at one time.

It is essential to adhere to the times and the procedure. If you do not, start again from the beginning.

Once the system has been programmed, the Master key transponder is strictly matched with the control unit. With this link established, it is now possible to encode new service keys, in the event of losses, replacements, etc. Each new programming deletes the previous one; to add or delete a key it is therefore necessary to repeat the procedure using all the keys that you intend to keep in use. If a service key becomes uncoded, the efficiency of the high voltage circuit shielding must be thoroughly inspected. In any case it is advisable to use resistor spark plugs.

Characteristic

MASTER key:

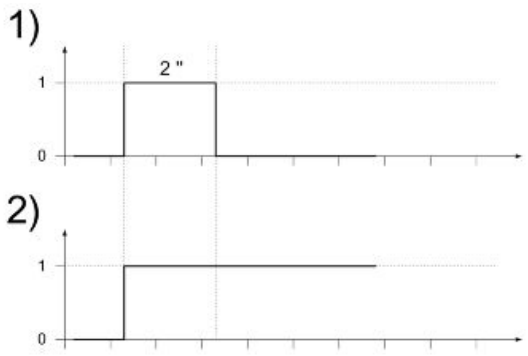
BROWN KEY

SERVICE key:

BLACK KEY

Diagnostic codes

The Immobilizer system is tested each time the ignition key is turned from «OFF» to «ON». During this diagnosis phase a number of control unit statuses can be identified and various light codes displayed. Regardless of the code transmitted, if at the end of the diagnosis the LED remains off permanently, the ignition is enabled. If, however, the LED remains on permanently, it means the ignition is inhibited:

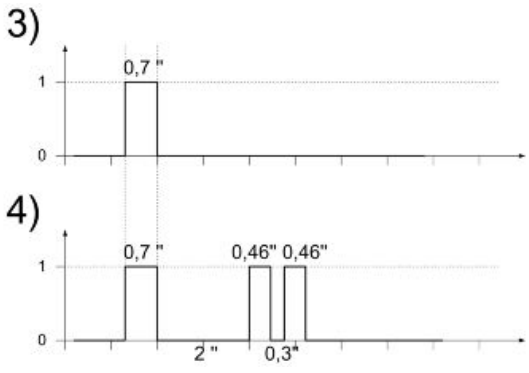


1. Previously unused control unit - key inserted: a single 2 second flash is displayed, after which the LED remains off permanently. The keys can be stored to memory, the vehicle can be started but with a limitation imposed on the number of revs.

2. Previously unused control unit - transponder absent or cannot be used: the LED is on permanently. In this condition no operations are possible including the start up of the vehicle.

3. **Programmed control unit - the service key in (normal condition of use)**: a single 0.7-second flash is displayed, after which the LED remains off steadily. The engine can be started.

4. **Programmed control unit - Master key in**: a 0.7-sec flash is displayed followed by the LED remaining off for 2 sec and then by short 0.46-sec flashes, the same number of times as there are keys stored in the memory including the Master key. When the diagnosis has been completed, the LED remains permanently OFF. The engine can be started.

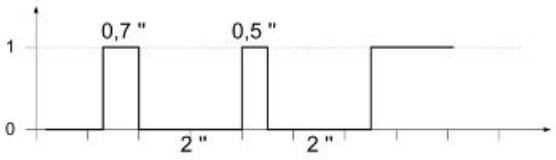


5. Programmed control unit - fault detected: a light code is displayed according to the fault detected, after which the LED remains on steadily. The engine cannot be started. The codes that can be transmitted are:

- 1-flash code
- 2-flash code
- 3-flash code

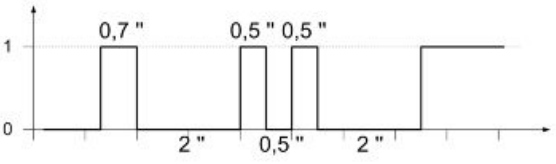
Diagnostic code - 1 flash

A one-flash code indicates a system where the serial line is not present or is not detected. Check the Immobilizer antenna wiring and change it if necessary.



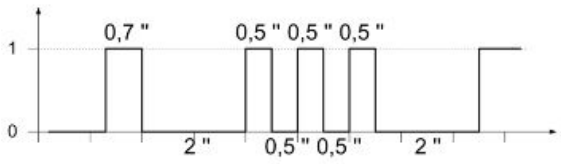
Diagnostic code - 2 flashes

Il codice 2 lampi contraddistingue un impianto dove la centralina non rileva il segnale del trasponder. Ciò può dipendere dalla inefficienza dell'antenna o del trasponder. Commutare l'interruttore in ON utilizzando più chiavi: se il codice viene ripetuto anche con la chiave Master verificare l'alimentazione dell' antenna e l'antenna stessa ed eventualmente sostituirla. In caso contrario procedere con la sostituzione della chiave difettosa e procedere con la riprogrammazione.



Diagnostic code - 3 flashes

Il codice 3 lampi contraddistingue un impianto dove la centralina non riconosce la chiave (ovvero riconoscimento del transponder, ma non inserito in programmazione, una chiave è rimasta fuori dalla programmazione). Procedere con una nuova programmazione, passando tutte le chiavi . Commutare l'interruttore in ON utilizzando più chiavi: se il codice di errore viene ripetuto anche con la chiave Master, la centralina risulta difettosa.



Remote controls check

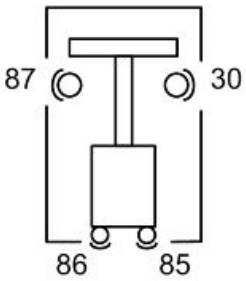
To check the operation of a relay:

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.



Battery recharge circuit

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

The generator 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.

Stator check

Checking the stator winding

WARNING

THE CHECK-UP CAN BE MADE WITH THE STATOR PROPERLY INSTALLED.

1) Remove the right side panel.

2) Disconnect the connector between stator and regulator with the three yellow cables as shown in the picture.

3) Measure the resistance between each of the yellow terminals and the other two.

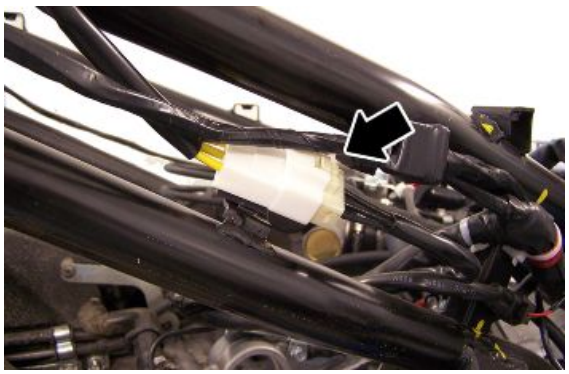
Electric characteristic

Resistance:

0.2 - 1 Ω

4) Check that there is insulation between the each yellow cable and the ground.

5) If values are incorrect, replace the stator.



Recharge system voltage 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 position OFF, 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 key always at OFF, the reading indicated by the ammeter must be ≤ 0.5 mA.

Charging current check

WARNING

BEFORE CARRYING OUT THE CHECK, MAKE SURE THAT THE BATTERY IS IN GOOD WORKING ORDER.

1) Place the vehicle on its centre stand

2) With the battery correctly connected to the circuit, place the multimeter leads between the battery terminals..

3) Turn on the engine, increase the engine rpm and, at the same time, measure the voltage.

Electric characteristic

Voltage ranging between 14.0 and 15.0V at 5000 rpm.

Maximum current output check.

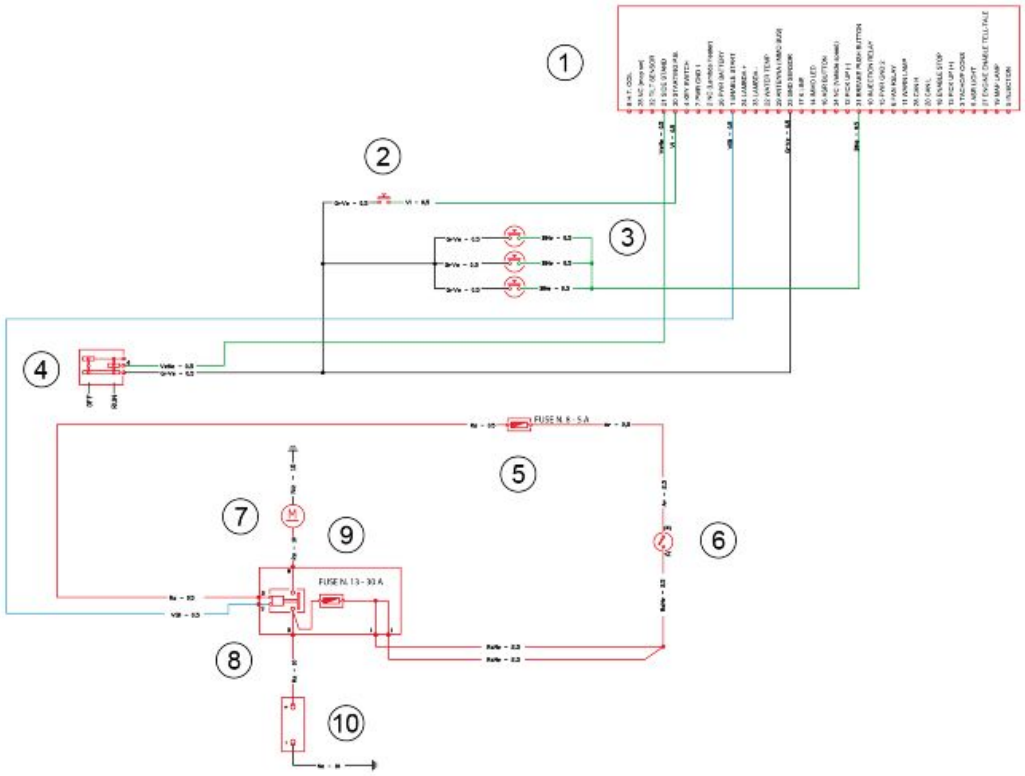
- With the engine off and the panel at «ON» with the lights on, allow the battery voltage to stop at 12V.
- Connect ammeter pliers to the 2 recharge positive poles in output from the regulator.
- Start the engine and rev it up to a high engine speed while reading the value on the pincer.

With an efficient battery a value must be detected: > 20A

VOLTAGE REGULATOR/RECTIFIER

Specification	Desc./Quantity
Type	Non-adjustable three-phase transistor
Voltage	14 to 15V at 5000 rpm with lights off

Starter motor



KEY

1. Injection ECU

2. Starter button

3. Stop buttons lever and brake pedals

4. engine stop switch

5. Fuse No. 8

6. ignition key contacts

7. Starter motor

8. Start-up relay

9. Fuse No. 13

10. Battery

WARNING

ALL CONTINUITY TESTS MUST BE CARRIED OUT WITH THE CORRESPONDING CONNECTORS DISCONNECTED.

1) Check fuses No. 8 and 13.

2) Check the contacts of the ignition switch, the stop buttons, the starter button and the engine stop switch.

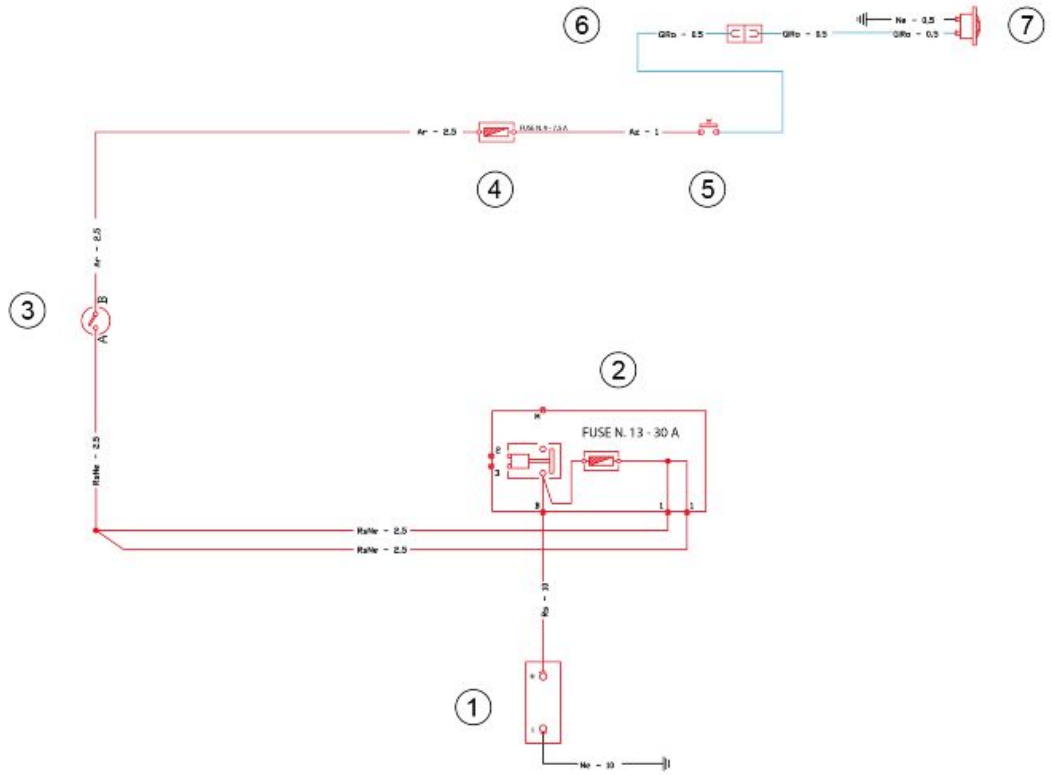
3) Check the correct operation of the starter relay.

4) Check the following wiring for continuity:

- Red-Black cables between fuse No. 13 (on starter relay) and ignition switch;
- Orange cable between ignition switch and fuse-box (fuse No. 8);
- Red cable between fuse-box (fuse No. 8) and starter relay;
- Purple-White cable between starter relay and injection control unit (pin 1).

5) Check the starter motor ground connection (Black cable).

Horn control



KEY

1. Battery

2. Fuse No. 13

3. Key switch contacts

4. Fuse No. 9

5. Horn button

6. Horn connection for anti-theft device

7. Horn

WARNING

ALL CONTINUITY TESTS MUST BE CARRIED OUT WITH THE CORRESPONDING CONNECTORS DISCONNECTED.

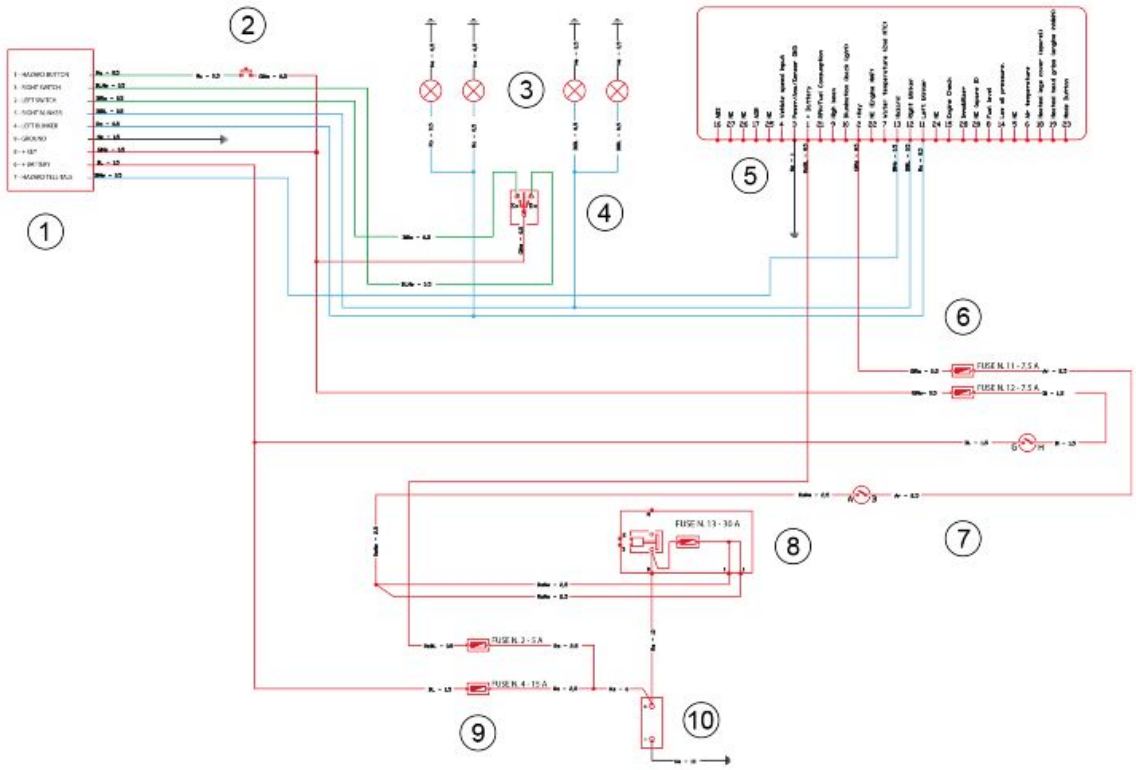
1) Check fuses No. 13 and 9 and the key switch contacts and the horn button.

2) Check the following wiring for continuity:

- Red-Black cables between fuse No. 13 (on starter relay) and ignition switch;
- Orange cable between ignition switch and fuse-box (fuse No. 9);
- Light blue cable between fuse-box (fuse No. 9) and horn button;
- Yellow-Pink cable between horn button and the horn itself.

3) Check the horn ground connection (Black cable).

Turn signals system check



KEY

1. Turn indicators control device

2. Emergency turn indicator switch

3. Turn indicator bulbs

4. Turn indicator switch

5. Instrument panel

6. Secondary fuses (no. 11 and 12)

7. ignition key contacts

8. Fuse No. 13

9. Main fuses (no. 2 and 4)

10. Battery

WARNING

ALL CONTINUITY TESTS MUST BE CARRIED OUT WITH THE CORRESPONDING CONNECTORS DISCONNECTED.

1) Check that bulbs operate properly.

2) Check fuses No. 4 and 12.

3) Check the contacts of the ignition switch, the turn indicator switch and the hazard warning light button.

4)With the ignition switch set to «**ON**», check whether there is voltage:

- between the White-Pink cable of the turn indicator control device and ground, with left operated turn indicator switch;
- between the Blue-Black cable of the turn indicator control device and ground, with right operated turn indicator switch;
- between the Brown cable of the turn indicator control device and ground, with pressed turn indicator button.

5) If there is no voltage, check that there is continuity in the relevant cable harness.

6) Check that the turn indicator control device is powered by making sure there is voltage:

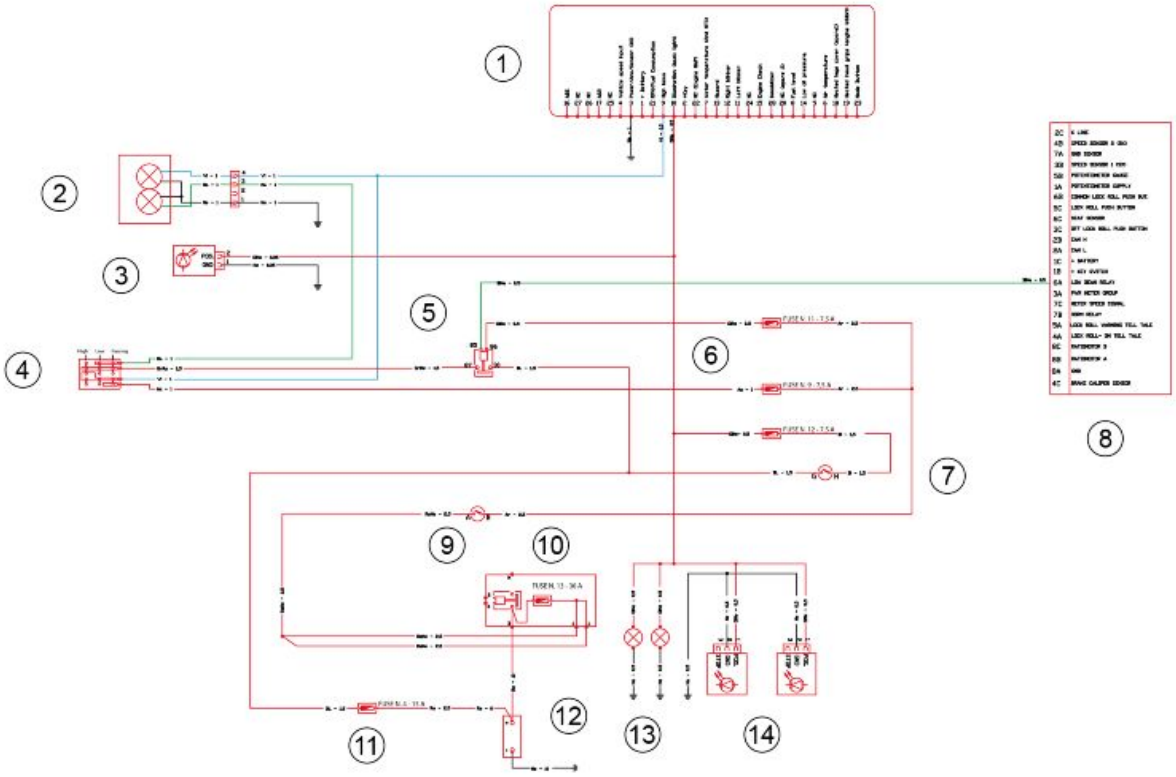
- between the Blue cable and the Black cable (pin 6 and 9);
- between the Yellow-Black cable and the Black cable (pin 8 and 9), with ignition switch to «**ON**».

7) If there is no voltage, check that there is continuity in the relevant cable harness.

8) Check that the cable harness connecting the bulbs to the turn indicator control device (White-Blue and Pink cables) are not interrupted.

9) Check the bulbs ground connection (Black cables).

Lights list



KEY

1. Instrument panel

2. Headlight

3. Front daylight running light bulb

4. Light switch

5. Headlight relay

6. Secondary fuses (no. 9, 11, 12)

7. ignition key contacts

8. Parking control ECU

9. Ignition switch contacts

10. Fuse No. 13

11. Fuse No. 4

12. Battery

13. License plate bulbs

14. Rear headlight assembly

WARNING

ALL CONTINUITY TESTS MUST BE CARRIED OUT WITH THE CORRESPONDING CONNECTORS DISCONNECTED.

DAYLIGHT RUNNING LIGHT LINE CHECK

1) Check that bulbs operate properly.

2) Check fuses No. 4 and 12.

3) Check ignition switch contacts.

4) With the ignition switch «**ON**», check if there is voltage between the Yellow-Black cable of fuse No. 12 and the ground lead. Otherwise, check the continuity of cable harnesses.

5) Check the continuity of the cable harnesses between the bulbs and the fuse No. 12 (Yellow-Black cables).

6) Check the bulbs ground connection (Black cables).

HIGH/LOW BEAM LIGHTS LINE - CHECK

1) Check that bulbs operate properly.

2) Check fuses No. 4, 9, 11 and 13.

3) Check ignition switch contacts.

4) Check there is voltage:

- between the Blue cable of the headlight relay and the ground lead;
- between the Yellow-Red cable of the headlight relay and the ground lead, with ignition switch to «**ON**»
- between the Light blue cable of the light switch and ground lead, with ignition switch set to «**ON**».

5) Check that the cable harnesses are not interrupted wherever no voltage is detected.

6) Check the correct operation of the headlight relay.

7) Check the light switch contacts.

8) check if there is continuity in:

- the White-Black cable between parking control ECU (pin 6A) and headlight relay
- the Grey-Red cable between headlight relay and light switch;
- the cable harnesses between headlight and light switch (Brown cable and Purple cable).

9) Check the bulbs ground connection (Black cables).

BULBS TABLE

	Specification	Desc./Quantity
1	Low beam bulb	**Type:** HALOGEN (H1) **Power:** 12V - 55W **Quantity:** 1
2	High beam bulb	**Type:** HALOGEN (H1) **Power:** 12V - 55W **Quantity:** 1
3	Front parking light	**Type**: LED **Quantity**: 1 **Power**: -
4	Stop light/rear daylight running light bulb	**Type**: LED **Quantity**: 1 Right - 1 Left **Power**: -
5	Front turn indicator light bulb	**Type**: Incandescent (BAU 15s) **Power**: 12V - 10W **Quantity**: 1 RHS + 1 LHS
6	Rear turn indicator light bulb	**Type:** Incandescent (BAU 15s) **Power:** 12V - 10W **Quantity:** 1 RHS + 1 LHS
7	Helmet compartment light bulb	**Type:** FESTOON BULB **Power:** 12V - 5W **Quantity:** 1
8	License plate light bulb	**Type:** Incandescent

Specification	Desc./Quantity
	Power:12V - 5W **Quantity:**2

Fuses

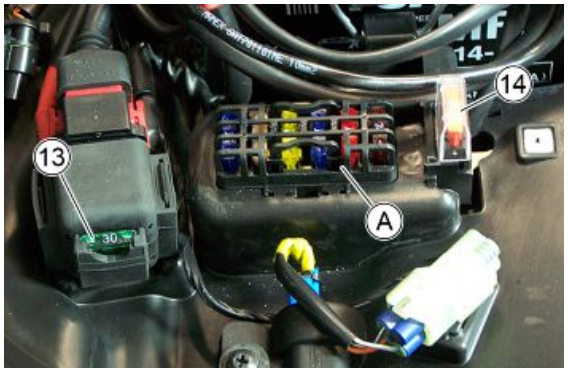
The electrical system has thirteen fuses for protection of different system circuits divided into one single fuse «**13**» and two fuse-boxes.

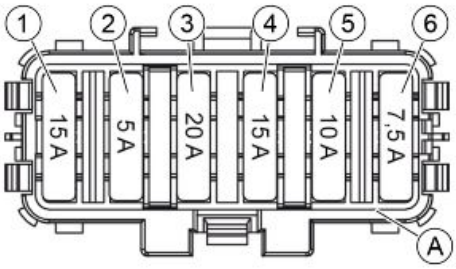
The fuse «**13**» and the first box, «**A**», are placed inside the battery compartment while the second box, «**B**», is inside the footrest on the left side of the vehicle.

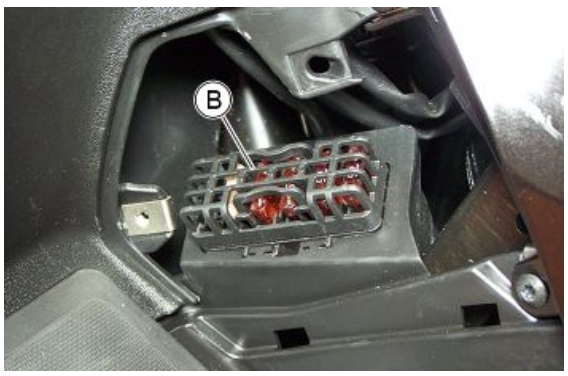
To reach the box «**B**», remove the plastic cover after removing the screw indicated in the picture.

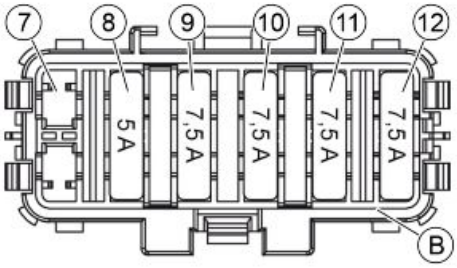
The vehicle version equipped with ABS - ASR system, is equipped with an additional fuse «**14**», for the protection of the ABS control unit circuit and placed inside the battery compartment.

The following tables show the characteristics of the fuses on the vehicle.









CAUTION

BEFORE REPLACING THE FUSE IT IS NECESSARY TO FIND AND SOLVE THE FAILURE THAT CAUSED IT TO BLOW.
DO NOT REPLACE THE FUSE WITH ANY ALTERNATIVE FORM OF CONDUCTOR.

CAUTION

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

CAUTION

MODIFICATIONS OR REPAIRS TO THE ELECTRICAL SYSTEM, PERFORMED INCORRECTLY OR WITHOUT STRICT ATTENTION TO THE TECHNICAL SPECIFICATIONS OF THE SYSTEM CAN CAUSE MALFUNCTIONING AND RISK OF FIRE.

CAUTION

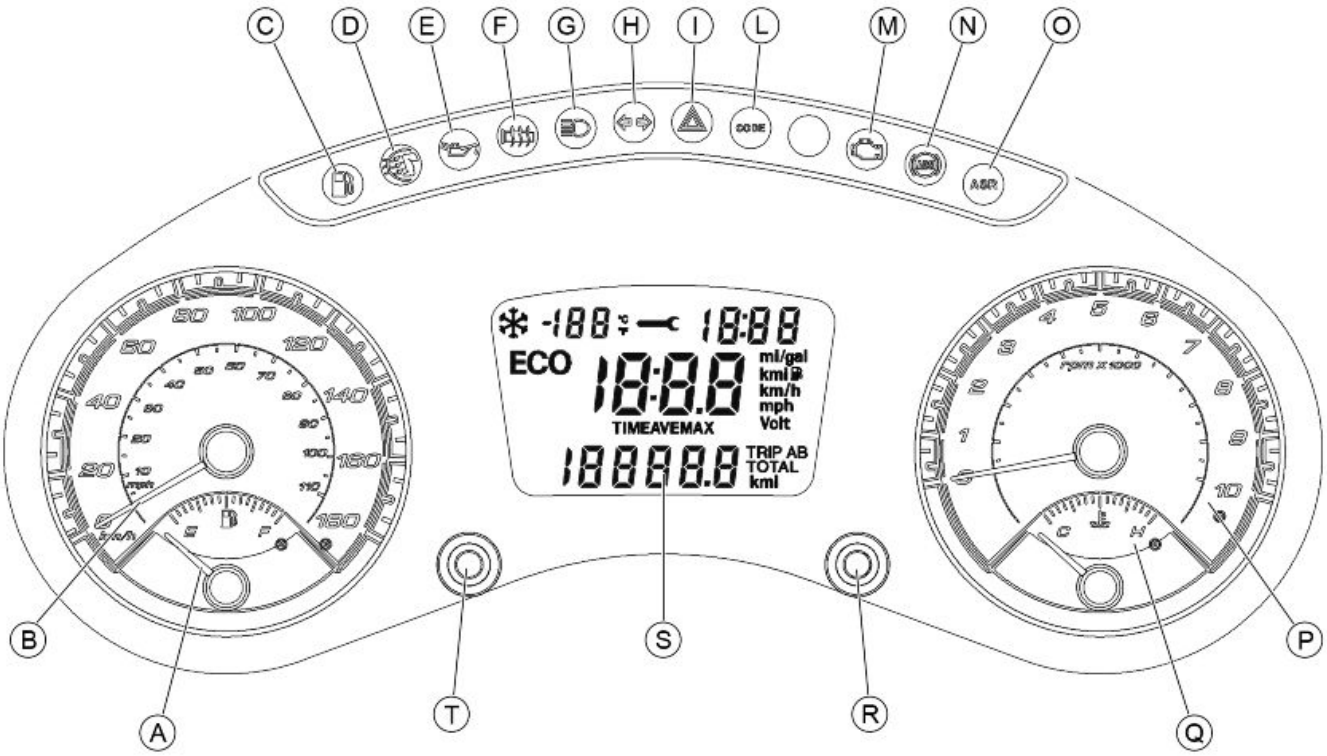
PROCEED WITH CAUTION.
DO NOT DAMAGE THE TONGUES OR THEIR SEATS. HANDLE THE PAINTED AND PLASTIC COMPONENTS CAREFULLY. DO NOT SCRATCH OR DAMAGE THEM.

FUSE CHART

	Specification	Desc./Quantity
1	Fuse no. 1	**Capacity:** 15 A **Protected circuits:** Plug socket, pre-installation heated handgrips control device and leg warmer.
2	Fuse no. 2	**Capacity:** 5 A **Protected circuits:** Instrument panel, PMP connection.
3	Fuse No. 3	**Capacity:** 20 A **Protected circuits:** Parking electronic control unit.
4	Fuse No. 4	**Capacity:** 15 A **Protected circuits:** Helmet compartment lighting, turn indicator control device, headlight (via relay), pre-installation for anti-theft device. **Protected circuits (live):** Saddle opening button, fuse No. 12.
5	Fuse No. 5	**Capacity:** 10 A **Protected circuits:** Electric fan (via solenoid).
6	Fuse No. 6	**Capacity:** 7.5 A **Protected circuits:** Engine control unit, injection load (via relay).
7	Fuse No. 7	Empty

	Specification	Desc./Quantity
8	Fuse No. 8	**Capacity:** 5 A **Protected circuits (live):** Stop lights (via relay), starter relay.
9	Fuse No. 9	**Capacity:** 7.5 A **Protected circuits (live):** Horn, high beam flashing switch.
10	Fuse No. 10	**Capacity:** 7.5 A **Protected circuits (live):** Injection load relay, ABS control unit, tip over sensor, engine control unit, immobilizer aerial.
11	Fuse No. 11	**Capacity:** 7.5 A **Protected circuits (live):** USB socket, parking electronic control unit, pressure sensor, horn (via relay), headlight relay, pre-installation for anti-theft device, instrument panel, warning lights unit.
12	Fuse No. 12	**Capacity:** 7.5 A **Protected circuits (live):** PMP connection, daylight running lights, licence plate lights, instrument panel lighting, turn indicator control device, pre-installation heated handgrips control device and leg warmer.
13	Fuse No. 13	**Capacity:** 30 A **Protected circuits:** Recharge circuit. **Protected circuits (live):** Fuses No. 8, 9, 10 and 11.
14	Fuse No. 14 (if present)	**Capacity:** 40 A **Protected circuits:** ABS control unit.

Dashboard



A = Fuel gauge

B = Speedometer

C = Fuel reserve warning light

D = Leg warmer warning light (if fitted)

M = Low oil pressure warning light

F = Heated handgrip warning light (if fitted)

G = High beam warning light

H= Turn indicator warning light

I = Hazard warning light

L = Immobilizer LED

M = Engine control warning light and engine failure warning light

N = ABS warning light (if fitted)

O = ASR warning light (if fitted)

P = Engine rpm indicator

Q = Coolant temperature gauge

R = SET button

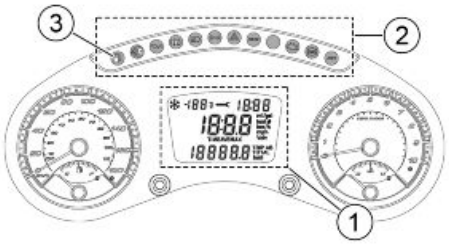
S = Digital display

T = ODO/TRIP button

Turning the ignition switch to «**ON**»:

- all the functions on the digital display «**1**» light up;

- All the warning lights «**2**» on the instrument panel light up; - The fuel reserve warning light e «**3**» remains on for two seconds, then it has the normal function to indicate that the fuel reaches the reserve; - The needles move up to full scale and back and then get set on the value to be displayed.



The digital display can be divided into five main zones, within which the functions and settings are developed:

- indication of temperature and ice warning «**4**»; - maintenance icon «**5**»; - clock «**6**»; - information about speed, instantaneous and average travel, autonomy and battery voltage «**7**»; - information about distances «**8**» for the «**TOTAL**», «**TRIP A**» and «**TRIP B**» functions.

WARNING LIGHT UNIT

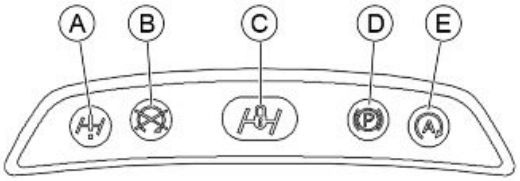
A = Front suspension locking system failure warning light

B = Engine stop warning light

C = Front suspension locking system warning light

D = Warning light for parking brake engaged

E = Warning light not active



ENGINE CONTROL WARNING LIGHT AND ENGINE FAILURE WARNING LIGHT

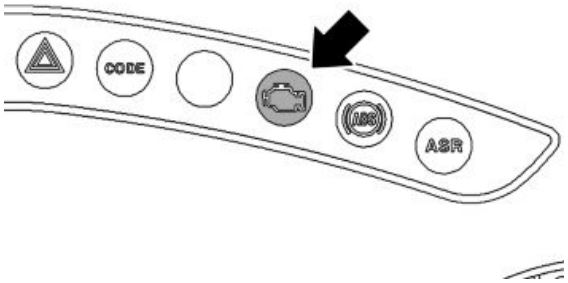
The warning light signals possible failure detected by the engine control unit. After the initial check of switching to «**ON**», the warning light, in case of failure, has two different signal modes:

- LIT CONSTANTLY

A failure was detected, which could compromise/ degrade the engine performance.

- FLASHING WARNING LIGHT

A failure was detected, which could compromise the rider's safety, therefore the engine performance is deliberately degraded.



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 BATTERY REFRESH AFTER OPEN CIRCUIT STORAGE

1) Voltage check

Before installing the battery on the vehicle, check the open circuit voltage with a standard tester.

- If voltage exceeds 12.60 V, the battery can 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 to 14.70V
- Initial charge voltage equal to 0.3 to 0.5 for Nominal capacity

- Charge time:

10 to 12 h recommended

Minimum 6 h

Maximum 24 h

3) Constant current battery charge mode

- Charge current equal to 1/10 of the battery rated capacity

- Charge time: Maximum 5 h

Battery installation

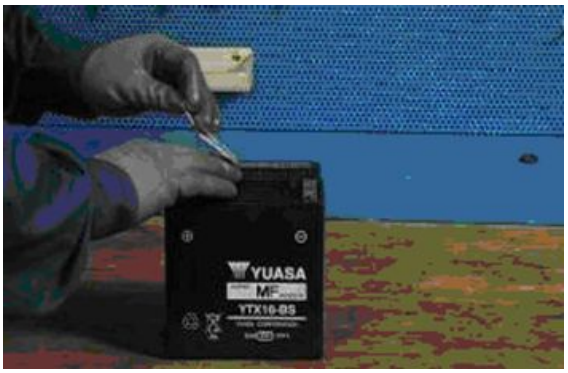
VRLA battery (valve-regulated lead-acid battery) Maintenance Free (MF)

WARNING

BATTERY ELECTROLYTE IS TOXIC AND IT MAY CAUSE SERIOUS BURNS. IT CONTAINS SULPHURIC ACID. AVOID CONTACT WITH YOUR 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 ACCIDENTALLY SWALLOWED, IMMEDIATELY DRINK LARGE QUANTITIES OF WATER OR MILK FOLLOWED BY MAGNESIUM MILK, BEATEN EGG OR VEGETABLE OIL. SEEK IMMEDIATE MEDICAL ATTENTION.
BATTERIES PRODUCE EXPLOSIVE GASES; KEEP CLEAR OF NAKED FLAMES, SPARKS OR CIGARETTES; VENTILATE THE AREA WHEN RECHARGING INDOORS.
ALWAYS WEAR EYE PROTECTION WHEN WORKING IN THE PROXIMITY OF BATTERIES.
KEEP OUT OF THE REACH OF CHILDREN

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.

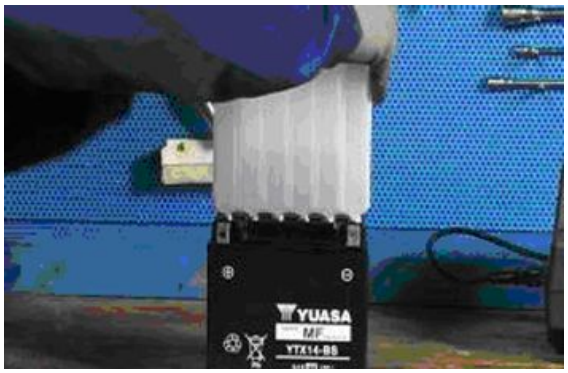


2) Electrolyte preparation.

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. Now, gently pull the container out from the battery, only do this when the container is completely empty, and proceed immediately to the next point.

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.

The filling process is now complete.

Do not remove the strip of caps under any circumstances, do not add water or electrolyte.

Place the battery down for 1 to 2 hours prior to the charging from 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 installing 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 no-load voltage between

12.8 - 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

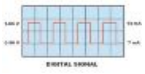
h - Disconnect the clamps from the battery and check the voltage, if voltages are detected of less than 12.8 V, proceed with a new recharge of the battery starting from point c of the recharge procedure of **the new battery**, otherwise go to point i

i - The battery is now completely activated, disconnect the battery charger from the fuel supply grid, disconnect the clamps from the battery and proceed to fitting the battery on the vehicle.

Phonic 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 hori-



zontal and vertical ax-

es.

Characteristic

Vibration 0.3 V

11.25 to 11.55 V ap-

proximately

For the correct operation, check the correct air gap

of the tone wheels:

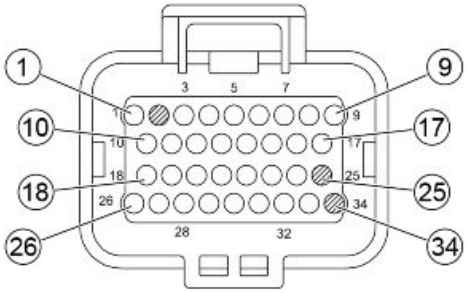
Characteristic

Air gap

0.1 to 2 mm

Connectors

INJECTION ECU CONNECTOR



1. Start-up enabling switch (Purple-White)

2. Not connected

3. Rpm indicator (Green)

4. Live power supply (Red-White)

5. Injector (Red-Yellow)

6. Electric fan relay (Green-White)

7. Ground lead 1 (Black)

8. HV coil (Pink-Black)

9. ABS Warning Light (Light blue-Red)

10. Injection loads relay (Black-Purple)

11. Injection warning light (Brown-Black)

12. Engine speed sensor negative (Brown)

13. Engine speed sensor positive (Red)

14. Immobilizer LED (Yellow)

15. Ground 2 (Black)

16. ASR Button (Light blue-Blue) (if applicable)

17. Line K (Orange-Black)

18. Stop light relay (Brown-White)

19. ECO mode (brown-red)

20. CAN L Line (Pink-White)

21. Engine stop switch (Green-Black)

22. Engine temperature sensor (Light blue-Green)

23. Ground sensors (Grey-Green)

24. Lambda probe positive (Green-Blue)

25. Not connected

26. Battery powered (Red-Green)

27. Engine stop warning light (Blue)

28. CAN H line (Pink-Red)

29. Immobilizer aerial (Orange-White)

30. Starter button (Purple)

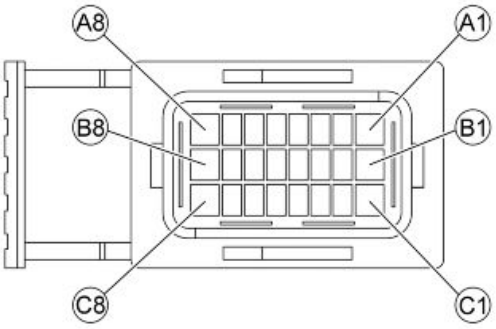
31. Stop buttons (White-Black)

32. Tip over sensor (Grey - Black)

33. Lambda probe negative (Light blue-Black)

34. Not connected

PARKING CONTROL ECU CONNECTOR



1A. Potentiometer power supply (Orange-Blue)

2A. CAN L Line (Pink-White)

3A. Warning light power supply (Yellow-Green)

4A. Roll lock activated warning light (Pink-Black)

5A. Roll lock system failure warning light (Grey-Black)

6A. Headlight solenoid (White-Black)

7A. Potentiometer ground lead, wheels and engine speed sensor, rider detection sensor (Yellow)

8A. Ground lead (Black)

1B. Key powered (Yellow-Red)

2B. CAN H line (Pink-Red)

3B. Left wheel speed sensor (Green)

4B. Right wheel speed sensor (Red)

5B. Potentiometer signal (Green-Blue)

6B. Suspension locking/unlocking button (Green-Grey)

7B. Horn relay for alarm (White)

8B. Geared motor (Yellow)

1C. Battery powered (Blue-Red)

2C. Line K (Orange-Black)

3C. Suspension locking/unlocking button (Yellow-Blue)

4C. Calliper sensor (Brown)

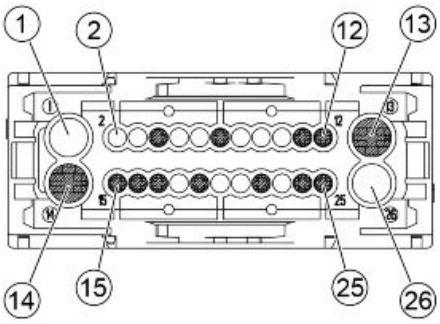
5C. Suspension locking/unlocking button (Purple-Black)

6C. Rider detection sensor (Purple)

7C. Vehicle speed signal (Sky blue)

8C. Geared motor (Blue)

ABS CONTROL UNIT CONNECTOR (IF APPLICABLE)



1. Battery-powered (Red)

2. Rear ABS sensor ground (Brown-Black)

3. Rear ABS sensor signal (Brown-Red)

4. Not connected

5. Right front ABS sensor signal (Purple-Red)

6. Right front ABS sensor ground (Purple-Black)

7. Not connected

8. Left front ABS sensor ground (Light blue-Black)

9. Left front ABS sensor signal (Light blue-Red)

10. ABS warning light (Orange)

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 power supply (Red-White)

21. CAN L Line (Pink-White)

22. Not connected

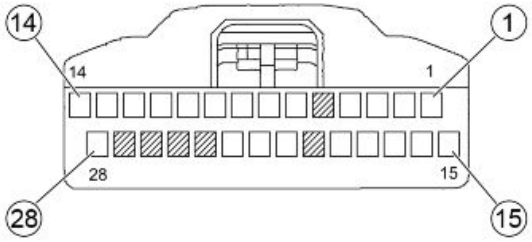
23. CAN H line (Pink-Red)

24. Not connected

25. Not connected

26. Ground lead (Black)

INSTRUMENT PANEL CONNECTOR



1. Battery-powered (Red-Blue)

2. Key powered (Yellow-Red)

3. Sensors ground lead (Black)

4. Vehicle speed signal (Sky blue)

5. Not connected

6. Ambient temperature signal (Yellow-Blue)

7. Engine temperature signal (Light blue-Black)

8. Fuel level indicator (White-Green)

9. High beam warning light (Purple)

10. Instrument panel lighting (Yellow - Black)

11. Left turn indicator warning light (Pink)

12. Right turn indicator warning light (White-Blue)

13. Emergency turn indicator warning light (White-Black)

14. Engine oil low pressure signal (Pink-White)

15. Injection warning light (Brown-Black)

16. ABS warning light (Orange) (if applicable)

17. ASR warning light (Light blue-Red) (if applicable)

18. Leg warmer warning light (Purple-White)

19. Heated handgrips warning light (Green-Orange)

20. Not connected

21. Engine speed signal (Green)

22. ECO mode (brown-red)

23. MODE button (Green-Blue)

24. Not connected

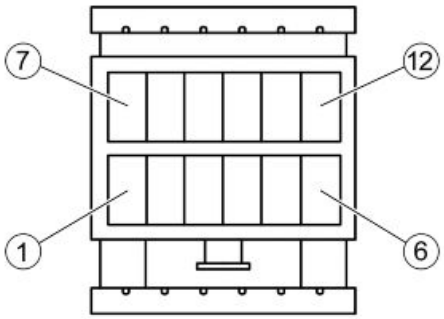
25. Not connected

26. Not connected

27. Not connected

28. Immobilizer LED (Yellow)

TURN INDICATOR CONTROL DEVICE CONNECTOR



1. Hazard button (Brown)

2. Left switch (White-Pink)

3. Right switch (Blue-Black)

4. Left turn indicators (Pink)

5. Right turn indicators (White-Blue)

6. Battery-powered (Blue)

7. Emergency warning light (White-Black)

8. Key powered (Yellow-Black)

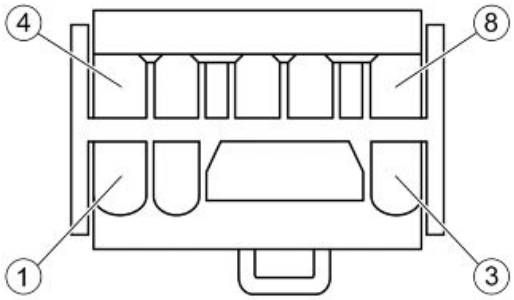
9. Ground lead (Black)

10. Not connected

11. Not connected

12. Not connected

ANTITHEFT DEVICE PRE-INSTALLATION CONNECTOR



1. Left turn indicators (Pink)

2. Right turn indicators (White-Blue)

3. Ground lead (Black)

4. Battery-powered (Blue)

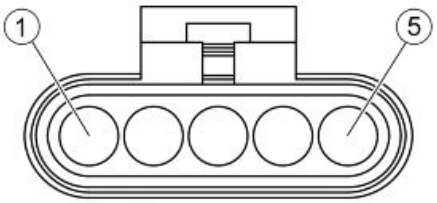
5. Key powered (Yellow-Red)

6. Helmet compartment lighting (Blue-Black)

7. Not connected

8. Saddle opening (Yellow-Grey)

FUEL PUMP CONNECTOR



1. Injection load relay (Black-Green)

2. Not connected

3. Not connected

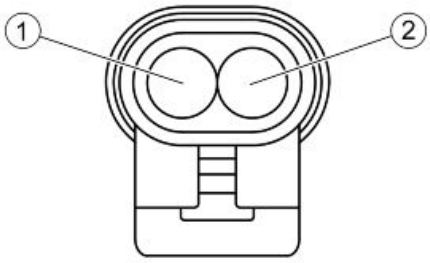
4. Ground lead (Black)

5. Not connected

H.V. COIL CONNECTOR

1. Injection load relay (Black-Green)

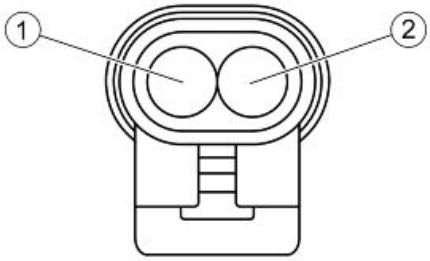
2. Injection ECU (Pink-Black)



PICK-UP CONNECTOR

1. Injection ECU (Red)

2. Injection ECU (Brown)



Diagnostic instrument

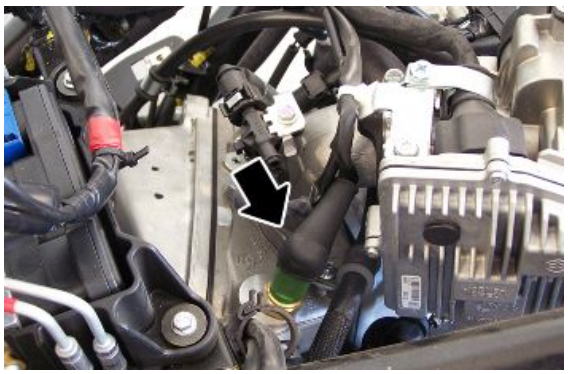
ENGINE TEMPERATURE SENSOR

Function

Serves the purpose of communicating the engine temperature to the control unit in order to optimise performance.

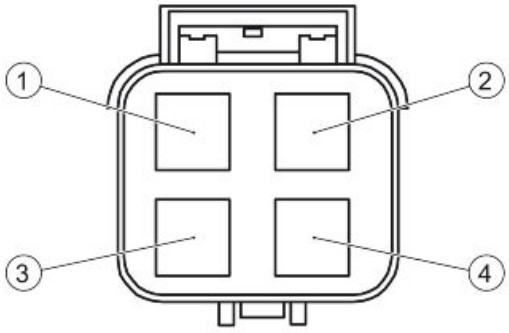
Operation / Operating principle

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



Pin-out:

1. Injection ECU
2. Instrument panel
3. Control unit ground
4. Ground lead



ELECTRICAL SPECIFICATIONS

Temperature	Resistance
20° C	1,965 - 2,500 Ω
60° C	561.1 - 590.5 Ω

Temperature	Resistance
90° C	227.3 - 235.1 Ω

ELECTRICAL ERRORS

WARNING

A FAILURE OF THIS CIRCUIT CAUSES THE SWITCHING ON OF THE INJECTION WARNING LIGHT AND THE TRIPPING OF THE SAFETIES (AMONG WHICH THE ELECTRIC FAN CONTINUOUS START). IN THESE CONDITIONS, THE ENGINE WORKS, EVEN THOUGH NOT IN AN OPTIMUM WAY, ALWAYS SAFEGUARDING THE CATALYTIC CONVERTER INTEGRITY.

Engine temperature sensor P0115 - open circuit or shorted to positive / shorted to negative.

Error cause

Open circuit or short circuit to positive: interruption of the circuit or excessive voltage at PIN 22 of the control unit connector.

Shorted to negative: zero voltage between PIN 22 and 23 of the control unit connector.

Troubleshooting

The circuit is open:

- Disconnect the connector of the control unit.
- Measure sensor resistance at different temperatures between PINS 22 and 23.
- Disconnect the sensor connector.
- Check the continuity of the wiring harness between the sensor connector and control unit connector: Control unit PIN 22, sensor PIN 1 and control unit PIN 23 - sensor PIN 3. If necessary, restore the wiring harness.
- If the wiring harness is intact but the sensor resistance value is incorrect, this means that the sensor is faulty and must be replaced, otherwise proceed with the checks.

Shorted to positive:

- With the sensor connector and the control unit disconnected, verify that the fault is a short with the battery positive of sensor connector PIN 1(control unit side PIN 22) and restore wiring harness.

Shorted to negative:

- Disconnect the sensor connector.
- Check the sensor connector PIN 1 ground insulation.
- If there is no ground insulation restore the wiring harness.
- If PIN 1 is insulated from the ground and the error persists, this means that there is a probable fault in the control unit.

INDEX OF TOPICS

Questa sezione descrive le operazioni da effettuare per lo smontaggio del motore dal veicolo.

N.B.

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Exhaust assy. Removal

- Remove the chassis central cover.
- Loosen the fixing clamp between the manifold and the exhaust end.

- Loosen the rear lock nut fixing the silencer to the bracket.

- Remove the rear screw fixing the silencer to the bracket.
- Slide off the mounting plate of the exhaust end from the upper housing.

- Remove the front screw fixing the exhaust end to the bracket.

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

CAUTION

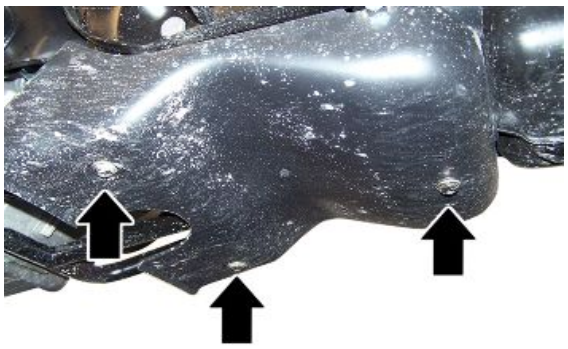
SHOULD IT BE NECESSARY TO REMOVE ONLY THE MUFFLER TIP, ALWAYS REPLACE THE GRAPHITE GASKET BETWEEN STUB AND TIP.

- Release the lambda probe connector and disconnect it.

CAUTION

FREE THE CABLES OF THE OXYGEN SENSOR BEFORE REMOVING THE SILENCER, PUTTING THIS CABLE HARNESS UNDER AN EXCESSIVE VOLTAGE MAY DAMAGE IT.

- Remove the lower cover placed under the exhaust manifold by unscrewing the three indicated clamps and collecting the washers and spacers.



- Remove the two exhaust manifold fixings at the engine head.

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

To fit, follow the removal steps but in reverse order; be careful to tighten to the correct locking torques once the muffler silencer has been refitted.

Removal of the engine from the vehicle

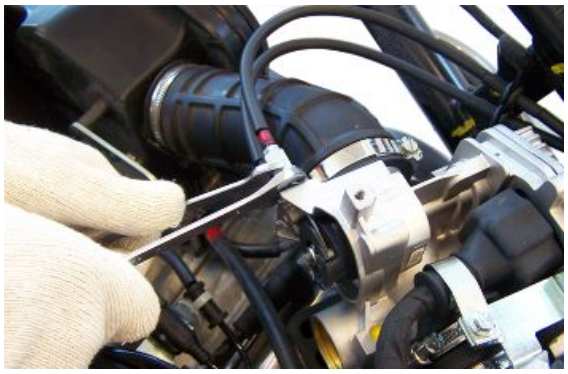
- Use a jack to support the vehicle properly.
- Disconnect the battery.
- Remove the helmet compartment.
- Remove the side fairings.
- Remove the footrests.
- Remove the full silencer unit.

CAUTION

THIS OPERATION MUST BE CARRIED OUT WHEN THE ENGINE IS COLD.

- Unscrew the fixing bolt of the throttle control cables cover, then remove the cover.

- Loosen the throttle control set nuts.

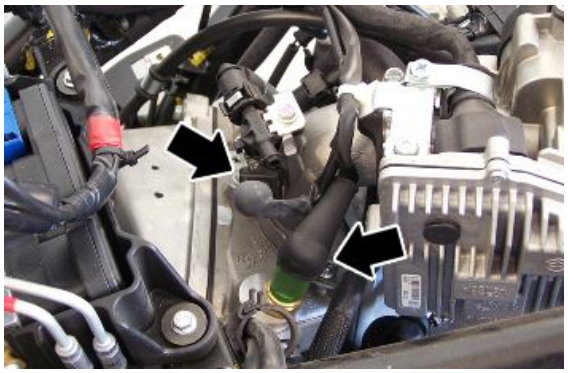


- Disconnect the throttle control cables from the throttle body.
- To facilitate the operation, loose the throttle control set screw on the throttle grip.

- Unscrew the bolt fixing the control unit connector to the bracket, then disconnect it.

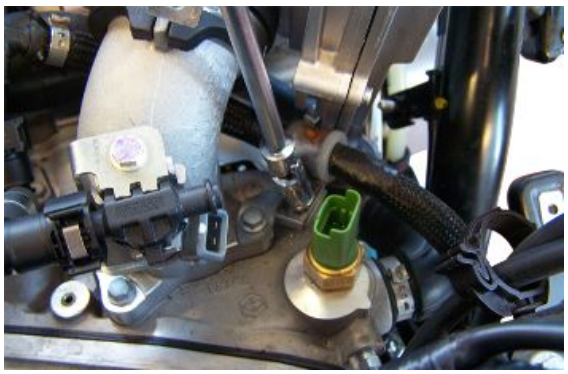
- Remove the cable ties clamp from the bracket.

- Disconnect the connectors of the injector and of the engine temperature sensor.

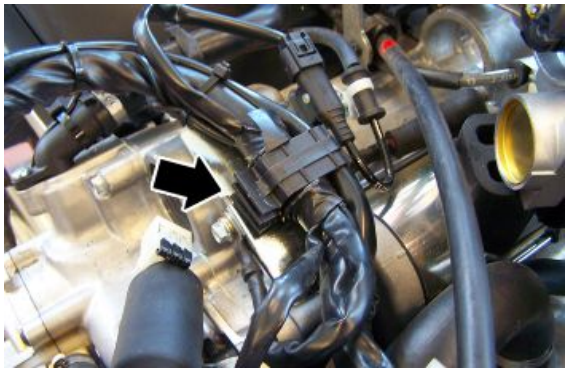


- Remove the corresponding stop and disconnect the fuel piping.

- Unscrew the bolt fixing the fuel piping to the engine head.



- Open the two cable ties clamps to release the main wiring harness.

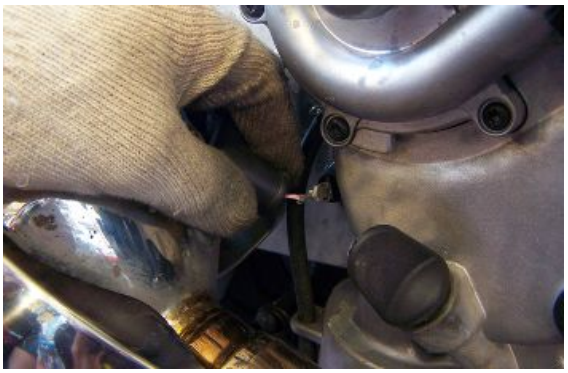


- Disconnect the rear ABS sensor connector, then remove the cable ties clamp from the bracket and release the connector.

- Disconnect the starter motor positive wire.

- Disconnect the starter motor negative cable and the engine ground cable.

- Cut the oil pressure sensor cable clamp, then disconnect it and release it from the cable grommets.



- Cut the three fixing clamps of the flywheel wiring harness.

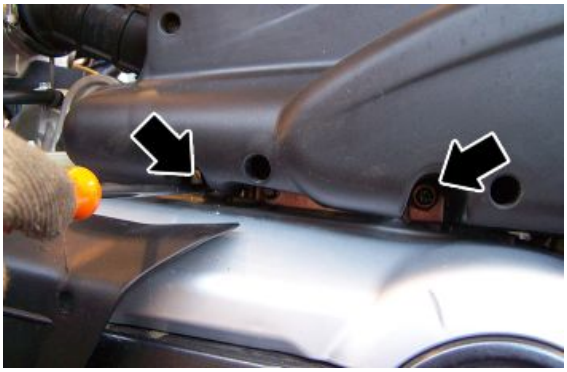
- Disconnect the voltage regulator connector.

- Disconnect the engine rpm sensor connector and release it from the slide housing.

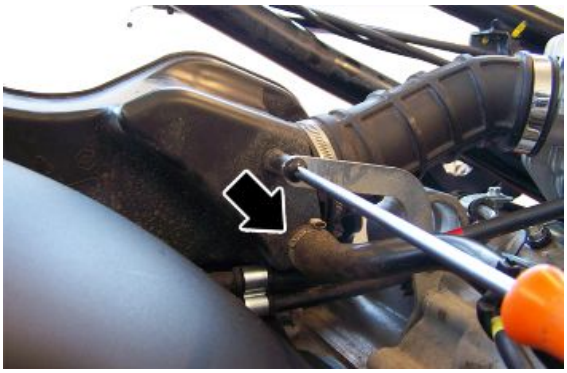
- Disconnect the spark plug caps.

- Remove the clamp and disconnect the filter box sleeve.

- Undo the two screws fixing the filter box to the crankcase.



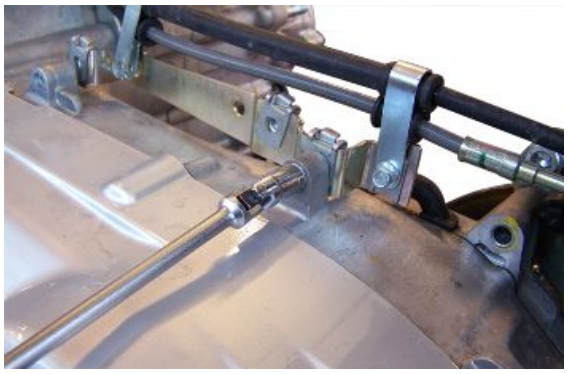
- Undo the screw fixing the filter box to the internal bracket and disconnect the oil drainage recovery pipe, then remove the filter box.
- Remove the rear wheel as described in chapter "Suspensions".



- Slightly bend the two safety stops of the brake calliper support plate with a screwdriver.

- Undo the two fixing bolts of the plate to remove it.

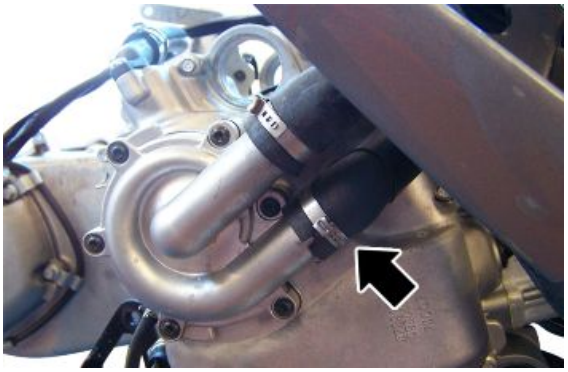
- Undo the bolt fixing the brake piping support bracket to the crankcase.



- Open the clamp and unscrew the fixing bolt to release the brake pipes.

- Unscrew the expansion tank cover, then open the clamp to release the water pump inlet pipe.

- Disconnect the water pump inlet pipe, by removing the clamp, then empty the cooling system.



- Remove the clamp from the coolant outlet pipe from the engine and empty the system from residual fluid.

- Remove the rear left shock absorber lower retainer.

- Remove the swinging arm - engine fixing pin by first undoing the nut and then operating on the head of the pin.
- The engine is now free.

When refitting the engine onto the vehicle, carry out the removal operations but in reverse order and respect the tightening torques shown in the Specifications Chapter.

- Check the engine oil level and if necessary, top it up with the recommended type.
- Fill and bleed the cooling circuit.
- Check accelerator and electric devices for correct functioning.

CAUTION

PAY SPECIAL ATTENTION WHEN POSITIONING THE THROTTLE CONTROL TRANSMISSION PROPERLY.

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This section describes the operations to be carried out on the engine and the tools required.

Automatic transmission

Transmission cover

- Loosen the 4 fastening screws
- Extract the outside plastic transmission cover.

- Using a screwdriver, remove the driven pulley axle cover near the bottom of the cap.

- Loosen the driven pulley shaft fastening nut using a misaligned wrench and prevent the pulley shaft rotation using a machine hexagon bush.
- Remove the nut and the two washers.

N.B.

DUE TO THE HIGH TIGHTENING TORQUE, USING DIFFERENT WRENCHES - SUCH AS A CONVENTIONAL POLYGONAL BUSH - MAY DAMAGE THE HEXAGON OBTAINED ON THE SHAFT OR BREAK THE BUSH ITSELF.

- Remove the six M6 screws.

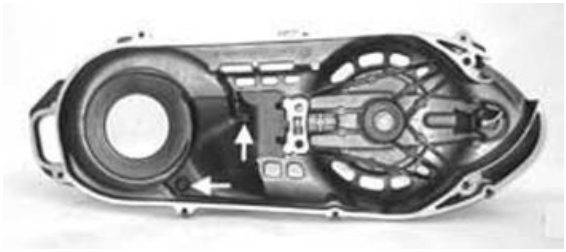
- Remove the four M8 screws.
- Remove the transmission cover.
- Check that the bearing rotates freely, otherwise replace it.

Air duct

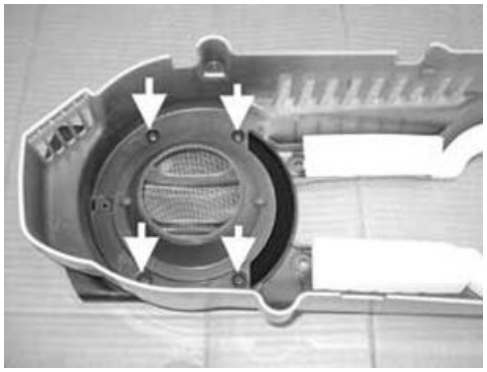
- Remove the transmission cover.
- Unscrew the two screws shown in the figure to remove the air conveyor.

Locking torques (N*m)

Air conveyor screws **11 - 12**



- Remove the external transmission cover.
- Unscrew the 4 fastening screws shown in the figure to remove the external air conveyor.



Air duct filter

- Remove the external air conveyor.
- Unscrew the 2 fastening screws shown in the figure to remove the conveyor filter.

Removing the driven pulley shaft bearing

- Remove the transmission cover.
- Remove the Seeger ring.

- Place transmission cover on a wood surface and use the special tool so that it is adequately supported.
- Pull out the bearing using the special tool.

N.B.

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.

Specific tooling

001467Y002 Driver for OD 73 mm bearing

020376Y Adapter handle

020375Y 28 x 30 mm adaptor

020439Y 17 mm guide

Refitting the driven pulley shaft bearing

- Heat the transmission cover interior using the heat gun.

N.B.

BE CAREFUL NOT TO OVERHEAT THE COVER AS THIS WOULD DAMAGE THE OUTSIDE PAINTED SURFACE.

Specific tooling

020151Y Air heater

- Place the bearing onto the special tool with a little grease to prevent it from coming out.
- Install the new bearing using the special tool.

N.B.

PROPERLY SUPPORT THE OUTSIDE COVER TO PREVENT DAMAGING THE PAINTED SURFACE.

Specific tooling

020376Y Adapter handle

020358Y 37 x 40 mm adaptor

020439Y 17 mm guide

Baffle roller

Plastic roller

- Check that the roller does not show signs of wear and that it turns freely.
- Loosen the retaining bolt using a 13 mm spanner.
- Remove the complete roller with bearing.

N.B.

IF THE ROLLER DOES NOT ROTATE FREELY, REPLACE THE COMPLETE ROLLER.

Installation of belt anti-vibration roller

- Install the anti-flapping roller with the lip facing the engine crankcase.
- Tighten the central screw to the prescribed torque.

N.B.

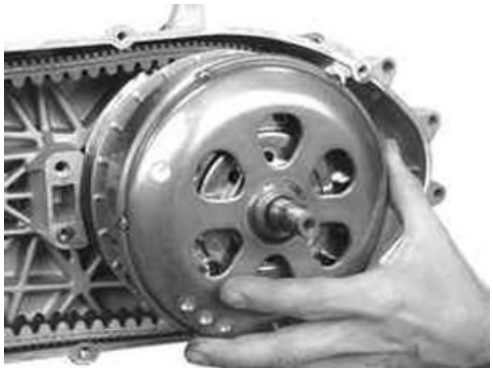
TURN THE DRIVEN AND/OR DRIVING PULLEY UNTIL A CORRECT TENSIONING OF THE BELT IS OBTAINED.

Locking torques (N*m)

Anti-vibration roller screw 16.7 ÷ 19.6

Removing the driven pulley

- Remove the clutch bell.



- Remove the stationary driving half-pulley.
- Remove the driven pulley assembly with the belt.

Inspecting the clutch drum

- Check that the clutch bell is not worn or damaged.
- Measure the clutch bell inside diameter.

N.B.

CHECK THE ECCENTRICITY MEASURED, 0.2 MM MAX.

Characteristic

Max. value:

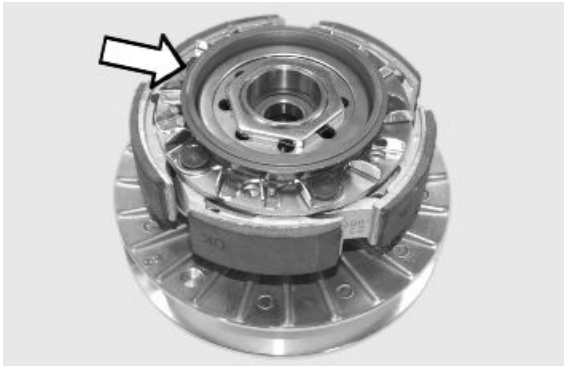
160.5 mm

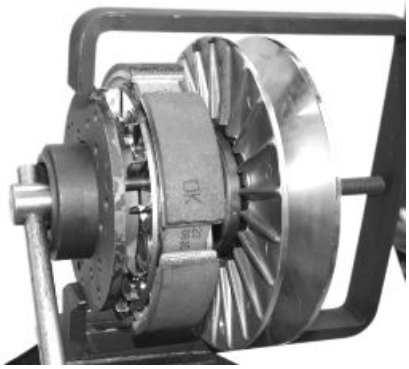
Standard value:

160.2 mm

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;
- 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.





CAUTION

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.

Specific tooling

020444Y Tool for fitting/removing the clutch on the driven pulley

Inspecting the clutch

- Check the thickness of the clutch mass friction material.

Characteristic

Minimum thickness permitted:

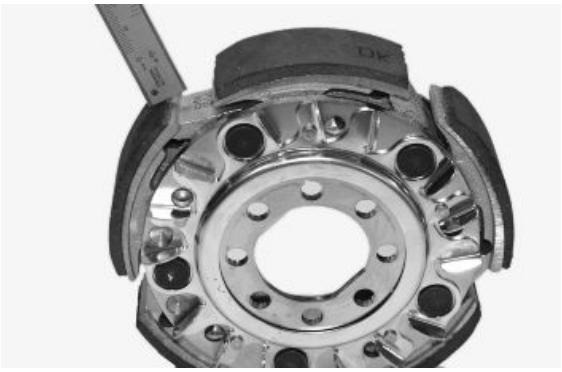
1 mm

- The masses must not show traces of lubricants. Otherwise, check the driven pulley unit seals.

N.B.

UPON RUNNING-IN, THE MASSES MUST EXHIBIT A CENTRAL CONTACT SURFACE AND MUST NOT BE DIFFERENT FROM ONE ANOTHER. VARIOUS CONDITIONS CAN CAUSE THE CLUTCH TO TEAR.

- Do not open the masses using tools to prevent a variation in the return spring load.



Pin retaining collar

- Extract the collar using 2 screwdrivers.

- Remove the 4 guide pins.
- Extract the moving driven half-pulley.

Removing the driven half-pulley bearing

- Check that the bushing is free from wear and damage; otherwise replace the fixed driven half-pulley.
- Remove the lock ring using pliers.

- Using the special tool inserted through the roller bearing, pull out the ball bearing.

N.B.

PROPERLY SUPPORT THE PULLEY TO PREVENT DAMAGING THE THREADING.

Specific tooling

020376Y Adapter handle

020456Y Ø24 mm adaptor

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

Specific tooling

001467Y002 Driver for OD 73 mm bearing

- Remove the roller bearing using the special tool, supporting the fixed half-pulley with the bell.

Specific tooling

020376Y Adapter handle

020375Y 28 x 30 mm adaptor

020364Y 25-mm Guide

001467Y002 Driver for OD 73 mm bearing

Inspecting the driven fixed half-pulley

- Check that the belt contact surface is free from wear.
- Measure the outer diameter of the pulley bushing.

Characteristic

Minimum admissible diameter

49.91 mm

Standard diameter:

50.00 -0.015 -0.035 mm

Inspecting the driven sliding half-pulley

- 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

Maximum admissible diameter:

50.05 mm

Standard diameter:

50.00 +0.035 0.00 mm

Refitting the driven half-pulley bearing

- Install a new roller bearing using the special 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.

Specific tooling

020478Y Punch for roller casing

001467Y002 Driver for OD 73 mm bearing

- Install a new ball bearing using the special tool.

Specific tooling

020376Y Adapter handle

020477Y 37-mm Adaptor

020363Y 20 mm guide

- Insert the Seeger lock ring.

Refitting the driven pulley

- Insert the new oil guards
- Insert the new 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.

- Install the half-pulley on the bushing being careful not to damage the top sealing ring during the introduction.
- Make sure the pins and collar are not worn, reassemble the pins and collar.

- Using a bent beak greaser, lubricate the driven pulley unit with about 10 gr. of grease, this operation should be carried out through one of the two holes into the bushing to obtain the exit of the grease from the opposite hole. This operation is necessary to avoid the presence of grease beyond the O-rings.

Recommended products

AGIP GREASE SM 2 Gray black smooth-textured lithium grease, containing molybdenum disulphide.

-

Inspecting the clutch spring

- Measure the length of the movable driven half-pulley spring while it is unloaded.

Characteristic

Standard length:

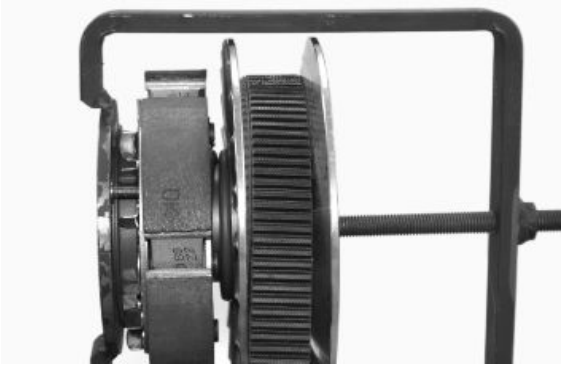
125.5 mm

Admissible limit after use:

120 mm

Refitting 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.



Specific tooling

020444Y Tool for fitting/removing the clutch on the driven pulley

- Compress the spring and insert the clutch on the driven pulley bushing.

N.B.

BE CAREFUL NOT TO DAMAGE THE SHEATH OR THE BUSHING THREADED END.

- Tighten the ring nut by hand and complete the tightening using the special wrench to the prescribed torque.

Specific tooling

020444Y Tool for fitting/removing the clutch on the driven pulley

Locking torques (N*m)

Clutch ring nut **65 - 75**

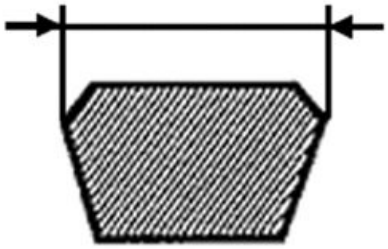
- To facilitate reassembly on the engine, turn the moving driven pulley and insert the belt onto the smaller diameter.

Refitting the driven pulley

- Install the driven pulley assembly with belt.

Drive-belt

- Check that the driving belt is not damaged.
- Check the width of the belt.



Characteristic

Minimum width

27.5 mm

Overall width

28.7 mm

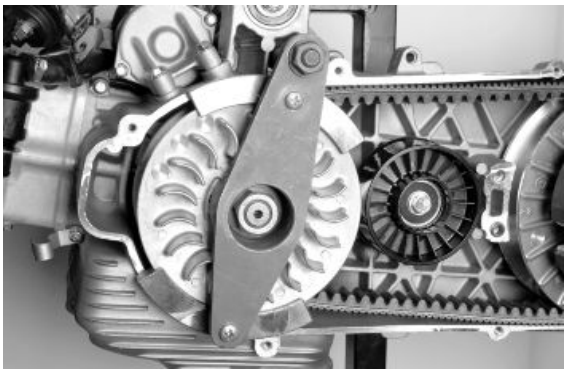
Removing the driving pulley

- Using a 27 mm wrench, turn the central pulley nut to horizontally align the central inside holes and install the special tool.

Specific tooling

020474Y Driving pulley lock wrench

- First fit the 2 retainer clamps of the special tool onto the pulley so that the splines are completely engaged.
- Then, insert the tool so as to insert the stud bolts on the ring into the holes obtained onto the tool itself.
- Tighten the two tool fixing screws, also manually.
- Loosen the central nut.
- Remove the spring washer and the flat washer.
- Remove the fixed driving half-pulley.
- Remove the bushing connection washer.



- Move the belt downwards.
- Suitable support the roller contrast and extract the movable driving half-pulley with the relevant bushing and the rear washer, being careful not to make the rollers come out.

Inspecting the rollers case

- Check that the inside bushings shown in the figure exhibit no signs of abnormal wear and measure the inside diameter.

CAUTION

DO NOT LUBRICATE OR CLEAN THE BUSHINGS

Characteristic

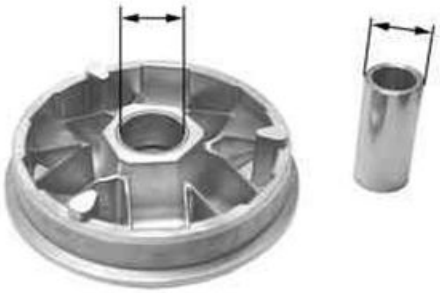
Maximum admissible diameter:

30.12 mm

Standard diameter:

30.021 mm

- Measure the pulley sliding bushing outside diameter shown in the figure.



Characteristic

Minimum admissible diameter

Ø 29.95 mm

Standard diameter:

Ø 29.959 mm

- Check that the rollers are not damaged or worn.

Characteristic

Minimum admissible diameter

Ø 24.5 mm

Standard diameter:

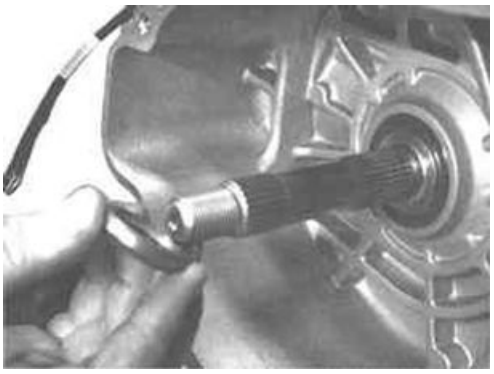
Ø 24.9 mm

- Check the guide shoes for the variator back-plate are not worn.
- Check the wear of the roller housings and of the belt faying surfaces on both pulley halves.

Refitting the driving pulley

Installing the roller container

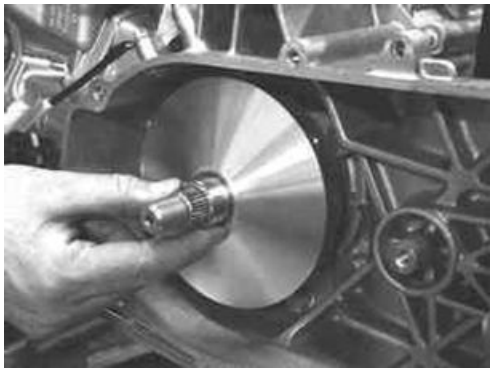
- Install the spacer with the internal chamfer facing towards the inside.



- 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.

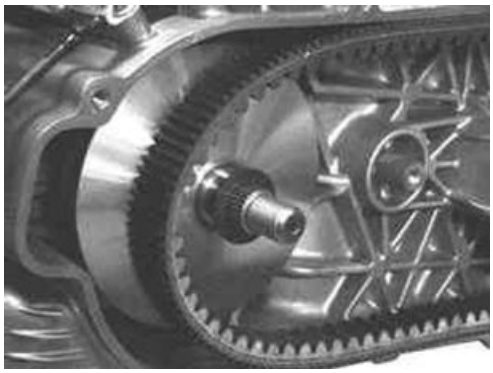
- Assembly the half-pulley with the roller contrast plate and sliding blocks.

- Insert the half-pulley on the crankshaft.
- Insert the spacer bushing.

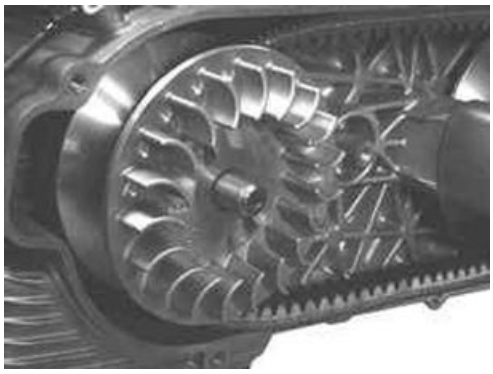


Installing the fixed driving half-pulley

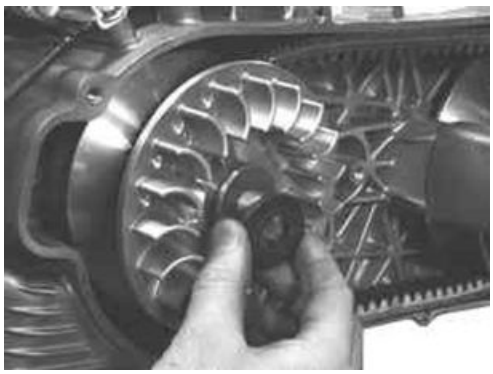
- Insert the spacer.



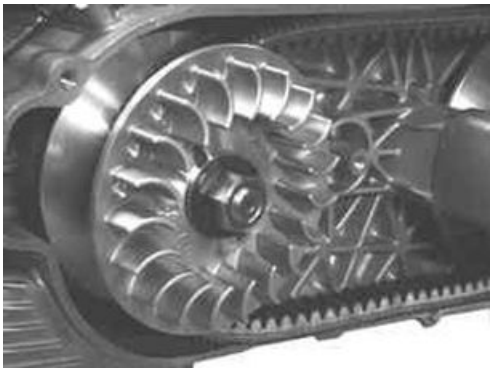
- Install the fixed driving half-pulley and check that it is in contact with the spacer and with the guide bushing of the movable driving pulley.



- 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).



- Turn the central pulley nut to horizontally align the holes and install the special tool.

N.B.

CHECK THAT THE STOP WRENCH TOOL IS EASILY INSERTED INTO THE PULLEY AND IN THE ENGINE CRANKCASE.

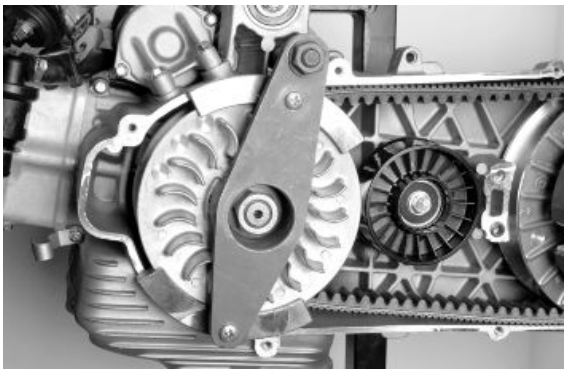
Specific tooling

020474Y Driving pulley lock wrench

- Install the lock ring from the rear so that the splines are completely engaged.
- Finally install the tool by siding the nuts by hand and ensuring the tool is resting flatly.
- Tighten the driving pulley fastening nut to the prescribed torque
- Remove the special tool.

Locking torques (N*m)

Driving pulley nut **160 - 175**



Refitting the transmission cover

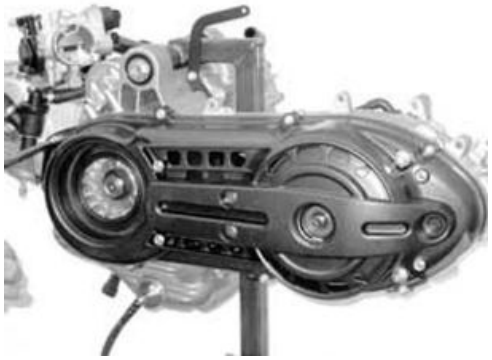
- Ensure the correct installation on the crankcase of the 2 centring dowels.

- Insert the transmission cover with the bearing and install the relevant retainers.
- Lock the four M8 retainers.

Locking torques (N*m)

M8 retainers for transmission cover **23 ÷ 26**

- Lock the 7 M6 retainers.



Locking torques (N*m)

M6 retainer **11 - 13**

- Insert the washers on the driven pulley shaft.

N.B.

INSERT THE SMALLER WASHER FIRST, THEN THE LARGER ONE.

- Insert the flanged nut.
- Prepare the torque wrench for LHS locking using a machine hexagon wrench.
- Tighten the driven pulley shaft fastening nut using an offset wrench.

N.B.

DUE TO THE HIGH TIGHTENING TORQUE, USING DIFFERENT WRENCHES - SUCH AS A CONVENTIONAL POLYGONAL BUSH - MAY DAMAGE THE HEXAGON OBTAINED ON THE SHAFT OR BREAK THE BUSH ITSELF.

Locking torques (N*m)

Driven pulley nut **92 - 100**

- Install the driving pulley shaft cover, positioning the tooth gap on the lower part with the reference mark on the transmission crankcase.

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 prescribed torque.

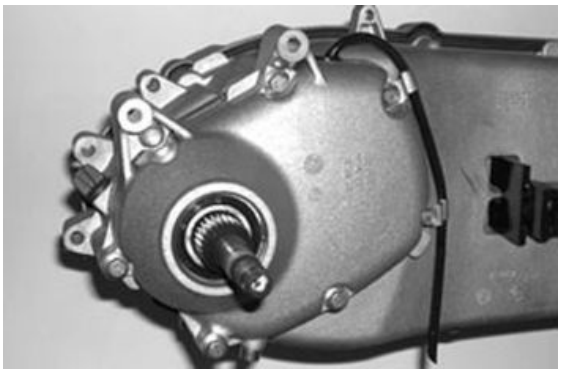
Locking torques (N*m)

External transmission cover screws 7 - 9

End gear

Removing the hub cover

- Drain the rear hub oil through the oil drainage cap located under the engine.
-Remove the 7 fastening screws. Remove the hub cover and the relevant gasket.



Removing the wheel axle

- Remove the countershaft.
- Remove the wheel axis complete with gear.

Removing the hub 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.

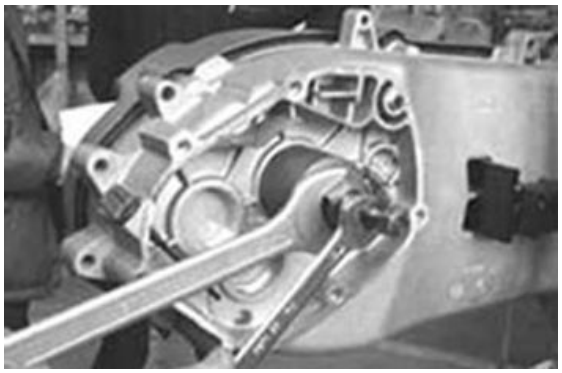
Specific tooling

001467Y014 Calliper to extract 15-mm diameter bearings

001467Y034 Calliper to extract 15-mm diameter bearings

001467Y031 Bell

- Use the special extractor to disassemble the bearing on the engine chassis of the countershaft.

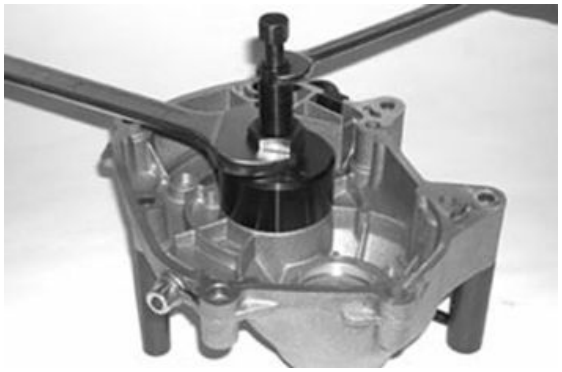


Specific tooling

001467Y006 Pliers to extract 20 mm bearings

001467Y035 Bell for 47-mm outside diameter bearings

- Support the hub cover using the stud bolt set.
- Pull out the bearing using the special tool.



Specific tooling

020476Y Stud bolt set

001467Y006 Pliers to extract 20 mm bearings

001467Y007 Bell for OD 54-mm bearings

Removing the wheel axle bearings

- Take out the clip on the outside of the gearbox cover.

- Support the hub cover using the stud bolt set.
- Pull out the bearing using the special tool.

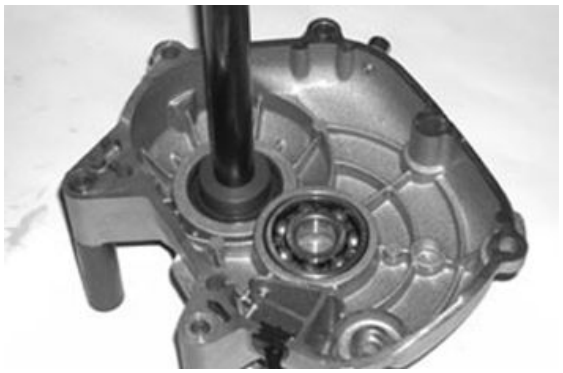
Specific tooling

020476Y Stud bolt set

020376Y Adapter handle

020477Y 37-mm Adaptor

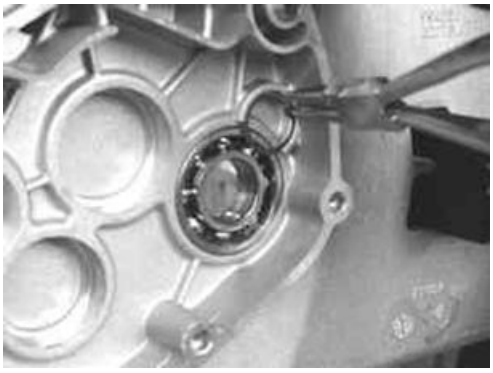
020483Y 30 mm guide



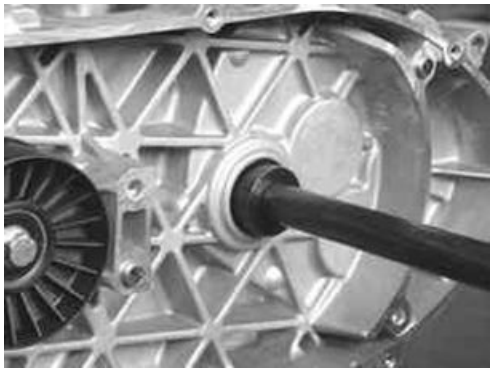
- Remove the oil guard using a screwdriver.

Removing 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 its 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.



Specific tooling

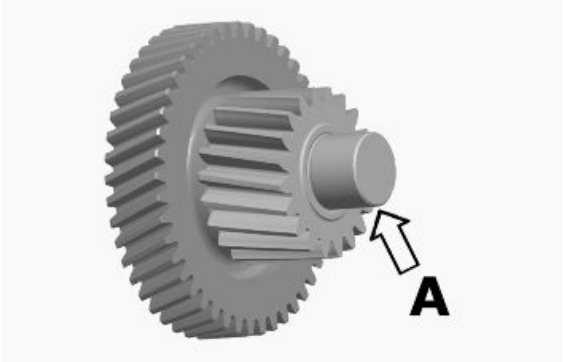
020376Y Adapter handle

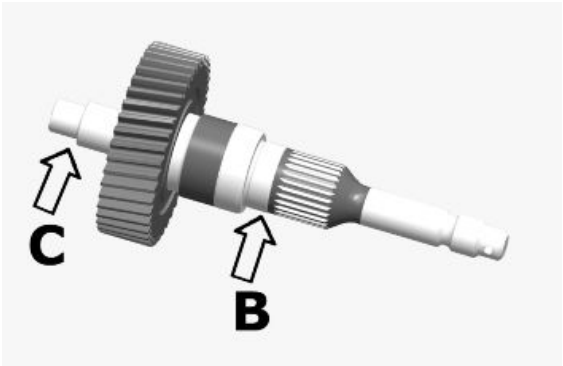
020358Y 37 x 40 mm adaptor

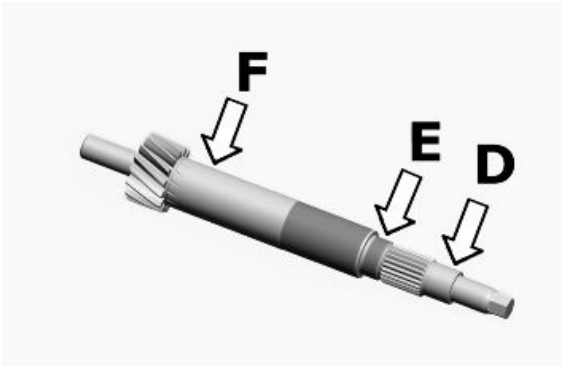
020364Y 25-mm Guide

Inspecting the hub shaft

- 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

Connection diameter for countershaft:

A = diameter 20 - 0.01 -0.02 mm

Connection diameter for wheel shaft:

B = diameter 30 - 0.010 -0.023 mm

C = diameter 15 - 0.01 -0.02 mm

Bearing diameter for driven pulley shaft:

D = diameter 17 - 0.01 -0.02 mm

E = diameter 20 - 0.01 -0.02 mm

F = diameter 25 - 0.01 -0.02 mm

Inspecting the hub cover

- Check that the mounting surface is not damaged or deformed.

- Check the capacity of the bearings.

In case of faults, replace the hub cover.

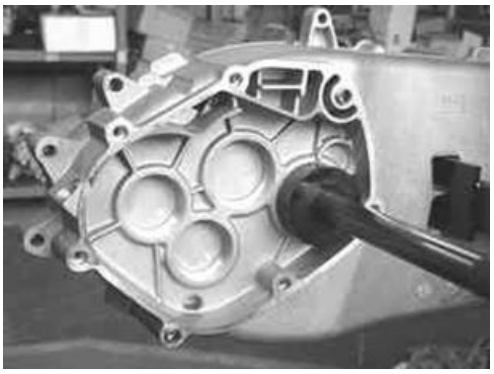
Refitting the driven pulley shaft bearing

- Heat the crankcase using the heat gun.

Specific tooling

020151Y Air heater

- Insert the driven pulley shaft bearing until it abuts against the bottom of the seat using the special tool.



N.B.

PLACE IT WITH THE BALLS FACING THE HUB (THIS APPLIES TO BEARINGS WITH PLASTIC CAGE).

Specific tooling

020376Y Adapter 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.

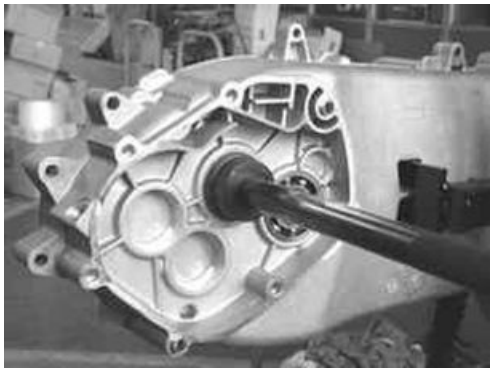
PLACE IT WITH THE BALLS FACING THE HUB (THIS APPLIES TO BEARINGS WITH PLASTIC CAGE).

Specific tooling

020376Y Adapter 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.

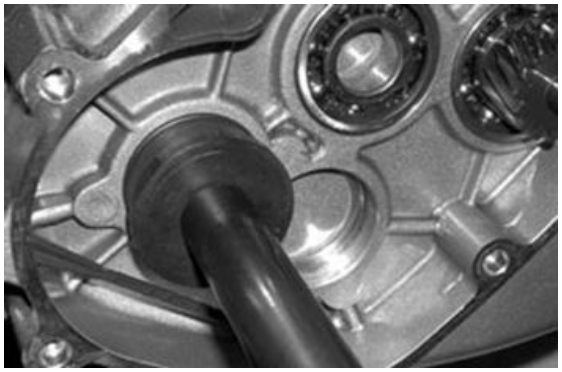
PLACE IT WITH THE BALLS FACING THE HUB (THIS APPLIES TO BEARINGS WITH PLASTIC CAGE).

Specific tooling

020376Y Adapter handle

020359Y 42 x 47-mm adaptor

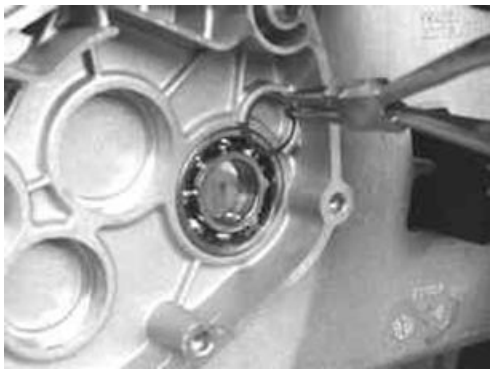
020412Y 15 mm guide



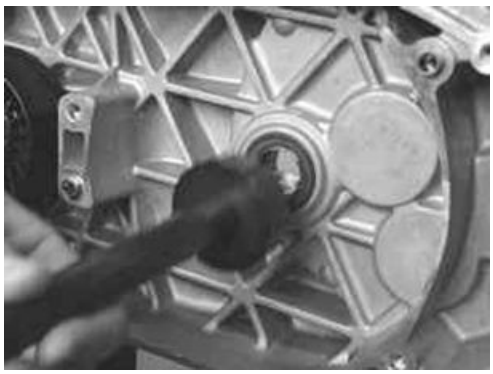
- Place the safety lock Seeger ring of the driven pulley shaft bearing.

N.B.

PLACE IT IN THE POSITION SHOWN IN THE FIGURE.



- Insert the pulley shaft oil guard on the transmission side.



Refitting the hub cover bearings

- Heat the bearing seats on the cover using the heat gun.
- Support the hub cover using the stud bolt set.

Specific tooling

020151Y Air heater

020476Y Stud bolt set

- Insert the intermediate shaft bearing on the cover using the special tool.

N.B.

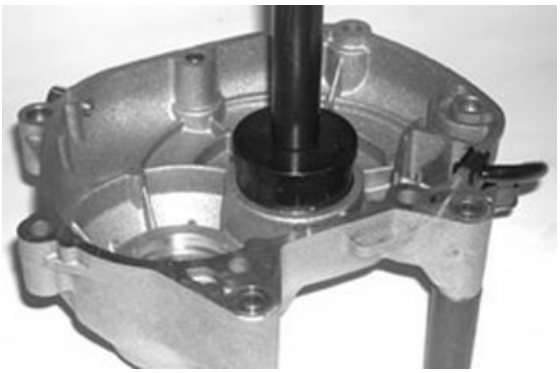
PLACE IT WITH THE BALLS FACING THE HUB (THIS APPLIES TO BEARINGS WITH PLASTIC CAGE).

Specific tooling

020376Y Adapter handle

020360Y 52 x 55-mm adaptor

020363Y 20 mm guide



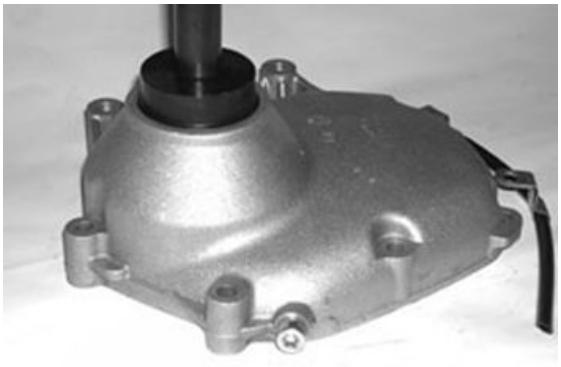
- Heat the gear shaft bearing seat from the cover outside.
- Insert the gear shaft bearing on the cover using the special punch until abutment.

Specific tooling

020376Y Adapter 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.

Specific tooling

020376Y Adapter handle

020360Y 52 x 55-mm adaptor

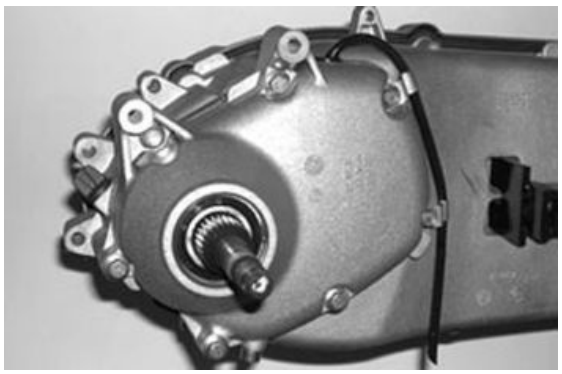
020476Y Stud bolt set

Refitting the hub bearings

- Place the 3 shafts as shown in the figure.

Refitting the ub cover

- Check the proper position of the centring dowels.
- Install a new gasket.
- Fit the gearbox cover, making sure the breather pipe is in the correct position.



- Position the 7 set screws, tighten them to the prescribed torque, being careful of the position of the bands holding the vent tube, and the position of the 3 shortest screws as indicated in the figure.
- Refill with the prescribed oil to the Max. level.

Recommended products

AGIP GEAR SAE 80W-90 Lubricant for gearboxes and transmissions.

API GL-4

Characteristic

Quantity:

approx. 250 cc

Locking torques (N*m)

Rear hub cover screws 24 - 27

Flywheel cover

- Remove the three bands shown in the figure for an easier removal of the flywheel cover, remove the feed hoses and disconnect the return hose from the pump cover.

N.B.

THE BANDS MUST BE REPLACED. TO REMOVE THEM, OPEN WITH A SCREWDRIVER OR CUT THEM.
BE CAREFUL NOT TO DAMAGE THE PLASTIC UNIONS.

Removing the hub cover

- Drain the engine oil by removing the drainage cap.
- Prepare a suitable container to collect the oil.

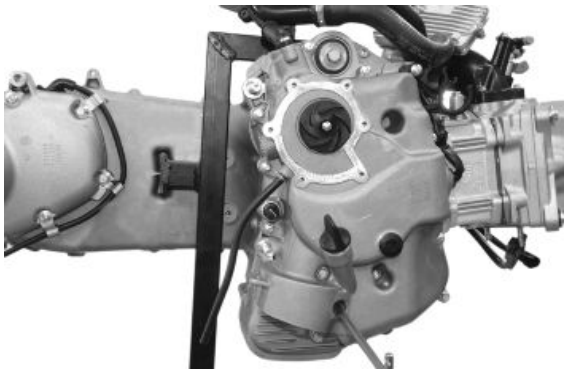
- Remove the pre-filter.

- Remove the oil filter using a filter tape or shaped cup wrench.

- Loosen the 14 fastening screws.
- Remove the flywheel cover with the relevant gasket and the cooling system sleeve support.

N.B.

THE SCREWS ARE OF 4 DIFFERENT LENGTHS. NOTE THE RELEVANT POSITIONS.



CAUTION

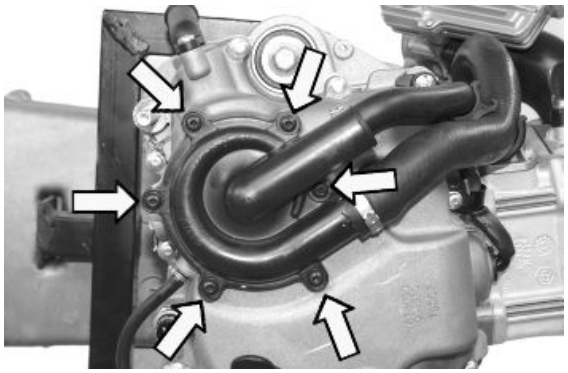
REMOVE THE COVER AVOIDING ANY POSSIBLE INTERFERENCE BETWEEN STATOR AND ROTOR.

CAUTION

BE CAREFUL TO PREVENT SLIPPAGE OF THE BY-PASS VALVE AND OF THE RELEVANT SPRING.

Removing the flywheel cover components

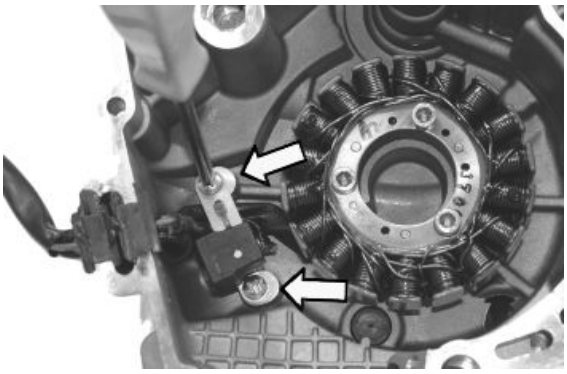
- Loosen the six mounting screws and remove the water pump cover.



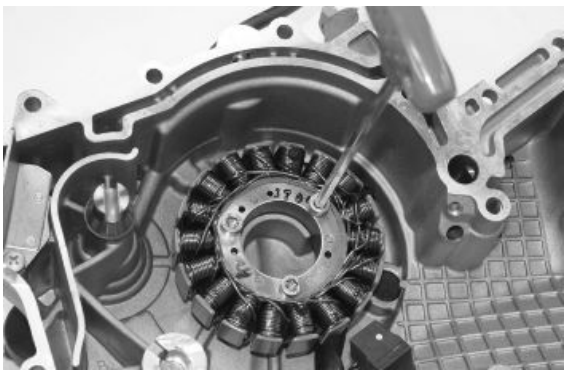
- Remove the by-pass and the relevant spring.
- Remove the oil pump seal.

Removing the stator

- Remove the two retaining screws and the cable guide bracket.

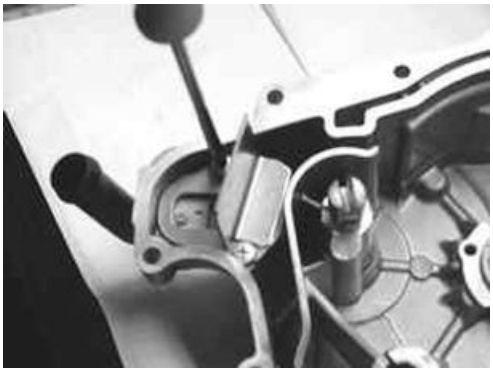


- Unscrew the 3 fastening screws and remove stator and its wiring.

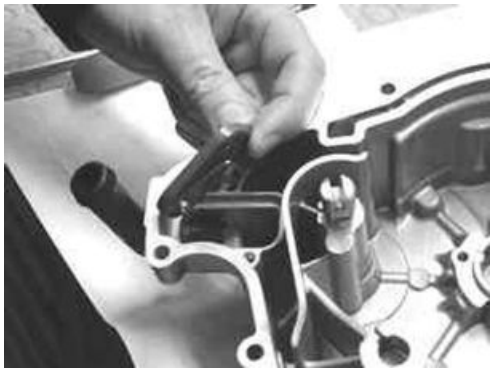


Inspecting the cover components

- Loosen the two retaining screws and remove the reed valve support with bulkhead.

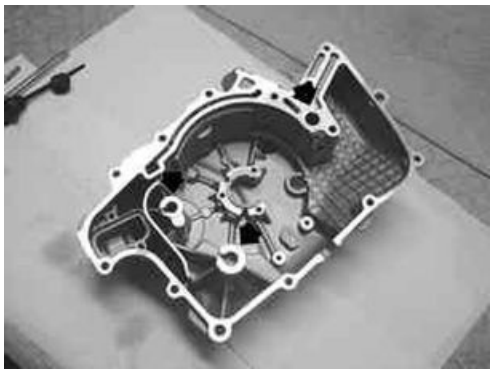


- Remove the blow-by reed valve with the relevant sealing gasket.



- 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

By-pass housing hole diameter:

13.9 mm

Connection diameter for start-up gear shaft:

12 mm

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 MAY RESULT IN VALUES HIGHER THAN THOSE STATED.

Electric characteristic

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.

Refitting the stator

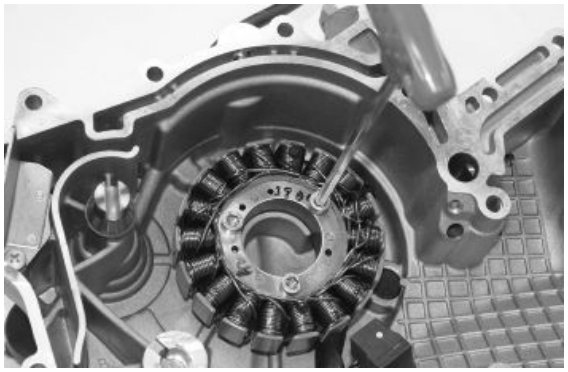
- Install the stator assembly together with the wiring harness, tightening the 3 screws to the prescribed torque.

N.B.

INSERT THE RUBBER WIRING SEALING GASKET INTO THE SPECIAL SEAT ON THE CRANKCASE.

Locking torques (N*m)

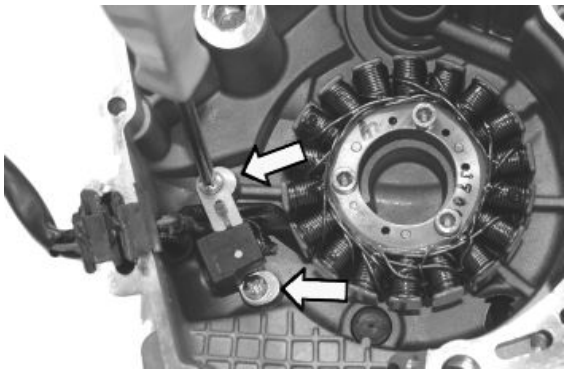
Stator clamps **8 - 10**



- Install the wiring guide bracket tightening the 2 screws to the prescribed torque.

Locking torques (N*m)

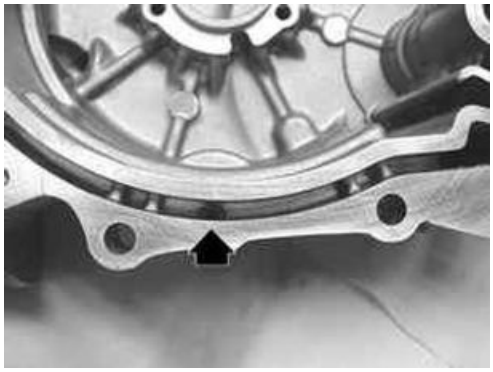
Stator cable harness guide bracket screws **3 - 4**



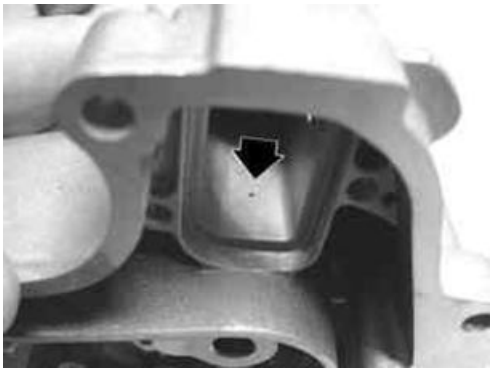
Refitting the flywheel cover components

- 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 screws to the prescribed torque.

Locking torques (N*m)

Blow-by recovery duct fixing screws **3 - 4**

- Insert the spring and the by-pass piston on the flywheel cover.

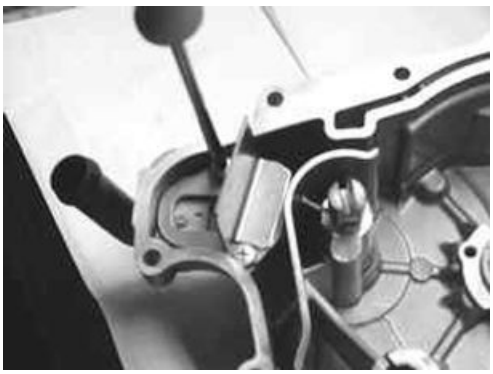
N.B.

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 prescribed torque.

Locking torques (N*m)

Supporting screws with bulkhead **0.3 ÷ 0.4**



- Correctly fit a new O-ring, do not allow it to come into contact with grease or oil.

FAILURE TO OBSERVE THIS PRECAUTION WILL IRRETRIEVABLY DEFORM THE O-RING.

- Refit the water pump cover and tighten the 6 fixing screws to the prescribed torque.

Locking torques (N*m)

Pump cover fixing screws: 3 ÷ 4

Refitting the flywheel cover

- Install a new oil filter, lubricate the gasket, screw on and finally tighten to the prescribed torque.

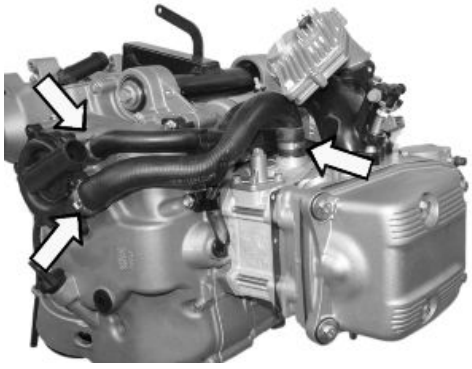
Locking torques (N*m)

Engine oil filter 12 - 16

- Install the supply hose to the cylinder and connect the return hose to the pump cover using 3 new clamps.

N.B.

TIGHTEN THE CLAMPS USING APPROPRIATE PLIERS, PAYING ATTENTION NOT TO CONSTRICT THE HOSES BUT ALSO TAKING CARE TO TIGHTEN THE CLAMPS SUFFICIENTLY.



- Install the pre-filter again and insert the engine oil drain plug, tightening to the prescribed torque.
- Refill the engine with the prescribed type of oil.

Recommended products

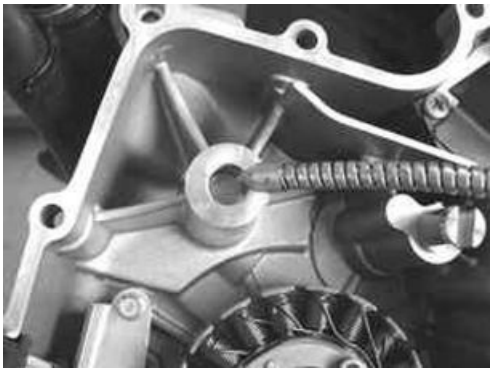
eni i-Ride PG 5W-40 Synthetic based lubricant for high-performance four-stroke engines.

JASO MA, MA2 - API SL - ACEA A3

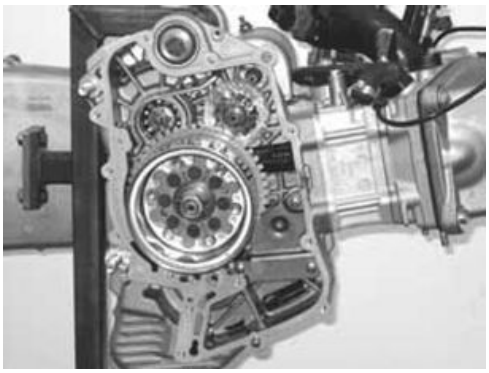
Locking torques (N*m)

Engine oil drainage plug 24 to 30

- 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.

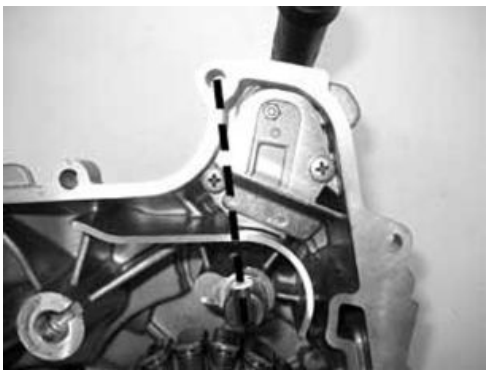


- Turn the crankshaft in order to align the countershaft movement sensor with a reference point on the crankcase (see figure).

- 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.

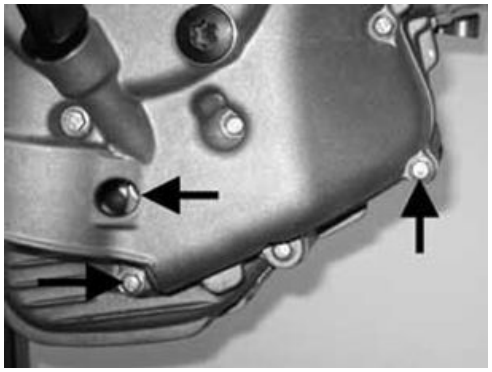
WARNING

FAILURE TO OBSERVE THIS PRECAUTION MAY RESULT IN DESTRUCTION OF THE CERAMIC MAGNETS.

- Tighten the 14 retaining bolts of the cover to the prescribed torque.

N.B.

THE BOLTS HAVE FOUR LENGTHS:
- THE 3 SHORTEST ARE INSERTED AS SHOWN IN THE FIGURE.
- THE LONGEST IS INSERTED UNDER THE ENGINE OIL FILLER PLUG.

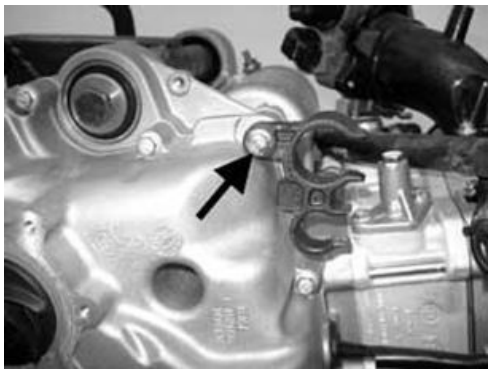


N.B.

- THE INTERMEDIATE BOLTS FOR THE REMAINING MOUNTING POINTS WITH THE EXCEPTION OF THE BOLT FOR THE MANIFOLD SUPPORT (SHOWN IN THE FIGURE) ARE SLIGHTLY LONGER.

Locking torques (N*m)

Flywheel cover screws **11 - 13**

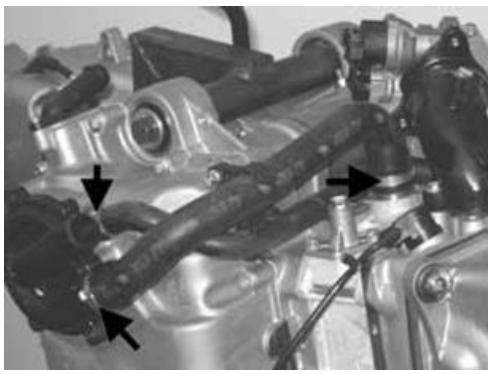


Flywheel and starting

- Remove the three bands shown in the figure for an easier removal of the flywheel cover, remove the feed hoses and disconnect the return hose from the pump cover.

N.B.

THE BANDS MUST BE REPLACED. TO REMOVE THEM, OPEN WITH A SCREWDRIVER OR CUT THEM.
BE CAREFUL NOT TO DAMAGE THE PLASTIC UNIONS.



The starter is sold as a complete part.

Before deciding to replace it, carry out the following tests:

1 - Battery

Check the voltage after not running (a few hours):

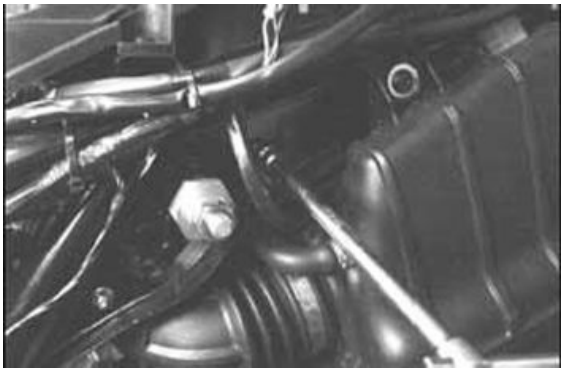
Voltage >12.5V

Check the density of the electrolyte of each cell:

Bé = 30 ÷ 32

Specific weight: 1.25 - 1.26

YES go to 2 NO go to 3



2 - Make sure the negative terminals (battery negative and starter negative) are correctly connected to each other and to the frame.

YES go to 4 NO go to 5

3 - Recharge and if necessary replace the battery.

4 - Connect the diagnostic tester (see chapter "Injection system").

Connect the induction clamp of an ammeter to the positive power supply cable of the starter motor.

Remove the 10A fuse no. 12 (see "fuses" chapter).

Switch in position "ON" with interrupt switch in position "RUN" and side stand raised.

Select the "PARAMETERS" function.

Start the engine (so that it cannot move) long enough to measure the rpm and starter absorption.

N.B.

THE DECLARED RPM VALUE IS THAT INDICATED BY THE TESTER, THE RPM READING IS NOT THE REAL ONE, BUT IS VALID FOR DIAGNOSTIC PURPOSES.

Specific tooling

020922Y Diagnosis Tool

Electric characteristic

Absorption at trailing speed:

80 - 120 A

Revolution speed =

approx. 300-400 rpm

YES go to 6 NO go to 7 NO go to 8 NO go to 9

5 - Restore the connections

6- **The values are correct.**

Finally carry out a check of the power consumption at idle speed.

Remove the starter motor (see the flywheel and starter system).

Reconnect the earth and positive and perform the test.

Electric characteristic

Current consumption at idle speed:

<40 A

YES go to 10 NO go to 11

7- **Low trailing speed**

High electrical absorption

Carry out a test of the engine rotation (example: possible melting of the bushes) and if no anomalies are found, replace the starter motor.

8- **Low trailing speed**

Low electrical absorption

Repeat the test, bridging the power terminals of the starter remote control switch or even better replacing them.

Check the new values.

YES go to 12 NO go to 13

9 - High trailing speed

Low electrical absorption

The engine turns too freely, check the compression end pressure.

If the values are not correct proceed as follows.

10 - The starter motor works properly.

11 - Check the rotation of the armature.

12 - Replace the starter remote control switch.

13 - Test the battery again and if necessary replace the starter motor.

N.B.

IF THE TRAILING SPEED OF THE CRANKSHAFT IS LOW AND COMBINED WITH STRANGE NOISE, CHECK THE FREEWHEEL OF THE TORQUE LIMITER (SEE THE "FLYWHEEL AND STARTER SYSTEM" CHAPTER).

STARTER MOTOR

Specification	Desc./Quantity
Type	Mitsuba sm13d
Power	0.9 kW

BATTERY

Specification	Desc./Quantity
Capacity	14 Ah
Starting current	125 A

START-UP REMOTE CONTROL SWITCH

Specification	Desc./Quantity
Type	SEALED
Maximum load	150 A continuous

STARTER TRANSMISSION

Specification	Desc./Quantity
Ring gear and freewheel coaxial to the flywheel.	Intermediate gear with built-in torque limiter.

The starter system has a transmission between the motor armature and engine shaft equipped with freewheel coaxial to the flywheel and torque limiter on the intermediate shaft.

The limiter is calibrated to 10 kgm (100 Nm); this component protects the structure of the engine and the starter kinematic mechanism in the event of incorrect starting with consequent inverse rotations.

The freewheel is used for a sufficiently silent starting.

The starter control (energised remote control) is slaved to enabling signals by the side stand and the emergency OFF/RUN switch, which does not allow starting given dangerous conditions.
The starter control circuit is not controlled by the immobilizer system, therefore before insisting on the starter system, check the consensus of the immobilizer.
In order to check the enabling switches circuit, see the «Electrical system» chapter, whereas to check the engine shaft control transmission, follow what is described in the «Flywheel and starter system» chapter.

Removing the starter motor

N.B.

THIS OPERATION MAY ALSO BE CARRIED OUT WITH FLYWHEEL COVER ASSEMBLED.

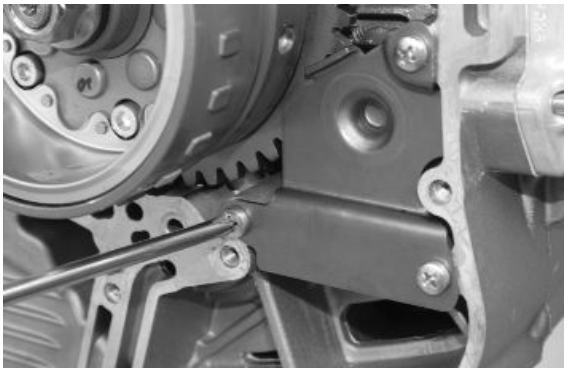
- Loosen the two fastening screws.
- Extract the complete starter motor.

Removing the flywheel magneto

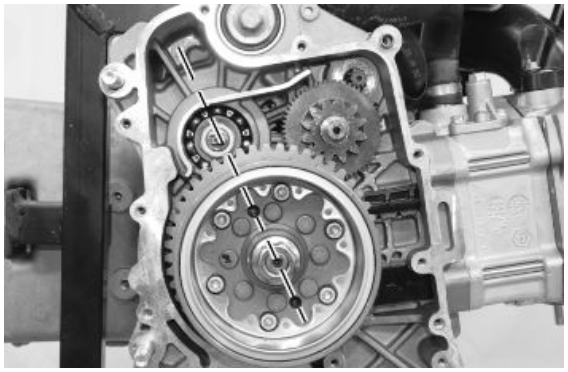
N.B.

IF YOU MUST REMOVE THE FLYWHEEL, IT IS NECESSARY TO REMOVE THE CHAIN GUIDE SLIDING BLOCK RETAIN PLATE FIRST.

- Unscrew the 3 fastening screws and remove the chain guide sliding block retain plate and the start-up rim.



- Align the holes obtained on the flywheel with the crankcase housing to allow the introduction of the special tool.

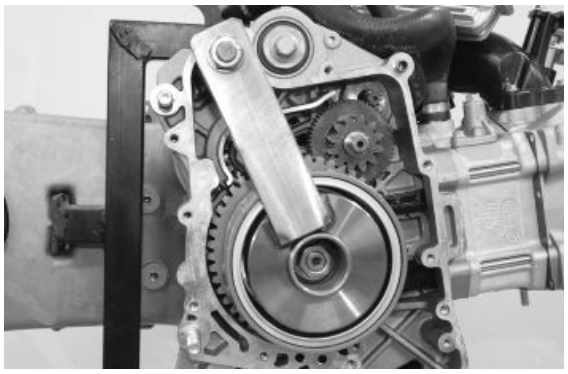


- Tighten the bushing of the flywheel lock tool on the removing tool threading.

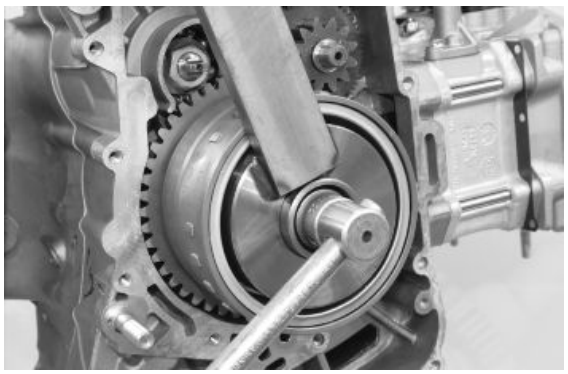
- Insert the special tool as shown in the figure, making sure that the pins are perfectly inserted into the previously aligned holes and that it is perfectly abutted and almost flush with the flywheel.

Specific tooling

020472Y Flywheel lock wrench



- Loosen the magneto flywheel fastening nut.
- Remove the special tool and the fastening nut.



- Remove the washer.

- Insert the nut again so as to slightly uncover the shaft and free the space that was occupied by the washer.

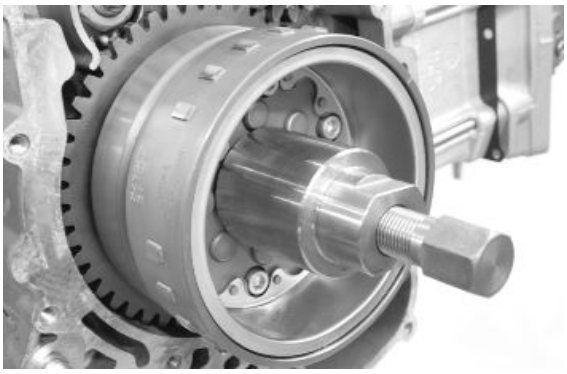
CAUTION

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.

Specific tooling

020467Y Flywheel extractor



- 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.

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.

Inspecting 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.

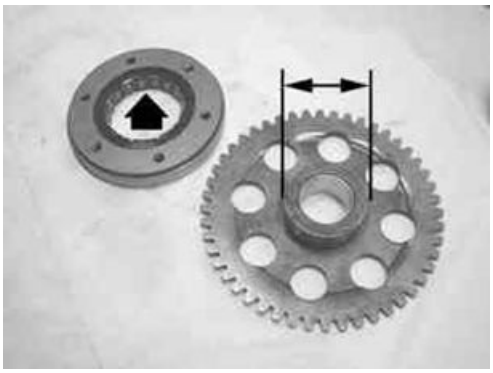
Starter gear rim

- 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

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

Inside diameter of the bushing:

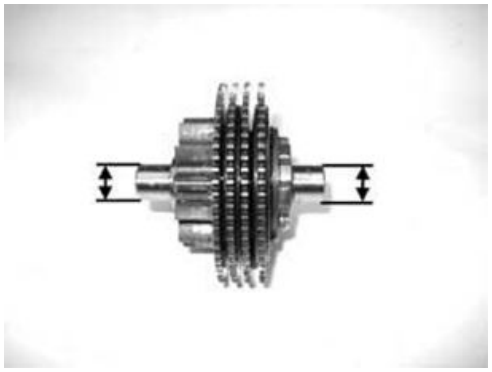
Diameter 27 + 0.020 +0.041 mm

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.

Intermediate gear

- Check that the toothing is not worn.
- Check the diameter of the two bearings.

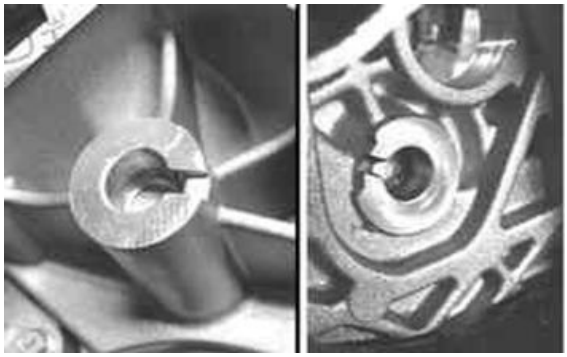


Characteristic

Gear bearing diameter:

12 - 0 0.011 mm

Also check the shaft diameter on the flywheel cover and on the engine crankcase.



Characteristic

Bearing diameter on the flywheel cover

12 + 0.034 -0.016 mm

Bearing diameter on the engine crankcase:

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.

Refitting the free wheel

- Make sure the freewheel faying 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.

Recommended products

Loctite 243 Medium strength threadlock

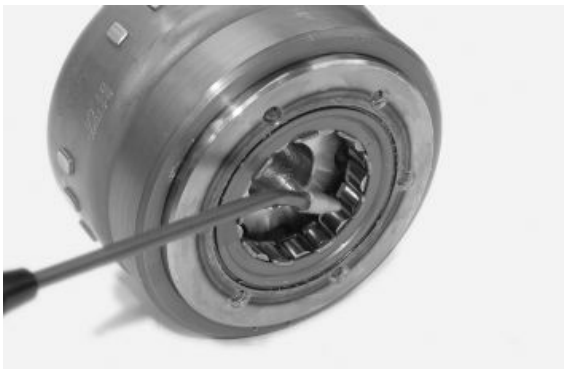
Medium Loctite 243 threadlock

- 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 prescribed torque.

Locking torques (N*m)

Screws fixing freewheel to flywheel 13 to 15

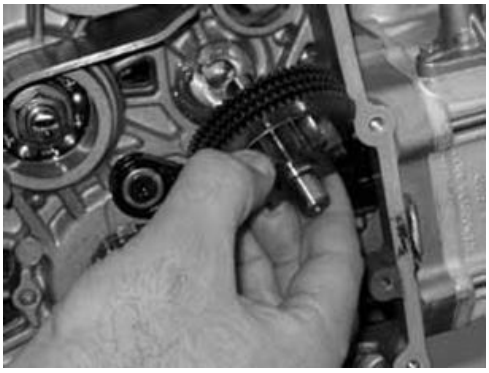
- Oil the free wheel "rollers".



Refitting the intermediate gear

- Lubricate the gear housing on the engine crankcase.

- Insert 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.

Refitting the flywheel magneto

- Insert the key on 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.

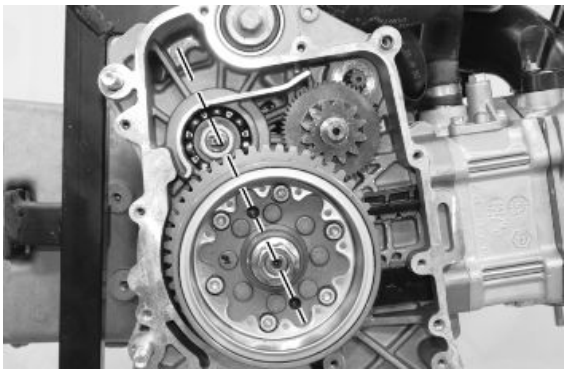
N.B.

FAILURE TO OBSERVE THIS PRECAUTION CAUSES THE LOCKING OF THE GUIDE ON THE FLYWHEEL.

Specific tooling

020472Y Flywheel lock wrench

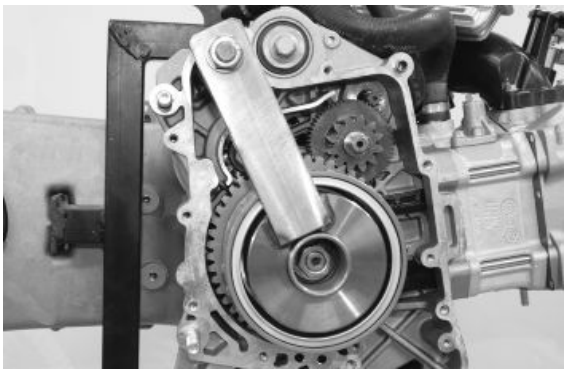
- Align the 2 holes of the flywheel with the case housing to allow the introduction of the special tool.



- Insert the special tool checking that the pins are perfectly introduced into the seat.

Specific tooling

020472Y Flywheel lock wrench



- Tighten the flywheel lock nut to the prescribed torque.

Locking torques (N*m)

Flywheel fixing nut **115 - 125**

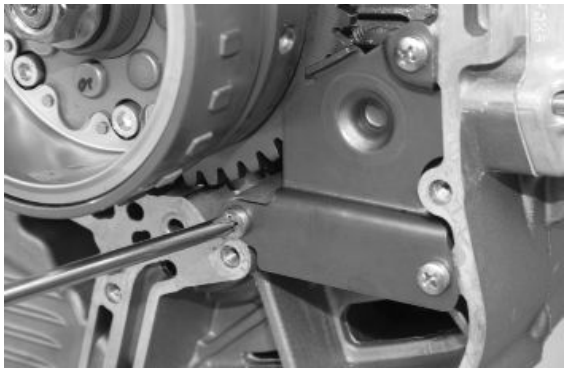
- Install the chain guide retain plate tightening the 3 screws to the prescribed torque.

N.B.

BEFORE TIGHTENING THE SCREWS, MOVE THE START-UP RIM IN CONTACT WITH THE CRANKCASE AND CHECK THAT IT IS FREE TO ROTATE IN ANTICLOCKWISE DIRECTION.

Locking torques (N*m)

Chain guide sliding block retain plate fastening screws 3 - 4



Refitting the starter motor

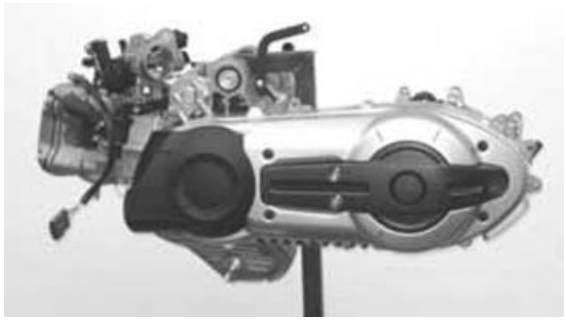
- Check that the O-ring is in good working order and lubricate it.
- Insert the starter motor.
- Tighten the 2 fastening screws to the prescribed torque.

Locking torques (N*m)

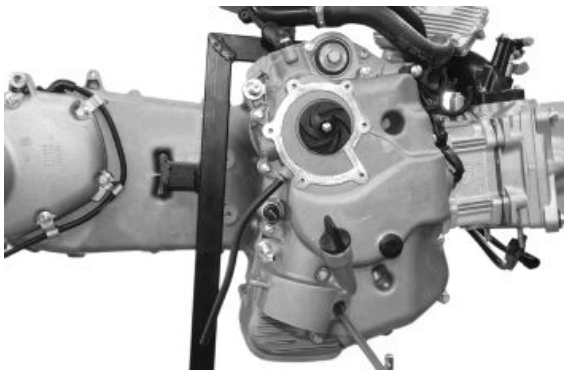
Starter screws 11 - 13

Cylinder assy. and timing system

- Remove the external and internal transmission cover.

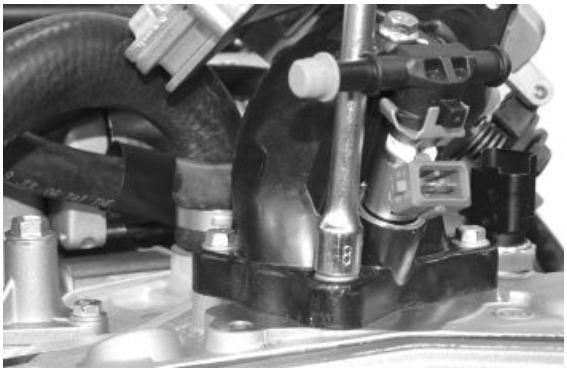


- Remove the flywheel cover, the flywheel and the torque limiter.



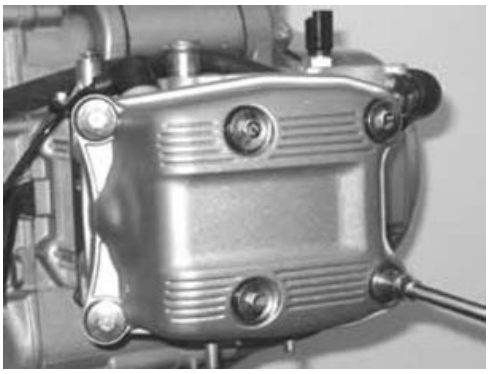
Removing the intake manifold

- Remove the 3 mounting screws.
- Remove the intake manifold unit.



Removing the rocker-arms cover

- Loosen the 6 special screws with stop and the relevant rubber gaskets.
- Remove the tappet cover with relevant gasket.



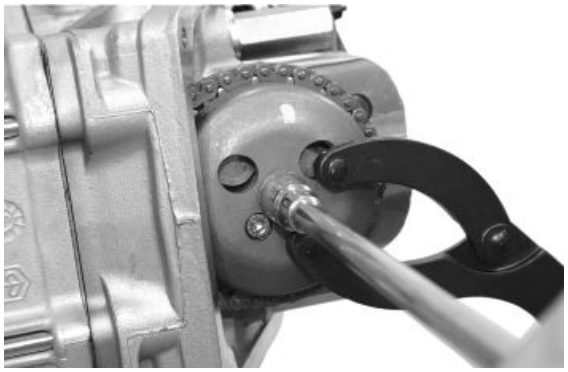
Removing the timing system drive

- Turn the engine to close the intake valves.

- Remove the central screw and the valve lifting device mass stop bell using the special tool.

Specific tooling

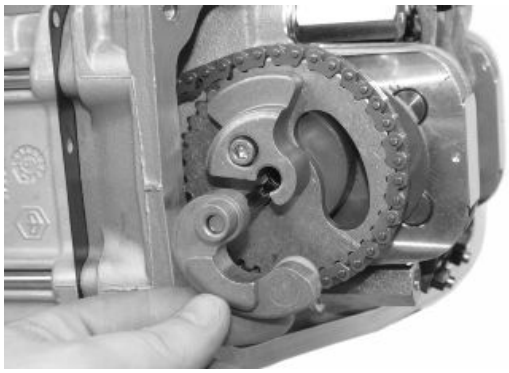
020565Y Flywheel lock calliper spanner



- Remove the return spring and the valve lifting mass with relevant travel end washer.

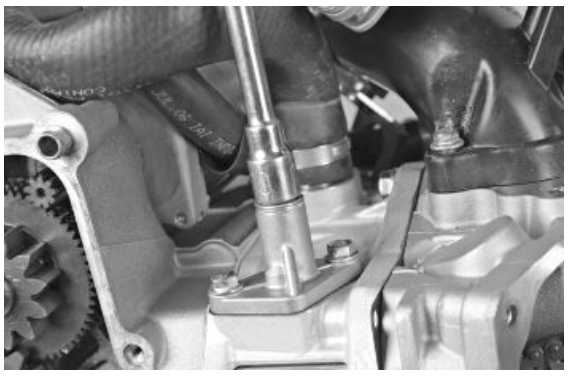
N.B.

BE CAREFUL NOT TO ALLOW THE WASHER AND SPRING TO FALL INTO THE ENGINE THROUGH THE CHAIN COMPARTMENT.

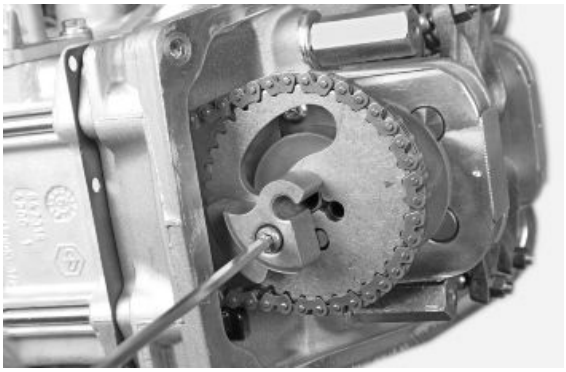


- Align the reference marks on the timing chain rim with those on the head.

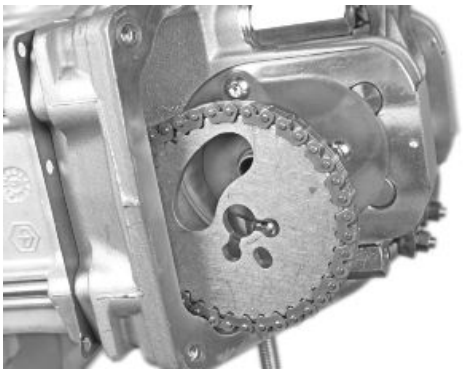
- Loosen the central screw on the tensioner first.
- Unscrew the 2 fastening screws and remove the tensioner with relevant gasket.



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.

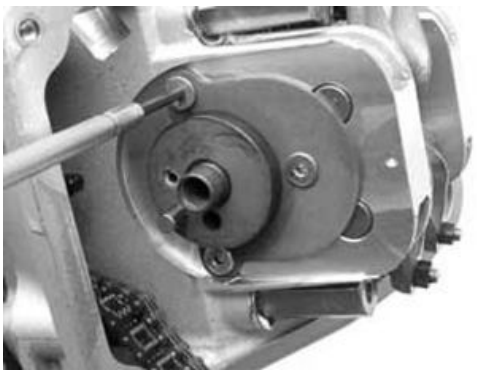


Removing the cam shaft

- Unscrew the 3 fastening screws and remove camshaft retaining bracket.

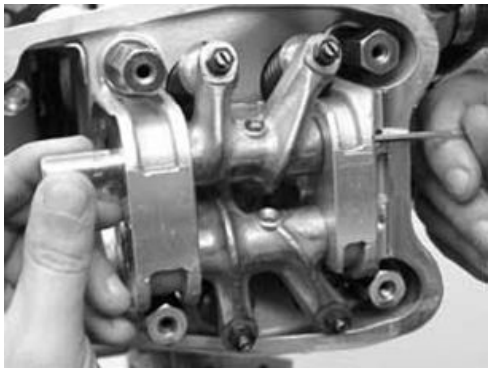
N.B.

REMOVING THE FASTENING SCREWS MAY BE DIFFICULT. BE CAREFUL NOT TO DAMAGE THE INSIDE HEXAGON. IF NECESSARY, SEPARATE THE THREADS IN ADVANCE.



- Remove the cam shaft.

- Remove pins and rocking levers by the transmission side holes.



Removing the cylinder head

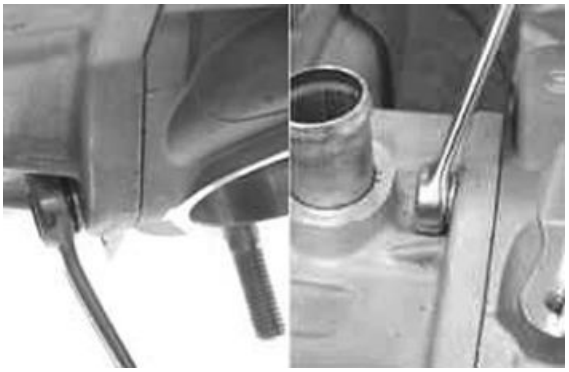
- Remove the spark plugs.
- Remove the cooling system outlet sleeve with thermostat.

- Remove the coolant temperature sensor.

N.B.

THE SENSOR CONTROLS BOTH INJECTION AND THE ANALOGUE INSTRUMENT ON THE PANEL. TO CHECK THIS COMPONENT, SEE THE INJECTION CHAPTER.

- Remove the 2 fastening nuts on the head, on the exhaust and on the intake side.



- Remove the two M6 screws into the distribution channel and the M6 screw on the spark plug side with the thermostat support.

N.B.

THE HEAD MAY BE REMOVED WITH THE CAMSHAFT, ROCKING LEVER PINS AND FITTING BRACKET IF NECESSARY.

- 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.

CAUTION

WHEN YOU HAVE TO REMOVE THE HEAD, PREPARE A SUITABLE CONTAINER SINCE THE THERMAL GROUP CONTAINS COOLANT.

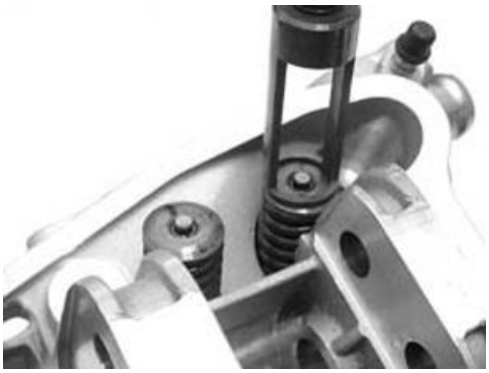
Removing the valves

- Using the appropriate tool fitted with an adaptor, remove the cotters, caps, springs and valves.

Specific tooling

020382Y Tool for removing valve cotters fitted with part 012

020382Y012 bush (valve removing tool)



CAUTION

ARRANGE THE VALVES SO AS TO RECOGNISE THE ORIGINAL POSITION ON THE HEAD (FLY-WHEEL SIDE AND TRANSMISSION SIDE).

- Remove the oil guards using the special tool.

Specific tooling

020431Y Valve oil seal extractor

- Remove the spring supports.

N.B.

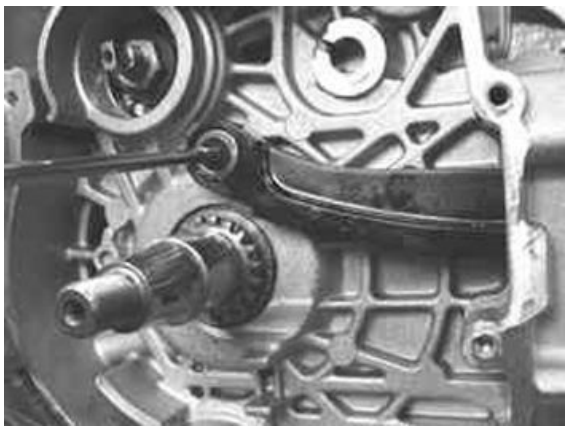
BLOW THE SEATS WITH COMPRESSED AIR TO FACILITATE THE SPRING SUPPORT REMOVAL.

Removing the cylinder - piston assy.

- 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.



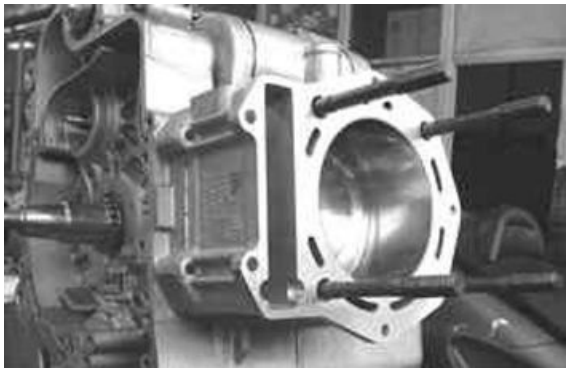
- Extract the cylinder with the relevant gasket and the centring dowel.

N.B.

THE SECOND CENTRING IS ENSURED BY A PIN SET INTO THE CYLINDER.

CAUTION

TO AVOID DAMAGING THE PISTON, KEEP IT FIRM WHILE REMOVING THE CYLINDER.



- Remove the 2 piston pin locking rings by the specific housings.

- Extract 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.

CAUTION

NOTE THE ASSEMBLY POSITIONS OF THE LININGS TO PREVENT INVERTING THE POSITION IN CASE OF REUSE.

N.B.

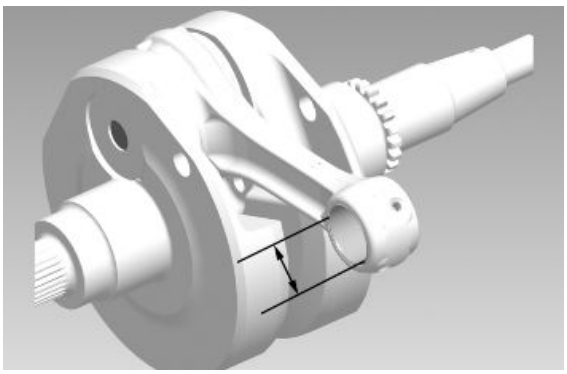
BE CAREFUL NOT TO DAMAGE THE SEALING RINGS DURING REMOVAL.

Inspecting the small end

- Measure the inside diameter of the connecting rod small end using a bore meter.

N.B.

IF THE CONNECTING ROD SMALL END DIAMETER EXCEEDS THE STANDARD DIAMETER, SHOWS SIGNS OF WEAR OR OVERHEATING, REPLACE THE CRANKSHAFT AS DESCRIBED IN THE «CRANKCASE AND CRANKSHAFT» CHAPTER.



Characteristic

Standard diameter:

22 + 0.025 +0.015 mm

Inspecting the wrist pin

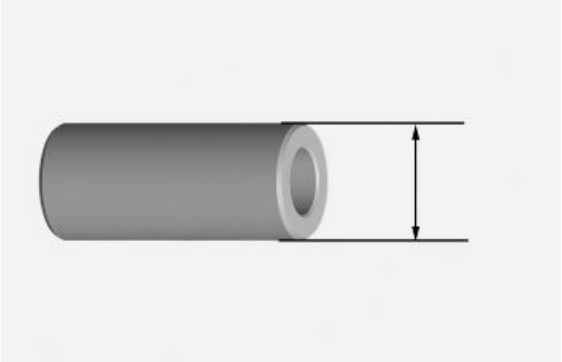
- Check the pin outside diameter using a micrometer.

Characteristic

Standard diameter:

22 0 -0.004 mm

- Calculate the coupling clearance between pin and connecting rod small end.



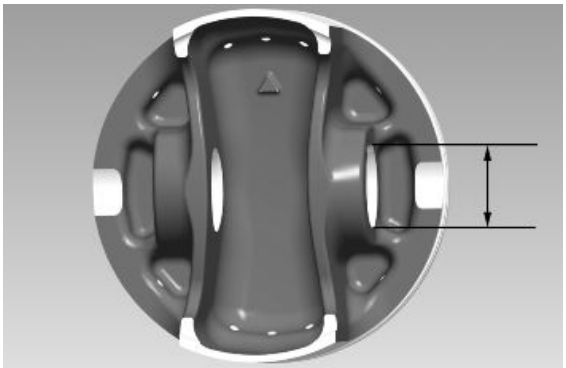
Characteristic

Standard clearance:

0.015 - 0.029 mm

Inspecting the piston

- Measure the diameter of the bearings on the piston.



Characteristic

Standard diameter:

22 + 0.006 +0.001 mm

- Calculate the pin - piston coupling clearance.

N.B.

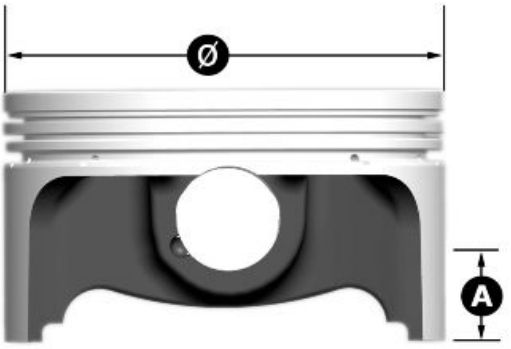
THE PIN HOUSINGS HAVE TWO LUBRICATION CHANNELS FOR THIS REASON MEASURE THE DIAMETER ACCORDING TO THE PISTON AXIS

Characteristic

Standard clearance:

0.001 - 0.010 mm

- Measure the outside diameter of the piston, perpendicular to the gudgeon pin axis.
- Take the measurement in the position shown in the figure.



N.B.

REFER TO THE «SPECIFICATIONS» SECTION FOR THE SIZES OF THE PISTON AND THE CYLINDER-PISTON COUPLING CLEARANCES.

Characteristic

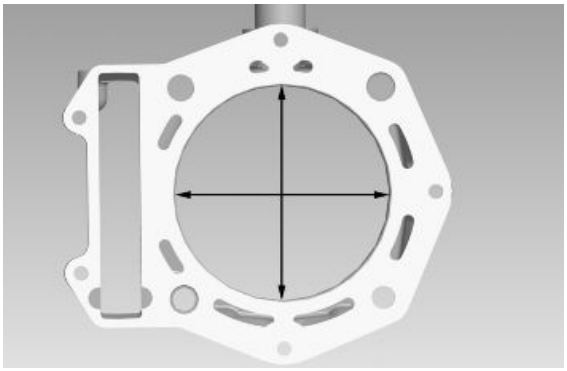
A:

10 mm

Piston diameter:

94 mm nominal value

- Using a bore meter, measure the cylinder inner diameter at a given height according to the directions shown in the figure.



Characteristic

B:

43 mm

Standard diameter:

94 mm nominal value

- Check that coating is free from flakes.
- Check that the coupling surface with the head is not worn or misshapen.

Characteristic

Maximum run-out allowed:

0.001 in 0.05 mm

- Pistons and cylinders are classified into categories based on their diameter. The coupling is carried out in pairs (A-A, B-B, C-C, D-D).

N.B.

REFER TO THE «SPECIFICATIONS» SECTION FOR THE SIZES OF THE CYLINDER AND THE CYLINDER-PISTON COUPLING CLEARANCES.

Inspecting the piston 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.

- If higher values than those prescribed are measured, replace the linings.

Check the size of the sealing ring opening:

Compression ring: 0.15 ÷ 0.35 mm. Max. value: 0.5 mm

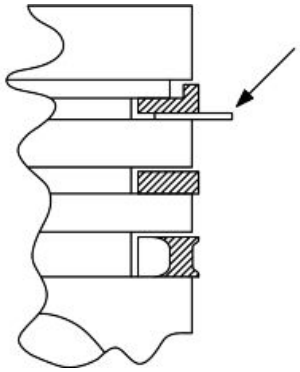
Scraper ring: 0.25 ÷ 0.50 mm. Max. value: 0.65 mm

Scraper ring: 0.25 ÷ 0.50 mm. Max. value: 0.65 mm

Rings/slots coupling clearances:

Carefully clean the sealing rings housings.

Check coupling clearances by placing a thickness gauge between the ring and the slot as shown in the figure.



Top ring: Standard coupling clearance: 0.01÷0.06 mm

Maximum clearances allowed after use: 0.10 mm

Middle ring: Standard coupling clearance: 0.02÷0.07 mm

Maximum clearances allowed after use: 0.10 mm

Oil scraper ring: Standard coupling clearance: 0.01÷0.06 mm

Maximum clearances allowed after use: 0.10 mm

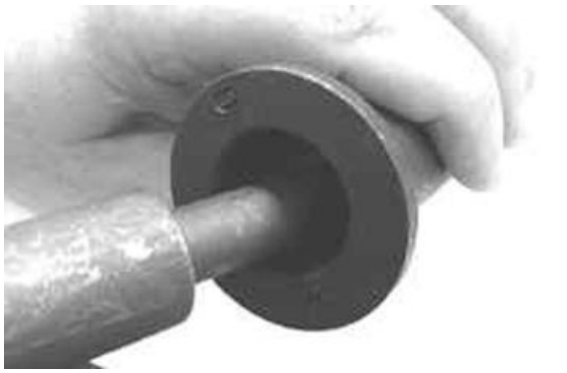
If clearances measured exceed the maximum values specified in the table, the piston should be replaced by a new one.

Removing the piston

- Install piston and wrist pin onto the connecting rod, aligning the piston arrow the arrow facing towards the exhaust.

- 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 stop ring into position using a punch



- Install the pin lock using the key shown in the figure.

Specific tooling

020470Y Pin snap ring fitting tool

N.B.

THE TOOL FOR INSTALLING THE RETAINER RINGS MUST BE USED MANUALLY.

CAUTION

USING A HAMMER MIGHT DAMAGE THE STOPS' HOUSING.

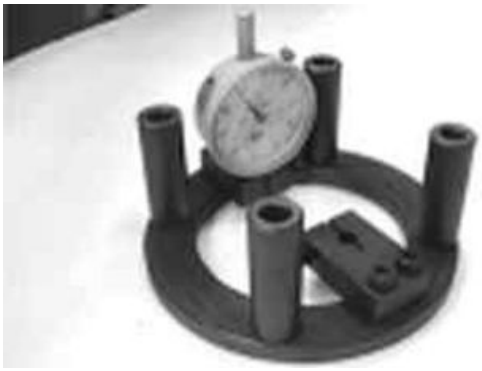
Choosing the gasket

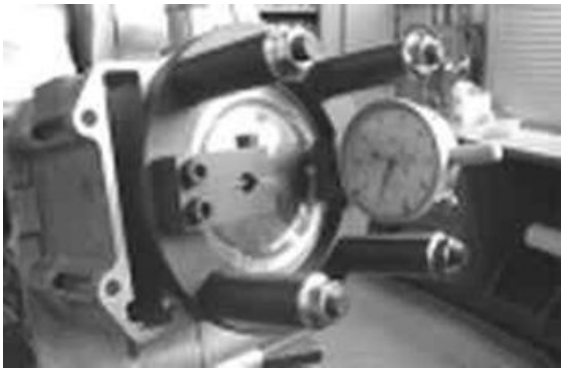
- Provisionally fit the piston into the cylinder, without any base gasket.
- Install a dial gauge on the special tool using the short union, as shown in the figure.

Specific tooling

020475Y Piston position checking tool

- With a contrasting surface, reset the dial gauge with a preloading of a few millimetres.
- Finally fix the dial gauge.
- Check the perfect sliding of the feeler pin.
- Fit the tool on the cylinder without changing the dial gauge position.
- Lock the tool with the original head fixing nuts.
- Rotate the crankshaft up to TDC (the reversal point of the dial gauge rotation).
- Measure the deviation from the reset value.





- Identify the thickness of the cylinder base gasket to be used for reassembly by the table below. 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.

Characteristic

Recess / Projection measured 1

- 0.185 - - 0.10

Gasket thickness 1

0.4 ± 0.05

Recess / Projection measured 2

- 0.10 - + 0.10

Gasket thickness 2

0.6 ± 0.05

Recess / Projection measured 3

+ 0.10 ÷ + 0.185

Gasket thickness 3

0.8 ± 0.05

Refitting the piston 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 lining 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.

Refitting the cylinder

- 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 THE LUBRICATION DUCT AND LUBRICATE THE CYLINDER LINER. CHECK THE PRESENCE OF THE TWO REFERENCE DOWELS.

Specific tooling

020468Y Piston fitting ring

020512Y Piston fitting fork

Inspecting the cylinder head

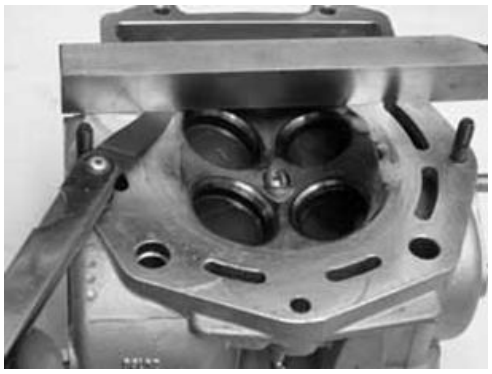
- Using a trued bar and a thickness gauge, check that the cylinder head surface is not worn or distorted.

Characteristic

Maximum run-out allowed:

0.1 mm

- In case of irregularities, replace the head.
- Check the sealing surfaces for the inlet and exhaust manifold.
- Check that the camshaft and the rocker pin bearings show no signs of wear.
- Check that the head cover show no signs of wear.
- Check that the coolant sealing buffer is not rusted.



Inspecting the timing system components

- Check that the guide shoe and the tensioner shoe are not worn out.
- 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 centre screw with the washer and the tensioner spring. Check that the one-way mechanism is not worn.
- Check the condition of the tensioner spring.
- If examples of wear are found, replace the whole unit.

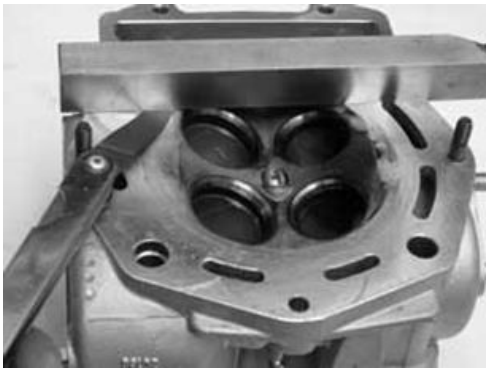
Inspecting the valve sealings

- Visually inspect the valve sealing surface.

CAUTION

DO NOT CHANGE THE VALVE FITTING POSITION (RH - LH).

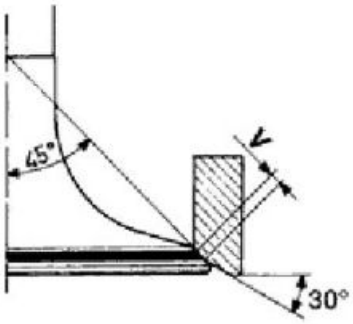
- If the sealing surface of the valve is found to be interrupted at one or more points or is not flat, replace the valve.



- Fit the valves into the cylinder head.
- Alternatively test the intake and exhaust valves.
- The test should be carried out by filling the manifold with fuel and checking that the head does not ooze through the valves when they are just pressed by the fingers.

Inspecting the valve housings

- Remove any carbon deposits from the valve seats.
- Check the width of the mark on the valve seat «**V**» with Prussian blue.



Characteristic

Standard value:

1 - 1.3 mm

Limit allowed:

1.6 mm

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

Inspecting the valves

- Measure the diameter of the valve stem at the three positions indicated in the diagram.

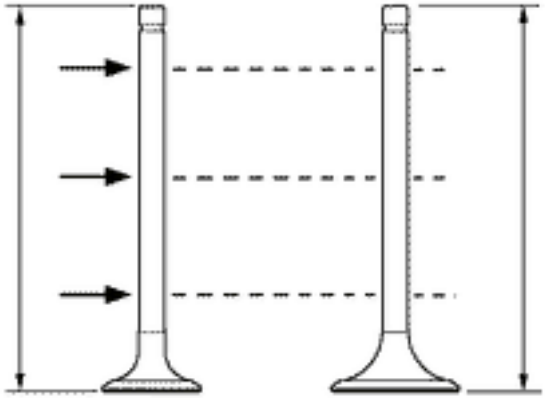
STANDARD DIAMETER

Specification	Desc./Quantity
Inlet:	4.987 ÷ 4.972 mm
Outlet:	4.975 ÷ 4.960 mm

MINIMUM DIAMETER ALLOWED

Specification	Desc./Quantity
Inlet:	4.96 mm
Outlet:	4.945 mm

- Calculate the clearance between the valve and its guide.

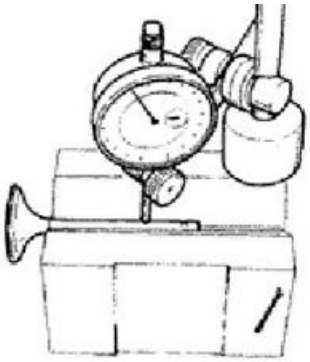


- Check the deviation of the valve stem by resting it on a «**V**» shaped support and measuring the extent of the deformation using a dial gauge.

Characteristic

Limit value allowed:

0.1 mm

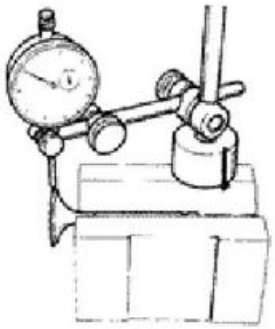


- Check the concentricity of the valve head by placing a dial gauge at right angles to the valve head and rotating it on the «**V**» shaped support.

Characteristic

Limit allowed:

0.03 mm



Inspecting the valve stem guide clearance

- After measuring the valve guide diameter and the valve stem diameter, check the clearance between guide and stem.

INTAKE

Specification	Desc./Quantity
Standard clearance:	0.013 ÷ 0.04 mm
Limit allowed:	0.08 mm

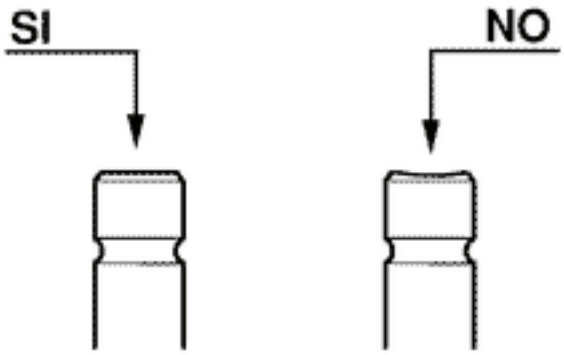
EXHAUST

Specification	Desc./Quantity
Standard clearance:	0.025 - 0.052 mm
Limit allowed:	0.09 mm

VALVE STANDARD LENGTH

Specification	Desc./Quantity
Inlet:	95.0 ± 0.3 mm
Outlet:	94.2 ± 0.3 mm

- Check that there are no signs of wear on the faying surface with the set screw articulated terminal.



- If no faults are found during the above checks, the same valves can be reused. For better sealing results, we recommend grinding the valve seats. Grind the valves gently with fine-grained lapping compound. Upon grinding, keep the cylinder head in horizontal position. This will prevent the lapping compound residues from penetrating between the valve stem and the guide (see figure).

CAUTION

TO AVOID SCORING THE FAYING 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.

CAUTION

DO NOT CHANGE THE VALVE FITTING POSITION (RH - LH).

Inspecting the springs and half-cones

- 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

Standard length:

44.4 mm

Limit allowed after use:

42.4 mm

Refitting the valves

- Place the valve spring support washers on the head.
- Alternately insert the 4 oil guards using the special tool.
- Lubricate the oil guards and the valve guides.

Specific tooling

020306Y Punch for fitting the valve seal rings

- Fit the valves, the springs and the caps. Using the appropriate tool with adapter, compress the springs and insert the cotters in their seats.

Specific tooling

020382Y Tool for removing valve cotters fitted with part 012

020382Y012 bush (valve removing tool)

N.B.

DO NOT CHANGE THE VALVE FITTING POSITION. FIT THE VALVE SPRINGS WITH THE REFERENCE COLOUR ON THE COTTERS SIDE (TURNS WITH GREATER PITCH).

Inspecting the cam shaft

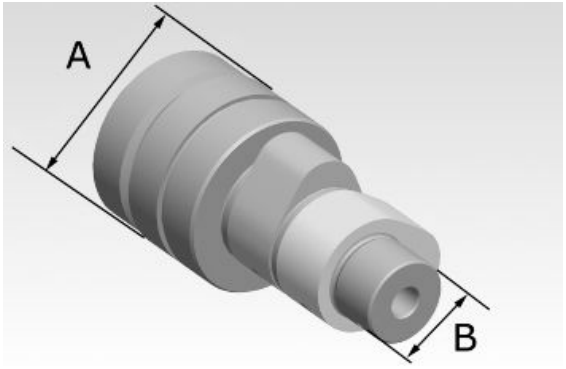
- Check the camshaft bearings for signs of abnormal wear or scores.
- Using a micrometer, measure the camshaft bearings.

STANDARD DIAMETER

Specification	Desc./Quantity
Bearing A Ø:	42- 0.060 -0.085 mm
Bearing B diameter:	20- 0.020 -0.041 mm

MINIMUM DIAMETER ALLOWED

Specification	Desc./Quantity
Bearing A Ø:	41.910 mm
Bearing B diameter:	19.940 mm



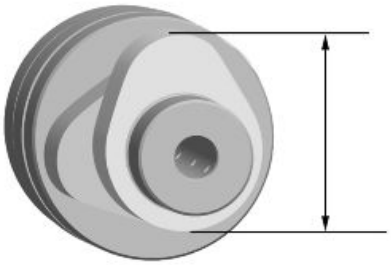
- Using a gauge, measure the height of the cams.

STANDARD HEIGHT

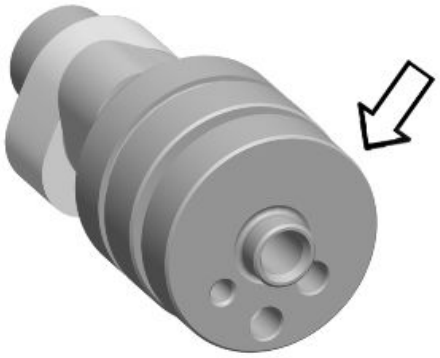
Specification	Desc./Quantity
intake	33.774 mm
discharge	33.273

ADMISSIBLE LIMITS

Specification	Desc./Quantity
intake	33.526 mm
discharge	33.026 mm
Standard axial clearance:	0 - 0.22 mm
Maximum axial clearance allowed:	0.3 mm



- If any of the above dimensions are outside the specified limits, or there are signs of excessive wear, replace the defective components with new ones.
- Check that the retaining plate seat shown in the figure exhibits no wear.



- Check that the automatic valve lifting device cam, the travel end roller and the rubber abutment on the containment bell are free from wear.
- Check that the valve lifting spring has not yielded.
- Replace any defective or worn components.

- Check that the rocking lever pins exhibit no scores or wear.

Characteristic

Standard diameter:

Ø 13 - 0.010 -0.018 mm

- Measure the inside diameter of each rocker.

Characteristic

Standard diameter:

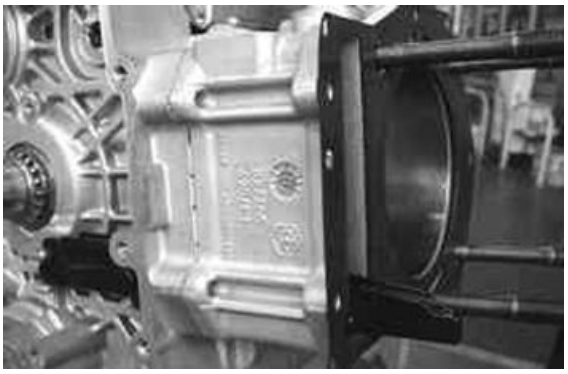
Ø 13 + 0.026 +0.015 mm

- Check that the cam contact sliding block and the articulated register cap is free from wear.

- In case of wear, replace the component.

Refitting the head and timing system components

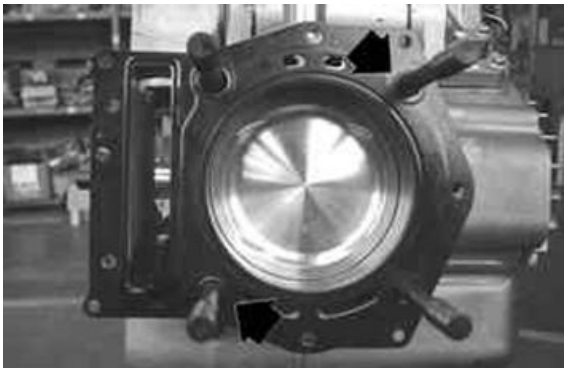
- Insert the chain guide sliding block.
- Insert the two centring dowels between head and cylinder.
- Install the head gasket.



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.

- The head gasket is made of steel and has a standard thickness.



- Check that the head lubrication channel is perfectly clean. Clean with compressed air jets, if required.
- Insert the head.
- Lubricate the stud bolts and the 4 fixing stud bolts.

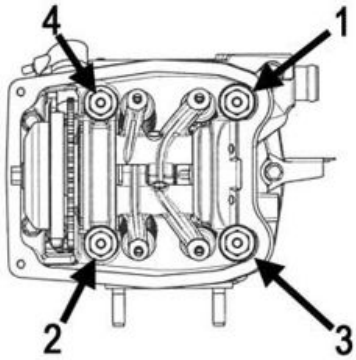
- Tighten the 4 fixing stud bolts crosswise to the prescribed torque as shown in the figure.

Locking torques (N*m)

Head fixing stud bolts *

******* Apply a preliminary torque of 7 Nm in a crossed sequence.

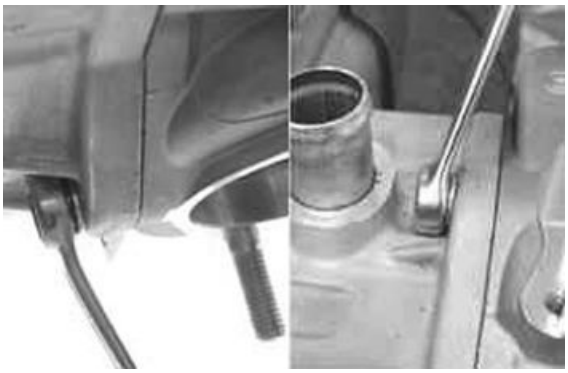
- Tighten by 90° in a crossed sequence.
- tighten again by 90° in a crossed sequence.



- Tighten the fastening nuts on the exhaust and on the intake side to the prescribed torque.

Locking torques (N*m)

Exhaust/ intake head fixing nuts **10 - 12**



- Tighten the 3 side screws to the prescribed torque.

Locking torques (N*m)

Head fixing screws **10 - 12**

- Install the coolant temperature sensor with the washer and tighten to the prescribed torque.

CAUTION

FAILURE TO OBSERVE THE TIGHTENING TORQUE CAN DAMAGE THE SENSOR.

Locking torques (N*m)

Coolant temperature sensor **10 - 12**

- Fit the spark plugs and tighten them to the prescribed torque.

Locking torques (N*m)

Spark plug 12 - 14

- 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.

Recommended products

Loctite 243 Medium strength threadlock

Medium Loctite 243 threadlock

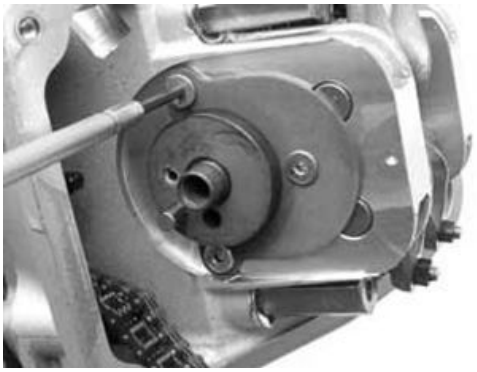
Locking torques (N*m)

Tensioner slider fixing screw 10 - 14

- 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.
- Apply the recommended product to the fixing screws and tighten to the prescribed torque.



Recommended products

Loctite 243 Medium strength threadlock

Medium Loctite 243 threadlock

- 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.

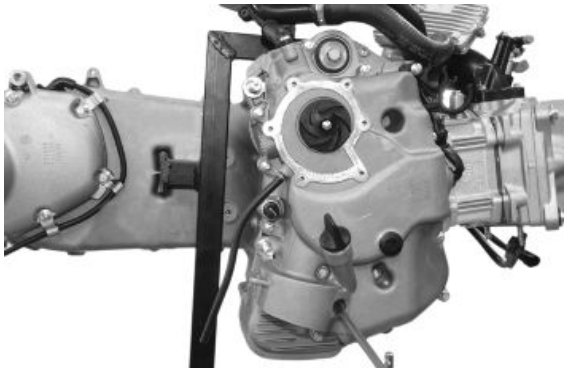
Locking torques (N*m)

Camshaft retaining bracket screws: 4 to 6

- 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.



- Using the TORX wrench, remove the timing check cap.

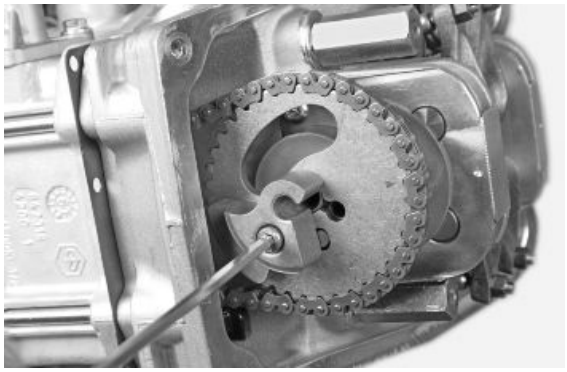
- Insert the belt on the camshaft control timing rim.
- Insert the timing rim on the camshaft checking that the references are aligned.

N.B.

DURING THE STROKE CHECK, KEEP THE BELT TENSIONED BY PRESSING ON THE TIGHTENER COMPARTMENT SIDE.

- 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 bell fastening screw.
- Lock the mass fixing screws to the prescribed torque, using the recommended product.



Recommended products

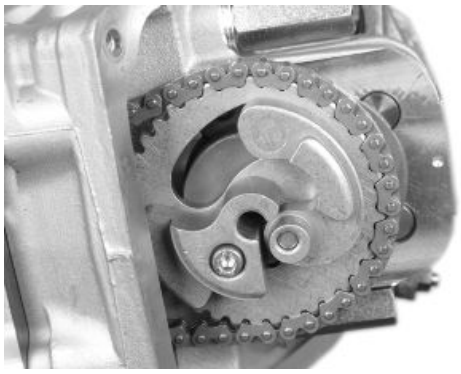
Loctite 243 Medium strength threadlock

Medium Loctite 243 threadlock

Locking torques (N*m)

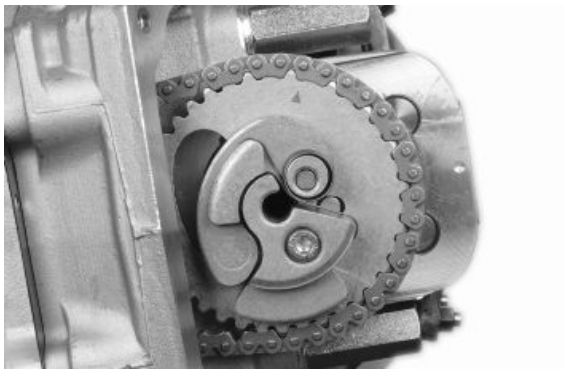
Counterweight screw 7 to 8.5

- 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.



- 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 bell.
- Tighten the retaining screw to the prescribed torque, using the recommended product.

N.B.

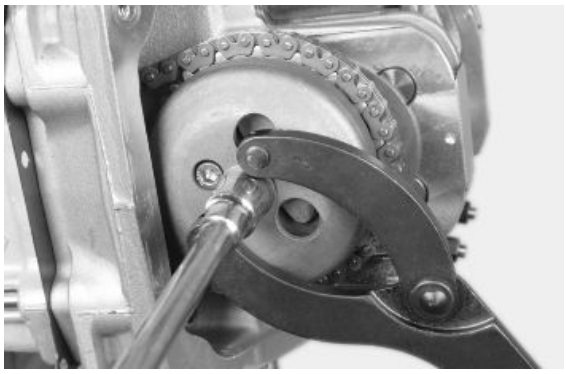
THE BELL TIMING IS ENSURED BY THE COUNTERWEIGHT MASS FASTENING SCREW HEAD.

Recommended products

Loctite 243 Medium strength threadlock

Medium Loctite 243 threadlock

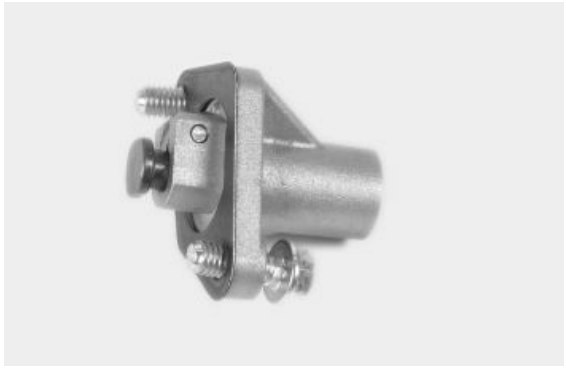
- Check that the decompression mass is free and that it is pulled by the spring.



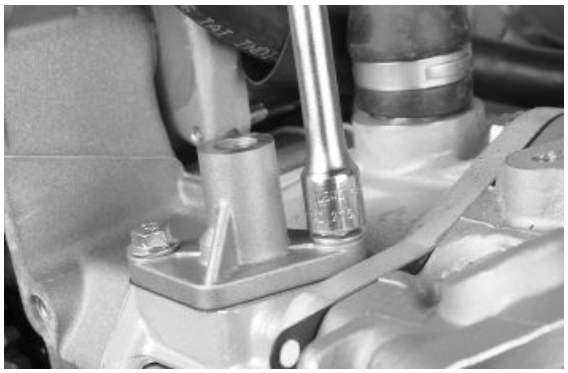
Locking torques (N*m)

Valve lifter mass stop bell fixing screws **30 - 35**

- 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.



Locking torques (N*m)

Tensioner fastening screws: **11 - 13**

- Insert the spring with the central screw and the washer.
- Tighten the central screw to the prescribed torque.

Locking torques (N*m)

Tightener screw: **5 - 6**

- Place the engine with the valve clearance adjustment timing references aligned with the head.
- Check the clearance between valve and rocking lever using a thickness gauge.

PRESCRIBED CLEARANCE

Specification	Desc./Quantity
Inlet	0.15 mm (engine cold)
drainage	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.

Refitting the timing chain

The 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.
It is possible to check whether the ignition advance determined by the injection system matches the value actually activated on the engine, by means of the stroboscopic light.

Specific tooling

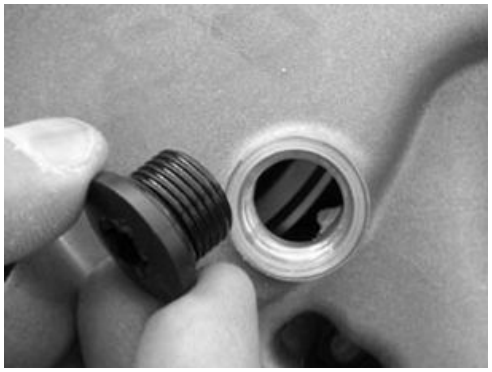
020922Y Diagnosis Tool

020330Y Stroboscopic light for timing checking

Proceed as follows:

- Remove the outside transmission cover as described in the automatic transmission chapter.

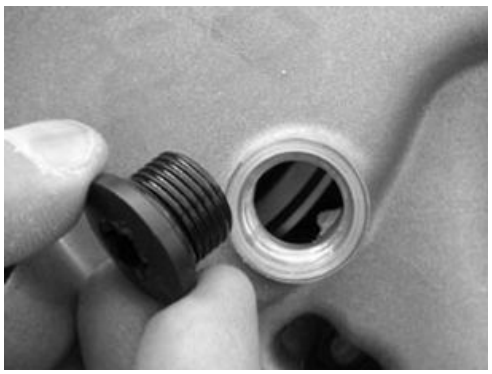
- Remove the TDC reference inspection cap between flywheel and crankcase cover. See the flywheel cover chapter.



- 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.
- Select the stroboscopic light control in the traditional four-stroke engine position (1 spark, 2 revs).
- Check that the real values of rpm and ignition advance match those measured using the diagnostic tester.



Specific tooling

020922Y Diagnosis Tool

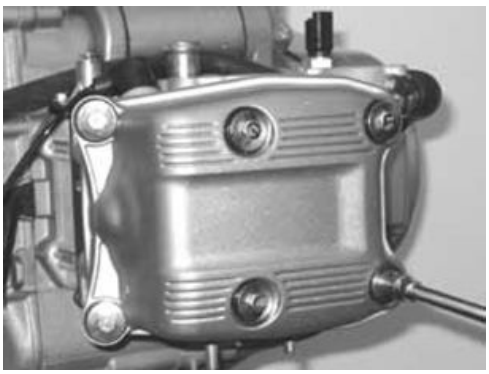
If the values do not match, check:

- distribution timing

- revolution timing sensor
- injection control unit

Refitting the rocker-arms cover

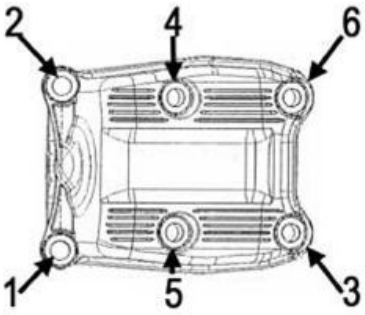
- Check that the gasket is in good working order.



- Tighten the two screws indicated in the figure with «**1**» and «**2**» to limit the reciprocal sliding of the cover surface with the head surface.
- Tighten the remaining 4 screws in a crossed sequence (**3**, **4**, **5**, **6**).

N.B.

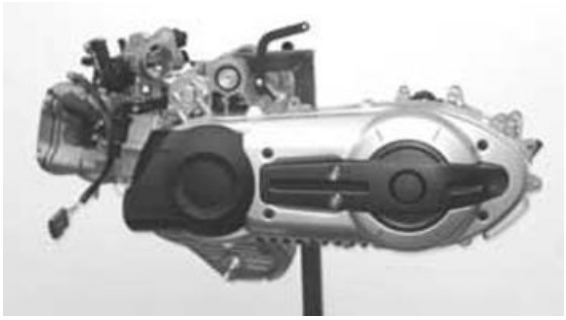
CHECK THE PROPER POSITION OF THE GASKET.



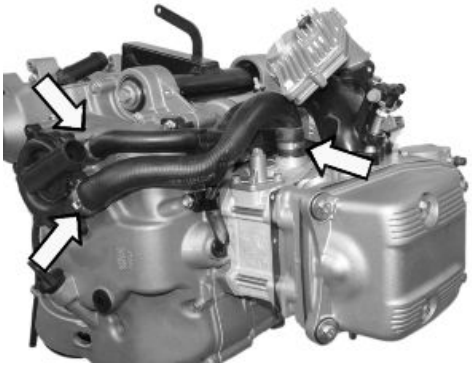
Locking torques (N*m)

Tappet cover fixing screws 7 - 9

- Install the transmission cover and the relevant mesh filter and the outside transmission cover as described in the "Automatic transmission" chapter.



- Install the cooling system sleeves using new bands, as described in the "Flywheel cover" chapter.

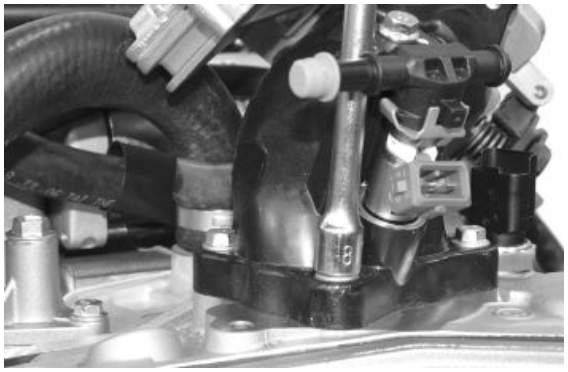


Refitting the intake manifold

- 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.

Locking torques (N*m)

Intake manifold screws **11 - 13**



Crankcase - crankshaft

- Remove the outside and inside transmission cover and the complete driving pulley as described in "Automatic transmission".
- Remove the flywheel cover with the cooling system sleeves, as described in the "Flywheel cover" chapter.
- Remove the flywheel with the starting system following the instruction given in "Flywheel and Starting system".
- Remove the thermal group (cylinder, head, piston) as described in the «Thermal group and timing system chapter».
- Before opening the crankcase, check the crankshaft axial clearance.

For this purpose, use a plate (e.g. the special tool) and a support with special tool comparator.

Specific tooling

020262Y Crankcase splitting strip

020335Y Dial gauge magnetic support

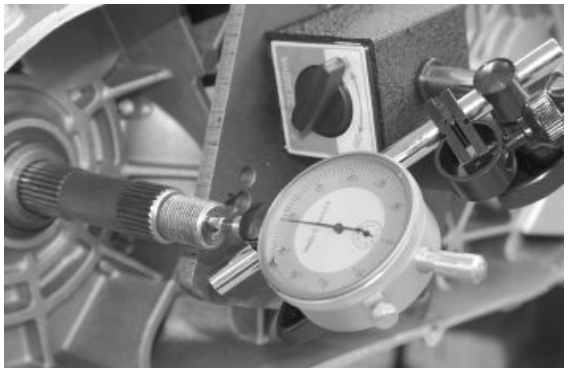
Characteristic

Standard clearance:

0.10 - 0.50 mm

Admissible increase limit after use:

0.60 mm



- Upper clearances are an indication of wear on the surfaces of the crankshaft casing support.
- To carry out an accurate measurement, measure the clearance in both directions between crankcase and crankshaft.

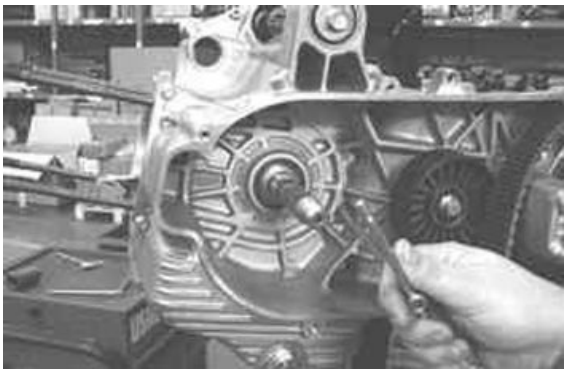
Splitting the crankcase halves

- Remove the engine support retain screw on the flywheel side half-crankcase.

- Remove the 14 crankcase coupling screws.

N.B.

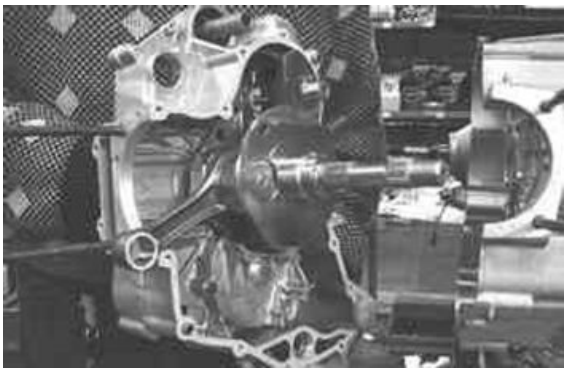
THE FASTENING SCREWS ARE OF 3 DIFFERENT LENGTHS. NOTE THEIR CORRECT POSITION.



- 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 FLY-WHEEL SIDE HALF-CRANKCASE.



Removing the crankshaft

- 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.

CAUTION

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.

CAUTION

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.

Removing the countershaft

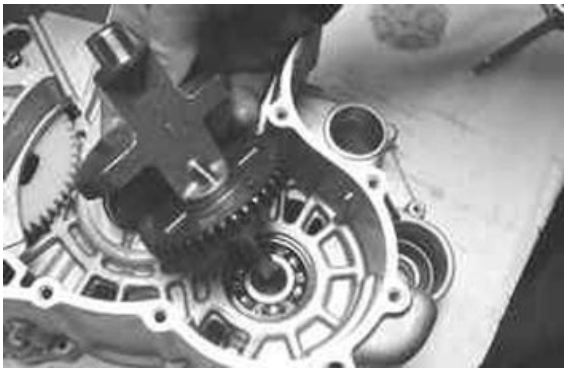
- Place the special tool as shown in the figure.

Specific tooling

020479Y Countershaft lock wrench

- Remove the fastening nut with relevant washer.

- Remove the special tool and extract the countershaft with the control gear.



Replacing the countershaft bearings

- Check that the bearings are free from irregular noise or clearance. If it does, replace it.

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.

Specific tooling

020376Y Adapter handle

020358Y 37 x 40 mm adaptor

020439Y 17 mm guide

- Remove the bearing from the transmission side half-crankcase using the special tool.

Specific tooling

001467Y008 Calliper to extract 17-mm diameter bearings

001467Y007 Bell for OD 54-mm bearings

- Before installing a new bearing, heat the flywheel side half-crankcase using the special tool.
- Place the half-crankcase on a wooden base.

Specific tooling

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.

Specific tooling

020376Y Adapter handle

020359Y 42 x 47-mm adaptor

020439Y 17 mm guide

- Fit the Seeger ring.

- Before installing the new bearing on the transmission side crankcase, heat the seat using the special tool.

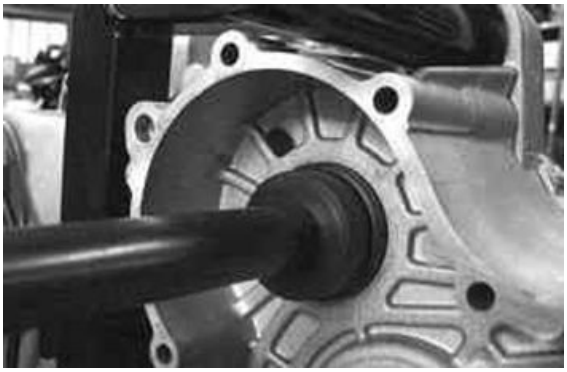
Specific tooling

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.



Specific tooling

020376Y Adapter handle

020359Y 42 x 47-mm adaptor

020439Y 17 mm guide

Inspecting the crankshaft components

- Check the axial clearance on the connecting rod.

Characteristic

Standard clearance:

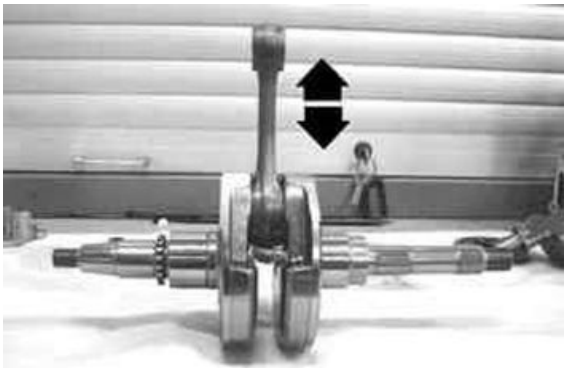
0.20 ÷ 0.40 mm

- Check the connecting rod diametrical clearance.

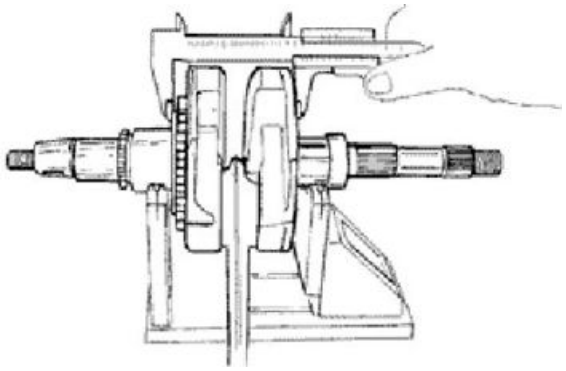
Characteristic

Standard clearance:

0.046 ÷ 0.076 mm



-Check the surfaces that limit the axial free-play are not scored and measure the width of the crankshaft between these surfaces, as shown in the diagram.



N.B.

BE CAREFUL NOT TO LET THE MEASUREMENT BE AFFECTED BY THE UNIONS WITH THE CRANKSHAFT ENDS.

Characteristic

Standard dimensions:

63.6 - 63.45 mm

CAUTION

THE CRANKSHAFT CAN BE REUSED WHEN THE WIDTH FALLS WITHIN THE STANDARD VALUES AND THE SURFACES ARE FREE FROM SCRATCHES.

Shimming

- Check the overall height of the crankshaft - shoulders - gear assembly.

Characteristic

Standard thickness:

71.804 - 72.000 mm

- Check that shim adjustment is free from scratches.

N.B.

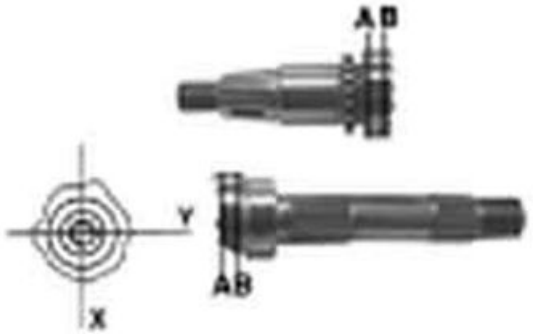
IN CASE OF NEW UTILISATION, MAINTAIN THE FIRST FITTING POSITION.

Specific tooling

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 the diameters of both bearings of the crankshaft in accordance with the axes and surfaces shown in the figure. Half shafts are classified into two categories, Cat 1 and Cat. 2. Refer to the chart below.



STANDARD DIAMETER

Specification	Desc./Quantity
Cat. 1	40.010 ÷ 40.016
Cat. 2	40.016 ÷ 40.022

Inspecting the crankshaft alignment

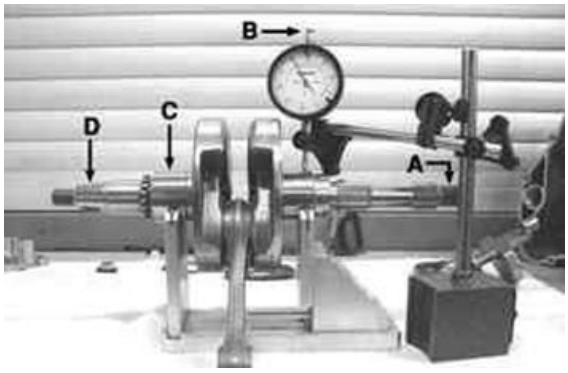
- Install the crankshaft on the support and measure the displacement at the 4 points shown in the figure.

Specific tooling

020074Y Support base for checking crankshaft alignment

MAX ADMISSIBLE DISPLACEMENT:

Specification	Desc./Quantity
A	= 0.15 mm
B	= 0.01 mm
C	= 0.01 mm
D	= 0.10 mm



- Check that the driving shaft cone, the tab seat, the oil seal capacity, the toothed gear and the threaded tangs are in good working order.

- In case of failures, replace the crankshaft.

N.B.

MAIN BEARINGS CANNOT BE MODIFIED.

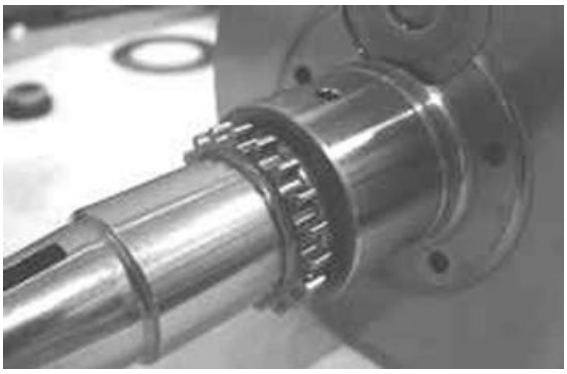
The connecting rod cannot be replaced. To check the connecting rod small end diameter, see chapter "Thermal group and timing system".

- When cleaning the crankshaft, be careful to prevent any impurity from entering into 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".



See also

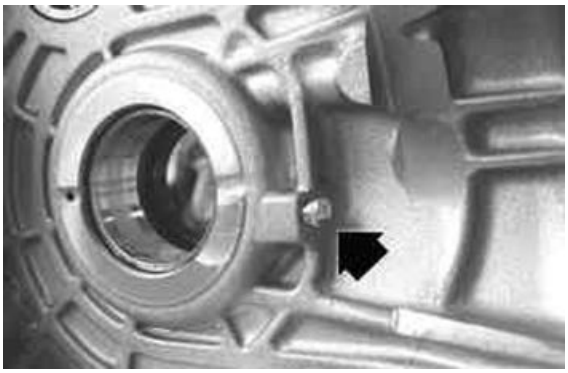
Cylinder assy. and timing system

Inspecting the crankcase halves

- 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.

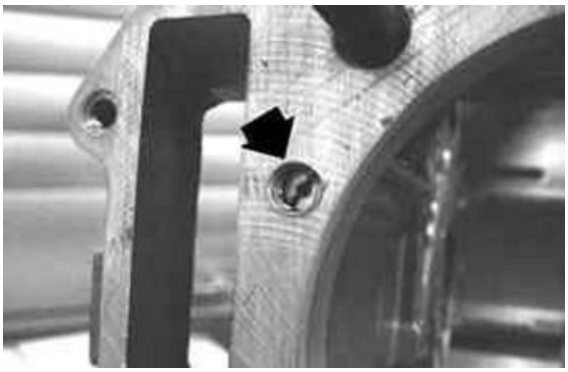
THE JET IS FED THROUGH THE MAIN BUSHINGS. PROPER OPERATION OF THIS COMPONENT IMPROVES THE PISTON TOP COOLING. CLOGGING HAS EFFECTS THAT ARE DIFFICULT TO DETECT (PISTON TEMPERATURE INCREASE). FAILURE OR LEAK CAN CONSIDERABLY DECREASE THE MAIN BUSHING AND CONNECTING ROD LUBRICATION PRESSURE.



- 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.

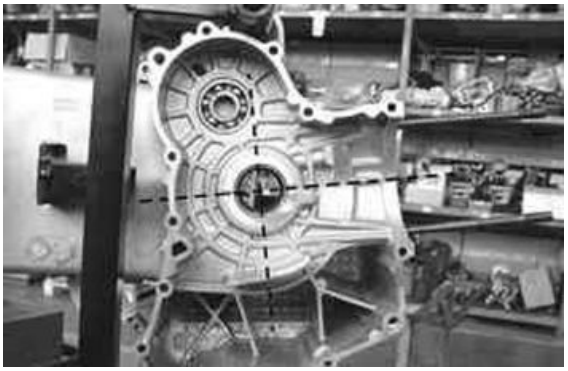


The jet clogging impairs the head lubrication and the timing mechanisms.

A jet failure causes a decrease in the main bearing and connecting rod lubrication pressure.

- Check that the surfaces exhibit no dents or deformations, with 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 the main bearing seats that limit axial clearance in the crankshaft exhibit no wear. For the dimensional check, refer to the instructions about checking the axial clearance and the dimensions on the crankshaft

Inspecting the crankshaft plain bearings



- 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 obstructions in the oil feeding channels, the matching surface of the two half-bearings must be perfectly perpendicular 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.

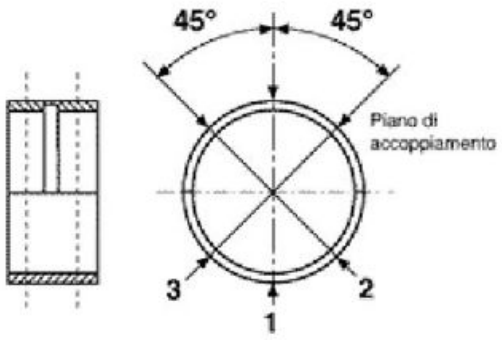
N.B.

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.

- Check the inside diameter of the main bushings in the three directions indicated in the diagram.
- Repeat the measurements for the other half of the bushing. See figure.

N.B.

DO NOT TAKE THE MEASUREMENT ON THE 2 HALF-SHELLS COUPLING SURFACE SINCE THE ENDS ARE RELIEVED TO ALLOW BENDING DURING THE DRIVING OPERATION.



Before assembling, check that the clearance between the engine crankcase bushing and the crankshaft is within the predetermined limits.

Characteristic

Crankshaft-bushing maximum clearance allowed:

0.08 mm

- 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.
- Bushings are subdivided into 4 categories according to their thickness (see the table).

CHECK THE BENCH BUSH

Name	Description	Dimensions	Initials	Quantity
Type A - Red		1.971 ÷ 1.974		
Type B - Blue		1.974 ÷ 1.977		
Type C - Yellow		1.977 ÷ 1.980		
Type D - Green		1.980 ÷ 1.983		

Coupling chart

Depending on the type of crankshaft/crankcase coupling, the following types of bushings listed in the table should be used.

		X	
		1	2
Y	1	B	A
	2	C	B
	3	D	C

KEY

X = Crankshaft category

Y = Crankcase halves category

A = Red

B = Blue

C = Yellow

D = Green

In case of breakdown, crankcases are together with bushings and are classified according to the centre to centre distance of the countershaft. Find below the possible couplings.

- Complete FC1 type crankcase equipped with bushings for housing a category 1 crankshaft and a countershaft with centre to centre distance A.
- Complete FC2 type crankcase equipped with bushings for housing a category 2 crankshaft and a countershaft with centre to centre distance A.

- Complete FC3 type crankcase equipped with bushings for housing a category 1 crankshaft and a countershaft with centre to centre distance B.
- Complete FC4 type crankcase equipped with bushings for housing a category 2 crankshaft and a countershaft with centre to centre distance B.

N.B.

THE CRANKSHAFT CATEGORY IS STAMPED ON THE COUNTERWEIGHT SHOULDER.

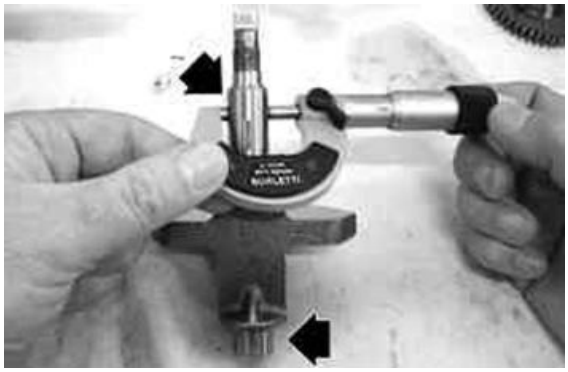
A spare crankcase cannot be combined with a driving shaft with mixed categories. Spare shafts have half-shafts of the same category.

N.B.

TO REPLACE THE HALF-SHAFTS, REMOVE THE COUNTERSHAFT BEARINGS AS DESCRIBED ABOVE. REMOVE THE COMPLETE DRIVEN PULLEY AND THE ANTI-FLAPPING ROLLER FROM THE TRANSMISSION SIDE HALF-CRANKCASE, AS DESCRIBED IN CHAPTER "AUTOMATIC TRANSMISSION", AND THE HUB COVER WITH THE RELEVANT GEARS AND BEARINGS AS DESCRIBED IN CHAPTER "FINAL REDUCTION".

Countershaft

- Using a micrometer, measure the 2 bearings of the countershaft as shown in the figure.



Characteristic

Standard diameter:

17 - 0.01 - 0.02 mm

- Check that the water pump drive is not worn.

Refitting the crankshaft

- 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.

Recommended products

Loctite 243 Medium strength threadlock

Medium Loctite 243 threadlock

- 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.

N.B.

TO AVOID DAMAGING THE SCREW CONTROL HEXAGON, IT IS PREFERABLE TO USE AN INSIDE HEXAGON SOCKET WRENCH.

Locking torques (N*m)

Gear mounting on crankshaft screws 10 -12

- 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 the special timing tool in the hole on the countershaft.

Specific tooling

020471Y Pin for countershaft timing

- Insert the crankshaft on the pin and into the bushing.
- Before inserting thoroughly, make the oil pump gear align with the control gear.
- Insert thoroughly and remove the special tool.

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.

Locking torques (N*m)

Oil pump compartment cover bulkhead screws 8 - 10

Refitting the crankcase halves

- 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.

CAUTION

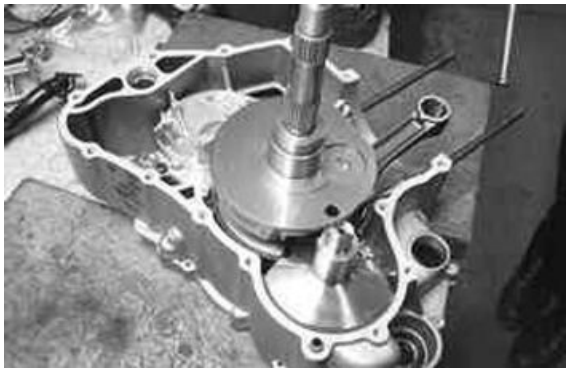
A WRONG POSITIONING OF THE OIL GUARD AFFECTS THE LUBRICATION OIL CIRCULATION.

Specific tooling

020360Y 52 x 55-mm adaptor

020376Y Adapter 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 fastening screws by arranging the single shorter screw «**A**» and the single longer screw «**B**» as shown in the figure.

- 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.

Locking torques (N*m)

Engine crankcase coupling screws 11 - 13

- 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.

See also

Cylinder assy. and timing system
Flywheel cover

Lubrication

TECHNICAL SPECIFICATIONS

SUMP CAPACITY

Specification	Desc./Quantity
Overhaul	1.7 l
Oil and filter replacement	1.5 l

RECOMMENDED ENGINE OIL

Product	Description	Specifications
eni i-Ride PG 5W-40	Synthetic based lubricant for high-performance four-stroke engines.	JASO MA, MA2 - API SL - ACEA A3

OIL PUMP

Specification	Desc./Quantity
Type	Trochoidal
Rotor washers	8 mm
Assembly clearances	Lobe ends 0.05-0.008 mm
External rotor radial clearance	0.05- 0.12 mm
Rotor axial clearance	0.025 - 0.065 mm

BY-PASS

Specification	Desc./Quantity
Type	with piston
Plunger diameter	13.9 - 0.039 -0.057 mm
Spring free length	62.5 mm
Calibration pressure	4 bar

PRE-FILTER

Specification	Desc./Quantity
Type	mesh, plastic

OIL FILTER

Specification	Desc./Quantity
Type	Paper with pressure relief and anti-drain back by-pass valves

OIL MINIMUM PRESSURE INDICATOR LIGHT SWITCH

Specification	Desc./Quantity
Calibration	0.3 - 0.6 bar

HEAD LUBRICATION CONTROL JET

Specification	Desc./Quantity
Diameter	1 ± 0.05 mm *

**** Tightening torque*** *5÷7 N·m*

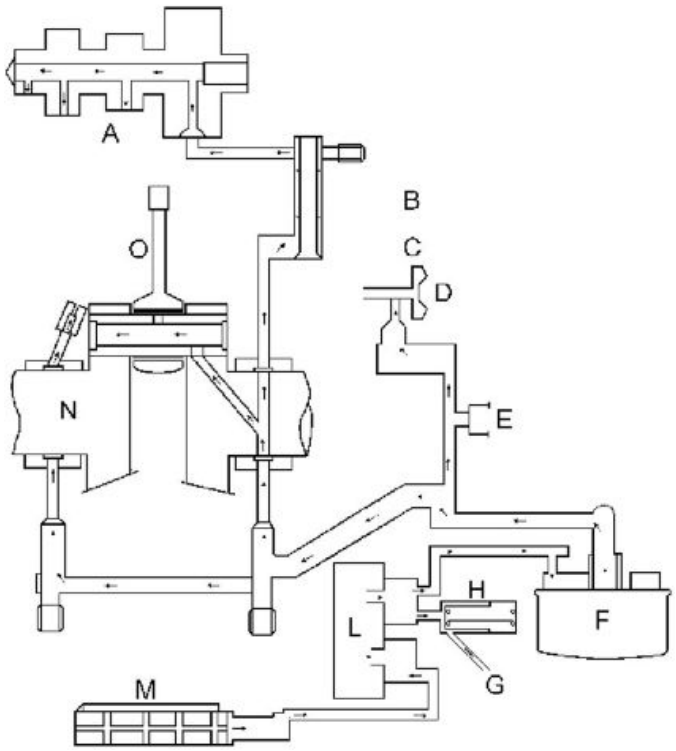
PISTON COOLING NOZZLE

Specification	Desc./Quantity
Diameter	0.8 ± 0.05 mm

CRANKCASE VENTILATION CHECK

Specification	Desc./Quantity
Device	metal reed valve and decantation chamber

Conceptual diagrams



PRINCIPLE DIAGRAM

Specification	Desc./Quantity
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
H	By-pass valve
L	Oil pump
M	Mesh pre-filter
N	Crankshaft
O	Connecting rod

General characteristics

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-relief 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 scooter 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.

Diagnosis guide

1 - Minimum oil pressure warning light on with hot engine.

AHEAD - go to 2

2 - Remove the minimum pressure switch electric connector.

Check that the warning light turns off.

YES - go to 3 NO go to 11

3 Check the actual oil pressure.

AHEAD - go to 4

4 - Remove the switch and fit the special tool with the relevant gasket.

Specific tooling

020193Y Gauge for oil pressure check

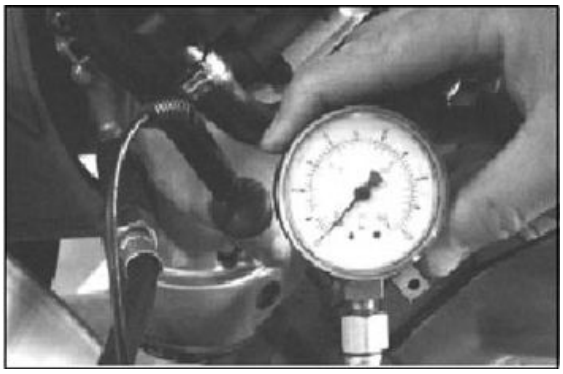
020434Y Fitting for oil pressure check

- Remove the dipstick with the oil filling cap and insert a cap fitted with the temperature probe supplied with the special tool. Insert the probe to feel contact with the crankcase bottom and pull back a few millimetres.

Specific tooling

020331Y Digital multimeter

AHEAD - go to 5



5 - Measure the pressure with cold and idling engine.

STANDARD VALUES

Specification	Desc./Quantity
20°C Temperature	
1400 rpm	

approx. 4.5 bar

N.B.

RPM CAN BE MEASURED BOTH BY THE EXHAUST GAS ANALYSER AND BY THE DIAGNOSTIC TESTER

Specific tooling

020922Y Diagnosis Tool

YES go to 6 NO go to 12

6 - Let the engine warm up and repeat the check with hot oil.

STANDARD VALUES

Specification	Desc./Quantity
80°C Temperature	
1400 rpm	

approx. 1.5 bar

YES go to 7 NO go to 8

7 - Replace the oil minimum pressure switch.

8 - If pressure lower than 1.3 ÷ 1.5 bar is measured.

AHEAD go to 9

9 - Replace the oil filter and repeat the pressure check with oil at 80°C.

YES go to 10 NO go to 13

10 - The failure was fixed.

It is recommended to respect the suggested number of kilometres covered.

11 - Check and restore the electrical system.

12 - If pressure lower than 4 bar is measured.

AHEAD go to 9

13 - Remove the flywheel cover and check the by-pass and the cover sealing gasket efficiency towards the case internal side, as described in the "Flywheel cover" chapter.

YES go to 14 NO go to 15

14 - Check whether there is an irregular clearance on the crankshaft:

- axial clearance (see the "Crankcase and crankshaft" chapter)
- radial clearance, especially in the direction of the cylinder axis
- clearance according to the direction of rotation with the connecting rod in quadrature

YES go to 16 NO go to 17

15 - Replace the faulty components ("Flywheel cover" chapter).

16 - Overhaul the engine ("Crankcase and crankshaft" chapter).

17 - Open the engine crankcase and remove the oil pump as described in the "Crankcase and crankshaft" chapter.

- Check the oil pump as described in the following pages.
- Check that the cooling nozzle and the timing system feeding jet are properly installed.
- Visually inspect the crankshaft couplings and their size ("Crankcase and crankshaft" chapter).

N.B.

POTENTIAL IRREGULARITIES IN COUPLINGS AND THE TIMING SYSTEM COMPONENTS CANNOT BE DETECTED WHEN INSPECTING THE LUBRICATION PRESSURE. THEY MAY BECOME EVIDENT BY AN INCREASE IN NOISE.

N.B.

IN CASE OF IRREGULAR PRESSURE ON THE CRANKCASE, CARRY OUT A VISUAL AND DIMENSIONAL INSPECTION OF THE TIMING SYSTEM COMPONENTS (SEE "THERMAL GROUP AND TIMING SYSTEM" CHAPTER).

Oil pressure check

1 - In case of oil leaks from the oil filter or from the flywheel cover coupling gasket, check the lubrication pressure.

AHEAD go to 2

2 - Install the special tool.

Specific tooling

020193Y Gauge for oil pressure check

020434Y Fitting for oil pressure check

AHEAD 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.

AHEAD 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.

Oil pump

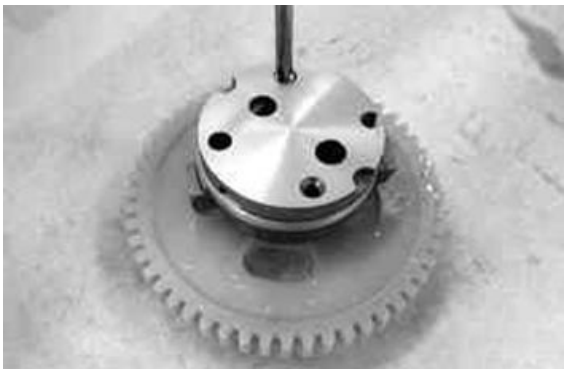
Removal

- Remove the closing plate of the oil pump housing by loosening the 2 retaining screws with their washers.

- Remove the oil pump complete with the gearing by loosening the 2 retaining screws through the eyes machined in the gearing proper.

- Remove the 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 thickness gauge, check the distance between the rotors in the position shown in the figure.

Characteristic

Admissible limit clearance:

0.012 mm

- Check the distance between external rotor and pump body; see figure.

Characteristic

Admissible limit clearance:

0.25 mm

- Check the rotor axial clearance using a rectified bar as reference plane, as shown in the figure.

Characteristic

Limit value allowed:

0.1 mm

Refitting

- 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 fixing screws to be aligned.
- Tighten the two fastening screws to the prescribed torque.

Locking torques (N*m)

Oil pump cover screws 0.7 ÷ 0.9

- 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.

Locking torques (N*m)

Screws fixing oil pump to crankcase **5 - 6**

- Insert the countershaft with gearing into the fly-wheel-side half-crankcase.
- Install the special tool in the position shown in the figure.

Specific tooling

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 special tool.

Recommended products

Loctite 243 Medium strength threadlock

Medium Loctite 243 threadlock

Locking torques (N*m)

Countershaft fixing nut **25 ÷ 29**

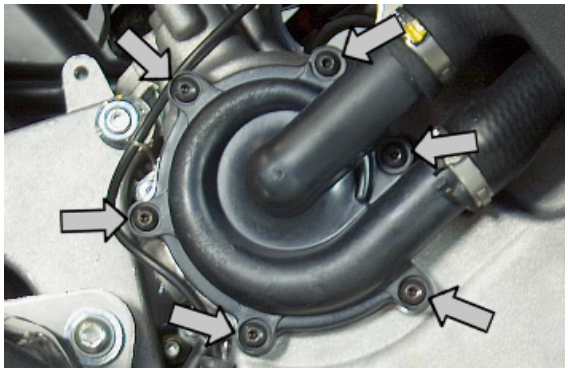
Water pump

Removal

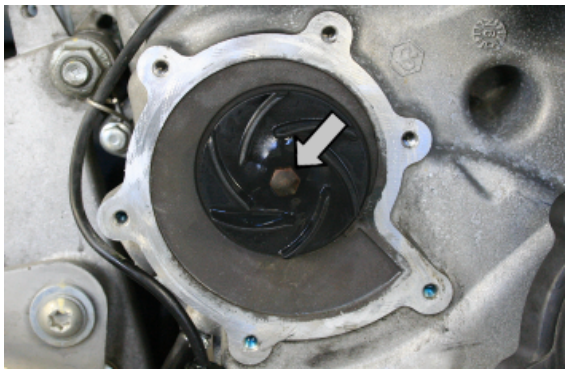
Specific tooling

020661Y Water pump overall seal replacement kit

- Remove the six screws and the pump cover with a screwdriver.



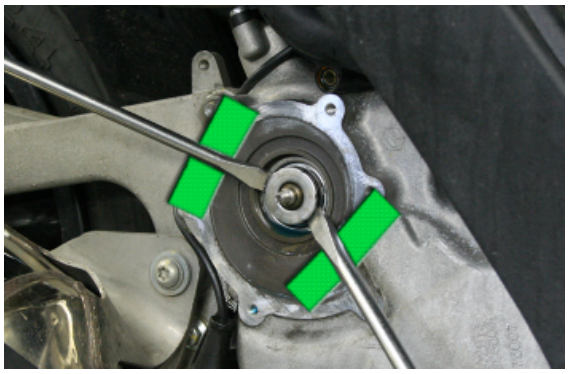
- Unscrew the water pump rotor with an 8-mm wrench.



- 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.

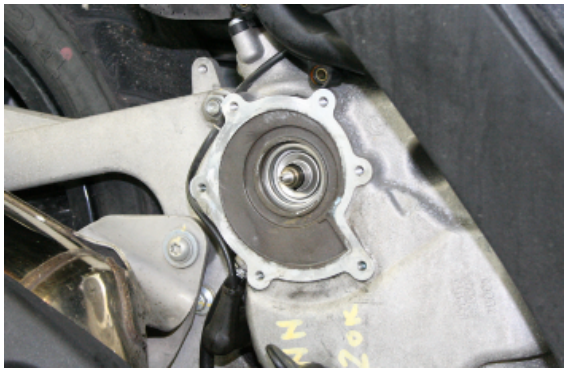
CAUTION

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.

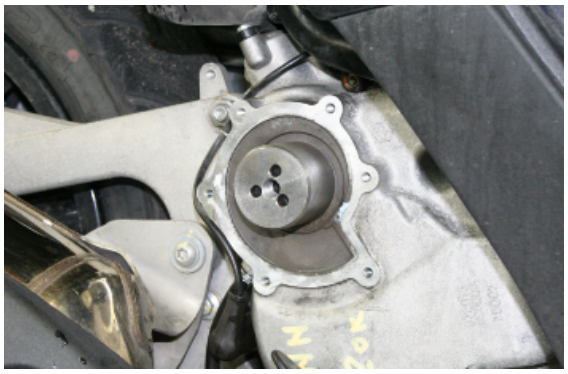
N.B.

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.

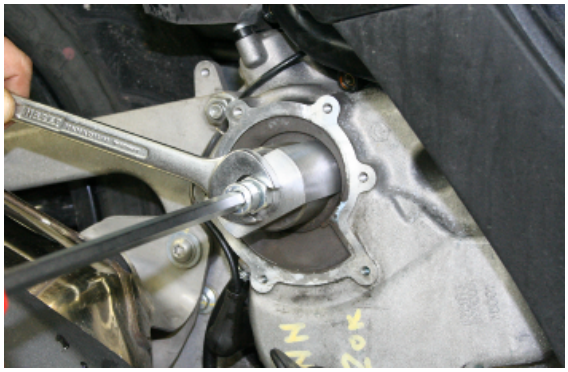
CAUTION

FIX IT PROPERLY WITHOUT "TEARING" THE PLATE



- Complete the tool by fitting the bracket, the screw and the nut.

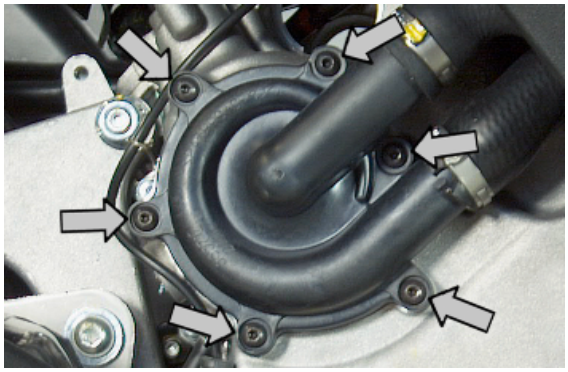
- Hold the screw in position and operate the nut until the fixed part of the sealing is completely removed.
- Remove the extractor with the fixed part of the overall seal.



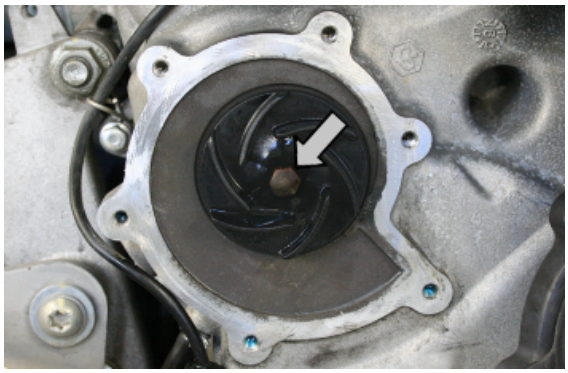
Specific tooling

020661Y Water pump overall seal replacement kit

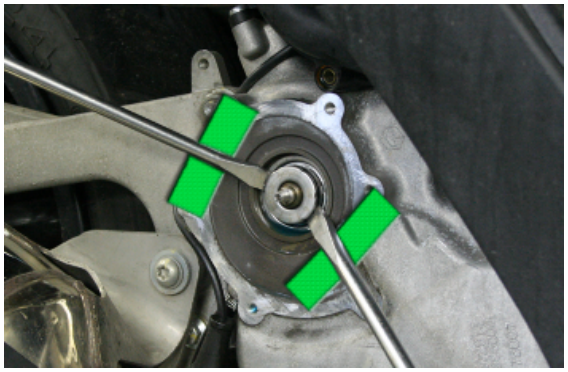
- Remove the six screws and the pump cover with a screwdriver.



- 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.

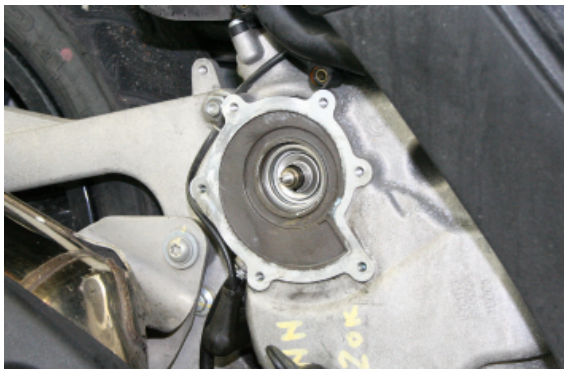


CAUTION

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.

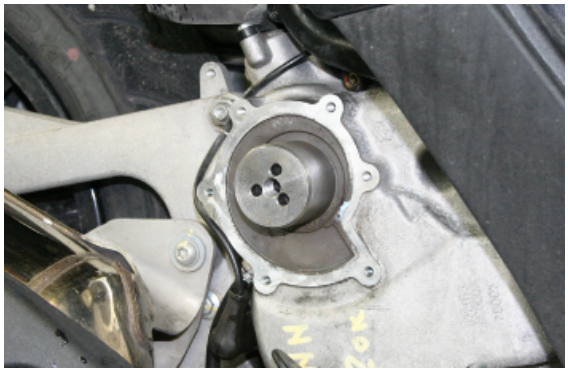
N.B.

**MAKE THE HOLES WITH A STRONG HIT.
MULTIPLE LIGHT BLOWS COULD DEFORM THE PART WITHOUT PASSING THROUGH.**

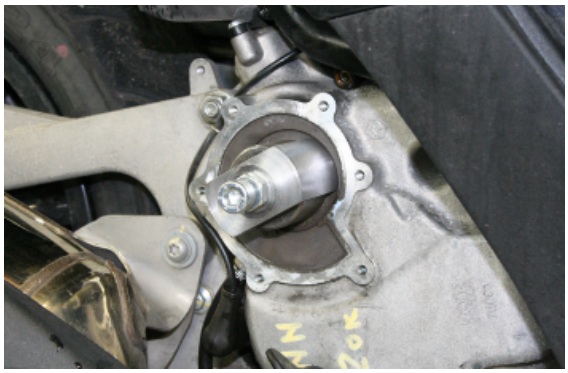
- Fix the extractor to the fixed part of the sealing using the screws supplied with the tool.

CAUTION

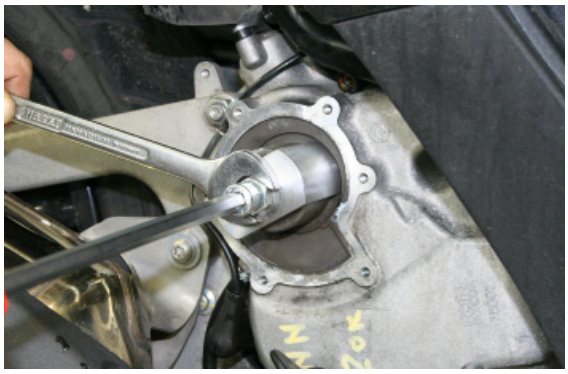
FIX IT PROPERLY WITHOUT "TEARING" THE PLATE



- 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.



Fitting

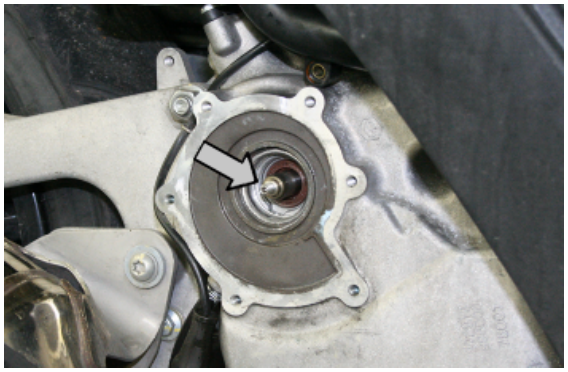
OVERALL SEAL FITTING

CAUTION

CLEAN ALL THE COMPONENTS THOROUGHLY.

CAUTION

LUBRICATE THE ROTOR SHAFT WITH ENGINE OIL.

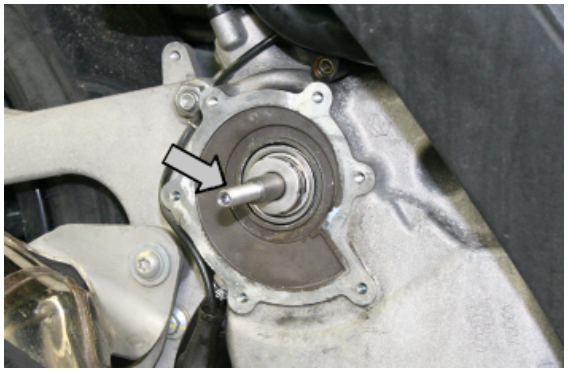


- Fit the tie rod by screwing it to the rotor shaft.

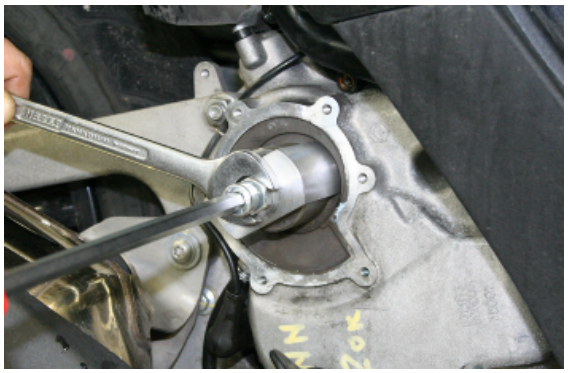
CAUTION

TIGHTEN MANUALLY UNTIL IT STOPS.

- Place the overall seal on the shaft.



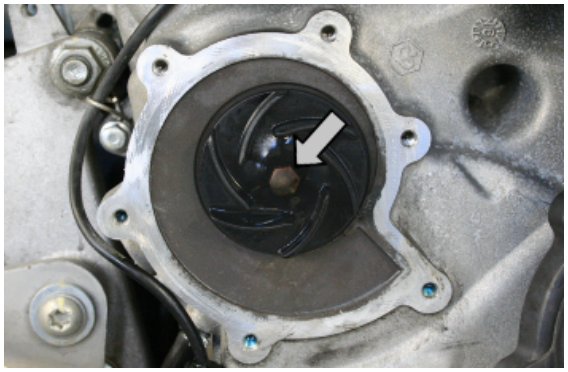
- Place the calibrated punch (at preloading value).
- Fit the nut to the tie rod.
- Keep the tie rod in position and screw the nut up to the end of stroke.
- The tool will drive the fixed part seat on the crank-case and the movable part seat on the shaft, thus obtaining the correct ceramic seal preloading.



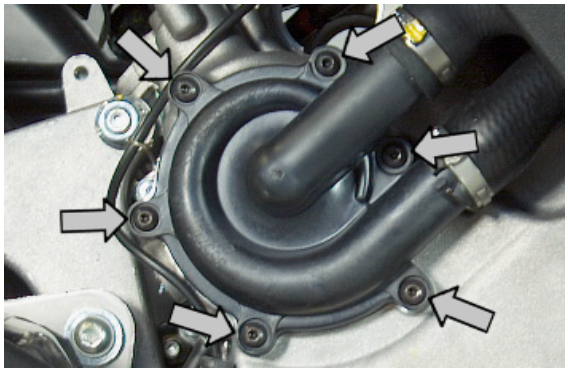
- Screw the rotor.

Locking torques (N*m)

Water pump rotor **4 ÷ 5**



- Fit the pump cover with a new gasket, lubricate the gasket previously with petroleum jelly grease.
- Tighten the six cover screws to the prescribed torque.



N.B.

TO AVOID DEFORMATION, DO NOT LUBRICATE THE O-RING WITH PETROLEUM GREASE.

Locking torques (N*m)

Water pump cover screws 3 - 4

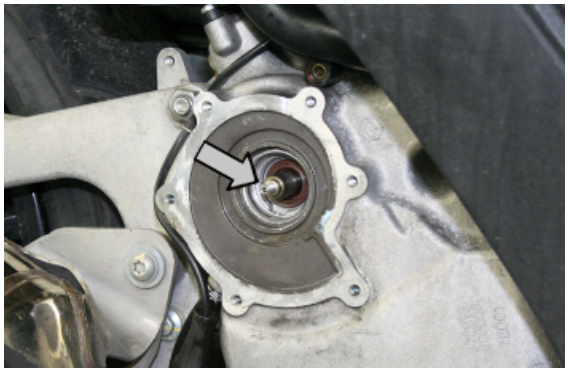
OVERALL SEAL FITTING

CAUTION

CLEAN ALL THE COMPONENTS THOROUGHLY.

CAUTION

LUBRICATE THE ROTOR SHAFT WITH ENGINE OIL.

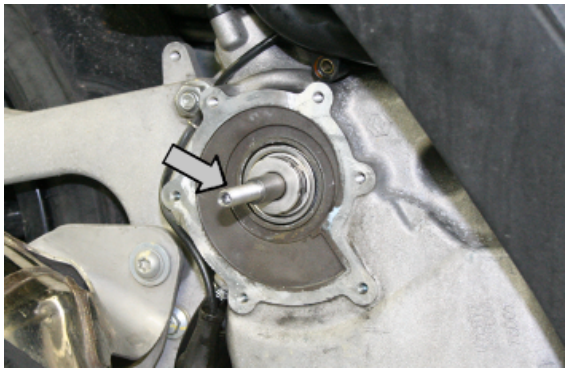


- Fit the tie rod by screwing it to the rotor shaft.

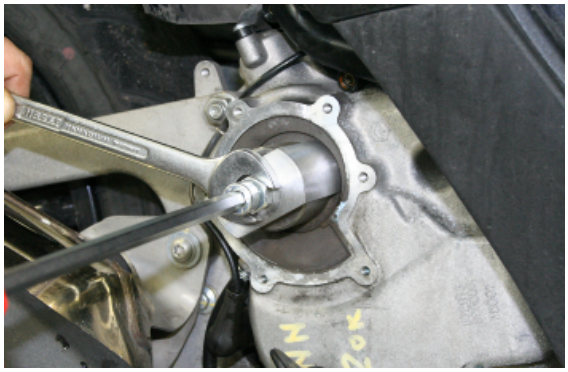
CAUTION

TIGHTEN MANUALLY UNTIL IT STOPS.

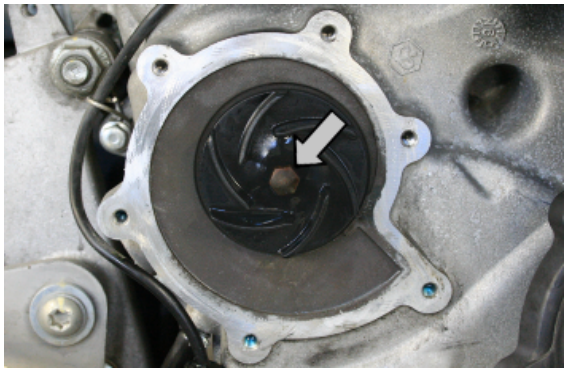
- Place the overall seal on the shaft.



- 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 crank-case and the movable part seat on the shaft, thus obtaining the correct ceramic seal preloading.



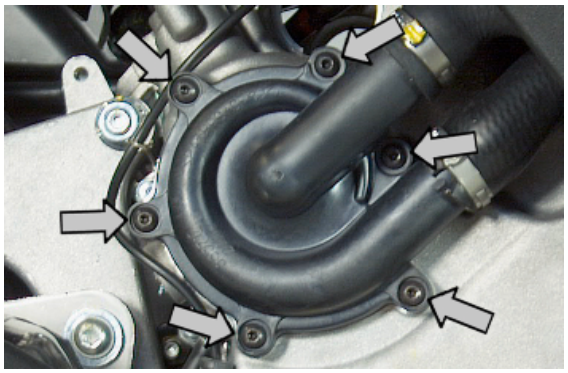
- Screw the rotor.



Locking torques (N*m)

Water pump rotor **4 ÷ 5**

- Fit the pump cover with a new gasket, lubricate the gasket previously with petroleum jelly grease.
- Tighten the six cover screws to the prescribed torque.



N.B.

TO AVOID DEFORMATION, DO NOT LUBRICATE THE O-RING WITH PETROLEUM GREASE.

Locking torques (N*m)

Water pump cover screws **3 - 4**

INDEX OF TOPICS

N.B.

THE UNITS OF MEASUREMENT CONTAINED IN THIS CHAPTER ARE EXPRESSED IN TERMS OF THE DECIMAL METRIC SYSTEM. TO REFER TO THE UNIT OF MEASUREMENT EXPRESSED IN TERMS OF THE ANGLO-SAXON SYSTEM, SEE THE «CHARACTERISTICS» CHAPTER.

KEY

1. Injection ECU

2. Injector

3. Engine temperature sensor

4. HV coil

5. Engine speed sensor

6. Lambda sensor

7. Fuel pump

8. Injection load relay

9. Diagnostic socket

10. Battery

RIU Injection system

This is an integrated ignition and injection system.

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

Injection and ignition are timed on the 4-stroke cycle using a tone wheel keyed onto the crankshaft (24-2 teeth) and a reluctant variation (pick-up) sensor.

Carburetion and ignition are managed on the basis of the 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 combustion.
In all conditions of use, carburetion is controlled by modifying the injector opening time.
Fuel delivery pressure is kept constant based on the ambient pressure.

The **fuel supply circuit** consists of:

- Fuel pump
- Fuel filter
- Injector
- Pressure regulator

Pump, filter and regulator are placed into the fuel tank using 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 RIU control unit; therefore the vehicle's safety is enhanced.

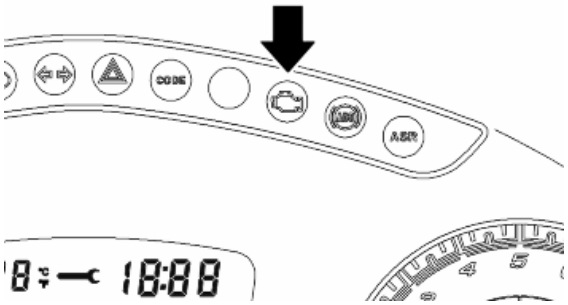
The **ignition circuit** consists of:

- HV coil
- HV cable
- Shielded cap
- RIU control unit
- Spark plug

The RIU control unit manages ignition with the best advance ensuring four-stroke timing (ignition only in the compression phase) at the same time.
The RIU 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.
Obviously, this cannot happen when the rev counter signal is missing, or when the failure concerns the control circuits:

- Fuel pump
- HV coil
- Injector

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

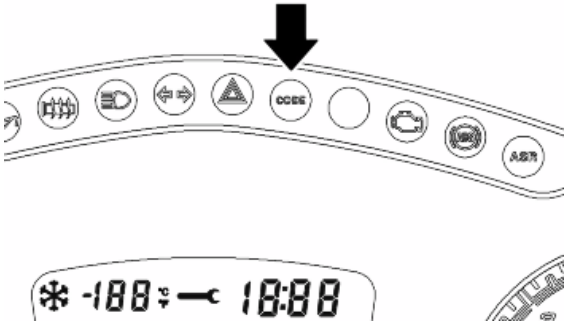


Failures are detected and restored by the diagnostic tester.
In any case, when the fault is no longer present, data storage is automatically wiped clean after 16 cycles of use (cold starting, running at regular engine temperature, stop).
The diagnostic tester is also required for adjusting idle speed carburetion.

Specific tooling

020922Y Diagnosis Tool

The RIU injection-ignition system carries out checks on the rpm indicator and the electric fan for radiator cooling.
The RIU control unit has a decoder for the anti-theft immobilizer system.
The RIU control unit is connected to a diagnostic LED on the instrument panel that also carries out the deterrent flashing function.



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 at ~ 300 kPa (3 BAR). 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.

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

9. Before disconnecting the RIU control unit 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 RIU 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 RIU control unit.

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

Troubleshooting tips

1. An RIU failure is more likely to be due to the connections than to the components.

Before troubleshooting the RIU system, carry out the following checks:

A: Electrical power supply

a. Battery voltage

b. Burnt fuse

c. Solenoids

d. Connectors

B: Chassis earthing

C: Fuel system

a. Faulty fuel pump

b. Dirty fuel filter

D: Ignition system

a. Faulty spark plug

b. Faulty coil

c. Faulty screened cap

E: Intake circuit

a. Air filter dirty

b. Dirty by-pass circuit

c. Faulty stepper motor

F: Other

a. Wrong distribution timing

b. Wrong idle speed carburetion

c. Wrong reset of the throttle valve position sensor

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

Check the connectors as follows:

A: check that the terminals are not bent.

B: check that the connectors have been properly connected.

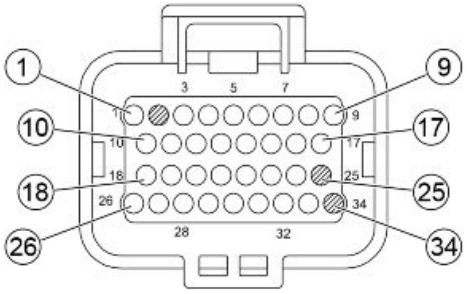
C: check whether the failure changes if the connector is slightly vibrating.

3. Check thoroughly the entire system before replacing the RIU control unit. If the fault is fixed even by replacing the RIU 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 10 KW/V. Improper instruments may damage the RIU control unit. The instruments to be preferred have a definition over 0.1V and 0.5W and an accuracy over ± 2%.

Terminals setup

INJECTION ECU CONNECTOR



1. Start-up enabling switch (Purple-White)

2. Not connected

3. Rpm indicator (Green)

4. Live power supply (Red-White)

5. Injector (Red-Yellow)

6. Electric fan relay (Green-White)

7. Ground lead 1 (Black)

8. HV coil (Pink-Black)

9. ABS Warning Light (Light blue-Red)

10. Injection loads relay (Black-Purple)

11. Injection warning light (Brown-Black)

12. Engine speed sensor negative (Brown)

13. Engine speed sensor positive (Red)

14. Immobilizer LED (Yellow)

15. Ground 2 (Black)

16. ASR Button (Light blue-Blue) (if applicable)

17. Line K (Orange-Black)

18. Stop light relay (Brown-White)

19. ECO mode (brown-red)

20. CAN L Line (Pink-White)

21. Engine stop switch (Green-Black)

22. Engine temperature sensor (Light blue-Green)

23. Ground sensors (Grey-Green)

24. Lambda probe positive (Green-Blue)

25. Not connected

26. Battery powered (Red-Green)

27. Engine stop warning light (Blue)

28. CAN H line (Pink-Red)

29. Immobilizer aerial (Orange-White)

30. Starter button (Purple)

31. Stop buttons (White-Black)

32. Tip over sensor (Grey - Black)

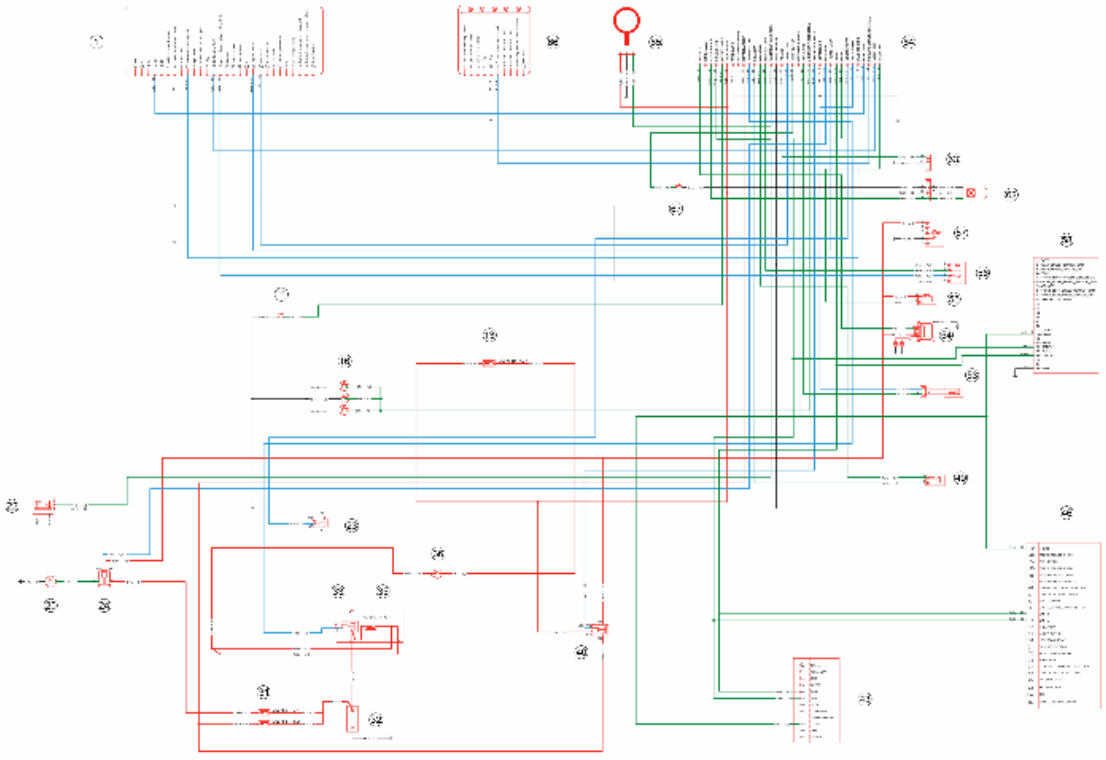
33. Lambda probe negative (Light blue-Black)

34. Not connected

EMS circuit diagram

CAUTION

THE FOLLOWING INSTRUCTIONS REFER TO THE VEHICLE VERSION EQUIPPED WITH ABS - ASR SYSTEM.



KEY

1. Instrument panel

11. Starter button

13. Secondary fuses

16. Stop buttons lever and brake pedals

22. engine stop switch

23. Stop light relay

24. Electric fan relay

25. Electric fan

31. Main fuses

32. Battery

33. Start-up relay

35. Fuse No. 13

36. ignition key contacts

40. Injection load relay

43. PMP connection

46. Parking control ECU

49. Lambda sensor

53. Engine speed sensor

54. HV coil

55. Injector

56. Engine temperature sensor

57. Fuel pump

58. ABS control unit

62. Tip over sensor

63. Diagnostic socket

64. Injection ECU

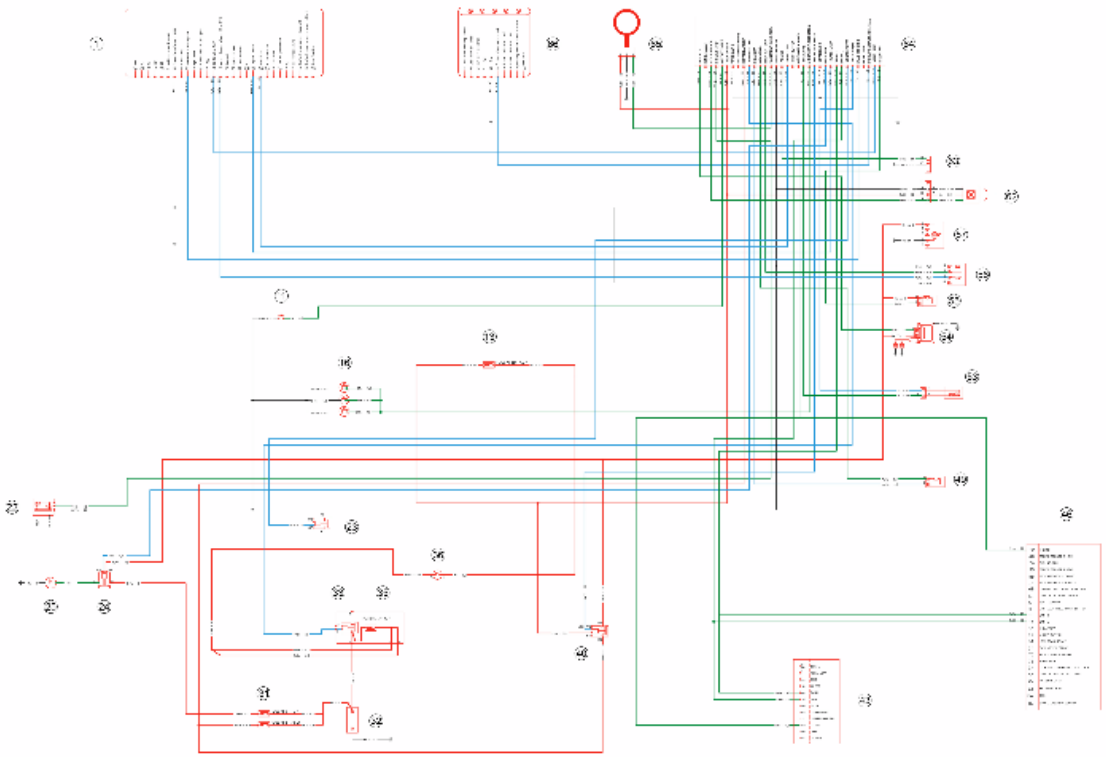
65. Immobilizer aerial

66. Warning light unit

67. ASR Button

CAUTION

THE FOLLOWING INSTRUCTIONS REFER TO THE VEHICLE VERSION NOT EQUIPPED WITH ABS - ASR SYSTEM.



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56. Engine temperature sensor

57. Fuel pump

62. Tip over sensor

63. Diagnostic socket

64. Injection ECU

65. Immobilizer aerial

66. Warning light unit

Troubleshooting procedure

Engine does not start

ENGINE DOES NOT START IF ONLY PULLED

Possible Cause	Operation
Immobiliser enabling signal	System not encoded System not efficient, repair according to the indications of the self-diagnosis
Faults detected by self-diagnosis	Pump relay HV coil Injector Engine speed timing sensor
Fuel system	Fuel present in the tank Fuel pump activation Fuel pressure (low) Injector flow (low)
Power to the spark plug	Spark plug Shielded cap HV Coil (secondary insulation)
Parameter reliability	Coolant temperature Distribution timing - injection ignition Intake air temperature
End of compression pressure	End of compression pressure

Starting difficulties

ENGINE STARTER PROBLEMS

Possible Cause	Operation
Presence of faults detected by the self diagnosis	Pump relay HV coil Injector Revolution timing sensor Air temperature Coolant temperature
Start-up speed	Starter motor and solenoid Battery Ground connections
End of compression pressure	End of compression pressure
Power to the spark plug	Spark plug Shielded cap HV coil Engine speed timing sensor Ignition advance
Fuel system	Fuel pressure (low) Injector flow (low) Injector seal (poor)
Correctness of the parameters	Coolant temperature

Possible Cause	Operation
	Stepper throttle valve position intake air temperature (steps and actual opening) Cleaning of the auxiliary air pipe and throttle valve; air filter efficiency

Engine stops at idle

ENGINE DOES NOT IDLE/ IDLING IS UNSTABLE/ IDLING TOO LOW

Possible Cause	Operation
Presence of faults detected by the self diagnosis	Pump relay HV coil Injector Revolution timing sensor Air temperature Coolant temperature
Ignition efficiency	Spark plug Ignition timing
Correctness of the parameters	Throttle valve position sensor Stepper Coolant temperature sensor Intake air temperature sensor
Intake system cleaning	Air filter Diffuser and throttle valve Additional air pipe and Stepper
Intake system sealing (infiltrations)	Intake manifold - head Throttle body - manifold Intake sleeve Filter box
Fuel system (low pressure)	Fuel pump Pressure regulator Fuel filter Injector flow

Engine does not rev down

ENGINE DOES NOT RETURN TO IDLING SPEED/IDLING SPEED TOO HIGH

Possible Cause	Operation
Presence of faults detected by the self diagnosis	Pump relay HV coil Injector Revolution timing sensor Air temperature Coolant temperature
Ignition efficiency	Ignition timing
Correctness of the parameters	Throttle valve position sensor Stepper Coolant temperature sensor Intake air temperature sensor
Intake system sealing (infiltrations)	Intake manifold - head Throttle body - manifold Intake sleeve Filter box
Fuel system (low pressure)	Fuel pump Pressure regulator Fuel filter Injector flow

Exhaust backfires in deceleration

EXHAUST BACKFIRES WHEN DECELERATING

Possible Cause	Operation
Presence of faults detected by the self diagnosis	Pump relay HV coil Injector Revolution timing sensor Air temperature Coolant temperature Lambda probe
Correctness of the parameters	Throttle valve position sensor Stepper Coolant temperature sensor Intake air temperature sensor
Intake system sealing (infiltrations)	Intake manifold - head Throttle body - manifold Intake sleeve Filter box
Fuel system (low pressure)	Fuel pump Pressure regulator Fuel filter Injector flow
Exhaust system seal (seepage)	Manifold - head Manifold - silencer Silencer welding

Engine revs irregularly

ENGINE IRREGULAR PERFORMANCE WITH VALVE SLIGHTLY OPEN

Possible Cause	Operation
Intake system cleaning	Air filter Diffuser and throttle valve Additional air pipe and Stepper
Intake system sealing	Intake sleeve Filter box
Ignition system	Spark plug wear check
Parameter reliability	Throttle valve position signal Coolant temperature indicator Intake air temperature indicator Ignition advance
TPS reset successful	TPS reset successful
Presence of faults detected by the self diagnosis	Pump relay HV coil Injector Revolution timing sensor Air temperature Coolant temperature Lambda probe

Poor performance at full throttle

POOR ENGINE PERFORMANCE AT FULL POWER/ ENGINE IRREGULAR PERFORMANCE ON PICKUP

Possible Cause	Operation
Presence of faults detected by the self diagnosis	Pump relay HV coil Injector Revolution timing sensor Air temperature Coolant temperature

Possible Cause	Operation
	Lambda probe
Power to spark plug	Spark plug Shielded cap HV Cable HV Coil
Intake system	Air filter Filter box (sealing) Intake sleeve (sealing)
Parameter reliability	Throttle valve position signal Coolant temperature indicator Intake air temperature indicator Ignition advance
Fuel system	Fuel level in the tank Fuel pressure Fuel filter Injector flow

Engine knocking

PRESENCE OF KNOCKING (COMBUSTION SHOCKS)

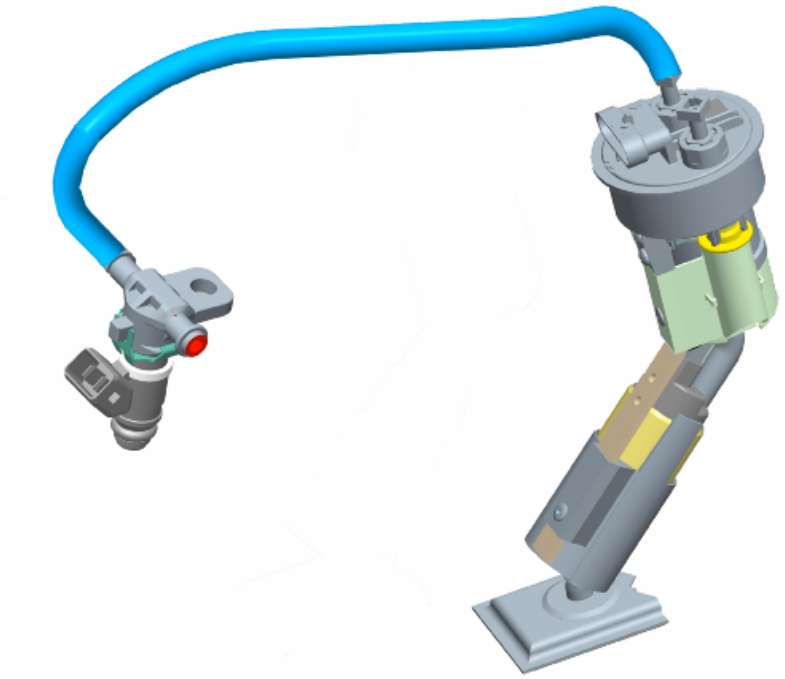
Possible Cause	Operation
Presence of faults detected by the self diagnosis	Pump relay HV coil Injector Revolution timing sensor Air temperature Coolant temperature Lambda probe
Ignition efficiency	Spark plug
Parameter reliability	Throttle valve position signal Coolant temperature indicator Intake air temperature indicator Ignition advance
Intake system sealing	Intake sleeve Filter box
TPS reset successful	TPS reset successful
Fuel system	Fuel pressure Fuel filter Injector flow Fuel quality
Selecting the thickness for the cylinder base gasket	Selecting the thickness for the cylinder base gasket

Fuel supply system

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

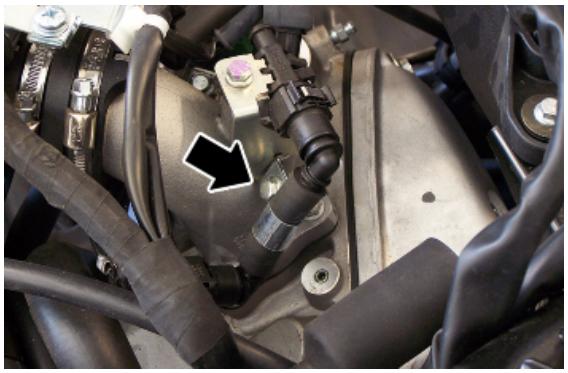
The electrical pump is located in the tank from which the fuel is pumped and sent to the injector through the filter.

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

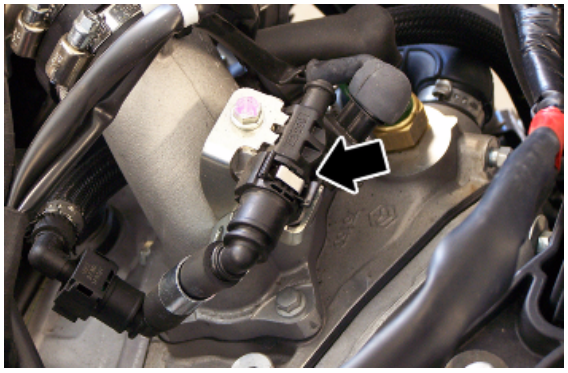


Removing the butterfly valve

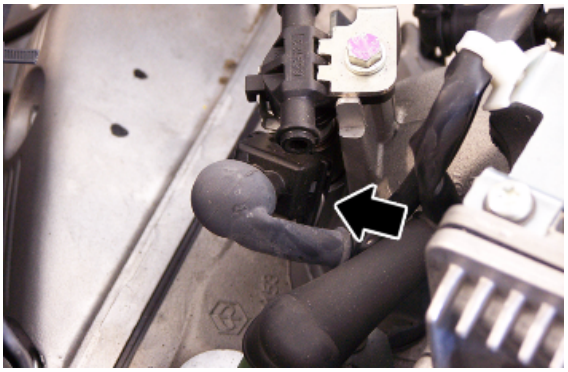
Remove the fuel piping clamping screw indicated in the figure.



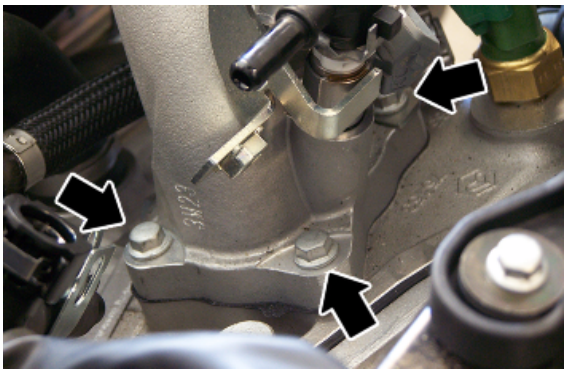
Remove the fast-release fitting from the injector support

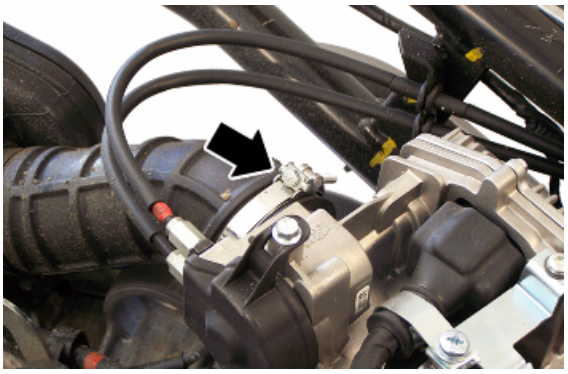


Remove the injector connector.

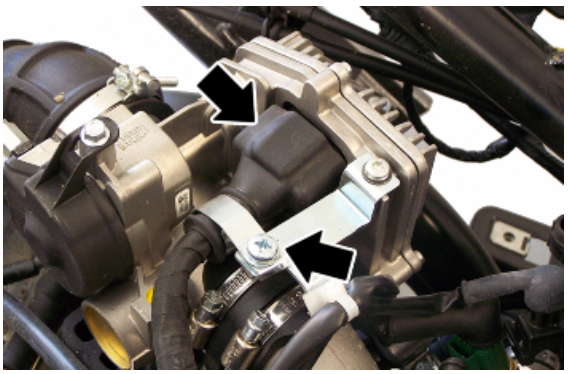


Remove the three screws fixing the manifold to the cylinder head and the clip fixing the throttle body to the manifold.

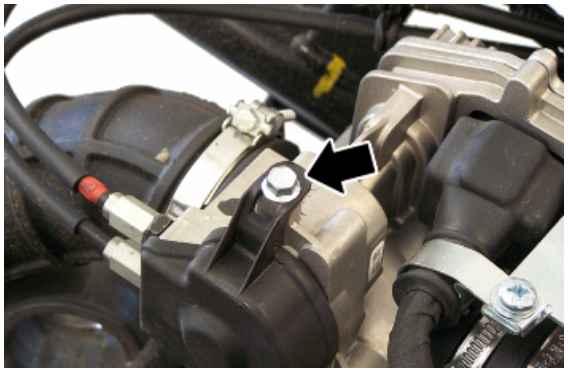


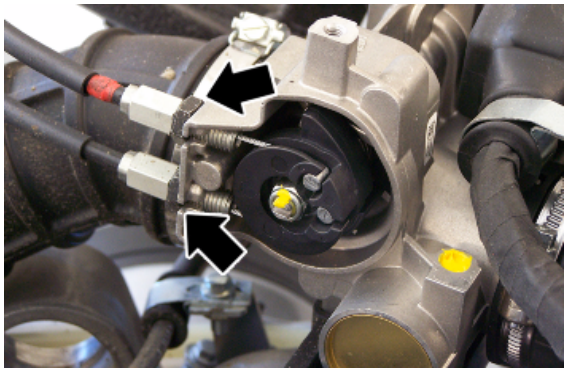


Remove the ECU RIU connector.

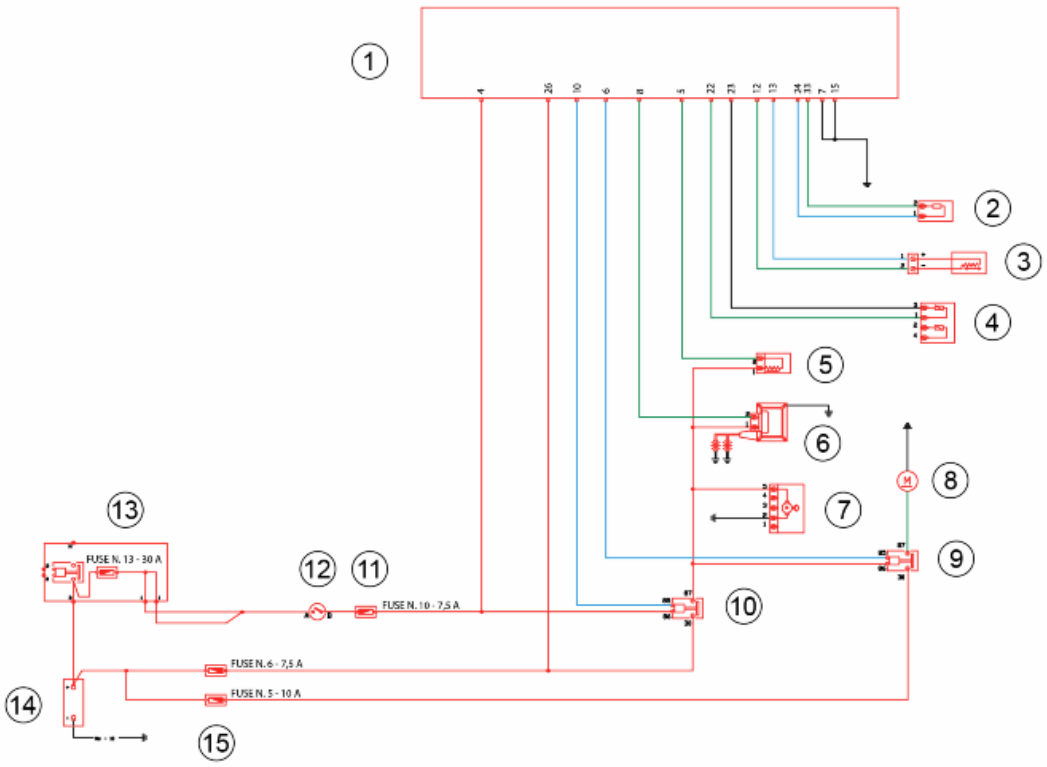


Remove the gas command fitting as indicated in the picture





Pump supply circuit



KEY

1. Injection ECU

2. Lambda probe

3. Engine rpm sensor

4. Engine temperature sensor

5. Injector

6. HV coil

7. Fuel pump

8. Electric fan

9. Electric fan relay

10. Injection load relay

11. Fuse No. 10

12. Ignition switch contacts

13. Fuse No. 13

14. Battery

15. Main fuses (no. 5, no. 6)

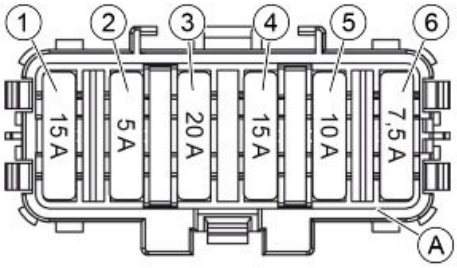
When switched to «**ON**», the fuel pump starts to rotate for 2 seconds and then stops. When the engine starts, in the presence of rpm timing signal the pump is continuously supplied.

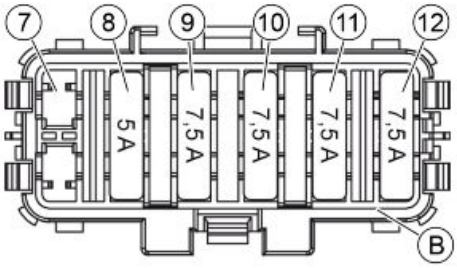
ELECTRICAL DATA

- Pump winding resistance ~ 1.5 Ω
- Input current during regular operation 1.8 to 2 A
- System pressure ~ 3 bar
- Flow rate ~ 40 l/h = 0.66 l/min

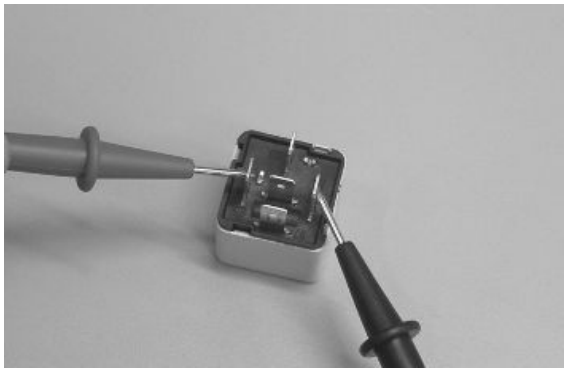
Check the efficiency of 7.5 A fuse No. 6 injection load.

Check that the live control unit power supply 7.5A fuse No. 10 works properly.





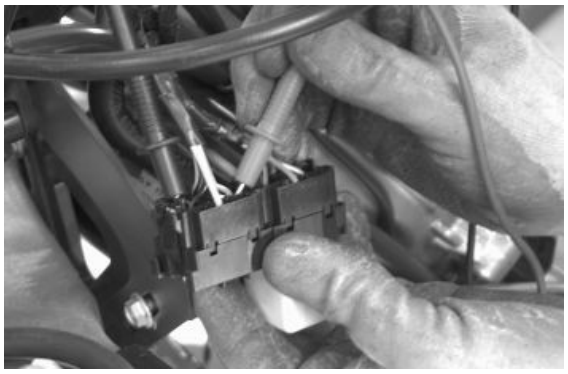
Check the efficiency of the injection load solenoid.
Check the resistance of the energising coil between pins 86 and 85: 40 to 80 Ohm
Apply a voltage of 12V to pins 86 and 85; make sure that there is continuity between pins 30 and 87 of the remote control.

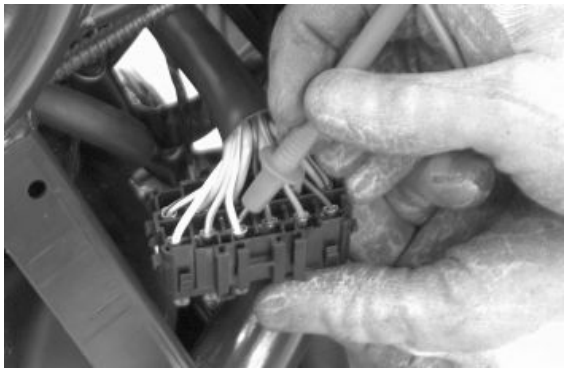


Check the power supply line of the injection loads relay energising coil: after switching to «**ON**», make sure there is battery voltage, for 2 seconds, between the Red-White cable and the Black-Purple cable of the relay base. If there is not, check the continuity of the Red-White cable between the fuse box and the relay base and of the Black-Purple cable between the pin 10 of the control unit and the relay base.

WARNING

ALL CONTINUITY TESTS MUST BE CARRIED OUT WITH THE CORRESPONDING CONNECTORS DISCONNECTED.

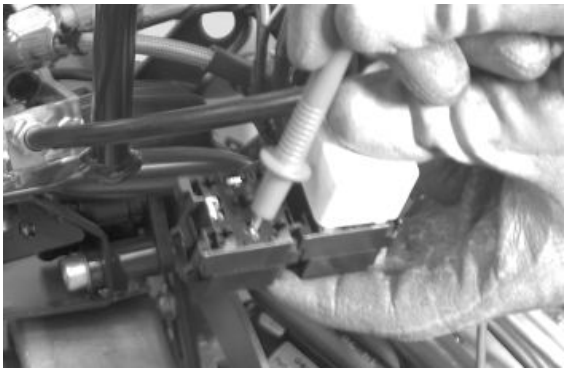


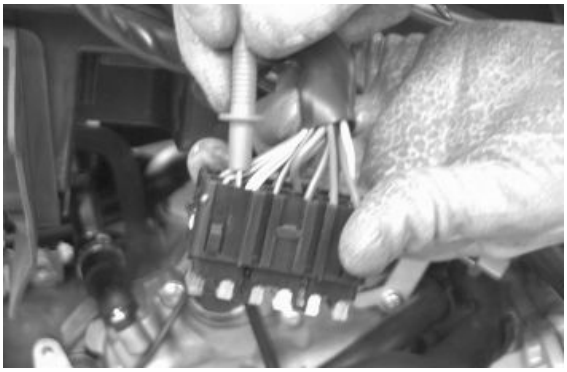


Check the presence of fixed voltage between the Red-Green cable of the solenoid base and ground. If there is none, check the continuity of the Red-Green cable between the fuse box (No. 6 10A) and the remote control base.

WARNING

ALL CONTINUITY TESTS MUST BE CARRIED OUT WITH THE CORRESPONDING CONNECTORS DISCONNECTED.

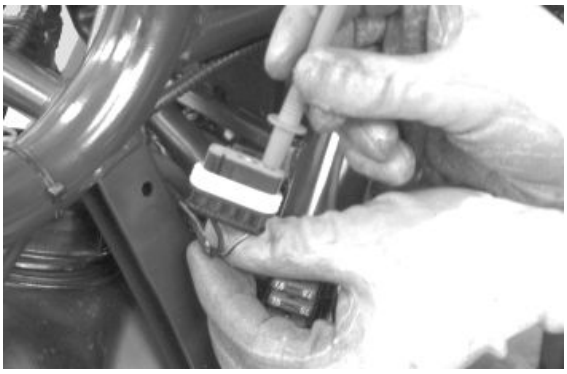


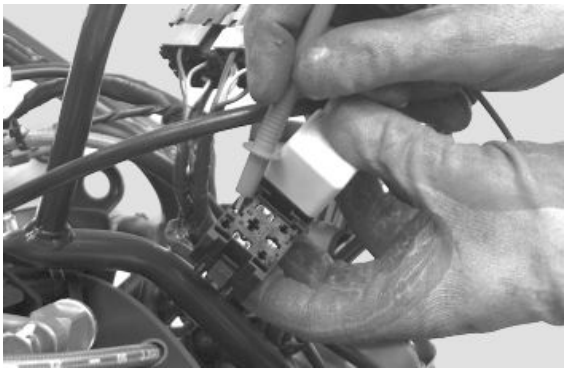


After switching to «**ON**», check that there is battery voltage, for about 2 seconds, between the Black-Green cable of the pump connector and the ground lead with the pump connector disconnected. Otherwise, check the continuity of the Black-Green cable between the pump connector and the relay base.

Check the efficiency of the ground line of the fuel pump by measuring the continuity between the pump connector black cable, system side, and the ground.

If, when switching to «**ON**», the pump continues to turn after 2 seconds of activation, check, with the control unit disconnected and the injection load relay disconnected, that the Black-Purple cable (pin 10 on the control unit) is insulated from the ground.





WARNING

ALL CONTINUITY TESTS MUST BE CARRIED OUT WITH THE CORRESPONDING CONNECTORS DISCONNECTED.

Specific tooling

020331Y Digital multimeter

Circuit leak test

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 that the fuel pressure is ~ 3 bar and that the input current is ~ 1.8 to 2 A.

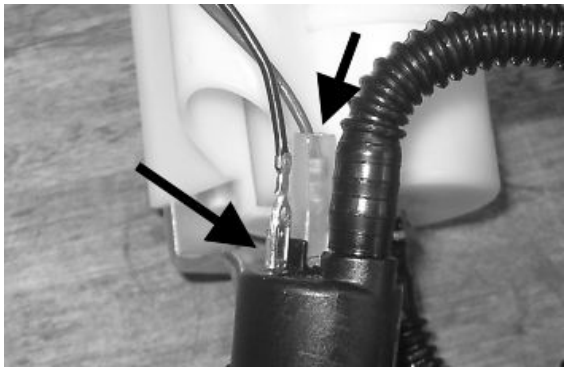
With the battery voltage > 12 V, check the pump flow rate by disconnecting from the injector the pipe equipped with the pressure gauge of the appropriate tool. Prepare a graded burette with flow rate of approximately 1 L. Turn the pump with active diagnosis of the PDA. Using a pair of long flat needle-nose pliers, choke the fuel pipe making the pressure stabilise at approx. 3 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. 300 cm^3.

Specific tooling

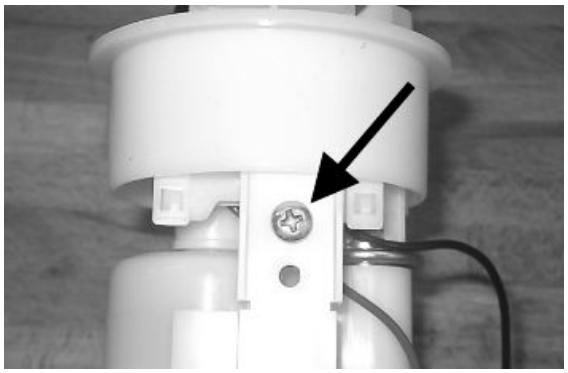
020480Y Fuel pressure check set

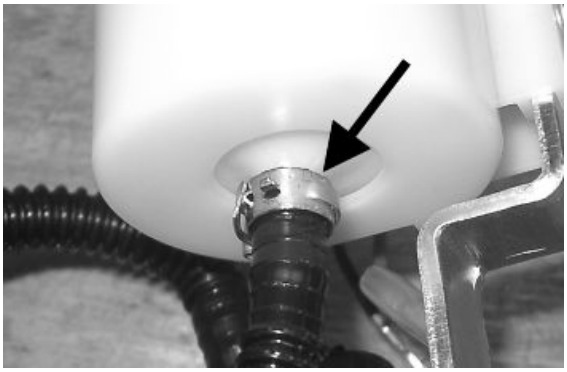
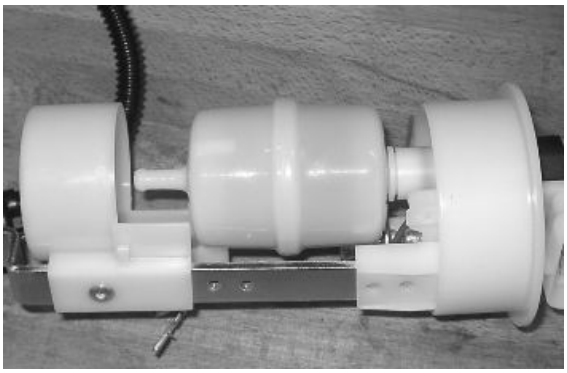
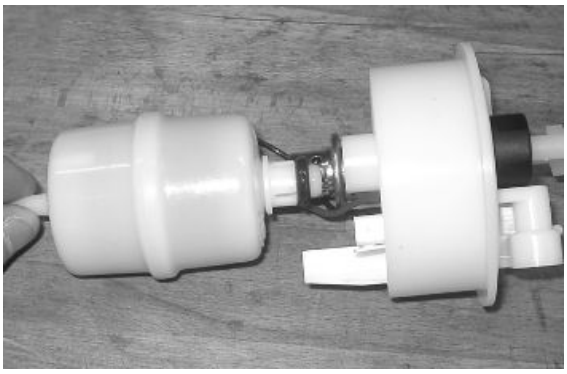
Fuel filter check

Disconnect the terminals from the electric pump

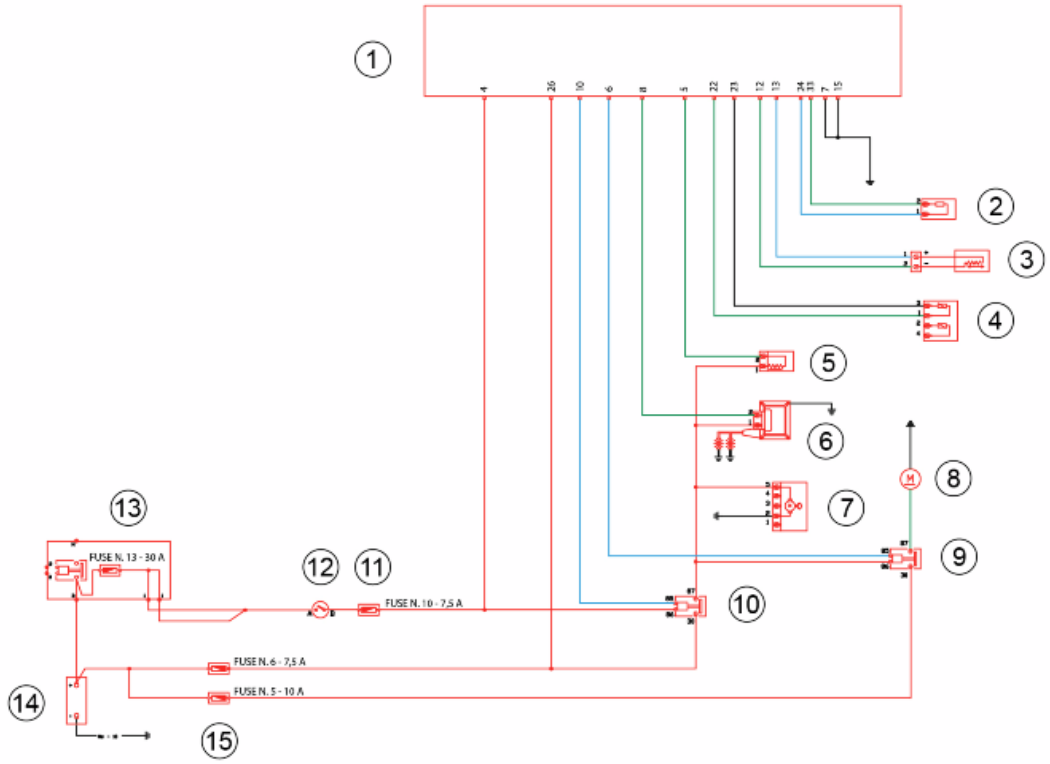


Remove the screw indicated in the photograph



Remove the clamp fixing the piping to the filter shown in the photograph	
Separate the lower part of the pump support as shown in the photograph.	
Remove the filter from the pump support	

Inspecting the injector circuit



KEY

1. Injection ECU

2. Lambda probe

3. Engine rpm sensor

4. Engine temperature sensor

5. Injector

6. HV coil

7. Fuel pump

8. Electric fan

9. Electric fan relay

10. Injection load relay

11. Fuse No. 10

12. Ignition switch contacts

13. Fuse No. 13

14. Battery

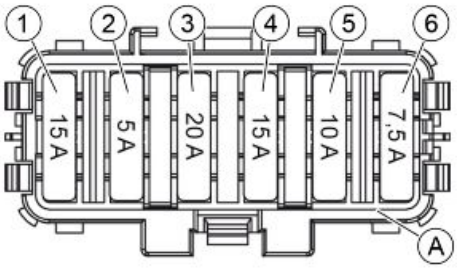
15. Main fuses (no. 5, no. 6)

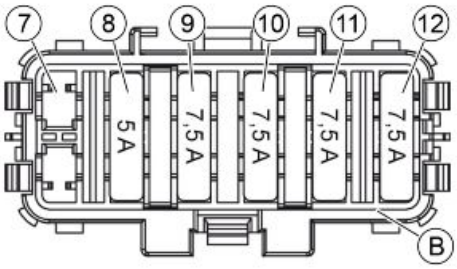
ELECTRICAL DATA

- Injector winding resistance 14,5 ± 5 Ω at 20°C

Check the efficiency of 7.5 A fuse No. 6 injection load.

Check that the live control unit power supply 7.5A fuse No. 10 works properly.

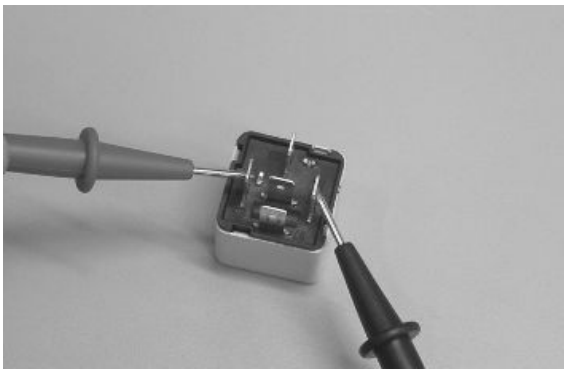




Check the efficiency of the injection load solenoid.

Check the resistance of the energising coil between pins 86 and 85: 40 to 80 Ohm

Apply a voltage of 12V to pins 86 and 85; make sure that there is continuity between pins 30 and 87 of the remote control.



Check the power supply line of the injection loads relay energising coil: after switching to «**ON**», make sure there is battery voltage, for 2 seconds, between the Red-White cable and the Black-Purple cable of the relay base. If there is not, check the continuity of the Red-White cable between the fuse box and the relay base and of the Black-Purple cable between the pin 10 of the control unit and the relay base.

WARNING

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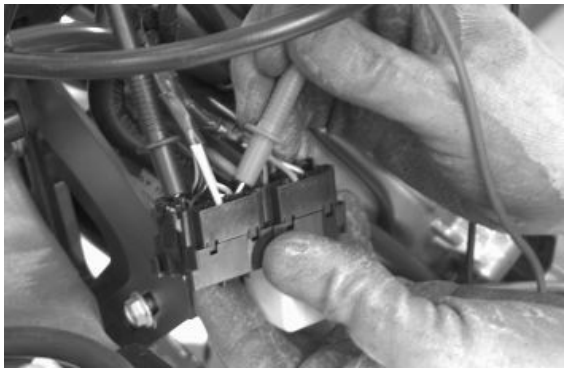
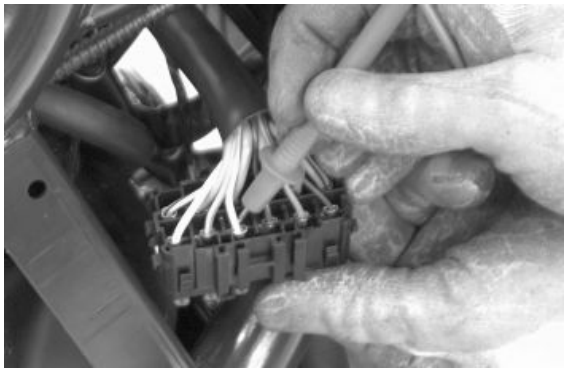
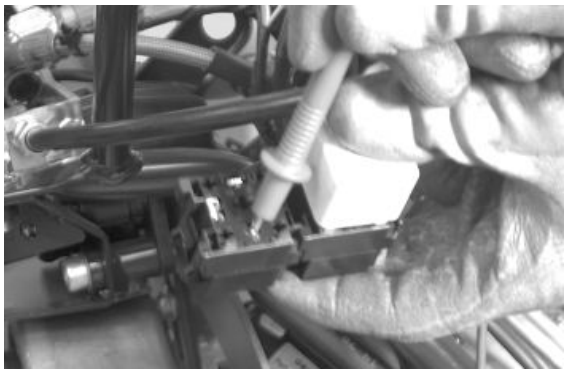


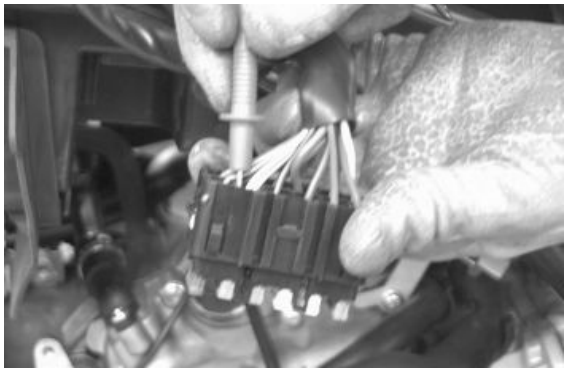


Check the presence of fixed voltage between the Red-Green cable of the solenoid base and ground. If there is none, check the continuity of the Red-Green cable between the fuse box (No. 6 10A) and the remote control base.

WARNING

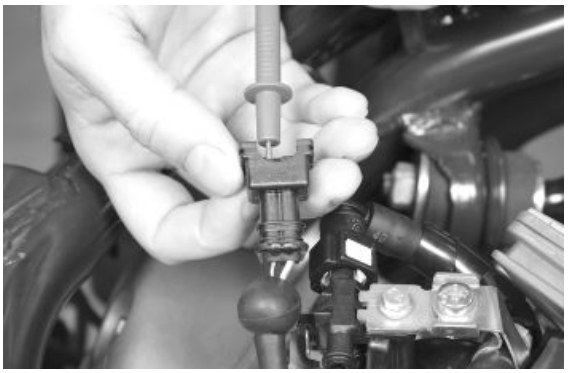
ALL CONTINUITY TESTS MUST BE CARRIED OUT WITH THE CORRESPONDING CONNECTORS DISCONNECTED.



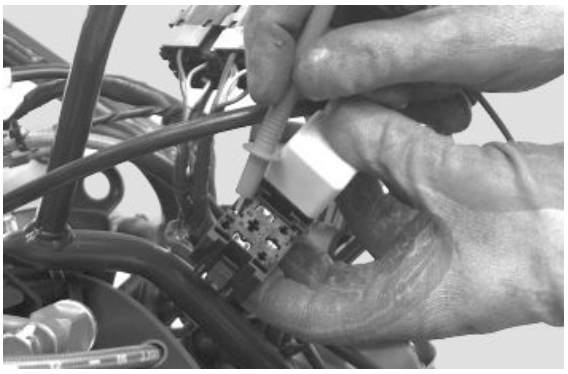


With the control unit and the injector disconnected, check if there is continuity in the Red-Yellow cable between pin 5 of the control unit connector and the injector connector.

Switch to «**ON**» and check if there is voltage, with injector disconnected and control unit connected, between the Black-Green cable of the injector connector and the ground lead.

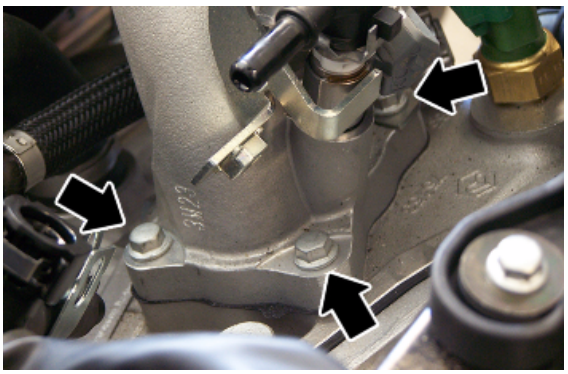


With injector disconnected and the injector load solenoid disconnected, check the continuity of the Black-Green cable between the injector connector and solenoid base.



Inspecting the injector hydraulics

To check the injector, remove the inlet manifold by removing the three fixing screws at the head and the three screws connecting the control unit to the manifold.

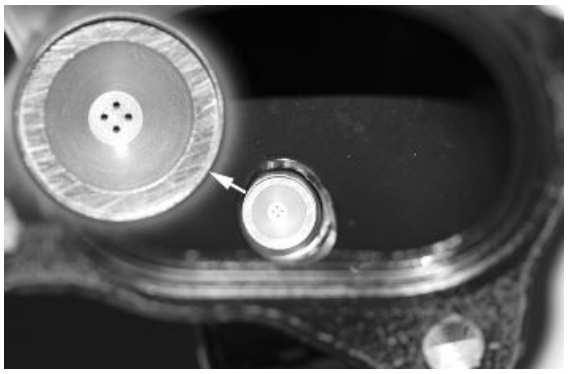


Install the specific tool to check the fuel pressure and position the manifold on a graduated container of at least 100 cm³. Connect the injector with the cable as part of the kit for the injection tester. Connect the clamps of the cable to an auxiliary battery. Activate the fuel pump with the active diagnosis. Check that within 15 approx. 70 cm³ of fuel is delivered with adjustment pressure of approx. 3 BAR.

Specific tooling

020480Y Fuel pressure check set

Proceed with the injector seal test.
Dry the injector outlet with a blast of compressed air. Activate the fuel pump. Wait for one minute, making sure there are no leaks coming from the injector. Slight oozing is normal.
Value limit = 1 drop per minute



Immobiliser circuit

The electronic ignition system is controlled by the control unit with the integrated Immobilizer system. The immobilizer is an anti-theft system that allows the operation of the vehicle only if it is started with the keys encoded and recognized by the control unit. The code is integrated in a transponder in the key body. This allows transparent operation to the driver who does not have to carry out any other operation than to normally turn the key. The immobilizer system contains the following components:

- an electronic control unit
- immobilizer aerial
- master key with built-in transponder
- service key with built-in transponder
- HV coil
- diagnosis LED

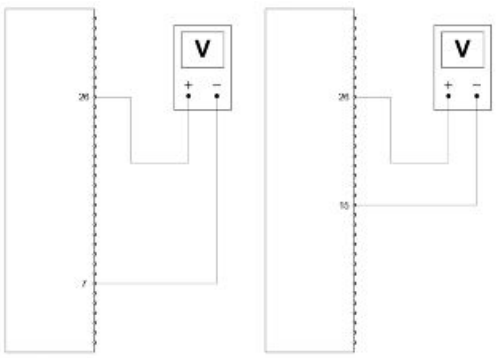
The diagnosis LED also works as a theft-deterrent blinker. This function is activated every time the ignition switch is set to «**OFF**» or the emergency stop switch is set to «**OFF**». It remains activated for 48 hours in order not to affect the battery charge. When the ignition switch is turned to «**ON**», the deterring blinker function is deactivated and a flash confirms the switching to « **ON**». The duration of the flash depends on the programming of the electronic control unit. If the LED is off regardless of the position of the ignition switch and/ or the instrument panel is not initiated, check if:

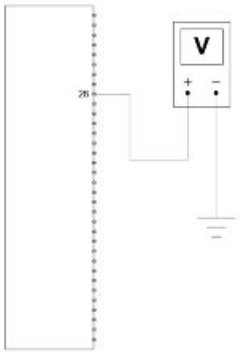
- there is battery voltage
- fuses 2, 11, 13 are in working order
- there is power to the control unit as specified below

Remove the connector mounting bracket shown in the photograph and disconnect the connector from the control unit. Check the following conditions:

With the key switch set to OFF:

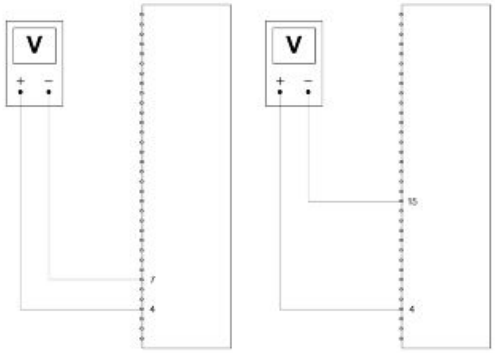
- if there is battery voltage between terminals 7-26, 15-26 and terminal 26-chassis ground (fixed power supply). If there is no voltage, check that fuse 6 and its cable harness are in working order.

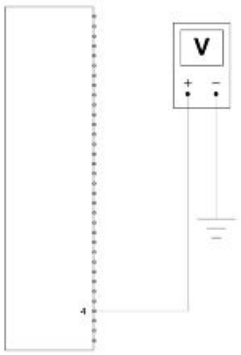




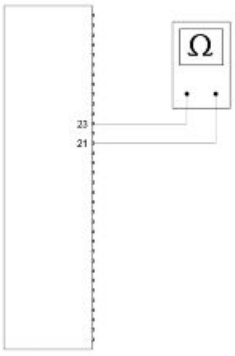
With the key switch in the ON position:

- if there is battery voltage between terminals 7-4, 15-4 and terminal 4-chassis ground (fixed power supply). If there is no voltage, check the ignition switch contacts and that fuses No. 10, 13 and their cables are in working order.

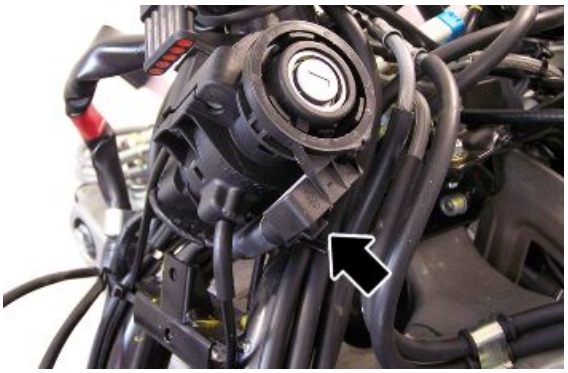




- There is continuity between terminals 21-23 with the emergency cut-off switch set to «RUN». If there is no continuity check the contacts of the switch.

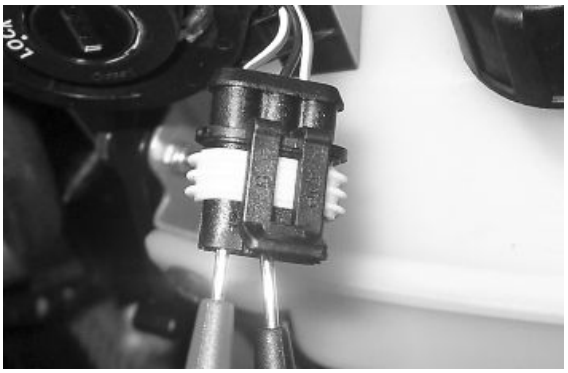


After removing the leg shield back plate, remove the electrical connection from the aerial as shown in the picture.



Remove the protective base from the connector.

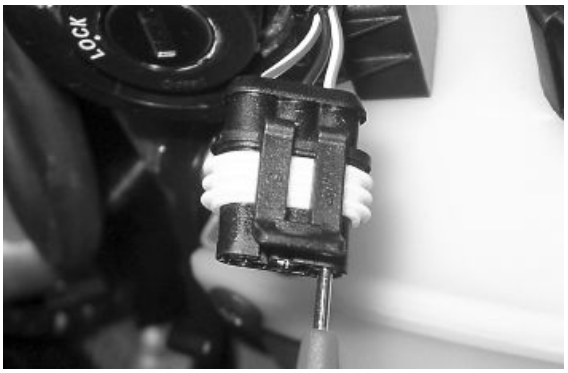
With the ignition key switch at «**ON**» check if there is battery voltage between the Red-White and Black cables.



Disconnect the control unit connector and check the continuity between pin 29 and the aerial Orange-White cable.

Specific tooling

020331Y Digital multimeter



Virgin circuit

When the ignition system is not encrypted, any key will start the engine but limited to 2000 rpm. The keys can only be recognised if the control unit has been programmed properly. The data storage procedure for a previously not programmed control unit provides for the recognition of the Master as the

first key to be stored to memory: this becomes particularly important because it is the only key that enables the control unit to be wiped clean and reprogrammed for the memorisation of the service keys.
The Master and service keys must be used to code the system as follows:
- Insert the Master key, turn it to «**ON**» and keep this position for 2 seconds (limit values 1-3 seconds).
- Insert the service key and turn it to «**ON**» for 2 seconds.
- If you have copies of the key, repeat the operation with each key.
- Insert the Master key again and turn it to «**ON** » for 2 seconds.

The maximum time to change keys is 10 seconds.
A maximum of 5 service keys can be programmed at one time.
It is essential to adhere to the times and the procedure. If you do not, start again from the beginning.
Once the system has been programmed, the Master key transponder is strictly matched with the control unit. With this link established, it is now possible to encode new service keys, in the event of losses, replacements, etc. Each new programming deletes the previous one; to add or delete a key it is therefore necessary to repeat the procedure using all the keys that you intend to keep in use. If a service key becomes uncoded, the efficiency of the high voltage circuit shielding must be thoroughly inspected. In any case it is advisable to use resistor spark plugs.

Characteristic

MASTER key:

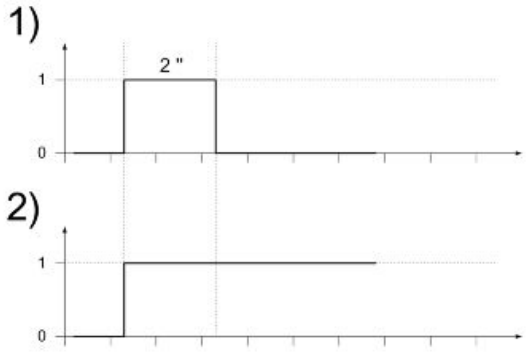
BROWN KEY

SERVICE key:

BLACK KEY

Diagnostic codes

The Immobilizer system is tested each time the ignition key is turned from «OFF» to «ON». During this diagnosis phase a number of control unit statuses can be identified and various light codes displayed. Regardless of the code transmitted, if at the end of the diagnosis the LED remains off permanently, the ignition is enabled. If, however, the LED remains on permanently, it means the ignition is inhibited:



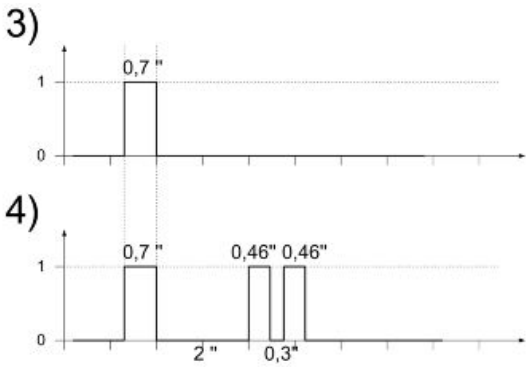
1. Previously unused control unit - key inserted: a single 2 second flash is displayed, after which the LED remains off permanently. The keys can be stored to memory, the vehicle can be star-

ted but with a limitation imposed on the number of revs.

2. Previously unused control unit - transponder absent or cannot be used: the LED is on permanently. In this condition no operations are possible including the start up of the vehicle.

3. **Programmed control unit - the service key in (normal condition of use)**: a single 0.7-second flash is displayed, after which the LED remains off steadily. The engine can be started.

4. **Programmed control unit - Master key in**: a 0.7-sec flash is displayed followed by the LED remaining off for 2 sec and then by short 0.46-sec flashes, the same number of times as there are keys stored in the memory including the Master key. When the diagnosis has been completed, the LED remains permanently OFF. The engine can be started.



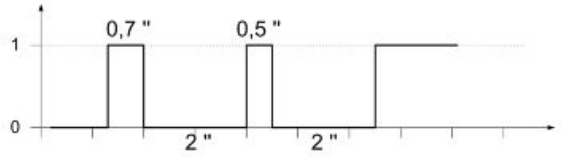
5. Programmed control unit - fault detected: a light code is displayed according to the fault detected, after which the LED remains on steadily. The engine cannot be started. The codes that can be transmitted are:

- 1-flash code
- 2-flash code
- 3-flash code

The LED indication is divided into 3 steps:
1st step: A flash: "**ON**" switching recognition
2nd step: Series of flashes: diagnosis code indication
3rd step: Steady light on or off:
- ON = start-up disabled
- OFF = start-up enabled

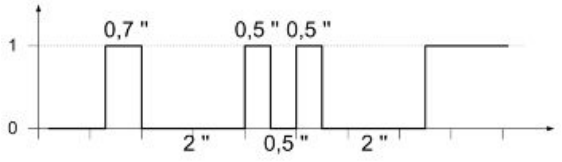
Code 1

A one-flash code indicates a system where the serial line is not present or is not detected. Check the Immobilizer antenna wiring and change it if necessary.



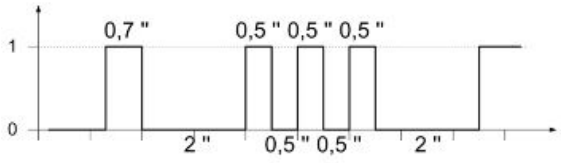
Code 2

A two-flash code shows a system where the control unit does not show the transponder signal. This might depend on the inefficiency of the immobilizer antenna or the transponder.
Turn the switch to ON using several keys: if the code is repeated even with the Master key, check the aerial wiring and change it if necessary. If this is not the case, replace the defective key and/or reprogram the control unit. Replace the control unit if the problem continues.

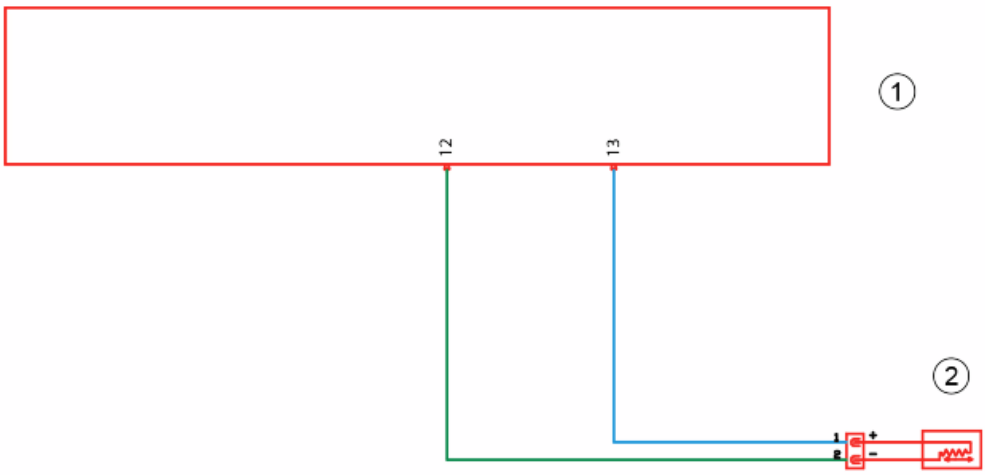


Code 3

A three-flash code indicates a system where the control unit does not recognise the key. Turn the switch to ON using several keys: if the error code is repeated even with the Master key, replace the control unit. If this is not the case, reprogram the decoder.



Tachometer



KEY

1. Injection ECU

2. Engine speed sensor

PIN RELATIONSHIP

PIN	PIN	Component	Reference value
12	13	Engine revolution sensor	100 ÷ 150 Ohm ~ 20°C

With wiring disconnected from the control unit and connected to the system, check that the sensor resistance between pins 12 - 13 is between 100 and 150 Ohm at an engine temperature of approximately 20°

Disconnect the fuel pump connector; start the engine and wait for it to stop. Try to start the engine and check that the voltage between pins 12 and 13 is ~ 2.8 V.

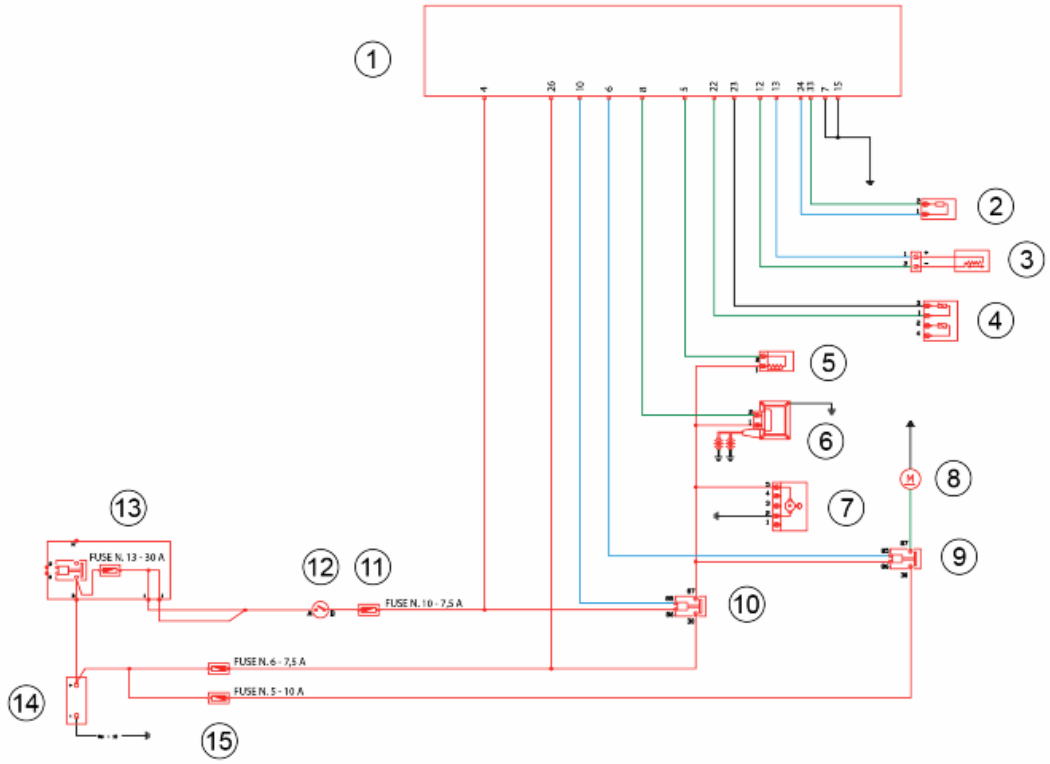
With the control unit disconnected, check if there is continuity between pin 12 and the brown cable of the engine speed sensor connector and between pin 13 and the red cable of the engine speed sensor connector.

With the control unit disconnected and the engine speed sensor disconnected, check that the red and brown cables (pins 12 and - 13) are isolated from each other and insulated from the ground lead.

Specific tooling

020331Y Digital multimeter

HT coil



KEY

1. Injection ECU

2. Lambda probe

3. Engine rpm sensor

4. Engine temperature sensor

5. Injector

6. HV coil

7. Fuel pump

8. Electric fan

9. Electric fan relay

10. Injection load relay

11. Fuse No. 10

12. Ignition switch contacts

13. Fuse No. 13

14. Battery

15. Main fuses (no. 5, no. 6)

PIN RELATIONSHIP

PIN	PIN	Component	Reference value
8	+Live supply	H.V. coil	~ 570 ± 50 Ohm

The combined ignition/injection system is a high-efficiency induction system.

The control unit manages two significant parameters:

- Ignition advance

This is optimised at once according to the engine revs, engine load, temperature and ambient pressure.

With the engine at idle, the ignition advance is optimised to stabilise the speed at 1500 ± 100 rpm.

- Magnetisation time

The coil magnetisation time is controlled by the control unit. The power of the ignition is increased during the engine start-up phase.

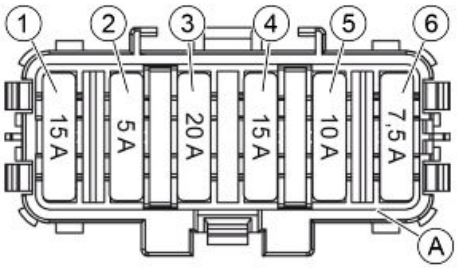
The injection system recognises the 4-stroke cycle so ignition is only commanded in the compression phase.

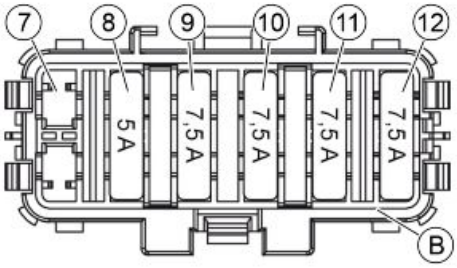
Specific tooling

020331Y Digital multimeter

Check the efficiency of 7.5 A fuse No. 6 injection load.

Check that the live control unit power supply 7.5A fuse No. 10 works properly.

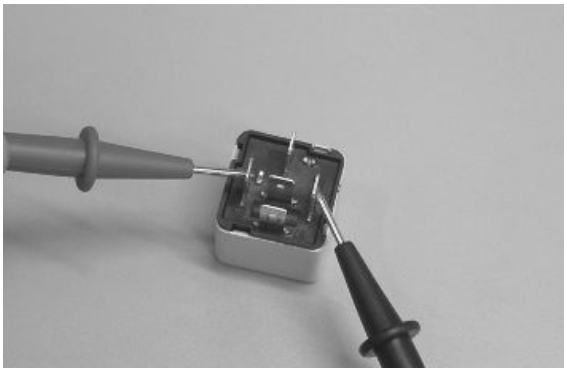




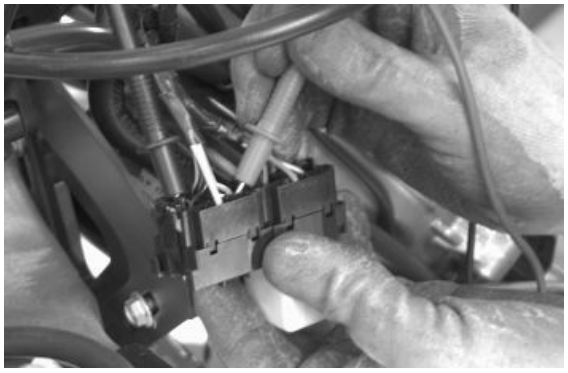
Check the efficiency of the injection load solenoid.

Check the resistance of the energising coil between pins 86 and 85: 40 to 80 Ohm

Apply a voltage of 12V to pins 86 and 85; make sure that there is continuity between pins 30 and 87 of the remote control.

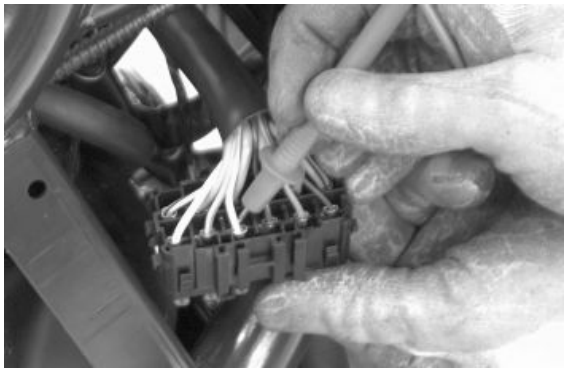


Check the power supply line of the injection loads relay energising coil: after switching to «**ON**», make sure there is battery voltage, for 2 seconds, between the Red-White cable and the Black-Purple cable of the relay base. If there is not, check the continuity of the Red-White cable between the fuse box and the relay base and of the Black-Purple cable between the pin 10 of the control unit and the relay base.

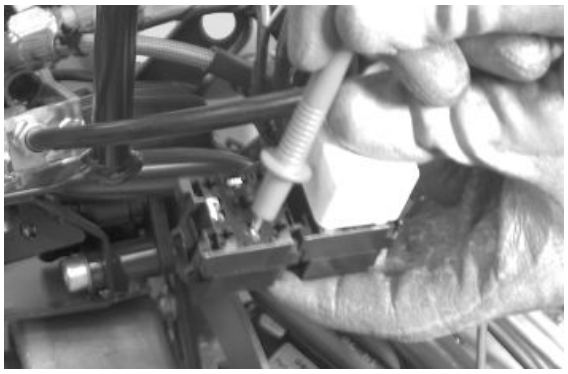


WARNING

ALL CONTINUITY TESTS MUST BE CARRIED OUT WITH THE CORRESPONDING CONNECTORS DISCONNECTED.

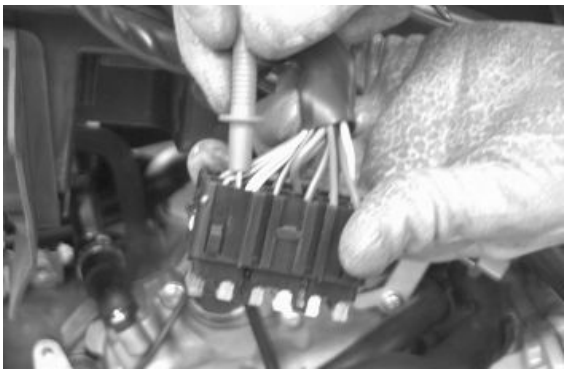


Check the presence of fixed voltage between the Red-Green cable of the solenoid base and ground. If there is none, check the continuity of the Red-Green cable between the fuse box (No. 6 10A) and the remote control base.



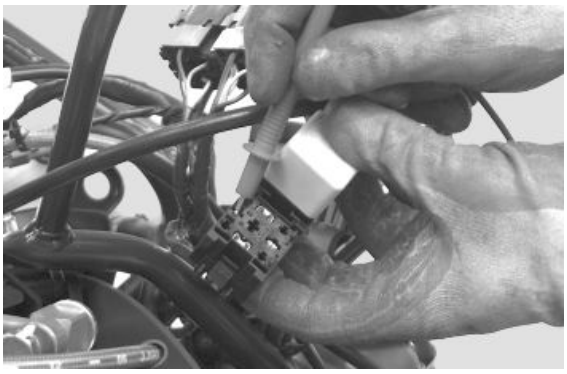
WARNING

ALL CONTINUITY TESTS MUST BE CARRIED OUT WITH THE CORRESPONDING CONNECTORS DISCONNECTED.



Switch to «**ON**» and check if there is voltage, for about 2 seconds, between pin 8 and 7 and between pin 8 and 15 of the control unit.

Check that the resistance of the primary coil between pin 8 of the control unit and the Black-Green cable of the injection load remote control base, with disconnected control unit and disconnected relay, is ~ 570 ± 50 Ohm.



Inspecting the spark plug shielded cap

Measure the shielded cap resistance.

Electric characteristic

Resistance:

5 KΩ

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

N.B.

A SHIELDLESS CAP OR SPARK PLUG CAN ADVERSELY AFFECT THE INJECTION SYSTEM. FOR INFORMATION ON THE SPARK PLUG, SEE THE «SPECIFICATIONS» AND «MAINTENANCE» CHAPTERS.

Spark advance

The 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.

It is possible to check whether the ignition advance determined by the injection system matches the value actually activated on the engine, by means of the stroboscopic light.

Specific tooling

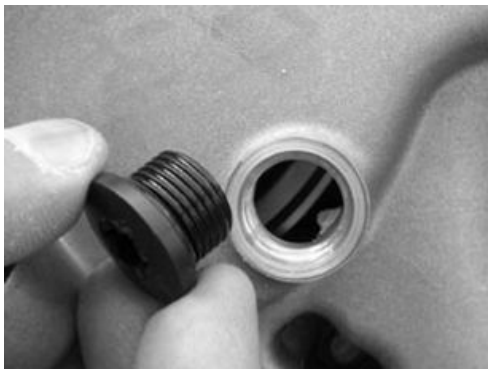
020922Y Diagnosis Tool

020330Y Stroboscopic light for timing checking

Proceed as follows:

- Remove the transmission compartment 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.

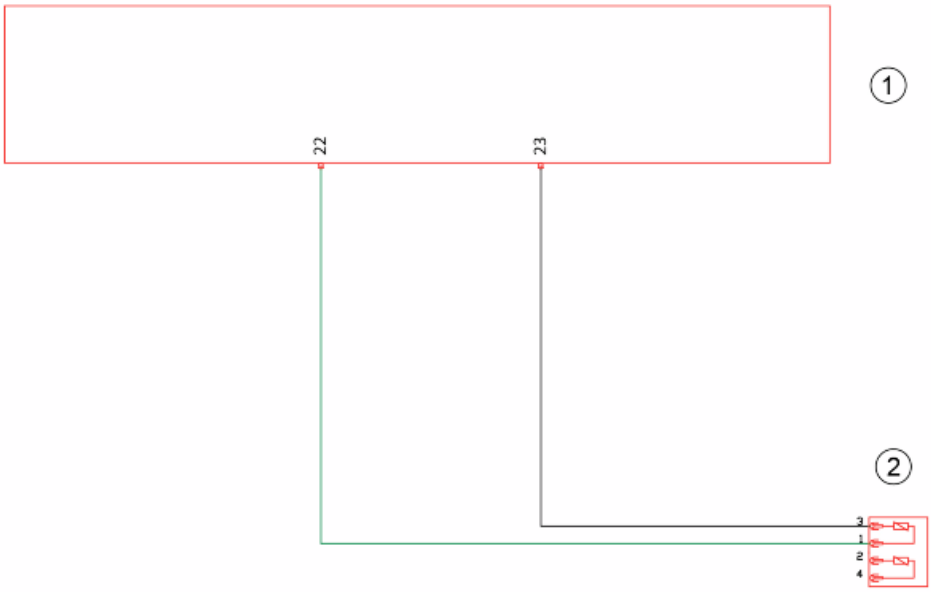
- Repeat for the reference between driving pulley and engine crankcase.

- Refit the inspection cap on the flywheel side.
- Connect the diagnostic tester.
- Start the engine.
- Select the «parameters» function in this menu.
- Select the stroboscopic light control in the traditional four-stroke engine position (1 spark, 2 revs).
- Check that the real values of rpm and ignition advance match those measured using the diagnostic tester.

If the values do not match, check:

- distribution timing
- revolution timing sensor
- injection control unit

Coolant temperature sensor



KEY

1. Injection ECU

2. Engine temperature sensor

PIN RELATIONSHIP

PIN	PIN	Component	Reference value
22	23	Engine temperature sensor	1965 to 2500 Ohm at 20°C; 561.1 to 590.5 Ohm at 60°C; 227.3 ÷ 235.1 mm at 90°C

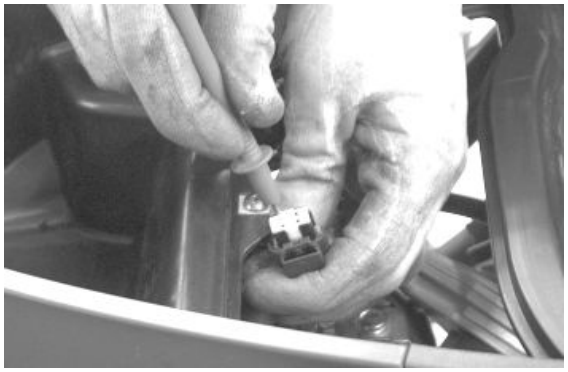
With the connector on the control unit side disconnected and the coolant temperature sensor connector connected, check that the resistance values between pins 22 and 23 correspond to the engine temperature, as shown in the table.

With the connector on the control unit disconnected and the coolant temperature connector disconnected, check the insulation between the light blue-green cable and ground lead.

With the connector on the control unit disconnected and the coolant temperature connector disconnected, check the continuity between pin 22 of the control unit connector and the light blue-green cable of the sensor connector.

Specific tooling

020331Y Digital multimeter



Zeroing the throttle

Throttle valve position signal reset (TPS reset)

The RIU control unit is supplied with throttle valve position sensor and is pre-calibrated.

Pre-calibration entails regulating the minimum opening of the throttle valve to obtain a certain flow of air under pre-set reference conditions.

Pre-calibration ensures optimal air flow for the control of the idle speed.

This regulation must not be tampered with in any way whatsoever.

The injection system will complete the management of the idling through the Stepper and the variation of the ignition advance.

After the pre-calibration the throttle body has an open valve with a variable angle depending on the tolerances of the machining of the pipe and the valve itself.

The valve position sensor can also have various fitting positions. For these reasons the mV of the sensor with the valve at idle can vary from one throttle body to another.

To obtain the optimum fuel mixture, especially at small openings of the throttle valve, it is essential to match the throttle body with the control unit following the TPS resetting procedure.

With this operation we inform the control unit, as a starting point, of the mV value corresponding to the pre-calibrated position.

To reset, proceed as indicated in the following.

Connect the diagnosis instrument and switch to «**ON**».

On the instrument, select the function «**TPS RE-SETTING**».

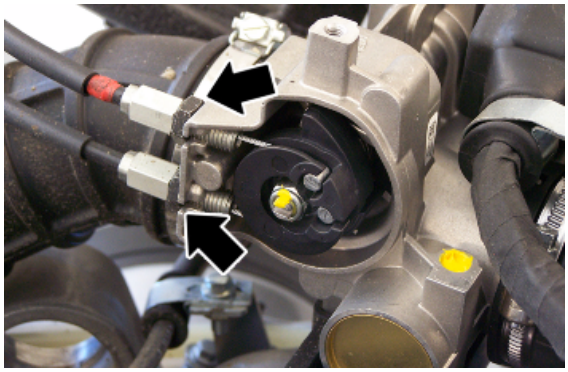
Make sure that the throttle valve with the control is supporting the stop screw, as shown in the picture.

Guaranteeing that this position will be kept, send a confirmation for the reset procedure.

Reset should be performed in the following cases:

- on first fitting;

- if the injection control unit is replaced.



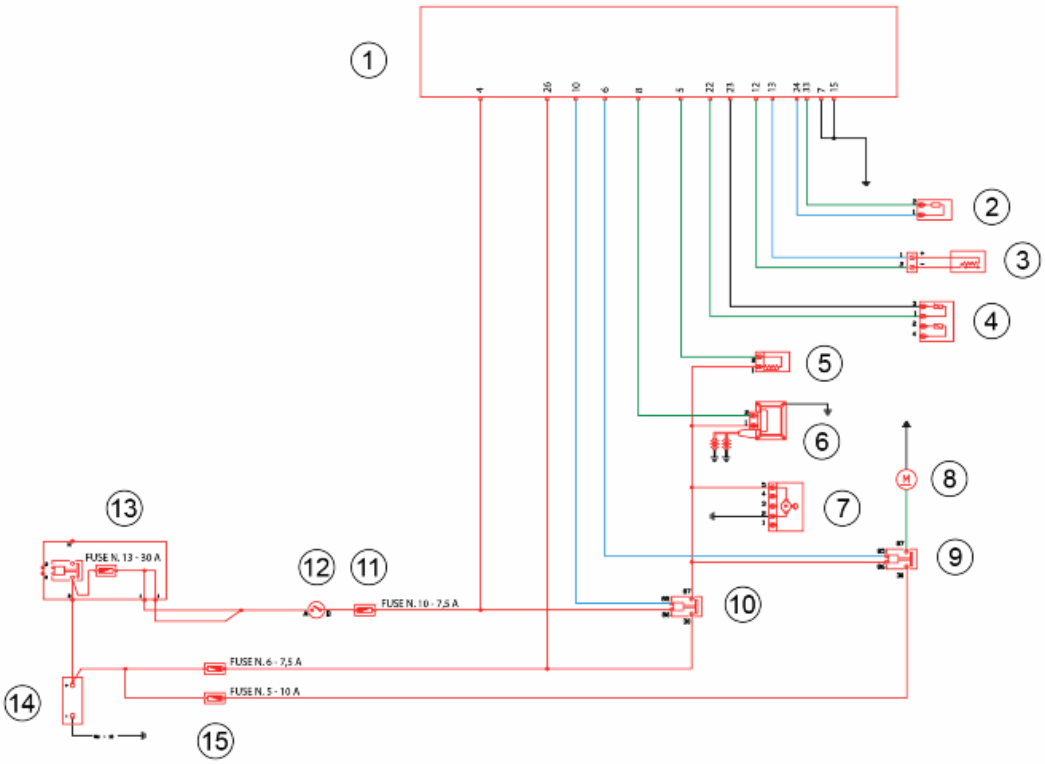
N.B.

THE TPS RESETTING PROCEDURE MUST NOT BE CARRIED OUT WITH A USED THROTTLE BODY BECAUSE POSSIBLE VALVE WEAR AND STOP WEAR FOR THE MINIMUM OPENING MAKE THE AIR FLOW DIFFERENT FROM THAT OF THE PRE-CALIBRATION.

Specific tooling

020922Y Diagnosis Tool

Lambda probe



KEY

1. Injection ECU

2. Lambda probe

3. Engine rpm sensor

4. Engine temperature sensor

5. Injector

6. HV coil

7. Fuel pump

8. Electric fan

9. Electric fan relay

10. Injection load relay

11. Fuse No. 10

12. Ignition switch contacts

13. Fuse No. 13

14. Battery

15. Main fuses (no. 5, no. 6)

PIN RELATIONSHIP

PIN	PIN	Component	Reference value
24	33	Lambda probe	200 to 800 mV in closed loop

The lambda probe or oxygen sensor is a sensor which provides information about the oxygen content in the exhaust fumes. The signal generated is not of the proportional type but of the ON/OFF type, i.e. there is oxygen or there is not. The probe is positioned on the exhaust manifold before the catalytic converter in an area where the gas temperature is always high. The temperature at which the sensor works is at least 350°C with a reaction time of just 50 milliseconds. The signal generated passes from a high value to a low value with a mixture with lambda equal to 1.

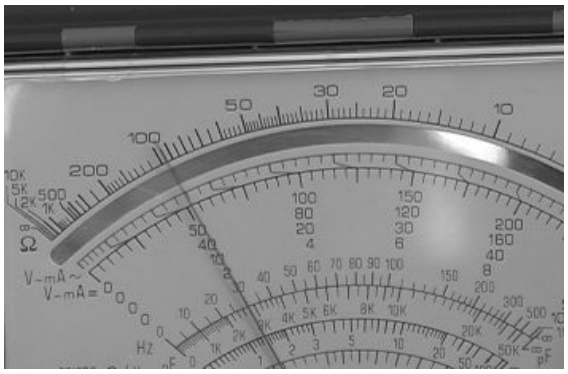
Specific tooling

020331Y Digital multimeter

At the start, the signal is close to 0 mV as long as the probe is not heated.

A value above 1200 mV is unlikely and can indicate a faulty probe.

Conversely, a low signal, less than 100 mV, may be either a signal of lean carburation or a damaged probe; for this reason there is no diagnostic that recognises the electric fault in this direction.



INDEX OF TOPICS

N.B.

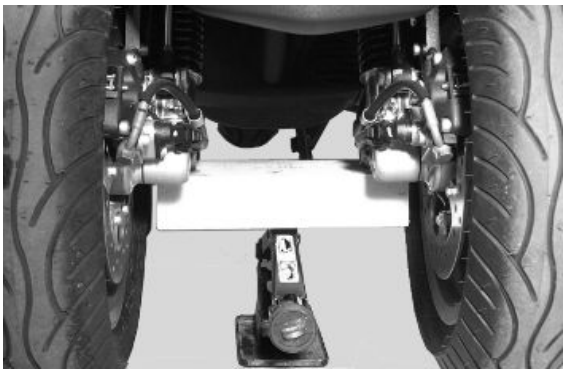
THE UNITS OF MEASUREMENT CONTAINED IN THIS CHAPTER ARE EXPRESSED IN TERMS OF THE DECIMAL METRIC SYSTEM. TO REFER TO THE UNIT OF MEASUREMENT EXPRESSED IN TERMS OF THE ANGLO-SAXON SYSTEM, SEE THE «CHARACTERISTICS» CHAPTER.

This section is dedicated to operations that can be carried out on the suspensions.

Wheel alignment

Tool fitting

How to use the tools



- Check that tyre pressure is correct.
- Park the vehicle on level, smooth and even ground.
- Rest the vehicle on its centre stand.
- Make sure that the parking system is disengaged.
- Lift the front wheels as shown in the picture
- Check that the wheel rims rotate evenly and whether there is abnormal clearance in bearings and suspension.
- Make sure that the steering control shows no signs of abnormal clearance in joints and bearings. Otherwise, correct this and then adjust them.

Characteristic

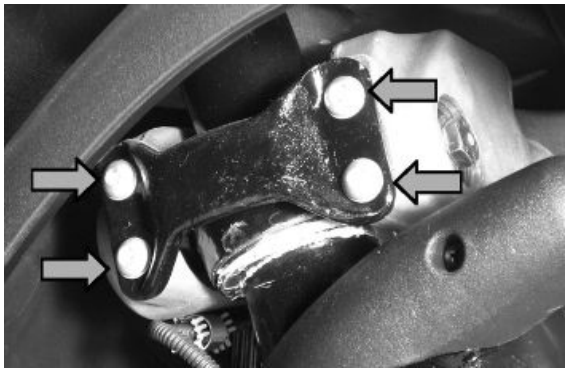
Front tyres pressure

2 bar

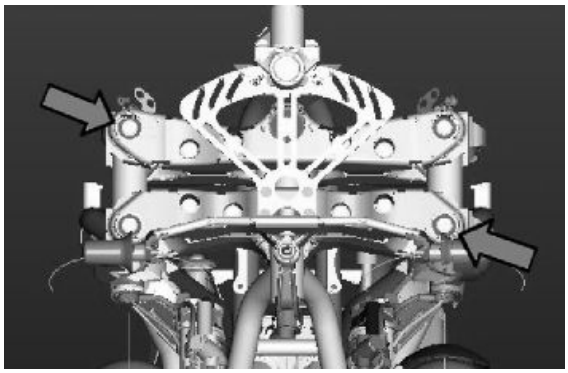
Rear tyre pressure (with passenger)

2.4 bar (2.6 bar)

- Get the vehicle off the stand, back on the ground.
- Remove the right lower coupling plate of the half-arm by undoing the screws indicated in the picture.



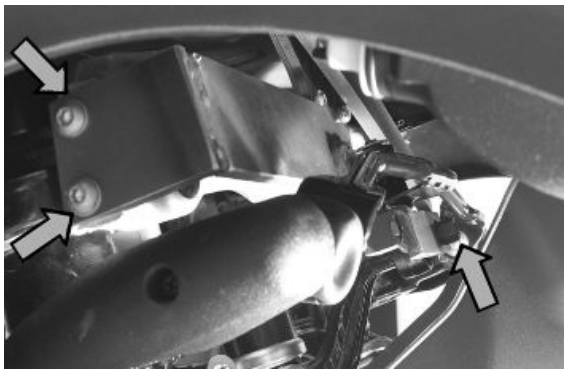
- Remove the right upper screw and the left bottom screw of the parallelogram unit.



- Fit the bracket locking the parallelogram in the holes of the previously removed screws; use the screws supplied with the tool and be careful to correctly centre the spacer in the bearing.

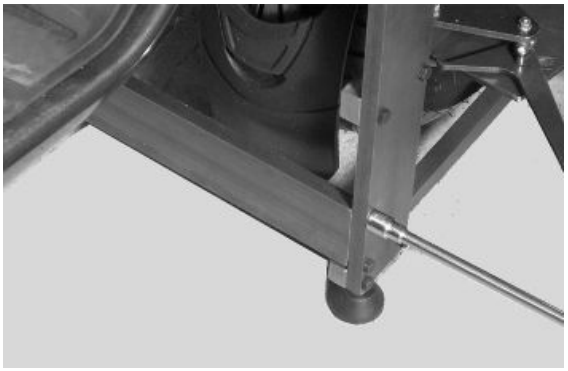
- Remove the nut fixing the steering control arm and keep the original washer in position.

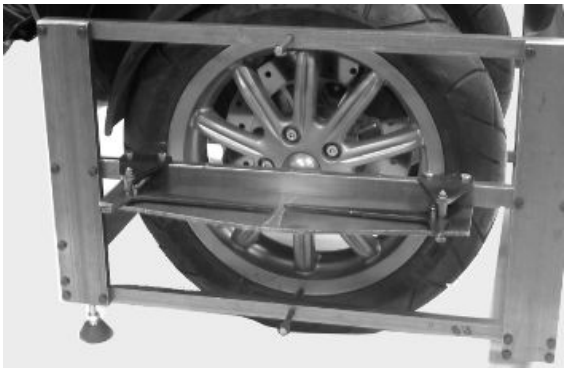
- Fit the steering guiding bracket in a straight riding position, fix one end to the attachment of the half-arm coupling flange and the other end to the screw fixing the steering control arm.



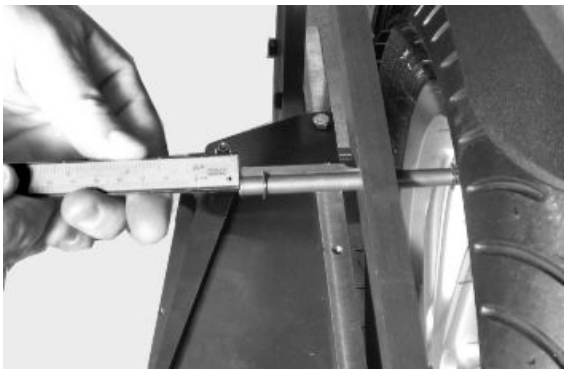
- Place the frame so that the sliders come into contact with the rim maximum diameter but without interfering with the tyre. If required, reposition the frame by operating the 3 adjustable support feet.

- Fit the frame locking bracket

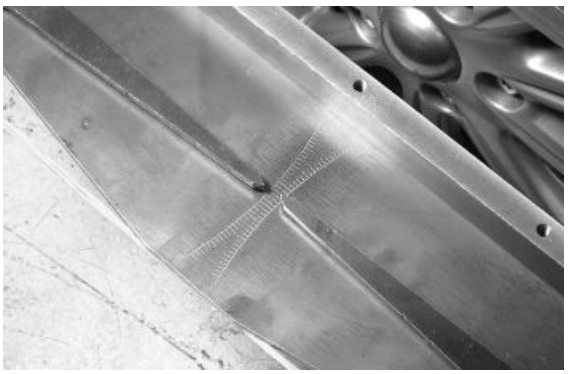




- Make sure the frame is adequately centred by checking with a gauge that the lugs along the vertical axis show the standard protrusion.



- Check that the pointers of both tyres are correctly aligned, as shown in the picture. Maximum misalignment allowed: 4 notches.
- Use tool 020647Y028 for LT version with extended track.

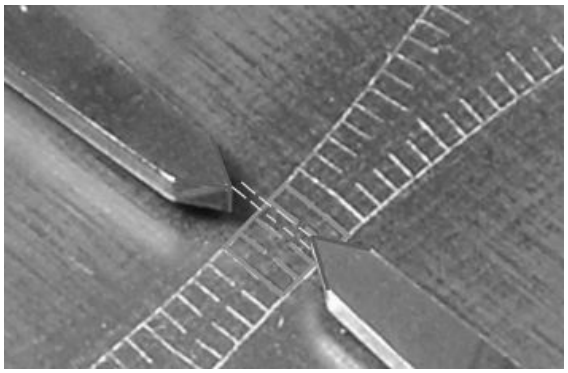


Specific tooling

020646Y Parallelogram and steering positioning tool

020647Y Toe-in checking tool

020647Y028 MP3 LT Toe-in tool (tricycle)



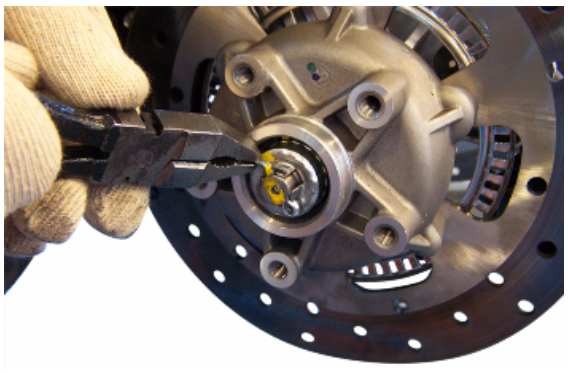
Front

Removing the front wheel

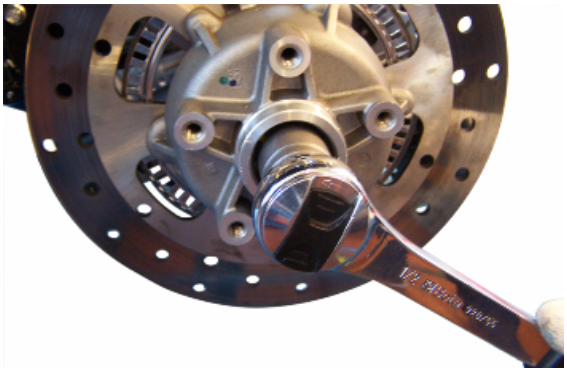
- Remove the five screws that fix the wheel.

Front wheel hub overhaul

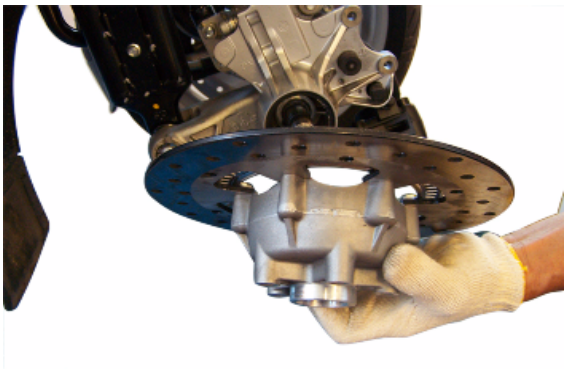
- Remove the wheel.
- Remove the brake calliper.
- Remove the cotter pin and the cap.



- 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

Specific tooling

001467Y014 Calliper to extract 15-mm diameter bearings

001467Y017 Bell for bearings, OD 39 mm

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

- Remove the roller bearing using the specific tool

Specific tooling

020376Y Adapter handle

020456Y Ø24 mm adaptor

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

Specific tooling

020151Y Air heater

020376Y Adapter handle

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

Specific tooling

020038Y Punch

Recommended products

AGIP GREASE MU3 Yellow-brown, lithium-base, medium-fibre multipurpose grease.

ISO L-X-BCHA 3 - DIN 51 825 K3K -20

Refitting the front wheel

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

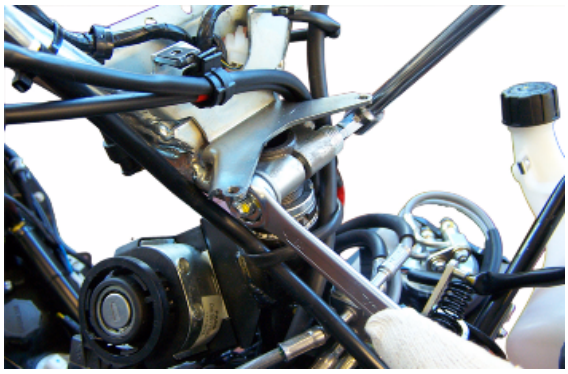
Locking torques (N*m)

Wheel fixing screw 20 - 25

Handlebar

Removal

- Remove the 2 handlebar covers working as explained in the Bodywork Chapter.
- Remove the handlebar wiring retaining straps and disconnect the electric connectors from the brake levers.
- Unscrew the fittings, then remove the front and rear brake pump piping.
- Remove the flexible transmission of the throttle grip and remove the throttle control.
- Loosen the clamp fixing the handlebar to the steering tube and remove the handlebar by pulling it upwards; then remove the lower plastic cover.



N.B.

IF THE HANDLEBAR IS BEING REMOVED TO REMOVE THE STEERING, IT IS ONLY NECESSARY TO TILT THE HANDLEBAR FORWARD ONTO THE FRONT PART OF THE VEHICLE WITHOUT REMOVING THE PARTS FITTED SO AS TO AVOID DAMAGING THE SHAFTS.

Refitting

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

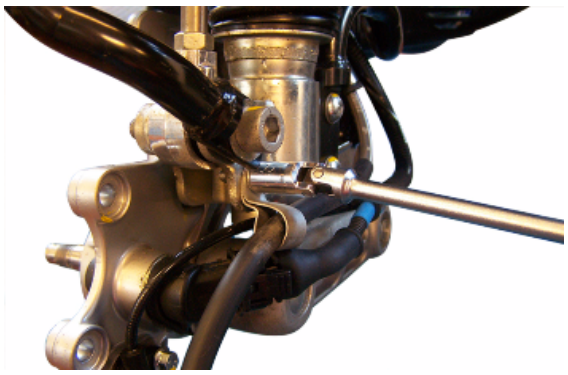
Locking torques (N*m)

Handlebar fixing screw 50 - 55

Front shock absorber

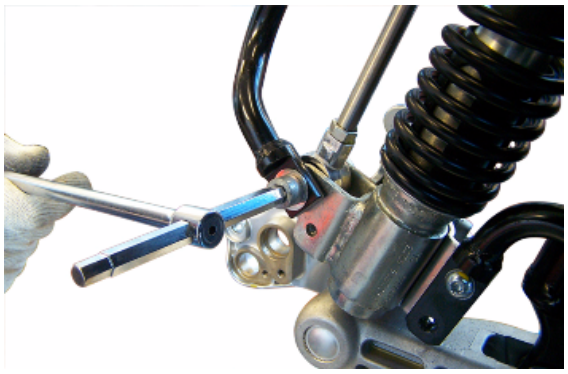
Removal

- Remove the fixing of the brake pipes from the shock absorber bracket.

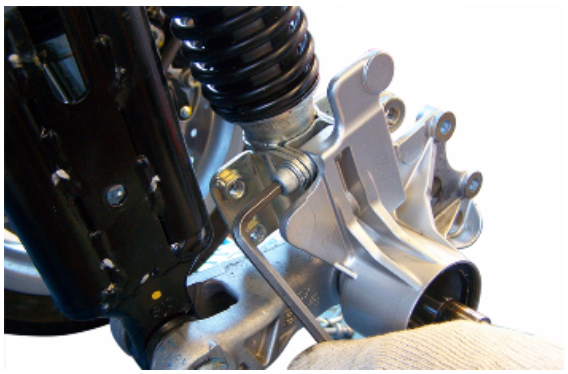


- Unscrew the two rear fixings of the mudguard support arm.

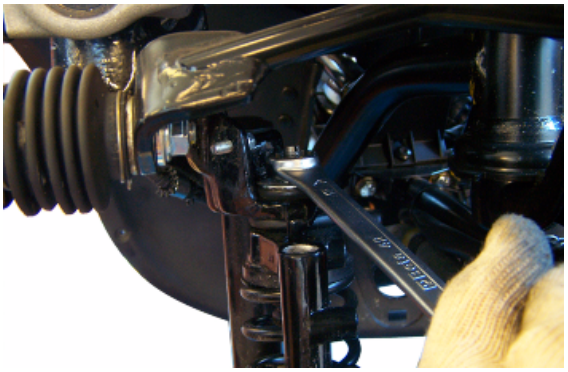
- Unscrew the front fixing and remove the arm complete with the mudguard and the suspension block device support pipe.



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



- Unscrew the upper retainer and remove the shock absorber.



Refitting

Follow the removal steps but in reverse order; be careful to tighten the retainers to the prescribed torques.

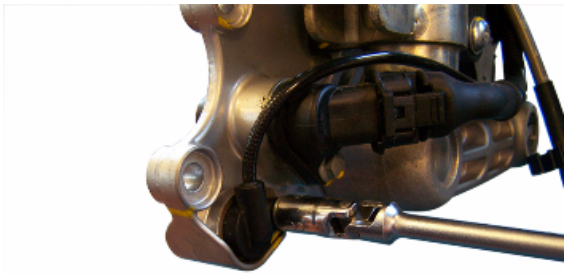
Locking torques (N*m)

Upper shock absorber retainer 19 to 29 Lower shock absorber clamp 19 to 26

Shock-absorber - calliper bracket

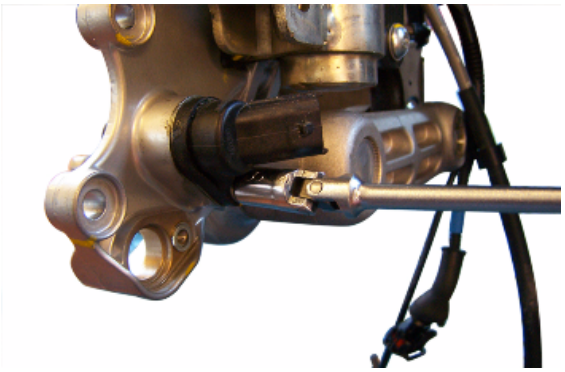
Removal

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

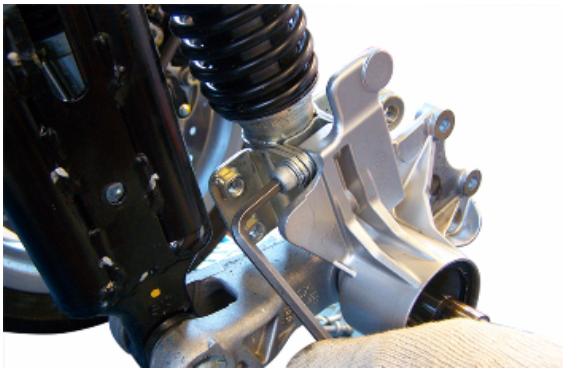


- Disconnect the speed sensor connector.

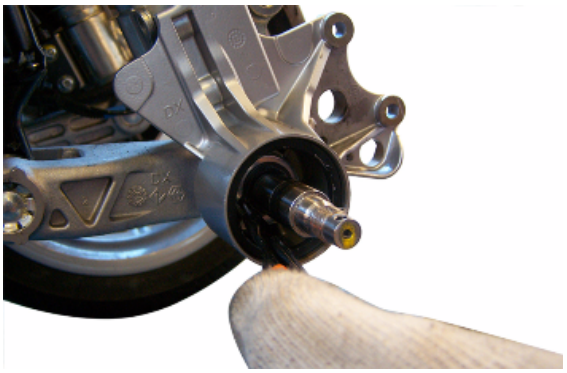
- Unscrew the fixing bolt of the sensor to remove it.



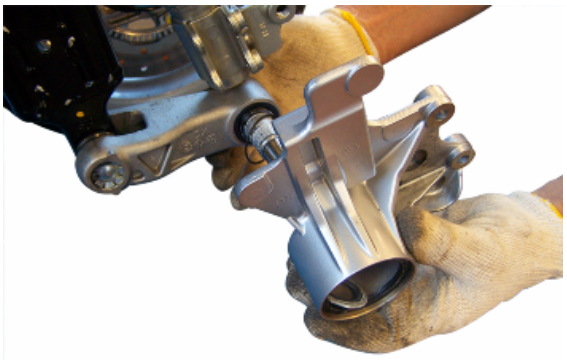
- Unscrew the two fixing of the shock absorber to the support.



- Remove the seeger stop ring of the support.



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



Refitting

Follow the removal steps but in reverse order; be careful to tighten the retainers to the prescribed torques.

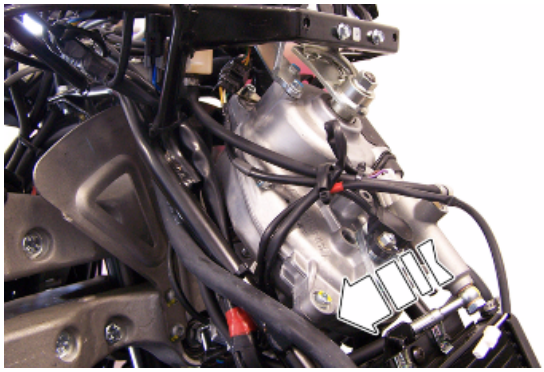
Locking torques (N*m)

Lower shock absorber clamp 19 to 26

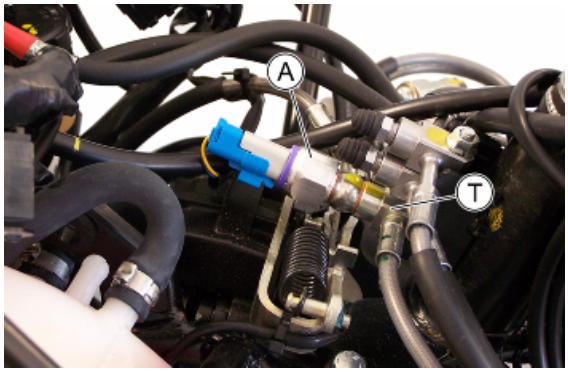
The tilt mechanism

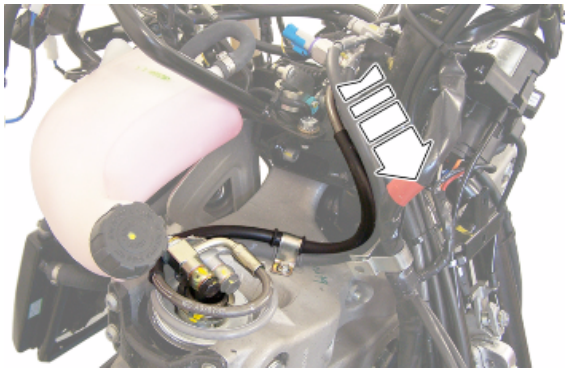
Hydraulic system layout

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

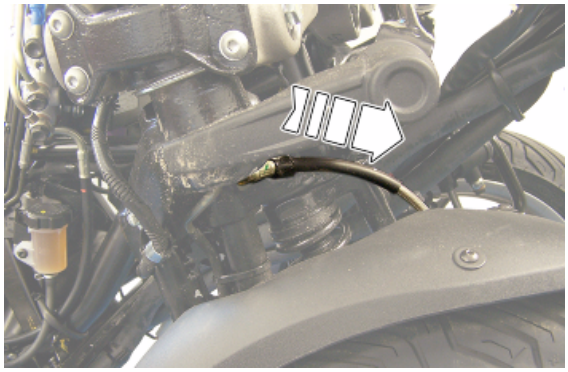


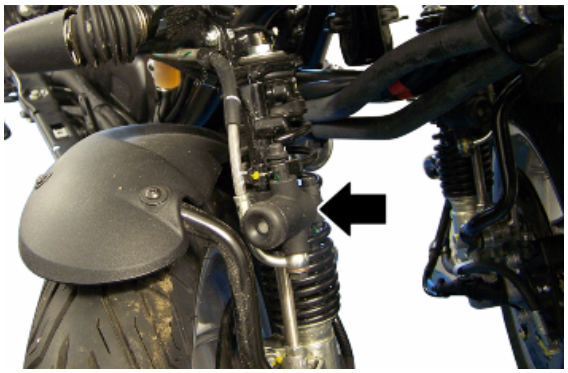
The pressurised oil reaches the distribution frame «**T**» and the pressure sensor «**A**». Then, the pipes branch out to reach the upper joints on the side steering tubes.





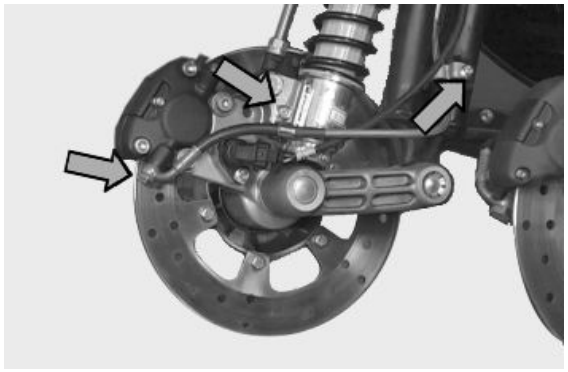
Through the rigid-flexible pipes inside the side steering tubes, the oil reaches the stem sliding locking device placed parallel to the shock absorber.



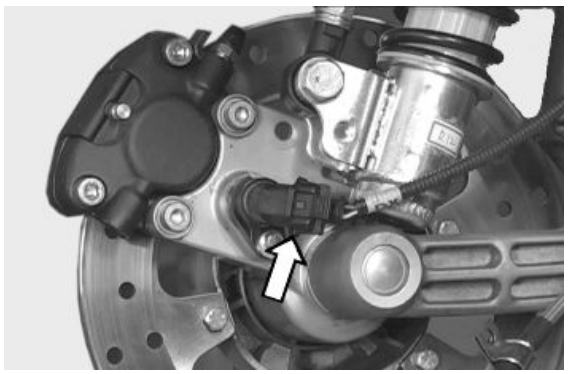


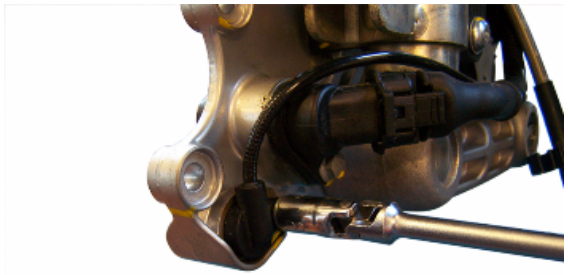
Steering tubes

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.

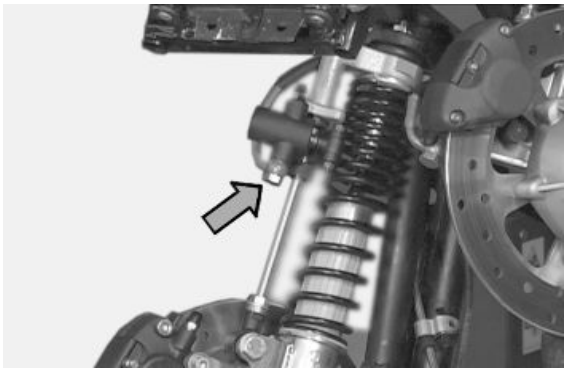




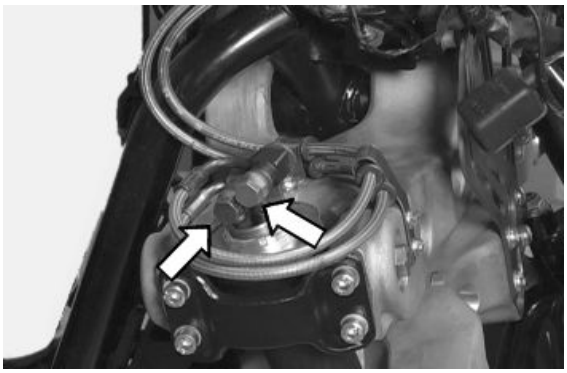
- Undo the ABS sensor fixing screw and remove it. *

*** ONLY FOR THE VEHICLE VERSION EQUIPPED WITH ABS - ASR SYSTEM.**

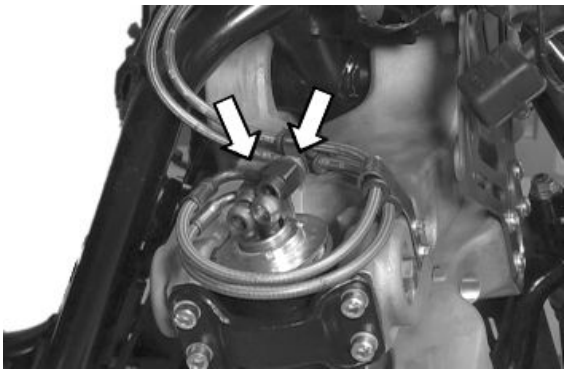
Remove the hydraulic pipe fitting from the sliding locking device, making sure again that the liquid drained is collected.



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

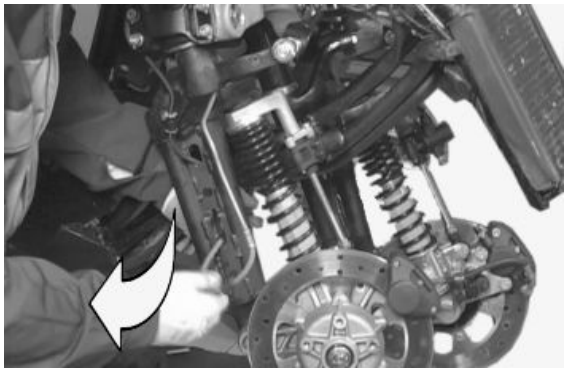


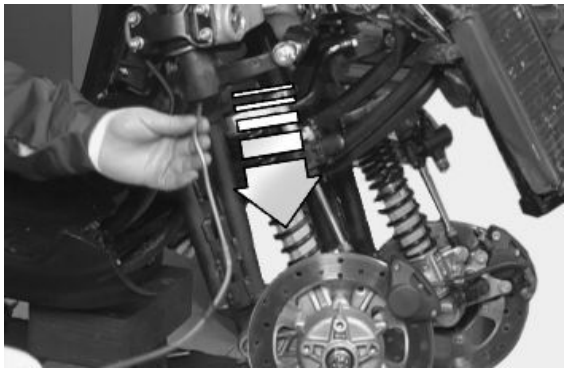
Remove the hydraulic pipe fitting fixing nuts indicated in the figure from the support bracket.



Remove the suspension roll lock device pipes from the headstock.

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

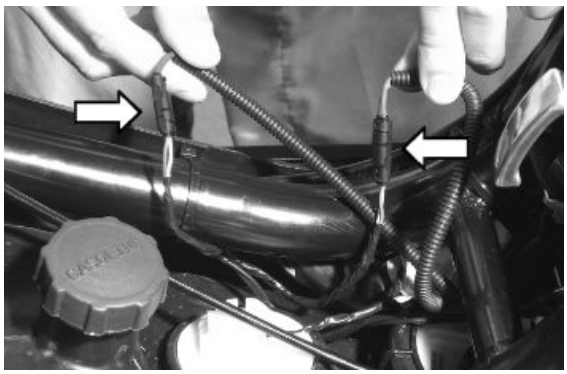


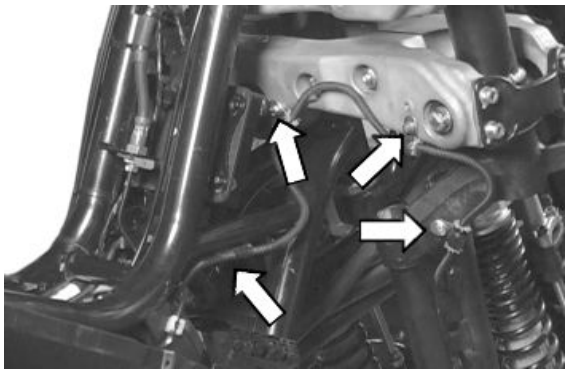


- Remove the leg shield back plate.
- Disconnect the ABS sensor connector, placed under the parking brake. *

*** ONLY FOR THE VEHICLE VERSION EQUIPPED WITH ABS - ASR SYSTEM.**

Remove the tone wheel wiring by disconnecting the connector on the fuel tank after removing the chassis central cover.
After that, remove the retainers indicated in the figure.



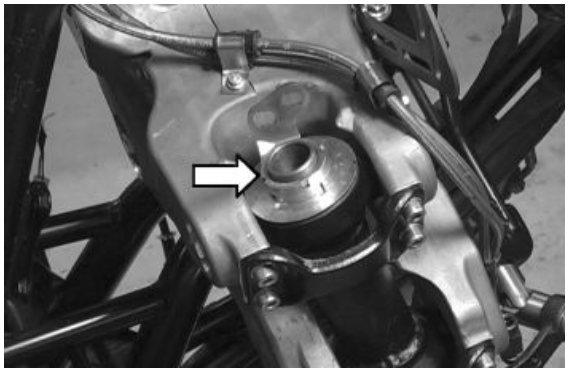


Remove the constant-velocity universal joint from the steering bar by undoing the nut indicated in the picture.

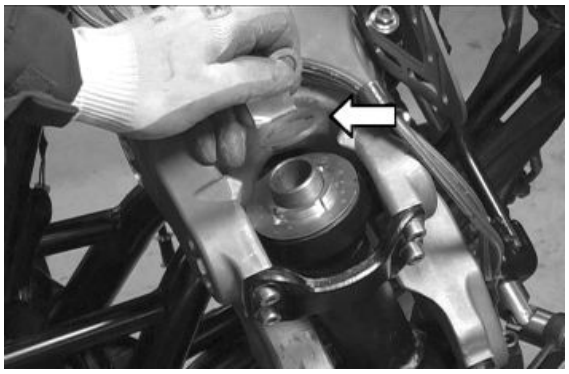
Use a specific tool to remove the upper tightening ring nut of the steering tube.

Specific tooling

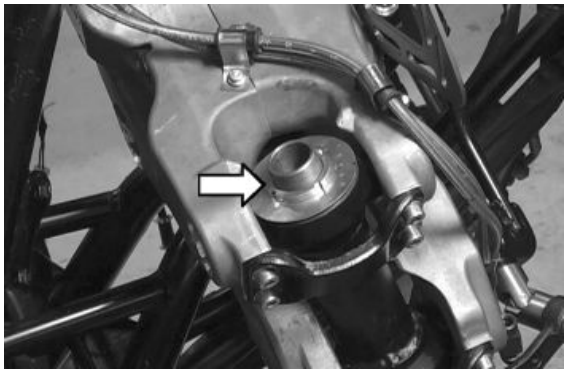
020055Y Wrench for steering tube ring nut

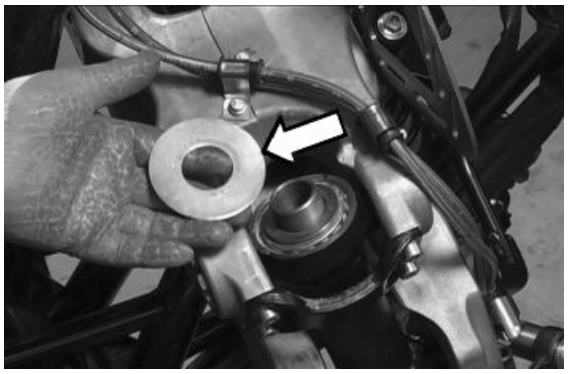


Remove the hydraulic pipe support bracket.



Remove the steering tube lower ring nut and the protection cap indicated in the picture.



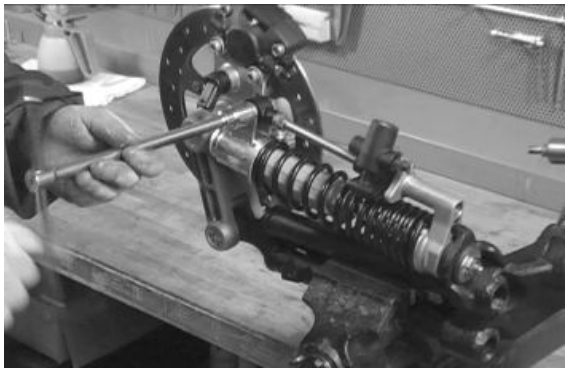


Now the steering tube can be removed.

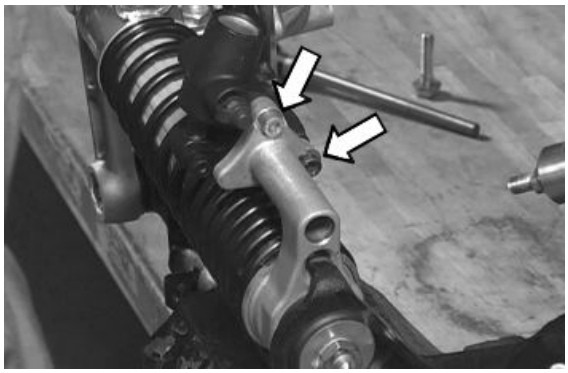
Check that the roller tapered bearing does not show signs of abnormal wear. If it does, replace it.

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.

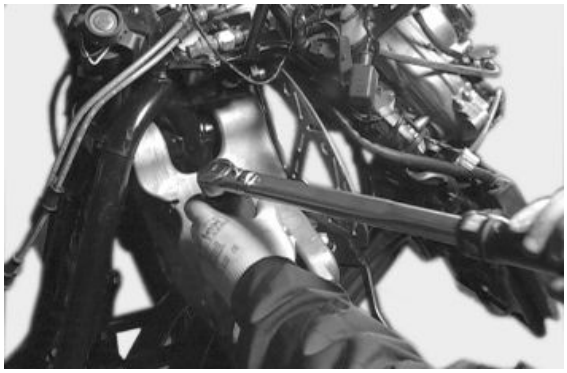


Remove the sliding stem locking device retainers indicated in the picture.



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.



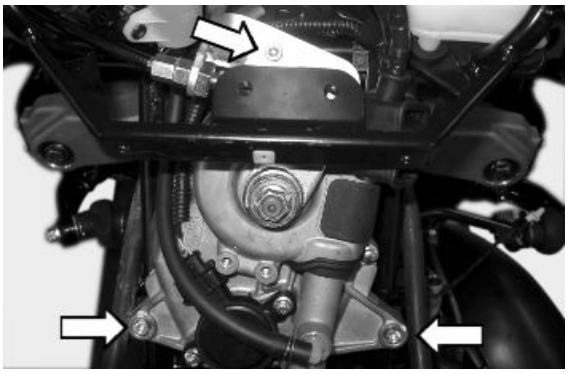
STEERING TUBES

Name	Torque in Nm
Side headstock upper ring nut	20 to 24
Side headstock lower ring nut	12 - 15
Screw fixing sliding stem to shock absorber	45 - 50
Clamp for sliding stem locking device	6.5 - 10.5
Fixing nuts for constant-velocity universal joints	18 - 20
Suspension lock calliper pipe fitting on side steering pipe	25 - 28
Brake calliper pipe fitting on side steering pipe	25 - 28

Parallelogram device

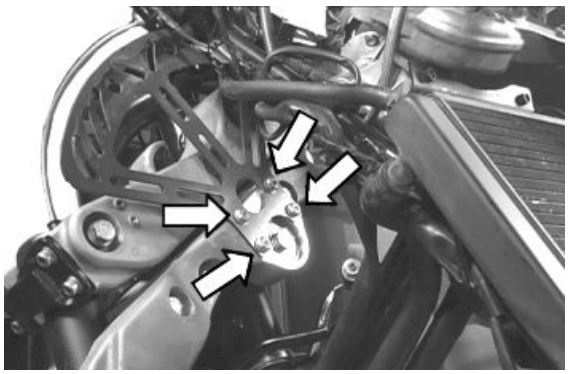
Remove the steering tubes.

To facilitate removal operations of the brake disc sector, loosen the 3 fixing screws in the hydraulic electro-actuator indicated in the picture.

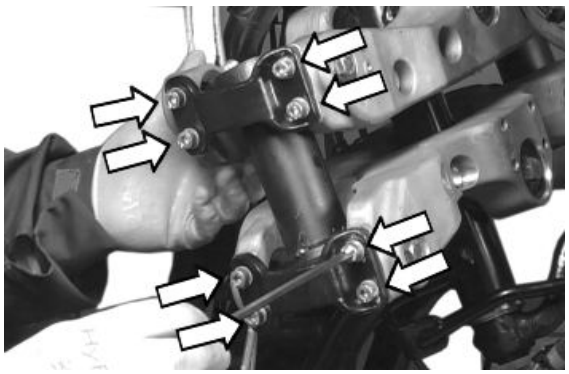


Remove the hydraulic pipe retainers from the parallelogram.

Remove the 4 screws fixing the tilt brake disc sector indicated in the picture.

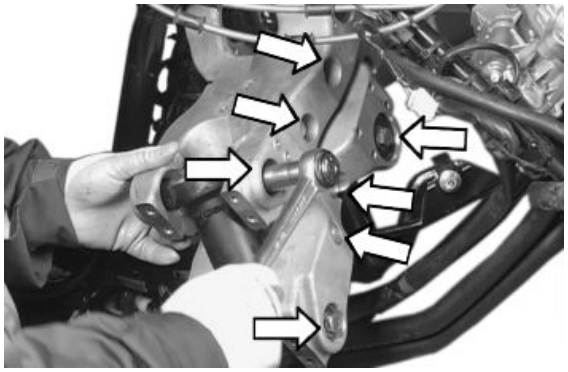


Remove the retainers indicated in picture of the half-arms joint flange.

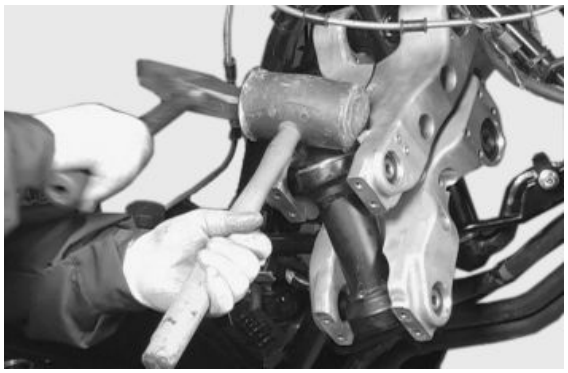


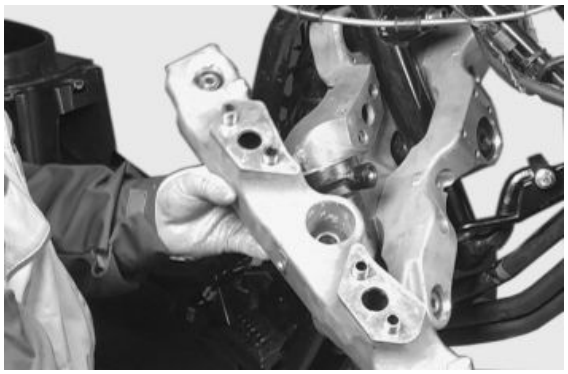
To facilitate the operations indicated below, remove the suspension locking electronic control unit indicated in the picture.

Remove the arm coupling retainers from the parallelogram by loosening the retainers indicated. For easy refitting operations, remember to take note of the positions of the components.



Separate the half-arms by hitting slightly with a wooden mallet where possible alternately to the left and right side of the parallelogram.



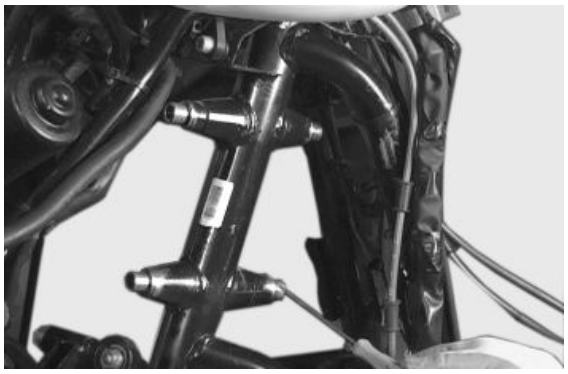


Remove the headstocks.

Carry out a visual check of the upper and lower bearings on the headstocks and their seats. Replace them in case of signs of abnormal wear.

Check the ball bearings on the parallelogram arms. Replace them in case of signs of abnormal wear.

Check the inside tracks of the parallelogram bearings on the chassis.



For refitting, follow the operations for removal but in reverse order, lubricating the reference dowels on the parallelogram half-arms and observing the prescribed torque.

PARALLELOGRAM DEVICE

Name	Torque in Nm
Arm coupling screws	45 - 50
Screws fixing arms to side headstocks	45 - 50
Screws fixing arms to central headstock	45 - 50
Screws fixing the half-arm coupling flange	20 - 25
Screws fixing roll lock disc section	20 - 25

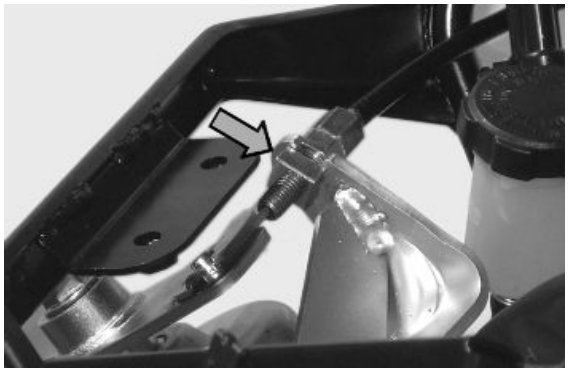
Geared motor and Suspension locking system

Before removing the gear motor:

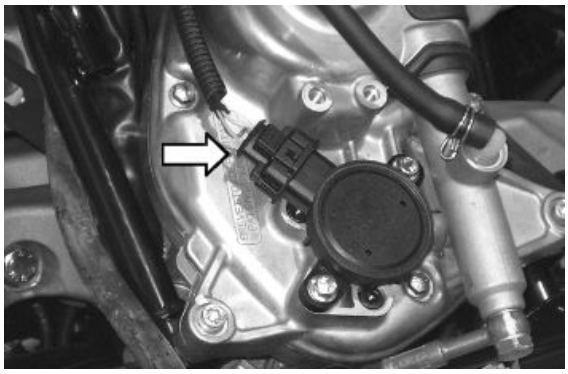
Disable the suspension lock.

Remove the legshield.

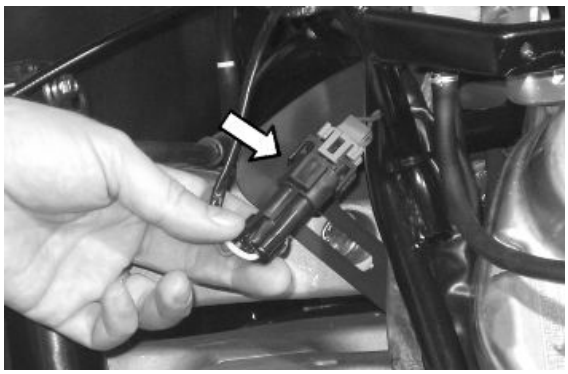
With the set nut indicated in the picture, remove the tensioning cable of the suspension locking mechanical calliper.



Remove the electrical connection of the gear motor position potentiometer.



Remove the electrical connection of the geared motor electric motor.



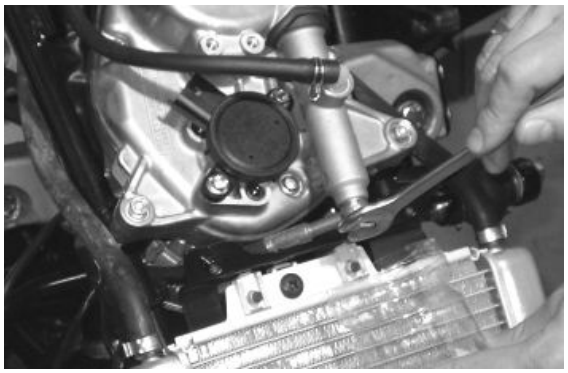
Disconnect the hydraulic pipes between the pump and the sliding stem locking clamps. Empty the system and use a container to collect the brake fluid.

CAUTION

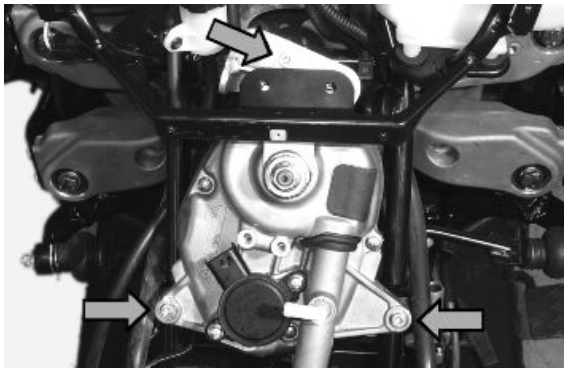
ELIMINATE ANY REMAINING BRAKE FLUID SPILLS.

WARNING: BRAKE FLUID IS HIGHLY POISONOUS. DO NOT INGEST OR SWALLOW. IF ACCIDENTALLY SWALLOWED, DRINK LARGE QUANTITIES OF MILK OR WATER AND SEEK MEDICAL ADVICE IMMEDIATELY. BRAKE FLUID DESTROYS SKIN AND OCULAR 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.



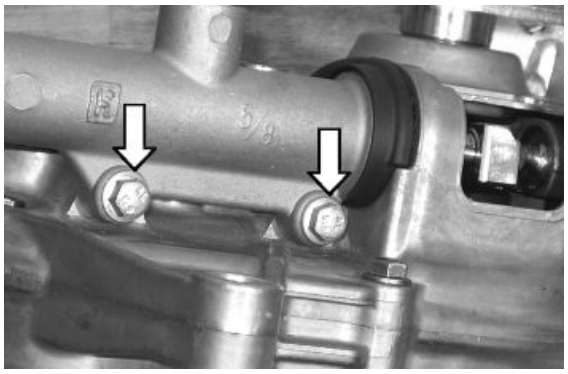
Remove the 3 fixing screws indicated and remove the whole gear motor.



Use a screwdriver to remove the plastic access cover to the pump joint/gear motor

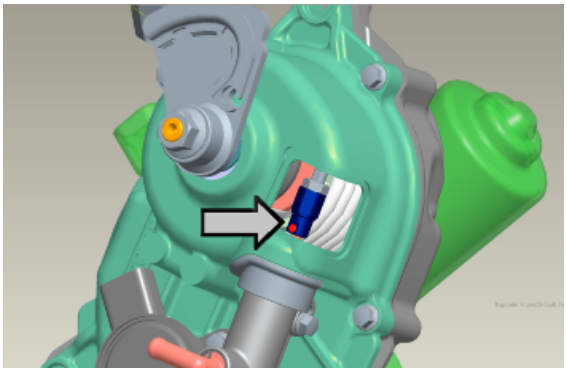
Undo the pump joint screw.

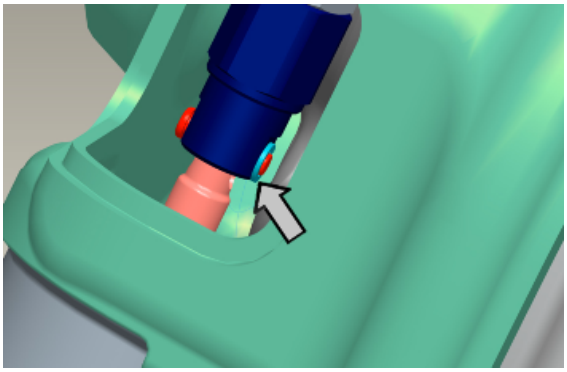
Undo the two gear motor pump locking screws.

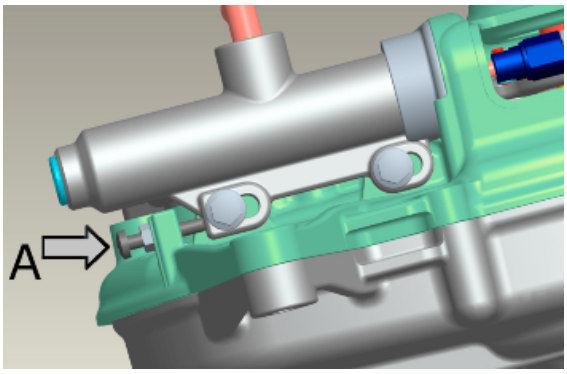


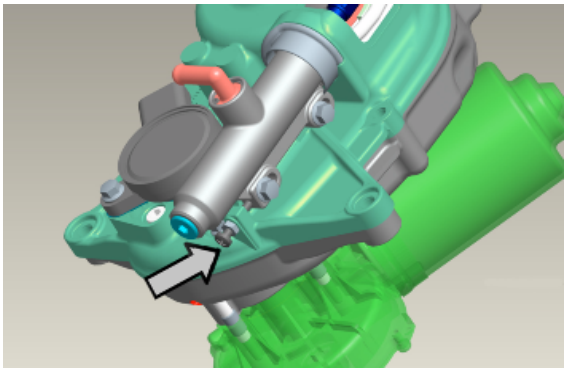
In the new solution to fix the pump to the suspension lock assembly, the retainers fixing the pump body to the assembly and the clamp fixing the pump joint have been modified as shown the figures below.

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.



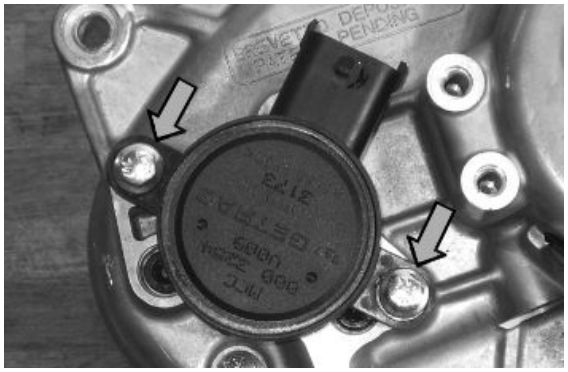






Undo the two potentiometer screws.

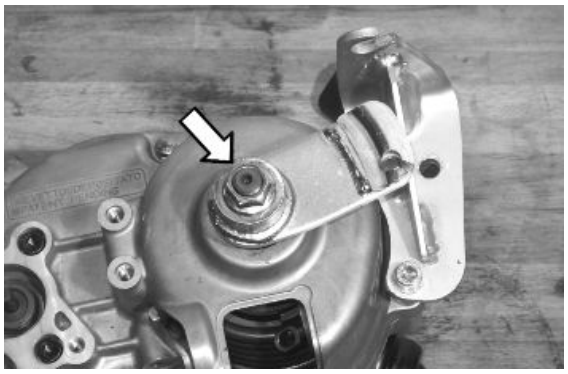
Upon refitting, plug the potentiometer in D-type connector, afterwards place it with its electric connection directed to the opposite side of the pump.



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.

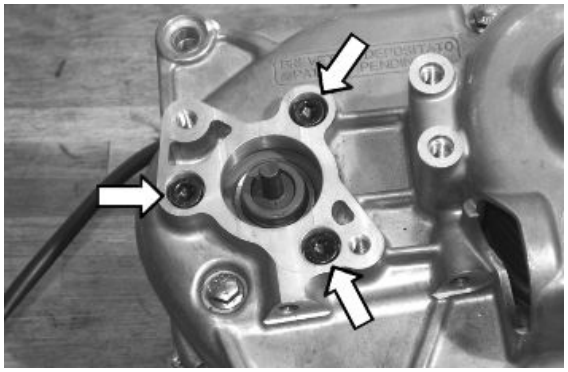


Specific tooling

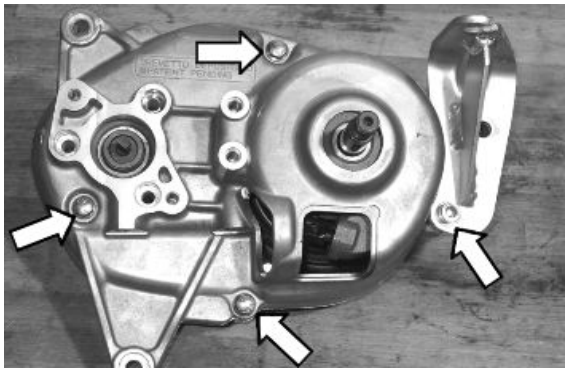
020234y extractor

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.



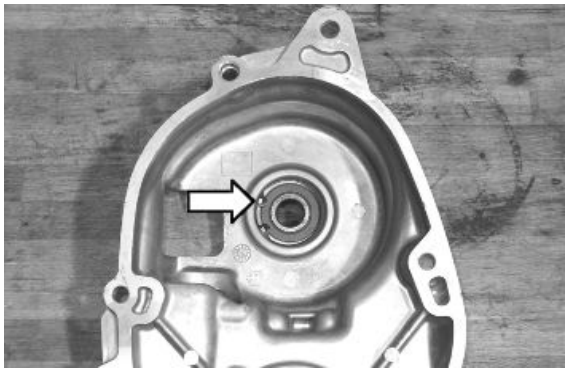
Remove the retaining Seeger ring of the bearing of the flexible transmission lever control shaft bearing.
Remove the bearing with the specific tool.

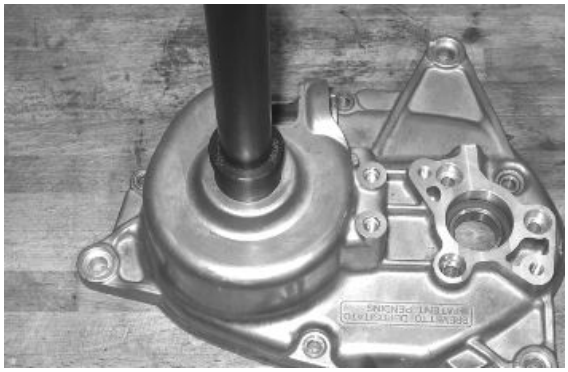
Specific tooling

020376Y Adapter handle

020441Y 26 x 28 mm adaptor

020362Y 12 mm guide





Extract the electric motor bearing with the specific tool.

Specific tooling

020376Y Adapter 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.

Specific tooling

020151Y Air heater

020376Y Adapter 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.

Specific tooling

020363Y 20 mm guide

020358Y 37 x 40 mm adaptor

020151Y Air heater

020376Y Adapter 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.

Specific tooling

001467Y002 Driver for OD 73 mm bearing

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

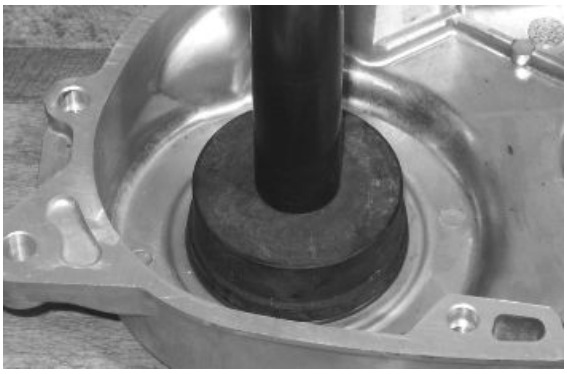
Hold the crankcase in a perfectly horizontal position, heat it with a specific heat gun at about 120 ° C, use the specific tool to fit the bearing of the spring/toothed sector unit. Hit slightly with a mallet if necessary.

Specific tooling

020360Y 52 x 55-mm adaptor

020151Y Air heater

020376Y Adapter 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.

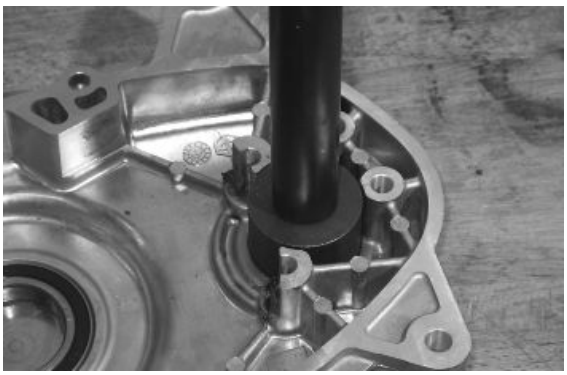
Specific tooling

020363Y 20 mm guide

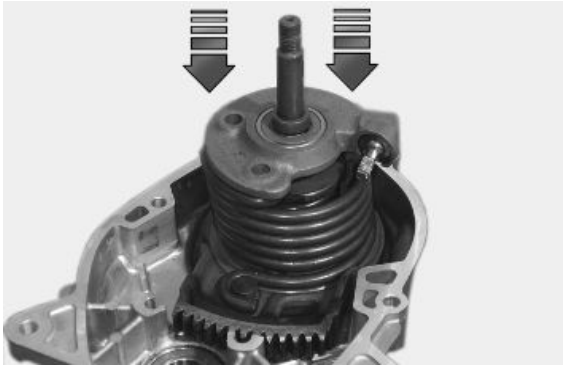
020151Y Air heater

020376Y Adapter handle

020477Y 37-mm Adaptor



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.

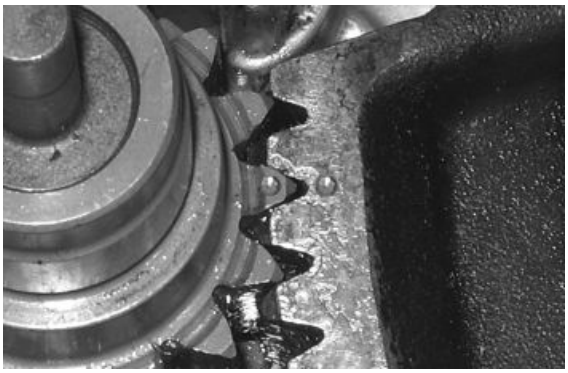
Grease the pinion and the toothed sector with specific grease.

Refit the toothed sector spacer.

Recommended products

MONTBLANC MOLYBDENUM GREASE MONTBLANC MOLYBDENUM GREASE

Grease with molybdenum disulphide

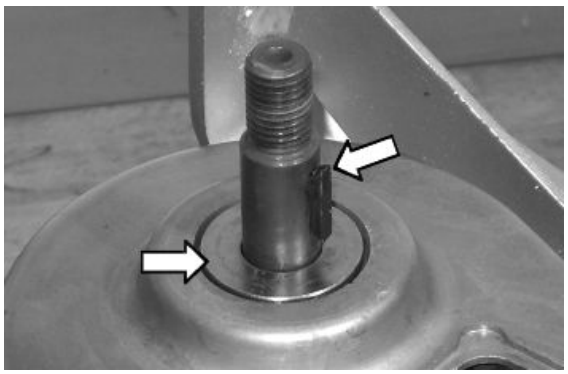


Lubricate the interference areas, match the crankcase halves with slight hits of a mallet to get them into contact.

Place the flexible transmission supporting bracket, refit the four screws, screw them to the prescribed torque.

Locking torques (N*m)

Gear motor crankcase halves coupling screws **11 to 13**



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.

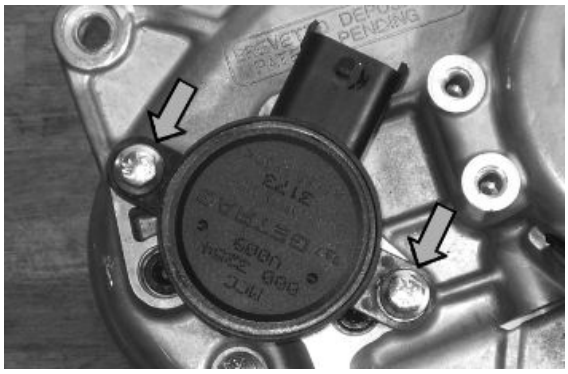
Locking torques (N*m)

Electric motor coupling screws **11 to 13**

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.



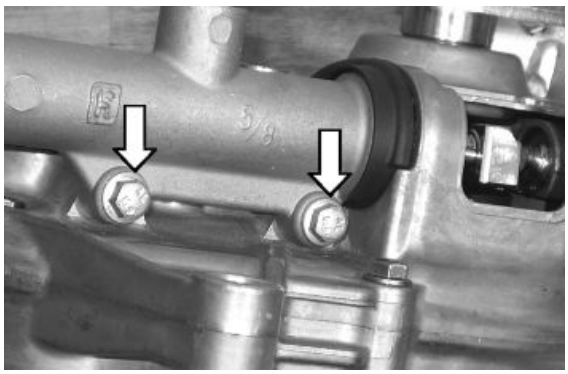
Refit the hydraulic pump on the gear motor body and tighten the screws to the prescribed torque.

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.

Locking torques (N*m)

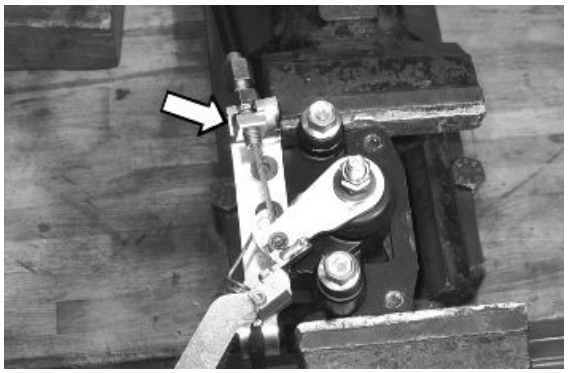
Gear motor hydraulic pump tightening screws **11 to 13**



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

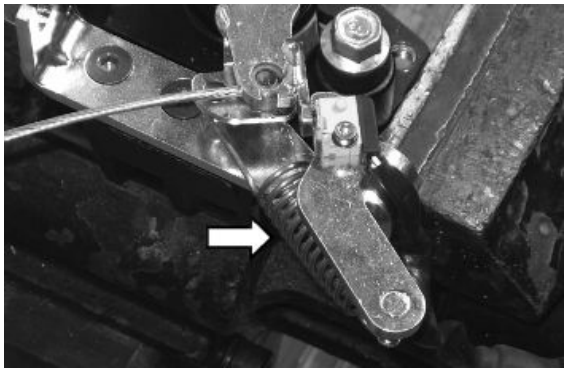
It is very important to remove the flexible transmission from its fitting only for replacement.

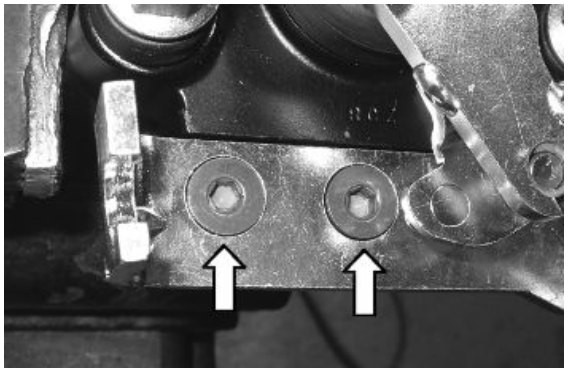
When refitting, tighten the two bracket screws and the flexible transmission lever nut to the prescribed torque.



Locking torques (N*m)

Bracket tightening screws **8 - 12**

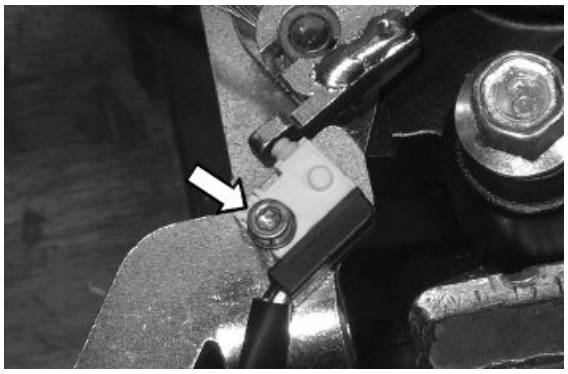




Undo the Allen screw and remove the switch.

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.

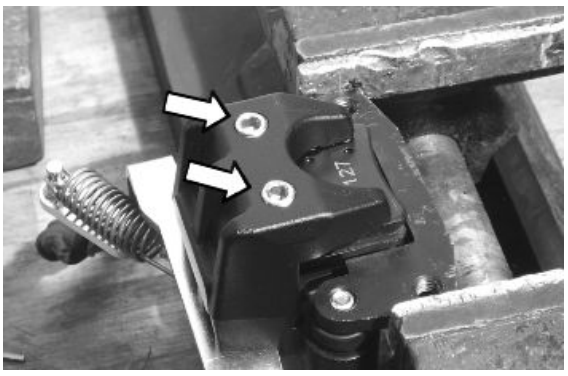
After refitting, check in detail that the switch is regularly activated by the stop on the lever.

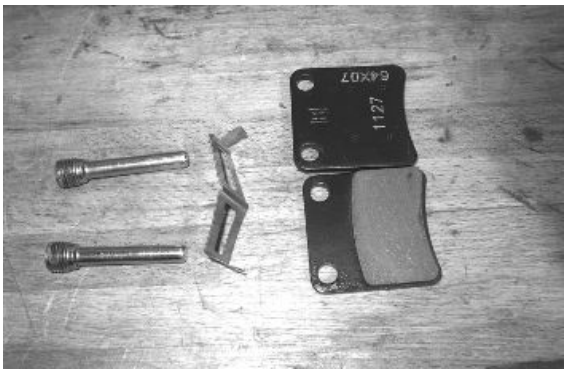


Undo the two pad pin screws; remove the pads with the spring.

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.



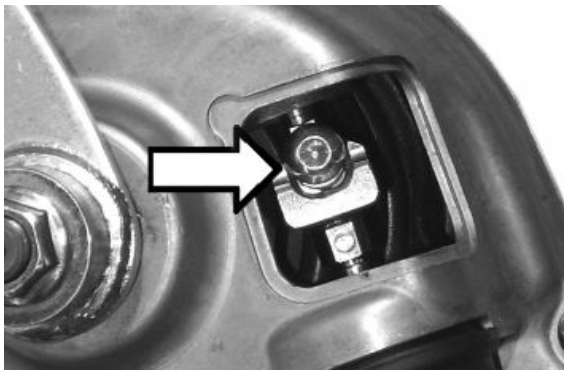


- Connect the diagnostic tool.
- Perform the troubleshooting of the lower stop and follow the indications given by the diagnostic tool.
- The parameter adjustment of the relative angle must be performed by acting on the screw indicated in the picture, after having removed the lower protection cap.

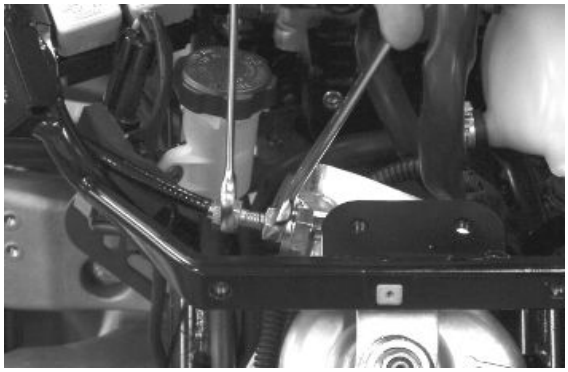
- Remove the upper protection cap, align the pump control and lock the screw to the prescribed torque.

Locking torques (N*m)

Clamp fixing pump spindle to anti-tilting device **11 - 13**

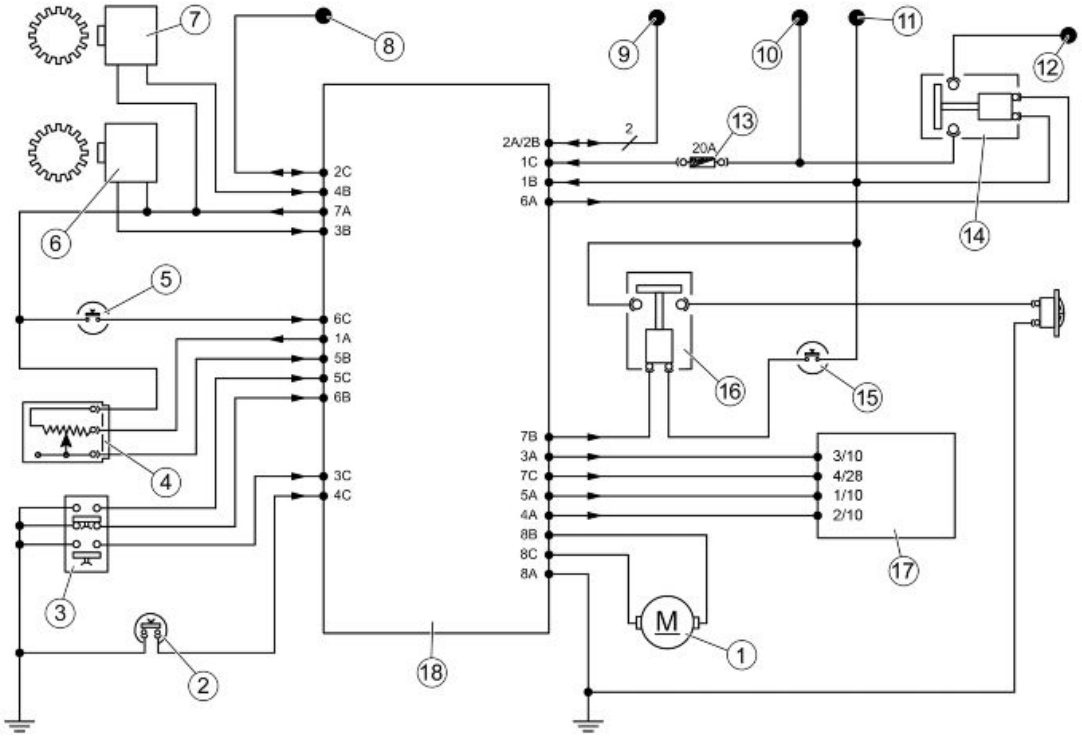


- Proceed with the reset of the potentiometer following the indications given by the diagnostic tool.
- The adjustment of the flexible transmission must be performed so that a small clearance is left to guarantee switch activation on the roll lock calliper.



Electrical devices test

BASIC CIRCUIT DIAGRAM FOR ROLL LOCK ELECTRICAL SYSTEM



KEY

1. Geared motor

2. Brake calliper sensor

3. Tilt unlocking-locking control switch

4. Potentiometer

5. Rider presence sensor

6. Left speed sensor

7. Right speed sensor

8. Diagnostic tool serial line

9. CAN line

10. + Battery

11. + Key

12. To light switch

13. 20 A Fuse No. 3

14. Light relay

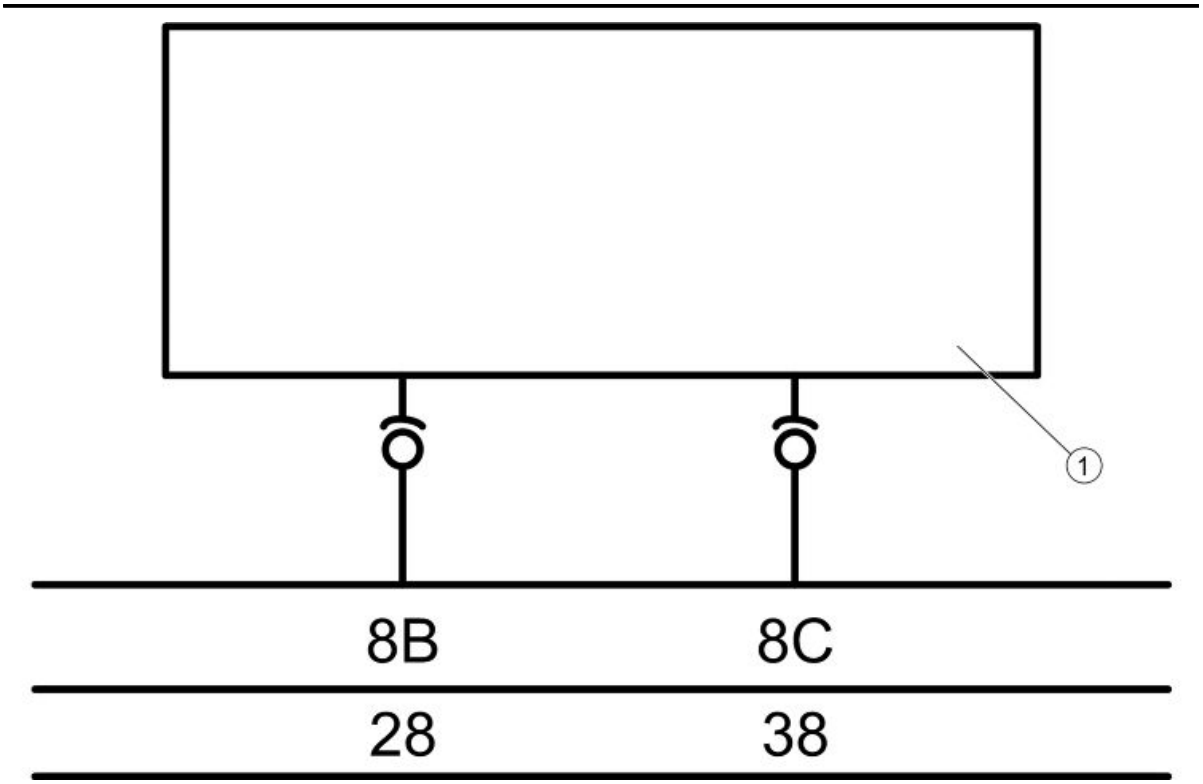
15. Pressure switch

16. Horn relay

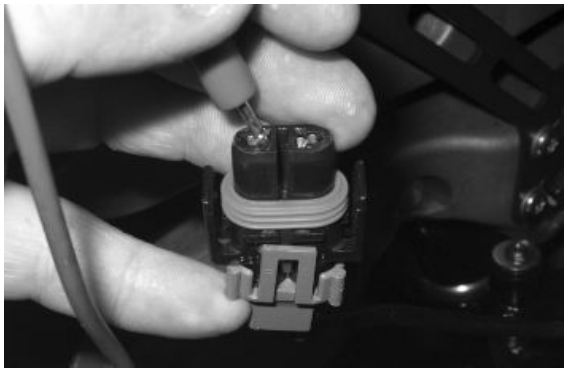
17. Instrument panel / Warning light module

18. Roll lock system control unit

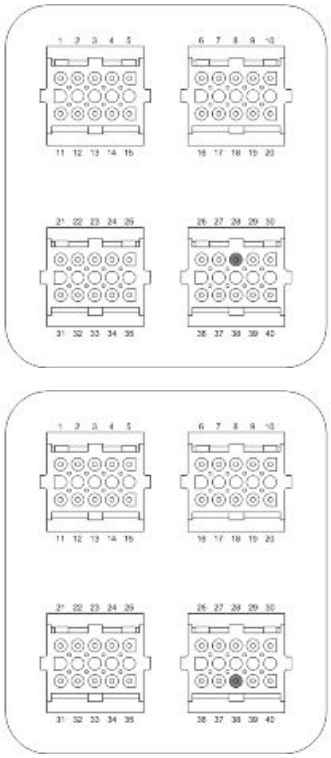
GEAR MOTOR



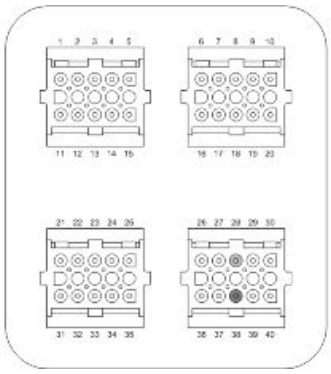
1: GEAR MOTOR



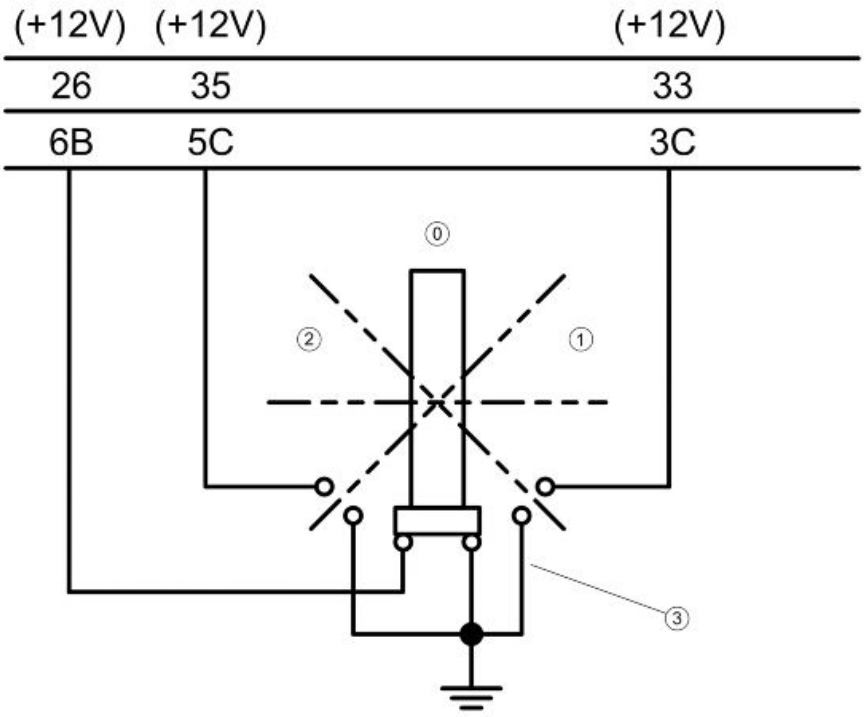
With the interface wiring disconnected from the control unit, check the continuity between pin 28 and the yellow cable, between pin 38 and the blue cable on the gear motor connector



With the interface wiring disconnected from the control unit, check the continuity of the geared motor winding placing the multimeter probes on pins 28 and 38 as indicated in the figure.



PULSANTE BLOCCO - SBLOCCO ROLLIO



0: REST POSITION

1: LOCKING POSITION

2: UNLOCKING POSITION

3: ROLL LOCK-UNLOCK SWITCH

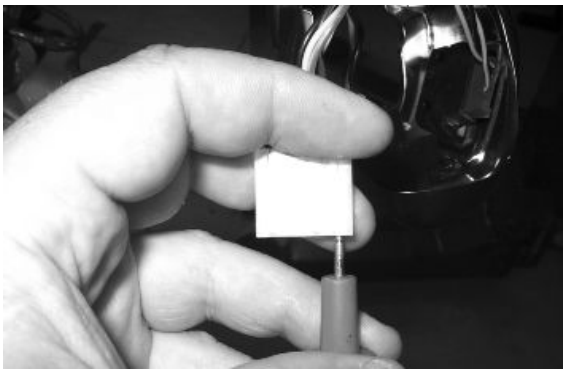
With the interface wiring disconnected from the control unit, check the continuity of the electrical lines between the interface wiring and the roll lock-unlock switch:

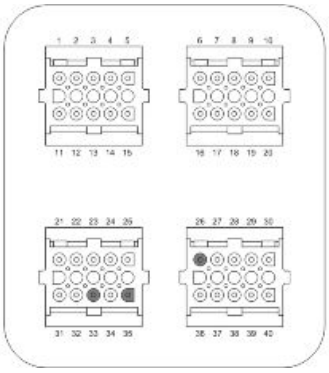
Pin 26 and green - grey cable

Pin 35 and violet - black cable

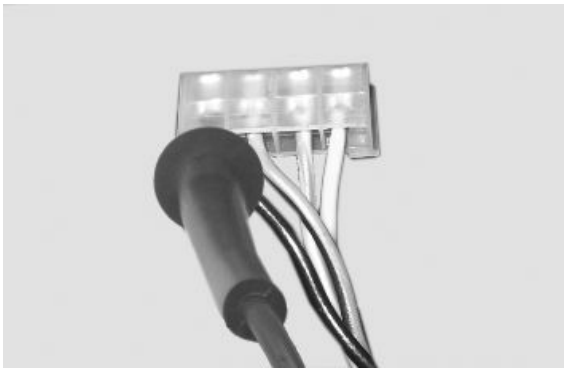
Pin 33 and yellow - blue cable

Also check that the above indicated electrical lines are insulated from the ground.





Check the continuity between the black cable on the connector and a ground point on the chassis.



With a multimeter, check the operation of the tilt locking-unlocking switch referring to the diagram indicated in the figure.

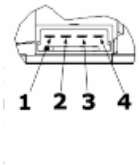
KEY

1. GROUND

2. LOCK

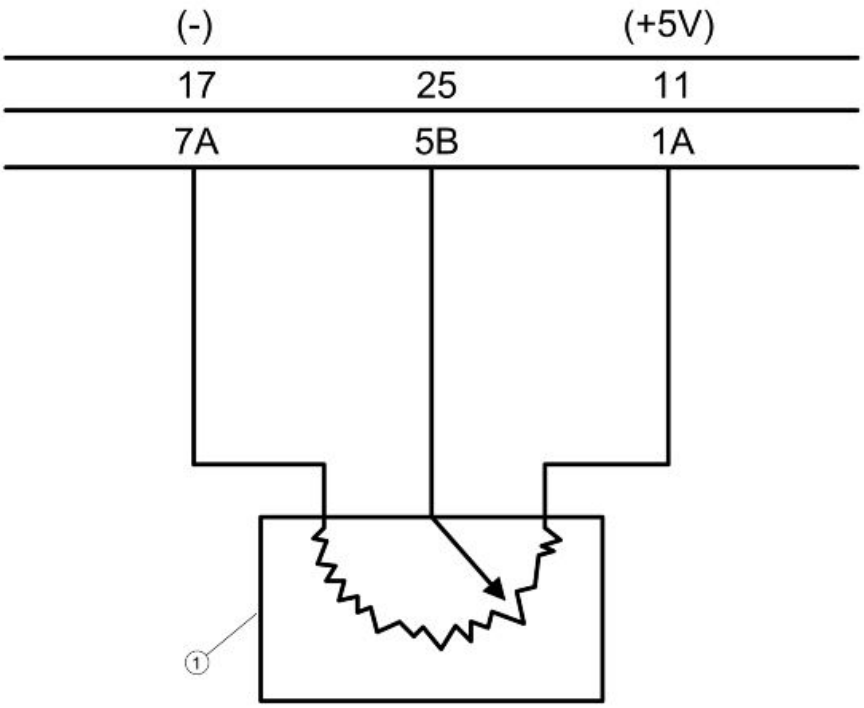
3. REST

4. UNLOCK



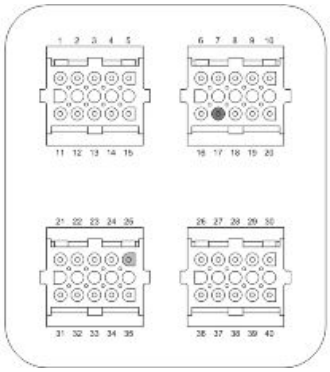
	2	3	4	1
			○	○
0		○		○
	○			○

POTENZIOMETRO

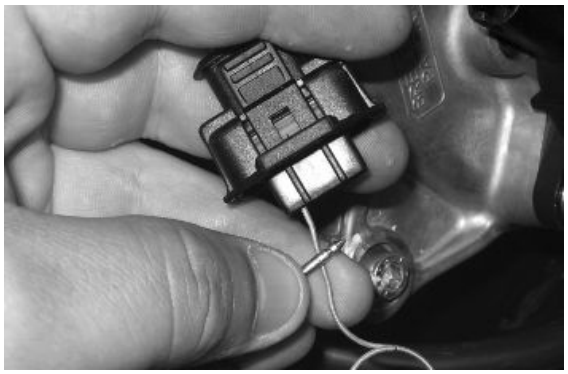


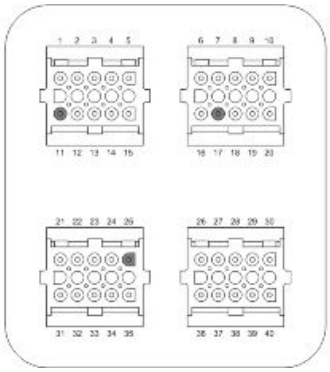
1: POTENTIOMETER

With the interface wiring connected to the control unit, secure the vehicle on its centre stand and switch to "ON". Select the reading scale on 20 V. Insert the multimeter probes on pins 17 and 25. Check that the voltage in the activated locking condition is 4V and 1V in the locking rest condition.

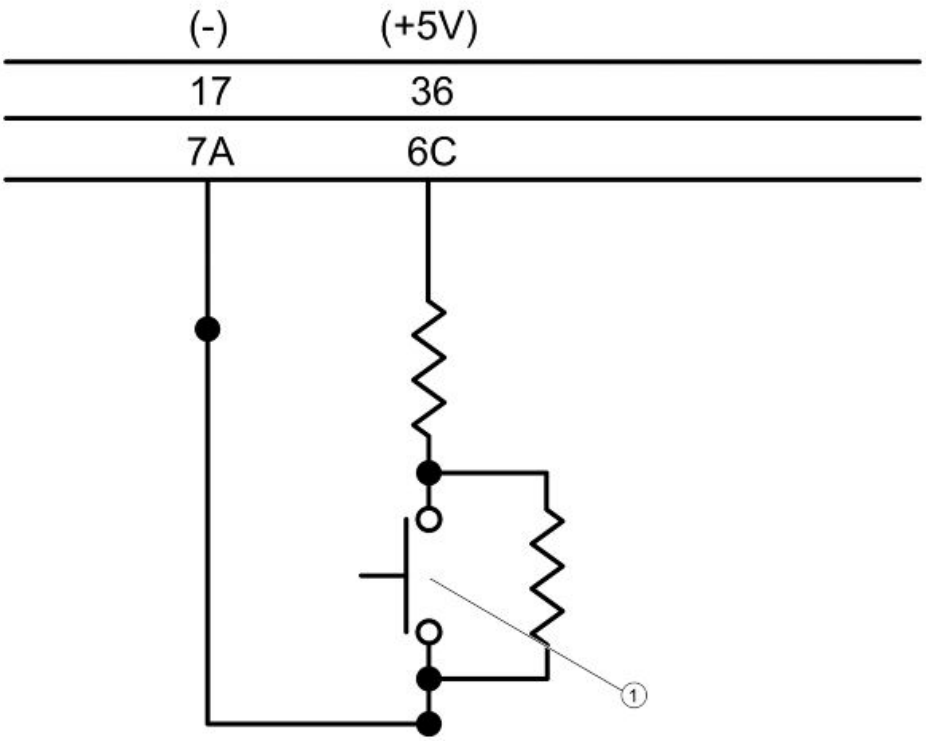


With the interface wiring disconnected from the control unit, check the continuity between pin 17 and the yellow cable of the potentiometer connector, between pin 25 and the green-blue cable, between pin 11 and the orange-blue cable. Also check that these lines are insulated from each other and ground.



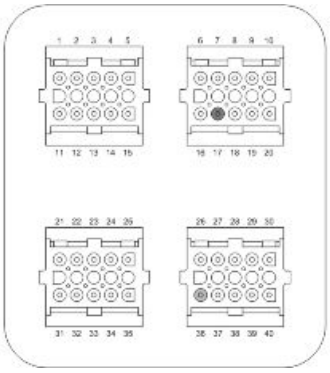


SENSORE PRESENZA PILOTA

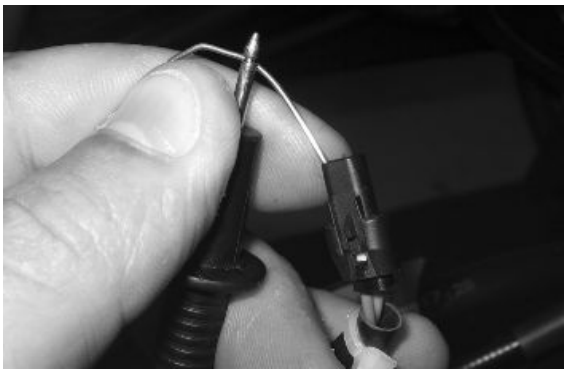


1: RIDER DETECTION SENSOR

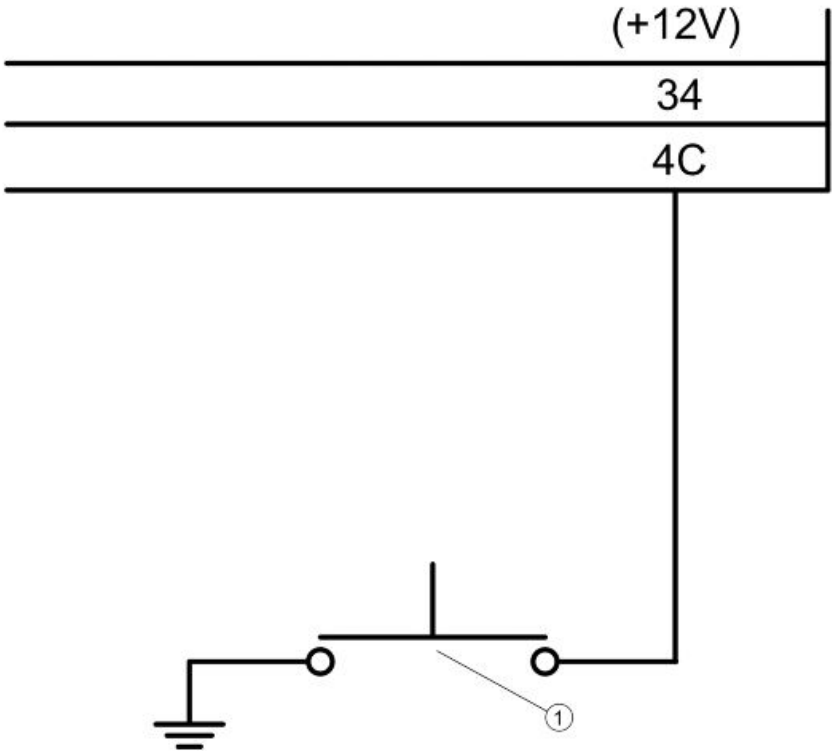
With the interface wiring disconnected from the control unit and connected to the system, check the following conditions:
pin 17 - 36: resistance 15 - 18 kOhm when the rider is not seated on the saddle.
pin 17 - 36: resistance of about 3 kOhm when the rider is seated on the saddle



Check the continuity between the interface wiring pin 17 and the yellow cable of the rider presence connector.
Check the continuity between the interface wiring pin 36 and violet cable of the rider presence connector.



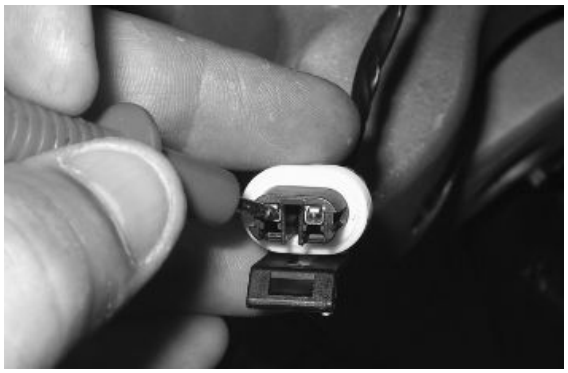
SENSORE PINZA BLOCCO ROLLIO

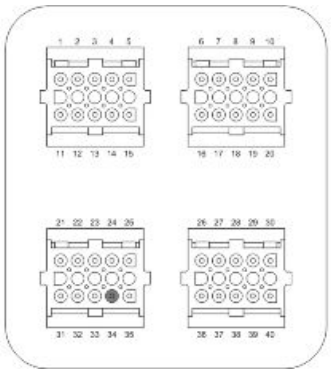


1: ROLL LOCK CALLIPER SENSOR

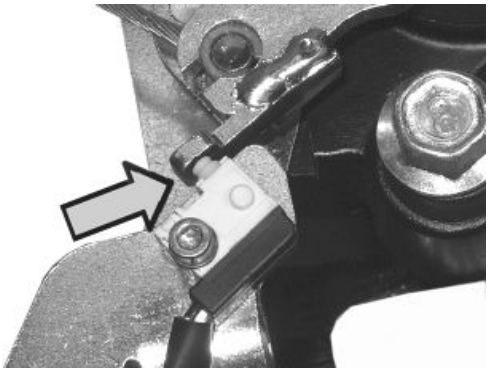
The roll lock calliper sensor is a normally opened switch. Check its correct operation with a multi-meter.

With the interface wiring disconnected from the control unit, check the continuity between pin 34 and the brown cable of the roll lock gripper sensor connector on the system side.
Check the continuity of the connector black cable and a ground point on the chassis

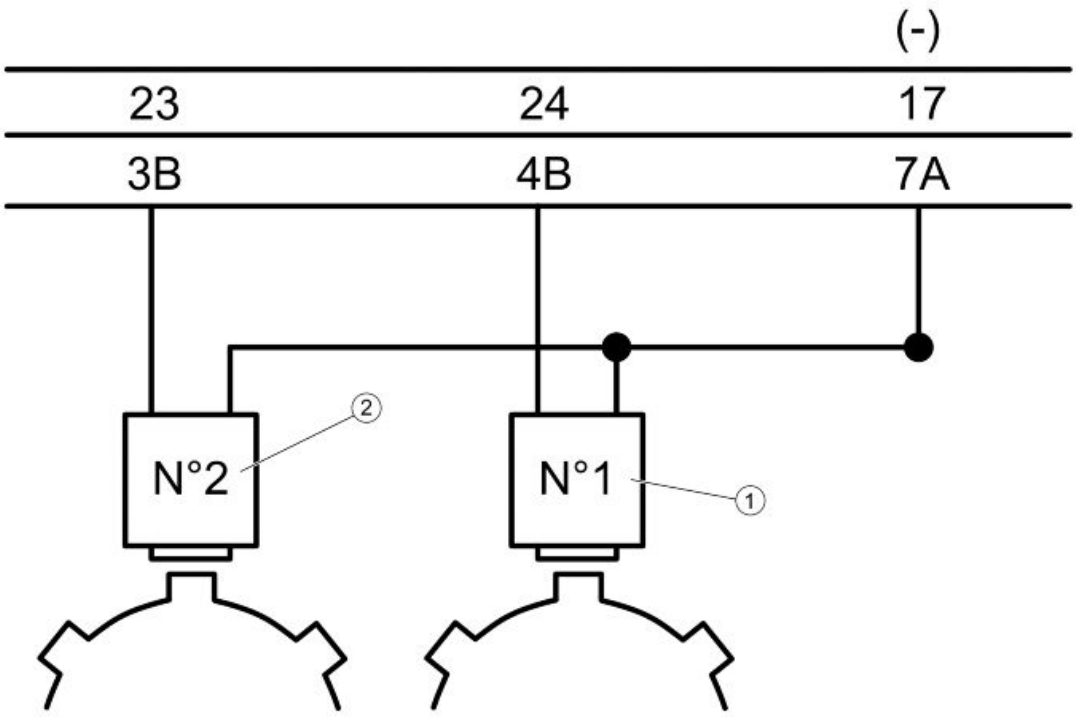




Also check that the flexible transmission control lever activates the limit stop switch properly.



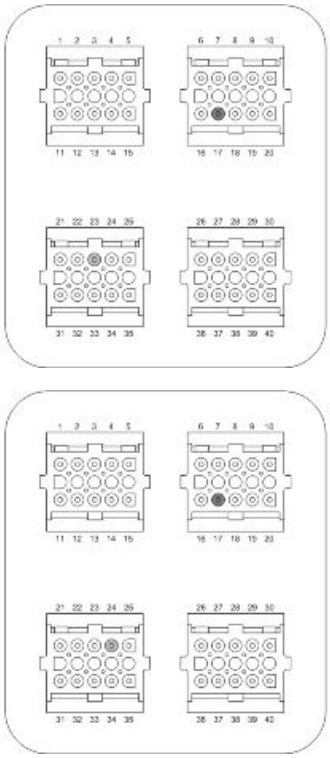
SENSORE RUOTA FONICA



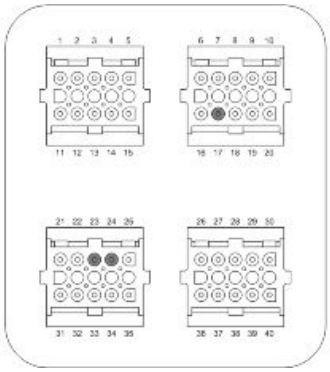
1: Right tone wheel

2: Left tone wheel

With the interface wiring disconnected from the parking electrical control unit and connected to the system, check that the sensor resistance between pins 23 - 17 and 24 - 17 is between 774 and 946 Ohm at approximately 20°

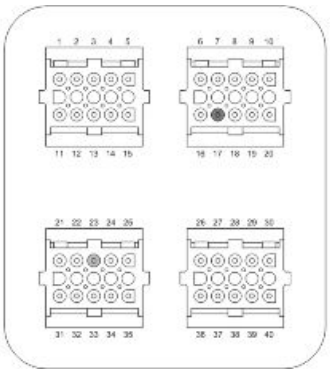


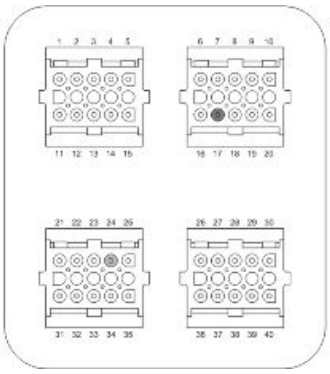
With the interface wiring disconnected from the control unit, check the continuity between pin 23 and the red cable of the LEFT wheel turning sensor connector; the continuity between pin 17 and the brown cables of the LEFT and RIGHT wheel turning sensors; and between pin 24 and the red cable of the RIGHT wheel turning sensor.



In case of failures, check the continuity between pin 23 and the connector green cable on the fuel tank after removing the chassis central cover; between pin 17 and the yellow cables on both connectors; between pin 24 and the red cable on the connector.

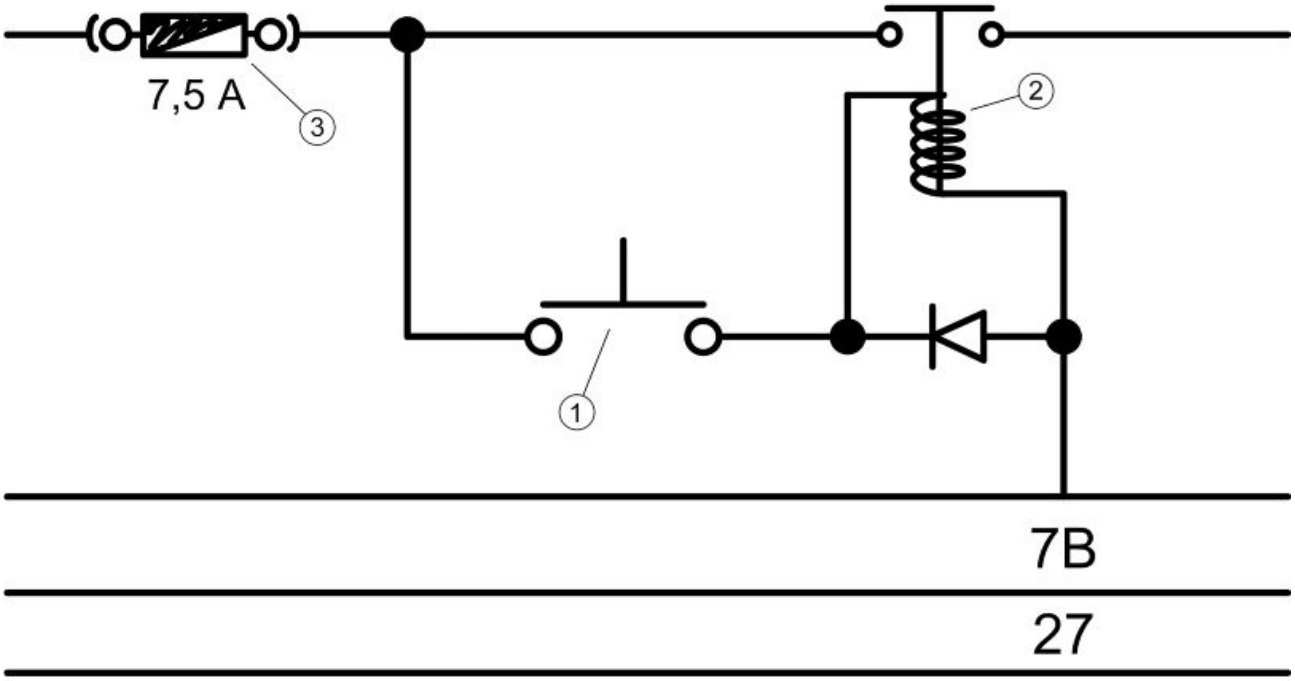
With the interface wiring disconnected from the control unit and the connectors disconnected from wheel turning sensors, check that pin 23 - 17 and 24 - 17 are insulated from each other and from ground.





With a feeler gauge, check that the air gap between the screw head and the sensor is between 0.35 and 1 mm

PRESSOSTATO

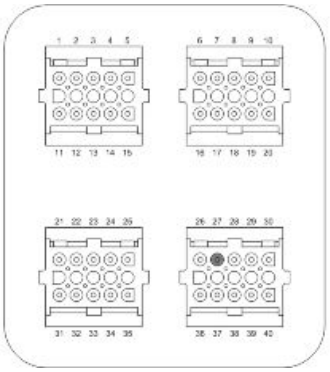


1: PRESSURE SWITCH

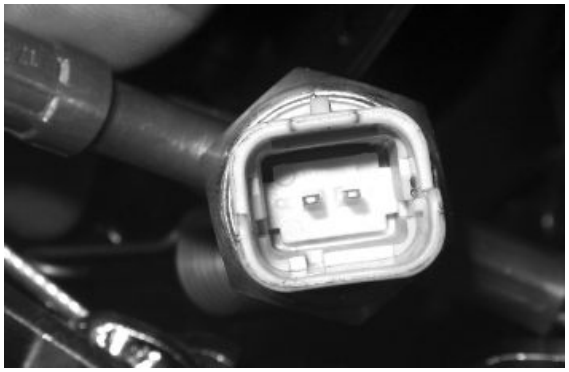
2: HORN SOLENOID

3: FUSE No. 11, 7.5A

Check that the 7.5A fuse No. 11 works properly. With interface wiring disconnected from the control unit, check the continuity of the blue - black cable between pressure sensor connector and the horn solenoid base as shown in the picture. Check the continuity between pin 27 and the solenoid base white cable.



Check the continuity of the yellow-red cable between the pressure switch connector and the fuse box (7.5A fuse No. 11) and between the remote control base and the fuse box (7.5A fuse No. 11). With a multimeter, also check the pressure switch operation as well as the continuity at rest as this is normally closed switch.

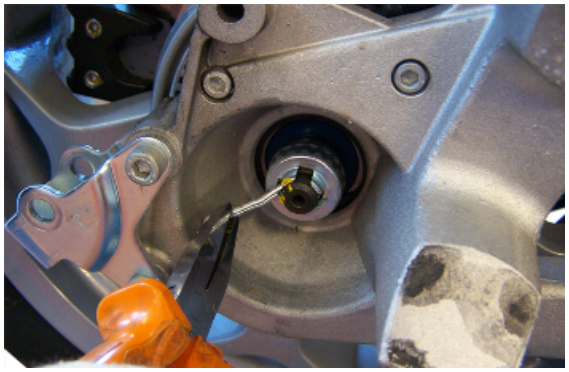


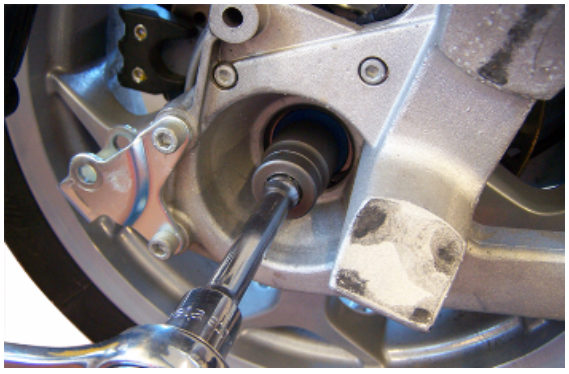
Rear

Removing the rear wheel

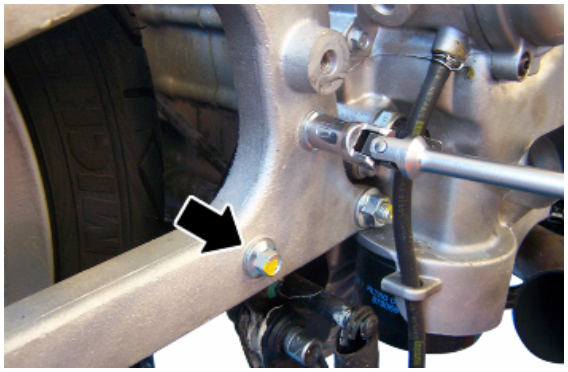
Before removing the rear wheel, support the vehicle properly and operate the parking brake so as to facilitate removing the wheel fixing screws.
- Remove the exhaust silencer.
- Undo the screw fixing the right shock absorber to the clamp.

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

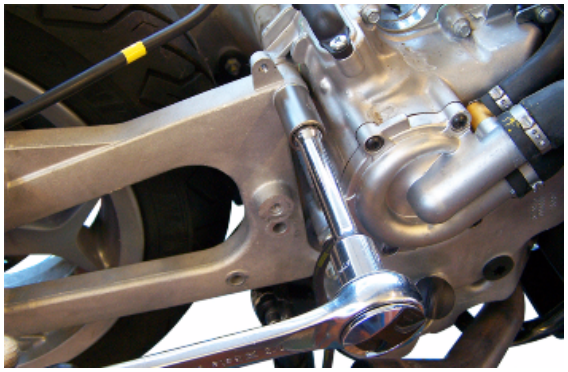




- Undo the two screws fixing the clamp to the centre stand.

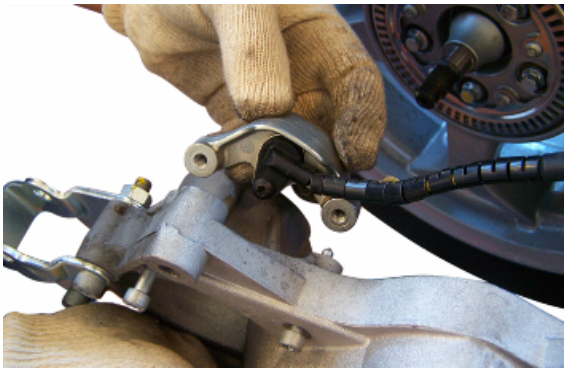


- Undo the two screws fixing the clamp to the engine.



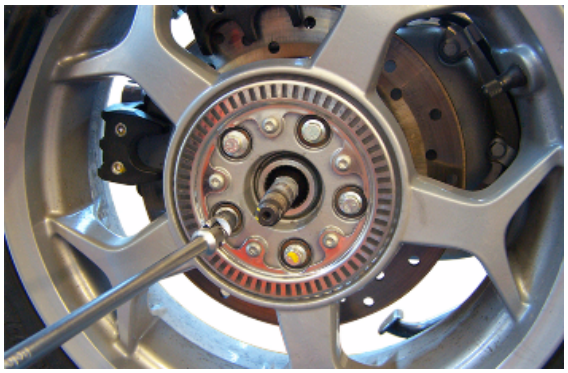
- Undo the two fixing screws of the ABS sensor support and remove it. *

*** ONLY FOR THE VEHICLE VERSION EQUIPPED WITH ABS - ASR SYSTEM.**



- Unscrew the clamp.

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



- Undo the upper fixing of the right shock absorber and remove it.
- Remove the wheel.
- If also the plastic of the side fairings has been removed previously, to allow the removal of the wheels, just pull aside the shock absorber towards the front part of the vehicle.

Refitting the rear wheel

To fit, follow the removal steps but in the reverse sequence, being careful to fit the spacers on the wheel axle as shown in the picture.

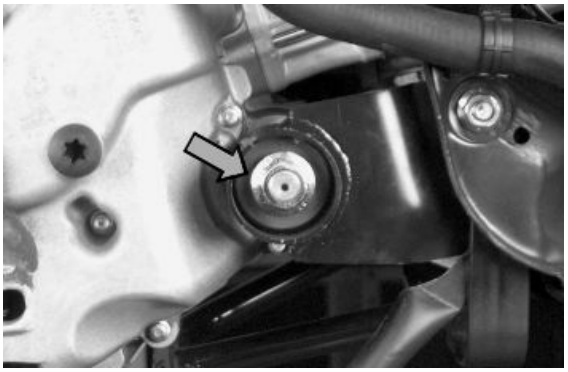
Locking torques (N*m)

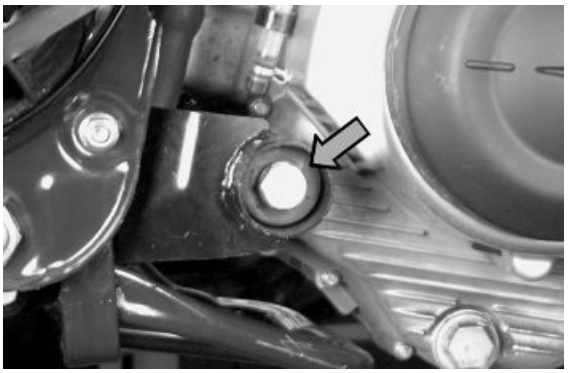
Silencer arm clamping screws 27 - 30 **Rear wheel axle nut** 104 to 126 **Shock absorber-crank-case attachment bracket** 20 - 25 **Lower shock absorber clamping screw** 33 - 41 Nm **Rear brake calliper fixing screws** 41.5 to 51.5

Swing-arm

Removal

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



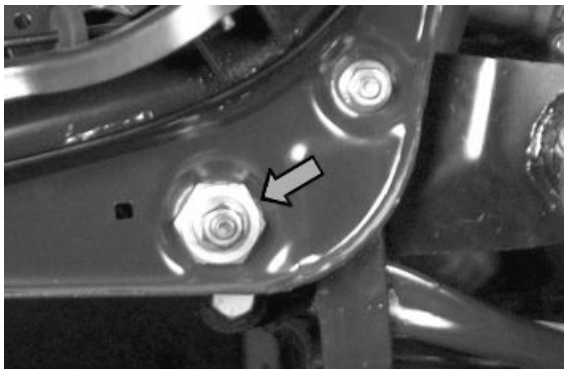


- Remove the silent-blocks.

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

- Remove the pin.

- 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.

Overhaul

- Properly support the swinging arm in the vice.
- Check there is no jamming in the movement of the joint connecting the swinging arm on the engine side to the swinging arm on the frame 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

Characteristic

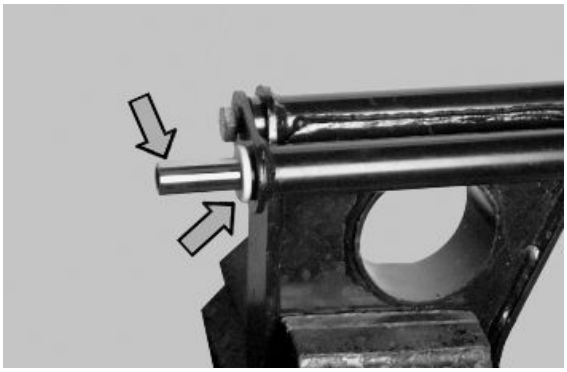
Standard clearance

0.40 - 0.60 mm

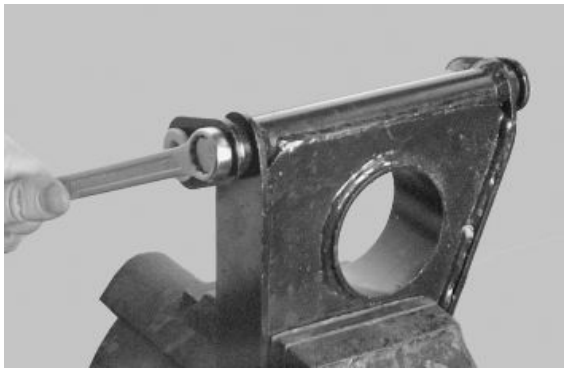
Allowable limit after use:

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.



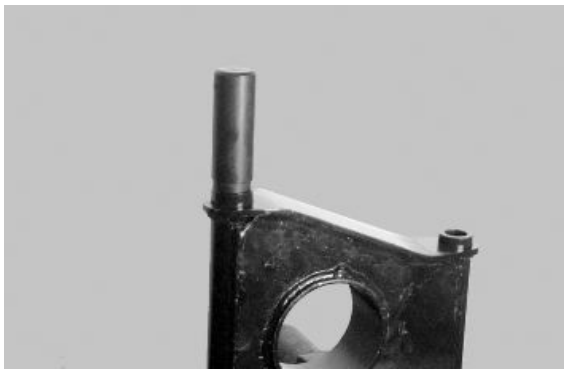
- Remove the pin connecting the engine swinging arm - frame swinging arm.



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

- Remove the internal spacer.
- Using a suitable pin remove the roller casings as shown in the photographs

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



Specific tooling

020244Y 15-mm diameter punch

Characteristic

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:

L182.5 ± 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 photograph
- Place the swinging arm, frame side, with the protruding part facing the transmission side

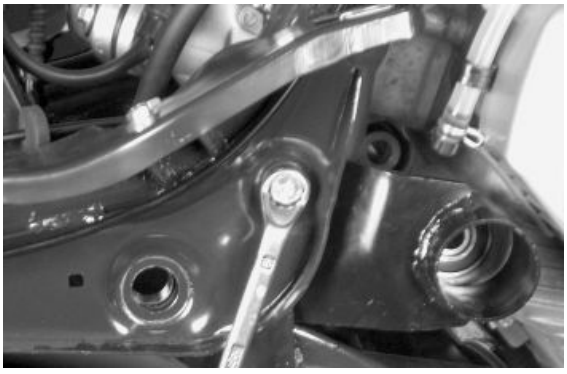
Recommended products

AGIP GREASE PV2 Ivory smooth-textured, slightly-stringy anhydrous calcium-base grease.

TL 9150 066, symbol 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.



Refitting

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

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

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

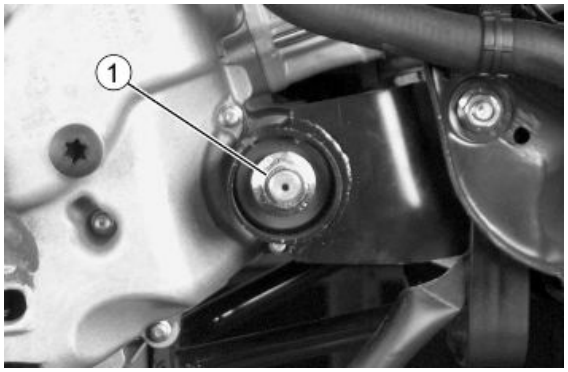
3. Tighten part **3** to the prescribed torque

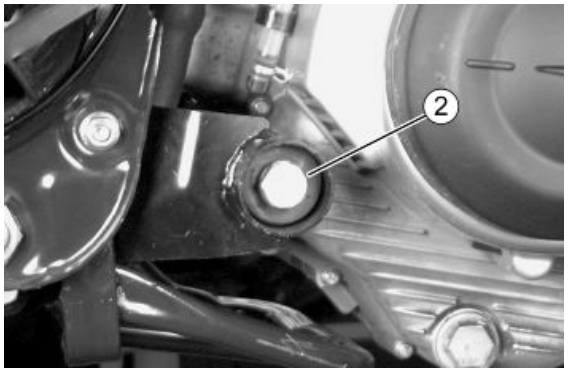
4. Screw on and tighten part **4** to the prescribed torque

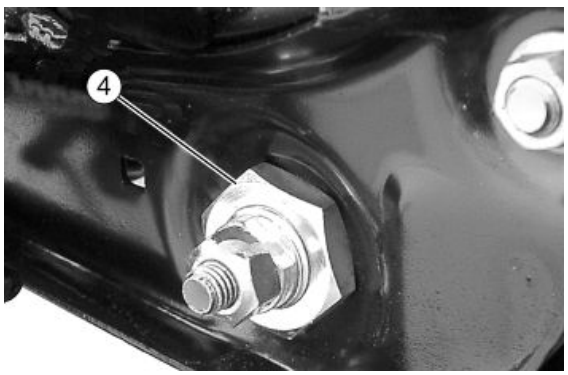
5. Screw on and tighten part **5** to the prescribed torque

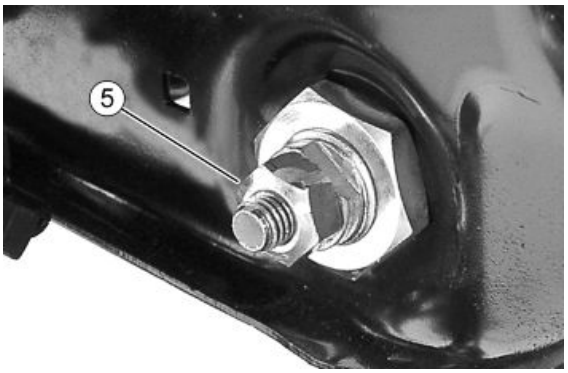
6. Tighten part **1** to the prescribed torque

Insert the swinging arm - engine bolt and tighten to the prescribed torque









SWINGING ARM FITTING

Name	Torque in Nm
Part 1	98 ÷ 118
Part 3	5 ÷ 7
Part 4	88.5 ÷ 108
Part 5	54 ÷ 60
Bolt for swinging arm, engine side / swinging arm, frame side	32.5 ÷ 40

Shock absorbers

Removal

Proceed as follows:

- place the scooter on its centre stand;
- lift the engine a little with a jack so as to free the two shock absorbers;
- remove the exhaust silencer;
- undo the shock absorber spring assembly clamping screw from the support fixed to the engine on the one side and from that fixed to the muffler on the other;
- unscrew the two upper nuts (one on each side) fixing the shock absorber spring assembly to the frame and remove the shock absorbers.

Refitting

Carry out the previous operations but in reverse order.

Locking torques (N*m)

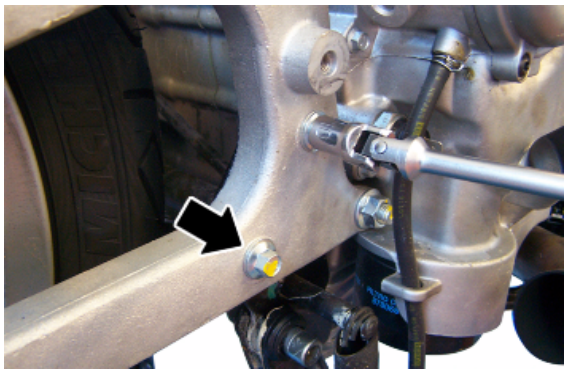
Lower shock absorber clamp 33 - 41 Upper shock absorber retainer 33 - 41

Centre-stand

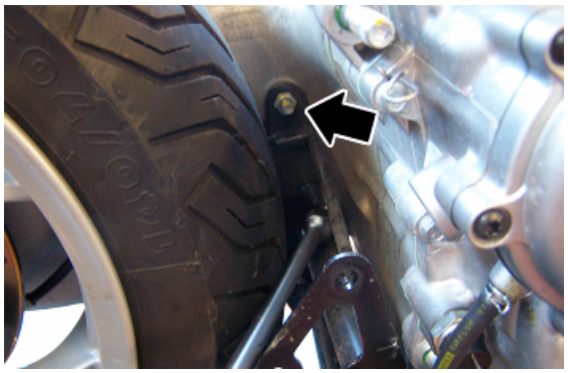
- Remove the exhaust end.
- Undo the two bolts fixing the centre stand support bracket to the silencer support bracket.

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.

Locking torques (N*m)

Centre stand bolt 31 - 39

INDEX OF TOPICS

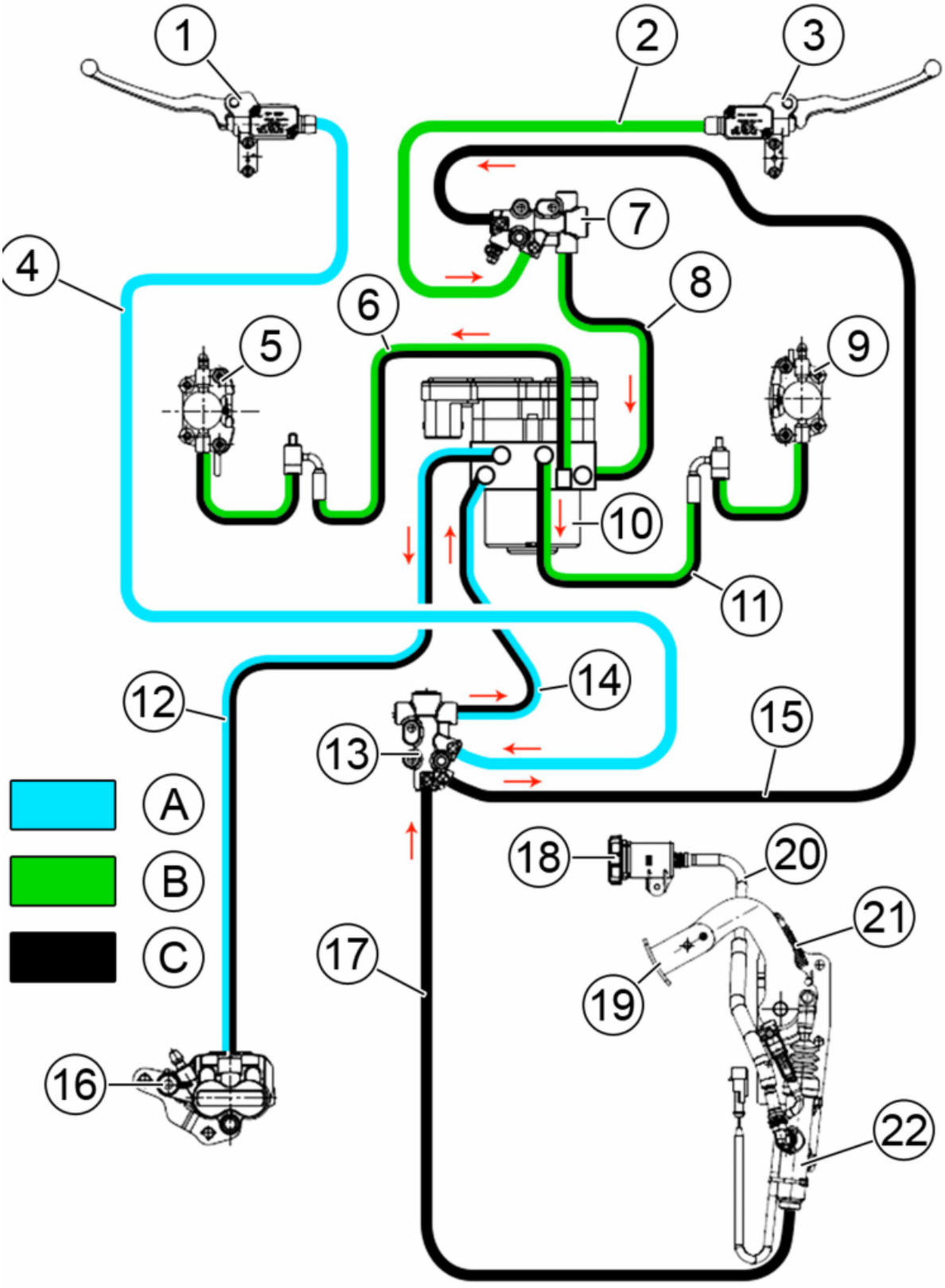
N.B.

THE UNITS OF MEASUREMENT CONTAINED IN THIS CHAPTER ARE EXPRESSED IN TERMS OF THE DECIMAL METRIC SYSTEM. TO REFER TO THE UNIT OF MEASUREMENT EXPRESSED IN TERMS OF THE ANGLO-SAXON SYSTEM, SEE THE «CHARACTERISTICS» CHAPTER.

This section is dedicated to the description of the brake system components.

CAUTION

THE FOLLOWING INSTRUCTIONS REFER TO THE VEHICLE VERSION EQUIPPED WITH ABS - ASR SYSTEM.



A = Rear brake circuit

B = Front brake circuit

C = Integral brake circuit

KEY

1. Rear brake pump ø 12.7 mm

2. Front brake pipes (front brake pump - front valve)

3. Front brake pump ø 14 mm

4. Rear brake pipes (rear brake pump - rear valve)

5. Front left brake calliper ø 30 mm

6. Front left brake calliper pipes (ABS modulator - wheel brake calliper)

7. Front valve

8. Front valve brake pipes (front valve - ABS modulator)

9. Front brake right calliper ø 30 mm

10. ABS Modulator

11. Front right brake calliper pipes (ABS modulator - wheel brake calliper)

12. Rear brake pipes (ABS modulator - wheel brake calliper)

13. Rear valve

14. Rear valve brake pipes (rear valve - ABS modulator)

15. Brake pipes (front valve - rear valve)

16. Rear brake calliper ø 22 mm

17. Brake pipes (integral brake pump - rear valve)

18. Integral brake fluid reservoir

19. Pedal fork

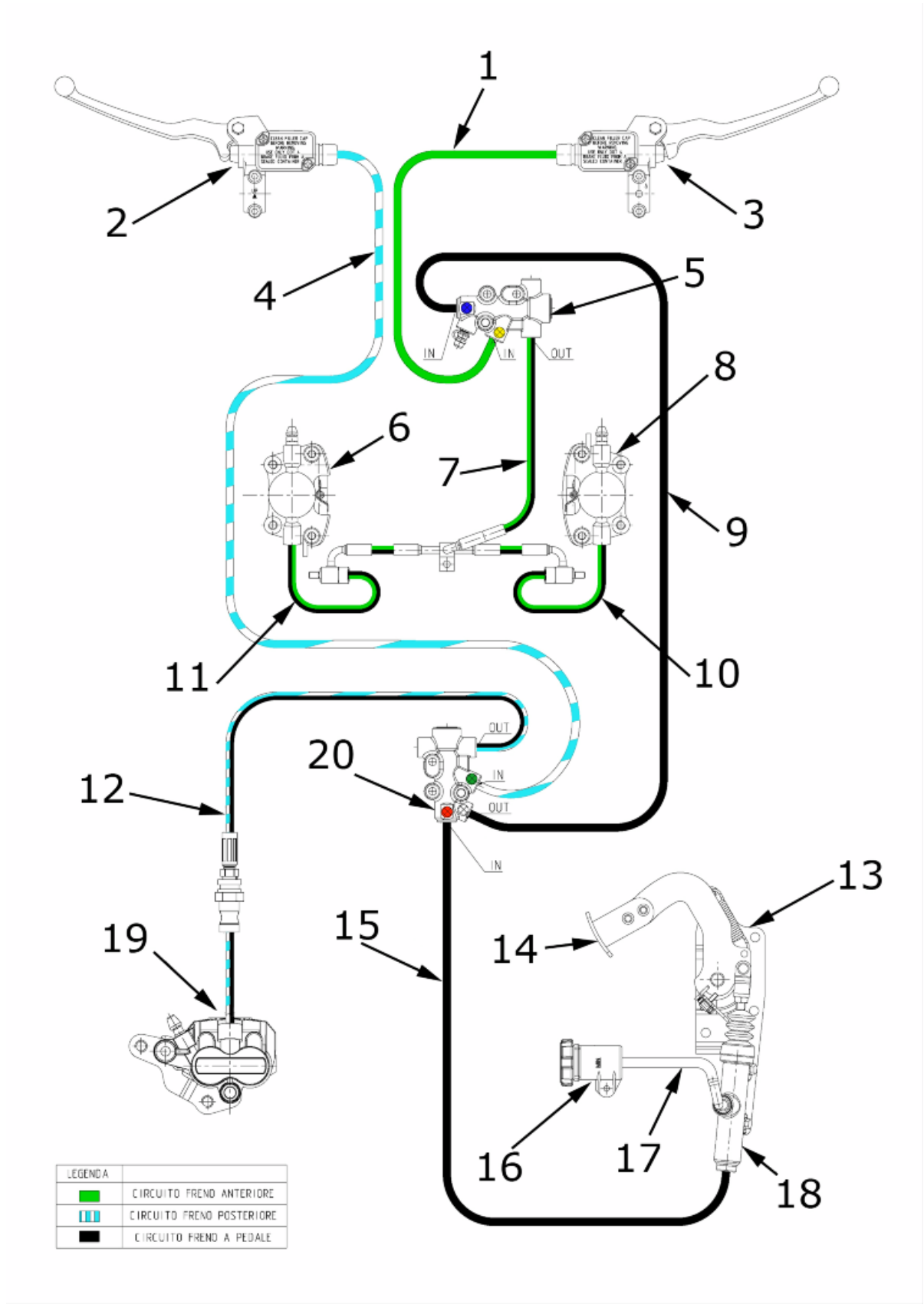
20. Integral brake fluid pipe fitting

21. Integral brake pump support bracket with pedal

22. Integral brake pump ø 15.87 mm

CAUTION

THE FOLLOWING INSTRUCTIONS REFER TO THE VEHICLE VERSION NOT EQUIPPED WITH ABS - ASR SYSTEM.



1. Front brake pipes
2. Rear brake pump ø 11 mm

3. Front brake pump ø 12 mm
4. Rear brake pipes (rear brake pump - rear valve)
5. Front valve
6. Front brake left calliper ø 30 mm
7. Front valve brake pipes (front valve - rigid pipes)
8. Front right brake calliper ø 30 mm
9. Brake pipes (front valve - rear valve)
10. Front brake right calliper pipes (fitting - wheel brake calliper)
11. Front brake left calliper pipes (fitting - wheel brake calliper)
12. Rear brake pipe on calliper side
13. Integral brake pump support bracket with pedal
14. Pedal fork
15. Brake pipes (pedal brake pump - rear valve)
16. Brake fluid reservoir
17. Brake fluid pipes fitting
18. Integral brake pump ø 15.87 mm
19. Rear brake calliper ø 22 mm
20. Rear valve ø 14 mm

Brake system fitting

CAUTION

THE FOLLOWING INSTRUCTIONS REFER TO THE VEHICLE VERSION EQUIPPED WITH ABS - ASR SYSTEM.

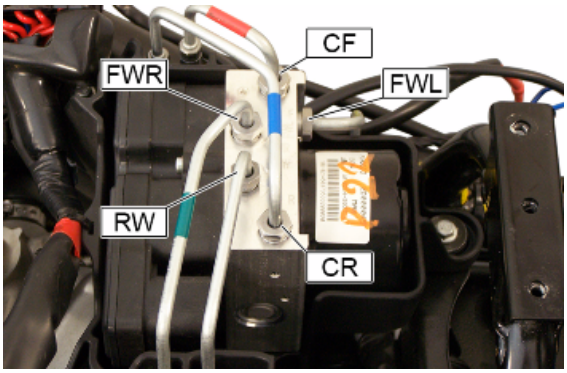
FWR = Front right brake calliper outlet

FWL = Front left brake calliper outlet

RW = Rear brake calliper outlet

CF = Front valve inlet

CR = Rear valve inlet



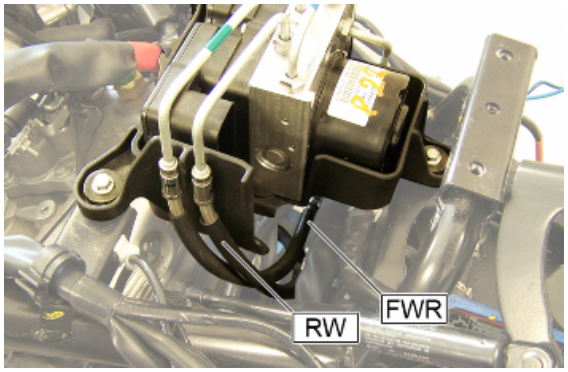
CF = ABS modulator pipes - front valve

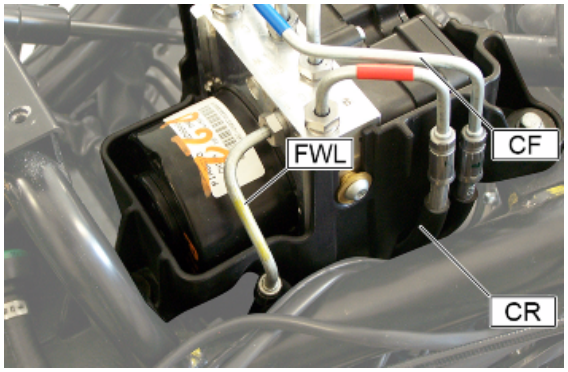
CR = ABS modulator pipes - rear valve

FWL = ABS modulator pipes - front left brake caliper

FWR = ABS modulator pipes - front right brake calliper

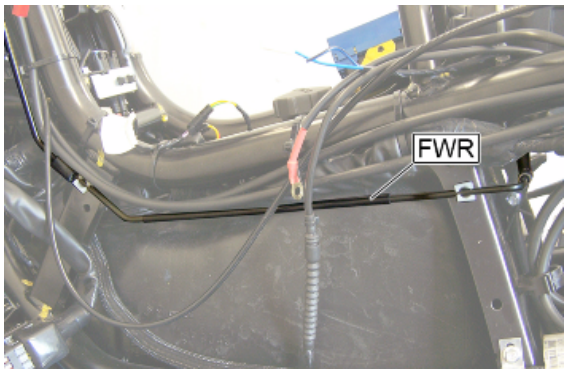
RW = ABS modulator pipes - rear brake calliper

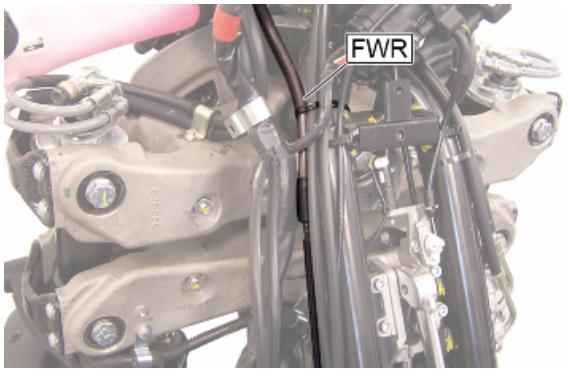


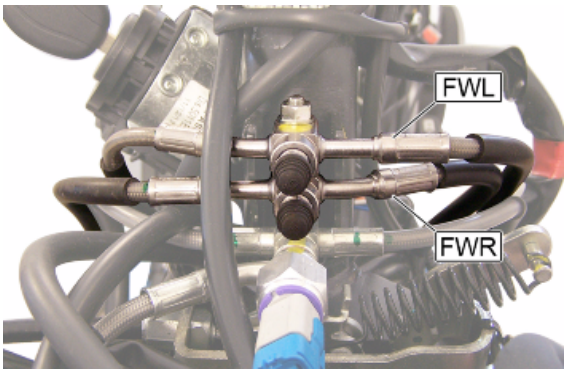


FWL = ABS modulator pipes - front left brake caliper

FWR = ABS modulator pipes - front right brake calliper







CF = ABS modulator pipes - front valve

CR = ABS modulator pipes - rear valve

FWL = ABS modulator pipes - front left brake caliper

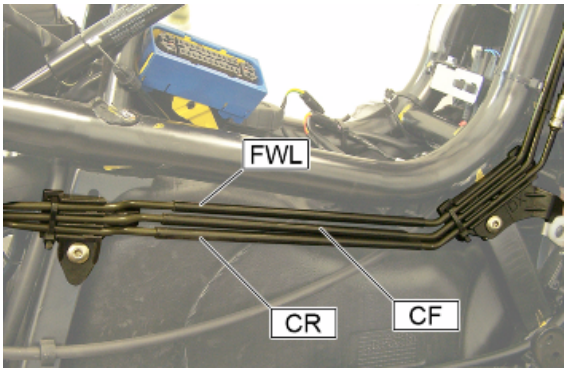
FWR = ABS modulator pipes - front right brake calliper

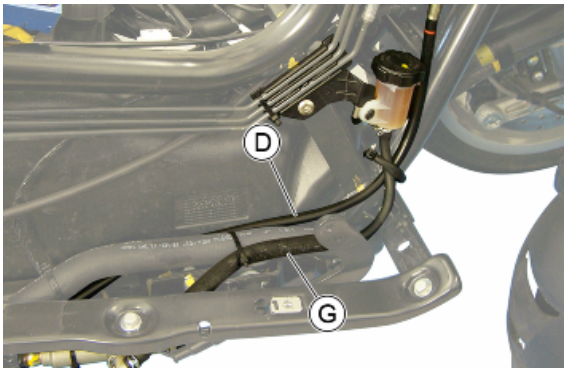
A = Left brake pump pipes

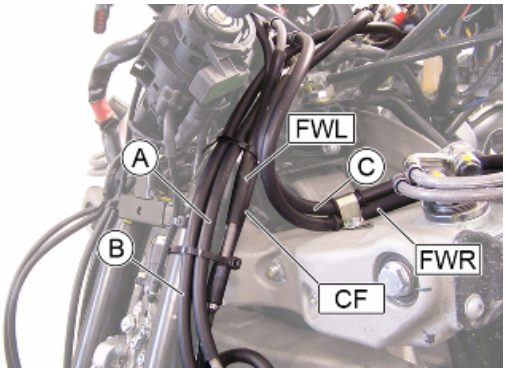
C = Right suspension block pipes

D = Integral brake pump pipes

G = Integral brake tank pipes







CF = ABS modulator pipes - front valve

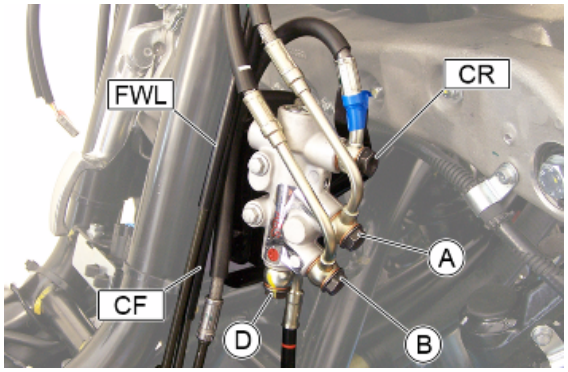
CR = ABS modulator pipes - rear valve

FWL = ABS modulator pipes - front left brake calliper

A = Left brake pump pipes

B = Front valve pipes - rear valve

D = Integral brake pump pipes



CF = ABS modulator pipes - front valve

FWL = ABS modulator pipes - front left brake calliper

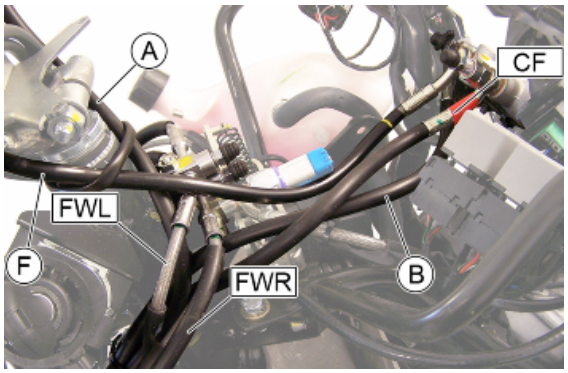
FWR = ABS modulator pipes - front right brake calliper

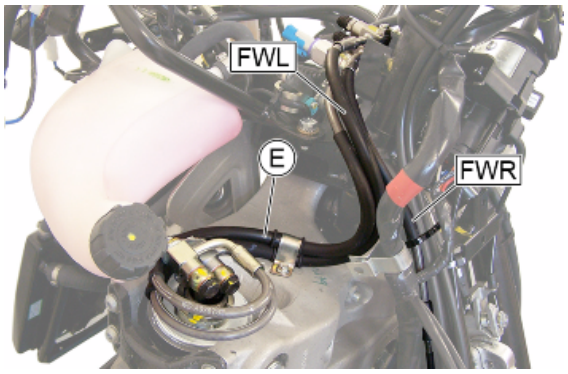
A = Left brake pump pipes

B = Front valve pipes - rear valve

E = Left suspension block pipes

F = Right brake pump pipes

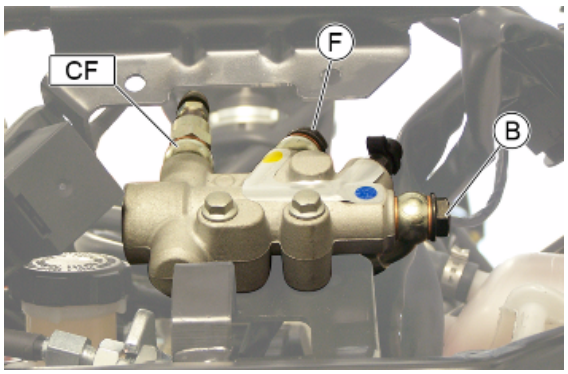




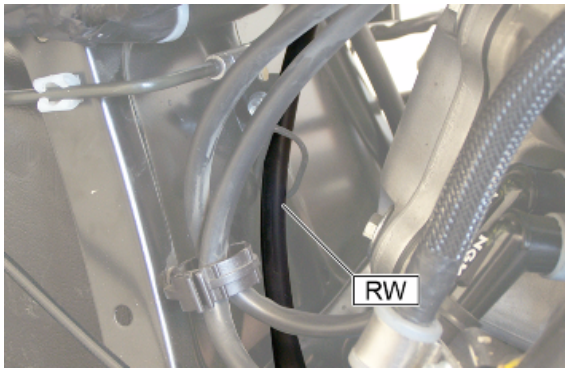
CF = ABS modulator pipes - front valve

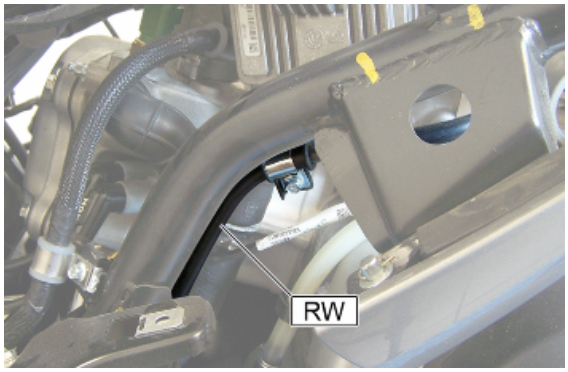
B = Front valve pipes - rear valve

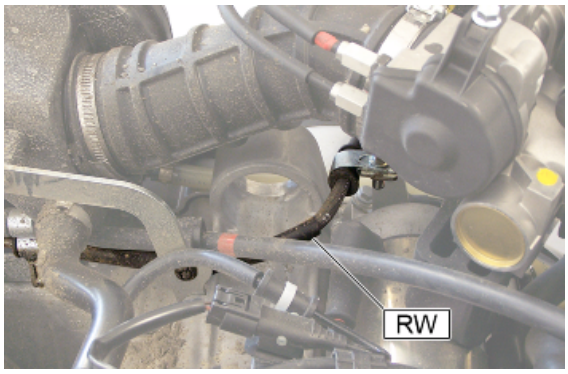
F = Right brake pump pipes



RW = ABS modulator pipes - rear brake calliper



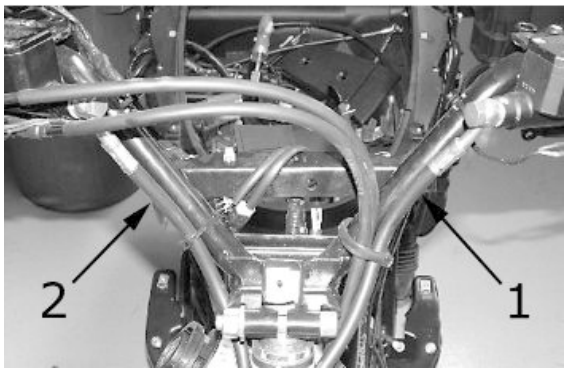


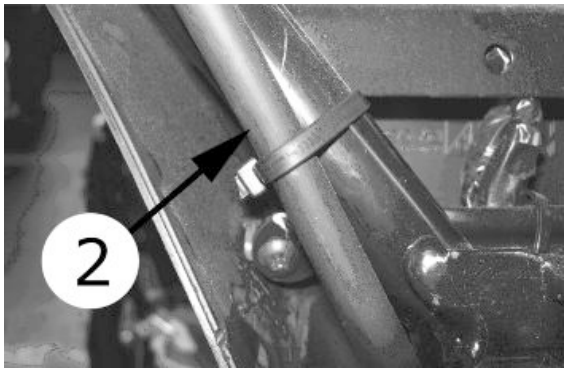


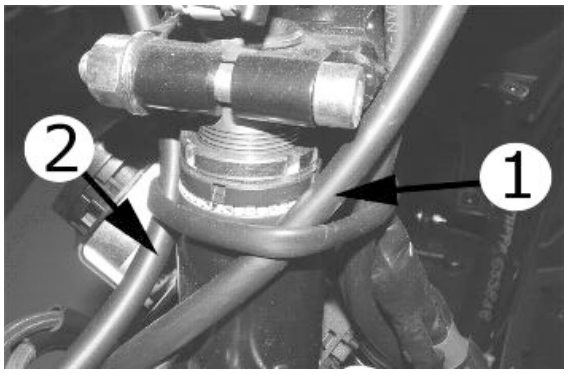
CAUTION

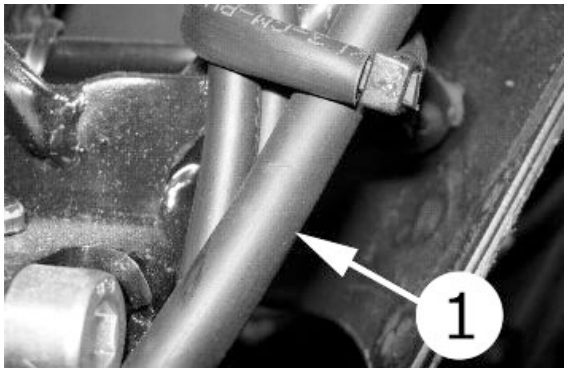
THE FOLLOWING INSTRUCTIONS REFER TO THE VEHICLE VERSION NOT EQUIPPED WITH ABS - ASR SYSTEM.

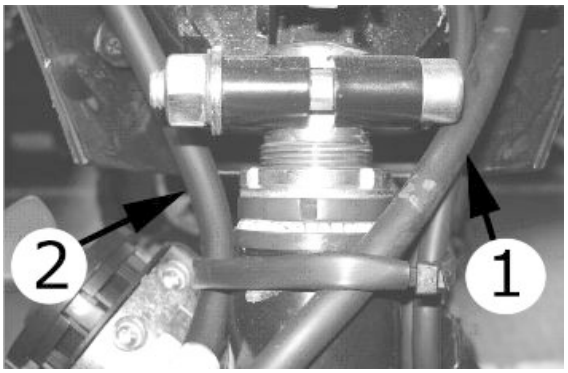
1. **LEFT PUMP PIPES TO REAR VALVE**
2. **RIGHT PUMP PIPES TO FRONT VALVE**



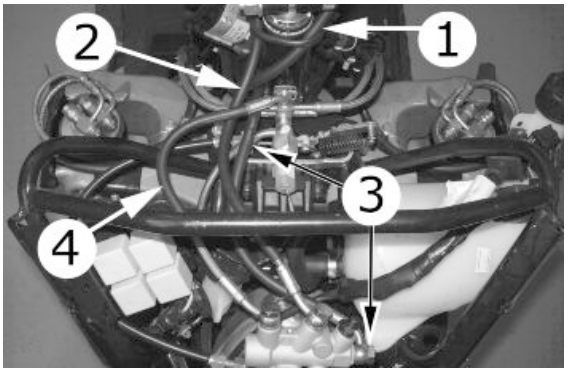


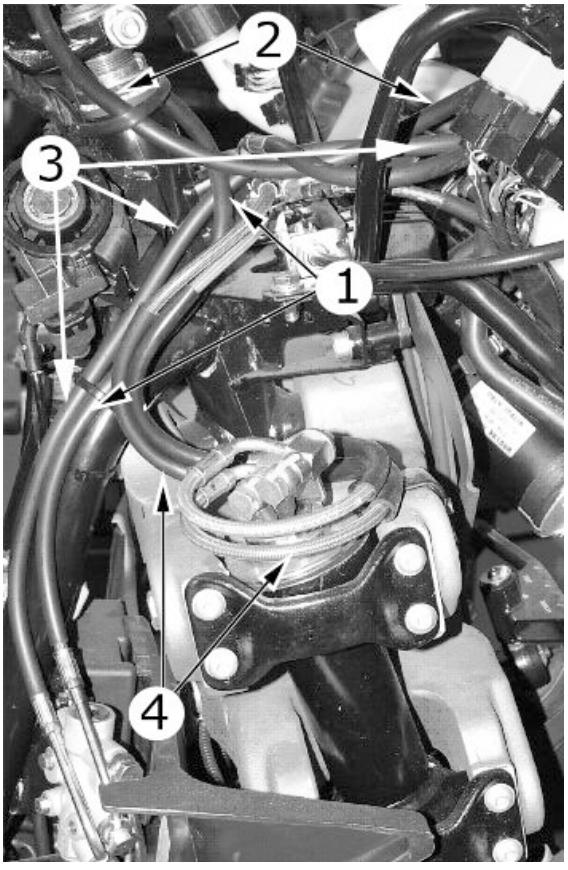




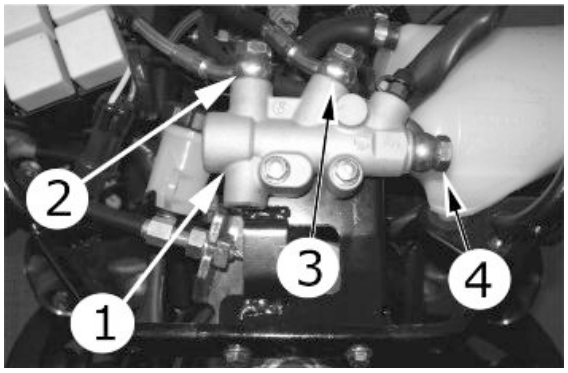


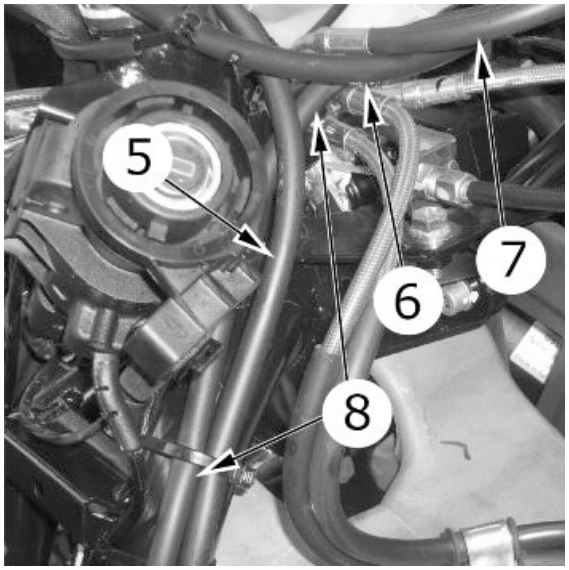
1. **LEFT PUMP PIPES TO REAR VALVE**
2. **RIGHT PUMP PIPES TO FRONT VALVE**
3. **FRONT VALVE PIPES TO REAR VALVE**
4. **FRONT BRAKE PIPES**

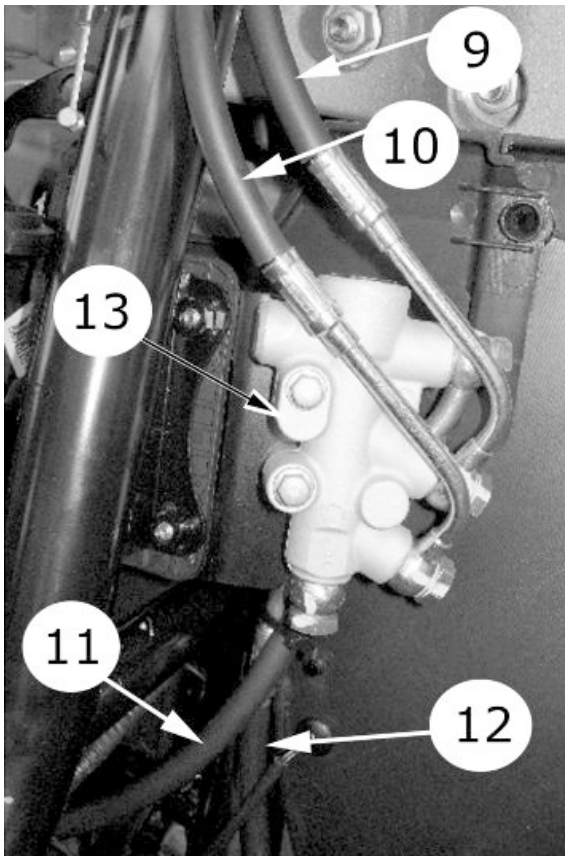




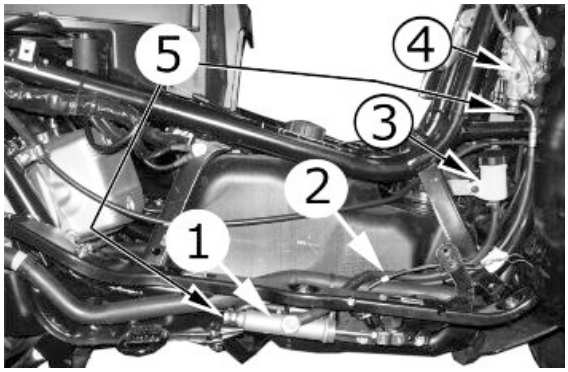
1. **FRONT PRESSURE ADJUSTMENT VALVE**
2. **FRONT BRAKE PIPES**
3. **RIGHT PUMP PIPES TO FRONT VALVE**
4. **FRONT VALVE PIPES TO REAR VALVE**
5. **LEFT PUMP PIPES TO REAR VALVE**
6. **RIGHT PUMP PIPES TO FRONT VALVE**
7. **FRONT BRAKE PIPES**
8. **FRONT VALVE PIPES TO REAR VALVE**
9. **LEFT PUMP PIPES TO REAR VALVE**
10. **FRONT VALVE PIPES TO REAR VALVE**
11. **REAR BRAKE PIPES**
12. **PEDAL PUMP PIPES TO REAR VALVE**
13. **REAR VALVE**



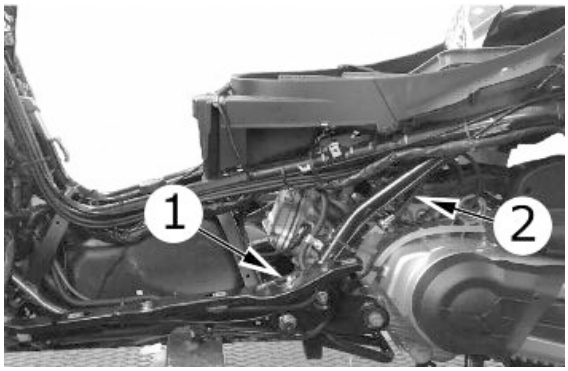


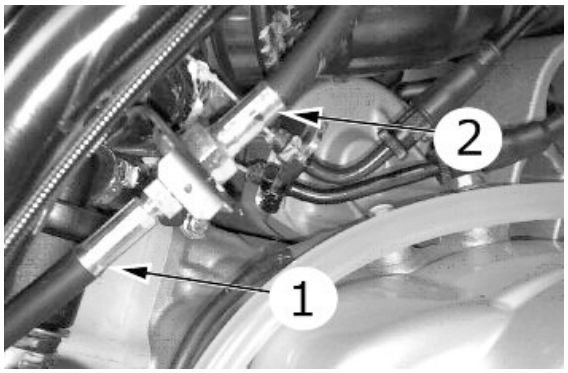


1. **PEDAL BRAKE PUMP**
2. **BRAKE FLUID RESERVOIR TO PEDAL BRAKE PUMP FITTING PIPES**
3. **BRAKE FLUID RESERVOIR**
4. **REAR VALVE**
5. **PEDAL PUMP - REAR VALVE PIPES**



1. **REAR BRAKE PIPES - REAR VALVE**
2. **REAR BRAKE PIPES**

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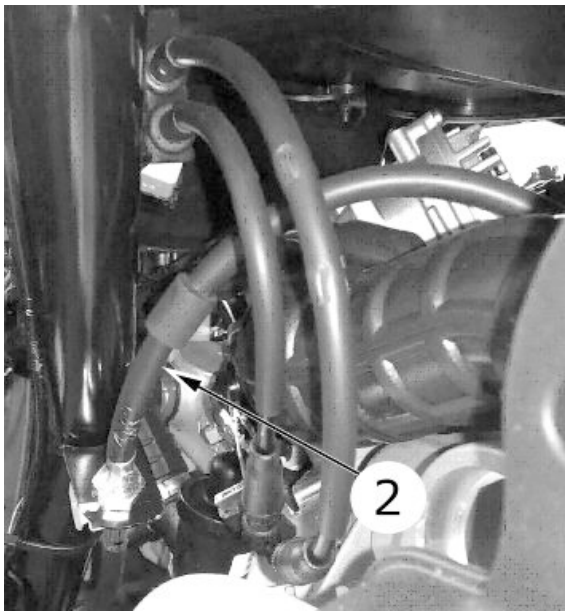
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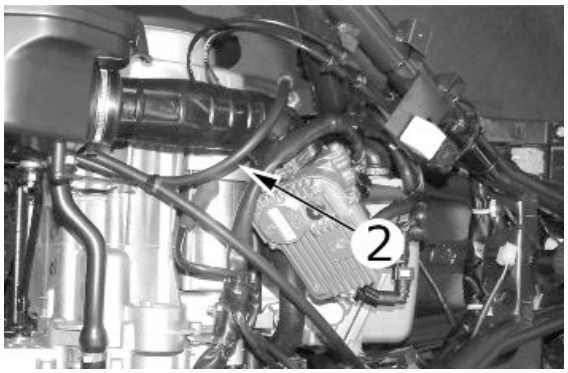
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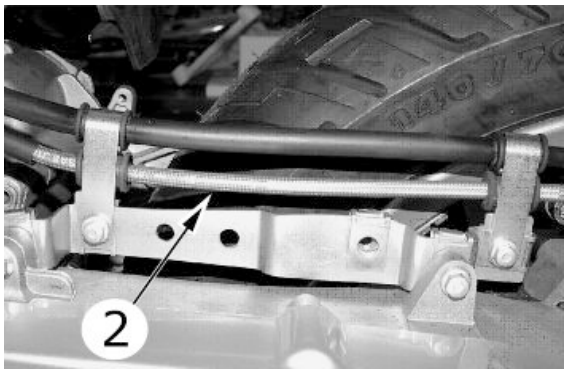
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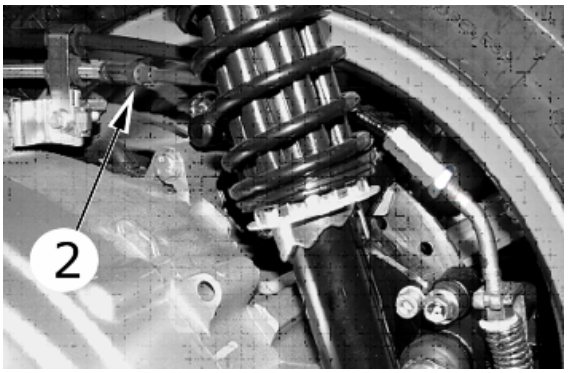
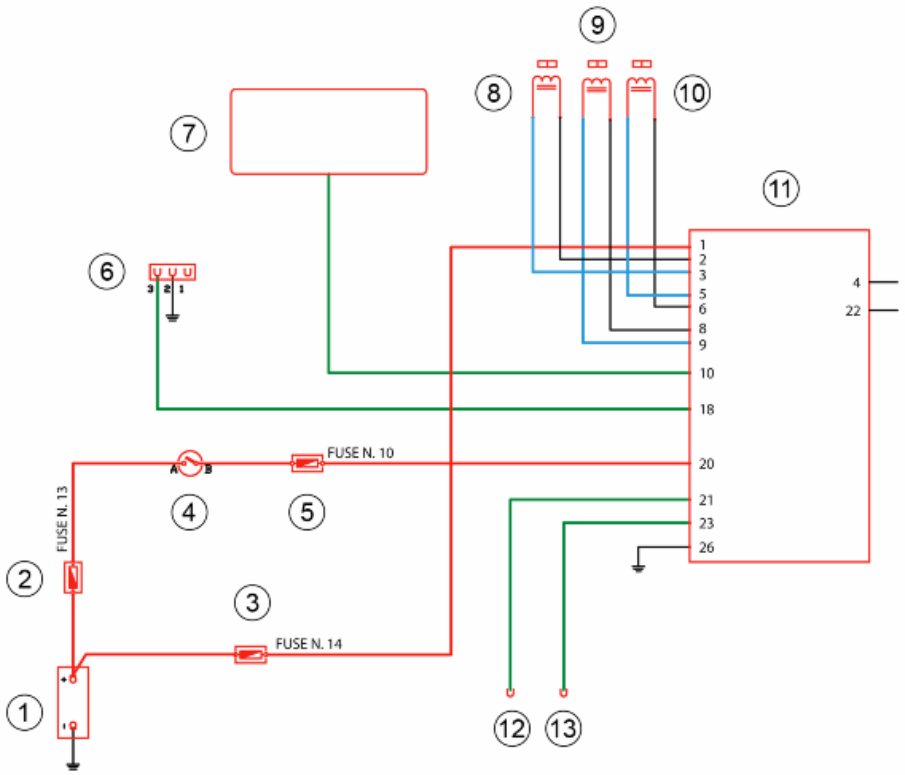


ABS

CAUTION

THE FOLLOWING INSTRUCTIONS REFER TO THE VEHICLE VERSION EQUIPPED WITH ABS - ASR SYSTEM.

Operating diagram



KEY

1. Battery

2. Fuse No. 13

3. Fuse No. 14

4. Ignition switch

5. Fuse No. 10

6. Diagnostic socket

7. Instrument panel

8. Rear wheel ABS sensor

9. Front left wheel ABS sensor

10. Front right wheel ABS sensor

11. ABS control unit

12. CAN L line

13. CAN H line

OPERATION OF THE ABS

General considerations

- The front circuit is the same as the rear one.
- The ABS intake valve is normally open and is closed only when the system intervenes to prevent locking.
- The exhaust valve is normally closed and is only opened when the system intervenes to prevent locking.
- With the system in stand-by mode, the ABS module controls, with the sensors, the wheel speed and acceleration instant by instant to assess any slippage of the wheels.
- While in stand-by, the system does not intervene in any way on the braking of the rider, the braking system is identical to the one without ABS.

ABS cycle phases

A - Pressure reduction: if a wheel lock risk is detected, the brake pressure is reduced. The ABS module closes the inlet valve, opens the exhaust valve and the recovery pump is activated. A part of the brake fluid is accumulated in the low pressure accumulator. This pressure reduction is made gradually so the wheel spin is reported in the optimal values.

B - Pressure restoration: once the wheel spin returns in a stable zone, the fluid pressure in the brake circuit is reset, because the brake fluid is pumped in the circuit again with the combined action of the recirculation pump and the brake pump. In this case the inlet solenoid valve is open, while the exhaust solenoid valve is closed and the hydraulic pump active.

Guide to diagnosis

Every time switching the key to «**ON**», at least one current or memorised ABS system error is identified immediately (whose diagnostic requires passing 5 km/h):

- The ABS warning light is on permanently and the ABS system is deactivated. The system operates perfectly just as any other braking system without ABS.

Every time switching the key **ON**, if no current or memorised system error is identified, the ABS warning light flashes:. Then:

- When exceeding 5 km/h, if no relevant error is identified, the ABS warning light turns off.
- If at least one failure is identified, the ABS warning light is on permanently and the ABS system is deactivated. The system operates perfectly just as any other braking system without ABS.

The detection of malfunctions may require more or less time depending on the type of fault. Error detection logic foresees that for the errors to be diagnosed one or more conditions must persist within a given time. If during this given time one of the conditions is missing but then it comes back, the timer is reset and the system is no longer able to diagnose the error. The ABS system continues to be inactive and the relevant warning light to flash.

When the ABS warning light turns on steady:

1. Connect the diagnostic tool.

- If the diagnostic tool is not communicating with the ABS control unit, check:

- If there is ground on PIN 26 of the ABS control unit
- if there is battery voltage on PIN 1
- if there is battery voltage on PIN 20 with key «ON»

2. Check if there are errors.

A. If there are, refer to the table of errors;

B. If there are no errors, proceed with the activation of the ABS warning light

- If the ABS warning light is active, contact the technical service;

- If the ABS warning light is not active, check:

- Connectors
- Continuity of the cables
- Fault of the ABS control unit
- Fault of the instrument panel

ERRORS DISPLAY TABLE

Error code	Description	Troubleshooting
5D90	Front left wheel speed sensor - electric fault	Electrical fault in sensor or cable harness.
5D91	Front left wheel speed sensor - discontinuity of the signal	Faulty sensor or signal interference.
5D92	Front left wheel speed sensor - the signal declines frequently	Possible tone wheel fault due to deformations or dirt; possible alterations on the wheel bearing surface. In very rare cases, abnormal tone wheel vibrations.
5D93	Front left wheel speed sensor - no signal or not plausible	Faulty sensor, missing sensor or tone wheel, excessive distance between the sensor and the tone wheel or tone wheel with wrong number of teeth.
5D94	Front left wheel speed sensor - no accel. after pressure reduction.	Faulty sensor, missing sensor or tone wheel or excessive distance of the sensor regarding the tone wheel.
5D95	Front left wheel speed sensor - identified speed excessive	Faulty sensor, tone wheel defect or with wrong number of teeth or wrong tyre size.
5DA0	Rear wheel speed sensor - electric fault	Electrical fault in sensor or cable harness.
5DA1	Rear wheel speed sensor - discontinuity of the signal	Faulty sensor or signal interference.
5DA2	Rear wheel speed sensor - the signal declines frequently	Possible tone wheel fault due to deformations or dirt; possible alterations on the wheel bearing surface. In very rare cases, abnormal tone wheel vibrations.
5DA3	Rear wheel speed sensor - no signal or not plausible	Faulty sensor, missing sensor or tone wheel, excessive distance between the sensor and the tone wheel or tone wheel with wrong number of teeth.
5DA4	Rear wheel speed sensor - no accel. after pressure reduction.	Faulty sensor, missing sensor or tone wheel or excessive distance of the sensor regarding the tone wheel.

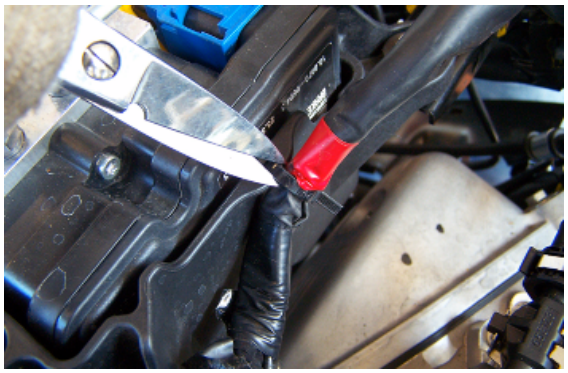
Error code	Description	Troubleshooting
5DA5	Rear wheel speed sensor - identified speed excessive	Faulty sensor, tone wheel defect or with wrong number of teeth or wrong tyre size.
5DC0	Front right wheel speed sensor - electric fault	Electrical fault in sensor or cable harness.
5DC1	Front right wheel speed sensor - discontinuity of the signal	Faulty sensor or signal interference.
5DC2	Front right wheel speed sensor - the signal declines frequently	Possible tone wheel fault due to deformations or dirt; possible alterations on the wheel bearing surface. In very rare cases, abnormal tone wheel vibrations.
5DC3	Front right wheel speed sensor - no signal or not plausible	Faulty sensor, missing sensor or tone wheel, excessive distance between the sensor and the tone wheel or tone wheel with wrong number of teeth.
5DC4	Front right wheel speed sensor - no accel. after pressure reduction.	Faulty sensor, missing sensor or tone wheel or excessive distance of the sensor regarding the tone wheel.
5DC5	Front right wheel speed sensor - identified speed excessive	Faulty sensor, tone wheel defect or with wrong number of teeth or wrong tyre size.
5DD3	Control unit failure	Possible control unit fault.
5DF0	ABS pump defect	Possible control unit fault.
5DF1	ABS pump defect	Possible control unit fault.
5DF2	Control unit failure	Possible control unit fault.
5DF3	Low electrical voltage - long period detection	Too low voltage detected for 30 seconds to PIN 1 of the ABS control unit.
5DF4	Low electrical voltage	Excessively low voltage detected to PIN 1 of the ABS control unit.
5DF5	Hardware inside error	Possible control unit fault.
5DF7	High electrical voltage	Excessive voltage detected to PIN 1 of the ABS control unit.
5E59	Code error	The control unit is configured (with the connections of PIN 4 and 22) for a different vehicle than the one on which it is mounted.

Modulator

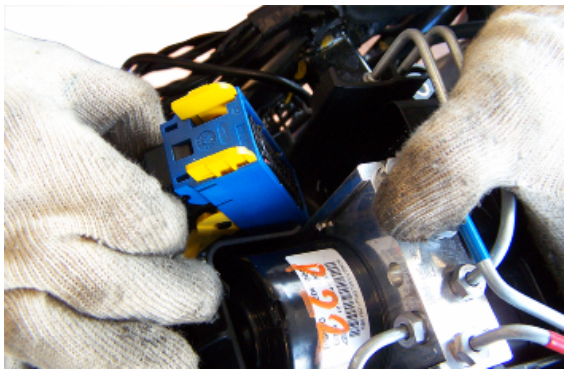
MODULATOR REMOVAL

- Remove the helmet compartment.

- Cut the clamp that fastens the ABS wiring harness.



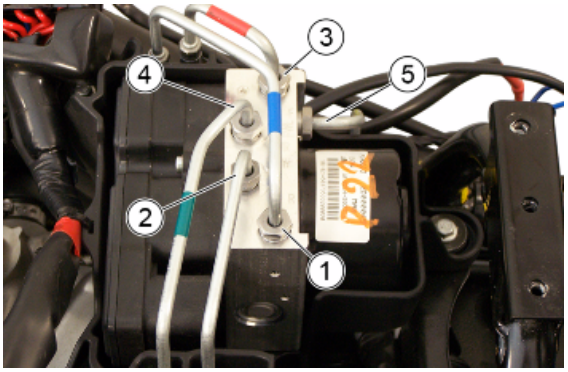
- Disconnect the ABS control unit, by pressing the safety stop.



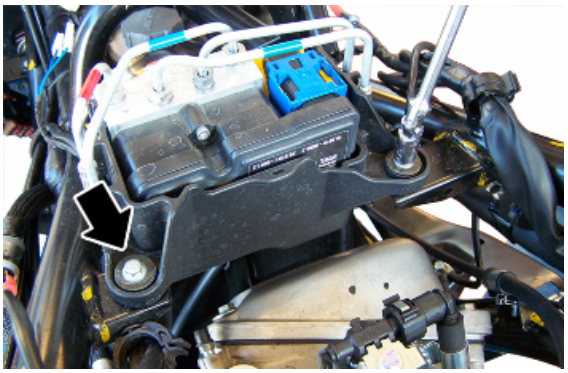
- By unscrewing the relative nuts, remove and plug the brake oil pipes in the numbered sequence indicated in the picture.

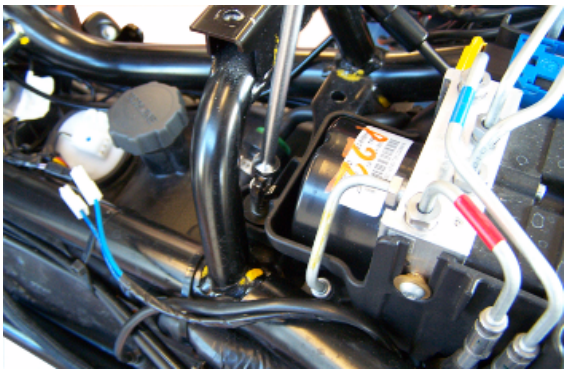
N.B.

PAY ATTENTION TO THE LOSS OF BRAKE FLUID DURING THE REMOVAL OF THE PIPING FROM THE MODULATOR. USE A SMALL CONTAINER AND A CLOTH.

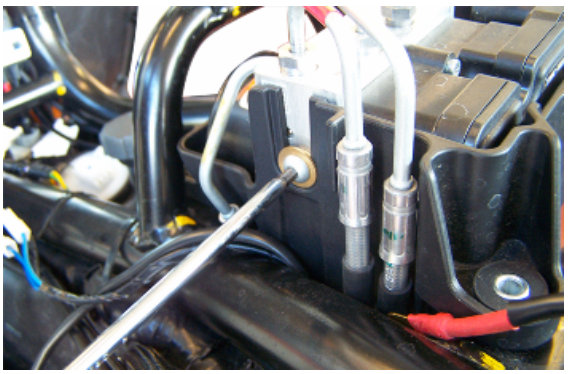


- Remove the three fixing bolts of the ABS modulator support.





- Remove the lateral screw fixing the ABS modulator to the support.



- Lift the ABS modulator support to unscrew the two lower fixing screws.
- Remove the ABS modulator.

MODULATOR INSTALLATION

To install the abs modulator, repeat the operations described in the removal in reverse order, paying close attention when inserting the piping.

Then perform the system bleed, in order to reset the correct operation of the braking system.

Locking torques (N*m)

Pipe fittings - ABS control unit 13 - 18 Screw fixing ABS control unit to support 10 to 12 ABS control unit supporting bracket fixing screw 8 ÷ 10

ASR

CAUTION

THE FOLLOWING INSTRUCTIONS REFER TO THE VEHICLE VERSION EQUIPPED WITH ABS - ASR SYSTEM.

System ASR

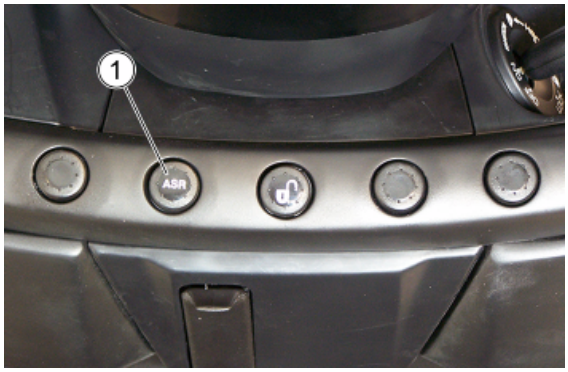
ASR SYSTEM

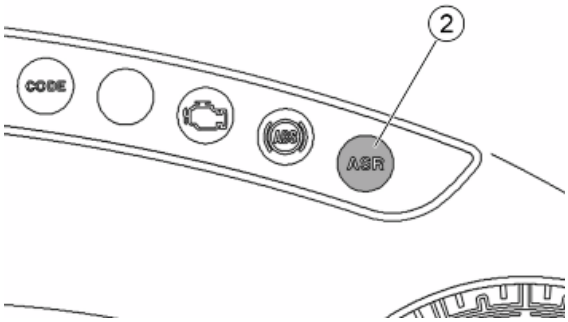
The ASR system is a device to help riding that helps the rider during acceleration manoeuvres, especially on slippery surfaces or in conditions that can cause sudden slippage of the rear wheel. The ASR in these situations automatically intervenes by reducing engine output within the limit imposed by 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 CONTROL UNIT PERFORM THE PROCEDURE BELOW.

- SWITCH «1»: on / off.
- WARNING LIGHT «2»: operating indication 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 up and running (conditions of low grip and intervention to reduce engine power); we recommend the utmost caution because the grip limit has been exceeded; restore the vehicle 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 replace the system as soon as possible.
- If the deactivation was NOT voluntary, there is an ASR failure: in this case you must contact an Authorised Service Centre for the diagnosis and the reactivation of the system.

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.
IN CASE OF ABSENCE OF FLASHING AT START-UP, THE SYSTEM MAY NOT WORKING, PLEASE CONTACT AN AUTHORISED SERVICE CENTRE.

WARNING

THE ASR SYSTEM IS ACTIVATED AT EVERY «ON» POSITIONING OF THE IGNITION SWITCH.
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; AT THE NEXT KEY ON THE ASR SYSTEM IS ENABLED AUTOMATICALLY.

CAUTION

IT IS EMPHASISED THAT THE RIDING AUXILIARY SYSTEM CAN NOT 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), THE ASR SYSTEM DOES NOT WORK.
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 THERE MAY OCCUR BRIEF ACTIVATION OF THE ASR SYSTEM. THIS OCCURS UNDER NORMAL OPERATING CONDITIONS OF THE VEHICLE.

N.B.

THE DEVICE PREVENTS IMPRESSING ON THE REAR HIGH SPEED ROTATION WHEEL WITH THE VEHICLE ON THE CENTRE STAND. IT IS RECOMMENDED NOT TO INSIST WITH THE THROTTLE GRIP IN THIS PARTICULAR CONDITION.

CAUTION

A POOR STATE OF MAINTENANCE OF THE TYRES CAN RESULT IN ABNORMAL OPERATION OF THE ASR SYSTEM.
IN CASE OF REPEATED INTERVENTIONS OF THE ASR, EVEN ON ROAD SURFACES WITH GOOD GRIP OR SMALL THROTTLE OPENINGS, IT IS NECESSARY TO CHECK FOR WEAR AND/OR THE STATE OF INFLATION OF TYRES FIRST. IF THE PROBLEM PERSISTS, CONTACT AN AUTHORISED SERVICE CENTRE.

CAUTION

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

ASR SYSTEM CALIBRATION PROCEDURE.

In order to maintain the effectiveness of the ASR system following the replacement of one or more tyres a calibration procedure of the system must be performed as follows on a straight flat stretch of road.

• It is necessary that the diagnostic phase of the ASR systems and ABS is complete: for this purpose, after switching to «**ON**», ride a short distance above 5 km/h and wait for the flashing of the two warning lights to stop.

• Allow the engine to idle for at least 5 seconds.

• Pull the brake lever and press the ASR on/off button «**1**» simultaneously for at least 3 seconds. The activation process will be confirmed by the ASR warning light «**2**» turning on with slow flashing.

• Accelerate to a constant speed of 30 to 40 km/h and maintain it for at least to 8 seconds. The continuity of the vehicle speed in the correct field to complete the procedure will be confirmed by a very fast flashing of the ASR warning light «**2**».

• The end of the procedure will be indicated by the steady lighting ASR warning light «**2**». The ASR system is not active.

• Once the procedure is complete it is necessary to switch to «**OFF**» and wait for at least 60 seconds before being able to switch again to «**ON**».

• In case of failure to complete the procedure within 5 minutes the ASR warning light «**2**» will stay on steady and the ASR will remain off until switching to «**OFF**».

• To switch again to «**ON**» it is necessary to reactivate the ASR. It is however necessary to repeat the process until it succeeds.

CAUTION

IF NECESSARY, CONTACT AN AUTHORISED SERVICE CENTRE.

Rear brake calliper

Removal

- Remove the rear wheel.
- Undo the screws fixing the filter box to the crank-case so that the calliper fixings can be inserted.
- Undo the two fixing screws of the calliper to re-move it.

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 EXAM-INED.

- For an easier operation, previously remove the calliper support plate by acting on the safety locks and unscrewing the two fixing bolts as indicated in the picture.

Refitting

To fit the rear brake calliper, follow the removal steps but in reverse order; be careful to tighten the screws to the prescribed torque.

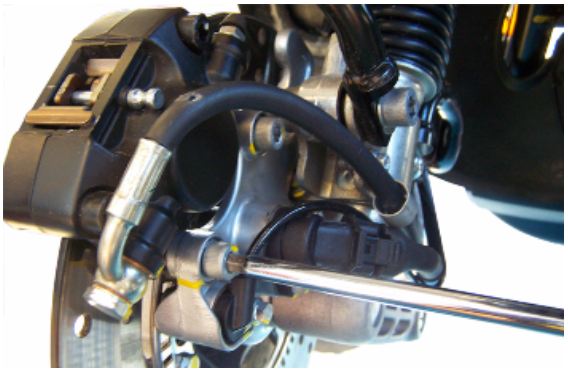
Locking torques (N*m)

Rear brake calliper fixing screws 41.5 to 51.5 Calliper support plate fixing screws xxx to xxx

Front brake calliper

Removal

- The operations described refer to only one caliper but apply to both.
- Remove the wheel.
- Undo the two fixing screws to the plate and remove the calliper.



Refitting

- To fit the front brake callipers, follow the removal steps but in reverse order; be careful to tighten the screws to the prescribed torque.

Locking torques (N*m)

Screw tightening calliper to support 20 - 25

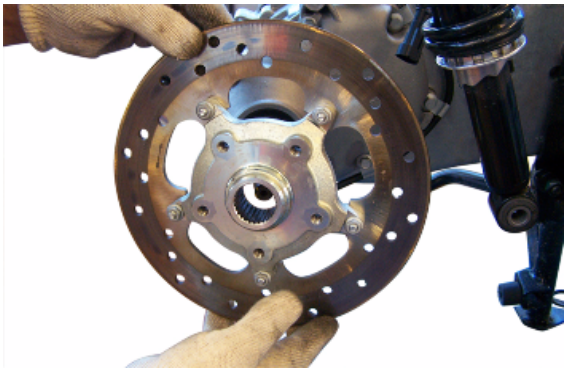
Rear brake disc

Removal

- Remove the rear wheel.
- Loosen the nuts fixing the safety washers.
- Undo the two screws fixing the plate supporting the calliper to the frame.

- Remove the calliper supporting clamp.

- Remove the brake disc



Refitting

- To fit the rear brake disc, follow the removal steps but in reverse order; be careful to tighten the screws to the prescribed torque using threadlock.

Recommended products

Loctite 243 Medium strength threadlock

Medium Loctite 243 threadlock

Locking torques (N*m)

Brake disc screws 8 ÷ 10

Disc Inspection

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

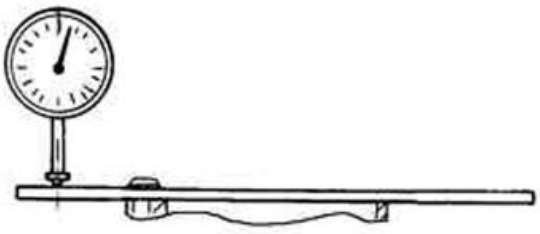
New rear disc thickness

5 mm

Disc thickness at wear limit (rear)

3.5 mm

- Remove the wheel and check using the appropriate tools that the axial run-out of the brake surface is within the prescribed limits.
- If this is not the case, replace the disc and repeat the test.



WHEN INSTALLING, THOROUGHLY CLEAN THE DISC AND ITS SEAT ON THE HUB.

Characteristic

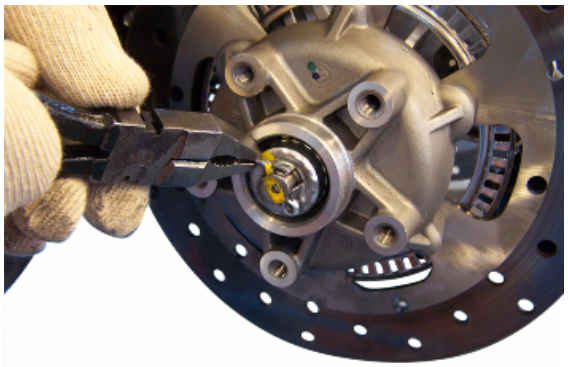
Max. axial run-out

0.1 mm

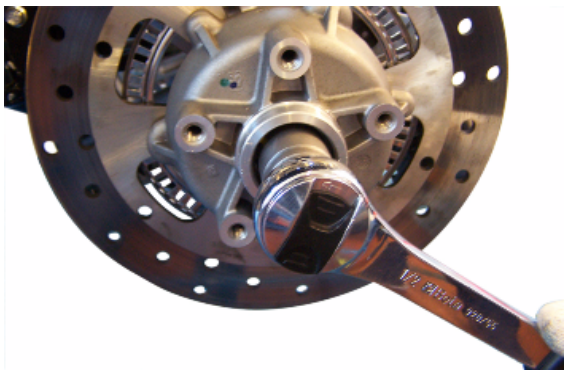
Front brake disc

Removal

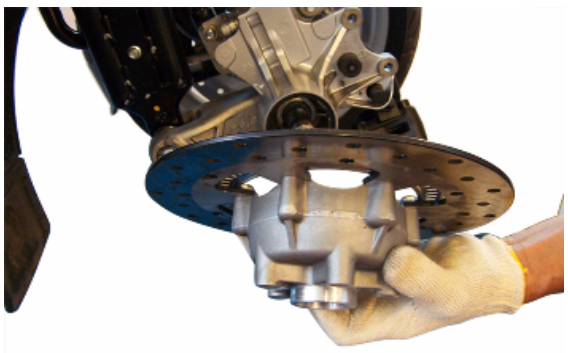
- The operations described refer to only one disc but apply to both.
- Remove the wheel.
- Remove the brake calliper.
- Remove the cotter pin and remove the cap.



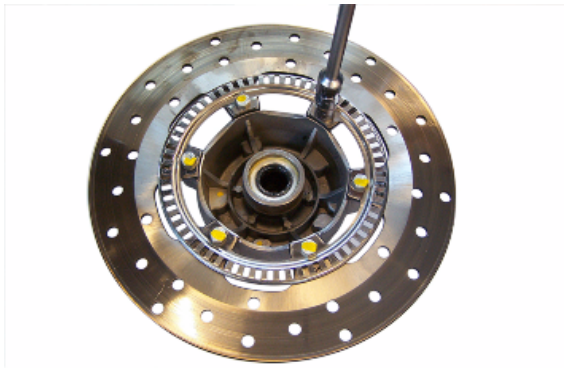
- Unscrew the fixing nut.



- Remove the wheel hub.



- Unscrew the six bolts securing the disc to the wheel hub.
- Remove the disc.



Refitting

- To fit the front brake disc, follow the removal steps but in reverse order; be careful to tighten the screws to the prescribed torque using threadlock.

Recommended products

Loctite 243 Medium strength threadlock

Medium Loctite 243 threadlock

Locking torques (N*m)

Brake disc screws 8 ÷ 10

Disc Inspection

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

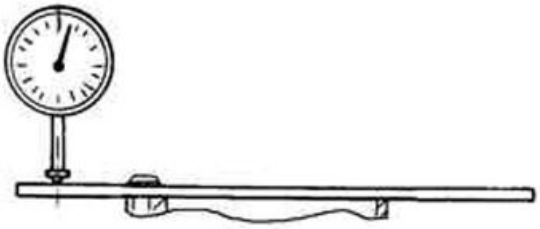
Thickness of a new front disc

4.0 mm

Disc thickness at wear limit (front)

3.5 mm

- Remove the wheel and check using the appropriate tools that the axial run-out of the brake surface is within the prescribed limits.
- If this is not the case, replace the disc and repeat the test.



WHEN INSTALLING, THOROUGHLY CLEAN THE DISC AND ITS SEAT ON THE HUB.

Characteristic

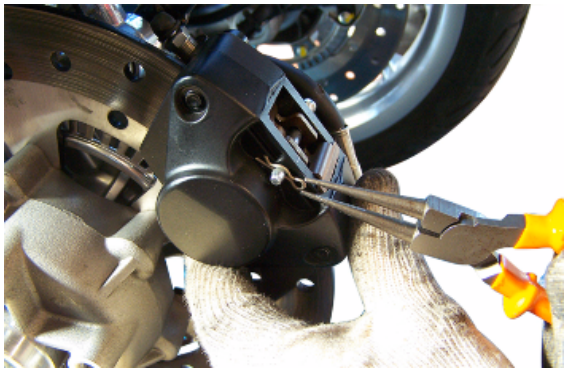
Max. axial run-out

0.1 mm

Front brake pads

Removal

- Remove the brake calliper.
- Remove the Benzing snap ring of the pad pin.



- Slide off the pin paying attention to collect the retaining spring of the pads.

- Remove the pads.

Characteristic

Minimum value

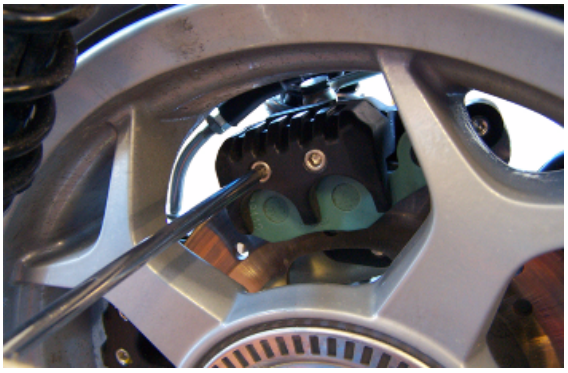
1.5 mm

Refitting

- Follow the removal steps but in reverse order; check that the Benzing snap ring of the pads is in good conditions.

Rear brake pads

Removal



Proceed as follows:

- Remove the rear brake calliper.
- Remove the two pins holding the brake pads.
- Remove the pads, paying attention to the pad retaining spring.
- Check the thickness of the pads.

If the thickness is less than the minimum value, replace the pads with new pads.

Characteristic

Minimum value

1.5 mm

Refitting

- To fit the rear brake pads, follow the removal steps but in reverse order; be careful to tighten the screws to the prescribed torque.

Locking torques (N*m)

Screws tightening the pad fixing pin 20 ÷ 25 Nm

Fill

Rear - combined

For the procedure in question see «**Various documents**» section.

Front

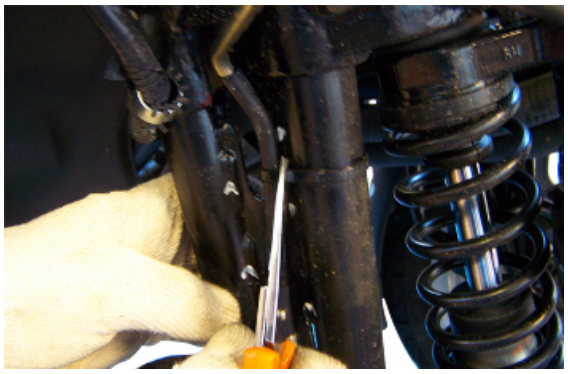
For the procedure in question see «**Various documents**» section.

Brake pipes

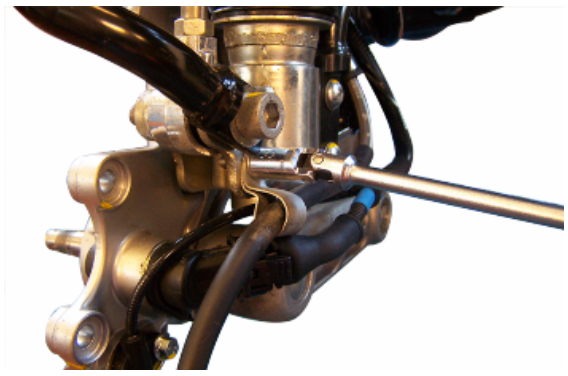
FRONT BRAKE CALLIPER PIPES REMOVAL

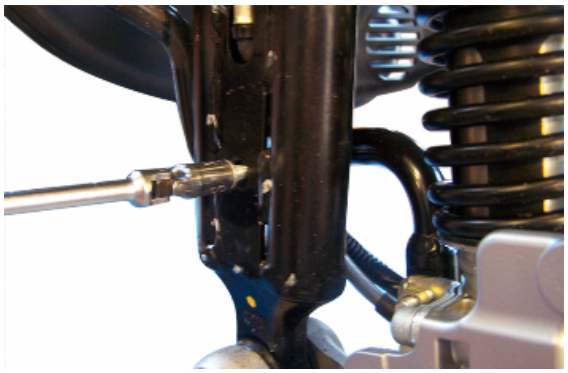
- The operations described refer to only one calliper but apply to both.
- Disconnect the brake pipes from the calliper and drain the brake fluid.
- Remove the brake oil tube fitting from the rigid pipe inside the front suspension arm and loosen the hydraulic joint fixing nut of the suspension locking to release the brake pipes.

- Cut the tie.



- Unscrew the two fixing bolts shown in the picture to release the brake pipes and slide it off the fork.





Parking brake

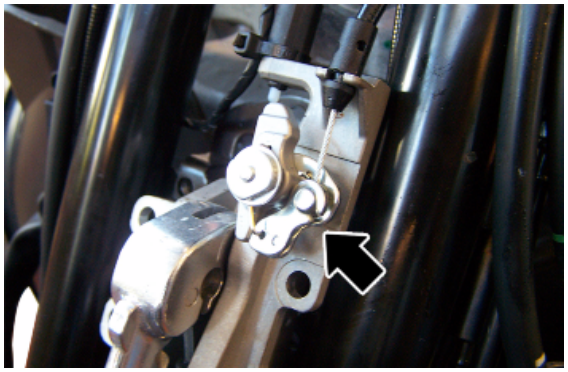
- Remove the rear wheel.
- Loosen the transmission set screw and release the cable from the calliper.
- Undo the two fixing screws of the mechanical calliper and remove it.
- When refitting, secure to the prescribed torque.

Locking torques (N*m)

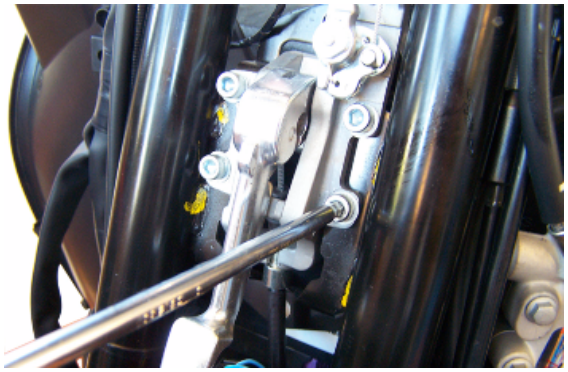
Parking brake - Screw tightening calliper to support (Apply medium LOCTITE threadlock of type 243) **24 - 27**

- For an easier operation, previously remove the calliper support plate by acting on the safety locks and unscrewing the two fixing bolts as indicated in the picture.

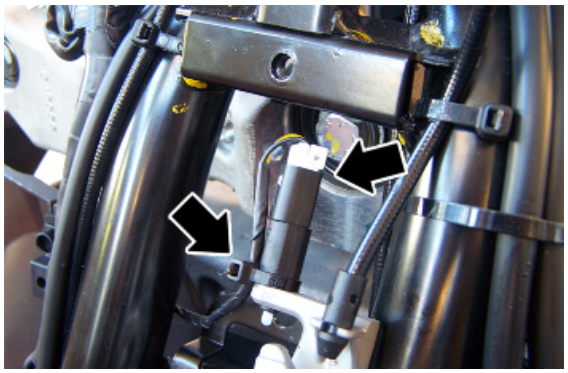
- After removing the leg shield back plate, remove the engaging cable for the safety mechanism removing it from its fitting.
- During refitting pay special attention to the correct insertion of the metallic drum in its seat, as shown in the picture.



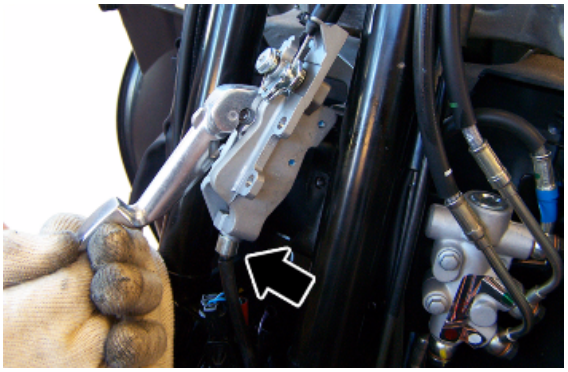
- Undo the four fixing screws of the lever.



- Cut the indicated clamp and disconnect the connector from the parking brake warning light button inserted.



- Remove the parking brake cable from the lever by operating the set screw.

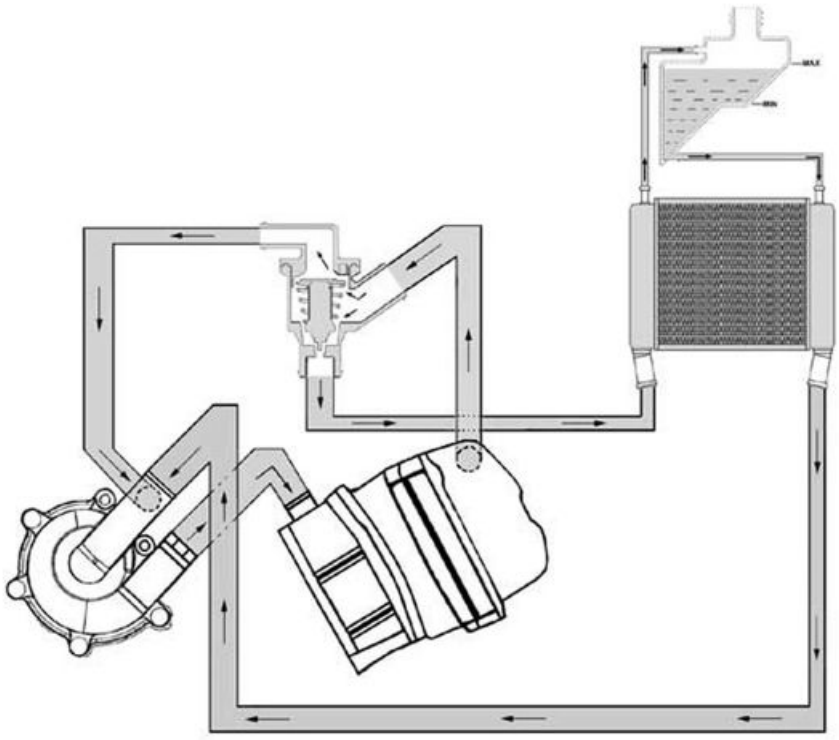


INDEX OF TOPICS

N.B.

THE UNITS OF MEASUREMENT CONTAINED IN THIS CHAPTER ARE EXPRESSED IN TERMS OF THE DECIMAL METRIC SYSTEM. TO REFER TO THE UNIT OF MEASUREMENT EXPRESSED IN TERMS OF THE ANGLO-SAXON SYSTEM, SEE THE «CHARACTERISTICS» CHAPTER.

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

Specification	Desc./Quantity
Cooling system capacity	1.8 l
Prescribed fluid	Mixture of 50% water and 50% fluid for sealed circuits
Sealing pressure	Cap calibrated at 0.9 bar

THERMOSTAT

Specification	Desc./Quantity
Type	Wax-type, with deviator
Starts opening	82 ± 2°C

ELECTRIC VENTILATION

Specification	Desc./Quantity
Type	With piston
Electric ventilation starts at	107°C
Electric ventilation stops at	103°C

WATER PUMP

Specification	Desc./Quantity
Type	Centrifugal
Control	Coaxial at the countershaft

RADIATOR

Specification	Desc./Quantity
Type	Aluminium, with horizontal circulation

EXPANSION TANK

Specification	Desc./Quantity
Calibration	Automatic bleeding, in parallel with the radiator

Electric fan check

- Connect the injection diagnostic tester and select the «ERRORS» function in this menu.
- Check any failures in the electric fan control circuit (see «Injection»chapter)

Specific tooling

020922Y Diagnosis Tool

- 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 starts: 107°C

Electric fan stops: 103°C

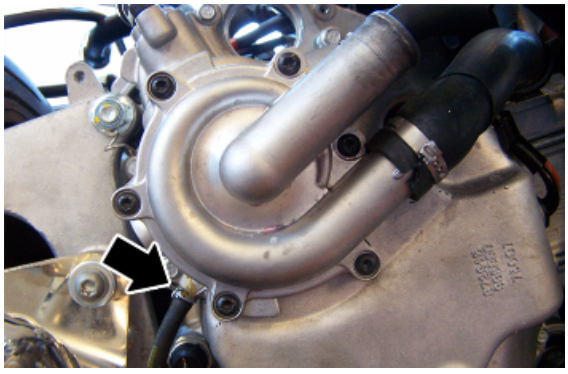
- If non-conforming values are detected, replace the injection control unit (see «Injection» Chapter).
- If the analogue instrument temperature is close to the red zone, but the degrees indicated by the diagnostic tester are below the electric fan start temperature, check the temperature sensor on the head and the relevant injection circuit (see «Injection» chapter);

N.B.

THE ELECTRIC FAN TEMPERATURE AT 107° 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 / 50% COOLING CIRCUIT FLUID MIXTURE.

System sealing check

- 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).

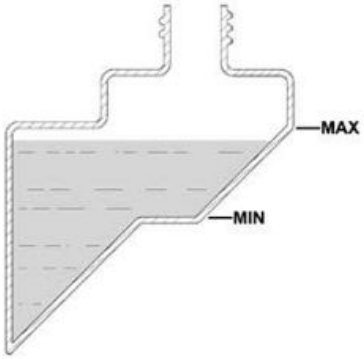
N.B.

DO NOT USE OILS OR GREASES WHILE MOUNTING THE COOLING SYSTEM. FAILURE TO OBSERVE THIS PRECAUTION WILL IRRETRIEVABLY DEFORM THE SEALING GASKETS.

Coolant replacement

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.
- Close the bleed screw.
- Stop the engine.
- Restore the level into the expansion tank and tighten the cap.
- Start the engine and let it warm up to reach the electric ventilation temperature.
- Stop the engine.
- Restore the level with cold engine.

CAUTION

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.

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.

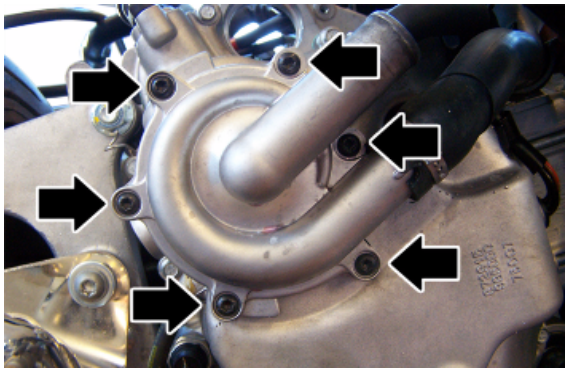
Proceed to carry out a few preliminary operations as described below:

- 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.

CAUTION

THIS OPERATION MUST BE CARRIED OUT 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

Cooling system

approx. 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.

CAUTION

FAILURE TO OBSERVE THIS PRECAUTION WILL IRRETRIEVABLY DEFORM THE O-RING.

- Refit the water pump cover and tighten the 6 fixing screws to the prescribed torque.

Locking torques (N*m)

Water pump cover screws 3 - 4

See also

Engine
Flywheel cover

Water pump - overhaul

If noise or loss of liquid at the drain bore of the water pump is discovered, it will be necessary to overhaul the pump as described in the «Engine/Water pump» Chapter.

Proceed to carry out a few preliminary operations as described below:

- Place the vehicle on its centre stand and on flat ground.

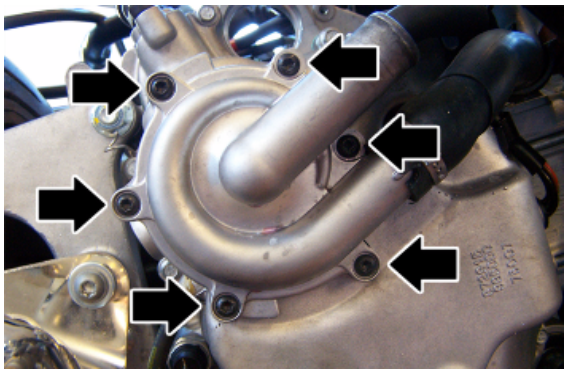
- Remove the tail section as described in the «Bodywork» Chapter.

- Empty the cooling system by removing the couplings on the pump cover and the filler plug on the expansion tank.

CAUTION

THIS OPERATION MUST BE CARRIED OUT WHEN THE ENGINE IS COLD.

- Remove the water pump cover as indicated in the figure by loosening the six fixing screws.
- Follow the instructions provided in the «Engine/ Water pump» chapter to inspect the pump.
- Refill and drain the system again once after having repaired the damage and reinstalled all the components.



N.B.

FOR CHANGING THE COOLANT AND BLEEDING THE SYSTEM, SEE CHAPTER "COOLING SYSTEM".

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.

- Adequately fit a new O-ring, be careful to lubricate it with petroleum jelly grease.

N.B.

TO AVOID DEFORMATION, DO NOT LUBRICATE THE O-RING WITH PETROLEUM GREASE.

CAUTION

FAILURE TO OBSERVE THIS PRECAUTION WILL IRRETRIEVABLY DEFORM THE O-RING.

- Refit the water pump cover and tighten the 6 fixing screws to the prescribed torque.

N.B.

FOR CHANGING THE COOLANT AND BLEEDING THE SYSTEM, SEE THE "COOLANT CHANGE" SECTION.

Locking torques (N*m)

Water pump cover screws 3 - 4

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.

Cooling fluid 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.

Oil in the fluid

1 - Presence of oil in the coolant.

YES go to 2

2 - Check the head gasket seal (see «Thermal group and timing system» chapter)

INDEX OF TOPICS

N.B.

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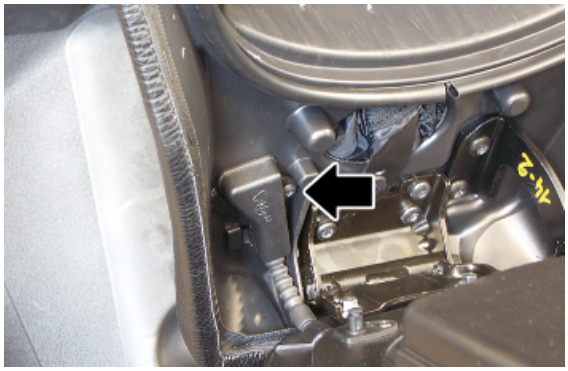
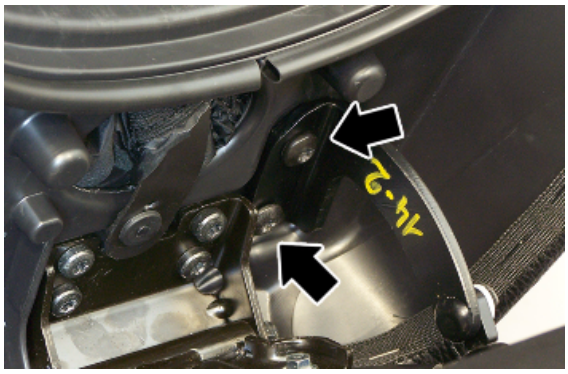
This section è is dedicated to the operations that can be carried out on the vehicle's bodywork.

Seat

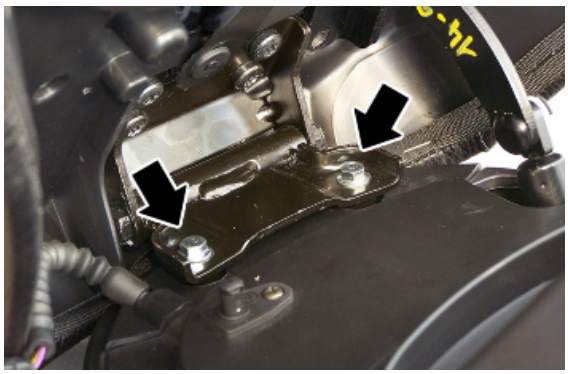
- Raise the saddle.
- Undo the screw shown in the figure, remove the cover and disconnect the rider presence sensor connector.



- Undo the two screws indicated in the figure.

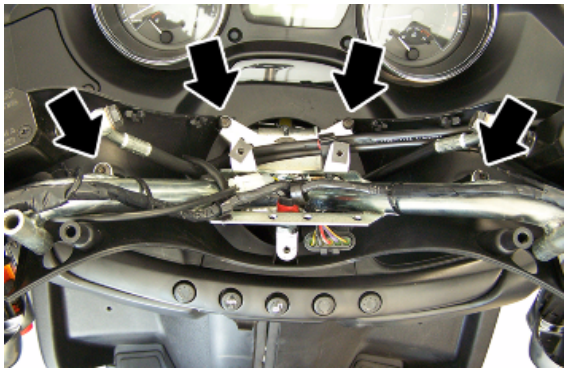


- Undo the two fixing screws of the saddle.



Rear handlebar cover

- Remove the upper handlebar cover.
- Remove the four indicated screws fixing the lower handlebar cover to the handlebar.



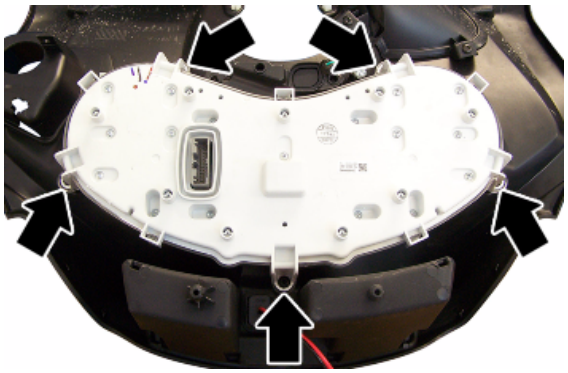
- Disconnect the environment temperature sensor connector.
- Remove the handlebar cover sliding it off towards the rear part of the vehicle.

See also

Front handlebar cover

Instrument panel

- Remove the shield back plate upper side.
- Unscrew the five fixing screws and remove the instrument panel.

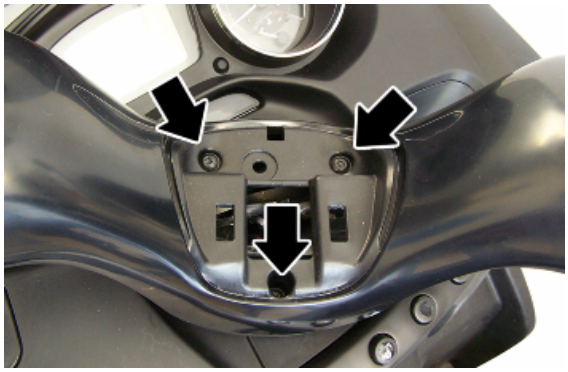


See also

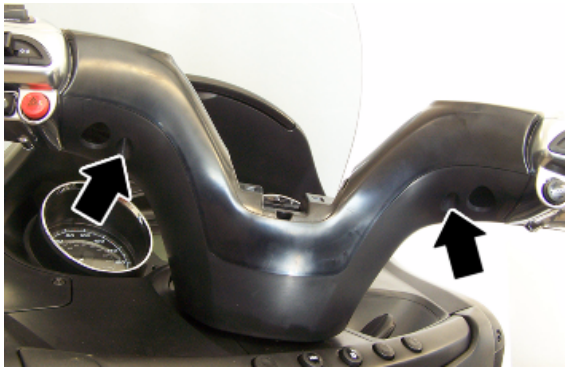
Knee-guard

Front handlebar cover

- Remove the rear-view mirrors.
- Remove the central plug of the handlebar cover, fixed to the fitting.
- Undo the three underlying screws.

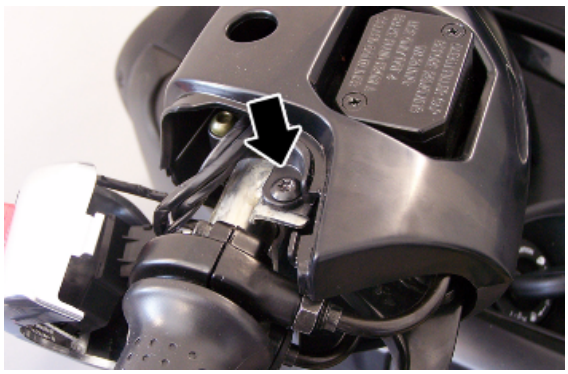


- Undo the two screws in the lower part of the handlebar.



- Working on both sides of the handlebar, undo the indicated screw to release the control lock.

- Unscrew the underlying screw on both sides.
- Remove the upper handlebar cover, by releasing the fittings in the front part.



Headlight assy.

DAYLIGHT RUNNING LIGHT

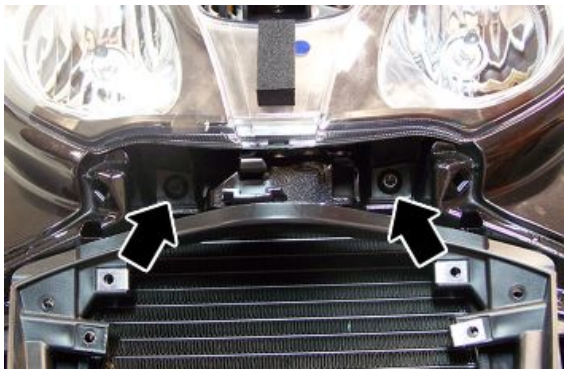
- Remove the windshield.
- Remove the central cover fixed to the joints on the legshield.

- Remove the two indicated daylight running light fixing screws.
- Remove the daylight running light by disconnecting the connector.

HEADLIGHT

- Remove the daylight running light.
- Remove the spoiler.
- Remove the two upper fixing screws of the headlight.

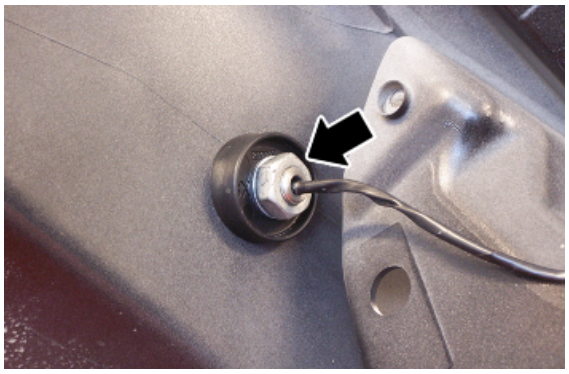
- Remove the front part of the radiator cover.
- Remove the two lower fastening screws.



- Disconnect the connector and remove the headlight.

TURN INDICATORS

- Remove the legshield.
- Remove the fixing nut inside the shield, paying attention to collect the spacer, the washer and the support plastic of the turn indicator.



WARNING

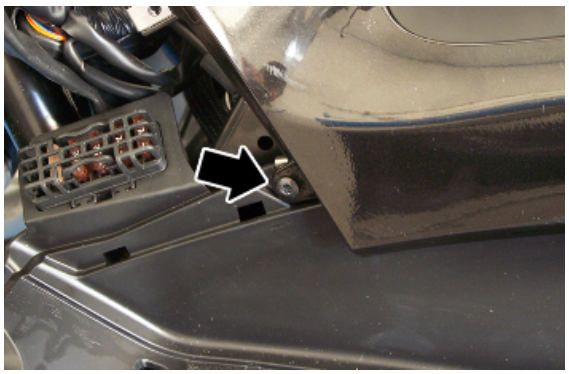
DURING REFITTING, PAY PARTICULAR ATTENTION TO THE CORRECT ALIGNMENT OF THE TURN INDICATOR WITH THE OTHER PLASTICS, REFERRING TO THE FITTINGS ON THEM.

See also

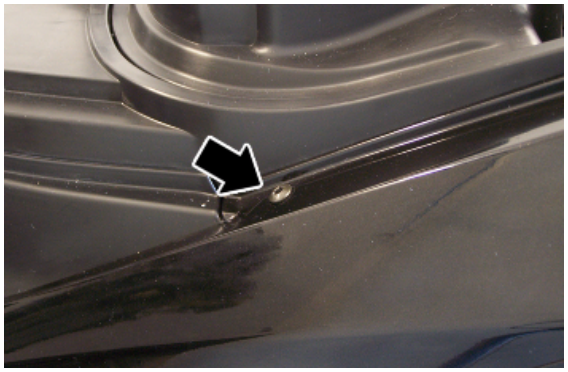
spoiler
Radiator cover
Legshield

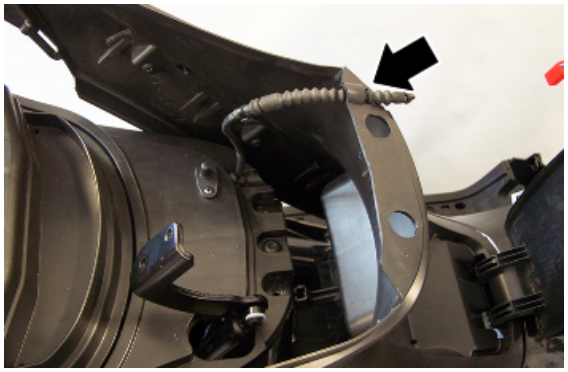
Frame central cover

- Remove the saddle.
- Remove the shield back plate.
- Remove the side fairings.
- Remove the front retainer on both sides of the cover.



- Remove the rear retainer on both sides.
- Open the fuel tank access cover and temporarily undo the plug to lift the central cover.
- Disconnect the cover opening transmission and slide off the rider presence sensor wiring to remove it.





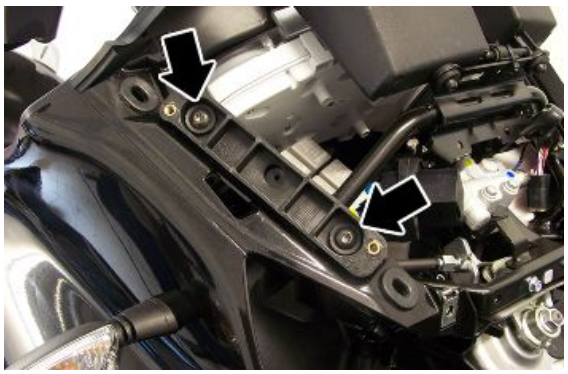
See also

Seat
Knee-guard
Side fairings

Legshield

- Remove the headlight.
- Undo the four indicated screws on the leg shield back plate.

- Working on both sides of the vehicle, unscrew the two indicated screws and remove the spoiler support plastic.



- Remove the two indicated screws from both sides of the vehicle, located inside the wheel housing.
- Detach the shield from the vehicle, complete with side bumpers and turn indicators and disconnect the connectors of the turn indicators.

WARNING

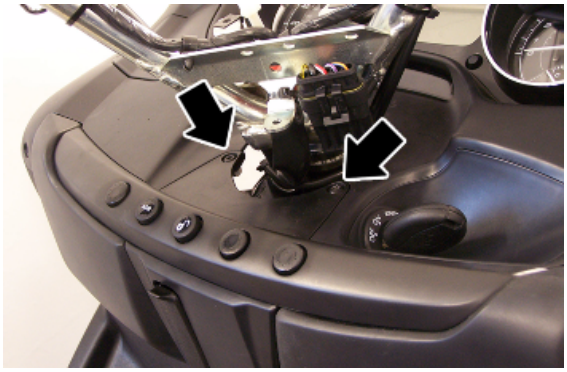
DURING THE REFITTING, PAY PARTICULAR ATTENTION TO THE CORRECT POSITION OF THE TWO SPOILER SUPPORT PLASTICS, REFERRING TO THE INDICATIONS ON THE PLASTIC.

See also

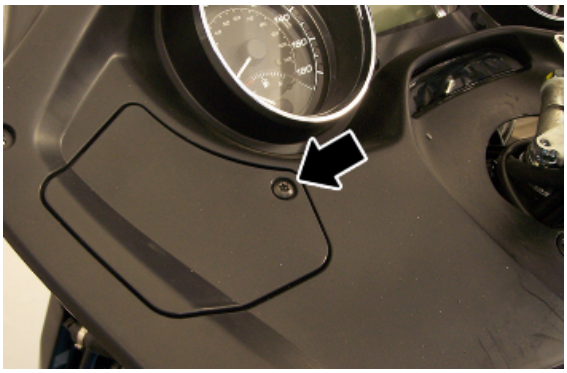
Headlight assy.

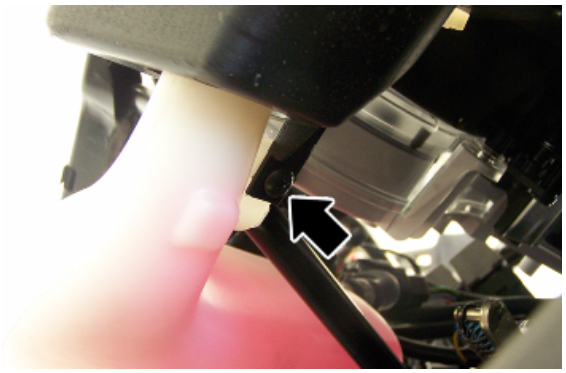
Knee-guard

- Remove the legshield.
- Undo the two central screws and remove the cover.

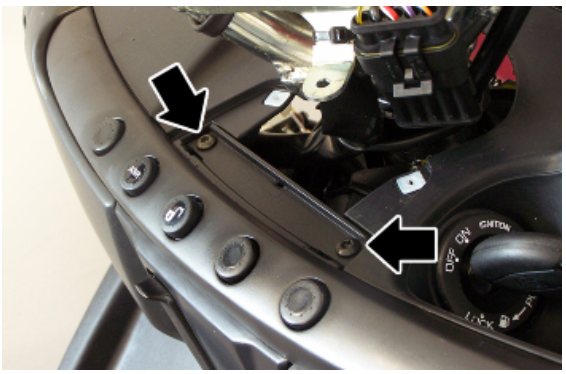


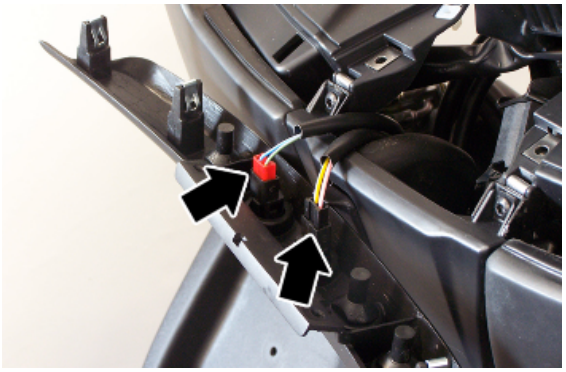
- Unscrew the screw and remove the coolant tank access cover.
- Remove the expansion tank fixing screw.



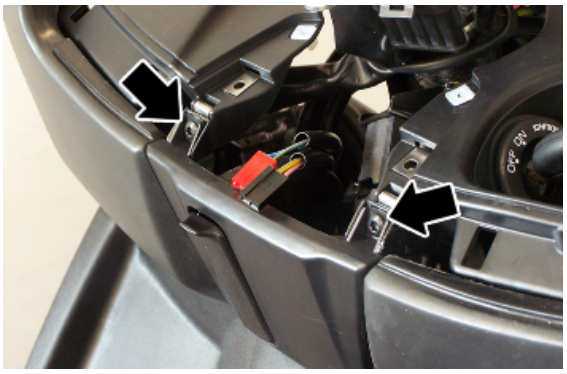


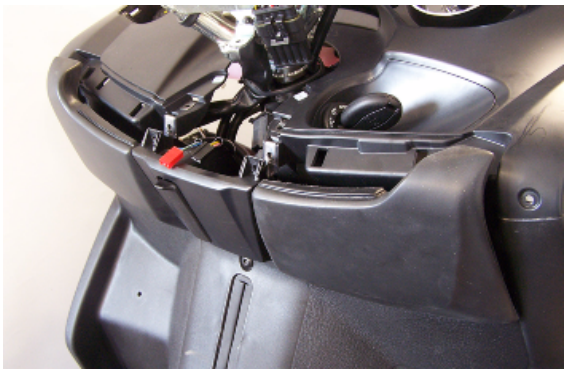
- Unscrew the two central screws and remove the button unit by disengaging the fittings and lifting it upwards.
- Disconnect the two connectors.



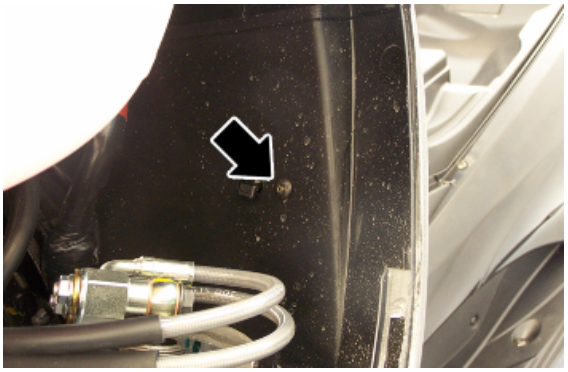


- Undo the two screws indicated.
- Remove the leg shield back plate cover by slightly lifting it upwards to loosen the fittings.

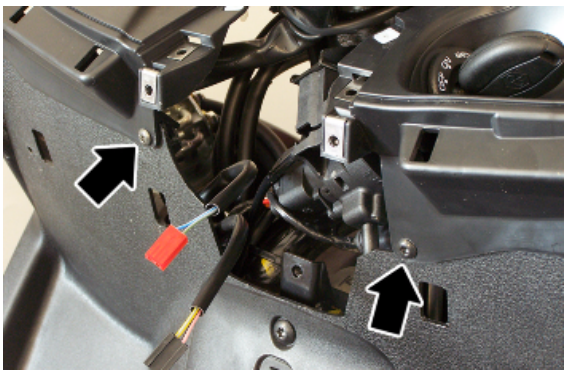


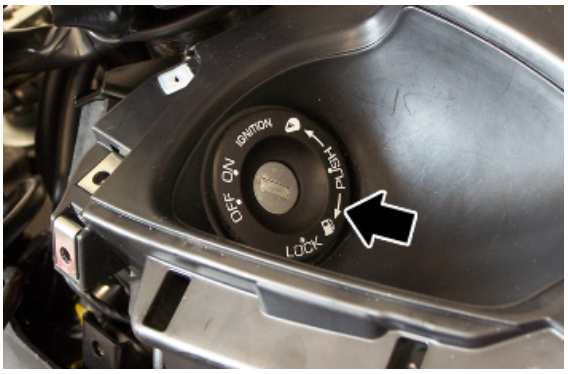


- Remove the screw shown in the figure and placed inside the leg shield back plate, on both sides.

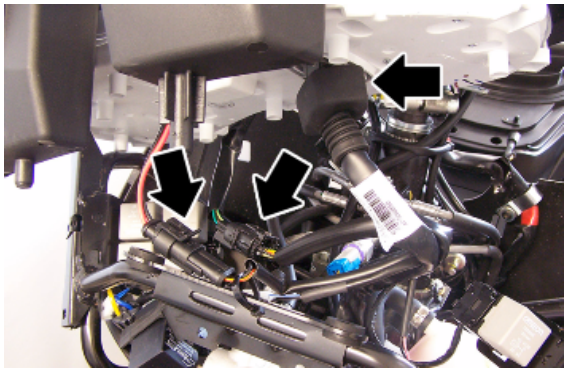


- Unscrew the indicated screw, then, if present, remove the key from the switch and the switch plate.

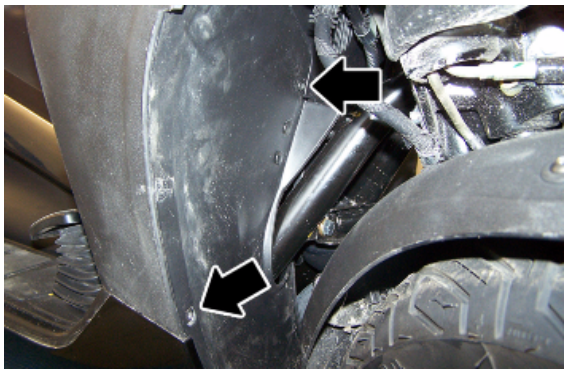


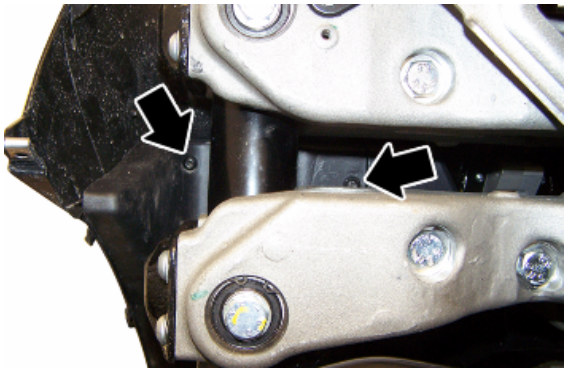


- Temporarily undo the expansion tank plug to allow the removal of the upper part of the leg shield back plate, complete with instrument panel and warning lights unit. For an easier operation, alternately turn the handlebar in the two directions.
- Disconnect the instrument panel, warning lights unit and USB socket connectors.



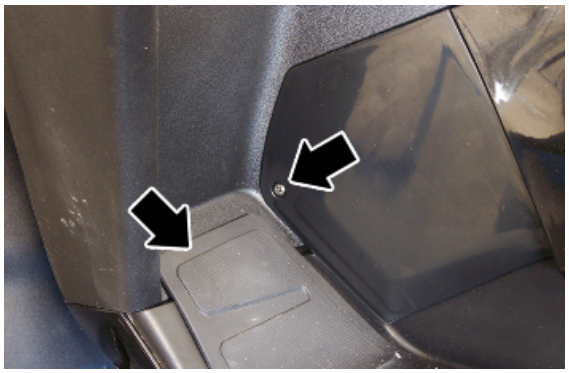
- Unscrew on both sides of the vehicle the four screws located in the front part of the leg shield back plate.

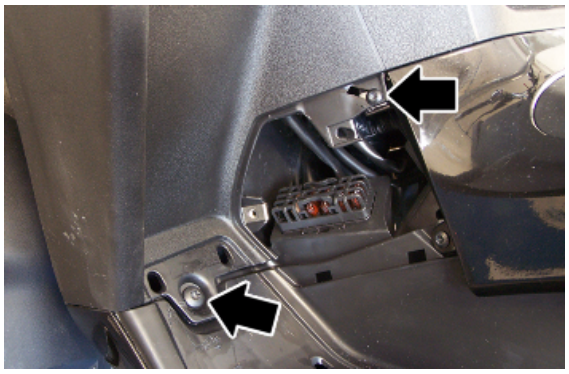




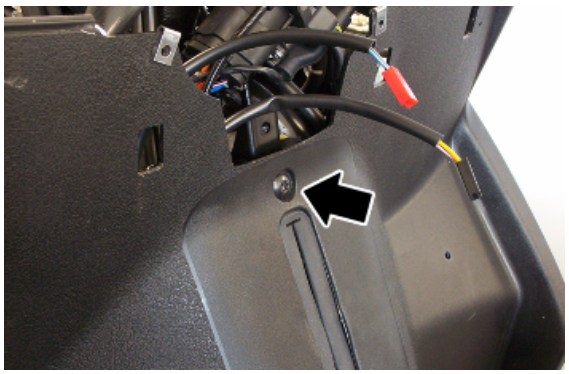
- Remove the cable grommet clamp, and collect the washer, located in the upper part.

- Remove on both sides the cover located near the footrest and unscrew the underlying screw.
- Lift the front part of the footpeg cover rubbers and unscrew the underlying screws.

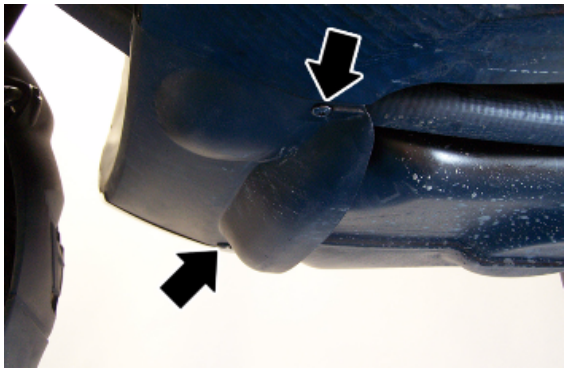




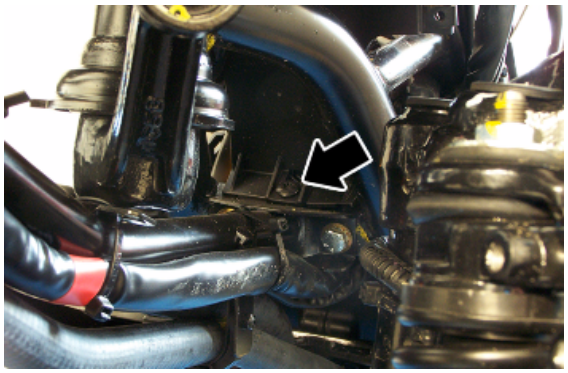
- Remove the central fixing.
- Remove the leg shield back plate, sliding off the parking brake lever from its seat.



- Unscrew the two indicated screws to remove the lower guard.



- Undo the indicated screw to remove the central plastic.

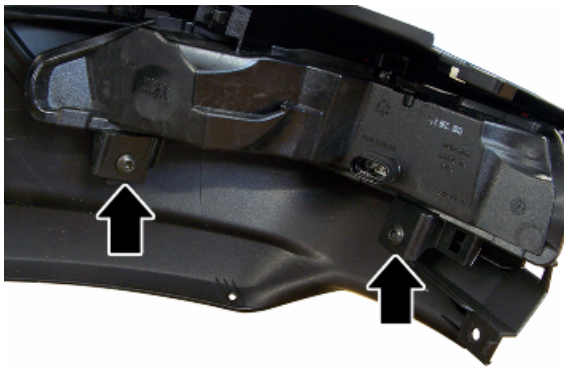


See also

Legshield

Taillight assy.

- Remove the side fairings.
- Remove the two screws inside the fairing for each side and then the external one to remove the light assembly.



TURN INDICATORS

- Remove the license plate support.
- Remove the indicated clamp and collect the washer and the support plastic of the turn indicator.

WARNING

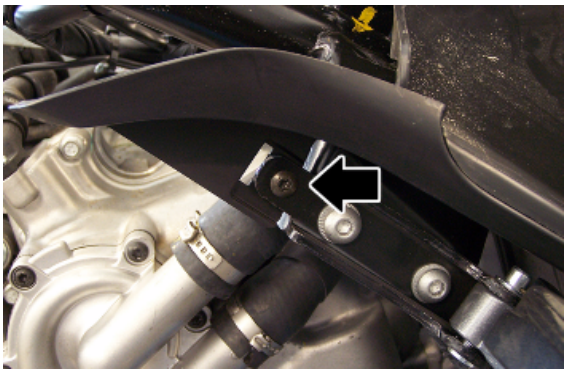
DURING REFITTING, PAY PARTICULAR ATTENTION TO THE CORRECT ALIGNMENT OF THE TURN INDICATOR WITH THE OTHER PLASTICS, REFERRING TO THE FITTINGS ON THEM.

See also

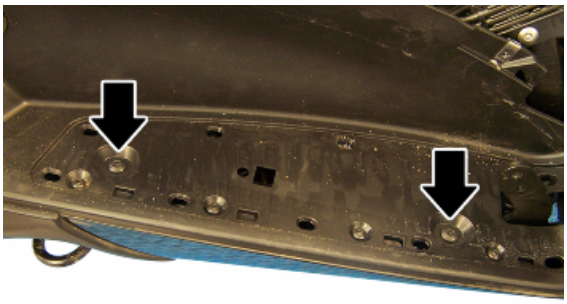
Side fairings
License plate holder

Footrest

First remove the central chassis cover, then, for both sides of the footpeg, proceed as follows:
- Open the passenger footpeg and unscrew the indicated underlying screw.

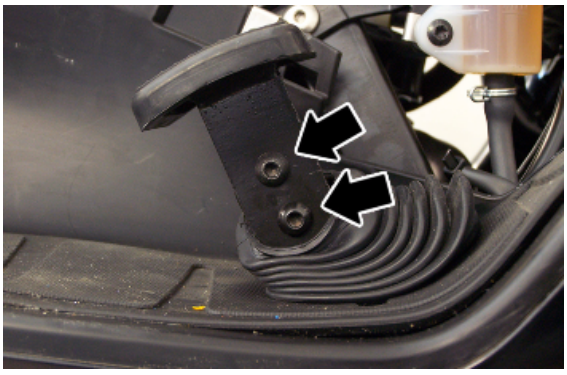


- Remove the footpeg rubber cover and undo the two underlying screws.



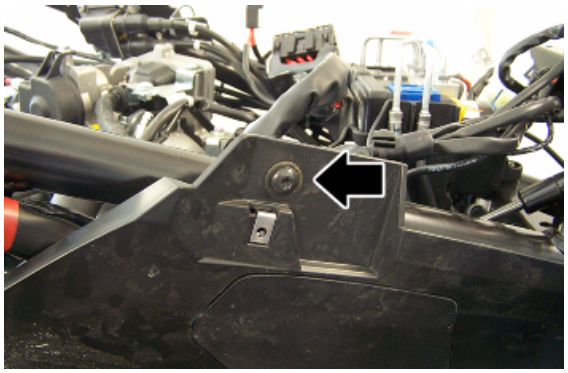
CAUTION

FOR THE RIGHT FOOTPEG, IT IS NECESSARY TO REMOVE THE BRAKE PEDAL FIRST, ACTING ON THE TWO INDICATED CLAMPS.



- Remove the indicated screw.

- Remove the upper clamp and collect the washer.



- Remove the footpeg.

CAUTION

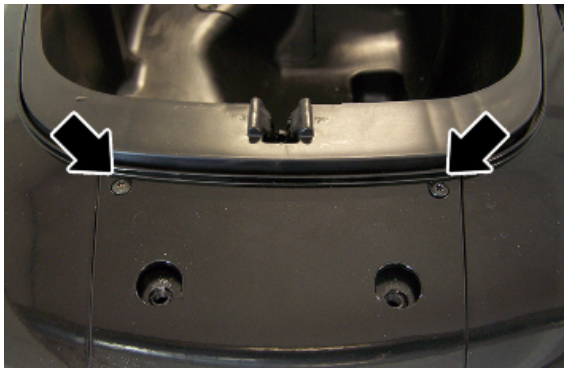
FOR THE LEFT FOOTPEG, SLIDE OFF THE FUSE HOLDER BOX FROM THE FITTINGS ON THE PLASTIC.

See also

Frame central cover

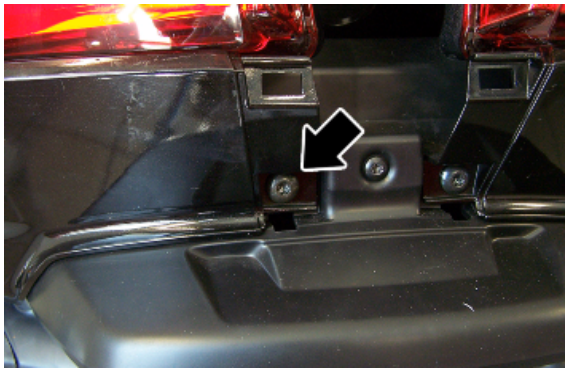
Side fairings

- Remove the handgrips.
- Remove the two screws indicated and then the centre cover.

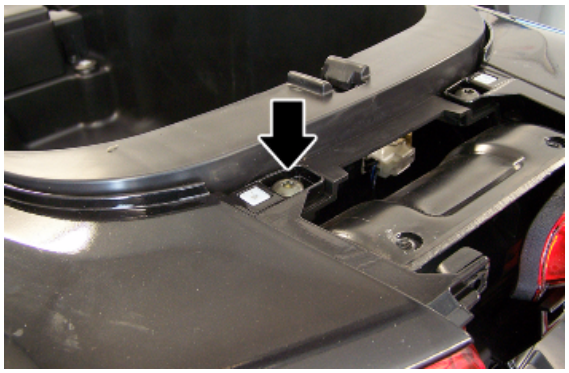


For each of the two fairings, proceed as follows:

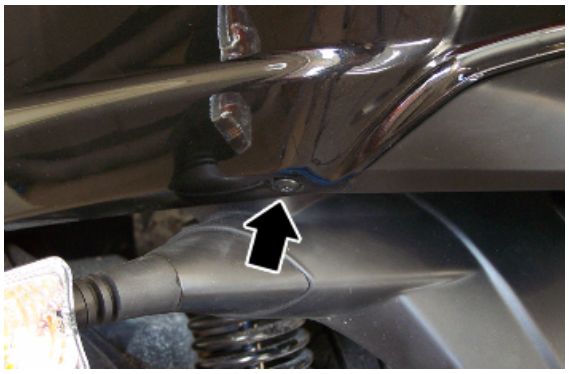
- Undo the lower rear screw.



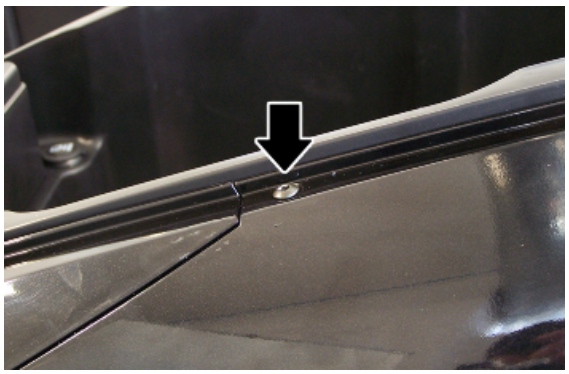
- Undo the upper rear screw.



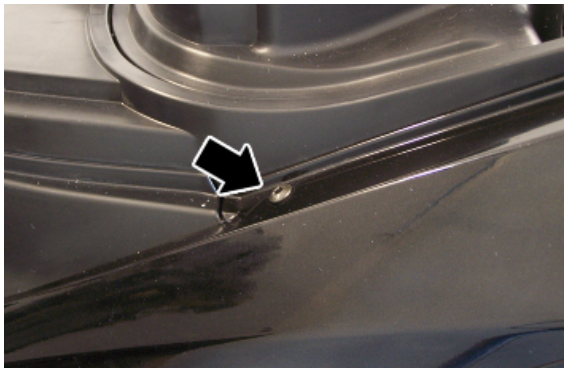
- Undo the fixing screw at the rear mudguard/license plate holder.
- Undo the lower side screw, placed near the passenger footrest.

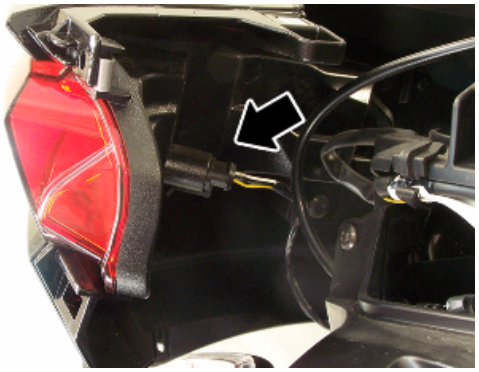


- Undo the upper side screw.



- The fairing is now loose, however to facilitate the removal it can be useful to unscrew the central cover screw, indicated in the figure.
- Then remove the fairing, by first moving it towards the rear part of the vehicle and then downwards to release the fittings and disconnect the light assembly connector.



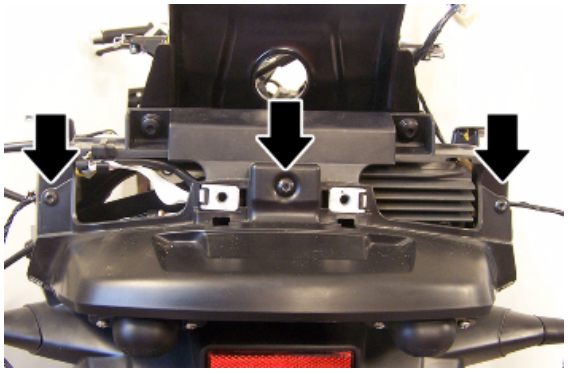


See also

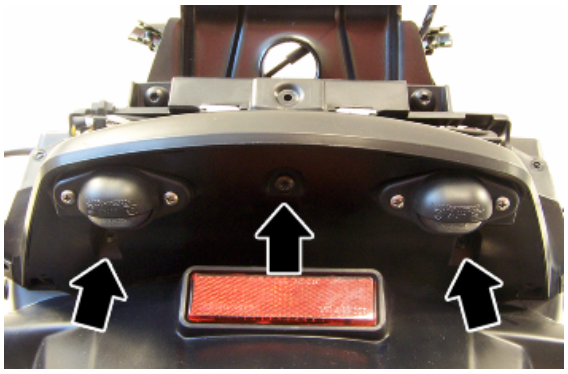
Handles and top side fairings

License plate holder

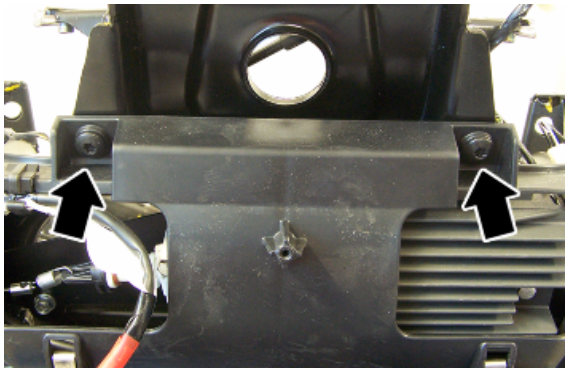
- Remove the side fairings.
- Remove the three indicated screws.



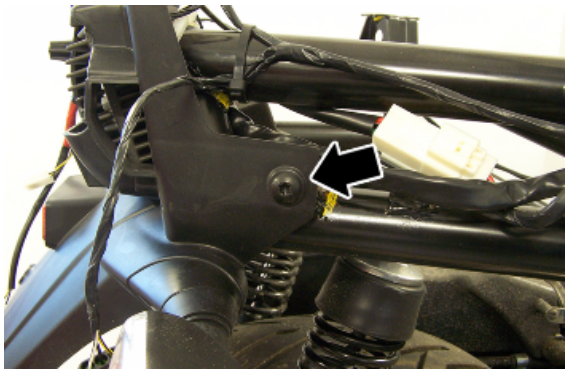
- Remove the three lower screws and slightly lift the upper cover of the license plate holder.
- Release it from the fittings and then disconnect the two licence plate lights connectors to remove it.



- Remove the two screws indicated.



- Remove the indicated screw on both sides to release the license plate support.
- Disconnect the connectors of the turn indicators.
- Release the wiring of the license plate lights from the fitting inside the support, then slide it off together with the saddle opening linkage.

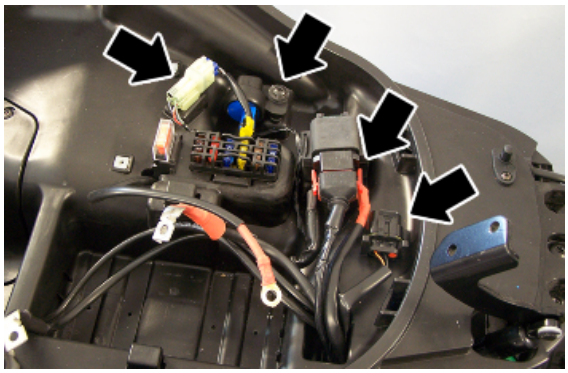


See also

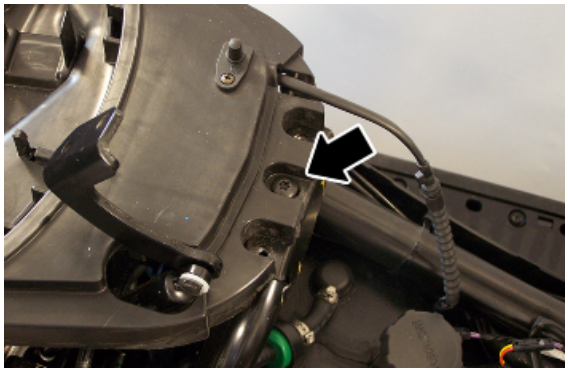
Side fairings

Helmet bay

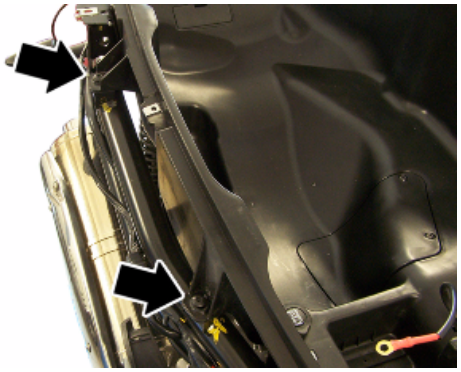
- Remove the central cover.
- Disconnect and remove the battery.
- Release the diagnostic socket and the tip over sensor connector from the fittings.
- Remove the tip over sensor by undoing the relative screw.
- Disconnect the starter relay connector, then undo the two Allen screws locking the connections to remove it.



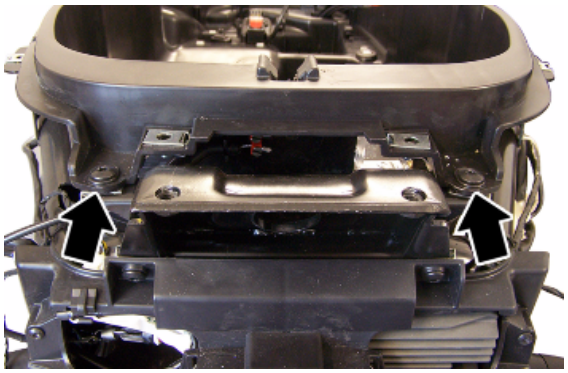
- Unscrew and remove the front central screw.



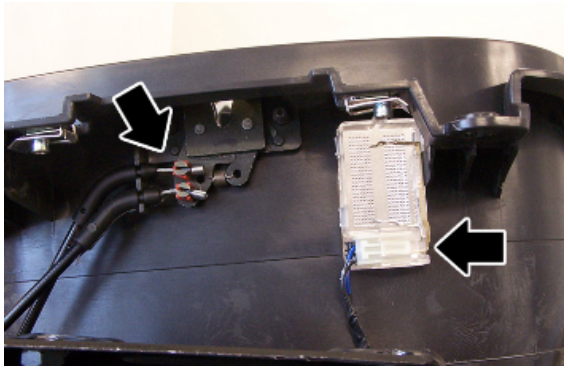
- Remove the two indicated screws on both sides.



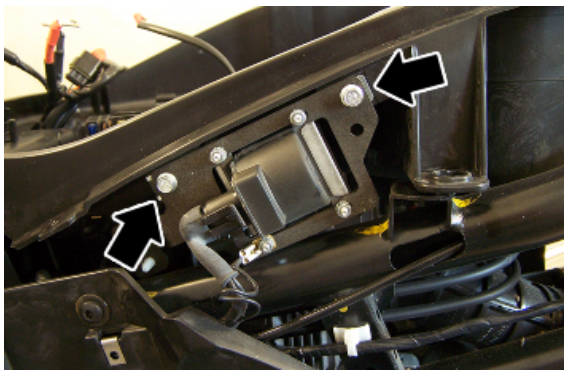
- Remove the two rear fastening screws.



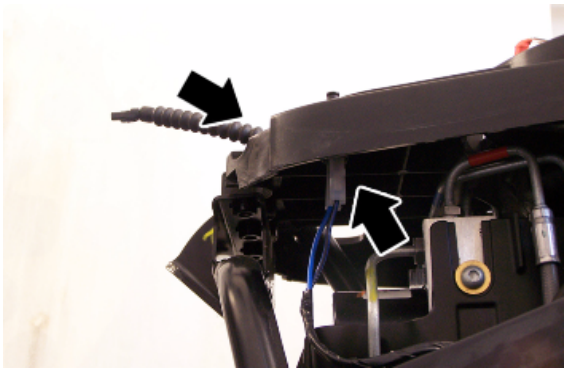
- Slightly lift the helmet compartment to disconnect the light connector and the saddle release linkage.



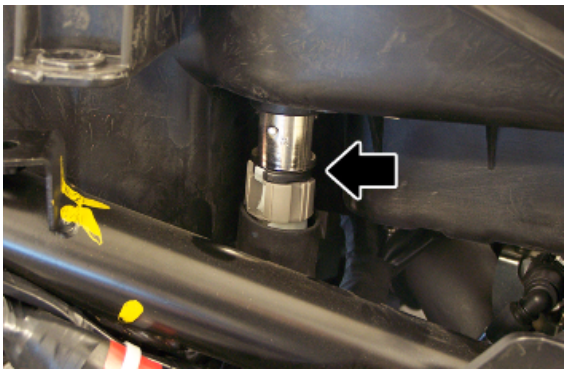
- Working on the left side, act on the two fixing bolts of the coil support bracket to remove it.



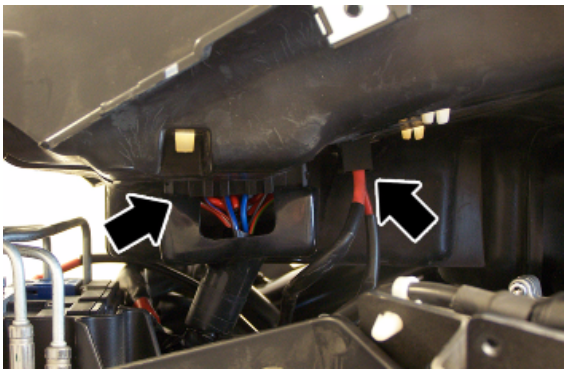
- Slide off the rider presence sensor wiring and disconnect the compartment lighting button connectors.



- Working on the right side, slide off the rubber protection and disconnect the plug socket connector.



- Slide off the two fuse boxes, all previously disconnected wiring and the saddle lever from the helmet compartment to remove it.

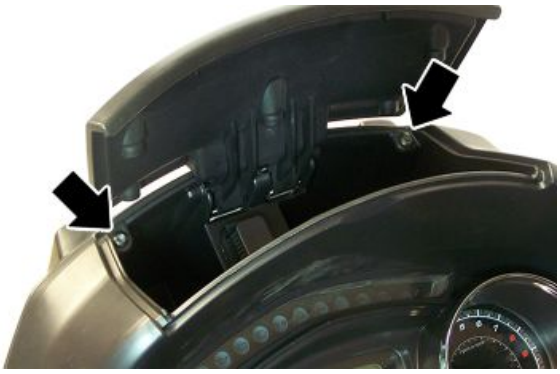


See also

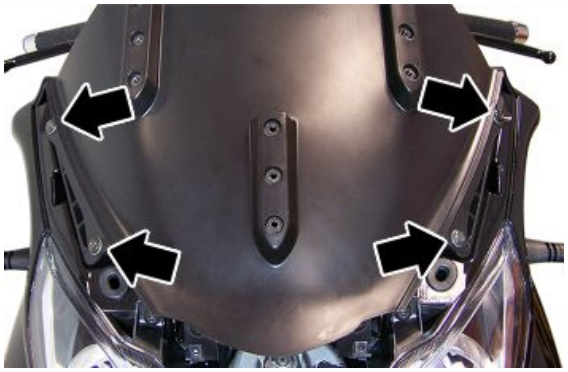
Frame central cover

spoiler

- Remove the front daylight running light.
- Remove the two screws inside the glove-box on the dashboard.



- Remove the four screws indicated and recover the related spacers.



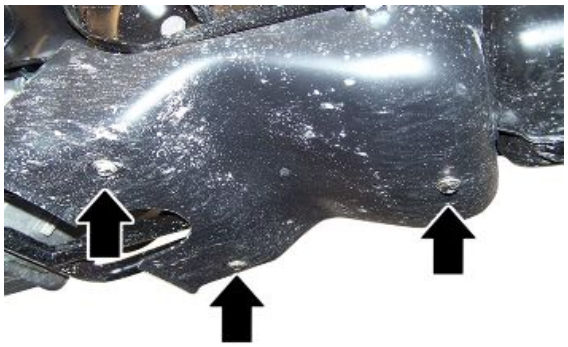
- Undo the two screws indicated, then remove the spoiler.

See also

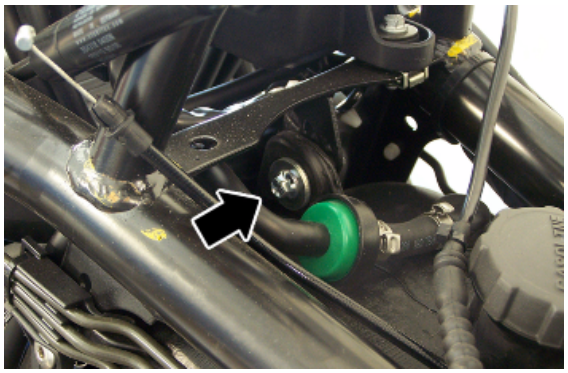
Headlight assy.

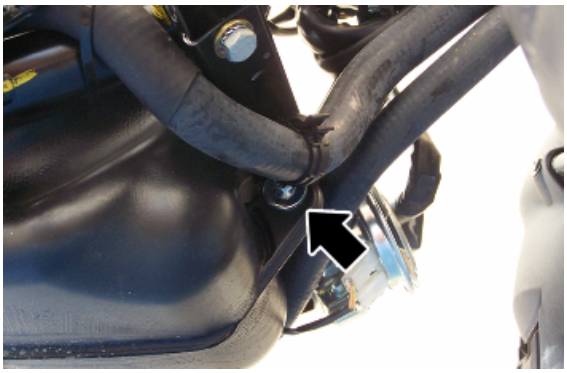
Fuel tank

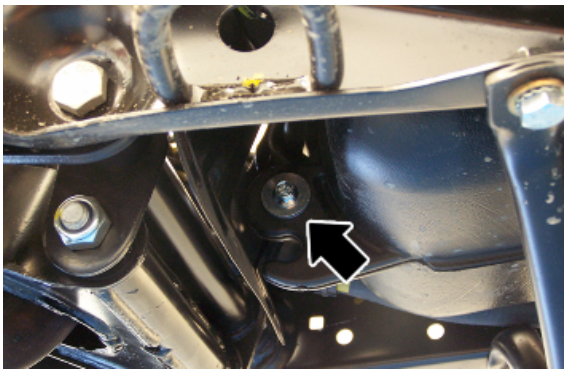
- Remove the central chassis cover.
- Remove the footrest.
- First remove the lower cover by removing the three indicated clamps and collecting the washers and spacers.



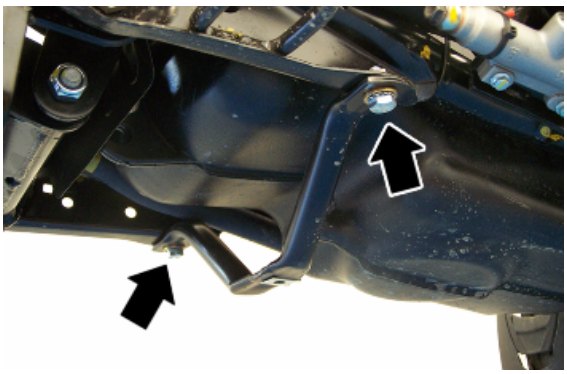
- Remove the three tank retainers.







- Remove the two lower bracket retainers indicated in the figure.
- Disconnect the electric wiring and the fuel pipes.



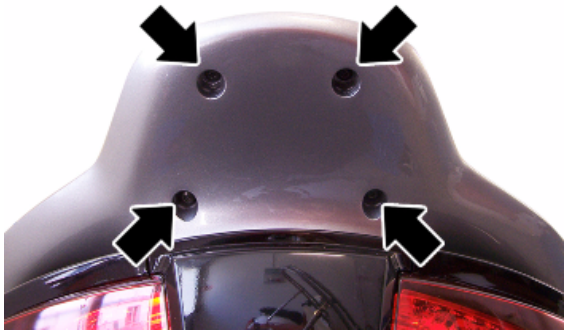
See also

Frame central cover
Footrest

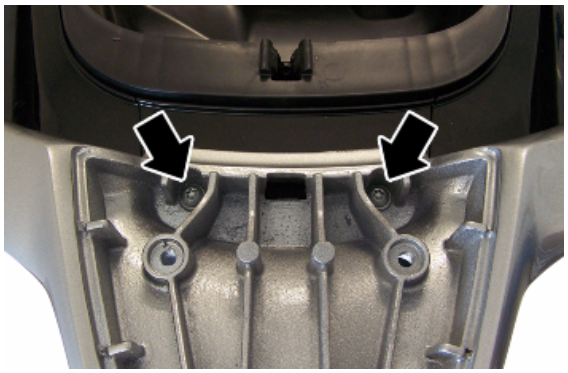
Handles and top side fairings

- Unscrew the two indicated screws and collect the washers.

- Unscrew the four screws located in the lower part of the luggage rack and remove the upper plastic fixed to the fitting.



- Unscrew the two indicated screws and collect the relative washers.



Radiator cover

FRONT COVER

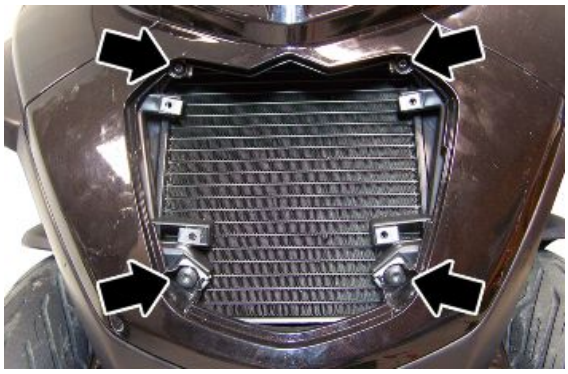
- Remove the Piaggio clip-on badge, fixed to the joint, by acting on the indicated slot.

- Remove the indicated screw and remove the radiator grille frame.

- Unscrew the four indicated screws and remove the radiator grille.

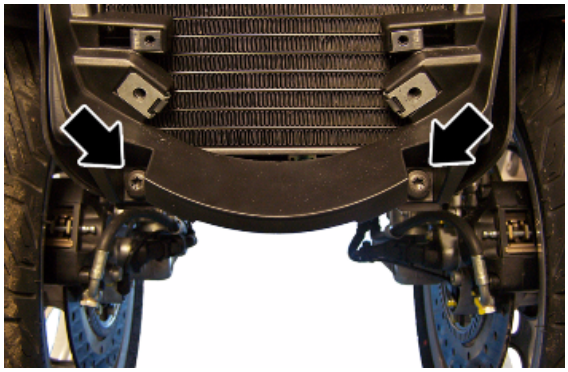
- Working on both sides of the vehicle, remove the two screws in the wheel housing.

- Unscrew the four indicated screws and remove the front radiator cover.

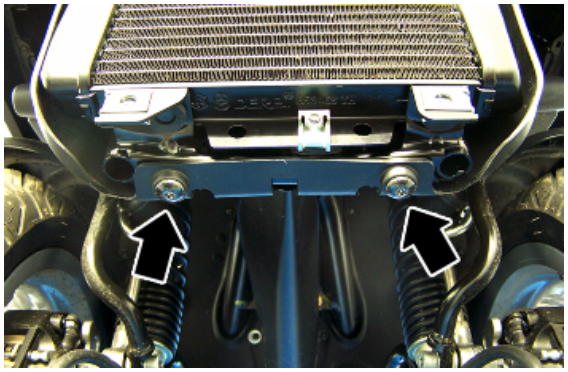


LOWER GUARD

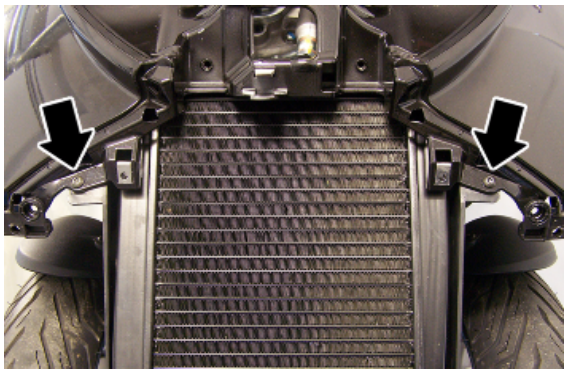
- Remove the two indicated clamps and the relative plastic.



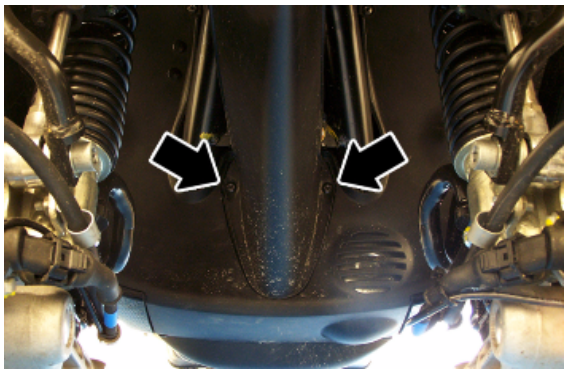
- Remove the two lower clamps.



- Remove the two upper clamps.



- Remove the two screws fixing the radiator lower protection to the leg shield back plate.
- After that, press up and pull the protection front part so as to release it from the radiator frame.

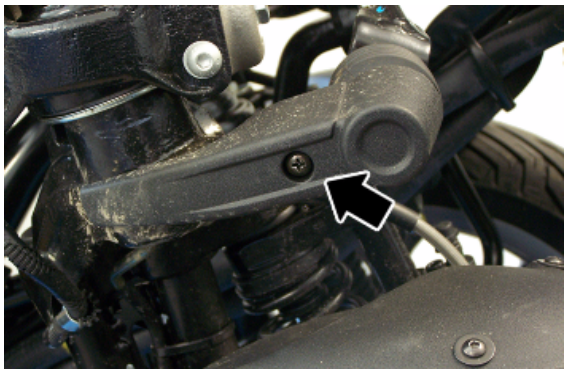


INDEX OF TOPICS

Carry out the listed checks before delivering the motorcycle.

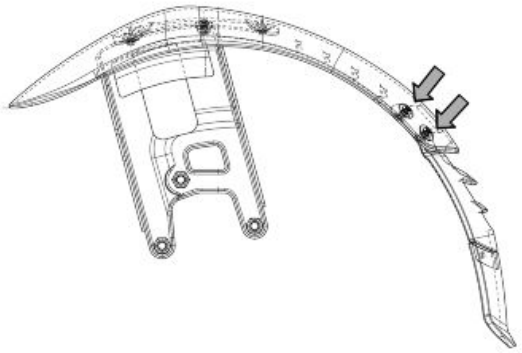
Warning - Handle fuel with care.

Fit the plastic cover supplied on the joint on the steering tube as shown in the figure.



Proceed as follows if the customer requests installation of splash guards on the vehicle:

- Fit the flap inside the mudguard shown in the figure, matching up the 4 anchor holes.
- Fit the 4 washers and the 4 screws on the outer side of the mudguard, then tighten to the specified torque.



Locking torques (N*m)

splash guard fastener screws **2 - 3**

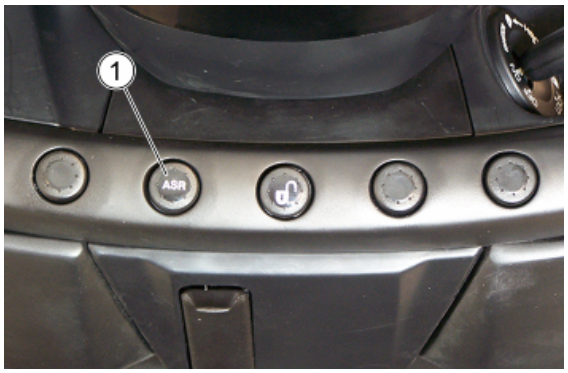
ASR SYSTEM CALIBRATION PROCEDURE.

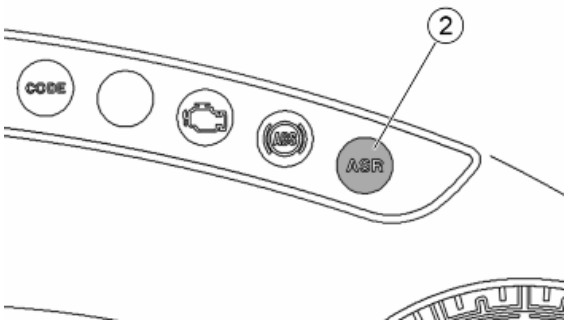
The calibration procedure of the system must be carried out according to what is indicated below, riding on a straight flat stretch of road. In order to maintain the effectiveness of the ASR system, the procedure must be carried out again after the replacement of one or more tyres:

• It is necessary that the diagnostic phase of the ASR systems and ABS is complete: for this purpose, after switching to «**ON**», ride a short distance above 5 km/h and wait for the flashing of the two warning lights to stop.

• Allow the engine to idle for at least 5 seconds.

• Pull the brake lever and press the ASR on/off button «**1**» simultaneously for at least 3 seconds. The activation process will be confirmed by the





ASR warning light «**2**» turning on with slow flashing.

• Accelerate to a constant speed of 30 to 40 km/h and maintain it for at least to 8 seconds. The continuity of the vehicle speed in the correct field to complete the procedure will be confirmed by a very fast flashing of the ASR warning light «**2**».

• The end of the procedure will be indicated by the steady lighting ASR warning light «**2**». The ASR system is not active.

• Once the procedure is complete it is necessary to switch to «**OFF**» and wait for at least 60 seconds before being able to switch again to «**ON**».

• In case of failure to complete the procedure within 5 minutes the ASR warning light «**2**» will stay on steady and the ASR will remain off until switching to «**OFF**».

• To switch again to «**ON**» it is necessary to reactivate the ASR. It is however necessary to repeat the process until it succeeds.

Aesthetic inspection

Appearance check:

- Paintwork
- Fitting of Plastic Parts
- Scratches
- Dirt

Tightening torques inspection

Safety locks check

Visually check that there is a yellow mark on the following clamps:

Front suspension

- Front left wheel fixing screws
- Front right wheel fixing screws
- Speed sensor fixing screws
- Screw pipe coupling - tilt locking gripper

rear suspension

- Shock absorbers upper fixing screw

- Lower screw fixing right shock absorber to supporting plate
- Lower screw fixing left shock absorber to engine
- Screws fixing muffler supporting arm to engine

Front brake

- Screws fixing brake disc to left wheel
- Screws fixing brake disc to right wheel
- Screws fixing front brake callipers
- Screws fixing brake pipe coupling to callipers

Rear brake

- Parking rake calliper fixing screws
- Screws fixing calliper to muffler supporting arm
- Screws fixing brake pipe coupling to calliper

Chassis

- Swinging arm pin to engine nut

Electrical system

• Battery
• Main switch
• Lights: high beam lights, low beam lights, taillights (front and rear) and relevant warning lights
- Headlight adjustment according to the regulations currently in force
• Front and rear stop light buttons and bulb
• Turn indicators and their warning lights
• Instrument lighting
• instruments: fuel and temperature indicator
•Instrument panel lights
• Horn
• Electric starter
• Engine stopping with emergency stop switch
• Electric opening of saddle with solenoid
• Tilting system locking - unlocking button

CAUTION

TO ENSURE MAXIMUM PERFORMANCE, THE BATTERY MUST BE CHARGED BEFORE USE. INADEQUATE CHARGING OF THE BATTERY WITH A LOW LEVEL OF ELECTROLYTE BEFORE IT IS FIRST USED SHORTENS BATTERY LIFE.

CAUTION

WHEN INSTALLING THE BATTERY, ATTACH THE POSITIVE LEAD FIRST AND THEN THE NEGATIVE ONE.

WARNING

THE BATTERY ELECTROLYTE IS POISONOUS AS IT MAY CAUSE SERIOUS BURNS. IT CONTAINS SULPHURIC ACID. AVOID CONTACT WITH YOUR 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 ACCIDENTALLY SWALLOWED, IMMEDIATELY DRINK LARGE QUANTITIES OF WATER OR VEGETABLE OIL. SEEK IMMEDIATE MEDICAL ATTENTION.
BATTERIES PRODUCE EXPLOSIVE GASES; KEEP CLEAR OF NAKED FLAMES, SPARKS OR CIGARETTES. VENTILATE THE AREA WHEN RECHARGING INDOORS. ALWAYS WEAR EYE PROTECTION WHEN WORKING IN THE PROXIMITY OF BATTERIES.
KEEP OUT OF THE REACH OF CHILDREN

CAUTION

NEVER USE FUSES WITH A CAPACITY HIGHER THAN THAT RECOMMENDED. USING A FUSE OF UNSUITABLE RATING MAY SERIOUSLY DAMAGE THE VEHICLE OR EVEN CAUSE A FIRE.

Levels check

Level check:

- Hydraulic brake system liquid level.
- Roll lock system fluid level
- Rear hub oil level
- Engine coolant level
- Engine oil level

Road test

Test ride

- Cold start
- Instrument operations
- Response to the gas command
- Stability on acceleration and braking
- Rear and front brake efficiency
- Parking brake efficiency
- Rear and front suspension efficiency
- Abnormal noise
- Tilting system locking - unlocking efficiency

Static test

Static control after the test ride:

• Hot engine restart
• Minimum seal (turning the handlebar)
• Uniform steering rotation
• Possible losses
• electric radiator fan operation

CAUTION

CHECK AND ADJUST TYRE PRESSURE WITH TYRES AT AMBIENT TEMPERATURE.

CAUTION

NEVER EXCEED THE RECOMMENDED INFLATION PRESSURES AS TYRES MAY BURST.

Functional inspection

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

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