

# **MANUALE STAZIONE DI SERVIZIO**

2Q000020



# **CAPONORD 1200**



# MANUALE STAZIONE DI SERVIZIO

# **CAPONORD 1200**

#### THE VALUE OF SERVICE

As a result of continuous updates and specific technical training programmes for Aprilia products, only **Aprilia** Official Network mechanics know this vehicle fully and have the specific tools necessary to carry out maintenance and repair operations correctly.

The reliability of the vehicle also depends on its mechanical conditions. Checking the vehicle before riding it, its regular maintenance and the use of **original Aprilia spare parts** only are essential factors! For information on the nearest **Official Dealer and/or Service Centre** consult our website:

www.aprilia.com

Only by requesting aprilia original spare parts can you be sure of purchasing products that were developed and tested during the actual vehicle design stage. All aprilia original spare parts undergo quality control procedures to guarantee reliability and durability.

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Not all versions/models shown in this publication are available in all countries. The availability of individual models should be confirmed with the official aprilia sales network.

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# MANUALE STAZIONE DI SERVIZIO CAPONORD 1200

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

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

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

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



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



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



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



# **INDEX OF TOPICS**

CHARACTERISTICS	CHAR
SPECIAL TOOLS	S-TOOLS
MAINTENANCE	MAIN
Troubleshooting	TROUBL
ELECTRICAL SYSTEM	ELE SYS
Engine from vehicle	ENG VE
Engine	ENG
Power supply	P SUPP
Suspensions	SUSP
Chassis	CHAS
Braking system	BRAK SYS
CLUTCH SYSTEM	CLU SYS
Cooling system	COOL SYS
Bodywork	BODYW
Pre-delivery	PRE DE
Pre-delivery	PRE DE



# **INDEX OF TOPICS**

CHARACTERISTICS CHAR

#### Rules

## Safety rules

#### Carbon monoxide

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

#### CAUTION



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

#### Fuel

#### CAUTION





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

DO NOT DISPERSE FUEL IN THE ENVIRONMENT.

KEEP OUT OF THE REACH OF CHILDREN

#### Hot components

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

#### Coolant

The coolant contains ethylene glycol which, under certain conditions, can become flammable.

When it burns, ethylene glycol produces an invisible flame which however can cause burns.

## CAUTION





TAKE CARE NOT TO POUR COOLANT ONTO HOT ENGINE OR EXHAUST SYSTEM COMPONENTS; THE FLUID MAY CATCH FIRE AND BURN WITH INVISIBLE FLAMES. WHEN CARRYING OUT MAINTENANCE OPERATIONS, IT IS ADVISABLE TO WEAR LATEX GLOVES. EVEN THOUGH IT IS TOXIC, COOLANT HAS A SWEET FLAVOUR WHICH MAKES IT VERY ATTRACTIVE TO ANIMALS. NEVER LEAVE THE COOLANT IN OPEN CONTAINERS IN AREAS ACCESSIBLE TO ANIMALS AS THEY MAY DRINK IT.

KEEP OUT OF THE REACH OF CHILDREN

DO NOT REMOVE THE RADIATOR CAP WHEN THE ENGINE IS STILL HOT. THE COOLANT IS UNDER PRESSURE AND MAY CAUSE BURNS.

Used engine oil and transmission oil

CAUTION





IT IS ADVISABLE TO WEAR PROTECTIVE IMPERMEABLE GLOVES WHEN SERVICING THE VEHICLE.

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

WASH YOUR HANDS CAREFULLY AFTER HANDLING OIL.

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

DO NOT DISPOSE OF OIL IN THE ENVIRONMENT

KEEP OUT OF THE REACH OF CHILDREN

Brake and clutch fluid



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

KEEP OUT OF THE REACH OF CHILDREN

Battery electrolyte and hydrogen gas

CAUTION



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

KEEP OUT OF THE REACH OF CHILDREN

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

#### Maintenance rules

### **GENERAL PRECAUTIONS AND INFORMATION**

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

#### BEFORE DISASSEMBLING COMPONENTS

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

#### **COMPONENTS REMOVAL**

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

#### REASSEMBLING COMPONENTS

#### CAUTION

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

- Only use ORIGINAL Aprilia SPARE PARTS.
- Comply with lubricant and consumables use guidelines.
- Lubricate parts (whenever possible) before reassembling them.
- When tightening nuts and screws, start either from the components with the largest diameter
  or from the innermost components, proceeding diagonally. Tighten nuts and screws in successive steps before applying the tightening torque.
- Always replace self-locking nuts, washers, sealing rings, circlips, O-rings (OR), cotter pins
  and screws with new parts if the thread is damaged.
- When assembling the bearings, make sure to lubricate them well.
- Check that each component is assembled correctly.
- After a repair or routine maintenance, carry out pre-ride checks and test the vehicle on private grounds or in an area with low traffic.
- Clean all mating surfaces, oil seal rims and gaskets before refitting. Smear a thin layer of lithium-based grease on the oil seal rims. Reassemble oil seals and bearings with the brand or batch number facing outward (visible side).

#### **ELECTRICAL CONNECTORS**

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

Press the relative safety clips, if applicable.

• Grip the two connectors and disconnect them by pulling them in opposite directions.

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

#### CAUTION

DO NOT DISCONNECT CONNECTORS BY PULLING THE CABLES.

NOTE

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

**TIGHTENING TORQUES** 

CAUTION

IN THE EVENT THAT A SELFBRAKING NUT IS UNSCREWED, IT IS NECESSARY TO REPLACE IT WITH A NEW ONE.

CAUTION

REMEMBER THAT THE TIGHTENING TORQUES FOR ALL FASTENING ELEMENTS ON WHEELS, BRAKES, WHEEL AXLES AND ANY OTHER SUSPENSION COMPONENTS PLAY A KEY ROLE IN ENSURING VEHICLE SAFETY AND MUST COMPLY WITH SPECIFIED VALUES. CHECK THE TIGHTENING TORQUES OF FASTENING ELEMENTS ON A REGULAR BASIS AND ALWAYS USE A TORQUE WRENCH TO REASSEMBLE THESE COMPONENTS. FAILURE TO COMPLY WITH THESE RECOMMENDATIONS MAY CAUSE ONE OF THESE COMPONENTS TO LOOSEN OR EVEN DETACH, CAUSING A WHEEL TO LOCK OR COMPROMISING VEHICLE HANDLING. THIS MAY LEAD TO FALLS, WITH THE RISK OF SERIOUS INJURY OR DEATH.

# Running-in

Running the engine in correctly is essential for ensuring engine longevity and functionality. Twisty roads and gradients are ideal for running in the engine, brakes and suspension effectively. Vary your riding speed during the running in period. This ensures that components operate in "loaded" conditions and then "unloaded" conditions, allowing the engine components to cool.

#### CAUTION

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

#### Follow these guidelines:

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



AFTER THE SPECIFIED MILEAGE, TAKE YOUR VEHICLE TO AN Official Aprilia Dealer FOR THE CHECKS INDICATED IN THE "AFTER-RUN-IN" TABLE IN THE SCHEDULED MAINTENANCE SECTION TO AVOID INJURING YOURSELF, OTHERS AND /OR DAMAGING THE VEHICLE.

### Vehicle identification

Write down the chassis and engine number in the specific space in this booklet. The chassis number is handy when purchasing spare parts.

#### CAUTION



THE MODIFICATION OF THE IDENTIFICATION CODES IS A SERIOUS PUNISHABLE CRIME. HOWEVER, THE LIMITED WARRANTY FOR NEW VEHICLES WILL BE VOID IF THE VEHICLE IDENTIFICATION NUMBER (VIN) HAS BEEN MODIFIED OR NOT PROMPTLY DETERMINED.

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

## ZD4VKA000YSXXXXXX

KEY:

ZD4: WMI (World manufacturer identifier) code;

VK: model;

A00: version variation;

0: free digit

Y: year of manufacture

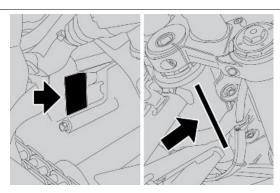
S: production plant (S= Scorzè);

XXXXXX: serial number (6 digits);

#### **ENGINE NUMBER**

The engine number is printed on the base of the engine crankcase, left hand side.

Engine No. .....



#### **CHASSIS NUMBER**

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

Chassis No. .....

### **Dimensions and mass**

#### **DIMENSIONS**

Specification	Desc./Quantity
Max. length	2245 mm (88.38 in)
Max. width (at hand guards)	1000 mm (39.37 in)
Max. height (fully extracted windshield)	1440 mm (56.69 in)
Saddle height	870 mm (34.25 in)
Wheelbase	1555 mm (61.22 in)
Kerb weight (Caponord 1200)	251 kg (553.36 lb)
Kerb weight (Caponord 1200 Travel Pack)	265 kg (584.22 lb)

Specification	Desc./Quantity
Dry weight (without fuel) (Caponord 1200)	233 kg (513.68 lb)
Dry weight (without fuel) (Caponord 1200 Travel Pack)	247 kg (544.54 lb)

# **Engine**

# ENGINE

Specification	Desc./Quantity
Model	M558M
Туре	90° longitudinal V-twin, 4-stroke, 4 valves per cylinder, 2 over-
	head camshafts.
No. of cylinders	2
Total engine capacity	1197 cm³ (73.05 cu in)
Bore / stroke	106 x 67.8 mm (4.17 x 2.67 in)
Compression ratio	12.0 +/- 0.5: 1
Electric	Starter
Engine idle speed	1450 ± 100 rpm
Clutch	Multiple-disk, oil-bathed clutch with control on the left side of
	the handlebar
Lubrication	Wet crankcase. Pressure system regulated by a trochoidal
	pump with oil radiator.
Air filter	Sponge.
Cooling	Fluid

## **G**EARBOX

Specification	Desc./Quantity
Туре	Mechanical, 6 speeds with foot lever on the left hand side of
	the engine

# **Transmission**

## **G**EAR RATIOS

Specification	Desc./Quantity
Gear ratio	Gear primary drive 40/69
1st gear ratio	14/36 (secondary)
2nd gear ratio	17/32 (secondary)
3rd gear ratio	20/30 (secondary)
4th gear ratio	22/28 (secondary)
5th gear ratio	23/26 (secondary)
6th gear ratio	24/25 (secondary)
Final drive gear ratio	17/42

# **Capacities**

# CAPACITY

Specification	Desc./Quantity
Fuel tank (reserve included)	24 I (5.28 UK gal; 6.34 US gal)
Fuel reserve	4 I (0.88 UK gal; 1.06 US gal)
Engine oil	3.1 I (without oil filter change) (0.68 UK gal; 0.82 US gal)
	3.35 I (with oil filter change) (0.74 UK gal; 0.88 US gal)
Coolant	2.5 I (0.55 UK gal; 0.66 US gal)
Seats	2
Maximum weight limit	460 kg (1014.12 lb)

# **Drive chain**

## **DRIVE CHAIN**

Specification	Desc./Quantity
Туре	Endless (without master link) and with sealed links. No. of links
	112
Model	525 ZRPK

# **Electrical system**

### **ELECTRICAL SYSTEM**

Specification	Desc./Quantity
Battery	VTX14-BS 12 V - 12 Ampere/hour
Main fuses	30A
Secondary fuses	7.5 A; 10 A; 15 A
Alternator (permanent magnet type)	13 V - 690 W at 6000 rpm

### **SPARK PLUGS**

Specification	Desc./Quantity
Standard spark plugs	NGK CR8EKB
Spark plug electrode gap	0.6 - 0.7 mm (0.024 - 0.028 in)
Resistance	5 kOhm

## WARNING LIGHTS

Specification	Desc./Quantity
Turn indicators	LED
High beam light	LED
Fuel reserve	LED
Cruise control warning light	LED
Gear in neutral	LED
General warning	LED
ABS	LED
ATC	LED

## **B**ULBS

Specification	Desc./Quantity
Low-/ high beam light	12V - 55W H11
Front daylight running lights	12V - 5W
Turn indicators	12V - 10W (White light)
Rear daylight running light / stop light	LED
Licence plate light	12V - 5W
Multifunction display lighting	LED

# Frame and suspensions

## **C**HASSIS

Specification	Desc./Quantity		
Туре	Component chassis (bolted). Die-cast aluminium plates and		
	high-strength steel tubular chassis.		
Steering inclination angle	24°		
Trail with suspension fully extended (without load)	128 mm (5.04 in)		

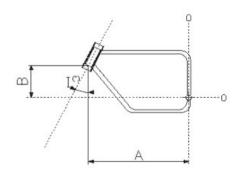
# SUSPENSION

Specification	Desc./Quantity	
Front (Caponord 1200)	Sachs telescopic "UPSIDE-DOWN" (upside-down stanchions)	
	fork with full-adjustable stanchions with 43mm diameter (ad-	

Specification	Desc./Quantity		
	justment of hydraulic brake extended on left stanchion and		
	compression on right stanchion and of spring preload on both)		
Front (Caponord 1200 Travel Pack)	Sachs telescopic "UPSIDE-DOWN" (upside-down stanchions)		
	fork with stanchions with 43mm diameter, hydraulic braking		
	dynamic adjustment during extension and compression (semi-		
	active Aprilia Dynamic Damping technology) on left stanchion;		
	and of spring preload on right stanchion, manually adjustable		
Travel	170 mm (6.69 in)		
Rear (Caponord 1200)	Oscillating swingarm connected with cantilever type link to a		
	Sachs single shock absorber, with adjustment of hydraulic		
	braking during extension and spring preload with knob.		
Rear (Caponord 1200 Travel Pack)	Oscillating swingarm connected with cantilever type link to a		
	Sachs single shock absorber, with adjustment of hydraulic		
	braking during extension and compression (semi-active Aprilia		
	Dynamic Damping technology) with "piggy-back" tank and au-		
	tomated management (or manually on instrument panel) of		
	spring preload via electro-hydraulic system.		
Wheel travel	150 mm (5.90 in)		

# SIZES A AND B

Specification	Desc./Quantity		
Size B	129.2 mm (5.07 in)		
Size A	519 ± 2 mm (20.43 ± 0.07 in)		



# **Brakes**

# **B**RAKES

Specification	Desc./Quantity
Front	Double floating disc, Ø 320 mm (12.60 in), radially-mounted
	calliper with four Ø 32 mm (1.26 in) pistons and two calliper
	pads
Rear	240 mm (9.45 in) diam. disc brake with 35 mm (1.38 in) diam.
	single piston calliper

# Wheels and tyres

## WHEEL RIMS

Specification	Desc./Quantity		
Туре	Light alloy rims with extractable bolt		
Front	3.50 x 17"		
Rear	6.00 x 17"		

# **T**YRES

Specification	Desc./Quantity		
Tyre type (standard)	DUNLOP QUALIFIER II		

Specification	Desc./Quantity		
Front tyre	120/70 ZR17" (58W)		
Front tyre pressure	rider only: 2.4 bar (240 kPa) (34.81 PSI)		
	rider + passenger: 2.5 bar (250 kPa) (36.26 PSI)		
Rear tyre	180/55 ZR17" (73W)		
Rear tyre pressure	rider only: 2.6 bar (260 kPa) (37.71 PSI)		
	rider + passenger: 2.8 bar (280 kPa) (40.61 PSI)		

# Supply

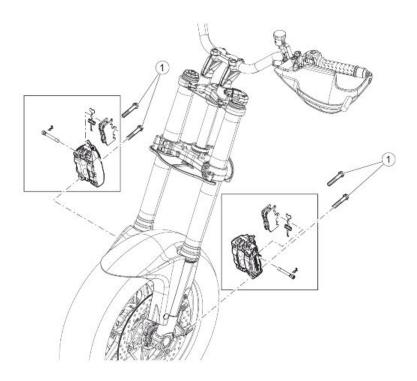
## FUEL SYSTEM

Specification	Desc./Quantity
Туре	Electronic injection (Multipoint)
Throttle valve diameter	Ø 52 mm (2.05 in)
Fuel	Premium unleaded petrol, minimum octane rating 95 (NORM)
	and 85 (NOMM)

# **Tightening Torques**

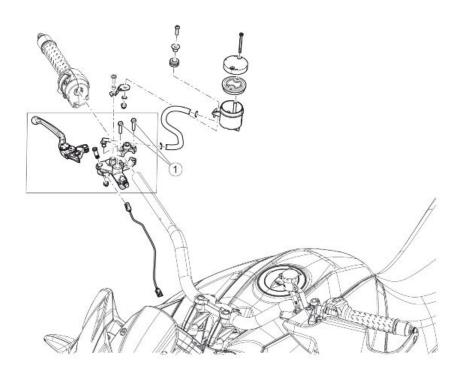
# **Chassis**

# Front side



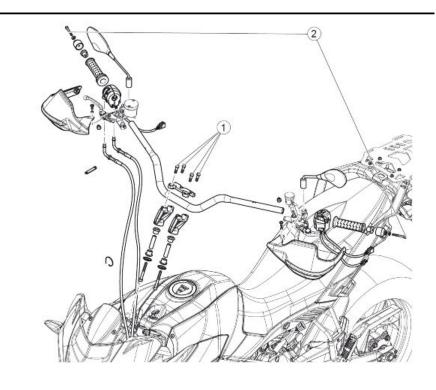
# FRONT BRAKE CALLIPER

pos.	Description	Type	Quantity	Torque	Notes
1	Callipers fastening screws	M10x55	4	50 ± 7.5 Nm (36.88 ± 5.53	-
				lb ft)	



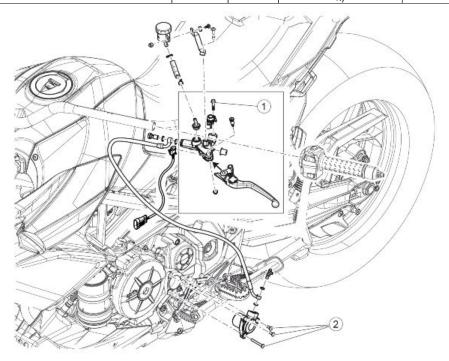
# FRONT BRAKE PUMP

р	os.	Description	Type	Quantity	Torque	Notes
1		Brake pump fixing screws	M6	2	10 ± 1,5 Nm (7.37 ± 1.10 lb	-
					ft)	



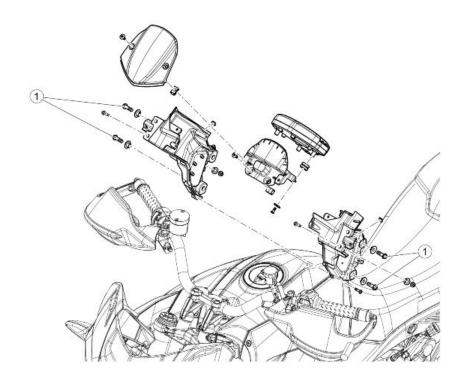
# CONTROLS HANDLEBAR

pos.	Description	Type	Quantity	Torque	Notes
1	Upper U-bolt fixing screw	M8x25	4	25 ± 3.75 Nm (18.44 ± 2.76	-
				lb ft)	
2	Anti-vibration weight fastening screws	-	2	20 ± 3 Nm (14.75 ± 2.21 lb	-
				ft)	



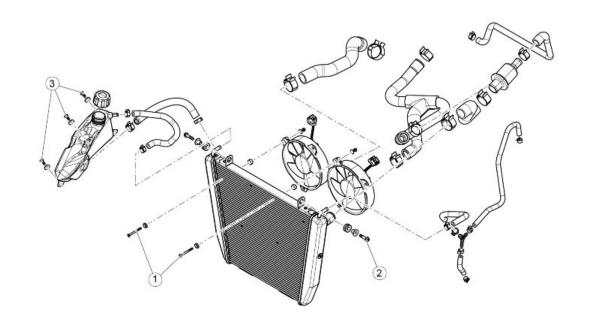
# **C**LUTCH CONTROL

pos.	Description	Type	Quantity	Torque	Notes
1	Clutch pump fixing screws	M6	2	10 ± 1,5 Nm (7.37 ± 1.10 lb	-
				ft)	
2	Throttle control fixing screws	M6	3	10 Nm (7.37 lb ft)	-



# INSTRUMENT SUPPORT

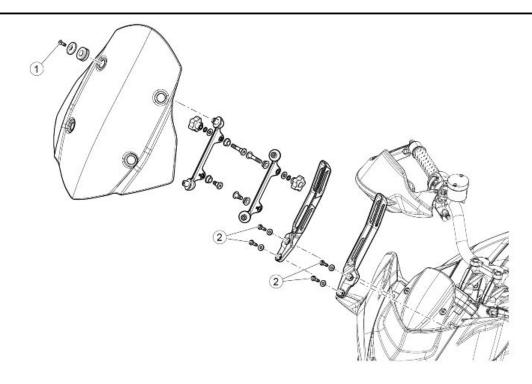
Pos.	Description	Type	Quantity	Torque	Notes
1	Instrument panel to trellis fixing screws	M8x25	4	25 ± 5 Nm (18.43 ± 3.68 lb	-
				ft)	



# COOLING SYSTEM

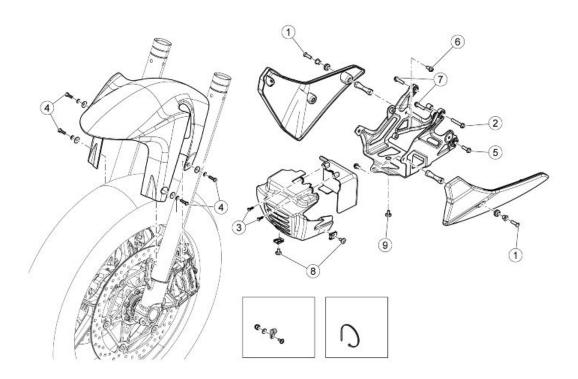
pos.	Description	Туре	Quantity	Torque	Notes
1	Electric fan fastener screw	M4x45	6	3 Nm (2.21 lb ft)	-

pos.	Description	Туре	Quantity	Torque	Notes
2	Flanged TE screw fastening left Ra- diator to trellis	M6x25	1	10 Nm (7.37 lb ft)	-
3	Flanged TE screw fastening expansion tank	M6x20	3	10 Nm (7.37 lb ft)	-



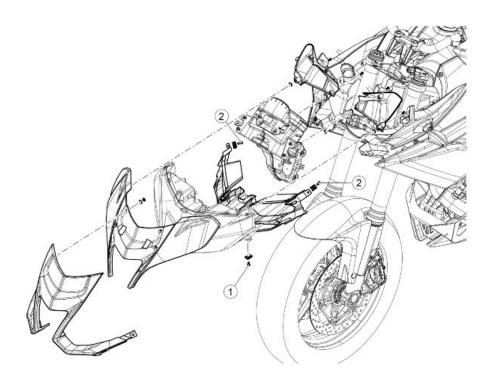
# TOP FAIRING\_WINDSHIELD

Pos.	Description	Туре	Quantity	Torque	Notes
1	Windshield on support fastener	M6x18	4	10 Nm (7.37 lb ft)	-
	screw				
2	Bracket retainer screw	M6x25	4	10 Nm (7.37 lb ft)	-



# Mudguard\_lug

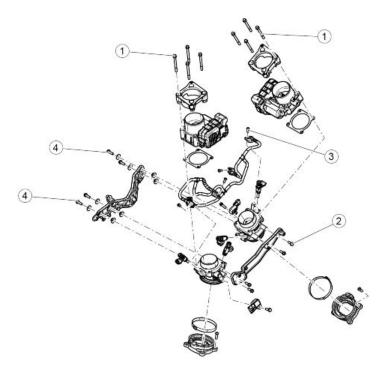
Pos.	Description	Туре	Quantity	Torque	Notes
1	Lug fixing screw	M6x20	2	10 Nm (7.37 lb ft)	-
2	Control unit support fixing screw	M6x35	1	10 Nm (7.37 lb ft)	-
3	Front with rear lug fixing screw	3.9x14	2	2 Nm (1.47 lb ft)	-
4	Front mudguard fixing screw	-	4	-	-
5	Control unit support fixing screw	M6x20	1	10 Nm (7.37 lb ft)	-
6	Lug on support fastener screw	M6x12	2	10 Nm (7.37 lb ft)	-
7	Control unit support fixing screw	M6x25	2	10 Nm (7.37 lb ft)	-
8	Lug on support fastener screw	M5	2	6 Nm (4,42 lb ft)	-
9	Spacer TCEI screw	M8	1	Tighten by hand	Loct. 243



FRONT FAIRING

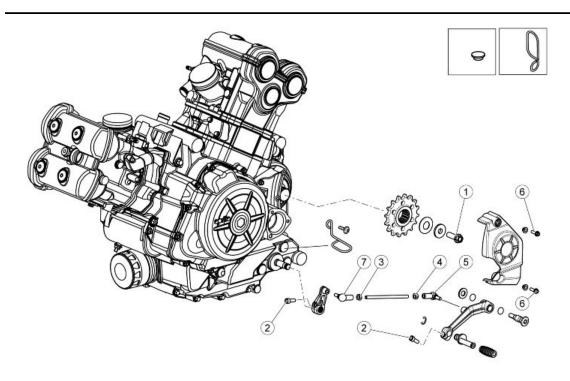
Pos.	Description	Type	Quantity	Torque	Notes
1	Deflector fixing screw	M5x12	2	6 Nm (4.42 lb ft)	-
2	Deflector fixing screw	M5x16	2	6 Nm (4.42 lb ft)	-

# **Central part**



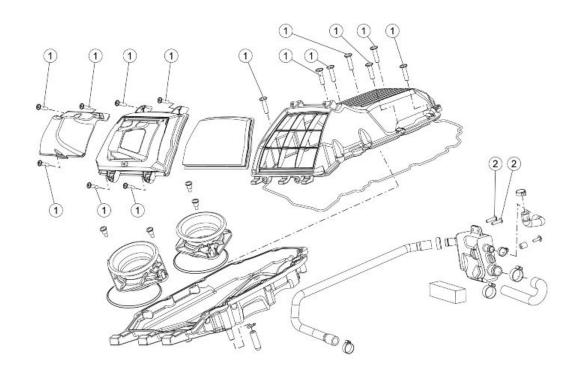
# THROTTLE BODY

pos.	Description	Type	Quantity	Torque	Notes
1	Intake union fastener screw	M6	8	12 Nm (8.85 lb ft)	Loctite 242
2	Map sensor fixing screw	M6	2	5.5 Nm (4.05 lb ft)	-
3	Injector fastener screw	M6	2	12 Nm (8.85 lb ft)	Loctite 242
4	Injection Throttle Body fastener	M6	8	12 Nm (8.85 lb ft)	Loctite 242
	screw				



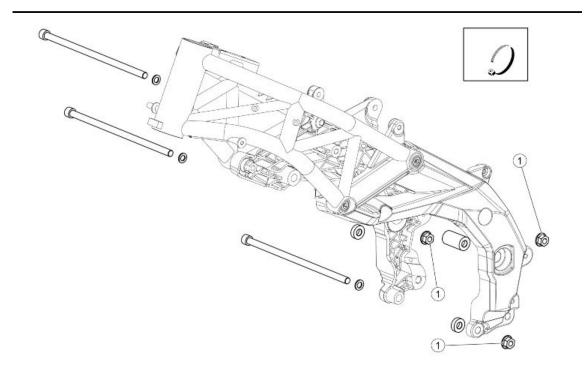
# **ENGINE**

pos.	Description	Type	Quantity	Torque	Notes
1	Flanged TE screw fastening pinion	M10x1.25	1	50 Nm (36.88 lbf ft)	Loctite 270
2	TCEI screw fastening Pin to gearbox	M6x16	2	12 Nm (8.85 lbf ft)	-
	lever and Gearbox Lever to knurled				
	shaft				
3	LH lock nut for ball joint	M6	1	10 Nm (7.37 lbf ft)	-
4	RH lock nut for ball joint	M6	1	10 Nm (7.37 lbf ft)	-
5	RH ball joint on gearbox control lever	M6	1	10 Nm (7.37 lbf ft)	-
6	Pinion protector fixing screw	M6x12	2	10 Nm (7.37 lbf ft)	-
7	LH ball joint on gearbox control lever	M6	1	10 Nm (7.37 lbf ft)	-
-	Fastener for positive cable on engine	-	1	10 Nm (7.37 lbf ft)	-
-	TE screw fastening negative cable to	M6x12	1	10 Nm (7.37 lbf ft)	-
	engine				



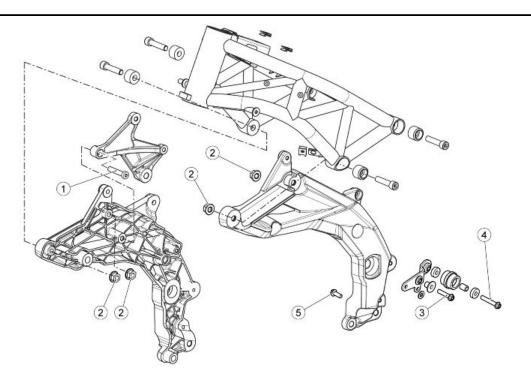
# **A**IR FILTER BOX

Pos.	Description	Type	Quantity	Torque	Notes
1	Cross head self-tapping screw fas-	M5x20	10	3 Nm (2.21 lb ft)	-
	tening covers / filter box				
2	Cross head self-tapping screw fas-	M5x20	2	3 Nm (2.21 lb ft)	-
	tening blow-by tank				



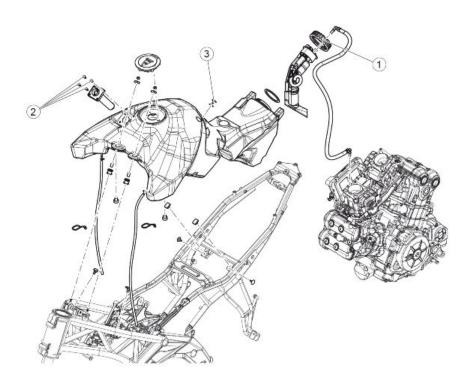
# CENTRE FRAME

pos.	Description	Type	Quantity	Torque	Notes
1	Flanged nut fastening side panels to	M12	3	80 Nm (59 lbf ft)	-
	engine				



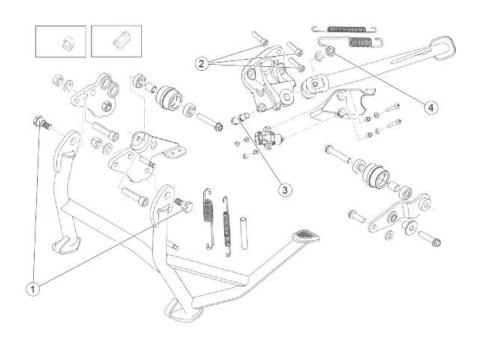
# FRONT CHASSIS

pos.	Description	Type	Quantity	Torque	Notes
1	TCEI screw fastening shock absorb-	M10x30	1	50 Nm (36.88 lbf ft)	-
	er counterplate to RH frame bracket				
2	Flanged nut fastening Trellis to frame	M12	4	80 Nm (59 lbf ft)	-
	side panels				
3	Flanged TE screw fastening chain	M8x35	1	25 Nm (18.44 lbf ft)	Loctite 243
	roller bracket to LH plate				
4	Flanged TE screw fastening chain	M8x45	1	25 Nm (18.44 lbf ft)	Loctite 243
	roller to chain roller bracket				
5	Screw fastening chain roller bracket	M8x20	1	25 Nm (18.44 lbf ft)	Loctite 243
	to LH plate				



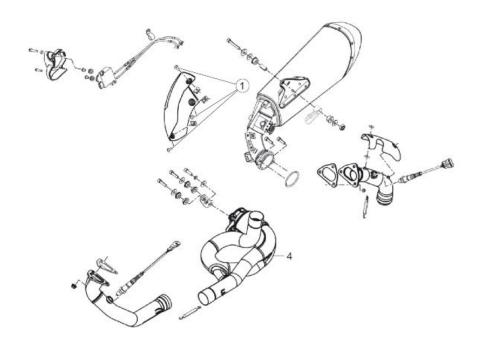
FUEL TANK

Pos.	Description	Туре	Quantity	Torque	Notes
1	Plastic ring nut	-	1	20 ± 3 Nm (14.75 ± 2.21 lb	-
				ft)	
2	Level indicator fixing screws	M6x16	4	$3 \pm 0.45 \text{ Nm} (2.21 \pm 0.33 \text{ lb})$	-
				ft)	
3	Saddle fixing	M5	1	$3 \pm 0.45 \text{ Nm} (2.21 \pm 0.33 \text{ lb})$	-
	·			ft)	



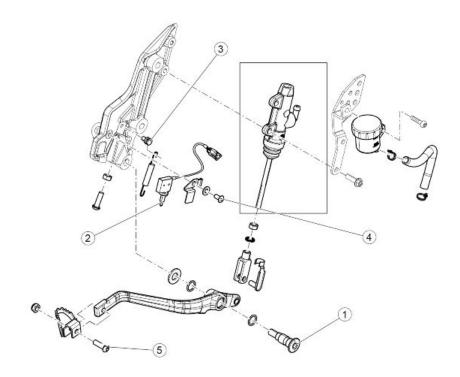
# <u>Stand</u>

pos.	Description	Type	Quantity	Torque	Notes
1	Fixing screw protection	M6x16	3	5 ± 1 Nm (3.68 ± 0.74 lb ft)	-
2	Plate fastening screws	M8x30	3	25 ± 5 Nm (18.43 ± 3.68 lb	Loctite 243
				ft)	
3	Stand screw	M10	1	25 ± 5 Nm (18.43 ± 3.68 lb	Loctite 243
				ft)	
4	Stand nut	M10x1.25	1	25 ± 5 Nm (18.43 ± 3.68 lb	Loctite 243
				ft)	



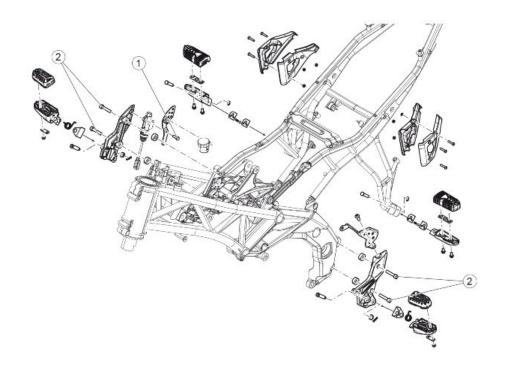
# EXHAUST

pos.	Description	Type	Quantity	Torque	Notes
1	Fixing screw protection	M6x16	3	5 ± 1 Nm (3.68 ± 0.74 lb ft)	-



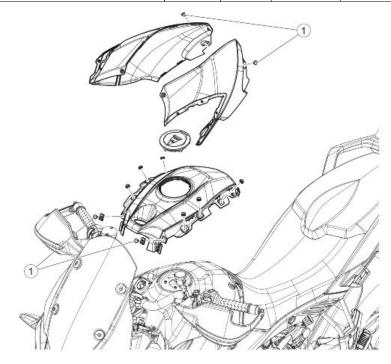
# REAR BRAKE PUMP

pos.	Description	Туре	Quantity	Torque	Notes
1	Rear brake lever pin	-	1	25 ± 3.75 Nm (18.44 ± 2.76 lb ft)	Loctite 243
2	Microswitch fixing nuts	M6	2	$0.4 \pm 0.08$ Nm $(0.29 \pm 0.05$ lb ft)	-
3	Spring linking pin	M5x7	1	6 ± 1.2 Nm (4.42 ± 0.88 lb ft)	Loctite 243
4	Microclip plate fixing screw	M5X15	1	6 ± 1.2 Nm (4.42 ± 0.88 lb ft)	Loctite 243
5	Brake lever push rod fixing screw	-	1	10 ± 1.5 Nm (7.37 ± 1.10 lb ft)	-



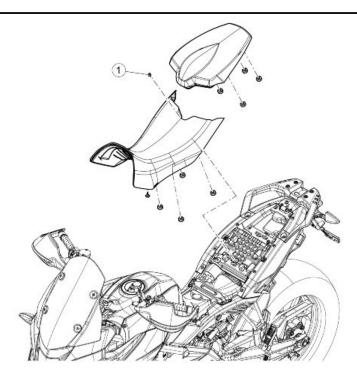
# **F**ootrests

pos.	Description	Type	Quantity	Torque	Notes
1	Rear brake pump fixing screws	M6x20	2	10 ± 1.5 Nm (7.37 ± 1.11 lb	Loctite 243
				ft)	
2	Footrest support fixing screws	M8x40	4	30 ± 4.5 Nm (22.12 ± 3.31	Loctite 243
	· · · · · · · · · · · · · · · · · · ·			lb ft)	



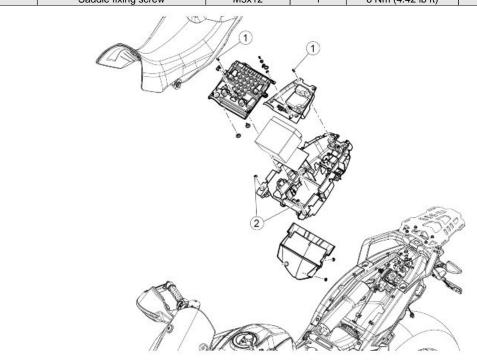
TANK COVER

Pos.	Description	Type	Quantity	Torque	Notes
1	Covers fastening screws	M5x9	4	$3 \pm 0.60 \text{ Nm} (2.21 \pm 0.44 \text{ lb})$	-
				ft)	



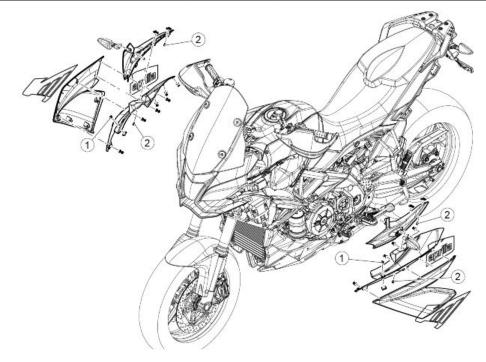
SADDLE

Pos.	Description	Туре	Quantity	Torque	Notes
1	Saddle fixing screw	M5v12	1	6 Nm (4.42 lb ft)	_



# HELMET COMPARTMENT

Pos.	Description	Type	Quantity	Torque	Notes
1	Covers fastener screw	M5x20	8	6 Nm (4.42 lb ft)	-
2	Compartment fixing screw	M5x12	2	6 Nm (4.42 lb ft)	-



# SIDE FAIRINGS

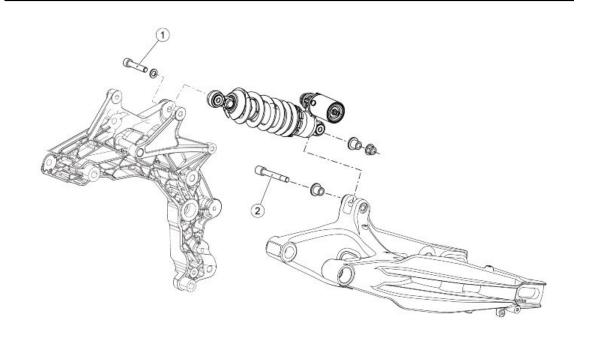
Pos.	Description	Туре	Quantity	Torque	Notes
1	Fairing fastener screw	M5x9	2	6 Nm (4.42 lb ft)	-
2	Fairing fastener screw	M5x16	4	6 Nm (4.42 lb ft)	-

# Back side



ABS SYSTEM

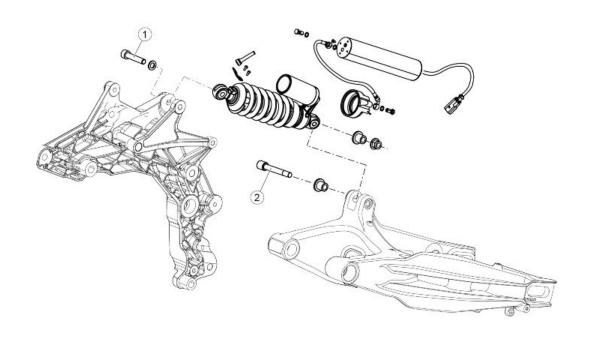
pos.	Description	Туре	Quantity	Torque	Notes
-	ABS ECU fastener screw	M6x25	1	10 Nm (7.37 lbf ft)	Loctite 243
-	ABS ECU fastener nut	M6	2	10 Nm (7.37 lbf ft)	-



# REAR SUSPENSION

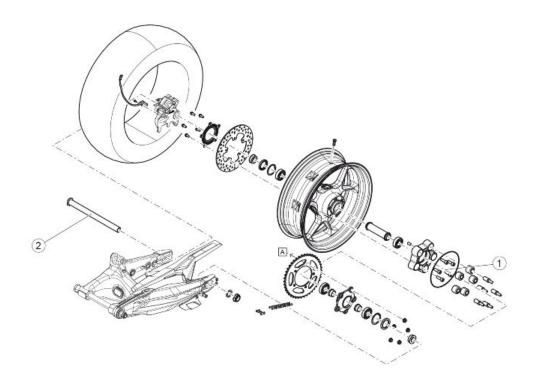
Pos.	Description	Type	Quantity	Torque	Notes
1	Upper TCEI mounting screw	M10x50	1	50 Nm (36.88 lb ft)	-
2	Lower TCEI mounting screw	M10x80	1	50 Nm (36.88 lb ft)	-

# **ADD Version**



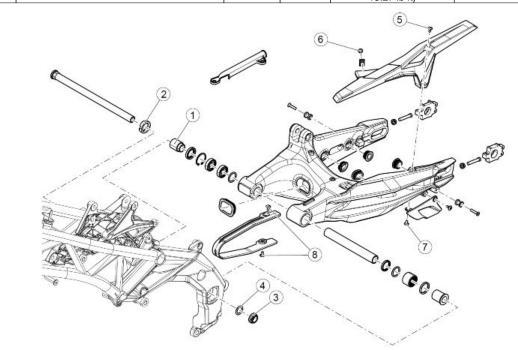
## REAR SUSPENSION ADD

Pos.	Description	Type	Quantity	Torque	Notes
1	Upper TCEI mounting screw	M10x50	1	50 Nm (36.88 lb ft)	-
2	Lower TCEI mounting screw	M10x80	1	50 Nm (36.88 lb ft)	-



# REAR WHEEL

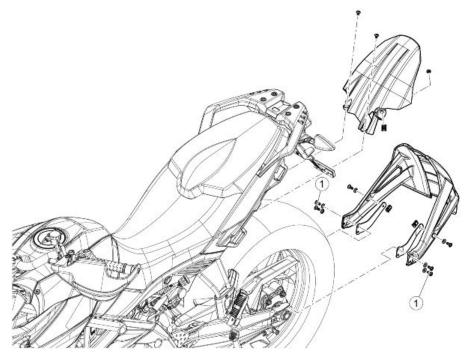
pos.	Description	Type	Quantity	Torque	Notes
1	Fastening screws flexible coupling	M10	5	•	-
2	Rear wheel axle	-	1	120 ± 18 Nm (88.50 ±	-
				13.27 lb ft)	



# **S**WINGARM

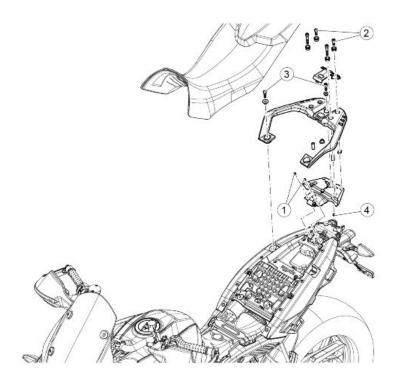
pos.	Description	Type	Quantity	Torque	Notes
1	Swingarm Pin adjustment bushing	-	1	12 Nm (8.85 lb ft)	-

pos.	Description	Type	Quantity	Torque	Notes
2	Swingarm pin ring nut	-	1	60 Nm (44.25 lb ft)	-
3	Swingarm pin nut	-	1	90 Nm (66.38 lb ft)	-
4	TPSI screw fastening rear stand bushing	M6x40	2	10 Nm (7.37 lb ft)	-
5	TBEI screw fastening chain guard to swingarm	M5x9	1	6 Nm (4.42 lb ft)	Loctite 243
6	TBEI Chainguard fixing screw	M5x9	1	4 Nm (2.95 lb ft)	-
7	TBEI screw fastening chain guide to swingarm	M5x9	2	6 Nm (4.42 lb ft)	Loctite 243
8	Flanged TBEI screw fastening chain slider	M5x9	2	6 Nm (4.42 lb ft)	-



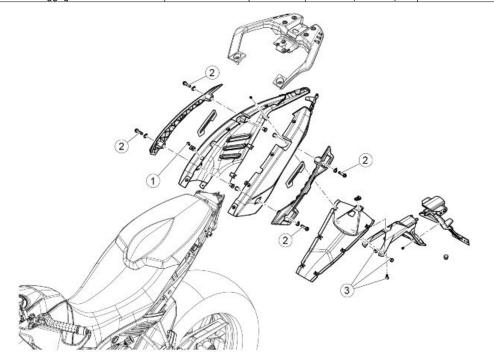
# REAR MUDGUARD

Pos.	Description	Type	Quantity	Torque	Notes
1	Mudguard fixing screws on wheel adjustment	-	1	10 ± 2 Nm (7.37 ± 1.47 lb ft)	Loctite 243



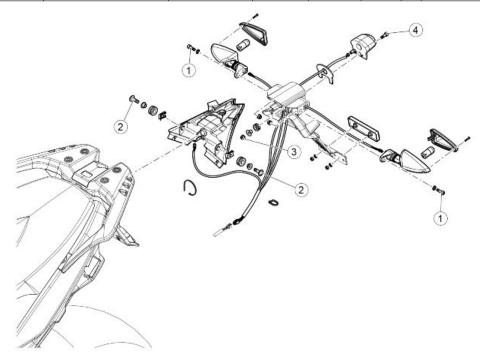
# LUGGAGE RACK

Pos.	Description	Туре	Quantity	Torque	Notes
1	Luggage rack screw	3.9x14	2	2 Nm (1.47 lb ft)	-
2	Luggage rack cover screw	M8x20	2	25 Nm (18.44 lb ft)	-
3	Luggage rack fastener screw	M8x25	3	25 Nm (18.44 lb ft)	-
4	Luggage rack screw	5x14	5	3 Nm (2.21 lb ft)	-



## REAR BODYWORK

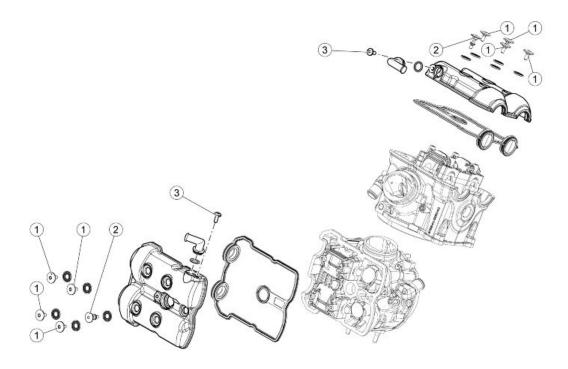
Pos.	Description	Type	Quantity	Torque	Notes
1	Tail fairing fastener screw	M5x12	6	6 Nm (4.42 lb ft)	-
2	Panniers connection fixing screw	-	4	-	-
3	License plate holder fastener screw	M6	3	10 Nm (7.37 lb ft)	-



## REAR LIGHTS

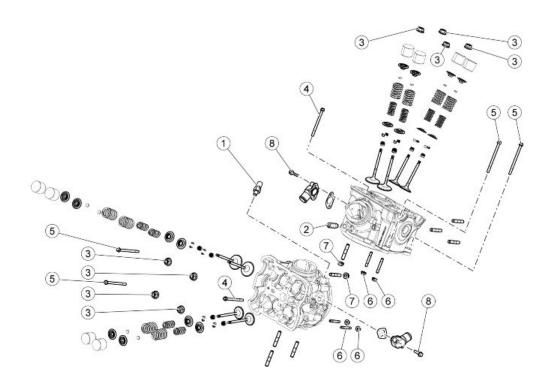
Pos.	Description	Type	Quantity	Torque	Notes
1	Turn indicator fixing screw	M5x16	2	6 Nm (4.42 lb ft)	-
2	Taillight screw	M5x16	2	6 Nm (4.42 lb ft)	-
3	License plate light nut	M5	1	6 Nm (4.42 lb ft)	-

## **Engine**



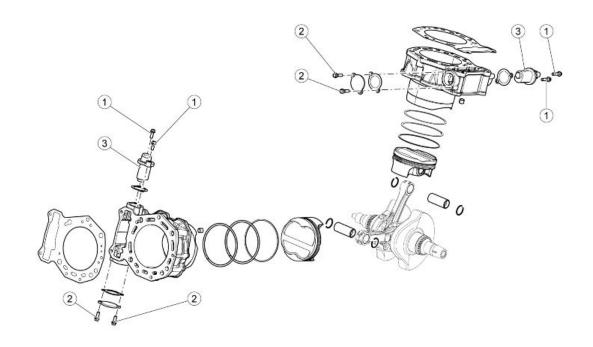
## HEAD COVER

pos.	Description	Type	Quantity	Torque	Notes
1	Special screw for fastening head	M6	8	9 Nm (6.64 lbf ft)	-
	cover				
2	Special screw for fastening head	M6	2	9 Nm (6.64 lbf ft)	-
	cover				
3	Oil breather fastener screw	M6	2	5.50 Nm (4.06 lbf ft)	-
-	Spark plugs	-	2	10-12 Nm (7.38-8.85 lbf	-
				ft)	



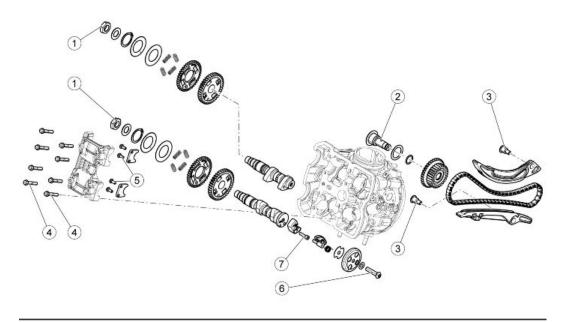
## <u>Head</u>

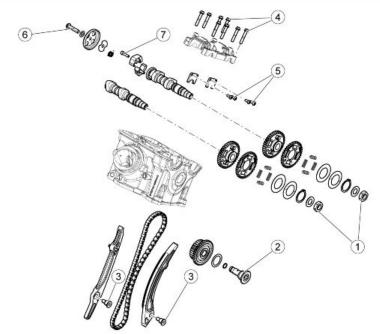
pos.	Description	Type	Quantity	Torque	Notes
1	Water Temperature Sensor	M12x1.5	1	22 Nm (16.22 lbf ft)	-
2	Threaded plug for water sensor seat	M12x1.5	1	10 Nm (7.38 lbf ft)	Loctite Drise AL 506
3	Head stud bolt fastener nut - pre- tightening	M10x1.25	8	10 Nm (7.38 lbf ft)	Lubricate the threads before tightening
3	Head stud bolt fastener nut - tightening	M10x1.25	8	13 Nm (9.59 lbf ft) + 135° + 135°	Lubricate the threads before tightening
4	Fastener for Head / Cylinder / Outer side crankcase	M6	2	12 Nm (8.85 lbf ft)	-
5	Fastener for Head / Cylinder / Inner side crankcase	M6	4	12 Nm (8.85 lbf ft)	-
6	Nut fastening Stud Bolts / Head	M6	4	12 Nm (8.85 lbf ft)	-
7	Nut fastening Stud Bolts / Head	M8	2	26 Nm (19.18 lbf ft)	-
8	Bleed union fastener screw	M5	4	5.50 Nm (4.06 lbf ft)	Loctite dry loc 2040



## CYLINDER

pos.	Description	Type	Quantity	Torque	Notes
1	Chain tensioner fastener screw	M6	4	13 Nm (9.59 lb ft)	-
2	Cylinder plate fastener screw	M6	4	7.84-9.81 Nm	-
				(5.78-7.23 lb ft)	
3	Chain tensioner adjustment screw	M6	2	5.50 Nm (4.06 lb ft)	-

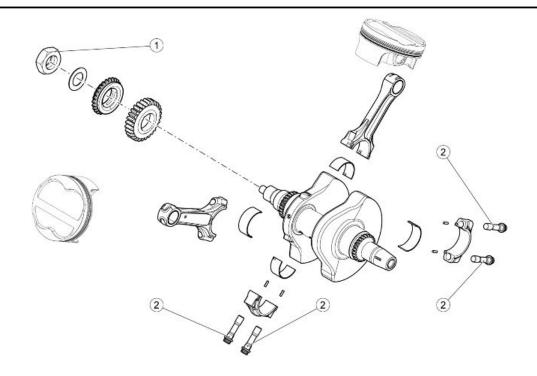




## **TIMING SYSTEM**

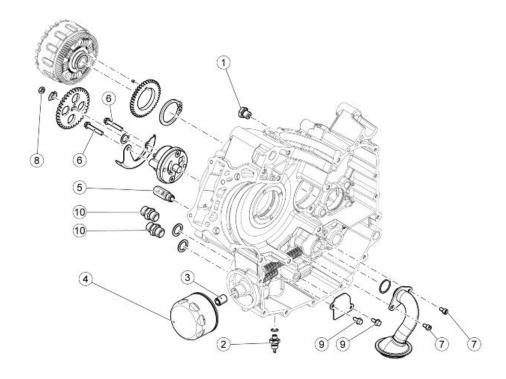
pos.	Description	Туре	Quantity	Torque	Notes
1	Camshaft gear fastener nut	M15x1	4	90 Nm (66.38 lbf ft)	-
2	Timing drive gear fastener screw	M24x1.5	2	40 Nm (29.50 lbf ft)	3M SCOTCH GRIP 2353
3	Special screw for fastening mobile / fixed shoes	M8	4	19 Nm (14.01 lbf ft)	3M SCOTCH GRIP 2353
4	Cam tower / head fastener screws	M6	16	12 Nm (8.85 lbf ft)	-
5	Camshaft retainer plate fastener	torx M5	8	8.5 Nm (6.26 lbf ft)	3M SCOTCH GRIP
	screw				2353

pos.	Description	Туре	Quantity	Torque	Notes
6	Decompression device fixing screw	torx M8	2	28.5 Nm (21.02 lbf ft)	3M SCOTCH GRIP
					2353
7	Fastener screw	M5	2	5.50 Nm (4.06 lbf ft)	3M SCOTCH GRIP
					2353



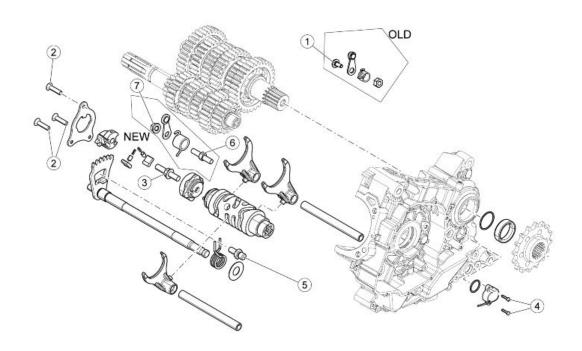
## CRANKSHAFT

pos.	Description	Type	Quantity	Torque	Notes
1	Crankshaft primary gear fastener nut	M24x1.5	1	300 Nm (221.27 lbf ft)	Anticlockwise nut
2	Connecting rod screw	M10	4	15 + 30 Nm (11.06 +	Lubricate the
				22.13 lbf ft) + $50^{\circ} \pm 2^{\circ}$ ,	threads before tight-
				final control torque 65 -	ening
				78 Nm (47.94 - 57.53 lbf	
				ft)	



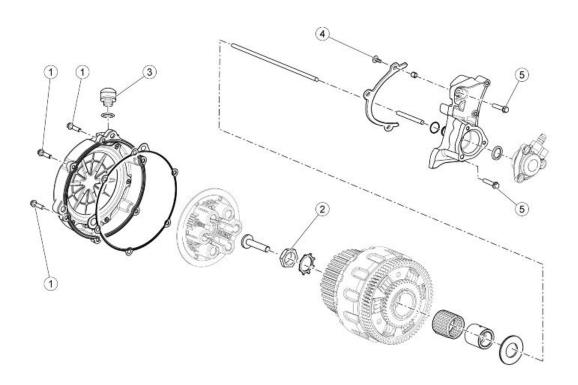
## OIL PUMP

pos.	Description	Type	Quantity	Torque	Notes
1	Oil drainage plug	M16x1.5	1	19 Nm (14.01 lbf ft)	-
2	Fastening oil sensor on clutch side	-	1	13 Nm (9.59 lbf ft)	-
	crankcase half				
3	Fastening oil filter union on clutch	-	1	20 Nm (14.75 lbf ft)	-
	side crankcase half				
4	Oil filter	-	1	14 Nm (10.33 lbf ft)	-
5	Oil pressure regulator valve	M18x1.5	1	42 Nm (30.98 lbf ft)	-
6	Oil pump fixing screw	M6	2	5-6 Nm (3.69-4.42 lbf ft)	3M SCOTCH GRIP
					2353
7	Rose pipe fixing screw	M6	2	12 Nm (8.85 lbf ft)	-
8	Oil pump driven gear fastener nut	M6	1	11 Nm (8.11 lbf ft)	-
9	By-Pass plate fastener screw	M5	2	5.50 Nm (4.06 lbf ft)	Loctite 242
10	Oil cooling radiator nipple	M16x1.5	2	42.5 Nm (31.35 lbf ft)	-



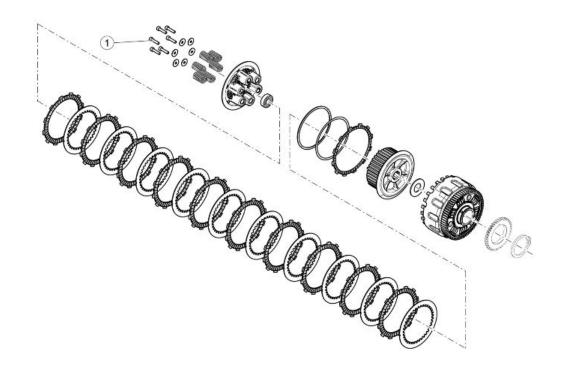
## **G**EAR SELECTOR

pos.	Description	Type	Quantity	Torque	Notes
1	Gear retainer pawl fastener screw	M6	1	12 Nm (8.85 lb ft)	Loctite dry loc 2040
2	Selector plate fastener screw	M5	3	5.50 Nm (4.06 lb ft)	3M SCOTCH GRIP 2353
3	Screw fastening Desmodromic se- lector drum / Selector sprocket	M8	1	20 Nm (14.75 lb ft)	3M SCOTCH GRIP 2353
4	Gear sensor fastener screw	M5	2	5.50 Nm (4.06 lb ft)	Loctite 270
5	Selector pin fastener onto clutch side crankcase half	M10x1.5	1	16 Nm (11.80 lb ft)	Loctite 242
6	Gear retainer pawl fastener pin	-	1	11-13 Nm (8.11-9.59 lb ft)	-
7	Gear retainer pawl fastener flanged nut	-	1	10-12 Nm (7.38-8.85 lb ft)	-



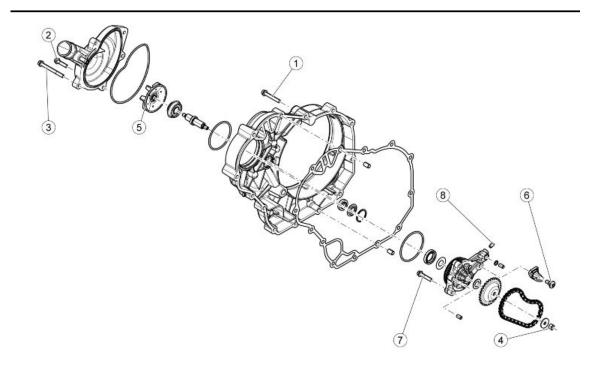
## **C**LUTCH COVER

pos.	Description	Туре	Quantity	Torque	Notes
1	Screw fastening Clutch Cover / inter-	M6	6	13 Nm (9.59 lbf ft)	-
	mediate Clutch side cover				
2	Clutch fastener nut	M24x1	1	170 Nm (125.38 lbf ft)	Chamfer
3	Fastening oil filler plug on Clutch cov-	-	1	2 Nm (1.48 lbf ft)	-
	er				
4	Screw fastening fixing Plate / Clutch	M5	3	5.50 Nm (4.06 lbf ft)	Loctite 242
	control Mounting				
5	Screw fastening clutch control	M6	2	8 Nm (5.90 lbf ft)	-
	mounting on flywheel side crankcase				
	half				



**C**LUTCH

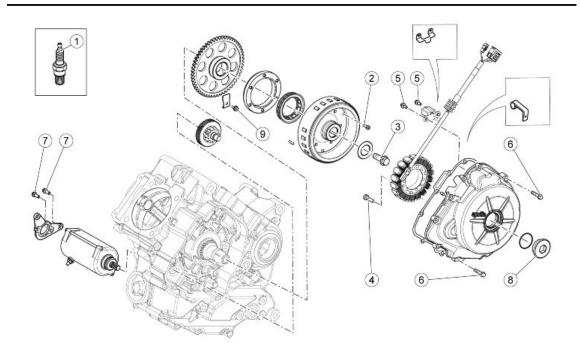
pos.	Description	Type	Quantity	Torque	Notes
1	Clutch spring fastener screw	M6	6	11 Nm (8.11 lbf ft)	-



## WATER PUMP

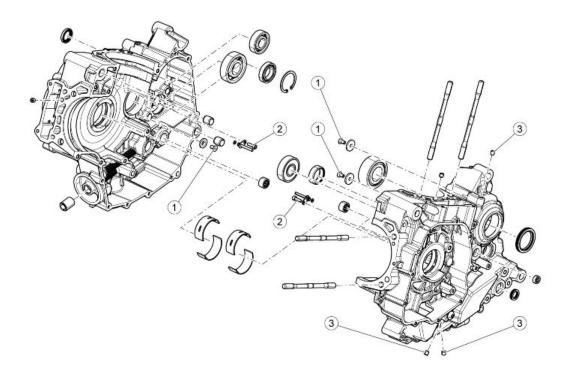
pos.	Description	Туре	Quantity	Torque	Notes
1	Clutch side cover fastener screw	M6	11	13 Nm (9.59 lbf ft)	-

pos.	Description	Type	Quantity	Torque	Notes
2	Fastener screw for Pump Cover / Clutch side cover	M6	3	13 Nm (9.59 lbf ft)	-
3	Screw fastening Pump Cover / Clutch Cover / clutch side crankcase half	M6	2	13 Nm (9.59 lbf ft)	-
4	Nut fastening water pump drive gear sprocket	M6	1	12 Nm (8.85 lbf ft)	-
5	Water pump rotor	-	1	4.50 Nm (3.32 lbf ft)	-
6	Screw fastening chain tensioner slider to water pump	M6	1	8-10 Nm (5.90-7.38 lbf ft)	-
7	Water pump support fixing screw	M6	3	12 Nm (8.85 lbf ft)	-
8	Water pump support plug	M6x10	1	6.5 Nm (4.79 lbf ft)	3M SCOTCH GRIP 2353



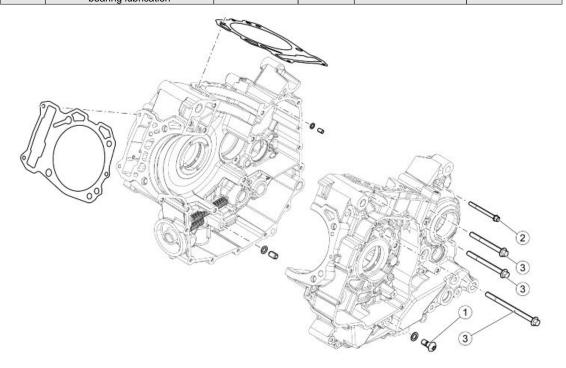
## **I**GNITION

pos.	Description	Type	Quantity	Torque	Notes
1	Spark plug	-	4	11 Nm (8.11 lb ft)	-
2	Freewheel Ring fastener screw	M6	6	14 Nm (10.33 lb ft)	3M SCOTCH GRIP 2353
3	Screw fixing rotor - Crankshaft - (12 mm - 0.47 in)	M12x1.25	1	130 Nm (95.88 lb ft)	-
3	Screw fixing rotor - Crankshaft - (14 mm - 0.55 in)	M12x1.25	1	190-200 Nm (140.14-147.51 lb ft)	-
4	Screw fastening Stator / Flywheel Cover	M6	3	9 Nm (6.64 lb ft)	-
5	Screw fastening pick-up / Flywheel cover	M5	2	3.50 Nm (2.58 lb ft)	Loctite 270
6	Flywheel cover fastener screw	M6	10	13 Nm (9.59 lb ft)	-
7	Screw fastening starter motor bracket to motor and crankcase	M6	4	6.86-7.84 Nm (5.06-5.78 lb ft)	Loct. 242
8	Crankshaft access cap	-	1	4 Nm (2.95 lb ft)	-
9	Retainer plate fastener screw	M6	1	8 Nm (5.90 lb ft)	3M SCOTCH GRIP 2353



## CRANKCASE 1

pos.	Description	Туре	Quantity	Torque	Notes
1	Bearing retainer fastener screw	M6	3	10 Nm (7.38 lbf ft)	Loctite 270
2	Piston oil jet fastener screw	M5	2	5.50 Nm (4.06 lbf ft)	Loctite 270
3	Tapered plug for crankshaft main bearing lubrication	M8x1	4	15 Nm (11.06 lbf ft)	-



## CRANKCASE 2

pos.	Description	Type	Quantity	Torque	Notes
1	Special calibrated screw for gearbox	M9x1	1	18 Nm (13.28 lbf ft)	-
	lubrication			· ·	
2	Screw fastening flywheel side /	M6	11	13 Nm (9.59 lbf ft)	-
	clutch side crankcase halves				
3	Screw fastening flywheel side /	M8	9	29 Nm (21.39 lbf ft)	-
	clutch side crankcase halves				

## Overhaul data

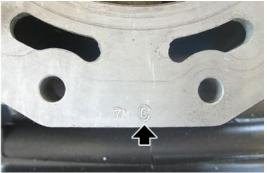
## **Assembly clearances**

## Cylinder - piston assy.

The pistons are available in four size types (A, B, C, D) to be coupled to the four cylinder types (A, B, C, D).

Only one type of piston ring is available.





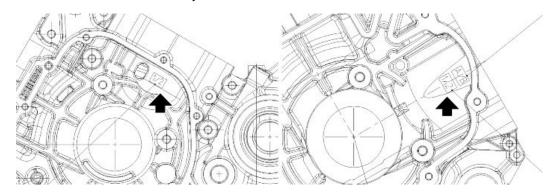
## **CYLINDER-PISTON COUPLING**

Name	Initials	Cylinder	Piston	Play on fitting
Cylinder-piston clear-	Type A - A	105.990 - 105.997 mm	105.928 - 105.935 mm	0.055 - 0.069 mm
ance A - A		(4.1728 - 4.1731 in)	(4.1704 - 4.1707 in)	(0.0022 - 0.0027 in)
Cylinder-piston clear-	Type B - B	105.997 - 106.004 mm	105.935 - 105.942 mm	0.055 - 0.069 mm
ance B - B		(4.1731 - 4.1734 in)	(4.1707 - 4.1709 in)	(0.0022 - 0.0027 in)
Cylinder-piston clear-	Type C -C	106.004 - 106.011 mm	105.942 - 105.949 mm	0.055 - 0.069 mm
ance C - C		(4.1734 - 4.1736 in)	(4.1709 - 4.1712 in)	(0.0022 - 0.0027 in)
Cylinder-piston clear-	Type D - D	106.011 - 106.018 mm	105.949 - 105.956 mm	0.055 - 0.069 mm
ance D - D		(4.1736 - 4.1739 in)	(4.1712 - 4.1715 in)	(0.0022 - 0.0027 in)

## Crankcase - crankshaft - connecting rod

## INTERNAL MARKING ON FIRST GENERATION CRANKCASES

Crankcases are classified in two classes (1 or 2) depending on the diameter of the main bearing seat. The class is indicated on both crankcase halves, specifically, in the rear cylinder area on flywheel side crankcase halves and in the front cylinder area on clutch side crankcase halves.

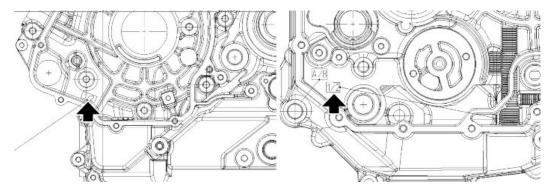


#### **C**RANKCASE CLASSES

Specification	Desc./Quantity
Crankcase class 1	Bushing seat diameter: 53.954 - 53.960 mm (2.1241 - 2.1244
	in)
Crankcase class 2	Bushing seat diameter: 53.960 - 53.966 mm (2.1244 - 2.1246
	in)

#### INTERNAL MARKING ON SECOND GENERATION CRANKCASES

Crankcases are classified in two classes (1 or 2) depending on the diameter of the main bearing seat. The class is indicated on both crankcase halves, specifically, in the starter gear area on flywheel side crankcase halves and in the gearbox control mechanism area on clutch side crankcase halves.



## See also

Removing the flywheel cover

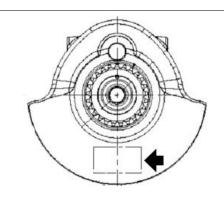
There are three crankshaft classes selectable for each bearing:

- 4 5 6 for the flywheel side;
- 7 8 9 for the clutch side;

The class is stamped on the outer face of the crankshaft counterweight.

#### NOTE

TWO DIFFERENT CRANKSHAFT CLASSES MAY BE POSSIBLE ON THE TWO BEARINGS.



#### **C**RANKSHAFT CLASSES

Specification	Desc./Quantity	
Crankshaft classes 4 - 7	Main journals - diameter: 49.978 - 49.984 mm (1.9676 - 1.9679	
	in)	
Crankshaft classes 5 - 8	Main journals - diameter: 49.972 - 49.978 mm (1.9674 - 1.9676	
	in)	
Crankshaft classes 6 - 9	Main journals - diameter: 49.984 - 49.990 mm (1.9679 - 1.9681	
	in)	

Once the categories below are checked:

- crankcase
- flywheel side main journal
- clutch side main journal

choose the bushings used for assembly from the following table

#### See also

Removing the flywheel cover

## **MAIN BUSHINGS**

wam journal	Crankcase class i	Crankcase class 2
Class 4 main journal (l.v.)	Semi-bushing type A (red)	Semi-bushing type B (blue)
Class 5 main journal (l.v.)	Semi-bushing type B (blue)	Semi-bushing type C (yellow)
Class 6 main journal (l.v.)	Semi-bushing type E (green)	Semi-bushing type A (red)
Class 7 main journal (l.f.)	Semi-bushing type A (red)	Semi-bushing type B (blue)
Class 8 main journal (l.f.)	Semi-bushing type B (blue)	Semi-bushing type C (yellow)
Class 9 main journal (l.f.)	Semi-bushing type E (green)	Semi-bushing type A (red)

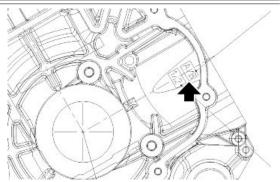
# Crankcase class (internal marking on first generation crankcases)

Two different crankcase classes (A or B) are available, selected in relation to the centre-to-centre distance between the primary reduction gears.

The class is indicated on the clutch side crankcase half near the front cylinder area.

#### NOTE

IN THE EVENT OF CRANKCASE REPLACEMENT, THE PRIMARY REDUCTION GEAR IS SUPPLIED READY MESHED.



## CRANKCASE CLASSES 01

Specification	Desc./Quantity
Crankcase class A	Centre-to-centre distance: 110.50 - 110.54 mm (4.3504 -
	4.3519 in)
Crankcase class B	Centre-to-centre distance: 110.46 - 110.50 mm (4.3488 -
	4.3504 in)

## See also

Removing the flywheel cover

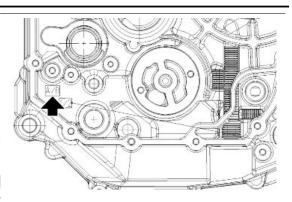
# Crankcase class (internal marking on second generation crankcases)

Two different crankcase classes (A or B) are available, selected in relation to the centre-to-centre distance between the primary reduction gears.

The class is indicated on the clutch side crankcase half, in the gearbox control mechanism area.

#### NOTE

IN THE EVENT OF CRANKCASE REPLACEMENT, THE PRIMARY REDUCTION GEAR IS SUPPLIED READY MESHED.



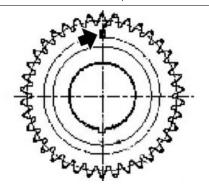
## CRANKCASE CLASSES 02

Specification	Desc./Quantity
Crankcase class A	Centre-to-centre distance: 110.50 - 110.54 mm (4.3504 -
	4.3519 in)
Crankcase class B	Centre-to-centre distance: 110.46 - 110.50 mm (4.3488 -
	4.2504 in)

### Class one

Two different pinion classes (A or B) are available, selected in relation to the centre-to-centre distance between the primary reduction gears.

On class B pinions only, the class is indicated on the pinion itself.



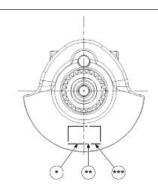
#### See also

Removing the flywheel cover

## Crankshaft class (crank pin)

There are four different classes of crankshaft available (0, 1, 2, 3), selected in relation to crank pin diameter.

There are four different classes of crankshaft available (E1, E2, ...) selectable in relation to connecting rod weight.



## Key:

- \* Class according to connecting rod weight.
- \*\* Class according to crank pin diameter.
- \*\*\* Serial number for traceability and indicating date.

#### **SHAFT CATEGORY**

Class	Crank pin diameter (mm)
0	42.000 - 42.006 mm (1.65354 - 1.65377 in)
1	41.994 - 42.000 mm (1.65330 - 1.65354 in)
2	41.988 - 41.994 mm (1.65307 - 1.65330 in)
3	41.982 - 41.988 mm (1.65283 - 1.65307 in)

#### See also

Removing the flywheel cover

#### Selecting bushings

There is only one dimension class for the connecting rod. As a result, the bushings used must be selected in accordance with the dimension class of the crank pin.

## **BUSHINGS**

Crank pin diameter	Connecting rod class 1
Crankshaft class 0	Semi-bushing type E (green)
Crankshaft class 1	Semi-bushing type A (red)
Crankshaft class 2	Semi-bushing type B (blue)
Crankshaft class 3	Semi-bushing type C (vellow)

#### Selecting connecting rods

Not all weight classes are available as spare parts. Only the two most significant weight classes are available - refer to the following table for selection:

#### **CONNECTING RODS**

crankshaft weight	Original connecting rod class (colour)	rod class ("E"	rod class
		marking)	
E1	Brown connecting rod	E1	Cat. A
E2	Blue connecting rod	E2	Cat. A
E3	Yellow connecting rod	E3	Cat. A
E4	Green connecting rod	E4	Cat. A
-	-	-	-
E5	Pink connecting rod	E5	Cat. B
E6	Black connecting rod	E6	Cat. B
E7	White connecting rod	E7	Cat. B
CAUTION			

WHEN ORDERING A NEW CONNECTING ROD OF CATEGORY "A" OR OF CATEGORY "B" (SEE TABLE), CAN BE RECEIVED:

- IN THE FIRST CASE (CAT. A) ANY CONNECTING ROD "E1 or E2 or E3 or E4" THAT CAN BE COUPLED TO THE CRANKSHAFT, EVEN IF IT IS DIFFERENT FROM THE ONE INSTALLED ORIGINALLY.
- IN THE SECOND CASE (CAT. B) ANY CONNECTING ROD "E5 or E6 or E7" THAT CAN BE COUPLED TO THE CRANKSHAFT, EVEN IF IT IS DIFFERENT FROM THE ONE INSTALLED ORIGINALLY

#### CAUTION

THE CONNECTING RODS OF THE SAME CRANKSHAFT MUST BE THE SAME COLOUR OR MARKING (EX. E1, E2, E3, ETC.) AND MUST HAVE THE SAME TYPE OF COUPLING WITH THE CRANKSHAFT.

WHEN REFITTING, ALSO ENSURE THAT THE SEMI-BUSHINGS ARE ALL OF THE SAME CLASS.

## See also

Removing the flywheel cover

## Recommended products chart

#### RECOMMENDED PRODUCTS TABLE

Product	Description	Specifications
ENI i-RIDE PG 15W-50	Engine oil	Use branded oils with performance equivalent to or exceeding API SJ, JASO MA - ACEA A3 - JASO MA2 specifications.
FUCHS TITAN SAF 1091	Fork oil (Caponord 1200)	tions.
OJ RACING FORK OIL TYPE 01		-
	Fork oil (Caponord 1200 Travel Pack)	-
FUCHS TITAN SAF 1091	Actuator oil of the active rear single shock	-
	absorber (Caponord 1200 Travel Pack)	
AGIP MP GREASE	Black smooth textured lithium-calcium	ISO L-X-BCHB 2 - DIN 51 825 KP2K-20
	soap based grease containing EP (ex-	
	treme pressure) additives with optimal	
	water-repellent properties	
AGIP CHAIN LUBE SPRAY	Spray lubricating grease	-
AGIP BRAKE 4	Brake / Clutch 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	ASTM D 3306 - ASTM D 4656 - ASTM D
	with organic inhibition additives. Red,	4985 - CUNA NC 956-16
	ready to use.	

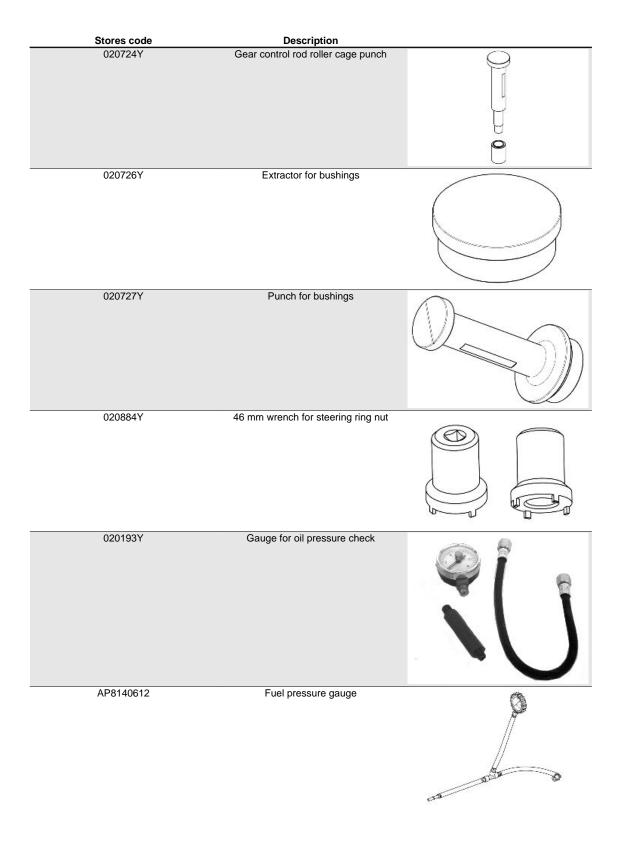
# **INDEX OF TOPICS**

SPECIAL TOOLS S-TOOLS

# SPECIAL TOOLS Stores code Description 020709Y Engine support 020710Y Engine plate AP8140187 Engine support stand 020850Y Primary gear lock 020712Y Handle for Flywheel cover removal 020713Y Flywheel extractor

Stores code	Description	
020714Y	Dial gauge mounting	
9100896	Clutch housing locking tool	
020716Y	Connecting rod locking	
020894Y	Pin snap ring fitting tool	
020895Y	Piston installation ring	
020719Y	Timing pin	

Stores code	Description	
020382Y	Valve cotters removal tool	4
020896Y	Bushing for valve removal	
020720Y	Timing tool	
020376Y	Adapter handle	
020891Y	Adapter 25 mm (0.98 in)	
020362Y	12 mm guide	



Stores code	Description	
AP8140199	Tool panel	
8140426	Hooks for panel	
020888Y	Pliers for pre-fill pipe	
020889Y	Pumping member ring nut locking span- ner	
020890Y	Pumping member stanchion support rod	
020922Y	P.A.D.S.	PADS
020957Y	Key for upper fork nut	

S-TOOLS - 60

Stores code	Description	
020958Y	Fork cartridge protection	6
AP8140149	Protection for fitting operations	
AP8140189	Oil seal fitting tool for Ø 43 mm (1.69 in) orifices	
AP8140146	Weight	

# **INDEX OF TOPICS**

Maintenance MAIN

#### Maintenance chart

Correct maintenance is fundamental for ensuring the longevity of your vehicle and maintaining optimum function and performance.

To this end, Aprilia offers a set of checks and maintenance services (at the owner's expense), that are summarised in the table shown on the following page. Any minor faults must be reported without delay to an **Authorised Aprilia Dealer or Sub-Dealer** without waiting until the next scheduled service to solve it.

All scheduled services must be carried out at the specified intervals and mileage, as soon as the predetermined mileage is reached. Carrying out scheduled services on time is essential for the validity of your warranty. For further information regarding Warranty procedures and "Scheduled Maintenance", please refer to the "Warranty Booklet".

#### NOTE

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

NOTE

THE TIMES LISTED ON THE SCHEDULED MAINTENANCE TABLE INCLUDE TIME DEDICATED TO MANAGEMENT ACTIVITIES.

- I: INSPECT AND CLEAN, ADJUST, LUBRICATE OR REPLACE IF NECESSARY
- C: CLEAN, R: REPLACE, A: ADJUST, L: LUBRICATE
- (1) Replace at whichever of the following occurs first: 40,000 km (24854 mi) or 48 months
- (2) Replace every 2 years or 50,000 Km (31068 mi).
- (3) Replace every 4 years
- (4) At each engine start
- (5) Check every month
- (6) Check each time the rear tyre is replaced
- (7) Lubricate if you are riding in the rain, on wet roads or after the vehicle has been washed

#### ROUTINE MAINTENANCE TABLE

km x 1,000	1	10	20	30	40
Rear shock absorber			I		
Spark plug			R		R
Drive chain (7)	I	I	I		I
Transmission cables and controls	I		I		Ι
Steering bearings and steering clearance	I		I		Ι
Wheel bearings			I		I
Control unit diagnosis	1		I		I
Brake discs	I		I		I
Air filter		I	R	I	R
Engine oil filter	R		R		R
Fork			I		1
General vehicle operation	I		I		
Valve clearance			A		A
Cooling system			I		ĺ

km x 1,000	1	10	20	30	40
Braking systems	I		I		I
Light circuit	I		I		I
Safety switches			I		I
Clutch control fluid (2)	I		I		I
Brake fluid (2)			I		I
Coolant (2)	I		I		I
Fork oil (1)					R
Engine oil	R		R		R
Light aiming			I		I
Fork oil seals		1	I	I	I
Flexible coupling (6)			I		I
Clutch lever pin (7)	L	L	L	L	L
Tyres - pressure/wear (5)	_	1	I		
Wheels			I		I
Bolts and nuts tightening	1		I		I
Stand joint	L	L	L	L	L
Suspension and setting			I		
Fault warning light on instru-					
ment panel (4)					
Fuel lines (3)			I		I
Clutch wear			I		I
Brake pad wear		I	I	I	I
Labour time - Caponord 1200	110	130	320	130	410
(minutes)					
Labour time - Caponord 1200	110	130	320	130	460
ADD (minutes)					

## Spark plug

At regular intervals, remove the spark plug and clean off any carbon deposits or replace as required.

## CAUTION



ALWAYS REPLACE ALL SPARK PLUGS, EVEN IF ONLY ONE NEEDS REPLACING.

- Remove the saddle.
- Remove the side fairings.

In order to reach the spark plugs:

## CAUTION



BEFORE CARRYING OUT THE FOLLOWING OPERATIONS AND IN ORDER TO AVOID BURNS, LEAVE ENGINE AND SILENCER TO COOL OFF TO AMBIENT TEMPERATURE.

## FRONT SPARK PLUGS

 Working on the left side of the vehicle, unscrew and remove the screw.



- Turn the radiator forwards to act on the coils.
- Unscrew and remove the two screws fixing coils to head cover.

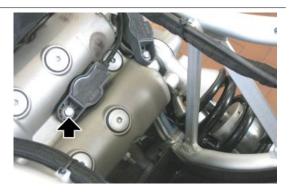


- Slide out the front coils.
- Unscrew and remove the front spark plugs.



## **REAR SPARK PLUGS**

- Lift the tank.
- Unscrew and remove the rear coil fixing screws.
- Slide out the rear coils.
- Unscrew and remove the rear spark plugs.





#### See also

## Fuel tank

Check the gap between the electrodes with a feeler gauge.

#### CAUTION



#### DO NOT ATTEMPT TO READJUST THE ELECTRODE GAP.

The gap between the electrodes should be 0.6 - 0.7 mm (0.023 - 0.027 in) Wear limit is achieved when the gap for one of the two electrodes reaches 1.0 mm (0.039 in)

Make sure the washer is in good conditions.

## Installation:

- Once the washer is fitted, screw the spark plug carefully to avoid damaging the thread.
- Screw the spark plug to the prescribed torque.

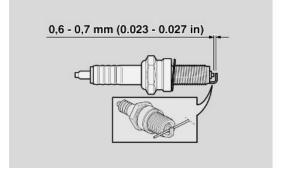
## CAUTION



TIGHTEN THE SPARK PLUG CORRECTLY, OTHERWISE THE ENGINE MAY OVERHEAT AND GET IRRETRIEVABLE DAMAGED. USE ONLY THE RECOMMENDED TYPE OF SPARK PLUG, OTHERWISE, THE ENGINE DURATION AND PERFORMANCE COULD BE COMPROMISED.

### See also

## **Engine**



## **Engine oil**

## Check

Check the engine oil level frequently.

#### NOTE

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



ENGINE OIL LEVEL MUST BE CHECKED WHEN THE ENGINE IS WARM.

IF YOU CHECK LEVEL WHEN THE ENGINE IS COLD, OIL LEVEL COULD TEMPORARILY DROP BELOW THE "MIN" MARK.

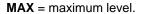
THIS SHOULD NOT BE CONSIDERED A PROBLEM PROVIDED THAT THE ALARM WARNING LIGHT AND THE ENGINE OIL PRESSURE ICON DO NOT TURN ON SIMULTANEOUSLY ON THE DISPLAY.

#### CAUTION

DO NOT LET THE ENGINE IDLE WITH THE VEHICLE AT STANDSTILL TO WARM UP THE ENGINE AND OBTAIN THE OPERATING TEMPERATURE OF ENGINE OIL.

PREFERABLY CHECK THE OIL AFTER A JOURNEY OF AFTER TRAVELLING APPROXIMATELY 15 Km (10 miles) IN EXTRAURBAN CONDITIONS (ENOUGH TO WARM UP THE ENGINE OIL TO OPERATING TEMPERATURE).

- Switch off the engine and wait at least five minutes to allow the lubricant to drain back into the sump.
- Keep the vehicle upright on a level surface and with both wheels on the ground.
- Check the oil level from the sight glass on the clutch case.



MIN = minimum level

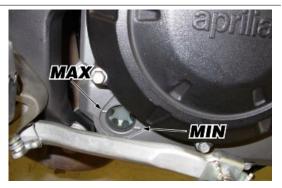
The difference between the "MAX" and "MIN" marks is approx. 460 cm<sup>3</sup> (28.07 cu.in).

CAUTION

DO NOT EXCEED THE MAXIMUM LEVEL

CAUTION

THE VEHICLE MUST BE UNLOADED.



## Replacement

Check the engine oil level frequently.

To change the oil:

CAUTION

HOT OIL IS MORE FLUID AND WILL DRAIN OUT MORE EASILY AND COMPLETELY; IDEAL TEMPERATURE IS REACHED AFTER THE ENGINE HAS RUN FOR ABOUT TWENTY MINUTES.



# OIL BECOMES VERY HOT WHEN THE ENGINE IS HOT; BE CAREFUL NOT TO GET BURNED WHEN CARRYING OUT THE OPERATIONS DESCRIBED BELOW.

- Use a cloth to wipe off any mud deposit on the area next to the filler plug (1).
- Place a container with + 4000 cm<sup>3</sup> (244 cu.in) capacity under the drainage plug
   (2).
- Unscrew and remove the drainage plug (2).
- Unscrew and remove the filler plug (1).
- Drain the oil into the container; allow several minutes for oil to drain out completely.
- Replace the sealing washer of the drainage plug (2).
- Remove any metal scrap attached to the drainage plug (2) magnet.
- Screw and tighten the drainage plug
   (2).
- Replace the oil filter.
- Fill up to the right engine oil level by adding recommended engine oil.



Engine oil filter Check

## **Engine oil filter**

 To access the oil filter (1), remove the ABS control unit first (2).







- Unscrew and remove the cap to drain out the engine oil.
- Unscrew and remove the engine oil filter.
- Fit a new engine oil filter.
- Add engine oil up to the correct level.
- Start the engine, wait some seconds, then stop the engine and check the oil level again. Top up and set the level if necessary.



## Air filter

- Remove the fuel tank.
- Unscrew and remove the ten screws.



Remove the filter box cover.



COVER THE INTAKE DUCTS WITH A CLEAN CLOTH SO THAT FOREIGN BODIES DO NOT GET INTO THE INLET DUCTS. UPON REFITTING AND BEFORE PLACING THE FILTER BOX COVER, MAKE SURE NEITHER THE CLOTH NOR ANY OTHER OBJECT HAS BEEN LEFT INSIDE THE FILTER BOX. MAKE SURE THE FILTERING ELEMENT IS CORRECTLY PLACED SO THAT UNFILTERED AIR DOES NOT FLOW IN. DO NOT FORGET THAT EARLY WEAR OF THE PISTON RINGS AND THE CYLINDER CAN BE CAUSED BY A MALFUNCTIONING OR MISPLACED FILTERING ELEMENT.



- Unscrew and remove the four screws.
- Remove the air-box cover.
- Remove the filtering element.



## Checking the valve clearance

The following operation can be carried out also with the engine fitted on the vehicle.

Remove both head covers.

#### CAUTION

# WHENEVER THE HEAD COVER IS REMOVED, ALL FOUR RUBBER RINGS AND THE GASKET SHOULD BE REPLACED.

- Using the pins, synchronise the cylinder being checked.
- Using a feeler gauge, measure the distance between the cam of the camshaft and the valve bucket tappet
- Take note of the measurement.

If valve clearance is not within the tolerance range, adjust as follows:

- Take the engine to the TDC.
- Lock the camshafts by using the corresponding timing pins.

## Specific tooling

020719Y Timing pin

#### Characteristic

Valve clearance at intake

0.15 - 0.20 mm (0.0059 - 0.0079 in)

## **Outlet valve clearance**

0.20 - 0.25 mm (0.0079 - 0.0098 in)

- Remove one camshaft at a time
- Leave the other camshaft assembled and blocked by means of the timing pin.

## CAUTION

## IF BOTH CAMSHAFTS ARE REMOVED, THE ENGINE SPINS MAKING TIMING NECESSARY.

See also



## Removing the

head cover

Remove the bowl tappets and the adjustment shims using a magnet.

#### NOTE

GREASE THE BOWL TAPPETS AND THE ADJUSTMENT SHIMS PROPERLY EACH TIME THEY ARE REMOVED.



- Replace calibrated pads with a pad thick enough to correct the valve clearance previously detected.
- List of calibrated break pads:
- 1. Calibrated pad 2.60
- 2. Calibrated pad 2.65
- 3. Calibrated pad 2.70
- 4. Calibrated pad 2.75
- 5. Calibrated pad 2.80
- 6. Calibrated pad 2.85
- 7. Calibrated pad 2.90
- 8. Calibrated pad 2.95
- 9. Calibrated pad 3.00
- 10. Calibrated pad 3.05
- 11. Calibrated pad 3.10
- 12. Calibrated pad 3.15
- 13. Calibrated pad 3.20
- 14. Calibrated pad 3.25
- 15.Calibrated pad 3.30
- 16.Calibrated pad 3.35
- 17. Calibrated pad 3.40
- 18. Calibrated pad 2.55
- 19. Calibrated pad 2.50
- 20. Calibrated pad 2.45
- 21. Calibrated pad 2.40



#### CAUTION

BEFORE REFITTING HEAD COVERS, CLEAN HEAD AND COVER SURFACES CAREFULLY.

- Apply THREEBOND on the head cover perimeter along the gasket housing.
- Apply THREEBOND on the head in the areas indicated in the figure.



# **INDEX OF TOPICS**

TROUBLESHOOTING

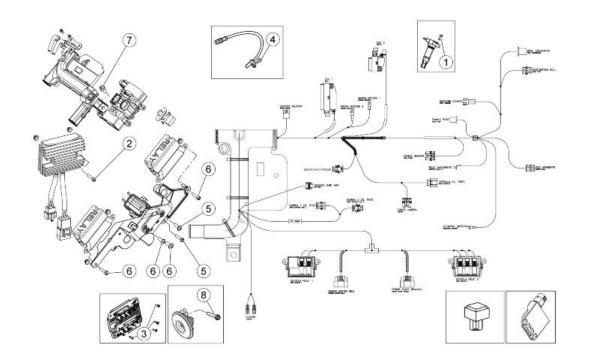
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# **INDEX OF TOPICS**

ELECTRICAL SYSTEM

**ELE SYS** 



## **ELECTRICAL SYSTEM**

pos.	Description	Type	Quantity	Torque	Notes
1	Coil fixing screw	M6	2	5.50 Nm (4.06 lbf ft)	-
2	TE screw fastening regulator to frame	M6x30	2	10 Nm (7.37 lbf ft)	-
3	Screw fastening ECU to filter box base	-	4	3 Nm (2.21 lbf ft)	-
4	Speed sensor TBEI fixing screw	M5x16	1	6 Nm (4.42 lbf ft)	-
5	Self-tapping screw fastening de- mand sensor mounting to demand sensor	5x14	3	4 Nm (2.35 lbf ft)	-
6	TBEI screw fastening relay support to demand sensor mounting	M6x16	4	10 Nm (7.37 lbf ft)	-
7	TEFL screw fastening cableway to demand sensor mounting	M6x12	1	10 Nm (7.37 lbf ft)	-
8	TEFL horn fixing screw	M6x12	1	10 Nm (7.37 lbf ft)	-
-	TBEI starter relay fixing screw	M6x10	2	10 Nm (7.37 lbf ft)	-

## **Electrical system installation**

## INTRODUCTION

## Scope and applicability

The scope of this document is to define exclusively the passages of the electrical cabling of the vehicle, its positioning, and fastening on the frame, instruments holding support and saddle mounting; the possible critical issues and the particular checks on connections and passages, in order to reach the reliability objectives of the vehicle. Other particulars that are not necessary to such purpose, could appear to be little detailed or even not correct.

## Materials used and corresponding quantities

The electrical system consists of the following cable harnesses and parts:

- No.1 Main Cable Harness.
- No.1 License Plate Cable Harness.
- No. 25 Large plastic clamp (4.5x280).
- No. 9 Small plastic clamp (2.5x160).
- No. 4 Rubber clamp (long).
- No. 5 Rubber clamp (short).
- No. 5 Tyco connector support.
- No. 8 Cable grommets.
- No. 3 Cable guide.
- No. 2 Cable guide for ABS sensors.
- No. 1 Cable grommets.
- No. 1 Headlamp water seal rubber.
- No. 2 Headlamp water seal rubber.

#### Motorcycle division

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

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



# SPECIAL CHECKS FOR THE CORRECT CONNECTION AND LAYING OF CABLES (ALL VERSIONS).

It is extremely important that any security-locks for the following connectors are properly connected and correctly tightened to ensure proper engine, and therefore, proper vehicle operation.

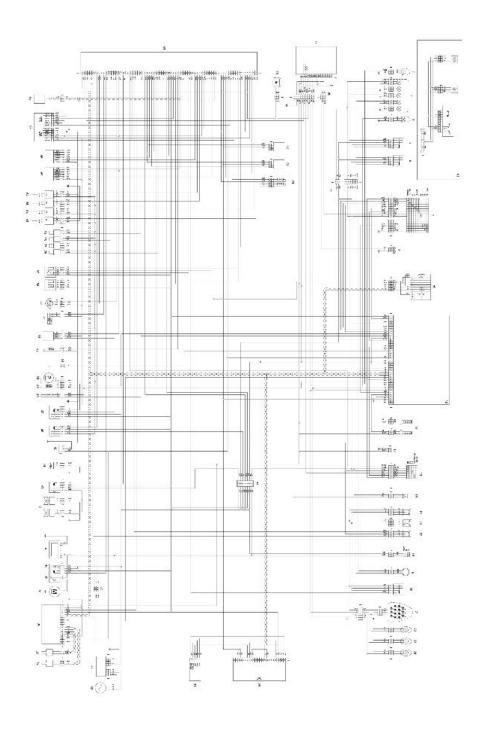
- 1. Dashboard connector and cap.
- 2. Demand Master and Slave connectors, check the closing of the security lock (grey)
- 3. Adjustable connector, Pick Up and alternator.
- 4. Gear sensor connector.
- 5. Side Stand Switch Connector.
- 6. Coils 1 and 2 connectors on front and rear cylinders.
- 7. Control unit connectors (7SM).

- 8. Fuel Pump Connector.
- 9. Key and aerial key connector (check correct passage).
- 10.RH and LH light switch connectors, front stop switch, clutch switch, MAP sensor front fork (with rubber plug well inserted), CDCi front fork.
- 11.ABS Control Unit Connector, correct positioning of the cap, and correct cabling passage.
- 12. Front and rear ABS sensor connector (speed).
- 13. Auxiliary fuses and VCU fuse (rubber housing correct positioning and closing).
- 14. Throttle motors connectors, check the Security Lock closing (yellow).
- 15.Map Sensor connectors (front and rear cylinder).
- 16.Intake air temperature (filter box).
- 17. Fuel injectors connectors (all 4).
- 18. Check the ground fastening on motor's rear cylinder head.
- 19. Check the correct fastening (to torque) of the screws on the positive cables of the starter relay and the correct passage of the cable Battery-Starter relay.
- 20.Check the fastening of the positive cable on the starter motor. Check if the cap has a hole and if it is well inserted.
- 21. Check the correct passage and fastening of the primary fuses and ABS under the saddle.
- 22. Check the correct connection VCU control unit and correct cabling passage.
- 23. Check if the gap of the corrugated under the saddle is hidden (downwards).
- 24. Check the connection of the rear CDCi shock absorber and if the cap is well inserted.
- 25. Check the passage of the rear CDCi cable and the correct cabling passage.
- 26. Check the connection of the rear shock absorber preload.
- 27. Check the connection of the USB port.
- 28. Check the connection of the starter relay (under the saddle) and if the fuses are 30A (green).
- 29. Check the connection of the relays: fans, safety, auxiliary and primary injection.
- 30.Check the connection on the (front) headlamp relay and the correct insertion of the lamps connectors.
- 31. Check the fans connections (left and right).
- 32. Check the connection and the correct positioning of the front and rear Lambda probes.
- 33. Check the connection and the correct routing of the rotary sensor on saddle mounting (LH side).
- 34. Check the T. Map on the fork (LH stanchion) and correct cables fastening and routing.
- 35. Make sure that the cables on the handlebar area are all soft, by turning the handlebar they should not be in traction.
- 36. Check correct insertion of the cap on the oil sensor and the presence of the clamp.
- 37. Check the connection of the motor's exhaust valve.
- 38. Check the connection of the auxiliary fuel level sensor.
- 39. Check that the RH light switch has the key "heated handgrips" and "cruise".

- 40. Check the positioning of the horn and make sure that the mufflers are not stuck on the flap, check the presence of the clamp retaining the horn's cables.
- 41. Check the GAP between the tone wheel and the ABS sensors (it must be between 0.5 and 2mm).
- 42. Check the correct tightening of the front and rear ABS sensors screws.

## **General wiring diagram**

**CAPONORD 1200** 



#### key:

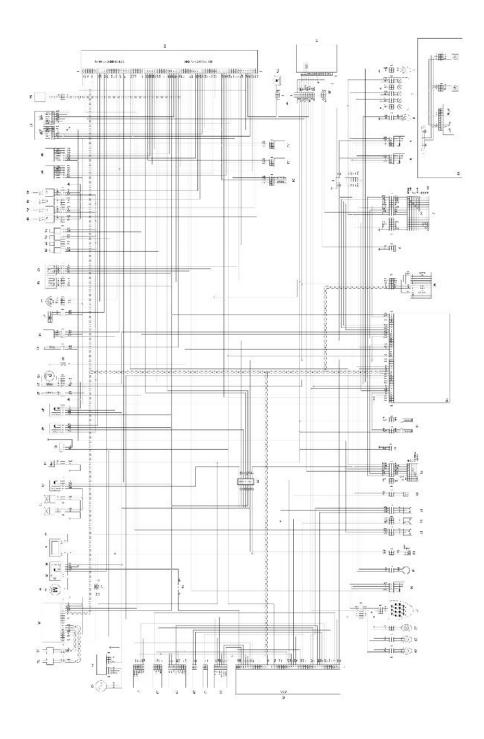
1. MULTIPLE CONNECTORS

ELE SYS - 80

- 2. FRONT LEFT TURN INDICATOR
- 3. FRONT HEADLAMP
- 4. FRONT RIGHT TURN INDICATOR
- 5. HIGH BEAM LIGHTS RELAY
- 6. LIGHT RELAY
- 7. LEFT LIGHT SWITCH
- 8. HORN
- 9. BLUEDASH PRE-INSTALLATION
- 10. INSTRUMENT PANEL
- 11. HEATED HANDGRIPS (WHERE PROVIDED)
- 12. POWER SUPPLY FOR GPS
- 13. RIGHT LIGHT SWITCH
- 14. QUICK SHIFT
- 15. FRONT STOP SWITCH
- 16. REAR STOP SWITCH
- 17. CLUTCH SWITCH
- 18. IGNITION SWITCH
- 19. IMMOBILIZER AERIAL
- 20. SAFETY RELAY
- 21. TAIL LIGHT
- 22. LICENSE PLATE LIGHT
- 23. REAR RIGHT TURN INDICATOR
- 24. REAR LEFT TURN INDICATOR
- 25. EVC CONTROL UNIT
- 31. EXHAUST VALVE MOTOR
- 32. ALTERNATOR
- 33. VOLTAGE REGULATOR
- 34. REAR ABS SENSOR
- 35. FRONT ABS SENSOR
- 36. ABS CONTROL UNIT
- 37. MAIN FUSES 2
- 38. STARTER MOTOR
- 39. START-UP RELAY
- 40. MAIN FUSE 1
- 41. BATTERY
- 42. ELECTRIC FANS
- 43. ELECTRIC FANS RELAY
- 44. USB PORT

- 45. ECU DIAGNOSIS
- 46. AUXILIARY INJECTION RELAY
- 47. PRIMARY INJECTION RELAY
- 48. FUEL RESERVE SENSOR 1 (NTC)
- 49. FUEL RESERVE SENSOR 2 (LEVEL)
- 50. FUEL PUMP
- 51. OIL PRESSURE SENSOR
- 52. INTAKE AIR TEMPERATURE SENSOR
- 53. FALL SENSOR (IF FITTED)
- 54. STAND SWITCH
- 55. GEAR SENSOR
- 56. REAR CYLINDER LAMBDA PROBE
- 57. FRONT CYLINDER LAMBDA PROBE
- 58. REAR CYLINDER INJECTOR (MARELLI/INTERNAL)
- 59. FRONT CYLINDER INJECTOR (MARELLI/INTERNAL)
- 60. REAR SIDE COIL
- 61. FRONT SIDE COIL
- 62. REAR CENTRAL COIL
- 63. FRONT CENTRAL COIL
- 64. SPARK PLUG
- 65. REAR MOTORISED THROTTLE
- 66. FRONT MOTORISED THROTTLE
- 67. DEMAND SENSOR
- 68. ENGINE SPEED SENSOR
- 69. 7SM MOTOR CONTROL UNIT
- 70. ANTI-THEFT LED (IF FITTED)
- 71. ANTI THEFT (IF FITTED)
- 72. FRONT MAP SENSOR
- 73. REAR MAP SENSOR
- 74. WATER TEMPERATURE SENSOR
- 75. SECONDARY FUSES
- 77. FRONT INJECTOR 2 (SYNERJET/EXTERNAL)
- 78. REAR INJECTOR 2 (SYNERJET/EXTERNAL)
- 80. BLUEDASH (IF FITTED)
- 81. FOG LIGHT LED (IF FITTED)

#### **CAPONORD 1200 TRAVEL PACK**



## key:

1. MULTIPLE CONNECTORS

- 2. FRONT LEFT TURN INDICATOR
- 3. FRONT HEADLAMP
- 4. FRONT RIGHT TURN INDICATOR
- 5. HIGH BEAM LIGHTS RELAY
- 6. LIGHT RELAY
- 7. LEFT LIGHT SWITCH
- 8. HORN
- 9. BLUEDASH PRE-INSTALLATION
- 10. INSTRUMENT PANEL
- 11. HEATED HANDGRIPS (WHERE PROVIDED)
- 12. POWER SUPPLY FOR GPS
- 13. RIGHT LIGHT SWITCH
- 14. QUICK SHIFT
- 15. FRONT STOP SWITCH
- 16. REAR STOP SWITCH
- 17. CLUTCH SWITCH
- 18. IGNITION SWITCH
- 19. IMMOBILIZER AERIAL
- 20. SAFETY RELAY
- 21. TAIL LIGHT
- 22. LICENSE PLATE LIGHT
- 23. REAR RIGHT TURN INDICATOR
- 24. REAR LEFT TURN INDICATOR
- 25. VCU CONTROL UNIT
- 26. PUMP MOTOR
- 27. REAR SOLENOID VALVE
- 28. FRONT SOLENOID VALVE
- 29. REAR ROTARY SENSOR
- 30. FRONT TEMPERATURE AND PRESSURE SENSOR
- 31. EXHAUST VALVE MOTOR
- 32. ALTERNATOR
- 33. VOLTAGE REGULATOR
- 34. REAR ABS SENSOR
- 35. FRONT ABS SENSOR
- 36. ABS CONTROL UNIT
- 37. MAIN FUSES 2
- 38. STARTER MOTOR
- 39. START-UP RELAY

- 40. MAIN FUSE 1
- 41. BATTERY
- 42. ELECTRIC FANS
- 43. ELECTRIC FANS RELAY
- 44. USB PORT
- 45. ECU DIAGNOSIS
- 46. AUXILIARY INJECTION RELAY
- 47. PRIMARY INJECTION RELAY
- 48. FUEL RESERVE SENSOR 1 (NTC)
- 49. FUEL RESERVE SENSOR 2 (LEVEL)
- 50. FUEL PUMP
- 51. OIL PRESSURE SENSOR
- 52. INTAKE AIR TEMPERATURE SENSOR
- 53. FALL SENSOR (IF FITTED)
- 54. STAND SWITCH
- 55. GEAR SENSOR
- 56. REAR CYLINDER LAMBDA PROBE
- 57. FRONT CYLINDER LAMBDA PROBE
- 58. REAR CYLINDER INJECTOR (MARELLI/INTERNAL)
- 59. FRONT CYLINDER INJECTOR (MARELLI/INTERNAL)
- 60. REAR SIDE COIL
- 61. FRONT SIDE COIL
- 62. REAR CENTRAL COIL
- 63. FRONT CENTRAL COIL
- 64. SPARK PLUG
- 65. REAR MOTORISED THROTTLE
- 66. FRONT MOTORISED THROTTLE
- 67. DEMAND SENSOR
- 68. ENGINE SPEED SENSOR
- 69. 7SM MOTOR CONTROL UNIT
- 70. ANTI-THEFT LED (IF FITTED)
- 71. ANTI THEFT (IF FITTED)
- 72. FRONT MAP SENSOR
- 73. REAR MAP SENSOR
- 74. WATER TEMPERATURE SENSOR
- 75. AUXILIARY FUSES 1
- 76. AUXILIARY FUSE 2
- 77. FRONT INJECTOR 2 (SYNERJET/EXTERNAL)

- 78. REAR INJECTOR 2 (SYNERJET/EXTERNAL)
- 80. BLUEDASH (IF FITTED)
- 81. FOG LIGHT LED (IF FITTED)

#### Colour key:

Ar Orange

Az Sky blue

B Blue

Bi White

G Yellow

Gr Grey

M Brown

N Black

R Red

Ro Pink

V Green

Vi Purple

## **Conceptual diagrams**

## **Checks and inspections**

#### **GENERAL CONCEPTS OF ELECTRICAL TROUBLESHOOTING**

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

#### CAUTION

BEFORE CARRYING OUT ANY TROUBLESHOOTING PROCEDURE ON THE VEHICLE, CHECK THAT THE BATTERY VOLTAGE IS ABOVE 12V.

#### **CONNECTOR CHECK PROCEDURE**

The procedure includes the following checks:

- Observation and check of the connector correct position on the component or on the coupling connector, making sure that the locking catch is released.
- 2. Observation of the terminals on the connector: no rust marks or dirt should be present and it is important to check terminal correct positioning on



the connector (i.e., all terminals aligned at the same depth) and terminal integrity (i.e., that terminals are not loose, open/bent, etc.). For connectors whose terminals are not visible (e.g. Marelli control unit) use a metal cable of suitable diameter and introduce it carefully in the connector slot at the same depth as for the other terminals of the connector.

#### CAUTION

IN CASE OF TEMPORAL MALFUNCTIONING, CARRY OUT ALL DUE CHECKS LOOKING FOR FAULT BY MOVING SLIGHTLY THE CABLE HARNESS BEING INSPECTED.

3. Pulling the cables slightly from the back of the connector in order to check the correct position of terminals on the connector and of the cable on the terminal.

#### **CONTINUITY check**

**Check goal:** this control is to check that there are not any circuit interruptions nor excessive resistance, for instance caused by rust, on the two terminals being inspected.

**Tester:** set the tester on the "continuity" symbol and place the tester probes on the two circuit ends: the tester emits a sound signal only if there is continuity; the tester can also be set to the Ohm symbol to check that the circuit resistance is null or a few tenths of an Ohm.

CAUTION: THE CIRCUIT SHOULD NOT BE ENERGISED, OTHERWISE THE TEST IS IRRELE-VANT.

#### **GROUND CONNECTION check**

**Check goal:** this control is to check if a cable or a circuit is in contact with the vehicle ground (-) connection.

Tester: set the tester on the "continuity" symbol and place one tester probe on the vehicle ground connection (or on the battery - terminal) and the other probe on the cable being inspected: the tester sends out a sound signal only if there is continuity. The tester can also be set to the Ohm symbol to check that the circuit resistance is null or a few tenths of an Ohm.

CAUTION! IF THERE IS A GROUND CONNECTION COMING FROM THE CONTROL UNIT, MAKE SURE THAT DURING THE TEST THE CONTROL UNIT IS GROUND CONNECTED TO THE CIRCUIT.

#### **VOLTAGE** check

**Check goal:** this control is to check if a cable is energised, i.e. if it receives power supply from the battery or the control unit.

**Tester:** set the tester on the direct current symbol and place the tester red probe on the cable being inspected and the black probe on the vehicle ground connection (or on the battery - terminal).

## CAUTION

IN CASE OF TEMPORAL MALFUNCTIONING, CARRY OUT ALL DUE CHECKS LOOKING FOR FAULT BY MOVING SLIGHTLY THE CABLE HARNESS BEING INSPECTED.

## **Immobiliser**

## System components

#### **Function**

detects the transponder code in the key and sends

it to the instrument panel

## Level in electrical circuit diagram:

Immobilizer

#### Location:

- on the vehicle: in the ignition switch assembly
- connector: two-way, black, behind the instrument panel

#### **Electrical specifications**

• ~ 10 - 20 Ohm

#### Pin out

not significant

## CAUTION

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

## **IMMOBILIZER ERRORS**

#### Error code B0003 (KEY CODE READ BUT NOT RECOGNISED)

The key has the working transponder, but it is not within the recognised ones.

#### **Troubleshooting**

Store the new key.

#### Error code B0004 (ERROR READING KEY CODE)

The key has no transponder or the transponder is damaged.

#### Troubleshooting

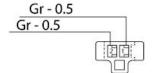
Replace the key and store it.

## Error code B0005 (AERIAL ELECTRICAL FAILURE (A.C. O S.C.))

An electric interruption or a ground short circuit or voltage to the circuit have been detected.

#### **Troubleshooting**

Check the sensor connector on the cable harness and the instrument panel connector. If not OK, restore; if OK, check electrical characteristics and aerial circuit continuity from the instrument panel connector on PIN 24 and 25: if not OK, restore cable harness; if OK, check circuit ground insulation: if not ground insulated, restore cable harness; if insulated, with key ON and instrument panel connector



disconnected, check that there is not voltage at the circuit ends: if there is voltage, restore the cable harness.

#### Error code B0006 (INSIDE ERROR)

There is a fault in the instrument panel.

Troubleshooting

Replace the instrument panel.

## Error code B0007 (INSUFFICIENT NUMBER OF MEMORISED KEYS)

The number of stored keys is less than two.

#### Dashboard

In case of doubts in operation of the engine revs indication, it is possible to connect the vehicle to the diagnostics instrument and activate the engine revs indication choosing the function "Rpm indicator" from the "Devices Activation" screen page (injector icon)

#### **SELECTING kph - mph UNIT OF MEASUREMENT**

- Connect the diagnostics instrument to the Marelli (7SM) engine control unit and start a diagnostics session.
- Go to the "adjustments" page and configure the vehicle.
- Close the current diagnosis session.
- Enter the instrument panel diagnosis and do a KEY OFF / KEY ON
- Enter the instrument panel diagnosis and make sure the error is present.
- To solve the error, go to the "adjustments" page and carry out a "Vehicle configuration reset".
- Follow the instructions on the screen.
- Delete the errors stored by the instrument panel.

## **Diagnosis**

The instrument errors are detected by means of the diagnosis instrument. It is therefore necessary to connect it to the vehicle.

Following are listed the errors generated by the instrument panel.

#### **CONFIGURATION**

## Error code B0000 (CONFIGURATION ERROR)

Error cause

The configuration memorised in the instrument panel does not correspond to the one detected in the vehicle where it is installed (e.g. configuration unit of measurement miles/kilometres).

Identification

Warning light on.

**Troubleshooting** 

Check the mapping of the control unit and reset the vehicle configuration.

#### **OIL SENSOR**

## Error code B0001 (OIL SENSOR FAILURE)

Oil motor low pressure alarm:

This alarm occurs when the engine is off and the pressure of the engine oil is low. If during the following OFF-ON key switching, the fault is not immediately detected, the error is no longer displayed. Only in case the fault occurs again after performing two TRIPs (minimum TRIP: 10 km) and following the third OFF-ON key switching, the error is displayed again.

#### Identification

Oil warning light fixed.

## **Troubleshooting**

Check the connector on the component and the instrument panel connector. Disconnect the two connectors and check the continuity of the cable between the sensor and the PIN 17 of the instrument panel (grey connector) and restore the cable harness. If the cable harness is not damaged, replace the sensor.

## Error code B0002 (OIL PRESSURE FAILURE)

Oil sensor disconnected alarm:

This alarm occurs when the sensor is disconnected, rpm higher than 900.

#### Identification

Oil warning light flashing.

#### Troubleshooting

Disconnect the connector of the component and check the insulation from ground: if the insulation is not present, restore the cabling, otherwise replace the sensor. It this error persists, use a pressure gauge to check the pressure of the oil in the engine circuit.

#### **CAN LINE**

## Error code B0008 (CAN LINE RECEPTION ERROR)

#### Error cause

The instrument panel is coded at the first key insertion, if the CAN line is missing, the error is activated.

#### Identification

Warning light on.

#### Troubleshooting

Check the cable harness of the CAN line.

## Error code B0009 (CAN LINE TRANSMISSION ERROR)

## Error cause

The instrument panel is coded at the first insertion of the key, if the received data do not coincide with the memorised ones, the error is activated.

#### Identification

Warning light on.

## **Troubleshooting**

ELE SYS - 90

Check the cable harness of the CAN line.

#### **ENGINE TEMPERATURE**

#### **Error code B0010 (ENGINE OVERTEMPERATURE)**

#### Error cause

Engine temperature > 115 °C.

#### **Troubleshooting**

The error is no longer displayed when the temperature falls below 113 °C. If the error continues to be displayed also with low engine temperature, the failure is probably in the sensor that is shortcircuited or in the cable harness: perform the diagnosis by connecting to the engine control unit.

#### **HEATED HANDGRIPS**

## Error code B0011 (HANDGRIPS HEATING BUTTON LOCKED)

#### Error cause

Alarm handgrips button locked:

This alarm occurs when, for various reasons, the activation button is locked.

#### Identification

Fixed warning light.

## Troubleshooting

Check the correct operation of the contact of the button and the insulation from ground and from supply of PIN 15 of the instrument panel (grey connector).

## **Battery recharge circuit**

#### **RECHARGING SYSTEM**

- Remove the tank and the filter casing;
- Disconnect the three-way connector
   (1) (white).

#### NOTE

THE ENGINE SIDE IS IDENTIFIED WITH THE LETTER "A"

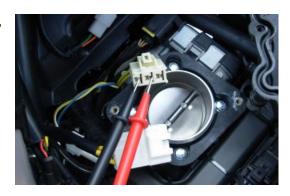


#### Measurement of resistance (with engine off)

 For a correct detection of the alternator resistance, an ambient temperature measurement must be carried out and afterwards a heat stabilisation (after turning fan on) by using a tester, using alternatively the 3 connector pins:



stage "1" (pin 1-2), stage "2" (pin 1-3), stage "3" (pin 2-3).



 Take the measurement; The correct value is determined by the value measured for each stage in which from time to time the resistance of the tester wires is subtracted, obtained by touching the two lugs.

## Example:

• Resistance of stage 1 read on the display = 0.65 Ohm



Resistance of the wires read on the display = 0.47 Ohm



- Effective resistance stage 1 = 0.65-0.47 = 0.18 Ohm
- If there is a significant difference between one stage and another (other than 0.15 Ohm), this means that the alternator is defective and must be replaced.

#### RESISTANCE MEASUREMENT

Winding stage	Ambient temperature (ohm)	Afterwards heat stabilisation (ohm)
Stage 1	0.15 - 0.20	0.18 - 0.23
Stage 2	0.15 - 0.20	0.18 - 0.23
Stage 3	0.15 - 0.20	0.18 - 0.23

## **Empty voltage**

- Disconnect the three-way connector (1);
- For a correct detection of the alternator voltage, a measurement must be carried out using alternatively the 3 engine side connector pins: stage "1" (pin 1-2), stage "2" (pin 1-3), stage "3" (pin 2-3).
- Take the measurements;
- If there is a significant difference between one stage and another (other than 15 V), this
  means that the alternator is defective and must be replaced.

#### CAUTION

WITH THE ENGINE HOT THE VALUES RECORDED ARE ON AVERAGE 4-5 V LESS THAN THOSE DETECTED WITH THE ENGINE COLD.

## **EMPTY VOLTAGE**

rpm	2000	6000	8000
Vm linked voltage Reference values (V rms)	20 - 30	75 - 85	95 - 105

#### Short circuit current

- For a correct detection of the short circuit current, a connector must be prepared that generates a downstream short circuit between the three alternator cables;
- Start the engine and with an ammeter clamp measure each single cable.
- If there is a significant difference between the measure of the single cables (other than 10 A), this means that the alternator is defective and must be replaced.



WITH THE ENGINE HOT THE VALUES RECORDED ARE ON AVERAGE 2-3 A LESS THAN THOSE DETECTED WITH THE ENGINE COLD.

#### WARNING

NEVER KEEP THE ENGINE RUNNING FOR MORE THAN ONE MINUTE; FAILURE TO DO SO COULD CAUSE SERIOUS OVERHEATING DAMAGES TO THE MOTORCYCLE CIRCUITS.



#### **C**OLD SHORT CIRCUIT CURRENT

RPM	2000	4000	6000	8000
RMS DC current (Arms) (average of the 3 stage	26 - 31	26 - 31	26 - 31	26 - 31
currents)				

## Voltage on battery poles with engine speed always between 3000 - 5000 RPM

 Start the engine, after about one minute of operating bring the speed to 3000-5000 RPM, then measure with a tester the voltage at the battery poles that must always be between 13V and 15V. Otherwise, if the correct operation of the alternator has already been checked, replace the regulator.

#### CAUTION

PERFORM THE CHECK DESCRIBED ABOVE WITH A BATTERY IN GOOD CONDITION (START VOLTAGE ABOUT 13V) MAKING SURE THAT THERE ARE NO ELEMENTS IN THE SHORT CIRCUIT.

## Start-up system check

#### **Function**

Communicates to the control unit the will to startup the engine.

## **Operation / Operating principle**

Press the start-up button to close the specific circuit taking the PIN 58 of the control unit to a voltage equal to zero (ground closing).

## Level in electrical circuit diagram:

Start-up signal

#### Location:

- on the vehicle: right light switch.
- connector: between filter box and water radiator, at the centre.

#### **Electrical characteristics:**

- key released: the circuit is open
- key pressed: the circuit is closed

#### Pin out:

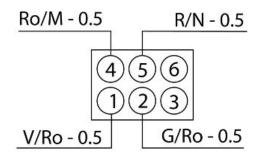
- 4: voltage + 5V
- 5: ground connection

#### CAUTION

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

#### **DIAGNOSTICS INSTRUMENT: ELECTRICAL ERRORS**

Starter switch P0170





shorted to positive / open circuit, shorted to negative.

#### **Error cause**

• If shorted to positive: excessive voltage has been detected at PIN 58; if the circuit is open, shorted to negative: voltage equal to zero has been detected.

## **DIAGNOSTICS INSTRUMENT: LOGIC ERRORS**

Starter switch P0169

signal not valid.

## **Error cause**

• Fault in the switch (lock) of the engine start-up. The instrument panel does not indicate the presence of this error even in the ATT status.

#### **Troubleshooting**

Check the locking cause and restore.

## **Lights list**

## Headlamp

## Characteristic

## Front daylight running lights

2V - 5W W5WB x 2

#### Low beam light

12V - 55W H11 x 2

#### High beam light

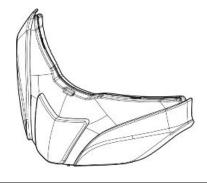
12V - 55W H11

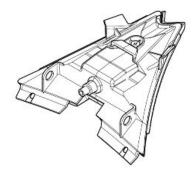
## **Taillight**

## Characteristic

#### Rear daylight running light / stop light

LED



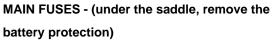


## **Fuses**

# AUXILIARY FUSES (front left, above the water radiator)

- 1 Safety relay, stop lights, horn, daylight running light, license plate light (10 A)
- 2 Instrument panel, anti-theft, VCU, BlueDash positive live (7.5 A)
- 3 Engine control unit positive live (15 A).
- 4 Permanent engine control unit positive (7.5 A).
- 5 Coils, petrol pump, injectors (15 A)
- 6 Low beam/high beam light logic (15 A)
- 7 Fans (15 A).
- 8 VCU positive live (15 A) (only Caponord 1200 Travel Pack)

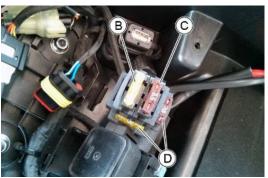
Spare fuses (7.5 - 10 - 15 A)



- A Battery recharge, primary injection relay, live positive, permanent BlueDash positive (30 A)
- B Permanent ABS control unit positive (20 A)
- C USB jack, heated handgrips, anti-theft, GPS, BlueDash (7.5 A)
- D Spare fuses (30 20 7.5 A)







## **Control unit**

Unscrew and remove the control unit cover screws.









Unscrew and remove the control unit fixing screw.



 Slide off the control unit from the mountings and remove it from the vehicle.







## NOTE

DURING THE REFITTING, PAY PARTICULAR ATTENTION TO FIX THE CONTROL UNIT IN THE MOUNTINGS.

**CONTROL UNIT - Diagnosis** 

**Function** 

ELE SYS - 98

it controls the Ride by wire system, the injection/ignition, the system safety checks and the self-diagnosis function

#### Level in electrical circuit diagram:

Each level in which the main component involves the control unit

#### Location:

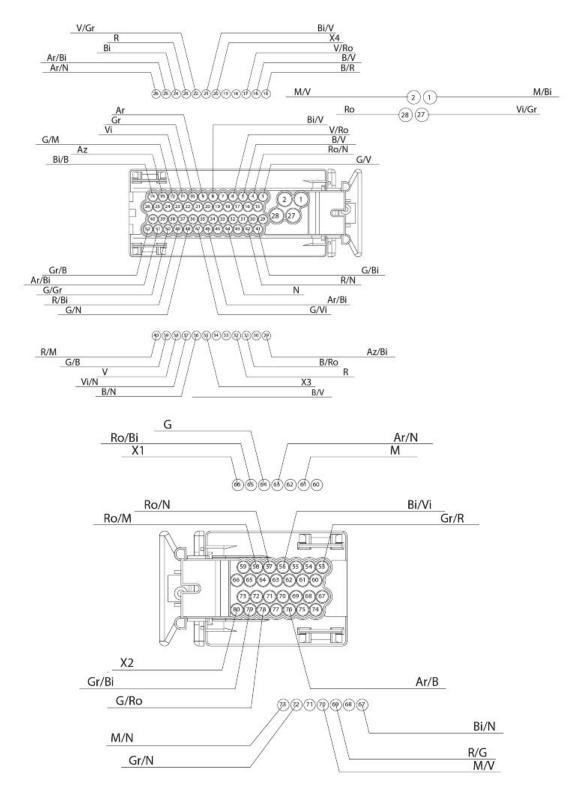
- on the vehicle: above the filter box
- connector: on the 52 PIN connector ENGINE control unit, 28 PIN connector VEHICLE

#### Pin out: See the CONNECTORS section

#### **DIAGNOSTICS INSTRUMENT: PARAMETERS ISO Screen page**

(screen/example value with key set to ON)

- ISO Code / -
- Type-approval Code / -
- Mapping / -
- Marelli spare part code / IAW7SMHW430
- Frame number (VIN) or diagnostics instrument serial number / -
- Drawing number / -
- Person in charge for last programming / Indicates the series number of the DIAGNOSTICS
   INSTRUMENT that has carried out the last control unit remapping
- BOOT version / -
- Control unit serial number (NIP) / -
- Vehicle model / -
- Internal code (IDVAG1) / -
- Internal code (IDEEKE) / -
- HW code / -



## **DIAGNOSTICS INSTRUMENT: PARAMETERS**

- Engine revs (rpm)
- Front throttle position (pot. 1) (°)

- Rear throttle position (pot. 1) (°)
- Front throttle position correction (°)
- Rear throttle position correction (°)
- Front lambda probe tension (mV)
- Rear lambda probe tension (mV)
- Correction front cylinder value (%)
- Correction rear cylinder value (%)
- Front cylinder fuel adaptive correction (%)
- Rear cylinder fuel adaptive correction (%)
- Grip opening percentage (%)
- Advance front cylinder ignition (central spark plug) (°)
- Advance front cylinder ignition (side spark plug) (°)
- Advance rear cylinder ignition (central spark plug) (°)
- Advance rear cylinder ignition (side spark plug) (°)
- Motor temperature (°C)
- Intake air temperature (°C)
- Front Cylinder Intake Pressure (mbar)
- Reference Front Cylinder Intake Pressure (mbar)
- Rear Cylinder Intake Pressure (mbar)
- Reference Rear Cylinder Intake Pressure (mbar)
- Battery voltage (V)
- Exhaust butterfly valve target position (%)
- Blue connector throttle grip position sensor track A (mV)
- Blue connector throttle grip position sensor track B (mV)
- White connector throttle grip position sensor track C (mV)
- White connector throttle grip position sensor track D (mV)
- Tension Front throttle Potentiometer 1 (mV)
- Tension Front throttle Potentiometer 2 (mV)
- Tension Rear throttle Potentiometer 1 (mV)
- Tension Rear throttle Potentiometer 2 (mV)
- Front throttle Limp Home position (mV)
- Front throttle lower position (mV)
- Rear throttle Limp Home position (mV)
- Rear throttle lower position (mV)
- Front throttle position (potentiometer 2) (°)
- Rear throttle position (potentiometer 2) (°)
- Motor temperature at start (°C)
- Front cylinder injection time (ms)

- Rear cylinder injection time (ms)
- Nominal idle speed (rpm)
- Vehicle speed (km/h)
- Front wheel speed (km/h)
- Rear wheel circumference (mm)
- Final drive gear ratio

#### CAUTION

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

#### **DIAGNOSTICS INSTRUMENT: STATUSES**

Front cylinder title control

Open loop/Closed loop/Rich in half closed loop/Lean in half closed loop

Rear cylinder title control

Open loop/Closed loop/Rich in half closed loop/Lean in half closed loop

Front lambda probe

Operative/Inoperative (Rich)/Inoperative (Lean)/Inoperative (Start-up)

Rear lambda probe

Operative/Inoperative (Rich)/Inoperative (Lean)/Inoperative (Start-up)

Front cylinder value

Rich/Lean/Not detected

Rear cylinder value

Rich/Lean/Not detected

Engine status

 Indefinite / Key ON / Running engine / Stopped / Power latch / Power latch 2 / Power latch finished

Engine mode

Indefinite / Start-up / Stable / Idle / Acceleration / Deceleration / Cut Off Input / Cut Off / Cut
 Off Output

Handle self-learning

Carried out/Not carried out

Front throttle self-acquisition

 Ice/Interrupted/Carried out/Limp home/Closed throttle stop/Springs check/Limp home selfacquisition/Initialise

Rear throttle self-acquisition

 Ice/Interrupted/Carried out/Limp home/Closed throttle stop/Springs check/Limp home selfacquisition/Initialise

Throttle self-learning with diagnostics instrument

Carried out/Not carried out

Start up enabling

Yes/No

Immobilizer signal

Yes/No

Gearbox in neutral

Yes/No

Side stand

Down/Up

fall sensor

Normal / Tip over

Fan relay

On / Off

RUN / STOP switch

Run/Stop

Clutch lever

Pulled/Released

Gear engaged

• 0 / 1 / 2 / 3 / 4 / 5 / 6 / Indeterminate

Throttle grip

Slightly twisted/Choked/Fully twisted

Rpm sensor signals panel

Synchronized/Partially synchronized/Not synchronized

Button + (during ATC setting)

Pressed/Released

Button - (during ATC setting)

• Pressed/Released

ATC (Aprilia Traction Control)

Present/Not present

Exhaust butterfly valve

• Indeterminate / Search / Self-cleaning / Operation / Failure / Home position search

Performing ATC (on bend)

Present/Not present

AQS (Aprilia Quick Shift)

Present/Not present

**ABS** 

Present/Not present

Front brake lever

Pulled/Released

rear brake pedal

Pressed/Released

ADD (Aprilia Dynamic Damping)

Present/Not present

Cruise control button

Pressed/Released

Cruise control

Enabled/Disabled/Set

Cruise control + button

Pressed/Released

Button - cruise control

Pressed/Released

ACC (Aprilia Cruise Control)

Present/Not present

Speedometer unit of measurement

• kph / mph

Vehicle configuration

Valid/Not valid

**EVC (Exhaust Valve Control)** 

Present/Not present

#### **DIAGNOSTICS INSTRUMENT: ACTIVATION**

- Rear cylinder central coil
- Front cylinder central coil
- Rear cylinder side coil

- Front cylinder side coil
- Internal rear cylinder injector
- Internal front cylinder injector
- External front cylinder injector
- External rear cylinder injector
- Deleting stored errors
- Freezes and saves the parameter and states values
- Rpm indicator
- Errors ambient parameters reading
- STOP light
- Fuel pump
- Heater rear lambda probe
- Heater front lambda probe
- Fan

#### DIAGNOSTICS INSTRUMENT: ELECTRICAL ERRORS

#### Error EEPROM P0601

circuit not operational

#### **Error cause**

 Replace injection ECU. The instrument panel does not indicate the presence of this error even in the ATT status

## Error RAM P0604

circuit not operational

#### **Error cause**

 Replace injection ECU. The instrument panel does not indicate the presence of this error even in the ATT status

#### Error ROM P0605

circuit not operational

#### **Error cause**

 Replace injection ECU. The instrument panel does not indicate the presence of this error even in the ATT status

#### A/D converter P0607

· circuit not operational

## **Error cause**

Replace injection ECU

Error stop lights relay P0610

short circuit to positive/ short circuit to negative / open circuit

#### **Error cause**

If shorted to positive: excessive voltage has been detected at PIN 31. If shorted to negative:
 no voltage has been detected. If the circuit is open: an interruption has been detected

#### **Troubleshooting**

- If shorted to positive: check the relay electrical specifications are correct by disconnecting
  it from the cable harness. If they are not correct, replace the relay; if OK, restore the cable
  harness (Blue/Pink cable)
- If shorted to negative: check the relay electrical specifications are correct by disconnecting
  it from the cable harness. If they are not correct, replace the relay; if OK, restore the cable
  harness (Blue/Pink cable)
- If the circuit is open: check the relay electrical characteristics are correct by disconnecting it from the cable harness; if not OK, replace the relay, if OK, check relay connector, engine-vehicle cable harness connector and ENGINE connector of the Marelli control unit: if not OK, restore; if OK, check continuity of cable harness (Blue/Pink cable)

#### **DIAGNOSTICS INSTRUMENT: LOGIC ERRORS**

Level 2 safety reset P0608

#### **Error cause**

As the level 2 safety system (comparison between requested torque and calculated torque)
has detected a fault, the control unit has reset engine (C gravity). The instrument panel does
not indicate the presence of this error even in the ATT status.

#### **Troubleshooting**

Continue fault search for the other errors detected.

Safety Engine Stop P0609

## Error cause

Since the safety system has detected a serious fault, the control unit has shut off the engine.

## **Troubleshooting**

Continue fault search for the other errors detected.

Saved data file (for safety) P0611

Filled

#### **Error cause**

 This indication appears only if the Level 2 safety has reset the engine (C gravity). The instrument panel does not indicate the presence of this error even in the ATT status.

## **Troubleshooting**

Continue fault search for the other errors detected.

## **DIAGNOSTICS INSTRUMENT: ADJUSTMENTS**

- Handle self-learning
- Throttle self-learning with diagnostics instrument
- EEPROM reset
- Saved data file download
- Saved data file deletion
- Vehicle configuration
- Exhaust valve (step 1) Acquire home position
- Exhaust valve (step 2) Self-learning

#### CAUTION

DELETING ALL THE SAVED DATA WHEN THE VEHICLE IS BEING MANUFACTURED (INCLUDING THE SELF-ADJUSTABLE PARAMETERS), THEN YOU MUST SELECT: HANDLE SELF-LEARNING AND CHECK THE TWO "AUTOMATIC FRONT THROTTLE SELF-LEARNING" AND "AUTOMATIC REAR THROTTLE SELF-LEARNING" STATUSES ARE "PERFORMED".

#### See also

Cylinders synchronisation

# CONTROL UNIT - Diagnosis

## (IF APPLICABLE)

#### **Function**

it manages the suspensions system, the exhaust butterfly valve, and the self-diagnosis function

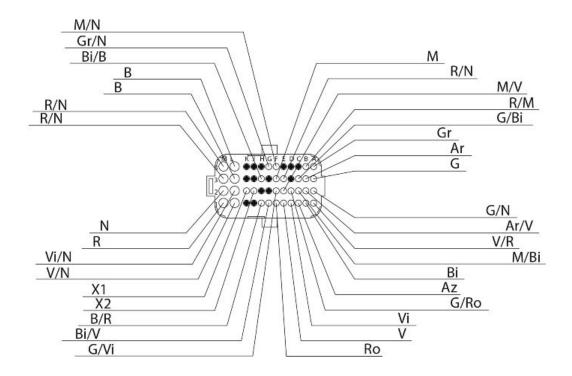
#### Level in electrical circuit diagram:

Each level in which the main component involves the control unit

#### Location:

- on the vehicle: in the front part, on the right side
- · connector: on the control unit

Pin out: See the CONNECTORS section



## **DIAGNOSTICS INSTRUMENT: PARAMETERS**

- Battery voltage (V)
- Tension potentiometer at the exhaust butterfly valve (mV)
- Rotary sensor trace 1 (mV)
- Rotary sensor trace 2 (mV)
- Pressure sensor (mBar)
- Temperature sensor (°C)
- Current front valve (mA)
- Current rear valve (mA)
- Number operations preload motor
- Exhaust butterfly valve target position (%)
- Exhaust butterfly valve upper travel limit
- Exhaust butterfly valve lower travel limit
- Maximum travel preload in impulses

## **DIAGNOSTICS INSTRUMENT: STATUSES**

Suspensions map

Indeterminate / 1 / ... / 8

Preload level

Indeterminate / 1 / ... / 5

Preload motor

Travel limits not acquired / Manual / Automatic / Fault

Exhaust butterfly valve automatic

Indeterminate / Seek / Verify / Adjustment / Fault / Zero

Front Suspension Valve

Operation / Constant Current Fault / Zero Current Fault

Rear suspension valve

Operation / Constant Current Fault / Zero Current Fault

Cruise Control button

Released / Pressed / Short-circuit Fault / Open Circuit Fault / Indeterminate Fault

Switch front brake

Released / Pressed / Short-circuit Fault / Open Circuit Fault

Switch rear brake

Released / Pressed / Short-circuit Fault / Open Circuit Fault

Exhaust butterfly valve output

• Not active / Active / Short-circuit Fault / Open Circuit Fault

Preload motor control output

Not active / Active / Short-circuit Fault / Open Circuit Fault

Rotary sensor reset

Not Carried out / Carried out

# **DIAGNOSTICS INSTRUMENT: ACTIVATION**

- Reset control unit
- Front Suspension Valve
- Rear suspension valve
- Exhaust butterfly valve
- Preload motor

#### **DIAGNOSTICS INSTRUMENT: ERRORS**

# Error VCU code C1000

# Error cause

 The stored IDMODELV and the current one do not coincide: the VCU is programmed for a vehicle different from the one on which it is fitted.

# **Troubleshooting**

Replace the motor control unit or perform the reset of the VCU using a diagnosis instrument.

#### Control unit internal error C1200

# Error cause

 The VCU memory was deleted following an unforeseen lack of supply; all stored data have been lost, such as the travel limits of the exhaust valve, of the shock absorber preload, or the idle position of the rotary potentiometer.

# Troubleshooting

Rest the VCU using the diagnosis instrument.

# **Battery**

# **Function**

Battery YTX 14-BS, which must be activated and loaded.

# Level in electrical circuit diagram:

Battery recharge

#### Location:

on the vehicle: under the saddle

· connector: on the battery

# Electrical specifications: 12 Ah

#### Pin out:

1. Positive pole (red): approx. 12.6 V

2. negative pole (black): ground connection

# DIAGNOSTICS INSTRUMENT: PARAMETERS

# **Battery voltage**

Example value with key ON: 12.0 V

Example value with engine on: 14.2 V

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

# **Battery voltage pre Recovery**

Example value with key ON: 12.0 V

Example value with engine on: 14.2 V

Value drawn from the signal read without taking

into account any recovery

# CAUTION

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

# **DIAGNOSTICS INSTRUMENT: LOGIC ERRORS**

Battery voltage P0560



too high/too low

#### **Error cause**

 If too high: too high a voltage has been detected at PIN 42. If too low: too low a voltage has been detected at PIN 42. The instrument panel does not indicate the presence of this error even in the ATT status.

# **Troubleshooting**

- If too high: check correct operation of the voltage regulator.
- If too low: check voltage regulator connectors, engine vehicle cable harness connector and the control unit connector (paying special attention to possible oxidation): if not OK, restore; if OK, check that Red/White cable resistance from the voltage regulator connector to the control unit connector is a few tenths of Ohm: if not OK, restore cable harness; if OK, check correct operation of the electrical alternator: if not OK, restore; if OK, check operation of the voltage regulator

#### **VCU ERRORS**

# Battery tension too low or too high C1001

#### Error cause

 The battery tension is below the minimum threshold (6 V with engine on, 10 V with engine off) or above the maximum threshold (16 V).

#### Troubleshooting

Check the battery.

# Speed sensor

# **VEHICLE FRONT SPEED SENSOR**

**FUNCTION:**To indicate the vehicle speed by reading the front wheel turning speed.

**OPERATION / OPERATING PRINCIPLE:** Magnetoresistive sensor: a square-wave pulse is generated with voltage approx. between 11.55 V and 11.25 V

**WIRING DIAGRAM** Level in wiring diagram: ABS.

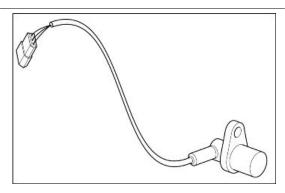
#### **REMOVAL**

**LOCATION ON THE VEHICLE:**on the fork, right stem, next to the brake calliper support.

CONNECTOR LOCATION (if available): under

the helmet compartment.

**PINS** 



- PIN 1- Ground connection (white)
- PIN 2 Power supply voltage/Output signal (white/brown)

# **DIAGNOSIS INSTRUMENT**

Parameters: Speed (km/h) - Vehicle speed.

**ELECTRICAL ERRORS** 

Speed sensor

5D90 electric malfunction: Electrical fault in sensor or cable harness.

<u>Troubleshooting:</u> Check the sensor connector and the ABS control unit connector. If they are not OK, restore the connectors. If they are OK, check continuity of the white/brown cable between PIN 2 of the sensor on the cable harness side and PIN 14 of the ABS control unit connector. If there is no continuity, restore them. If there is, PIN 2 of the sensor on the cable harness side, with the sensor disconnected and key set to ON, must have 12V voltage approximately: if there is no voltage, check PIN 2 for continuity with the vehicle ground connection: if it is grounded, restore the cable harness. If OK, replace the control unit. If PIN 2 has approx. 12 V, check the continuity of the white cable between PIN 1 of the sensor on the cable harness side and PIN 13 of the ABS control unit connector. If there is no continuity, restore the cable harness. If there is, replace the logic errors sensor.

#### LOGIC ERRORS

#### Speed sensor

**5D91 the signal works irregularly:** faulty sensor or signal interference.

<u>Troubleshooting:</u> Check speed sensor retainer. If it is not OK, restore it. If it is OK, check if the tone wheel is dirty, deformed or wrongly fixed. If any of this happens, replace the tone wheel. Otherwise, replace the speed sensor.

**5D92 the signal decreases periodically:** Possible tone wheel fault due to deformations or dirt; possible alterations on the wheel bearing surface. In very rare cases, abnormal tone wheel vibrations.

<u>Troubleshooting:</u> Check if the tone wheel is dirty, deformed or wrongly fixed. If the tone wheel is not OK, replace it. If it is OK, check for possible faults in the wheel bearings and if it is not OK, replace the bearings.

**5D93** missing signal or speed measured too low in relation to the rear wheel: faulty sensor or missing sensor/tone wheel. Or excessive distance between the sensor and the tone wheel or tone wheel with wrong number of teeth.

<u>Troubleshooting:</u> Check that the speed sensor and the tone wheel are installed. If they are not, install them. If they are, check the speed sensor retainer. If it is not OK, restore it. If it is, check if the tone wheel has the correct number of teeth or if it is dirty, deformed or wrongly fixed. If it is not OK, replace the tone wheel and if it is OK, replace the speed sensor.

**5D94 no acceleration after pressure reduction:** Faulty sensor or missing sensor/tone wheel or excessive distance between the sensor and the tone wheel.

<u>Troubleshooting:</u> Check that the speed sensor and the tone wheel are installed. If they are not, install them. If they are, check the speed sensor retainer. If it is not OK, restore it. If it is, check if the tone wheel has the correct number of teeth or if it is dirty, deformed or wrongly fixed. If it is not OK, replace the tone wheel and if it is OK, replace the speed sensor.

**5D95 excessive speed measured:** Faulty sensor or tone wheel, or tone wheel with wrong number of teeth or wrong tyre size.

Troubleshooting: Check that the speed sensor and the tone wheel are installed. If they are not, install them. If they are, check the speed sensor retainer. If it is not OK, restore it. If it is, check if the tone wheel has the correct number of teeth or if it is dirty, deformed or wrongly fixed. If it is not OK, replace the tone wheel and if it is OK, check that the tyre size is the correct one. If it is not OK, replace it. If it is OK, check that the tyre pressure is the correct one. If it is not OK, restore it; if it is OK, replace the speed sensor.

#### **VEHICLE REAR SPEED SENSOR**

**FUNCTION:**To indicate the vehicle speed by reading the rear wheel turning speed.

**OPERATION / OPERATING PRINCIPLE:** Magnetoresistive sensor: a square-wave pulse is generated with voltage approx. between 11.55 V and 11.25 V

**WIRING DIAGRAM** Level in wiring diagram: ABS. **REMOVAL** 

**LOCATION ON THE VEHICLE:**on the swingarm, right side, under the chain tension screw.

**CONNECTOR LOCATION (if available):** under the saddle, right side.

#### **PINS**

- PIN 1- Ground connection (yellow)
- PIN 2 Power supply voltage/Output signal (yellow/brown)

# **DIAGNOSIS INSTRUMENT**

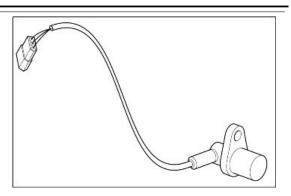
Parameters: Speed (km/h) - Vehicle speed.

# **ELECTRICAL ERRORS**

# Speed sensor

**5DA0 electric malfunction:** Electrical fault in sensor or cable harness.

<u>Troubleshooting:</u>Check the sensor connector and the ABS control unit connector. If they are not OK, restore the connectors. If they are OK, check continuity of the yellow/brown cable between PIN 2 of the sensor on the cable harness side and PIN 11 of the ABS control unit connector. If there is no continuity,



restore them. If there is, PIN 2 of the sensor on the cable harness side, with the sensor disconnected and key set to ON, must have 12V voltage approximately: if there is no voltage, check PIN 2 for continuity with the vehicle ground connection: if it is grounded, restore the cable harness. If OK, replace the control unit. If PIN 2 has approx. 12 V, check continuity of the yellow cable between PIN 1 of the sensor on the cable harness side and PIN 12 of the ABS control unit connector. If this is not OK, restore the cable harness. If it is OK, replace the sensor.

#### **LOGIC ERRORS**

# Speed sensor

**5DA1 the signal works irregularly:** faulty sensor or signal interference.

<u>Troubleshooting:</u>Check speed sensor retainer. If it is not OK, restore it. If it is OK, check if the tone wheel is dirty, deformed or wrongly fixed. If any of this happens, replace the tone wheel. Otherwise, replace the speed sensor.

**5DA2 the signal decreases periodically:** Possible tone wheel fault due to deformations or dirt; possible alterations on the wheel bearing surface. In very rare cases, abnormal tone wheel vibrations.

<u>Troubleshooting:</u> Check if the tone wheel is dirty, deformed or wrongly fixed. If the tone wheel is not OK, replace it. If it is OK, check for possible faults in the wheel bearings and if it is not OK, replace the bearings.

**5DA3** no signal or speed measured too low in relation to the front wheel: Faulty sensor or missing sensor/tone wheel. Or excessive distance between the sensor and the tone wheel or tone wheel with wrong number of teeth.

<u>Troubleshooting:</u> Check that the speed sensor and the tone wheel are installed. If they are not, install them. If they are, check the speed sensor retainer. If it is not OK, restore it. If it is, check if the tone wheel has the correct number of teeth or if it is dirty, deformed or wrongly fixed. If it is not OK, replace the tone wheel and if it is OK, replace the speed sensor.

**5DA4 missing acceleration after pressure reduction:** Faulty sensor or missing sensor/tone wheel or excessive distance between the sensor and the tone wheel.

<u>Troubleshooting:</u> Check that the speed sensor and the tone wheel are installed. If they are not, install them. If they are, check the speed sensor retainer. If it is not OK, restore it. If it is, check if the tone wheel has the correct number of teeth or if it is dirty, deformed or wrongly fixed. If it is not OK, replace the tone wheel and if it is OK, replace the speed sensor.

**5DA5 excessive measured speed:** Faulty sensor or tone wheel, or tone wheel with wrong number of teeth or wrong tyre size.

<u>Troubleshooting:</u>Check that the speed sensor and the tone wheel are installed. If they are not, install them. If they are, check the speed sensor retainer. If it is not OK, restore it. If it is, check if the tone wheel has the correct number of teeth or if it is dirty, deformed or wrongly fixed. If it is not OK, replace the tone wheel and if it is OK, check that the tyre size is the correct one. If it is not OK, replace it. If it is

OK, check that the tyre pressure is the correct one. If it is not OK, restore it; if it is OK, replace the speed sensor.

# Engine rpm sensor

#### **ENGINE SPEED SENSOR**

#### **Function**

It informs crankshaft position and speed to the Marelli control unit.

# **Operation / Operating principle**

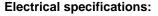
Inductive sensor: sinusoidal-type generated voltage; two teeth are missing on the flywheel for the reference position.

Level in electrical circuit diagram: engine spe-

ed sensor

#### Location:

- on the vehicle: inside the flywheel cover
- connector (if available): near the Marelli control unit



Resistance at ambient temperature:
 130 +/- 20 Ohm

# Pin-out:

- 1. Negative signal
- Positive signal

# CAUTION

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

#### **DIAGNOSTICS INSTRUMENT: STATUSES**

Synchronised panel

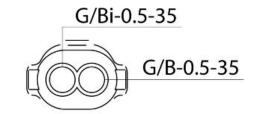
No under analysis standby Yes

#### **DIAGNOSTICS INSTRUMENT: ELECTRICAL ERRORS**

#### CAUTION

IF THE ELECTRIC CIRCUIT IS INTERRUPTED OR SHORT-CIRCUITED, NO ERROR IS DISPLAYED. CHECK THE ENGINE SPEED SENSOR CONNECTOR AND THE MARELLI CONTROL UNIT CONNECTOR: IF NOT OK, RESTORE; IF OK, CHECK THE CORRECT ELECTRIC CHARACTERISTICS OF THE SENSOR: IF NOT OK, REPLACE THE SENSOR. IF OK, CHECK THAT THERE IS CONTINUITY ON BOTH CABLES, SUPPLY INSULATION AND GROUND INSULATION.





CARRY OUT THE TESTS FROM THE SENSOR CONNECTOR TO THE SENSOR. IF NOT OK, RESTORE THE CABLE HARNESS/REPLACE THE SENSOR. IF OK, PERFORM THE TEST FROM PIN 20 AND 35 OF THE MARELLI CONTROL UNIT ENGINE CONNECTOR.

#### DIAGNOSTICS INSTRUMENT: LOGIC ERRORS

Engine speed sensor P0336

signal not valid

#### **Error cause**

Probable bad contact in the electric circuit detected at PIN 20 - 35 of the ENGINE connector

# **Troubleshooting**

Check the electric circuit is in good conditions and the flywheel teeth cleaning and correct
positioning of the sensor in its own housing: if it is not, replace it. If it is OK, replace the
sensor

# Twistgrip position sensor

# Removal

- Remove the filter box.
- Loosen the throttle cable nuts.
- Unscrew and remove the two fixing screws.



- Disconnect the two connections and remove the throttle grip position sensor
- Remove the throttle cables.



# See also

Air box

# THROTTLE GRIP POSITION SENSOR

# **Function**

The throttle grip is the part to which the throttle control cables arrive; its task is to translate the rider's power request (Demand) into an electrical signal to be sent to the electronic control unit.

# **Operation / Operating principle**

The two throttle cables (opening and closing) actuate on a scroll mounted on a shaft which is sent back to its home position by a return spring. On the shaft covers there are 2 double track potentiometers (4 control tracks) by means of which the torque demand is read (and checked). The 4 potentiometers are tinned and magnetically controlled (contactless); they cannot be overhauled nor replaced

Level in electrical circuit diagram: Throttle grip position sensor.

# Location:

- on the vehicle: left side, under the filter box
- · connector: on the sensor

#### **Electrical characteristics:**

 Not detected by a multimeter as they are contactless: read the voltage of the 4 tracks by the diagnosis instrument.

# MASTER connector (blue)

- A: Track A supply
- B: Track A ground
- C: Track A signal
- D: Track B supply
- E: Track B ground
- F: Track B signal

# **SLAVE** connector (white)

- A: Track C supply
- B: Track C ground
- C: Track C signal
- D: Track D supply
- E: Track D ground
- F: Track D signal

#### **DIAGNOSIS INSTRUMENT: PARAMETERS**

Blue front connector throttle grip position sensor - track A

- Example value with key ON: 1107 mV
- Example value with engine on: -

Voltage value of the front potentiometer - track A

Blue front connector throttle grip position sensor - track B

- Example value with key ON: 1070 mV
- Example value with engine on: -

Voltage value times 2 of the front potentiometer track B

White rear connector throttle grip position sensor - track C

- Example value with key ON: 3560 mV
- Example value with engine on: -

Voltage value of the rear potentiometer track C

White rear connector throttle grip position sensor - track D

- Example value with key ON: 3555 mV
- Example value with engine on: -

Voltage value times 2 of the rear potentiometer track D

Throttle grip position sensor

- Example value with key ON: 1107 mV
- Example value with engine on: -

Voltage corresponding to the potentiometer track A

Throttle grip opening percentage

- Example value with key ON: 0 mV
- Example value with engine on: -

With a released throttle grip, the value read should be 0%, whereas 100 % should be read with throttle grip fully twisted.

#### **DIAGNOSIS INSTRUMENT: STATUSES**

Throttle grip

Slightly twisted\_choked\_fully twisted

Handle self-learning

carried out/not carried out

#### CAUTION

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

# **DIAGNOSTICS INSTRUMENT: ELECTRICAL ERRORS**

Blue front connector throttle grip position sensor - track A P0150

short circuit to positive / open circuit, short circuit to negative

# Error cause

 If shorted to positive: excessive voltage has been detected at PIN 39 of the ENGINE connector. If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 39 of the ENGINE connector.

#### **Troubleshooting**

shorted to positive: check the value shown by the parameter of the BLUE front connector
 Throttle Grip Position Sensor - track A: disconnect the connector and read the value indi-

- cated by the diagnostics instrument: if the voltage does not vary, there is a short circuit in the cable wiring; replace the throttle grip sensor if the voltage drops to zero.
- if the circuit is open, shorted to negative: check the throttle grip sensor connector and the Marelli control unit connector. If not OK, restore. If OK, check circuit continuity between the two cable terminals. If not OK, restore; if OK, check the cable ground insulation (from the throttle grip sensor connector or the control unit connector): if the cable is not ground insulated, restore the wiring. If it is ground insulated, and with the key set to ON, check that there is power supply for the potentiometer PIN A and that PIN C is connected to ground. If both are correct, replace the throttle grip sensor; if not, check the continuity of the cable that is not functioning properly: if there is continuity, replace the control unit; if not, restore the wiring

Blue front connector throttle grip position sensor - track B P0151

• short circuit to positive / open circuit, short circuit to negative

#### **Error cause**

 If shorted to positive: excessive voltage has been detected at PIN 13 of the ENGINE connector. If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 13 of the ENGINE connector

# **Troubleshooting**

- short circuit to positive: check the value shown by the parameter of the BLUE front connector
   Throttle Grip position Sensor track B: disconnect the connector and read the value indicated
   by the diagnostics instrument: if the voltage does not vary, there is a short circuit in the cable
   wiring; replace the throttle grip sensor if the voltage drops to zero.
- if the circuit is open, shorted to negative: check the throttle grip sensor connector and the Marelli control unit connector. If not OK, restore. If OK, check circuit continuity between the two cable terminals. If not OK, restore; if OK, check the cable ground insulation (from the throttle grip sensor connector or the control unit connector): if the cable is not ground insulated, restore the wiring. If it is ground insulated, and with the switch key set to ON, check that there is power supply for the potentiometer PIN D and that PIN F is connected to ground. If both are correct, replace the throttle grip sensor; if not, check the continuity of the cable that is not functioning properly: if there is continuity, replace the control unit; if not, restore the wiring

# **DIAGNOSTICS INSTRUMENT: ELECTRICAL ERRORS**

White rear connector throttle grip position sensor - track C P0152

short circuit to positive / open circuit, short circuit to negative

# **Error cause**

 If shorted to positive: excessive voltage has been detected at PIN 23 of the ENGINE connector. If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 23 of the ENGINE connector

# **Troubleshooting**

- shorted to positive: check the value shown by the parameter of the white rear connector
   Throttle Grip Position Sensor track C: disconnect the connector and read the value indicated by the diagnostics instrument: if the voltage does not vary, there is a short circuit in
   the cable wiring; replace the throttle grip sensor if the voltage drops to zero.
- if the circuit is open, shorted to negative: with open circuit, short it to negative: check the throttle grip sensor connector and the Marelli control unit connector. If not OK, restore. If OK, check circuit continuity between the two cable terminals. If not OK, restore; if OK, check the cable ground insulation (from the throttle grip sensor connector or the control unit connector): if the cable is not ground insulated, restore the wiring. If it is ground insulated, and with the key set to ON, check that there is power supply for the potentiometer PIN A and that PIN C is connected to ground. If both are correct, replace the throttle grip sensor; if not, check the continuity of the cable that is not functioning properly: if there is continuity, replace the control unit; if not, restore the wiring

White rear connector throttle grip position sensor - track D P0153

short circuit to positive / open circuit, short circuit to negative

# **Error cause**

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

# **Troubleshooting**

- shorted to positive: check the value shown by the parameter of the white rear connector
   Throttle Grip Position Sensor track D: disconnect the connector and read the value indi cated by the diagnostics instrument: if the voltage does not vary, there is a short circuit in
   the cable wiring; replace the throttle grip sensor if the voltage drops to zero.
- if the circuit is open, shorted to negative: check the throttle grip sensor connector and the Marelli control unit connector. If not OK, restore. If OK, check circuit continuity between the two cable terminals. If not OK, restore; if OK, check the cable ground insulation (from the throttle grip sensor connector or the control unit connector): if the cable is not ground insulated, restore the wiring. If it is ground insulated, and with the switch key set to ON, check that there is power supply for the potentiometer PIN D and that PIN F is connected to ground. If both are correct, replace the throttle grip sensor; if not, check the continuity of the cable

that is not functioning properly: if there is continuity, replace the control unit; if not, restore the wiring

#### **DIAGNOSTICS INSTRUMENT: LOGIC ERRORS**

Blue front connector throttle grip position (tracks A-B) P0154

inconsistent signal

#### **Error cause**

 Two illogical voltage signals have been detected at PIN 13 and 39 of the ENGINE connector (tracks A-B)

# **Troubleshooting**

• Check the parameters of the blue front connector Throttle Grip Position Sensor - tracks A and B: if one of the two values clearly deviates from 600-1400 mV, it means that this potentiometer is defective. Check the throttle grip sensor connector and the control unit connector: if not OK, restore. If OK, check that cable resistance between the throttle grip sensor connector and the control unit is a few tenths of Ohm: if this is not the case, restore wiring. If the value is correct, replace the complete throttle grip sensor

White rear connector throttle grip position (tracks C-D) P0155

inconsistent signal

#### **Error cause**

 Two illogical voltage signals have been detected at PIN 23 and 11 of the ENGINE connector (tracks A-B)

#### **Troubleshooting**

• Check the parameters of the white rear connector Throttle Grip Position Sensor - tracks C and D: if one of the two values clearly deviates from 600-1400 mV, it means that this potentiometer is defective. Check the throttle grip sensor connector and the control unit connector: if not OK, restore. If OK, check that cable resistance between the throttle grip sensor connector and the control unit is a few tenths of Ohm: if this is not the case, restore wiring. If the value is correct, replace the complete throttle grip sensor

Throttle grip position P0156

inconsistent signal

# **Error cause**

• The value of the front side sensor (tracks A-B) does not coincide with the value of the rear sensor (tracks C-D)

#### **Troubleshooting**

Replace the throttle grip sensor

#### **DIAGNOSTICS INSTRUMENT: ADJUSTABLE PARAMETERS**

Handle self-learning: -

# RESET PROCEDURE

If Marelli control unit or its mapping are replaced or if you carry out control unit EEPROM
zero setting or if you replace the throttle grip sensor, it is necessary to carry out the Handle
self-learning procedure with the diagnostics instrument: once the check is completed, make
sure that the Handle self-learning status indicates: carried out

#### CAUTION

THE TWO CONNECTORS WHICH GET TO THE THROTTLE GRIP SENSOR ARE ALIKE BUT THEY SHOULD NEVER BE INVERTED. MARK OR CHECK THE CONNECTOR MARKING BEFORE REMOVING THEM (BLUE STAMP + BLUE BAND). THE CONNECTOR AND THE BLUE BAND SHOULD BE PLACED AT THE FRONT. THE CONNECTOR AND THE WHITE BAND SHOULD BE PLACED AT THE BACK.

# Intake pressure sensor

# Figure key

- A Rear
- B Front

#### **Function**

The pressure sensors (one at the front, one at the rear) are fundamental for calculation of generated torque, for calculation of ambient pressure and for correct ignition timing during start-up.

# **Operation / Operating principle**

Diaphragm sensor which translates the diaphragm position into electrical voltage when in contact with the intake air.

# Level in electrical circuit diagram:

Intake air pressure sensor

#### Location:

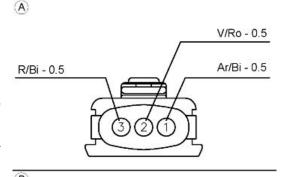
- on the vehicle: rear cylinder sensor on rear throttle body right side, front cylinder sensor on front throttle body left side.
- connector: on the sensor.

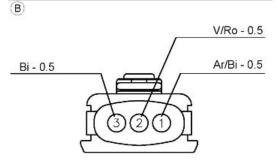
#### **Electrical specifications: -**

#### Pin out:

- 1. Power supply 5V
- 2. Ground connection
- 3. Output signal

# **DIAGNOSIS INSTRUMENT: PARAMETERS**







# Front Cylinder Intake Pressure

- Example value with key ON: 1004 mbar
- Example value with engine on: 715 mbar
- NOTE: pressure read by the front sensor

#### Rear Cylinder Intake Pressure

- Example value with key ON: 1003 mbar
- Example value with engine on: 720 mbar
- NOTE: pressure read by the rear sensor

# Front Cylinder estimated Intake Pressure

- Example value with key ON: 1004 mbar
- Example value with engine on: 735 mbar
- NOTE: pressure estimated by the control unit according to the throttle position

# Rear Cylinder estimated Intake Pressure

- Example value with key ON: 1003 mbar
- Example value with engine on: 721 mbar
- NOTE: pressure estimated by the control unit according to the throttle position

#### CAUTION

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

# **DIAGNOSIS INSTRUMENT: ELECTRICAL ERRORS**

front cylinder air pressure sensor P0105

• shorted to positive / open circuit, shorted to negative.

# **Error cause**

 If shorted to positive: excessive voltage has been detected at PIN 24. If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 24.

#### **Troubleshooting**

- If shorted to positive: verify that the parameter of the front cylinder air Pressure Sensor on
  the diagnosis instrument is approx. 1200 mbar; disconnect the sensor connector: if the value
  does not vary, it means that the cable is shorted between the control unit connector and the
  sensor connector: restore the cable harness; Replace the sensor if the value varies.
- If the circuit is open, shorted to negative: check the Marelli control unit connector and the sensor connector; if not OK, restore. If everything is OK, with key set to OFF, check if there is continuity between the PIN 24 of the Marelli control unit and the sensor connector PIN 3: if there is no continuity, restore the cable harness. If there is continuity, check the cable ground insulation: if there is continuity to ground, restore the cable harness; if not, with key set to ON check that the voltage on sensor connector PIN 1 is approx. 5 V: if not OK, set

the key to OFF and check continuity between the ENGINE connector PIN 25 and the sensor connector PIN 1: if not OK, restore the cable harness; if OK, replace the control unit; if there is 5V voltage at PIN 1, and with key set to ON, check the continuity to ground of the sensor connector PIN 3: if not OK, restore the cable harness; if OK, replace the sensor.

rear cylinder air pressure sensor P0106

shorted to positive / open circuit, shorted to negative.

#### **Error cause**

 If shorted to positive: excessive voltage has been detected at PIN 49. If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 49.

# **Troubleshooting**

- If shorted to positive: verify that the parameter of the rear cylinder air Pressure Sensor on the diagnosis instrument is approx. 1200 mbar; disconnect the sensor connector: if the value does not vary, it means that the cable is shorted between the control unit connector and the sensor connector: restore the cable harness; Replace the sensor if the value varies.
- If the circuit is open, shorted to negative: check the Marelli control unit connector and the sensor connector; if not OK, restore. If everything is OK, with key set to OFF, check if there is continuity between the PIN 49 of the Marelli control unit and the sensor connector PIN 3: if there is no continuity, restore the cable harness. If there is continuity, check the cable ground insulation: if there is continuity to ground, restore the cable harness; if not, with key set to ON check that the voltage on sensor connector PIN 1 is approx. 5 V: if not OK, set the key to OFF and check continuity between the ENGINE connector PIN 25 and the sensor connector PIN 1: if not OK, restore the cable harness; if OK, replace the control unit; if there is 5V voltage at PIN 1, and with key set to ON, check the continuity to ground of the sensor connector PIN 3: if not OK, restore the cable harness; if OK, replace the sensor.

# **DIAGNOSIS INSTRUMENT: LOGIC ERRORS**

front cylinder air pressure sensor P0107

signal not valid.

#### **Error cause**

According to the engine operation data (rpm, throttle, etc.) an average value for the intake
pressure is estimated: if the value read deviates by a given percentage, this error is activated. The most frequent causes can be: abnormal resistance in the sensor circuit (for
example, rusted terminals) or sensor with poor performance.

#### **Troubleshooting**

 Check the Marelli control unit connector and the sensor connector; if not OK, restore. If everything is OK, check that resistance between ENGINE connector PIN 24 and sensor connector PIN 3 is a few tenths of an Ohm; If it is above that value, restore cable harness. Replace the sensor if it is correct.

rear cylinder air pressure sensor P0108

signal not valid.

# **Error cause**

According to the engine operation data (rpm, throttle, etc.) an average value for the intake
pressure is estimated: if the value read deviates by a given percentage, this error is activated. The most frequent causes can be: abnormal resistance in the sensor circuit (for
example, rusted terminals) or sensor with poor performance.

# **Troubleshooting**

Check the Marelli control unit connector and the sensor connector; if not OK, restore. If
everything is OK, check that resistance between ENGINE connector PIN 49 and sensor
connector PIN 3 is a few tenths of an Ohm; If it is above that value, restore cable harness.
 Replace the sensor if it is correct.

Error for unexpected air intake in the front cylinder manifold P0210

signal not valid.

#### **Error cause**

 A small difference between the estimated pressure and the measured pressure has been detected: the measured pressure is higher than the estimated one (intake manifold conditions).

# **Troubleshooting**

- Check the conditions of the intake manifold and cleanliness of the hole for pressure reading.
   Error for unexpected air intake in the rear cylinder manifold P0211
  - signal not valid.

#### **Error cause**

 A small difference between the estimated pressure and the measured pressure has been detected: the measured pressure is higher than the estimated one (intake manifold conditions).

# **Troubleshooting**

- Check the conditions of the intake manifold and cleanliness of the hole for pressure reading.
- Estimation error for front cylinder intake manifold pressure P0215
  - too high pressure/too low pressure.

# **Error cause**

 A substantial difference between the estimated pressure and the measured pressure has been detected (for example, the hole for pressure reading is clogged or sensor screw is loose).

# **Troubleshooting**

Check the conditions of the intake manifold and cleanliness of the hole for reading the pressure: there is an evident defect in the intake and pressure reading systems.

Estimation error for rear cylinder intake manifold pressure P0216

• too high pressure/too low pressure.

# **Error cause**

 A substantial difference between the estimated pressure and the measured pressure has been detected (for example, the hole for pressure reading is clogged or sensor screw is loose).

#### **Troubleshooting**

Check the conditions of the intake manifold and cleanliness of the hole for reading the pressure: there is an evident defect in the intake and pressure reading systems.

Pressure too low at front cylinder manifold error P0217

signal not valid.

#### Error cause

 A small difference between the estimated pressure and the measured pressure has been detected: the measured pressure is below the estimated one (for example, smeared throttle body).

# **Troubleshooting**

Check the conditions of the intake manifold and cleanliness of the hole for pressure reading.

Pressure too low at rear cylinder manifold error P0218

signal not valid.

# **Error cause**

 A small difference between the estimated pressure and the measured pressure has been detected: the measured pressure is below the estimated one (for example, smeared throttle body).

# **Troubleshooting**

• Check the conditions of the intake manifold and cleanliness of the hole for pressure reading.

# **Engine temperature sensor**

#### **Function**

It tells the engine temperature to the control unit to improve its performance and to calculate the engine friction for a better estimation of the generated torque.

# G/M - 0.5 N - 0.5 V/Ro - 0.5 N - 0.5

# **Operation / Operating principle**

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

# Level in electrical circuit diagram:

Temperature sensors

#### Location:

- on the vehicle: on the front cylinder, inside the "V"
- connector: on the sensor.

#### **Electrical characteristics:**

• Resistance at 25°: 2.05 k $\Omega$  ± 100  $\Omega$ 

• Resistance at 60°: 575 k $\Omega$  ± 15  $\Omega$ 

Resistance at 90°: 230 kΩ ± 5 Ω

# Pin out:

1. Yellow/Brown: 0-5 V signal

2. Green/Pink: Ground connection

# **DIAGNOSIS INSTRUMENT: PARAMETERS**

# Engine temperature:

Example value with key ON: 25° C

Example value with engine on: 75° C

 In case of recovery, this value is set by the control unit: if there is a malfunction after engine start-up, temperature decreases up to approximately 90°.

# Engine temperature pre Recovery:

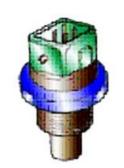
Example value with key ON: -40° C

Example value with engine on: -40° C

 Value drawn from the signal read without taking into account any recovery: the value in the example refers to an open circuit.

# Engine temperature at start-up:

Example value with key ON: -40° C



- Example value with engine on: 25° C
- The temperature value is stored during engine start-up. With key ON, value -40°C is read.

#### CAUTION

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

#### **DIAGNOSTICS INSTRUMENT: ELECTRICAL ERRORS**

engine temperature sensor P0115

• open circuit, shorted to positive / shorted to negative.

#### **Error cause**

 If the circuit is open, shorted to positive: excessive voltage has been detected at PIN 12 of the ENGINE connector. If shorted to negative: voltage equal to zero has been detected. The instrument panel does not indicate the presence of this error even in the ATT status.

# **Troubleshooting**

- If the circuit is open, shorted to positive: check the sensor connector and the Marelli control unit connector. If they are OK, check sensor continuity: replace the sensor if not OK; if OK, check continuity between the ENGINE connector PIN 12 and the sensor PIN 1: restore cable harness if there is not continuity; if it is OK, reconnect the control unit connector and, with key set to key ON, check the continuity between the sensor connector PIN 2 and the vehicle ground connection: if OK, it means that the error cause is that the cable is shorted to positive and it is necessary to restore the cable harness between ENGINE PIN 12 and sensor PIN 1; if there is no continuity with the ground connection, check the sensor connector and the Marelli control unit connector. If not OK, restore the cable harness. If OK, check continuity between the ENGINE connector PIN 6 or 17 and the sensor connector PIN 2: restore the cable harness if there is not continuity. If there is, it means that the control unit does not supply the ground connection and therefore should be replaced.
- If shorted to negative, check sensor correct resistance: if resistance is null, replace the sensor; if resistance is correct, it means that the Yellow/Brown cable has ground connection:
   restore the cable harness

# **DIAGNOSTICS INSTRUMENT: LOGIC ERRORS**

engine temperature sensor P0116

signal not valid.

#### **Error cause**

An excessive temperature variation has been detected: for example, the cause may be a
contact resistance between the terminals. The instrument panel does not indicate the presence of this error even in the ATT status.

# **Troubleshooting**

• Check the sensor connector and the ENGINE connector of the Marelli control unit.

#### **NOTES**

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

# Air temperature sensor

#### **Function**

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



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

# Level in wiring diagram:

Temperature sensors

#### Location:

- sensor: on filter box left side, next to rear throttle body
- connector: on the sensor

#### Electrical characteristics: Resistance

• at 0 °C (32 °F): 32.5 kΩ ± 5%

• at 25 °C (77 °F):  $10.0 \text{ k}\Omega \pm 5\%$ 

#### Pin out:

- 1. 0-5 V signal
- 2. Ground connection

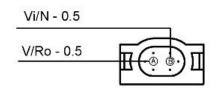
# **DIAGNOSIS INSTRUMENT: PARAMETERS**

# Air temperature

Example value with key ON: 45 °C (113 °F)
In case of recovery, this value is set by the control unit

#### Air temperature pre Recovery

Example value with key ON: -40 °C (-40.0 °F)





Value drawn from the signal read without taking into account any recovery: the value in the example refers to an open circuit

#### CAUTION

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

#### **DIAGNOSIS INSTRUMENT: ELECTRICAL ERRORS**

air temperature sensor P0110

open circuit, shorted to positive / shorted to negative

#### **Error cause**

 If the circuit is open, shorted to positive: excessive voltage has been detected at PIN 37 of the ENGINE connector. If shorted to negative: voltage equal to zero has been detected. The instrument panel does not indicate the presence of this error even in the ATT status.

# **Troubleshooting**

- If the circuit is open, shorted to positive: check the sensor connector and the Marelli control unit connector. If they are OK, check sensor continuity: replace the sensor if not OK; if OK, check continuity between the ENGINE connector PIN 37 and the sensor PIN 1: restore cable harness if there is not continuity; if it is OK, reconnect the control unit connector and, with key set to key ON, check the continuity between the sensor connector PIN 2 and the vehicle ground connection: if OK, it means that the error cause is that the cable is shorted to positive and it is necessary to restore the cable harness between ENGINE PIN 37 and sensor PIN 1; check the sensor connector and the Marelli control unit connector. If not OK, restore the cable harness. If OK, check continuity between the ENGINE connector PIN 6 or 17 and the sensor connector PIN 2: restore the cable harness if there is not continuity. If there is, it means that the control unit does not supply the ground connection and therefore should be replaced
- If shorted to negative, check sensor correct resistance: if resistance = 0, replace the sensor;
   if resistance is correct, it means that the Purple/Black cable has ground connection: restore
   the cable harness

# Lambda sensor

#### **Function**

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

#### Operation / Operating principle

The Marelli injection control unit reads and interprets a voltage generated by the difference in oxygen content between the exhaust fumes and the ambient. It does not require an external supply source but,

in order to work properly, it should reach a high operating temperature: that is why there is a heating circuit inside.

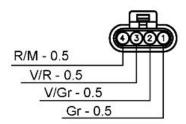
# Level in electrical circuit diagram:

Lambda probe

#### FRONT CYLINDER LAMBDA PROBE

#### Location:

- on the vehicle: exhaust end behind the rear head
- connector: on the right side, at the back of the filter box



# **Electrical specifications**

Heater circuit: 7-9Ω at Ambient temp.

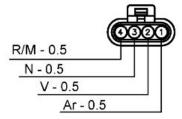
#### Pin out:

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

#### **REAR CYLINDER LAMBDA PROBE**

# Location:

- on the vehicle: exhaust end behind the rear head
- connector: on the right side, at the back of the filter box



# **Electrical specifications**

Heater circuit: 7-9Ω at Ambient temp.

#### Pin out:

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

#### **DIAGNOSTICS INSTRUMENT: PARAMETERS**

#### Lambda probe

- Example value with key ON: 0 mV
- Example value with engine on: 100--900 mV

If there is a short circuit at + 5 V or above, the lambda probe parameter is not equal to the value read by the control unit; a recovery value is displayed instead.

# Lambda sensor correction

- Example value with key ON: 1.00 mV
- Example value with engine on: 0.90 1.10mV

In closed loop, the value must be close to 1.00 (values not within the 0.90 - 1.10 interval indicate a fault): for example, value 0.75 corresponds to +25% with respect to the reference injection time; 1.25 corresponds to -25%. In an open circuit, the oxygen sensor signal is too low. Therefore, the control unit takes it as a lean combustion condition and will try to enrich it. The value read will be 0.75: once this correction has been tried, the value shifts to 1.00 fixed and the Lambda probe error is signalled.

#### CAUTION

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

#### **DIAGNOSTICS INSTRUMENT: STATUSES**

Lambda probe: Start-up\_Lean\_Rich\_Fault due to rich value\_Fault due to lean value

 If the probe connector is removed (voltage almost equal to zero), the status is Fault due to lean value.

Lambda check: Open loop/Closed loop/Rich in closed loop/Lean in closed loop/enriched

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

# **DIAGNOSTICS INSTRUMENT: ACTIVATION**

Lambda probe heating

• The auxiliary injection relay (No. 46 in the wiring diagram, placed in the front relay box, left side; CHECK, however, the identification of the relay with the colour of the cables) is energised and the heating circuit is closed to ground 5 times (pin 3 of the lambda probe connector). The continuity of the wiring is necessary for correct activation: no error indications are displayed in case of lack of activation.

# **DIAGNOSTICS INSTRUMENT: ELECTRICAL ERRORS**

# Front lambda probe P0130

shorted to positive

#### **Error cause**

Excessive voltage (battery voltage) has been detected at PIN 10 and 22 of the ENGINE
connector. Caution: the 'Oxygen sensor' parameter is not the real value that is read; a recovery value is displayed instead. The instrument panel does not indicate the presence of
this error even in the ATT status.

#### **Troubleshooting**

shorted to positive: with key set to ON, disconnect the sensor connector and measure PIN
 1 voltage on the cable harness side (grey cable): if there is voltage (5 or 12 V), restore the cable harness; if there is not, replace the lambda probe.

#### Rear lambda probe P0136

shorted to positive

#### **Error cause**

Excessive voltage (battery voltage) has been detected at PIN 9 and 38 of the ENGINE
connector. Caution: the 'Oxygen sensor' parameter is not the real value that is read; a recovery value is displayed instead. The instrument panel does not indicate the presence of
this error even in the ATT status.

# **Troubleshooting**

shorted to positive: with key set to ON, disconnect the sensor connector and measure PIN
 voltage on the cable harness side (orange cable): if there is voltage (5 or 12 V), restore
 the cable harness; if there is not, replace the lambda probe.

# Front lambda probe heating P0135

short circuit to positive/ open circuit, short circuit to negative

#### **Error cause**

If shorted to positive: excessive voltage has been detected at PIN 32 of the ENGINE connector. If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 32 of the ENGINE connector. The instrument panel does not indicate the presence of this error even in the ATT status.

# **Troubleshooting**

- If shorted to positive: disconnect the probe connector and check the correct resistance of the sensor: if not OK, replace the sensor; if OK restore the cable harness (green/red cable).
- If circuit is open, shorted to negative: check circuit continuity from probe connector (PIN 3 and 4) toward the probe: if it is not OK, replace the probe; if it is OK, check the sensor connector and the Marelli control unit connector: if it is not OK, restore; if it is OK, with key set to ON and sensor connector disconnected, check if there is battery voltage at PIN 4: if it is not OK, check the Red/Brown cable continuity between the probe connector and the auxiliary injection relay (No. 46 in the wiring diagram, placed in the front relay box, left side; CHECK, however, the identification of the relay with the colour of the cables). If there are also coil, lower and upper injector and secondary air errors, check the relay and its excitation and power line; if there is voltage at PIN 4, check the Green/Red cable ground insulation (PIN 3): if not OK, restore the cable harness. If it is OK, check the continuity of the Green/Red cable (between the sensor connector PIN 3 and the ENGINE PIN 32) and restore the cable harness.

# Rear lambda probe heating P0141

short circuit to positive/ open circuit, short circuit to negative

#### **Error cause**

If shorted to positive: excessive voltage has been detected at PIN 44 of the ENGINE connector. If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 44 of the ENGINE connector. The instrument panel does not indicate the presence of this error even in the ATT status.

#### **Troubleshooting**

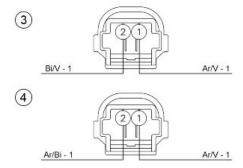
- If shorted to positive: disconnect the probe connector and check the correct resistance of the sensor: if not OK replace the sensor; if OK restore the cable harness (black cable).
- If circuit is open, shorted to negative: check circuit continuity from probe connector (PIN 3 and 4) toward the probe: if it is not OK, replace the probe; if it is OK, check the sensor connector and the Marelli control unit connector: if it is not OK, restore; if it is OK, with key set to ON and sensor connector disconnected, check if there is battery voltage at PIN 4: if it is not OK, check the Red/Brown cable continuity between the probe connector and the auxiliary injection relay (No. 46 in the wiring diagram, placed in the front relay box, left side; CHECK, however, the identification of the relay with the colour of the cables). If there are also coil, lower and upper injector and secondary air errors, check the relay and its excitation and power line; if there is voltage at PIN 4, check the Black cable ground insulation (PIN 3): if not OK, restore the cable harness. If it is OK, check the continuity of the Black cable (between the sensor connector PIN 3 and the ENGINE PIN 44) and restore the cable harness.

# WARNING

The control unit does not detects the following malfunctions of the oxygen sensor circuit according to the signal: interrupted circuit, shorted to ground or sensor malfunction (for example non variable voltage). In case of fault indication, carry out the following troubleshooting.

# Injector

# Injectors key: 1. Front cylinder internal injector (Marelli) 2. Rear cylinder internal injector (Marelli) 3. Front cylinder external injector (Synerject) 4. Rear cylinder external injector (Synerject) Bi/N-1 Ar/V-1



# **Function**

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

# **Operation / Operating principle**

Injector coil is excited for the petrol passage to open.

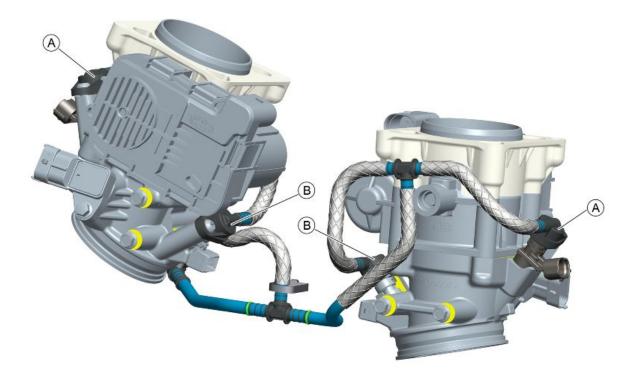
The external injectors (Synerject) are always working, whereas the internal ones (Marelli, aka "high-pressure" injectors) are opened only when high power is required.

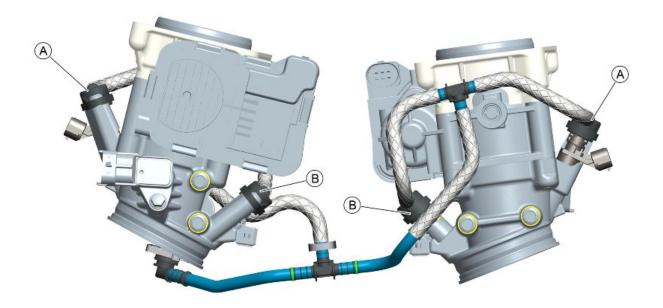
# Level in electrical circuit diagram:

Coils and injectors

# Location:

- A. External injectors (Synerject)
- B. Internal injectors (Marelli)
  - on the vehicle: intake manifold
  - connector: on injectors





# **Electrical specifications:**

- internal injectors (Marelli): 14.8 Ω ± 5% (at ambient temp.)
- external injectors (Synerject): 12.0 Ω ± 5% (at ambient temp.)

# Pin out:

- 1. Fuel system
- 2. Negative from control unit

#### DIAGNOSTICS INSTRUMENT: PARAMETERS

Front cylinder injection time

• Example value with engine on: 1.9 ms

Rear cylinder injection time

• Example value with engine on: 1.9 ms

# CAUTION

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

# **DIAGNOSTICS INSTRUMENT: ACTIVATION**

Internal front cylinder injector

 The auxiliary injection relay (No. 46 in the wiring diagram, placed in the front relay box, left side; CHECK, however, the identification of the relay with the colour of the cables) is energised for 5 seconds and the injector cable connected to control unit is closed to ground for 4 ms per second. Disconnect the 4-way connector of the fuel pump to be able to hear the relay and injector activation. The continuity of the wiring is necessary for correct activation: no error indications are displayed in case of lack of activation.

#### Internal rear cylinder injector

• The auxiliary injection relay (No. 46 in the wiring diagram, placed in the front relay box, left side; CHECK, however, the identification of the relay with the colour of the cables) is energised for 5 seconds and the injector cable connected to control unit is closed to ground for 4 ms per second. Disconnect the 4-way connector of the fuel pump to be able to hear the relay and injector activation. The continuity of the wiring is necessary for correct activation: no error indications are displayed in case of lack of activation.

# External front cylinder injector

• The auxiliary injection relay (No. 46 in the wiring diagram, placed in the front relay box, left side; CHECK, however, the identification of the relay with the colour of the cables) is energised for 5 seconds and the injector cable connected to control unit is closed to ground for 4 ms per second. Disconnect the 4-way connector of the fuel pump to be able to hear the relay and injector activation. The continuity of the wiring is necessary for correct activation: no error indications are displayed in case of lack of activation.

# External rear cylinder injector

• The auxiliary injection relay (No. 46 in the wiring diagram, placed in the front relay box, left side; CHECK, however, the identification of the relay with the colour of the cables) is energised for 5 seconds and the injector cable connected to control unit is closed to ground for 4 ms per second. Disconnect the 4-way connector of the fuel pump to be able to hear the relay and injector activation. The continuity of the wiring is necessary for correct activation: no error indications are displayed in case of lack of activation.

#### **DIAGNOSTICS INSTRUMENT: ELECTRICAL ERRORS**

#### External front cylinder injector P0201

short circuit to positive/ short circuit to negative / open circuit

# **Error cause**

• If shorted to positive: excessive voltage has been detected at PIN 8. If shorted to negative: no voltage has been detected. If the circuit is open: an interruption has been detected.

# **Troubleshooting**

If shorted to positive: disconnect the injector connector, set key to ON, activate the component with the diagnosis instrument and check the voltage on the white/green cable on the injector connector. If following the activation the voltage does not drop, restore the cabling, otherwise replace the injector.

- If shorted to negative: disconnect the injector connector, set the key to ON and check if there
  is a ground connection on the white/green cable: if there is connection, restore the cable
  harness. If there is no connection, replace the injector.
- If the circuit is open: check the connector on the component and the Marelli control unit connector: if not OK, restore. If OK, check cable continuity between the ENGINE PIN 8 and component PIN 2 and restore the cable harness.

# External rear cylinder injector P0202

short circuit to positive/ short circuit to negative / open circuit

#### **Error cause**

If shorted to positive: excessive voltage has been detected at PIN 46. If shorted to negative:
 no voltage has been detected. If the circuit is open: an interruption has been detected.

#### **Troubleshooting**

- If shorted to positive: disconnect the injector connector, set key to ON, activate the component with the diagnosis instrument and check the voltage on the orange/white cable on the injector connector. If following the activation the voltage does not drop, restore the cabling, otherwise replace the injector.
- If shorted to negative: disconnect the injector connector, set the key to ON and check if there
  is a ground connection on the orange/white cable: if there is connection, restore the cable
  harness. If there is no connection, replace the injector.
- If the circuit is open: check the connector on the component and the Marelli control unit connector: if not OK, restore. If OK, check cable continuity between the ENGINE PIN 46 and component PIN 2 and restore the cable harness.

#### Internal front cylinder injector P0205

• short circuit to positive/ short circuit to negative / open circuit

# **Error cause**

• If shorted to positive: excessive voltage has been detected at PIN 53. If shorted to negative: no voltage has been detected. If the circuit is open: an interruption has been detected.

# **Troubleshooting**

- If shorted to positive: disconnect the injector connector, set key to ON, activate the component with the diagnosis instrument and check the voltage on the grey/red cable on the injector connector. If following the activation the voltage does not drop, restore the cabling, otherwise replace the injector.
- If shorted to negative: disconnect the injector connector, set the key to ON and check if there
  is a ground connection on the Grey/Red cable: if there is connection, restore the cable harness. If there is no connection, replace the injector.

 If the circuit is open: check the connector on the component and the Marelli control unit connector: if not OK, restore. If OK, check cable continuity between the ENGINE PIN 53 and component PIN 2 and restore the cable harness.

# Internal rear cylinder injector P0206

short circuit to positive/ short circuit to negative / open circuit

#### **Error cause**

 If shorted to positive: excessive voltage has been detected at PIN 67. If shorted to negative: no voltage has been detected. If the circuit is open: an interruption has been detected.

#### **Troubleshooting**

- If shorted to positive: disconnect the injector connector, set key to ON, activate the component with the diagnosis instrument and check the voltage on the white/black cable on the injector connector. If following the activation the voltage does not drop, restore the cabling, otherwise replace the injector.
- If shorted to negative: disconnect the injector connector, set the key to ON and check if there
  is a ground connection on the White/Black cable: if there is connection, restore the cable
  harness. If there is no connection, replace the injector.
- If the circuit is open: check the connector on the component and the Marelli control unit connector: if not OK, restore. If OK, check cable continuity between the ENGINE PIN 67 and component PIN 2 and restore the cable harness.

# Fuel pump

#### **Function**

Fuel pump: keeps pressure of the injectors supply duct.

Low fuel: tells to the instrument panel about low fuel

# **Operation / Operating principle**

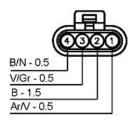
Low fuel: it is a resistance that if correctly supplied varies its electrical resistance if it is damped or not by petrol.

# Level in electrical circuit diagram:

Injection load relay

# Location:

- on the vehicle: on the tank.
- connector: near the fuel pump (4 ways, black).



#### **Electrical characteristics:**

PIN 1-2: 0.5 - 1 ohm; PIN 3-4: you do not need to measure the component electrical resistance since it works correctly with suitable supply from the instrument panel only. Check correct operation as follows: connect in series a bulb of approximately 2 W: it should turn on if the tank is in reserve, otherwise, it remains off.

#### Pin out:

- 1. + 12 V
- 2. ground connection
- 3. ground connection
- 4. + 12 V (signal)

#### CAUTION

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

# **DIAGNOSTICS INSTRUMENT: ACTIVATION**

Fuel pump

NOTE: The auxiliary injection relay (No. 35 on the electrical circuit diagram, in the two relay box, however VERIFY the identification of the relay with the colour of the cables) is energised for 30 seconds. The continuity of the wiring is necessary for correct activation: no error indications are displayed in case of lack of activation

# **DIAGNOSTICS INSTRUMENT: ELECTRICAL ERRORS**

fuel pump relay control P0230

• shorted to positive / open circuit, shorted to negative.

# Error cause

 If shorted to positive: excessive voltage has been detected at PIN 73 of the VEHICLE connector. If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 73 of the VEHICLE connector.

#### **Troubleshooting**

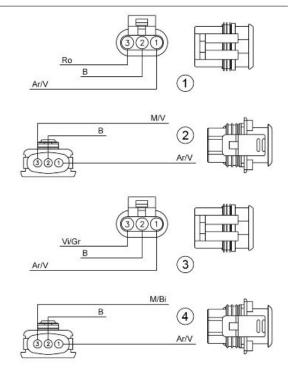
- If shorted to positive: check whether the relay electrical specifications are correct by disconnecting it from the cable harness. If are not OK, replace the relay; if OK, restore the cable harness (Brown/Black cable).
- If the circuit is open, shorted to negative: check the relay electrical characteristics are correct
  by disconnecting it from the cable harness; if it is not OK, replace the relay, if it is OK, check
  relay connector, engine-vehicle cable harness connector and VEHICLE connector of the

Marelli control unit: if not OK, restore; if OK, check continuity of cable harness (Brown/Black cable)

# Coil

# Coils key:

- 1. Front cylinder central coil
- 2. Front cylinder side coil
- 3. Rear cylinder central coil
- 4. Rear cylinder side coil



#### **Function**

Spark generation

# **Operation / Operating principle**

Inductive discharge system

# Level in electrical circuit diagram:

Coils and injectors

#### Location:

- on the vehicle: on the head covers.
- connector:
- FRONT CENTRAL COIL with long cable, left side, on the frame near filter box cover, above the front side coil connector.
- FRONT SIDE COIL with short cable and retaining tongue, left side, on the frame near filter box cover, below the front central coil connector.
- REAR CENTRAL COIL with long cable, at the centre, under the filter box, at the back compared to connector.
- REAR SIDE COIL with short cable and retaining tongue, at the centre, under the filter box, at the front compared to the rear central coil connector.

# **Electrical specifications:**

# $0.7 - 0.9 \Omega$ at ambient temperature

#### Pin out:

- 1. Power supply + Vbatt
- 2. Secondary circuit to ground
- 3. Activation from control unit

# **DIAGNOSTICS INSTRUMENT: PARAMETERS**

Example value with key ON: Current ignition advance.

Example value with engine on: Indicates the cylinder advance where combustion will take place.

#### CAUTION

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

#### DIAGNOSTICS INSTRUMENT: ACTIVATION

#### Front Central Coil:

The auxiliary relay (No. 46 in the wiring diagram, placed in the front relay box, left side; CHECK, however, the identification of the relay with the colour of the cables) is energised for 5 seconds and the coil Pink cable is closed to ground for 2 ms per second. Disconnect the 4-way connector of the fuel pump to be able to hear the relay and injector activation. The continuity of the wiring is necessary for correct activation: no error indications are displayed in case of lack of activation.

#### **Rear Central Coil:**

The auxiliary relay (No. 46 in the wiring diagram, placed in the front relay box, left side; CHECK, however, the identification of the relay with the colour of the cables) is energised for 5 seconds and the coil Purple/Grey cable is closed to ground for 2 ms per second. Disconnect the 4-way connector of the fuel pump to be able to hear the relay and injector activation. The continuity of the wiring is necessary for correct activation: no error indications are displayed in case of lack of activation.

#### Front Side Coil:

The auxiliary injection relay (No. 46 in the wiring diagram, placed in the front relay box, left side; CHECK, however, the identification of the relay with the colour of the cables) is energised for 5 seconds and the coil Brown/Green cable is closed to ground for 2 ms per second. Disconnect the 4-way connector of the fuel pump to be able to hear the relay and injector activation. The continuity of the wiring is necessary for correct activation: no error indications are displayed in case of lack of activation.

#### Rear Side Coil:

The auxiliary injection relay (No. 46 in the wiring diagram, placed in the front relay box, left side; CHECK, however, the identification of the relay with the colour of the cables) is energised for 5 seconds and the coil Brown/White cable is closed to ground for 2 ms per second. Disconnect the 4-way connector of the fuel pump to be able to hear the relay and injector activation. The continuity of the wiring is necessary for correct activation: no error indications are displayed in case of lack of activation.

#### **DIAGNOSTICS INSTRUMENT: LOGIC ERRORS**

Front cylinder central coil P0351

shorted to positive / shorted to negative, open circuit.

#### **Error cause**

 If shorted to positive: excessive voltage has been detected at PIN 28 of the ENGINE connector. If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 28 of the ENGINE connector.

# **Troubleshooting**

- If shorted to positive: disconnect the coil connector, set the key to ON, activate the coil with the diagnostics instrument and check voltage at connector PIN 28: if there is voltage, restore the cable harness; if voltage = 0, replace the coil.
- If the circuit is open, shorted to negative: check electric characteristics of the coil: if not OK, replace the coil, if OK check the coil connector and the Marelli control unit connector; if not OK, restore, if OK, check cable continuity between the two cable terminals: if there is not continuity, restore the cable harness; if there is cable continuity, with key set to ON, check the ground insulation of the cable (from coil connector or control unit connector), if not OK, restore cable harness.

Rear cylinder central coil P0352

shorted to positive / shorted to negative, open circuit.

#### **Error cause**

 If shorted to positive: excessive voltage has been detected at PIN 27 of the ENGINE connector. If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 27 of the ENGINE connector

# **Troubleshooting**

- If shorted to positive: disconnect the coil connector, set the key to ON, activate the coil with
  the diagnostics instrument and check voltage at connector PIN 27: if there is voltage, restore
  the cable harness; if voltage = 0, replace the coil.
- If the circuit is open, shorted to negative: check electric characteristics of the coil: if not OK, replace the coil, if OK check the coil connector and the Marelli control unit connector; if not OK, restore, if OK, check cable continuity between the two cable terminals: if there is not continuity, restore the cable harness; if there is cable continuity, with key set to ON, check the ground insulation of the cable (from coil connector or control unit connector), if not OK, restore cable harness.

Front cylinder side coil P0353

shorted to positive / shorted to negative, open circuit.

# **Error cause**

 If shorted to positive: excessive voltage has been detected at PIN 2 of the ENGINE connector. If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 2 of the ENGINE connector.

# **Troubleshooting**

- If shorted to positive: disconnect the coil connector, set the key to ON, activate the coil with the diagnostics instrument and check voltage at connector PIN 2: if there is voltage, restore the cable harness; if voltage = 0, replace the coil.
- If the circuit is open, shorted to negative: check electric characteristics of the coil: if not OK, replace the coil, if OK check the coil connector and the Marelli control unit connector; if not OK, restore, if OK, check cable continuity between the two cable terminals: if there is not continuity, restore the cable harness; if there is cable continuity, with key set to ON, check the ground insulation of the cable (from coil connector or control unit connector), if not OK, restore cable harness.

#### Rear cylinder side coil P0354

shorted to positive / shorted to negative, open circuit.

#### **Error cause**

 If shorted to positive: excessive voltage has been detected at PIN 1 of the ENGINE connector. If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 1 of the ENGINE connector.

# **Troubleshooting**

- If shorted to positive: disconnect the coil connector, set the key to ON, activate the coil with the diagnostics instrument and check voltage at connector PIN 1: if there is voltage, restore the cable harness; if voltage = 0, replace the coil.
- If the circuit is open, shorted to negative: check electric characteristics of the coil: if not OK, replace the coil, if OK check the coil connector and the Marelli control unit connector; if not OK, restore, if OK, check cable continuity between the two cable terminals: if there is not continuity, restore the cable harness; if there is cable continuity, with key set to ON, check the cable ground insulation (from coil connector or control unit connector), if not OK, restore cable harness

# Throttle body

#### **Function**

Sends to the injection control unit the throttle position and activates the throttle according to the control unit

# **Operation / Operating principle**

All the unit internal components (potentiometer and electric motor) are contactless; therefore, no electrical diagnosis is possible for the throttle body, but for the circuits connected to it only.

#### Level in electrical circuit diagram:

Throttle check and throttle grip sensor (Demand)

#### Location:

- on the vehicle: inside the filter box
- connector: near the throttle motors

#### Pin out:

- 1. potentiometer signal 1
- 2. supply voltage + 5V
- 3. throttle valve control (+)
- 4. potentiometer signal 2
- 5. throttle valve control (+)
- 6. ground connection

#### **DIAGNOSIS INSTRUMENT: PARAMETERS**

# Front cylinder throttle correction

- Example value with key ON: 0.0°
- Example value with engine at idle: -0.5°

The system, reading the intake pressure, tries to balance the intake pressures between the front cylinder and the rear one working on the throttle position: an acceptable value should be between -0.8° and +0.8°.

#### Rear cylinder throttle correction

- Example value with key ON: 0.0°
- Example value with engine on: -0.3°

The system, reading the intake pressure, tries to balance the intake pressures between the front cylinder and the rear one working on the throttle position: an acceptable value should be between -0.8° and +0.8°.

# Front throttle Potentiometer 1 (degrees)



- Example value with key ON: 5.5°
- Example value with engine at idle: 2.1°

With key set to ON, the throttle is kept in position by the springs (around 5 -7°). After the engine starts up at idle, the throttle is kept close to the mechanical minimum (above or equal to 0.5°). When the gear is not engaged, at approx. 6000 rpm, throttles open very little because the requested torque is too low (around 5-7°)

# Rear throttle Potentiometer 1 (degrees)

- Example value with key ON: 5.2°
- Example value with engine on: 2.2°

With key set to ON, the throttle is kept in position by the springs (around 5 -7°). After the engine starts up at idle, the throttle is kept close to the mechanical minimum (above or equal to 0.5°). When the gear is not engaged, at approx. 6000 rpm, throttles open very little because the requested torque is too low (around 5-7°)

# Front throttle Potentiometer 1 (voltage)

- Example value with key ON: 761 mV
- Example value with engine on: 610 mV

# Rear throttle Potentiometer 1 (voltage)

- Example value with key ON: 746 mV
- Example value with engine on: 605 mV

# Front throttle Potentiometer 2 (degrees)

- Example value with key ON: 5.5°
- Example value with engine on: 2.5°

With key set to ON, the throttle is kept in position by the springs (around 5 -7°). After the engine starts up at idle, the throttle is kept close to the mechanical minimum (above or equal to 0.5°). When the gear is not engaged, at approx. 6000 rpm, throttles open very little because the requested torque is too low (around 5-7°)

# Rear throttle Potentiometer 2 (degrees)

- Example value with key ON: 5.2°
- Example value with engine on: 2.5°

With key set to ON, the throttle is kept in position by the springs (around 5 -7°). After the engine starts up at idle, the throttle is kept close to the mechanical minimum (above or equal to 0.5°). When the gear is not engaged, at approx. 6000 rpm, throttles open very little because the requested torque is too low (around 5-7°)

# Front throttle Potentiometer 2 (voltage)

- Example value with key ON: 4245 mV
- Example value with engine on: 4377 mV

# Rear throttle Potentiometer 2 (voltage)

Example value with key ON: 4226 mV

Example value with engine on: 4372 mV

# Key to throttle connectors figure:

- A Front cylinder throttle connector
- B Rear cylinder throttle connector

### Front cylinder throttle Limp Home position

Example value with key ON: 878 mV

Voltage stored in the control unit corresponding to the Limp home position

# Rear cylinder throttle Limp Home position

Example value with key ON: 888 mV

Voltage stored in the control unit corresponding to the Limp home position

# Front throttle lower position

Example value with key ON: 502 mV

Voltage stored in the control unit corresponding to the throttle mechanical minimum position

# Rear throttle lower position

Example value with key ON: 492 mV

Voltage stored in the control unit corresponding to the throttle mechanical minimum position

### CAUTION

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

# **DIAGNOSIS INSTRUMENT: STATUSES**

Front throttle automatic self-acquisition

 ice/ interrupted/carried out/limp home/closed throttle stop/springs check/limp home self-acquisition/initialise

Indicates if self-acquisition carried out by control unit has/has not been carried out: it is essential to know if the last self-acquisition with key ON has been successful

Rear throttle automatic self-acquisition

ice/ interrupted/carried out/limp home/closed throttle stop/springs check/limp home self-acquisition/initialise

Indicates if self-acquisition carried out by control unit has/has not been carried out: it is essential to know if the last self-acquisition with key ON has been successful

Throttle self-learning with diagnostics instrument

· carried out/not carried out

Indicates whether the self-acquisition process through the diagnosis instrument has/has not been carried out: if it has been carried out once, will always be carried out unless EEPROM control unit zero setting is carried out

# **DIAGNOSIS INSTRUMENT: ELECTRICAL ERRORS**

#### CAUTION

IF ERRORS ARE DETECTED ON BOTH THROTTLE BODIES, CHECK ALSO THE CORRECT SUPPLY OF THE CONTROL UNIT TO PIN 42.

potentiometer 1 sensor, front throttle position P0120

• short circuit to positive / open circuit, short circuit to negative

#### **Error cause**

 If shorted to positive: excessive voltage has been detected at PIN 48. If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 48.

# **Troubleshooting**

- If shorted to positive: check the value shown by the parameter of the front throttle Potentiometer 1 (voltage): disconnect the connector and read the value indicated by the diagnosis
  instrument: if the voltage does not vary, there is a short circuit in the cable; replace the throttle
  body if the voltage drops to zero
- If the circuit is open, shorted to negative: check the throttle body connector and the control unit connector. If not OK, restore; if everything is OK, check circuit continuity between the two terminals. If not OK, restore the cable harness; if OK, check the circuit ground insulation (from throttle sensor connector or control unit connector). If it is ground insulated, check that there is power (+5 V) at the throttle body connector PIN 2, and that PIN 6 is connected to ground. If both are correct, replace the throttle body

potentiometer 2 sensor, front throttle position P0122

• short circuit to positive / open circuit, short circuit to negative

### **Error cause**

 If shorted to positive: excessive voltage has been detected at PIN 50. If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 50.

# **Troubleshooting**

- If shorted to positive: check the value shown by the parameter of the front throttle Potentiometer 2 (voltage): disconnect the connector and read the value indicated by the diagnosis instrument: if the voltage does not vary, there is a short circuit in the cable; replace the throttle body if the voltage drops to zero
- If the circuit is open, shorted to negative: check the throttle body connector and the control unit connector. If not OK, restore; if everything is OK, check circuit continuity between the two terminals. If not OK, restore the cable harness; if OK, check the circuit ground insulation (from throttle sensor connector or control unit connector). If it is ground insulated, check that

there is power (+5 V) at the throttle body connector PIN 2, and that PIN 6 is connected to ground. If both are correct, replace the throttle body

potentiometer 1 sensor, rear throttle position P0125

short circuit to positive / open circuit, short circuit to negative

### **Error cause**

 If shorted to positive: excessive voltage has been detected at PIN 36. If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 36

# **Troubleshooting**

- If shorted to positive: check the value shown by the parameter of the Rear throttle Potentiometer 1 (voltage): disconnect the connector and read the value indicated by the diagnosis instrument: if the voltage does not vary, there is a short circuit in the cable wiring; replace the throttle body if the voltage drops to zero.
- If the circuit is open, shorted to negative: check the throttle body connector and the control unit connector. If not OK, restore; if everything is OK, check circuit continuity between the two terminals. If not OK, restore the cable harness; if OK, check the circuit ground insulation (from throttle sensor connector or control unit connector). If it is ground insulated, check that there is power (+5 V) at the throttle body connector PIN 2, and that PIN 6 is connected to ground. If both are correct, replace the throttle body

potentiometer 2 sensor, rear throttle position P0127

short circuit to positive / open circuit, short circuit to negative

# **Error cause**

 If shorted to positive: excessive voltage has been detected at PIN 21. If the circuit is open, shorted to negative: voltage equal to zero has been detected at PIN 21.

# **Troubleshooting**

- If shorted to positive: check the value shown by the parameter of the Rear throttle Potentiometer 2 (voltage): disconnect the connector and read the value indicated by the diagnosis instrument: if the voltage does not vary, there is a short circuit in the cable wiring; replace the throttle body if the voltage drops to zero.
- If the circuit is open, shorted to negative: check the throttle body connector and the control unit connector. If not OK, restore; if everything is OK, check circuit continuity between the two terminals. If not OK, restore the cable harness; if OK, check the circuit ground insulation (from throttle sensor connector or control unit connector). If it is ground insulated, check that there is power (+5 V) at the throttle body connector PIN 2, and that PIN 6 is connected to ground. If both are correct, replace the throttle body

Front throttle control circuit P0166

 short circuit to positive / short circuit to negative / open circuit, overvoltage, excessive internal temperature.

### **Error cause**

 If shorted to positive: excessive voltage has been detected at PIN 29 - 41. If shorted to negative: no voltage has been detected. If the circuit is open: an interruption or excessive ampere input or control unit overheating has been detected

# **Troubleshooting**

- If shorted to positive: disconnect the throttle body connector, set key to ON and check voltage at PIN 3: if the voltage read is higher or equal to 5V, there is a short circuit on the cable harness; replace the throttle body if the voltage is null
- If shorted to negative: disconnect the throttle body connector, set the key to ON and check
  if PIN 3 is in continuity with the vehicle ground connection: if there is continuity, restore the
  cable harness; if there is not continuity, replace the throttle body
- If the circuit is open, there is overvoltage or excessive internal temperature: check the throttle body connector and the control unit connector: if not OK, restore; if OK, disconnect the throttle body connector and control unit connector and check if there is cables continuity; if there is no continuity, restore the cable harness. If there is continuity, with the throttle body connector connected, check that the resistance, from the throttle control unit connector, between PIN 29 and 41 is within 1 and 2.5 Ohm; if it is not, replace the throttle body; if it is, check that the throttle body is not mechanically blocked: if blocked, solve the problem and replace the body; if it is not, replace the control unit

# Rear throttle control circuit P0186

• short circuit to positive / short circuit to negative / open circuit, overvoltage, excessive internal temperature circuit open

#### **Error cause**

If shorted to positive: excessive voltage has been detected at PIN 3 - 15. If shorted to negative: no voltage has been detected. If the circuit is open: an interruption or excessive ampere input or control unit overheating has been detected

# **Troubleshooting**

- If shorted to positive: disconnect the throttle body connector, set key to ON and check voltage at PIN 3: if the voltage read is higher or equal to 5V, there is a short circuit on the cable harness; replace the throttle body if the voltage is null
- If shorted to negative: disconnect the throttle body connector, set the key to ON and check if PIN 3 is in continuity with the vehicle ground connection: if there is continuity, restore the cable harness; if there is not continuity, replace the throttle body
- If the circuit is open, there is overvoltage or excessive internal temperature: check the throttle body connector and the control unit connector: if not OK, restore; if OK, disconnect the

throttle body connector and control unit connector and check if there is cables continuity; if there is no continuity, restore the cable harness. If there is continuity, with the throttle body connector connected, check that the resistance, from the throttle control unit connector, between PIN 3 and 15 is within 1 and 2.5 Ohm; if it is not, replace the throttle body; if it is, check that the throttle body is not mechanically blocked: if blocked, solve the problem and replace the body; if it is not, replace the control unit

#### **DIAGNOSIS INSTRUMENT: LOGIC ERRORS**

potentiometer 1 sensor, front throttle position P0121

signal not valid

#### **Error cause**

Signal not within the expected value drawn according to the values of the intake pressure

# **Troubleshooting**

• Check the parameter of the Potentiometer 1 Front throttle (voltage) to get which signal the control unit receives and to compare it to the Potentiometer 1 Rear throttle (voltage). Check the throttle body connector as well as the control unit connector. Check that cable resistance between the throttle body connector (PIN 1) and the control unit (PIN48) is a few tenths of an Ohm. If this is not the case, restore the cable harness. If the value is correct, replace the complete throttle body

potentiometer 2 sensor, front throttle position P0123

signal not valid

# **Error cause**

Signal not within the expected value drawn according to the values of the intake pressure

#### **Troubleshooting**

• Check the parameter of the Potentiometer 2 Front throttle (voltage) to get which signal the control unit receives and to compare it to the Potentiometer 2 Rear throttle (voltage). Check the throttle body connector as well as the control unit connector. Check that cable resistance between the throttle body connector (PIN 4) and the control unit (PIN 50) is a few tenths of an Ohm. If this is not the case, restore the cable harness. If the value is correct, replace the complete throttle body

front throttle position potentiometer P0124

incongruent signal

 Potentiometer 1 and potentiometer 2 do not show a logical value: the sum of the two voltages should be constant. The cause may be a malfunction in one of the two sensors or an abnormal resistance in one of the two circuits

# **Troubleshooting**

• Check the throttle body connector as well as the control unit connector. Check that cable resistance between the throttle body connector (PIN 1) and the control unit (PIN 48) is a few tenths of an Ohm. Check that cable resistance between the throttle body connector (PIN 4) and the control unit (PIN 50) is a few tenths of an Ohm. If one of the two is different, restore the cable harness. If correct, replace the complete throttle body.

potentiometer 1 sensor, rear throttle position P0126

signal not valid

#### **Error cause**

Signal not within the expected value drawn according to the values of the intake pressure

# **Troubleshooting**

• Check the parameter of the Potentiometer 1 Rear throttle (voltage) to get which signal the control unit receives and to compare it to the Potentiometer 1 Front throttle (voltage). Check the throttle body connector as well as the control unit connector. Check that cable resistance between the throttle body connector (PIN 1) and the control unit (PIN 36) is a few tenths of an Ohm. If this is not the case, restore the cable harness. If the value is correct, replace the complete throttle body

potentiometer 2 sensor, rear throttle position P0128

signal not valid

# **Error cause**

Signal not within the expected value drawn according to the values of the intake pressure

# **Troubleshooting**

• Check the parameter of the Potentiometer 2 Rear throttle (voltage) to get which signal the control unit receives and to compare it to the Potentiometer 2 Front throttle (voltage). Check the throttle body connector as well as the control unit connector. Check that cable resistance between the throttle body connector (PIN 4) and the throttle control unit (PIN 21) is a few tenths of an Ohm. If this is not the case, restore the cable harness. If the value is correct, replace the complete throttle body

rear throttle position potentiometer P0129

incongruent signal

 Potentiometer 1 and potentiometer 2 do not show a logical value: the sum of the two voltages should be constant. The cause may be a malfunction in one of the two sensors or an abnormal resistance in one of the two circuits

# **Troubleshooting**

Check the throttle body connector as well as the control unit connector. Check that cable
resistance between the throttle body connector (PIN 1) and the control unit (PIN 36) is a few
tenths of an Ohm. Check that cable resistance between the throttle body connector (PIN 4)
and the throttle control unit (PIN 21) is a few tenths of an Ohm. If one of the two is different,
restore the cable harness. If correct, replace the complete throttle body.

Front throttle Limp Home self-acquisition P0160

failed test

#### **Error cause**

Throttle position, kept by the springs, not within the expected range (at each key ON). The
instrument panel does not indicate the presence of this error even in the ATT status

# **Troubleshooting**

- Check if the throttle body and the intake duct are clean. If OK, replace the throttle body Front throttle mechanical springs self-acquisition P0161
  - failed test

# **Error cause**

Return time of the throttle, kept in position by the springs, not within the expected limits: the
causes can be a deterioration of the performance of the springs or excessive throttle friction
(at each key ON)

### **Troubleshooting**

- Check if the throttle body and the intake duct are clean. If OK, replace the throttle body
   Front throttle minimum mechanical position self-acquisition P0162
  - failed test

# **Error cause**

Position of the throttle stop not within the expected field (at each key ON)

#### **Troubleshooting**

- Check if the throttle body and the intake duct are clean. If OK, replace the throttle body
- Detection of the front throttle Recovery conditions (air temp., water temp.) P0163
  - possible presence of ice

 A correct throttle rotation cannot be detected given low ambient and engine temperatures: some ice may have formed in the duct (at each key ON). The instrument panel does not indicate the presence of this error even in the ATT status

# **Troubleshooting**

 Check that the throttle body is clean and that there is no ice or condensation in the intake duct. If OK, replace the throttle body

Front throttle power supply voltage during self-acquisition P0164

low power supply voltage

#### **Error cause**

 The throttle power supply voltage is too low to carry out the self-acquisition test correctly (at each key ON). The instrument panel does not indicate the presence of this error even in the ATT status

### **Troubleshooting**

• Delete errors hindering throttle self-learning.

Front throttle position error P0167

misalignment between control and activation

#### **Error cause**

The throttle mechanical control may be damaged

# **Troubleshooting**

Replace the throttle body

Rear throttle Limp Home self-acquisition P0180

failed test

# Error cause

Throttle position, kept by the springs, not within the expected range (at each key ON). The
instrument panel does not indicate the presence of this error even in the ATT status

# **Troubleshooting**

Check if the throttle body and the intake duct are clean. If OK, replace the throttle body

Rear throttle mechanical springs self-acquisition P0181

failed test

#### **Error cause**

Return time of the throttle, kept in position by the springs, not within the expected limits: the
causes can be a deterioration of the performance of the springs or excessive throttle friction
(at each key ON)

# **Troubleshooting**

- Check if the throttle body and the intake duct are clean. If OK, replace the throttle body
   Rear throttle minimum mechanical position self-acquisition P0182
  - failed test

#### **Error cause**

Position of the throttle stop not within the expected field (at each key ON)

### **Troubleshooting**

Check if the throttle body and the intake duct are clean. If OK, replace the throttle body

Detection of the rear throttle Recovery conditions (air temp., water temp.) P0183

• possible presence of ice

#### **Error cause**

 A correct throttle rotation cannot be detected given low ambient and engine temperatures: some ice may have formed in the duct (at each key ON). The instrument panel does not indicate the presence of this error even in the ATT status

#### **Troubleshooting**

 Check that the throttle body is clean and that there is no ice or condensation in the intake duct. If OK, replace the throttle body

Rear throttle supply voltage during self-acquisition P0184

low power supply voltage

# **Error cause**

 The throttle power supply voltage is too low to carry out the self-acquisition test correctly (at each key ON). The instrument panel does not indicate the presence of this error even in the ATT status

### **Troubleshooting**

Delete errors hindering throttle self-learning.

Rear throttle position error P0187

misalignment between control and activation

# **Error cause**

The throttle mechanical control may be damaged

# **Troubleshooting**

Replace the throttle body

# **DIAGNOSIS INSTRUMENT: ADJUSTABLE PARAMETERS**

Throttle Self-learning

NOTE

THROTTLE BODY ACTIVATION TAKES PLACE EVERY TIME THE KEY IS SET TO ON: CORRECT ACTIVATION IS INDICATED WHEN THE STOP LIGHTS TURN ON: IF DURING ACTIVATION, THE

ENGINE IS STARTED, THE ACTIVATION IS NOT COMPLETED AND THE STOP LIGHTS DO NOT TURN ON. EVERY 150 KEY-ONS, HOWEVER, THE THROTTLE VALVES ARE FORCED TO ACTIVATION. IF START-UP IS ATTEMPTED DURING THIS ACTIVATION (WHICH REQUIRES 3 SECONDS), THE ENGINE WILL NOT START.

FITTING: MECHANICAL/ELECTRICAL REFIT

#### RESET PROCEDURE

If a throttle body is replaced, after key is set to ON, do not start the engine within the 3 seconds; during this time the control unit carries out the throttle self-learning process: according to the throttle body replaced check that the status "Front throttle automatic self-acquisition" or "Rear throttle automatic self-acquisition" indicates: "carried out". If indication is not "Carried out", delete possible errors on the vehicle and then, with key set to ON, check that the statuses are "Carried out". If necessary, carry out "Throttle self-learning" process on the adjustable parameters screen page (screwdriver and hammer), and check again that the "Throttle self-learning with diagnostics instrument" status indicates: "Carried out" and that the "Front throttle automatic self-acquisition" or "Rear throttle automatic self-acquisition" indicate: "carried out"

# Engine oil pressure sensor

#### **ENGINE OIL PRESSURE SENSOR**

**Function: it i**ndicates to the instrument panel if there is enough oil pressure (0.5 + / - 0.2 bar (7.25 + / - 2.9 PSI)) in the engine.

Operation / Operating principle: normally closed switch. With oil pressure above 0.5 + / -0.2 bar (7.25 + / - 2.9 PSI), open circuit.

Location on the vehicle: right side of the vehicle,

under the oil sump **Pin-out**: Voltage 5V





#### **Neutral sensor**

#### **Function**

It tells the gear position to the control unit, from the 1st gear to the 6th gear, and if the gear is neutral or riding.

# **Operation / Operating principle**

The sensor has 2 circuits: one to indicate the engaged gear, whose resistance varies according to the gear engaged: in this way, the injection ECU, according to detected electric voltage, identifies the engaged gear and sends the information via CAN to the instrument panel; the other indicates neutral gear, whose voltage is taken to zero if in neutral position.



Start-up enabling switches

# Location:

- on the vehicle: under chain pinion, behind the pinion cover.
- connector: left side, on flywheel cover

#### **Electrical characteristics:**

PIN 64: gear indication: closed circuit (continuity); gear engaged: open circuit (infinite resistance). Gear engaged circuit resistance: 1st gear: 0.8 kohm, 2nd gear 0.5 kohm, 3rd gear 15.0 kohm, 4th gear 6.9 kohm, 5th gear 2.8 kohm, 6th gear 1.5 kohm.

#### Pin out:

White/Black: ground from ECU, Light Blue: + 12V from ECU (gear), Pink: + 5V from ECU (gears).

#### CAUTION

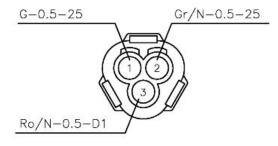
BEFORE CARRYING OUT ANY TROUBLESHOOTING, CAREFULLY READ THE GENERAL TROUBLESHOOTING CONCEPTS FOR ELECTRICAL DEVICES AT THE BEGINNING OF THE CHECK AND CONTROL SECTION IN THE ELECTRICAL SYSTEM CHAPTER.

### **DIAGNOSTICS INSTRUMENT: STATUSES**

Gearbox in neutral

Yes/No

Gear engaged: 0 - 1 - 2- 3 - 4 - 5 - 6





# **DIAGNOSTICS INSTRUMENT: ELECTRICAL ERRORS**

Gear sensor P0461

shorted to positive or open circuit / shorted to negative.

#### **Error cause**

• If the circuit is open, shorted to positive: excessive voltage has been detected at PIN 72. If shorted to negative: voltage equal to zero has been detected at PIN 72.

# **Troubleshooting**

- If the circuit is open, shorted to positive: the error is detected with gear engaged only. Check the sensor connector and the VEHICLE connector of the control unit: if not OK, restore; if they are OK, check the continuity of the Grey/Black cable between the two connectors: if not OK, restore; if they are OK, with key set to ON and control unit connector disconnected, check from the control unit side if the cable is in voltage: if it is in voltage, disconnect the sensor connector and check if the cable is in voltage: if it is in voltage, restore the cable harness; if it is not in voltage, replace the sensor (there is an interruption or shorted to positive of the Pink/Black cable in the section from the sensor connector to the sensor or inside the sensor).
- If shorted to negative: disconnect the sensor connector and with key set to ON, check Grey/ Black cable voltage: if equal to zero, restore the cable harness; if equal to approx. 5 V, replace the sensor (there is short circuit to ground of the Pink/Black cable in the section from the sensor connector to the sensor or inside the sensor).

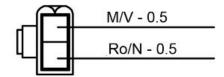
# Side stand sensor

#### **Function**

It tells the side stand position to the control unit.

# **Operation / Operating principle**

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



#### Level in electrical circuit diagram:

Start-up enabling switches

#### Location:

- on the vehicle: on the stand
- connector: on the alternator cover (2way connector)

# Pin out:

- 1. Ground connection
- 2. Voltage 12V

# **Electrical specifications:**

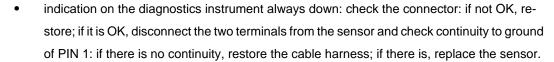
- Side Stand Up: closed circuit (continuity)
- Side Stand Down: open circuit (infinite resistance)

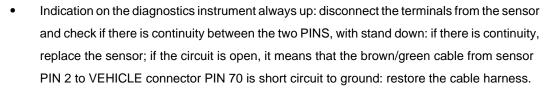


BEFORE CARRYING OUT ANY TROUBLESHOOTING, CAREFULLY READ THE GENERAL TROUBLESHOOTING CONCEPTS FOR ELECTRICAL DEVICES AT THE BEGINNING OF THE CHECK AND CONTROL SECTION IN THE ELECTRICAL SYSTEM CHAPTER.



Side stand sensor: up/down





# Bank angle sensor

# (IF APPLICABLE)

# **Function**

It tells the vehicle position to the control unit.

# **Operation / Operating principle**

When the sensor is inverted, the circuit is closed to ground: When the Marelli control unit detects this ground connection, it does not enable start-up or shuts off the engine.

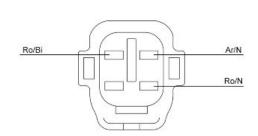
# Level in electrical circuit diagram:

Start-up enabling switches

#### Location:

- on the vehicle: under the saddle, behind the battery.
- connector: next to the sensor (4-ways connector).





# **Electrical specifications:**

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

#### Pin out:

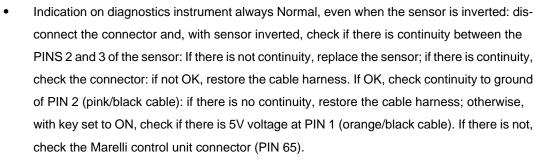
- 1. Voltage 5V
- 2. Ground connection
- 3. Signal

# CAUTION

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

### **DIAGNOSTICS INSTRUMENT: STATUSES**

Fall sensor: Normal / Tip over



• Indication on the diagnostics instrument always Tip over: disconnect the connector and, with sensor upright, check if there is continuity between the PINS 2 and 3 of the sensor: if there is continuity, replace the sensor; if there is not, it means that, with key set to ON, there is no 5V voltage at PIN 1: restore the cable harness whose orange/black cable will be shorted to ground.

#### CAUTION

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



#### Electric fan circuit

#### **Function**

Radiator fan and coolant - Operation

# **Operation / Operating principle**

When the control unit detects a temperature of approx. 102 °C, it closes the fan control relay pickup circuit to ground

#### Level in electrical circuit diagram:

electric fan

#### Location:

- sensor: relay located inside the rear relay box, the one toward motorcycle rear end (also CHECK relay identification with the colour of the cables)
- connector: on the relay



- relay normally open;
- drive coil resistance 110 Ohm (+/- 10 %)

# DIAGNOSTICS INSTRUMENT: STATUSES Fan relay

on/off

# **DIAGNOSTICS INSTRUMENT: ACTIVATION**

Fan

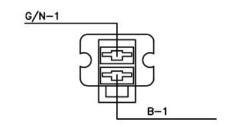
The fan relay (No. 43 in the wiring diagram) is energised for 10 seconds. The continuity of the wiring is necessary for correct activation: no error indications are displayed in case of lack of activation

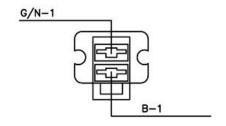
# CAUTION

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

# **DIAGNOSTICS INSTRUMENT: ELECTRICAL ERRORS**

Cooling fan relay P0480







short circuit to positive/ short circuit to negative / open circuit

#### **Error cause**

If shorted to positive: excessive voltage has been detected at PIN 61 of the VEHICLE connector. If shorted to negative: no voltage has been detected. If the circuit is open: 5V voltage has been detected. Error recognition carries out only when the fan relay is activated.

# **Troubleshooting**

- If shorted to positive: check the relay electrical specifications are correct by disconnecting it from the cable harness. If not OK, replace the relay; if OK, restore the cable harness (Brown cable)
- If shorted to negative: check the relay electrical specifications are correct by disconnecting
  it from the cable harness. If not OK, replace the relay; if OK, restore the cable harness (Brown
  cable)
- If the circuit is open: check the relay electrical characteristics are correct by disconnecting
  it from the cable harness; if not OK, replace the relay, if OK, check relay connector and
  VEHICLE connector of the Marelli control unit: if not OK, restore; if OK, check continuity of
  cable harness (Brown cable)

# **RUN/STOP** switch

#### **Function**

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

# **Operation / Operating principle**

If the rider wants to shut off the engine or to disable engine start-up, the switch should be open, i.e. VEHICLE connector PIN 78 of the Marelli control unit must not be connected to ground.

# Level in electrical circuit diagram:

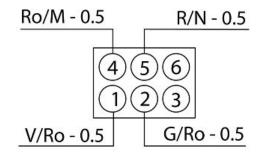
Start-up enabling switches

#### Location:

- on the vehicle: right light switch.
- connector: at the centre between air filter box and water radiator.

# **Electrical specifications:**

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





#### Pin out:

1 blue/green cable: ground connection

2 yellow/red cable: 5 V

#### CAUTION

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

#### **DIAGNOSTICS INSTRUMENT: STATUSES**

RUN / STOP switch

Run/Stop

#### **NOTES**

- Indication on the diagnostics instrument always on STOP: disconnect the connector and, with the switch set to RUN, check if there is continuity towards the two cables switch Blue/ Green and Yellow/Red: If there is not continuity, replace the sensor; if there is continuity, check the connector: if not OK, restore the cable harness; if OK, check, with key set to ON, if there is voltage on Yellow/Red cable: if there is no voltage, restore the cable harness; if there is, check the Yellow/Red cable ground insulation: If there is continuity with ground connection, restore the cable harness; if OK, set the key to OFF and check the VEHICLE connector and the engine-vehicle cable harness connector: if it is not OK, restore; if it is OK, check the continuity of the Yellow/Red cable between the switch connector and VEHICLE connector PIN 78: if not OK, restore the cable harness; if OK, replace the Marelli control unit.
- Indication on the diagnostics instrument always on RUN: disconnect the connector and, with
  the switch set to STOP, check if there is continuity between the two cables of the switch: if
  there is continuity, replace the switch; otherwise, it means that, with key set to ON, the
  Yellow/Red cable (between switch and the PIN 78 of the control unit connector) is shorted
  to positive: restore the cable harness.

# **Butterfly valve in exhaust**

# **Function**

It optimised the operation of the engine at low revolutions without compromising the efficiency of the exhaust system at high revolutions.

# **Operation / Operating principle**

The system consists of a throttle valve with a return spring placed on the exhaust pipe. Two cables operated by an electric motor control the closing



of the valve; the logic and the control of the motor are provided by the VCU control unit (Caponord 1200 Travel Pack) or by the EVC control unit (Caponord 1200).

The motor is fitted with an integrated potentiometer for controlling the position. The exhaust butter-fly valve is managed as follows:

- With engine off: open by 75%;
- With engine running: regardless of the gear, at low revolutions and small throttle opening, it is completely closed; if the revolutions or the throttle opening exceed preset thresholds defined during calibration, it is completely open, otherwise it is in an intermediate position. With bike stopped and in neutral the valve stays closed, regardless of rpm.

# Level in electrical circuit diagram:

Exhaust valve control unit - Caponord 1200
VCU (Vehicle Control Unit) control unit - Caponord
1200 Travel Pack

# Location:

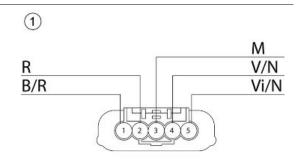
- On the vehicle: The motor is placed in the front lower part of the engine.
- The valve in the exhaust duct.
- Connector: on the motor.

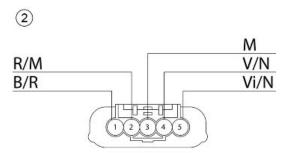
# Connector:

- 1. Caponord 1200
- 2. Caponord 1200 Travel Pack

# Pin out:

- 1. Supply from VCU
- 2. Exhaust valve potentiometer signal
- 3. Ground from VCU
- 4. Exhaust valve positive
- 5. Exhaust valve negative





#### **DIAGNOSTICS INSTRUMENT: ADJUSTMENTS**

### Exhaust valve - Zero position search

- After having pressed the enter button for the zero position search, shut off the vehicle and leave the keys in OFF, even in the event that the instruments indicate the opposite.
- Slacken the exhaust throttle valve cable tension.

# NOTE

IF IT IS NECESSARY TO REPLACE THE MOTOR, FROM POSITION ZERO LOOSEN THE CABLES COMPLETELY TO REMOVE THEM, THEN, AFTER DISCONNECTING THE CONNECTOR, REMOVE THE MOTOR ITSELF.

- Using the specific adjuster screw, tension the upper cable and leave around 1.8 mm (0.07 in) between the retainer and opening travel limit of the valve.
- Using the specific adjuster screw, tension the lower cable until the tensioning is as close as
  possible to the one of the upper cable (failing this the subsequent adjustment with the tool
  will fail).
- Tightening the lower cable will probably have caused the travel limit to shift: repeat the
  procedure until the correct position is obtained.
- Turn the key to ON.

#### CAUTION

THE ZERO SEARCH OF THE DISCHARGE VALVE MOTOR PROCEDURE ENTAILS RESETTING THE EXISTING MECHANICAL STOPS. AN ERROR FOR STOP SEARCH NOT CARRIED OUT IS THEN INDICATED, WHICH REMAINS UNTIL THE SELF-LEARNING OF THE DISCHARGE VALVE PROCEDURE IS PERFORMED. DO NOT CARRY OUT THIS OPERATION WHEN USING A NON-ORIGINAL EXHAUST SYSTEM WHERE ANY CABLES CONSIDERED NOT NECESSARY HAVE BEEN DISCONNECTED.

#### Exhaust valve - Self-acquisition

 The search for the opening travel limit (open valve) and of the closing travel limit (closed valve) is performed. During both normal operation and the self-cleaning cycle, the valve will only move within this range and without reaching the mechanical end stops, to prevent strain to the electric motor.

DIAGNOSTICS INSTRUMENT: ELECTRICAL ERRORS

**CAPONORD 1200** 

Exhaust butterfly valve stop research P0191

excessive time / search not performed, wrong stroke

#### Error cause

• If time is excessive: failed memorisation of the travel limit positions of the valve. The EVC control unit is not able to record the valve's travel limits: possible interruption of the circuit. If research has not been carried out or wrong stroke: failed memorisation of the travel limit positions of the valve: this occurs in case of first ignition of the motorbike or following a reset of the control unit.

# **Troubleshooting**

- If time is excessive: check the connector on the component and the EVC connector. Disconnect the two connectors and check the continuity of the cable between the PIN 4 engine
   PIN C1 EVC and between PIN 5 engine PIN A1 EVC. If all the above-mentioned tests have a positive outcome, replace the motor.
- If research has not been carried out or wrong stroke: carry out the self-learning procedure using the diagnosis instrument.

# Exhaust valve engine P0192

 open circuit / shortcircuit to negative / shortcircuit to positive, shortcircuit between the two cables

#### Error cause

If the circuit is open: an interruption of the circuit has been detected. If shorted to negative:
 a null tension has been detected on PIN A1 or on PIN C1 EVC. If shorted to positive or short
 circuit between both cables: an excessive tension has been detected on PIN A1 or on PIN
 C1 EVC.

# **Troubleshooting**

- If the circuit is open: check the connector on the component and the EVC connector. Disconnect the two connectors and check the continuity of the cable between the PIN 4 engine
   PIN C1 EVC and between PIN 5 engine PIN A1 EVC. If the cable harness is not damaged, replace the component.
- If shorted to negative: disconnect the connector of the engine and check its insulation from ground of PIN 4 and 5: if the insulation is not present, restore the cabling, otherwise replace the component.
- If shorted to positive or short circuit between both cables: check the connector on the component and the EVC connector. Disconnect the connector of the component and check its insulation from supply system of PIN 4 and 5; also ensure that the two PINs are insulated between each other. If all the above-mentioned tests have a positive outcome, replace the component.

# **Exhaust valve potentiometer P0193**

short circuit to positive / open circuit, short circuit to negative

#### Error cause

If shorted to positive: an excessive voltage has been detected at PIN A5 EVC. If the circuit
is open, shorted to negative: a null voltage has been detected at PIN A5 EVC.

#### Troubleshooting

- If shorted to positive: disconnect the connector of the component and check its insulation from supply system of PIN 2; if the insulation is not present, restore the cabling, otherwise replace the component.
- If the circuit is open, shorted to negative: check the connector on the component and the EVC connector. Disconnect the two connectors and check the continuity of the cable between PIN 2 potentiometer and PIN A5 EVC and restore the cable harness. If the cable harness is not damaged check the insulation from ground of PIN 2 of the component: if the insulation is not present, restore the cabling, otherwise replace the component.

#### **CAPONORD 1200 TRAVEL PACK**

#### **VCU ERRORS**

#### Error control output exhaust valve Status Flag active C1613

#### Error cause

Overcurrent on exhaust valve: the VCU goes in the recovery mode.

#### Troubleshooting

Check the connector on the component and the VCU connector. Disconnect the connector
of the component and check its insulation from ground and supply system of PIN 4 and 5;
also ensure that the two PINs are insulated between each other. If all the above-mentioned
tests have a positive outcome, replace the component.

#### Error control output exhaust valve shortcircuit C1614

# Error cause

A shortcircuit on PIN L1 or on PIN L2 of the VCU connector has been detected.

#### <u>Troubleshooting</u>

Disconnect the connector of the valve and check its insulation from ground and supply system of PIN 4 and 5: if the insulation is not present, restore the cabling, otherwise replace the component.

# Error control output exhaust valve open circuit C1615

# Error cause

An interruption of the circuit has been detected.

#### Troubleshooting

Check the connector on the component and the VCU connector. Disconnect the two connectors and check the continuity of the cable between the PIN 4 valve - PIN L1 VCU and

between PIN 5 valve - PIN L2 VCU. If the cable harness is not damaged, replace the component.

# Error potentiometer exhaust valve shortcircuit C1707

#### Error cause

An excessive or null tension has been detected on PIN B4 VCU.

# **Troubleshooting**

 Disconnect the connector of the component and check its insulation from ground and supply system of PIN 2: if the insulation is not present, restore the cabling, otherwise replace the component.

# Error potentiometer exhaust valve open circuit C1708

#### Error cause

An interruption of the circuit has been detected.

# **Troubleshooting**

Check the connector on the component and the VCU connector. Disconnect the two connectors and check the continuity of the cable between PIN 2 potentiometer and PIN B4 VCU and restore the cable harness. If the cable harness is not damaged, replace the component.

# **Cruise Control Button**

# (IF APPLICABLE)

#### **Function**

Cruise Control is an electronic system that makes it possible to set the desired speed and keep it constant also in case of driving uphill or downhill, without using the gas control.

The system is deactivated automatically when the rider uses any of the brake/clutch controls or Cruise Control button. It is very useful during long motorway journeys, because it helps saving fuel and makes riding less tiring.

# **Operation / Operating principle**

To activate the function (switching from OFF to ON), press and hold the Cruise Control button on the handlebar for approximately 2 seconds: the warning light on the instrument panel flashes to indicate the ON status of the Cruise Control. The set speed must be within the thresholds below:



- 3rd gear: 50 - 100 km/h;- 4th gear: 60 - 120 km/h;- 5th gear: 65 - 160 km/h;- 6th gear: 70 - 180 km/h.

Once the desired speed is reached, the system may be activated (SET state) by pressing the cruise control button briefly: the instrument panel indicator lamp lights continuously to indicate that the system is active. The throttle grip may now be released, and the cruise control function will autonomously maintain the selected speed.

During the run at cruising speed, it is possible to use the accelerator to increase the speed up to a maximum of 30 km/h without causing the system to deactivate. By using again the accelerator, the Cruise Control will be deactivated (back to ON status, the warning light starts flashing again). The speed control is deactivated (warning light starts flashing) if:

- you accelerate until the cruising speed is exceeded by more than 30 km/h;
- the clutch is activated;
- one of the brake switches is activated;
- the vehicle speed goes out of the speed range previously shown;
- the button ON/OFF Cruise is pressed briefly.
   The system deactivates completely, the cruising speed is reset, and the warning light goes off, if:
- the ON/OFF Cruise button is pressed for longer;
- the RUN/STOP switch is set to STOP;
- the key is set to OFF.

#### Level in electrical circuit diagram:

Pre-installations and accessories

#### Location:

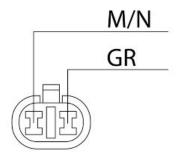
 On the vehicle: on the handlebar, right hand side. • Connector: under the dashboard cov-

er.

#### Pin out:

M/N - Ground

Gr - Signal



# (WHERE DIAGNOSIS IS AVAILABLE)

**DIAGNOSTICS INSTRUMENT: ELECTRICAL ERRORS** 

# **VCU ERRORS**

# **Error Cruise Control ON/OFF button shortcircuit C1401**

#### Error cause

A shortcircuit on PIN A4 or on PIN F4 of the VCU connector has been detected.

### **Troubleshooting**

 Check the insulation from ground and from supply system of the two cables of the Cruise Control button (PIN A4 and PIN F4 VCU).

# Error Cruise Control ON/OFF button open circuit C1402

# Error cause

An interruption of the circuit has been detected.

# Troubleshooting

 Check the continuity of the two cables between the connector of the Cruise Control button and the VCU connector (PIN A4 and PIN F4).

# **Error Cruise Control ON/OFF button indeterminate C1403**

# Error cause

 An interruption of the circuit or a shortcircuit on PIN A4 or on PIN F4 of the VCU connector has been detected.

# **Troubleshooting**

 Check the correct operation of the contact of the button, the insulation from ground and from the supply system of the two cables of the button (PIN A4 and PIN F4 VCU) and their continuity.

# **Brake switch**

# (WHERE DIAGNOSIS IS AVAILABLE)

#### **Function**

Communicate the braking phase to the VCU control unit.

# **Operation / Operating principle**

On the basis of the condition of the brake lever (pulled/released) the switch communicates the status to the VCU control unit.

# Level in electrical circuit diagram:

VCU (Vehicle Control Unit) control unit

# Location:

- On the vehicle: on the brake.
- Connector: on the component.

#### Connector:

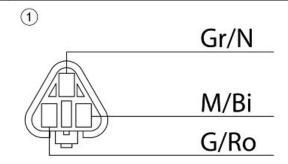
- 1. Switch front brake
- 2. Switch rear brake

# Pin out:

Gr/N - ground

M/Bi - Brake released signal

G/Ro - Pulled brake signal

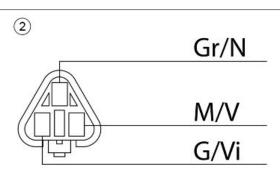


# Pin out:

Gr/N - ground

M/V - Brake released signal

G/Vi - Pulled brake signal



**DIAGNOSTICS INSTRUMENT: ELECTRICAL ERRORS** 

**VCU ERRORS** 

Error switch front brake shortcircuit C1505

Error cause



**ELE SYS - 171** 

A shortcircuit on PIN C2 or on PIN D2 of the VCU connector has been detected.

#### **Troubleshooting**

 Check the insulation from ground and from supply system of the two cables of the button (PIN C2 and PIN D2 VCU).

# Error switch front brake open circuit C1506

# Error cause

An interruption of the circuit has been detected.

# **Troubleshooting**

Check the correct operation of the contacts of the button on its two positions and the continuity of the cables between the button connector and VCU connector (PIN C2 and PIN D2).
 If the above-mentioned tests have a positive outcome, replace the button.

#### Error switch rear brake shortcircuit C1507

#### Error cause

A shortcircuit on PIN E2 or on PIN F2 of the VCU connector has been detected.

#### **Troubleshooting**

 Check the insulation from ground and from supply system of the two cables of the button (PIN E2 and PIN F2 VCU).

# Error switch rear brake open circuit C1508

# Error cause

An interruption of the circuit has been detected.

# **Troubleshooting**

Check the correct operation of the contacts of the button on its two positions and the continuity of the cables between the button connector and VCU connector (PIN E2 and PIN F2).
 If the above-mentioned tests have a positive outcome, replace the button.

# Temperature and pressure sensor

# (IF APPLICABLE)

#### **Function**

Detect the temperature and the diving/extension speed of the fork.

# **Operation / Operating principle**

The system, by means of the VCU control unit (Vehicle Control Unit), measures in real time the energy transmitted to Caponord 1200 (damping of the shock absorber) from the roughness of the



road surface and it adapts the calibration of the suspension in real time in order to maximise comfort and keep the correct setup of the motorbike.

### Level in electrical circuit diagram:

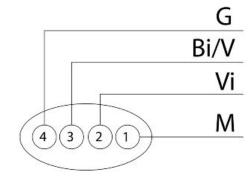
VCU (Vehicle Control Unit) control unit

#### Location:

- On the vehicle: in the upper part from the active fork leg (LH) of the fork.
- Connector: on the component.

#### Pin out:

- 1. Ground from VCU
- 2. Temperature signal output
- 3. Supply from VCU
- 4. Pressure signal output



#### **DIAGNOSTICS INSTRUMENT: ELECTRICAL ERRORS**

### **VCU ERRORS**

# Error pressure sensor shortcircuit C1407

#### Error cause

An excessive tension or a null tension has been detected on PIN A3 VCU.

# **Troubleshooting**

 Disconnect the connector of the sensor and check its insulation from ground and supply system of PIN 4: if the insulation is not present, restore the cabling, otherwise replace the sensor.

# Error pressure sensor open circuit C1408

#### Error cause

An interruption of the circuit has been detected.

# **Troubleshooting**

Check the connector on the component and the VCU connector. Disconnect the two connectors and check the continuity of the cable between PIN 4 sensor and PIN A3 VCU and restore the cable harness. If the cable harness is not damaged, replace the sensor.

# Error temperature sensor shortcircuit C1409

#### Error cause

An excessive or null tension has been detected on PIN D1 VCU.

# **Troubleshooting**

 Disconnect the connector of the sensor and check its insulation from ground and supply system of PIN 2: if the insulation is not present, restore the cabling, otherwise replace the sensor.

# Error temperature sensor open circuit C1410

# Error cause

An interruption of the circuit has been detected.

# **Troubleshooting**

Check the connector on the component and the VCU connector. Disconnect the two connectors and check the continuity of the cable between PIN 2 sensor and PIN D1 VCU and restore the cable harness. If the cable harness is not damaged, replace the sensor.

# Rotary sensor

# (IF APPLICABLE)

#### **Function**

Detect the position of the fork, that is the angle between the fork and the frame.

# **Operation / Operating principle**

The system, by means of the VCU control unit (Vehicle Control Unit), measures in real time the energy transmitted to Caponord 1200 (damping of the shock absorber) from the roughness of the road surface and it adapts the calibration of the suspension in real time in order to maximise comfort and keep the correct setup of the motorbike.

# Level in electrical circuit diagram:

VCU (Vehicle Control Unit) control unit

### Location:

- On the vehicle: on the LH of the motorbike, fastened to the frame.
- Connector: on the component.



Bi/V

Ar

Bi/V

# Pin out:

- 1. Supply from VCU
- 2. Output 1
- 3. -
- 4. Supply from VCU
- 5. Output 2
- 6. -
- 7. Ground from VCU
- 8. Ground from VCU

# **DIAGNOSTICS INSTRUMENT: ADJUSTMENTS**

# Rotary sensor reset

 When the motorbike comes off the assembly line, a setup measurement (in mm) is set (height from the ground) that the system recognises as reference position.

M

M

G/Bi

• In case of replacement of the rotary potentiometer or of the VCU control unit, it is necessary to reset the potentiometer by putting the motorbike on the central stand with the rear wheel raised above the ground.

#### **DIAGNOSTICS INSTRUMENT: ELECTRICAL ERRORS**

# **VCU ERRORS**

# Error rotary sensor Output 1 shortcircuit or open circuit C1404

### Error cause

• If shortcircuit: an excessive or a null tension has been detected on PIN B3 VCU. If the circuit is open: an interruption has been detected.

# **Troubleshooting**

- If shortcircuit: disconnect the connector of the rotary sensor and check its insulation from ground and supply system of PIN 2: if the insulation is not present, restore the cabling, otherwise replace the sensor.
- If the circuit is open: Check the connector on the component and the VCU connector. Disconnect the two connectors and check the continuity of the cable between PIN 2 sensor and PIN B3 VCU and restore the cable harness. If the cable harness is not damaged, replace the sensor.

# Error rotary sensor Output 2 shortcircuit or open circuit C1405

# Error cause

• If shortcircuit: an excessive or a null tension has been detected on PIN C3 VCU. If the circuit is open: an interruption has been detected.

# Troubleshooting

- If shortcircuit: disconnect the connector of the rotary sensor and check its insulation from ground and supply system of PIN 5: if the insulation is not present, restore the cabling, otherwise replace the sensor.
- If the circuit is open: Check the connector on the component and the VCU connector. Disconnect the two connectors and check the continuity of the cable between PIN 5 sensor and PIN C3 VCU and restore the cable harness. If the cable harness is not damaged, replace the sensor.

# Error rotary sensor failed consistency C1406

### Error cause

 The sum of the tensions detected on the two outputs of the sensor (PIN 2 and PIN 5) is different from 5 V.

# **Troubleshooting**

Replace the sensor.

# Preload motor

# (IF APPLICABLE)

#### **Function**

Check the preload of the rear single shock absorber in order to keep the optimal setup.

# **Operation / Operating principle**

It is possible to adjust the preload of the spring of the rear shock absorber using an electrical device, on 5 positions, which are highlighted with specific icons on the digital instrument panel: only rider, only rider with luggage, rider with passenger, rider with passenger and luggage, automatic. During the automatic operation, the system will adjust automatically the preload level, on the basis of the motorbike load, in order to maintain the optimal setup. The system works in two phases:

- 1. With the vehicle at a standstill, the engine running, gear in idle, crutch closed, the system performs a first overall preload adjustment.
- 2. With the vehicle moving, the system constantly monitors (cyclically every minute) various signals coming from the vehicle and if some conditions are



not met (speed and constant setup), it acts on the preload until it reaches the ideal setup.

If the system has already reached the ideal posi-

tion, it will make no further adjustments.

# Level in electrical circuit diagram:

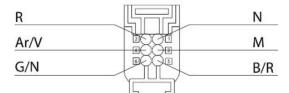
VCU (Vehicle Control Unit) control unit

#### Location:

- On the vehicle: under the saddle.
- Connector: on the component.

#### Pin out:

- 1. Negative preloaded motor
- 2. Positive preloaded motor
- 3. Ground from VCU
- 4. Encoder 2
- 5. Supply from VCU
- 6. Encoder 1



### **DIAGNOSTICS INSTRUMENT: ADJUSTMENTS**

# Travel limits preloaded motor

- When you replace the hydraulic press of the rear shock absorber preload, do the self-acquisition of the end-of-travel positions.
- Otherwise, if you replace the VCU control unit with a new from spare parts, the procedure is automatically performed the first time the engine is switched ON.

# **DIAGNOSTICS INSTRUMENT: ELECTRICAL ERRORS**

#### **VCU ERRORS**

# Error preload motor Status Flag active C1619

#### Error cause

Overcurrent on the preload motor.

#### **Troubleshooting**

Check the connector on the component and the VCU connector. Disconnect the connector
of the component and check its insulation from ground and supply system of PIN 1 and 2;
also ensure that the two PINs are insulated between each other. If all the above-mentioned
tests have a positive outcome, replace the motor.

# Error blocked preload motor C1620

# Error cause

The motor does not run not even with routing of current greater than ~ 4 A.

# **Troubleshooting**

 Check the preload motor because it is likely to be mechanically locked, otherwise replace the motor.

# Error preload motor control open circuit C1621

#### Error cause

An interruption of the circuit has been detected.

# **Troubleshooting**

Check the connector on the component and the VCU connector. Disconnect the two connectors and check the continuity of the cable between the PIN 1 motor - PIN M2 VCU and between PIN 2 motor - PIN M1 VCU. If the cable harness is not damaged, replace the motor.

# Error acquisition travel limits preload motor C1701

#### Error cause

• Failed memorisation of the travel limit positions of the motor: this occurs in case of first ignition of the motorbike or following a reset of the VCU.

#### **Troubleshooting**

Carry out the self-learning procedure using the diagnosis instrument.

# Error timeout search travel limits preload motor C1702

# Error cause

 Failed memorisation of the travel limit positions of the preload motor. The error occurs if, after 2 minutes from the start of the acquisition procedure, the VCU cannot record the motor's travel limits: possible interruption of the circuit.

# **Troubleshooting**

Check the connector on the component and the VCU connector. Disconnect the two connectors and check the continuity of the cable between the PIN 4 motor - PIN B2 VCU and between PIN 6 motor - PIN A2 VCU. If all the above-mentioned tests have a positive outcome, replace the motor.

# **Error connections preload motor C1703**

#### Error cause

Inverted connections of the preload motor.

# **Troubleshooting**

Check the connector on the component and the VCU connector. Disconnect the connector
of the component and ensure that PIN 1 and 2 are insulated between themselves. Disconnect also the VCU connector and check the continuity of the cable between PIN 1 motor PIN M2 VCU and between PIN 2 motor - PIN M1 VCU.

# Error timeout during normal operation preload C1706

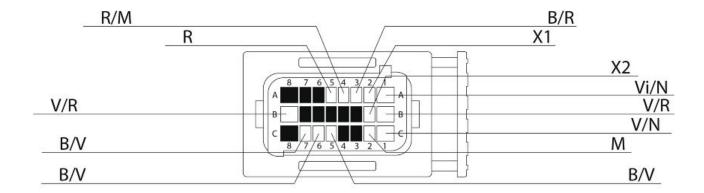
• Failed preload motor movement after a 50 seconds timeout.

# **Troubleshooting**

Check the preload motor because it is likely to be mechanically blocked. If the motor is free, check the connector on the component and the VCU connector: disconnect the two connectors and check the continuity of the cable between the PIN 1 motor - PIN M2 VCU and between PIN 2 motor - PIN M1 VCU. If all the above-mentioned tests have a positive outcome, replace the motor.

# **Connectors**

# **EVC (EXHAUST VALVE CONTROL UNIT) (CAPONORD 1200)**



# EVC pin out key:

- A1. Exhaust valve engine "B"
- A2. CAN L line
- A3. Reference voltage output
- A4. Live supply
- A5. Exhaust valve TPS signal
- A6. -
- A7. -
- A8. -
- B1:. Power from battery 1

B2:. CAN H line

B3:. -

B4:. -

B5:. -

B6:. -

B7:. -

**B8**:. Power from battery 2

C1. Exhaust valve engine "A"

C2. Analogue ground connection

C3. -

C4. -

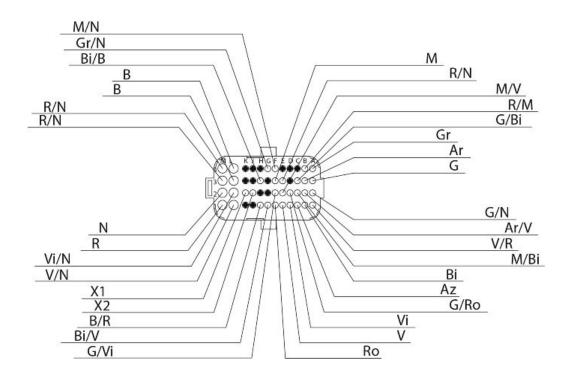
C5. Power ground connection 1

C6. Power ground connection 2

C7. Power ground connection 3

C8. -

# VCU (VEHICLE CONTROL UNIT) (CAPONORD 1200 TRAVEL PACK)

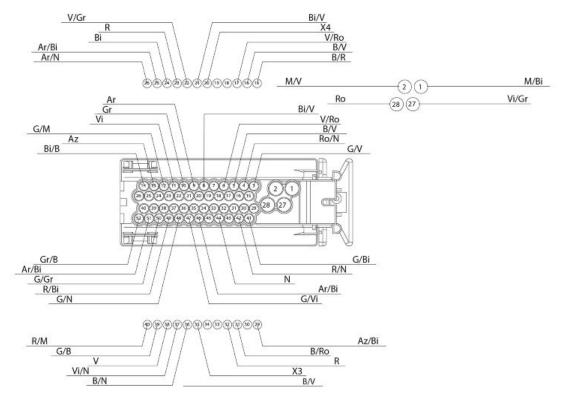


# VCU pin out key:

- A1. Battery supply
- A2. Pump engine encoder 1
- A3. Front pressure sensor
- A4. ON/OFF Cruise control

- B1:. Front solenoid valve positive
- B2:. Pump engine encoder 2
- B3:. Rotary sensor signal 1
- B4:. Exhaust valve potentiometer signal
- C1. Front solenoid valve negative
- C2. Front stop switch
- C3. Rotary sensor signal 2
- C4. -
- D1. Front temperature sensor
- D2. Front stop switch
- D3. -
- D4. -
- E1:. Rear solenoid valve positive
- E2. Rear stop switch
- E3. Live supply 1
- E4. -
- F1. Rear solenoid valve negative
- F2. Rear stop switch
- F3. 1 Sensors ground connection
- F4. 2 Sensors ground connection
- **G1**. 1 Sensors power supply
- G2. -
- G3. -
- G4. Digital ground connection
- H1. 2 Sensors power supply
- H2. -
- H3. Serial line
- H4. -
- J1. -
- J2. CAN H line
- J3. -
- J4. -
- K1. -
- K2. CAN L line
- K3. -
- K4. -

## **ECU**



#### Engine pinout key:

Rear cylinder side spark plug coil control output PIN 1

Front cylinder side spark plug coil control output PIN 2

Rear throttle motor output (+) PIN 3

Analogue ground connection 2 PIN 4

Power ground connection 1 PIN 5

Analogue ground connection 1 PIN 6/17

Cylinder 2 injector control output PIN 8

Rear lambda sensor input (+) PIN 9

Front lambda sensor input (+) PIN 10

Track D hand grip input PIN 11

Water temp. sensor input PIN 12

Track B hand grip input PIN 13

Serial line K for diagnosis PIN 14

Rear throttle motor output (-) PIN 15

Power ground connection 2 PIN 16

Engine speed sensor input (-) PIN 20

Input for rear throttle potentiometer 2 signal PIN 21

Front lambda sensor input (-) PIN 22

Track C hand grip input PIN 23

Front cylinder intake pressure sensor input PIN 24

Reference voltage output + 5 V: tracks A-C, front throttle and pressure sensor PIN 25/51

Reference voltage output + 5V: tracks B-D and rear throttle PIN 26

Rear cylinder central spark plug coil control output PIN 27

Front cylinder central spark plug coil control output PIN 28

Front throttle motor output (-) PIN 29

SAFETY relay control output PIN 31

Front lambda heating control output PIN 32

Engine speed sensor input (+) PIN 35

Input for rear throttle potentiometer 1 signal PIN 36

Air temperature sensor input PIN 37

Rear lambda sensor input (-) PIN 38

Track A hand grip input PIN 39

Key input PIN 40/42

Front throttle motor output (+) PIN 41

Rear lambda heating control output PIN 44

Rear cylinder 2 injector control output PIN 46

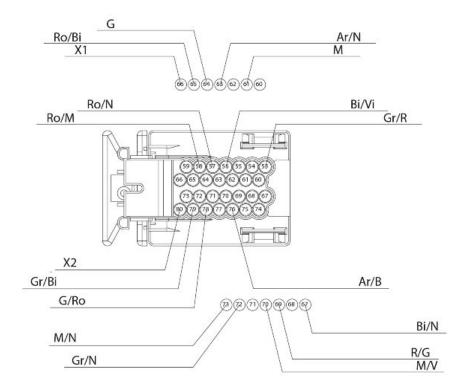
Quick shift switch PIN 47

Input for front throttle potentiometer 1 signal PIN 48

Rear cylinder intake pressure sensor input PIN 49

Input for front throttle potentiometer 2 signal PIN 50

Direct power supply to control unit PIN 52



## Vehicle pinout key:

Front cylinder 1 injector control output PIN 53

Clutch sensor input PIN 56

Analogue ground connection 2 PIN 57

"Start engine" switch input PIN 58

Electric fan relay control output PIN 61

Reference voltage output + 5V: tracks B-D and rear throttle PIN 63

Neutral input PIN 64

Fall sensor input PIN 65

CAN L line (high speed) PIN 66

Rear cylinder 1 injector control output PIN 67

Start-up control output PIN 69

Side stand input PIN 70

Gear input PIN 72

Auxiliary injection relay control output PIN 73

Clutch switch PIN 76

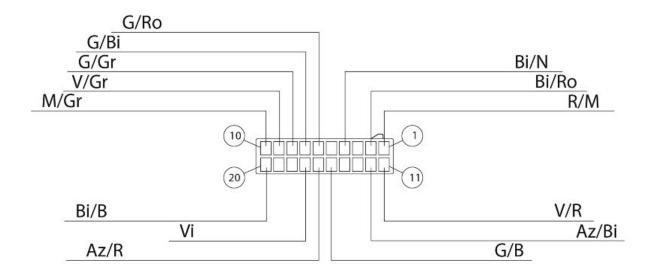
"engine stop" input PIN 78

Vehicle speed input PIN 79

CAN H line (high speed) PIN 80

## **Dashboard**

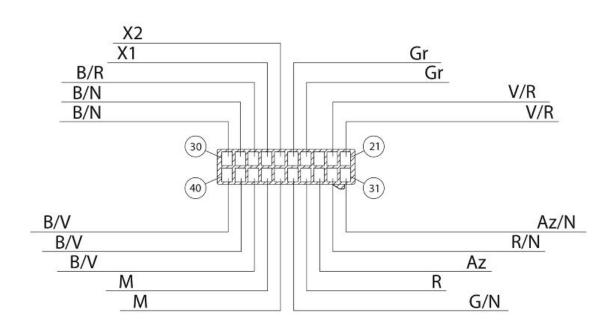




## Grey-bodied instrument panel pinout key:

1. Live supply

- 2. RH indicator switch
- 3. -
- 4. High beam warning light
- 5. -
- 6. Signal SELECT 3 (ENTER)
- 7. Signal SELECT 2 (DOWN)
- 8. Signal SELECT 1 (UP)
- 9. Fuel reserve warning light
- 10. Fuel level signal
- 11. Power from battery 1
- 12. LH indicator switch
- 13. -
- 14. -
- 15. Signal heated handgrips control
- 16. Indicators reset
- 17. Oil pressure warning light
- 18. -
- 19. -
- 20. Serial line

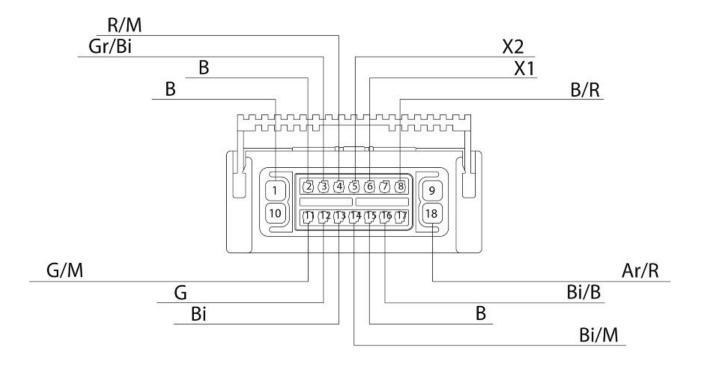


## Black-bodied instrument panel pinout key:

21. Power from battery 2

- 22. Power from battery 3
- 23. -
- 24. Signal aerial "B"
- 25. Signal aerial "A"
- 26. CAN H line
- 27. CAN L line
- 28. ABS warning light
- 29. Sensors analogue ground connection 1
- 30. Sensors analogue ground connection 2
- 31. LH front indicator
- 32. RH front indicator
- 33. LH rear indicator
- 34. RH rear indicator
- 35. Light relay
- **36**. LH handgrip control
- 37. RH handgrip control
- 38. Power ground connection 1
- 39. Power ground connection 2
- 40. Power ground connection 3

### **ABS Modulator**



### ABS control unit pin out key:

- 1. Power ground connection 1
- 2. Power ground connection 2
- 3. Vehicle speed signal
- 4. Live supply
- 5. CAN H line
- 6. CAN L line
- 7. -
- 8. ABS warning light
- 9. -
- 10. -
- 11. Rear ABS sensor positive
- 12. Rear ABS sensor negative
- 13. Front ABS sensor negative
- 14. Front ABS sensor positive
- 15. Power ground connection 3
- 16. Serial line
- 17. -
- 18. Battery supply

#### Can line

#### **Function**

It allows communication between the Marelli injection ECU and the instrument panel.

#### Operation / operating principle

#### **CAN SYSTEM ADVANTAGES**

A CAN (controller Area network) line is a connection among the vehicle several electronic devices, organised as a computer network (Internet). The CAN network has greatly simplified the electrical system layout and consequently, its complexity. With this communication line, needless duplication of several sensors present on the motorbike has been obviated. The sensor signals are shared by the two electronic elaboration units (instrument panel and control unit).

- Cable number reduction: The CAN line travels through a twisted cable to several nodes.
- These nodes can also isolate the errors without causing a system breakdown (FaultsConfination).
- Immunity to interference: the signal travels through two cables and the signal reading is
  differential (voltage difference between the two signals on both cables). If the two signals
  are disturbed by an external factor, their difference remains unaltered.

 Communication speed: messages travel at a speed of 250 kbps (data arrive at nodes every 20 ms, i.e. 50 times/second).

## **CAN PROTOCOL (CONT. NETWORK AREA)**

The communication protocol is CSMA/CD (Carrier Sense Multiple Access w/ Collision Detection). In order to transmit, every nod must first check that the BUS (the connection among all devices) is free before attempting to send a message with BUS (Carrier Sense).

If during this period there is no activity on BUS, every nod has the same chance to send a message (Multiple Access). If two nodes start transmitting simultaneously, the nodes recognise the "collision" (Collision Detection) and initiate an exchange action based on message priority (messages remain unaltered during exchange and there is no delay for high priority messages).

CAN protocol is based on messages and not on addresses. The message itself is divided into several parts (frames), each of which has a meaning: message priority, data contained, error detection, reception confirmation, etc.

Every network nod receives all the messages sent through the BUS (with reception confirmation or error messages) and each nod decides if the message is to be processed or rejected. Besides, every nod can request information from the other nodes (RTR = Remote Transmit Request).

### Level in electrical circuit diagram:

**CAN line** 

### **Electrical specifications:**

- between PIN 66 and 80 of the control unit: approximately 130 Ohm
- between PIN 26 and 27 of the instrument panel: approximately 120 Ohm

#### Pin out:

- Line L: Orange cable between Marelli control unit PIN 66 and the black-bodied connector PIN 27 of the instrument panel.
- Line H: White/Black cable between Marelli control unit PIN 80 and the black-bodied connector PIN 26 of the instrument panel.

#### CAUTION

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

#### **DIAGNOSTICS INSTRUMENT: ELECTRICAL ERRORS**

CAN line "Mute Node" U1601

Mute Node.

## Error cause

 The injection ECU cannot send CAN signals; it receives signals from the instrument panel and the ABS control unit (if any): the control unit may need replacing.

### **Troubleshooting**

Replace the Marelli control unit.

CAN line without signals U1602

Bus Off.

#### **Error cause**

 No communication on CAN line (PIN 66 and/or PIN 80): problem on the whole network (for example, battery cut-off or short circuited or shorted to ground).

## **Troubleshooting**

• Check the Marelli control unit VEHICLE connector: if not OK, restore; if OK, check the ground insulation of the two CAN lines from PIN 66 and PIN 80 of the VEHICLE connector: if not OK, restore cable harness; if OK, check the continuity of the two CAN lines from Marelli control unit VEHICLE connector to the instrument panel connector: if not OK, restore the cable harness; if OK, check that the two lines are not shorted to positive testing each of the 2 connectors (Marelli control unit and instrument panel connector) with 1 connector disconnected at a time and by setting the key to ON: If not OK, restore; if OK, replace the Marelli control unit.

CAN line towards instrument panel U1701

no signal.

#### **Error cause**

No signal is received from the instrument panel.

#### **Troubleshooting**

Check the connector of the instrument panel: if not OK, restore; if OK, check the continuity
of the two lines from the instrument panel connector to the VEHICLE connector of the Marelli
control unit: if not OK, restore the cable harness; if OK, replace the instrument panel.

#### DIAGNOSTICS INSTRUMENT: ELECTRICAL ERRORS

CAN line towards instrument panel U1702 - Intermittent signal or communication error

#### **Error cause**

Probable bad contact in the CAN line.

## **Troubleshooting**

Check the pins 66 and 80 and the Vehicle connector of the Marelli control unit. If not OK, restore. If OK, check pins 26 and 27 and the instrument panel connector. If not OK, restore.
 If OK, check overall operation of the Marelli control unit and instrument panel: replace the affected component if you find any fault

CAN line towards ABS control unit U1712 - Intermittent signal or communication error

## Error cause

Probable bad contact in the CAN line

### **Troubleshooting**

Check the pins 66 and 80 and the Vehicle connector of the Marelli control unit. If not OK, restore. If OK, check pins 5 and 6 and the ABS control unit connector. If not OK, restore. If OK, check overall operation of the Marelli control unit and ABS control unit: replace the affected component if you find any fault.

#### **DIAGNOSTICS INSTRUMENT: LOGIC ERRORS**

CAN line towards ABS control unit U1711 - No signal/Configuration error

#### **Error cause**

If there is no signal, no signal is received from the ABS control unit. In case of configuration
error, some devices are present (e.g. ABS) that were not foreseen in the vehicle configuration stored in the control unit.

#### **Troubleshooting**

Open the diagnosis tool devices status page to check if the control unit setting is actually
consistent with the motorcycle setting. Example: if the bike has an ABS system the correct
state that should be found in the diagnostics instrument device status screen will be: Aprilia
Traction Control present. In the event of a bike with ABS system present and indication of
the diagnostics instrument of: Aprilia Traction Control not present, update the control unit.

#### **VCU ERRORS**

#### Failed CAN reception from motor ECU C1300

## Error cause

• The VCU does not receive the signal from the motor control unit.

### **Troubleshooting**

Check the continuity of the cable between PIN K2 VCU - PIN 66 VEHICLE motor control
unit and between PIN J2 VCU - PIN 80 VEHICLE motor control unit. The error is automatically memorised when the communication between the two control units is restored. To exit
the diagnosis status and allow the VCU to resume operation in normal conditions, it is however necessary to switch from «OFF» to «ON».

#### Failed CAN reception from instrument panel C1301

### Error cause

The VCU does not receive the signal from the instrument panel.

#### **Troubleshooting**

• Check the continuity of the cable between the PIN K2 VCU - PIN 27 instrument panel (black connector) and PIN J2 VCU - PIN 26 instrument panel (black connector). The error is automatically memorised when the communication between the two control units is restored. To exit the diagnosis status and allow the VCU to resume operation in normal conditions, it is however necessary to switch from «OFF» to «ON».

## Failed CAN reception from ABS C1303

#### Error cause

The VCU does not receive the signal from the ABS control unit.

#### **Troubleshooting**

 Check the continuity of the cable between PIN K2 VCU - PIN 6 ABS control unit and between PIN J2 VCU - PIN 5 ABS control unit. The error is automatically memorised when the communication between the two control units is restored. To exit the diagnosis status and allow the VCU to resume operation in normal conditions, it is however necessary to switch from «OFF» to «ON».

#### Error Frame Counter motor control unit C1306

#### Error cause

 Failed synchronisation between VCU and motor control unit on data packets sent/received (for each packet sent, the VCU increases by 1 its internal counter, and when it reaches 15 it resets itself).

#### **Troubleshooting**

Possible contact or interruption of the cable that must be checked: Check the continuity of
the cable between PIN K2 VCU - PIN 66 VEHICLE motor control unit and between PIN J2
VCU - PIN 80 VEHICLE motor control unit. Check also the insulation of the two cables
between themselves, from supply and ground.

#### **Error Frame Counter ABS C1307**

## Error cause

 Failed synchronisation between VCU and ABS control unit on data packets sent/received (for each packet sent, the VCU increases by 1 its internal counter, and when it reaches 15 it resets itself).

#### Troubleshooting

Possible contact or interruption of the cable that must be checked: Check the continuity of
the cable between PIN K2 VCU - PIN 6 ABS control unit and between PIN J2 VCU - PIN 5
ABS control unit. Check also the insulation of the two cables between themselves, from
supply and ground.

#### **Error Frame Counter instrument panel C1308**

## Error cause

 Failed synchronisation between VCU and instrument panel on data packets sent/received (for each packet sent, the VCU increases by 1 its internal counter, and when it reaches 15 it resets itself).

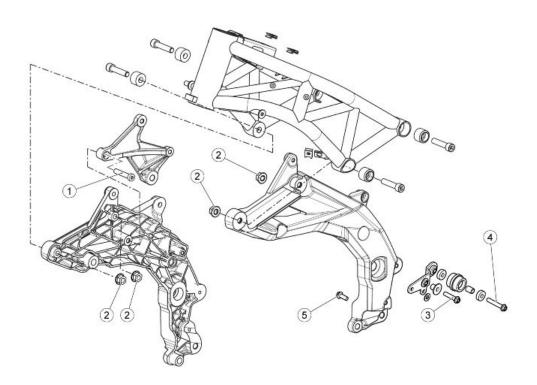
#### Troubleshooting

 Possible contact or interruption of the cable that must be checked: Check the continuity of the cable between the PIN K2 VCU - PIN 27 instrument panel (black connector) and PIN J2 VCU - PIN 26 instrument panel (black connector). Check also the insulation of the two cables between themselves, from supply and ground.

# **INDEX OF TOPICS**

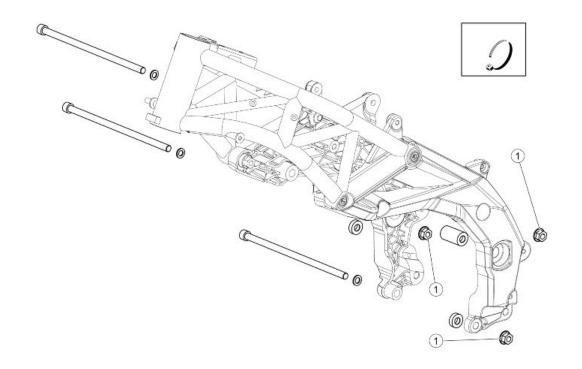
ENGINE FROM VEHICLE

**ENG VE** 



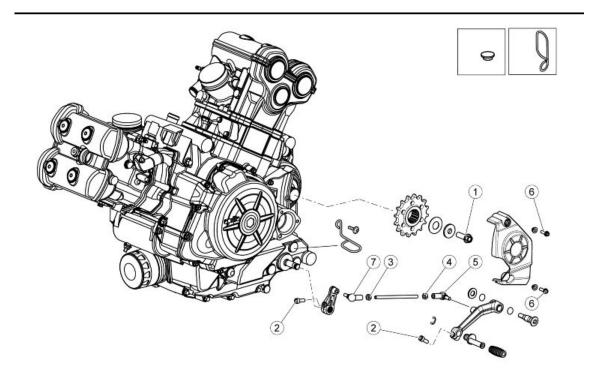
## FRONT CHASSIS

pos.	Description	Туре	Quantity	Torque	Notes
1	TCEI screw fastening shock absorber counterplate to RH frame bracket	M10x30	1	50 Nm (36.88 lbf ft)	-
2	Flanged nut fastening Trellis to frame side panels	M12	4	80 Nm (59 lbf ft)	-
3	Flanged TE screw fastening chain roller bracket to LH plate	M8x35	1	25 Nm (18.44 lbf ft)	Loctite 243
4	Flanged TE screw fastening chain roller to chain roller bracket	M8x45	1	25 Nm (18.44 lbf ft)	Loctite 243
5	Screw fastening chain roller bracket to LH plate	M8x20	1	25 Nm (18.44 lbf ft)	Loctite 243



**C**ENTRE FRAME

pos.	Description	Type	Quantity	Torque	Notes
1	Flanged nut fastening side panels to	M12	3	80 Nm (59 lbf ft)	-
	engine				



## **ENGINE**

pos.	Description	Type	Quantity	Torque	Notes
1	Flanged TE screw fastening pinion	M10x1.25	1	50 Nm (36.88 lbf ft)	Loctite 270

pos.	Description	Type	Quantity	Torque	Notes
2	TCEI screw fastening Pin to gearbox	M6x16	2	12 Nm (8.85 lbf ft)	-
	lever and Gearbox Lever to knurled				
	shaft				
3	LH lock nut for ball joint	M6	1	10 Nm (7.37 lbf ft)	-
4	RH lock nut for ball joint	M6	1	10 Nm (7.37 lbf ft)	-
5	RH ball joint on gearbox control lever	M6	1	10 Nm (7.37 lbf ft)	-
6	Pinion protector fixing screw	M6x12	2	10 Nm (7.37 lbf ft)	-
7	LH ball joint on gearbox control lever	M6	1	10 Nm (7.37 lbf ft)	-
-	Fastener for positive cable on engine	-	1	10 Nm (7.37 lbf ft)	-
-	TE screw fastening negative cable to	M6x12	1	10 Nm (7.37 lbf ft)	-
	engine				

## **Vehicle preparation**

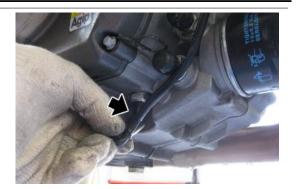
- Remove the battery.
- Remove the fuel tank.
- Remove the water radiator and oil radiator.
- Remove the air filter box.

## See also

Fuel tank Removing the radiator

Engine oil cooler Air box

> Disconnect the engine oil pressure sensor connector.

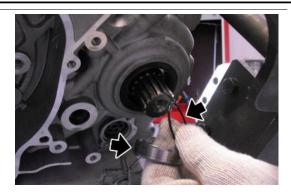


- Disconnect the starter motor power supply cable.
- Remove the ABS control unit and disconnect the control unit connector.





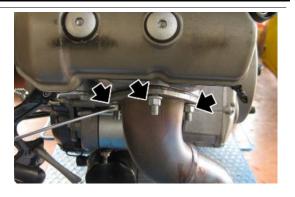
 Slide out bushing and O-ring from gearbox secondary shaft.



• Disengage the spring.



 Unscrew and remove the three nuts from the front exhaust manifold



 Disengage the spring joining the central exhaust manifold to the rear exhaust manifold.



 Remove the front exhaust manifold, moving the central exhaust manifold.



Unscrew and remove the catalytic converter mounting screw



- Unscrew and remove the three nuts from the rear exhaust manifold.
- Remove the exhaust manifold.



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

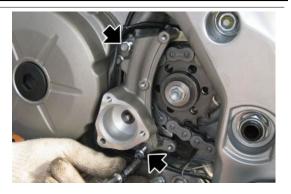




 Undo and remove the two screws and remove the pinion protection case.



 Unscrew and remove the two clutch support screws.



 Disconnect the side stand sensor connector.



Disconnect the gear in neutral sensor connector.



- Slacken the gearing chain tension.
- Unscrew and remove the screw; collect the washer and the spacer.
- Slide off the pinion from the chain and remove.





 Loosen the screw and slide off the gear transmission connecting rod keeping it linked to the gear shift lever through the rod.



## Removing the engine from the vehicle

- Carry out the operations described under Vehicle preparation.
- Support the engine by means of belt and hoist.
- Working on the left side, unscrew and remove the three nuts.



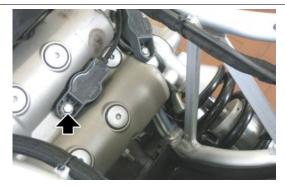




## See also

Vehicle preparation

- Unscrew and remove the rear coil fixing screws.
- Slide out the rear coils.





• Slide off the rear top pin and collect the washer.



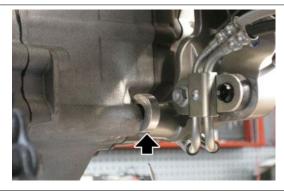
 Remove the two spacers. The thinner spacer is on the right.



 Slide off the rear bottom pin and collect the washer.



 Remove the bottom spacer on the right side.



 Slide off the front pin and collect the washer.



Remove the bottom spacer on the right side.



- Unscrew and remove the screw.
- Release the ground points.



 Unscrew and remove the two screws of the ECU.





- Move the ECU aside but keep it connected to the wiring harness.
- Loosen the two clamps.





 Lift the throttle body but keep it connected to the wiring harness.



 Disconnect the engine temperature sensor from the front cylinder.



• Disconnect the alternator connectors.





- Disconnect the throttle body and fasten it using an elastic band.
- Unscrew and remove the screws, sliding out the front coils.



Lower the engine and take it out of the chassis.



## Installing the engine to the vehicle

- Place the engine on a suitable lower stand.
- Lift the engine.
- Place the engine so that the rear attachments on the chassis are aligned.

- Working on the right side, insert the three bolts with their washers.
- Working on the right side, place the spacers on the three bolts between the engine block and the chassis.

#### CAUTION

THE SPACERS HAVE DIFFERENT SIZES. REFIT THEM IN THE SAME WAY THEY WERE BEFORE BEING REMOVED.







- Working from the left side, tighten the three nuts.
- Release the engine from the belt and the hoist.
- Refit the pinion and restore the gearing chain clearance.
- Reconnect the electric connections and clamp the cable harnesses.
- Carry out the vehicle preparation operations but in reverse order, restore the correct level of all fluids and carry out the adjustments that may be required.







See also

Vehicle preparation Adjusting

# **INDEX OF TOPICS**

Engine	ENG
--------	-----

 Use the special plate to duly support the engine during the servicing operations.

#### CAUTION

TAKE PARTICULAR CARE TO ENSURE THAT THE ENGINE AND ENGINE MOUNTING ARE STABLE AND ENSURE THAT THE ENGINE IS SECURELY FASTENED TO THE MOUNTING PLATE.

## Specific tooling

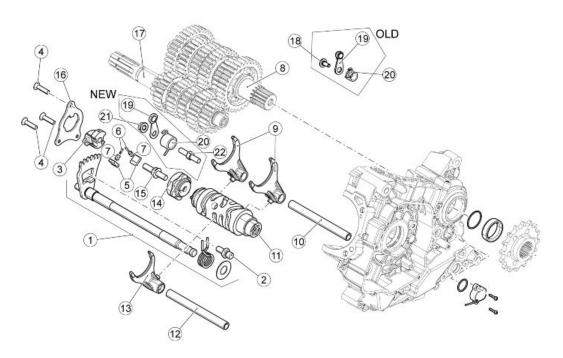
020710Y Engine plate

AP8140187 Engine support stand



## **Gearbox**

## **Diagram**



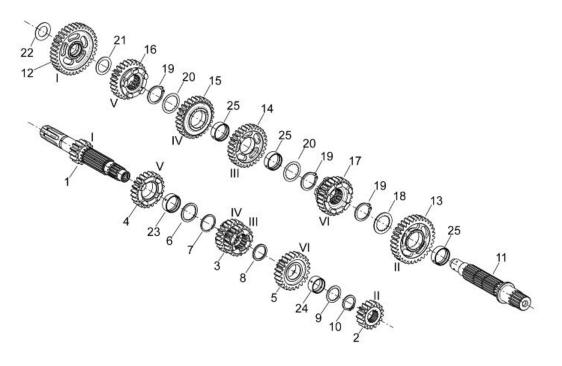
## Key

- 1. Complete gear shaft and spring
- 2. Selector lock
- 3. Selector sprocket wheel
- 4. M5x16 Screw
- 5. Sprocket wheel pawl
- 6. Spring
- 7. Pin for spring

- 8. Complete transmission gear shaft
- 9. Forks
- 10.Fork shaft
- 11.Gear selector
- 12.Fork shaft
- 13.Fork
- 14.Gear selector drum
- 15.M8x1.25 threaded pin
- 16. Selector locking plate
- 17. Complete main gear shaft
- 18.TE flanged screw, M6x15
- 19.Complete index lever
- 20.Spring
- 21.Nut
- 22. Threaded pin

## **Gearbox shafts**

## Gearbox shafts diagram



### key:

1. Main gear shaft Z=14

- 2. 2nd gear on primary Z=17
- 3. 3rd 4th gear on secondary Z=20/22
- 4. 5th gear on primary Z=23
- 5. 6th gear on primary Z=24
- 6. Thrust washer
- 7. Circlip
- 8. Thrust washer
- 9. Thrust washer
- 10.Circlip
- 11.Transmission shaft
- 12.1st gear on primary Z=36
- 13.2nd gear on secondary Z=32
- 14.3rd gear on secondary Z=30
- 15.4th gear on secondary Z=28
- 16.5th gear on secondary Z=26
- 17.6th gear on secondary Z=25
- 18.Thrust washer
- 19.Circlip
- 20.Thrust washer
- 21.Thrust washer
- 22.Thrust washer
- 23. Floating bushing
- 24. Floating bushing
- 25. Floating bushing

## Disassembling the gearbox

- Open the crankcase halves.
- Slide off the gearbox lubrication diffuser pipe.
- Remove the two bolts of the forks.







## See also

# Splitting the crankcase halves

 Slide off the desmodromic drum control.



Remove the three gear selection forks.

## CAUTION

SIZE.

THE MAIN SHAFT FORK IS SMALLER THAN THOSE OF THE SECONDARY SHAFT.
ALL THE SECONDARY SHAFT FORKS ARE THE SAME





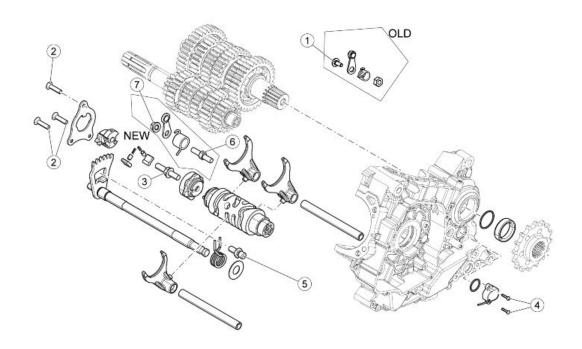
- Carefully rotate the engine support.
- Carefully slide off the whole gear unit.



 Repeat the removal operations but in reverse order.



## **Gear selector**



## **G**EAR SELECTOR

pos.	Description	Type	Quantity	Torque	Notes
1	Gear retainer pawl fastener screw	M6	1	12 Nm (8.85 lb ft)	Loctite dry loc 2040
2	Selector plate fastener screw	M5	3	5.50 Nm (4.06 lb ft)	3M SCOTCH GRIP
					2353
3	Screw fastening Desmodromic se-	M8	1	20 Nm (14.75 lb ft)	3M SCOTCH GRIP
	lector drum / Selector sprocket				2353
4	Gear sensor fastener screw	M5	2	5.50 Nm (4.06 lb ft)	Loctite 270
5	Selector pin fastener onto clutch side	M10x1.5	1	16 Nm (11.80 lb ft)	Loctite 242
	crankcase half				
6	Gear retainer pawl fastener pin	-	1	11-13 Nm (8.11-9.59 lb	-
				ft)	
7	Gear retainer pawl fastener flanged	-	1	10-12 Nm (7.38-8.85 lb	-
	nut			ft)	

## Removing the gear selector

Remove the clutch.

Remove the selector shaft.



## See also

### Disassembling the

clutch

Collect the washer.

NOTE

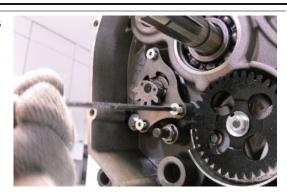
REPLACE THE WASHER ON EVERY SERVICING



Heat the screws of the gearbox selector mounting plate.



 Unscrew and remove the three screws fastening the gearbox selector mounting plate.



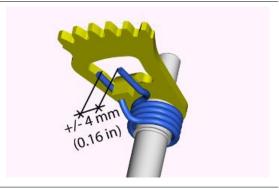
Remove the plate complete with selector



# Checking the gear selector

### **Selector spring**

In the position shown, ensure that the gap between spring ends is +/- 0.4 mm (0.016 in), compared to the same gap measured at the corresponding teeth.



#### **Pawl**

Make sure that both pawl tips run free, without jamming



# Reassembling the gear selector

#### CAUTION

ON REASSEMBLY, ENSURE THAT THE REFERENCE MARKS ON GEARBOX SHAFT AND SELECTOR SPROCKET ARE ALIGNED



#### CAUTION

QUALORA SIA NECESSARIO SOSTITUIRE GLI ELEMENTI DI FISSAGGIO DELLA LEVA INDEX, ACCERTARSI DI ORDINARE I COMPONENTI CORRETTI. ESISTONO DUE VERSIONI NON INTERCAMBIABILI TRA LORO.

### **Gearbox Selector Shaft**

#### Removal

 Place the left hand crankcase in a press and extract the roller cage with the specific tool.

#### NOTE

REPEAT THE SAME OPERATION FOR THE RIGHT HAND CRANKCASE HALF.

#### Specific tooling

020724Y Gear control rod roller cage punch

#### **INSTALLATION**

 Place the left hand crankcase in a press and install the roller cage with the specific tool.

### CAUTION

TO INSTALL THE ROLLER CAGE IN THE RIGHT HAND CRANKCASE HALF, WORK WITH THE CYLINDER ON THE SIDE OF THE 1 mm (\*) STEP ON THE TOOL TURNED TOWARD THE ROLLER CAGE, WHEREAS TO INSTALL THE CAGE IN THE LEFT HAND CRANKCASE HALF, USE THE CYLINDER ON THE SIDE OF THE 2 mm (\*\*) STEP ON THE TOOL.

### Specific tooling

020724Y Gear control rod roller cage punch







# **Starter motor**

# Removing the starter motor

Disconnect the starter motor power supply cable.

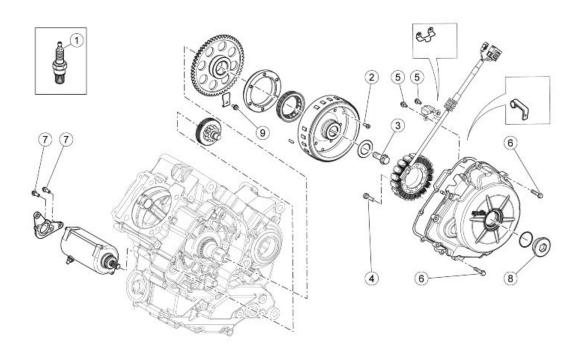


 Unscrew and remove the two screws and remove the starter motor.





# **Generator side**



# **I**GNITION

pos.	Description	Type	Quantity	Torque	Notes
1	Spark plug	-	4	11 Nm (8.11 lb ft)	-
2	Freewheel Ring fastener screw	M6	6	14 Nm (10.33 lb ft)	3M SCOTCH GRIP
					2353
3	Screw fixing rotor - Crankshaft - (12	M12x1.25	1	130 Nm (95.88 lb ft)	-
	mm - 0.47 in)				
3	Screw fixing rotor - Crankshaft - (14	M12x1.25	1	190-200 Nm	-
	mm - 0.55 in)			(140.14-147.51 lb ft)	
4	Screw fastening Stator / Flywheel	M6	3	9 Nm (6.64 lb ft)	-
	Cover				
5	Screw fastening pick-up / Flywheel	M5	2	3.50 Nm (2.58 lb ft)	Loctite 270
	cover				
6	Flywheel cover fastener screw	M6	10	13 Nm (9.59 lb ft)	-
7	Screw fastening starter motor brack-	M6	4	6.86-7.84 Nm	Loct. 242
	et to motor and crankcase			(5.06-5.78 lb ft)	
8	Crankshaft access cap	-	1	4 Nm (2.95 lb ft)	-
9	Retainer plate fastener screw	M6	1	8 Nm (5.90 lb ft)	3M SCOTCH GRIP
					2353

# Removing the flywheel cover

Remove the flywheel cover inspection cap.



• Unscrew and remove the ten screws.



Remove the flywheel cover using the specific tool.

### **Specific tooling**

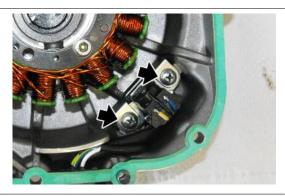
020712Y Handle for Flywheel cover removal



• Collect the gasket and the two dowel pins.

### Removing the flywheel cover components

Remove the two pick-up fixing screws.



Remove the three stator fixing screws.

### CAUTION

THE PICK-UP AND STATOR SHALL BE REMOVED SIMULTANEOUSLY AS THEY ARE PART OF THE SAME ELECTRICAL BRANCH.



# Magneto flywheel removal

- Remove the flywheel cover.
- Unscrew and remove the screw and remove the retention plate.



- Heat the magneto flywheel with the specific heater.
- Lock the flywheel using the specific tool and loosen the screw.

### Specific tooling

020713Y Flywheel extractor



- Screw the anticlockwise bolt of the special tool on the external body.
- Keeping the external body blocked and gripping the key, screw the anticlockwise bolt so as to remove the flywheel from the crankshaft.



### Specific tooling

### 020713Y Flywheel extractor

- Unscrew and remove the anticlockwise bolt of the special tool from the external body.
- Unscrew the screw from the crankshaft.

### Specific tooling

### 020713Y Flywheel extractor

Remove the flywheel together with the freewheel.



- Remove the start-up transmission gear.
- Check dimensions of the supports of transmission gear on crankcase and cover: the limit is 12.005 mm (0.4726 in) for both supports
- In case of malfunction, the start-up transmission gear cannot be overhauled. Therefore, the complete transmission gear should be replaced.



Collect the crankshaft woodruff key.



### Freewheel removal

- Remove the flywheel.
- Remove the freewheel gear.



- Heat the magneto flywheel with the specific heater.
- Unscrew and remove the six screws.
- Remove the bearing retainer and bearing from the magneto flywheel.



### See also

Magneto flywheel removal

# Installing the flywheel

 Insert the woodruff key on the crankshaft.



 Insert the start-up transmission gear after applying a layer of grease.



- Insert the flywheel on the crankshaft.
- Screw the screw together with the washer but without tightening.



- Place the appropriate tool for locking the flywheel.
- Locking the flywheel in position, using the specific tool, tighten the screw on the crankshaft.

### **WARNING!:**

TO APPLY THE CORRECT TIGHTENING TOR-QUE, CHECK THE MEASUREMENT OF THE SCREW THAT MAY BE M12 OR M14.

Remove the special tool.



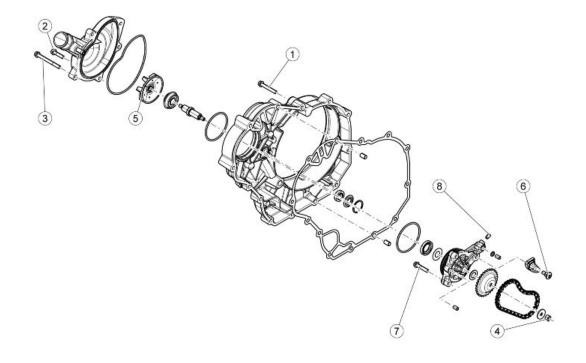
# Specific tooling

# 020713Y Flywheel extractor

- Place the retention plate.
- Tighten the screw.



# Clutch side

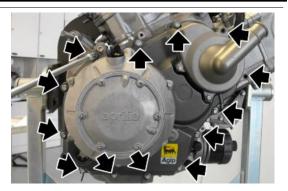


## WATER PUMP

pos.	Description	Type	Quantity	Torque	Notes
1	Clutch side cover fastener screw	M6	11	13 Nm (9.59 lbf ft)	-
2	Fastener screw for Pump Cover /	M6	3	13 Nm (9.59 lbf ft)	-
	Clutch side cover				
3	Screw fastening Pump Cover /	M6	2	13 Nm (9.59 lbf ft)	-
	Clutch Cover / clutch side crankcase				
	half				
4	Nut fastening water pump drive gear	M6	1	12 Nm (8.85 lbf ft)	-
	sprocket				
5	Water pump rotor	-	1	4.50 Nm (3.32 lbf ft)	-
6	Screw fastening chain tensioner slid-	M6	1	8-10 Nm (5.90-7.38 lbf	-
	er to water pump			ft)	
7	Water pump support fixing screw	M6	3	12 Nm (8.85 lbf ft)	-

pos.	Description	Type	Quantity	Torque	Notes
8	Water pump support plug	M6x10	1	6.5 Nm (4.79 lbf ft)	3M SCOTCH GRIP
					2353

 Unscrew and remove the thirteen screws in a cross pattern (the two screws also retaining the water pump cover are longer than the other eleven ones).



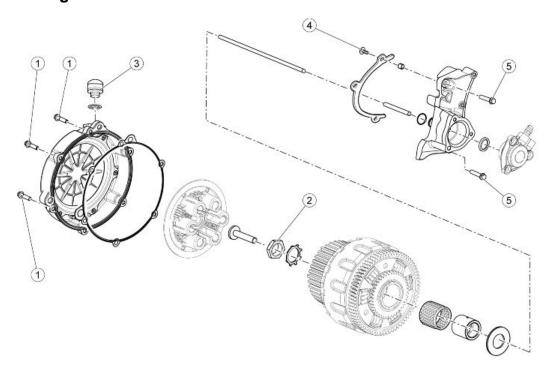
- Drain the engine oil.
- Detach clamp retaining water pump pipe.



Collect the gasket.



# Removing the clutch cover



# **C**LUTCH COVER

pos.	Description	Type	Quantity	Torque	Notes
1	Screw fastening Clutch Cover / inter-	M6	6	13 Nm (9.59 lbf ft)	-
	mediate Clutch side cover				
2	Clutch fastener nut	M24x1	1	170 Nm (125.38 lbf ft)	Chamfer
3	Fastening oil filler plug on Clutch cov-	-	1	2 Nm (1.48 lbf ft)	-
	er				
4	Screw fastening fixing Plate / Clutch	M5	3	5.50 Nm (4.06 lbf ft)	Loctite 242
	control Mounting				
5	Screw fastening clutch control	M6	2	8 Nm (5.90 lbf ft)	-
	mounting on flywheel side crankcase				
	half				

- Unscrew and remove the six perimeter fastener screws.
- Remove the clutch cover.
- Remove the gasket



Removing the clutch cover alone is only recommended when replacing the clutch plates. When removing the entire clutch assembly, removing the clutch side cover is recommended.

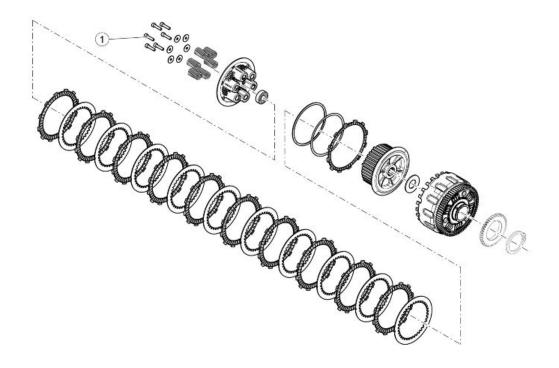
However, removing the entire clutch assembly is possible by removing the clutch cover alone. In this case, proceed as follows:

- measure the projection of the clutch housing from the crankcase before disassembling;
- when refitting, check that the projection has not changed before tightening the clutch nut. If the projection has changed, rotate the crankshaft to correctly engage the engine oil pump drive gear on the clutch housing with the oil pump driven gear.





# Disassembling the clutch



<u>O</u> LUTCH						
pos.	Description	Туре	Quantity	Torque	Notes	
1	Clutch spring fastener screw	M6	6	11 Nm (8.11 lbf ft)	-	

- Remove the clutch-side cover.
- Unscrew and remove the six screws by loosening them 1/4 of a turn at a time; operate in stages and diagonally, and retrieve the washers and the clutch springs.



 Remove the thrust plate, the plates and belleville washer.



 Remove the mushroom head clutch control rod.



 Working on the flywheel side, push the clutch control rod so that it comes out on the other side.



Remove the clutch control rod.



 Fasten the clutch housing using the specific tool.

# Specific tooling 9100896 Clutch housing locking tool



 Unscrew and remove the clutch hub nut.



• Remove the washer to be chamfered.



• Remove the clutch hub.



 Collect the washer between the clutch hub and the housing.



• Collect the clutch housing.



 Collect the spacer and the needle bearings.



 Collect the special shim featuring two thicknesses.

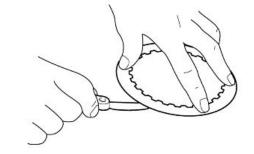


# Checking the clutch plates

 Lay the friction discs and steel discs on a level surface and check them for cracks and potential distortions.

# Maximum distortion allowed: 0.20 mm (0.0079 in)

 Measure the driving plate thickness at four positions, replace them all if not complying with specifications.



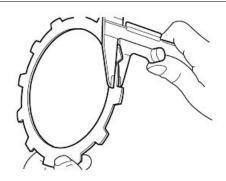
#### CAUTION

THE STEEL DISCS MUST SHOW NO SCORES OR TEMPERING COLOUR.

 Measure the thickness of the clutch plates at four positions, replace them if not complying with specifications.

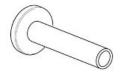
Minimum thickness of the eleven driving plates (individually): 2.75 mm (0.11 in).

Minimum thickness of the ten driven plates (individually): 2,75 - 2,85 mm (0.108 ÷ 0.112 in).



#### **MUSHROOM VALVE CHECK**

- Check if the valve slides freely, without jamming.
- Blow compressed air into the valve and check that the lubricating oil passage holes open.



# Checking the clutch housing

- Remove the clutch bell.
- Remove the seeger ring.



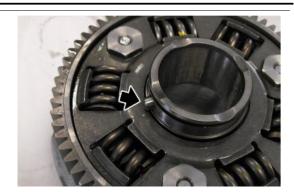
Remove the oil pump control gear.



UPON REFITTING, THE GEAR COLLAR MUST ALWAYS BE FACING THE CLUTCH BELL.



 Remove the rotation locking pin from the oil pump control gear.



Check the clutch bell for damage and wear that may result in clutch irregular operation. Deburr the teeth or replace the bell.

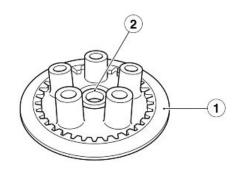
### MAIN DRIVEN GEAR CHECK

Check the main driven gear for damage and wear and, if necessary, replace the main transmission driving gear and the clutch bell all together.

Make sure there is not excessive noise during operation; if necessary, replace the main transmission driving gear and the clutch bell all together.

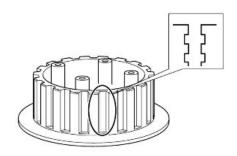
# Checking the pusher plate

Check the thrust plate and the bearing for damage and wear. If necessary, replace the parts.



# Checking the clutch hub

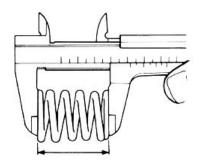
Check the clutch hub for damage and wear that may result in clutch irregular operation. If necessary, replace the bell.



# **Checking the springs**

- Check the springs for damage and, if necessary, replace the them all together.
- Measure the clutch spring length when unloaded; if necessary, replace the springs all together.

Clutch spring length when unloaded: 69.2 + -5 mm (2.72 + -0.2 in)



# Assembling the clutch

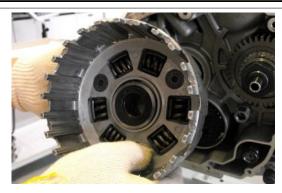
• Fit the shim washer.



• Fit the needle bearing and the spacer.



- Fit the clutch housing.
- Make sure that the oil pump control drive gear of the clutch housing engages correctly with the oil pump driven gear.



 Place the washer correctly between the clutch housing and the hub.



Position the clutch hub.



- Fit the clutch-side cover.
- Check that the measurement has not changed compared with the one carried out upon removal; tighten the clutch nut afterwards. If the projection has changed, rotate the crankshaft to correctly engage the engine oil pump drive gear on the clutch housing with the oil pump driven gear.



- Fit the washer and a new clutch hub nut.
- Tighten the clutch hub nut using the specific tool.

### Specific tooling

9100896 Clutch housing locking tool



Tighten the nut and proceed to caulk.

#### CAUTION

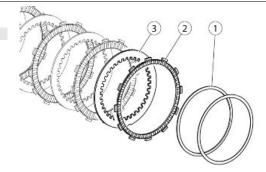
BE CAREFUL WITH THE CUPPED RING FITTING SIDE; THE RING CONE SHALL BE DIRECTED TOWARDS THE ENGINE.



Insert the cupped ring (1).

#### CAUTION

BE CAREFUL WITH THE CUPPED RING FITTING SIDE; THE RING CONE SHALL BE DIRECTED TOWARDS THE ENGINE.



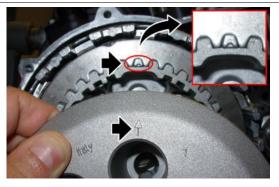
- Fit the lathed driven disc (2).
- Fit the nitrided steel disc (3).
- Fit the clutch plates. Start with the friction material discs and alternate with steel discs.
- Position all friction material discs with their teeth aligned in one of the long slots of the clutch housing.
- Place the control rod.



Place the thrust plate.

### CAUTION

ENSURE TO ALIGN THE ARROW ON THRUST PLATE WITH THE MACHINED REFERENCE ON HUB.



- Fit the clutch springs.
- Fit the screw washers.
- Tighten the six screws operating in stages and diagonally.



On reassembly, replace the gasket under clutch cover.

# Installing the clutch cover

### **CLUTCH-SIDE COVER OIL SEAL INSTALLATION**

- For controlled driving of the oil seal, take a 0.5 mm (0.020 in) thick washer, having an inside diameter of 12 mm (0.47 in) and outside diameter of 20 mm (0.79 in).
- Prepare the following tools:

### Specific tooling

020376Y Adapter handle

020362Y 12 mm guide

### 020891Y Adapter 25 mm (0.98 in)

 Assemble the tool using the washer for controlled driving then, paying attention to the assembly direction, set the oil seal in its seat, with marking facing the operator.



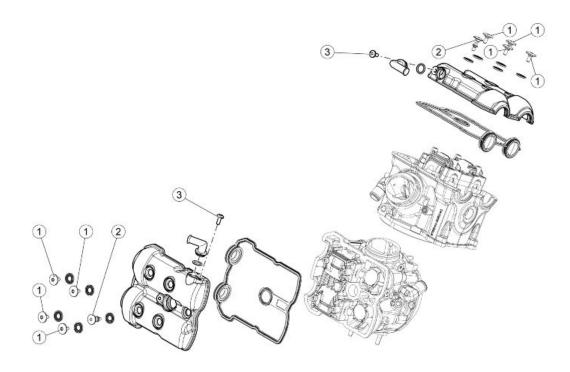
 Place the oil seal retainer with its flat side resting against the oil seal.



Position the retainer ring.

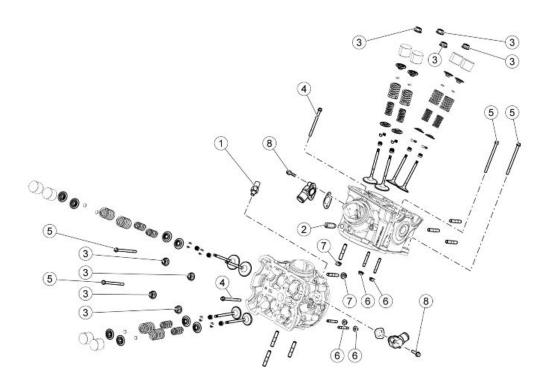


# Heads



# HEAD COVER

pos.	Description	Type	Quantity	Torque	Notes
1	Special screw for fastening head	M6	8	9 Nm (6.64 lbf ft)	-
	cover				
2	Special screw for fastening head	M6	2	9 Nm (6.64 lbf ft)	-
	cover				
3	Oil breather fastener screw	M6	2	5.50 Nm (4.06 lbf ft)	-
-	Spark plugs	-	2	10-12 Nm (7.38-8.85 lbf	-
				ft)	



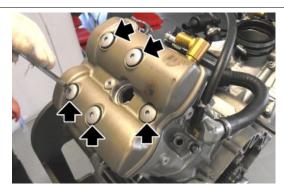
<u>Head</u>

pos.	Description	Type	Quantity	Torque	Notes
1	Water Temperature Sensor	M12x1.5	1	22 Nm (16.22 lbf ft)	-
2	Threaded plug for water sensor seat	M12x1.5	1	10 Nm (7.38 lbf ft)	Loctite Drise AL 506
3	Head stud bolt fastener nut - pre- tightening	M10x1.25	8	10 Nm (7.38 lbf ft)	Lubricate the threads before tight-
					ening
3	Head stud bolt fastener nut - tighten-	M10x1.25	8	13 Nm (9.59 lbf ft) +	Lubricate the
	ing			135° + 135°	threads before tight-
					ening
4	Fastener for Head / Cylinder / Outer	M6	2	12 Nm (8.85 lbf ft)	-
	side crankcase				
5	Fastener for Head / Cylinder / Inner	M6	4	12 Nm (8.85 lbf ft)	-
	side crankcase				
6	Nut fastening Stud Bolts / Head	M6	4	12 Nm (8.85 lbf ft)	-
7	Nut fastening Stud Bolts / Head	M8	2	26 Nm (19.18 lbf ft)	-
8	Bleed union fastener screw	M5	4	5.50 Nm (4.06 lbf ft)	Loctite dry loc 2040

### Head cover removal

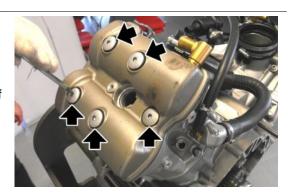
The operations described below are valid for both heads.

- Unscrew and remove the five screws and collect the rubber rings.
- Remove the head cover.



### **HEAD COVER FITTING**

- Installation operations apply to both head covers.
- Ensure gasket is in good conditions. If required, change it and use a gasket having the same features.
- Fit the cover.
- Fit the rubber blocks in their seats.
- Start and tighten the five screws to the prescribed torque working diagonally and in stages.



### Front head

# Removing camshafts

- Remove the head cover.
- Unscrew and remove the two screws.
- Remove the coolant fitting.



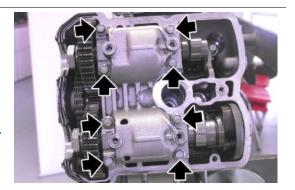
• Disconnect the coolant breather pipe.



#### See also

Head cover removal

- Remove the cap from flywheel cover.
- Turn the crankshaft until the front cylinder piston reaches the TDC (combustion).
- Unscrew and remove the eight cam tower screws working in a diagonal sequence and in stages.



- Remove the cam tower.
- Remove the camshafts with the gears.



# Inspecting camshafts

#### **CAMSHAFT TOOTHED WHEEL CHECK**

Check that the camshaft gear works properly: if it is damaged or does not move smoothly,
 replace the timing chain and the camshaft gear.

### **CAMSHAFT LOBES**

- Check that they do not show blue colouring, cracks or scratches; otherwise, replace the camshaft, gear and chain.
- Remove the exhaust camshaft.
- Position the camshaft on a vice featuring protective shoes.
- Unscrew and remove the screw and collect the washer.



 Remove the decompression device housing.



 Remove the counterweight and decompression device with the relevant spring.



- To refit, engage spring on decompression device and preload it by one turn.
- Install the counterweight and engage the preloaded device to it.
- Tighten the counterweight fixing screw.



# Installing camshafts

The camshaft refitting procedure is described in the "Timing" section.

### See also

**Timing** 

### Front head removal

- Remove the clutch assembly.
- Unscrew and remove the screw and collect the washer and the internal spring.



- Unscrew and remove the two screws.
- Remove the chain tensioner and collect the gasket.

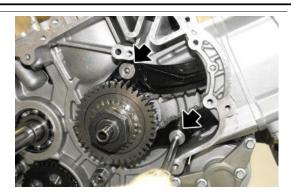


• Remove the camshafts with the gears.

### See also

Removing camshafts Disassembling the clutch

> Unscrew and remove the two chain slider screws.



- Unscrew and remove the chain intermediate gear pin.
- Pay attention to avoid damaging the Oring



- Remove the primary gear following the explanation given on crankcase opening.
- Remove the mobile chain slider.



- Remove the primary gear following the explanation given on crankcase opening
- Remove the intermediate gear with chain.

#### NOTE

IT IS ADVISABLE TO MARK THE CHAIN IN ORDER TO ENSURE THAT THE INITIAL DIRECTION OF ROTATION IS MAINTAINED.

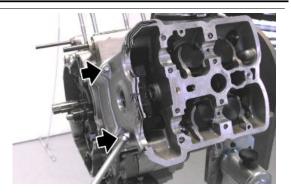


#### See also

Splitting the

crankcase halves

 Unscrew and remove the two external head fixing screws.



 Unscrew and remove the external screw on the flywheel side.

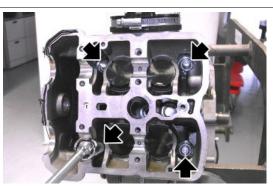


 Unscrew and remove the three bottom head fixing nuts.

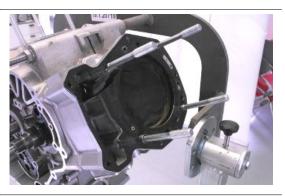




 Unscrew and remove the four nuts, proceeding in stages and in a diagonal pattern.



- Slide head off the stud bolts.
- Remove the gasket between the head and the cylinder.



• Rimuovere il pattino catena fisso.



### Front head check

Using a round scraper, clean off any carbon deposits in the combustion chamber.

### CAUTION

DO NOT USE A POINTED INSTRUMENT TO AVOID DAMAGING OR SCRATCHING THE SPARK PLUG THREADS OR THE VALVE SEATS.

- Check that cylinder head is not damaged or scratched; replace it if necessary.
- Check that there are no mineral deposits or rust in the cylinder head water cooled jacket;
   remove them if necessary.
- Check that the tappet covers and the camshaft toothed wheel cover are not damaged or worn; replace the defective part(s).

### Rear head

# Removing camshafts

• Remove the head cover.



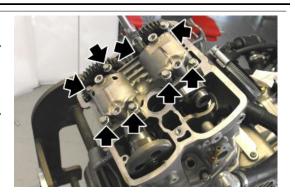
- Unscrew and remove the two screws.
- Remove the coolant fitting.



### See also

### Head cover removal

- Remove the cap from flywheel cover.
- Rotate the crankshaft until the rear cylinder piston reaches the TDC.
- Unscrew and remove the eight cam tower screws working in a diagonal sequence and in stages.



Remove the cam tower.



Remove the camshafts with the gears.



# Inspecting camshafts

### **CAMSHAFT TOOTHED WHEEL CHECK**

Check that the camshaft gear works properly: if it is damaged or does not move smoothly,
 replace the timing chain and the camshaft gear.

#### **CAMSHAFT LOBES**

- Check that they do not show blue colouring, cracks or scratches; otherwise, replace the camshaft, gear and chain.
- Remove the exhaust camshaft.
- Position the camshaft on a vice featuring protective shoes.
- Unscrew and remove the screw and collect the washer.



 Remove the decompression device housing.



 Remove the counterweight and decompression device with the relevant spring.



- To refit, engage spring on decompression device and preload it by one turn.
- Install the counterweight and engage the preloaded device to it.
- Tighten the counterweight fixing screw.



# Installing camshafts

The camshaft refitting procedure is described in the "Timing" section.

### See also

**Timing** 

### Rear head removal

- Remove the magneto flywheel.
- Unscrew and remove the screw and collect the washer and the internal spring.



- Unscrew and remove the two screws.
- Remove the chain tensioner and collect the gasket.



Remove the camshafts with the gears.

### See also

### Removing camshafts

### Magneto flywheel removal

 Unscrew and remove the two chain slider screws.



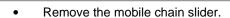
- Unscrew and remove the chain intermediate gear pin.
- Pay attention to avoid damaging the Oring.



- Remove the primary gear following the explanation given on crankcase opening.
- Remove the intermediate gear with chain.

#### NOTE

IT IS ADVISABLE TO MARK THE CHAIN IN ORDER TO ENSURE THAT THE INITIAL DIRECTION OF ROTATION IS MAINTAINED.



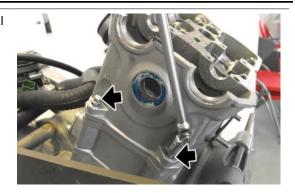




### See also

Splitting the crankcase halves

 Unscrew and remove the two external head fixing screws.



 Unscrew and remove the external screw on the flywheel side.

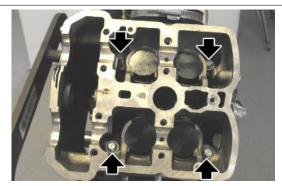


 Unscrew and remove the three bottom head fixing nuts.





 Unscrew and remove the four nuts, proceeding in stages and in a diagonal pattern.



- Slide head off the stud bolts.
- Remove the gasket between the head and the cylinder.



Remove the fixed chain slider.

#### NOTE

ON REASSEMBLY, PERFECTLY CLEAN THE MATING SURFACE OF THE SPECIAL SCREW RETAINING THE IDLE GEAR AND THE THREE TIMING GEARS AND REPLACE THE ALUMINIUM WASHER.



### Rear head check

Using a round scraper, clean off any carbon deposits in the combustion chamber.

#### CAUTION

## DO NOT USE A POINTED INSTRUMENT TO AVOID DAMAGING OR SCRATCHING THE SPARK PLUG THREADS OR THE VALVE SEATS.

- Check that cylinder head is not damaged or scratched; replace it if necessary.
- Check that there are no mineral deposits or rust in the cylinder head water cooled jacket;
   remove them if necessary.
- Check that the tappet covers and the camshaft toothed wheel cover are not damaged or worn; replace the defective part(s).

### **Valves**

### Valve removal

- Remove the head.
- Place the head on supporting surface.
- Number the valves and their bucket tappets in order to position them correctly upon refitting.
- Remove the bucket tappets and the adjustment shims using a magnet.





 Compress the valve springs with the specific wrench and with the spring compressing tool.

### Specific tooling

020382Y Tool for removing valve cotters fitted with part 012

020896Y Bushing for valve removal



• Remove the cotters using a magnet.



- Release the valve springs.
- Remove the valve spring fittings and the springs.



Remove the valves.



### Valve check

#### CAUTION

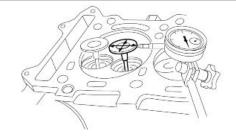
REPLACE THE VALVES ONE AT A TIME. DO NOT MIX THE COMPONENTS. EACH VALVE MUST BE INSERTED INTO ITS SEAT, WHICH IS MARKED PRIOR TO REMOVAL.

#### **VALVE STEM DEVIATION**

Lift up the valve approx. 10 mm (0.39 in) from its seat.

Measure the valve stem deviation in two perpendicular directions and position the dial gauge as shown in the figure.

If the measured deviation exceeds the specified limit, determine if the valve or the guide must be replaced.



### Characteristic

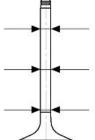
### Valve stem distortion

0.25 mm (0.0098 in)

If the valve stem, when measured with a micrometer, is worn to its limit and the clearance exceeds the specified limit, replace the valve.

If the valve stem lies within the specific limit, replace the valve guide.

Recheck the clearance after replacing the valve or the guide.



### Characteristic

#### Intake valve stem diameter

5.987 - 5.973 mm (0.2357 - 0.2352 in)

### Exhaust valve stem diameter

5.975 - 5.960 mm (0.2352 - 0.2346 in)

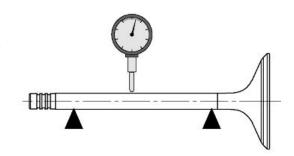
Support the valve with two "V" blocks as shown and check the run-out with a dial gauge.

If the run-out exceeds the specified limit, replace the valve.

### Characteristic

#### Valve stem run-out

0.05 mm (0.0020 in)



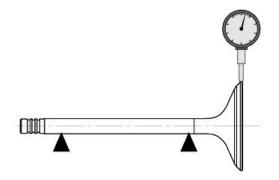
Position the dial gauge at a right angle to the valve head face and measure the eccentricity.

If the eccentricity exceeds the specified limit, replace the valve.

### Characteristic

### Valve head eccentricity

0.03 mm (0.0012 in)

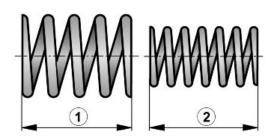


### **Spring check**

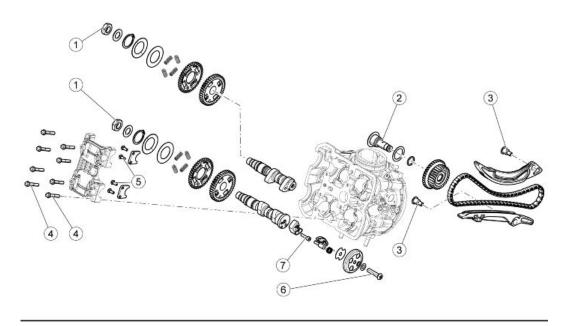
Carry out a measurement and a visual inspection of the valve springs for damage, distortion or loss of tension.

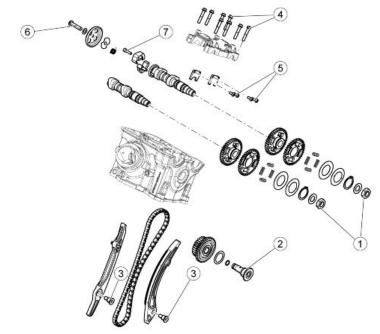
Measure the spring length at release position. Valve springs: minimum wear limit (1) **43.8 mm** (1.724 in).

minimum wear limit (2) 36.7 mm (1.445 in).



### **Timing**





### **TIMING SYSTEM**

pos.	Description	Type	Quantity	Torque	Notes
1	Camshaft gear fastener nut	M15x1	4	90 Nm (66.38 lbf ft)	-
2	Timing drive gear fastener screw	M24x1.5	2	40 Nm (29.50 lbf ft)	3M SCOTCH GRIP
					2353
3	Special screw for fastening mobile /	M8	4	19 Nm (14.01 lbf ft)	3M SCOTCH GRIP
	fixed shoes				2353
4	Cam tower / head fastener screws	M6	16	12 Nm (8.85 lbf ft)	-

pos.	Description	Type	Quantity	Torque	Notes
5	Camshaft retainer plate fastener	torx M5	8	8.5 Nm (6.26 lbf ft)	3M SCOTCH GRIP
	screw				2353
6	Decompression device fixing screw	torx M8	2	28.5 Nm (21.02 lbf ft)	3M SCOTCH GRIP
					2353
7	Fastener screw	M5	2	5.50 Nm (4.06 lbf ft)	3M SCOTCH GRIP
					2353

### Installing the chain tensioner

Refit the removed timing system chain tensioner on the cylinder - head:

- Fit the timing chain on the crankshaft and on the intermediate gear.
- Remove the screw and collect the washer and the spring.
- Fit the chain tensioner body on the cylinder and insert a new paper gasket.
- Tighten the two screws to the prescribed torque.

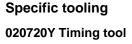


• Insert the spring and tighten the screw together with the washer.

### **Cam timing**

### **Timing**

- Remove the flywheel.
- Install the timing chains on the intermediate gears.
- Install special tool flange on flywheel side crankcase and fasten it using the two screws supplied.

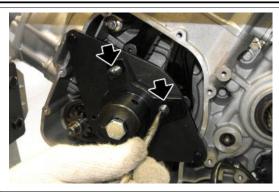




- Fit tool on crankshaft matching the flywheel key.
- Tighten the screw on the crankshaft.
- Turn crankshaft until the tool "V" is positioned at the front cylinder.



• Tighten the two pins of the tool.

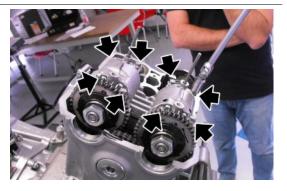


- Screw without tighten the nuts on camshaft gears.
- Install the camshafts on front head, aligning them using the suitable pins.

### Specific tooling 020719Y Timing pin



 Fit cam tower and tighten the eight screws working in a diagonal sequence and in stages.



Pre-tighten the gear nut on the camshaft.



REFIT THE NUT WITH THE MACHINED SURFACE FACING THE GEAR (THE MATERIAL ACRONYM SHOULD BE VISIBLE).

### Locking torques (N\*m)

Nut fixing camshaft gears (pre-tightening) - M15x1 (4) 30 Nm (22.13 lb ft)

• Remove the two pins.



 Unscrew and remove the eight fixing screws and remove the cam tower.



 Remove both camshafts, lock them on a vice with aluminium jaws, then tighten the gear retaining nut to the prescribed torque.



DO NOT TIGHTEN THE CAMSHAFT GEAR NUT TO THE ULTIMATE TIGHTENING TORQUE WITH THE SHAFT MOUNTED ON THE HEAD.

THIS OPERATION WOULD IRRETRIEVABLY DAMAGE THE HEAD.



Nut fixing camshaft gears - M15x1 (4) 90 Nm (66.38 lb ft)



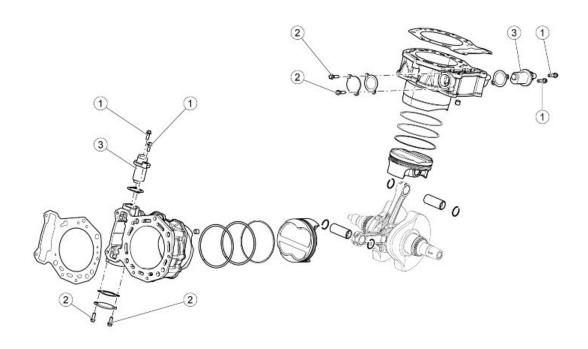
- Release the crankshaft from the specific special tool.
- Rotate the crankshaft in the riding direction until the rear cylinder piston reaches the top dead centre (270°).
- Lock the crankshaft with the specific special tool.
- Carry out the timing operations performed on the front cylinder; please remember that rear camshaft gear nuts are anticlockwise and cam position is divergent.

### Specific tooling



### 020720Y Timing tool

### **Cylinder-piston assembly**



### CYLINDER

Description	Туре	Quantity	Torque	Notes
Chain tensioner fastener screw	M6	4	13 Nm (9.59 lb ft)	-
Cylinder plate fastener screw	M6	4	7.84-9.81 Nm	-
			(5.78-7.23 lb ft)	
Chain tensioner adjustment screw	M6	2	5.50 Nm (4.06 lb ft)	-
	Chain tensioner fastener screw Cylinder plate fastener screw	Chain tensioner fastener screw M6 Cylinder plate fastener screw M6	Chain tensioner fastener screw M6 4 Cylinder plate fastener screw M6 4	Chain tensioner fastener screw         M6         4         13 Nm (9.59 lb ft)           Cylinder plate fastener screw         M6         4         7.84-9.81 Nm (5.78-7.23 lb ft)

### Removing the cylinder

- Remove the head
- Slide cylinder out of stud bolts collecting the base gasket.





### See also

Front head removal

Rear head removal

### Disassembling the piston

- Remove the cylinder.
- Take out the pin locking ring.



- Lock the connecting rod using the specific tool.
- Slide out the pin, using the assembly tool pin, and remove the piston.

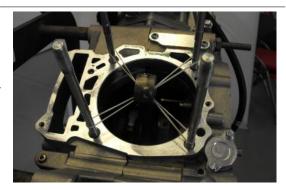
Specific tooling
020716Y Connecting rod locking
020894Y Pin snap ring fitting tool



Lock the connecting rod using circlips.



FOR SAFETY REASONS COVER THE CRANKCASE WITH A CLEAN CLOTH SO THAT THE PARTS DO NOT FALL INTO THE CRANKCASE.



### See also

Removing the cylinder head Removing the cylinder

 Remove the top ring, the intermediate ring and the three oil scraper rings.







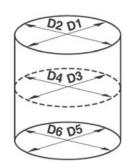
### Checking the cylinder

- All seal surfaces must be clean and flat.
- Make sure all threads are in proper conditions.
- Check cylinder sliding surface for signs of friction and scratches. Also check the seal surfaces for damages.

#### CAUTION

## IF THE GROOVES ON THE CYLINDER LINER ARE EVIDENT, REPLACE THE CYLINDER AND THE PISTON.

- Clean off lime scales on the cylinder cooling slots.
- Measure the cylinder bore at a distance of 10 43 90 mm (0.39 1.69 3.54 in) from the head coupling surface; the highest value should be considered to estimate wear limits.



Cylinder bore (C): 106.000 mm (4.1732 in) C= D1 or D2 max

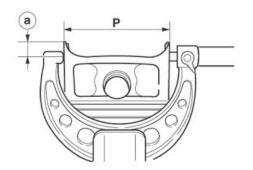
Replace the cylinder, the piston and the piston ring all together if not complying with specifications.

### Checking the piston

- Measure the piston skirt diameter "P" with a micrometer (a=10 mm (0.39 in) from the piston lower border).
- Calculate the clearance between piston and cylinder as follows:

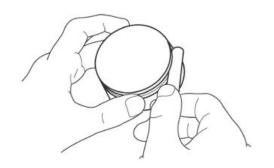
Piston diameter (P): 106.000 mm (4.1732 in)
Piston - cylinder clearance C = C - P
Piston - cylinder clearance: 0.085 mm (0.00335 in)

 Replace the cylinder, the piston and the piston ring all together if not complying with specifications.



#### **PISTON RINGS**

- Clean off any carbon deposits from the grooves in the piston rings and from the rings themselves.
- Measure the piston ring side clearance and replace the piston and the piston rings all together if not complying with specifications.



### Piston ring side clearance:

Top ring (1st slot): with new engine 0.030 - 0.065 mm (0.0012 - 0.0026 in). Wear limit: 0.075 mm (0.0029 in)

Intermediate ring (2nd slot): with new engine 0.020 - 0.055 mm (0.0008 - 0.0022 in). Wear limit 0.065 mm (0.0026 in)

Oil scraper ring (3rd slot): with new engine 0.010 - 0.045 mm (0.0004 - 0.0018 in). Wear limit 0.055 mm (0.0022 in)

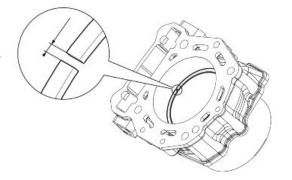
- Fit the piston ring to the cylinder.
- Level the installed piston ring with the piston crown.
- Measure piston ring port and replace it if not complying with specifications.

#### Piston ring end gap:

Top ring: with new engine 0.25 - 0.45 mm (0.0079 - 0.0177 in). Wear limit: 0.65 mm (0.026 in)

Intermediate ring: with new engine 0.35 - 0.60 mm (0.0138 - 0.0236 in). Wear limit: 0.80 mm (0.032 in)

Oil scraper ring: with new engine 0.20 - 0.70 mm (0.0079 - 0.0276 in). Wear limit: 0.90 mm (0.035 in)



### PIN

Clean off combustion residues from the piston crown and from the area above the top ring.

Check for cracks on the piston and for compression on the piston sliding surface (seizing);
 Replace the piston if required.

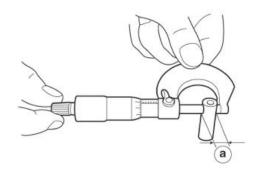
#### CAUTION

#### SMALL STRIATIONS ON THE PISTON LINER ARE ADMISSIBLE.

 Measure the pin outside diameter (a) and if not complying with specifications, replace the pin.

Pin outside diameter: 22.00 - 21.97 mm (0.8661

- 0.8650 in) Limit: 21.96 mm (0.8646 in)



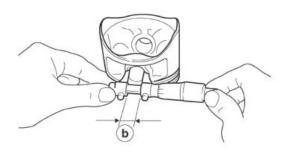
 Measure the pin housing diameter (b) and replace the piston if not complying with specifications.

## Pin housing diameter (b): 22.010 - 22.015 mm (0.8665 - 0.8667 in)

 Calculate the clearance between pin and pin hole and, if not complying with specifications, replace both pin and piston.

Pin - piston clearance: C = b - a 0.010 - 0.045 mm (0.0004 - 0.0018 in)

Limit: 0.060 mm (0.0024 in)



### **CYLINDER-PISTON COUPLING**

Name	Initials	Cylinder	Piston	Play on fitting
Cylinder-piston clear-	Type A - A	105.990 - 105.997 mm	105.928 - 105.935 mm	0.055 - 0.069 mm
ance A - A		(4.1728 - 4.1731 in)	(4.1704 - 4.1707 in)	(0.0022 - 0.0027 in)
Cylinder-piston clear-	Type B - B	105.997 - 106.004 mm	105.935 - 105.942 mm	0.055 - 0.069 mm
ance B - B		(4.1731 - 4.1734 in)	(4.1707 - 4.1709 in)	(0.0022 - 0.0027 in)
Cylinder-piston clear-	Type C -C	106.004 - 106.011 mm	105.942 - 105.949 mm	0.055 - 0.069 mm
ance C - C		(4.1734 - 4.1736 in)	(4.1709 - 4.1712 in)	(0.0022 - 0.0027 in)
Cylinder-piston clear-	Type D - D	106.011 - 106.018 mm	105.949 - 105.956 mm	0.055 - 0.069 mm
ance D - D		(4.1736 - 4.1739 in)	(4.1712 - 4.1715 in)	(0.0022 - 0.0027 in)
NOTE				

### MAXIMUM CLEARANCE AT WEAR LIMIT 0.085 mm (0.0033 in)

### Installing the cylinder

Fit the stud bolts, if previously removed.

#### CAUTION

THE STUD BOLTS SHOULD BE FITTED SO THAT THEY PROTRUDE.

DISTRIBUTE Loctite 270 (high-strength) ON THE THREAD AND SCREW THE STUD BOLT ON THE CRANKCASE UNTIL THEY PROTRUDE BY 137 mm (5.39 in), THEN MAKE SURE THE Loctite HAS SET.

- The piston rings are different and must be installed with the marking at the top.
- Fit the lower oil scraper ring on the piston with the gap turned towards the exhaust side.
- Install the remaining piston rings on the piston, offsetting the gaps in the rings by 90° relative to each other.
- Fit a new retainer ring on the piston.
- Insert piston in the cylinder using the tool.

# Specific tooling 020895Y Piston installation ring





- Install the second pin retainer ring on the tool guide, as shown in the figure.
- Insert tool shaft and push retainer ring inside the guide until reaching the height shown in the figure.
- Fit a new base gasket.
- Fit the piston-cylinder assembly previously assembled on the stud bolts, aligning pin with connecting rod big end.
- Fit the tool in the pin and push shaft to position the retainer ring in its seat.

# Specific tooling 020894Y Pin snap ring fitting tool









### See also

Selecting the base gasket

 Remove the tool and fully push cylinder on the stud bolts.



### Selecting the base gasket

• Temporarily, fit the piston to the cylinder, without base or head gasket.

- Fit a dial gauge on the specific tool.
- Set the dial gauge to zero on a reference surface with a medium preload,
   e.g. 5 mm (0.2 in). Keeping the zero setting, fit the tool on the cylinder and lock it with two nuts (10 Nm 7.38 lb ft) as shown in the figure.



### Specific tooling

### 020714Y Dial gauge mounting

- Rotate the crankshaft up to the TDC (the reversal point of the dial gauge rotation).
- Lock the crankshaft at TDC using the specific tool.
- Calculate the difference between the two measurements: using the chart below, identify the thickness of the cylinder base gasket to be used upon refitting. By correctly identifying the cylinder base gasket thickness, an adequate compression ratio can be maintained
- Remove the specific tool and the cylinder.



### Specific tooling

### 020720Y Timing tool

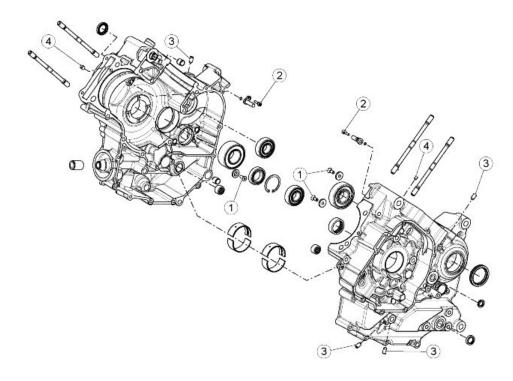
#### BASE GASKET

Specification	Desc./Quantity
Measured protrusion -0.10 / + 0.0 mm (- 0.0039 / 0.0000 in)	Gasket 0.4 mm (0.0157 in)
Measured protrusion 0.05 / 0.10 mm (0.0020 / 0.0039 in)	Gasket 0.5 mm (0.0197 in)
Measured protrusion 0.15 / 0.30 mm (0.0059 / 0.0118 in)	Gasket 0.6 mm (0.0236 in)

### See also

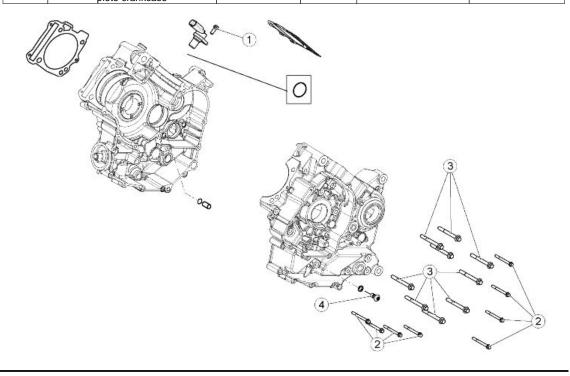
Installing the cylinder

### **Crankcase - crankshaft**



### CRANKCASE 1

pos.	Description	Туре	Quantity	Torque	Notes
1	Bearing retainer fastener screw	M6	3	10 Nm (7.38 lbf ft)	Loctite 270
2	Piston oil jet fastener screw	M5	2	5.50 Nm (4.06 lbf ft)	Loctite 242
3	Tapered plug for crankshaft main	M8x1	4	15 Nm (11.06 lbf ft)	-
	bearing lubrication				
4	Calibrated Brass dowel fixed to com-	M8	2	5.50 Nm (4.06 lbf ft)	-
	plete crankcase				



### CRANKCASE 2

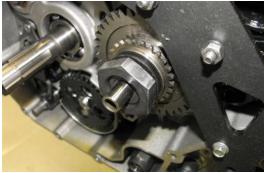
pos.	Description	Type	Quantity	Torque	Notes
1	Engine speed sensor fixing screw	M6	1	13 Nm (9.59 lbf ft)	Loctite 243
2	Screw fastening flywheel side / clutch side crankcase halves	M6	8	13 Nm (9.59 lbf ft)	-
3	Screw fastening flywheel side / clutch side crankcase halves	M8	9	29 Nm (21.39 lbf ft)	-
4	Special calibrated screw for gearbox lubrication	-	1	18 Nm (13.28 lbf ft)	-

### Splitting the crankcase halves

- Fit the special tool, tightly fastening the three screws securing the tool onto the crankcase.
- Unscrew and remove the crankshaft fastener nut anticlockwise using the special tool, retrieving the washer and the water pump drive gear.

### Specific tooling 020850Y Primary gear lock







- Remove the clutch.
- Remove the complete flywheel.
- Remove the selector.
- Remove the starter motor.

- Remove the oil filter.
- Using a heating gun, heat the area shown in the figure then remove the crankshaft gear with a commercially available extractor.





### See also

Disassembling the clutch

Magneto flywheel removal

- Remove the head-cylinder assemblies.
- Remove the gear sensor loosening the two fixing screws.



• Collect the O-ring.



### See also

Removing the cylinder

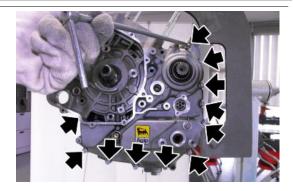
 Unscrew and remove the selector drum fastener screw.



 Unscrew and remove the nine flywheel side M8 screws.



 Unscrew and remove the eleven flywheel side M6 screws.



• Turn the engine into horizontal position.

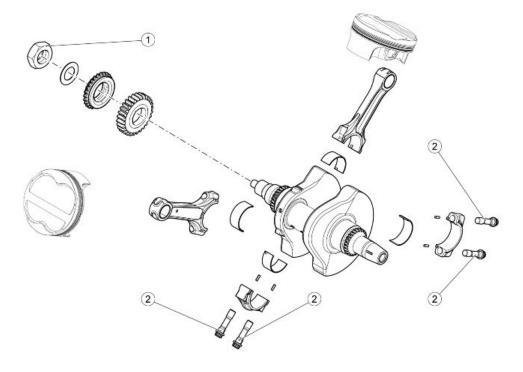
 Unscrew and remove the two engine support nuts.



• Open the crankcase halves.



### Removing the crankshaft



### CRANKSHAFT

pos.	Description	Туре	Quantity	Torque	Notes
1	Crankshaft primary gear fastener nut	M24x1.5	1	300 Nm (221.27 lbf ft)	Anticlockwise nut

pos.	Description	Туре	Quantity	Torque	Notes
2	Connecting rod screw	M10	4	15 + 30 Nm (11.06 +	Lubricate the
				22.13 lbf ft) + $50^{\circ} \pm 2^{\circ}$ ,	threads before tight-
				final control torque 65 -	ening
				78 Nm (47.94 - 57.53 lbf	
				ft)	

- Open the crankcase halves.
- Remove the crankshaft.



#### See also

Splitting the crankcase halves

### Inspecting the crankcase halves

#### **BEARINGS AND OIL SEAL CHECK**

Thoroughly clean the two sections of the crankcase, the ball bearings, the threads of the crankcase fixing screws and the bearing seats with a non-aggressive solvent. Clean the seal surfaces and check that they are not damaged.

### CAUTION

#### TO AVOID DAMAGING BOTH CRANKCASE HALVES PLACE THEM ON A FLAT SURFACE.

Check that both crankcase halves are not cracked or damaged.

Check that all threads are in proper conditions.

Check that all oil seals remaining in their position are not worn or damaged.

Check all ball bearings for clearance, smoothness and potential distortions.

#### CAUTION

#### LUBRICATE BALL BEARINGS WITH ENGINE OIL BEFORE FURTHER CHECKING.

If the internal ring does not rotate smoothly and silently or if there is some noise while it turns, it means that the bearing is faulty and must be replaced.

#### OIL FILTER AND OIL DELIVERY PIPE CHECK

Check the oil filter for damage. If necessary, replace the part.

Clean the oil net with petrol and inspect the net links for potential damage.



CHECK THE ENGINE OIL FILTER O-RING.



### **LUBRICATION CHECK**

 Working on both crankcase halves, remove and thoroughly clean the nozzle that lubricates the piston crown.

REPLACE THE SPRAY NOZZLE O-RING IF NECESSARY.



Replace the O-Rings on oil ducts.





### Before refitting



UPON REFITTING THE CRANKSHAFT, GREASE THE SHAFT BUSHING-CONNECTING ROD COUPLING.

### Inspecting the crankshaft components

### Crankshaft axial clearance check

- The shaft axial clearance on the crankcase should be checked with a dial gauge mounted on the specific dial gauge support.
- The clearance should be between 0.1
   0.26 mm (0.0039 0.0102 in).
- If the clearance is beyond tolerance, check the reference surfaces.

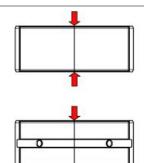


### Specific tooling

### 020714Y Dial gauge mounting

### Removal

- Mark the position of the original semi-bushings on the crankcase.
- To reduce the installation force necessary, score an incision approximately
   0.5 mm (0.02 in) deep (without cutting into the steel shell) in each semi-bushing in the area indicated in the figure.



 Remove the bushings with the crankcase cold, using a press and the specific tool and pushing inward from the outside of the crankcase.

# Specific tooling 020726Y Extractor for bushings

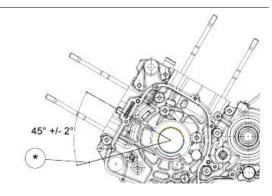


### Installing

 The orientation of the semi-bushings must match the specifications indicated in the drawing as closely as possible.

#### NOTE

WHEN REPLACING THE SEMI-BUSHINGS ALONE, THE NEW COMPONENTS MUST BE THE SAME COLOUR AS THE REMOVED COMPONENTS. IF THE COLOUR OF THE OLD COMPONENTS IS NO LONGER VISIBLE, USE THE TABLE TO IDENTIFY THE CORRECT COMPONENTS, REFERRING TO THE CRANKCASE AND CRANKSHAFT CLASSES.



### Key:

- \* Semi-bushing joint line.
  - Fit the new bushings with the crankcase cold, using a press and the specific tool and pushing outward from the inside of the crankcase, until the punch comes into contact with the crankcase surface.



### Specific tooling

020727Y Punch for bushings

### Assembling the connecting rod

#### CAUTION

TO FIT THE CONNECTING RODS, CHECK THE COUPLING TYPES INDICATED IN THE "CRANK-CASE- CRANKSHAFT CONNECTING ROD" SECTION, IN THE "CHARACTERISTICS" CHAPTER OF THE WORKSHOP MANUAL.

### Installing the crankshaft

- Place the left side crankcase half on the engine support adequately.
- Place the crankshaft on the seat of the crankcase half with caution.



### Refitting the crankcase halves

- Fit the strum box, if previously removed.
- Tighten the two strum box fixing screws.



- Turn the engine support into horizontal position.
- Place the left crankcase half on the engine support, fitting it on the engine support plate pins.

#### CAUTION

## TAKE PARTICULAR CARE TO ENSURE THAT THE ENGINE AND ENGINE MOUNTING ARE STABLE AND ENSURE THAT THE ENGINE IS SECURELY FASTENED TO THE MOUNTING PLATE.

- Install the complete gearbox assembly and the gearbox lubrication diffuser pipe, checking O-ring conditions.
- Apply black sealing paste (Threebond) on the left crankcase half.

#### CAUTION



BE CAREFUL NOT TO APPLY THREEBOND IN EXCESS AS IT MAY BLOCK OIL DUCTS THROUGH THE CRANKCASE HALVES.



 Place the right crankcase half with the aid of a rubber hammer.



• Tighten the two fixing pins.

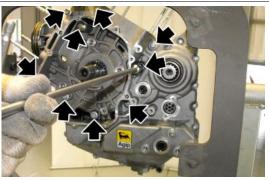




- Rotate the engine and the engine support into vertical position.
- Working on the left side, place the eleven M6 screws fixing the crankcase.



- Working on the left side, place the nine
   M8 screws fixing the crankcase.
- Tighten all the crankcase fixing screws, both M6 and M8 type.



 Tighten the two screws fixing the selector drum.



• Fit a new O-ring in the seat.



 Position the gear sensor and screw the two fixing screws.



- Refit both head-cylinder assemblies.
- Position the crankshaft gear.



 Fit the special tool, tightly fastening the three screws securing the tool onto the crankcase.

### Specific tooling 020850Y Primary gear lock

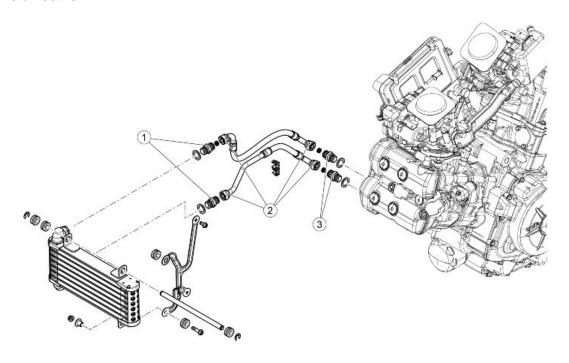


 Position the water pump drive gear, the washer and crankshaft fastener nut and tighten it to the specified torque.





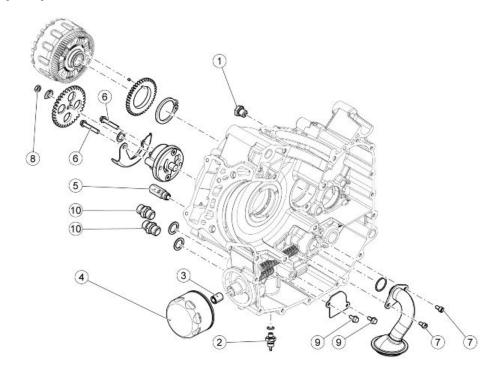
### Lubrication



### OIL RADIATOR

pos.	Description	Type	Quantity	Torque	Notes
1	Fastening nipple to oil radiator	M16x1.5	2	20 ± 3 Nm (14.75 ± 2.21 lb	-
				ft)	
2	Oil radiator tubes fastening	M16x1.5	4	15 ± 2.25 Nm (11,06 ± 1.66	-
				lb ft)	
3	Fastening nipple to engine	M16x1.5	2	42 ± 6.3 Nm (30.97 ± 4.64	-
				lb ft)	

### Oil pump



OIL PUMP

pos.	Description	Type	Quantity	Torque	Notes
1	Oil drainage plug	M16x1.5	1	19 Nm (14.01 lbf ft)	-
2	Fastening oil sensor on clutch side crankcase half	-	1	13 Nm (9.59 lbf ft)	-
3	Fastening oil filter union on clutch side crankcase half	-	1	20 Nm (14.75 lbf ft)	-
4	Oil filter	-	1	14 Nm (10.33 lbf ft)	-
5	Oil pressure regulator valve	M18x1.5	1	42 Nm (30.98 lbf ft)	-
6	Oil pump fixing screw	M6	2	5-6 Nm (3.69-4.42 lbf ft)	3M SCOTCH GRIP 2353
7	Rose pipe fixing screw	M6	2	12 Nm (8.85 lbf ft)	-
8	Oil pump driven gear fastener nut	M6	1	11 Nm (8.11 lbf ft)	-
9	By-Pass plate fastener screw	M5	2	5.50 Nm (4.06 lbf ft)	Loctite 242
10	Oil cooling radiator nipple	M16x1.5	2	42.5 Nm (31.35 lbf ft)	-

### Removing

- Remove the clutch.
- Bend the chamfering tongue.



 By means of a calliper spanner lock out gear rotation and loosen the nut to remove it.



### See also

Disassembling the clutch

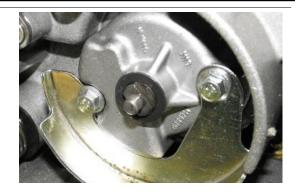
Collect the washer.



Collect the gear.



Collect the spacer.



- Unscrew and remove the two nuts fixing the protection.
- Collect the protection.



Remove the oil pump.



#### Inspection

Undo and remove the two fixing screws.



 Using a thickness gauge check clearance between rotor and stator and replace the rotor / stator unit if necessary.

clearance between rotor and stator:  $0.04 \pm 0.10$  mm (0.0016 in - 0.0039 in).



Slide off the shaft with the cover.



• Collect the lock pin from the shaft.



Remove the oil pump rotor.



Remove the oil pump stator.

#### CAUTION

CHECK THAT THE ROTOR AND STATOR ARE NOT DAMAGED (NO EVIDENT ABRASIONS, SCORES OR ANY OTHER MARKS).



#### Installing

#### NOTE

PAY ATTENTION TO ALIGN THE REFERENCES ON STATOR AND ROTOR DURING INSTALLATION AND CHECK CLEARANCE WITH A FEELER GAUGE.

IF REQUIRED, REPLACE THE STATOR / ROTOR UNIT.





• Fit the oil pump.



• Fit the protection and tighten the two retaining screws.



Fit the spacer.



• Fit the gear.



• Place the washer.



 By means of a calliper spanner lock out gear rotation and tighten the retaining nut.



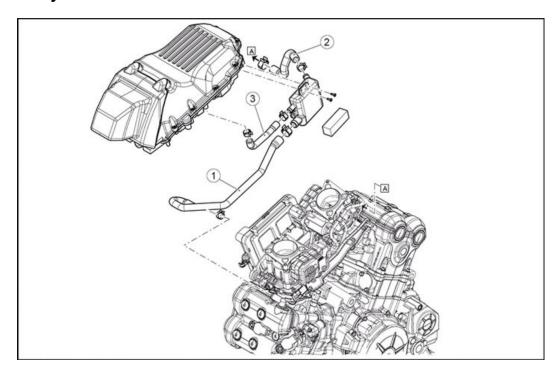
- Bend the chamfering tongue.
- Refit the clutch.



#### See also

Assembling the clutch

#### **Blow-by**



The Blow By system allows for oil vapours to be recycled. The law requires that these gas and oil vapours cannot be released into the atmosphere for environmental reasons. Therefore, there are systems for the recirculation of these gas-oil vapours inside the intake ducts to burn them in the subsequent active phases of the engine. This system separates the engine oil into oil vapour.

The oil vapours coming from the joints (1) and (2), are filtered and enter into the filter box through the joint (4).

### **INDEX OF TOPICS**

POWER SUPPLY

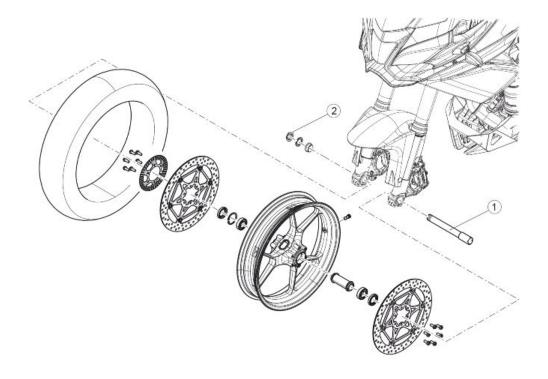
P SUPP

CAPONORD 1200	Power supply
Fuel pump	

### **INDEX OF TOPICS**

Suspensions

#### **Front**



#### FRONT WHEEL

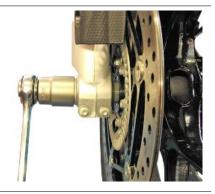
pos.	Description	Type	Quantity	Torque	Notes
1	Wheel axle	-	1	80 ± 12 Nm (59 ± 8.85 lb ft)	-

#### Removing the front wheel

- Hold the vehicle front part.
- Unscrew the screws fixing the front pliers and slide them off the disc.



- Remove the wheel axle fixing nut.
- Retrieve the sealing washer.



 Loosen the screws on the wheel axle clamps.



- Tap the wheel axle slightly with a rubber mallet so that the hole on the opposite side is exposed.
- Remove the wheel axle by inserting a screwdriver in the holes on the pin.
- During extraction, support the wheel and then remove it.



 Collect the spacer from the front wheel right side.



#### Checking the front wheel

#### FRONT WHEEL BEARINGS

Carry out the check with the bearings fitted on the wheel.



#### CHECK THAT ALL PARTS ARE IN GOOD CONDITION, ESPECIALLY THOSE LISTED AS FOL-LOWS.

#### **ROTATION CHECK**

 Manually rotate the inside ring of each bearing. Rotation must be constant, smooth and noiseless.

If one or both bearings do not fall within the control parameters:

Replace both wheel bearings.

#### RADIAL AND AXIAL CLEARANCE CHECK

Check the radial and axial clearance.

Axial clearance: a minimum axial clearance is allowed.

Radial clearance: none.

If one or both bearings do not fall within the control parameters:

Replace both wheel bearings.



### ALWAYS REPLACE BOTH BEARINGS. ALWAYS REPLACE THE BEARINGS WITH OTHERS OF THE SAME TYPE.

#### **GASKETS**

 Check that the gaskets are in good conditions; replace them if they show signs of damage or excessive wear.



# ALWAYS REPLACE BOTH GASKETS. ALWAYS REPLACE THE GASKETS WITH OTHERS OF THE SAME TYPE.

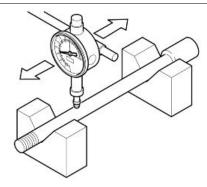
#### **WHEEL AXLE**

 Use a dial gauge to check the wheel axle eccentricity. Replace the wheel axle if the eccentricity exceeds the limit value.

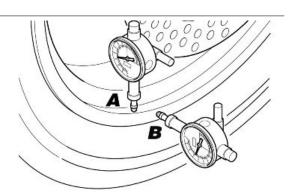
#### Characteristic

#### Maximum eccentricity:

0.25 mm (0.0098 in)



Using a dial gauge, check that the radial (A) and the axial (B) eccentricities of the rim do not exceed the limit value. An excessive eccentricity is usually caused by worn or damaged bearings. Replace the rim if, after replacing the bearings, the value is not within the specified limit.

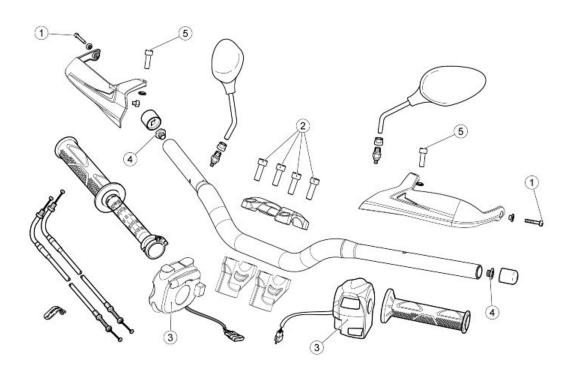


#### Characteristic

Maximum radial and axial eccentricity:

2 mm (0.0079 in)

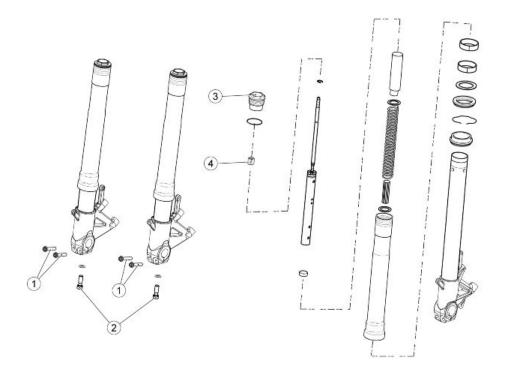
#### Handlebar



#### HANDLEBAR

pos.	Description	Type	Quantity	Torque	Notes
1	TCEI screw fastening counterweight	M6x50	2	10 Nm (7.37 lbf ft)	-
	to handlebar end				
2	Stainless steel TCC screw fastening	M8x25	4	25 Nm (18.44 lbf ft)	-
	upper U-bolt to lower clamp				
3	Screws fastening light switch assem-	-	2+2	1.5 Nm (1.11 lbf ft)	-
	bly				
4	Anti-vibration weight terminal	M18	2	20 Nm (14.75 lbf ft)	-
5	TBEI screw	M6x16	2	12 Nm (8.85 lbf ft)	-

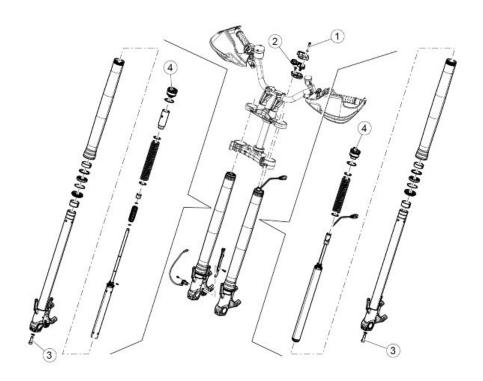
#### Front fork



#### FRONT FORK

Pos.	Description	Type	Quantity	Torque	Notes
1	TEFL screw (fasten onto Fork Hubs)	M6x40	4	10 Nm (7.37 lb ft)	-
2	Screw (Pumping member pin fixing to the stem base)	-	2	30 Nm (22.13 lb ft)	-
3	Upper cover	-	2	20 Nm (14.75 lb ft)	-
4	Upper cover locking nut	-	2	20 Nm (14.75 lb ft)	-

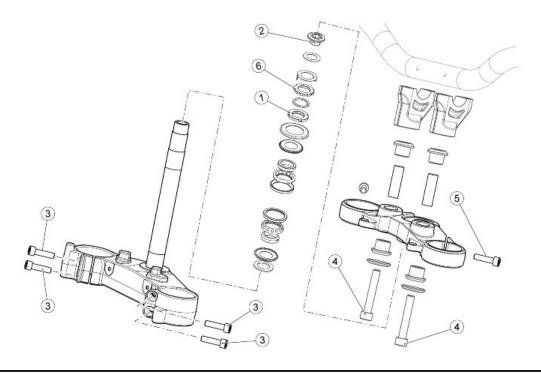
#### **ADD Version**



#### FRONT FORK ADD

Pos.	Description	Type	Quantity	Torque	Notes
1	Sensor upper cover screw	M6x20	1	10 Nm (7.37 lb ft)	-
2	Sensor lower cover screw	M6x12	2	10 Nm (7.37 lb ft)	-
3	Screw (Pumping member pin fixing	-	2	30 Nm (22.13 lb ft)	-
	to the stem base)				
4	Upper cover	-	2	20 Nm (14.75 lb ft)	-

### Diagram

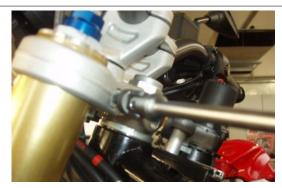


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Pos.	Description	Type	Quantity	Torque	Notes
1	Headstock ring nut - pre-tightening	M25x1	1	60 Nm (44.25 lb ft)	Unscrew after pre- tightening
1	Headstock ring nut - tightening	M25x1	1	50 +/- 5 Nm (36.88 +/- 3.69 lb ft)	-
2	Headstock cap	M22x1	1	100 Nm (73.75 lb ft)	-
3	TCEI screw fastening fork legs to bottom yoke	M8x35	4	25 Nm (18.44 lb ft)	-
4	TCEI screw fastening U-bolt onto fork yoke	M10x60	2	50 Nm (36.88 lb ft)	-
5	TCEI screw fastening fork legs to top yoke	M8x30	2	25 Nm (18.44 lb ft)	-
6	Headstock counter-lock ring	M25x1	1	-	Manually screw

#### Removing the fork legs

- Remove the front wheel.
- Support the stanchion and loosen the screws on the upper and then the lower plate.
- Remove the stanchion.





# FOR THE ADD VERSION, THE PRESSURE SENSOR MUST BE DISCONNECTED BEFORE REMOVING THE LEFT STEM.

 Undo and remove the sensor fixing screw located on the fork head.

#### CAUTION



TO AVOID OIL LEAKAGE FROM THE STEM WHEN REMOVING THE PRESSURE SENSOR, REPLACE IT WITH A CAP. AS AN ALTERNATIVE, DO NOT PLACE THE STEM HORIZONTALLY.





- Undo and remove the sensor base fixing screw located above the fork.
- Disconnect the connector.
- Remove the cable guide, making sure that you do not damage the cable itself.

At this point the stem can be removed from the plate.

#### WARNING

USING APPROPRIATE EQUIPMENT, ACCESS THE SPACE BETWEEN THE CABLE GUIDE AND THE CABLE, THEN LEVERAGE MAKING SURE THAT YOU DO NOT DAMAGE THE CABLE.







#### Disassembling the fork

#### NOTE

THE OPERATIONS DESCRIBED BELOW ARE VALID FOR BOTH STEMS.

 Using the appropriate tool fasten the stem in the vice.

#### Specific tooling

#### **AP8140149 Protection for fitting operations**



 Operating on the upper screw, unload the spring.



 Loosen the cover without unscrewing it completely, using the suitable equipment.

#### Specific tooling

#### 020957Y Key for upper fork nut



#### NOTE

# THE OPERATIONS REPORTED BELOW ARE VALID FOR BOTH CAPONORD 1200 STANCHIONS, AND THE RH STANCHION OF CAPONORD 1200 aDD VERSION.

- Put the stem upright and using the appropriate tool fasten the stem in the vice.
- Completely unscrew the plug.

#### Specific tooling

**AP8140149 Protection for fitting operations** 



- Using the specific tool, fixed to the preloading pipe, compress the spring.
- Insert a spanner in the lock nut of the cover.

# Specific tooling 020888Y Pliers for pre-fill pipe

• Unscrew the cap and remove it.



Remove the spring preload pipe.



• Remove the lock nut and the washer.



 Remove the spring paying attention to drain the oil correctly.



 Drain the oil into a container of suitable capacity to collect fluids.



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



- Discharge the fork, remove the internal dipstick of the pumping member pin (1) and the washer (2).
- Operate repeatedly on the pumping member pin (3) so as to drain completely the oil from inside.



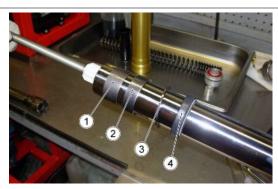
- Slide off the dust scraper from the sleeve using a screwdriver as a lever.
- During this operation, pay attention not to damage the sleeve rim.



Remove the retainer ring.



- Take out the sleeve from the stem using the stem as a hammer puller.
- Remove the fixed bushing (1), the movable bushing (2), the ring (3) and the oil seal (4) from the stem.



- Remove the lock seeger ring of the spring guide.
- Remove the spring guide.



- Using a hook spanner lock the pumping member pin
- Remove the stem bottom screw.

#### **Specific tooling**

020889Y Pumping member ring nut locking spanner



Remove the pumping member pin.



# THE FOLLOWING PROCEDURE APPLIES TO aDD VERSION OF THE LH STEM.

- Using the appropriate tool fasten the stem in the vice.
- Undo completely the sleeve cap using the special tool.

#### NOTE

THE STEMS ARE DIFFERENT.

#### **Specific tooling**

**AP8140149 Protection for fitting operations** 





 Drain the oil into a container of suitable capacity to collect fluids.



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

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



 Unscrew and remove the bottom screw and collect the washer.



• Remove the pumping member pin.



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



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

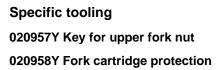


- Remove the fixed bushing (1), the movable bushing (2), the ring (3) and the oil seal (4) from the stem.
- remove the ring and the dust guard.



# THE FOLLOWING PROCEDURE APPLIES TO THE ADD VERSION.

- Lock the pumping member in a vice using the special tool.
- Lubricate the sliding edges with fork oil or sealing grease.
- Using the special key, unscrew the cap and remove the spring.
- Pay attention to place the key in the lower seat of the "lock nut".







• Before removing the cap (1) from the pumping member, the electric cable harness must be released. To do this, loosen the ring nut (2) and remove the sleeve (3) by unscrewing it.





NOTE

DURING THE ASSEMBLY PHASE REMEMBER TO REPLACE THE CABLE GUIDE WITH A NEW ONE.

WARNING

DURING THE REASSEMBLY PHASE TIGHTEN THE RING NUT (2) AND THE SLEEVE (3) TO THE TORQUE 20 Nm (14.75 lb ft)

 Remove the cap from the pumping member and finally the spring.





#### **Checking the components**

#### Stem

Check the sliding surface for scorings and/or scratches.

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

If the scorings are deep, replace the stem.

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

If over the value, replace the stem.

CAUTION

SUSP - 312

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

#### Characteristic

#### **Bending limit:**

0.2 mm (0.00787 in)

#### Sleeve

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

#### **Spring**

Check the spring is in good conditions.

Check that the following components are in good conditions:

· upper bushing;



lower bushing;



• piston.

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

#### CAUTION

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



Replace the following components with new ones:

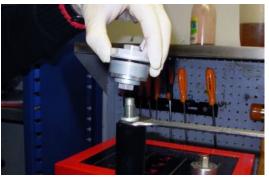
seal ring;



dust gaiter;



O-Ring on the cap.



#### Reassembling the fork

#### NOTE

THE OPERATIONS REPORTED BELOW ARE VALID FOR BOTH CAPONORD 1200 STANCHIONS, AND THE RH STANCHION OF CAPONORD 1200 aDD VERSION.

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



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





 Fit the sleeve on the stem and set the oil seal into position with the aid of the specific tool.

#### Specific tooling

AP8140189 Oil seal fitting tool for Ø 43 mm (1.69 in) orifices

#### **AP8140146 Weight**

• Insert the retainer ring in its position.





Fit the dust gaiter with the specific tool.

#### **Specific tooling**

AP8140189 Oil seal fitting tool for Ø 43 mm (1.69 in) orifices

**AP8140146 Weight** 



Insert the pumping member pin in the stem.



 Using a hook spanner lock the pumping member pin and tighten the fixing screw on the fork end to the prescribed torque.

#### Specific tooling

020889Y Pumping member ring nut locking spanner



- Insert the spring guide and lock it by the appropriate seeger.
- Place the fork vertically.
- Insert the washer.



 Refill the fork with oil according to the prescribed quantity.



Fit the spring.

#### CAUTION

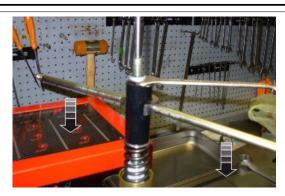
BE CAREFUL WHEN INSERTING THE SPRING SINCE THE COMPRESSED SPIRAL PART MUST BE PLACED DOWNWARDS.



#### See also

#### Filling oil

- Insert the washer that will be supported on the spring
- Insert and hand tighten the nut on the pumping member pin
- Place the preload pipe.
- Tighten the appropriate tool on the pumping member pin rod and keep it raised to allow, inserting a wrench in the nut by compressing the spring.



#### **Specific tooling**

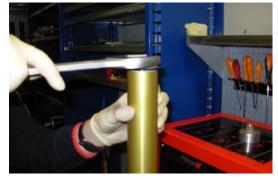
020890Y Pumping member stanchion support rod

AP8140147 Spacer tool

- Tighten the nut as much as possible.
- Insert the cover and tighten until it stops.



- Remove the specific tools.
- Screw the cover in the sleeve to the prescribed torque.



# THE FOLLOWING PROCEDURE APPLIES TO THE ADD VERSION.

- Lock the pumping member in a vice using the special tool.
- Lubricate the sliding edges with fork oil or sealing grease.
- Using the special key, unscrew the cap and remove the spring.
- Pay attention to place the key in the lower seat of the "lock nut".

Specific tooling
020957Y Key for upper fork nut
020958Y Fork cartridge protection



 With the key hold, turn the spring clockwise until the ring nut is fully uncovered and manually tighten the ring nut against the cap.



Insert the key on the ring nut seat.



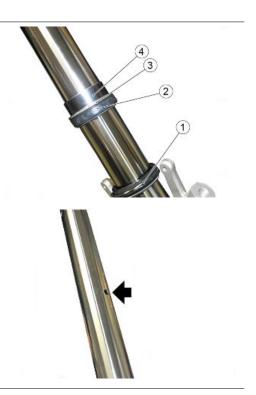
 Using a wrench and the special tool, tighten the cap and the ring nut to the prescribed torque.



Protect the bushing seat with adhesive tape.



- Install first the dust scraper (1), then the oil seal (2), the ring (3) and the movable bushing.
- When inserting the above listed elements, pay attention not to damage them passing over the hole on the stem.



- Remove the adhesive tape.
- Install the fixed bushing on the stem.



 Fit the sleeve on the stem and set the oil seal into position with the aid of the specific tool.

#### **Specific tooling**

AP8140189 Oil seal fitting tool for  $\emptyset$  43 mm (1.69 in) orifices

**AP8140146 Weight** 



Insert the retainer ring in its position.



Fit the dust gaiter with the specific tool.

#### Specific tooling

AP8140189 Oil seal fitting tool for Ø 43 mm (1.69 in) orifices

**AP8140146 Weight** 

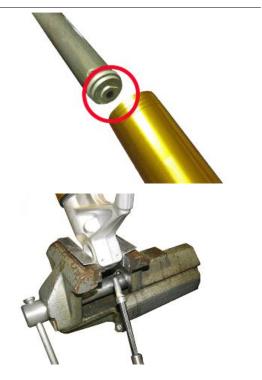


 Fit the pumping member inside the stem, paying attention that it is placed inside the seat of the stem.

#### CAUTION



PAY PARTICULAR ATTENTION TO THE CORRECT INSERTION OF THE PUMPING MEMBER INSIDE THE STEM. IN THE RIGHT POSITION, THE PUMPING MEMBER SHOULD NOT TURN. ALSO DURING THE SCREW TIGHTENING ALWAYS CHECK THAT THE PUMPING MEMBER IS NOT TURNING.



#### Filling oil

- Place the sleeve upright in a vice fitted with protection shoes.
- Compress the sleeve in the stem. Place a support under the stem in order to leave it compressed.

- Pour part of the fork oil into the sleeve.
- Wait some minutes until the oil fills all the ducts.
- Pour the remaining oil.
- Pump out oil a few times.
- Measure the air gap between the oil level and the rim.



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

#### Specific tooling

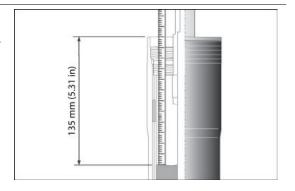
AP8140149 Protection for fitting operations

Oil level: 135 mm (5.31 in) (from the sleeve edge, without a spring and with preload pipe).

#### Characteristic

Fork oil (check also the correct air level in the stem)

441 cm<sup>3</sup> (26.91 cu.in) (for each stanchion)



#### **ADD Version**

Oil level LH stem: 130±2mm (5.12±0.08 in) (from sleeve rim, without spacer spring and total cap).

Oil level RH stem: 120±2mm (4.72±0.08 in) (from sleeve rim, without spacer spring and total cap).

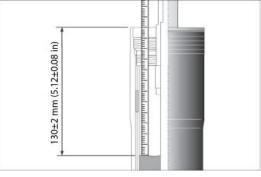
#### Characteristic

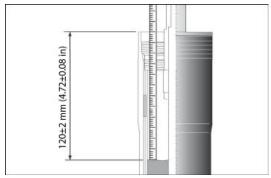
#### Fork oil LH stem

119±5 cm³ (7.26±0.30 cu in) (Fork oil)

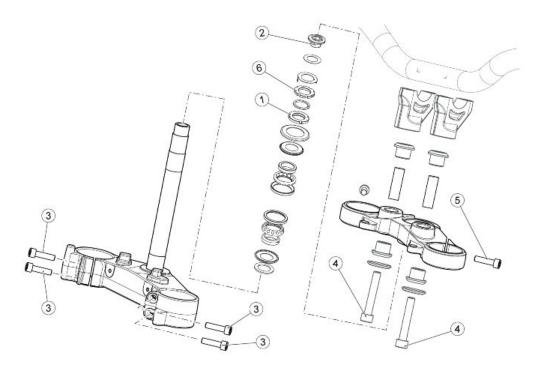
#### Fork oil RH stem

449±5 cm<sup>3</sup> (27.40±0.30 cu in) (Fork oil)





#### Steering bearing



#### **S**TEERING

Pos.	Description	Type	Quantity	Torque	Notes
1	Headstock ring nut - pre-tightening	M25x1	1	60 Nm (44.25 lb ft)	Unscrew after pre-
					tightening
1	Headstock ring nut - tightening	M25x1	1	50 +/- 5 Nm (36.88 +/-	-
				3.69 lb ft)	
2	Headstock cap	M22x1	1	100 Nm (73.75 lb ft)	-
3	TCEI screw fastening fork legs to	M8x35	4	25 Nm (18.44 lb ft)	-
	bottom yoke				
4	TCEI screw fastening U-bolt onto	M10x60	2	50 Nm (36.88 lb ft)	-
	fork yoke				
5	TCEI screw fastening fork legs to top	M8x30	2	25 Nm (18.44 lb ft)	-
	yoke				
6	Headstock counter-lock ring	M25x1	1	-	Manually screw

#### **Adjusting play**

- Place the vehicle so that the front wheel is off the ground.
- Carry out a handlebar rotation test, using a dynamometer at the hand grip external end.
- The handlebar resistance to rotation must be of  $400 \pm 150$  g  $(0.88 \pm 0.33 \text{ lb})$  in both directions.
- Adjust if clearance is detected.

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



 Unscrew and remove the upper plug from steering yoke pin and collect the washer.



 Operating from both sides, loosen the screws fixing the stanchions to the upper plate.

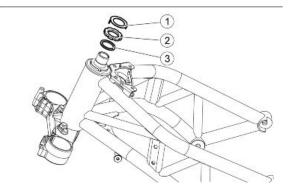


 Undo and remove the two screws fixing the instrument panel support to the fork upper plate.



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

- Straighten the safety plate (1) on the counter-lock ring (2) and remove it from steering yoke pin.
- Take the suitable tool for working on the steering ring nuts.
- Loosen the counter-lock ring (2) and remove it together with the rubber spacer (3) from the steering yoke pin.



#### Specific tooling

#### 020884Y 46 mm wrench for steering ring nut

Carry out the following operations:

- carry out a first tightening of the ring nut to the indicated tightening torque for the settlement of the steering package.
- turn the steering completely from both sides, for several times.

Loosen the ring nut completely.

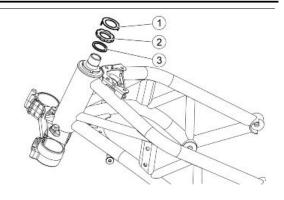
- carry out the final tightening of the ring nut to the indicated tightening torque.



#### **STEERING RING NUT**

pos.	Description	Туре	Qua ntit	Torque	Notes
4	Handata da do marte a un timbia di un	MOT	<u>y</u>	00 No. (44 05 lb	Llandari of the same of the transfer of
1	Headstock ring nut - pre-tightening	M25x1	1	60 Nm (44.25 lb ft)	Unscrew after pre-tightening
1	Headstock ring nut - tightening	M25x1	1	50 +/- 5 Nm (36.88 +/- 3.69 lb ft)	-

- Install the rubber spacer (3).
- Hand screw counter-lock ring (2) until against spacer (3).
- Install a new safety plate (1) and bend it on the ring nuts.



- Fit the entire fork upper plate, adjusting with short taps with a rubber hammer
- Fit the washer and tighten the upper plug to the specified tightening torque.



### **STEERING UPPER PLATE**

pos.	Description	Туре	Quantity	Torque	Notes
2	Headstock cap	M22x1	1	100 Nm (73.75 lb ft)	-
3	TCEI screw fastening fork legs to bottom yoke	M8x35	4	25 Nm (18.44 lb ft)	-
4	TCEI screw fastening U-bolt onto fork yoke	M10x60	2	50 Nm (36.88 lb ft)	-
5	TCEI screw fastening fork legs to top yoke	M8x30	2	25 Nm (18.44 lb ft)	-
6	Headstock counter-lock ring	M25x1	1	-	Manually screw

 Tighten the fixing screws of the upper plate to the prescribed tightening torque.



When refitting the U-bolt, position the two references facing the front part of the vehicle.



### **Assembling**

- Grease the lower and upper bearing rollers
- Prefit the shim, dust gaiter and lower bearing on the steering yoke as shown in the figure.

# Recommended products AGIP MP GREASE Grease for bearings, joints, couplings and linkages

As an alternative to the recommended product, use top brand grease for roller bearings with an operating temperature range of -22°F to +284°F (-30°C to +140°C), drop point between 302°F to 446°F (150°C to 230°C), high corrosion protection qualities and good water and rust resistance.





 Install the upper bearing on the steering yoke pin as shown in the figure, with the conical part facing downward.



- After inserting, the bearing must slide freely on the steering pin till matching with the steering bearing conic in the frame.
- Ensure the bearing mating in its seat, using a teflon buffer from a suitable diameter.



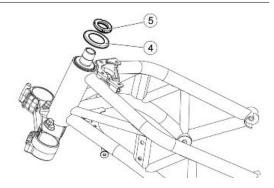
- Fit the specific upper seal ring with the lip placed upwards and the surface with the words downwards.
- Fit it on the pin and place it on the upper rim of the headstock.
- Finish inserting, until the stop, with the teflon buffer and rubber hammer.



 Pass with a brush on the seal ring to lay down potential grease storage.



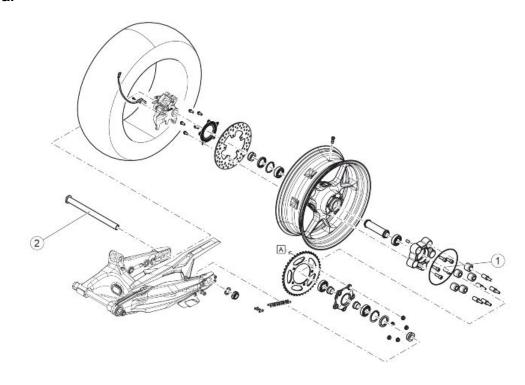
- Install dust gaiter (4) on frame headstock.
- Place the tightening ring nut (5) with the indicated rim placed downwards.
- Carry out the steering bearings clearance adjustment.



#### See also

Assembling

### Rear

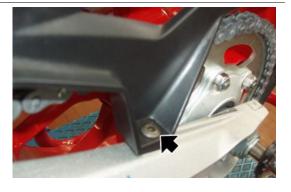


### REAR WHEEL

pos.	Description	Type	Quantity	Torque	Notes
1	Fastening screws flexible coupling	M10	5	•	-
2	Rear wheel axle	-	1	120 ± 18 Nm (88.50 ±	-
				13.27 lb ft)	

### Removing the rear wheel

- Place the vehicle on its rear service stand.
- Fasten the vehicle handlebar to the bench using belts.
- To facilitate operations, it is advisable to remove the chain protection by unscrewing the two screws.





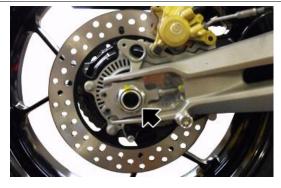
#### CAUTION

# RIMUOVERE IL SENSORE VELOCITA' PRIMA DI PROCEDERE CON LA RIMOZIONE DELLA RUOTA POSTERIORE EVITANDO QUINDI DI DANNEGGIARLO

- Fully slacken the gearing chain tension.
- Make the wheel move forward and release the gearing chain from the sprocket.



- Unscrew and remove the nut on the wheel axle.
- Collect the thrust washer and the right chain tensioner slider.



#### See also

#### Adjusting

- Working on the left side, hit the wheel axle lightly so as to take out the head from its housing.
- Working on the right side, slide off the wheel axle together with the chain guide slider.
- Remove the wheel by freeing the disc from the brake calliper.



- Collect the rear wheel spacer.
- Working from the left side, unscrew and remove the five nuts and remove the sprocket and the bolts.



- Unscrew and remove the five screws and remove the anti-vibration buffer holder.
- Check the flexible couplings according to the routine maintenance table.





#### See also

Adjusting

### Checking the rear wheel



CHECK THAT ALL PARTS ARE IN GOOD CONDITION, ESPECIALLY THOSE LISTED AS FOLLOWS.

#### **REAR WHEEL BEARINGS**

Carry out the check with the bearings fitted on the wheel.

#### **ROTATION CHECK**

 Manually rotate the inside ring of each bearing. Rotation must be constant, smooth and noiseless.

If one or both bearings do not fall within the control parameters:

Replace both wheel bearings.



#### ALWAYS REPLACE BOTH BEARINGS. ALWAYS REPLACE THE BEARINGS WITH OTHERS OF THE SAME TYPE.

Check the radial and axial clearance.

Axial clearance: a minimum axial clearance is allowed.

Radial clearance: none.

If one or both bearings do not fall within the control parameters:

Replace both wheel bearings.

#### **REAR WHEEL GASKETS**

Check that the gaskets are in good conditions; replace them if they show signs of damage or excessive wear.



#### ALWAYS REPLACE BOTH GASKETS. ALWAYS REPLACE THE GASKETS WITH OTHERS OF THE SAME TYPE.

#### **REAR WHEEL AXLE**

Use a dial gauge to check the wheel axle eccentricity (1). Replace the wheel axle if the eccentricity exceeds the limit value (1).



#### Maximum eccentricity:

0.25 mm (0.0098 in)

#### **REAR WHEEL RIM**

Using a dial gauge, check that the radial (A) and the axial eccentricity (B) of the rim (2) do not exceed the limit value.

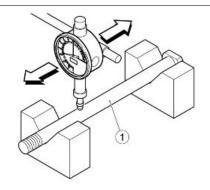
An excessive eccentricity is usually caused by worn or damaged bearings. Replace the rim (2) if after replacing the bearings, the value is not within the specified limit.

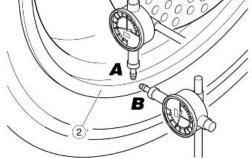


### Characteristic

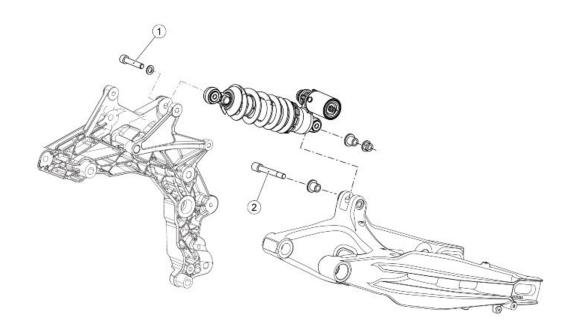
#### Maximum radial and axial eccentricity:

2 mm (0.0079 in)





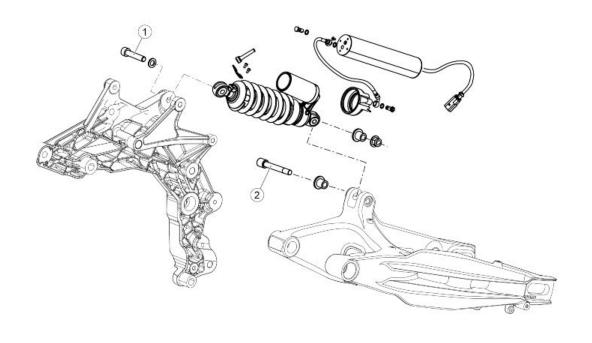
### **Shock absorbers**



### REAR SUSPENSION

Pos.	Description	Type	Quantity	Torque	Notes
1	Upper TCEI mounting screw	M10x50	1	50 Nm (36.88 lb ft)	-
2	Lower TCEI mounting screw	M10x80	1	50 Nm (36.88 lb ft)	-

### **ADD Version**



#### REAR SUSPENSION ADD

Pos.	Description	Туре	Quantity	Torque	Notes
1	Upper TCEI mounting screw	M10x50	1	50 Nm (36.88 lb ft)	-
2	Lower TCEI mounting screw	M10x80	1	50 Nm (36.88 lb ft)	-

### Removing

#### THE FOLLOWING PROCEDURE APPLIES TO THE ADD VERSION

- Disconnect the electric motor connector (1).
- Release the elastic that keeps the electric motor in position.



Unscrew and remove the shock absorber upper fixing screw.



Unscrew and remove the shock absorber lower fixing screw.



Disconnect the shock absorber valve.





 When removing the shock absorber pay attention to the electric motor, it must be removed from the frame taking care not to damage it.

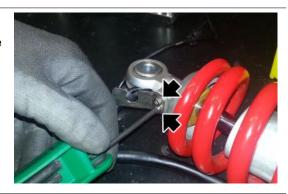


### Revision

 Disconnect the cabling from the support bracket



 After removing the two fastening screws of the support bracket, remove it



 Put the shock absorber in the special tool for the spring compression

#### CAUTION

MAKE SURE NOT TO DAMAGE THE CABLE HARNESS AND THE TUBE BETWEEN THE MOTOR AND THE SHOCK ABSORBER



Compress the shock absorber spring



Remove the retainer ring.



 Discharge the spring and remove the suspension from the specific tool



 Remove the lock plate of the spring making sure not to damage the cable harness



 Remove the spring making sure not to damage the cable harness



#### **BLEEDING**

- It is possible to carry out a bleeding and replace the oil in the suspension using a special pump.
- Loosen the bleeding valve from suspension



• Insert and tighten the special joint



 Connect the tube for the oil bleeding/ filling to the joint



 Connect the tube for the oil bleeding/ filling to the tool



After the bleeding and the oil filling remove the tube from the joints

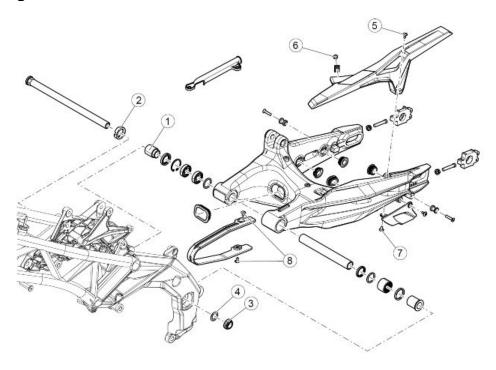


- Remove the joints
- Insert and tighten the screw for bleeding the suspension

# **INDEX OF TOPICS**

CHASSIS

### **Swinging arm**



#### **SWINGARM**

pos.	Description	Type	Quantity	Torque	Notes
1	Swingarm Pin adjustment bushing	-	1	12 Nm (8.85 lb ft)	-
2	Swingarm pin ring nut	-	1	60 Nm (44.25 lb ft)	-
3	Swingarm pin nut	-	1	90 Nm (66.38 lb ft)	-
4	TPSI screw fastening rear stand bushing	M6x40	2	10 Nm (7.37 lb ft)	-
5	TBEI screw fastening chain guard to swingarm	M5x9	1	6 Nm (4.42 lb ft)	Loctite 243
6	TBEI Chainguard fixing screw	M5x9	1	4 Nm (2.95 lb ft)	-
7	TBEI screw fastening chain guide to swingarm	M5x9	2	6 Nm (4.42 lb ft)	Loctite 243
8	Flanged TBEI screw fastening chain slider	M5x9	2	6 Nm (4.42 lb ft)	-

### Removing

- Remove the exhaust system.
- Support the vehicle by means of the engine service stand and a hoist with belts fastened to the rear section of the frame.
- Remove the rear wheel.

Cut the clamp.



 Slide off the rear calliper holding plate, keeping it linked to the brake pipe.

#### CAUTION

DO NOT ACTUATE ON THE REAR BRAKE LEVER AFTER REMOVING THE WHEEL. OTHERWISE, THE CALLIPER PLUNGERS COULD GO OUT OF THEIR SEAT, RESULTING IN BRAKE FLUID LEAKAGE.



- Unscrew and remove the shock absorber lower screw and collect the nut.
- Fasten the shock absorber to the chassis.



 With the specific box-spanner, unscrew and remove the locking ring nut.



 Working from the left side, unscrew and remove the nut and collect the washer.



REMOVAL SHOULD BE CARRIED OUT WITH UTMOST CAUTION.

SUPPORT THE SWINGARM FROM THE FRONT TO AVOID ACCIDENTAL FALLS.

PLACE A WOODEN SUPPORT UNDER THE FRONT PART OF THE REAR SWINGARM TO PREVENT IT FROM LOW-ERING AND TO KEEP IT UPRIGHT.

> Working on the right side, unscrew and remove the swingarm bolt.



UPON REMOVING THE REAR SWINGARM PAY ATTENTION NOT TO JAM THE GEARING CHAIN.





#### See also

Removing the rear wheel

#### **Drive chain**

### Adjusting

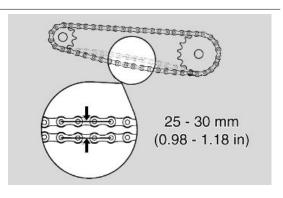
The vehicle is fitted with an endless chain, without master link.

#### NOTE

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

#### To check clearance:

- Shut off the engine.
- Rest the vehicle on its stand.
- Engage neutral gear.
- Check that the vertical oscillation at a point between the pinion and the sprocket on the lower branch of the chain is approx. 25 - 30 mm (0.98 - 1.18 in).



- Move the vehicle forward so as to check vertical oscillation of the chain in other positions too. clearance should remain constant at all wheel rotation phases.
- If clearance is uniform but over 30 mm (1.18 in) or below 25 mm (0.98 in), adjustment is necessary.

#### **ADJUSTMENT**

#### CAUTION

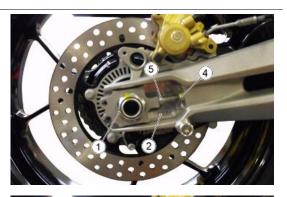
GET A SPECIFIC REAR SERVICE STAND (OPT) TO ADJUST THE CHAIN.

If you need to adjust chain tension after the check:

- Place the vehicle on its rear service stand (OPT).
- Loosen the nut (1) completely.
- Loosen both lock nuts (4).
- Actuate on the adjuster screws (5) and adjust the chain clearance checking that the references (2-3) match on both sides of the vehicle.
- Tighten both lock nuts (4).
- Tighten the nut (1).
- Check chain clearance.

#### CAUTION

TO ENSURE THAT THE WHEEL IS CORRECTLY CENTRED, THERE ARE FIXED REFERENCE MARKINGS (2-3) INSIDE THE CHAIN TENSIONER SLIDER SEATS ON THE SWINGARMS, IN FRONT OF THE WHEEL AXLE.





#### CHECKING THE CHAIN, THE PINION AND THE SPROCKET FOR WEAR

Furthermore, check the following parts and make sure the chain, the pinion and the sprocket do not show:

- damaged rollers;
- loosened pins;
- dry, rusty, flattened or jammed chain links;
- excessive wear;
- missing sealing rings;
- excessively worn or damaged pinion or sprocket teeth.



IF THE CHAIN ROLLERS ARE DAMAGED, THE PINS ARE LOOSE AND/OR THE SEAL RINGS ARE MISSING OR DAMAGED, THE WHOLE CHAIN UNIT (PINION, SPROCKET AND CHAIN) SHOULD BE REPLACED.

LUBRICATE THE CHAIN ON A REGULAR BASIS, PARTICULARLY IF YOU DETECT DRY OR RUSTY PARTS.

FLATTENED OR JAMMED CHAIN LINKS SHOULD BE LUBRICATED AND GOOD OPERATING CONDITIONS RESTORED.



THE GEARING CHAIN HAS SEALING RINGS AMONG THE LINKS THAT KEEP THE GREASE INSIDE.

ADJUST, LUBRICATE, WASH AND REPLACE THE CHAIN WITH UTMOST CAUTION.

#### **CLEANING AND LUBRICATION**

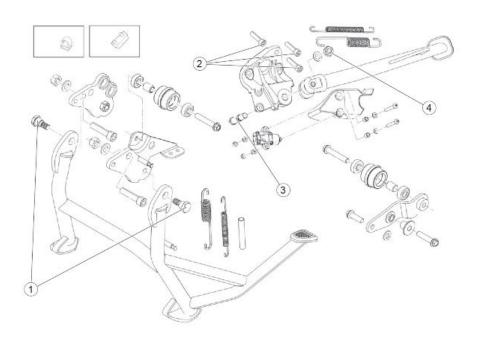
Do not wash the chain with water jets, steam jets, high-pressure water jets and highly flammable solvents.

Wash the chain with fuel oil or kerosene. Maintenance operations should be more frequent
if there are signs of quick rust.

Lubricate the chain at the intervals specified on the routine maintenance table and whenever necessary.

• Wash the chain, allow to dry and lubricate with spray grease for sealed chains.

#### **Stand**



<u>Stand</u>

pos.	Description	Type	Quantity	Torque	Notes
1	Fixing screw protection	M6x16	3	5 ± 1 Nm (3.68 ± 0.74 lb ft)	-
2	Plate fastening screws	M8x30	3	25 ± 5 Nm (18.43 ± 3.68 lb ft)	Loctite 243

pos.	Description	Туре	Quantity	Torque	Notes
3	Stand screw	M10	1	25 ± 5 Nm (18.43 ± 3.68 lb	Loctite 243
				ft)	
4	Stand nut	M10x1.25	1	25 ± 5 Nm (18.43 ± 3.68 lb	Loctite 243
				ft)	

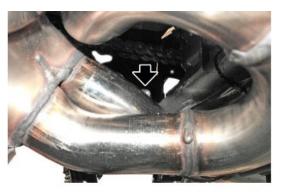
#### **Centre stand**

#### WHERE CONTEMPLATED

 Working on the left side, unscrew and remove the central stand fixing screw.



Working on the left inside, unscrew and remove the central stand fixing screw.



 Working on the right side, unscrew and remove the central stand fixing screw.



• Remove the centre stand.

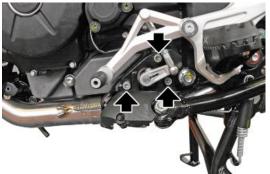


### Side stand

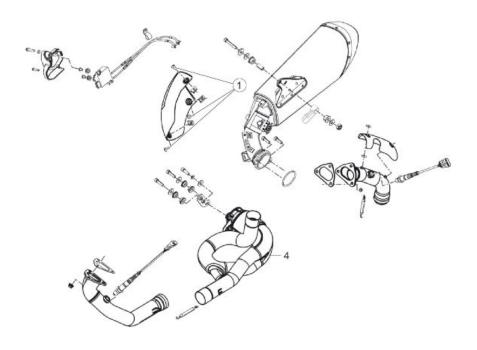
- Remove the gearshift lever first.
- Disconnect the stand sensor.



- Unscrew and remove the three fixing screws.
- Remove the side stand.



### **Exhaust**



 EXHAUST

 pos.
 Description
 Type
 Quantity
 Torque
 Notes

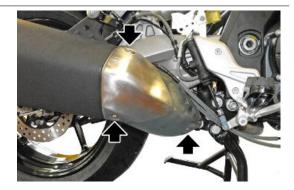
 1
 Fixing screw protection
 M6x16
 3
 5 ± 1 Nm (3.68 ± 0.74 lb ft)

### Removing the tail pipe

- Unscrew and remove the two exhaust valve motor fixing screws.
- Remove the exhaust valve motor.



- Unscrew and remove the three exhaust end cover fixing screws.
- Remove the cover.



- Unscrew and remove the two fixing screws.
- Remove the exhaust end.



### Removing the catalytic converter

- Remove the exhaust end first.
- Unscrew and remove the catalytic converter fixing screw.

#### CAUTION



DURING THE ASSEMBLY AND REFITTING, PAY ATTENTION TO THE GASKET.





• Remove the catalytic converter.



#### See also

Removing the tail pipe

### Removing the exhaust manifold

Disengage the spring.



 Unscrew and remove the three nuts from the front and rear exhaust manifold





 Disengage the spring joining the rear exhaust manifold and the catalytic converter.



- Disconnect the front and rear lambda probe.
- Remove the exhaust manifolds.





### Removing the lambda sensor

 To remove the lambda probe refer to exhaust end removal.



#### See also

Removing the tail pipe

### **Engine oil cooler**

- Remove the fairing lug.
- Drain the engine oil.
- Remove both side fairings.
- Working on the right side, unscrew the two oil pipes.



• Disconnect the horn connectors.



#### See also

### Side body panels

 Working on the left side, unscrew and remove the screw from the front cylinder.



 Remove the seeger ring and slide off the pin.



 Remove the oil radiator together with support and horn.



# **INDEX OF TOPICS**

BRAKING SYSTEM

BRAK SYS

### Interventions rules

#### CAUTION

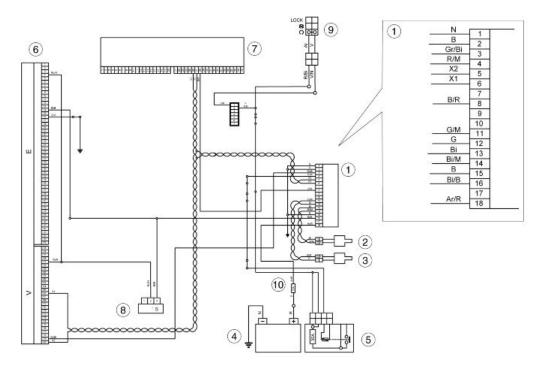
THE FRONT BRAKE DISC SHAPE DOES NOT CHANGE THE OPERATING AND MAINTENANCE SPECIFICATIONS OF THE SYSTEM.

### **ABS**



### **ABS** SYSTEM

pos.	Description	Туре	Quantity	Torque	Notes
-	ABS ECU fastener screw	M6x25	1	10 Nm (7.37 lbf ft)	Loctite 243
-	ABS ECU fastener nut	M6	2	10 Nm (7.37 lbf ft)	-



#### Key:

- 1. ABS ECU control unit
- 2. Front ABS sensor
- 3. Rear ABS sensor
- 4. Battery
- 5. Main fuse
- 6. ECU
- 7. Instrument panel
- 8. K line (diagnosis)
- 9. Key

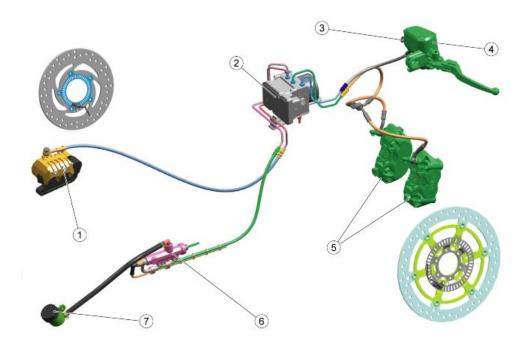
10.ABS control unit fuse

#### ABS ECU control unit pin configuration

- PIN 1 GND Ground
- PIN 2 PCC1 Vehicle identification ground connection
- PIN 3 Speed signal to ECU
- PIN 4 IGN Injection
- PIN 5 CAN H line
- PIN 6 CAN L line
- PIN 8 WL Alarm warning light
- PIN 11 R\_SIGN Rear ABS sensor signal
- PIN 12 R\_GND Rear ABS sensor ground connection

- PIN 13 F\_GND Front ABS sensor ground connection
- PIN 14 F\_SIG Front ABS sensor signal
- PIN 15 PCC2 Vehicle identification ground connection
- PIN 16 ISO\_K K line (diagnosis)
- PIN 18 KL30 Power supply

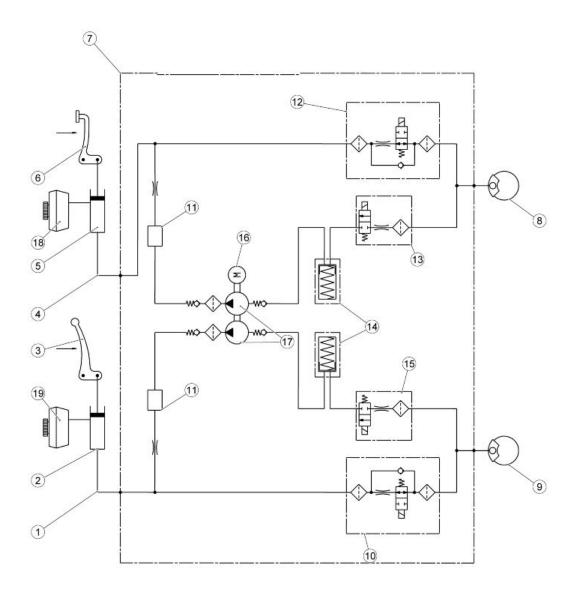
### **Foreword**



#### key:

- 1. Rear brake calliper
- 2. Modulator
- 3. Front bleed valve
- 4. Front brake reservoir
- 5. Front brake callipers
- 6. Rear brake pump
- 7. Rear brake reservoir

### **Operating diagram**



### ABS functional diagram key

- 1. Front system circuit
- 2. Front brake pump
- 3. Front brake lever
- 4. Rear system circuit

- 5. Rear brake pump
- 6. Rear brake pedal control
- 7. ABS control unit
- 8. Rear brake calliper
- 9. Front calliper (2 callipers)
- 10. Front brake circuit intake solenoid valve (normally open)
- 11. Humidifier
- 12. Rear brake circuit intake solenoid valve (normally open)
- 13. Rear brake exhaust circuit solenoid valve (normally closed)
- 14. Rear/front brake circuit low pressure accumulator
- 15. Front brake exhaust circuit solenoid valve (normally closed)
- 16.DC electric motor
- 17. Double circuit hydraulic pump (ABS)
- 18. Rear brake reservoir
- 19. Front brake reservoir

#### **ABS OPERATION**

#### **General specifications:**

The front circuit is similar to the rear circuit.

- The ABS inlet valve (10 12) is normally open and it is closed only when the system intervenes to avoid wheel locking.
- The outlet valve (13 15) is normally closed and it is opened only when the system intervenes to avoid wheel locking.
- When the system is in standby, the ABS processor never stops monitoring the speed of the wheels in order to assess potential wheel slippage.
- When in standby, the system does not intervene at all when the rider brakes; the braking system is the same as the one without ABS.

Stages in ABS cycle (the following operations refer to the front circuit but are also applicable to the rear one):

- A Brake activation: the rider starts braking as he would usually do.
- **B Pressure reduction:** it coincides with danger recognition (wheel slippage above threshold): the system closes the inlet valve (10-12) and opens the outlet valve (13-15) temporarily.

At this stage the rider cannot increase the pressure on the callipers (8-9) and the system reduces the pressure on the callipers partially. The excess fluid temporarily fills the front reservoir (18-19) until the ABS pump (17) self-activates and delivers the fluid back to the brake pump (2-5).

**C - Pressure maintained:** the pressure in the callipers (8-9) remains low until total recovery of speed / wheel grip.

The system restores the fluid taken from the calliper (8-9) in the section of the system between the brake pump (2-5) and the ABS inlet valve (10-12).

**D - Pressure restored:** by opening the inlet valve (10-12) momentarily, the pressure of the callipers (8-9) is increased until maximum deceleration is reached. Then, the system gives the control over the braking back to the rider.

**E** - If the wheel does not reach complete grip, the system continues operating as before until complete grip is obtained or until the vehicle stops. An error can be detected if the duration of the pressure reduction phase exceeds the pre-set time limit.

#### **ABS SYSTEM DESCRIPTION**

The ABS system is a device to avoid wheels locking in case of emergency braking, increasing vehicle braking stability when compared to a traditional braking system.

The ABS system enhances control over the vehicle, taking into consideration never to exceed the physical limits of vehicle grip on the road. The rider is fully responsible for riding at a suitable speed based on weather and road conditions, always leaving an appropriate safety margin. Under no circumstances can the ABS system compensate for the rider's misjudgement or improper use of brakes. Sometimes when the brake is operated, the tyre locks with a consequent loss of grip, which makes it difficult to control the vehicle.

A position sensor (3) on the tone wheel (2), forming an integral unit with the vehicle wheel, "reads" the status of the vehicle wheel spotting any possible lock.

A control unit (1) signals this out and adjusts the pressure in the braking circuit accordingly.

#### CAUTION

WHEN THE ABS STARTS WORKING, A PULSING IS FELT ON THE BRAKE LEVER.



THE WHEEL ANTILOCK SYSTEM DOES NOT PREVENT FALLS WHILE ON A BEND. AN EMER-GENCY BRAKING WITH THE VEHICLE INCLINED, HANDLE BAR TURNED, ON UNEVEN OR SLIPPERY ROADS, OR WITH POOR GRIP CREATES LACK OF STABILITY DIFFICULT TO HAN-DLE. THEREFORE, RIDE CAREFULLY AND SENSIBLY AND ALWAYS BRAKE GRADUALLY. BRAKING WHILE TURNING A CORNER IS SUBJECT TO LAWS OF PHYSICS WHICH NOT EVEN ABS CAN ELIMINATE.



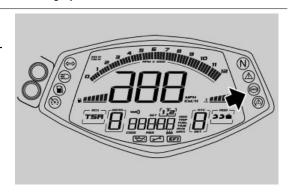
When sensors (3) detect a significant speed difference between the rear and the front wheels (for example, when rearing up on the back wheel), the ABS system could take this as a dangerous situation. In this case, 2 things may occur:

- the ABS system intervenes by releasing pressure from the calliper until the wheel turns again at the same speed of the other wheel; it is not possible to brake for an instant.
- if the speed difference lasts long, the system may detect an error and deactivates the ABS system. As a consequence, the system works as any regular braking system.

#### Riding with an active ABS system

 During the vehicle start-up, after the instrument panel initial check, the ABS warning light stops flashing when the speed is under 5 km/h (3.1 mph).

If the ABS warning light remains on when the vehicle is running, it means that a fault has been detected and the ABS system has been automatically deactivated.

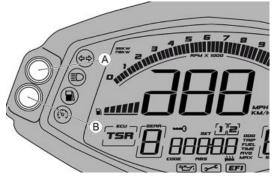




IN CASE OF FAILURE OR WITH ABS DISCONNECTED, THE VEHICLE OPERATES AS IF IT DID NOT HAVE THIS SYSTEM.

#### ABS enable/disable

By short pressing the button "B" move the various functions until the one regarding the ABS appears. To activate or deactivate the system, briefly press button "A", which will either activate or deactivate the system in cycles.



If the system is activated, the ABS warning light will blink.

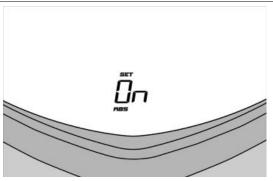
If the system is deactivated, the ABS warning light will stay permanently on.

In both cases, to confirm the selected mode, hold button "B" pressed for a few seconds.

The function will automatically appear after five seconds, if the selection is not made promptly, or when the motorcycle is running.

#### NOTE

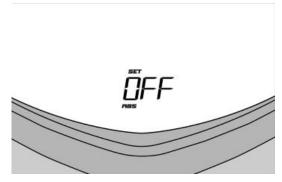
AT KEY ON, IF THE SYSTEM IS FUNCTIONING CORRECTLY, THE ABS INDICATOR LIGHT WILL BLINK (ONCE A VEHICLE SPEED OF 5 Km/h - 3.1 mph IS EXCEEDED, THE



SYSTEM WILL ONLY BE ACTIVE IF THE WARNING LIGHT GOES OFF)

#### NOTE

WHEN THE BIKE'S PANEL IS OFF AND WHEN TURNING IT ON THE NEXT TIME THE ABS SYSTEM IS STILL ACTIVE, REGARDLESS OF WHAT WAS SET PREVIOUSLY.



#### Riding with a deactivated ABS system.

When the ABS system is deactivated, the warning light on the instrument panel turns on permanently.



#### **Guide to diagnosis**

Each time the key is ON, if at least one current or stored\* error of the ABS system is not detected:

• the ABS warning light flashes

#### When the 5 km/h (3.11 mph) are exceeded:

- if errors are not detected
  - the ABS warning light turns off
- if at least one malfunction is detected
  - the ABS warning light turns on permanently

#### 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 according to the type of failure.

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 is still inactive.

#### **Example:**

- error code 5D93 requires some minutes before it is diagnosed during the given time:

• the ABS warning light ABS keeps flashing

#### **ABS FAULTS - GUIDE TO THE DIAGNOSIS**

- 1. ABS WARNING LIGHT ON
- 2. CONNECT P.A.D.S.

#### DOES P.A.D.S. COMMUNICATES? (NO, go to 3; YES, go to 4)

- 3. PERFORM THESE CHECKS:
  - A. Ground connection PIN 1
  - B. +12V at PIN 18
  - C. +12V at PIN 4 with key ON
    - 4. ARE THERE ANY ERRORS? YES, go to point 5; NO, go to 6)
- 5. CONSULT THE ERRORS DISPLAY TABLE
- 6. ABS WARNING LIGHT ACTIVATION

#### ACTIVE?(YES, go to 7; NO, go to 8)

- 7. CONTACT TECHNICAL SERVICE
- 8. PERFORM THESE CHECKS:
  - A. Cable continuity between PIN 8 of the ABS control unit connector and PIN 28 of the instrument panel.
  - B. Check connectors refer to the operations described in the chapter

#### If the previous checks are OK, the causes might be:

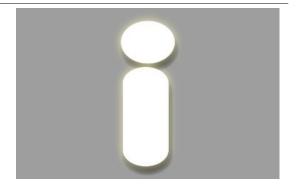
- C. ABS control unit malfunction
- D. Instrument panel malfunction

### Use of diagnostics instrument for ABS system

#### Abs screen pages

# **ECU INFO screen page**

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



#### **INFO ECU SCREEN PAGE**

Characteristic	Value/example	Unit of measure ment	Notes
Vehicle manufacturing date			
Frame number			
Software version			
Vehicle code	Caponord 1200		The vehicle code stored in the control unit is read.
Vehicle identification according to	Norge / Stelvio / Identi-		A different type of vehicle is associated with each
state of Pins 2 and 15	fication provided by ECU		configuration of PIN 2 and PIN 15 connections.
			Possible indications are as follows: Norge / Stel- vio / ID by ECU.
			Configuration with PIN 2 and PIN 15 connected to ground, as is the case with Caponord 1200, provides the following indication: "Identification provided by ECU";
			the ECU also requires a CAN message from the injection ECU in order to determine vehicle ID.

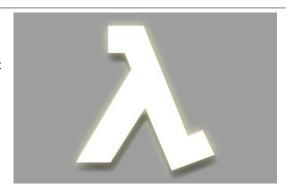
NOTE: the "X" in the table identifies the connector pin is grounded.

\* - CAPONORD 1200 and all motorcycles equipped with ABS control units connected via CAN line

aprilia		PIN2	PIN15
	*	x	Х

# **PARAMETERS** screen page

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



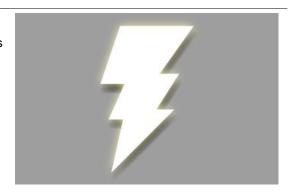
#### **PARAMETERS**

Characteristic	Value/example	Unit of measure ment	Notes
Front wheel speed	0	km/h	With stopped wheel, 0 Km/h is displayed
Rear wheel speed	0	km/h	With stopped wheel, 0 Km/h is displayed

Characteristic	Value/example Unit of measure ment		Notes
Battery voltage	11.9	V	

# **ACTIVATION** screen page

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



### **ACTIVATION**

Characteristic	Value/example	Unit of measure ment	Notes
Front brake bleeding procedure			Useful in case of lever sponginess although the bleeding has been done as in a regular braking system
Rear brake bleeding procedure			Useful in case of lever sponginess although the bleeding has been done as in a regular braking system
ABS warning light			The ABS warning light is made to flash.
Ambient parameter error reading (1)			The ambient parameters are 4: Number of error detections, Operation cycles from the last detection, Battery voltage, Speed.
Ambient parameter error reading (2)			Number of error detections: number of times the error has been detected by the control unit;
Ambient parameter error reading (3)			for example, if it indicates 2, it means that the error has been detected (ATT), then it has not been detected for a while (sent to the MEM) and then it has been detected again.
Ambient parameter error reading (4)			Operation cycles from the last reading: a cycle is counted if the following occurs: key ON and speed over 20 km/h.
Ambient parameter error reading (5)			If for example 5 is shown, it means that the last time the error has been measured was 5 cycles ago.
Error clearing (1)			Press "enter" to transfer errors from the memory (MEM) to the historical record (STO).
Error clearing (2)			At the next connection between diagnostics instrument and the control unit, the historical errors (STO) will no longer appear.

# **ERRORS** screen page

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



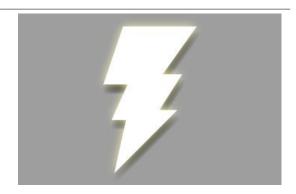
# **ERRORS**

Characteristic	Value/example	Unit of measure ment	Notes
Front speed sensor: 5D90 electric malfunction			Electrical fault in sensor or cable harness
Front speed sensor: 5D91 the signal works irregularly			Faulty sensor or signal interference
Front speed sensor: 5D92 the signal decreases periodically			Possible tone wheel fault due to deformations or dirt; possible alterations on the wheel bearing surface. In very rare cases, abnormal tone wheel vibrations
Front speed sensor: no signal or speed measured too low in relation to the rear wheel 5D93  Front speed sensor: 5D94 no accel-			Faulty sensor or missing sensor/tone wheel or excessive distance between the sensor and the tone wheel or tone wheel with wrong number of teeth Faulty sensor or missing sensor/tone wheel or ex-
eration after pressure reduction			cessive distance between the sensor and the tone wheel
Front speed sensor: 5D95 excessive measured speed			Faulty sensor/tone wheel, or tone wheel with wrong number of teeth or wrong tyre size
Rear speed sensor: 5DA0 electric malfunction			Electrical fault in sensor or cable harness
Rear speed sensor: 5DA1 the signal works irregularly			Faulty sensor or signal interference
Rear speed sensor: 5DA2 the signal decreases periodically			Possible tone wheel fault due to deformations or dirt; possible alterations on the wheel bearing surface. In very rare cases, abnormal tone wheel vibrations
Rear speed sensor: 5DA3 no signal or speed measured too low in relation to the front wheel			Faulty sensor or missing sensor/tone wheel or excessive distance between the sensor and the tone wheel or tone wheel with wrong number of teeth
Rear speed sensor: 5DA4 no acceleration after pressure reduction			Faulty sensor or missing sensor/tone wheel or excessive distance between the sensor and the tone wheel
Rear speed sensor: excessive measured speed 5DA5			Faulty sensor or tone wheel with wrong number of teeth or wrong tyre size
Control unit: missing valve calibration 5DD2			Possible control unit fault
Control unit 5DD3			Possible control unit fault
Recirculation pump 5DF0			Possible control unit fault
Recirculation pump 5DF1			Possible control unit fault
Control unit 5DF2			Possible control unit fault
Low electric voltage - long period measurement 5DF3			Voltage too low measured for 30 seconds at PIN  18 of the ABS control unit:
Control unit 5DF5			Possible control unit fault
High electric voltage 5DF7			Excessive voltage measured at PIN 18 of the ABS control unit
Vehicle code 5E59			This error appears if the control unit detects an inconsistency between its memorised code

Characteristic	Value/example	Unit of measure ment	Notes
			(can be read in the ISO page on the Vehicle code line) and the value detected by the cabling identification PINs
			(can be read in the ISO page Vehicle identification line on the basis of the status of Pins 2 and 15) and, for Caponord 1200, from the CAN signal re- ceived from the injection control unit
Control unit F000			Possible control unit fault

# **SETTINGS** screen page

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



#### **ADJUSTMENTS**

Characteristic	Value/example	Unit of measure ment	Notes
Coding (1)			Used for re-coding the control unit or coding a new one.
Coding (2)			Vehicle identification is done according to the connection of PINS 2 and 15 of the ABS control unit connector and is stored in the control unit memory.
Coding (3)			The identification can be read in the INFO ECU screen page in the line: Vehicle code.

NOTE: the "X" in the table identifies the connector pin is grounded.

\* - CAPONORD 1200 and all motorcycles equipped with ABS control units connected via CAN line

aprilia		PIN2	PIN15
	*	х	х

# **Modulator**

#### **MODULATOR REMOVAL**

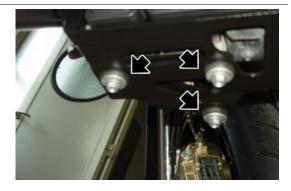
- Remove the fairing lug.
- Release clamp (1) and disconnect connector (2).



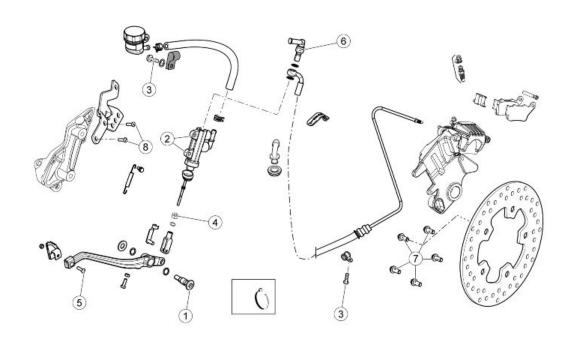
 By unscrewing the nuts, remove and plug the brake oil pipes following this sequence: (3) - (4) - (6) - (5).



- Slide off the rear system pipes from the hooks (7).
- Undo and remove the three screws, collect the washers and remove the ABS modulator.



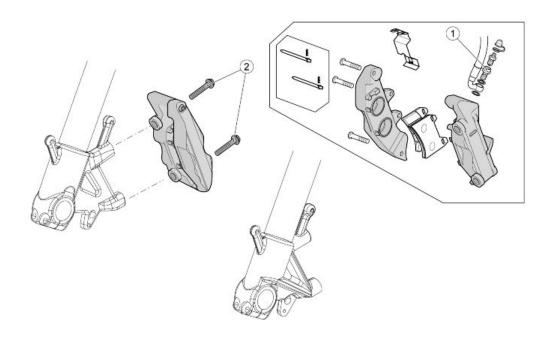
# Rear brake calliper



# REAR BRAKE

pos.	Description	Type	Quantity	Torque	Notes
1	Rear brake lever pin	-	1	10 Nm (7.37 lbf ft)	Loctite 243
2	Flanged TE screw fastening pump to footrest mounting	M6x16	2	10 Nm (7.37 lbf ft)	-
3	TBEI screw fastening oil pipe to swingarm	M5x12	4	8 Nm (5.90 lbf ft)	-
4	Flanged self-locking nut	M6	1	10 Nm (7.37 lbf ft)	-
5	Screw + nut fastening pedal to brake lever	M6	1	10 Nm (7.37 lbf ft)	-
6	Brake pipe union	M10x1	2	25 Nm (18.44 lbf ft)	-
7	Flanged TE screw fastening rear disc	M8x18	5	25 Nm (18.44 lbf ft)	Loctite 243
8	TCEI screw	M6x16	2	12 Nm (8.85 lbf ft)	-
-	Flanged TE screw	M6x16	1	10 Nm (7.37 lbf ft)	-

# Front brake calliper



#### FRONT BRAKE

pos.	Description	Type	Quantity	Torque	Notes
1	Union with breather (fixing pipe to	M10x1	2	25 Nm (18.44 lbf ft)	-
	callipers)				
2	TEFL screw (Fixing calliper to fork	M10x1.25	4	50 Nm (36.88 lbf ft)	Loctite 270
	stems)			·	

# Front brake pads

#### Removal

- Remove the cotter pin.
- Unscrew and remove the pin.
- Collect the anti-vibration springs.
- Extract one pad at a time.

#### CAUTION

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



# Rear brake pads

#### Removal

Remove the cotter pin.



 Remove the pin by sliding it backwards.



Extract one pad at a time.

#### CAUTION

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



# Bleeding the braking system

#### **VEHICLE PREPARATION**

- It is important to check that there is always enough brake fluid in the reservoir.
- Using a bleed device facilitates these operations while, in the meantime, the "Brake fluid replacement" operations are performed.
- In this case, the bleed process must be accompanied by further pedal strokes and with the bleed device connected (about 5 for each wheel circuit).

# BLEED SYSTEM AFTER BRAKE PUMP RE-PLACEMENT

#### PRELIMINARY OPERATIONS

- Install the new brake pump.
- Connect the reservoir to the brake pump.
- Connect the brake pipe to the pump line coupling.
- Fill the reservoir with new DOT4 brake fluid.



#### **REGULAR BLEEDING SYSTEM**

- Connect the bleed bottle to the bleed screw of the front brake calliper.
- Operate the brake lever.
- Open the bleed screw until all the pressure has been release and then close it.
- Release the brake lever.
- After releasing the lever, wait two seconds so that the brake fluid flows into the cylinder.
- Repeat this procedure until the brake fluid is clear and has no air bubbles.
   (about 10 to 20 times).

# NOTE: CHECK BRAKE FLUID LEVEL IN THE RESERVOIR AND, IF NECESSARY, TOP UP (CHECKING BRAKE PAD WEAR).

- Bleed as previously described, also on the bleed valve installed on the front brake pump.
- Then perform the same procedure for the rear brake calliper, acting only on the valve installed on that calliper.
- Fill the reservoir until it reaches the reference "MAX" and refit the cap (check pad wear).



- Detach the bleed hoses and close the bleed screws again to the correct tightening torque.
- Check the stroke and the sensitivity of both the lever and the brake pedal.

NOTE: IF AFTER BLEEDING, THE STROKE OF THE PEDAL OR THE LEVER IS TOO LONG, CHECK THAT THERE ARE NO LEAKS IN THE BRAKING SYSTEM AND IF EVERYTHING IS OK. CONTINUE BLEEDING OPERATIONS USING THE DIAGNOSIS INSTRUMENT.

# BRAKE BLEEDING AFTER ABS CONTROL UNIT REPLACEMENT VEHICLE PREPARATION

- Connect the bleed bottle to the bleed screws of the front and rear callipers and open it.
- Fully press down the lever and the brake pedal and fix them into position with the respective locking devices.
- Close the bleed screws of the front and rear callipers and remove the bleed bottle.
- Remove the damaged ABS control unit.

Note: First of all, detach the brake pipes that go from the ABS control unit to the brake pump (1-4) and immediately seal the opened unions of the ABS control unit with protective caps.

Afterwards, remove pipes (2-3) that go from the ABS control unit to the brakes and also seal these unions with protective caps.

- Install the new ABS control unit, previously filled up.
- So that the brake fluid remains in the ABS control unit, first remove the pro-



tective caps of the braking circuit unions and connect the respective pipes.

Once all the braking circuits have been connected, remove the protective caps from the braking pump unions and connect the braking pump pipes to the ABS control unit.

- Unlock the lever and the brake pedal.
- Remove the cap of the reservoir and fill it with the new DOT 4 brake fluid up to the reference "MAX".
- Reinstall the cap.

#### CAUTION

PERFORM THE REGULAR BRAKING SYSTEM BLEED, AS DESCRIBED AT THE BEGINNING OF THE CHAPTER.

- Check the stroke and the sensitivity of both the lever and the brake pedal.
- If, after bleeding, the pedal or the lever stroke is too long, check that there are no leaks in the braking system and if everything is OK, continue bleeding operations using the diagnostics instrument as described.
- Detach the bleed hoses and close the bleed screws again to the correct tightening torque.

# BRAKE BLEEDING AFTER CALLIPER RE-PLACEMENT

VEHICLE PREPARATION - The operations are described for the front system, but they are also valid for both braking systems.

- Connect the bleed bottles to the bleed screw of the front calliper and open it.
- Fully press down the brake lever and fasten it into position with a locking device so as to avoid fluid flowing out from the open system.
- Close the bleed screws of the front calliper and remove the bleed bottle.
- Replace the damaged calliper with a new one.
- Unlock the brake lever.



- Remove the cap of the reservoir and fill it with the new DOT 4 brake fluid up to the reference "MAX".
- Reinstall the cap.

#### **BRAKING SYSTEM BLEEDING (only the new**

#### calliper)

#### CAUTION

PERFORM THE REGULAR BRAKING SYSTEM BLEED, AS DESCRIBED AT THE BEGINNING OF THE CHAPTER.

- Check the stroke and the sensitivity of both the lever and the brake pedal.
- If, after bleeding, the pedal or the lever stroke is too long, check that there are no leaks in
  the braking system and if everything is OK, continue bleeding operations using the diagnostics instrument as described.
- Detach the bleed hoses and close the bleed screws again to the correct tightening torque.

#### **BLEEDING SYSTEM WITH DIAGNOSTICS INSTRUMENT**

This type of bleeding has to be carried out if after all the checks the brake lever and the pedal are still spongy.

The operations described here are valid for both systems even though the description refers to the front system.

#### **FRONT**

- With diagnostics instrument properly connected, select the function "FRONT BRAKE BLEEDING PROCEDURE".
- The pump starts rotating.
- While the pump is performing a rotation cycle, operate and release the front brake lever until
  the message diagnostics instrument cycle completion is received.
- This procedure allows the air to turn and to accumulate.
- Once the procedure with diagnostics instrument is finished, perform the REGULAR BLEED-ING to remove the air from the system completely.

#### CAUTION

PERFORM THE REGULAR BRAKING SYSTEM BLEED, AS DESCRIBED AT THE BEGINNING OF THE CHAPTER.

# Changing the brake fluid

# BRAKE FLUID REPLACEMENT VEHICLE PREPARATION

Connect the bleeding unit to the reservoir of the braking system.

Max. filling pressure to be applied to the system= 3 bar (300 kPa - 43.51 PSI).

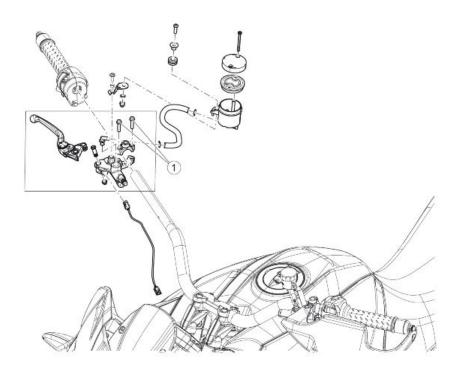
# PURGING PROCESS TO CHANGE THE BRAK-ING SYSTEM FLUID

Connect the bleed bottle to the bleed screw of the front calliper and open it.

- Operate the bleeding unit and while the system is being purged, top up the reservoir with the new DOT 4 brake fluid; keep doing this until clean oil begins to flow out through the bleed tube.
- Leave the screw open until the fluid in the tube is clear and free of air bubbles.
- Close the bleed screw.
- Repeat this procedure on the remaining bleed valves of the system and close them all to the prescribed tightening torque.
- Remove the bleeding unit.
- Always fill the reservoir up to the reference "MAX" and refit the cap.
- Check the stroke and the sensitivity of both the lever and the brake pedal.
- If, after bleeding, the pedal or the lever stroke is too long, check that there are no leaks in the braking system and if everything is OK, continue bleeding operations using the diagnostics instrument as described.
- Detach the bleed hoses and close the bleed screws again to the correct tightening torque.



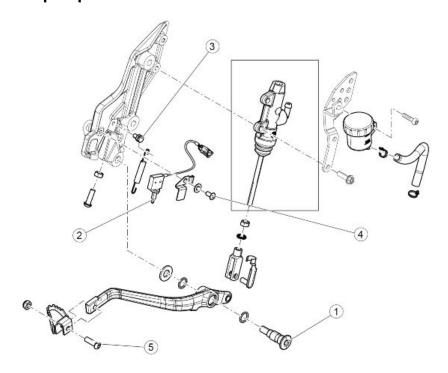
# Front brake pump



# FRONT BRAKE PUMP

pos.	Description	Type	Quantity	Torque	Notes
1	Brake pump fixing screws	M6	2	10 ± 1,5 Nm (7.37 ± 1.10 lb	-
				ft)	

# Rear brake pump



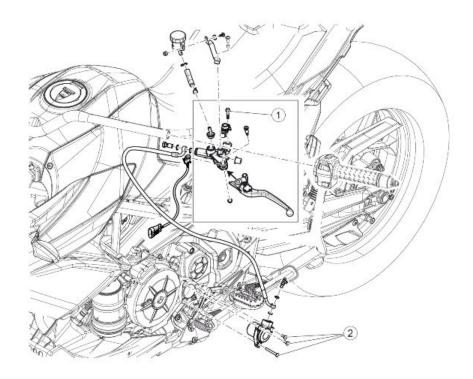
# REAR BRAKE PUMP

pos.	Description	Type	Quantity	Torque	Notes
1	Rear brake lever pin	-	1	25 ± 3.75 Nm (18.44 ± 2.76	Loctite 243
2	Microswitch fixing nuts	M6	2	lb ft) $0.4 \pm 0.08 \text{ Nm } (0.29 \pm 0.05)$	
2	MICIOSWILCH HXING HUIS	IVIO		lb ft)	-
3	Spring linking pin	M5x7	1	6 ± 1.2 Nm (4.42 ± 0.88 lb ft)	Loctite 243
4	Microclip plate fixing screw	M5X15	1	6 ± 1.2 Nm (4.42 ± 0.88 lb ft)	Loctite 243
5	Brake lever push rod fixing screw	-	1	10 ± 1.5 Nm (7.37 ± 1.10 lb ft)	-

# **INDEX OF TOPICS**

CLUTCH SYSTEM

**CLU SYS** 



# **C**LUTCH CONTROL

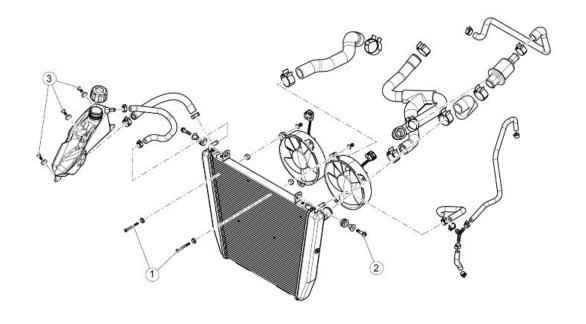
pos.	Description	Type	Quantity	Torque	Notes
1	Clutch pump fixing screws	M6	2	10 ± 1,5 Nm (7.37 ± 1.10 lb	-
				ft)	
2	Throttle control fixing screws	M6	3	10 Nm (7.37 lb ft)	-

# **INDEX OF TOPICS**

COOLING SYSTEM

**COOL SYS** 

# Circuit diagram

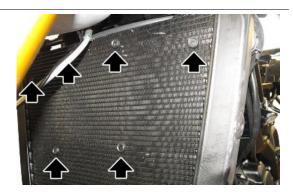


### COOLING SYSTEM

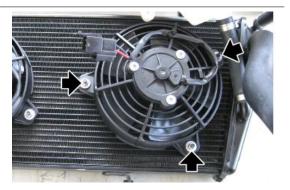
pos.	Description	Type	Quantity	Torque	Notes
1	Electric fan fastener screw	M4x45	6	3 Nm (2.21 lb ft)	-
2	Flanged TE screw fastening left Ra-	M6x25	1	10 Nm (7.37 lb ft)	-
	diator to trellis				
3	Flanged TE screw fastening expan-	M6x20	3	10 Nm (7.37 lb ft)	-
	sion tank				

# Electric fan

- Remove the radiator
- Tighten the three screws on radiator front side.



- Unscrew and remove the three nuts on the opposite side, collecting the washers.
- Remove the electric fan collecting the spacers.
- From the front side, collect the screws and dished washers.



#### See also

Removing the radiator

# **Coolant replacement**

- Remove the right side fairing.
- Place a container of suitable capacity.
- Loosen the screw, move the clamp and slide off the sleeve.



• Remove the cap.



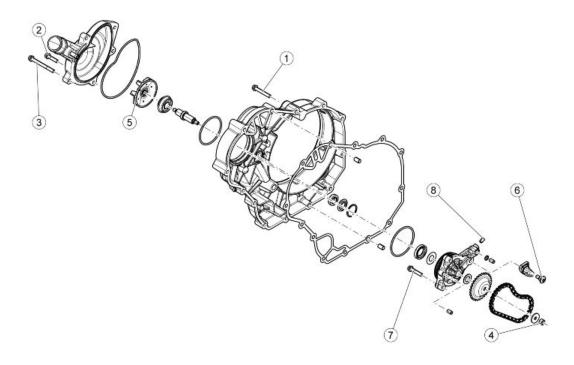
Slide off the sleeve and empty the system completely.

#### CAUTION

SHOULD GREASE BE NOTED IN THE WATER THIS IS TO BE CONSIDERED NORMAL BECAUSE DURING THE ASSEMBLY PHASE OF THE WATER PUMP SIGNIFICANT LUBRICATION OF THE SAME IS REQUIRED IN ORDER TO PREVENT DAMAGE.



# Water pump



#### WATER PUMP

pos.	Description	Туре	Quantity	Torque	Notes
1	Clutch side cover fastener screw	M6	11	13 Nm (9.59 lbf ft)	-
2	Fastener screw for Pump Cover / Clutch side cover	M6	3	13 Nm (9.59 lbf ft)	-
3	Screw fastening Pump Cover / Clutch Cover / clutch side crankcase half	M6	2	13 Nm (9.59 lbf ft)	-
4	Nut fastening water pump drive gear sprocket	M6	1	12 Nm (8.85 lbf ft)	-
5	Water pump rotor	-	1	4.50 Nm (3.32 lbf ft)	-
6	Screw fastening chain tensioner slider to water pump	M6	1	8-10 Nm (5.90-7.38 lbf ft)	-
7	Water pump support fixing screw	M6	3	12 Nm (8.85 lbf ft)	-
8	Water pump support plug	M6x10	1	6.5 Nm (4.79 lbf ft)	3M SCOTCH GRIP 2353

COOL SYS - 383

#### Removal

#### **COVER REMOVAL**

- Drain off the cooling circuit completely.
- Unscrew and remove the five water pump cover fixing screws.



Release the clamp.



#### See also

#### Coolant replacement

• Remove the water pump cover.

#### **PUMP ROTOR REMOVAL**

- Remove the water pump cover H20.
- Unscrew and remove the (anticlockwise) screw
- Remove the rotor.



#### **COMPLETE H2O PUMP REMOVAL**

- Remove the clutch cover.
- Unscrew and remove the three H2O pump fixing screws.



 Remove the H2O pump and slide off the drive chain.

#### NOTE

#### REPLACE THE O-RINGS ON REASSEMBLY

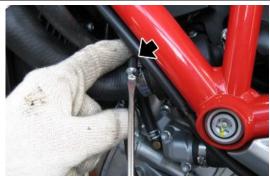


# Removing the radiator

- Remove the fuel tank.
- Slide out the connection pin with oil radiator.



- Drain the fluid from the system.
- Slacken the clamp on the left side.
- Slide off the pipe from the thermostatic valve.



#### See also

Fuel tank

#### Coolant replacement

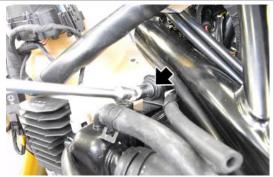
 Release the clamp retaining the breather pipe to radiator.

#### NOTE

UPON REFITTING, ALWAYS REPLACE WITH A NEW CLAMP.



 Operating from the right side, unscrew and remove the radiator upper screw.



• Disconnect the left electric fan.



- Unscrew and remove the three fixing screws.
- Remove the expansion tank.



 Lower radiator and disconnect the right electric fan.



Remove the radiator with the expansion tank.



- To install the radiator, follow the operations explained above but in reverse order, and replace all the clamps removed.
- Restore the correct coolant level.

# Thermostatic valve

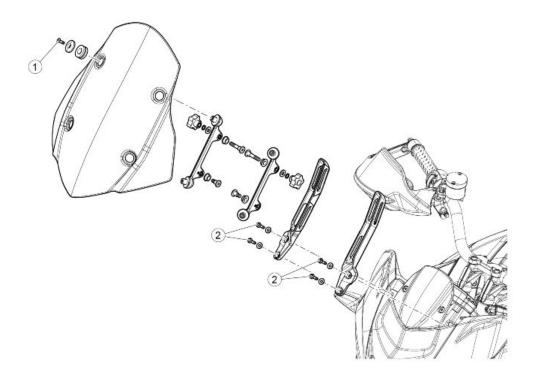
Traditional circuit, three-way thermostatic valve:

- 1. Hot water inlet from the heads.
- 2. Outlet towards the short circuit (direct to the pump).
- 3. Outlet towards the radiator



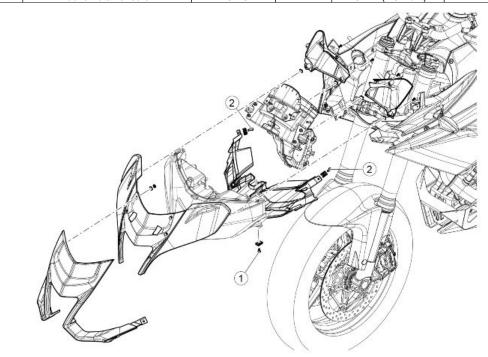
# **INDEX OF TOPICS**

BODYW



# TOP FAIRING\_WINDSHIELD

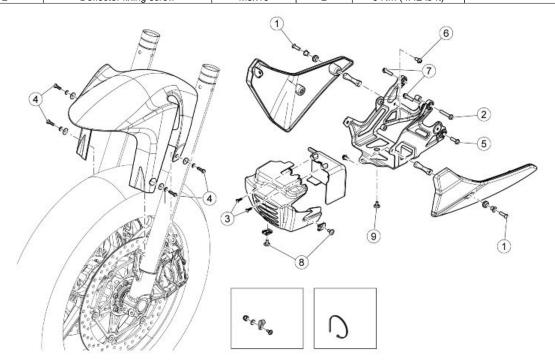
Pos.	Description	Type	Quantity	Torque	Notes
1	Windshield on support fastener	M6x18	4	10 Nm (7.37 lb ft)	-
	screw				
2	Bracket retainer screw	M6x25	4	10 Nm (7.37 lb ft)	-



# FRONT FAIRING

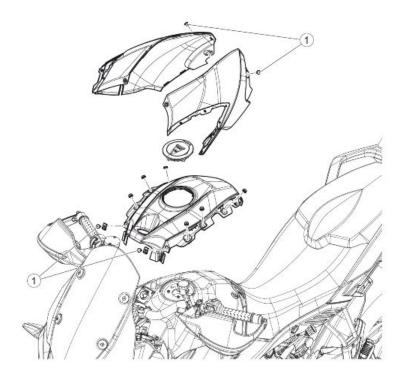
Pos.	Description	Туре	Quantity	Torque	Notes
1	Deflector fixing screw	M5x12	2	6 Nm (4.42 lb ft)	-

Pos.	Description	Type	Quantity	Torque	Notes
2	Deflector fixing screw	M5x16	2	6 Nm (4.42 lb ft)	- 1



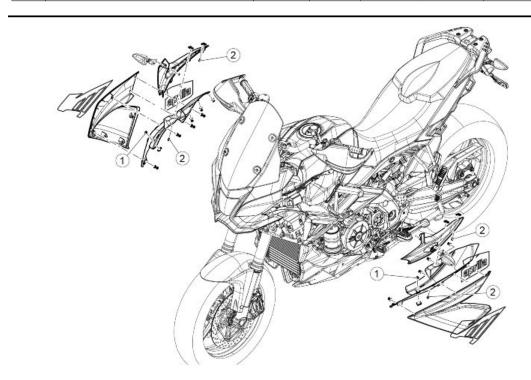
### Mudguard\_lug

Pos.	Description	Туре	Quantity	Torque	Notes
1	Lug fixing screw	M6x20	2	10 Nm (7.37 lb ft)	-
2	Control unit support fixing screw	M6x35	1	10 Nm (7.37 lb ft)	-
3	Front with rear lug fixing screw	3.9x14	2	2 Nm (1.47 lb ft)	-
4	Front mudguard fixing screw	-	4	-	-
5	Control unit support fixing screw	M6x20	1	10 Nm (7.37 lb ft)	-
6	Lug on support fastener screw	M6x12	2	10 Nm (7.37 lb ft)	-
7	Control unit support fixing screw	M6x25	2	10 Nm (7.37 lb ft)	-
8	Lug on support fastener screw	M5	2	6 Nm (4,42 lb ft)	-
9	Spacer TCEI screw	M8	1	Tighten by hand	Loct. 243



TANK COVER

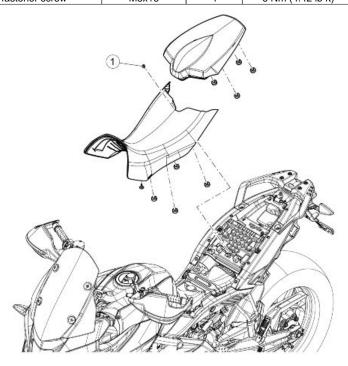
Pos.	Description	Type	Quantity	Torque	Notes
1	Covers fastening screws	M5x9	4	$3 \pm 0.60 \text{ Nm} (2.21 \pm 0.44 \text{ lb})$	-
				ft)	



SIDE FAIRINGS

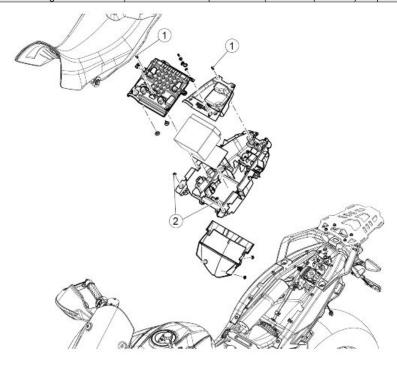
Pos.	Description	Type	Quantity	Torque	Notes
1	Fairing fastener screw	M5x9	2	6 Nm (4.42 lb ft)	-

Pos.	Description	Type	Quantity	Torque	Notes
2	Fairing fastener screw	M5x16	4	6 Nm (4 42 lh ft)	_



SADDLE

Pos.	Description	Type	Quantity	Torque	Notes
1	Saddle fixing screw	M5x12	1	6 Nm (4.42 lb ft)	-



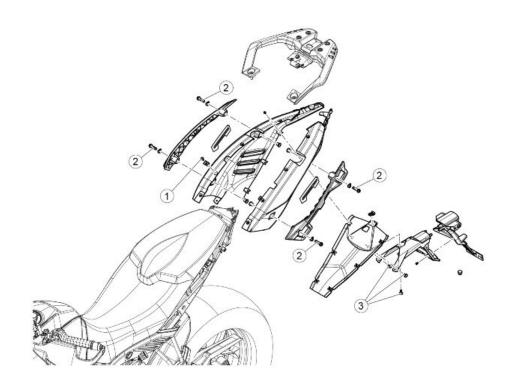
# HELMET COMPARTMENT

Pos.	Description	Type	Quantity	Torque	Notes
1	Covers fastener screw	M5x20	8	6 Nm (4.42 lb ft)	-
2	Compartment fixing screw	M5x12	2	6 Nm (4.42 lb ft)	-



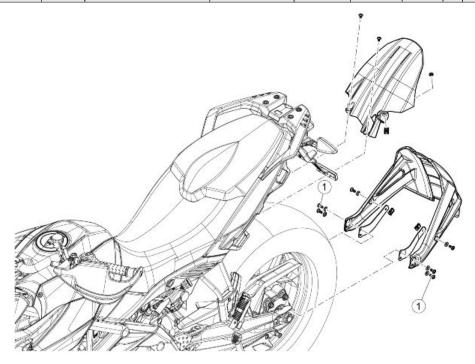
### LUGGAGE RACK

Pos.	Description	Туре	Quantity	Torque	Notes
1	Luggage rack screw	3.9x14	2	2 Nm (1.47 lb ft)	-
2	Luggage rack cover screw	M8x20	2	25 Nm (18.44 lb ft)	-
3	Luggage rack fastener screw	M8x25	3	25 Nm (18.44 lb ft)	-
4	Luggage rack screw	5x14	5	3 Nm (2.21 lb ft)	-



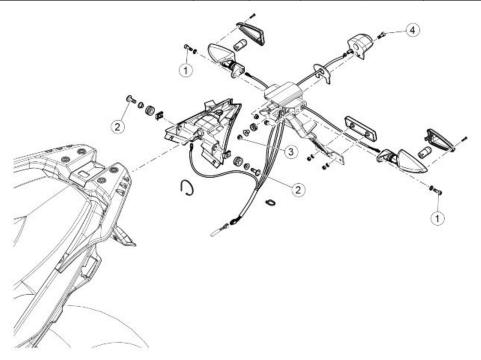
### REAR BODYWORK

Pos.	Description	Type	Quantity	Torque	Notes
1	Tail fairing fastener screw	M5x12	6	6 Nm (4.42 lb ft)	-
2	Panniers connection fixing screw	-	4	-	-
3	License plate holder fastener screw	M6	3	10 Nm (7.37 lb ft)	-



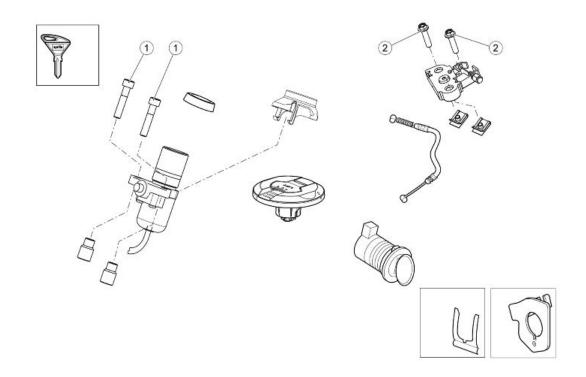
# REAR MUDGUARD

Pos.	Description	Type	Quantity	Torque	Notes
1	Mudguard fixing screws on wheel adjustment	-	1	10 ± 2 Nm (7.37 ± 1.47 lb	Loctite 243
				ft)	



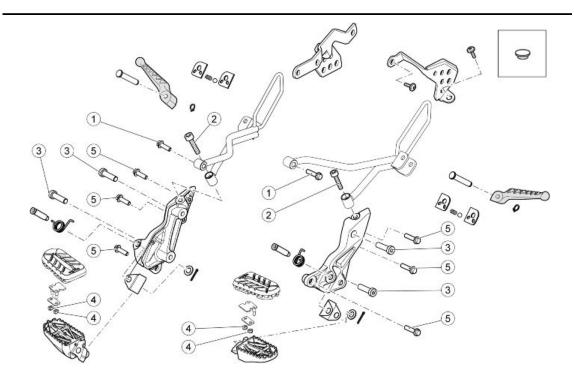
# REAR LIGHTS

Pos.	Description	Туре	Quantity	Torque	Notes
1	Turn indicator fixing screw	M5x16	2	6 Nm (4.42 lb ft)	-
2	Taillight screw	M5x16	2	6 Nm (4.42 lb ft)	-
3	License plate light nut	M5	1	6 Nm (4.42 lb ft)	-



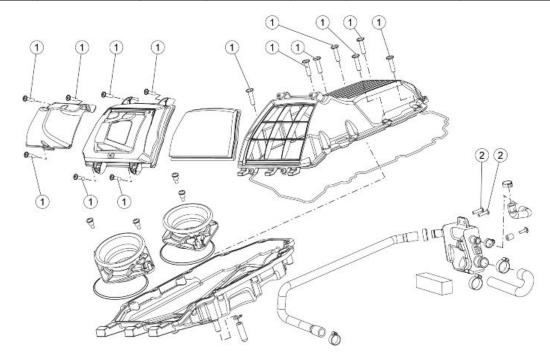
**Locks** 

Pos.	Description	Туре	Quantity	Torque	Notes
1	Switch fastener	shear head	1	Manual	-
		screw			
2	TE screw fastening saddle lock / bat- tery compartment to saddle mount- ing	M6x25	2	10 Nm (7.37 lb ft)	To reuse: Loctite 243



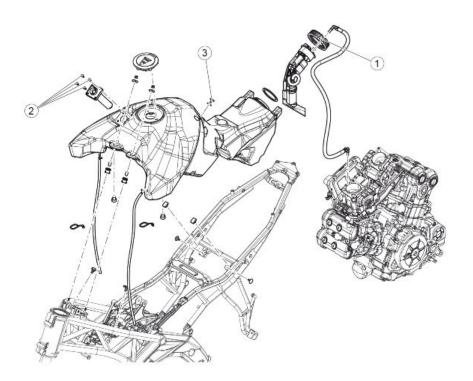
# **F**ootrests

Pos.	Description	Type	Quantity	Torque	Notes
1	Upper screw fastening passenger footrests to frame side panels	M8x35	2	25 Nm (18.44 lb ft)	Loct. 243
2	Lower TCEI screw fastening passen- ger footrests to rider footrest mount- ing	M8x35	2	25 Nm (18.44 lb ft)	Loct. 243
3	TCEI screw fastening rider footrest mounting to frame	M8x35	4	30 Nm (22.12 lb ft)	Loct. 243
4	Footrest rubber fastener narrow nut	M5	4	6 Nm (4.42 lb ft)	-
5	TCEI screw fastening rider footrest mounting	M6x16	6	10 Nm (7.37 lb ft)	-



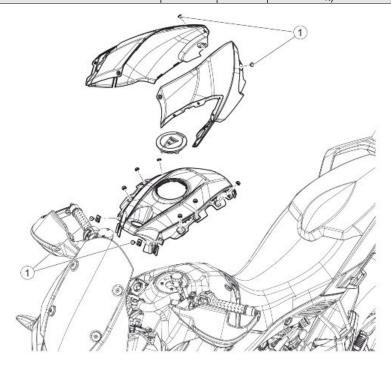
## **A**IR FILTER BOX

Pos.	Description	Type	Quantity	Torque	Notes
1	Cross head self-tapping screw fas-	M5x20	10	3 Nm (2.21 lb ft)	-
	tening covers / filter box				
2	Cross head self-tapping screw fas-	M5x20	2	3 Nm (2.21 lb ft)	-
	tening blow-by tank				



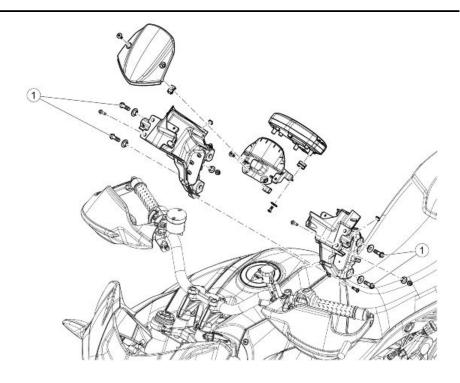
FUEL TANK

Pos.	Description	Туре	Quantity	Torque	Notes
1	Plastic ring nut	-	1	20 ± 3 Nm (14.75 ± 2.21 lb	-
				ft)	
2	Level indicator fixing screws	M6x16	4	$3 \pm 0.45 \text{ Nm} (2.21 \pm 0.33 \text{ lb})$	-
	-			ft)	
3	Saddle fixing	M5	1	$3 \pm 0.45 \text{ Nm} (2.21 \pm 0.33 \text{ lb})$	-
				ft)	



# TANK COVER

Pos.	Description	Type	Quantity	Torque	Notes
1	Covers fastening screws	M5x9	4	$3 \pm 0.60 \text{ Nm} (2.21 \pm 0.44 \text{ lb})$	-
				ft)	



## **INSTRUMENT SUPPORT**

Pos.	Description	Type	Quantity	Torque	Notes
1	Instrument panel to trellis fixing screws	M8x25	4	25 ± 5 Nm (18.43 ± 3.68 lb	-
				ft)	

# Seat

- Insert the key in the lock located on the left fairing.
- Turn the key clockwise.
- Remove the rear saddle.



Unscrew and remove the front saddle fixing screw.



• Remove the front saddle.



# Instrument panel

Loosen the two fastening screws.



• Remove the dashboard upper cover.



 Remove the two screws fastening the lower cover of the dashboard.



Remove the cover.



- Disconnect the connector.
- Remove the instrument panel.



# Headlight assy.

- The following procedure refers to one single part of the dashboard, but is valid for both.
- Unscrew and remove the two lower screws of the left dashboard.



- Unscrew and remove the upper screw of the left dashboard.
- Remove the dashboard.



 Unscrew and remove the two fixing screws of the central dashboard.



- Unscrew and remove the screw in the lower part of the light unit.
- Remove the headlight assembly.



 Unscrew and remove the light unit upper fixing screw.



Undo and remove the light unit lower screw.



- Unscrew and remove the screw in the lower part of the light unit.
- Remove the headlight assembly.



# Taillight assy.

- Remove the tail fairing and license plate holder first.
- Unscrew and remove the two fixing screws.
- Disconnect the connector, then remove the rear light unit.



## See also

Tail guard

License plate holder

## **Footrest**

#### **RIGHT FOOTREST**

- Unscrew and remove the upper screw
   (1).
- Unscrew and remove the two outer screws (2).



- Remove the right footrest
- Unscrew and remove both rear brake pump internal fixing screws.



#### **LEFT FOOTREST**

Unscrew and remove the two external screws.



- Loosen the gear shift lever rod screw.
- Slide off the gear shift lever rod.
- Remove the left footrest.



# Side fairings

- The following procedure refers to one single fairing, but is valid for both.
- Remove the rear expansion cap.



Remove the front expansion cap.





Release the fairing from its fasteners.



Remove the fairing.



 For the left side fairing, the cable of the saddle lock must be removed.



# License plate holder

Unscrew and remove the two fixing screws.



 Remove the access cap, unscrew and remove the lower mounting screw.



 Disconnect the connectors and remove the license plate support.



# Air box

- Remove the air filter box cover.
- Remove the four screws.



Remove the two intake ducts.



## See also

Air filter

Cut the ties.



• Disconnect the air temperature sensor.



 Remove the two clamps from the blowby system.





• Remove the air filter box.

# Splash guard

 Operating from both sides, unscrew and remove the four fixing screws.



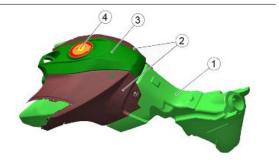
Remove the rear splash guard.





# Fuel tank

Before accessing the tank (1), the side covers (2), the central cover (3) and the tank cap (4) must be removed.



Unscrew and remove the rear fixing screw.



Unscrew and remove the front fixing screw.



 Remove the three expansion caps on the inside of the fairing.





Remove the internal upper expansion cap.



• Undo and remove the front screw.



 Remove the expansion cap placed on the side part of the fairing, near the turn indicator.



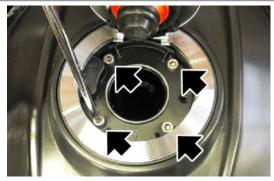
- Disconnect the turn indicator connector.
- Remove the side plastic.



 Undo and remove the six fixing screws of the central cover of the tank.



 Unscrew and remove the four fixing screws of the tank cap.



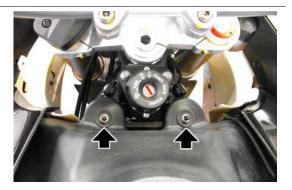
Remove the tank cap.



• Remove the tank central cover.



 Undo and remove the two mounting fixing screws.



• Disconnect the level sensor.





 Working from both sides, disconnect both breather pipes.



 Unscrew and remove the two fixing screws that connect the tank to the underfairing.



• Disconnect the fuel pump connector.



- Disconnect the fuel pipe from the pump.
- Remove the tank.



## Rear

Remove the lock and turn the key anticlockwise.



- Remove the case.
- Repeat the operation for the case on the opposite side.



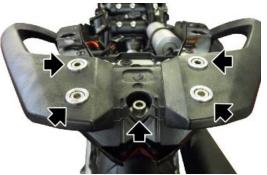


# Rear grab rail

 Remove the plastic that covers the handgrip central fixing screw.



 Unscrew and remove the five rear fixing screws.



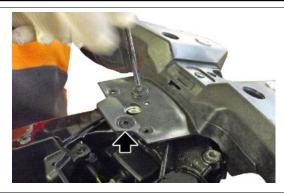
 Unscrew and remove the two front fixing screws.



Unscrew and remove the two central fixing screws.



 Disconnect the saddle lock by undoing the two screws.



• Remove the handgrip.



## Windscreen

- Unscrew and remove the four fixing screws of the top fairing.
- Remove the windshield.



# Instrument cluster support

- Undo and remove the two instrument panel support fixing screws.
- Remove the instrument panel paying attention to the cable harness.



 Undo and remove the two shells fixing screws of the instrument support.



Disconnect the connectors.



# **Radiator cover**

- Undo and remove the three fixing screws of the expansion tank.
- Remove the expansion tank.



 Unscrew and remove the screw indicated in the figure.



 Disconnect the connector of the ADD management control unit



- Unscrew and remove the two ADD control unit fixing screws.
- Remove the control unit.



Disconnect the indicated connector.



Unscrew and remove the left fairing lug fixing screw.



 Unscrew and remove the left fairing lug rear fixing screw.



 Unscrew and remove the front fairing lug fixing screw.



• Remove the left fairing lug.



 Unscrew and remove the two right fairing lug fixing screws.



Remove the right fairing lug.



 Undo and remove the two upper fixing screws of the right duct bulkhead.



 Unscrew and remove the lower fixing screw of the right duct bulkhead.



• Remove the right duct bulkhead.



Undo and remove the fairing lug lower screw.



 Unscrew and remove the fixing screw of the left part of the fairing lug.



 Undo and remove the fixing screw of the oil radiator support.



Undo and remove the fairing lug lower screw.



Undo the two upper fixing screws of the fairing lug.



• Undo the radiator fixing screw.



• Undo and remove the stud bolt.



• Disconnect the radiator pipe.



• Remove the expansion caps.

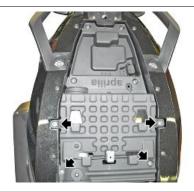


• Separate the two radiators and remove the radiator protection.



# **Battery**

 Undo and remove the four fixing screws of the battery cover.



• Remove the battery cover.



• Disconnect the battery and remove it.





# Tail guard

 Remove the side panniers support by unscrewing the two fastening screws.





• Remove the two expansion caps.



Undo and remove the six fixing screws
 (1).



- Remove the rear handgrip and the license plate support.
- Remove the tail fairing.



## See also

Rear grab rail

License plate holder

## Side air deflectors

• Undo and remove the upper screw.



 Unscrew and remove the front screw placed near the radiator.



Unscrew and remove the rear screw.



Remove the duct.



## **INSIDE FAIRING**

The following procedure refers to one single fairing, but is valid for both.

Cut and remove the clamp.



Remove the relay indicated in the figure.



• Disconnect the voltage regulator.



- Cut and remove the clamp.
- Release the cables.







• Remove the relay box.



• Cut and remove the clamp.



• Remove the inside fairing.



# **INDEX OF TOPICS**

Pre-delivery PRE DE

Carry out the listed checks before delivering the motorcycle.

#### WARNING





HANDLE FUEL WITH CARE.

# **Aesthetic inspection**

- Paintwork
- Fitting of Plastic Parts
- Scratches
- Dirt

# Tightening torques inspection

- Safety fasteners:

front and rear suspension unit

front and rear brake calliper retainer unit

front and rear wheel unit

engine - chassis retainers

steering assembly

- Plastic parts fixing screws

# **Electrical system**

- Main switch
- Headlamps: high beam lights, low beam lights, tail lights (front and rear) and their warning lights
- Headlight adjustment according to regulations in force
- Front and rear stop light switches and their bulbs
- Turn indicators and their warning lights
- Instrument panel lights
- Instrument panel: fuel and temperature indicator (if present)
- Instrument panel warning lights
- Horn
- Electric starter
- Engine stop via emergency stop switch and side stand
- Helmet compartment electrical opening switch (if present)

- Through the diagnosis tool, check that the last mapping version is present in the control unit/s and, if required, program the control unit/s again: consult the technical service website to know about available upgrades and details regarding the operation.

CAUTION



TO ENSURE MAXIMUM PERFORMANCE, THE BATTERY MUST BE CHARGED BEFORE USE. INADEQUATE CHARGING OF THE BATTERY WITH A LOW LEVEL OF ELECTROLYTE BEFORE IT IS FIRST USED SHORTENS BATTERY LIFE.

CAUTION



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

WARNING



THE BATTERY ELECTROLYTE IS POISONOUS AS IT MAY CAUSE SERIOUS BURNS. IT CONTAINS SULPHURIC ACID. AVOID CONTACT WITH YOUR EYES, SKIN AND CLOTHING. 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 THE RECOMMENDED CAPACITY. USING A FUSE OF UNSUITABLE RATING MAY SERIOUSLY DAMAGE THE VEHICLE OR EVEN CAUSE A FIRE.

#### Levels check

- Hydraulic braking system fluid level
- Clutch system fluid level (if present)
- Gearbox oil level (if present)
- Transmission oil level (if present)
- Engine coolant level (if present)
- Engine oil level
- Mixer oil level (if present)

#### Road test

- Cold start
- Instrument panel operation

- Response to throttle control
- Stability when accelerating and braking
- Front and rear brake efficiency
- Front and rear suspension efficiency
- Abnormal noise

#### Static test

#### Static check after test drive:

- Restarting when warmed up
- Starter operation (if present)
- Minimum holding (turning the handlebar)
- Uniform turning of the steering
- Possible leaks
- Radiator electric fan operation (if present)

## **Functional inspection**

- Hydraulic braking system
- Stroke of brake and clutch levers (if present)
- Clutch Check for correct operation
- Engine Check for correct general operation and absence of abnormal noise
- Other
- Documentation check:
- Chassis and engine numbers check
- Supplied tools check
- License plate fitting
- Locks checking
- Tyre pressure check
- Installation of mirrors and any possible accessories



NEVER EXCEED THE RECOMMENDED INFLATION PRESSURES AS TYRES MAY BURST.



CHECK AND ADJUST TYRE PRESSURE WITH TYRES AT AMBIENT TEMPERATURE.

## Specific operations for the vehicle

#### **HAND GUARDS**

PRE DE - 434

 Remove the TCEI M6 X 50 screw which fastens the antivibration weight.



Fit the rubber ring in the hand guards.



 Position and fasten the top screw ensuring to insert the bushing between the hand guard and the handlebar fastening point.





 Place the hand guards fastening them on the sides using TCEI M6 X 50 screw being careful when inserting the bushing.





#### Α

ABS: 187, 354, 362 Air filter: 69, 407

Air temperature sensor: 129

#### В

Battery: 91, 110, 424

Brake: 171, 368, 369, 375–377 Brake calliper: 368, 369

Brake fluid: 375 Brake pads: 369 Brake pump: 376, 377

Bulbs: Bushings:

## C

CAN line: 188

Catalytic converter: 348 Centre stand: 345 Chain: 14, 261, 342 Chain tensioner: 261

Clutch: 217, 227, 229, 230, 234-237, 240, 246, 275, 288, 293, 379

Coil: 141 Connecting rods: Connectors: 179 coolant: 382, 384, 386 Coolant: 382, 384, 386

Crankcase: 49, 214, 247, 254, 273, 274, 278, 282

Crankshaft: 49, 273, 277, 280, 281 Cylinder: 49, 264, 266, 267, 269, 272, 276

#### D

Diagnostics: 362 Drive chain: 14, 342

#### Ε

ECU: 182, 362 Electric fan: 161, 381 Electrical system: 14, 76, 432

Engine oil: *67*, *197*, *351* Engine temperature sensor: *127* 

Exhaust: *163*, *347*, *349* Exhaust manifold: *349* 

## F

Fairings: 405 Filter box:

Fork: 301, 303, 304, 314 Front head: 243, 246, 249, 265 Front wheel: 297, 299

Fuel: 66, 139, 197, 295, 385, 409

Fuel pump: 139, 295

Fuses: 96

#### G

Gearbox selector: 219

### Н

Handlebar: 300

Head cover: 71, 242, 243, 250

Headlight: 401 Helmet compartment:

#### ı

Identification: 12 Instrument panel: 400 Intake pressure sensor: 122

#### L

License plate holder: 403, 406, 426

Luggage rack:

## M

Magneto flywheel: 223, 225, 253, 275

Maintenance: 9, 63 Maintenance Table:

Mudguard:

#### 0

Oil filter: 68

Oil pressure sensor: 156

### R

Radiator: 197, 382, 385, 418 Rear head: 249, 252, 256, 265 Rear wheel: 329, 331, 342 Recommended products: 54 Run/Stop switch: 162

## S

Saddle:

Shock absorbers: 333 Side fairings: 405 Side stand: 158, 346 Side stand sensor: 158 Spark plug: 64

Spark plugs: Speed sensor: 111 Stand: 158, 344–346

Start-up: 94

Starter motor: 219, 220

## T

Tank: 66, 197, 385, 409 Throttle body: 145 Transmission: 13 Tyres: 15

# W

Warning lights: Water pump: 383 Wiring diagram: 79