DUCATI MONSTER 821 Workshop Manual 2015

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  - CAN line
  - Ducati traction control (DTC)
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Symbols - Abbreviations - References

To allow quick and easy consultation, this manual uses graphic symbols to highlight situations in which maximum care is required, as well as practical advice or information. Pay attention to the meaning of the symbols since they serve to avoid repeating technical concepts or safety warnings throughout the text. The symbols should therefore be seen as real "reminders". Please refer to this page whenever in doubt as to their meaning.

The terms right-hand and left-hand refer to the motorcycle viewed from the riding position.

Warning
Failure to comply with these instructions may put you at risk, and could lead to severe injury or even death.

Important
Failure to follow the instructions in text marked with this symbol can lead to serious damage to the motorcycle and its components.

Note
This symbol indicates additional useful information for the current operation.

Product specifications

Symbols in the diagram show the type of threadlocker, sealant or lubricant to be used at the points indicated. The table below shows the symbols used and the specifications of the various products.

Symbol		Specifications	Recommended product
		Engine oil (for characteristics see Fuel, lubricants and other fluids).	SHELL Advance 4T Ultra
		DOT 4 special hydraulic brake fluid.	SHELL Advance Brake DOT 4
		SAE 80-90 gear oil or special products for chains with O rings.	SHELL Advance Chain or Advance Teflon Chain
		Anti-freeze (nitride, amine and phosphate free) 30 to 40% + water.	SHELL Advance coolant or Glycoshell
	GREASE A	Multipurpose, medium fibre, lithium grease.	SHELL Alvania R3
	GREASE B	Molybdenum disulphide grease, high mechanical stress and high temperature resistant.	SHELL Retinax HDX2
	GREASE C	Bearing/joint grease for parts subject to prolonged mechanical stress. Temperature range: -10 to 110 °C.	SHELL Retinax LX2

	GREASE D	Protective grease, with anti-corrosive and waterproofing properties.	SHELL Retinax HD2
	GREASE E	Grease	PANKL - PLB 05
	GREASE F	Grease	OPTIMOL - PASTE WHITE T
	GREASE G	Grease	PANKL - PLB07
	GREASE H	Grease	KLÜBER STABURAGS NBU 30 PTM
	GREASE I	Copper grease	CUPRUM 320
	LOCK 1	Low-strength threadlocker.	Loctite 222
	LOCK 2	Medium-strength threadlocker, compatible with oil.	Loctite 243
	LOCK 3	High-strength threadlocker for threaded parts.	Loctite 270
	LOCK 4	Surface sealant resistant to high mechanical stress and solvents. Resists high temperatures (up to 200 °C) and pressures up to 350 bar; fills gaps up to 0.4 mm.	Loctite 510
	LOCK 5	Permanent adhesive for freely sliding cylindrical couplings or threaded couplings on mechanical parts. High resistance to mechanical stress and solvents. Temperature range: 55 to 175 °C.	Loctite 648
	LOCK 6	Pipe sealant for pipes and medium to large fittings. For water and gases (except oxygen). Maximum filling capacity: 0.40 mm (diameter clearance).	Loctite 577
	LOCK 7	Instant adhesive for rubber and plastics with elastomer charged ethylic base.	Loctite 480
	LOCK 8	High-strength retaining compound for threaded parts, bearings, bushes, splines and keys. Operating temperature range: 55 to 150 °C.	Loctite 601

	LOCK 9	Medium-strength threadlocker.	Loctite 406
	LOCK 10	Product for metal parts to seal and lock freely sliding cylindrical couplings or threaded couplings. Resistant to high mechanical stress and high temperature, excellent resistance to solvents and chemical attack.	Loctite 128443
	LOCK 11	Medium-strength threadlocker.	Loctite 401
	LOCK 12	Instant adhesive gel offering tensile/shear strength.	Loctite 454 gel
		DUCATI sealing compound.	Three bond 1215 - Sealing compound
		Exhaust pipe sealing paste. Self-sealing paste hardens when heated and resists temperatures exceeding 1000 °C.	Holts Firegum
		Clear universal silicone.	BOSTIK clear universal silicone.
		Spray used to protect electric systems. Eliminates moisture and condensation and provides excellent corrosion resistance. Water repellent.	SHELL Advance Contact Cleaner
		Dry lubricant, polymerising on contact with air.	Molykote M55 Plus
		Emulsion for lubrication of rubber.	P 80
		Protection lubricant emulsion.	KLUBERPLUS S 06/100
		Lubricant for mechanical elements	Castor oil
		Degreasing agent	Deta Blu

Acronyms and abbreviations used in the manual

ABS
Antilock Braking System
BBS

Black Box System
CAN
Controller Area Network
DDA
DUCATI Data Acquisition
DSS
DUCATI Skyhook Suspension
DSB
Dashboard
DTC
DUCATI Traction Control
HF
Hands Free
ECU
Engine Control Unit

Technological Dictionary

Riding Mode
The rider can choose from three different preset bike configurations (Riding Modes) and pick the one that best suits his/her riding style or ground conditions. The Riding Modes allow the user to instantly change the engine power delivery (ENGINE), the ABS settings, the DTC settings.
Available Riding Modes: Sport, Touring and Urban.
Within every Riding Mode, the rider can customise any settings.

Ducati Traction Control (DTC)
The Ducati Traction Control system (DTC) supervises the rear wheel slipping control and settings vary through eight different levels that are programmed to offer a different tolerance level to rear wheel slipping. Each Riding Mode features a pre-set intervention level. Level eight indicates system intervention whenever a slight slipping is detected, while level one is for very expert riders because it is less sensitive to slipping and intervention is hence softer.

Anti-lock Braking System (ABS)
The ABS system fitted on Monster 1200 and Monster 1200 S is a system that actuates combined braking with anti lift-up function for the rear wheel so as to guarantee not only a reduced stopping distance, but also a higher stability under braking. The ABS features 3 levels, one associated to each Riding Mode.

General safety rules

Carbon monoxide

When a maintenance operation must be performed with the engine running, make sure that the working area is well-ventilated. Never run the engine indoors.

Warning
Exhaust gases contain carbon monoxide, which is a poisonous gas that can cause unconsciousness or even death if inhaled.

Run the engine outdoors or, if working indoors, use an exhaust gas extraction system.

Fuel

Always make sure the working area is well ventilated. Keep any sources of ignition, such as cigarettes, open flames or sparks, well away from working area and fuel storage area.

Warning
Fuel is highly flammable and can explode under certain conditions. Keep away from children.

Hot parts

Warning
The engine and exhaust parts become hot when the motorcycle engine is running and will stay hot for some time after the engine has been stopped. Wear heat-resistant gloves before handling these components or allow the engine and exhaust system to cool down before proceeding.

Warning
The exhaust system might be hot, even after engine is switched OFF; pay particular attention not to touch exhaust system with any body part and do not park the motorcycle next to inflammable material (wood, leaves etc.).

Used engine oil

Warning
Prolonged or repeated contact with used engine oil may cause skin cancer. If working with engine oil on a daily basis, we recommend washing your hands thoroughly with soap immediately afterwards. Keep away from children.

Brake dust

Never clean the brake assembly using compressed air or a dry brush.

Warning
Inhalation of asbestos fibres is a proven cause of respiratory illness and cancer.

Brake fluid

Warning
Spilling brake fluid onto plastic, rubber or painted parts of the motorcycle may cause damages. Protect these parts with a clean shop cloth before proceeding to service the system. Keep away from children.

Coolant

Engine coolant contains ethylene glycol, which may ignite under particular conditions, producing invisible flames. Although the flames from burning ethylene glycol are not visible, they are still capable of causing severe burns.

Warning

Take care not to spill engine coolant on the exhaust system or engine parts. These parts may be hot and ignite the coolant, which will subsequently burn with invisible flames. Coolant (ethylene glycol) is irritant and poisonous when ingested. Keep away from children. Never remove the radiator cap when the engine is hot. The coolant is under pressure and will cause severe burns.

The cooling fan operates automatically: keep hands well clear and make sure your clothing does not snag on the fan.

Battery

 Warning

The battery gives off explosive gases; never cause sparks or allow naked flames and cigarettes near the battery. When charging the battery, ensure that the working area is properly ventilated.

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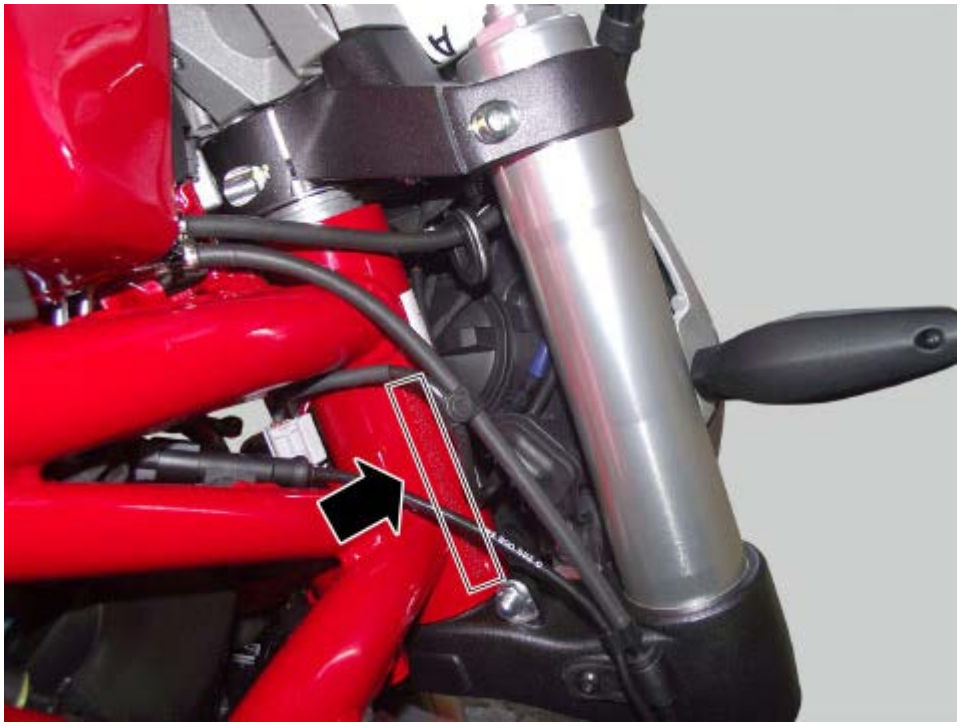
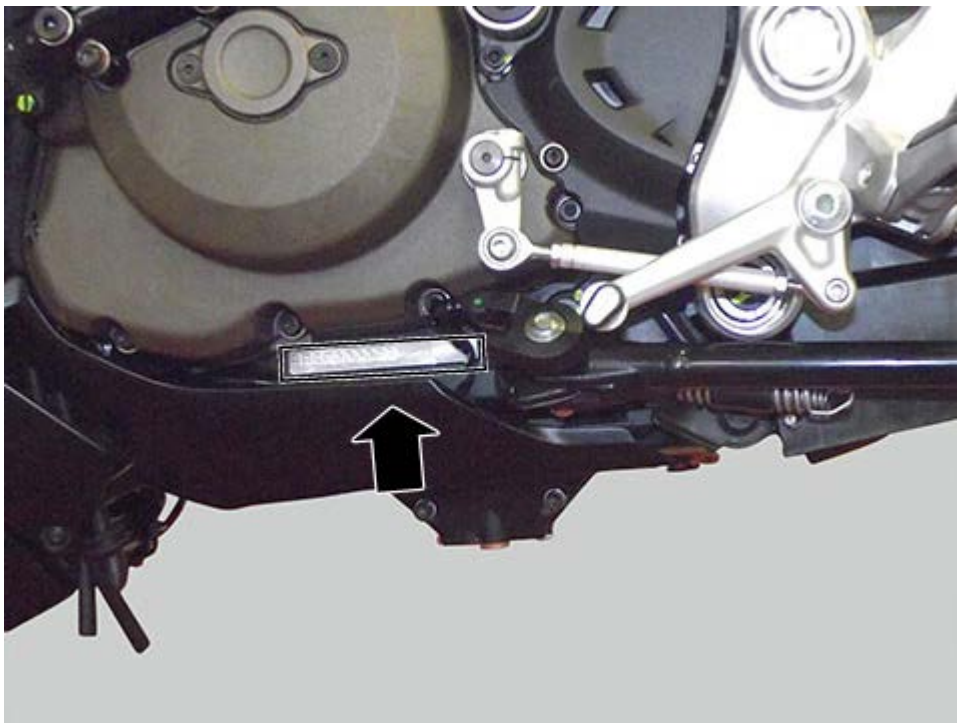
Model identification

Identification data

Each Ducati motorcycle is identified by two numbers, one for the frame and one for the engine.

Note
Please quote these numbers, which identify the motorcycle model, when ordering spare parts.



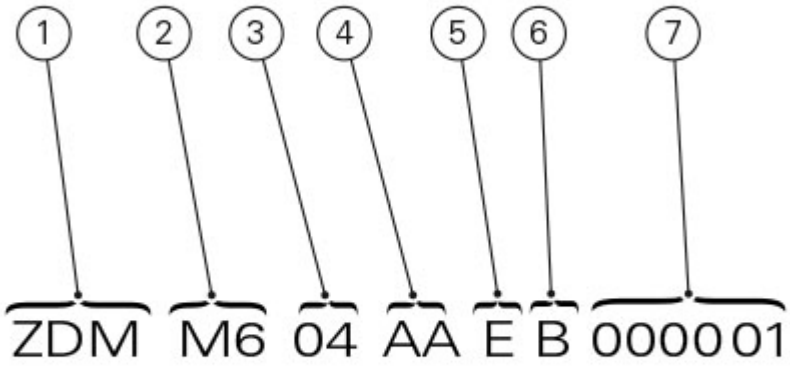


DATA STAMPED ON THE FRAME
Europe and Australia versions

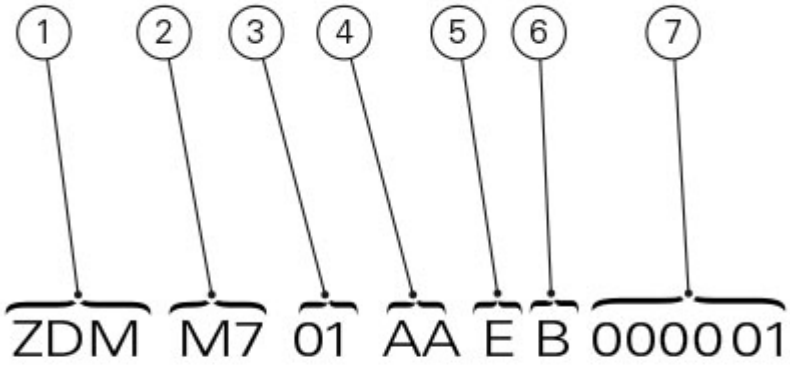
1 Manufacturer: Ducati Motor Holding
2 Type
3 Variant
4 Version
5 Production year (E = 2014) (F= 2015)
6 Manufacturing facility

7 Progressive serial no.

Data stamped on the frame, Europe (Monster 821) and Australia version



Data stamped on the frame, Europe (Monster 821 – 35 kW) version



Data stamped on the frame, France (Monster 821 — 25 kW) version

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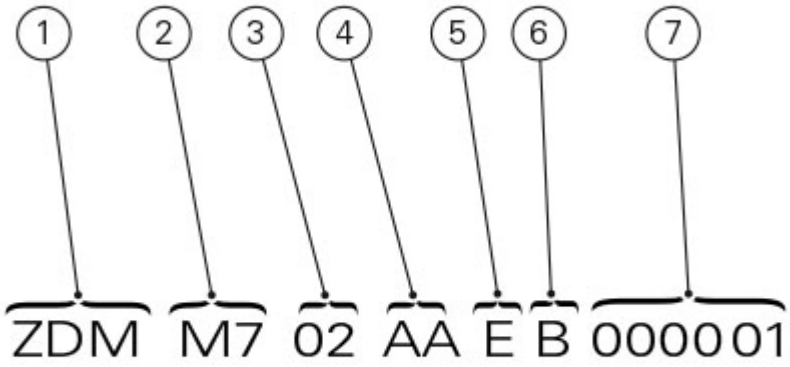
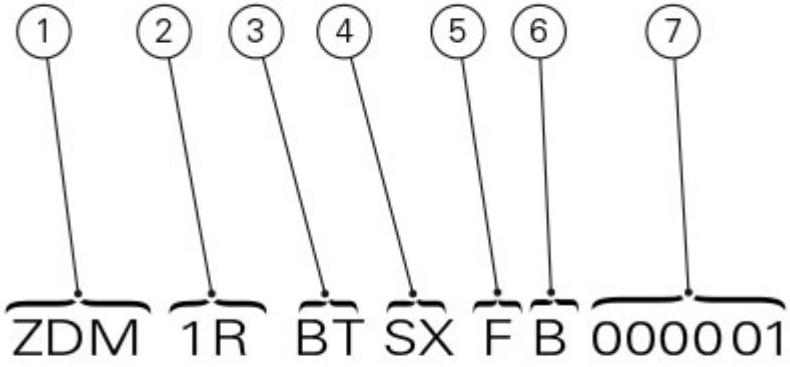
2 Type
3 Variant
4 Version
5 Production year (E = 2014) (F= 2015)
6 Manufacturing facility
7 Progressive serial no.



Data stamped on the frame, USA / Canada, California version

1 Manufacturer: Ducati Motor Holding
2 Type
3 Variant
4 Version (X= Check Digit)
5 Model Year (F= 2015) (G=...)
6 Manufacturing facility
7 Progressive serial no.



DATA STAMPED ON ENGINE

Data stamped on the Europe / France / Japan version engine

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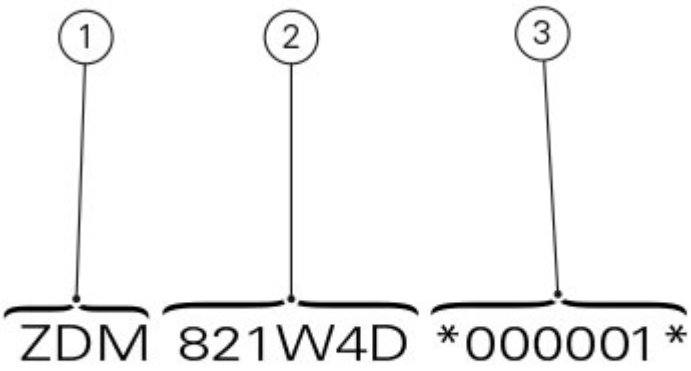
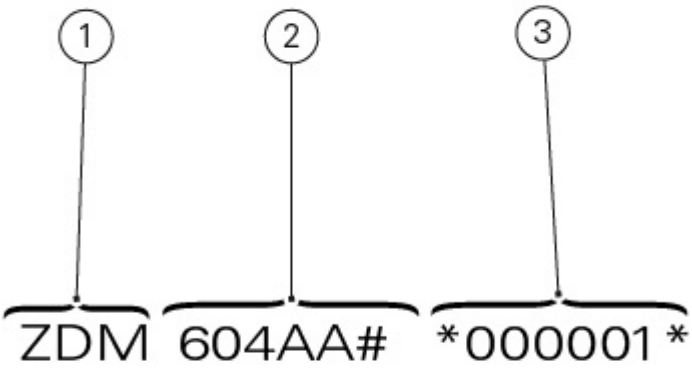
2 Engine type
3 Progressive production no.



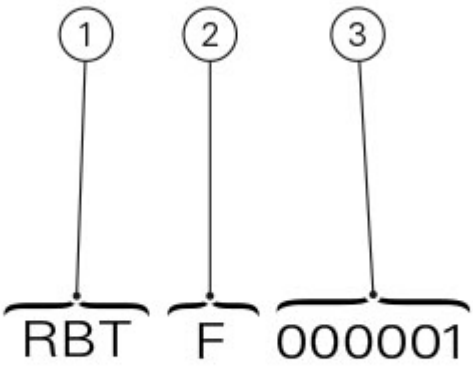
Data stamped on engine, Australia version

1 Manufacturer: Ducati Motor Holding
2 Engine type
3 Progressive production no.



Data stamped on the USA/Canada version engine

1 Engine type
2 Model Year (F= Model Tear 2015) (G=...)
3 Progressive serial no.


1
2
3
RBT
F
000001

Injection system

	Make	Type
Control unit	CONTINENTAL	M3D

Cooling system

	Reference	Technical specifications
Type	Liquid-cooling with closed-circuit radiator, twin fan with thermostat	
Coolant capacity		2.5±0.5 litres
Thermostat	Starts opening at	65 °C ±2 °C
	Electric fan enabling	103 °C
	Electric fan disabling	100 °C

Gearbox

	Reference	Standard value	Service limit
Gearbox shafts	End float		0.05÷0.20 mm
Selector drum	End float		0.10÷0.40 mm
Gear selector fork	Fork slider thickness	3.90÷4.00 mm	
	Fork–to-gear clearance	0.070÷0.285 mm	0.4 mm

Crankshaft

	Reference	Standard value	Service limit
Crankshaft	Oval		0.005 mm
	Taper		0.005 mm
	Main journal alignment		0.01 mm on diameter

Lights/instrument panel

	Reference	Technical specifications
Headlight	low beam	H4 BV (12V - 60/55W)
	high beam	H4 BV (12V - 60/55W)
	front parking light	No. 6 LEDs (12V - 2.8W)
Tail light	stop indication light	No. 12 LEDs (13.5V - 2.8W)
	rear parking light	No. 8 LEDs (13.5V - 0.45W)
	Number plate light	No. 3 LEDs (12V - 5W)
Front turn indicators	lamp	(12V - 10W)
Rear turn indicators	Lamp type	(12V - 10W)

Fuses		
RH fuse box key	Lights	5 A
	Instrument panel	10 A
	Key-1	10 A
	Key-2	15 A
	Relay	20 A
	Control unit	5 A
	BBS	10 A
	Spare	10 A
	Spare	20 A
	Spare	15 A

LH fuse box key	Optional key	7.5 A
	Alarm	5 A
	Stop	5 A
	Diagnostics	3 A
	Spare	7.5 A
	Spare	25 A
	Spare	30 A

Key of fuses on solenoid starter	ABOVE, Regulator Protection	30 A
	ABOVE, Regulator Protection	30 A
	SIDE, ABS	30 A

	SIDE, ABS	25 A

Fuel system

Important

Do not use any additives in fuel or lubricants. Using them could result in severe damage of the engine and motorcycle components.

Warning

The motorcycle is only compatible with fuel having a maximum content of ethanol of 10% (E10). Using fuel with ethanol content over 10% is forbidden. Using it could result in severe damage to the engine and motorcycle components. Using fuel with ethanol content over 10% will make the warranty null and void.

	Make	Type
	Unleaded fuel Fuel specifications for the US market.	95-98 RON Unleaded fuel with a minimum octane rating of 90 (RON+MON)/2
	Throttle body	MIKUNI with full Ride-by-wire system Diameter: 53 mm
	Injectors per cylinder	no. 1 (39–N003)
	Firing points per injector	4

Injection-ignition system

	Reference	Technical specifications
Ignition	Type	Electric with inductive discharge, mono Spark
Starting	Type	Electric starter motor, 12 V - 0.7 kW
Spark plugs	Make and type	NGK MAR9-J
	Electrode gap	0.8±0.1 mm
Coils	BERU Monospark	(A0 040 100 503)

Charging system/generator

	Reference	Technical specifications
Battery	Voltage	12 V
	Charge	10 Ah
	Type	dry, sealed, maintenance-free
Generator	Capacity	DENSO ferrite 490W – 14 V – 34.8 A Rated power 487 Watt at 6000 rpm. Minimum 22 A with 14 Volt at 1500 rpm.

Hydraulic brakes

Separate-action anti-lock brake system operated by hall-type sensors mounted to each wheel with phonic wheel detection: ABS can be disabled.

	Reference	Standard value	Service limit
FRONT			
Brake disc	Type	Drilled steel dual-disc	
	Thickness	4.5 mm	4 mm
	Braking surface material	Steel	
	Disc diameter	320 mm	
Brake calliper	Make	Brembo	
	Type	M4.32b pistons	
	Calliper cylinder diameter	32	
	Pad friction material	Toshiba TT2182 FF	
Master cylinder	Type	PR 16/22	
	Master cylinder diameter	16 mm	
REAR			
Brake disc	Type	Drilled steel disc	
	Thickness	4.2 mm	3.8 mm (min.)
	Diameter	245 mm	
Brake calliper	Make	Brembo	
	Type	P34e	
	Calliper cylinder diameter	34 mm	
	Pad friction material	Toshiba TT2172 HH	
Master cylinder	Type	PS11	
	Master cylinder diameter	11 mm	

Rear suspension

	Reference	Technical specifications
Type		SACHS Progressive The shock absorber is adjustable for rebound and spring preload.
Shock absorber	Stroke	61.5 mm
	Wheel travel	147mm

The four different settings were defined based on average parameters (dressed rider weighing 80-90 kg, dressed passenger weighing 70-80 kg): "Default", "Sport", "Comfort", "Rider+Passenger".

Adjustment range
- rebound: 0÷5 turns;
- preload: 10÷20 mm

"Default" setting

- rebound: 1.5 turns (from fully closed position).
- preload: 15 mm (from fully uncompressed).

"Sport" adjustments

- rebound: 0.5 turns (from fully closed position).
- preload: 15 mm (from fully uncompressed).

"Comfort" adjustments

- rebound: 2.5 turns (from fully closed position).
- preload: 15 mm (from fully uncompressed).

"Rider+Passenger" adjustments

- rebound: 1.5 turns (from fully closed position).
- preload: 19 mm (from fully uncompressed).

Rear wheel

	Reference	Standard value	Service limit
Minimum tread depth	In the most worn part		2 mm
Tyre pressure	Cold	2.5 bar (rider only) 2.8 bar (with passenger)	
Swinging arm shaft runout	On 100 mm		0.2 mm
Wheel rim runout	Radial	0.8 mm	2 mm
	Axial	0.5 mm	2 mm
Drive chain	Make	REGINA	
	Type	520 ZRDK	
	Size	5/8” x 1/4”	
	No. of links	108	

Front suspension

	Reference	Technical specifications
Type	KAYABA	Hydraulic upside-down fork
	Leg diameter	Ø 43 mm
	Travel on leg axis	130 mm
	Oil quantity, per leg	521 cc (right leg) 394 cc (left leg)

Front wheel

	Reference	Standard value	Service limit
Minimum tread depth	In the most worn part		2 mm
Tyre pressure	Cold	2.5 bar (rider only) 2.6 bar (with passenger)	
Wheel shaft runout	On 100 mm		0.2 mm
Wheel rim runout	Radial	0.8 mm	2 mm
	Axial	0.5 mm	2 mm

Cylinder/piston

	Reference	Standard value	Service limit
CYLINDER			
	Cylinder nominal diameter	88 mm	
	Max. oval		0.005
	Max. taper		0.015 Inspection: Section A: 10 mm from the upper edge Section B: 50 mm from the upper edge Section C: 100 mm from the upper edge
		In order for the liner to be conforming, the following conditions must be true:	Diam A ≤ Diam B ≤ Diam C Diam C - Diam A ≤ 0.015 mm
Diameter	Section A Section B Section C	88.000 mm ÷ 88.010 mm 88.010 mm ÷ 88.020 mm 88.020 mm ÷ 88.030 mm	
Piston-to-bore clearance		0.025 ÷ 0.045 mm	
PISTON			
	Piston nominal diameter	88 mm	
Diameter	Section A Section B Section C	87.965 mm ÷ 87.975 mm 87.975 mm ÷ 87.985 mm 87.985 mm ÷ 87.995 mm	
CONNECTING ROD			
	Connecting-rod big-end diameter	43.67 (0 ÷ 0.013) mm	
	Crankshaft class	Connecting rod class	Bearings colour
Big-end bearing pairings	A B A B	A A B B	Blue + Yellow Yellow + Yellow Blue + Blue Blue + Yellow
Big-end bearing-to-crankpin clearance	Crankpin selection	A: Ø40.025 (+0.016; +0) mm B: Ø40.025 (+0; -0.016) mm	
Gudgeon pin–to-piston clearance		0.015 ÷ 0.024 mm	
	Nominal diameter	Ø 18 mm	
	Piston	Ø 18(+0.020;+0.015) mm	

	Gudgeon pin	Ø 18 mm (+0;-0.004) mm	
Gudgeon pin-to-connecting rod clearance		0.035 ÷ 0.049 mm	
Engine cylinder compression measured with DDS2		11÷12 bar	10 bar (MIN.), difference between the two cylinders: 2 bar (MAX.)

Timing system/valves

	Reference	Assembly value	Check value every 24,000 km
Timing diagram	With 1 mm valve lift		
	Intake	Opening 4° B.T.D.C. Closing 52° A.B.D.C.	
	Exhaust	Opening 58° B.B.D.C. Closing 7° A.T.D.C.	
	Intake valve diameter	35.5 mm	
	Exhaust valve diameter	28.8 mm	
Valve lift	With 0 mm valve clearance	Intake Exhaust	11.3 mm 9.6 mm
Valve clearance			
	Opening rocker arm - intake	0.13÷0.18 mm	0.10÷0.25 mm
	Opening rocker arm - exhaust	0.13÷0.18 mm	0.10÷0.25 mm
	Closing rocker arm - intake	0.05÷0.10 mm	0.05÷0.15 mm
	Closing rocker arm - exhaust	0.05÷0.10 mm	0.05÷0.15 mm

Transmission

Reference	Technical specifications
Clutch	Wet slipper clutch with less effort at the lever
Clutch control	Hydraulically operated by a control lever on the handlebar left side
Gearbox	6 speed
Front chain sprocket/clutch gearwheel ratio (primary drive)	33/61
Drive ratio	1.848:1
Gearbox output sprocket/rear chain sprocket ratio (final drive)	15/46
Gearbox type	With constant mesh spur gears, operated by a lever on the left side of the motorcycle

Transmission	Gear ratios	
	1st	37/15 2.467:1
	2nd	30/17 1.765:1
	3rd	28/20 1.400:1
	4th	26/22 1.182:1
	5th	24/23 1.043:1
	6th	23/24 0.958:1

Drive chain	Make	Regina	
	Type	520 ZRDK	
	Size	5/8" x 1/4"	
	No. of links	108	

Colours

RED	
Primer (Acriflex White)	L0040652 (LECHLER)
Primer (Ducati Red)	473.101 (PPG)
Varnish (Acriplast Red Stoner SF)	LMC06017 (LECHLER)
Charcoal black frame	44974 (INVER SPA)
Rear subframe (Matt Black Powder Enamel)	CN201V (AKZO NOBEL)
Rims (Black)	

STAR WHITE SILK	
White primer 2 K	873.AC001 (PALINAL)
Star White primer	928.T948(PALINAL)
Clear lacquer	96598 (LECHLER)
Red frame (Ducati Red)	81784 (INVER SPA)
Rear subframe (Matt Black Powder Enamel)	CN201V (AKZO NOBEL)
Rims (Red)	

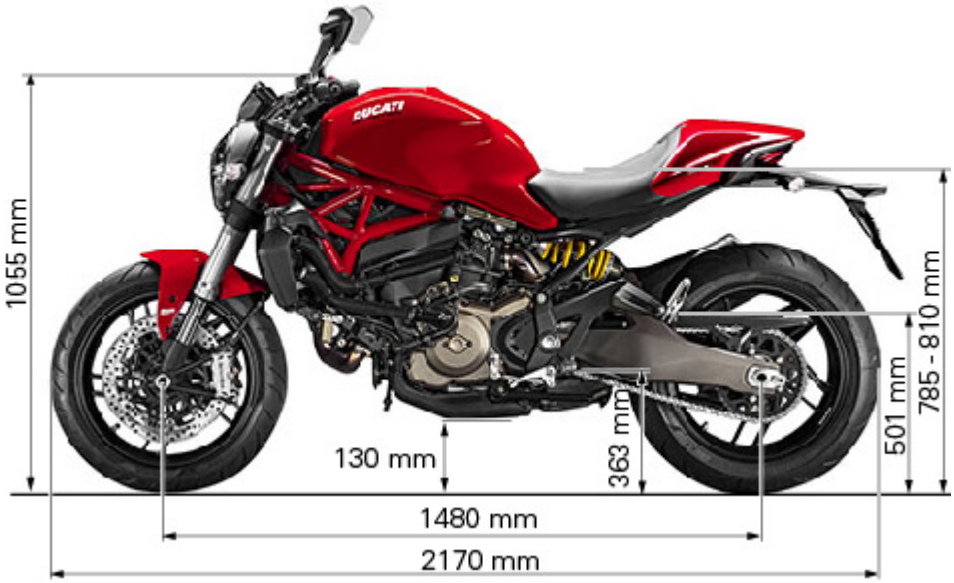
Monster 821 DARK: seat cover not supplied.

DARK STEALTH	
Primer (Black primer 2 K)	873.A002 (PALINAL)
Primer (Black Stealth — Black 94)	929.R223 (PALINAL)
Clear coat (clear coat 2 K matt)	923I.2176 (PALINAL)
Charcoal black frame	44974 (INVER SPA)
Rear subframe (Matt Black Powder Enamel)	CN201V (AKZO NOBEL)
Rims (Black)	

	Reference	Technical specifications
Motorcycle dimensions	Total length	2170 ± 20 mm
	Handlebar width	800 ± 20 mm
	Total height (without rear-view mirrors)	1055 ± 20 mm
	Handlebar height	1045 ± 20 mm
	Seat height (adjustable)	785 – 810 mm
	Minimum ground clearance	180 mm
	Front footpeg height	363 mm
	Rear footpeg height	501 mm
	Wheelbase	1480 ± 20 mm
Frame	Type	Molybdenum-chrome steel tubular trellis fixed to the head
Subframe	Type	Die-cast aluminium steel tube trellis
	Steering head angle	24.3°
	Steering angle (per side)	30°
	Trail	93.2 mm
	Front suspension	KAYABA hydraulic upside-down fork Leg diameter: 43 mm
	Front wheel travel	130 mm
	Rear suspension	Progressive with SACHS monoshock, with rebound and spring preload adjustment. Suspension travel: 61.5 mm Wheel travel: 147 mm.
	Front wheel rim	Ten-spoke light aluminium alloy rim
	Front wheel rim size	MT3.50x17”
	Front tyre size	120/70 - ZR 17
	Rear wheel rim	Ten-spoke light aluminium alloy rim
	Rear wheel rim size	MT5.50x17"
	Rear tyre size	180/60 - ZR 17
	Type of tyres	Radial, tubeless
	Front brake	With drilled steel dual-disc ABS as a standard
	Rear brake	With fixed drilled steel disc. ABS as a standard.

Engine	Type	Twin cylinder, longitudinal 90° "L" type, four-stroke
	Bore	88 mm
	Stroke	67.5 mm
	Displacement	821,1 cu.cc
	Compression ratio	(12.8±0.5):1
	Timing system	Toothed belt type with two overhead camshafts; Desmodromic, 4 valves per cylinder and eight rocker arms
	Lubrication system	Forced by pump
	Oil pump type	Lobe type, with bypass valve
	Cooling system	Liquid cooling with thermostat
	Air filter	One cylindrical filtering element
	Crankshaft type	One-piece
	Clutch	Wet, multiple plates with absorption and anti-hop mechanism
	Clutch control	Cable type

Dimensions


1055 mm
130 mm
363 mm
501 mm
785 - 810 mm
1480 mm
2170 mm

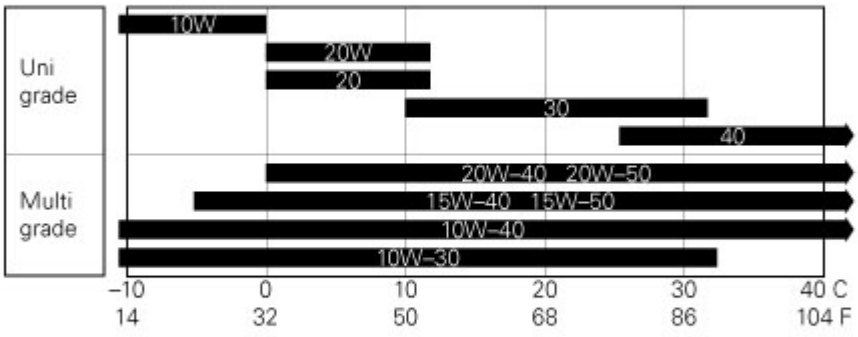

800 mm
1045 mm

Warning
Failure to observe weight limits could result in poor handling, impair performance and you may lose control of the motorcycle.

Fuel, lubricants and other fluids	Type	cu. dm (litres)
Fuel tank, including a reserve of 2.5 cu. dm (litres)	Unleaded fuel with 95 RON fuel octane rating (at least). For the US market, unleaded fuel with 90 (RON+MON)/2 fuel octane rating (at least).	17.5
Oil sump and filter	SHELL Advance 4T Ultra	3.2
Front/rear brake and clutch circuits	SHELL – Advance Brake DOT 4	-
Protectant for electric contacts	SHELL – Advance Contact Cleaner	-
Front fork (KAYABA)	SHELL - Advance Fork 7.5 or Donax TA	521 cc (right leg); 394 cc (left leg)
Cooling circuit	ENI Agip Permanent Spezial antifreeze (do not dilute, use pure)	2.5

Important
Do not use any additives in fuel or lubricants. Using them could result in severe damage of the engine and motorcycle components.

Warning
The motorcycle is only compatible with fuel having a maximum content of ethanol of 10% (E10). Using fuel with ethanol content over 10% is forbidden. Using it could result in severe damage to the engine and motorcycle components. Using fuel with ethanol content over 10% will make the warranty null and void.



Engine oil
A good quality engine oil has special properties. Use only a highly detergent engine oil with certified SE, SF or SG or higher service ratings as marked on the container.

Viscosity
SAE 15W-50
The other viscosity grades specified in the table can be used where the average ambient temperatures are within the limits shown.

Engine tightening torque values

Description	Thread length	Threading	Torque (Nm)			Notes
			Rated	Min	Max	
Head						
FIXED tensioner pin		M20x1	50	45	55	Pre-applied product
MOBILE tensioner pin		M20x1	50	45	55	LOCK 2 (or TB1324)
FIXED and MOBILE tensioner pin		M20x1	50	45	55	LOCK 2 or TB 1324
Camshaft belt roller ring nut		M17x1	71	64	78	GREASE A
Rocker arm shaft blanking plug + washer		M12x1.25	15	14	16	Pre-applied product (if new, apply LOCK 2)
Temperature sensor on water union		M12x1.5	23	20	26	LOCK 4: hold insert while tightening
Nut for head/cylinder stud bolt (snug torque)		M10x1.5	20			Apply GREASE C under nut head and on stud bolt thread
Nut for head/cylinder stud bolt (preload)		M10x1.5	40	38	42	
Nut for head/cylinder stud bolt (tightening)		M10x1.5	60	57	63	
Camshaft cap retaining screw (preload)	32	M8x1.25	10	9	11	Apply SHELL ADVANCE ULTRA 4 oil
Camshaft cap retaining screw (tightening)	32	M8x1.25	22.5	21	25	
Belt roller flange retaining screw	12	M6x1	14	12.5	15.5	
Head cover retaining screw		M6x1	10	9	11	
Head cover retaining special screw		M6x1	10	9	11	
Secondary air cover retaining screw		M6x1	6	5	7	
Exhaust manifold stud bolt		M6x1	10	9	11	LOCK 5
Screw securing vacuometer to head	8	M6x1	5	4	6	LOCK 2 (or TB 1324) (Europe version)
Screw securing water unions to head		M5x0.8	6	5	7	Pre-applied threadlocker
Head union for canister (USA version only)		M6x1	5	4	6	LOCK 2 (or TB 1324) (California versions)
Horizontal head air breather union		M6x1	2.5	2	3	LOCK 2
Vertical head air breather blanking screw	8	M6x1	8	7	9	LOCK 2
Intake manifold retaining screw	16	M6x1	10	9	11	
MAP sensor special screw		M6x1	5	4	6	

Casing						
Plastic oil mesh filter		M24x1.25	10	9	11	
Oil mesh filter plug		M32x1.5	42	38	46	
Oil cartridge		M16x1.5	11	10	12	SHELL ADVANCE ULTRA 4 oil on seal
Nipple for oil cartridge		M16x1.5	42	38	46	LOCK 2 (or TB 1324)
Oil intake duct cap		M16x1.5	24	21	27	LOCK 5
Oil cooler nipple		M14x1.5	32	29	35	LOCK 5
Oil drain plug with magnet		M12x1.5	20	18	22	TB1215
Clutch crankcase oil delivery channel plug (lobe pump)		M15x1	25	22	28	LOCK 5
Cylinder/head stud bolt		M10x1.5	30	28	32	LOCK 2 (or TB 1324)
Clutch oil channel tapered plug		M10x1	20	18	22	LOCK 5
Casing jointing screw in cylinder area (preload)	75	M8x1.25	19	17	21	GREASE B on thread
Casing jointing screw in cylinder area (tightening)	75	M8x1.25	25	22	28	
Crankcase central jointing screw + swinging arm connection area (preload)	75	M8x1.25	19	17	21	GREASE B on thread
Crankcase central jointing screw + swinging arm connection area (tightening)	75	M8x1.25	25	22	28	
Gear stopper lever retaining screw	21.5	M8x1.25	18	16	20	LOCK 2 (or TB 1324)
Special dowel for roller bearing bush	14	M8x1.25	16	15	17	LOCK 2 (or TB 1324)
Blow-by valve retaining screw	16	M6x1	10	9	11	
Secondary bearing, chain side, stop screw	12	M6x1	10	9	11	LOCK 2 (or TB 1324)
Primary bearing, clutch side, stop screw	16	M6x1	10	9	11	LOCK 2 (or TB 1324)
Casing jointing screw in idle gear shaft area	75	M6x1	10	9	11	
Casing outer jointing screw	35	M6x1	10	9	11	
Radial pick-up retaining screw	16	M6x1	10	9	11	
Clutch recess screw + brass washer (S=2mm)		M6x9	10	9	11	
Oil squirter under piston retaining screw	10	M5x0.8	8	7	9	LOCK 2 (or TB 1324)
Blow-by valve upper shell screw		M3	1.2	1	1.4	LOCK 5
Electric starter						
Starter motor inner retaining TCEI screw	18	M6x1	10	9	11	Pre-applied product
Starter motor inner retaining TCEIF screw	20	M6x1	10	9	11	Pre-applied product
Starter motor outer retaining screw	25	M6x1	10	9	11	Pre-applied product

Starter motor rear retaining screw	30	M6x1	10	9	11	Pre-applied product
Connecting rods						
Primary sprocket retaining nut		M22x1	190	171	209	GREASE 2
Flywheel retaining nut		M24x1	330	313	346	LOCK 5
Steel/aluminium crankshaft plug		M20x1	15	13.5	16.5	LOCK 5
Connecting rod bolt (Class 12.9)	4	M10x1				
1) Apply the recommended grease to the thread						GREASE B on thread
2) Tightening at 50rpm				35		
3) Pause of 2 seconds and 360° loosening at 30rpm						
4) Snug torque at 30rpm				20		
5) Snug torque at 10rpm				35		
6) 65° +/-1° tightening at 14rpm						
7) Torque check				70 to 103		
Crankshaft dowel	8	M8x1.25	13	11	15	LOCK 5
Crankshaft drilled dowel	8	M8x1.25	13	11	15	LOCK 5
Gear selector control						
Gearbox drum positioning screw		M16x1.5	30	27	33	Pre-applied product
Neutral sensor		M10x1.25	11	9	10	
Gearbox pawl screw	25	M8x1.25	36	34	38	LOCK 2 (or TB 1324)
Pawl positioner retaining nut		M6x1	10	9	11	
Gearbox pawl screw	20	M6x1	16	15	17	LOCK 2 (or TB 1324)
Timing system						
Timing layshaft belt roller ring nut		M15x1	71	64	78	GREASE A
Camshaft gear nut		M14x1	55	50	60	GREASE A
FIXED tensioner bearing retaining screw		M14x2	50	45	55	GREASE A
Nut securing MOBILE tensioner		M8x1.25	25	22	28	GREASE A
Plastic cover retaining screw	18	M6x1	10	9	11	Pre-applied product
Cover filter self-tapping screw	12	ST3.5	1.75	1.5	2	
Covers						
Water intake union		M30x1.5	25	23	27	LOCK 5

Water delivery union		M22x1.5	25	23	27	LOCK 5
Wet clutch fluid filler cap		M20x1.5	5	4.5	5.5	
Pick-up inspection screw		M12x1	15	13	17	LOCK 2 (or TB 1324)
Water pump cover plug		M10x1	15	13.5	16.5	
Clutch recess blanking plug			15	13.5	16.5	LOCK 5
Water pump bearing retaining screw	16	M6x1	10	9	11	LOCK 2 (or TB 1324)
Timing inspection cover TSPEI screw	14	M6x1	5	4.5	5.5	
Water pump cover closing screw (through hole), TCEI	32	M6x1	13.5	12.5	14.5	
Water pump cover closing screw, TCEI	18-25	M6x1	13.5	12.5	14.5	
Water pump cover closing screw (blind holes)	18-25	M6x1	13.5	12.5	14.5	
Generator cover closing screw, TCEIF	20-25-30-35	M6x1	13.5	12.5	14.5	
Generator stator retaining screw	30-40	M6x1	10	9	11	LOCK 2 (or TB 1324)
Clutch cover closing screw	30-80-90	M6x1	13.5	12.5	14.5	
Special screw securing clutch cover to stud bolt	30	M6x1	13.5	12.5	14.5	
Screw securing pushrod plug on generator cover	12	M6x1	10	9	11	
Stator cable retaining screw	14	M5x0.8	5	4.5	5.5	LOCK 2
Gearbox and clutch						
Clutch drum nut		M25x1.5	190	180	200	GREASE B
Wet clutch spring screw	20	M5x0.8	5	4.5	5.5	
Ignition						
Spark plug		M10x1	12	11	13	
Screw securing rotor to flywheel	25-35	M6x1	13	11	15	Pre-applied product
Oil pump						
By-pass pump plug		M15x1	17	15	19	LOCK 5
Oil lobe pump assembling screw	16-50	M6x1	10	9	11	
Cylinders						
Water delivery union		M22x1.5	25	23	27	LOCK 5
Cooling circuit						

Water circuit ties			2.5	2	3	

Frame tightening torque values

Description	Threading	Nm ±10% Tolerance	Notes
Headlight fairing			
LH rear-view mirror retainer	M8x1.25	25	
RH rear-view mirror retainer	M8x1.25 - LH	25	
Stand			
Side stand plate to engine retainer	M10x1.25	36	LOCK 2
Stand sensor to stand pin retainer	M6x1	5	Pre-applied threadlocker
Nut securing stand to stand plate	M8x1.25	24	
Stand plate pin	M8x1.25	24	GREASE A — Residue cleaning — LOCK 2
Chain and front sprocket			
Sprocket retaining nut	25x1.5	186*	GREASE B
Front sprocket cover retainer	M6x1	6	LOCK 2
Lights			
Headlight to support retainer	M6x1	8	
Headlight support to bottom yoke retainer	M6x1	8	
Front turn indicators to headlight support retainer (NO USA version)	M5x0.8	3	LOCK 2
Headlight unit to headlight support retainer	AF5	1	
Headlight unit to headlight support retainer	M5x0.8	5	
Tail light support to rear subframe retaining screw	AF5	3	
Front turn indicator RH/LH spacer (USA version) to leg retainer	M6x1	5	
Turn indicator spacer (USA version) to indicator cover retainer	M6x1	5	Pre-applied threadlocker
Turn indicators to spacer (USA version) retainer	M5x0.8	3	Pre-applied threadlocker
Rear turn indicators to rear indicator spacer retainer	M5x0.8	3	Pre-applied threadlocker
RH/LH turn indicator support cover to rear RH/LH turn indicator support retainer	M5x0.8	3	
Rear turn indicator support to special screw retainer	M6x1	10	

Instrument panel			
Instrument panel to support retainer	M5x0.8	5	
Retainer of instrument panel to instrument panel cover and support	M5x0.8	5	
Front fork			
Steering bearing ring nut	M35x1	30*	GREASE B
Steering head locking screw on fork legs	M8x1.25	24*	GREASE B
Steering head central locking screw	M8x1.25	24*	GREASE B
Bottom yoke locking screw	M8x1.25	22*	GREASE B (sequence 1-2-1)
Handlebar U-bolt locking screw	M8x1.25	25*	GREASE B (sequence 1-2-3-4-3)
Nut securing handlebar lower U-bolts to steering head	M10x1.25	45*	
Steering limit stop adjuster lock nut	M8x1.25	18	LOCK 2
Screw securing brake cable ring to steering head	M6x1	8	Pre-applied threadlocker
Screw securing brake hose guide to bottom yoke	M6x1	10	Pre-applied threadlocker
Screw securing speed sensor hose guide to left fork bottom end	M6x1	10	
Fork bottom end locking screw	M6x1	10*	GREASE B (sequence 1-2-1)
Electric system			
Screw securing voltage regulator	M6x1	8	
Screw securing the voltage regulator protection to the battery mount cover	M5x0.8	3	
Screw securing battery mount cover to electrical component support	M6x1	5	
Screw securing battery box heat guard to electric component support	M5x1	3.5	
Screw securing the exhaust valve motor to electric component support	M5x1	3.5	
Screw securing cables to solenoid starter	M6x1	5	
Screw securing electrical component support to engine	M8x1.25	18	LOCK 2
Screw securing solenoid starter cover to electric component support	M5x0.8	4	
Screw securing fuse support rubber bracket to electric component support	M3.5	2	
Screw securing electric component pin to electric component LH bracket	M10x1.25	20	GREASE B

Screw securing electric component RH bracket to engine	M10x1.25	36	GREASE B
Lock nut retaining electric component support RH bracket to electric component pin	M6x1	10	
Coil to coil support upper retaining screw	M5x0.8	6	
Coil to coil support lower retaining screw	M5x0.8	6	
Screw securing coil support to frame	M5x0.8	6	
Screw securing wiring protection to vertical head	M5x0.8	5	
Screw securing ignition switch to frame	M6x1	>12	Pre-applied threadlocker; Shear the screw head
Ignition switch cover retaining cap nut	M6x1	7	
Wiring bracket retaining screw	M6x1	10	
Screw securing RH/LH switches	M4x0.7	1.3	
Front ABS sensor retaining screw	M6x1	7	Pre-applied threadlocker
Rear ABS sensor retaining screw	M6x1	7	Pre-applied threadlocker
Ground cable on engine retaining screw	M6x1	10	
Lower screw securing horn bracket	M6x1	8	
Upper screw securing horn bracket	M5x0.8	5	
Screw securing horn to horn bracket	M6x1	6	
Rear swinging arm			
Swingarm shaft screw	M15x1.25	72*	GREASE B (on thread and underhead)
Upper front chain sliding shoe retainer	M5x0.8	5	Pre-applied threadlocker
Lower chain sliding shoe retainer	M5x0.8	5	Pre-applied threadlocker
Upper rear chain sliding shoe retainer	M5x0.8	5	Pre-applied threadlocker
Screw securing rear brake hose guide to swinging arm	M5x0.8	5	Pre-applied threadlocker
Rear brake hose protection retaining screw	M6x1	5	
Calliper holder plate guide screw	M5x0.8	6	LOCK 2
Braking system			
Screw securing front brake master cylinder to handlebar	M6x1	10	Sequence 1-(UP)-2-1
Front brake calliper retaining screw (RH+LH)	M10x1.25	45*	GREASE B
Front brake calliper pre-tightening for settling (RH+LH)	M10x1.25	2	GREASE B
Union on brake master cylinder tightening	M10x1	23	

Unions to ABS control unit tightening	M10x1	23	
Brake calliper bleeder tightening (RH/LH)	M6x1	4	
Screw securing ABS control unit to bracket	M6x1	6.8±1	LOCK 2
Screw securing ABS fuse support bracket to frame	M6x1	10	
Screw securing ABS control unit to ABS fuse support bracket	M6x1	10	Pre-applied threadlocker
Rear brake master cylinder retaining screw	M6x1	10	LOCK 2
Brake draining union	M10x1	23	
Screw securing rear brake fluid reservoir to support	M6x1	2	
Rear brake calliper retaining screw	M8x1.25	25*	GREASE B
Screw securing ABS hose rear bracket to engine	M6x1	10	Pre-applied threadlocker
Screw securing ABS hose plug to ABS hose support bracket	3.5	1.6	
Number plate holder			
Screw securing number plate holder to rear guard	M6x1	5	
Special screw to rear subframe retainer	M8x1.25	20	
Number plate holder to special screw retainer	M6x1	10	
Lower number plate holder to upper number plate holder retainer	M5x0.8	3.5	
Nut securing lower number plate holder cat's eye	M4x0.7	2	
Screw securing number plate light to lower number plate holder	3.5	2	
Handlebar - clutch control			
Screw securing clutch lever to handlebar	M6x1	6–7	Seq. 1-(UP)-2-1
Screw securing clutch lever to lever unit	M6x1	10-15	
Screw securing clutch cable plate to engine	M6x1	10	
Rear suspension			
Screw securing shock absorber to vertical head	M10x1.25	42*	GREASE B
Screw securing shock absorber to rear swinging arm	M10x1.25	42*	GREASE B
Front mudguard			

Front mudguard retainer (RH+LH)	M6x1	8	Pre-applied threadlocker
Front brake hose guide on mudguard retainer	3.5	0.4	
Cooling system			
Upper screw securing radiator to frame	M6x1	10	
Threaded pin to horizontal head retainer	M6x1	10	
Screw securing radiator to threaded pin	M5x0.8	5	
Screw securing expansion reservoir support bracket to manifold	M6x1	10	Pre-applied threadlocker
Screw securing expansion reservoir to bracket	M6x1	8	
Bushing on reservoir retaining screw	M6x1	8	
Water hose clamps on thermostat and radiator retainer		3	
Water hose clamp on thermostat and engine retainer		3	
Vertical head water radiator breather pipe retaining clamp		0.6	
Horizontal head thermostat union retaining clamp		0.6	
Union to engine retaining clamp		3	
Vertical head to union retaining clamp		3	
Nut securing expansion reservoir to ABS support bracket	M6x1	6	
Footpegs and levers: right side — rear brake			
Brake lever pin on footpeg plate	M8x1	24	Pre-applied threadlocker
Stop switch on footpeg holder plate	M8x1	5	
Brake master cylinder control rod retainer	M6x1	7.5	
Brake lever adjuster retainer	M6x1	8	
Rear brake return spring retaining pin	M6x1	10	LOCK 2
Lower footpegs to engine retaining adjuster	M20x1	0.6	GREASE B
Footpeg holder plate adjuster ring nut to adjuster	M20x1	80*	GREASE B
Footpeg holder plate to adjuster retaining screw	M10x1.25	45*	GREASE B
Screw retaining silencer heel guard to footpeg holder plate	M5x0.8	5	Pre-applied threadlocker
Screw securing brake fluid reservoir support to footpeg holder plate	M6x1	10	LOCK 2
Footpeg holder plate and rear subframe to engine retaining nut	M12x1.25	60*	GREASE B

Footpegs and levers: left side — gearbox			
Gearchange lever pin on footpeg holder plate	M8x1	24	Pre-applied threadlocker
Screw securing gearchange rod joints to gear shift lever	M6x1	10	
Screw securing gearchange rod joints to gear shift lever	M6x1	10	Pre-applied threadlocker
Screw locking gearchange lever to pawl	M6x1	10	LOCK 1
Right nut locking joints to gearchange rod	M6x1	5	
Left nut locking joints to gearchange rod	M6x1	5	
Lower footpegs to engine retaining adjuster	M20x1	0.6	GREASE B
Footpeg holder plate adjuster ring nut to adjuster	M20x1	80*	GREASE B
Footpeg holder plate to adjuster retaining screw	M10x1.25	45*	GREASE B
Rear mudguard			
Screw securing rear mudguard to swinging arm	M5x0.8	5	Pre-applied threadlocker
Screw securing number plate holder plate to splash guard	M6x1	10	
Screws securing rear mudguard to swinging arm	M5x0.8	5	Pre-applied threadlocker
Screws securing rear mudguard to swinging arm (clip)	M5x0.8	5	
Screws securing rear mudguard to swinging arm (plastic insert)	M5x0.8	5	
Front wheel			
Brake disc retaining screw	M8x1.25	30*	LOCK 2
Front wheel nut	M25x1.25	63*	GREASE B
Tyre (angle) valve locking nut	M8x1.25	9	LOCK 2
Rear wheel			
Phonic wheel to brake disc retainer	M8x1.25	25*	LOCK 2
Valve retainer	M8x1.25	9	
Cush drive damper pin to driving flange retainer	M14x1.5	44*	LOCK 5
Rear sprocket to driving flange retainer	M10x1	44*	LOCK 2
Rear wheel shaft pre-assembly	M30x1.5		LOCK 8 - Manually tighten nut until exceeding pin threading end by 1.25 mm

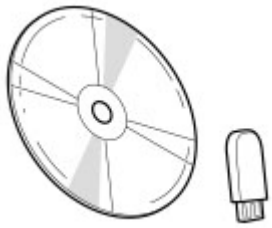
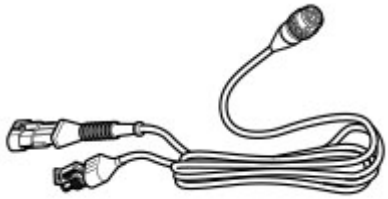
Double-sided swinging arm rear wheel pack retainer (RH side)	M30x1.5	180*	GREASE B
Chain tensioner adjuster retainer	M8x1.25	8	(loosening)
Fuel tank			
Screw retaining buffers to fuel tank	M5x0.8	6	
Tank plug retaining screw	M5x0.8	4	(TCEI)
Tank plug retaining screw	M5x0.8	4	(TCEI M5x14 8.8)
GAC retaining screw	M5x0.8	5	GREASE B
Male quick coupling fastener	1/4 NPT	10	LOCK 6
Belt knob to tank retainer	M6x1	8	
Canister to bracket retaining nut (USA ONLY)	M6x1	8	
Canister bracket to radiator support bracket retaining screw (USA ONLY)	M5x0.8	6	Pre-applied threadlocker
Special screw to engine retainer (USA ONLY)	M6x1	8	
Canister bracket to special screw retainer (USA ONLY)	M5x0.8	6	Pre-applied threadlocker
Exhaust			
Nut securing exhaust pipe flange to vertical and horizontal head	M6x1	10	
Endcap (upper and lower) to silencer retaining screw	M5x0.8	4	
Silencer heat guard retaining screw	M5x0.8	4	
Lambda sensor fastener	M12x1.25	25	
Exhaust gas plug retainer	M10x1.25	25	GREASE I
Screw securing silencer to bracket	M6x1	7	
Silencer clamp retainer		18	
Screw securing silencer support to footpeg holder plate	M8x1.25	20	
Exhaust valve cover retaining screw	M6x1	8	
Vertical primary heat guard (plastic) retaining screw	M6x1	8	
Vertical and vertical primary manifold retaining clamp		18	
Vertical manifold heat guard retaining clamps		5	
Vertical primary pipe heat guard retaining clamps		2.5	
Silencer endcap retainer	M6x1	4.5	

Seat assembly			
Seat cover retaining screw	M5x0.8	4	
Seat lock to seat bottom cover ring nut retainer	M22x1.25	4	
Frame assembly			
Frame to horizontal and vertical head retaining screw	M12x1.25	90*	GREASE B (on thread and underhead)
Screw retaining subframe to vertical head	M18x1.5	150*	GREASE B (on thread and underhead)
Screw securing tank seat support to rear subframe	M6x1	10	
RH and LH underseat panel to rear subframe retaining screw (with clip)	M5x0.8	3	
RH and LH underseat panel to rear subframe retaining screw	M5x0.8	3	Pre-applied threadlocker
Screw securing latch to rear subframe	M6x1	5	
Tank pin retaining plate to tank seat support retaining screw	M5x0.8	5	
Lubrication			
Pressure switch to remote oil pipe retainer	M10x1	24	
Pressure switch oil pipe to engine retainer	M14x1.5	32	
Screw securing pressure switch support to engine	M6x1	10	
Air inlet - oil breather			
Blow-by pipe clip		1.5	
Screw securing ECU and electric component support to airbox upper box	M5x0.8	5	
Screw securing ignition switch connector support to ECU and electric component support	M5x0.8	5	
Screw securing ECU to ECU and electric component support	M5x0.8	5	
Screw securing MAP sensor support and union to airbox lower box	M5x0.8	6	
Screw securing air temperature sensor to airbox upper box (ATS05 Marelli)	3.5	0.3	
Screw securing clamp base (RICHO) to airbox upper box	3.5	0.5	
Screw securing throttle body to airbox lower box	M6x1	8	
Screw securing fuel pipes to throttle body	M5x0.8	5	

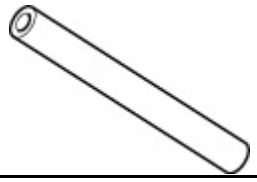
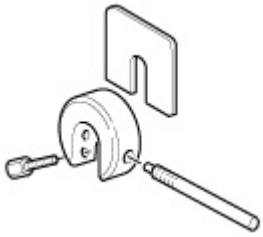
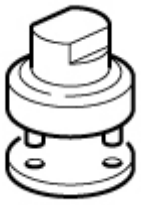
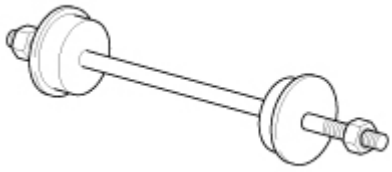
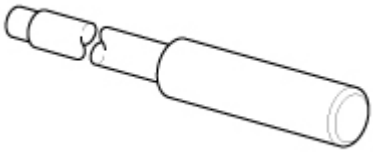
Screw securing intake funnels to throttle body	M5x0.8	5	Pre-applied threadlocker
Screw securing air filter cover to airbox upper box	M5x0.8	3	
Air filter retaining ring nut	M6x1	6	
Screw securing upper box to airbox lower box	5	2.25	
Clip securing throttle body to intake ducts		2.5	
Secondary air system actuator to airbox upper box retainer	3.5	0.3	
Fairings			
Water radiator cover to water radiator retaining screw	M5x0.8	3	Pre-applied threadlocker
Water radiator cover to water radiator retaining screw	M5x0.8	3	Pre-applied threadlocker
RH/LH fan cover to water radiator retaining screw	M5x0.8	3	Pre-applied threadlocker
RH/LH fan cover to water radiator retaining screw	M5x0.8	3	
Screw securing wiring support to engine	M5x0.8	5	
RH/LH strip to underseat plate cover retaining screw	M5x0.8	3	
Screw retaining underseat plate cover to rear subframe	M5x0.8	3	
RH lateral cover to engine retaining screw	M6x1	1	
Screw securing wiring cover to engine	M5x0.8	5	
LH lateral cover to wiring cover retaining screw	M5x0.8	3	
Rear - front subframe special screw retaining screws	M8x1.25	20	
Rear - rear subframe special screw retaining screws	M8x1.25	20	
Side cover to wiring support retaining screws	M5x0.8	4	

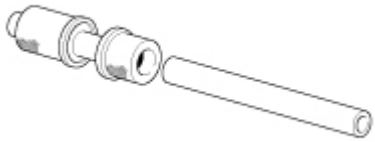
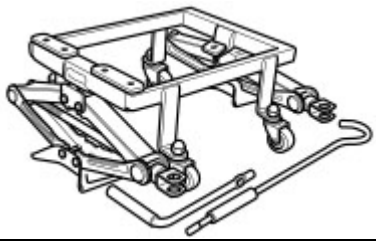
*dynamic safety-critical point; tightening torque tolerance must be Nm ±5%.

Diagnosis special tools

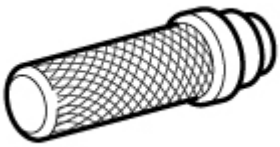
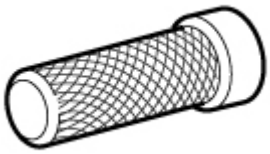
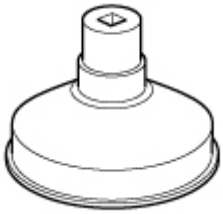
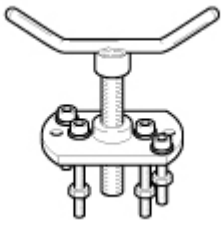
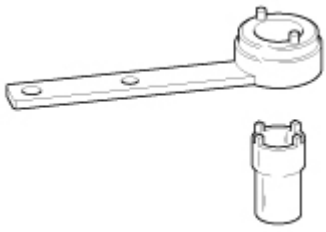
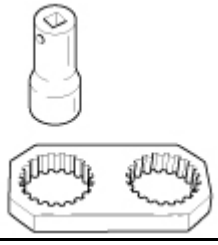
PART NO.	DESCRIPTION	IMAGE
28620441A	“PC HASP DDS2.0” wrench	
979000252	DDS 2 (Ducati Diagnosis System 2.0)	
979000253	Belt tensioning	
979000254	Diagnosis and power supply cable	
979000255	Diagnosis and power supply cable (CAN)	
979000256	Power supply cable from DDS battery	

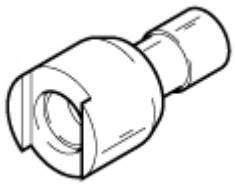
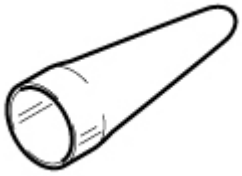
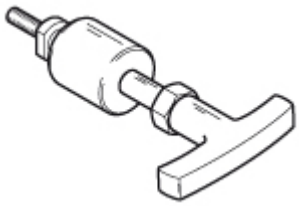
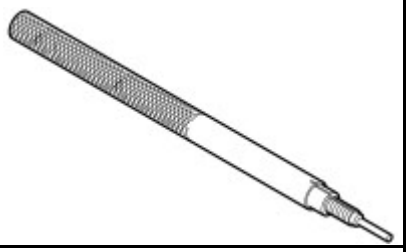
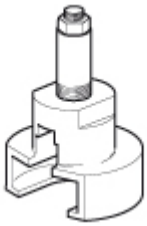
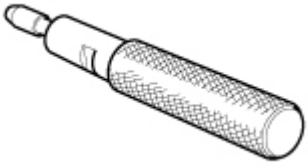
Frame special tools

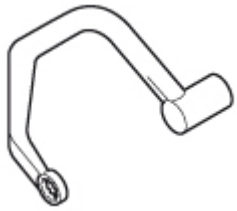
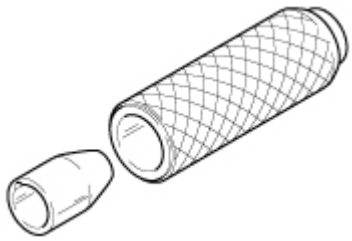
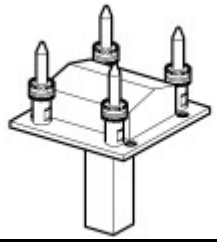
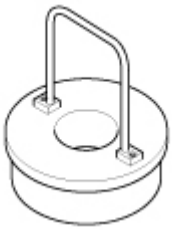
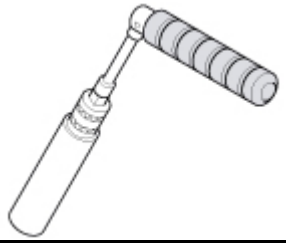
PART NO.	DESCRIPTION	IMAGE
80007.0139	Front wheel shaft wrench	
88713.0950	Traction bar for Kayaba fork overhaul	
88713.0957	Preload tube retaining tool for Kayaba fork	
88713.1058	Wrench to fit steering tube plug	
88713.1062	Steering tube bearing installation tool	
88713.1074	Swingarm shaft removal tool	
88713.1096	Driving tool for Kayaba fork oil seal	

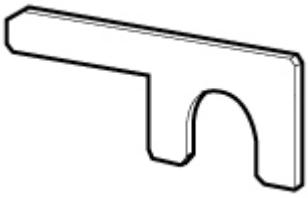
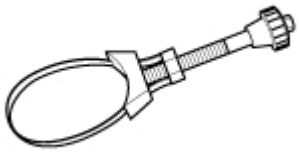
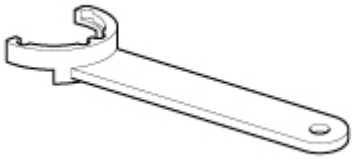
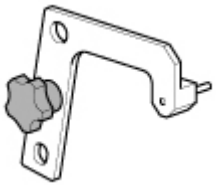
88713.2409	Ball bearing installation tool	
88713.3220	Engine repair work bench	
88713.4513	Frame/engine support	

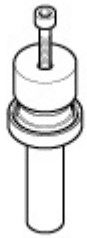
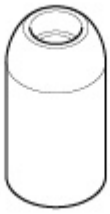
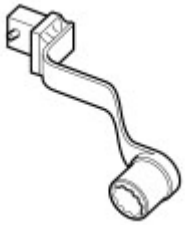
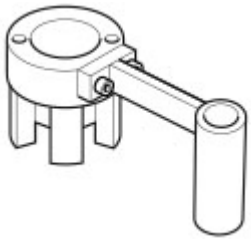
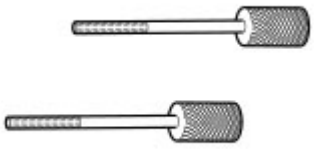
Engine special tools

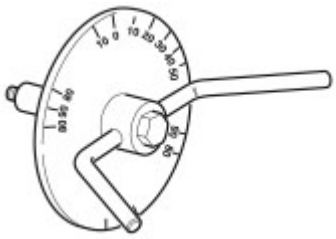
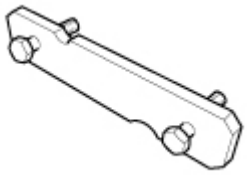
PART NO.	DESCRIPTION	IMAGE
88713.0137	Primary drive sprocket retainer key	
88713.0869	Water pump front seal installation tool	
88713.0870	Water pump front seal counter-washer installation tool	
88713.0944	Oil cartridge wrench	
88713.1749	Puller for driving pulley and cover	
88713.1805	Driving pulley tightening tool	
88713.1806	Camshaft pulley (Z=20) tightening tool	

88713.1821	Tensioner pin wrench	
88713.1920	Tool to install O-rings on engine block stud bolts	
88713.1994	Rocker arm shaft puller	
88713.2011	Tool to block crankshaft at Top Dead Centre (TDC)	
88713.2087	Gauge to check Top Dead Centre (TDC)	
88713.2092	Primary drive gear puller	
88713.2442	Tool to install seal ring on valve guide	
88713.2556	Clutch housing reaction tool	

		
88713.2676	Cylinder head nut tightening tool	
88713.2834	Snap ring installation tool	
88713.2861	Camshaft seal ring installation tool	
88713.2863	Bearing surface for head installation	
88713.2870	Con-rod guiding tool	
88713.2877	Spark plug wrench	
88713.2878	Spacer and fork feeler gauge 0.2/0.3 mm	

		
88713.2906	Oil cartridge wrench	
88713.3219	Reaction tool for pulley tightening	
88713.3334	Selector fork positioning plate	
88713.3367	Flywheel wrench	
88713.3497	Wrench to tension the belt mobile tensioner	
88713.3992	Piston pin circlip fitting tool	
88713.4145	Main bearing shell assembling tool	

		
88713.4189	821 main bearing shell saving tool	
88713.4198	vertical cylinder exhaust manifold upper nut disassembly tool	
88713.4284	Clutch pack assembly reaction tool	
88713.4285	Clutch pack locking screws	
88713.4286	Clutch pack assembly/disassembly support	
88713.4411	Insert (together with part no. 88713.2011)	
88713.4803	Special socket wrench 18 to tighten mesh filter	

		
88765.1000 88765.1005 88765.1006	Fork feeler gauges	
88765.1298	Valve lower shim check spacer	
88765.1523	Timing check tool	
88765.1623	Timing pulley positioning tool	

Vehicle pre-delivery

- Transport packaging integrity visual check (where applicable).
- Transport packaging removal (where applicable).
- Motorbike integrity visual check.
- Check of the supplied kit completeness (refer to the parts list supplied together with the kit).
- Rear-view mirror assembly (Refitting the rear-view mirrors).
- Handlebar balancing weight assembly.
- Battery start-up (Recharging the battery- Topping up the electrolyte) and fitting on the vehicle (Refitting the battery);
- Final drive correct tensioning check.
- Tyre pressure check (Front 2.3 bar - 2.5 bar with passenger / Rear 2.5 bar - 2.8 bar with passenger).
- Check brake and clutch fluid and coolant level (top up, if necessary).
- Check engine oil level (top up, if necessary).
- Lights, turn indicators, horn and controls check. Headlight beam height adjustment check. Check handlebar free movement and possible interference.
- Check key and steering lock operation.
- Check front and rear wheel shaft tightening (front: 63 Nm±5% - rear: 230 Nm±10%).
- Check the brake calliper retaining screws tightening (front: 45 Nm±5% - rear: 25 Nm±5%).
- Fuel top-up until the reserve warning light turns off (approx. 5 litres).
- Check engine stop switch, side stand switch and clutch lever operation.
- Check the presence of any technical updates and recall campaigns on DCS.
- Install any Ducati Performance accessories required by Customer's order and check their operation.
- Final test and road test of the motorcycle (test correct operation of safety devices and electric fan).
- Reading of the error memory with DDS 2.0 and check of software version update on control units (use the Global Scan function).
- Motorcycle cleaning.
- Motorcycle warranty activation and on-board documentation filling in (General warranty conditions).
- Show Customer how the motorcycle works and how to adjust seat height (Removing the seat and Refitting the seat).
- Turn in to Customer the documentation and the Service Booklet (appropriately filled in).

Scheduled maintenance chart: operations to be carried out by the customer

List of operations and type of intervention [set mileage (km/mi) or time interval *]	km. x1000	1
	mi. x1000	0.6
	Months	6
Check engine oil level		•
Check brake fluid level		•
Check tyre pressure and wear		•
Check the drive chain tension and lubrication		•
Check brake pads		•

* Service operation to be carried out in accordance with the specified distance or time intervals (km, miles or months), whichever occurs first.

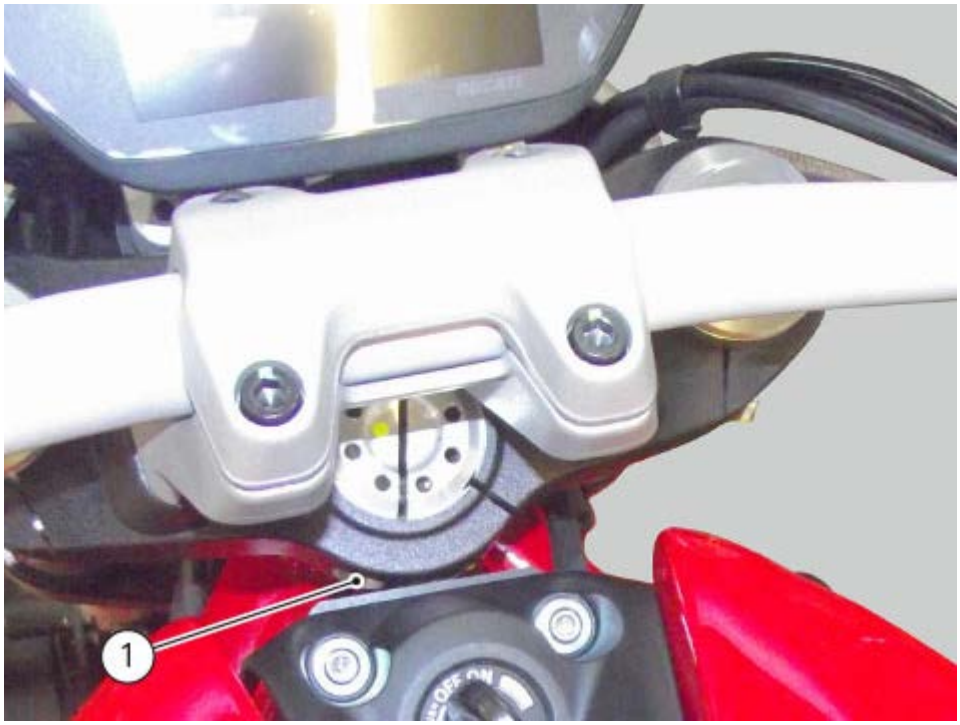
Scheduled maintenance chart: operations to be carried out by the dealer

List of operations and type of intervention [set mileage (km/mi) or time interval *]	km. x1000	1	15	30	45	60	Time (months)
	mi. x1000	0.6	9	18	27	36	
Reading of the error memory with DDS and check of software version update on control units		•	•	•	•	•	12
Check the presence of any technical updates and recall campaigns		•	•	•	•	•	12
Change engine oil and filter		•	•	•	•	•	12
Clean the engine oil mesh filter assembly		•		•		•	-
Check and/or adjust valve clearance				•		•	-
Change timing belts				•		•	60
Change spark plugs			•	•	•	•	-
Clean air filter			•		•		-
Change air filter				•		•	-
Check brake fluid level		•	•	•	•	•	12
Change brake fluid							36
Check brake disc and pad wear. Change if necessary		•	•	•	•	•	12
Check the proper tightening of brake calliper bolts and brake disc flange screws		•	•	•	•	•	12
Check front and rear wheel nuts tightening		•	•	•	•	•	12
Check frame-to-engine fasteners tightening			•	•	•	•	-
Check wheel hub bearings				•		•	-
Check and lubricate the rear wheel shaft				•		•	-
Check the cush drive damper on rear sprocket				•		•	-
Check the proper tightening of final drive front and rear sprocket nuts		•	•	•	•	•	12
Check final drive (chain, front and rear sprocket) and sliding shoes wear			•	•	•	•	12
Check final drive chain tension and lubrication		•	•	•	•	•	12
Check steering bearings and lubricate, if necessary				•		•	-
Change front fork fluid				•		•	-
Visually check the front fork and rear shock absorber seals		•	•	•	•	•	12
Check the freedom of movement and tightening of the side and central stand (if any)		•	•	•	•	•	12
Visually check the fuel lines			•	•	•	•	12
Check rubbing points, clearance, freedom of movement and positioning of hoses and electric wiring in view		•	•	•	•	•	12
Lubricate the levers at the handlebar and pedal controls			•	•	•	•	12

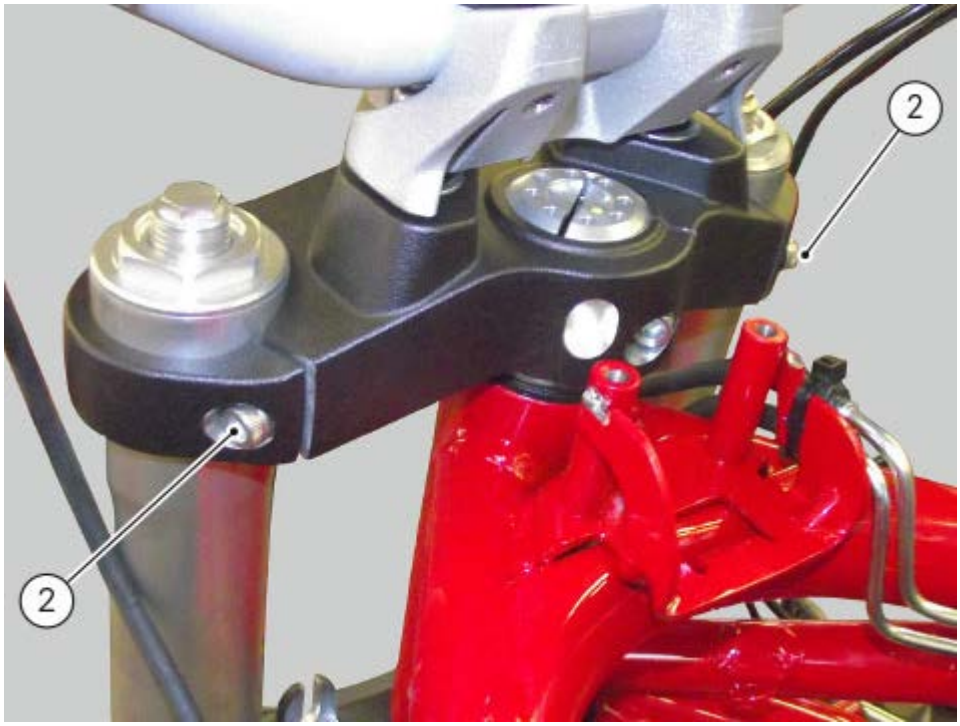
Change coolant				•		48
Check the coolant level and circuit for damage	•	•	•	•	•	12
Check tyre pressure and wear	•	•	•	•	•	12
Check the battery charge level	•	•	•	•	•	12
Check the operation of the safety electrical devices (side stand switch, front and rear brake switches, engine stop switch, gear/neutral sensor)	•	•	•	•	•	12
Check lighting, turn indicators, horn and controls	•	•	•	•	•	12
Reset the Service indication through the DDS	•	•	•	•	•	-
Final test and road test of the motorcycle, testing safety devices (ex. ABS and DTC), electric fans and idling	•	•	•	•	•	12
Softly clean the motorcycle	•	•	•	•	•	12
Fill out that the service was performed in on-board documentation (Service Booklet)	•	•	•	•	•	12

Adjusting the steering head bearing play

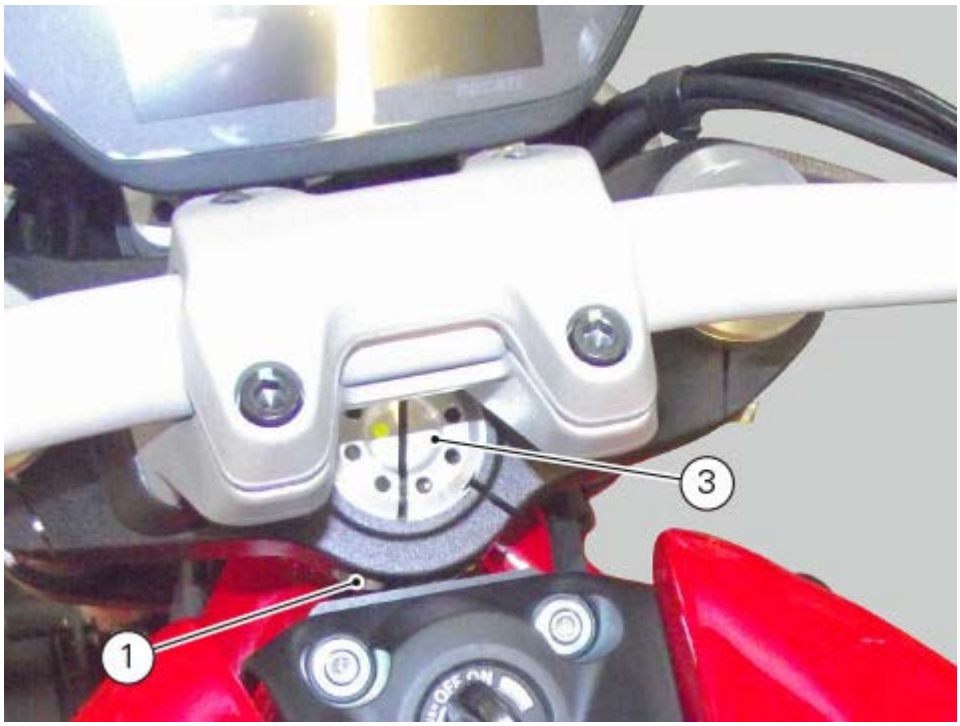
Excessive handlebar play or shaking fork in the steering head indicate that the play of the steering head bearings requires adjustment. Proceed as follows:
loosen the clamp screw (1) that holds the steering tube to the steering head.



Slacken the clamp screws (2) securing the steering head to both fork legs.



Using the special tool part no. **88713.1058** lock the ring nut (3) to a torque of 30 Nm ±5%.
Push the steering head against the ring nut (3) and tighten the screws (1) to a torque of 18Nm ±5% and screws (2) to a torque of 24Nm ±5%.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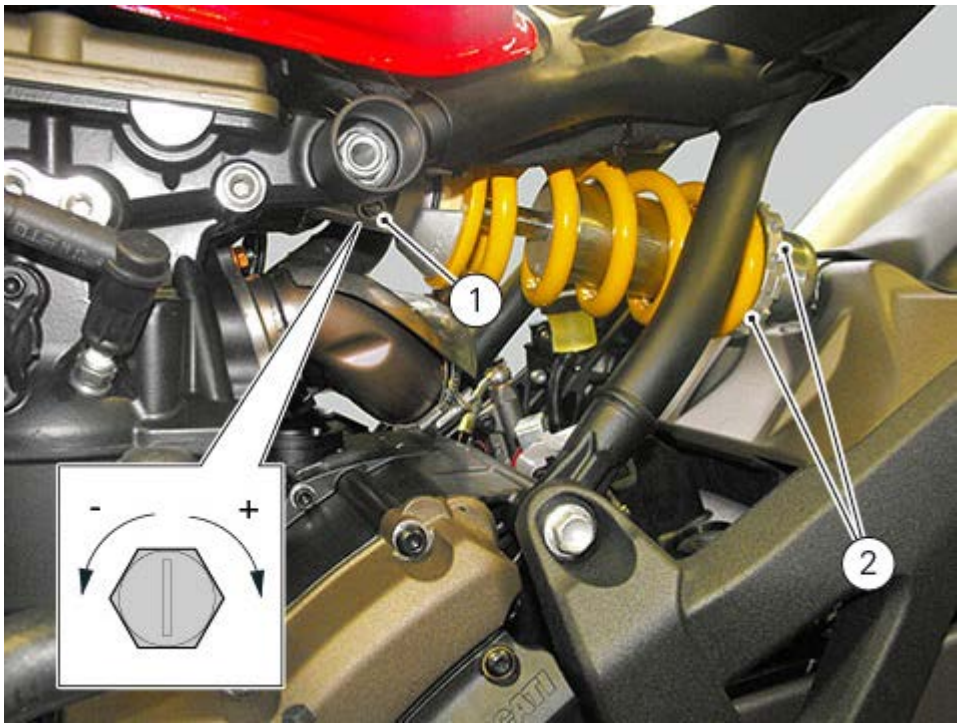
Change timing belts

To replace the timing belts follow the procedure described under paragraphs "Removing the mobile tensioner/timing belt" and "Refitting the timing belts".

Adjusting the rear shock absorber

The rear shock absorber has commands that enable you to adjust the setting to suit the load on the motorcycle.
Adjuster (1) located close to the connection with head, on LH side, adjusts the damping during the rebound phase (return). Turn adjuster (1) clockwise to stiffen the damping, or counter clockwise to soften it.
The two ring nuts (2), located in the shock absorber lower side, adjust the external spring preload. To change spring preload, slacken the lower locking ring nut: Then TIGHTEN or SLACKEN the upper ring nut to INCREASE or DECREASE spring preload. After setting spring preload as desired, tighten the lower locking ring nut.
Four different settings were defined based on average parameters (dressed rider weighing 80-90 kg, dressed passenger weighing 70-80 kg): "Default", "Sport", "Comfort", "Rider+Passenger".



Warning
To turn the preload adjuster ring nut use a pin wrench. Pay attention to avoid hand injuries by hitting motorcycle parts in case the wrench tooth suddenly slips on the ring nut groove while moving it.

Warning

The shock absorber is filled with gas under pressure and may cause severe damage if taken apart by someone who is unskilled.

Adjustment range
- rebound: 0÷5 turns;
- preload: 10÷20 mm

"Default" setting

- rebound: 1.5 turns (from fully closed position).
- preload: 15 mm (from fully uncompressed).

"Sport" adjustments

- rebound: 0.5 turns (from fully closed position).
- preload: 15 mm (from fully uncompressed).

"Comfort" adjustments

- rebound: 2.5 turns (from fully closed position).
- preload: 15 mm (from fully uncompressed).

"Rider+Passenger" adjustments

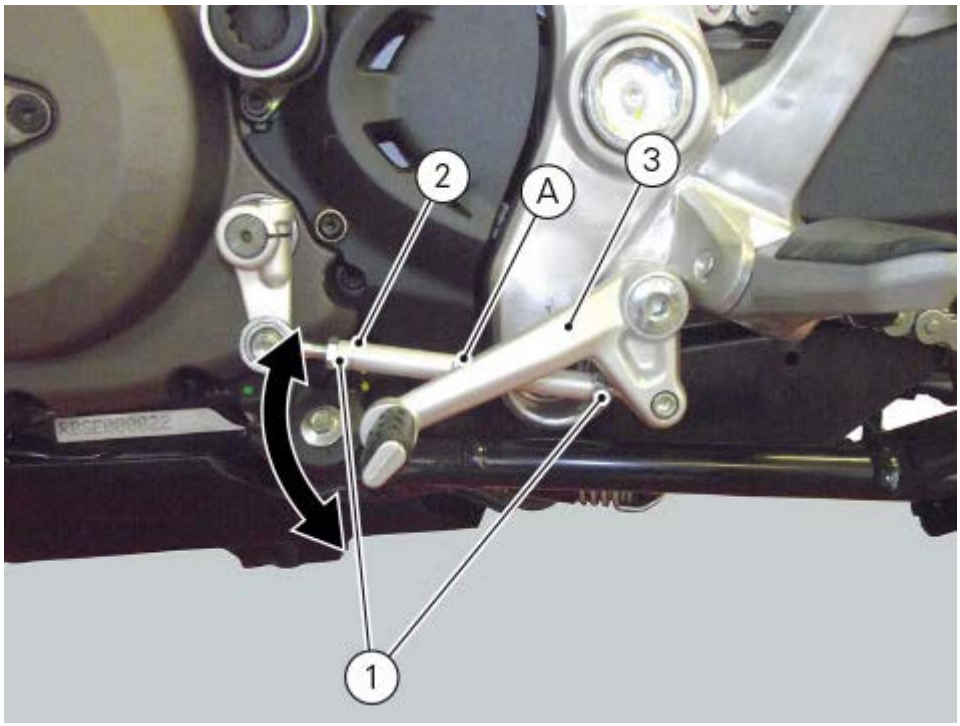
- rebound: 1.5 turns (from fully closed position).
- preload: 19 mm (from fully uncompressed).

Adjusting the position of the gearchange pedal and rear brake pedal

GEAR CHANGE PEDAL

The position of the gear change and rear brake pedals in relation to the footpegs can be adjusted to suit the preferred riding position.
To adjust the position of the gearchange pedal, proceed as follows:
Loosen the retaining nuts (1).
Lever (2) can be shortened or lengthened, thus gear change pedal (3) can be raised or lowered by turning the flat (A).
In particular:
- screw lever (2) (clockwise) to raise gearchange lever (3);
- loosen lever (2) (counter clockwise) to lower gearchange lever (3).

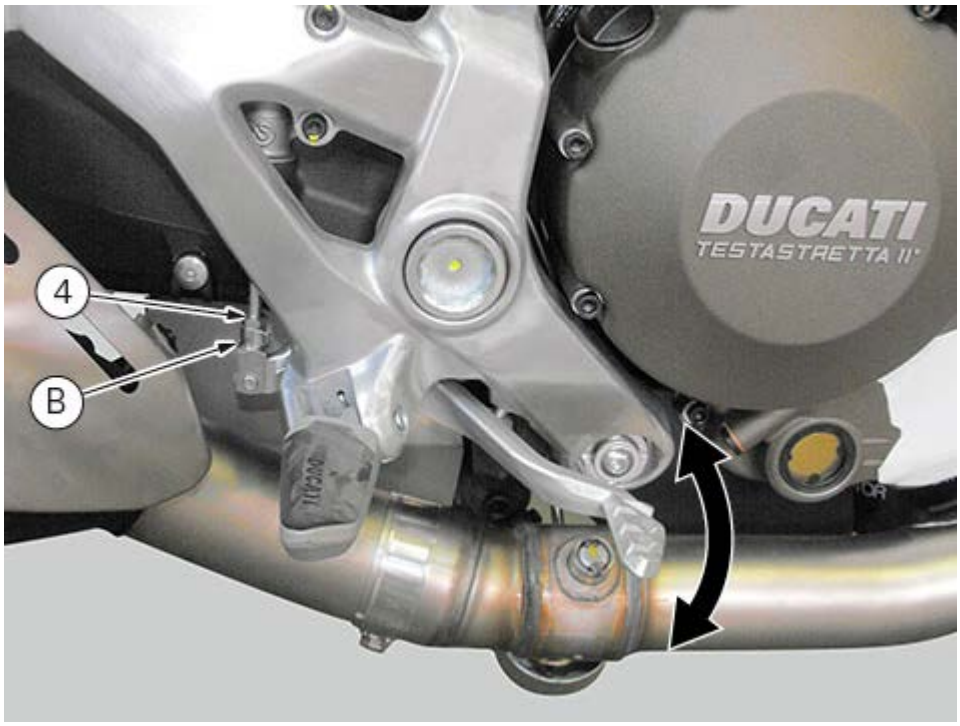
Once all adjustment operations are completed, screw retaining nuts (1) and tighten them to a torque of 5Nm ± 10%.

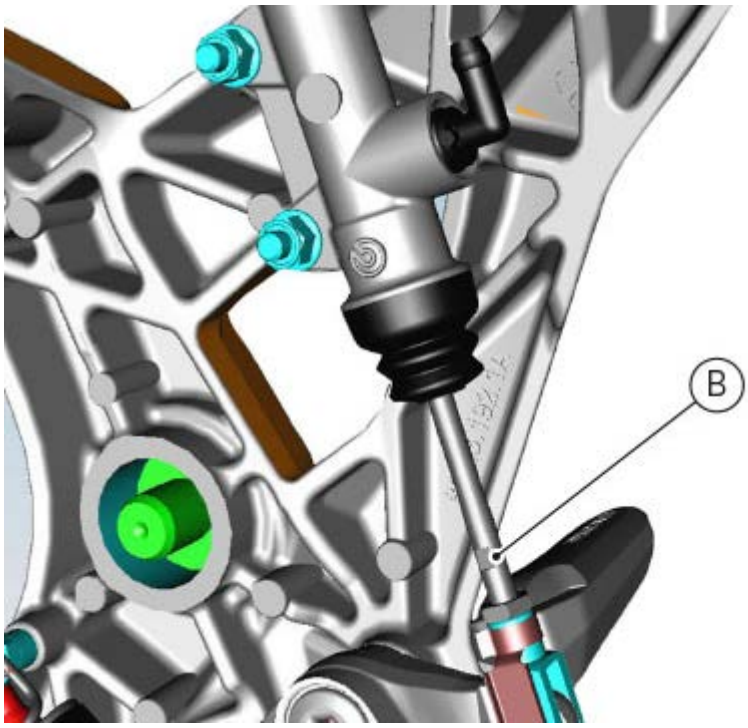


REAR BRAKE LEVER PEDAL

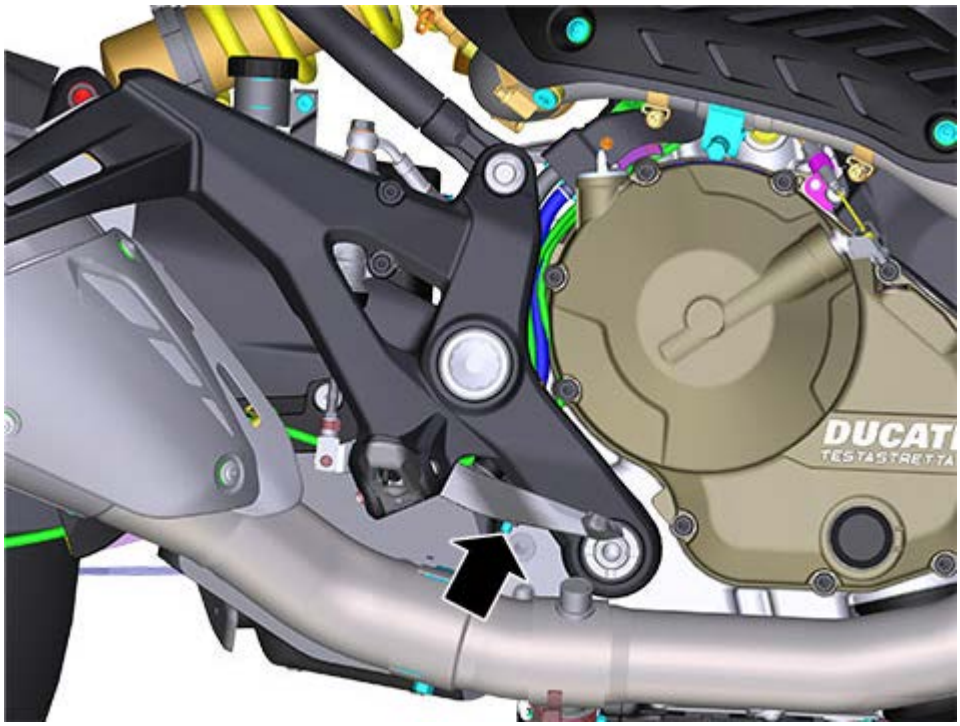
To adjust the position of the rear brake pedal, proceed as follows.
Loosen lock nut (4).
Adjust rear brake pedal angle (6) by turning the flat (B).
In particular:
- screw rod (clockwise) to lower pedal;
- loosen rod (clockwise) to raise pedal.

Operate the pedal by hand to check that there is 1.5 to 2 mm of free play before the brake bites.
If not, adjust the length of the master cylinder pushrod.
Tighten the check nut (4) to a torque of 5Nm ±10%, and check play again.

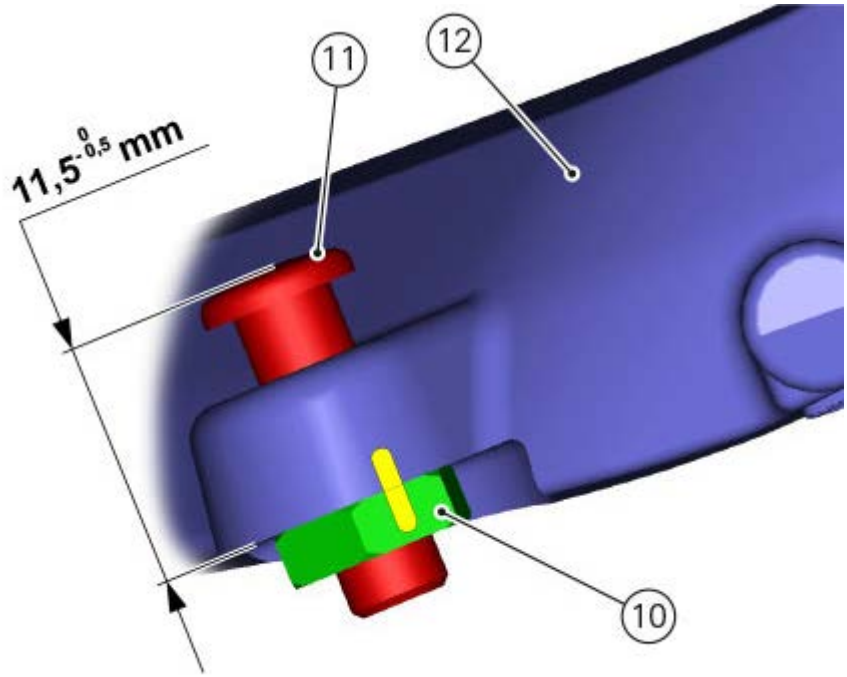




Also check stop plate of stop sensor.

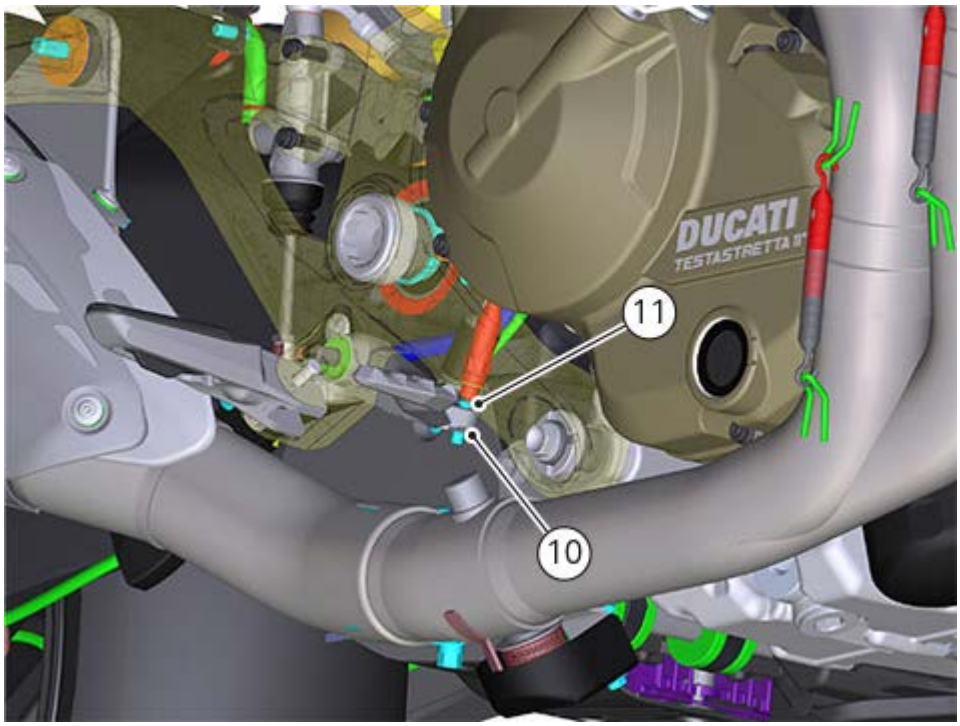


Check the indicated value of dowel projection (11) on brake lever (12), as shown.
The distance must be between 11.0 and 11.5 mm.
If non conforming, work on nut (10) as described.



To adjust the distance, loosen nut (10), set the right distance of dowel (11) and tighten nut (10) to a torque of 8Nm±10%.
Check the distance again and, if non conforming, repeat the procedure.

Warning
The nut tightening procedure must be carried out while dowel is tight.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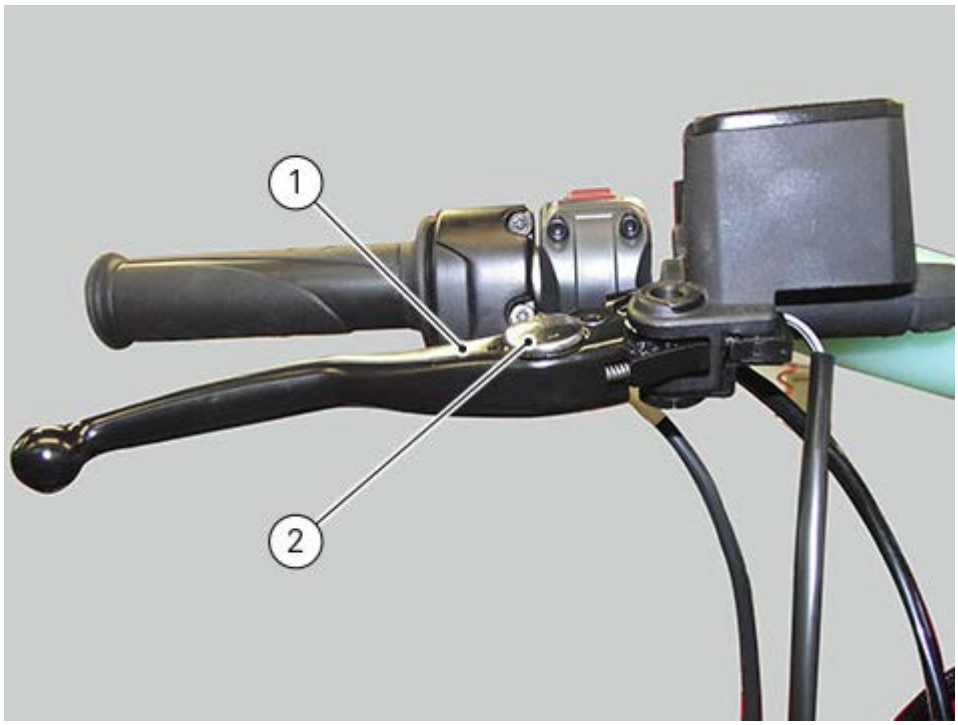
Adjusting the front brake lever

Pull in the lever (1) towards the handgrip to operate the front brake. The system is hydraulically operated and you just need to pull the lever gently.
The brake lever has a dial (2) for adjusting the distance between lever and handgrip on the handlebar. To adjust it, keep lever (1) fully extended, and turn dial (2), turning it to one of the four foreseen positions. Keep in mind that the position no. 1 corresponds to the maximum distance between the lever and the handgrip, whereas position no. 4 corresponds to the minimum distance.

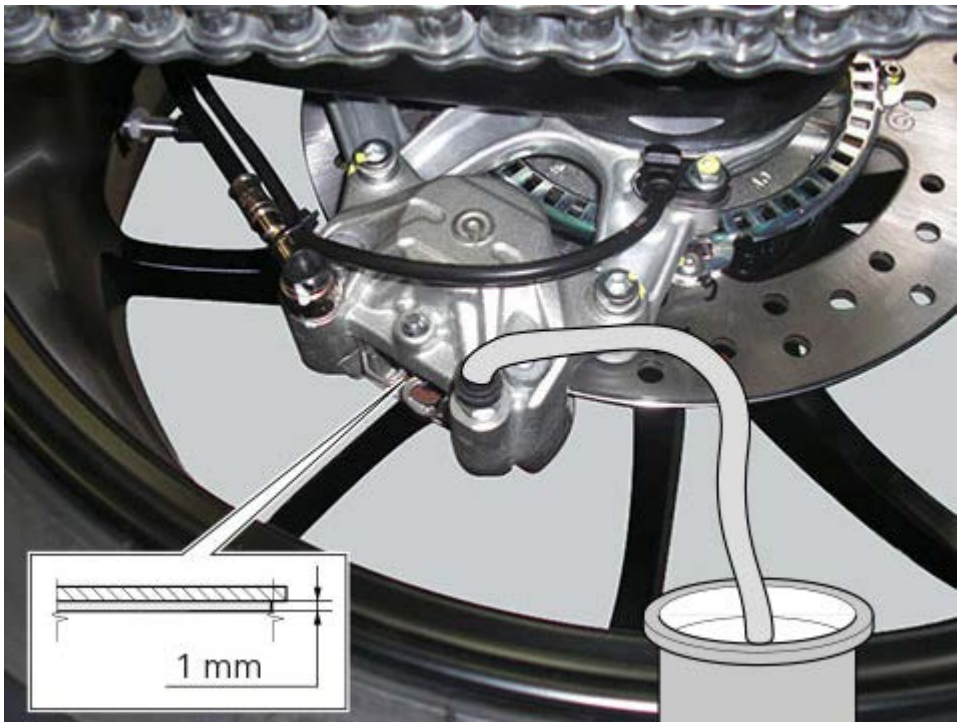
Warning
Set front brake lever when motorcycle is stopped.



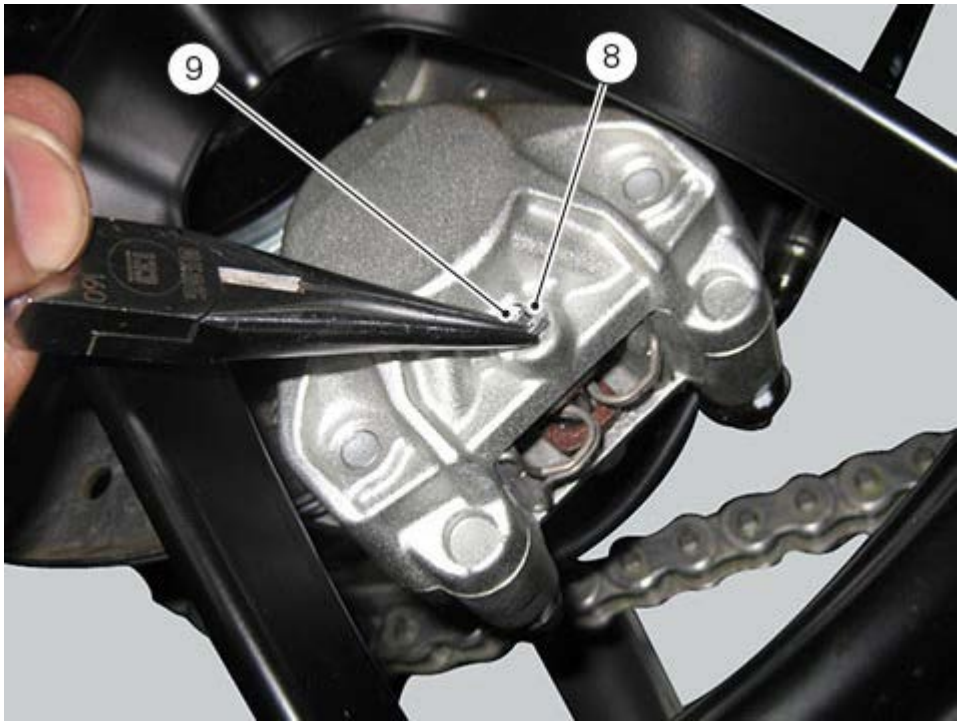
Checking rear brake pad wear and replacing brake pads

Check through the slot between the two calliper halves, and make sure that at least 1 mm of the friction material on pads is visible.

Important
Change both pads even if just one of them is worn.



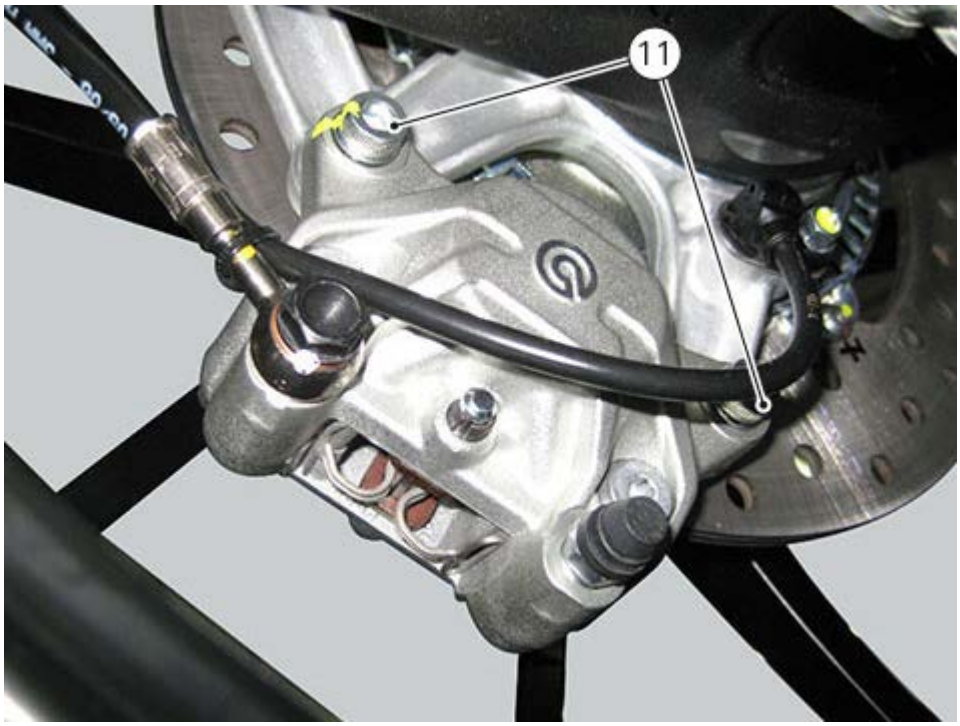
Change the brake pads as follows.
Remove the snap ring (8) from the pad retaining pin (9).



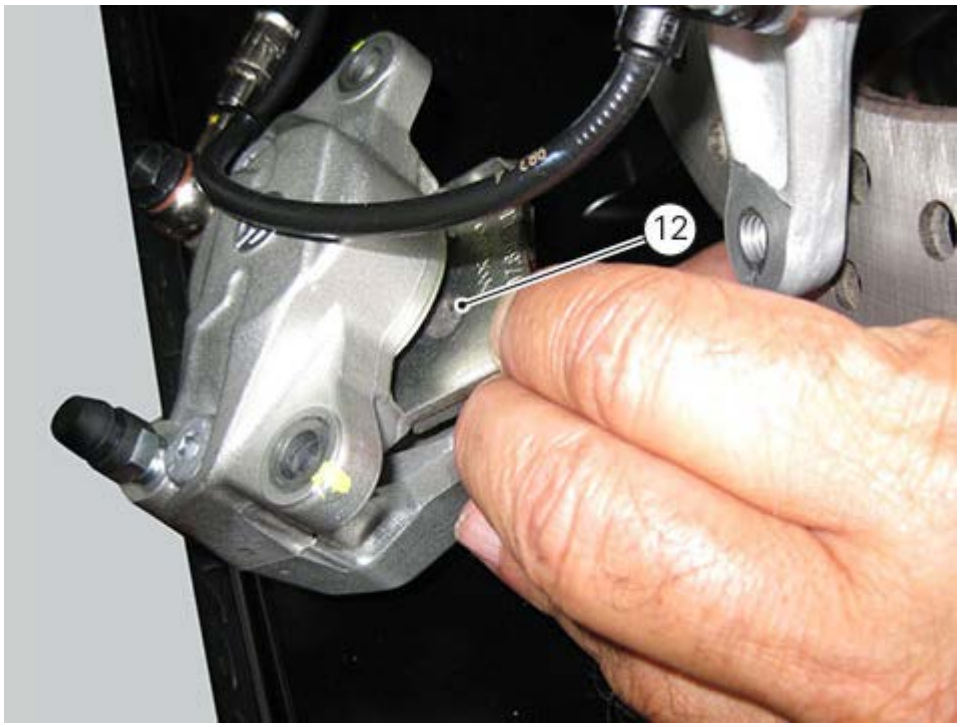
Slide pad retaining pin (9) outwards.

Remove pad retaining clip (10) from between the two calliper halves.

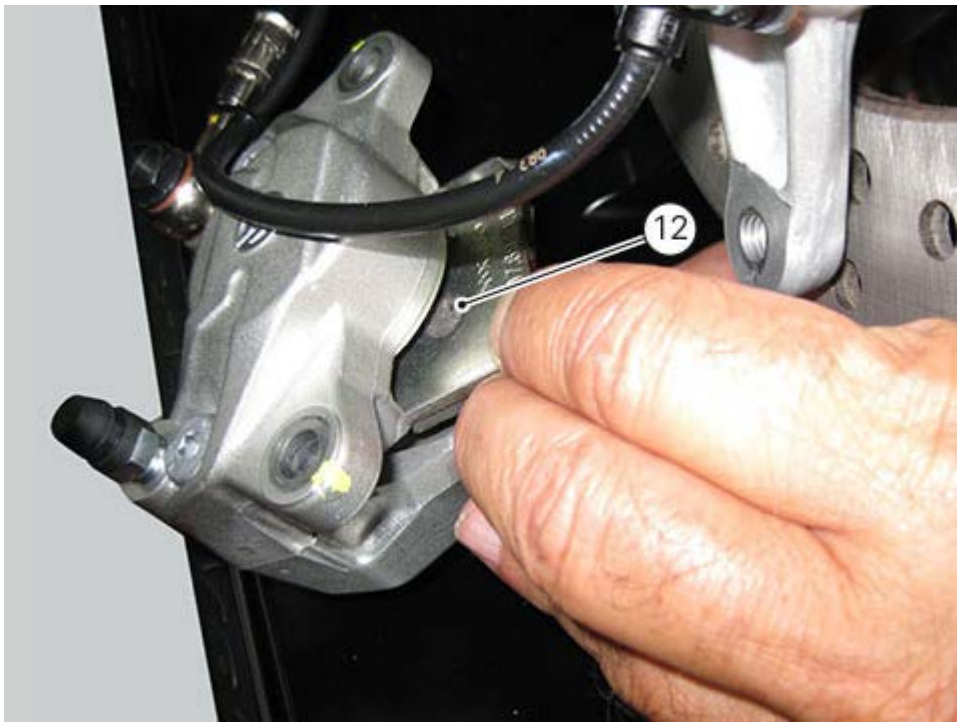
Remove the rear brake calliper by loosening the screws (11).

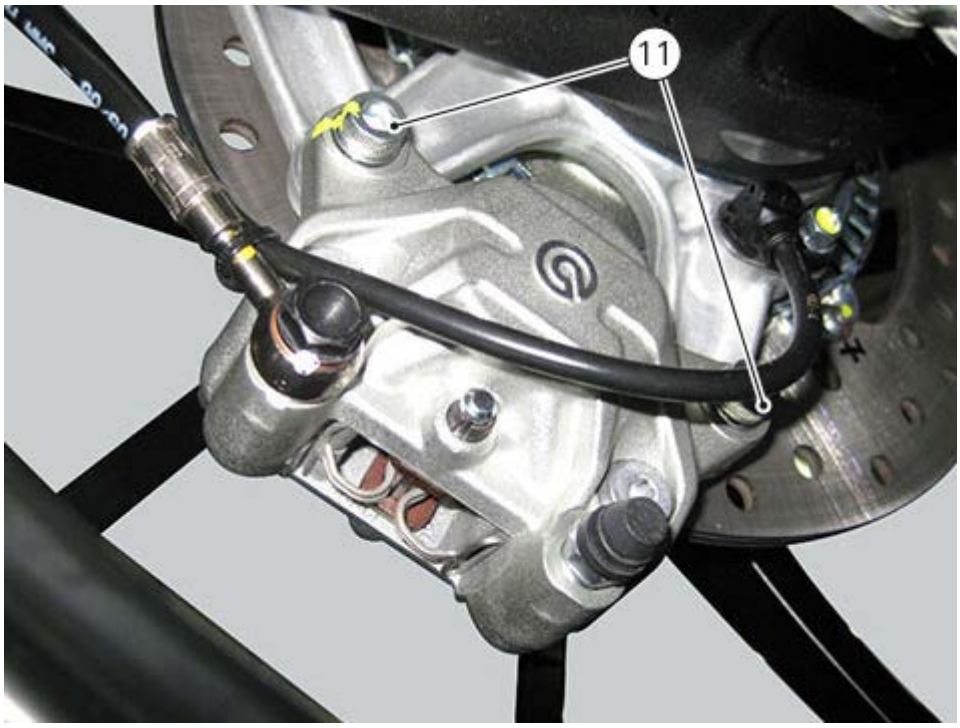


Force the calliper pistons back into their seats by forcing the old brake pads apart.
Remove the worn pads (12).

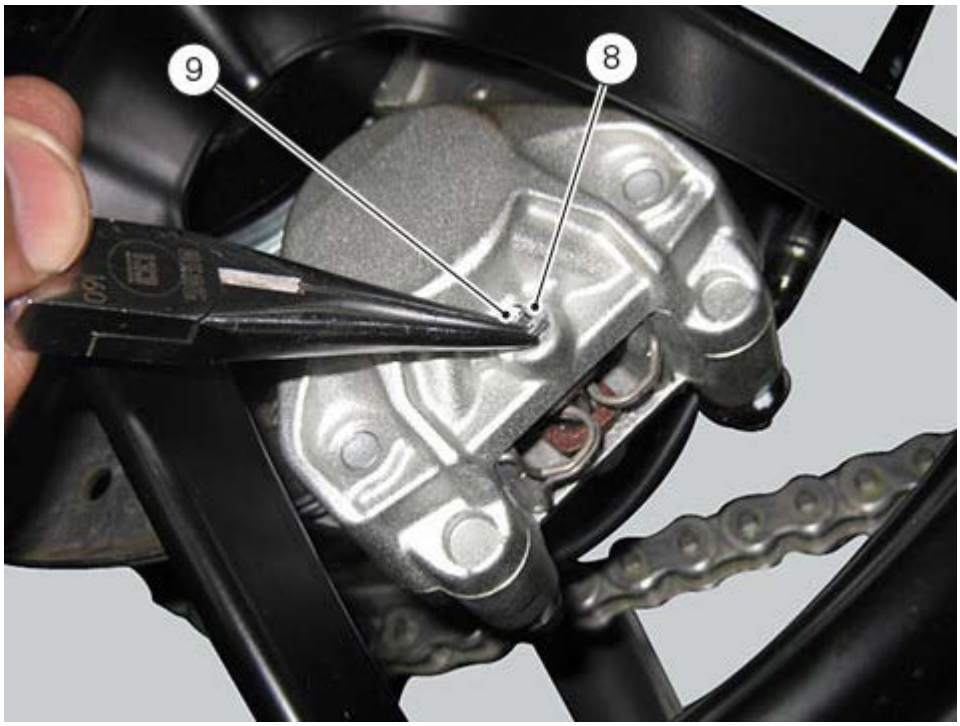


Fit the new pads.
Refit rear brake calliper, then start and tighten the screws (11) to a torque of 25 Nm ± 5%.

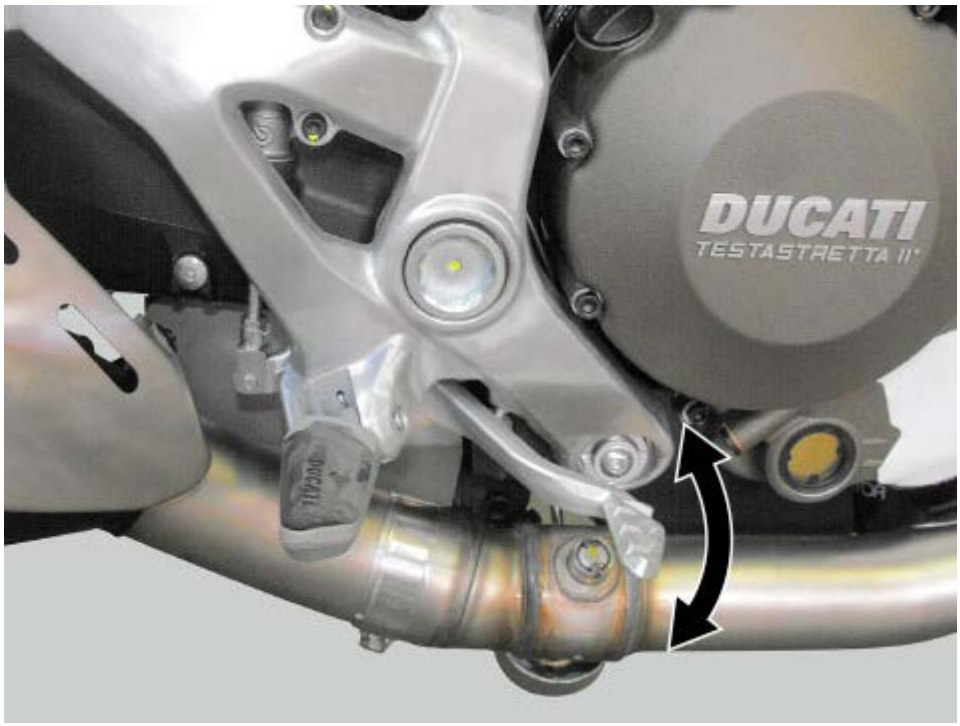




Insert pad retaining clip (10) and centring pin (9), locking it in place with ring (8).



Operate the brake pedal repeatedly so that the pads firmly bed in against the disc thanks to the brake fluid pressure.



Check that the fluid level inside reservoir is between the "MIN" and "MAX" marks.
If this is not the case, unscrew the reservoir cover (6) and top up.

Being the brake callipers a safety component of the motorcycle, follow the instruction indicated in section "Removing the front brake system" and "Removing the complete rear brake control", and remember to tighten the rear brake calliper screws (11) to a torque of 25Nm ± 5% upon refitting.

Checking front brake pad wear and replacing brake pads

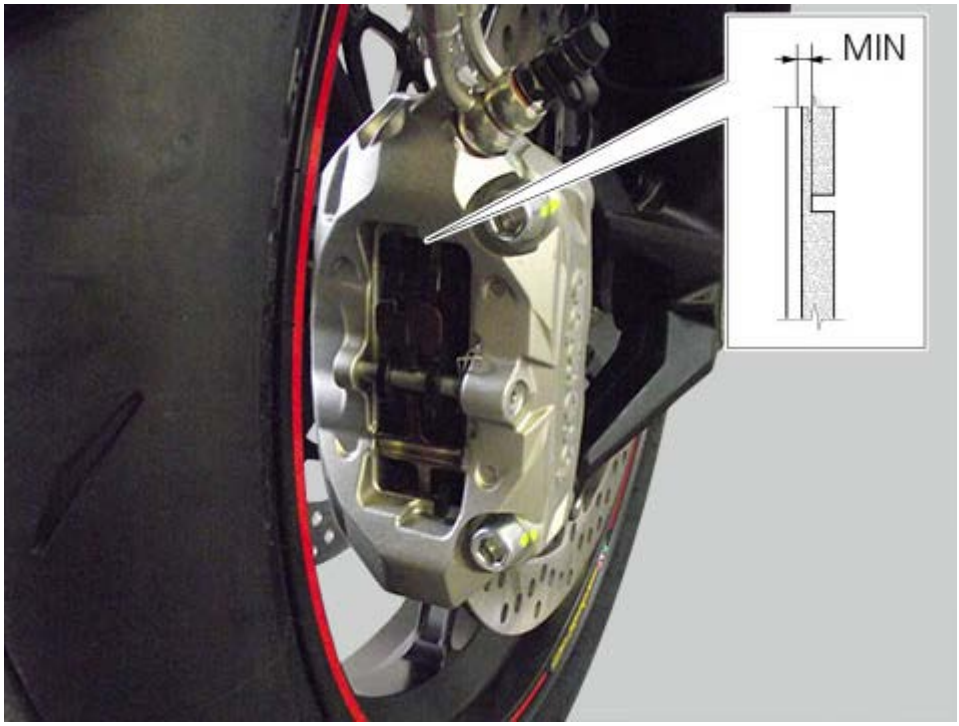
Warning
Brake fluid is corrosive and will damage paint. Avoid contact with eyes and skin. In case of accidental contact, wash thoroughly with water.

Important
On handing over the motorcycle after changing the brake pads, inform the Customer that the front brake must be used gently for the first 100 km to allow the pads to bed in completely.

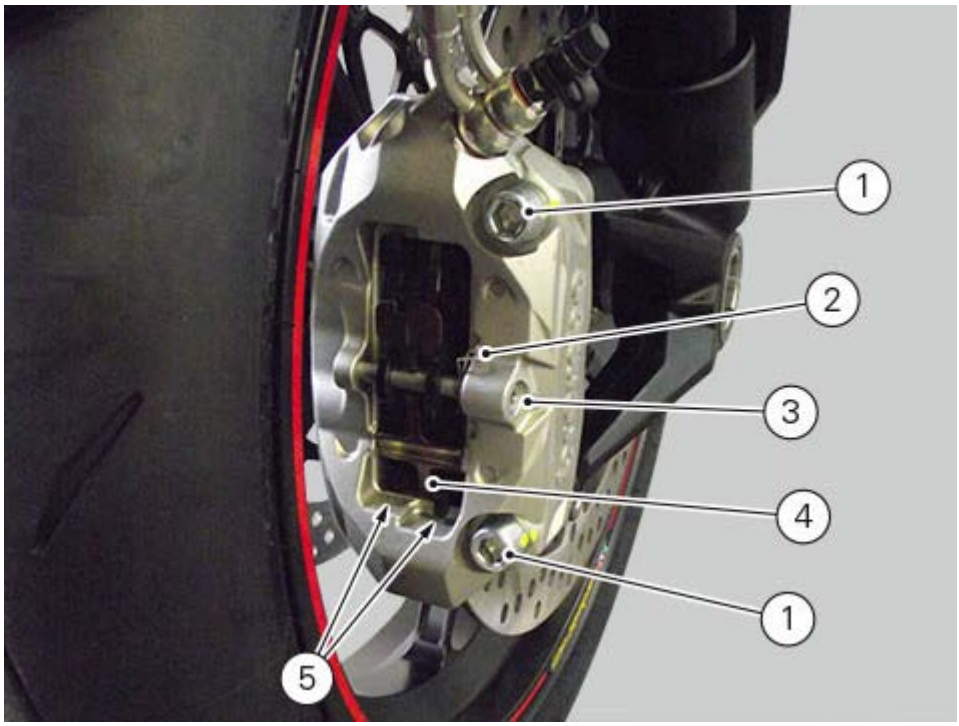
Check through the calliper slot and make sure that the friction material on pads (1) is visible.

Important
Change both pads even if just one of them is worn.

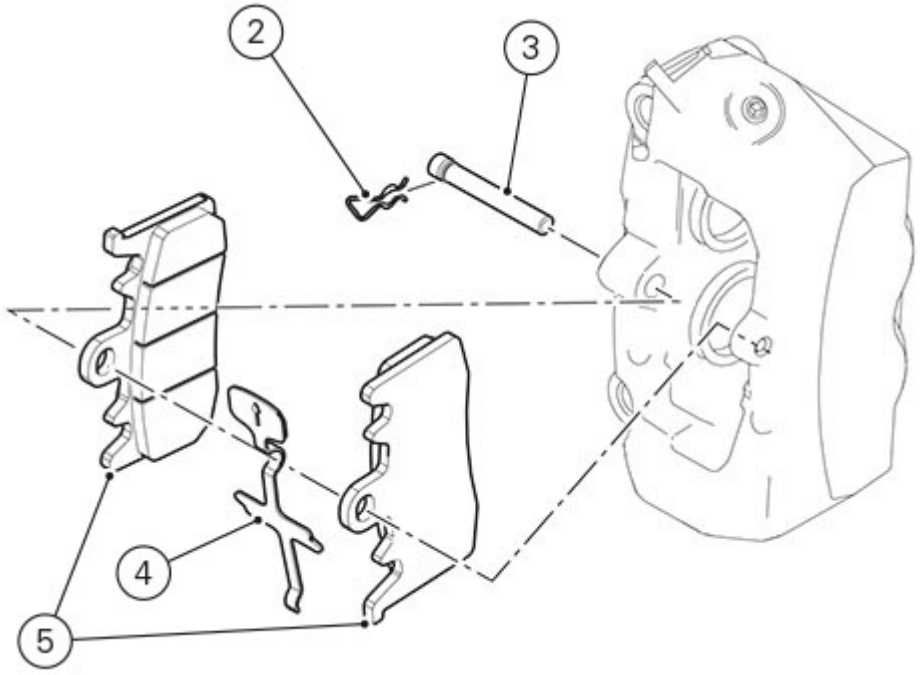
Note
Work in the same way on both front brake callipers.



Loosen the two screws (1) and remove calliper from disc.
Remove the safety split pin (2).
Turn shaft (3) clockwise and slide it out.
Remove the spring (4).

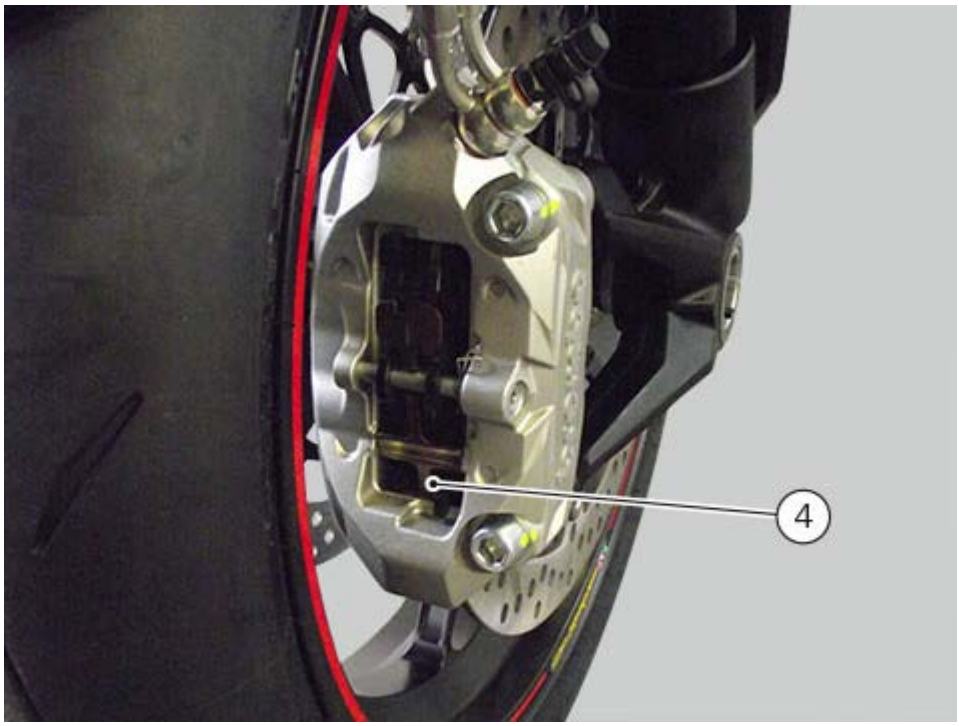


Force the calliper pistons back into their seats by forcing the old brake pads apart.
Remove the worn pads (5).

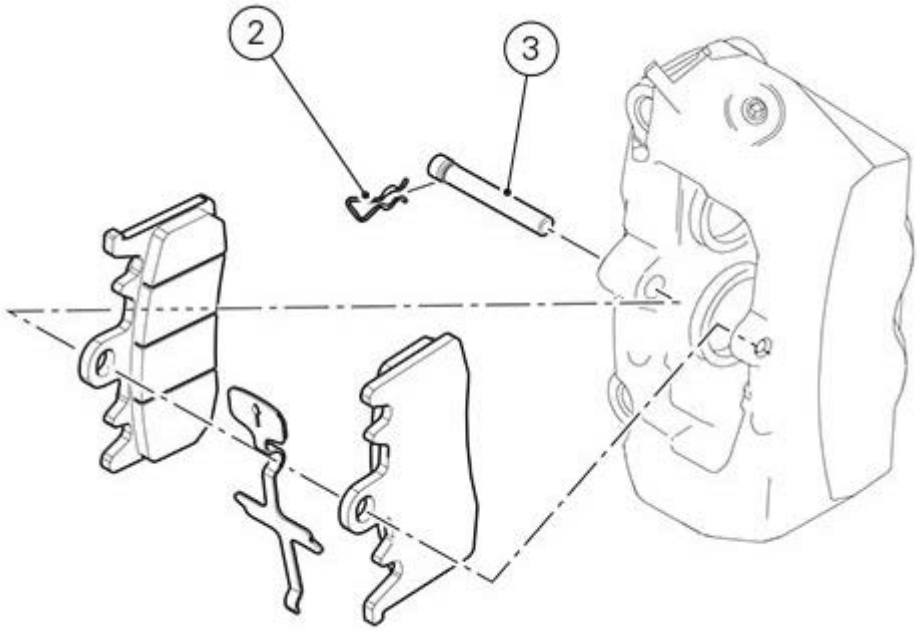


Note
Change pads that have a shiny or "vitrified" appearance.

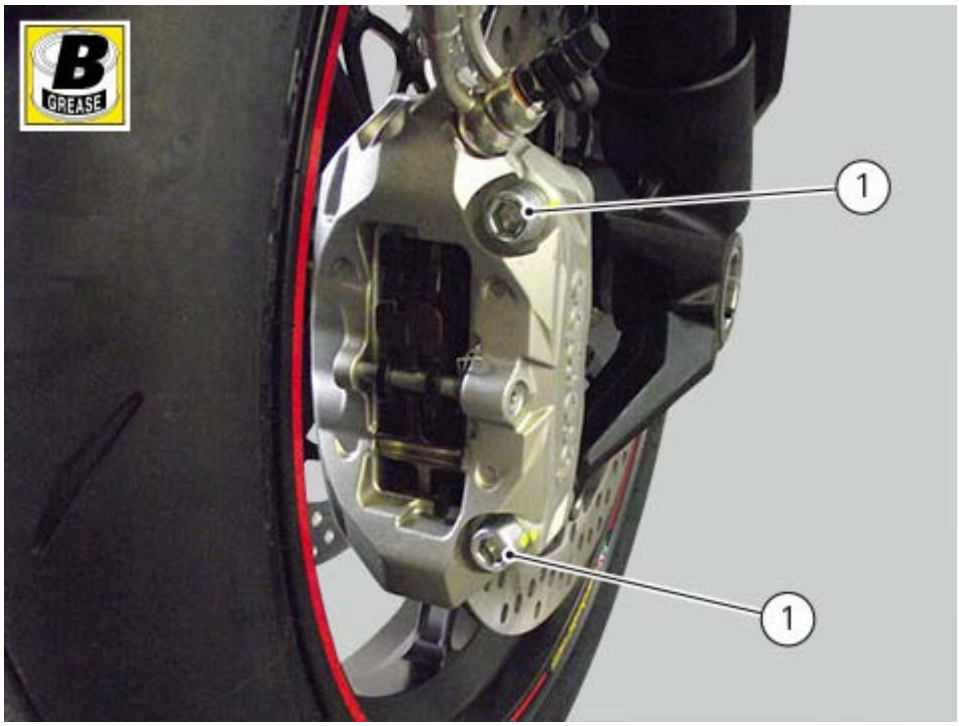
Fit the new pads and their spring (4) making sure to position it as shown.



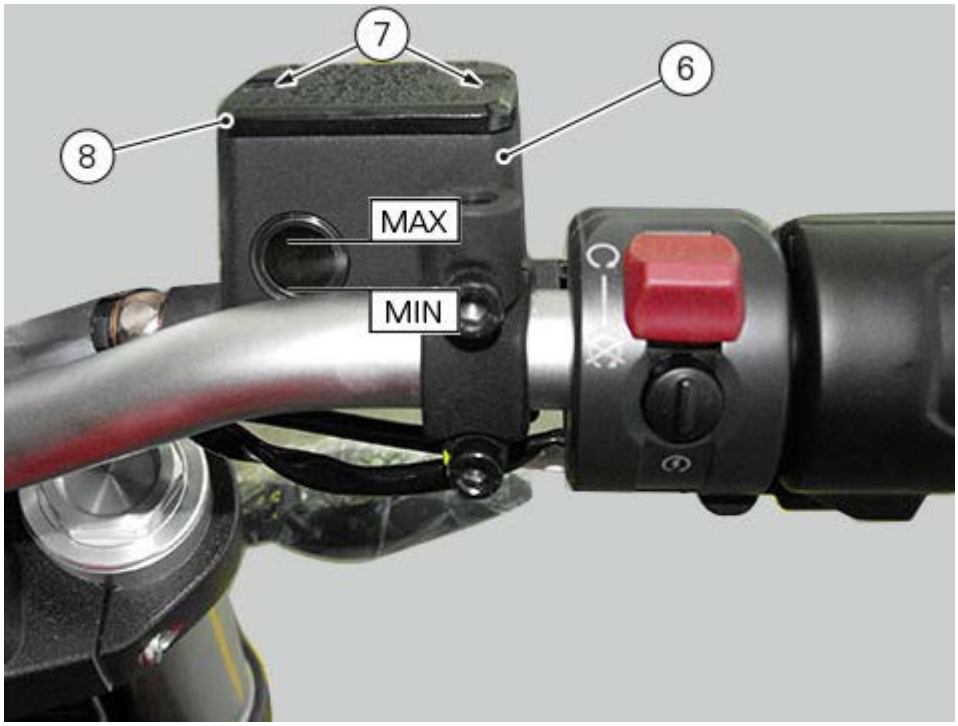
Fit the pad retaining pin (3) and fasten it with safety split pin (2).



Pre-tighten screws (1) to a torque of 2Nm ± 10%, then tighten them to a torque of 25Nm ± 5%.



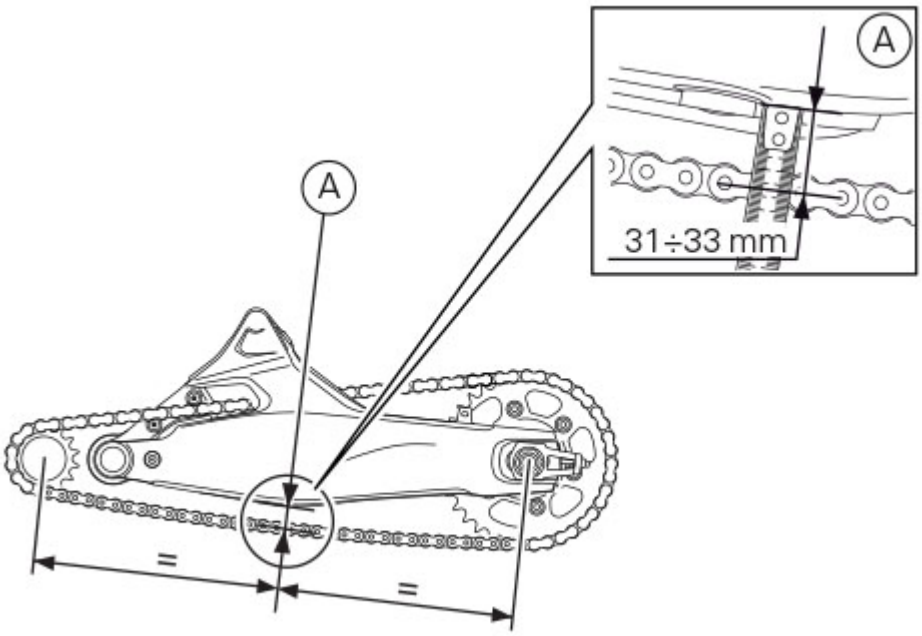
Turn the pad retaining pin (3) counter clockwise.
Operate the brake lever repeatedly so that the pads firmly bed in against the disc thanks to the brake fluid pressure.
Check that the level in the master cylinder reservoir (6) is between the "MAX" and "MIN" marks.
If necessary, top up by loosening the two screws (7) and removing cover (8), until reaching the "MAX" level.



Being the brake callipers a safety component of the motorcycle, follow instructions indicated in "Removing the front brake system".
Close cover (8) and tighten the two screws (7).

Adjusting the chain tension

Kill the engine and set gear to neutral.
Set motorcycle on the side stand.
With a finger, pressing down and then releasing, check the vertical slack in point (A) (where swinging arm changes its angle).
Measure the distance (A) between the centre of the chain pins and the aluminium section of the swinging arm. The distance should be A=31 to 33 mm.
Move the vehicle, and check chain slack in other positions, but always tensioned.

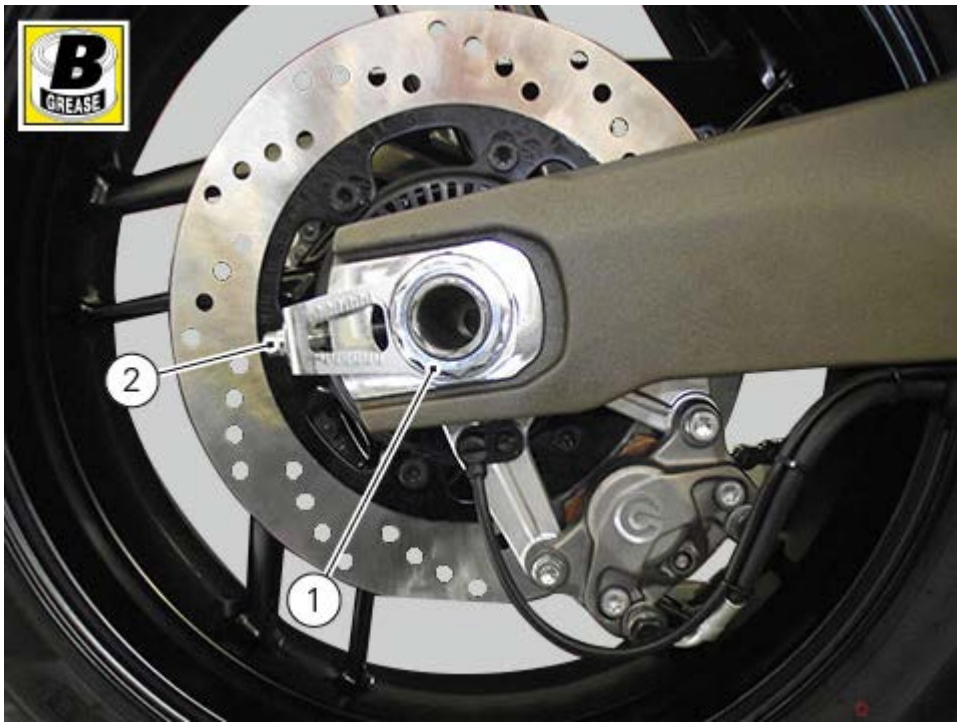


Important
If drive chain is too tight or slack, adjust tension so as to bring values back to the specified range.

Important
An incorrectly tensioned chain will lead to early wear of the transmission components.

Check the correspondence of the positioning marks, working on both sides of the swinging arm to ensure a perfect wheel alignment.

Warning
Correct tightening of swinging arm screws (2) is critical to rider and passenger safety.



Grease the nut thread (1) with the specified product and tighten nut to a torque of 145 Nm.
Grease the adjuster screw thread (2) with the specified product and tighten screws to a torque of 10 Nm.

Clutch control cable adjustment

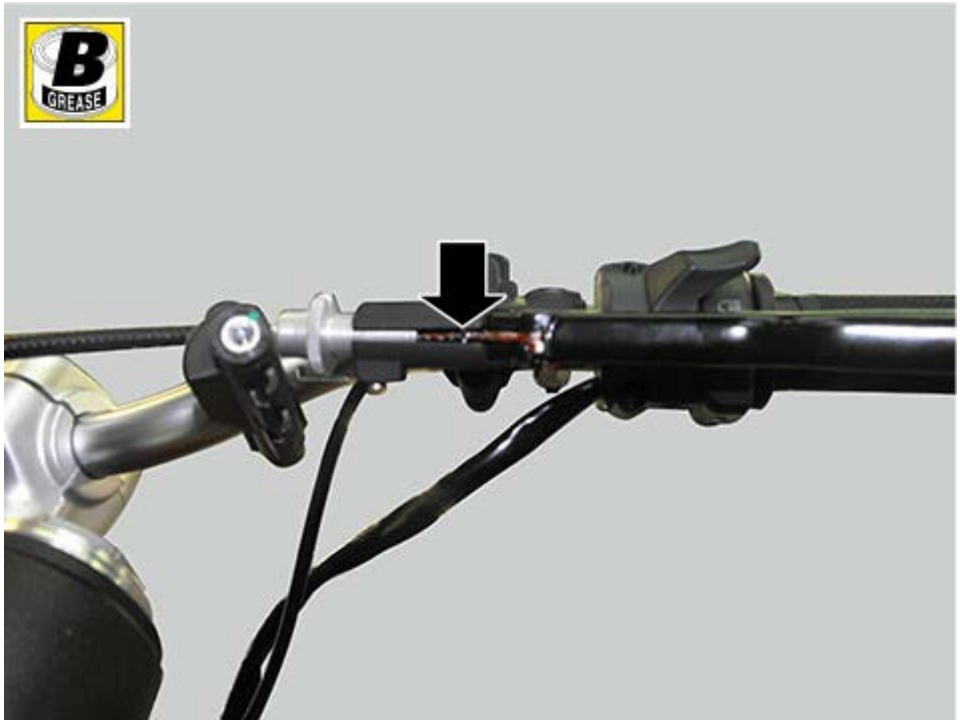
Warning
A wrong adjustment can seriously affect the clutch operation and duration.

A worn clutch tensions the clutch cable. Always check the free play, with cold engine, before using the vehicle.

Warning
Lever free play adjustment must be carried out with cold engine and with the motorcycle on its side stand and the handlebar fully turned to the right.

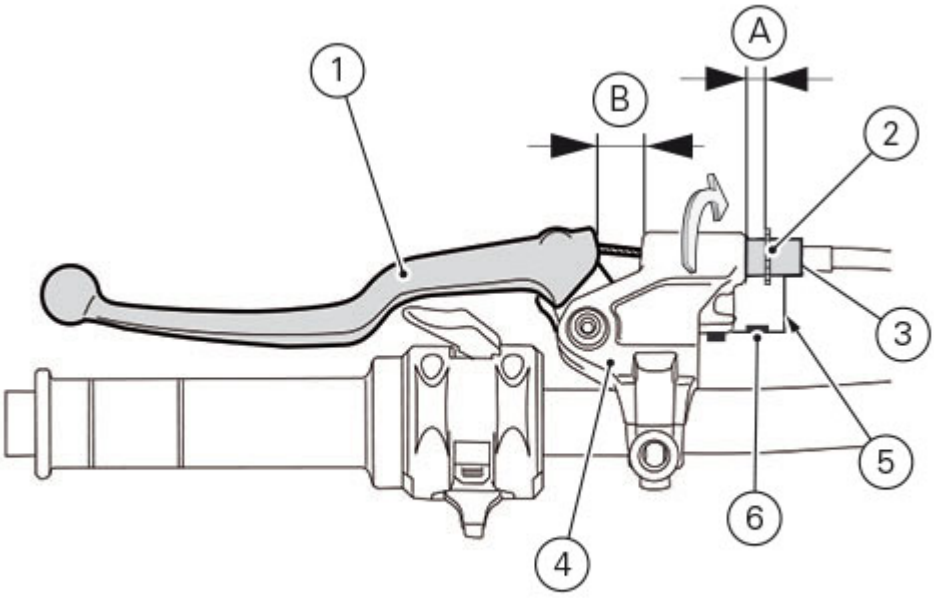
When operating the clutch lever (1), you must clearly feel the passage from a very low resistance to a very high resistance (operating force).
The free play corresponds to the lever travel where the clutch resistance force is very low.

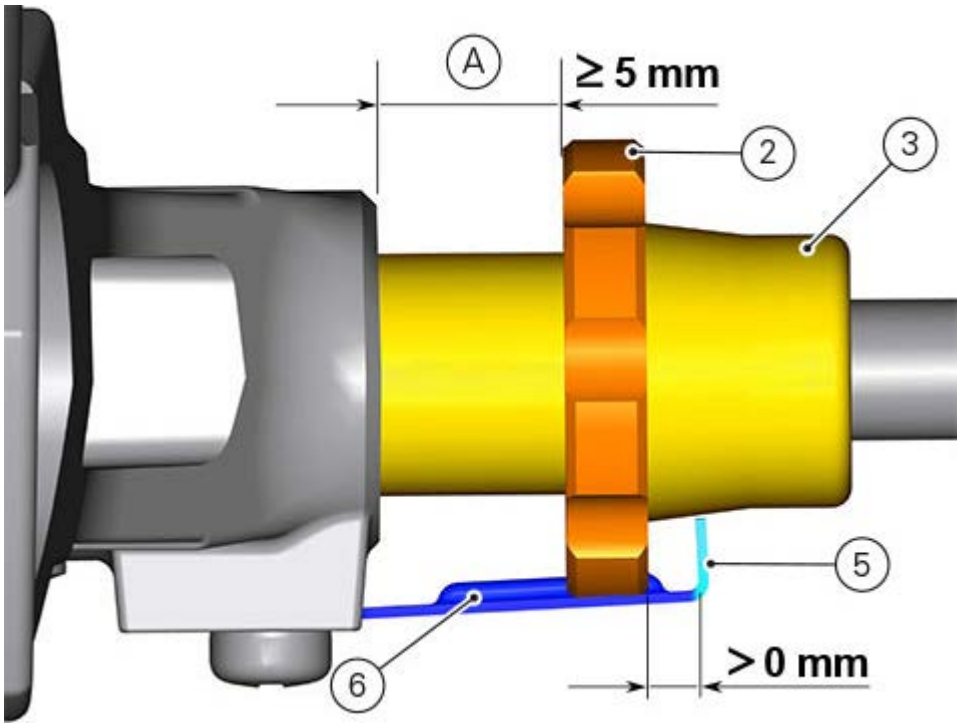
Before positioning the nipple in its seat, lubricate the cable with the specified grease.



Determine ring nut (2) and adjuster (3) position; ring nut (2) must be at a distance (A) of at least 5 mm from the lever rotation plate (4) and must not touch edge (5) of stop plate (6).

Operate the lever through its free play and check that distance "B" is between 2 mm and 3 mm.
Use a gauge as reference, and check that distance "A" is higher or equal to 5 mm.





Adjuster (3), located on the lever, allows , through ring nut (2), a maximum adjustment of 11 mm, whereas the standard setting (starting one) is of 5 mm.

Warning

In case of a slipping clutch due to clutch wear, adjuster on the lever must NEVER be loosened, but screwed, as described above.

If the described conditions are not met, restore them by sliding out protective caps (7) and (8) and loosening adjuster (10) nut (9).

- To increase distance (A), increase the free play by tightening adjuster (10) and then loosening adjuster (3) ring nut (2).
- To decrease distance (A), decrease the free play by loosening adjuster (10) and then tightening adjuster (3) ring nut (2).

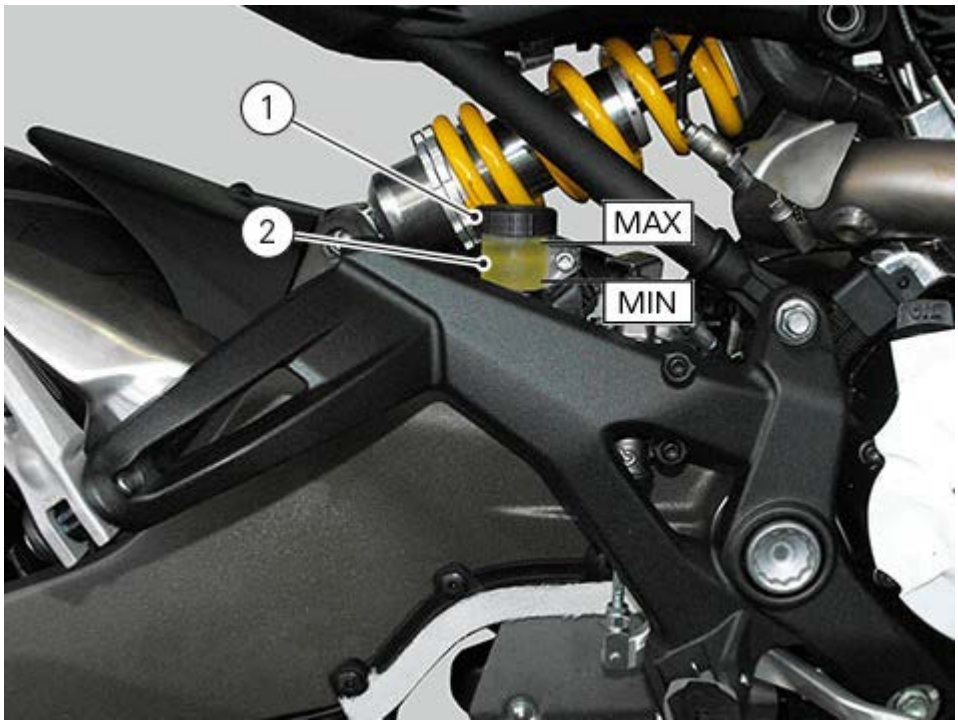
Tighten nut (9) to the specified torque while holding adjuster (10) and bring protective caps (7) and (8) back in place.
Repeat all the tests.

Changing the fluid in the rear brake system

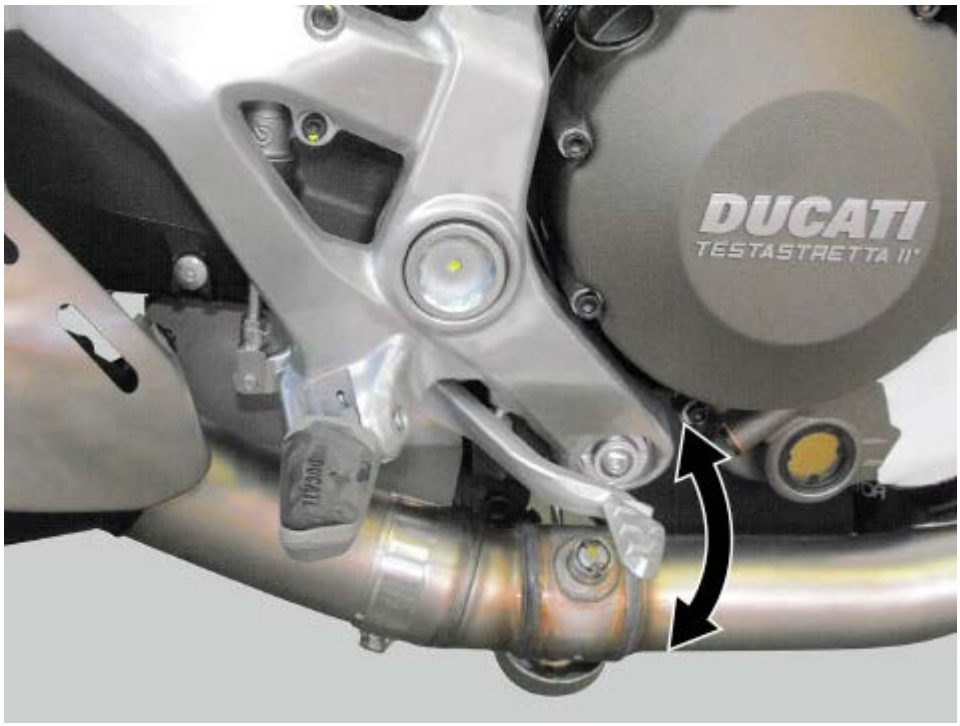
Unscrew the cover (1) of the rear brake fluid reservoir (2).

Attach a transparent plastic tubing to the bleed valve (3) and insert the other end of the tubing in a container placed on the floor.

Siphon the fluid from the reservoir (2).
Fill the reservoir (2) with new oil up to the "MAX" mark.



Operate the brake pedal to pressurise the circuit.
Keep pedal pushed down.



Open the bleed valve (3) to allow fluid to flow out.
The pedal is at the end of travel when it is in the lower position.
Now, screw bleed valve (3) to a torque of 4Nm ±10%, and release the pedal; press the pedal again.
Repeat the above operation until the old fluid flows out completely.

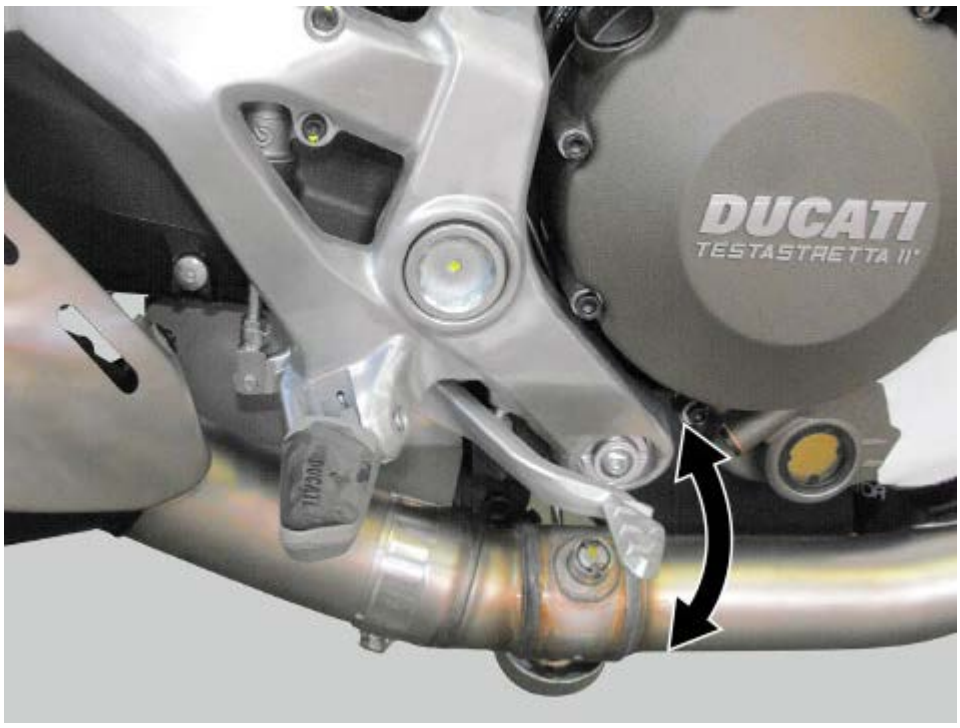
Warning
After draining the old fluid from the reservoir and while filling the system, always keep the fluid level above the MIN mark to avoid any air bubbles in the circuit.

Note
If bleeding tool is not available, move back calliper pistons as well.

Fill the reservoir (2) with the specified fluid taken from an intact container.

Important
During this operation, fluid level inside reservoir must remain above the MIN mark at all times. The end of the transparent plastic hose must remain immersed in the discharged fluid at all times.

Operate brake pedal and keep it pressed during the whole filling operation.



BLEEDING THE REAR BRAKE SYSTEM

Connect bleeding tool to left-hand front brake calliper bleed valve (3) or to rear brake bleed valve (8).

Note
Follow the manufacturer's instructions when using a commercial brake bleeding tool.

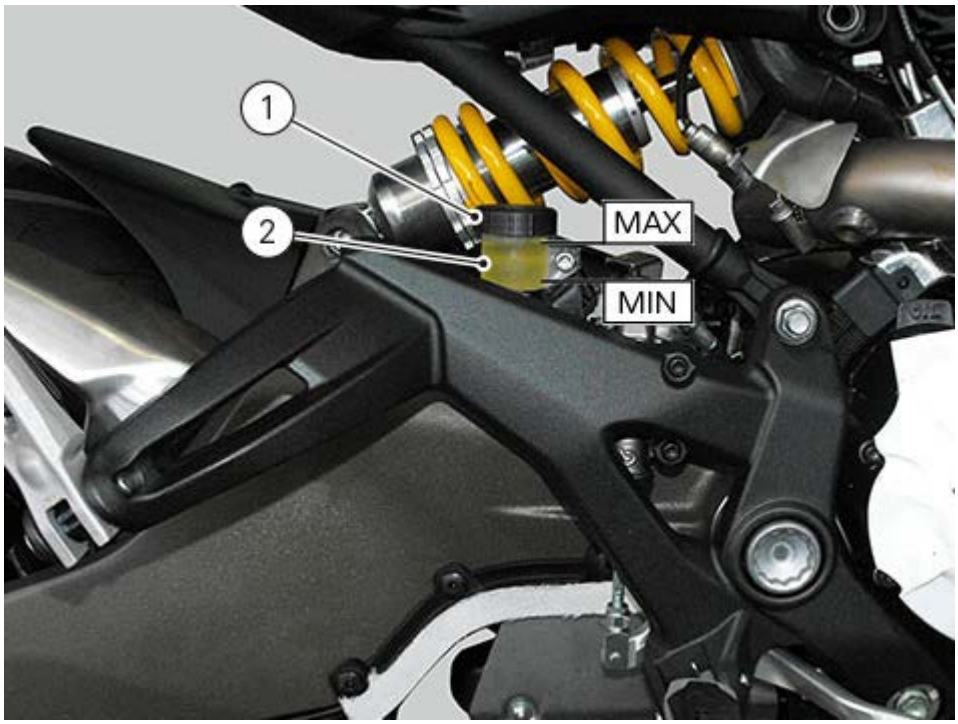
Suck with the bleeding tool and open the bleed valve (3) making sure that the level of the concerned reservoir does not fall below the "MIN" mark.
Continue this operation until all air is bled out of system.
Tighten bleed valve (3) to a torque of 4Nm ± 10%.
If you do not have a bleeding tool available, connect a transparent plastic tubing to the bleed valve (3) as outlined in the draining procedure.

Press pedal to make half stroke or until system is pressurised, open bleed valve and let pedal make full stroke; tighten bleed valve to the specified torque and release pedal.

Important
Do not release the brake pedal until the bleed valve has been fully tightened.

Repeat the operation until the fluid inside system is free of air bubbles.
Make sure that, with bleed valve duly closed, pressure is correctly developed through brake pedal.
Tighten bleed valve (3) to a torque of 4Nm ± 10%, and fit protective cap.

Level fluid and refit cover (1) on reservoir (2).

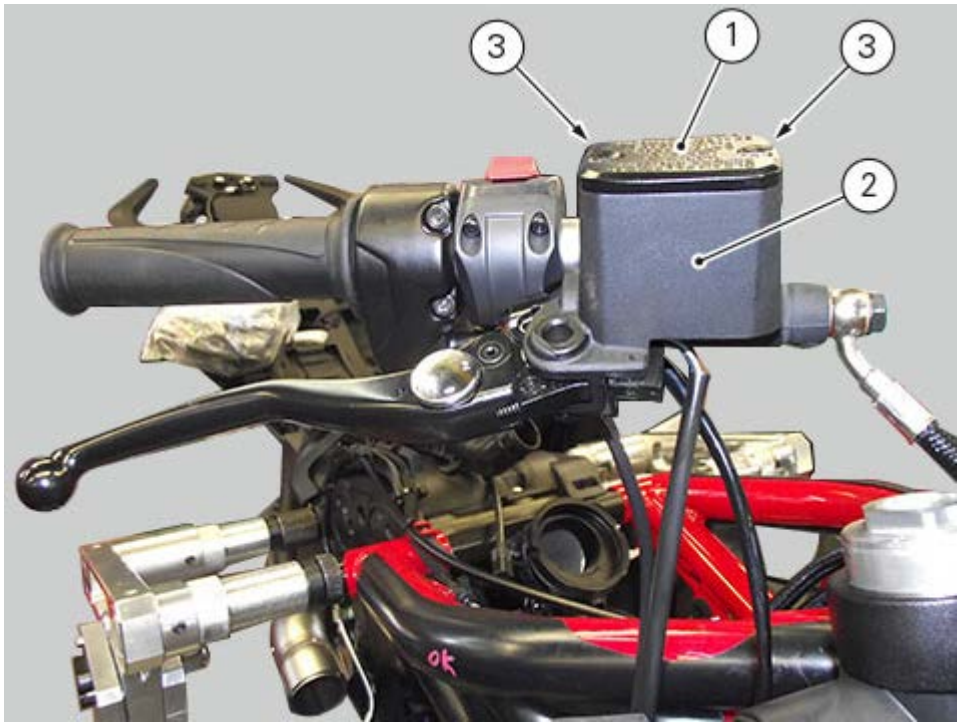


Changing the fluid in the front brake circuit

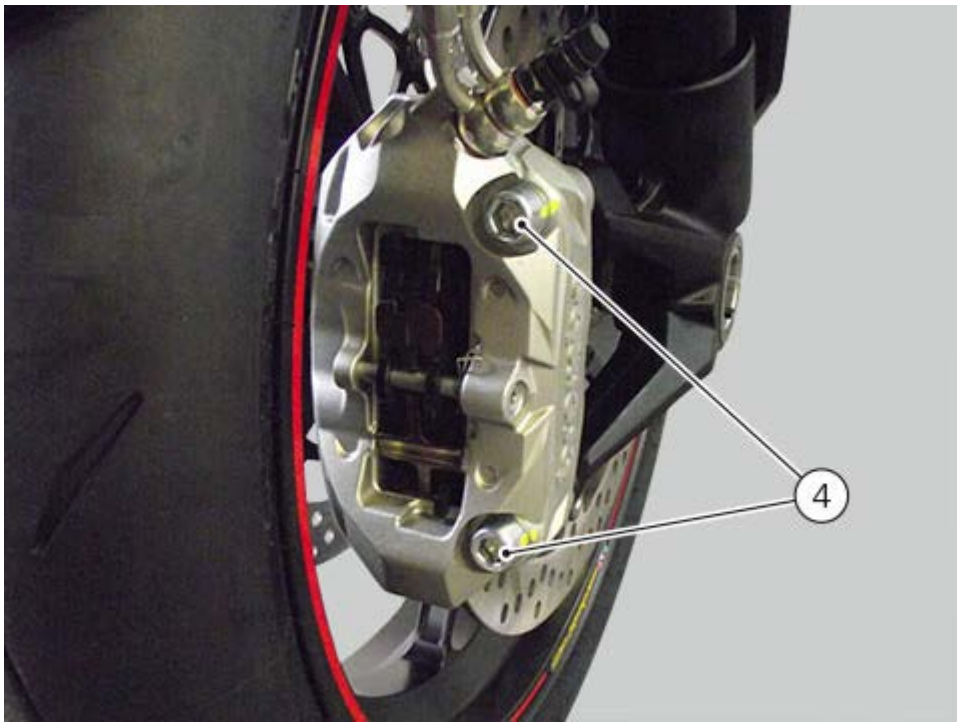
Warning

Brake fluid is corrosive and will damage paint. Avoid contact with eyes and skin. In case of accidental contact, wash thoroughly with water.

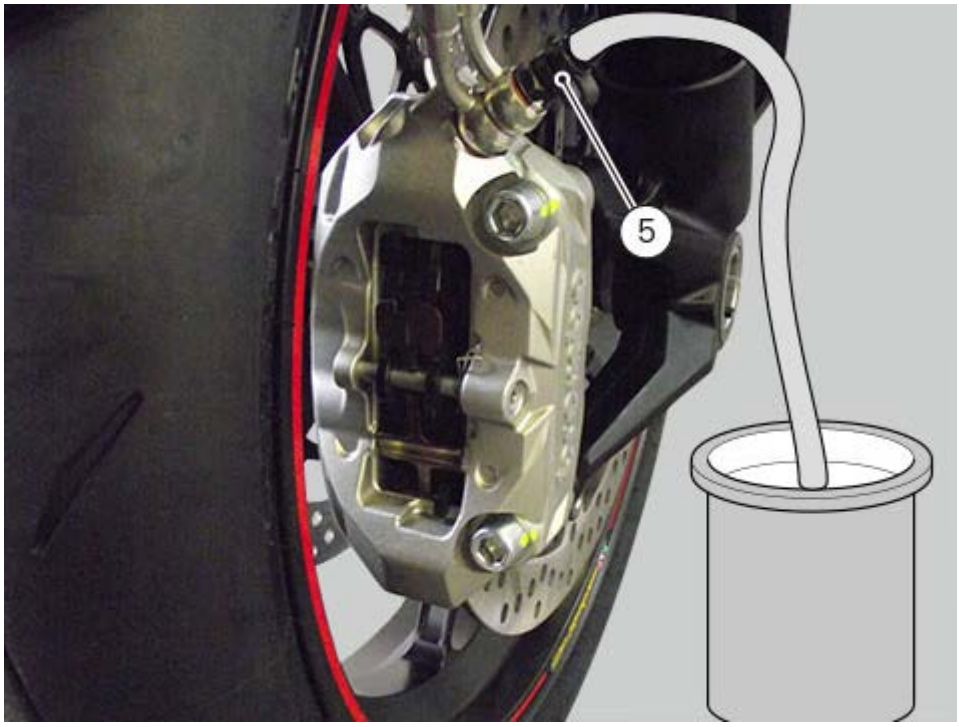
Remove the cover (1) with membrane from the front brake fluid reservoir (2) by undoing the screws (3). Siphon the fluid from the reservoir (2).
Refit the membrane (without the plug) on the reservoir to avoid brake fluid splashes during the following operations.



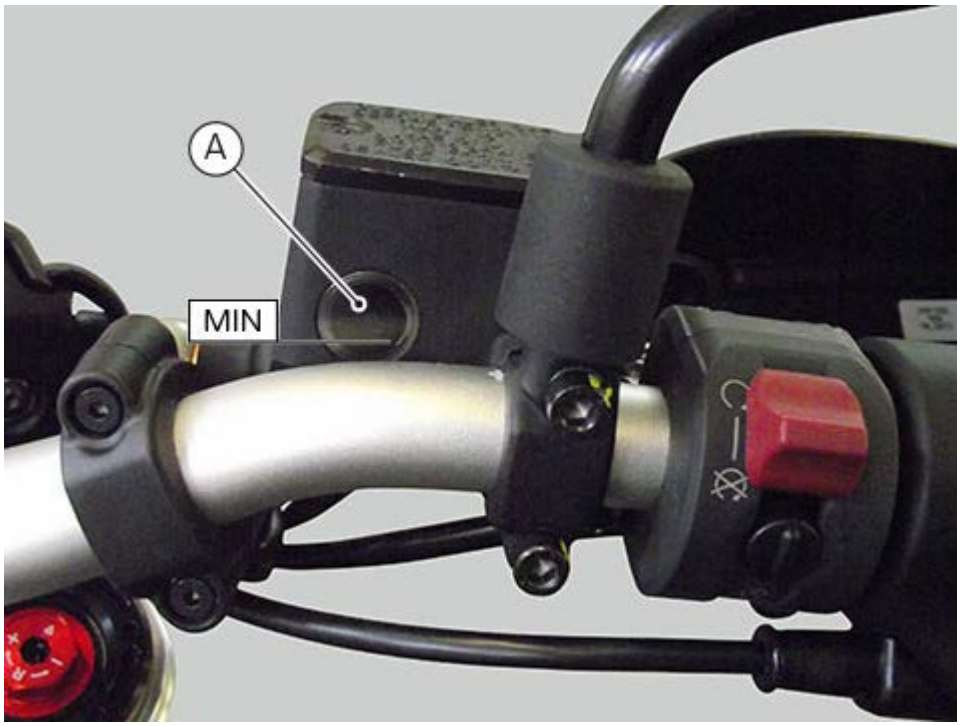
Move the brake calliper pistons back: to carry out this operation undo the fixing screws (4) of the callipers on the fork bottom end and push both pads of every calliper, taking them apart; during this operation, be careful with the fluid level, which must always be sucked out each time it flows back in the reservoir.



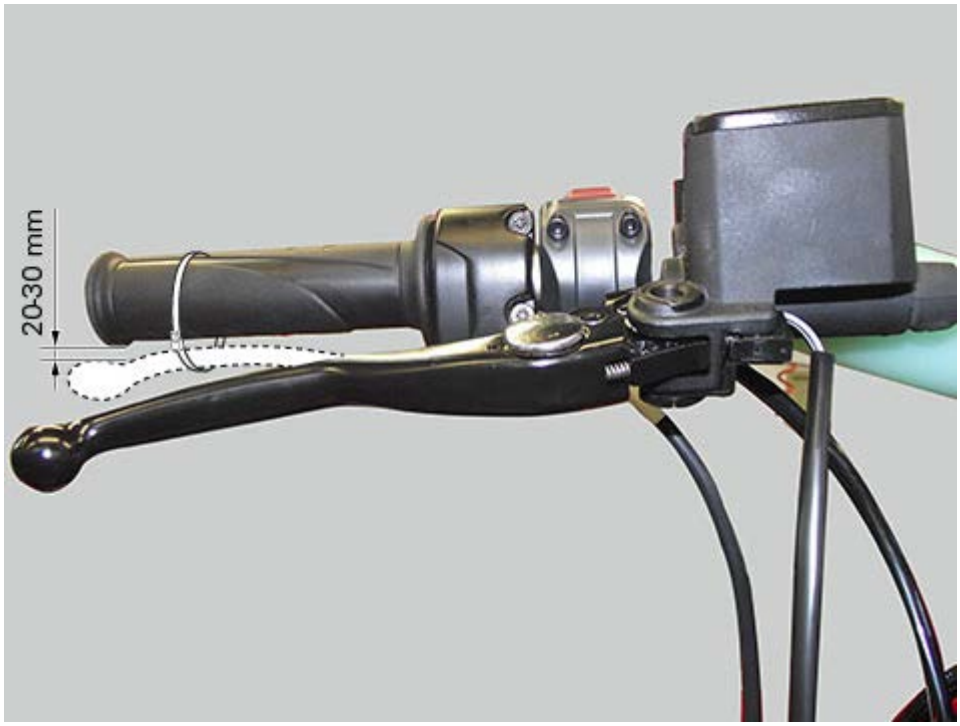
Once that all pistons of both callipers are fully moved back and that all the fluid in the tank has been sucked out, connect to the bleed valve (5) a transparent tube by immersing the end in a container placed on the floor.



Fill up the reservoir (2) with new oil until the sight glass (A) is covered.



Pull the lever to make a 20 - 30 mm stroke and keep the lever in this position using a non-elastic clamp.



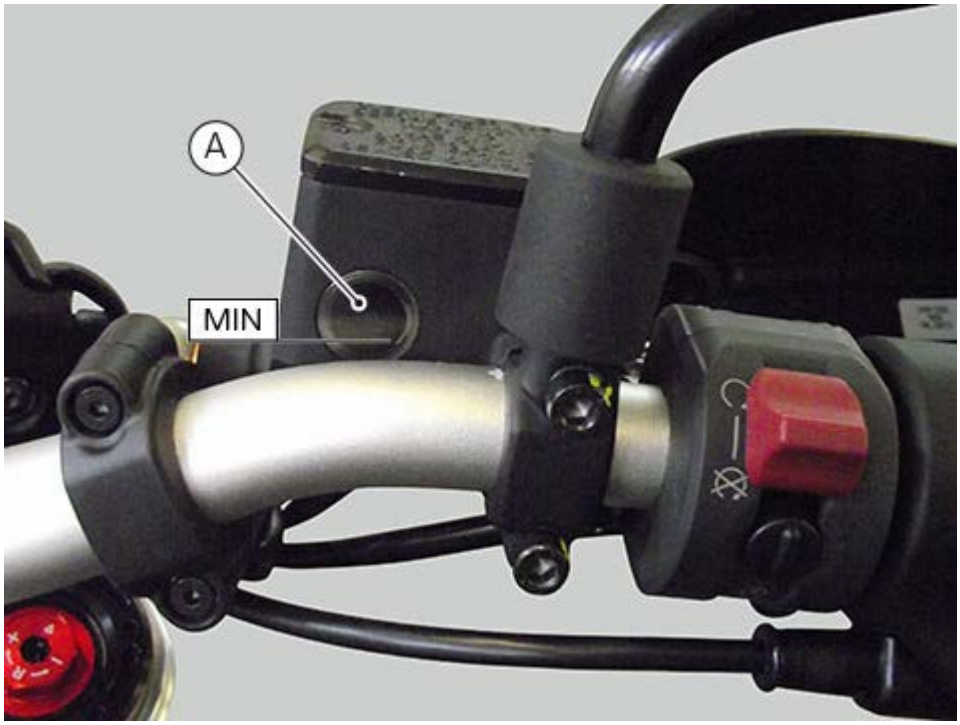
Loosen the bleed valve of the left-hand calliper (as seen by the rider) (5) and then take the lever through the whole stroke to allow fluid to flow out.
The lever is resting against the handgrip.

Tighten the bleed valve (5) to a torque of 10 Nm ±10% and then release the lever.
Repeat the above operation until the old fluid flows out completely.
Then, with the bleed valve definitely closed to the specified torque actuate repeatedly the lever until a pressure is detected in the brake system.

Warning
After draining the old fluid from the reservoir and while filling the system, always keep the fluid level above the MIN mark to avoid any air bubbles in the circuit.

Note
With this procedure, the front brake system callipers are still filled with fluid; if callipers have to be drained as well, move back calliper pistons by keeping the bleeding tool (if available) working and connected to bleed valve.

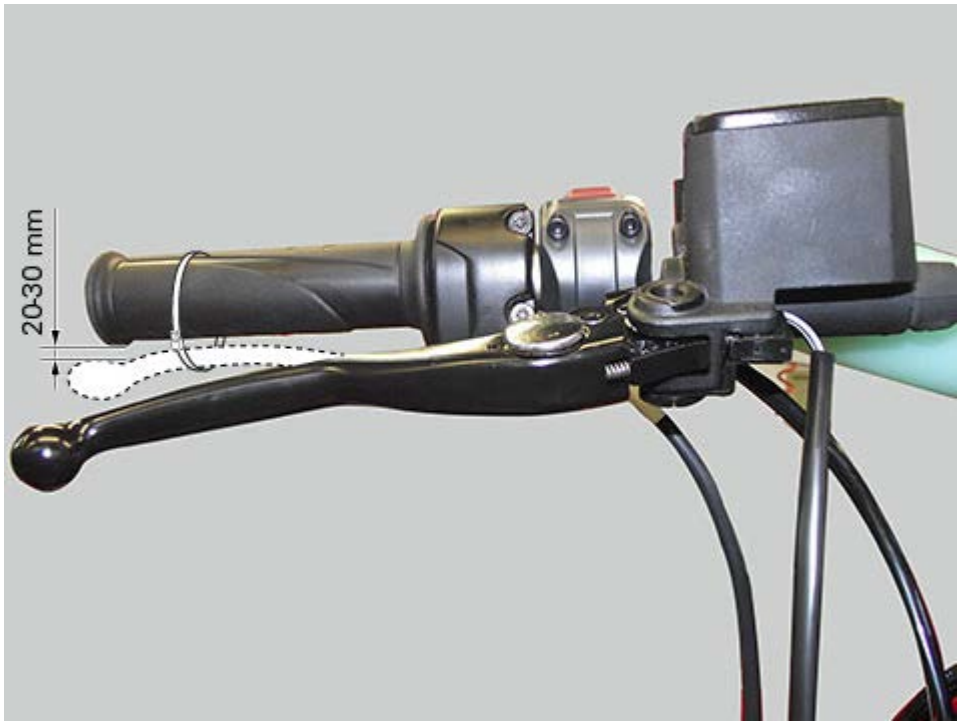
Fill the reservoir (2) with the specified fluid taken from an intact container.



Important

During this operation, oil level inside reservoir must remain at a visible level from the sight glass at all times. The end of the transparent plastic hose must remain immersed in the discharged fluid at all times.

Operate brake lever and keep it activated during the whole filling operation.



Connect it to left-hand front brake calliper bleed valve (5).

Note
Follow the manufacturer's instructions when using a commercial brake bleeding tool.

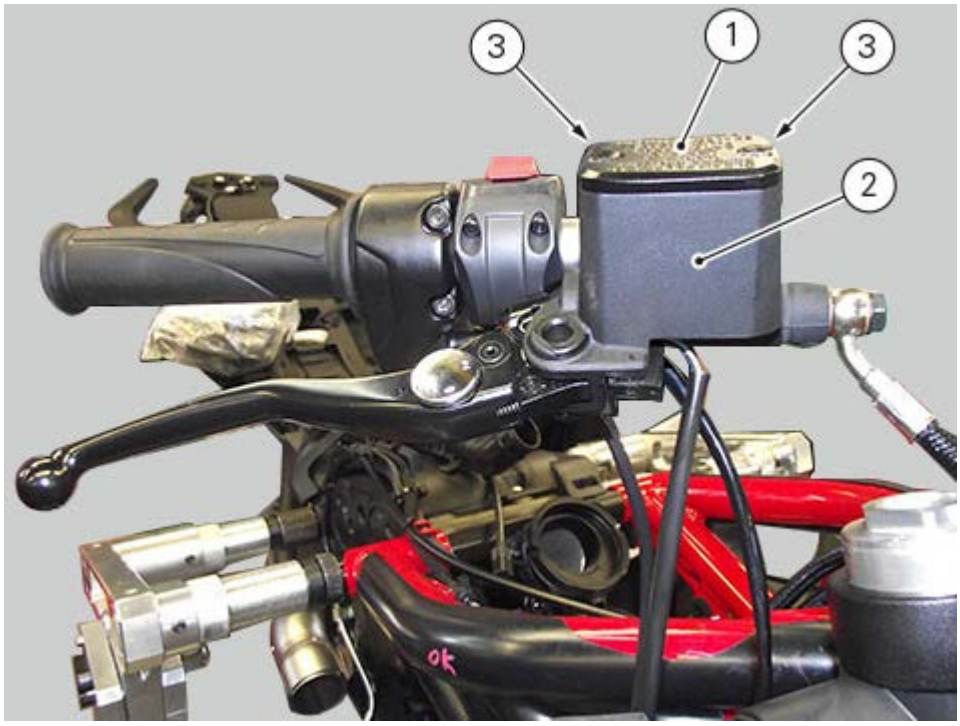
Suck with the bleeding tool and open the bleed valve (5) making sure that the level of the concerned reservoir does not fall below the sight glass.
Continue this operation until all air is bled out of system.
Tighten bleed valve (5) to a torque of 4 Nm ± 10%.
If you do not have a bleeding tool available, connect a transparent plastic tubing to the bleed valve (5) as outlined in the draining procedure.

Operate the lever to half stroke or until system is pressurised, open bleed valve (5) and operate lever to full stroke; tighten bleed valve to the specified torque and release lever.

Important

Do not release the brake lever until the bleed valve has been fully tightened.

Repeat the bleeding operation until the fluid inside system is free of air bubbles; once filling is completed, proceed to bleeding by working on both valves (5) from front brake callipers.
Make sure that, with bleed valves duly closed, pressure is correctly developed through brake lever or pedal.
Close bleed valves (5) to a torque of 4 Nm ± 10%, and fit protective caps.
Level fluid and refit cover (1) by tightening screws (3) on reservoir (2).

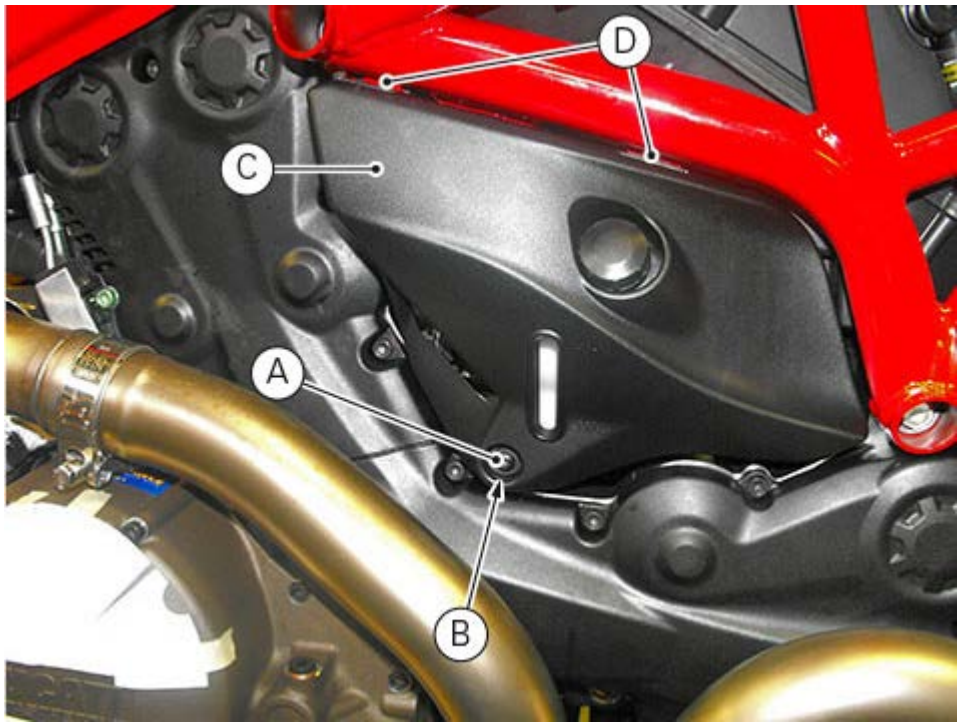


Changing the coolant

Warning

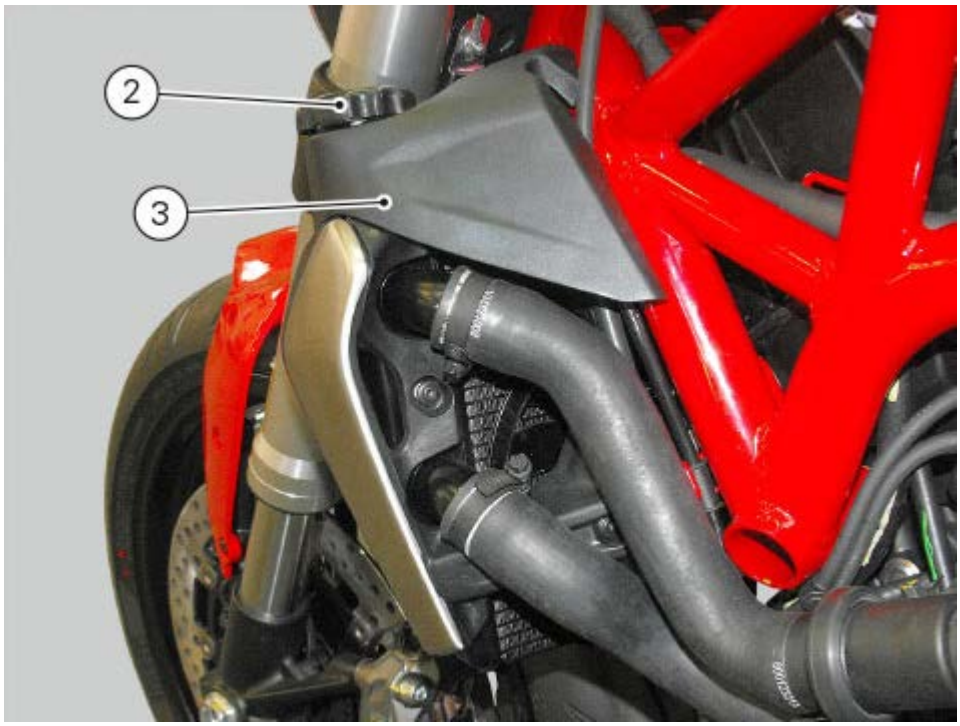
Make sure the engine is cold before proceeding. Attempting to change the coolant with the engine hot could lead to burns from hot coolant or scalding steam.

If necessary, remove coolant tank cover, on vehicle right side.
Loosen screw (A) and keep spacer (B), sliding cover (C) out of frame tabs (D).

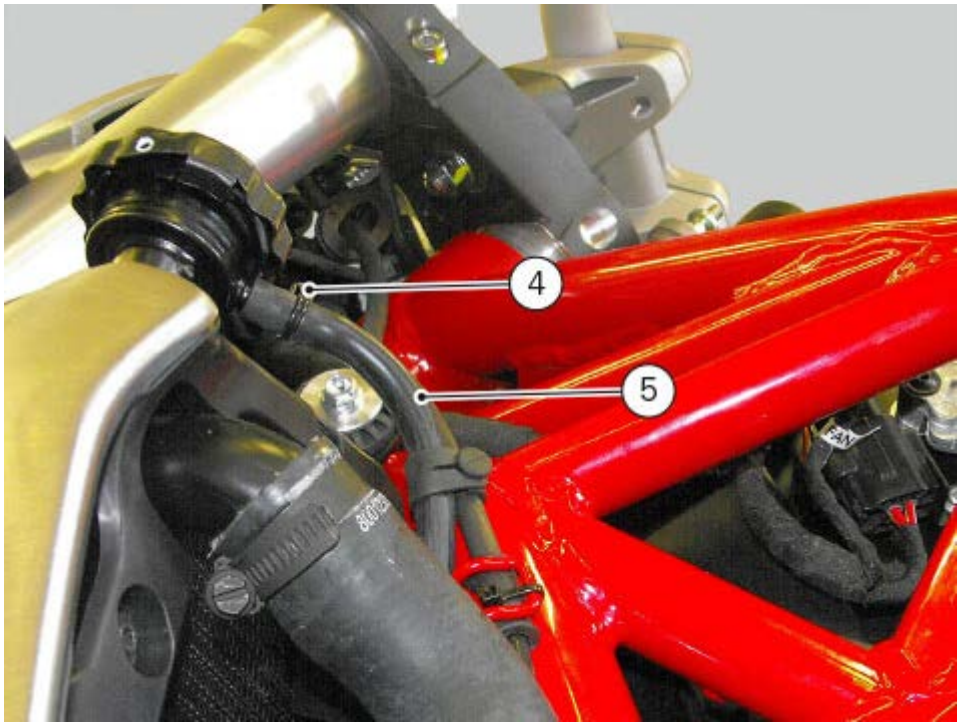


Place a container under the engine and set the motorcycle on its side stand.
Remove the expansion reservoir filler plug (1).

Loosen radiator plug (2) and remove cover (3).

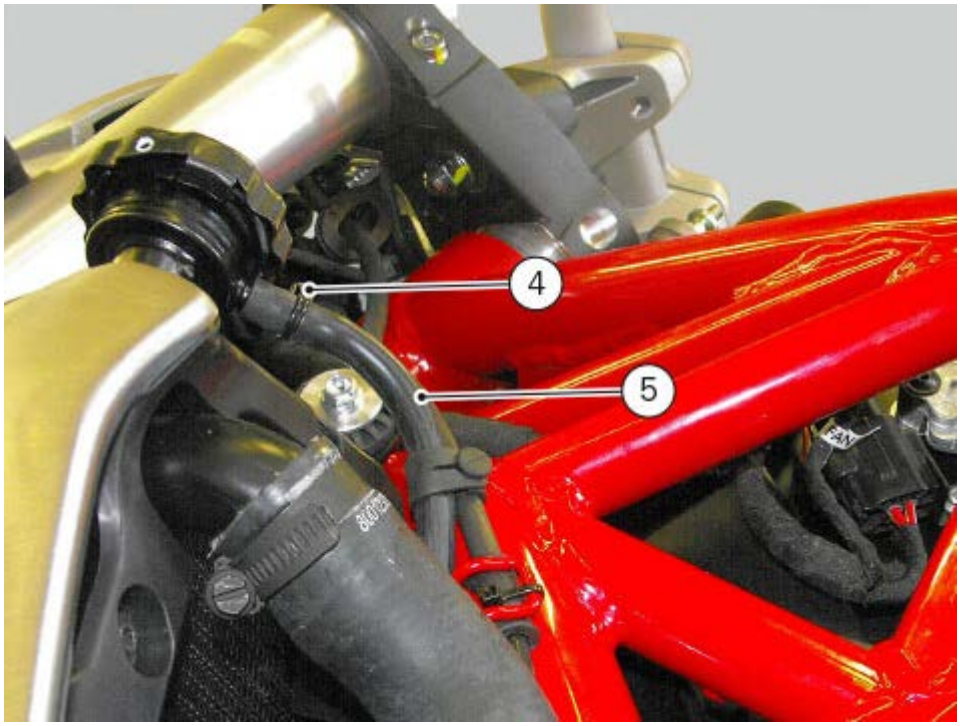


Slide out clamp (4), disconnect hose (5) and allow all coolant to drain in a container.

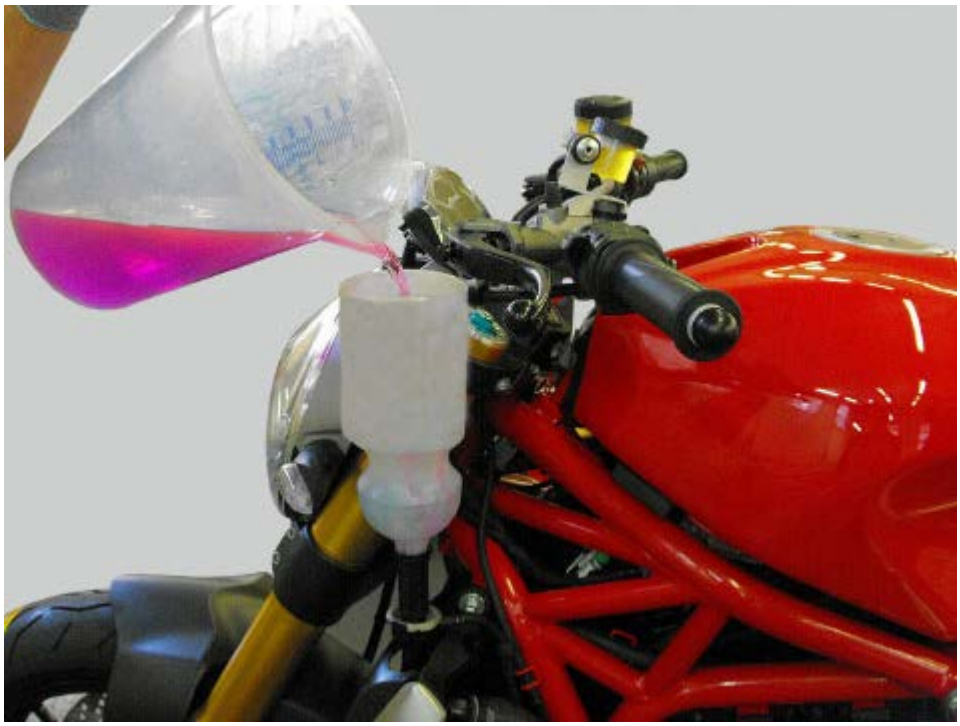


Loosen plug (6) from fluid drain hole located on the pump cover.
Allow the coolant to drain off completely.
Screw plug (6) in the fluid drain hole with a new seal.
Tighten plug (6) to a torque of 20Nm ± 10%.

Insert hose (5) and secure it to radiator with clamp (4).



Fill the circuit with new coolant through radiator filler plug inlet.



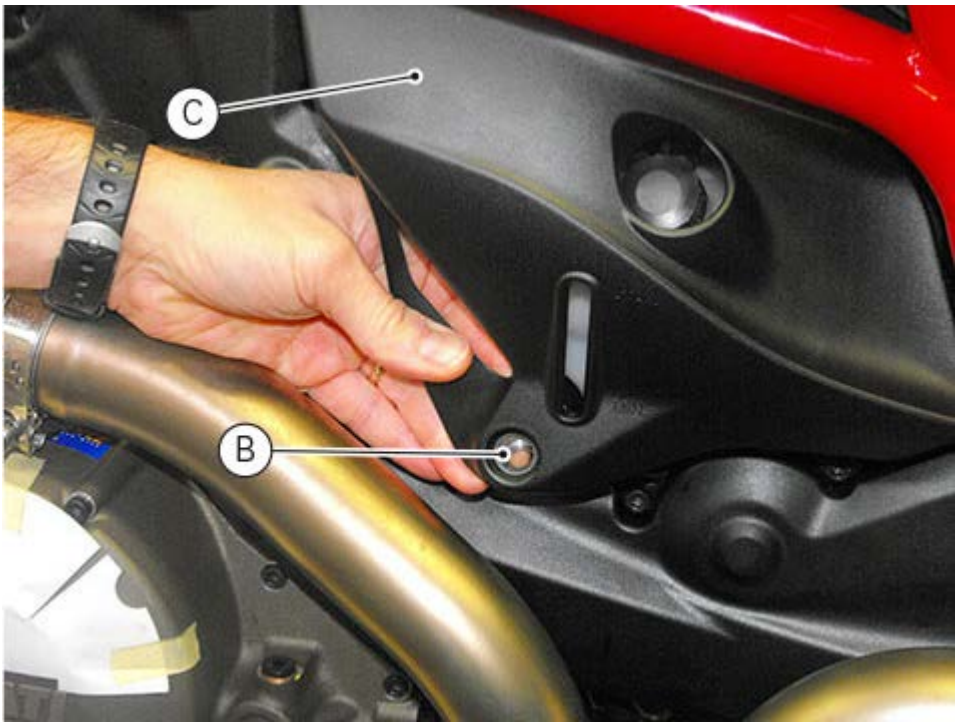
Wait several minutes for the coolant to fill all the internal passages.
Start the engine and wait for the coolant to reach 110 °C; run the engine for about 10 minutes.
Stop the engine and allow it to cool down so that all the air is expelled from the circuit.

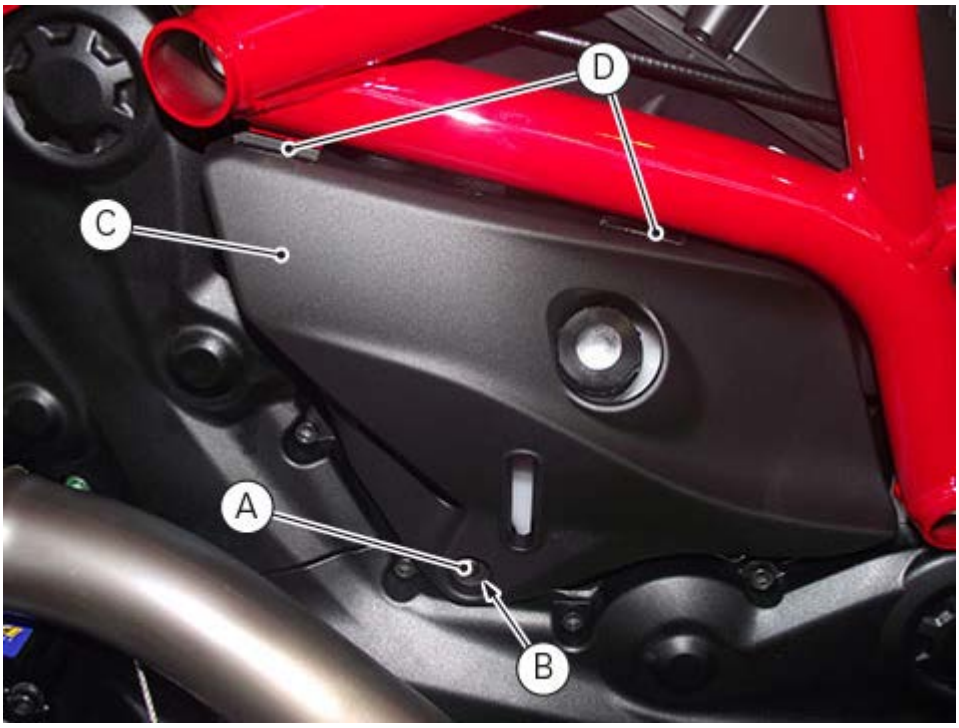
Warning
Keep your hands, clothing and tools well clear of the radiator fan at all times; this fan starts automatically without warning and could cause serious injury or damage.

Important
Check the circuit for possible leaks.

Top up the coolant through the expansion reservoir filler to bring the level up to the "MAX" mark.
Tighten the plug (1) of the expansion reservoir.

If previously removed, refit coolant tank cover (C), locking it inside frame tabs (D).
Position spacer (B) behind cover, and tighten screw (A) to a torque of 1Nm ± 10%.


C
B


D
C
A
B

Check the coolant level

Check the coolant level in the expansion reservoir, on the right-hand side of the vehicle, at the intervals specified in the chart: "Scheduled maintenance chart-operations to be carried out by the Dealer".
The coolant level must be between the "MAX" and "MIN" marks on the reservoir.
If the level is low, top up with the recommended coolant.
Remove the filler plug (1) and top up with new coolant to the specified level.
Refit the plug (1).

For optimal operating conditions (coolant mixture starting to freeze at 20 °C), the recommended coolant should be mixed with water in the following percentages:
ANTIFREEZE: 35÷40% of the volume;
WATER: 65÷60% of the volume.

Important
Very hard water with a high mineral salt content can damage the engine.
Increase the amount of antifreeze to up to 55% volume in the case of very cold climates.

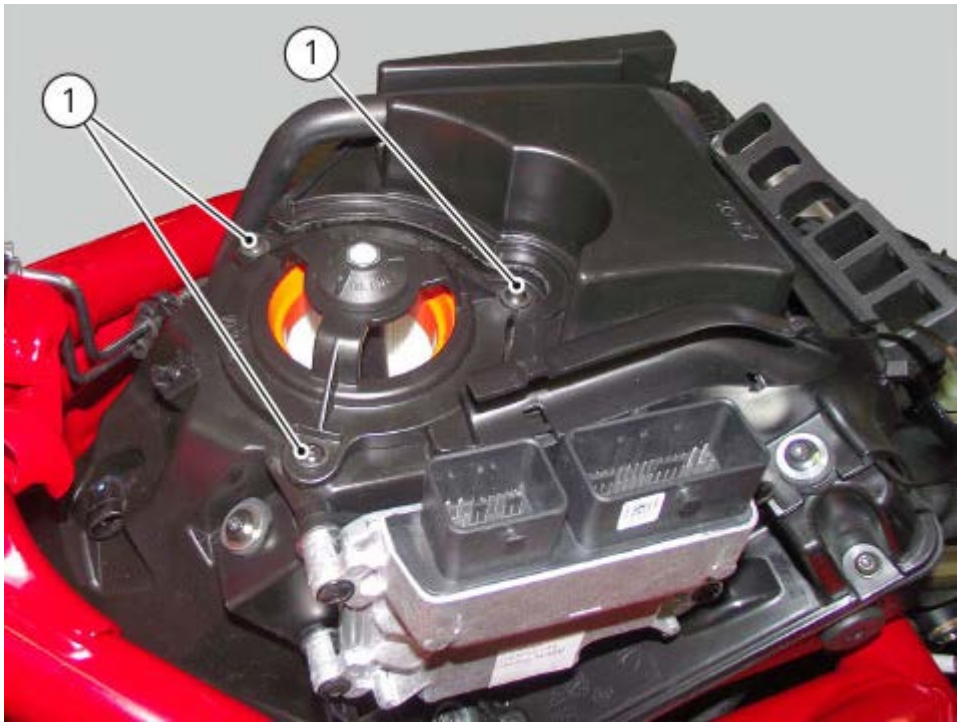
Important
Solutions with less than **30%** of antifreeze will not provide sufficient protection against corrosion.

Changing and cleaning the air filters

The air filter must be replaced at the intervals specified in the "Scheduled maintenance chart-operations to be carried out by the Dealer".

Remove the seat (Removing the seat).
Remove the fuel tank (Removing the fuel tank).

Loosen the three screws (1) and, keeping spacers (8), slide out air filter (2) complete with cover (3).
Slide out and separate cover (3) from air filter (2).



The filter can be cleaned with a jet of compressed air or replaced, if necessary.

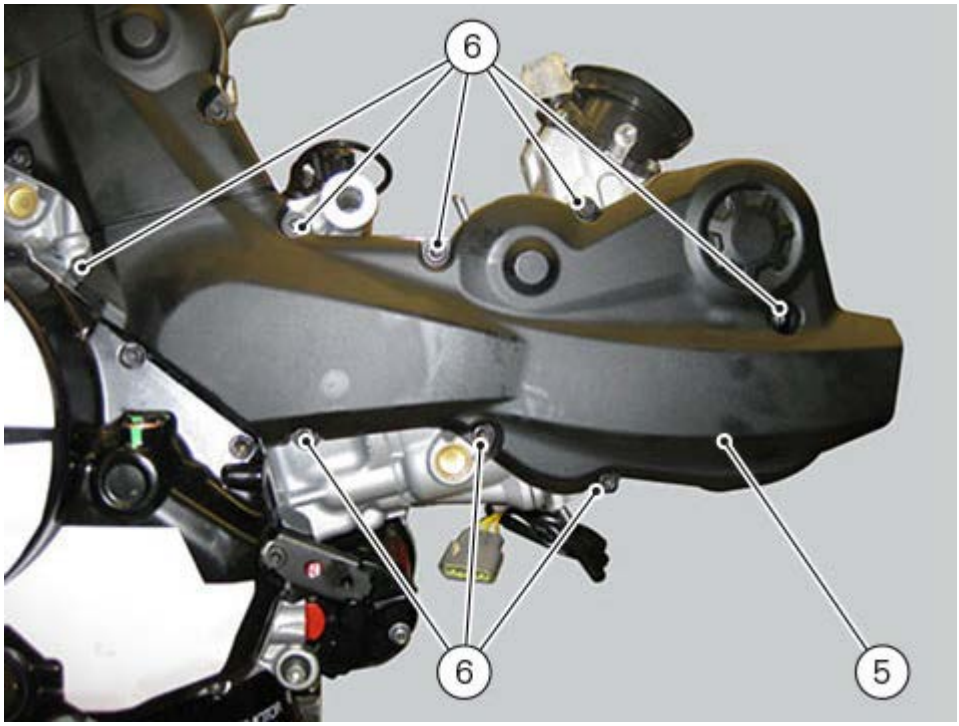
Important
A clogged air filter will reduce air intake and engine power, increase fuel consumption and cause a build up of deposits on the spark plugs. Do not use the motorcycle without a filter as impurities in the air could get into the engine and cause damage.

Duly refit filter (2), pre-assembled with cover (3), inside its seat on airbox.
Start screws (1) and tighten them to a torque of 3Nm ± 10%.

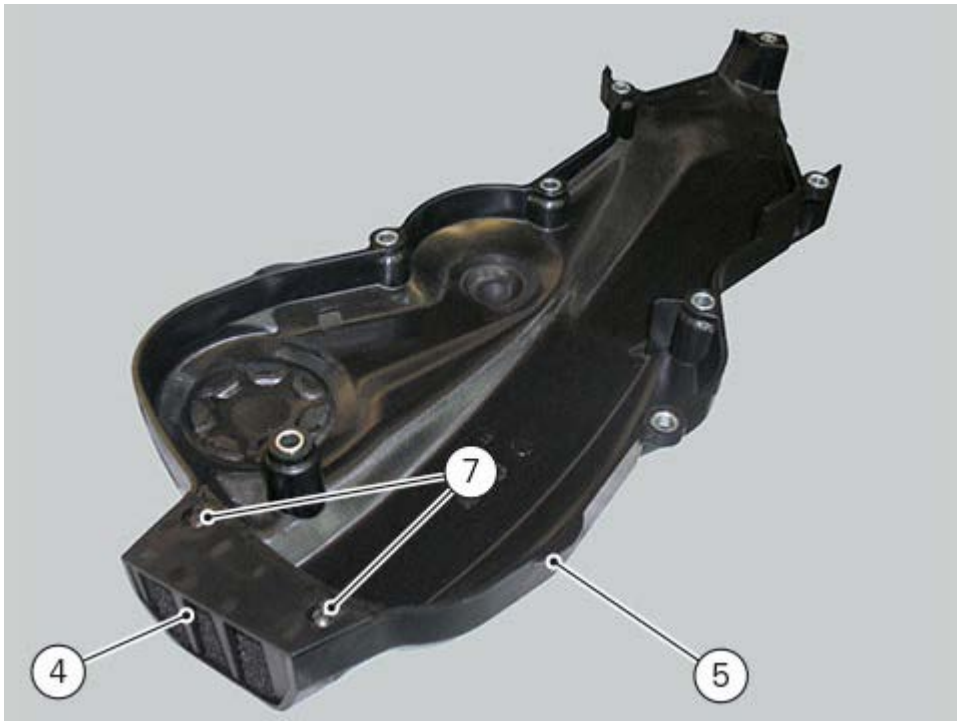
Important
If the motorcycle is used in very damp or dusty conditions, the air filter cartridge must be changed more frequently.

Remove primary pipes from horizontal and vertical head exhaust pipes (Removing the exhaust system).

Loosen the screws (6) fixing the horizontal belt cover (5), and remove it from the horizontal piston-cylinder assy.



Loosen the screws (7) and remove the filter (4).
Check air filter (4).
Once the check has been carried out, refit filter (4), start (without tightening) screws (7), and refit the horizontal timing belt cover (5) on the horizontal piston-cylinder assembly by tightening the screws (6) to a torque of 10 Nm (Min. 9 Nm - Max. 11 Nm) for plastic covers and 6 Nm (Min. 5.5 Nm - Max. 6.5 Nm) for carbon covers.



Refit primary exhaust pipes (Refitting the exhaust system), complete with heat guards.

Refit the fuel tank (Refitting the fuel tank).
Refit the seat (Refitting the seat).

Replacing the spark plugs

Check the colour of the ceramic insulation around the central electrode: an even, light brown colour indicates the engine is in good condition and running at the right temperature.
Check central electrode for wear.

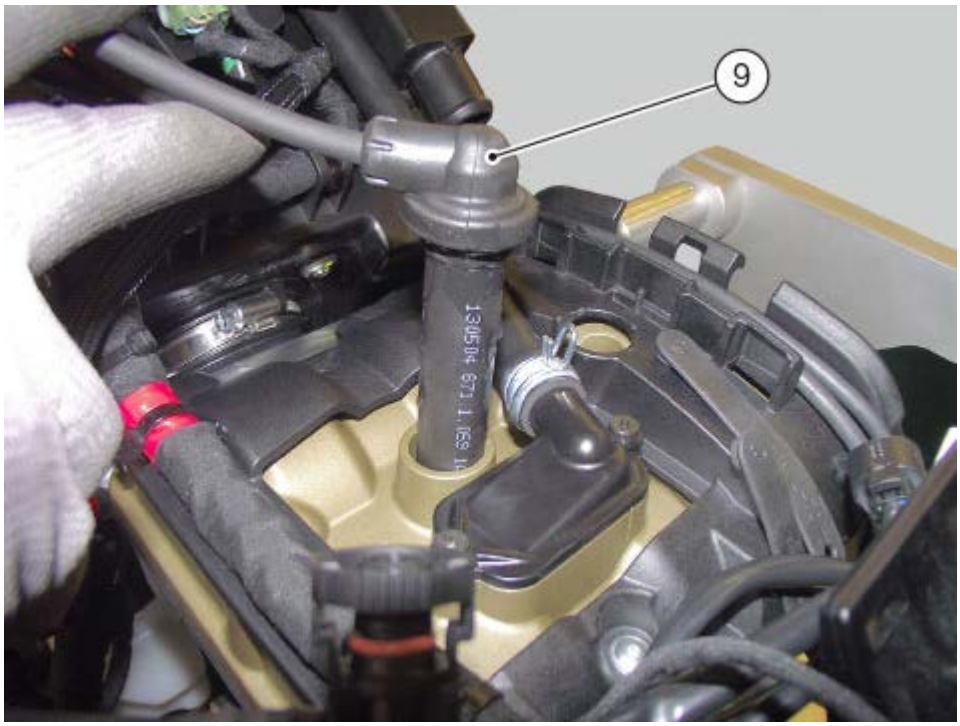
Warning

Do not use spark plugs with inadequate heat rating or incorrect thread length.
The spark plug must be securely installed.
If a spark plug is loose, it can overheat and damage the engine.

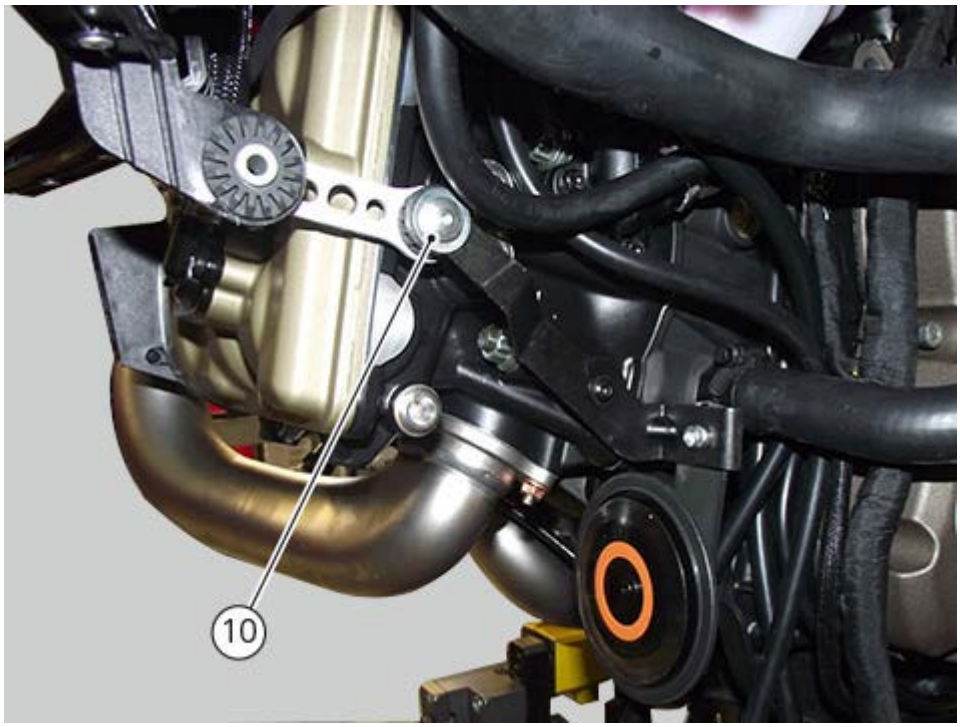
Spark plug type
Make: NGK
Type: MAR9A-J

Remove the seat (Removing the seat).
Remove the fuel tank (Removing the fuel tank).

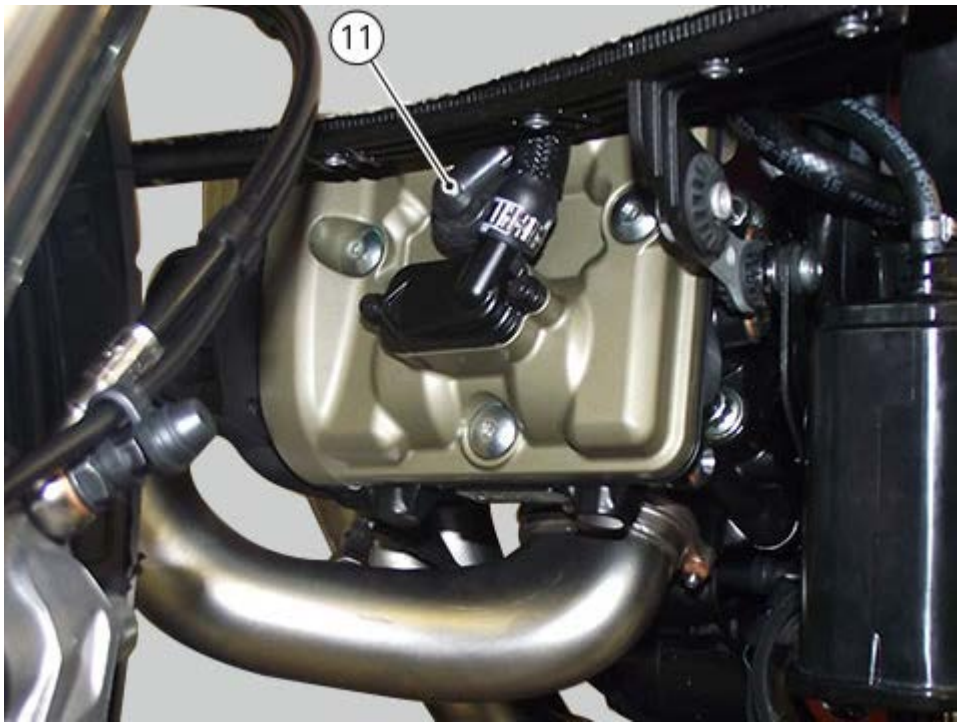
Slide caps (9) out of vertical head.



To reach horizontal head spark plug, loosen threaded pin (10) securing water radiator, working on both sides, and slightly moving it towards forks.



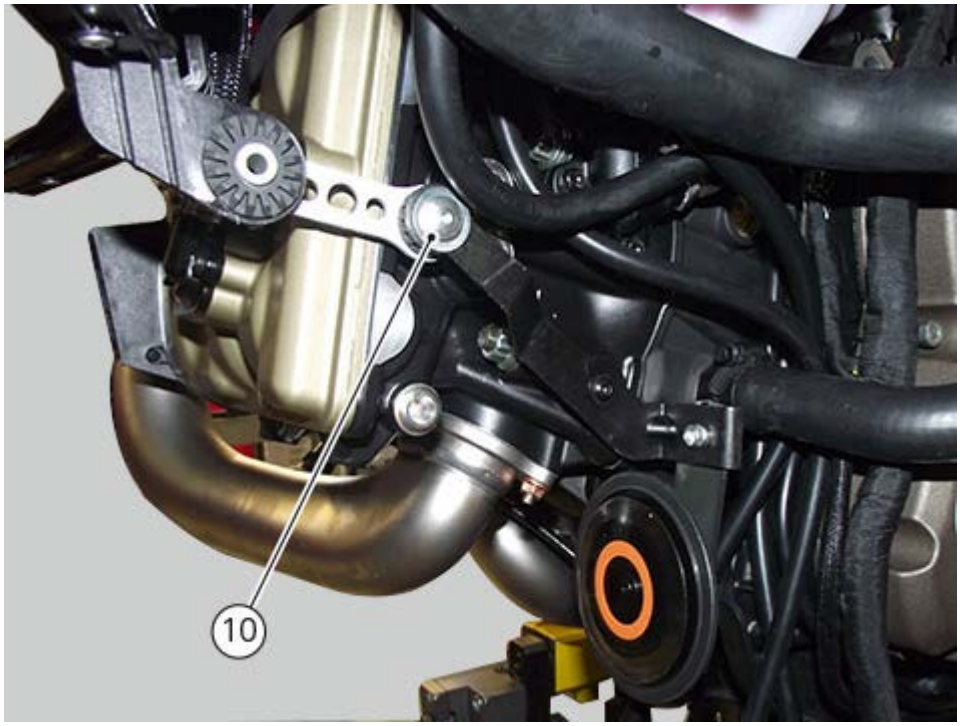
Slide cap (11) out of horizontal head.



Use tool part no. **88713.2877** to replace spark plug, and tighten it to a torque of 12 Nm (Min. 11 Nm - Max. 13 Nm).

Position caps (9) and (11) inside their seats.
Work in the same way on both heads.

Secure water radiator to support by starting and tightening threaded pins (10) to a torque of 5 Nm ± 10%.



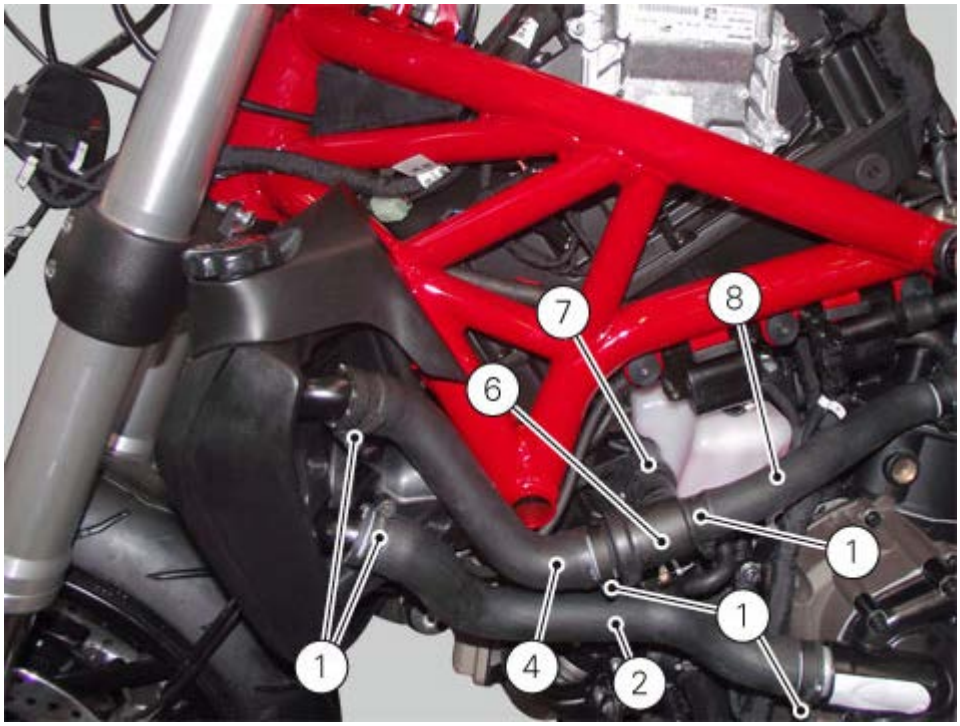
Refit the fuel tank (Refitting the fuel tank).
Refit the seat (Refitting the seat).

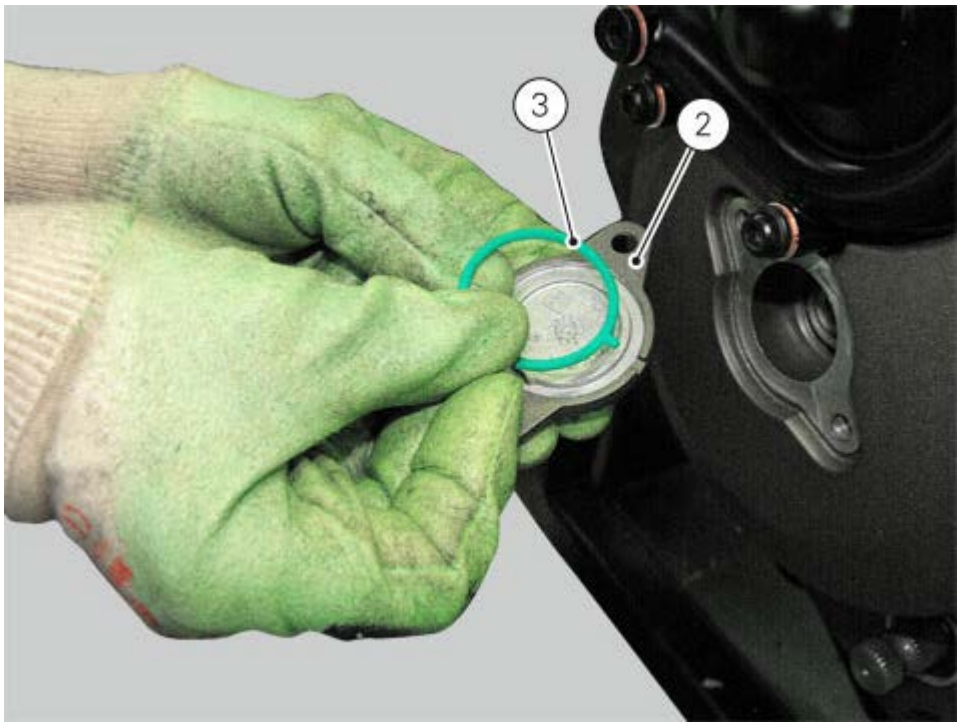
Checking valve clearance

Remove the seat (Removing the seat).
Remove the lateral covers (Removing the water tank).
Remove the fuel tank (Removing the fuel tank).
Remove the airbox (Removing the airbox and throttle body).
Loosen the timing belt covers (Removing the timing belt external covers).
Loosen the water radiator retaining screws by leaving the radiator connected to the cooling system (Removing the water radiator).
Disconnect the coil caps.
Disconnect the secondary air units of the head covers (Removing the secondary air system).
Remove the cylinder head cover (Removing the camshafts).

Note
For clarity, the figures show the engine removed from the frame.

Loosen the two screws (1) retaining cover (2) and remove them together with gasket (3).





Fit the tool handgrip no. **88765.1523** in the holes of the generator cover to be able to turn the crankshaft so that the valve on which the check is carried out is in rest position and the relevant piston at the top dead centre.

Check the valve clearance of the head you are working on.

Checking the opening clearance

Using a feeler gauge, check the clearance between the opening rocker arm (A) and the lowest point of the camshaft lobe (B), taking care not to compress the rocker arm return spring.

Important
Hold the feeler gauge at a distance of at least 4-5 cm from the point of measurement between cam and rocker arm.

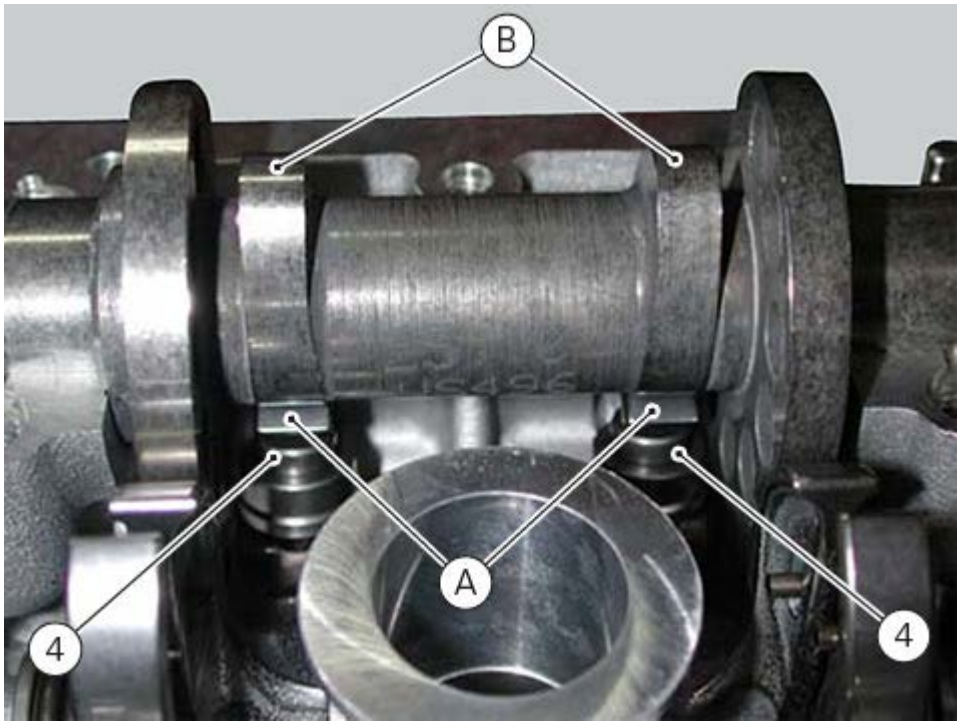
Important
During this operation, press on the camshaft perpendicularly to the head surface to keep it in seat.

The value must be within the prescribed ones (Timing system/valves).

	Reference	Assembly value	Check value every 24,000 km
Valve clearance	Opening rocker arm - intake	0.13÷0.18 mm	0.10÷0.25 mm
	Opening rocker arm - exhaust	0.13÷0.18 mm	0.10÷0.25 mm

If not so, remove the opening shim (4) (Removing the valves), and replace it with one of suitable height to obtain the prescribed clearance.

Note
Opening rocker arm shims measuring 1.80 to 3.45 are available as spare parts: the size is punched on the shim.



Checking the closing clearance

Using a feeler gauge, check the clearance between the closing rocker arm (C) sliding shoe and the highest point of the camshaft lobe (D).

Important
Hold the feeler gauge at a distance of at least 4-5 cm from the point of measurement between cam and rocker arm.

Important
During this operation, press on the camshaft perpendicularly to the head surface to keep it in seat.

The value must be within the prescribed ones (Timing system/valves).

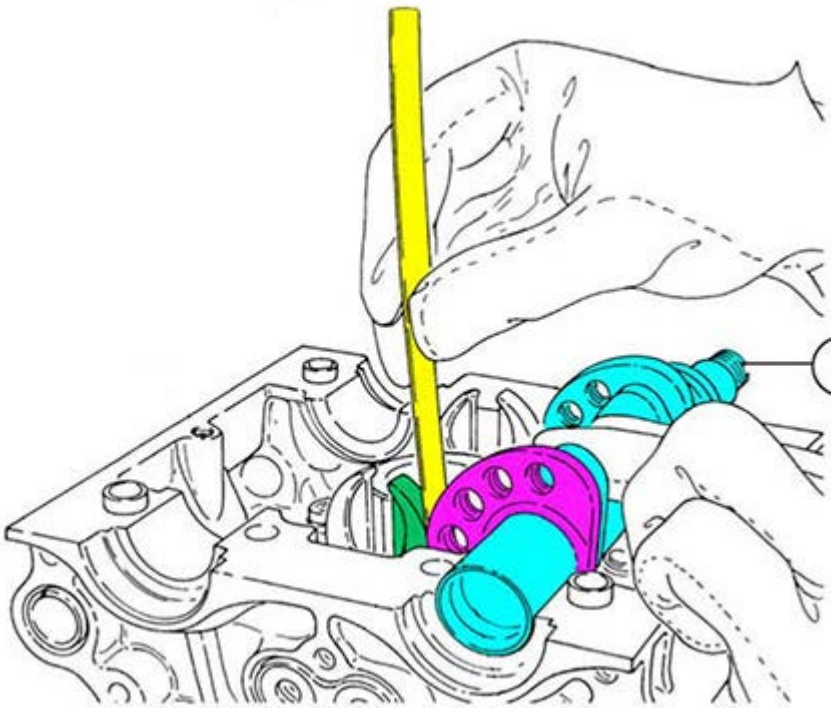
	Reference	Assembly value	Check value every 24,000 km
Valve clearance	Closing rocker arm - intake	0.05÷0.10 mm	0.05÷0.25 mm

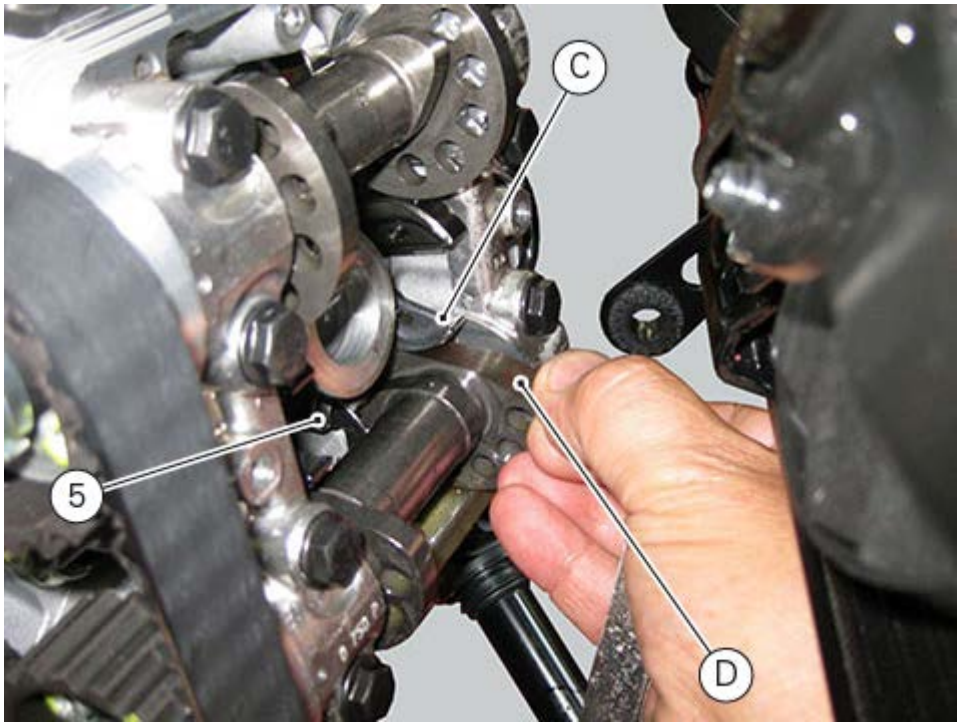
	Closing rocker arm - exhaust	0.05÷0.10 mm	0.05÷0.25 mm

If not, remove the closing shim (5), as described in paragraph (Removing the valves), and replace it with one of suitable height to obtain the prescribed clearance.

Note

Closing rocker arm shims measuring 2.2 to 4.5 are available as spare parts: the size is punched on the shim.





Restore the original conditions by refitting the previously removed components.

Changing the engine oil and filter cartridge

Note

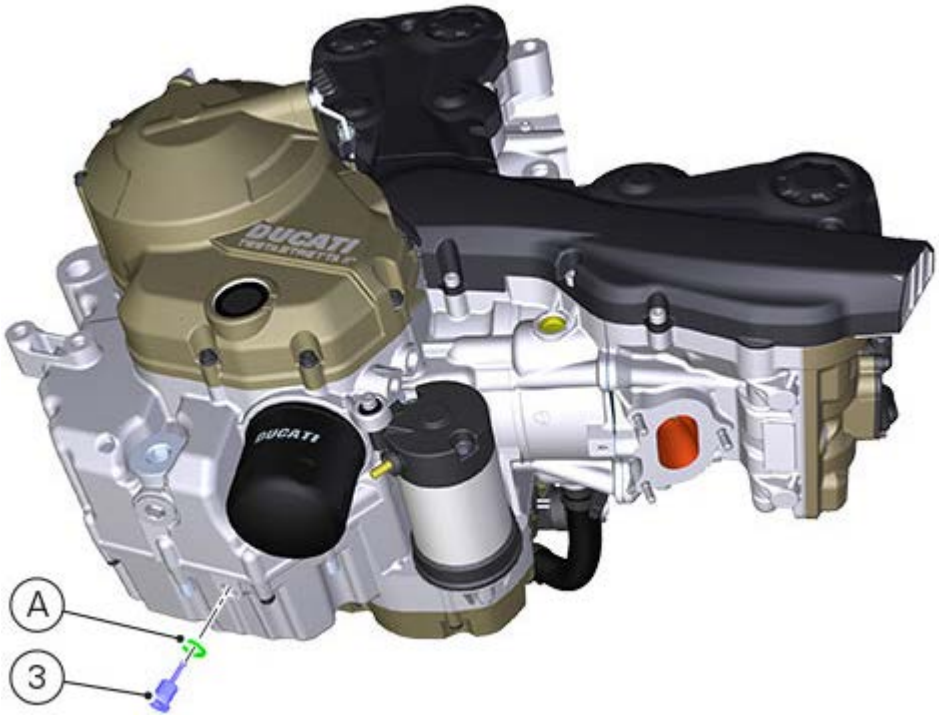
This operation has to be carried out with hot engine (but turned off) because the oil in these conditions is more fluid and comes out faster and completely.

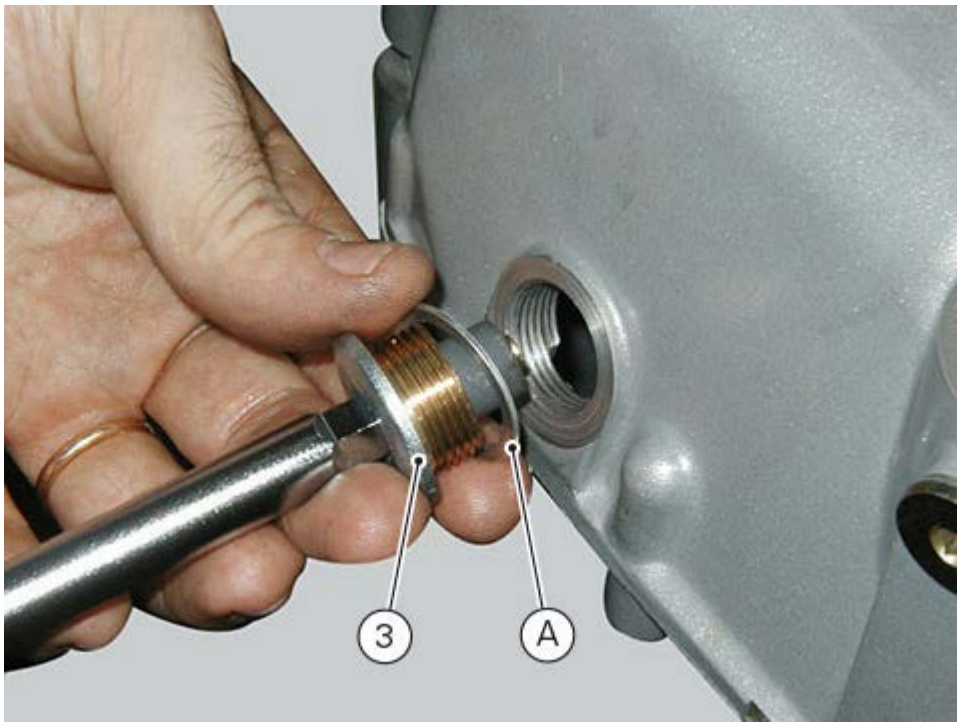
Remove the drain plug (3) with gasket (A) from the oil sump and allow the oil to drain off.

Warning

Dispose of oil and/or filter cartridges in compliance with environmental protection regulations.

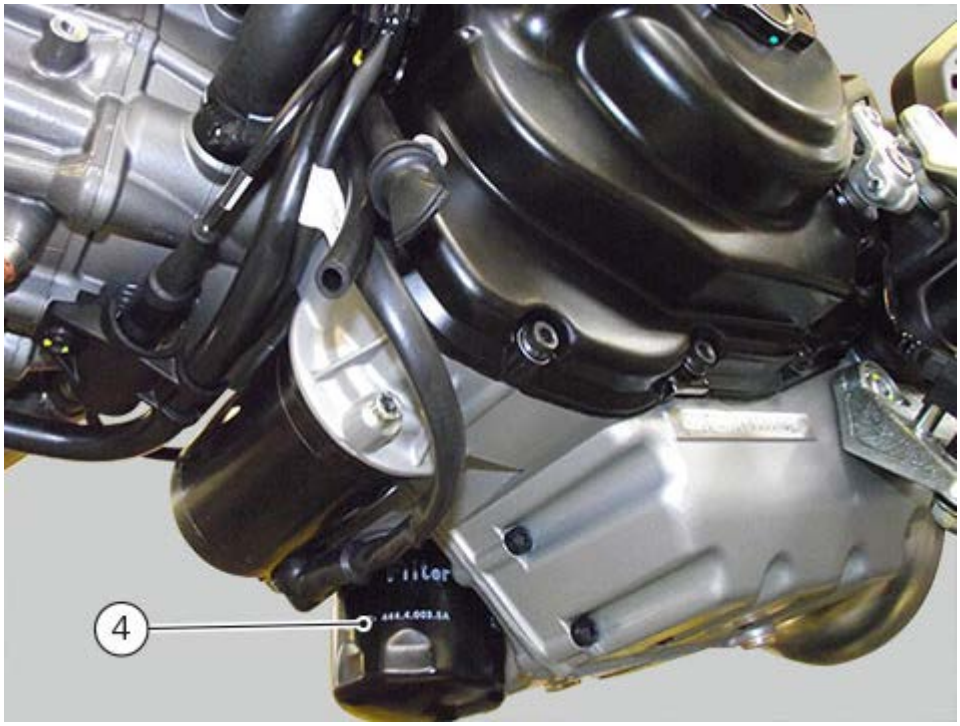
Remove any metal deposits from the end of the magnetic drain plug (3) and refit the drain plug complete with seal (A) to the sump.





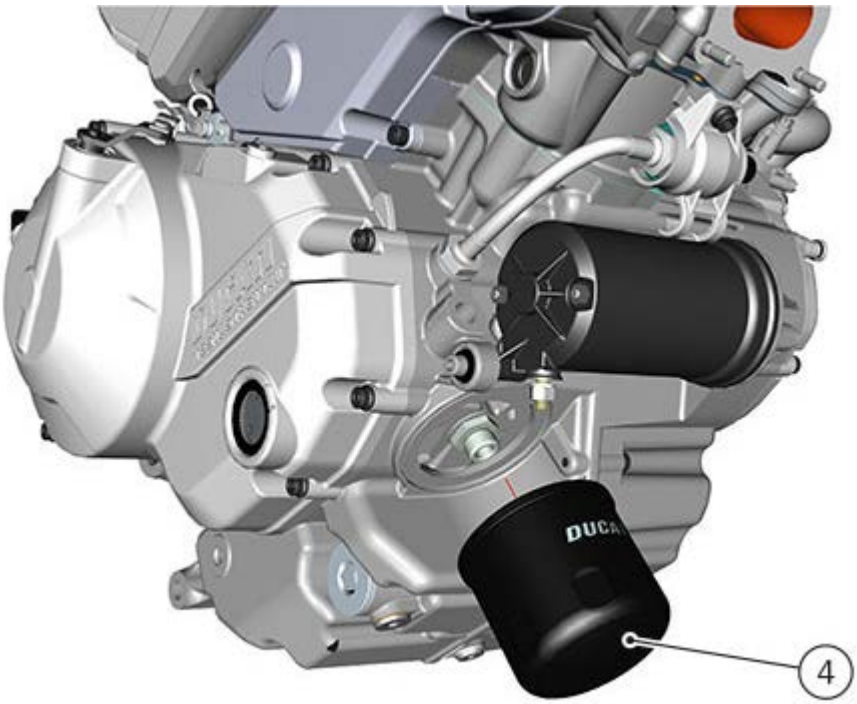
Tighten plug (3) to a torque of 20 Nm (Min. 18 Nm - Max. 22 Nm).
Remove the oil sump filter cartridge (4) using service tool no. **88713.2906**.

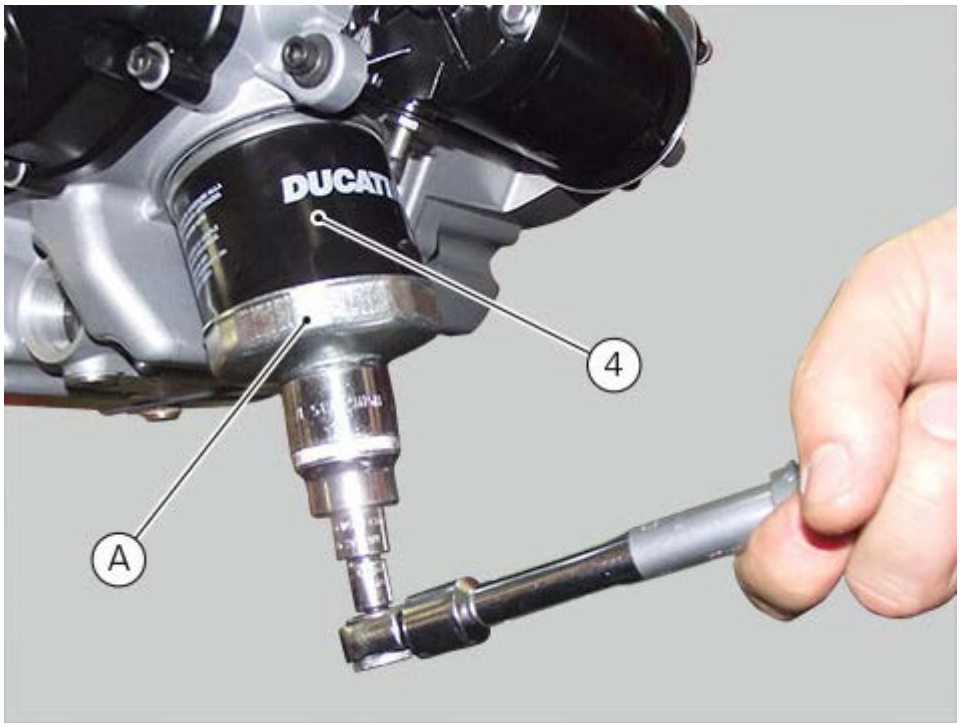
Important
Dispose of the used filter, do not re-use it.



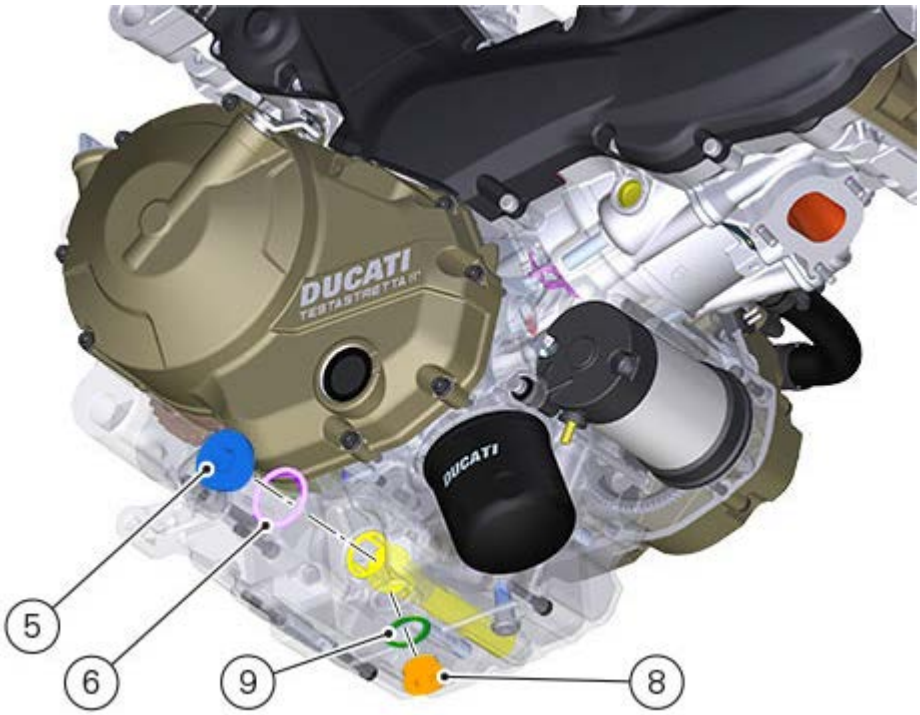
Fit a new cartridge (4) using tool no. **88713.0944** (A) tightening it to a torque of 11 Nm (Min. 10 Nm - Max 12 Nm): lubricate seal with engine oil.

Note
It is advisable to refill the filter cartridge with engine oil before fitting it: this enables the recommended oil level to be maintained without topping up.

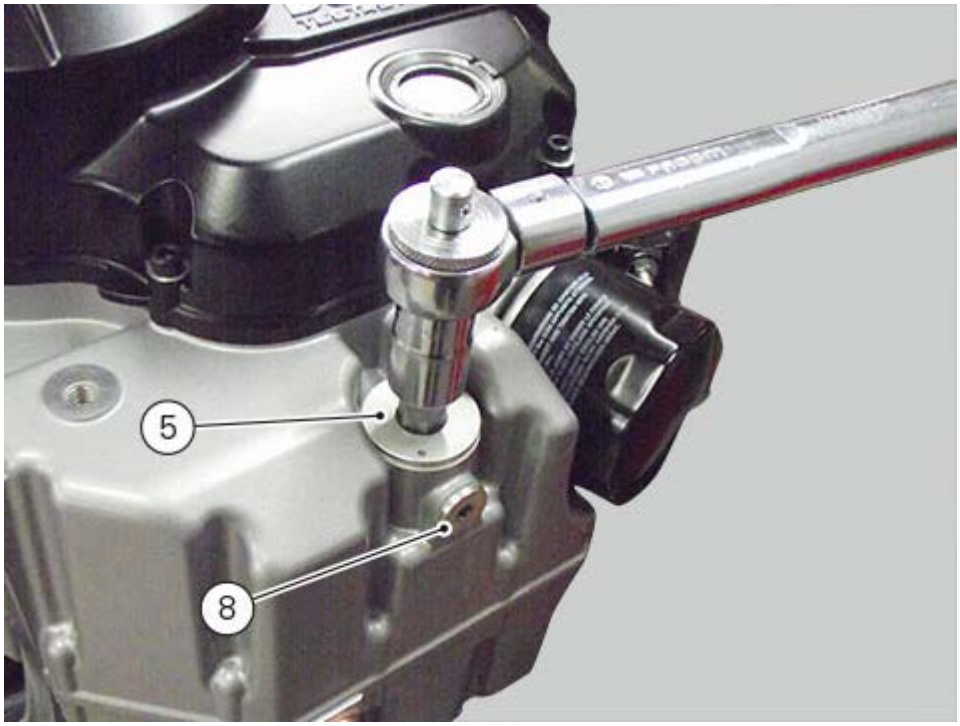


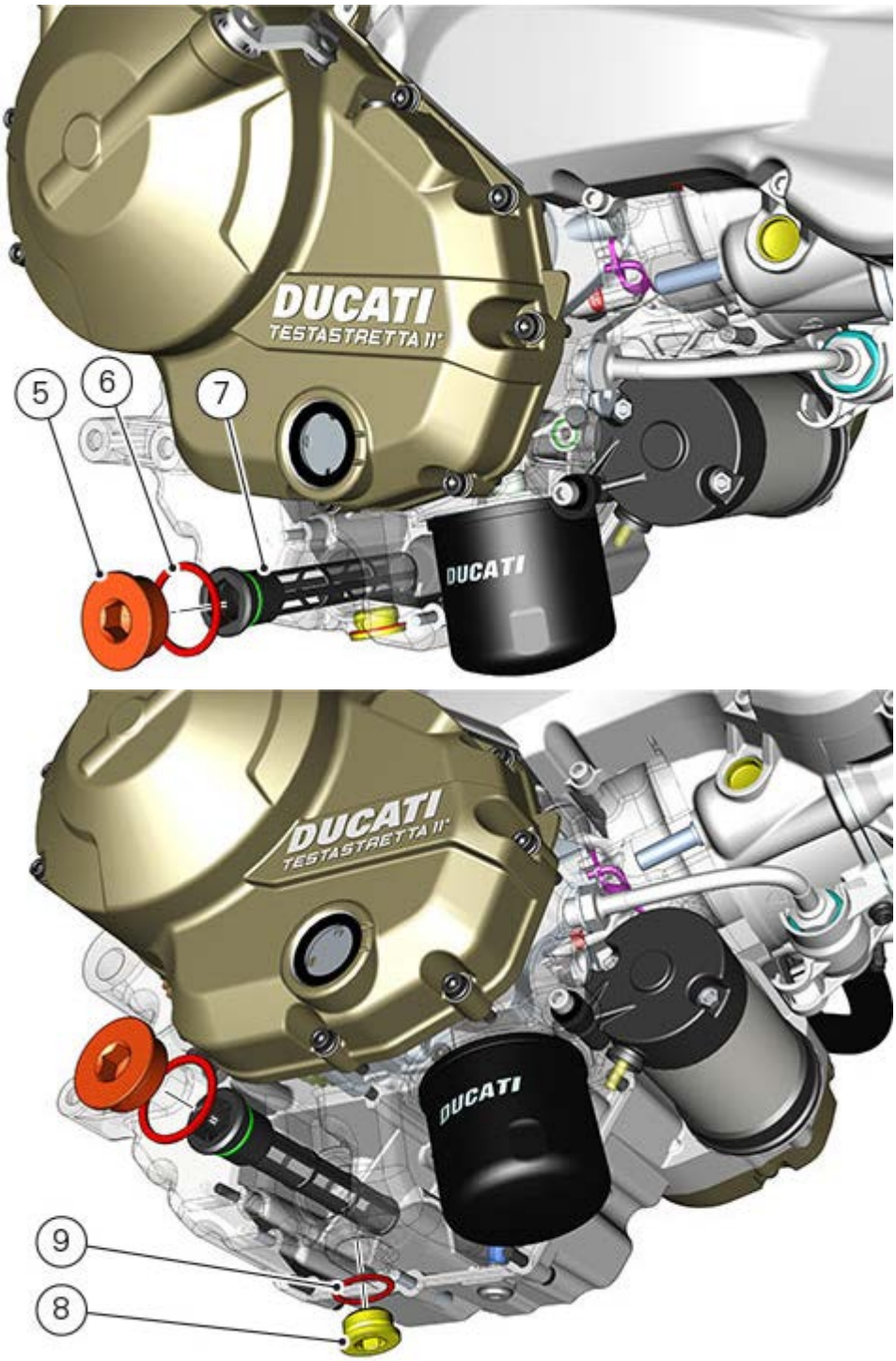


Screw it into relevant seat and tighten it to 11 Nm (Min. 10 Nm - Max. 12 Nm).
Every two oil changes, clean the oil intake mesh filter.
Loosen outer plug (5) and collect seal (6).

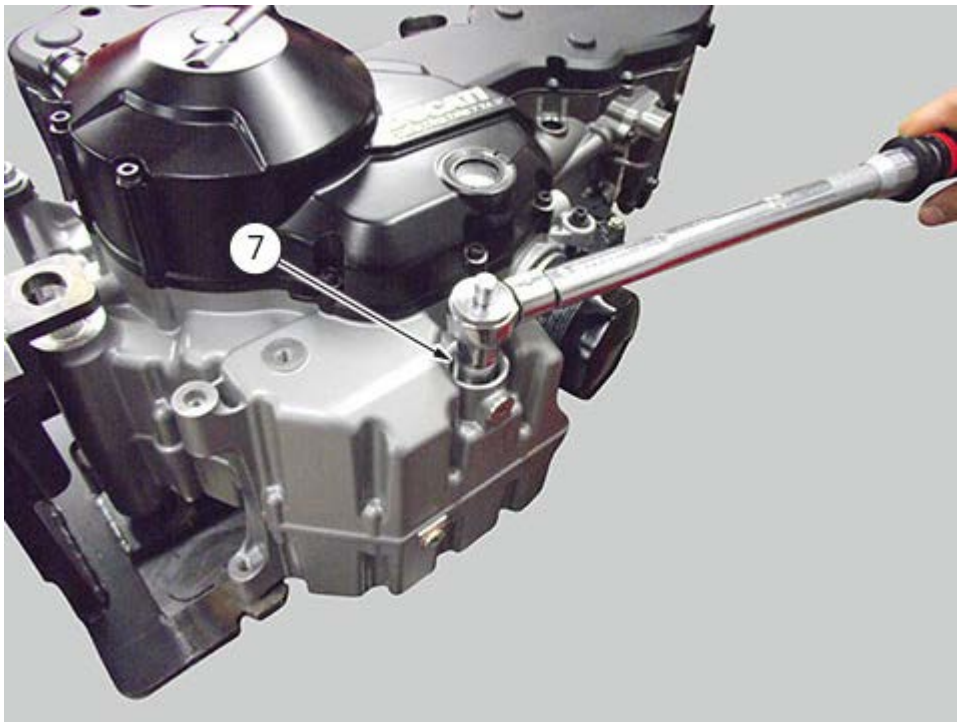


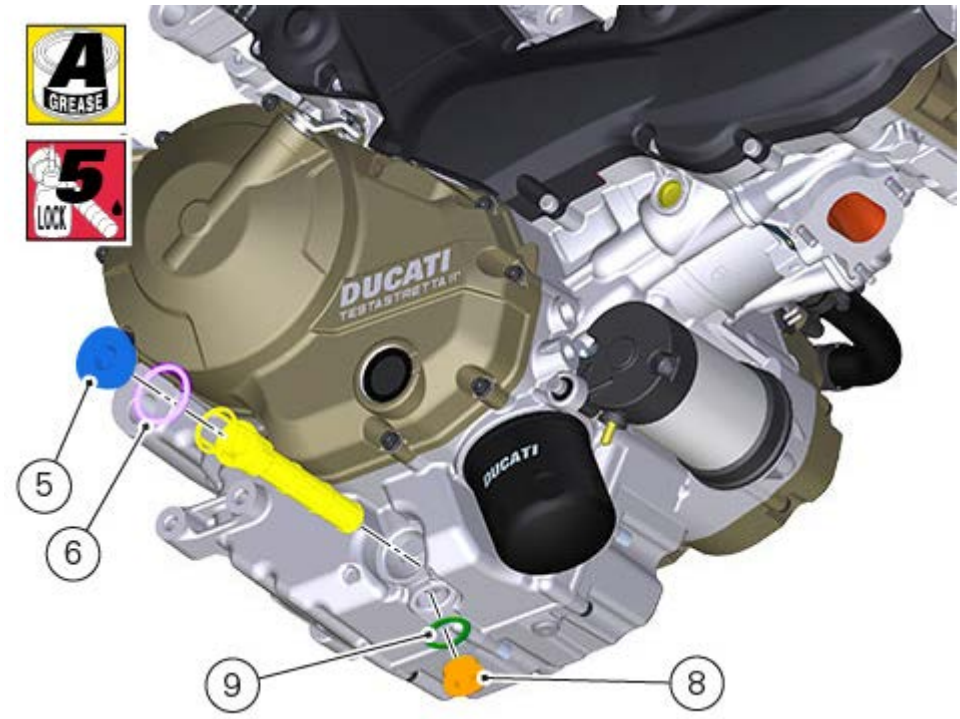
Loosen filtering element (7) using suitable tool part no. **88713.4803** and slide it out.
Loosen lower plug (8) and collect seal (9).
Clean the filter with fuel and compressed air. Take care not to damage the mesh.



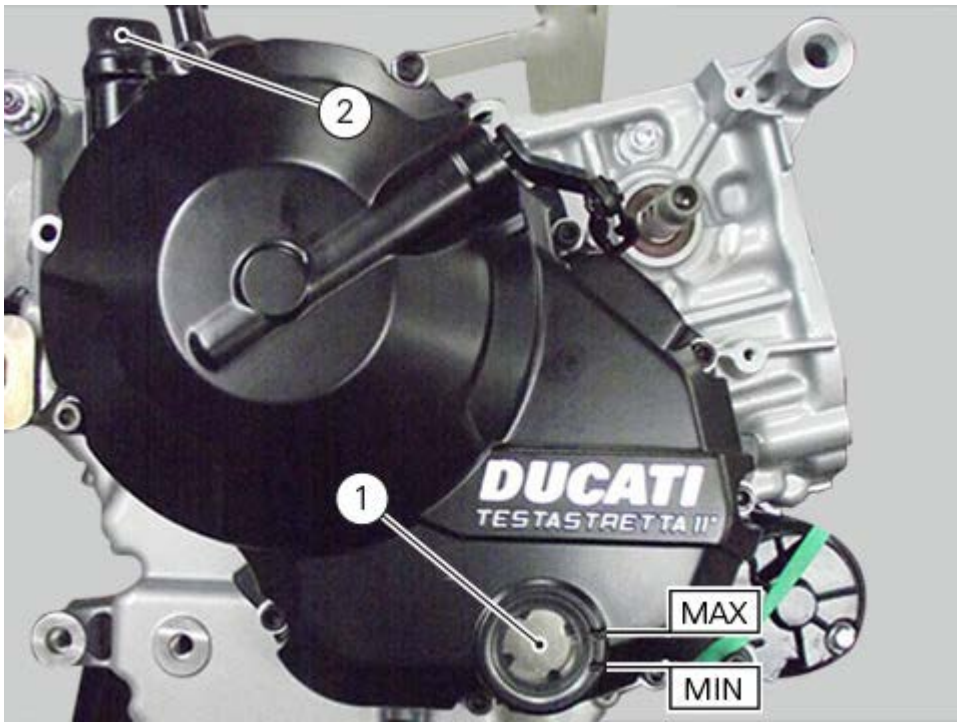


Lubricate mesh filter thread (7) with the specified grease.
Refit mesh filter (7) and tighten it to a torque of 42 Nm (Min. 38 Nm - Max. 46 Nm).
Insert seal (6) in plug (5) with the cutting edge facing the crankcase.
Tighten plug (5) to a torque of 42 Nm (Min. 38 Nm - Max. 46 Nm).
Position seal (9) in hole and lubricate intake service plug thread (8) with grease to a torque of 25 Nm (Min. 22 Nm - Max. 28 Nm).





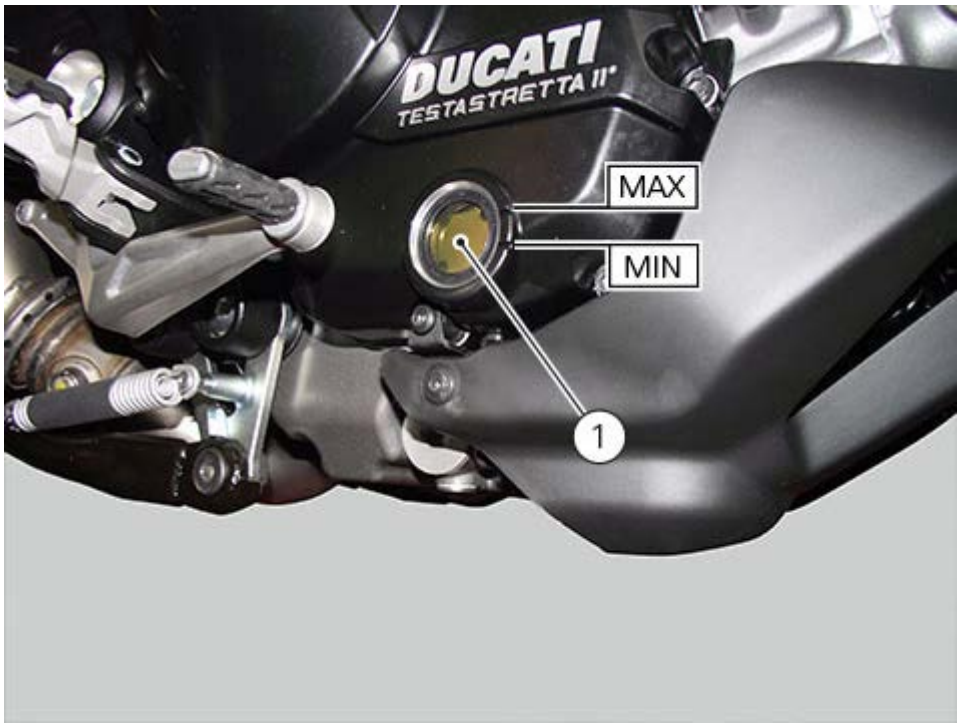
Remove the filler plug (2) and carry out refilling with the specified oil type up to reaching the notch that identifies the MAX level in the sight glass.
Refit the filler plug (2). Run the engine at idle speed for a few minutes.

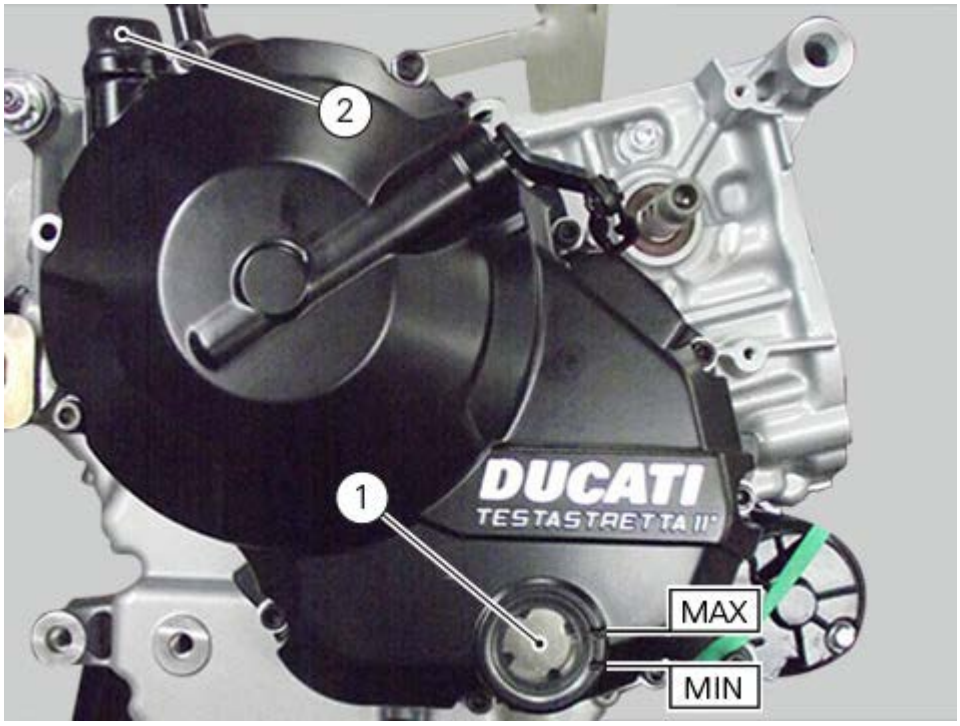


Check that there are no oil leaks and that the warning light on the instrument panel switches off a few seconds after starting up the engine. If not, stop the engine and trace the fault.
After a few minutes, check that the oil level is the specified one; if necessary, restore the MAX. level.
Refit the central exhaust system (Refitting the exhaust system)
Refit any removed parts.

Check engine oil level

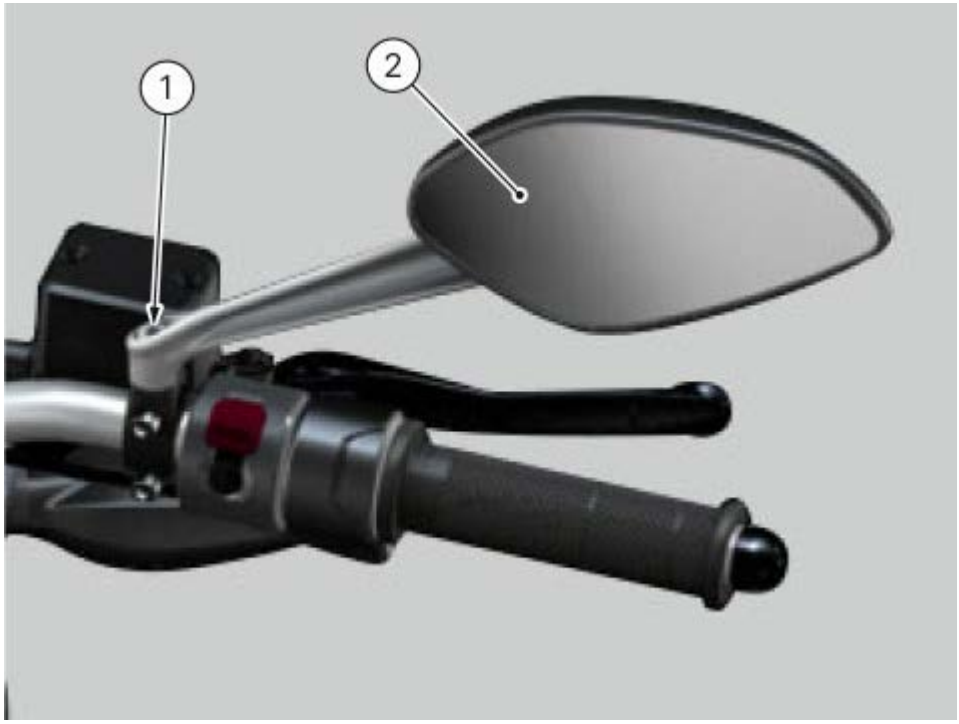
Remove the central exhaust system (Removing the exhaust system)
Check the engine oil level through the sight glass (1) on the right-hand side of the oil sump.
Stop the engine and allow a few minutes for the oil to settle to a steady level.
Oil level must be checked with the vehicle perfectly upright and the engine cold. Oil level must be between the MIN and MAX marks.
Top up if the level is low.
Remove the filler plug (2) and top up with the recommended oil.
Refit the filler plug (2).





Refitting the rear-view mirrors

Position the RH rear-view mirror (2) and after fitting the washer on screw (1) tighten the screw to a torque of 25 Nm ± 10%.



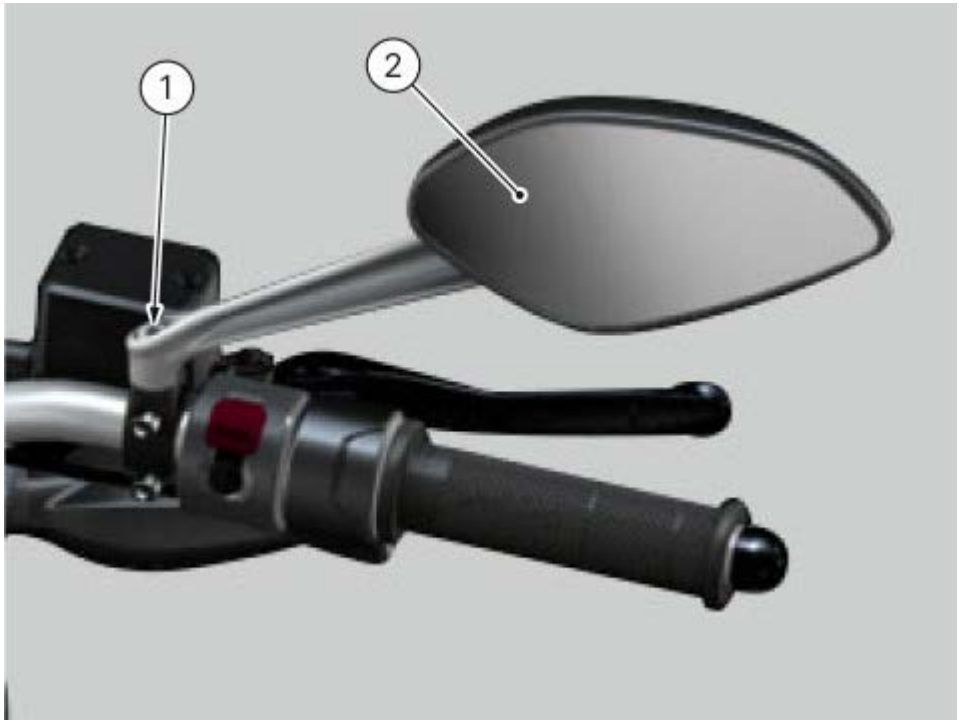
Follow the same procedure on the LH rear-view mirror (4) and tighten screw (3) to a torque of 25 Nm ± 10%.

Warning

The screw features a left-hand thread: tighten it counter clockwise.

Removing the rear-view mirrors

Loosen the screw (1) and remove it collecting the lower washer.
Remove the RH rear-view mirror (2).



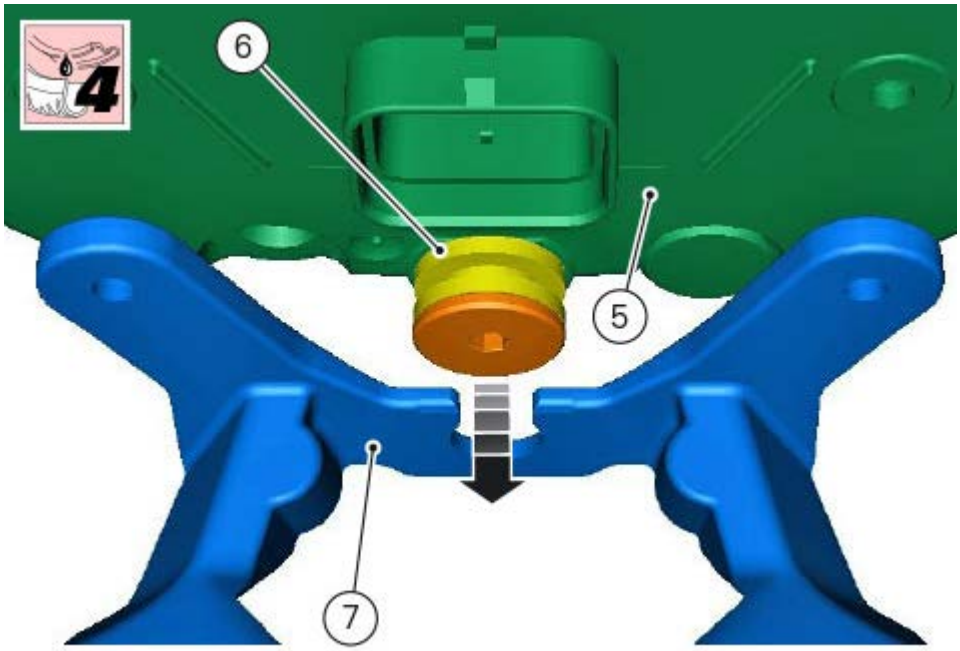
Loosen the screw (3) and remove it collecting the lower washer.
Remove the LH rear-view mirror (4).

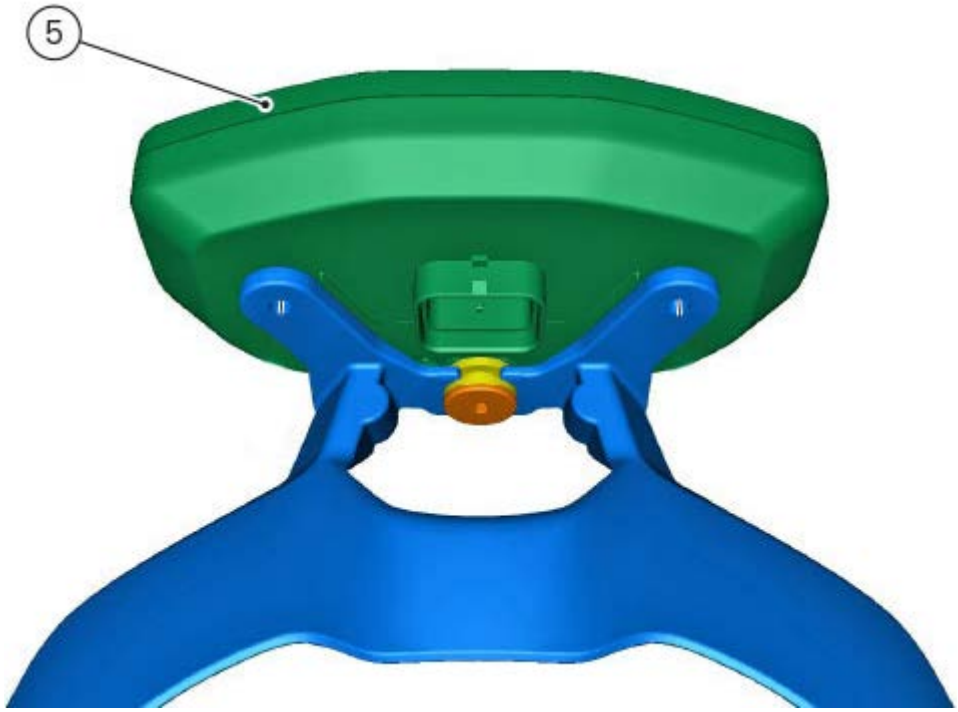
Warning

The screw features a left-hand thread: loosen it clockwise.

Refitting the instrument panel assembly

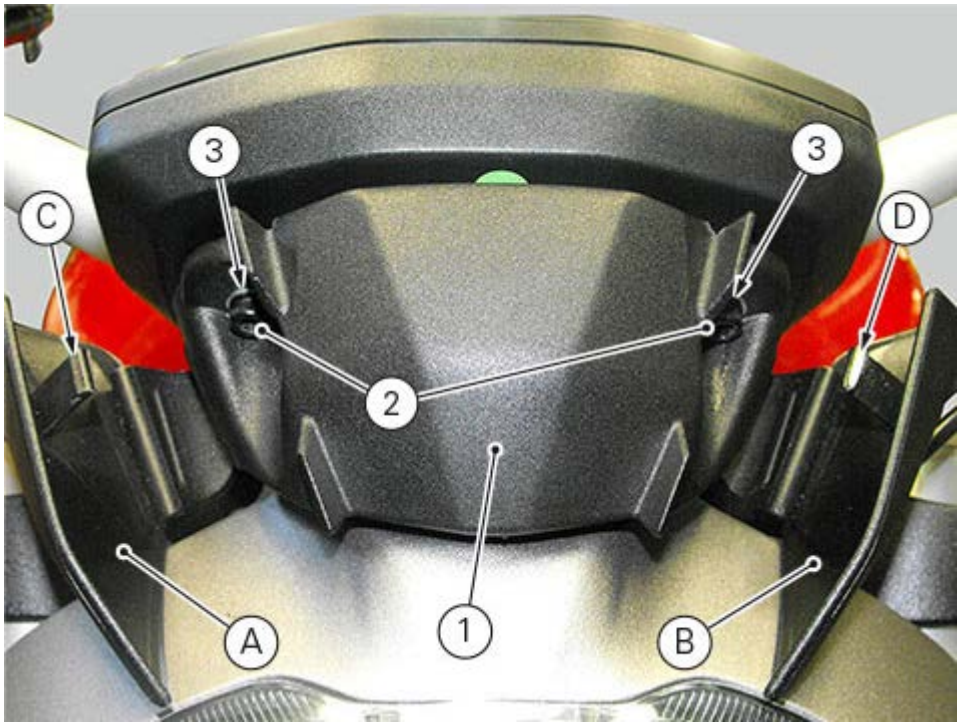
After having applied the specified product on vibration damper (6), position instrument panel (5) on support (7).

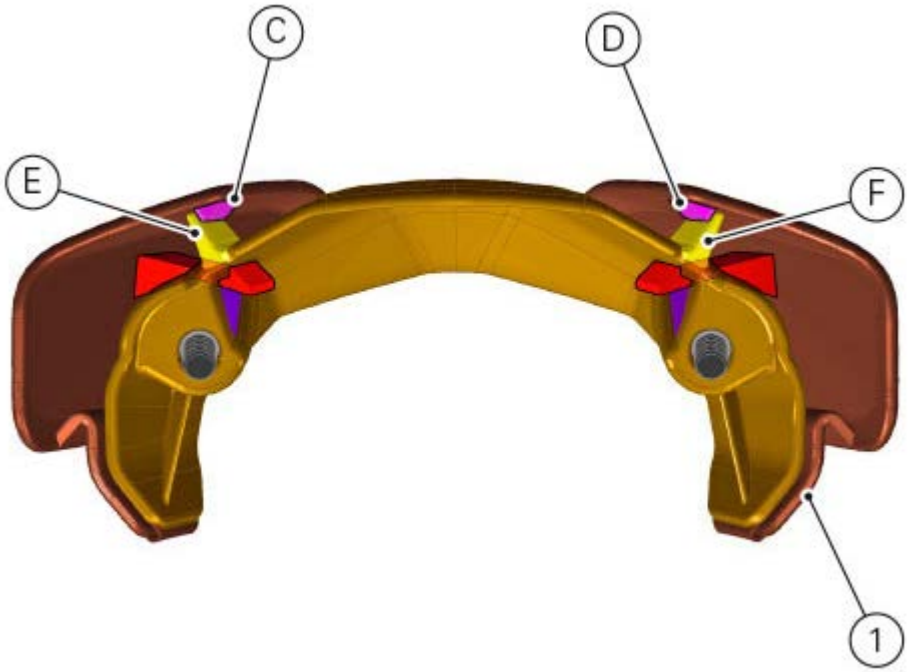




Connect the instrument panel connector (4).

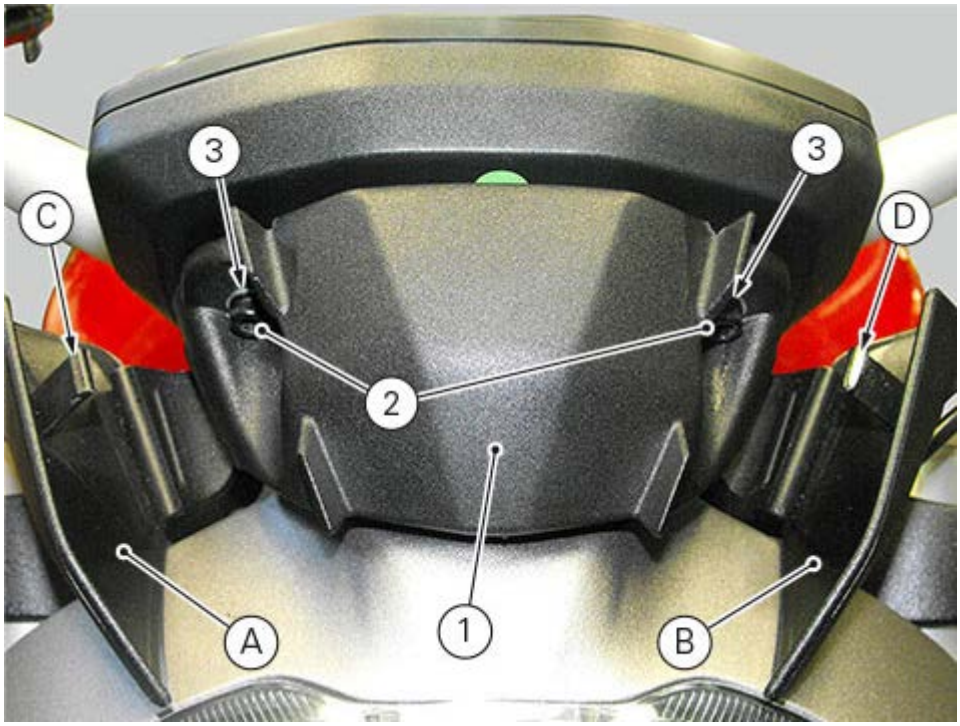
Position the instrument panel cover (1).
Secure instrument panel cover (1) using the two screws (2), with spacers (3), tightening them to a torque of 2Nm ± 10%.
Close instrument panel cover (1) by coupling tabs (C) and (D) with tabs (E) and (F).





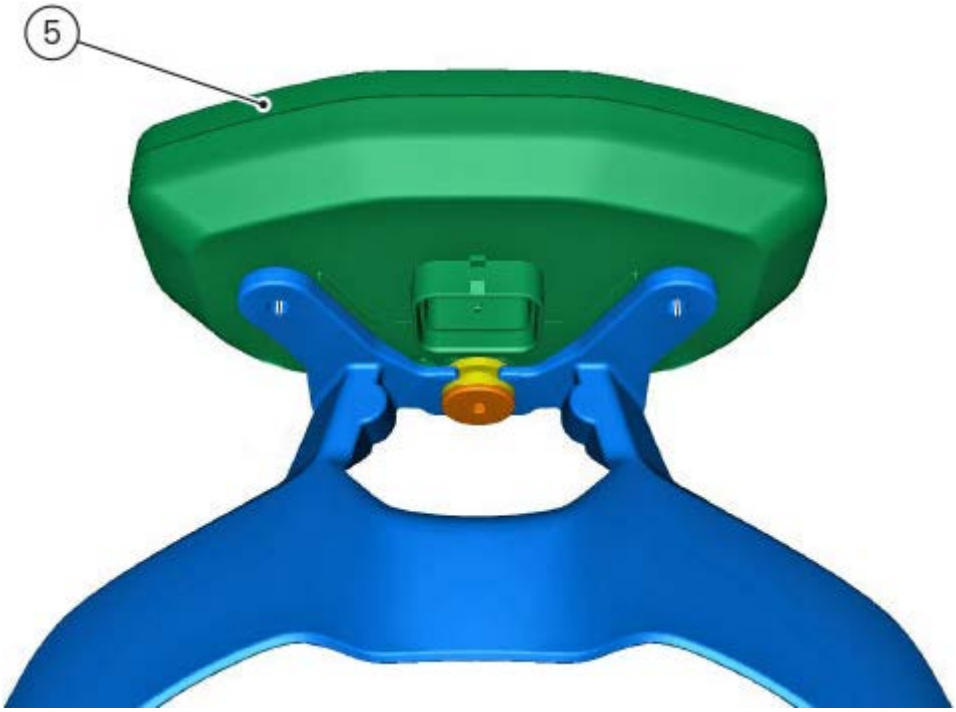
Removing the instrument panel assembly

Press on instrument panel cover (1) tabs (A) and (B), open them outwards sliding tabs (C) and (D) out of their seats.
Loosen the two screws (2) and collect the two spacers (3).
Slide out instrument panel cover (1).



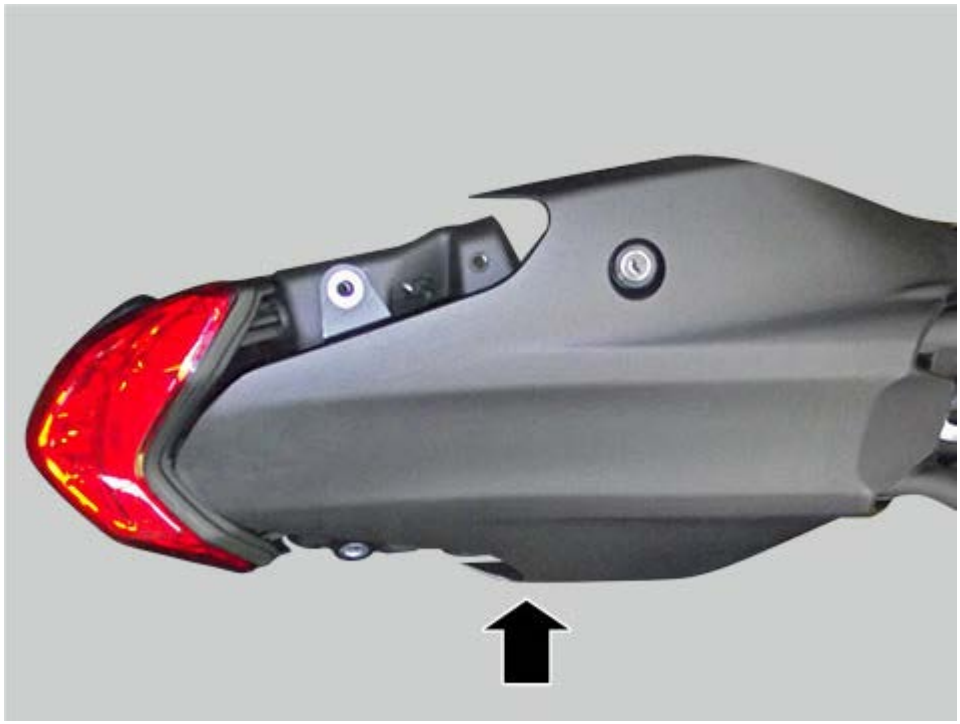
Disconnect the instrument panel connector (4).

Slide instrument panel (5) out pulling it up.



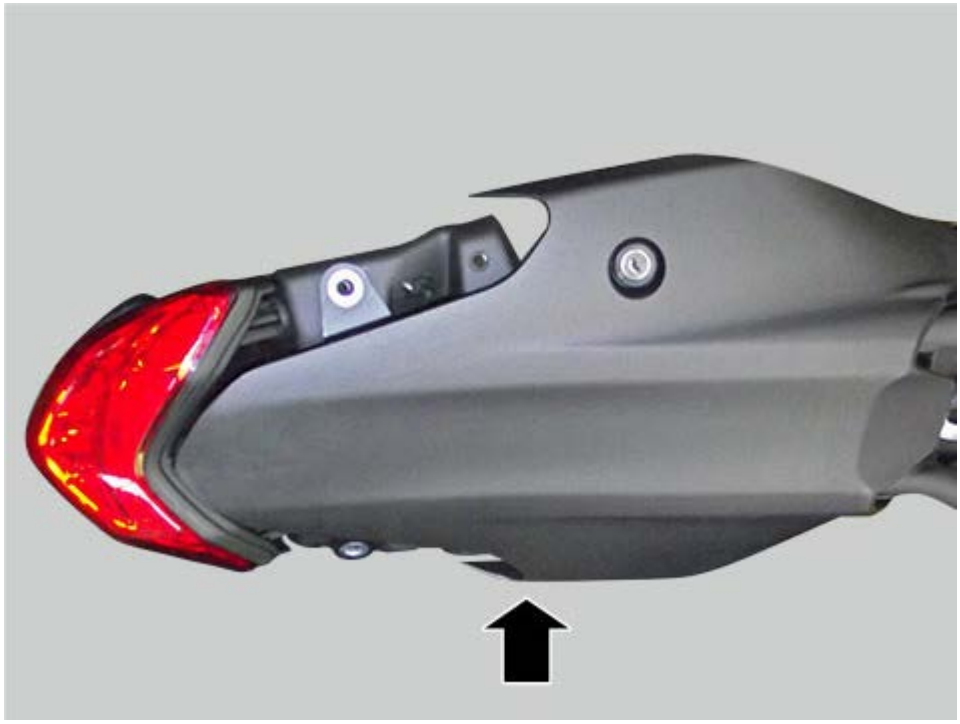
Refitting the seat bottom cover

Refitting the seat bottom cover is the reverse of the procedure described in "Removing the seat bottom cover".



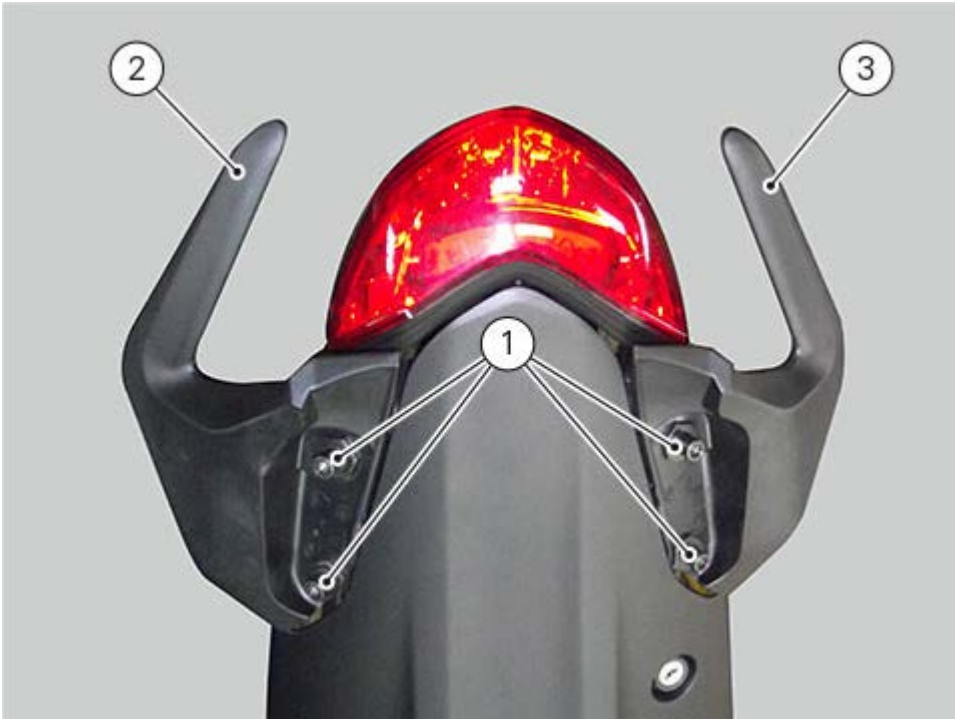
Removing the seat bottom cover

Remove the seat, the side covers (if vehicle is set for "Raised Seat") and side strips (Removing the seat).
Disconnect the seat release mechanism from the seat bottom cover (Removing the seat release mechanism).
Refit the splash guard (only for Australia version) and the number plate holder (Removing the number plate holder).
Remove the rear grab handles (Removing the rear grab handles).
Remove seat bottom cover.



Refitting the rear grab handles

Fit the RH grab handle (3) and start the two fastening screws (1).
Follow the same procedure for LH grab handle (2).
Tighten the four special screws (1) to a torque of 20 Nm ± 10%.



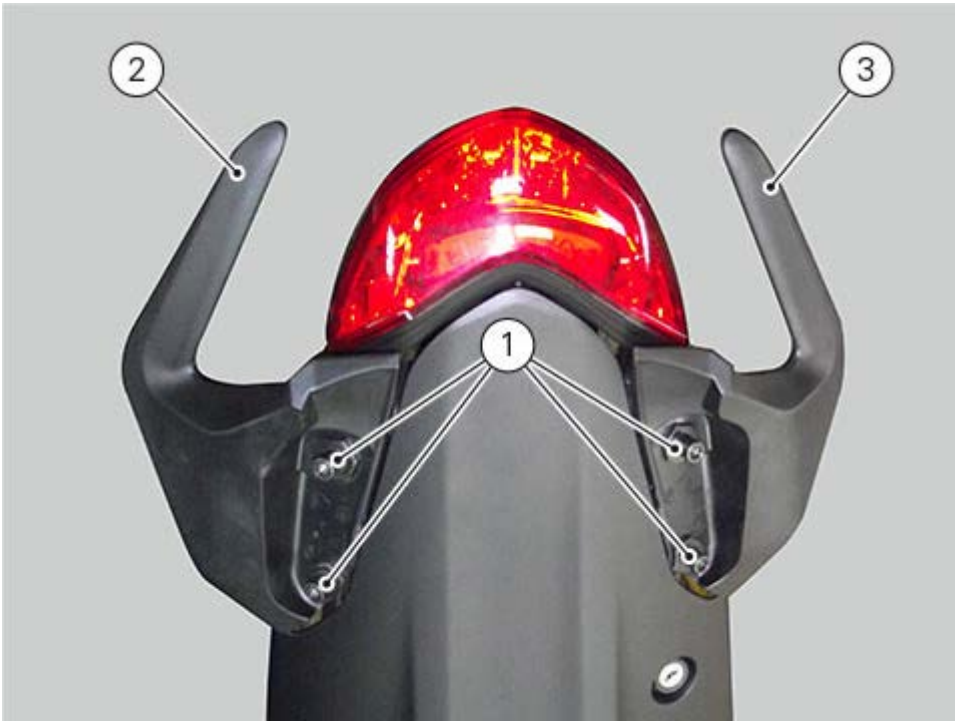
Refit the number plate holder and the splash guard (only for Australia version) (Refitting the number plate holder).
Refit the seat (Refitting the seat).

Removing the rear grab handles

Note
The procedure below refers to one grab handle but it applies to both of them.

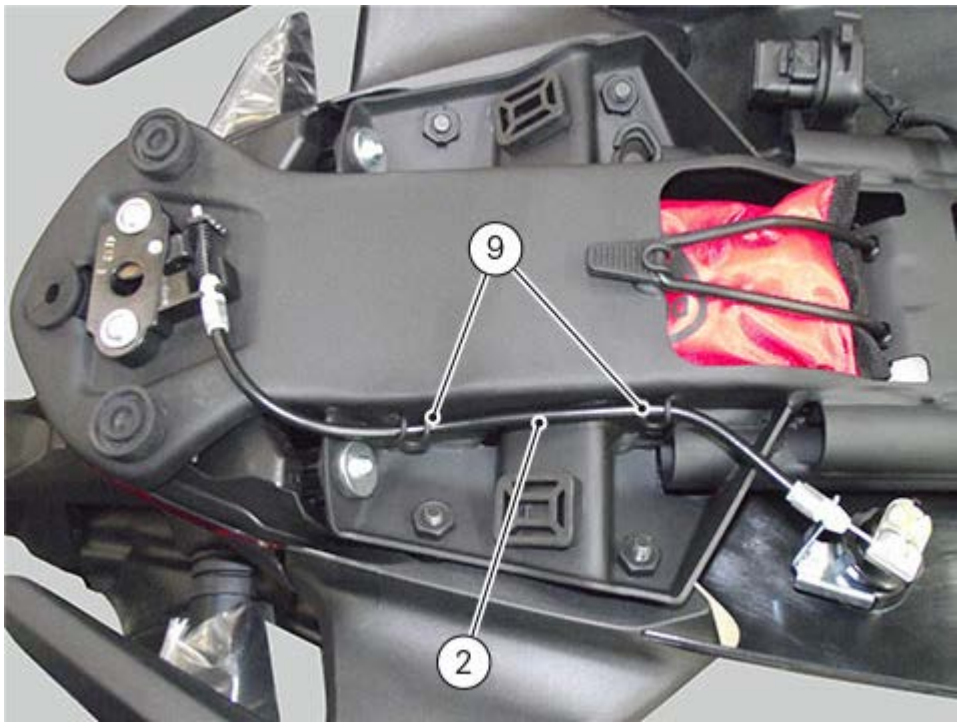
Remove the seat (Removing the seat).
Remove the number plate holder and the splash guard (only in the Australia version) (Removing the number plate holder).

Undo special screws (1) to remove rear grab handles (2) and (3).



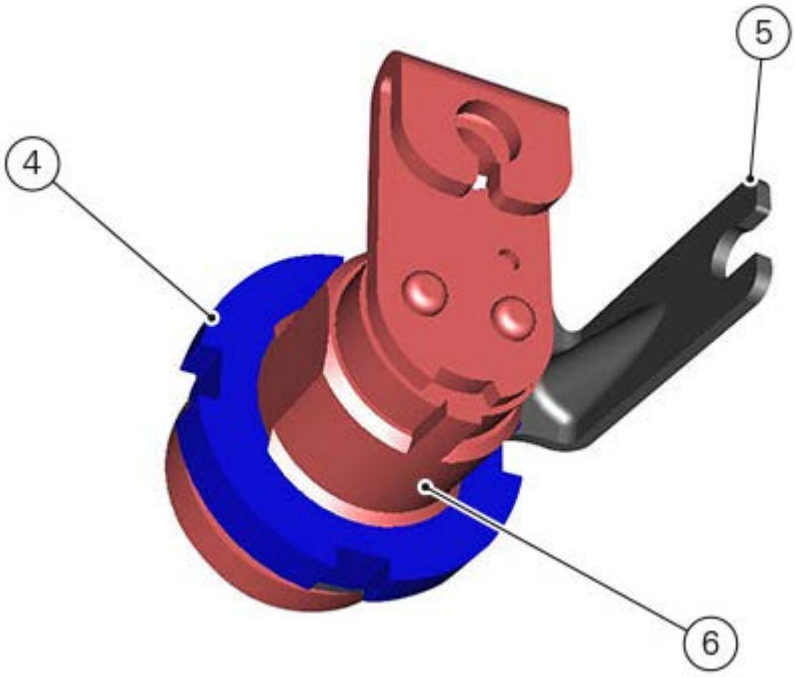
Refitting the seat release mechanism

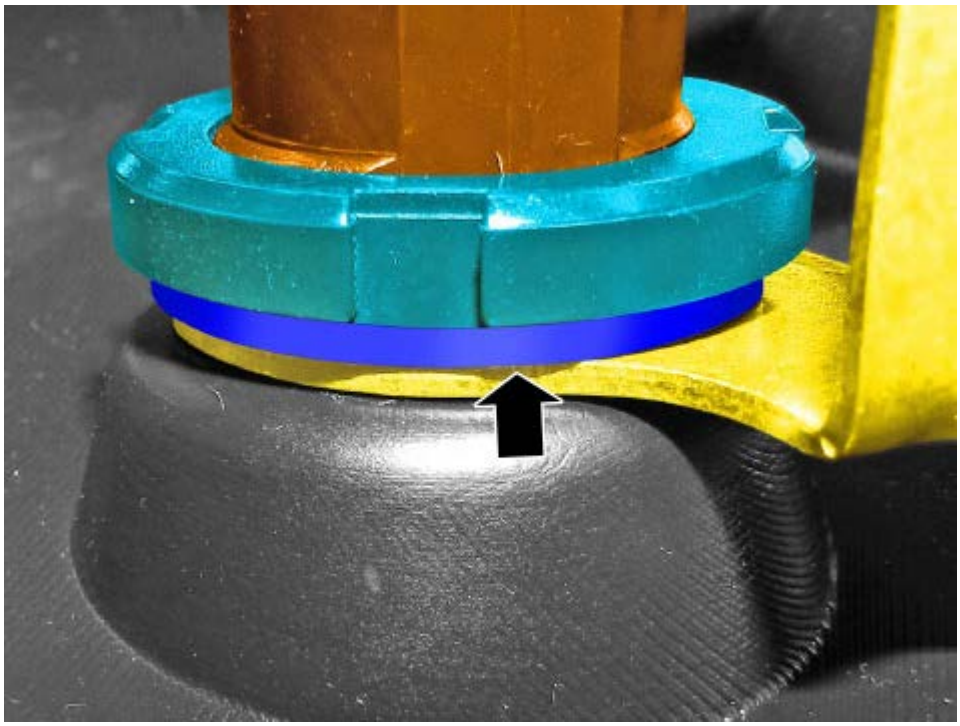
Position seat lock cable (2) by engaging it in cable ring (9).



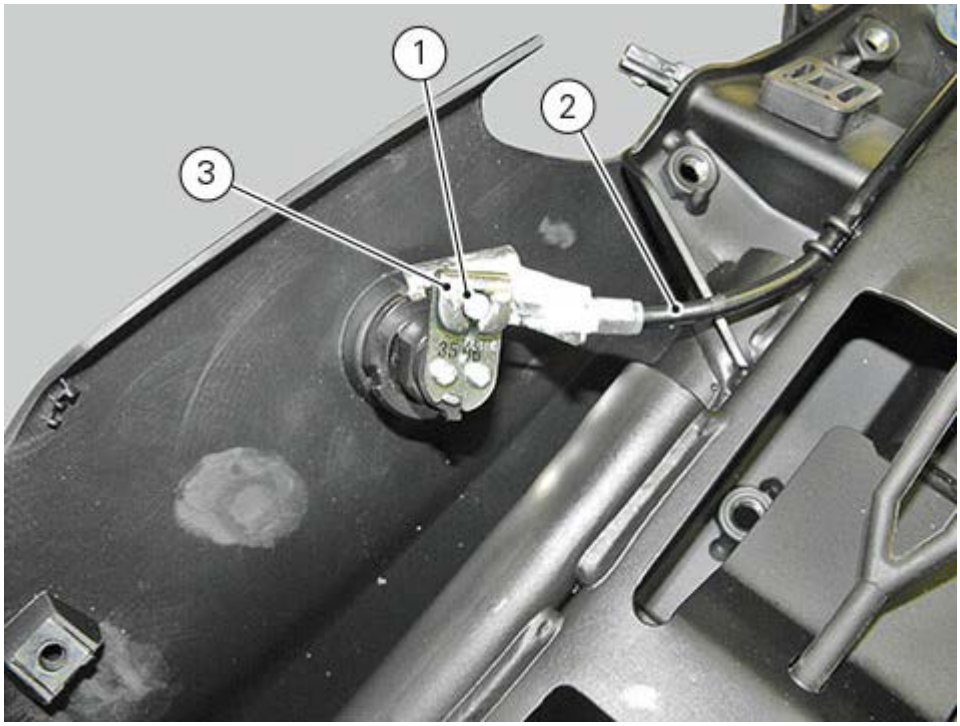
Fit lock (6) in the relevant hole on the RH side of the rear tail guard.
Fit plate (5) by starting ring nut (4) and tighten it to a torque of 3 Nm ± 10%.

Warning
Move the ring nut until the collar is facing downwards.

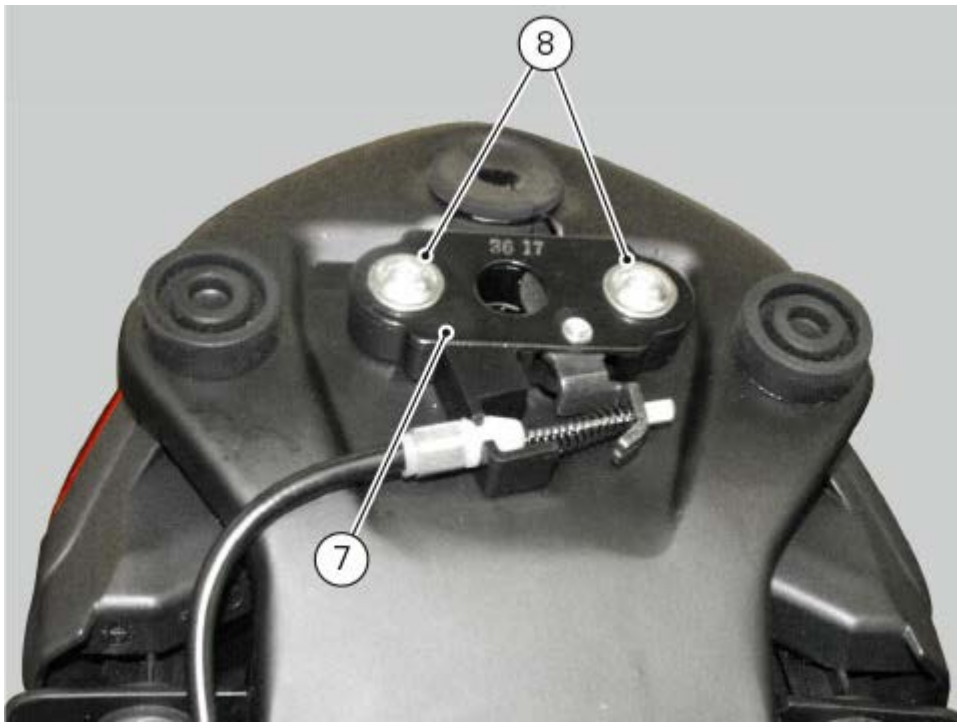




Fit nipple (1) into its seat (3).



Position latch (7) as shown in the figure and tighten the two screws (8) to a torque of 5 Nm ± 10%.

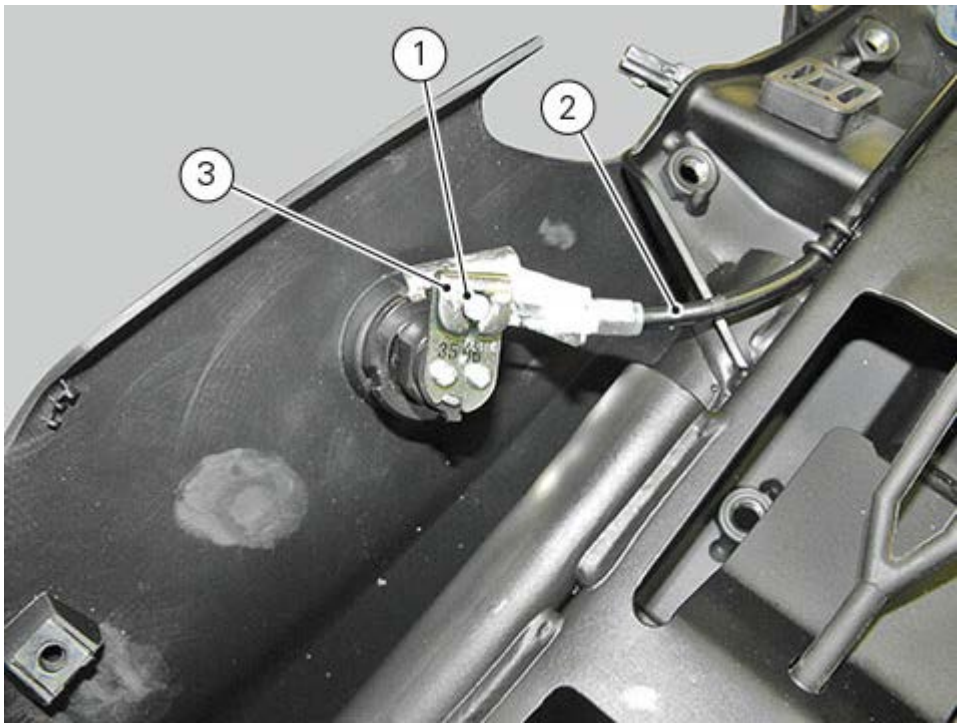


Refit the seat (Refitting the seat)

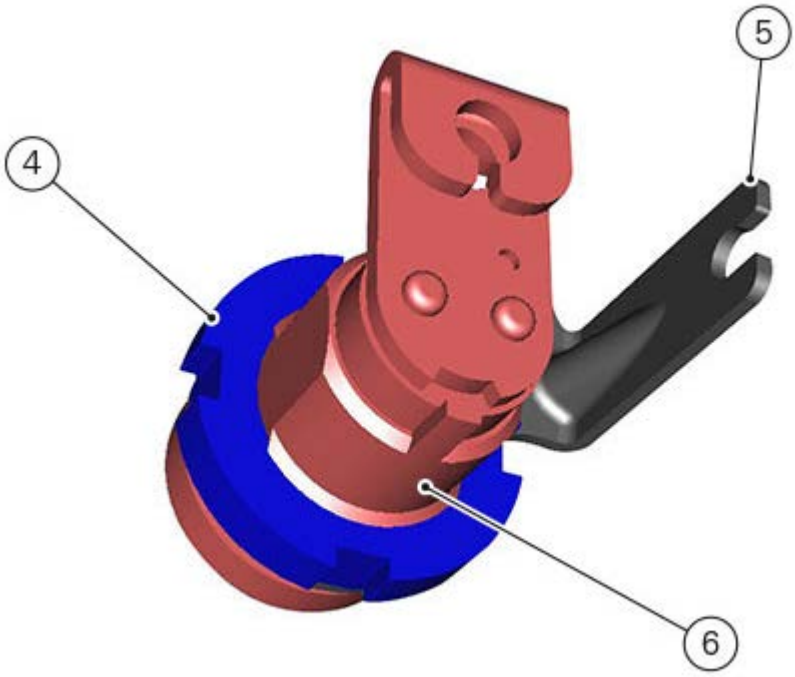
Removing the seat release mechanism

Remove the seat (Removing the seat).

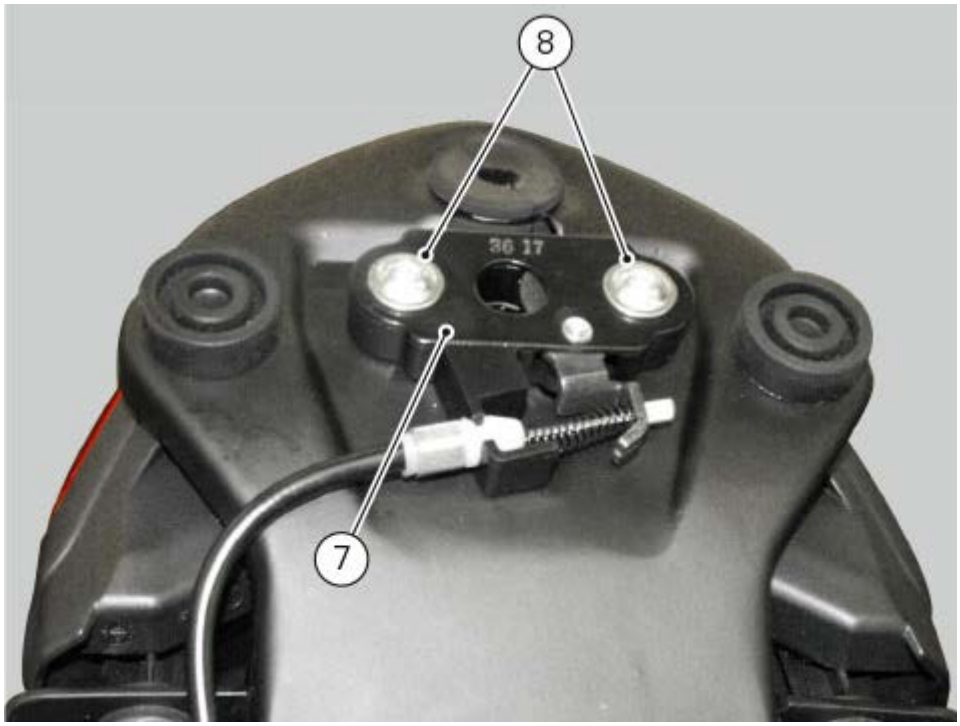
Slide nipple (1) of the seat lock cable (2) out of its seat (3).



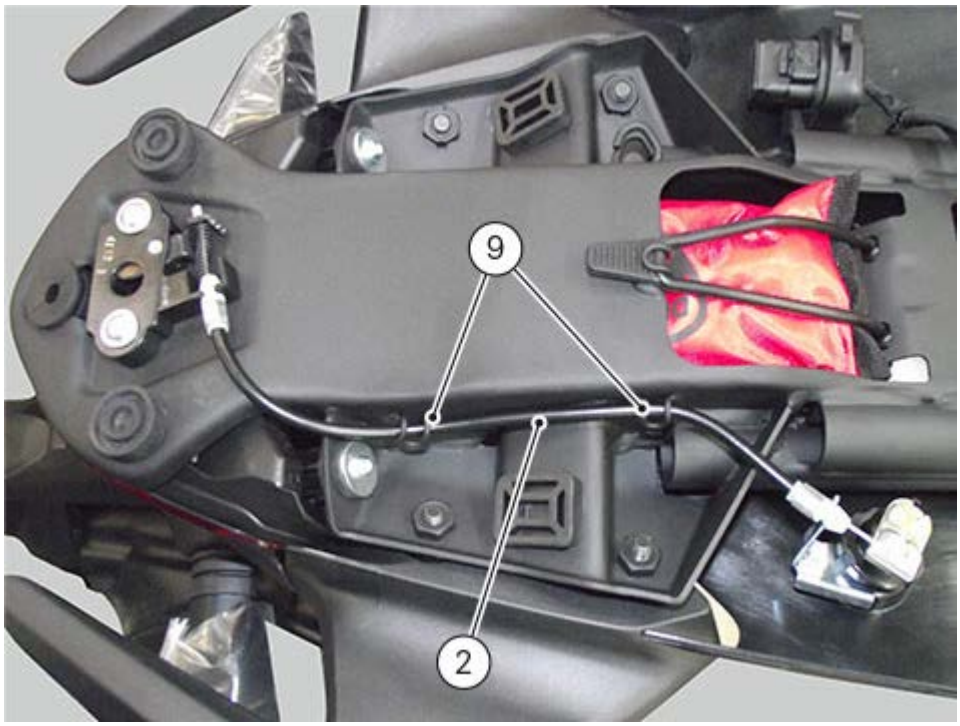
Loosen the ring nut (4) and remove plate (5).
Remove lock (6).



Remove latch (7) by loosening the two screws (8).

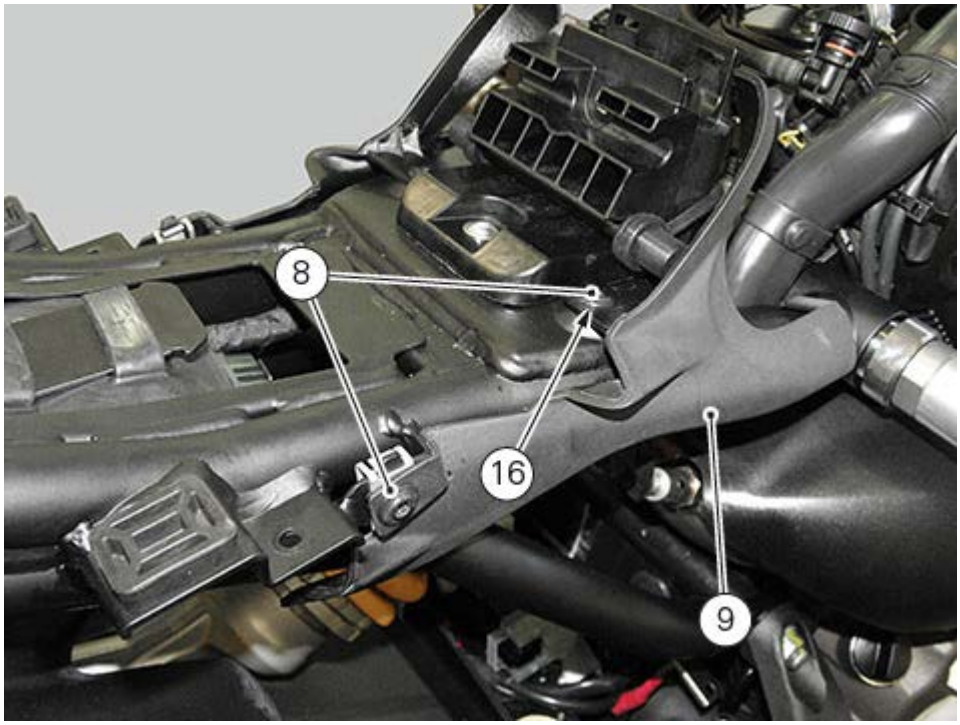


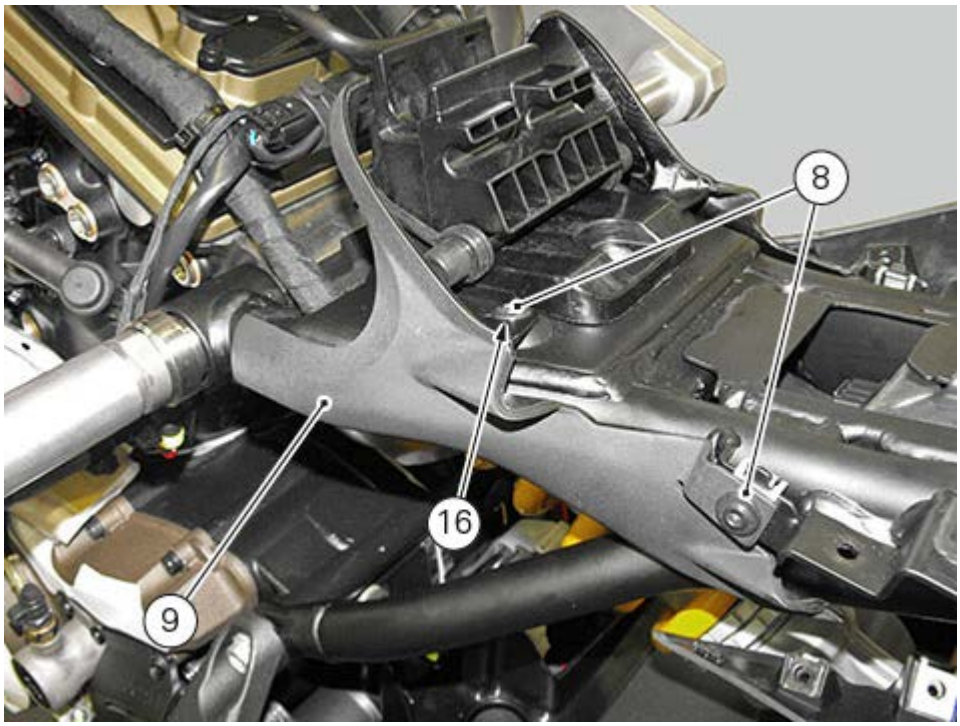
Working on the right side, release cable (9) from cable ring (10) to remove it from the seat lock.

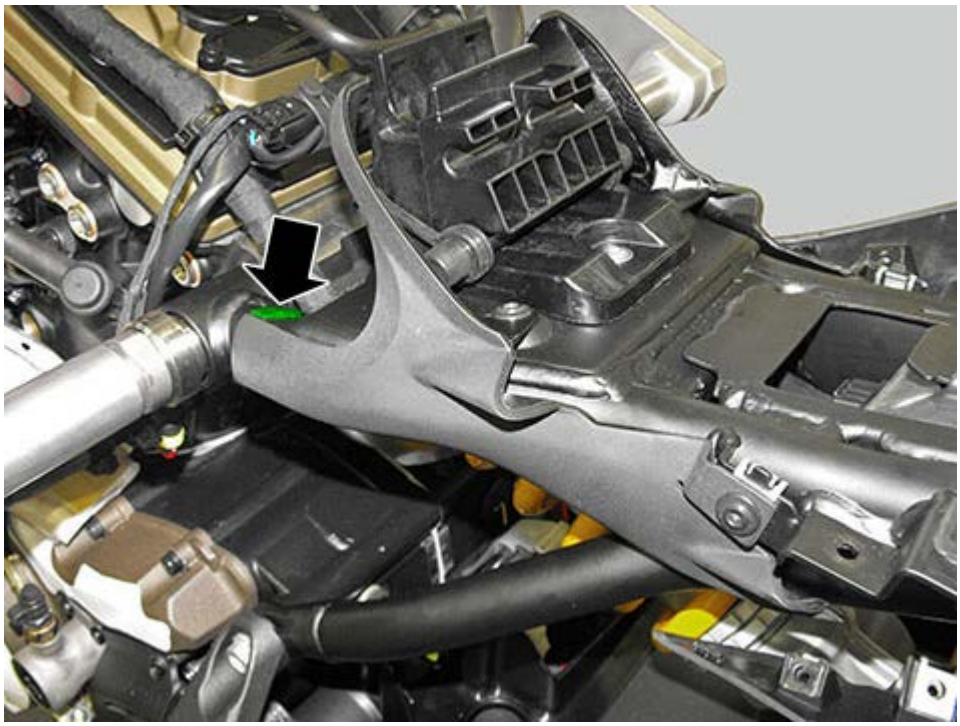


Refitting the seat covers
If previously removed, fit the two side panels (9) and tighten the two relevant screws (8) to a torque of 3 Nm ± 10%.

Warning
Properly insert the front tabs on the subframe tube.

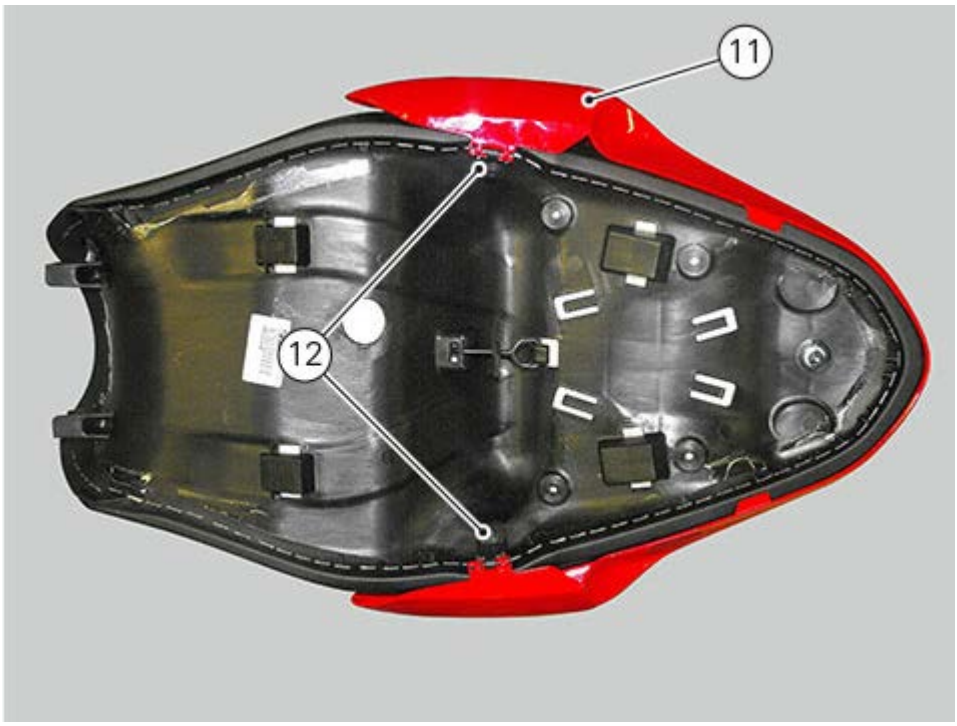




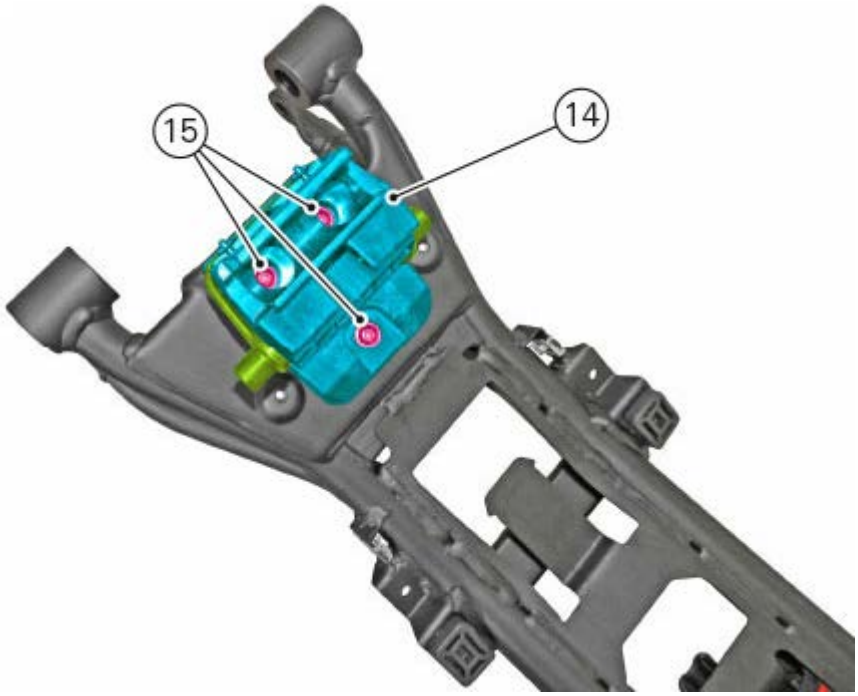


If previously removed, refit seat cover (11) and secure it by engaging the lower tabs (13) (not for Dark version).

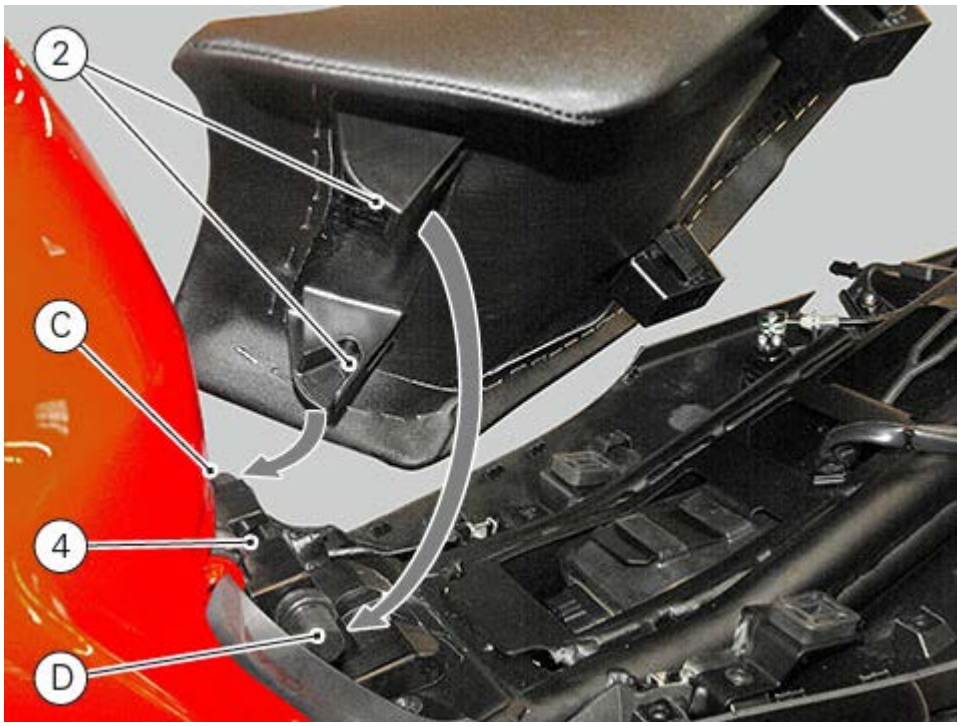
Tighten the two lower screws (12) to a torque of 3Nm ± 10%.



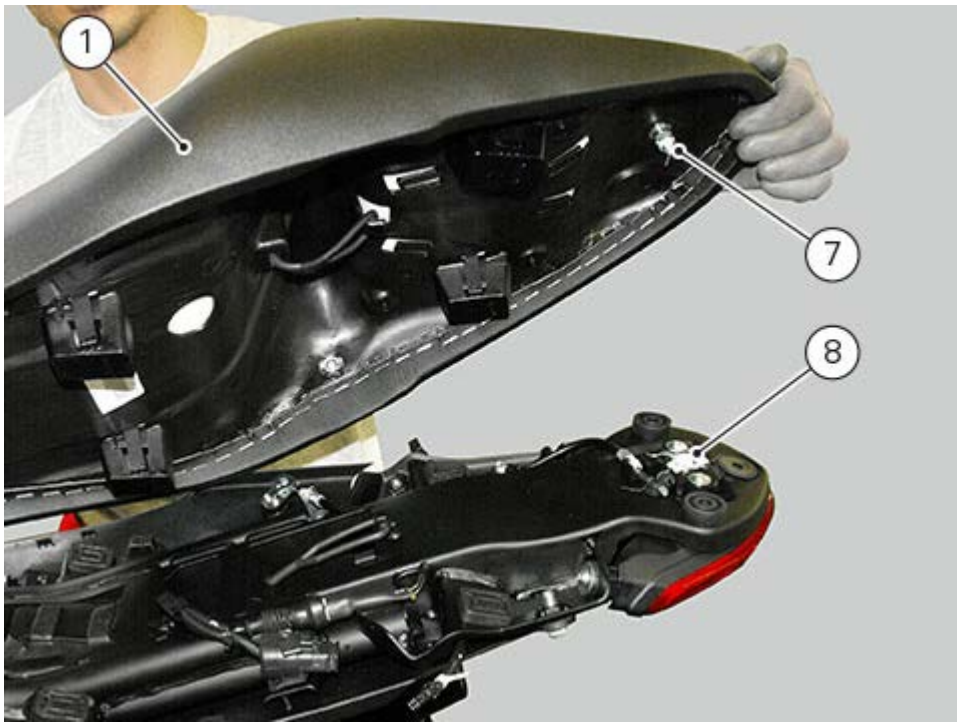
If previously removed, refit seat support (14) and tighten screws (15) to a torque of 10 Nm ± 10%.



Then check the position of elastic (C) and pin (4) according to the seat configuration (HIGH or LOW).
Position seat (1) on the motorcycle.
The front tabs (2) of the seat must be engaged on buffers (C) and (D) of pin (4).



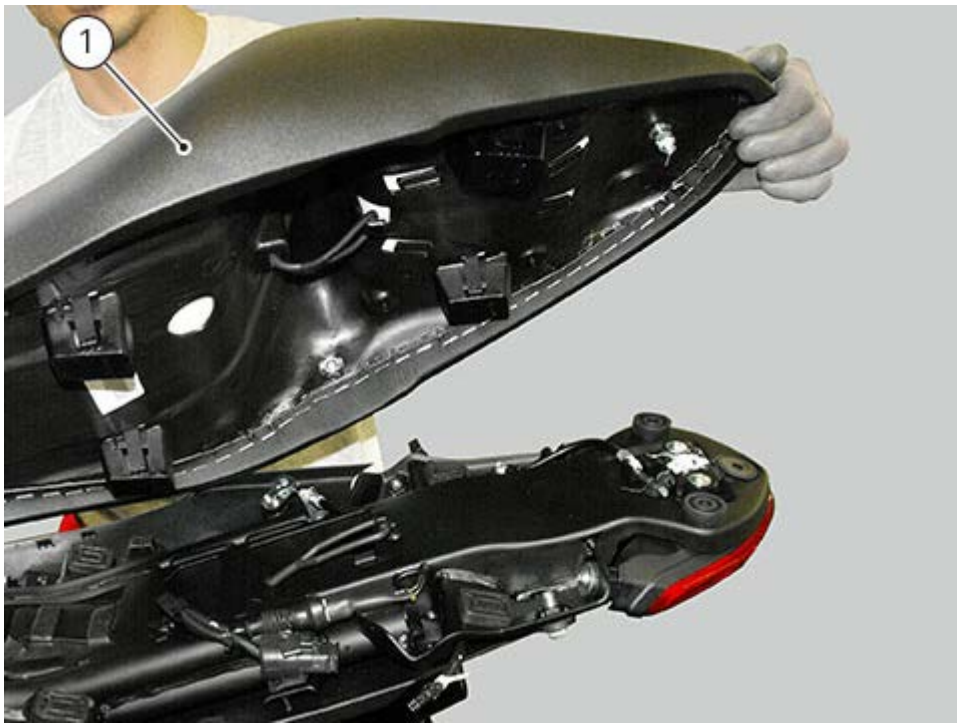
Pin (7) in the rear part of seat (1) must be positioned so as to be aligned with seat (8) on the rear subframe.
Lower the seat (1) and press on the seat rear side to properly engage it.



Removing the seat

Open the lock.

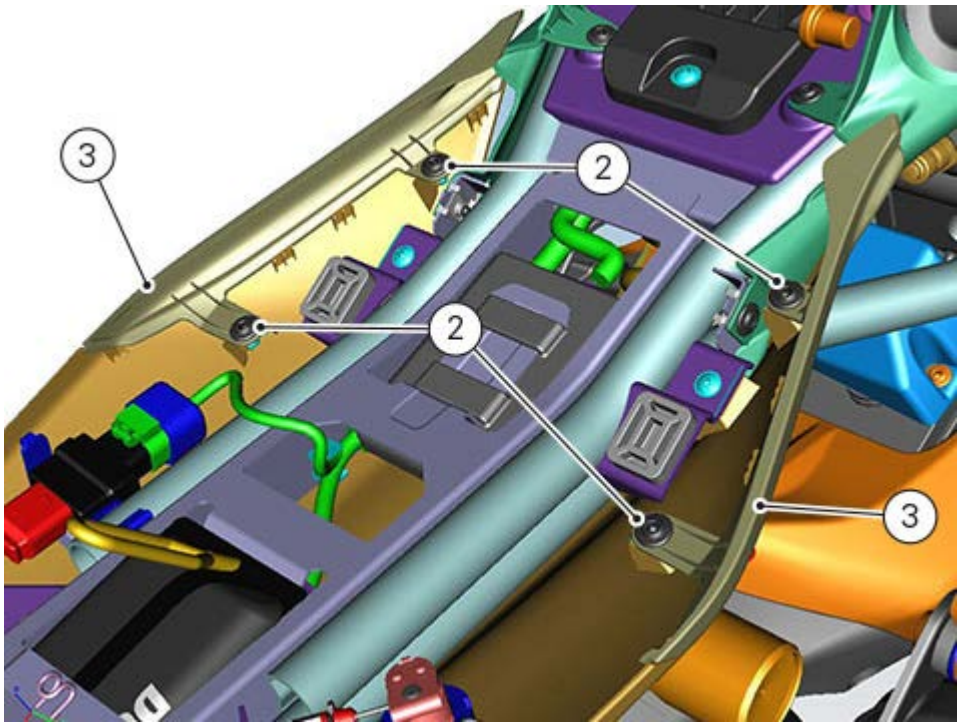
Lift up seat (1).
Remove seat (1).



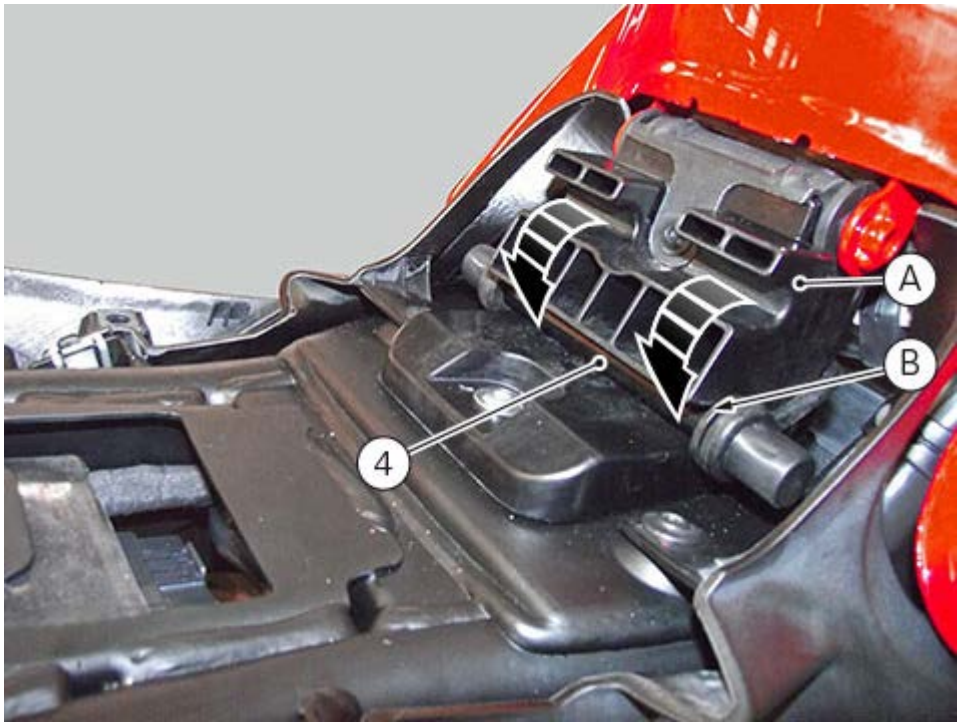
"HIGH SEAT" AND "LOW SEAT" POSITIONS
The vehicle in the basic condition is in the "HIGH SEAT" configuration.

"LOW SEAT" position
To modify the riding position in "LOW SEAT" proceed as follows.

Working on both sides, loosen the two screws (2) and remove side covers (3).

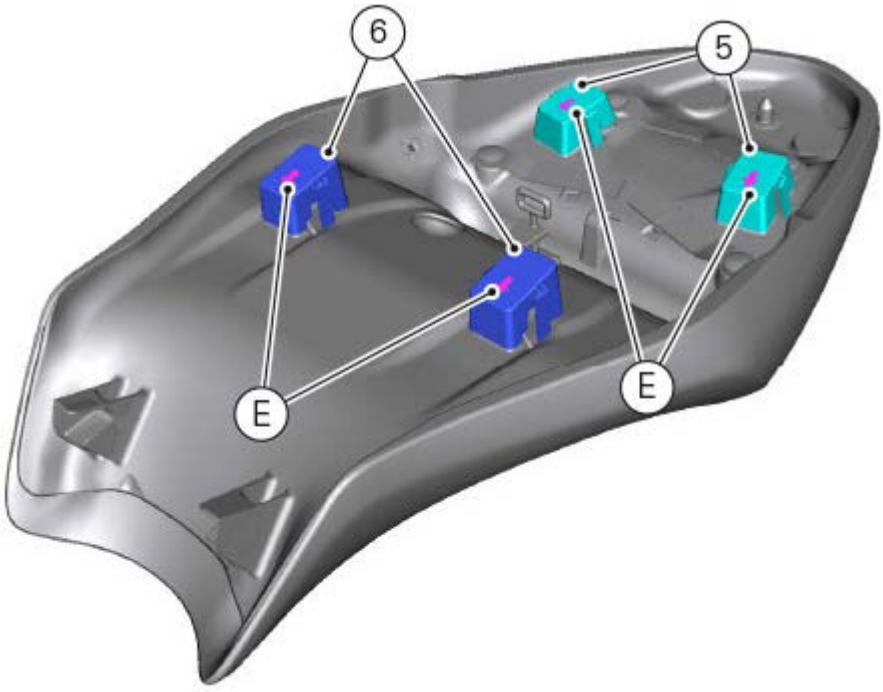


Move the seat pin (4) from seat (A) to seat (B).

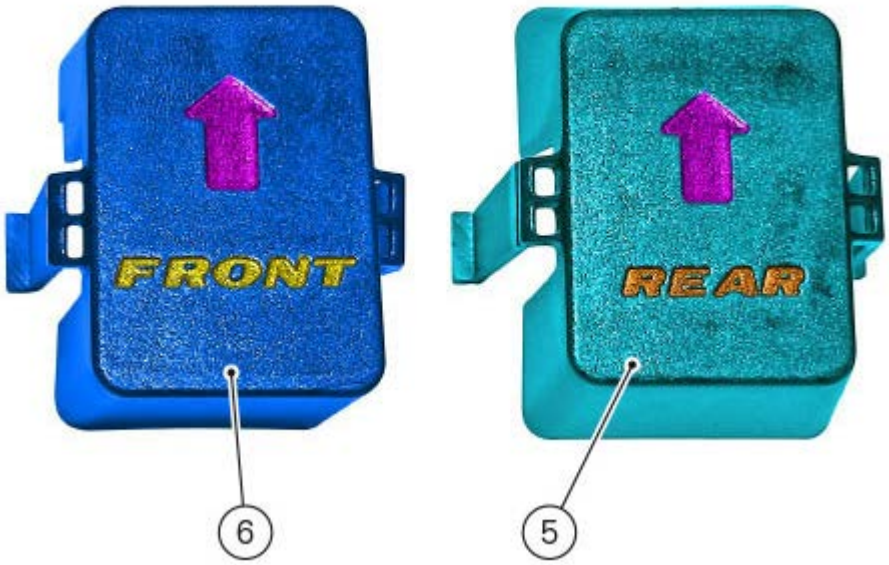


Slide out the two rear (5) and the two front (6) "HIGH SEAT" supports by pressing them on the longest sides.

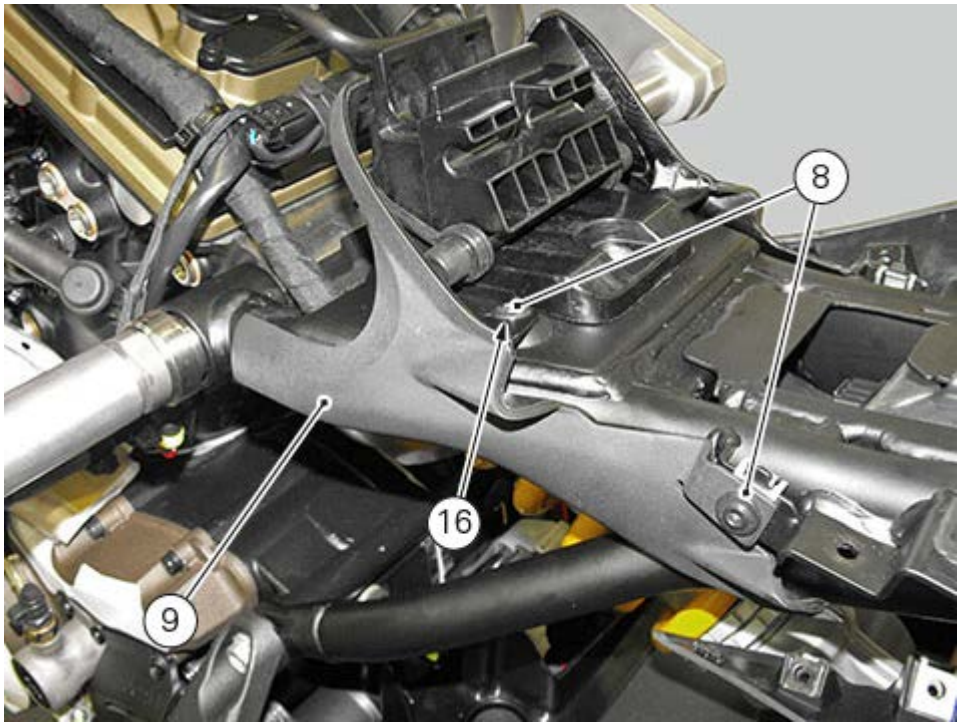
"HIGH SEAT" position
The vehicle in the basic condition is in the "HIGH SEAT" configuration.
To change the riding position to "HIGH SEAT" follow the previously described procedure in the reverse order and tighten the two screws (2) to a torque of 3 Nm ± 10% on the relevant clips.
On the seat internal side, fit the two front (6) and rear (5) supports as indicated on them, with arrows (E) facing the front side of the vehicle and insert the lateral tabs in the relevant seats.

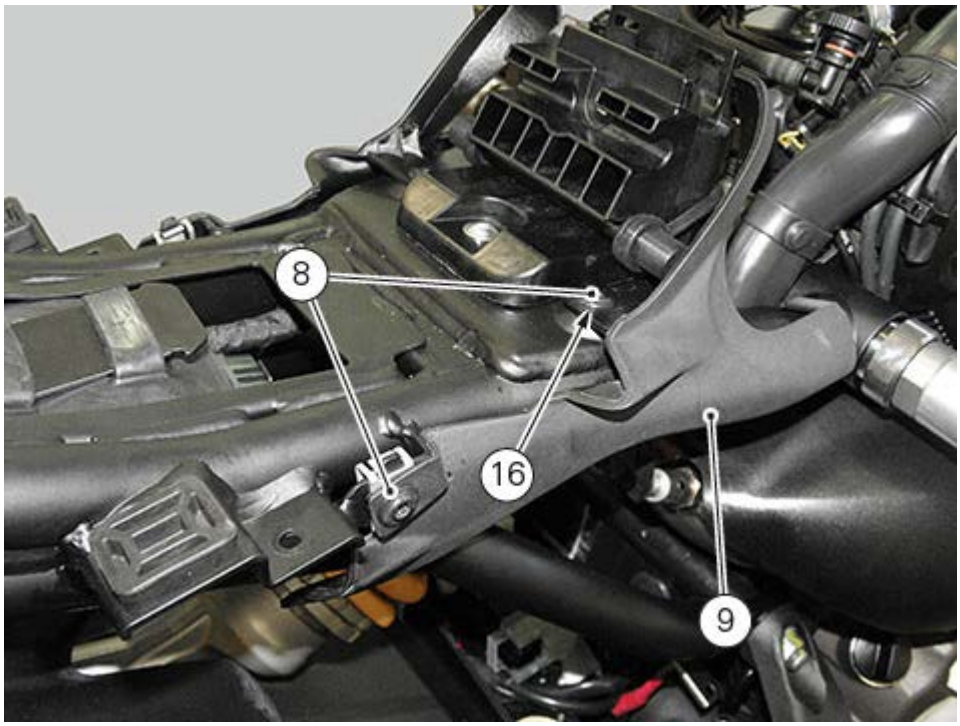


Note
The front and rear buffers differ from each other. To identify them refer to the indication printed on them (FRONT) or (REAR).

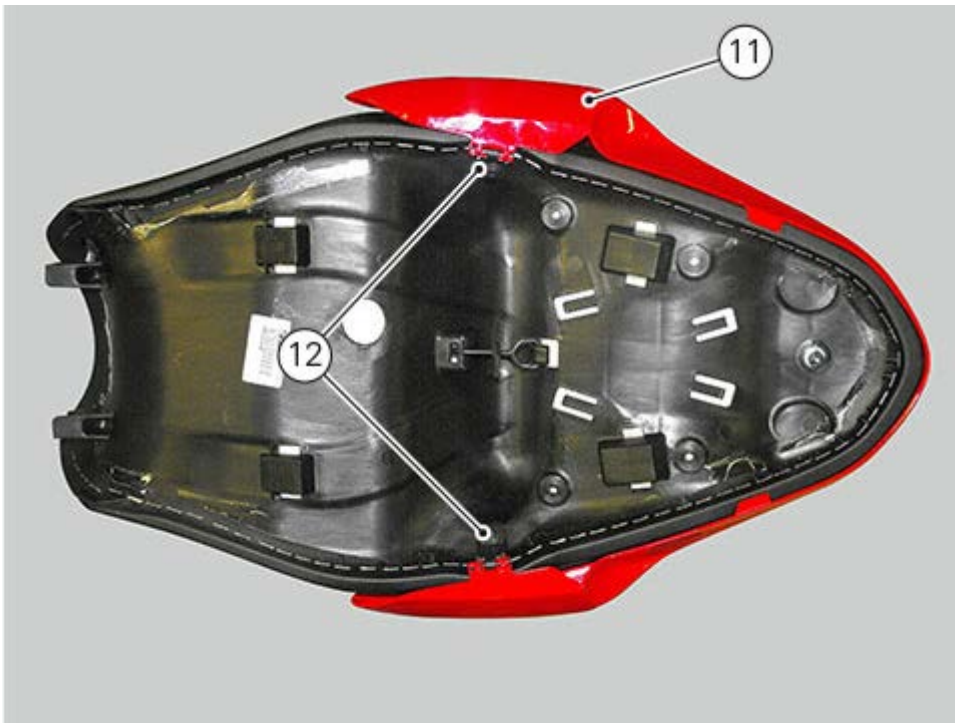


Removing the seat covers
If necessary, remove the side panels (9) from the frame following the same procedure, i.e. loosen the relevant two retaining screws (8) and collect toothed washers (16).





If necessary, loosen the two lower screws (12), remove seat cover (11) and replace it (not for Dark version).



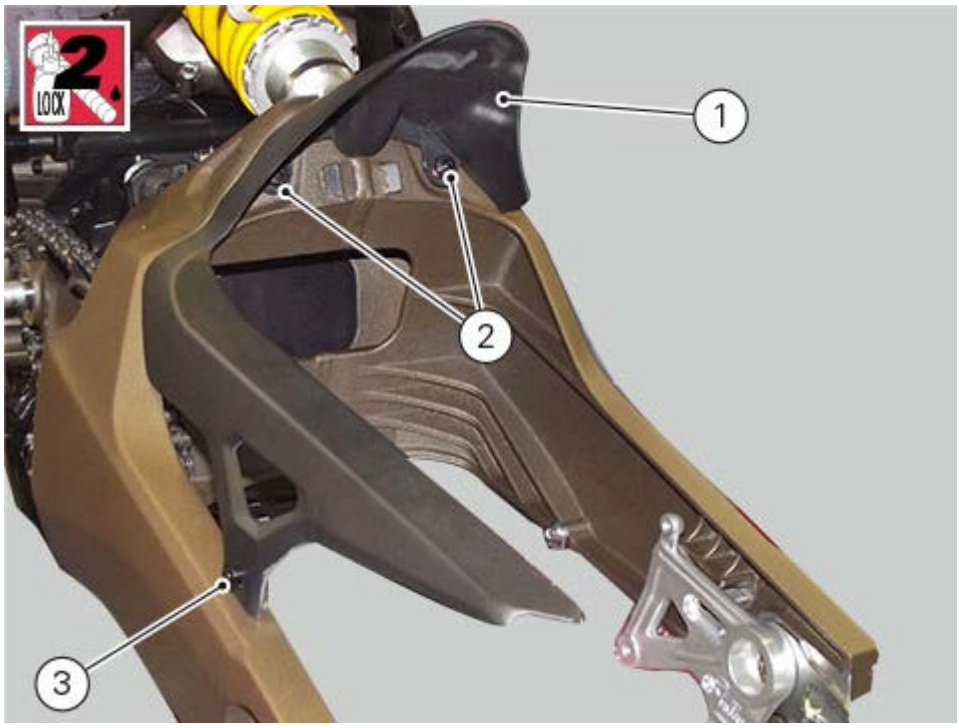
Refitting the rear mudguard

Fit the rear mudguard (1) on swinging arm by inserting it from the RH side.

Start side screw (3).
Tighten the two central screws (2) with pre-applied threadlocker to a torque of 5 Nm ± 10%.

Note
If the screws are new, apply specified threadlocker on screw threads.

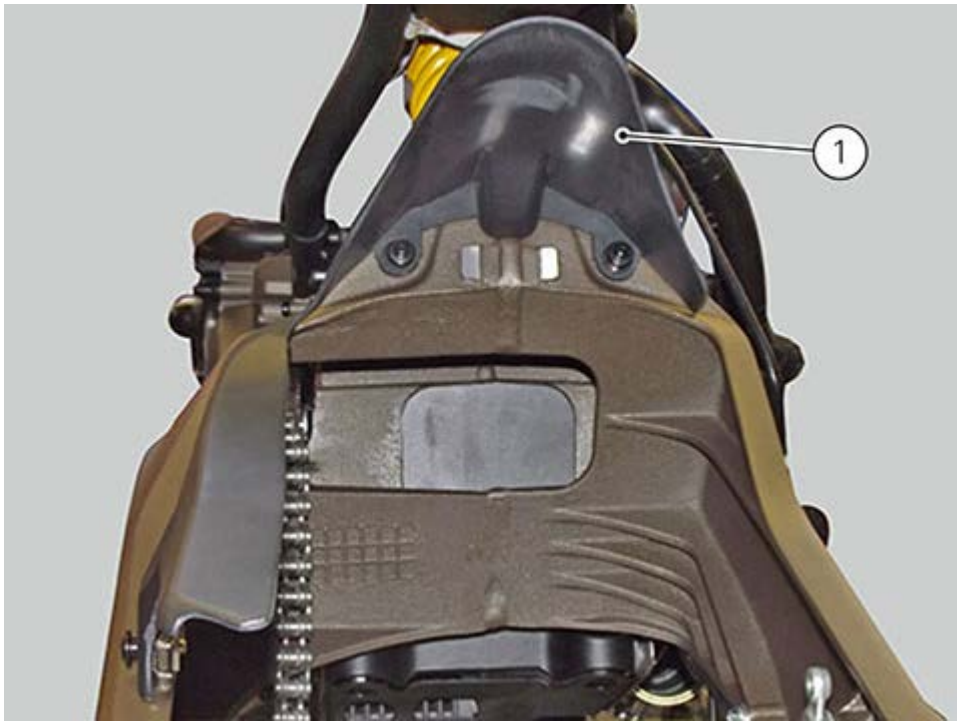
Tighten the screw (3) to a torque of 5 Nm ± 10%.



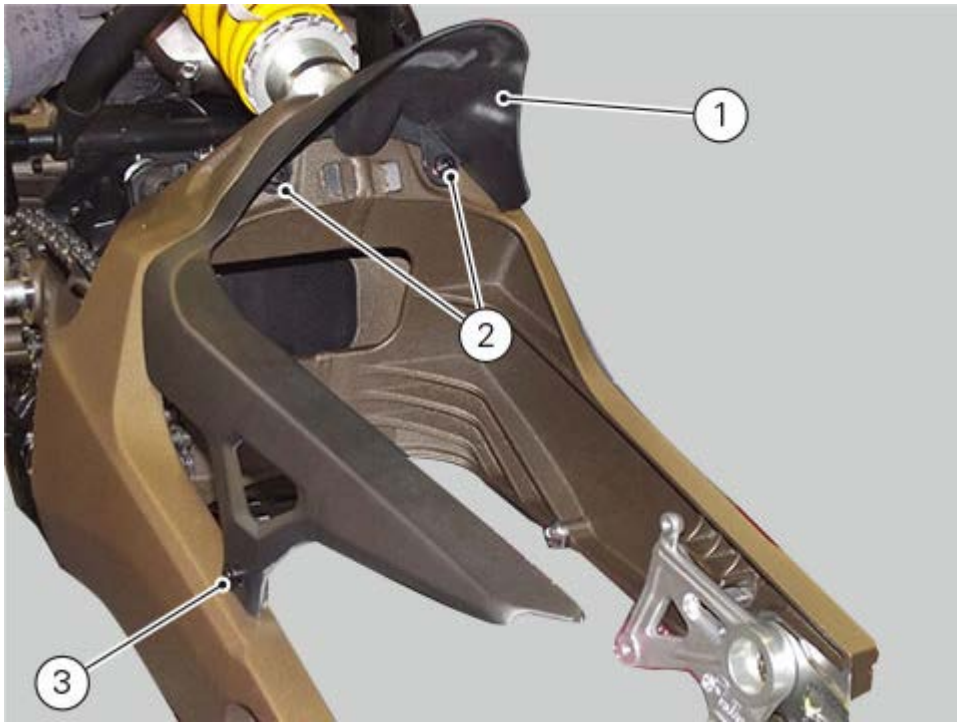
If the rear wheel has been removed, refit it (Refitting the rear wheel).

Removing the rear mudguard

If necessary, remove the rear wheel to remove the rear mudguard (1) (Removing the rear wheel).

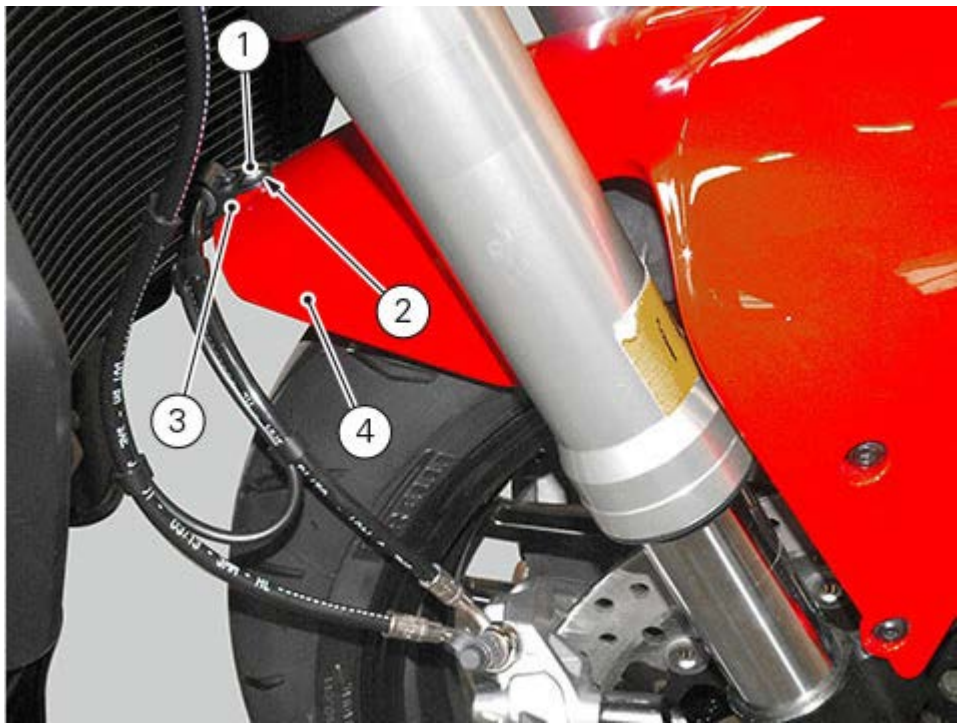


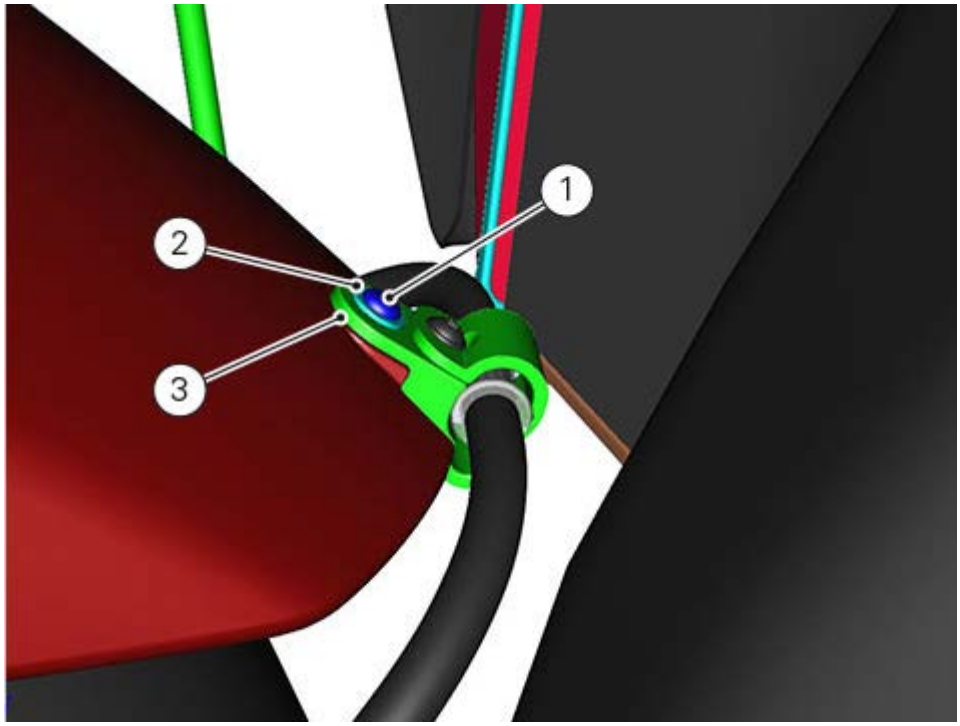
Loosen the two central screws (2).
Loosen the LH side screw (3) and slide the rear mudguard out.



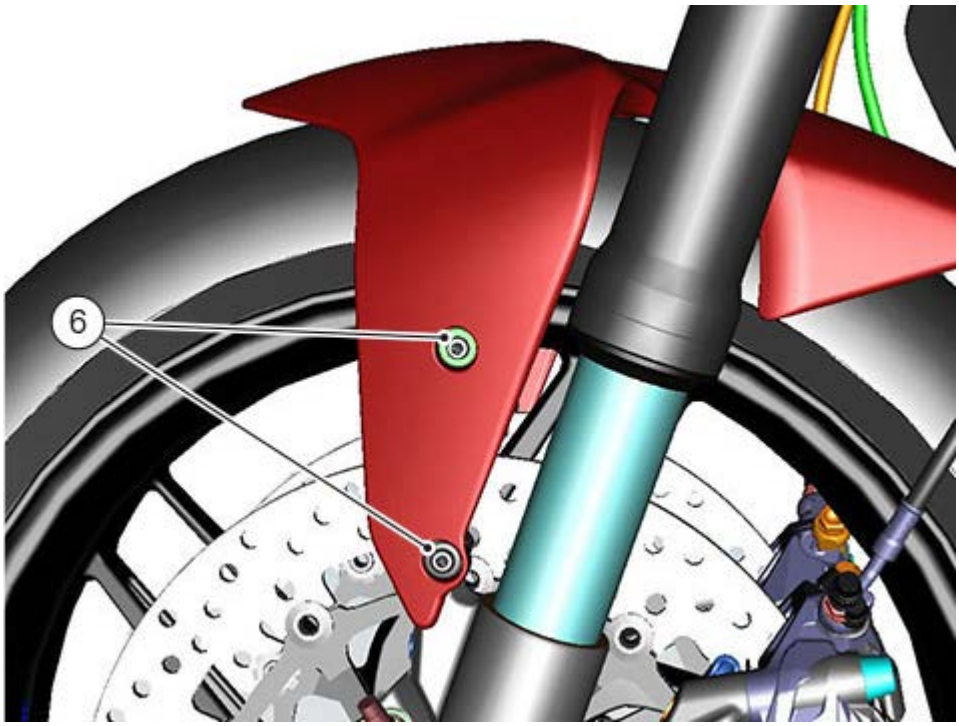
Refitting the front mudguard

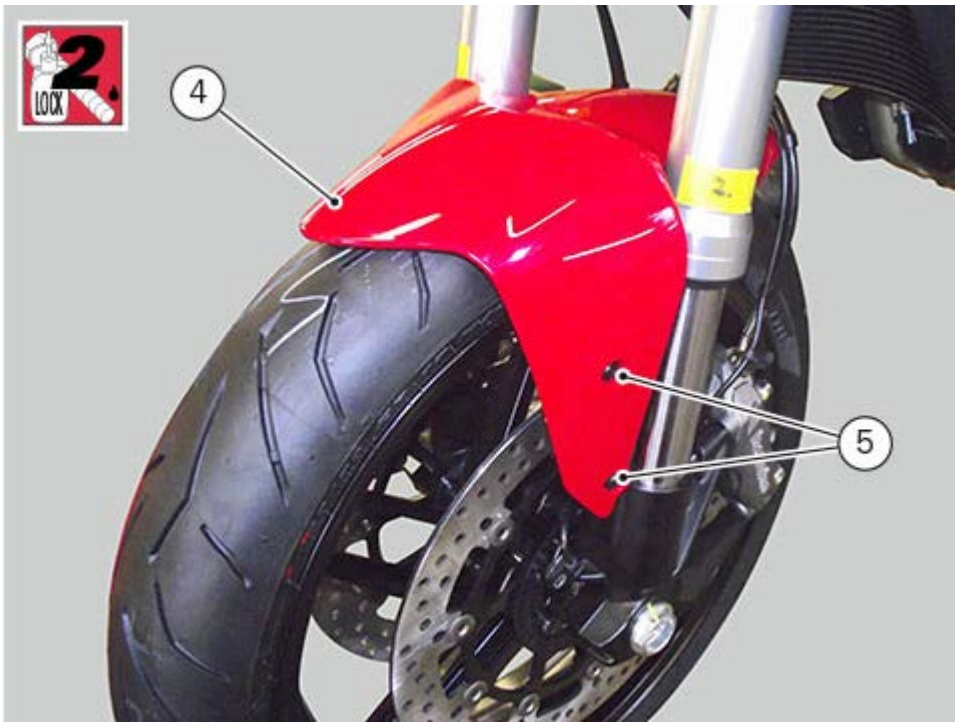
Position the front mudguard (4) between the two forks and move it up to the fork bottom ends.
Position the cables of the front braking system and the speed sensor on cable ring (3) of front mudguard (4).
Fix it to the mudguard by fitting washer (2) and tightening screw (1) to a torque of 0.4 Nm ± 10%.





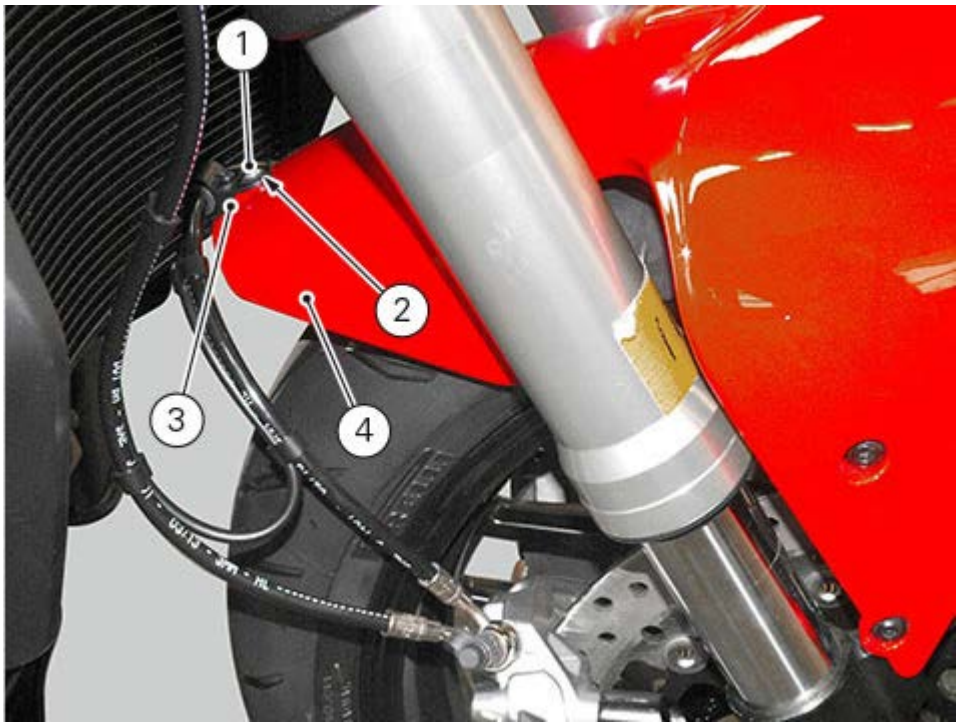
If screws (5) are not new, apply specified threadlocker.
Fit washers (6) to the relevant screws (4).
Start screws (5) securing front mudguard (4) to the forks.
Tighten screws (5) to a torque of 8 Nm ± 10 %.

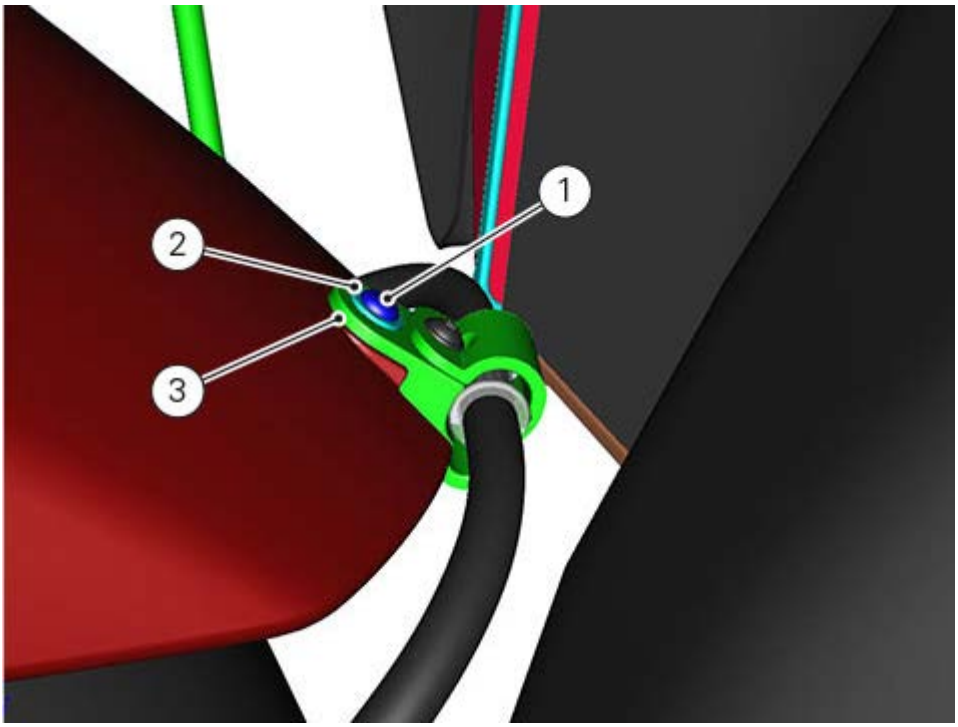



2.
LOCK
4
5

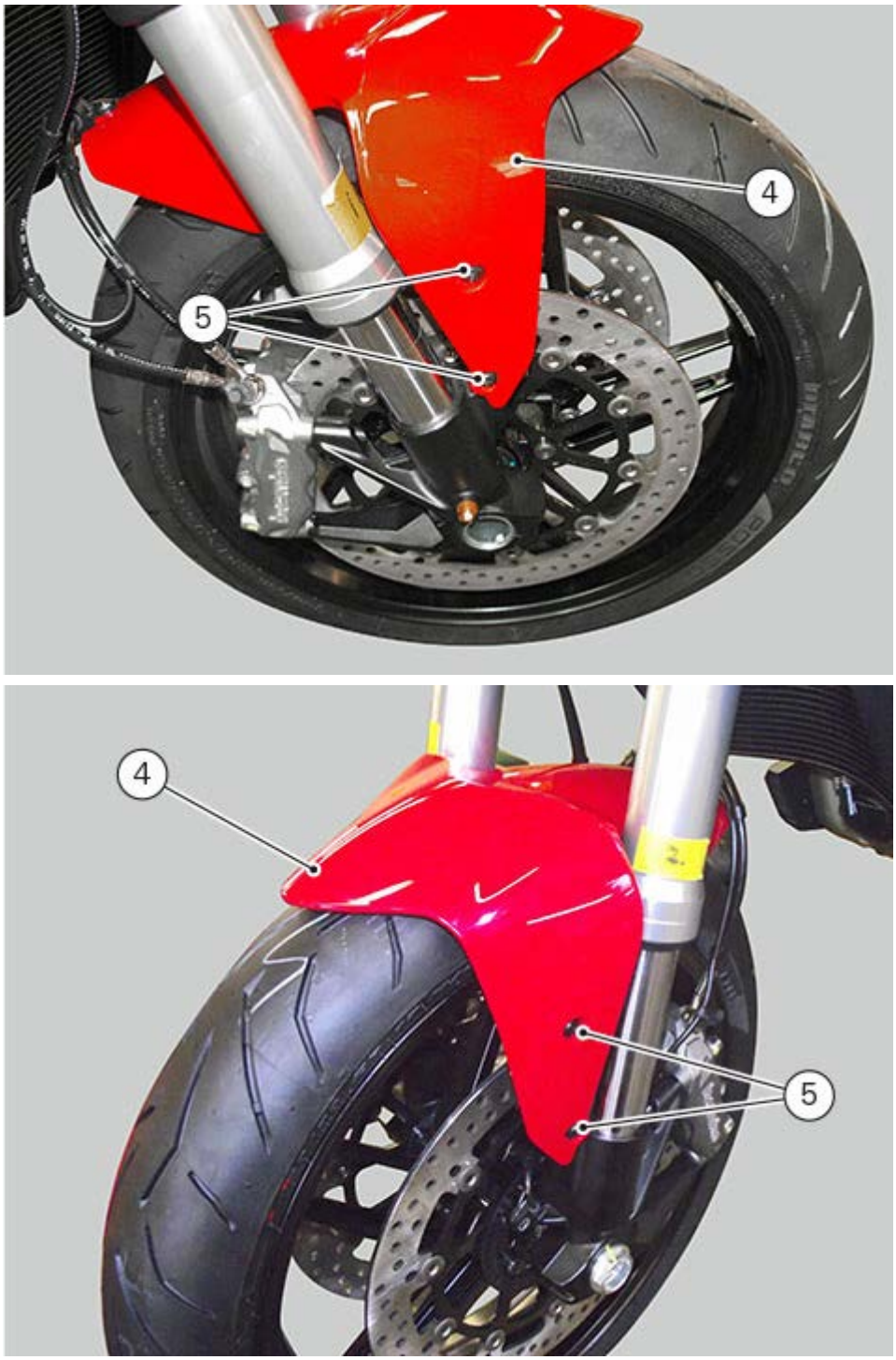
Removing the front mudguard

Loosen screw (1) and collect washer (2), slide cable ring (3) out of front mudguard (4).





Loosen screws (5) that retain the front mudguard (4) and collect the relevant spacers (6) on both sides.

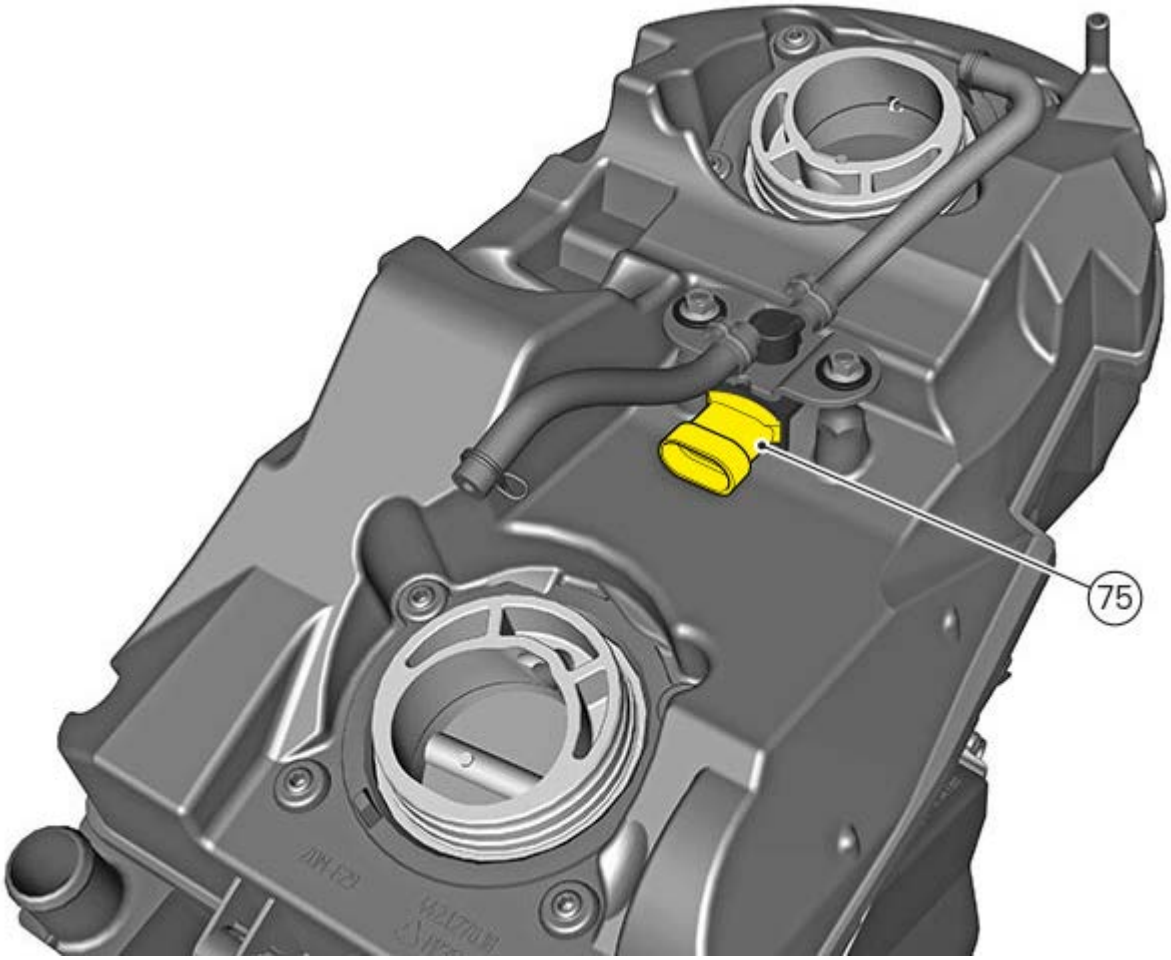


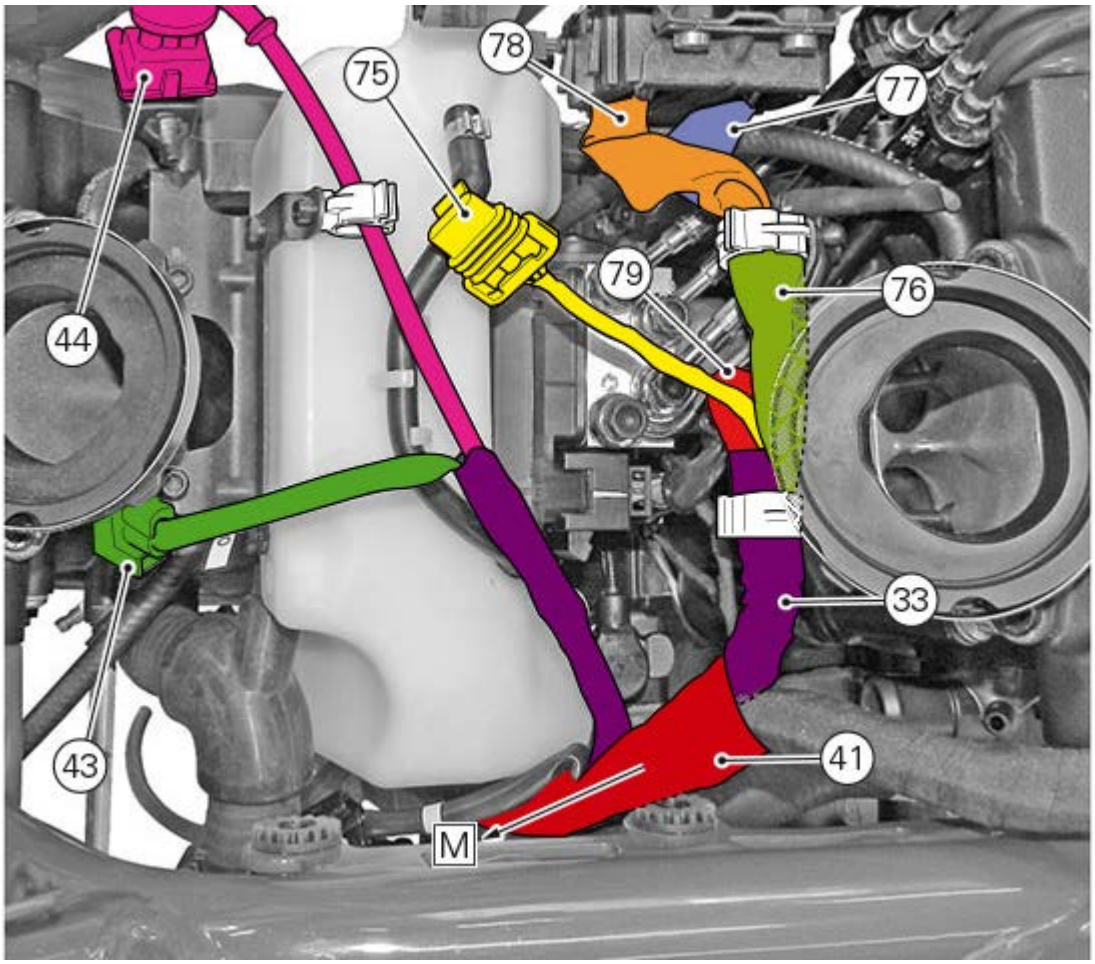
Slide out front mudguard (4) from the front side having care not to damage the forks and the braking system.

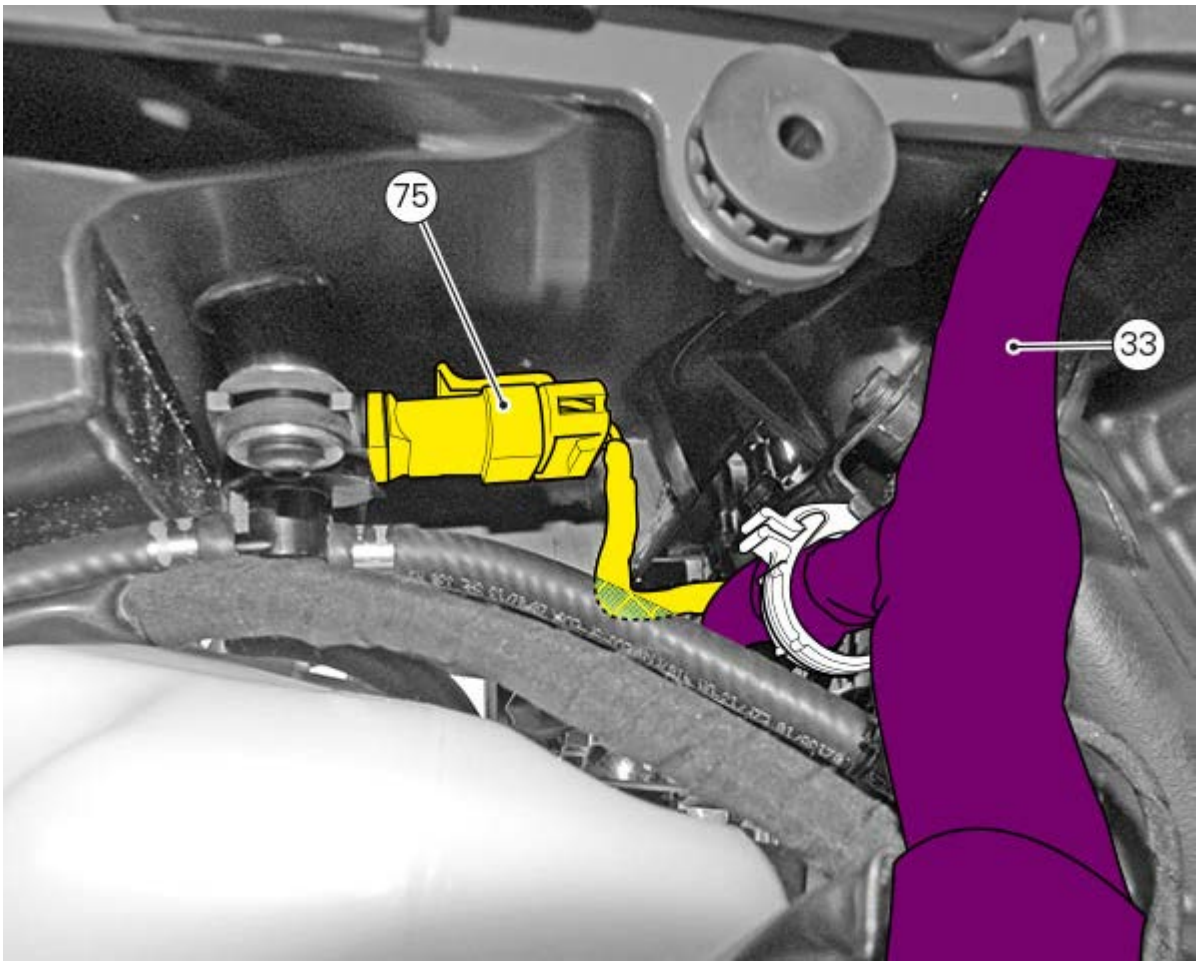
Table V

MAP sensor, fuse boxes, ABS control unit

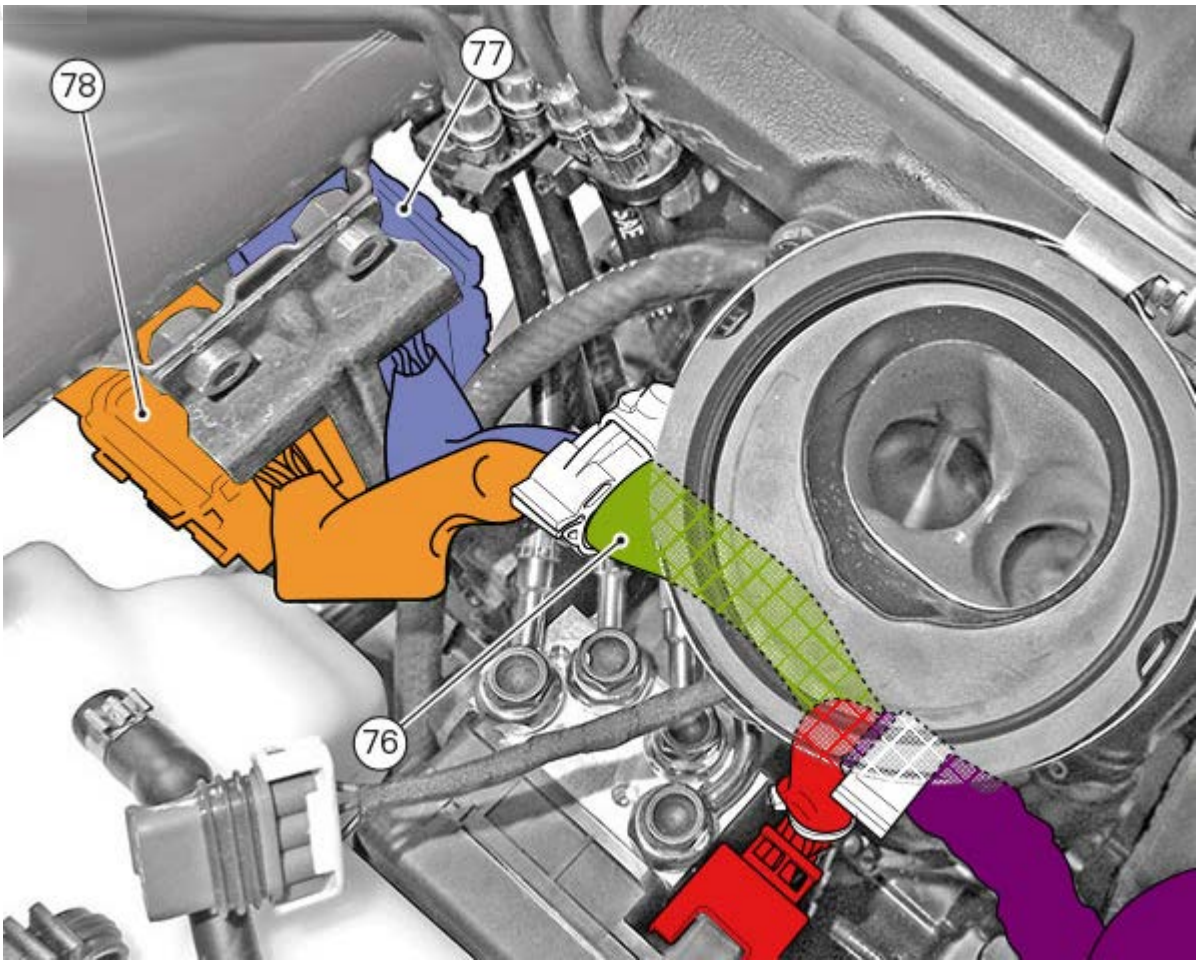
MAP sensor
MAP sensor (75).

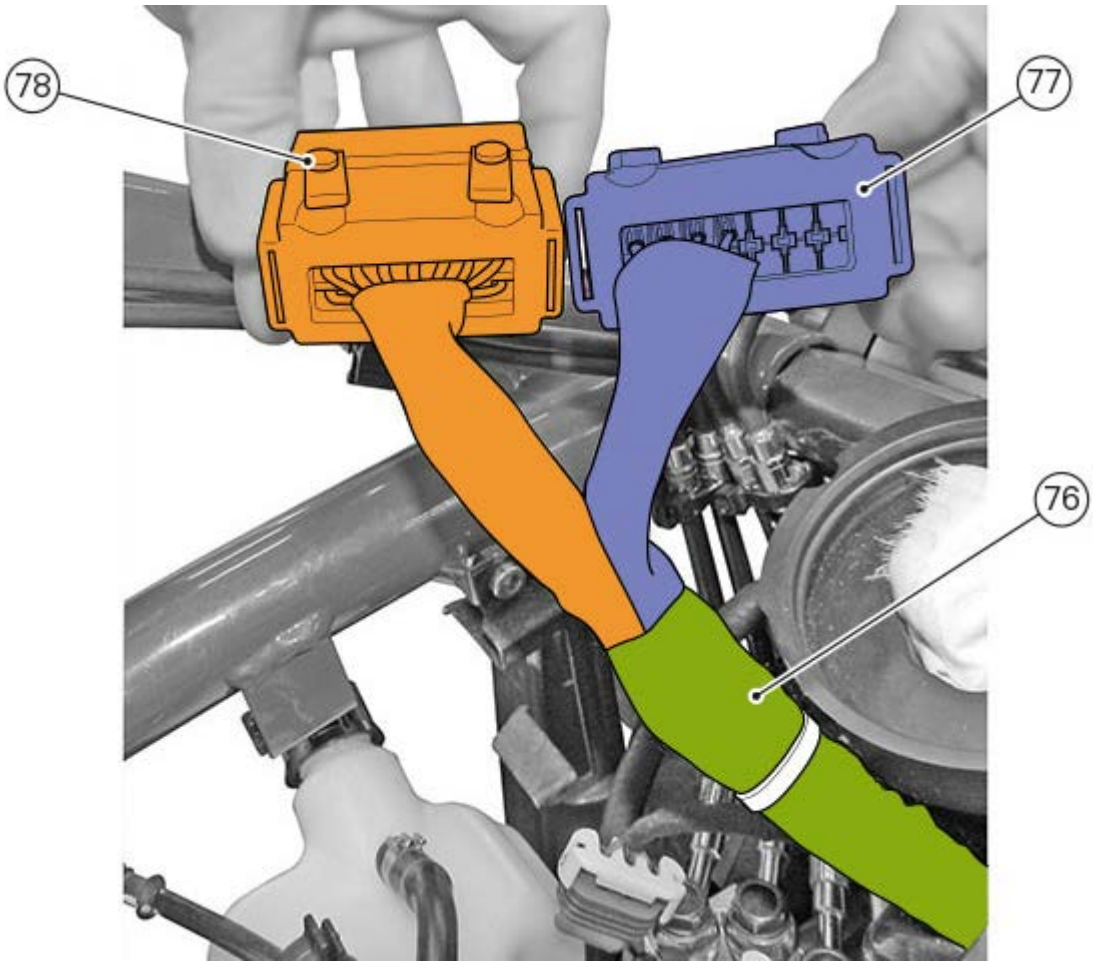




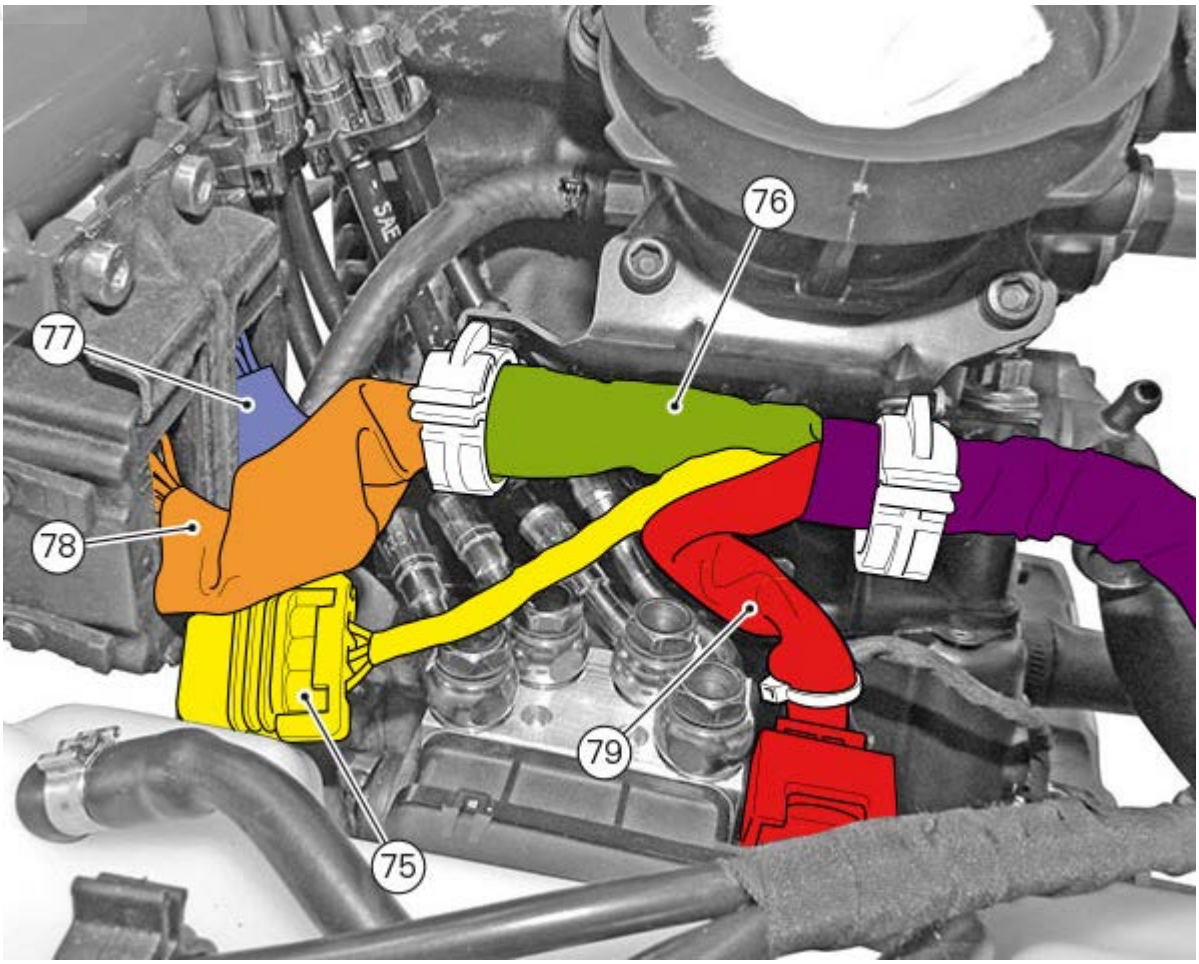


Fuse boxes
The front fuse box wiring (78) has more wires than the rear fuse box wiring (77).
The front fuse box wiring (78) is longer than the rear fuse box wiring (77).





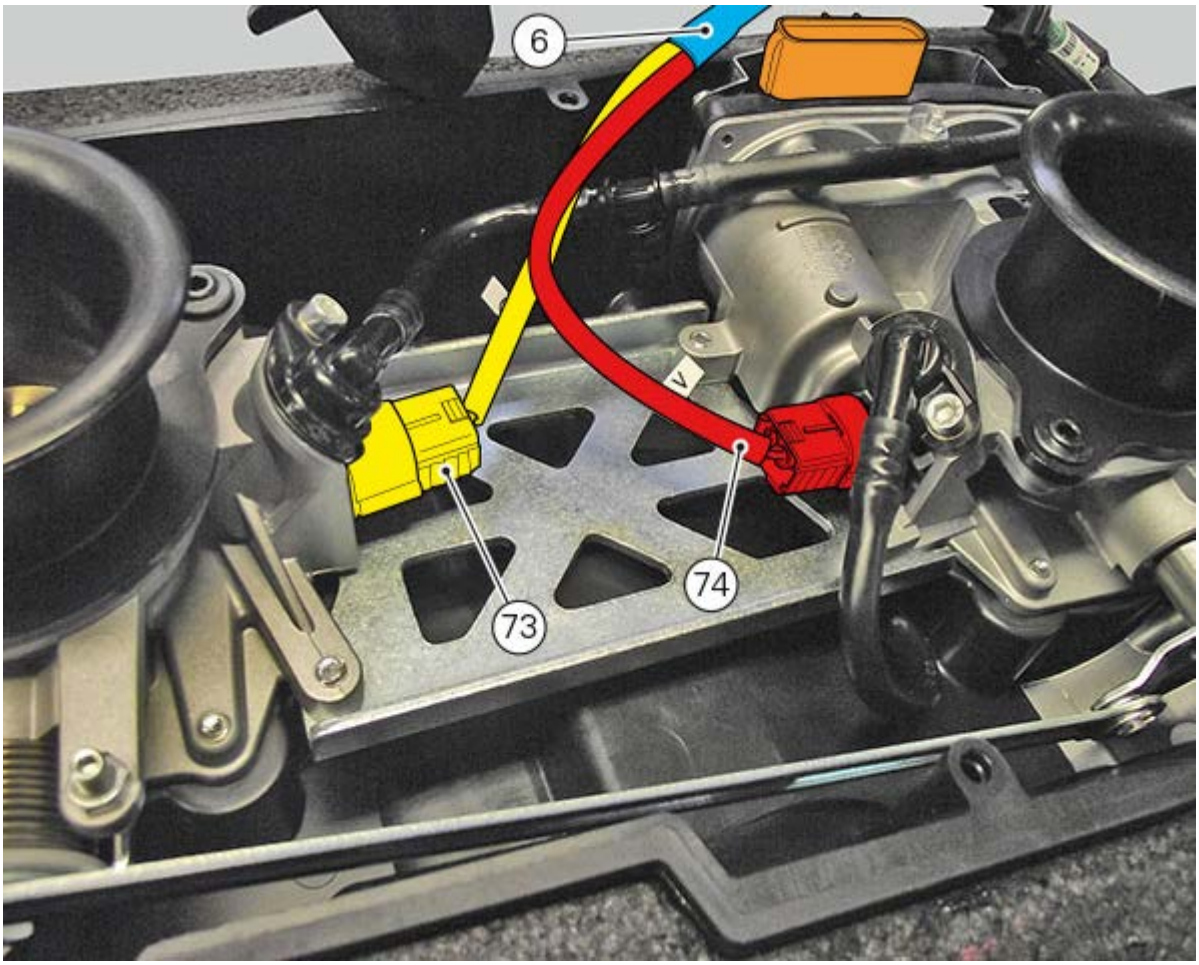
ABS control unit wiring



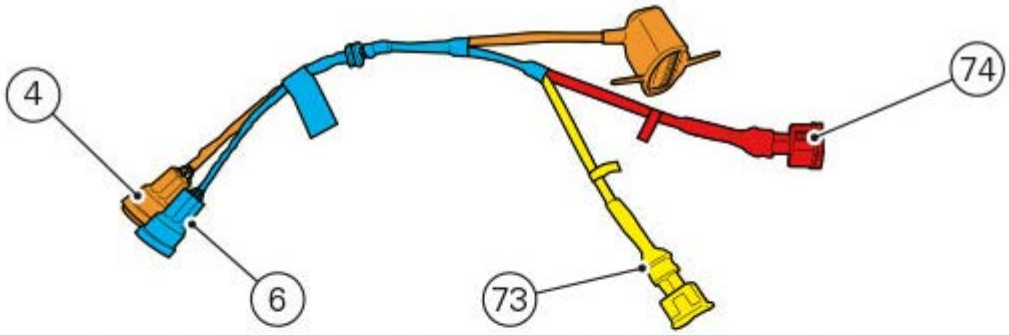
For the complete index of the wirings, divided by tables, refer to chapter "Routing of wiring on frame".

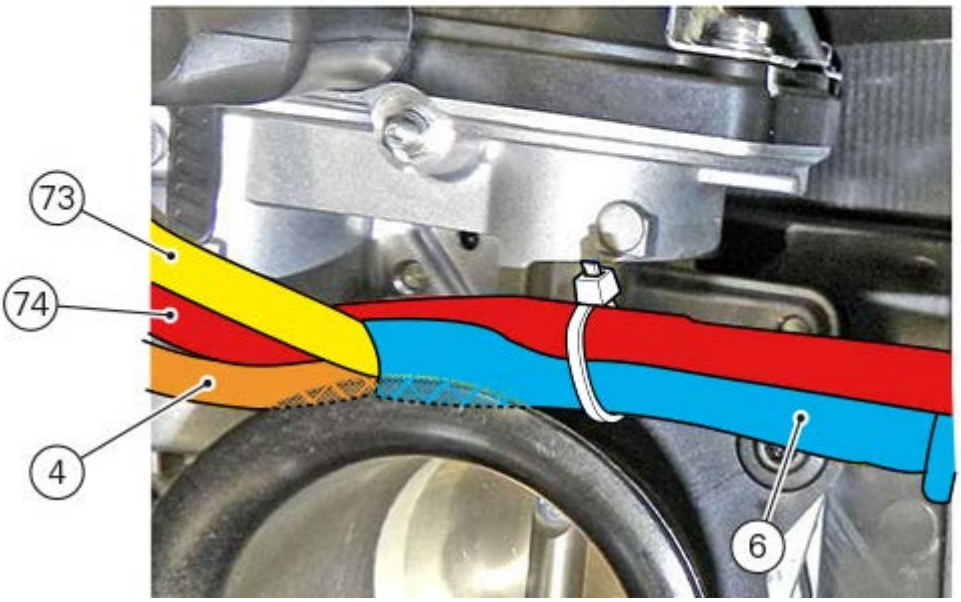
Table U

Airbox

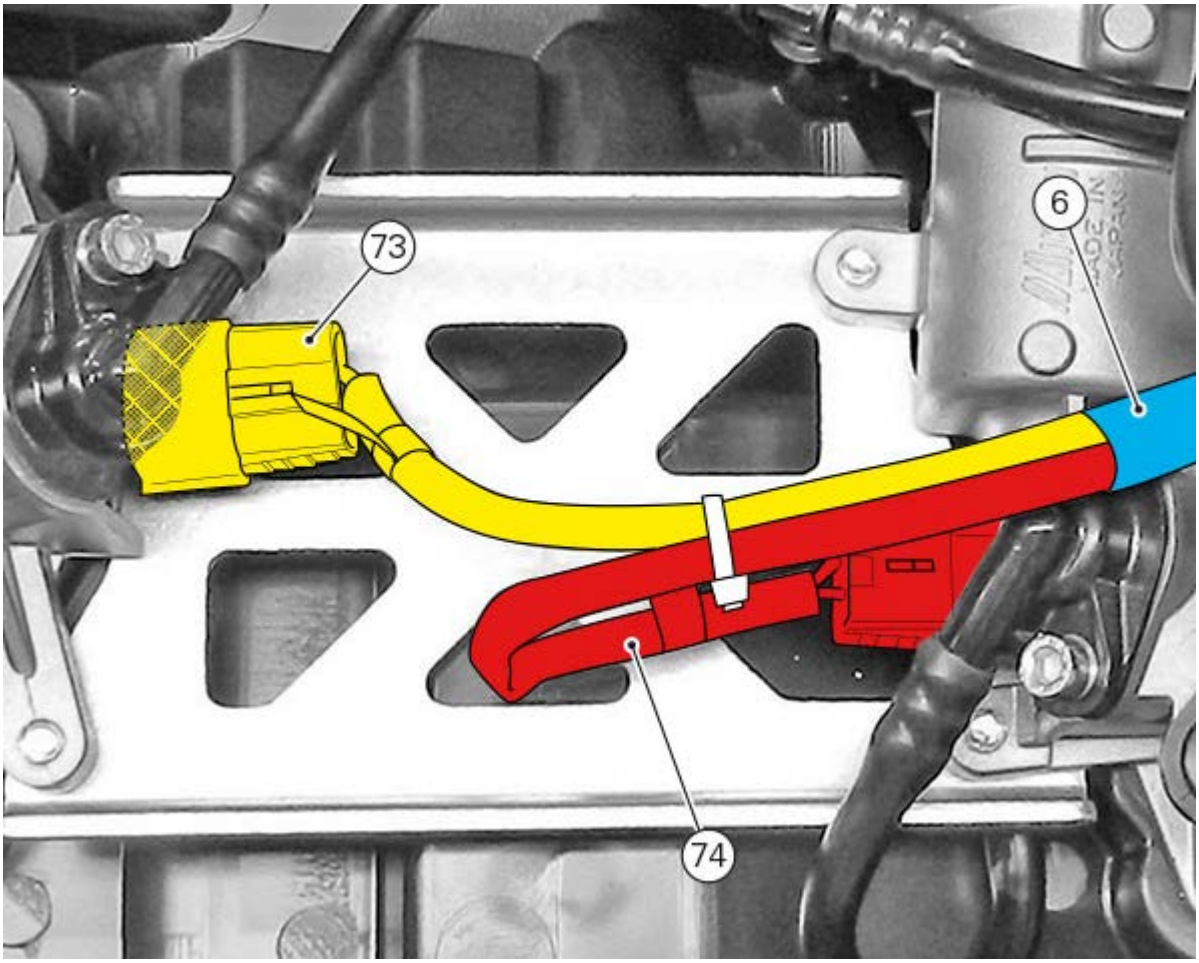


In order to identify the injector wiring branches, cables are marked with "V" (vertical) (74) and "O" (horizontal) (73) labels.
Tie together the fuel-throttle body hose and the injector wiring (6), in the indicated position.

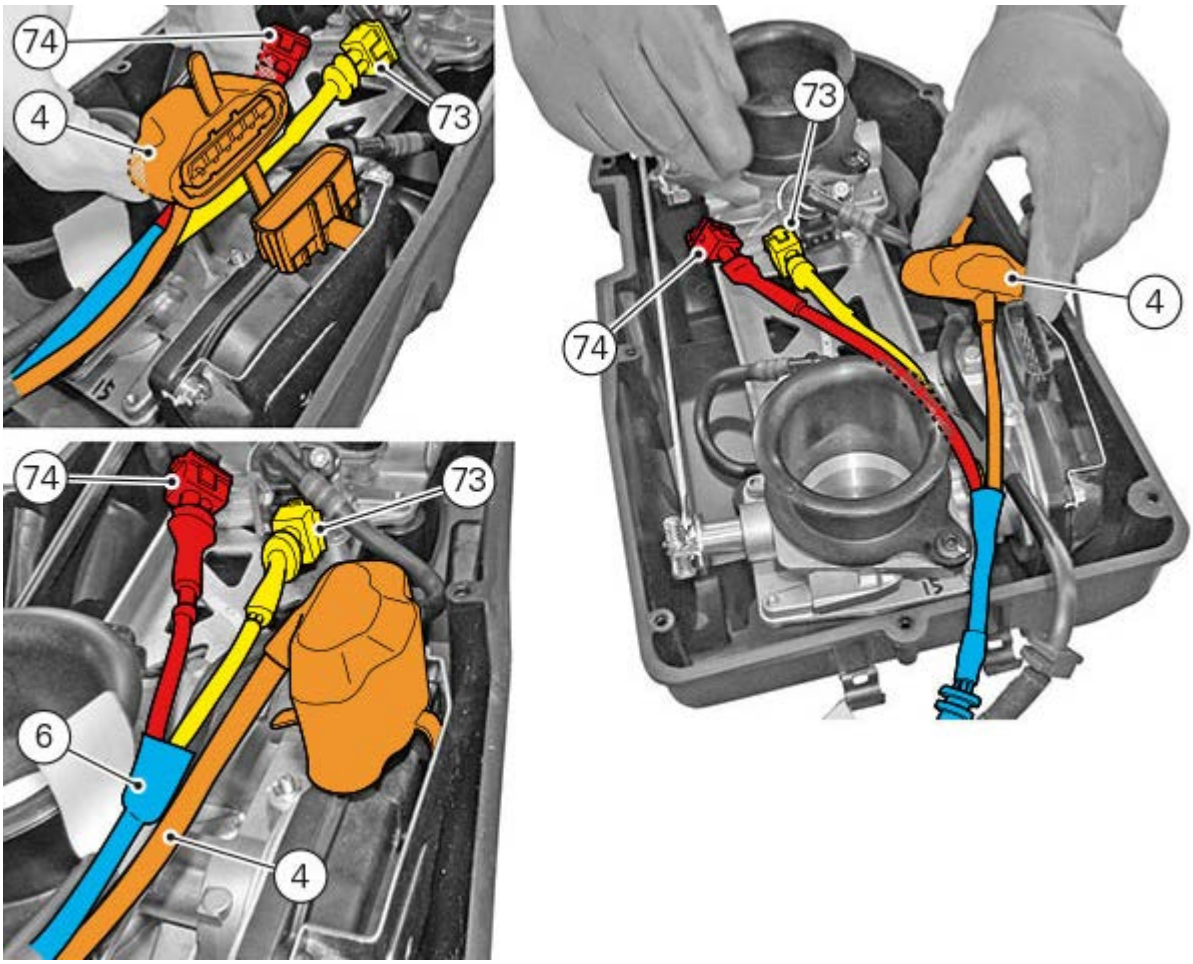




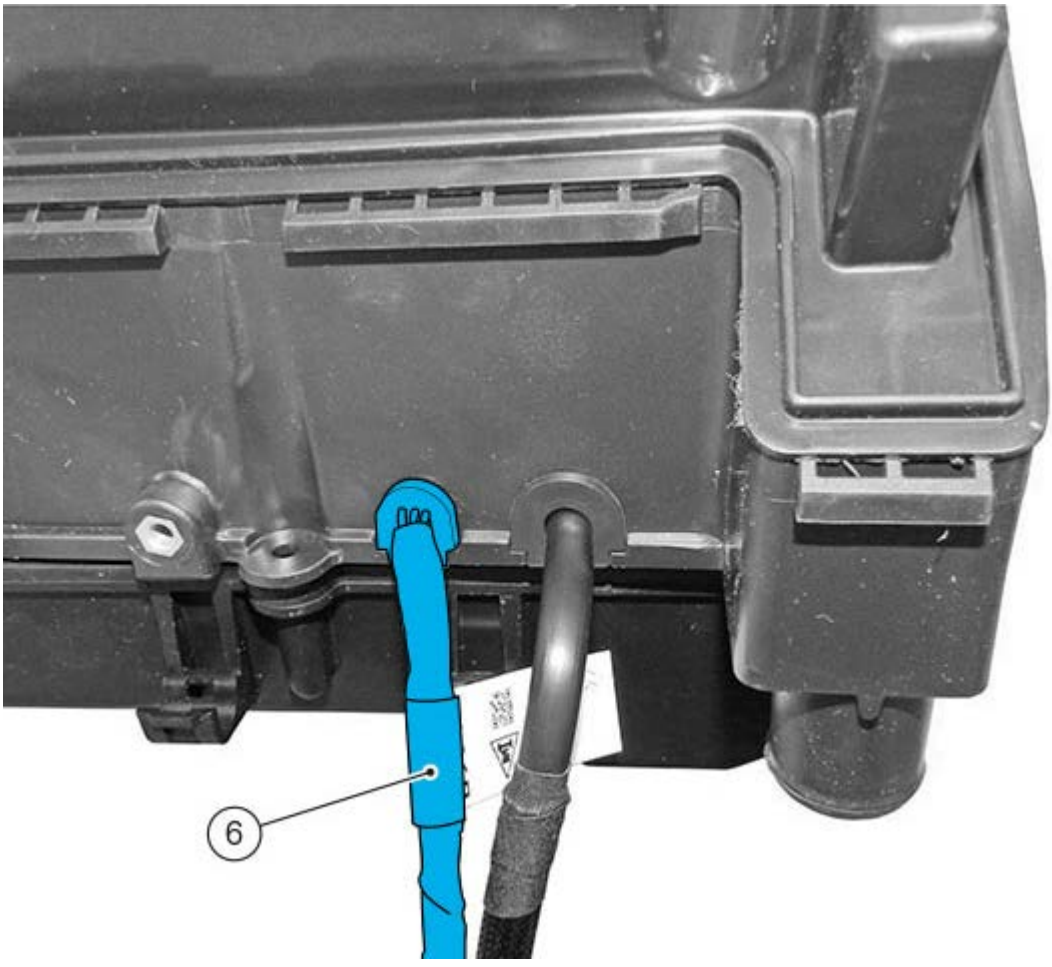
Tie together the horizontal injector wiring (73) and the vertical injector wiring (74), as indicated. The wiring of this vehicle features a female connector for connector (6) of injectors (4) and a male connector for the potentiometer.



Make sure that the potentiometer wiring (4) is not squeezed between the fuel pipe (AC) and the throttle body surface (AD).



Check that wiring (6) and fuel-throttle body pipe come out of the airbox with the relevant seals in their seats, as indicated.

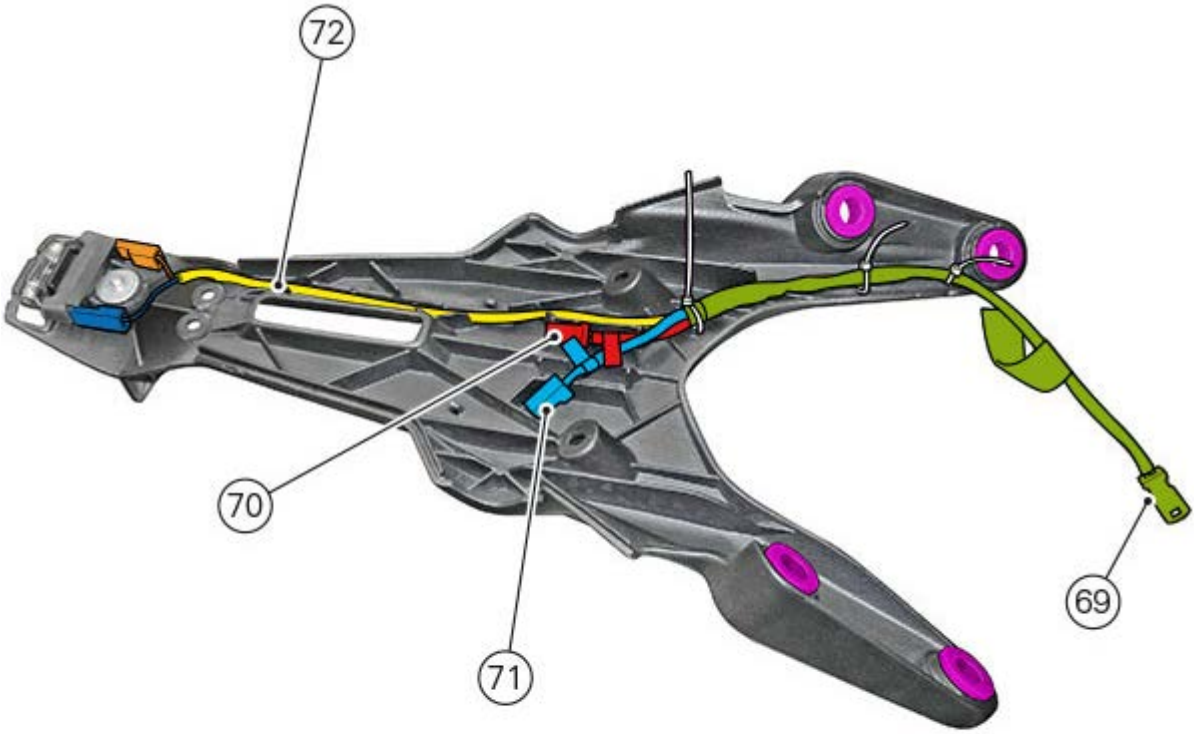


For the complete index of the wirings, divided by tables, refer to chapter "Routing of wiring on frame".

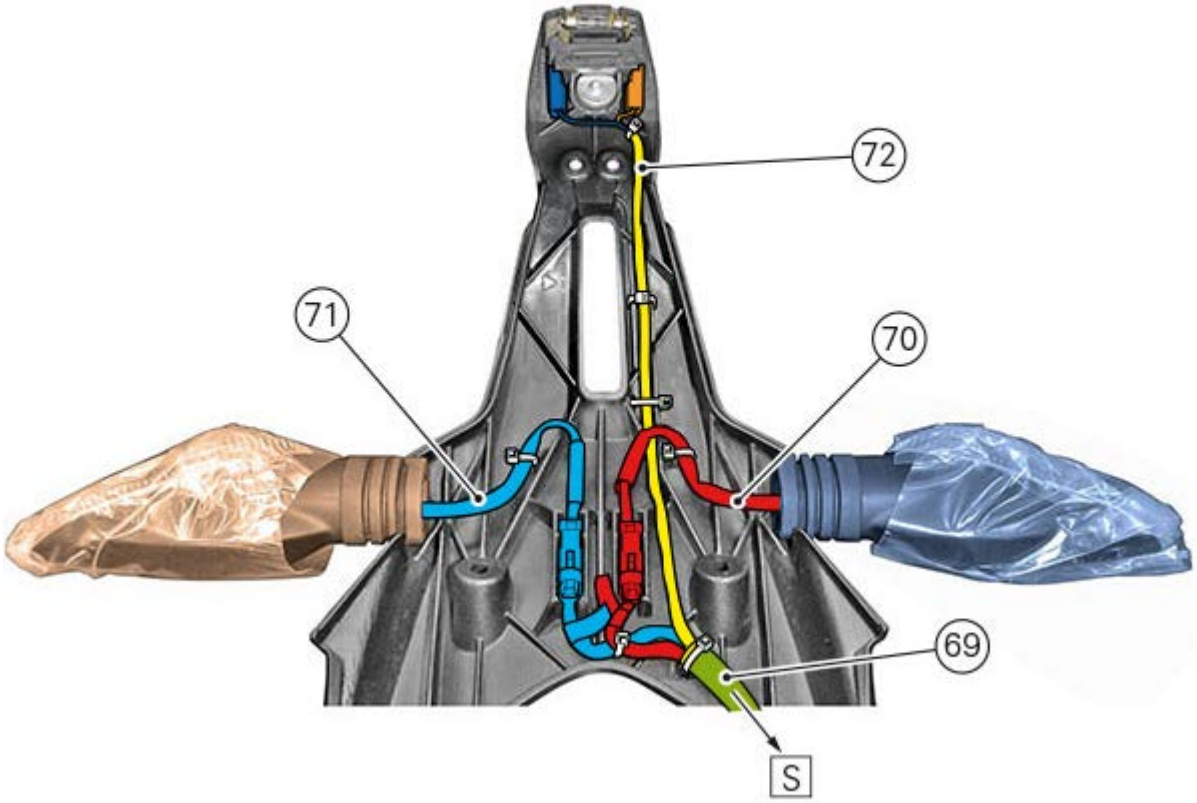
Table T

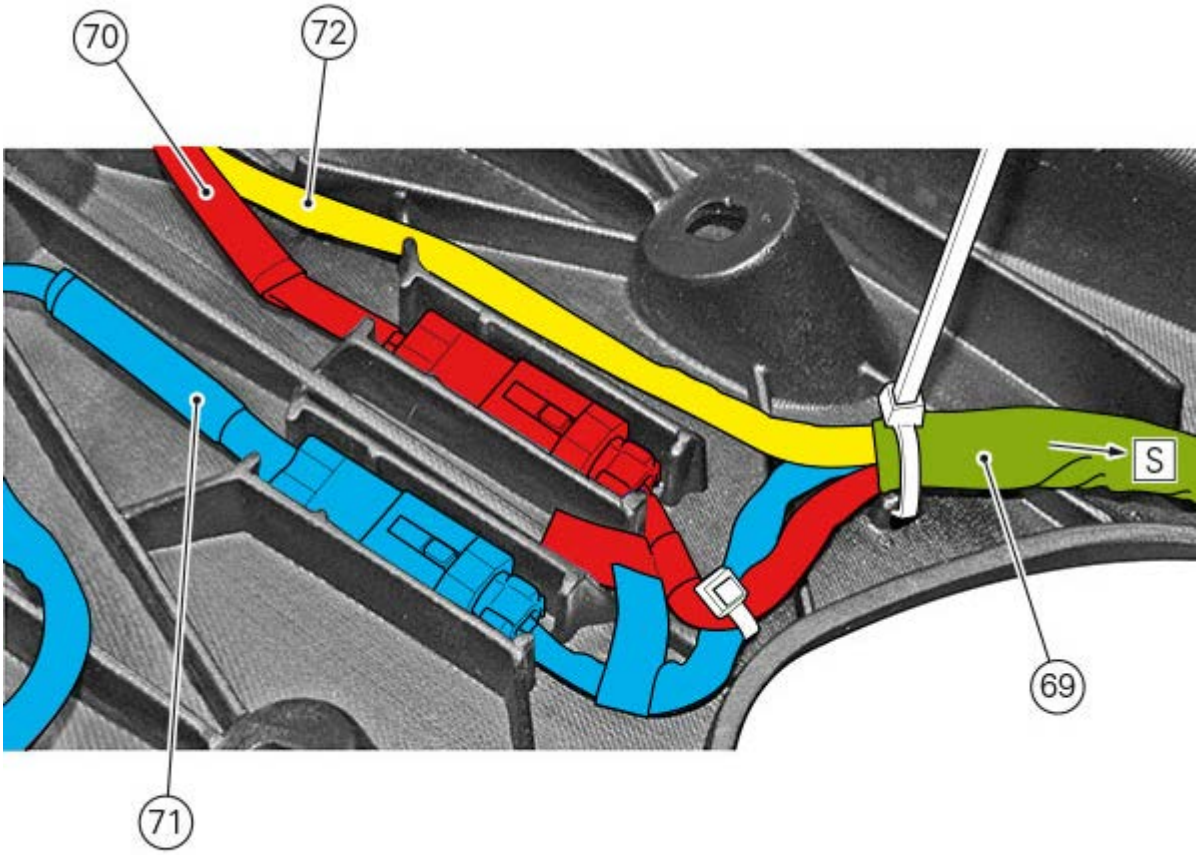
Rear guard

Tie the wirings as indicated.
A correct positioning of the rear guard wiring (69) implies a better position of the LH (70) and RH (71) turn indicator wirings and of the number plate light wiring (72).



The RH (71) and LH (70) turn indicator wiring branches are identified by specific labels with the writing "RH" and "LH".



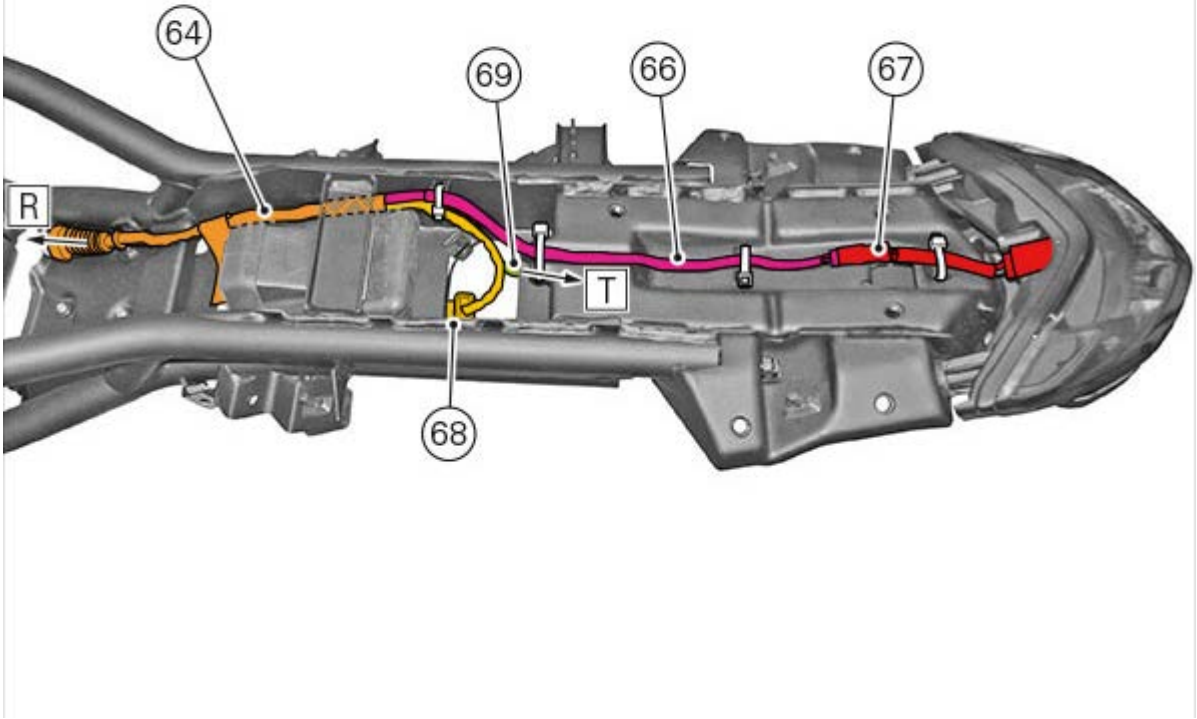


For the complete index of the wirings, divided by tables, refer to chapter "Routing of wiring on frame".

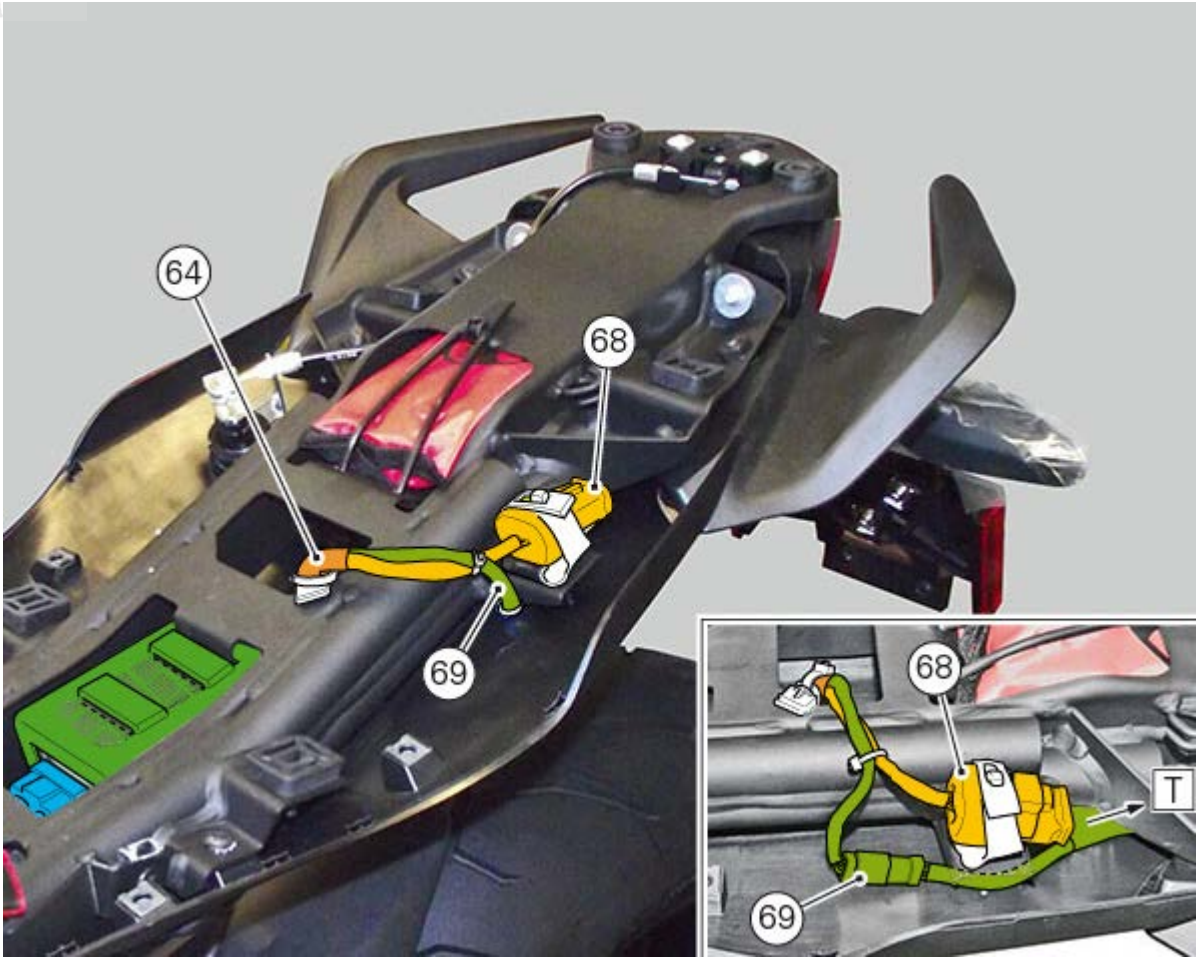
Table S

Rear subframe

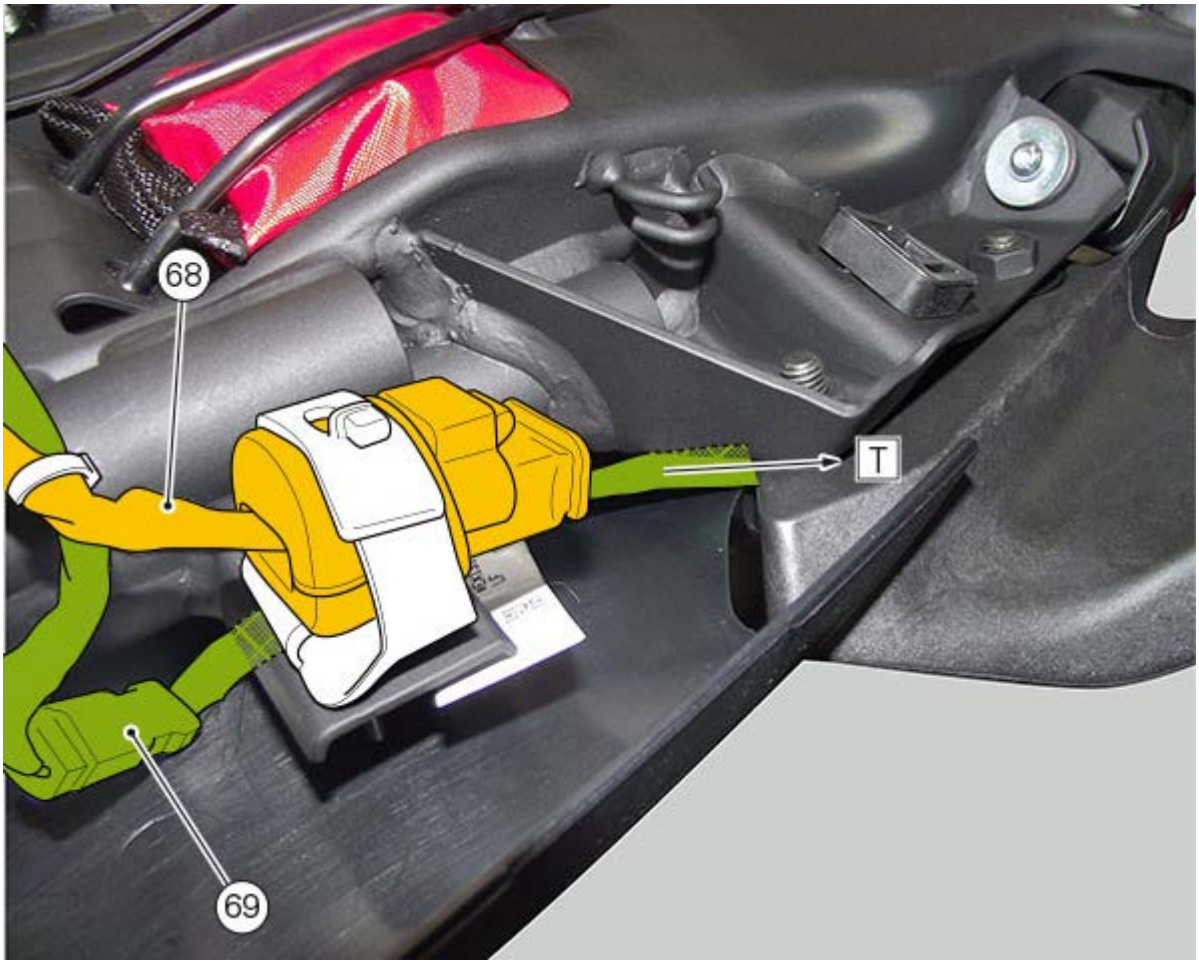
Tie the wirings as indicated.
Lower view



Upper views



Pay attention to the rear guard wiring passage (69).

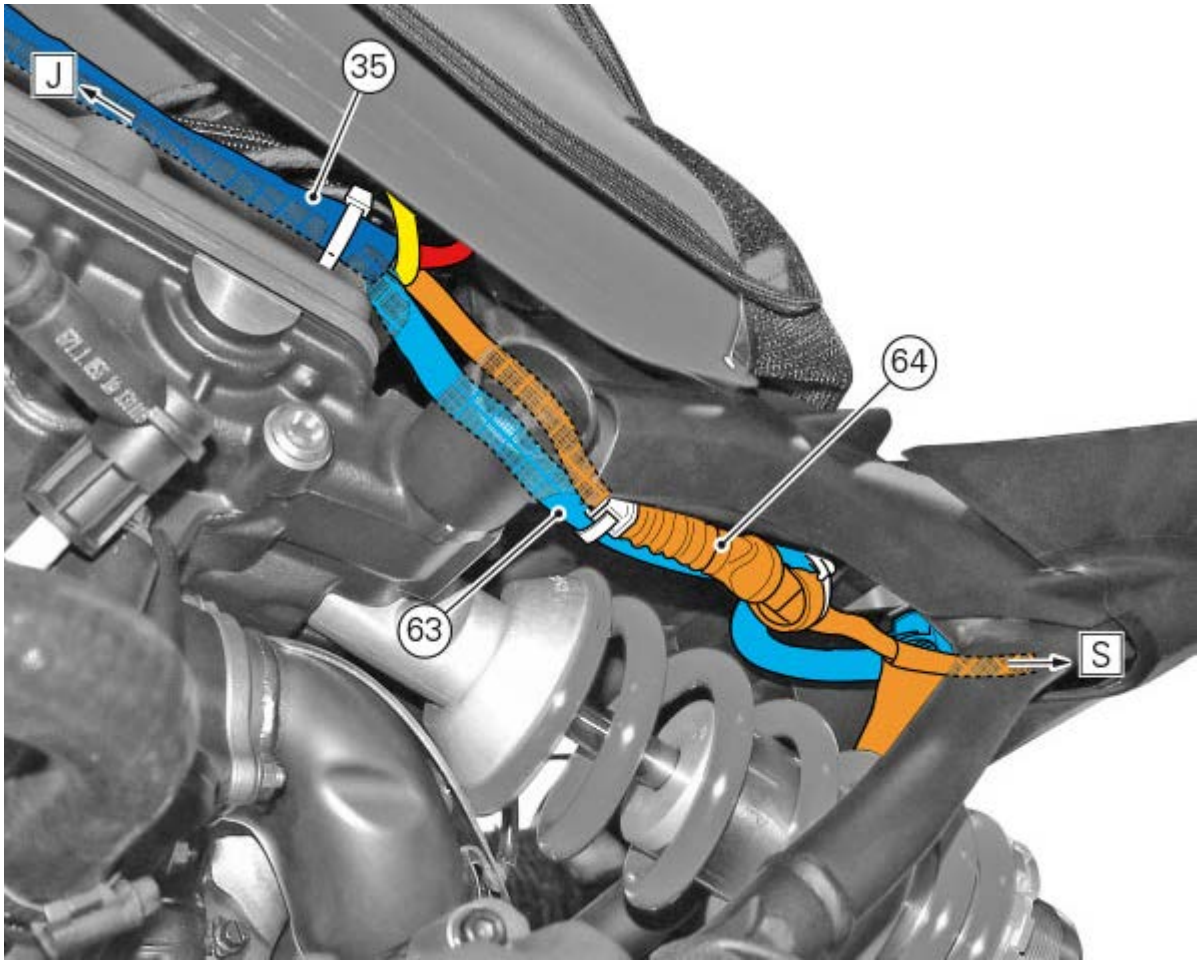


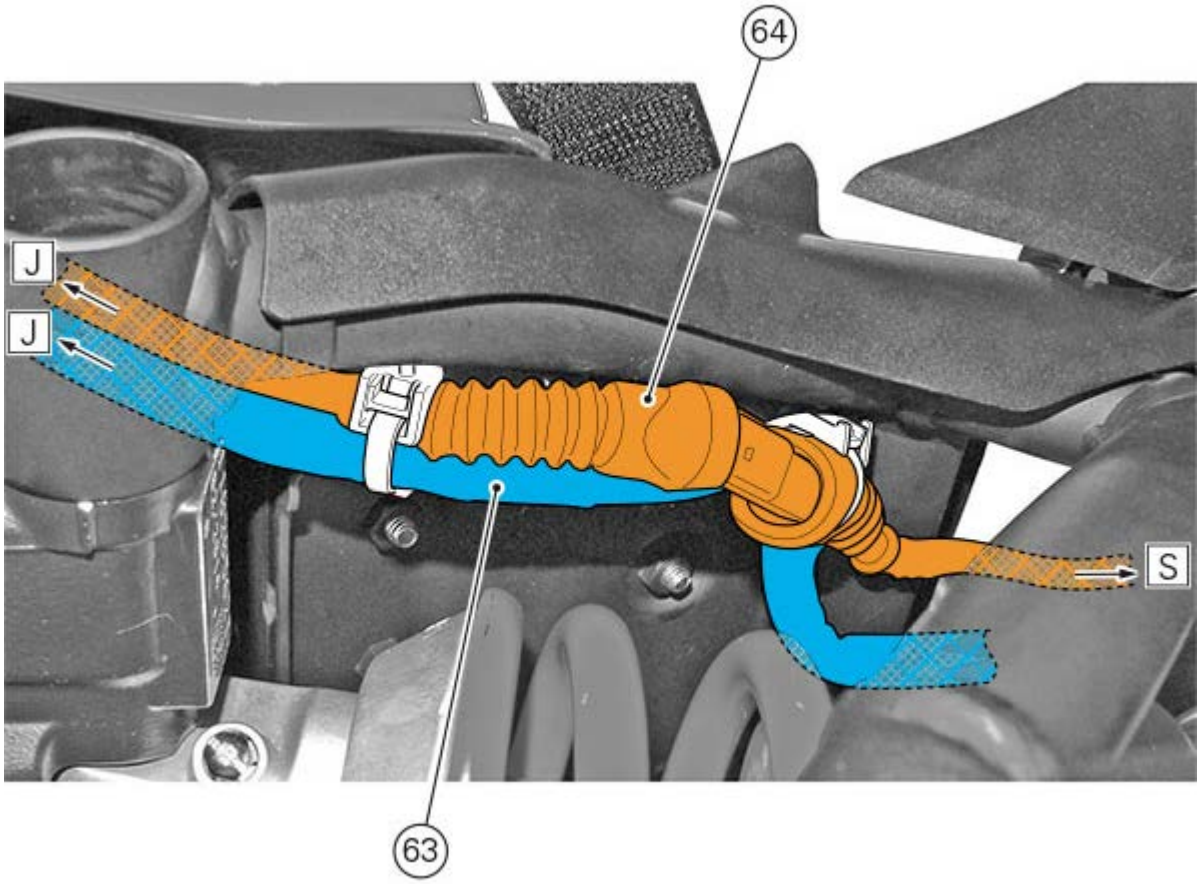
For the complete index of the wirings, divided by tables, refer to chapter "Routing of wiring on frame".

Table R

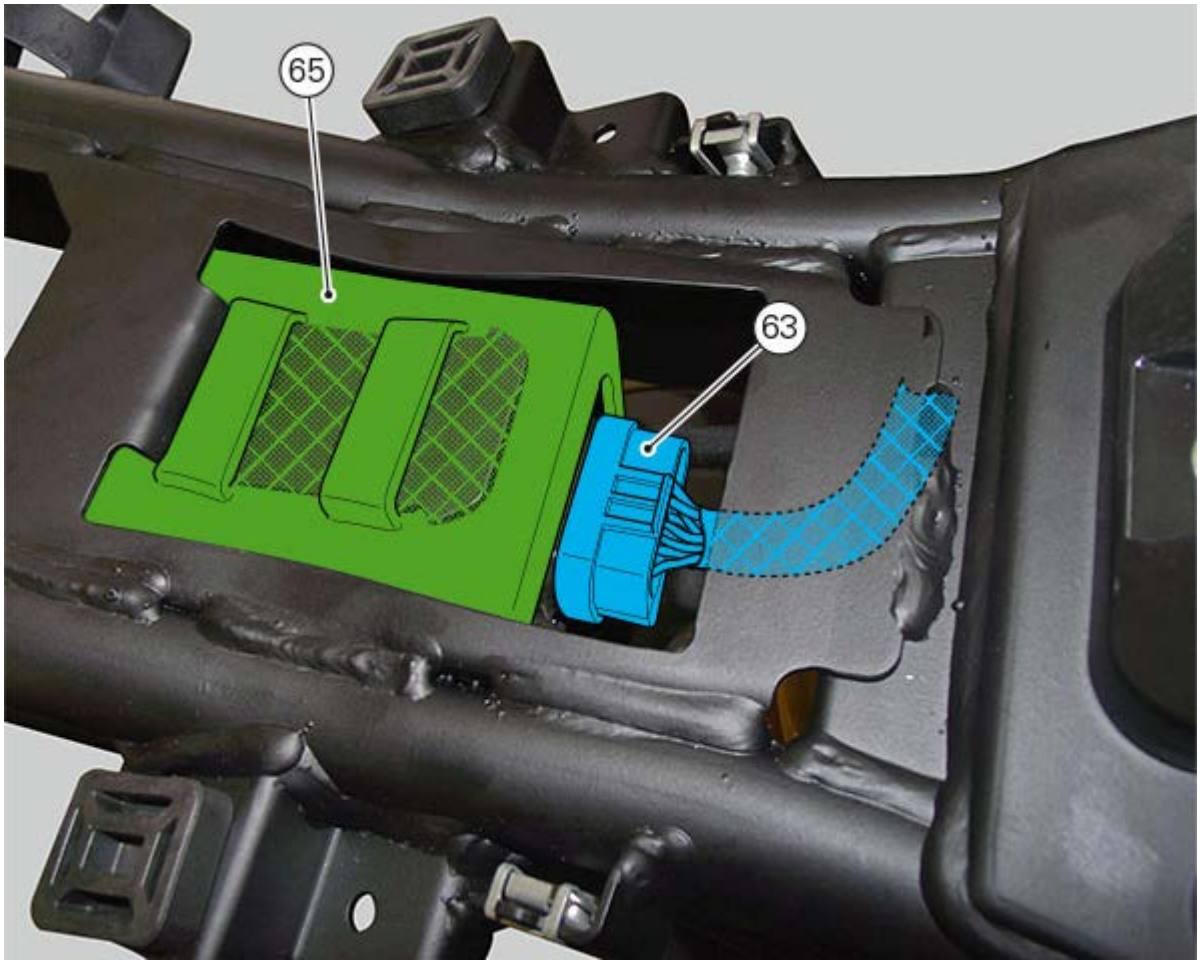
Rear subframe and BBS control unit wiring

Tie the BBS wiring (63) and the rear subframe branch (64), as indicated.





Connect the connector to the BBS control unit (65).

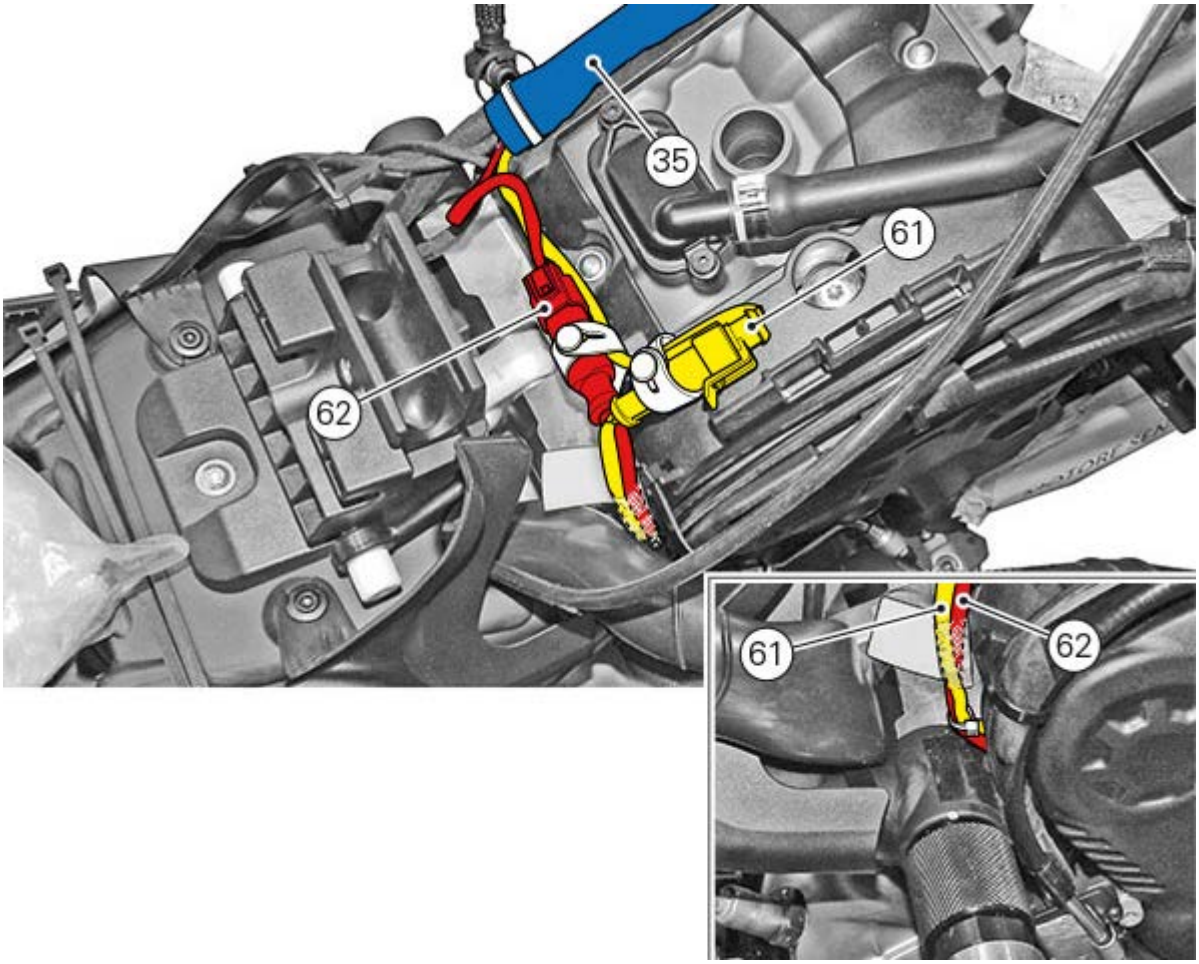


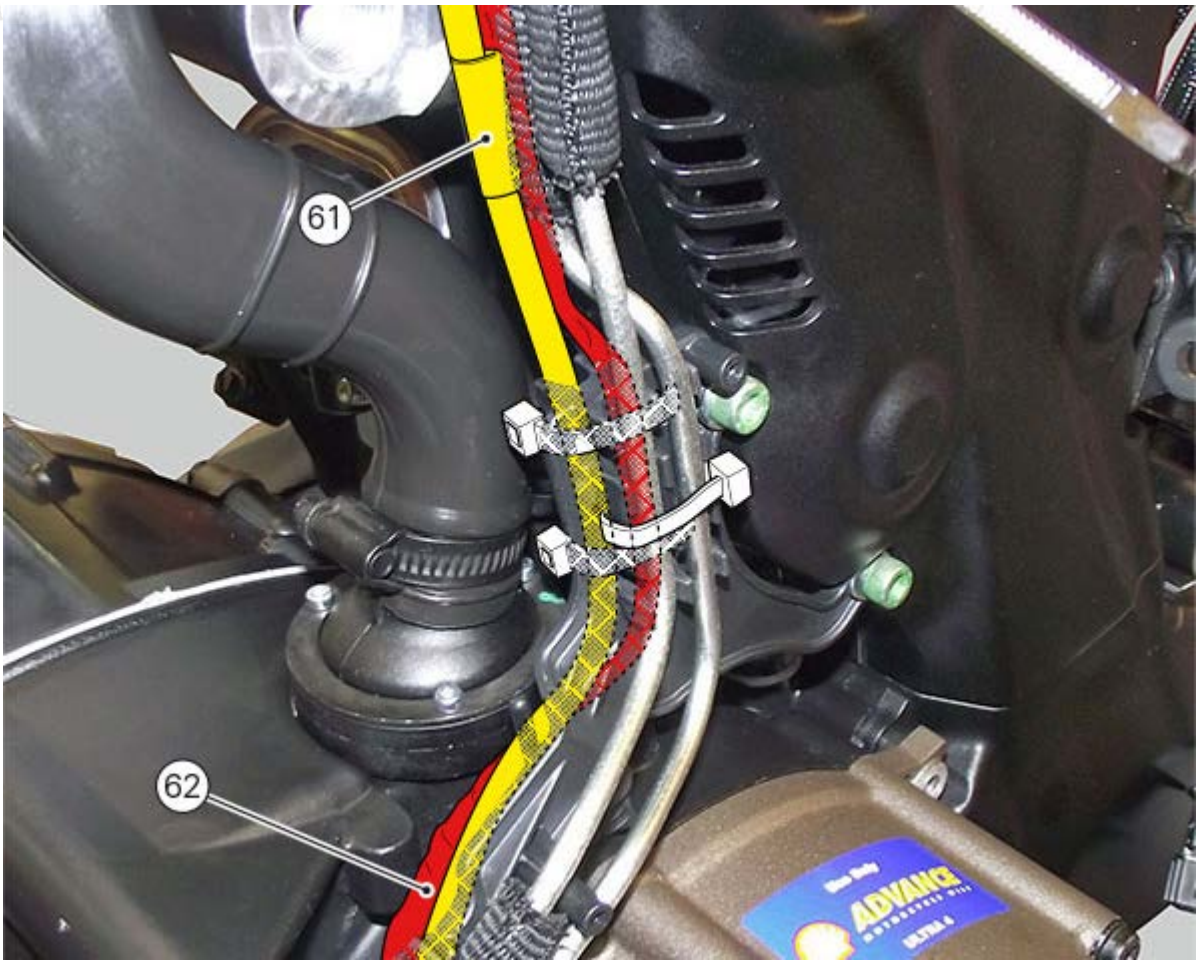
For the complete index of the wirings, divided by tables, refer to chapter "Routing of wiring on frame".

Table Q

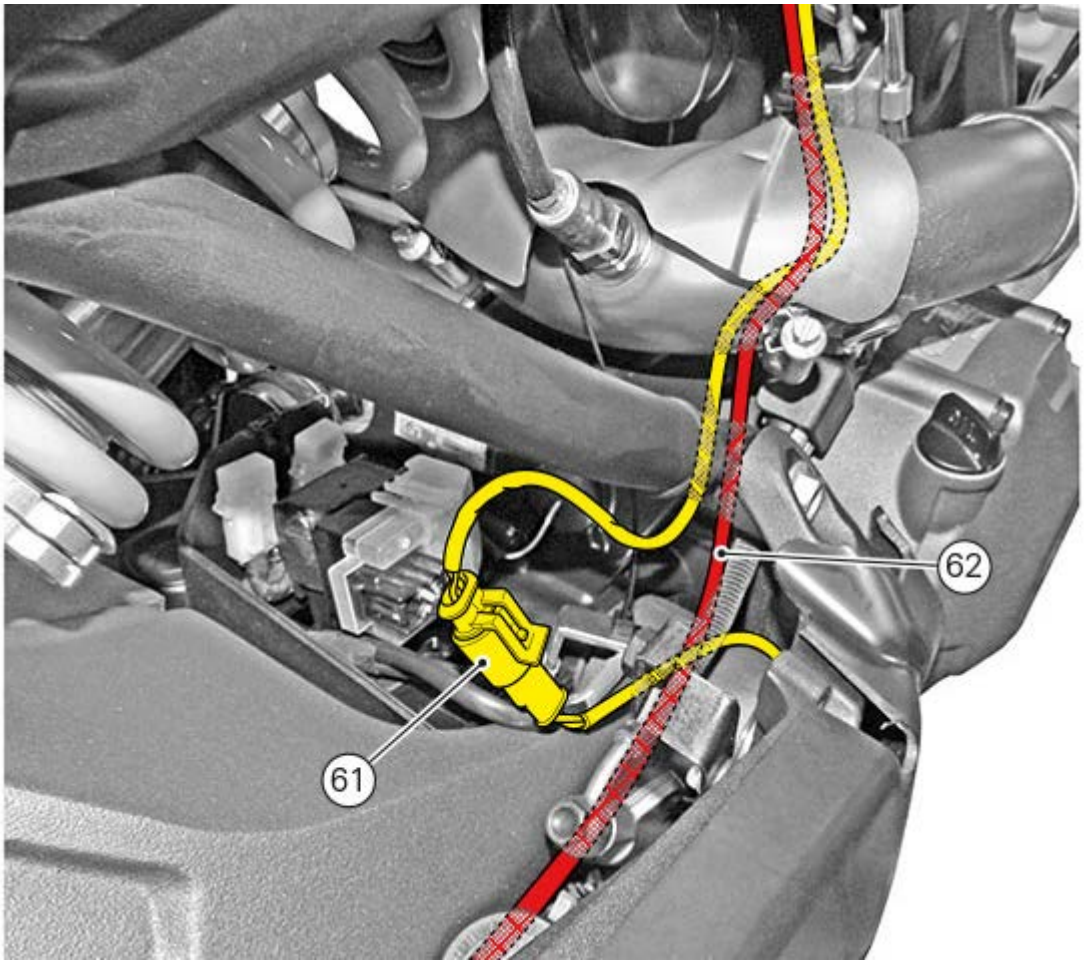
Wiring for rear speed and rear stop sensor

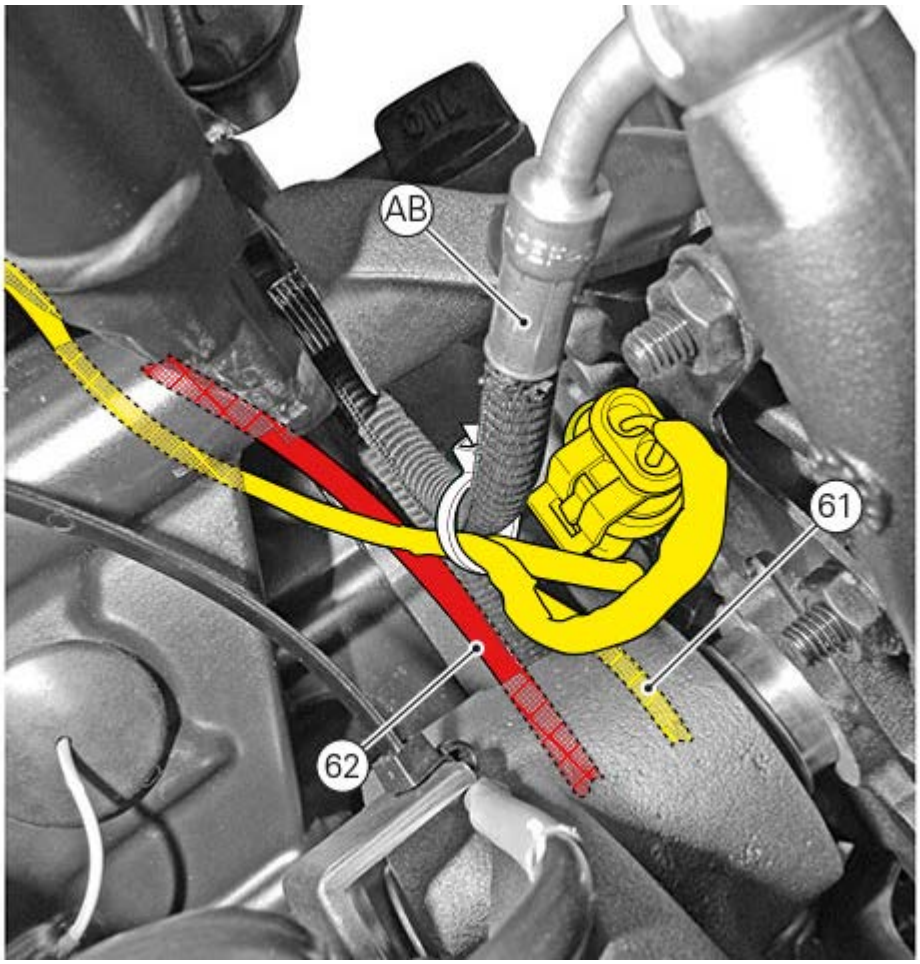
Tie the rear stop light wiring (62) with the rear speed sensor cable (61) as indicated.



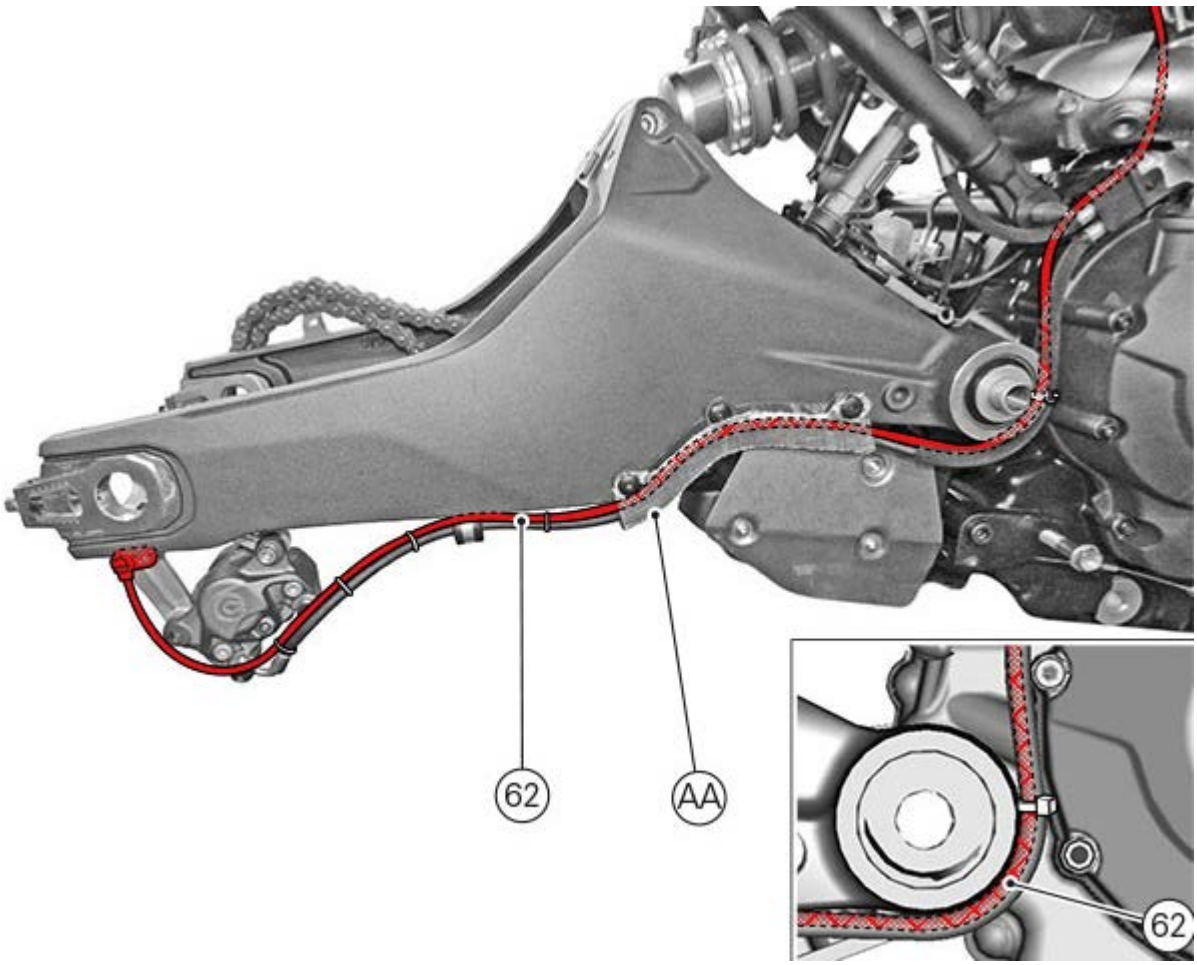


Tie rear stop light cable (62) and the relevant branch to the rear brake master cylinder hose (AB).





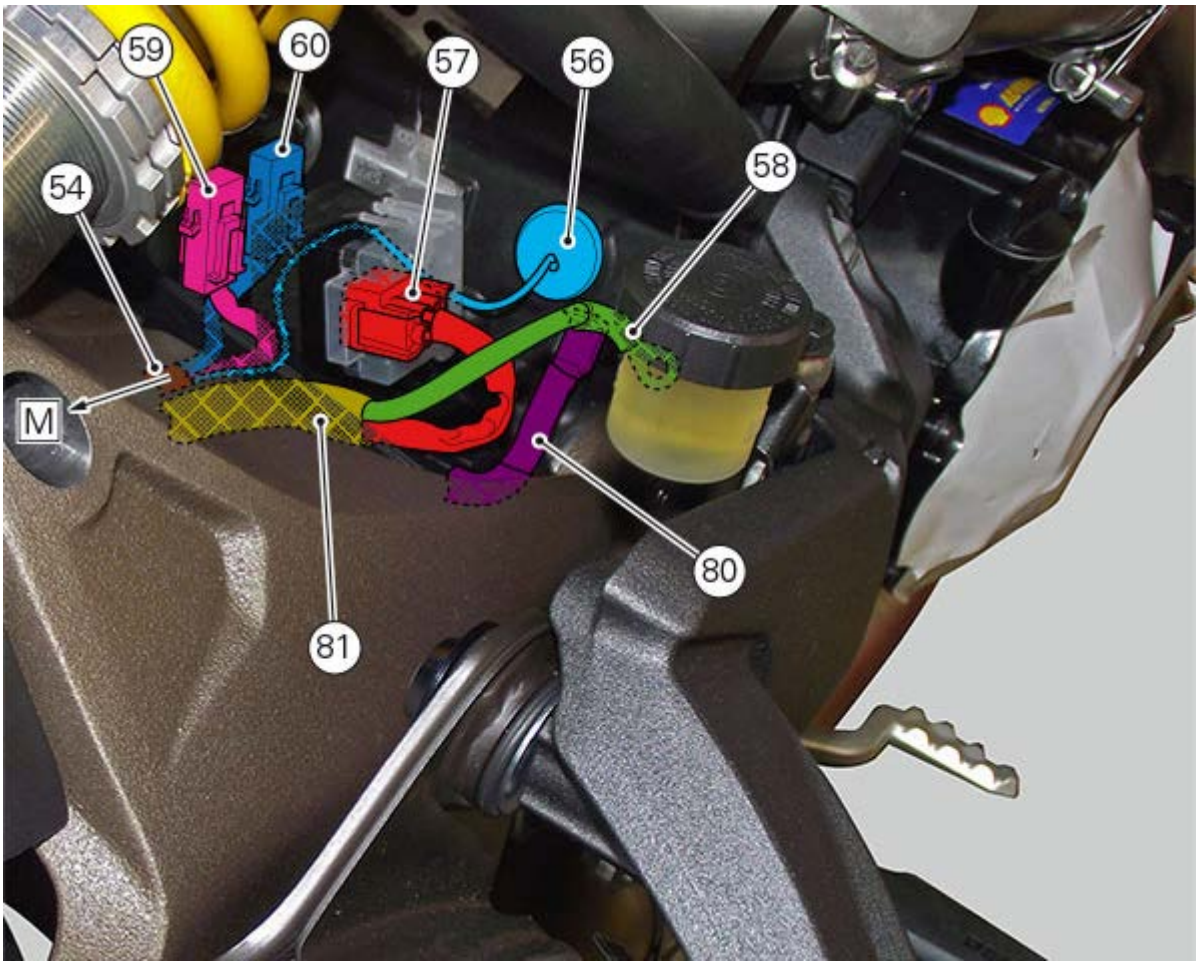
Tie rear speed sensor cable (62) to the rear brake calliper hose, where indicated.
Fasten the rear speed sensor cable (62) and the rear brake master cylinder hose to the hose passage (AA).

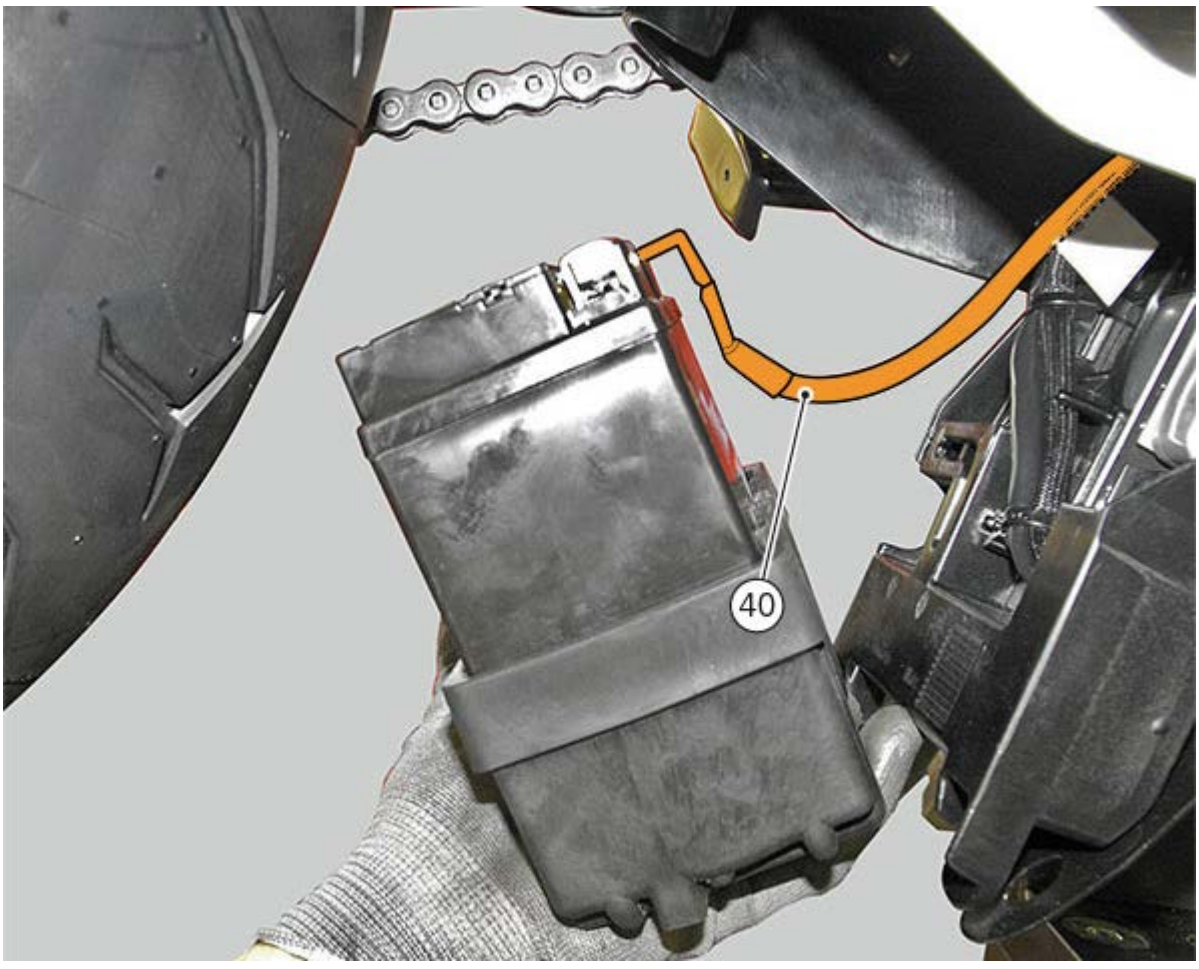


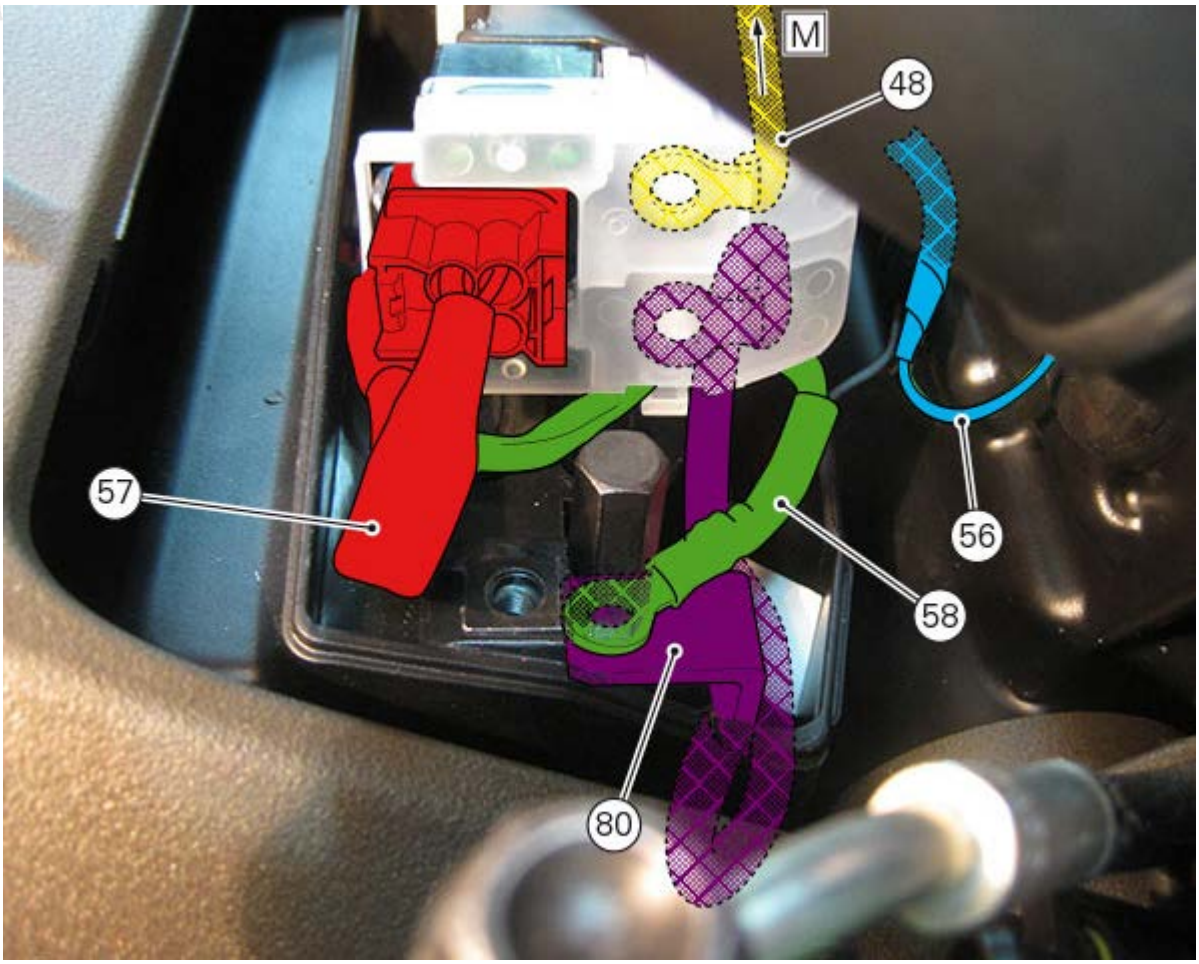
For the complete index of the wirings, divided by tables, refer to chapter "Routing of wiring on frame".

Table P

Electrical component box: solenoid starter, battery





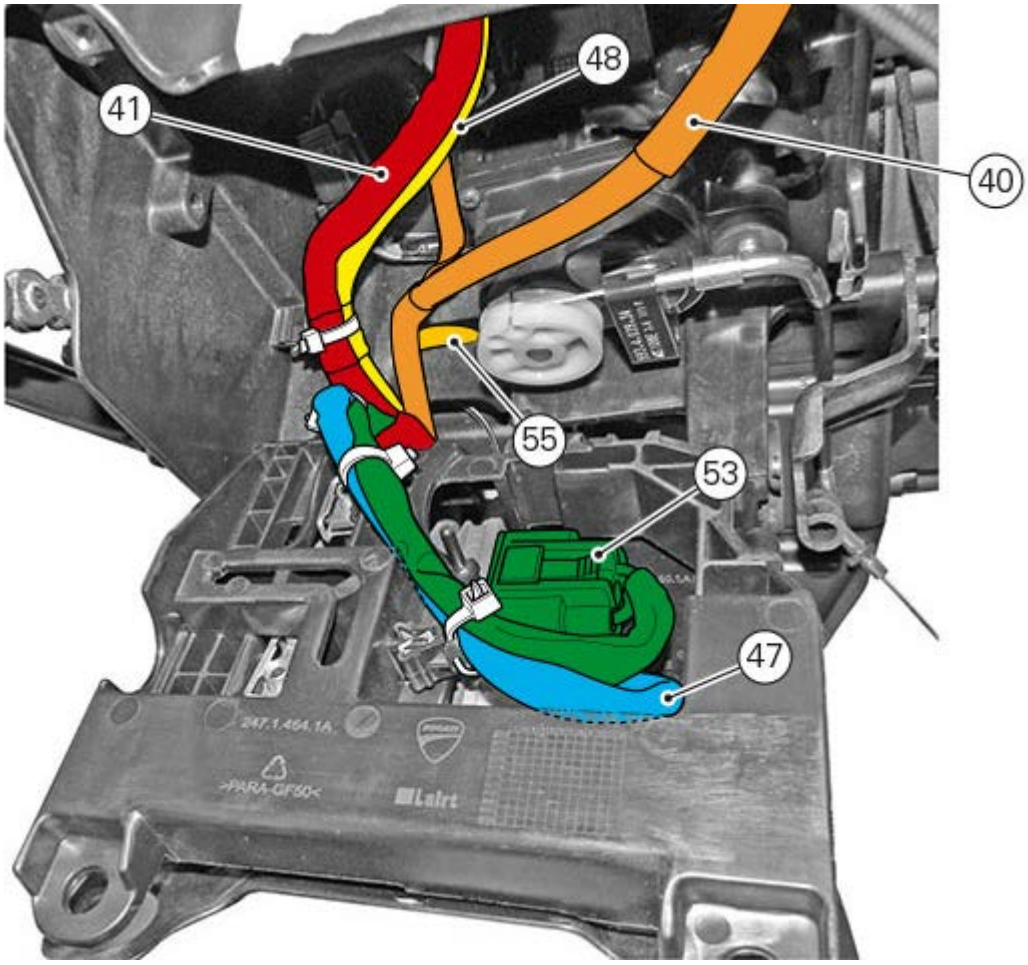


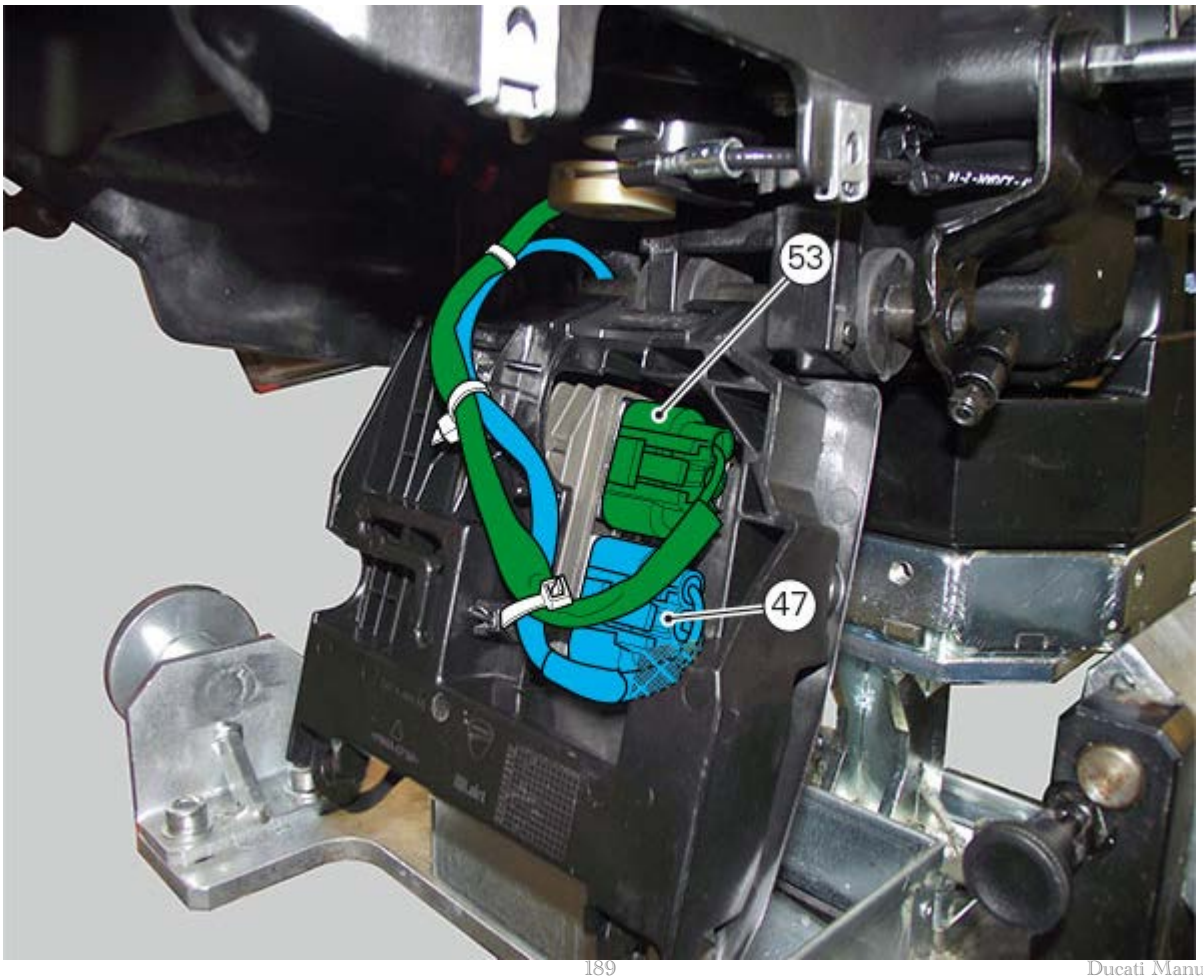
For the complete index of the wirings, divided by tables, refer to chapter "Routing of wiring on frame".

Table O

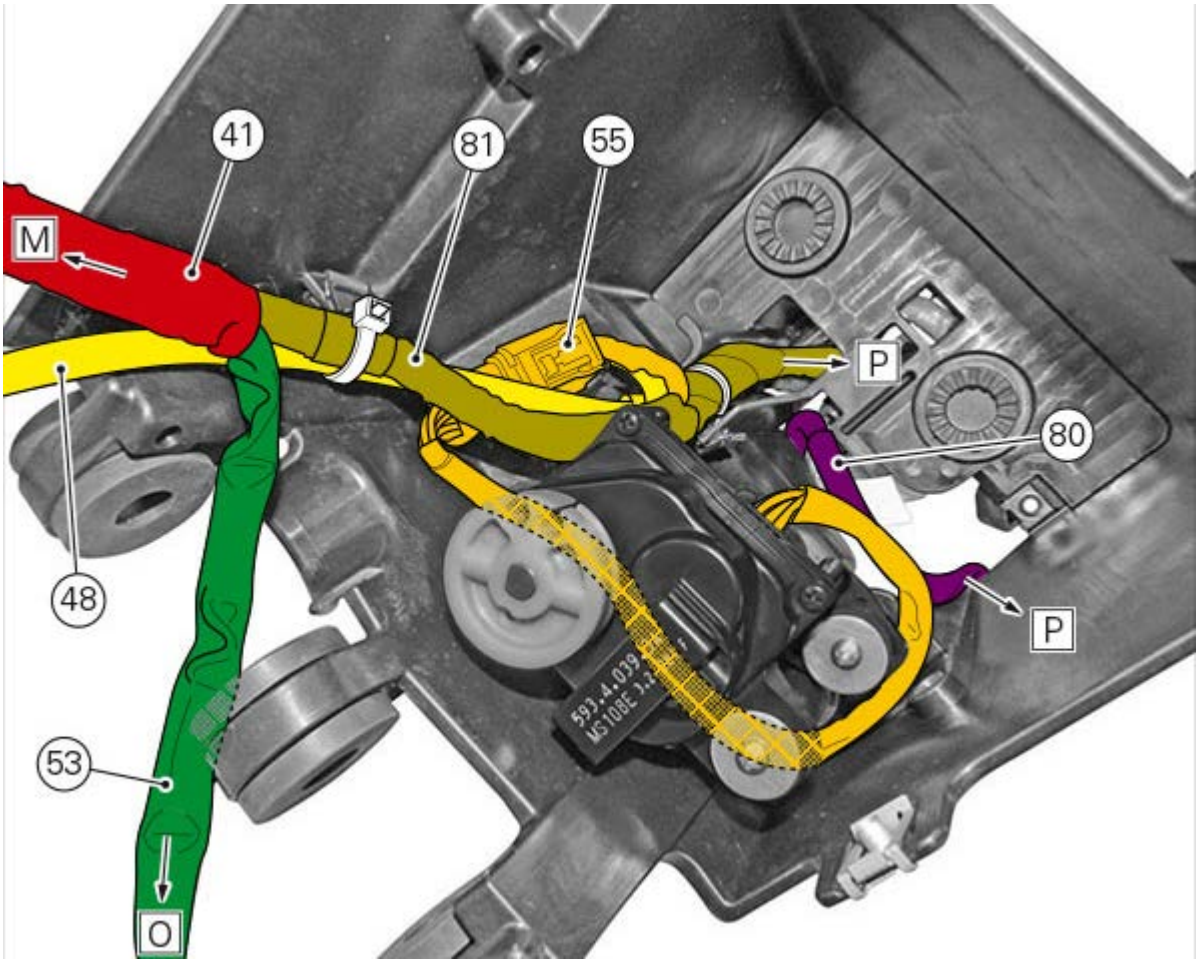
Electrical component compartment and box

Tie together the voltage regulator wiring (53) and the generator cable (47), where indicated.





Electrical components box

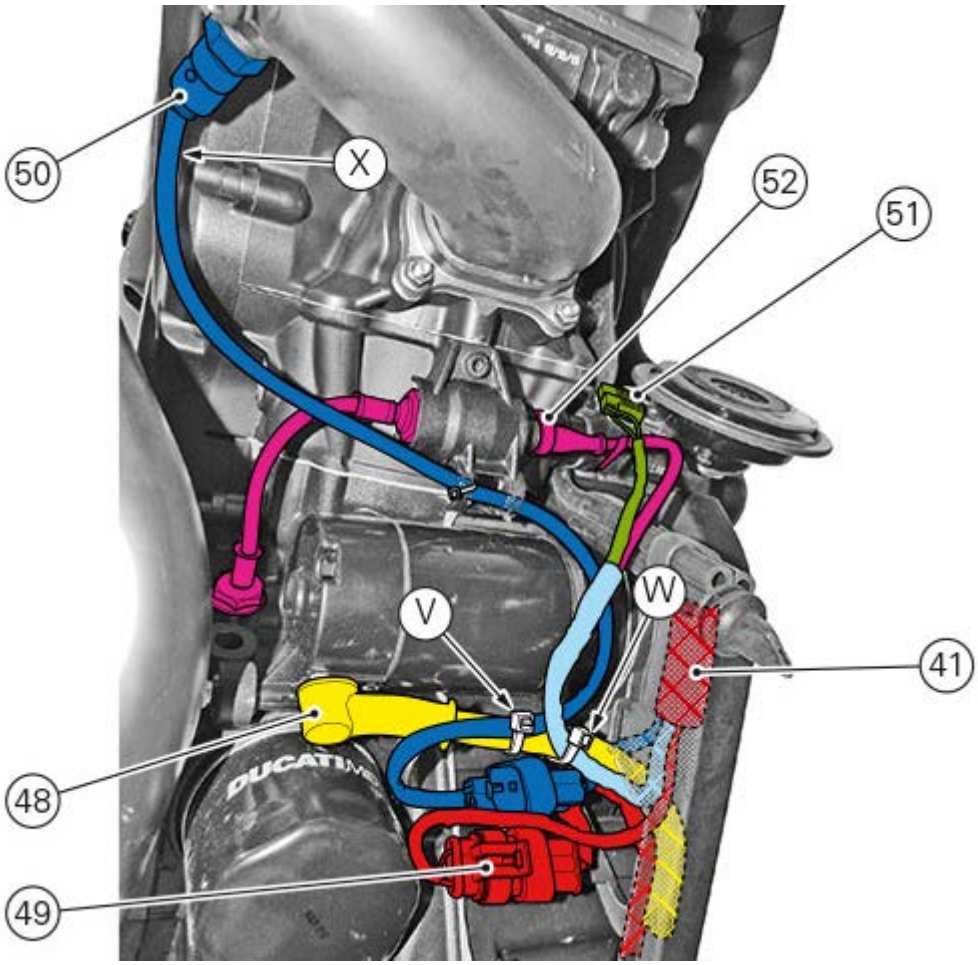


For the complete index of the wirings, divided by tables, refer to chapter "Routing of wiring on frame".

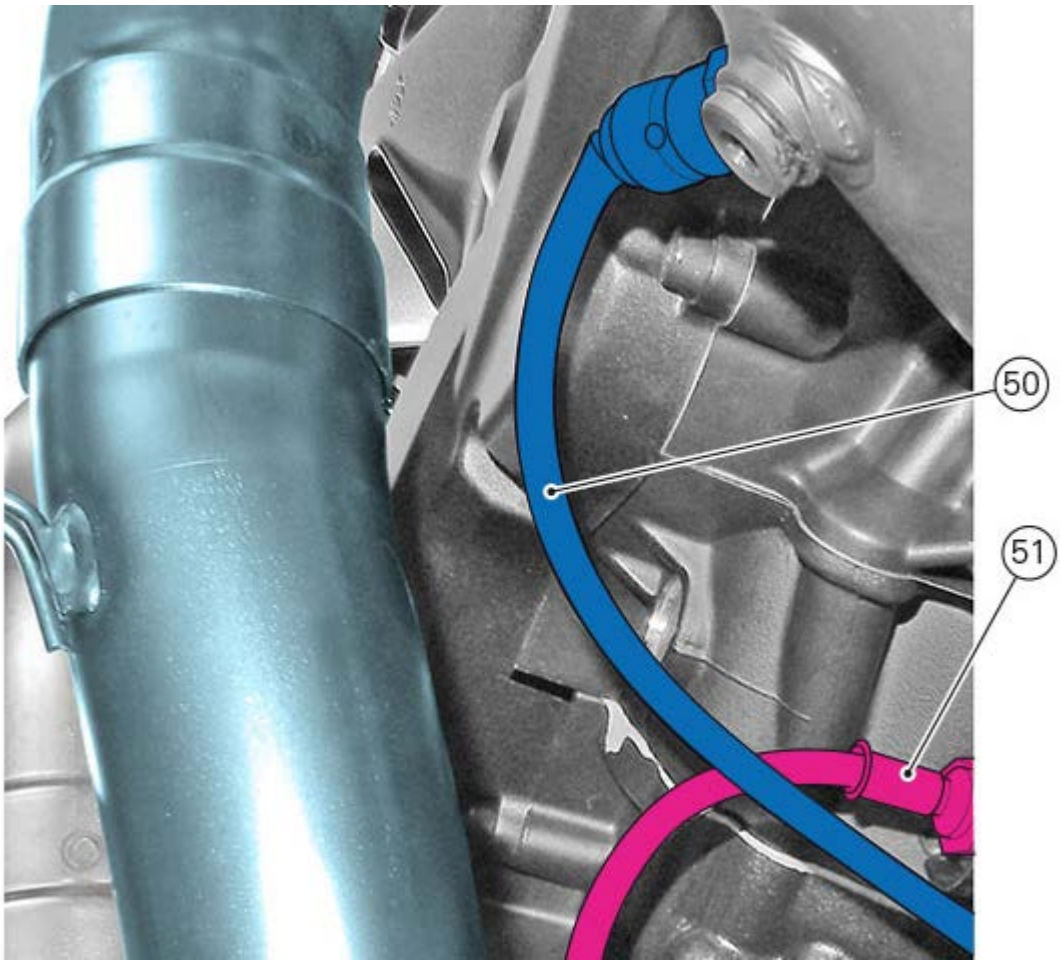
Table N

Lower/front cable passage

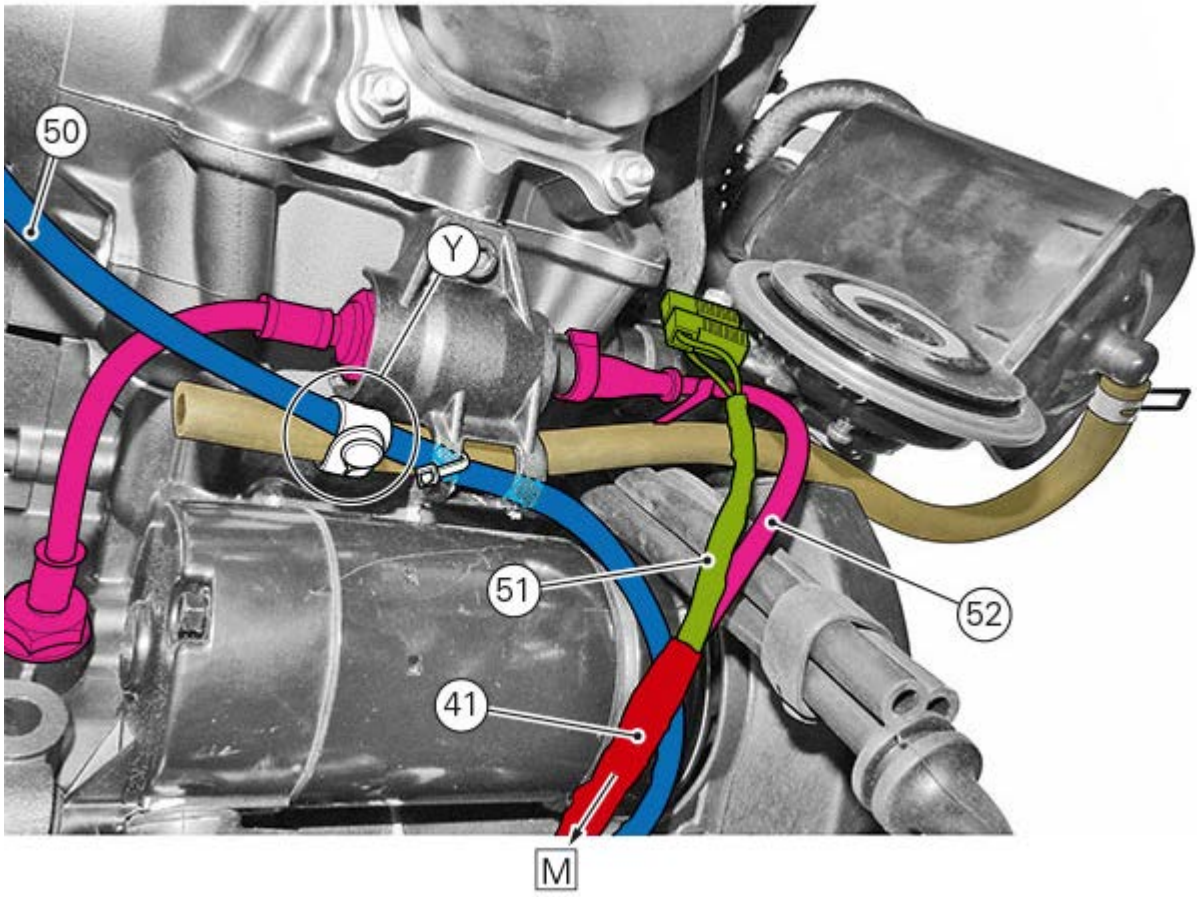
(V): tie the starter motor cable (48) to the lambda sensor cable (50);
(W): tie to the starter motor cable (48), the horn and pressure switch wiring branch (41);
(X): the cable sheath of the horizontal cylinder lambda sensor (50) must be brought as close as possible to the lambda sensor.



Attention
FOR SAFETY REASONS, THE LAMBDA SENSOR CABLE MUST BE KEPT DISTANT FROM THE EXHAUST WITHOUT BEING TOO MUCH TENSIONED.



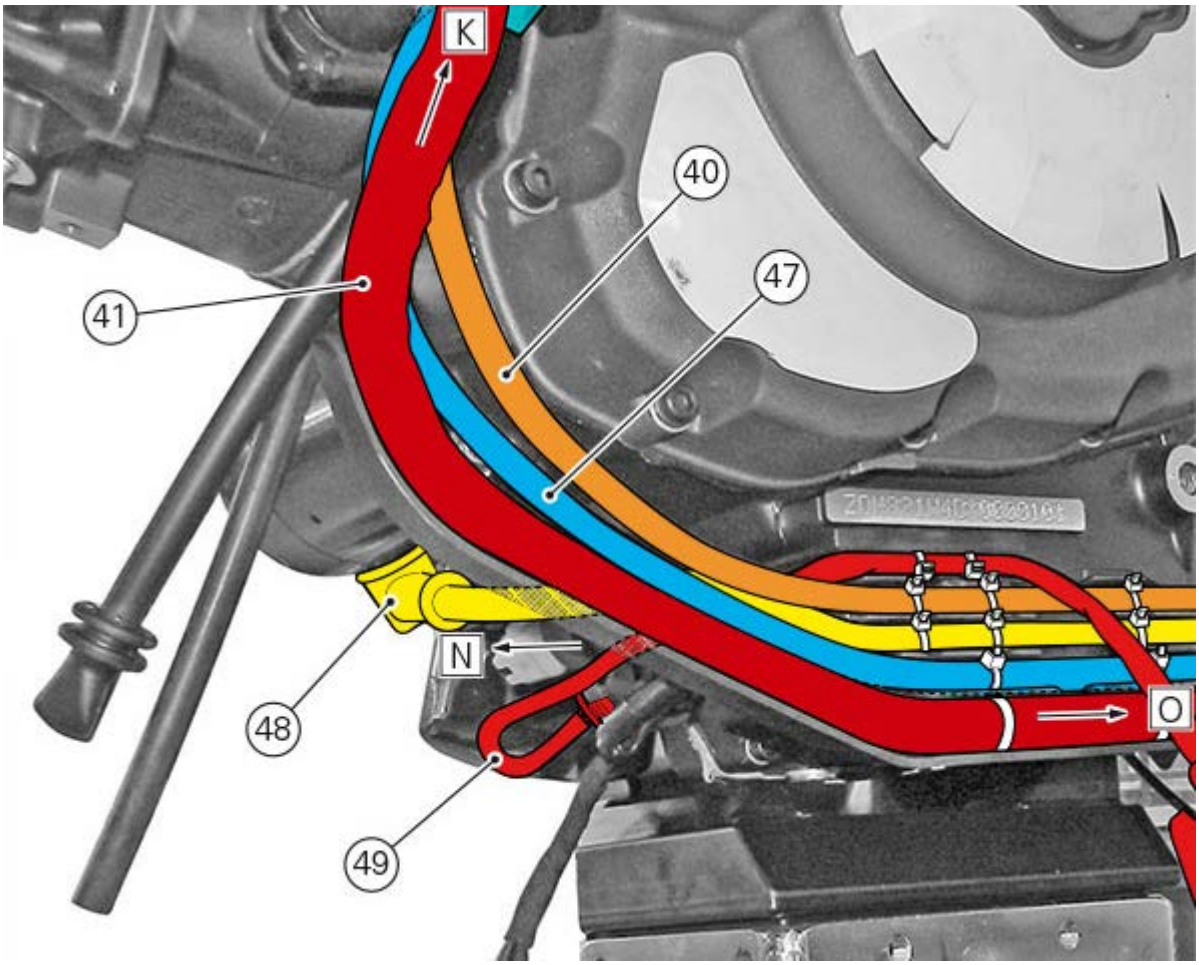
USA VERSION
(Y): tie the still air hose with the lambda sensor cable (50) of the horizontal cylinder.

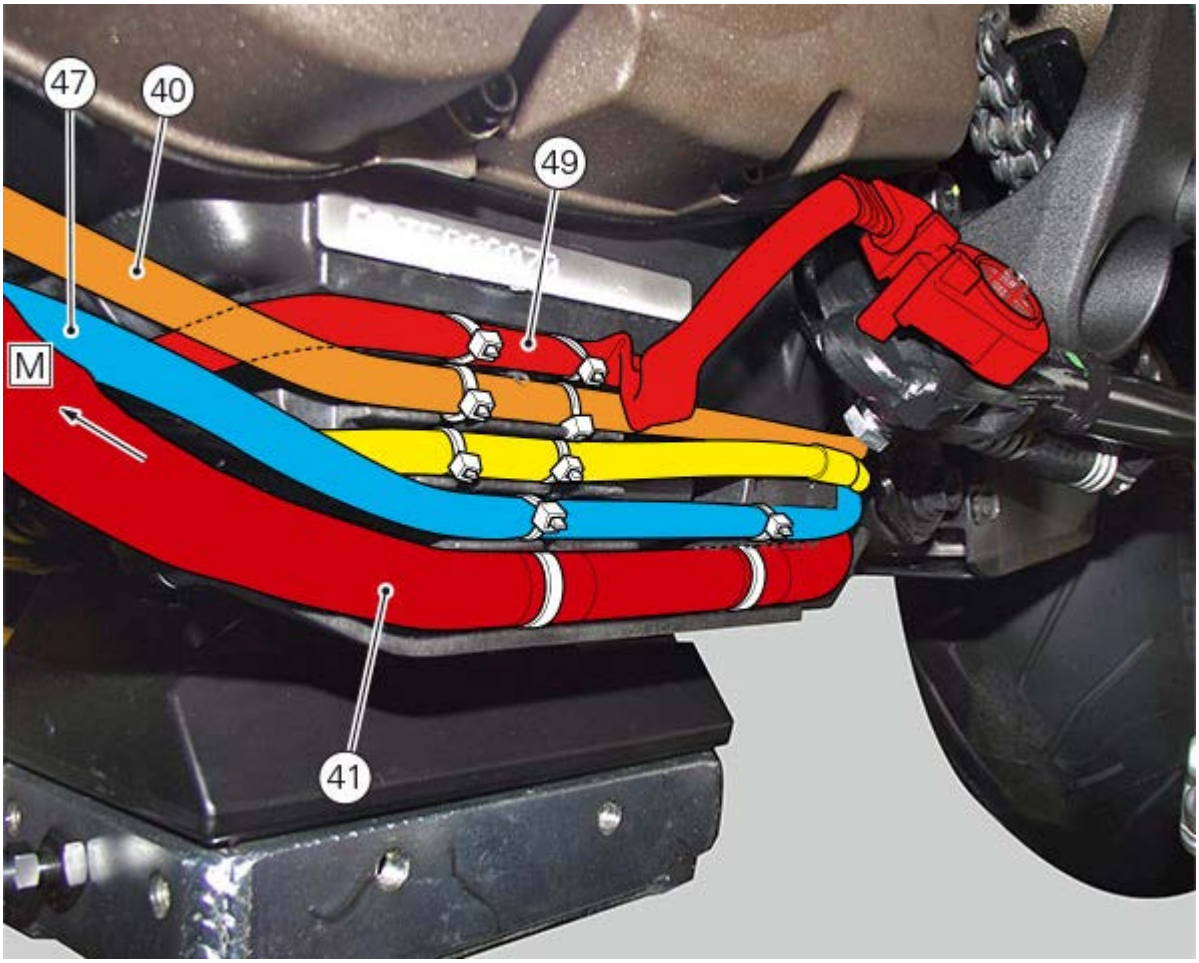


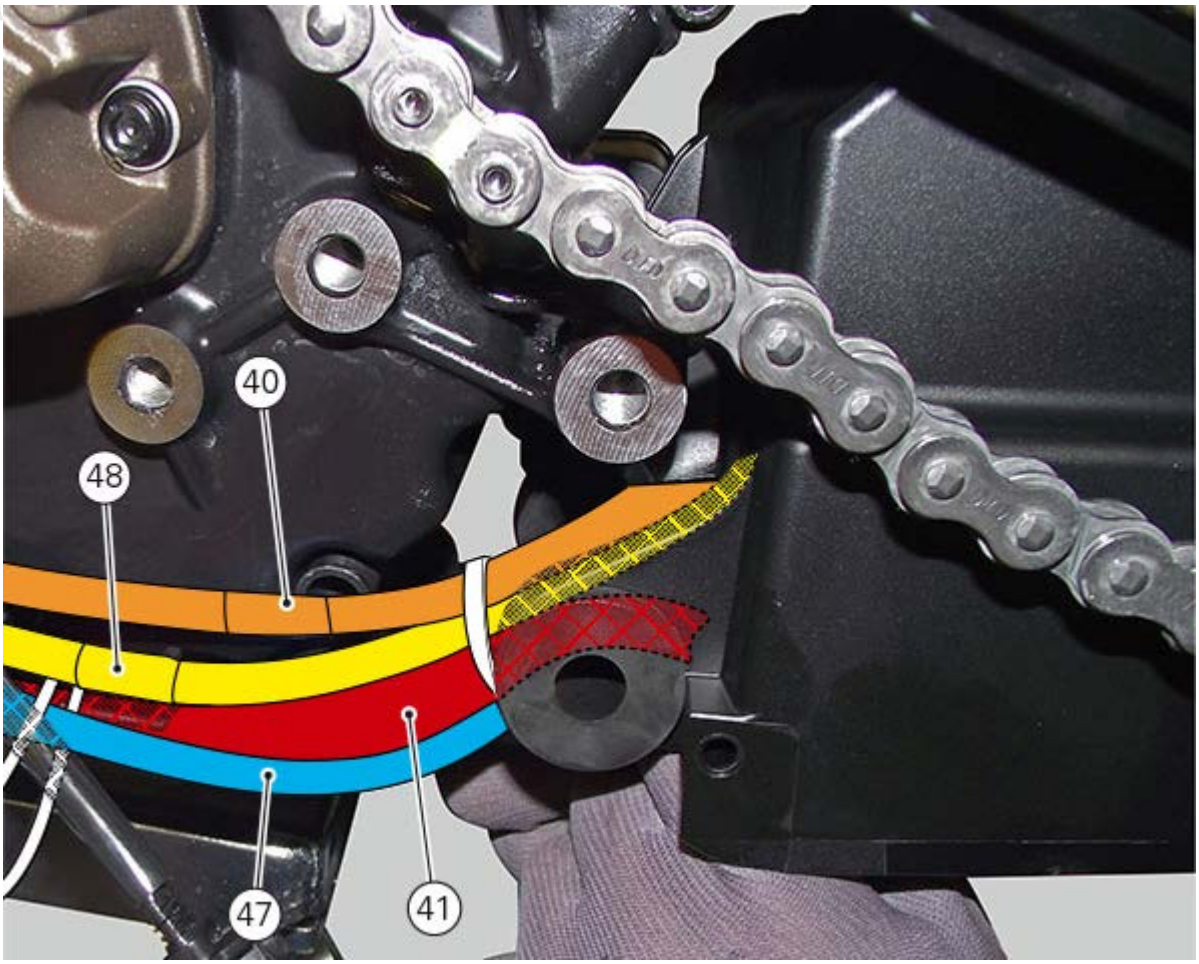
For the complete index of the wirings, divided by tables, refer to chapter "Routing of wiring on frame".

Table M

Crankcase LH / lower cables



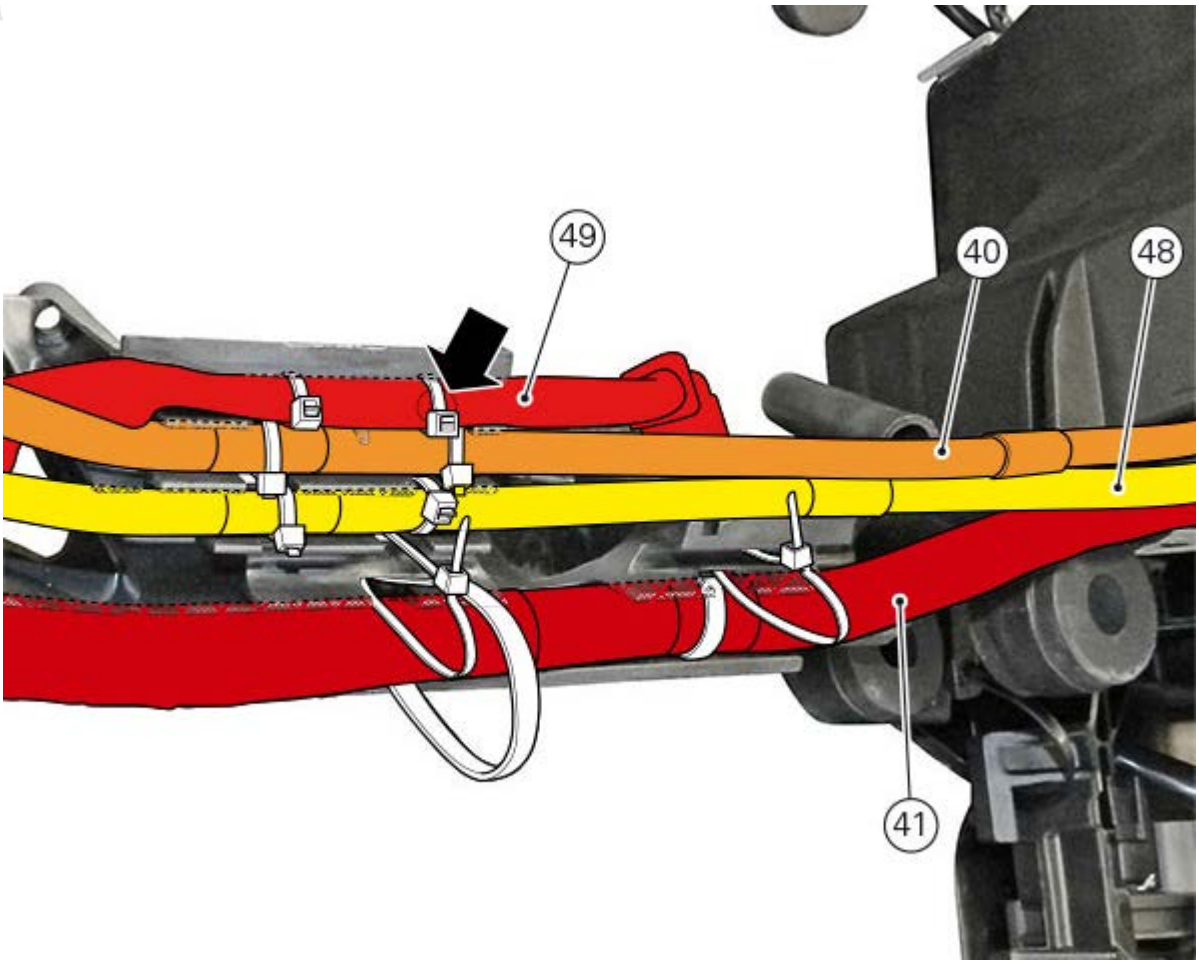




Six ties fasten the side stand sensor cable (49), the battery negative cable (40) and the starter motor solenoid starter cable (48) against the lower side body panel.

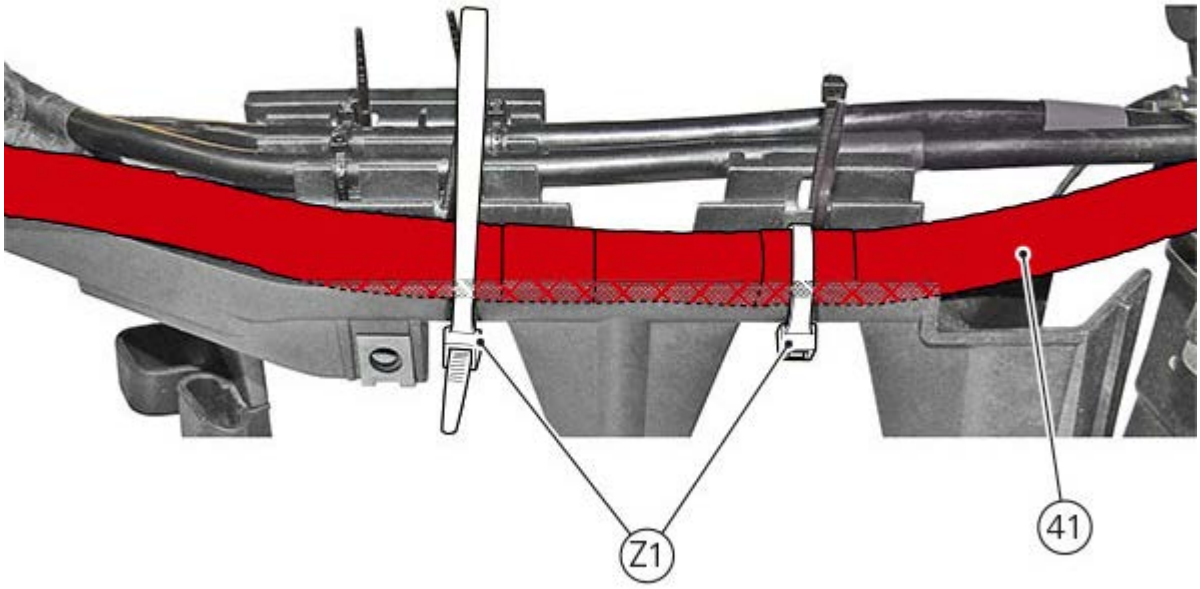
Note

Tie the side stand sensor cable in the marked point.

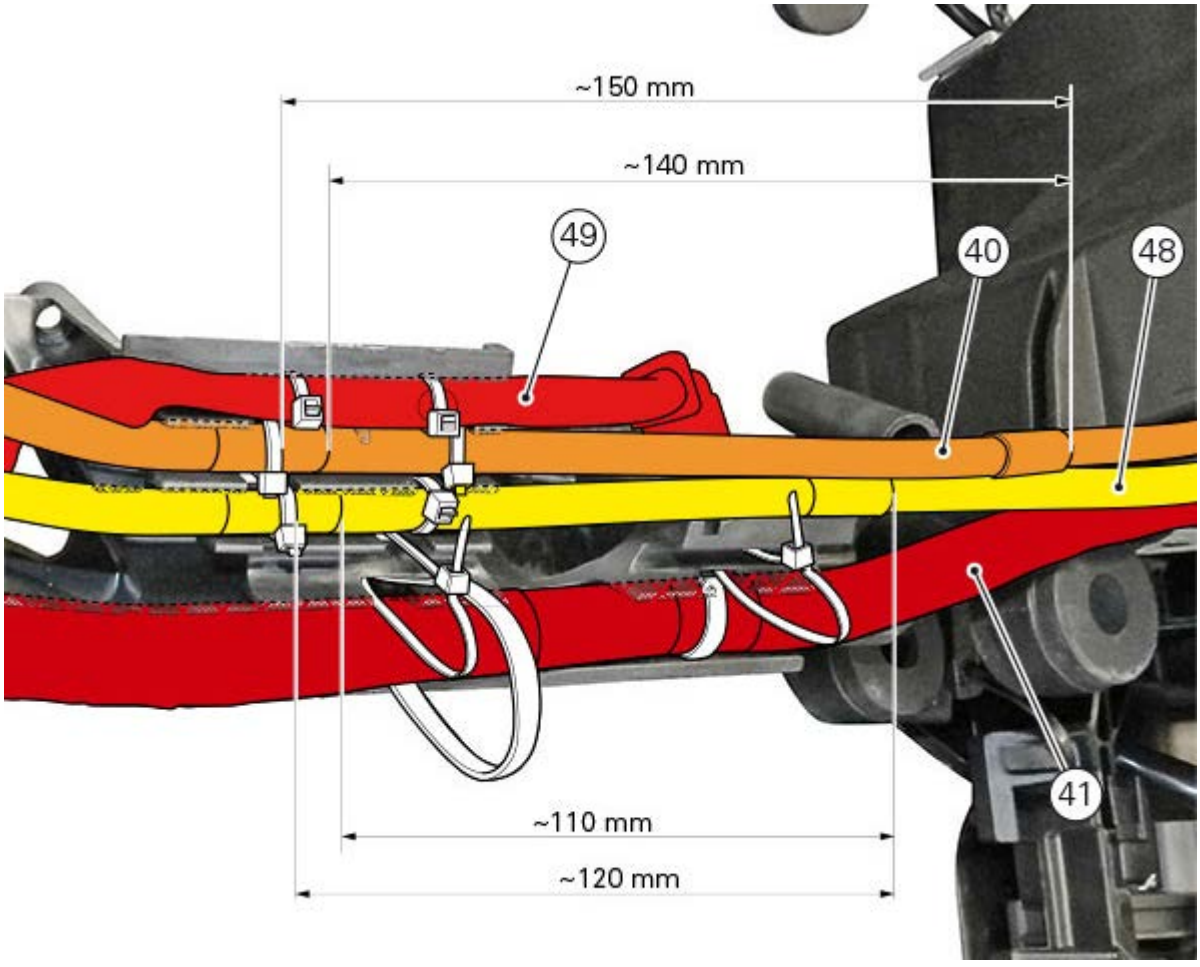


Two ties (Z1) fasten the main wiring (41) to the lower side body panel.

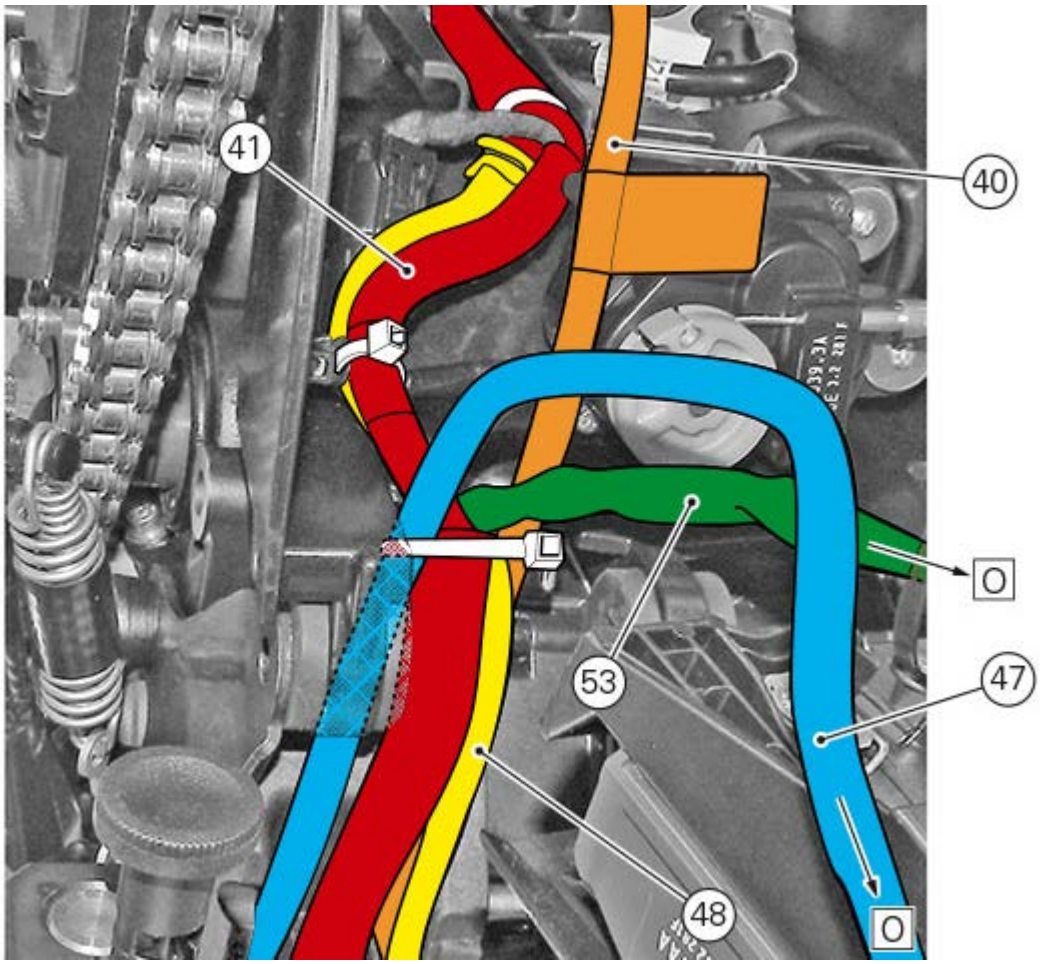
Warning
Aim tie closure as shown in the figure.



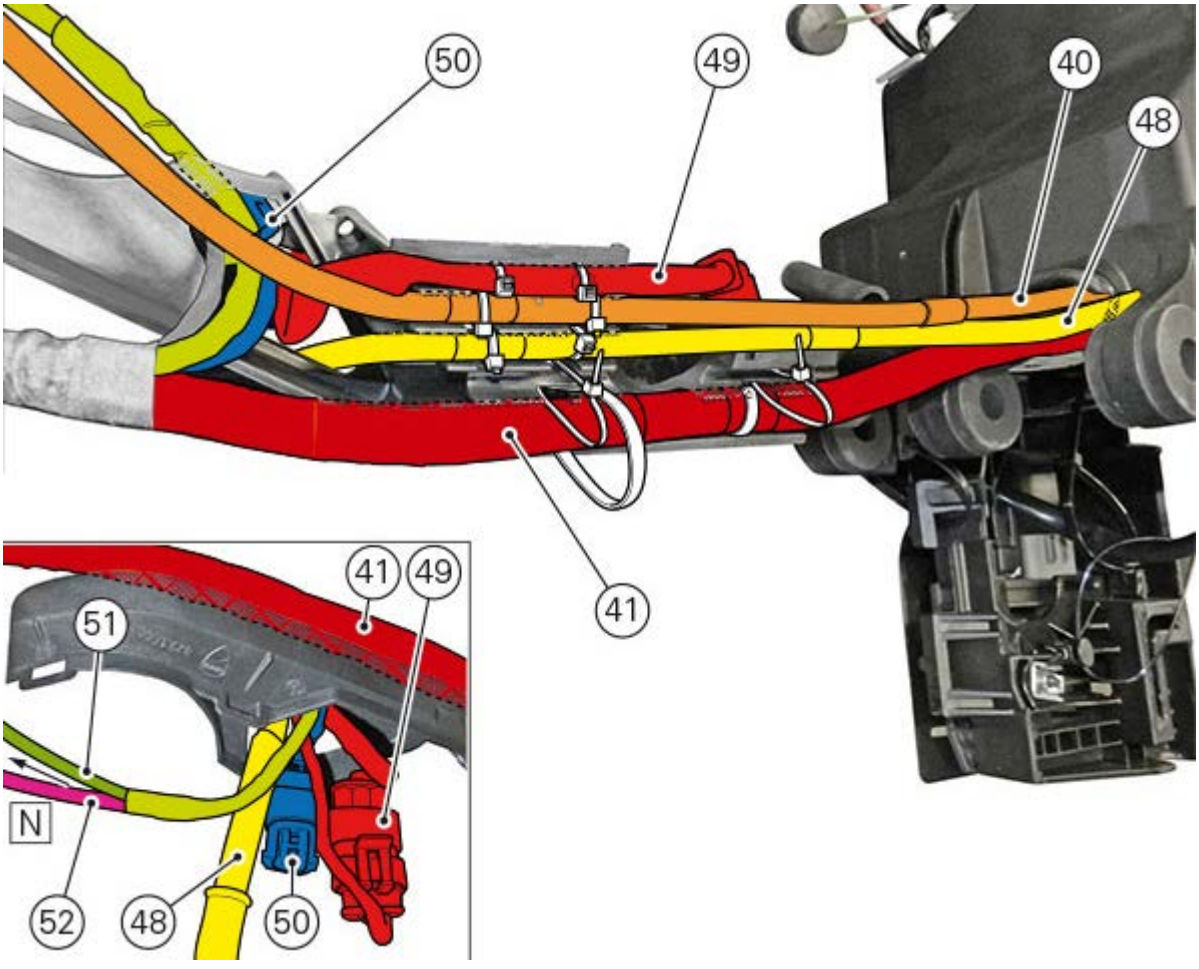
Make sure to respect the distance between the ties of side body panel indicated in the figure.



Tie main branch (41), generator cable (47), battery negative cable (40) and starter motor/solenoid starter cable (48) to the electrical component box.



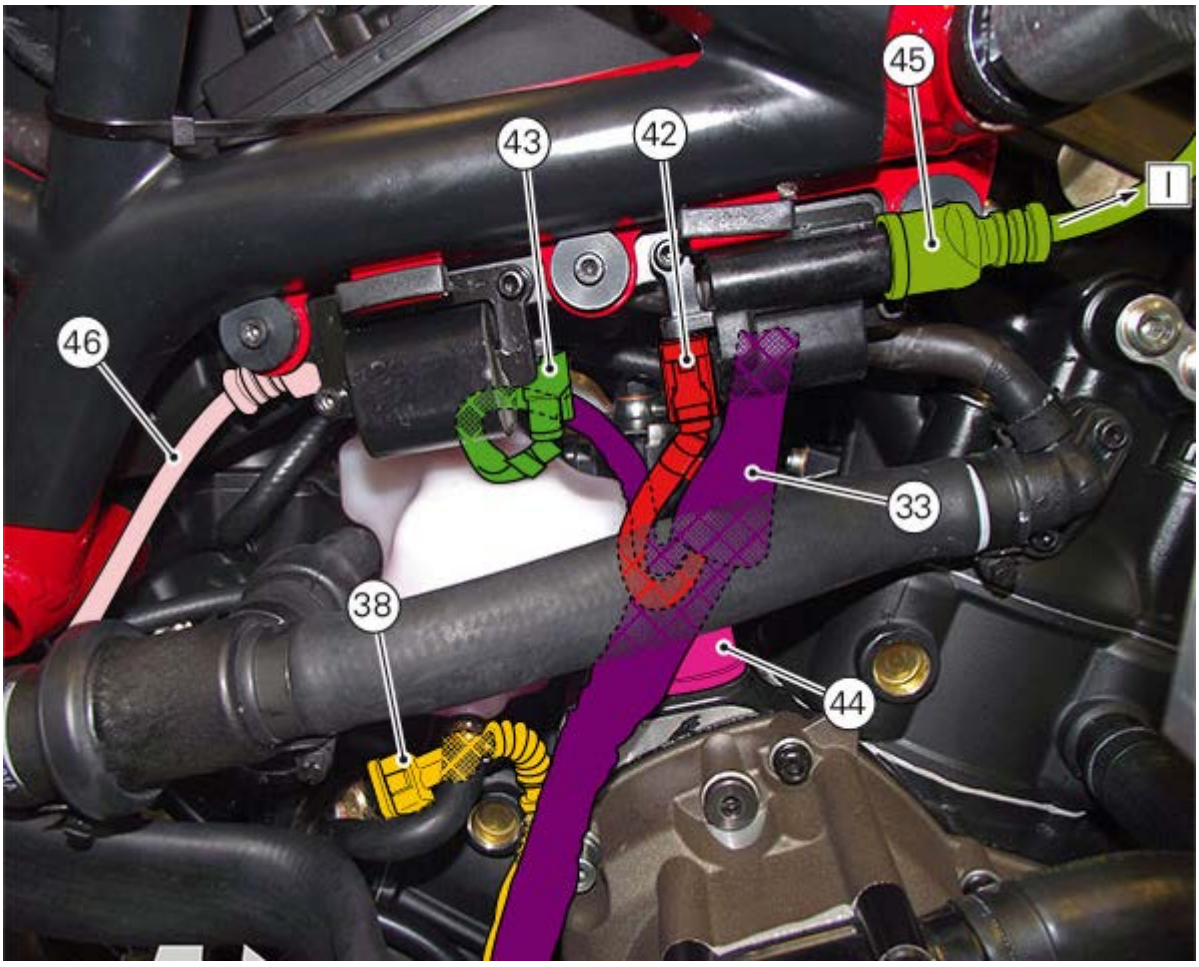
Route the indicated wirings in the relevant support opening, as indicated.

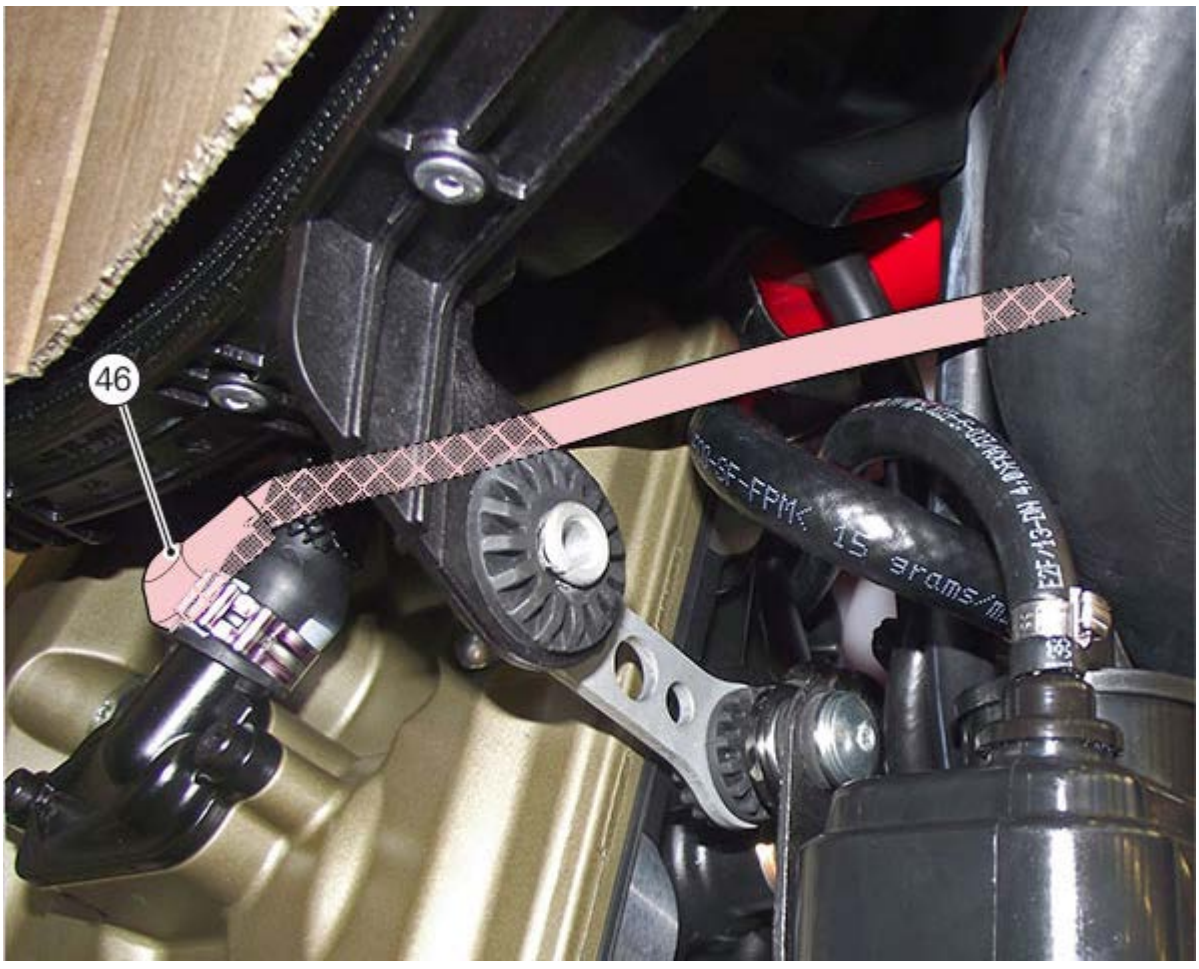


For the complete index of the wirings, divided by tables, refer to chapter "Routing of wiring on frame".

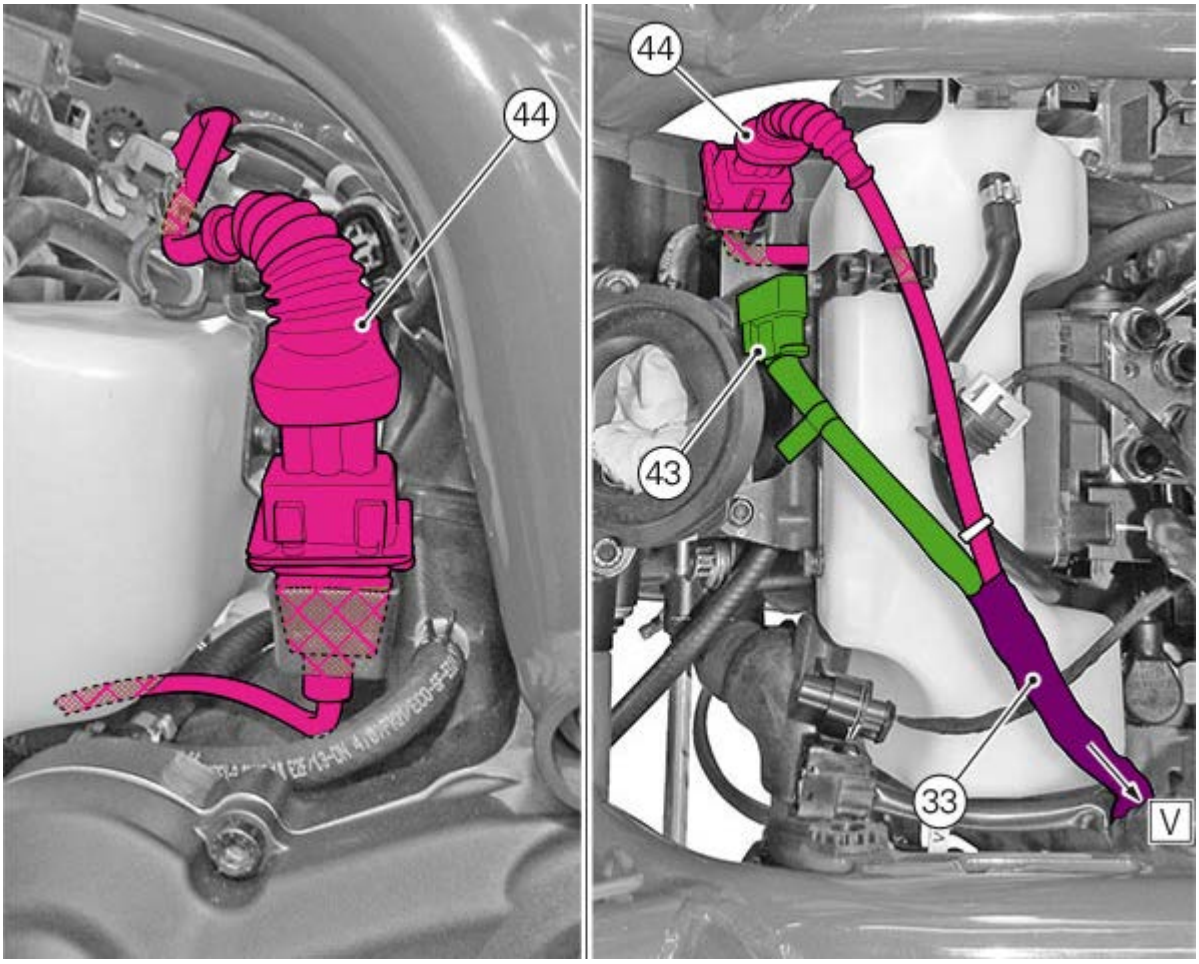
Table L

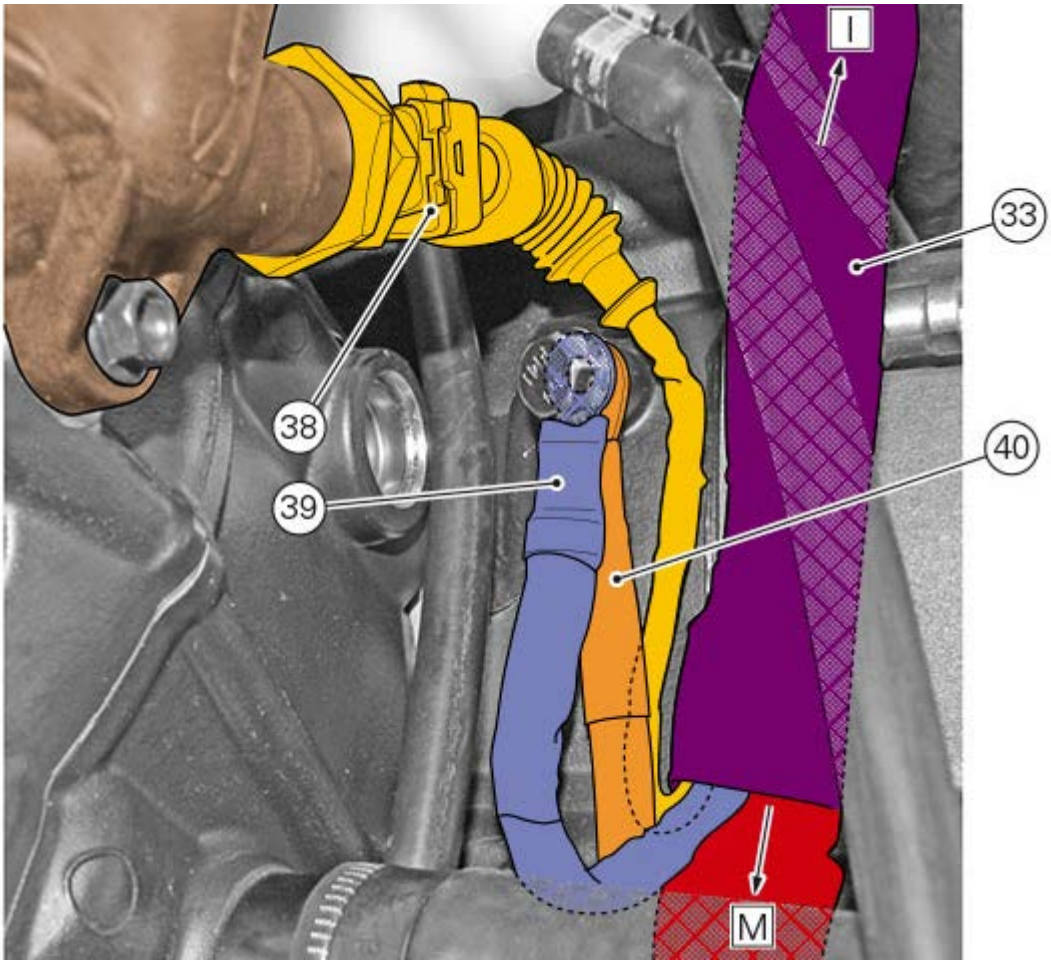
LH side wiring branch: coils, pick-up





Tie the pick-up wiring (44) to the expansion reservoir, by orienting the tie closing towards the reservoir. Close the tie without squeezing the expansion reservoir hose.

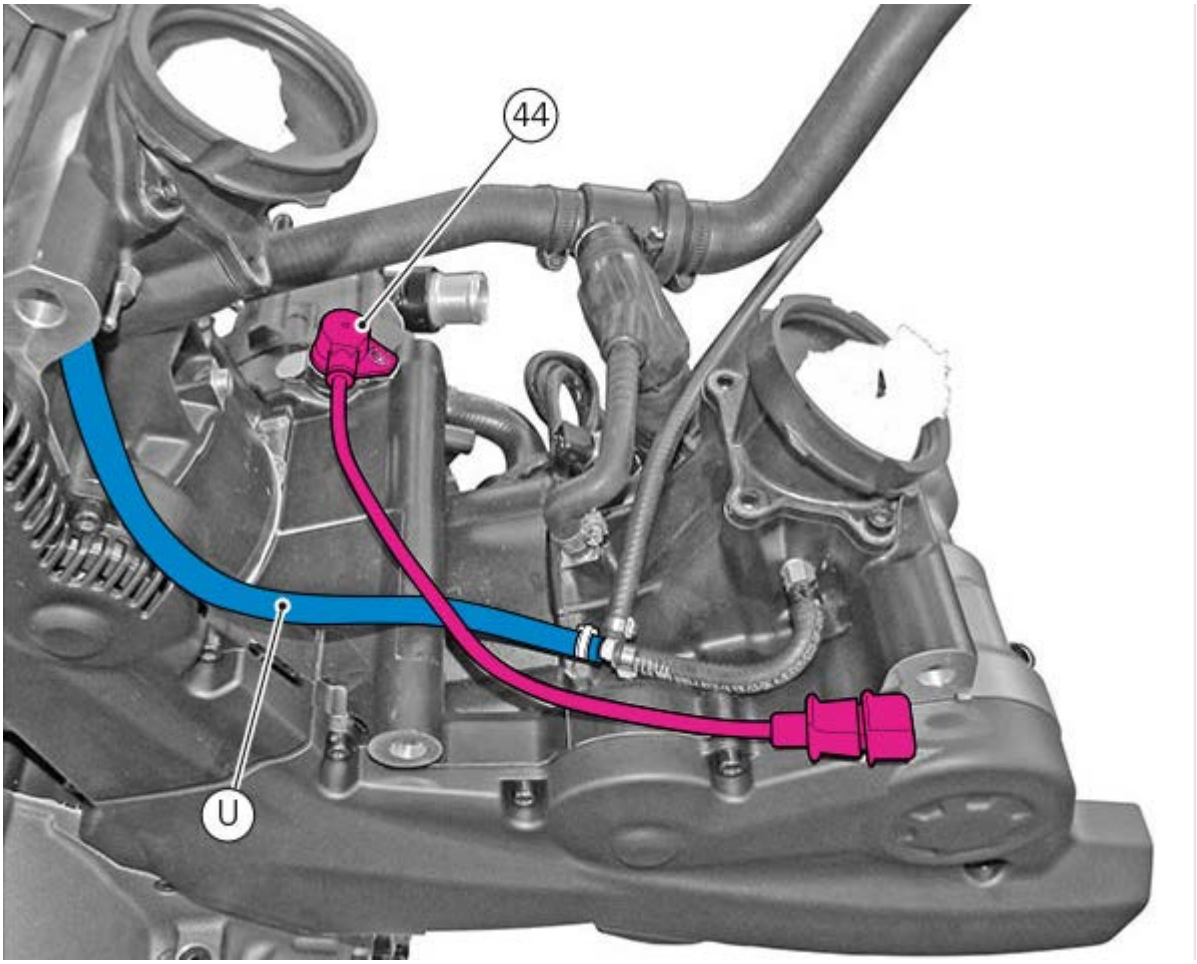




USA VERSION

Warning

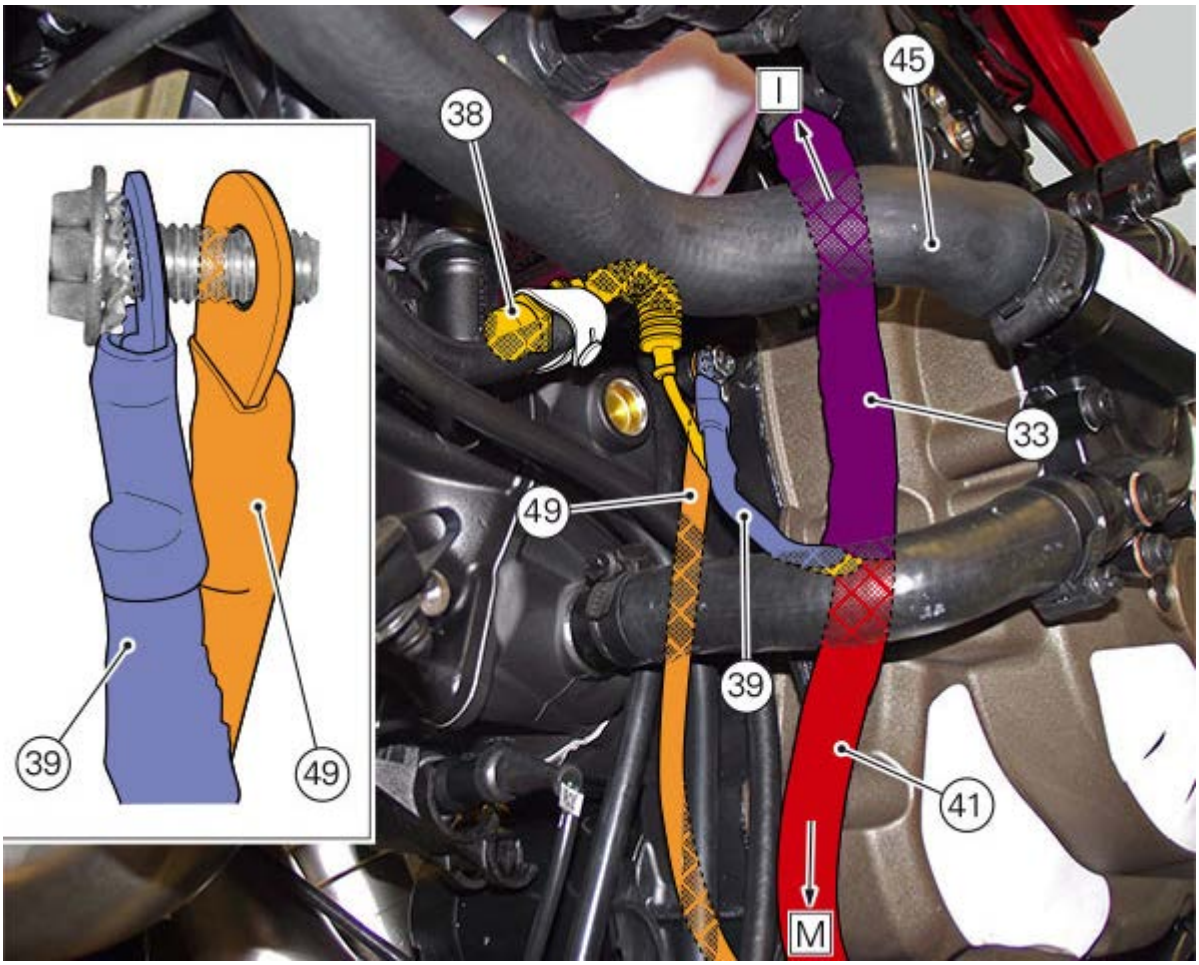
The pick-up cable must pass over the canister pipes.



For the complete index of the wirings, divided by tables, refer to chapter "Routing of wiring on frame".

Table K

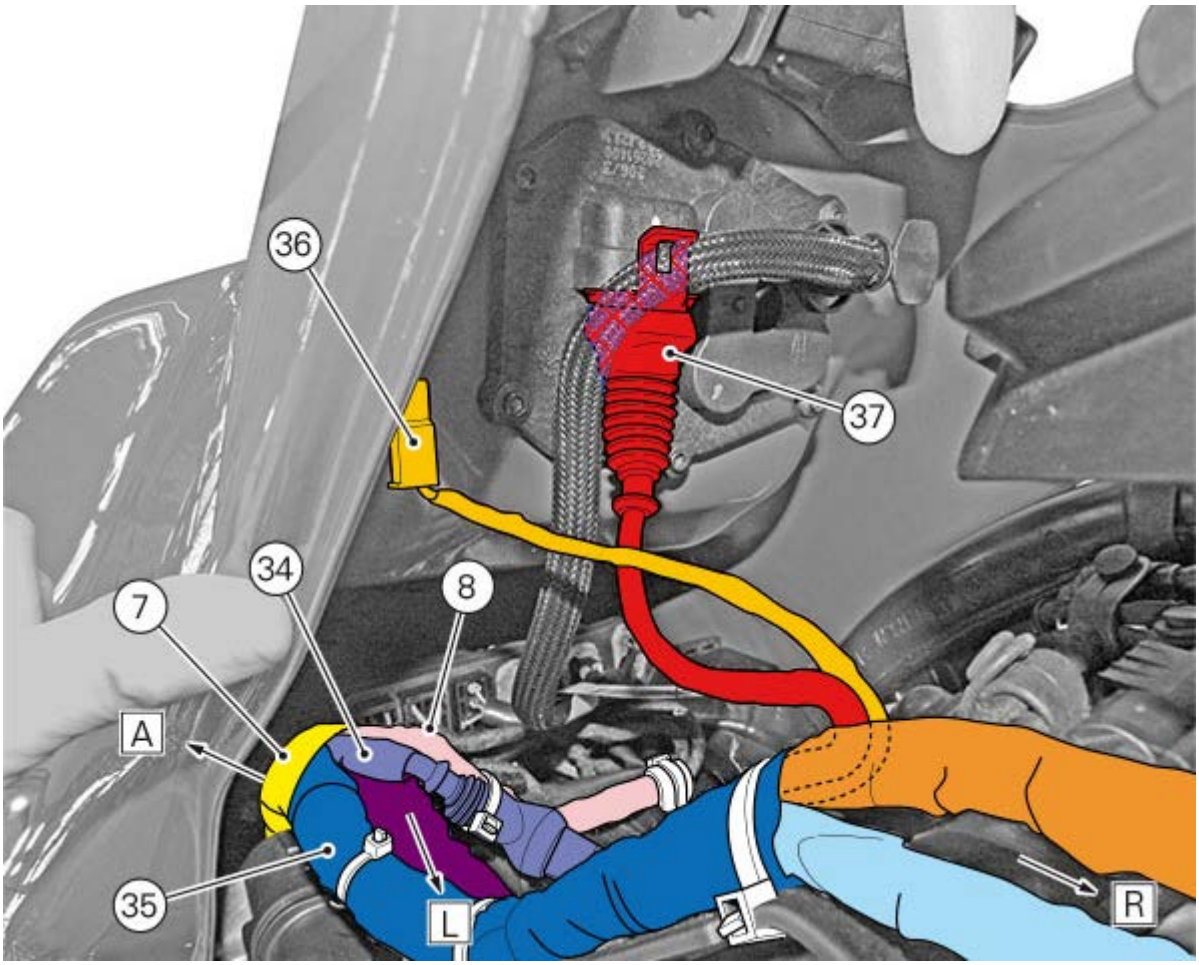
Vertical head LH side wiring branch: temperature and ground sensor



For the complete index of the wirings, divided by tables, refer to chapter "Routing of wiring on frame".

Table J

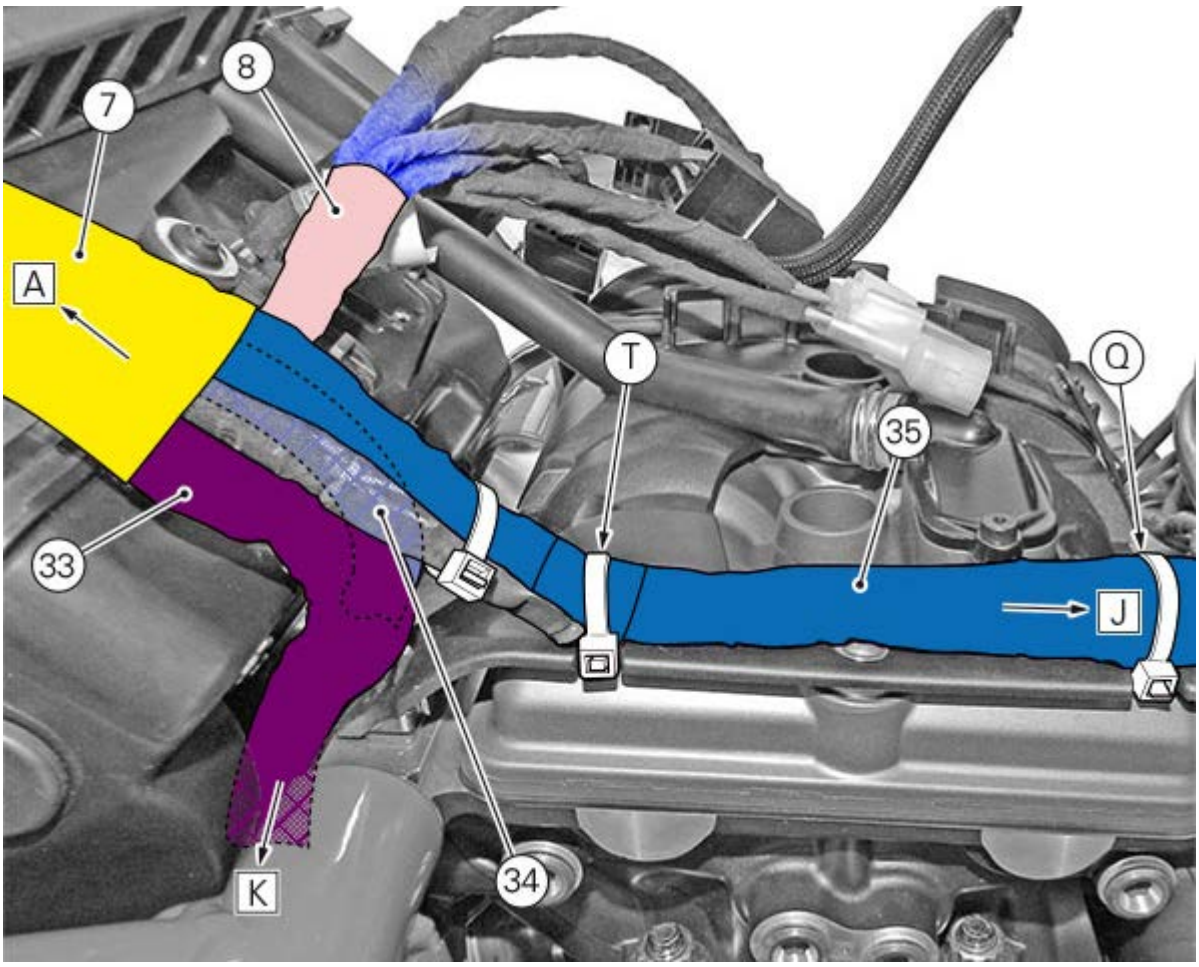
Tank ground and fuel pump wiring

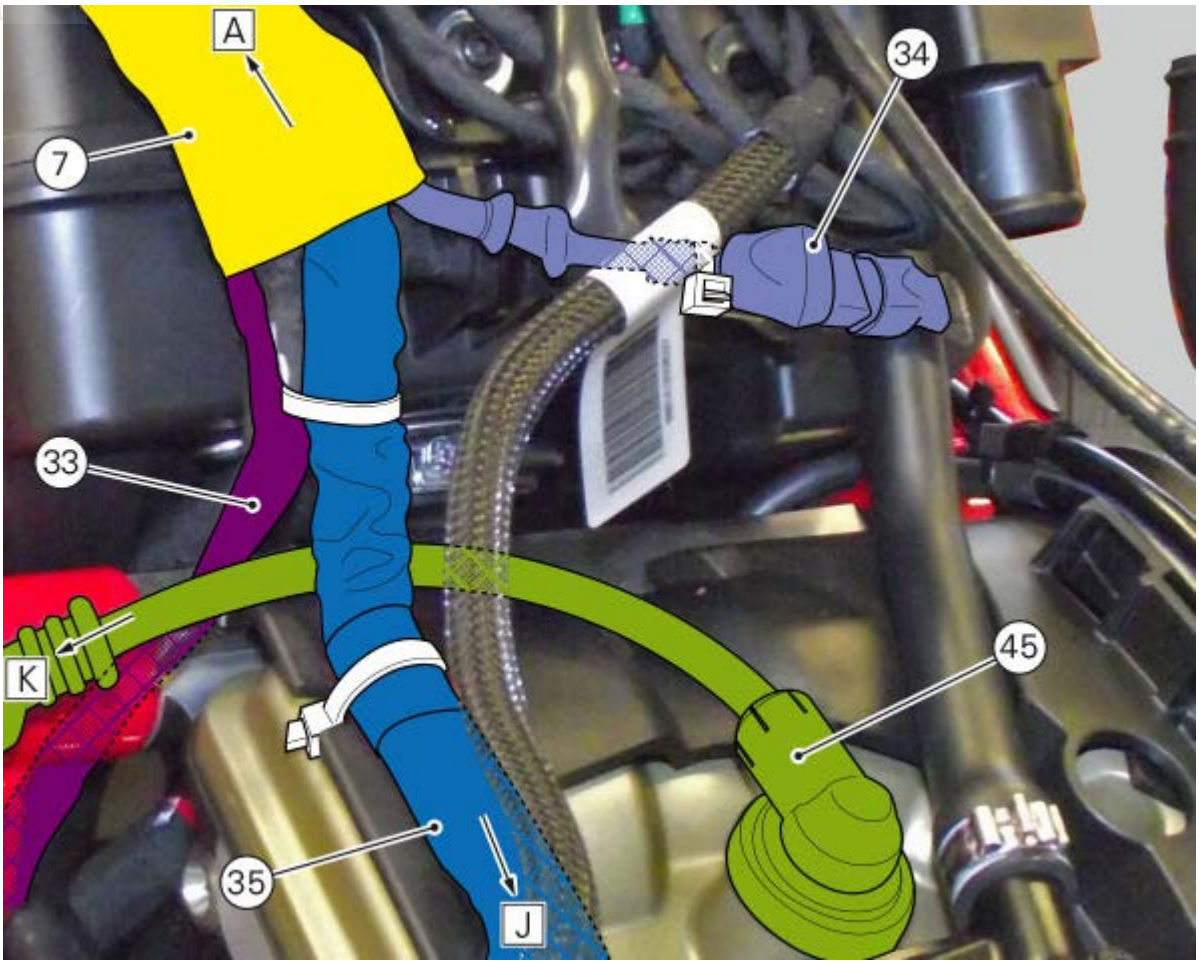


For the complete index of the wirings, divided by tables, refer to chapter "Routing of wiring on frame".

Table I

Vertical head LH side wiring branch
T: Zero point of the vehicle electric system.
Use two ties to fasten the rear branch (35) to the vertical head cover, positioning the tie closure as indicated in the figure.

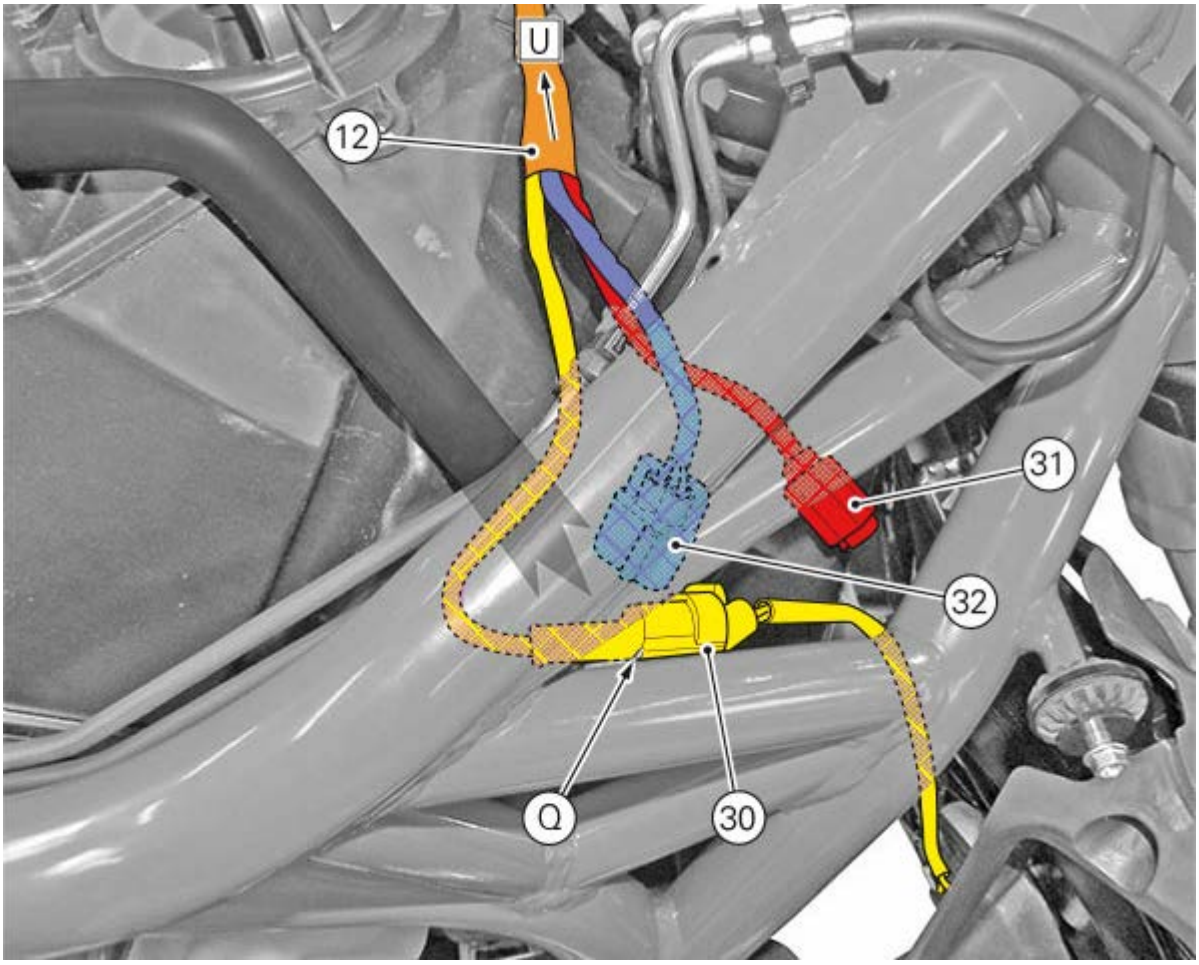




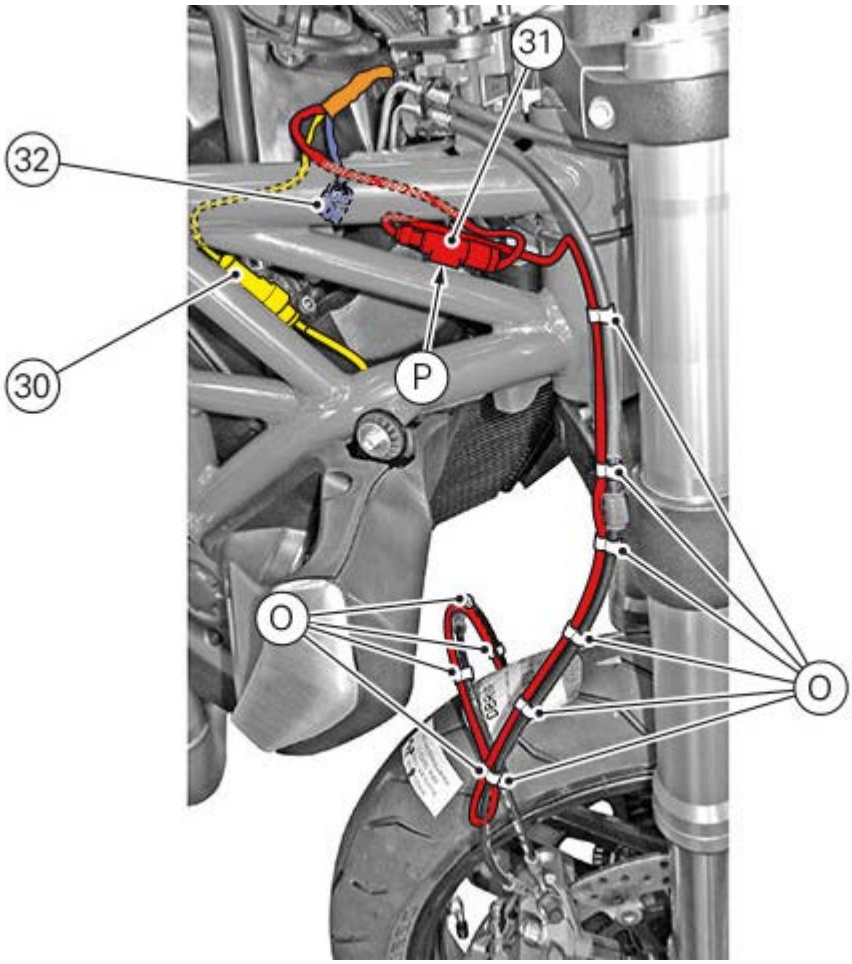
For the complete index of the wirings, divided by tables, refer to chapter "Routing of wiring on frame".

Table H

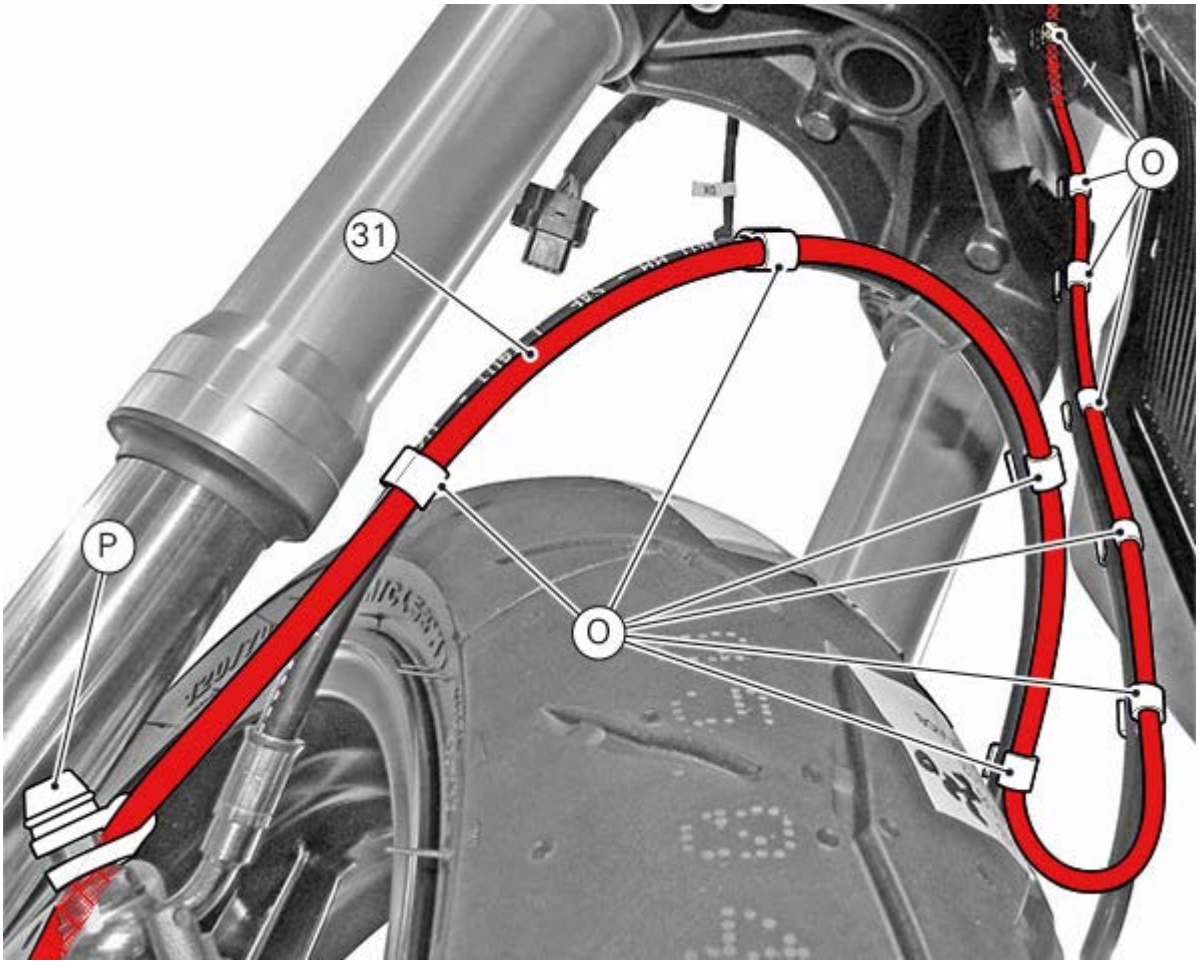
Front RH wiring branch
Engage RH fan connector (30) to tab (Q) on the frame.

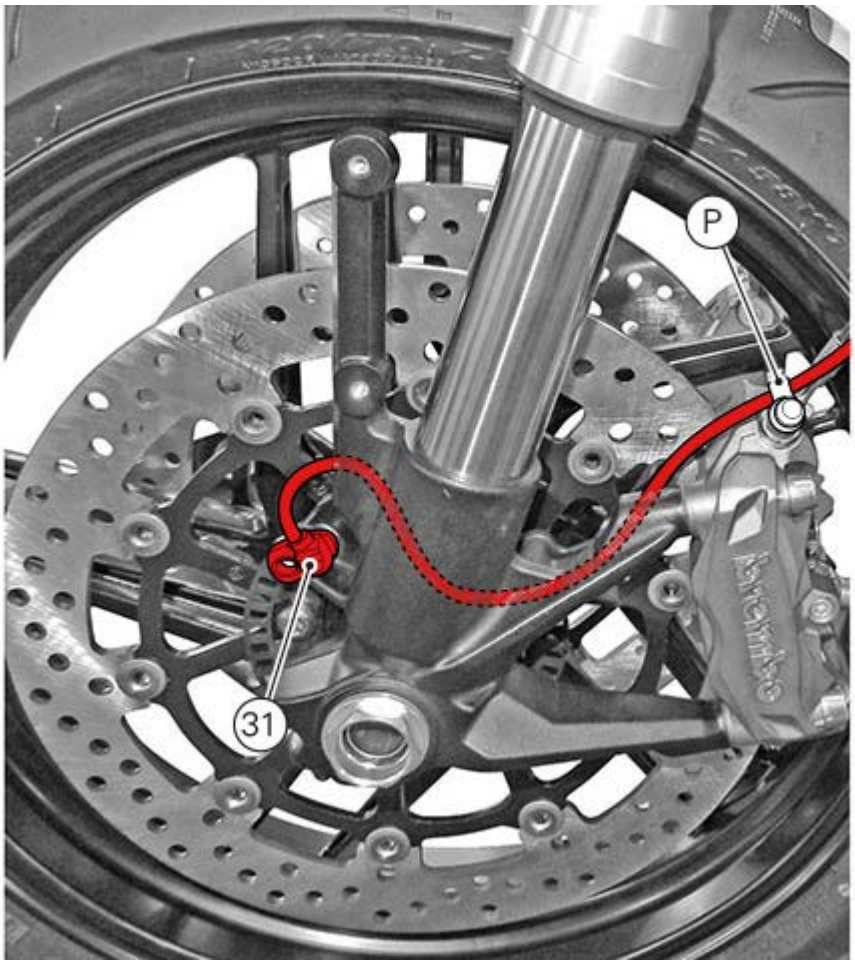


Engage speed sensor connector (31) to tab (R) on the frame.
Fasten the speed sensor cable (31) to the front brake hose through the ten indicated cable rings (O).

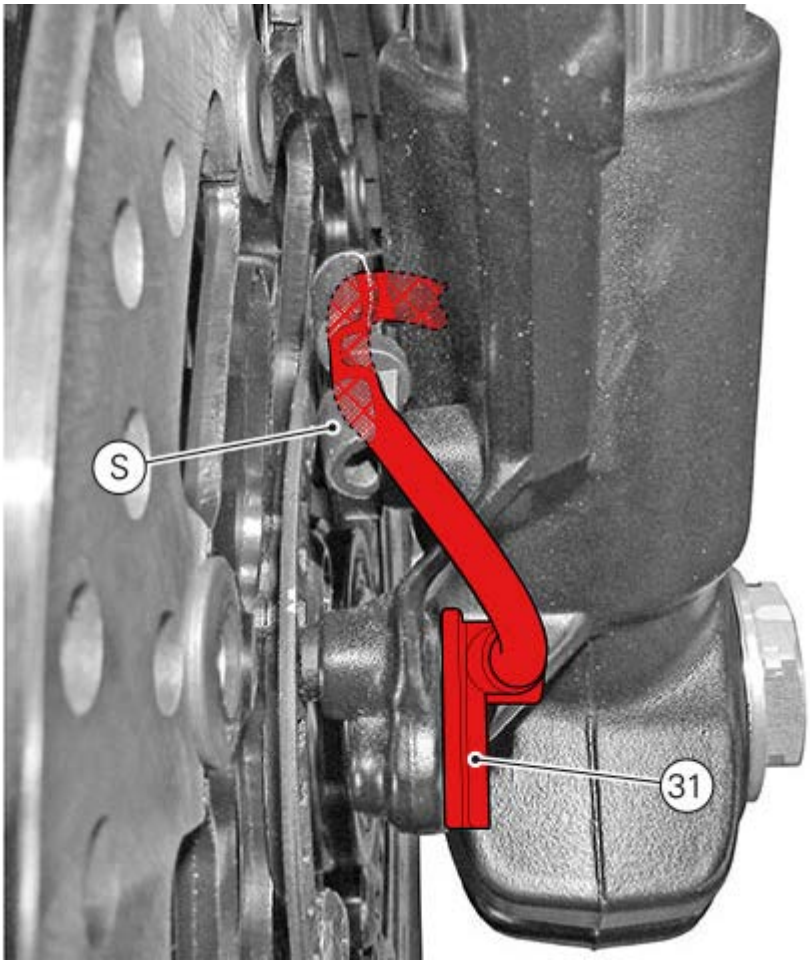


Then fasten the speed sensor cable (31) in the front brake bleed cap (P).

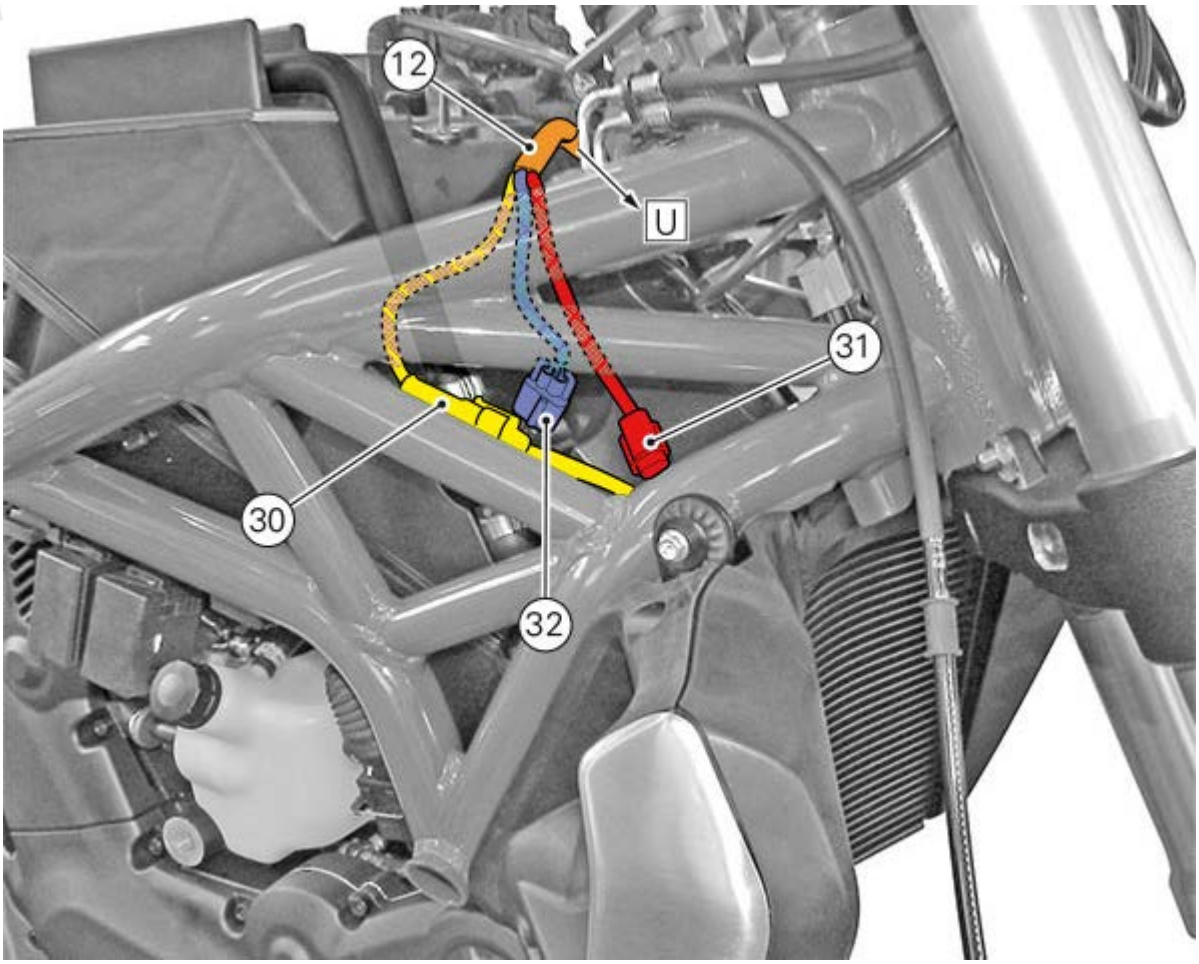




Fasten the speed sensor cable (31) on hose clamp (S) inside the left leg.



Connect the secondary air sensor (32) to the actuator after positioning the wiring as indicated.

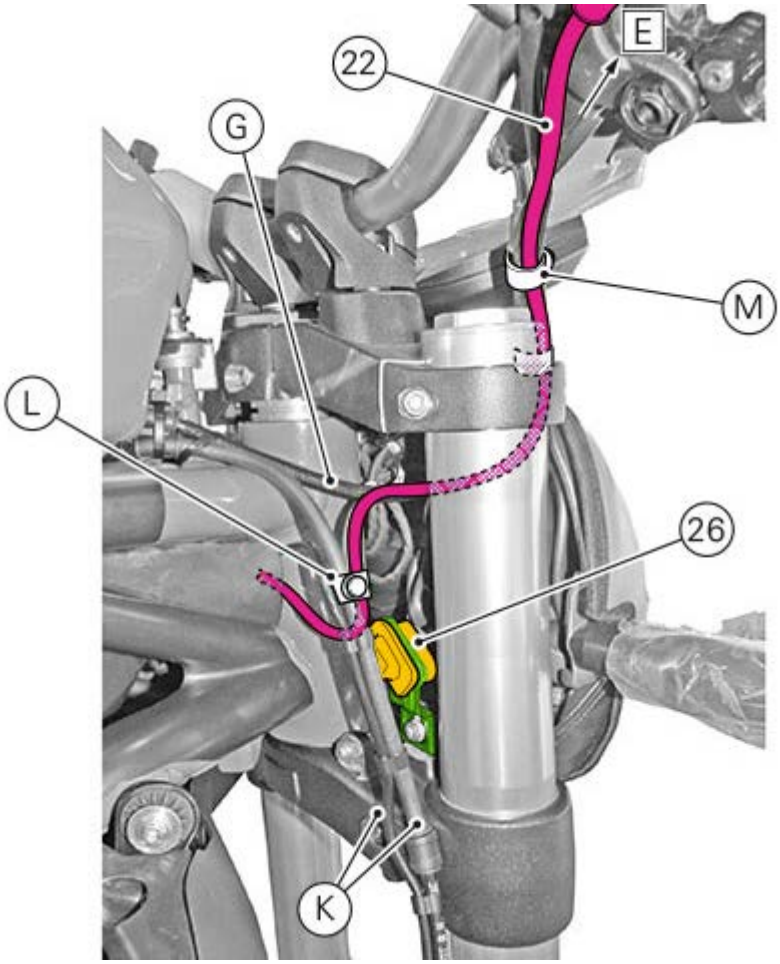


For the complete index of the wirings, divided by tables, refer to chapter "Routing of wiring on frame".

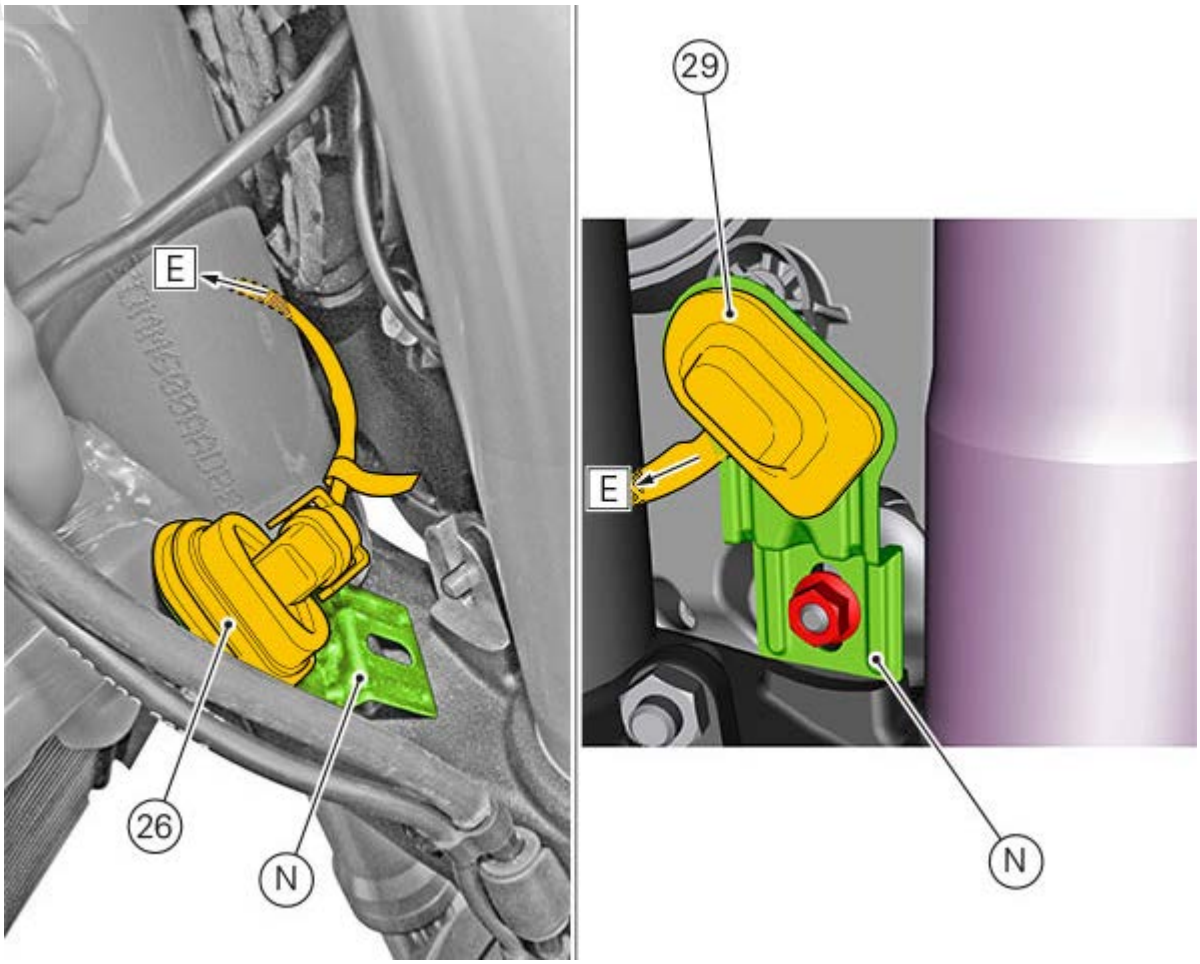
Table G

Front branches in headlight rear area (right)

ALL VERSIONS
Tie the throttle control cable (22):
- with tie (L) in the lower section, together with hoses (K) connecting the front brake callipers to the ABS control unit;
- with tie (M) in the upper section, together with hose (G) connecting the front brake master cylinder to the ABS control unit.



When positioning the instrument panel air temperature sensor (26), while tightening nut (N) keep the sensor support bracket pressed downwards (against the bottom yoke), to ensure fork leg safety in case of damages.

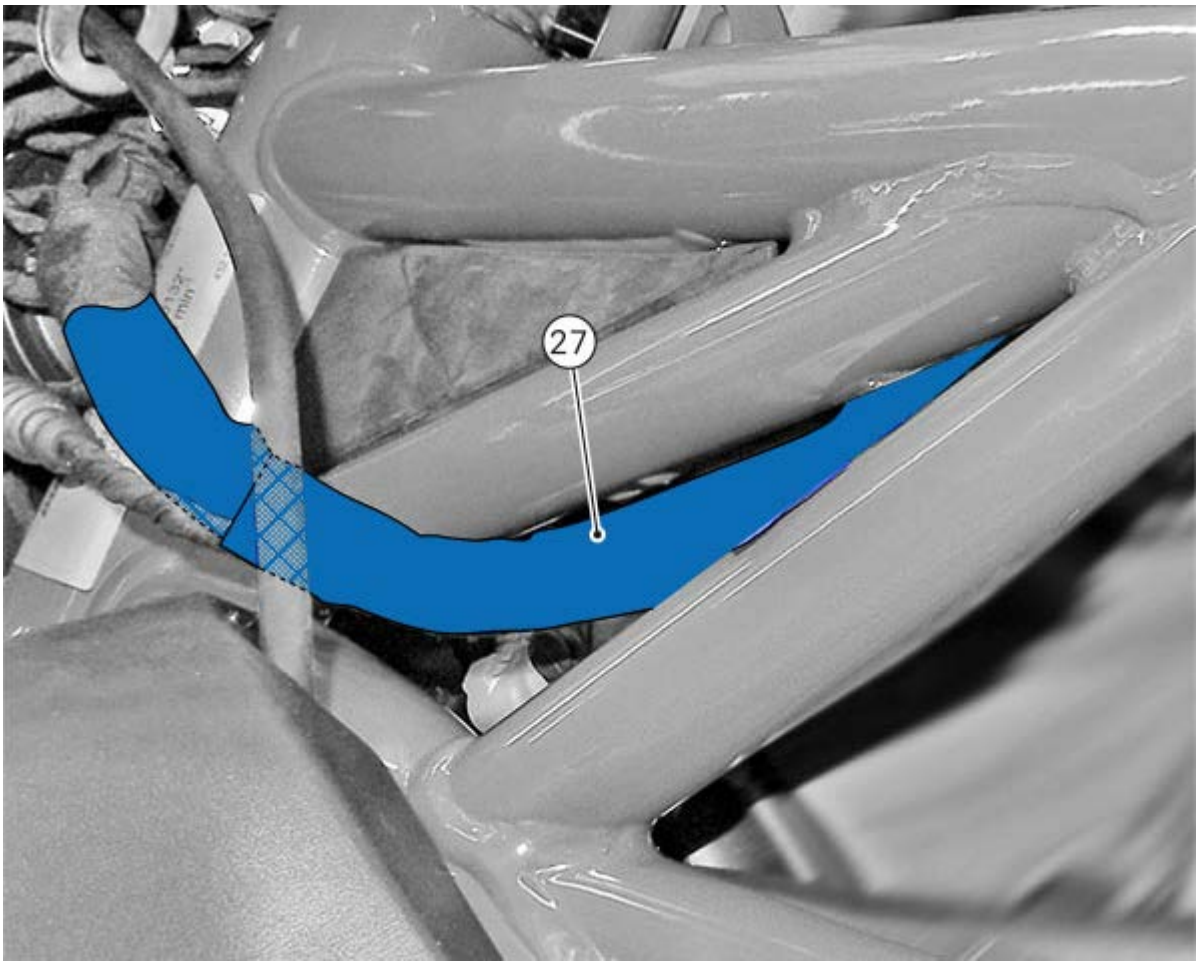


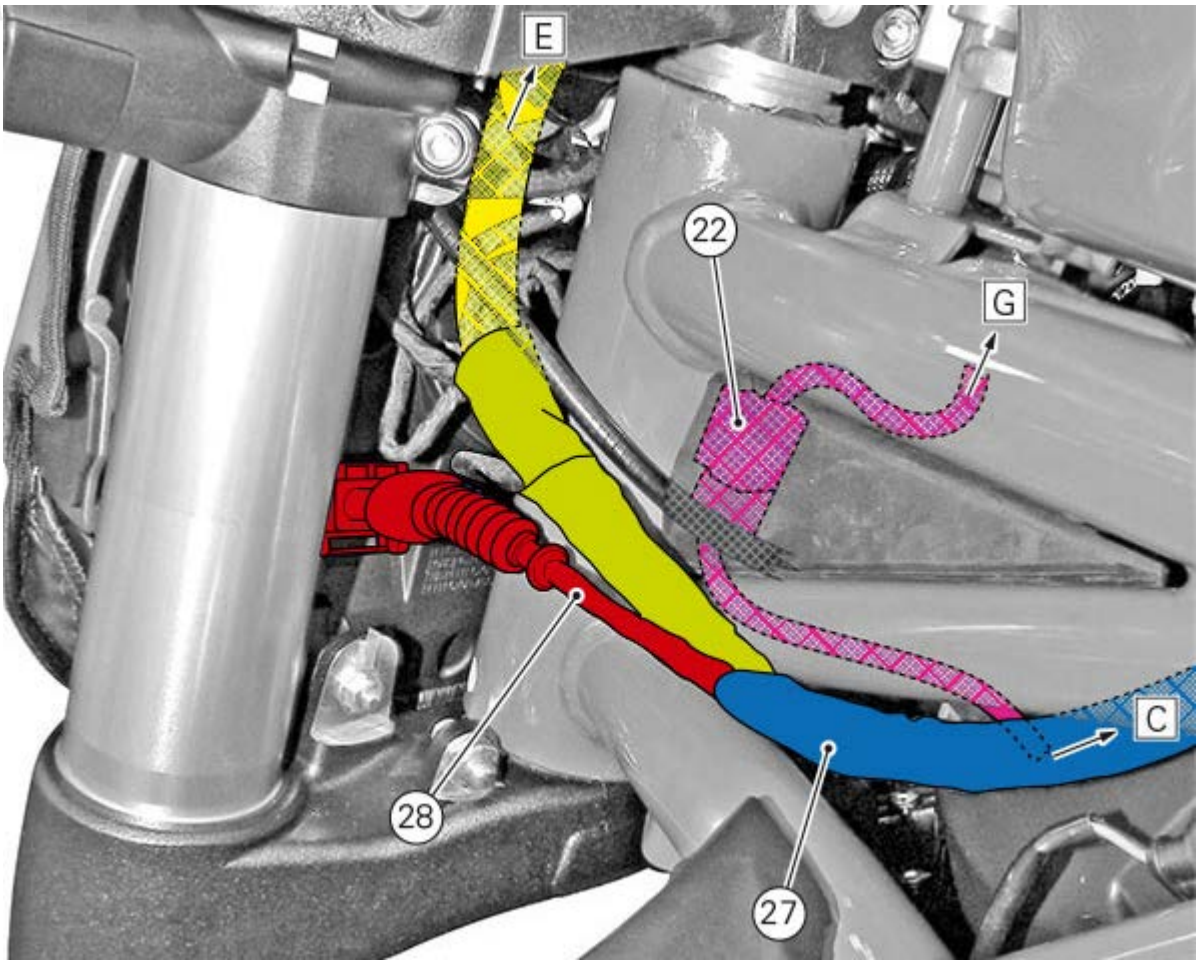
For the complete index of the wirings, divided by tables, refer to chapter "Routing of wiring on frame".

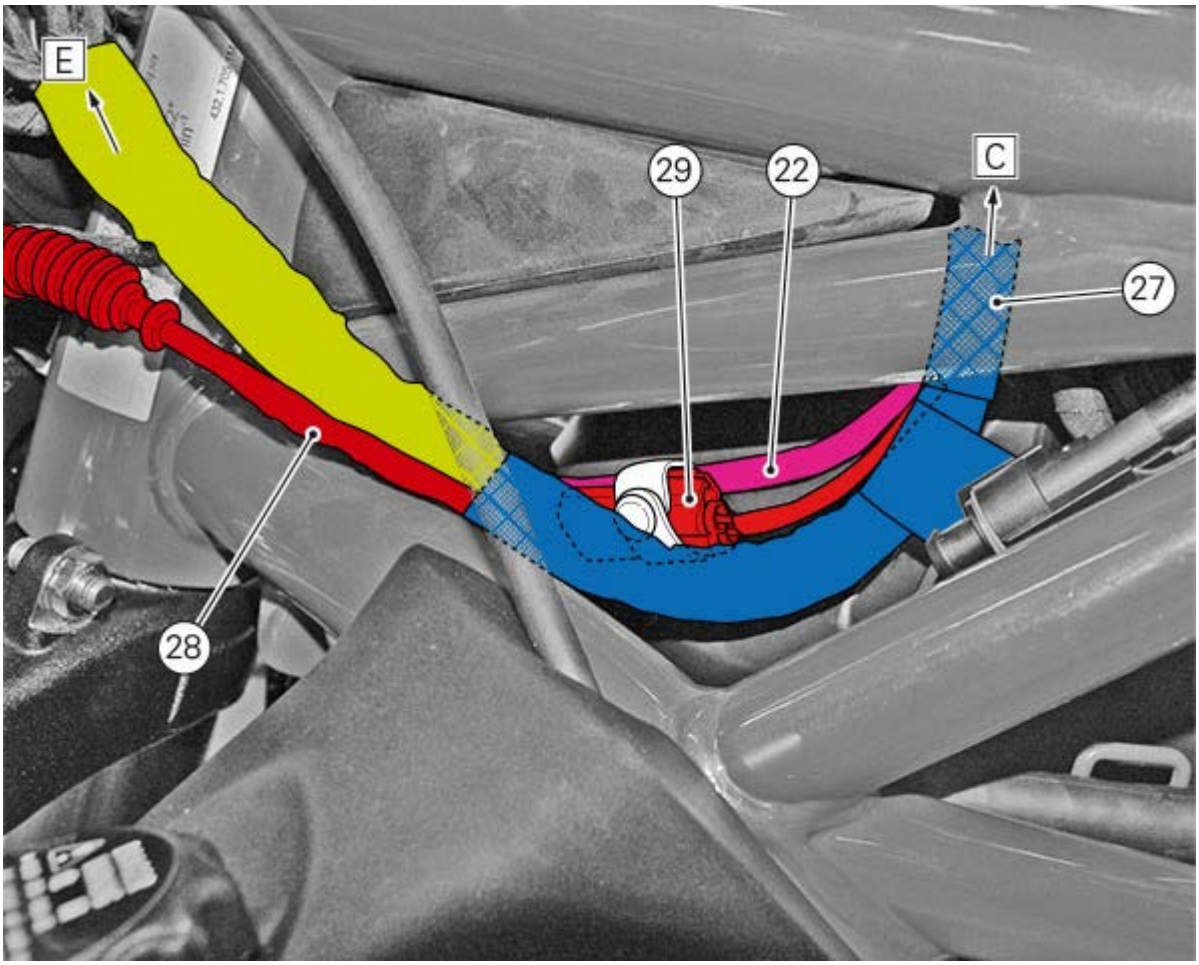
Table F

Front branches in headlight rear area (left)

ALL VERSIONS
Tie together the throttle control wiring (22) and the wiring branch connector of the 12V power outlet (29).







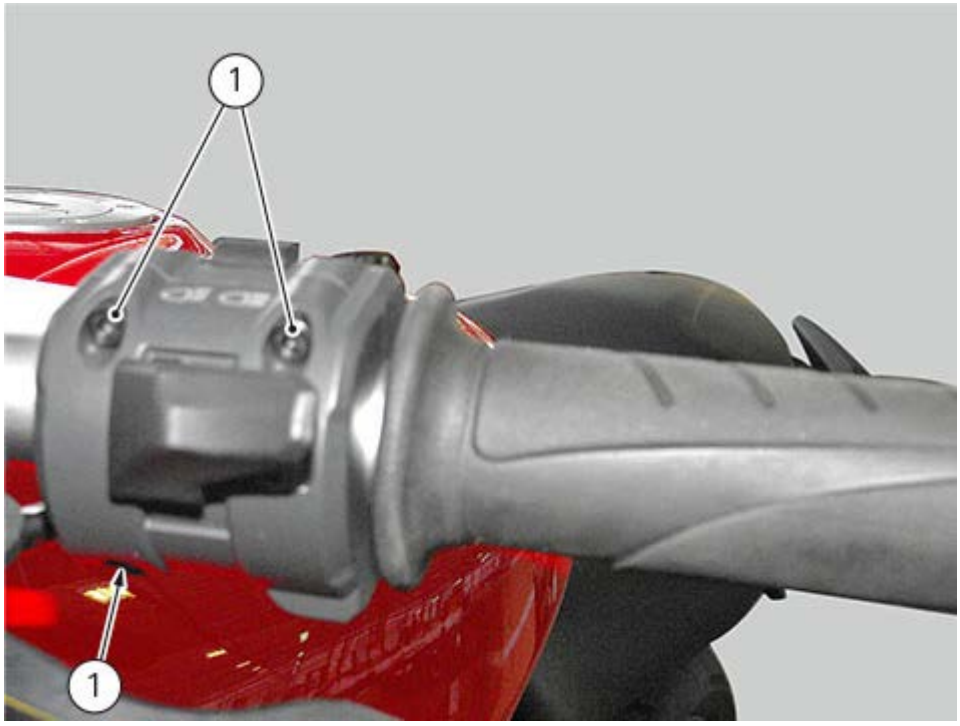
For the complete index of the wirings, divided by tables, refer to chapter "Routing of wiring on frame".

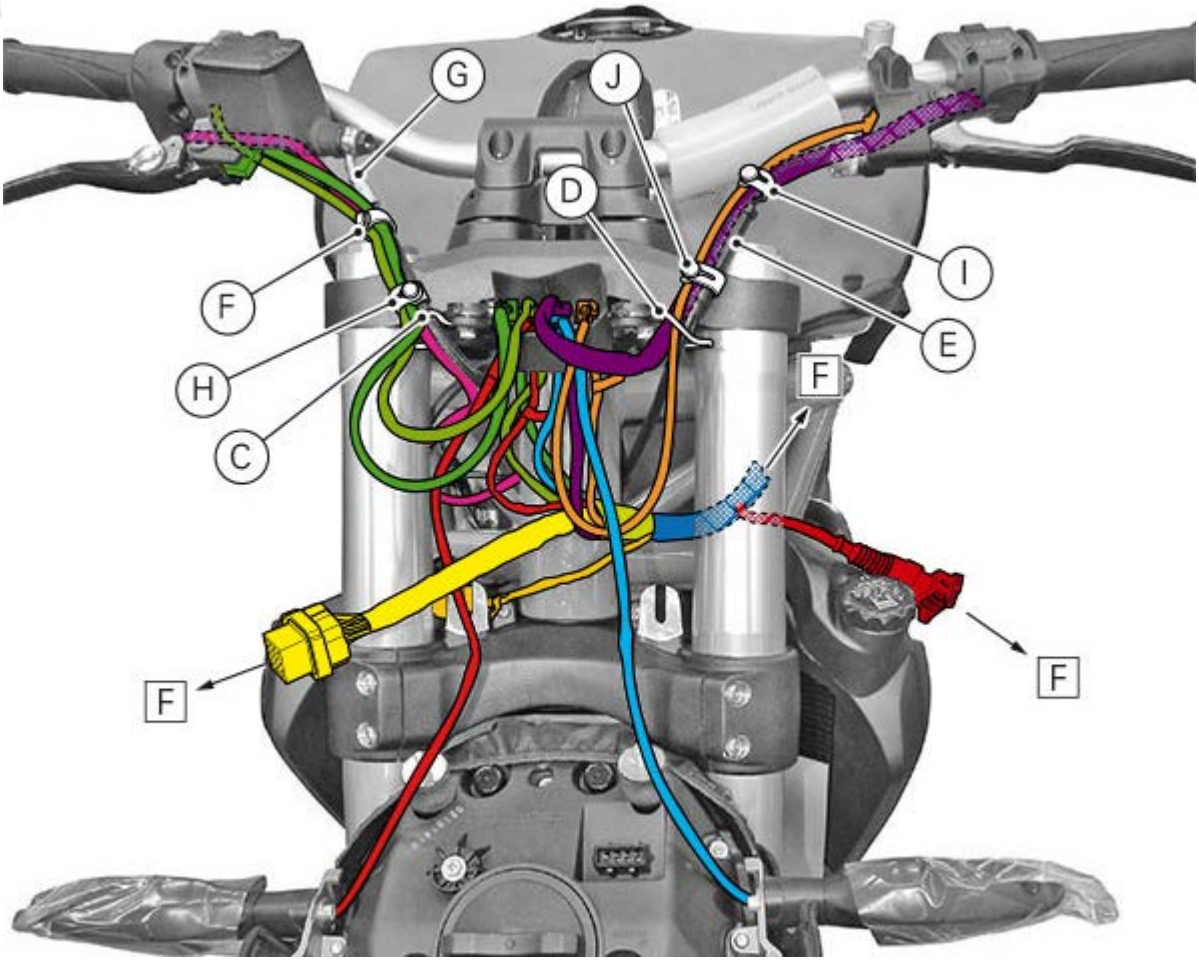
Table E

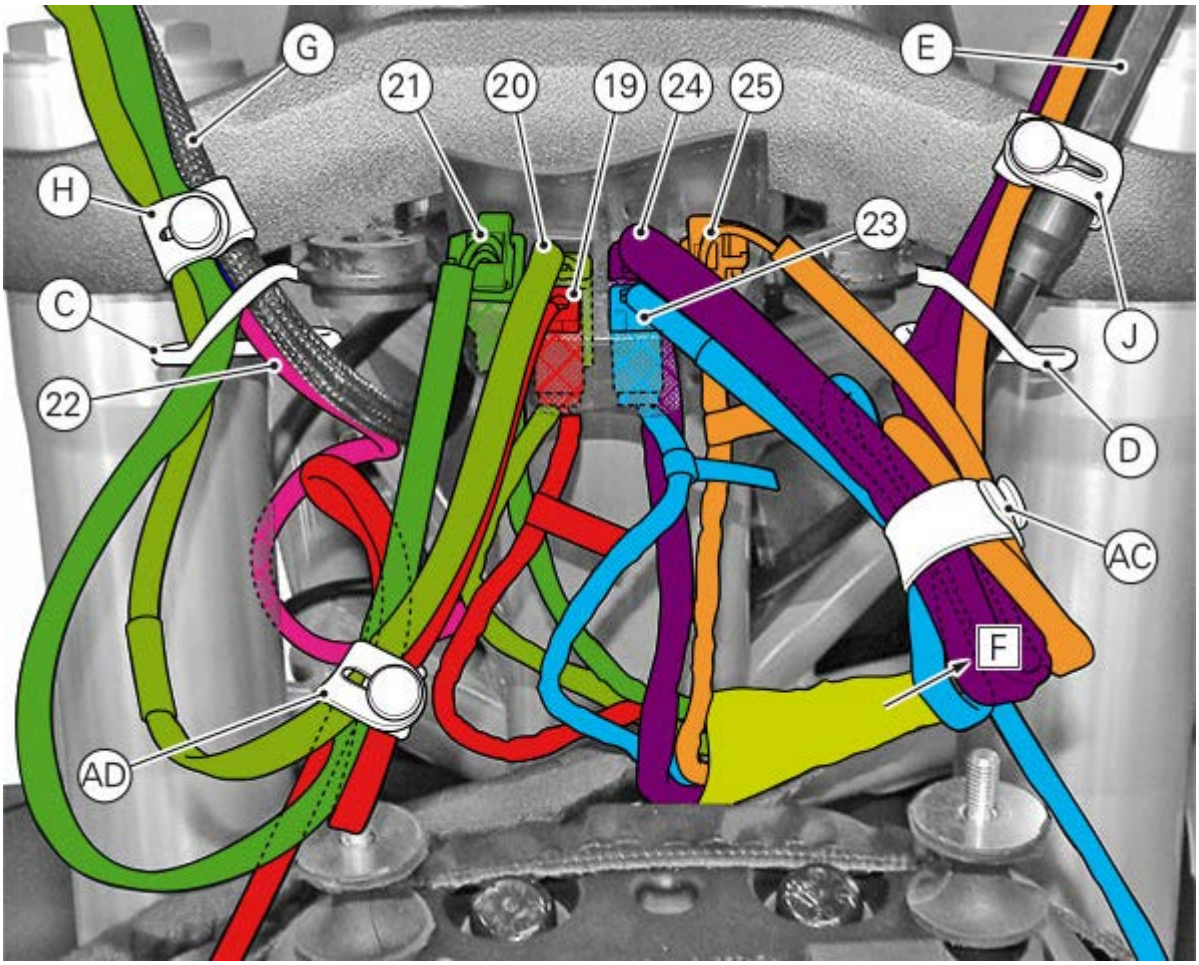
Front branches in headlight rear area

EUROPE VERSION
Tie the wirings as shown in the figure, in particular:
- use a tie (F) to fasten the throttle control cable (22), the front brake switch cable (21) and the right-hand switch cable (20) to pipe (G) of the front braking system fluid tank;
- use tie (H) that fastens pipe (G), throttle control cable (22), front brake switch cable (21) and right-hand switch cable (20);
- use a tie (I) to fasten together the clutch cable (E), the left-hand switch cable (23) and the clutch switch cable (25);
- use a tie (J) to fasten the exceeding length of the LH turn indicator cable (23), the left-hand switch cable (24) and the clutch switch cable (25).

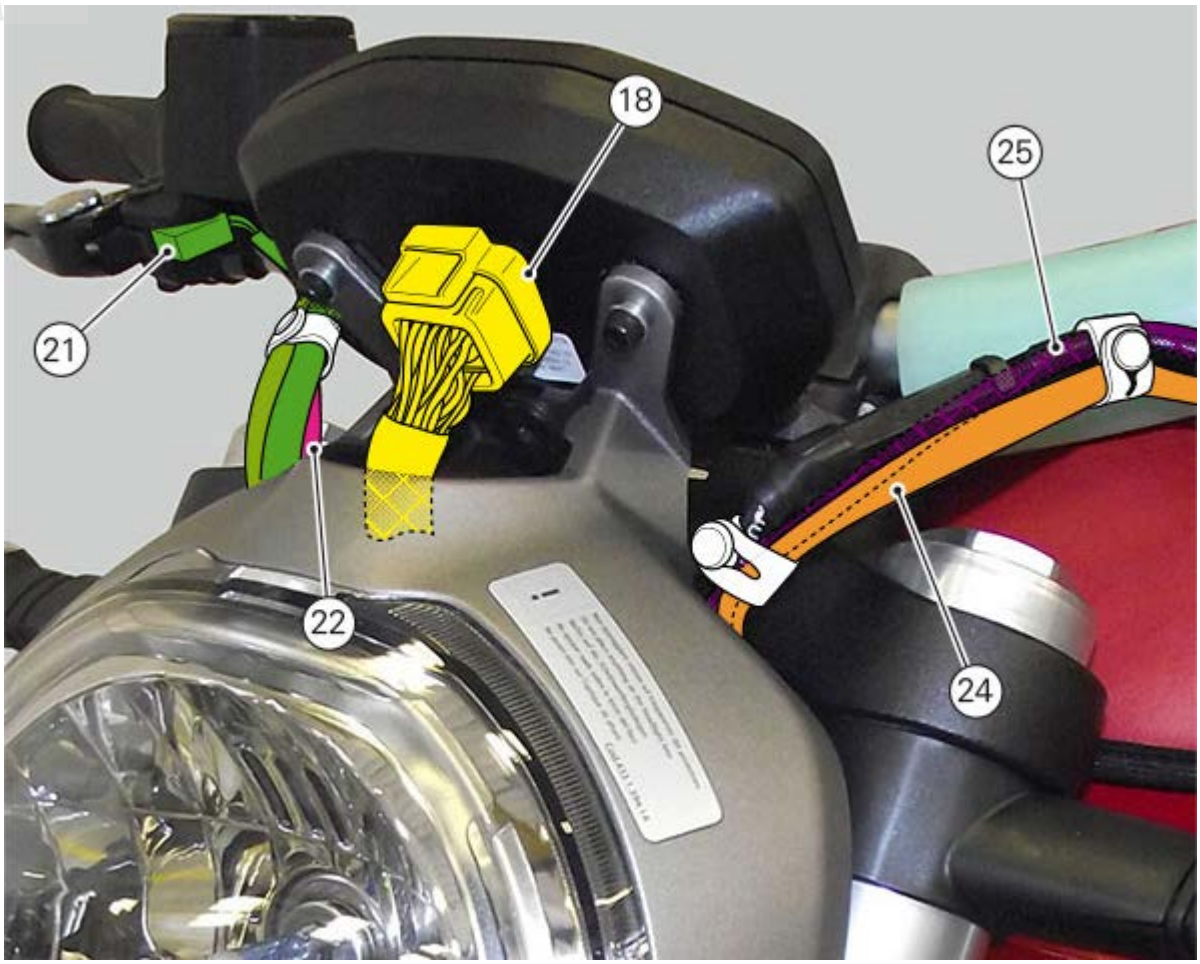
After fitting the ties, fasten the wirings in cable rings (C) on the right and (D) on the left side, as indicated.







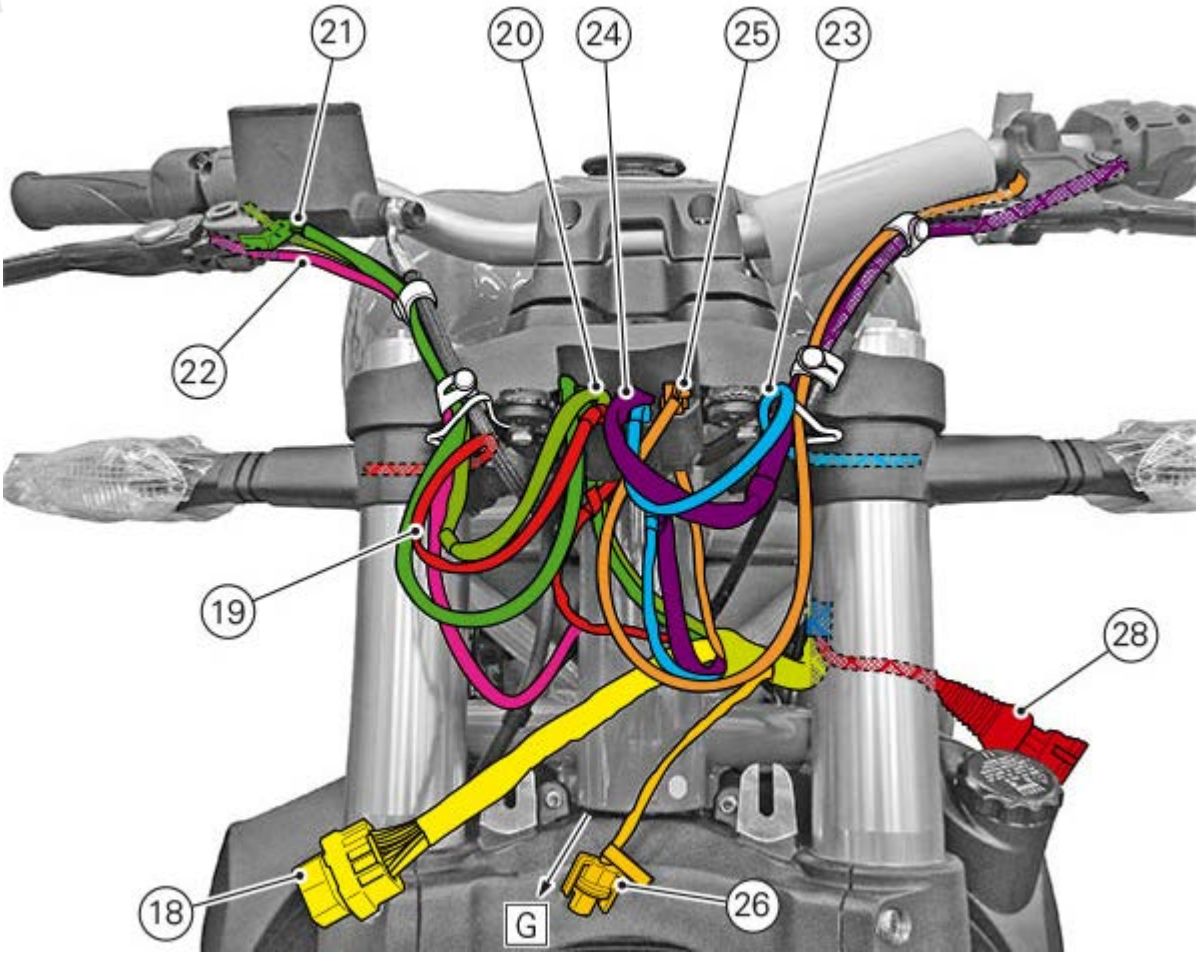
Instrument panel wiring (18).

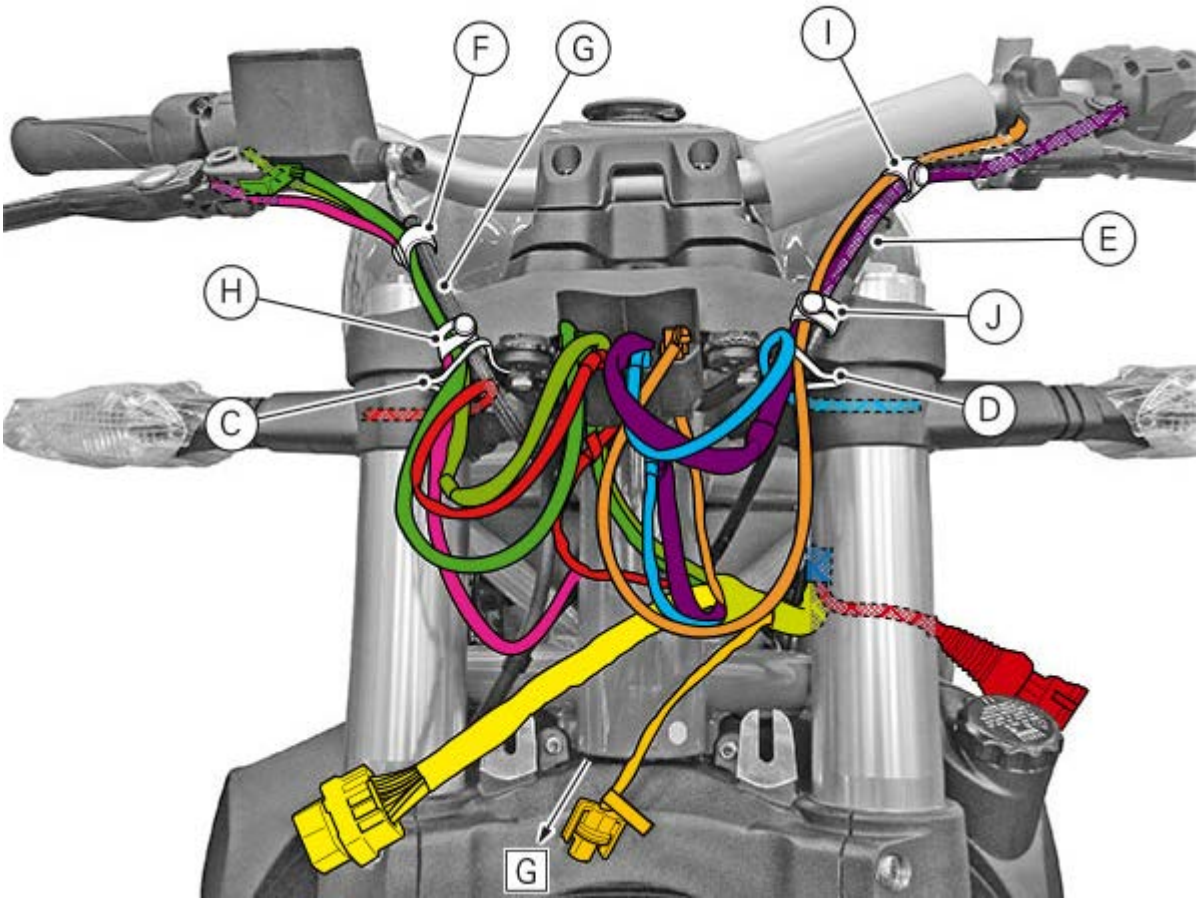


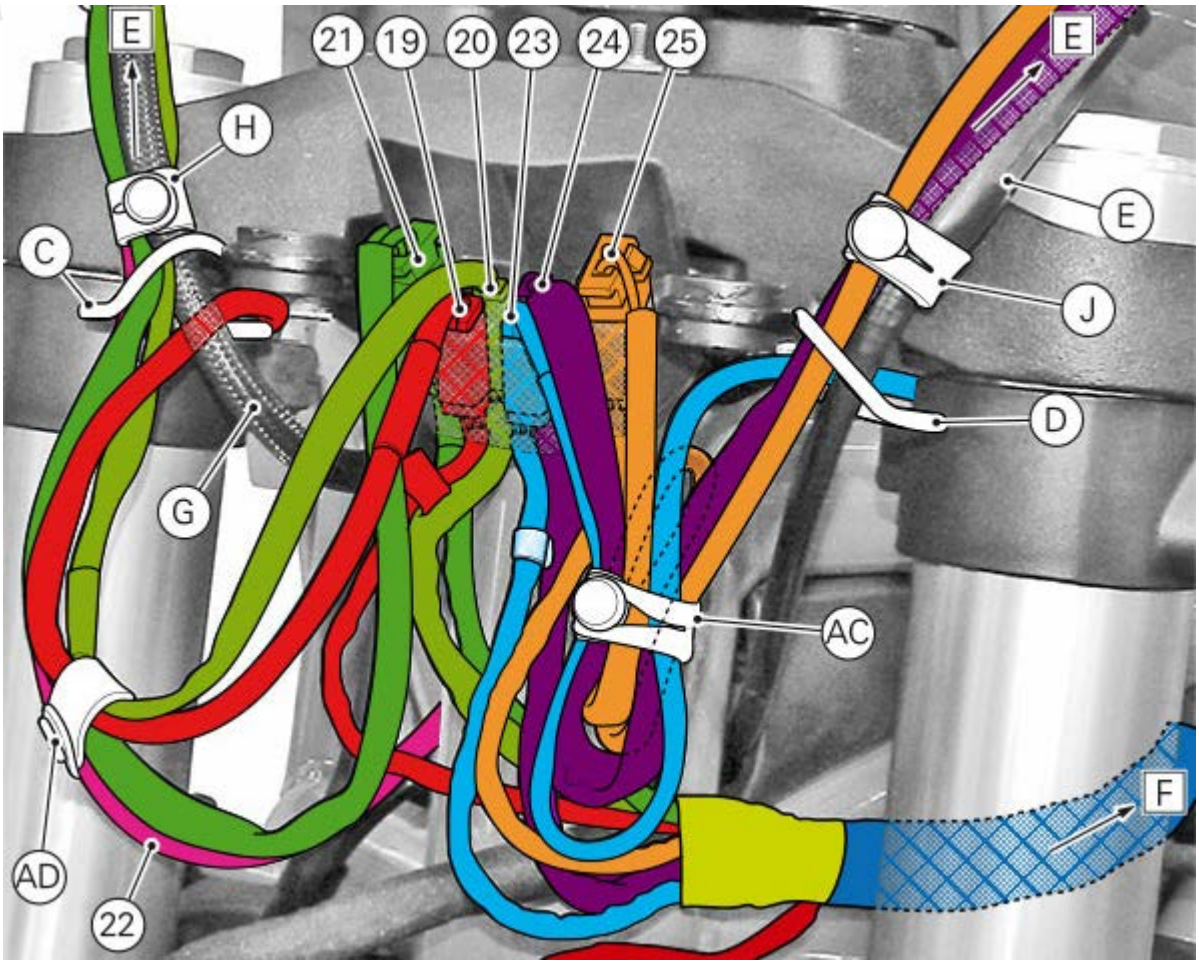
USA VERSION

Tie the wirings as shown in the figure, in particular:

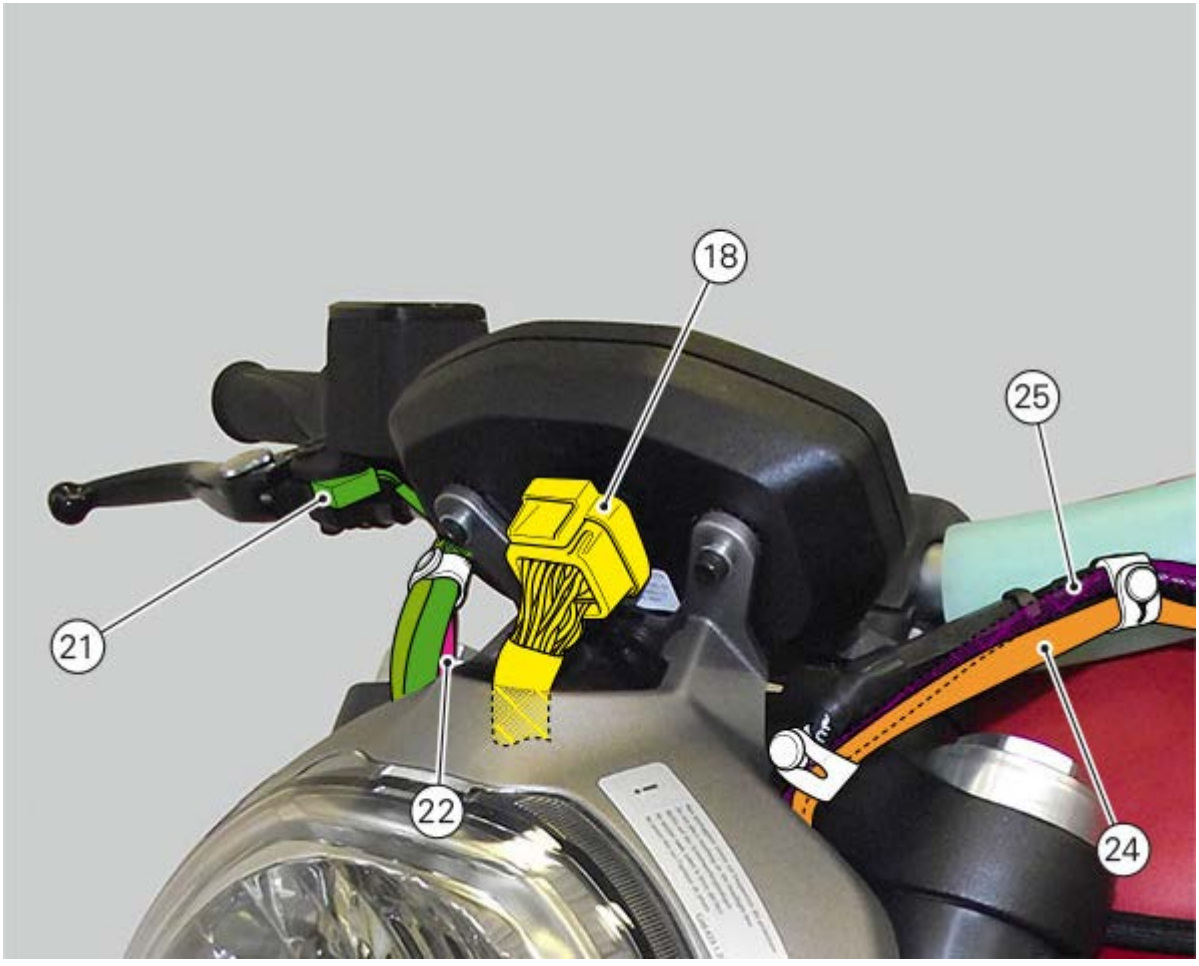
- use tie (H) that fastens pipe (G), throttle control cable (22), front brake switch cable (21) and right-hand switch cable (20);
- use tie (AD) that fastens pipe (G), throttle control cable (22), front brake switch cable (21) and right-hand switch cable (20);
- use tie (H) that fastens pipe (G), throttle control cable (22), front brake switch cable (21) and right-hand switch cable (20);
- use a tie (J) to fasten together the clutch cable (E), the left-hand switch cable (23) and the clutch switch cable (25);
- use a tie (AC) to fasten the exceeding length of the LH turn indicator cable (23), the left-hand switch cable (24) and the clutch switch cable (25). After fitting the ties, fasten the wirings in cable rings (C) on the right and (D) on the left side, as indicated.







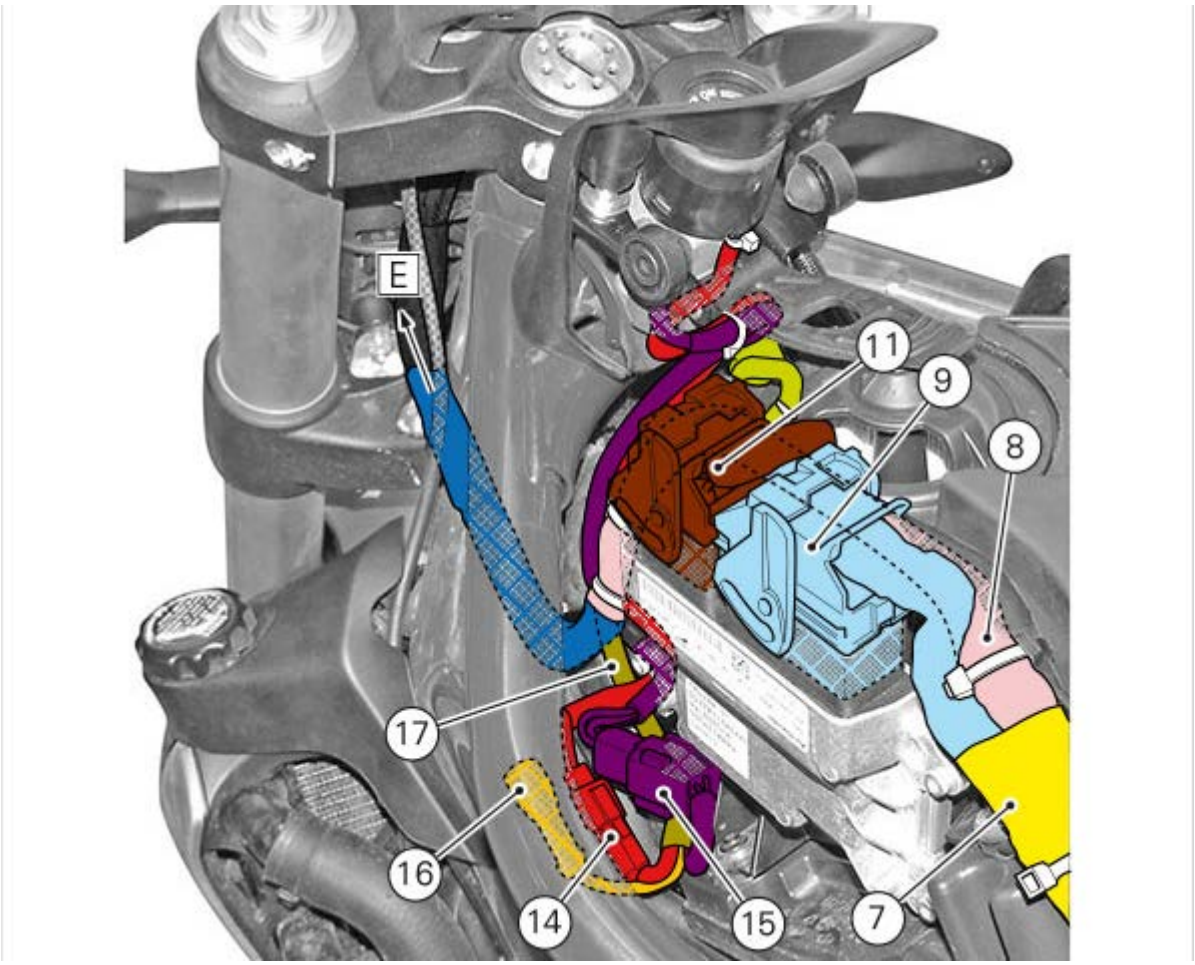
Instrument panel wiring (18).



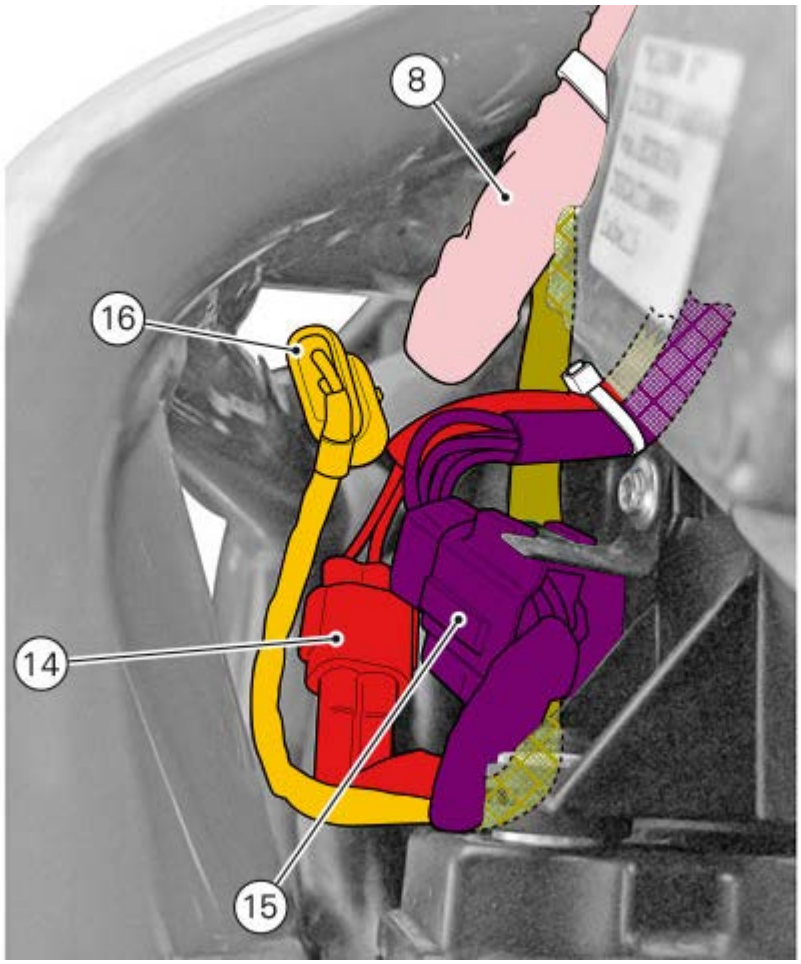
For the complete index of the wirings, divided by tables, refer to chapter "Routing of wiring on frame".

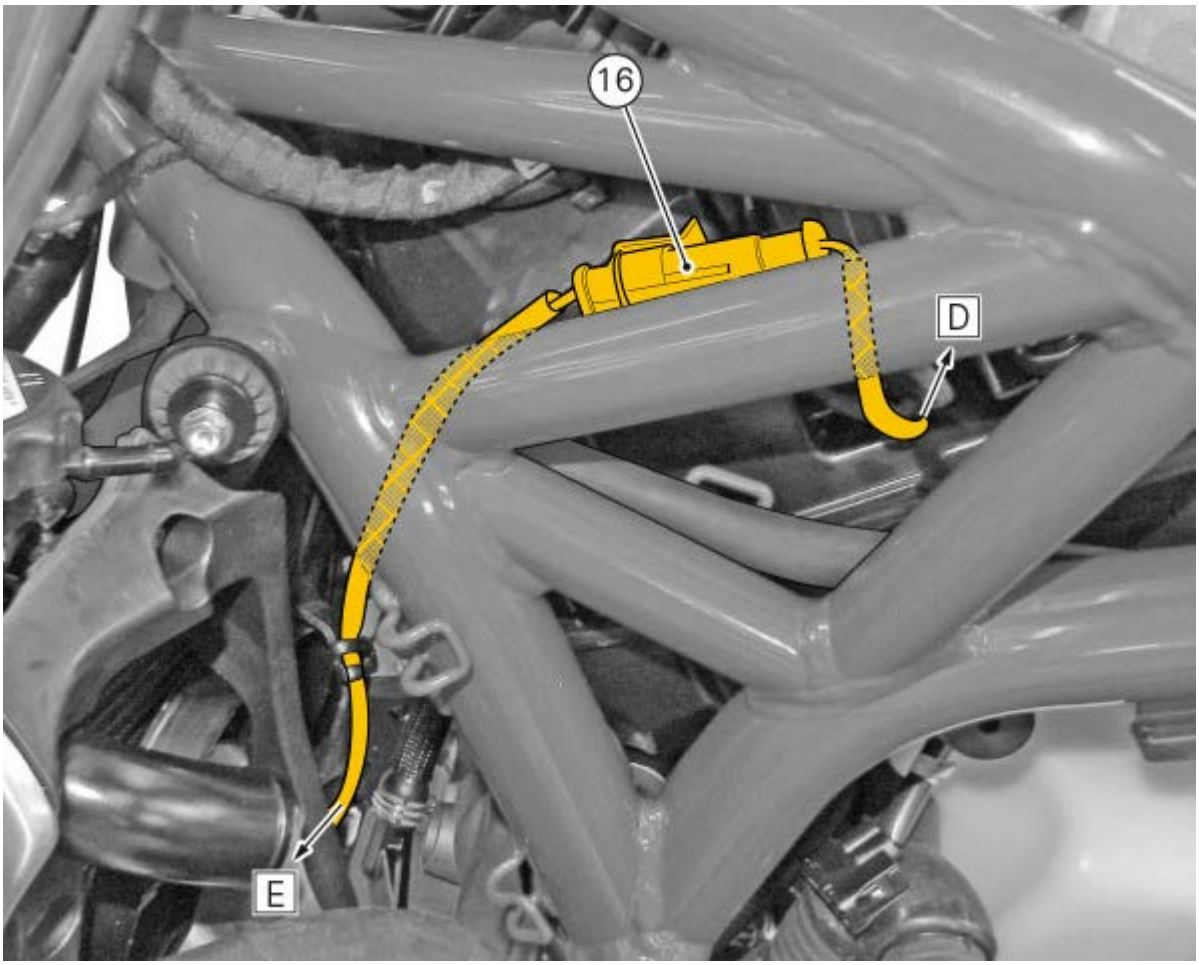
Table D

LH front wiring



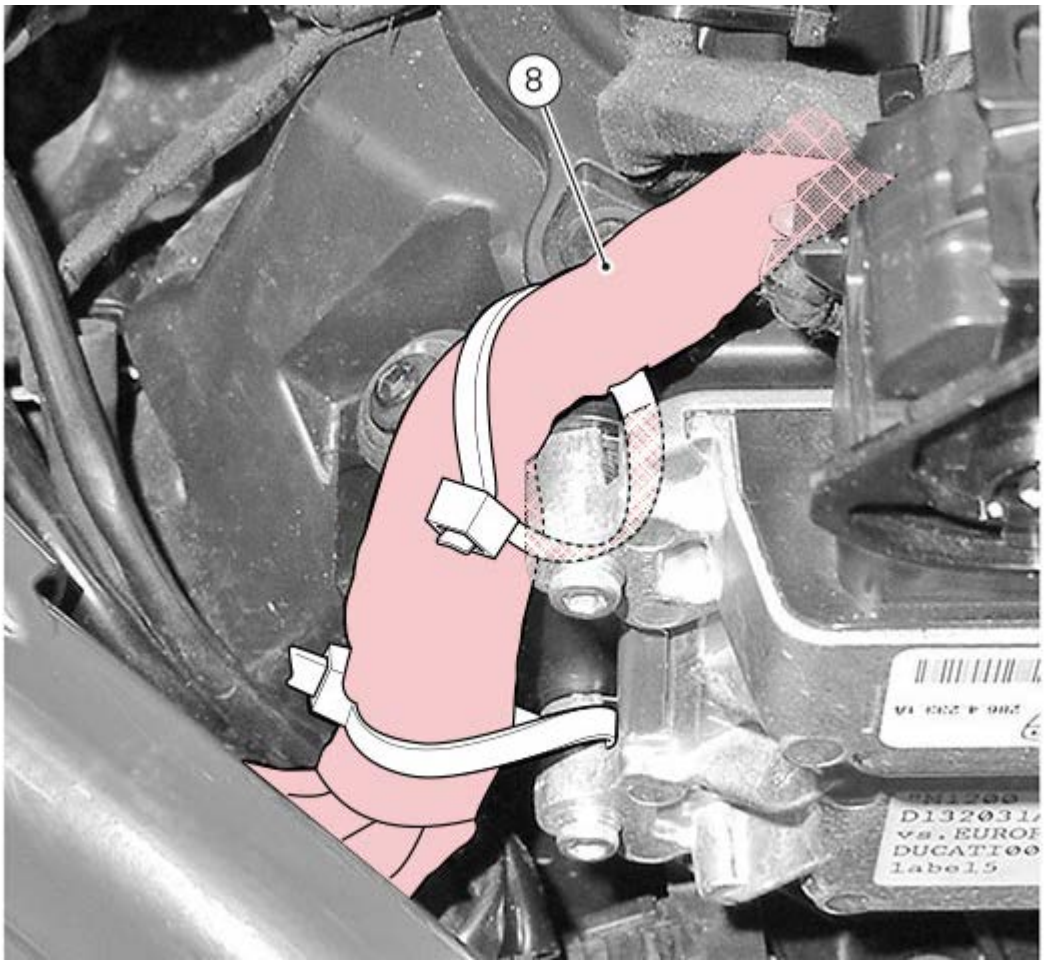
Position the ties on the cable sheath.
Engage the LH fan connector (16) on the frame tab and route the wiring through the cable ring.





Important

It is necessary to fit the ties in the indicated position: in this condition, the main wiring primary front branch is forced to slide (during the vehicle use) in the frame opposite direction towards the airbox, avoiding the risk of breakage due to wear.

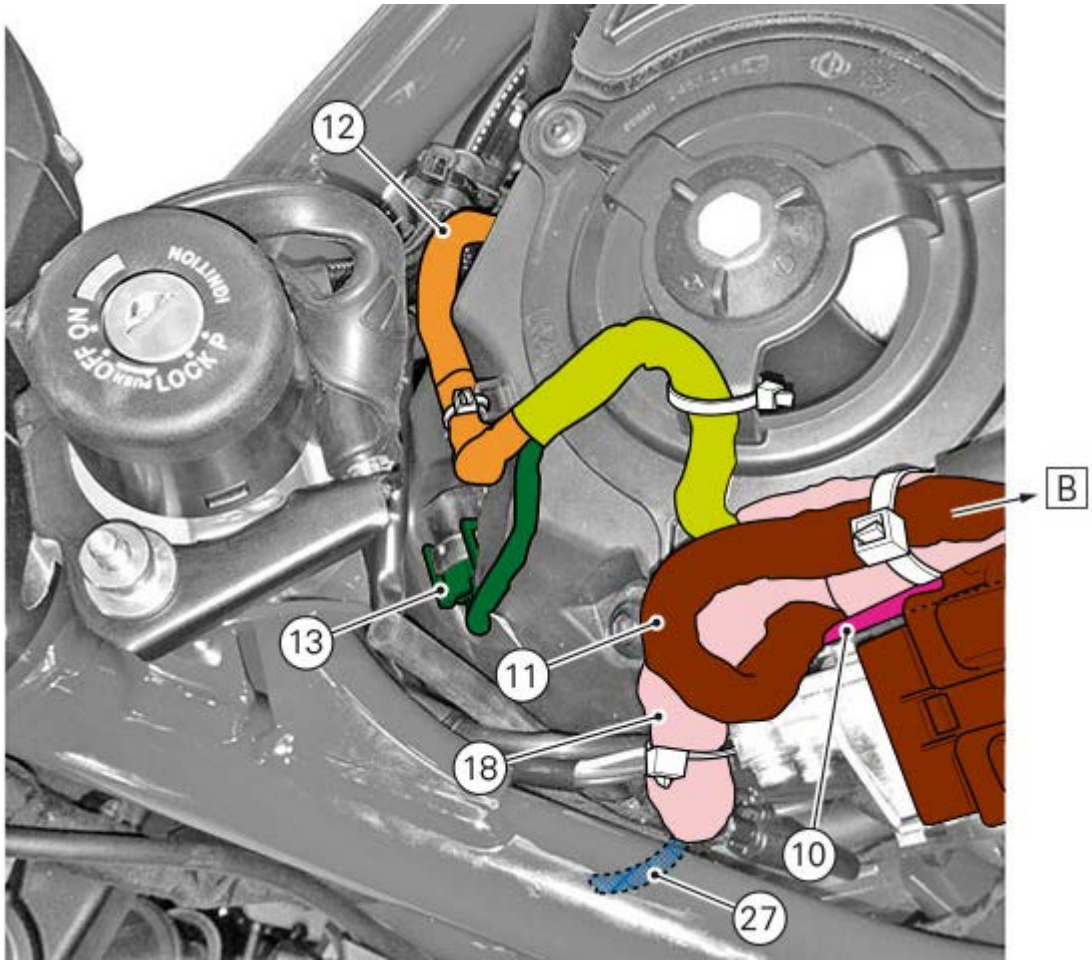


For the complete index of the wirings, divided by tables, refer to chapter "Routing of wiring on frame".

Table C

Airbox front main wiring branch

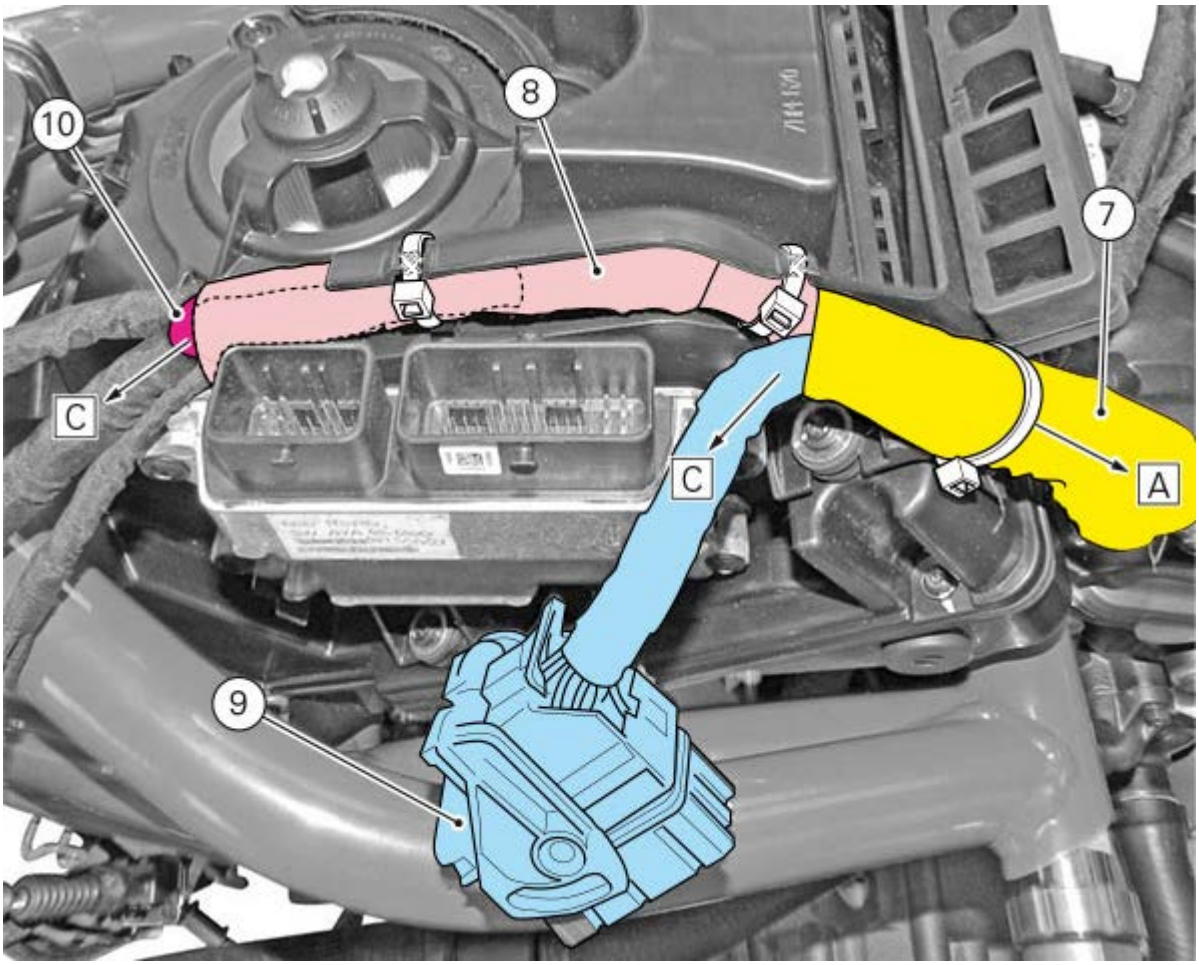
Warning
Aim tie closure as shown in the figure

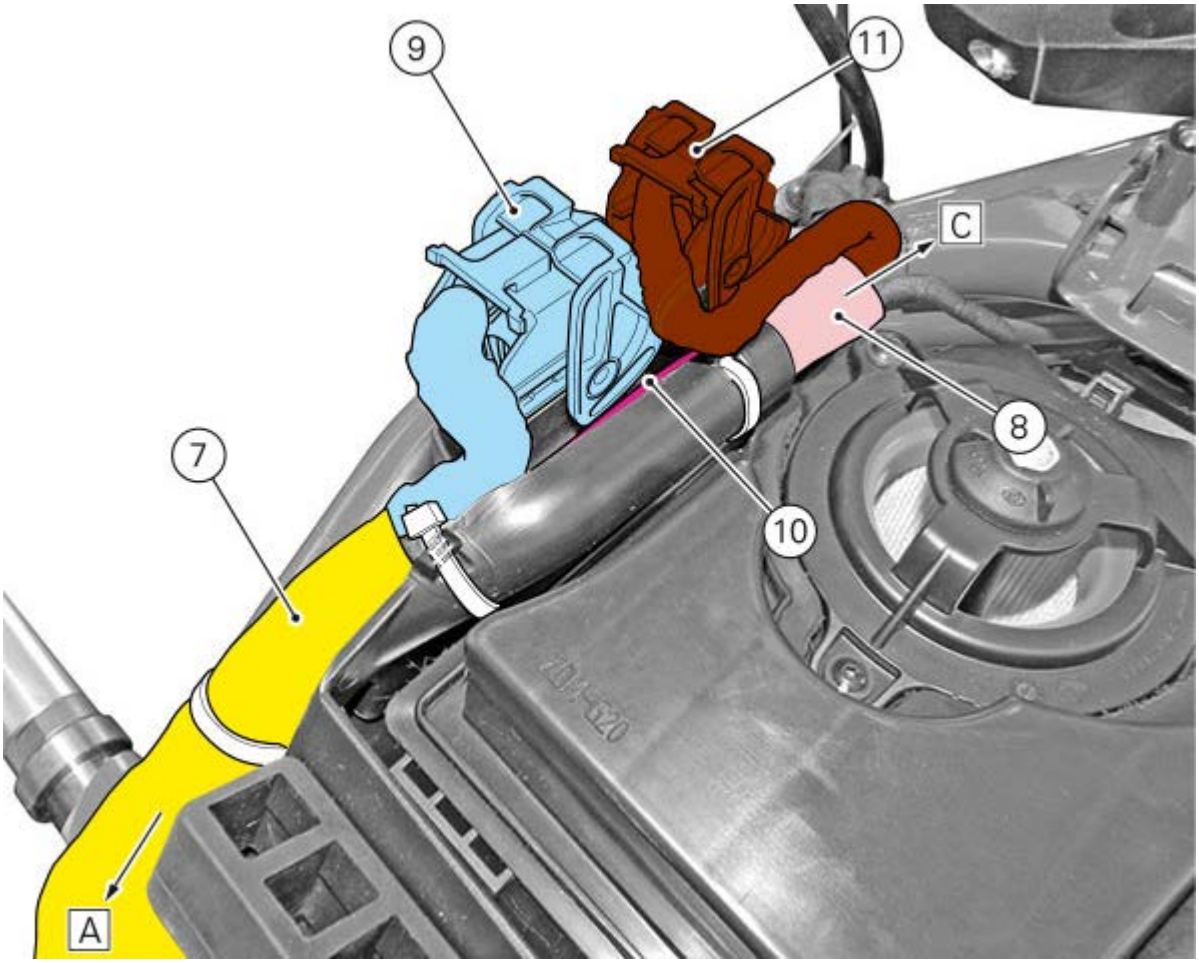


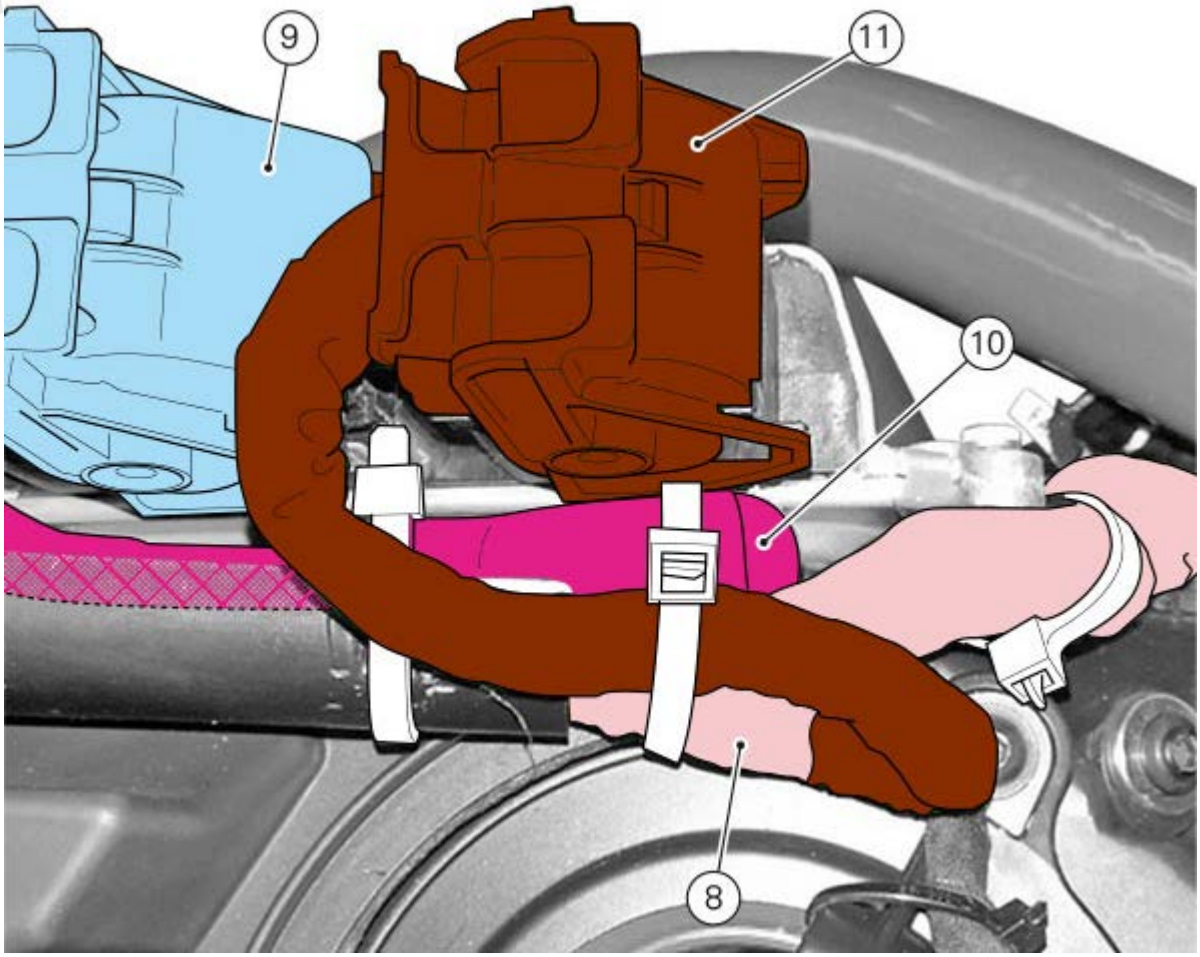
For the complete index of the wirings, divided by tables, refer to chapter "Routing of wiring on frame".

Table B

Airbox LH side wiring branch





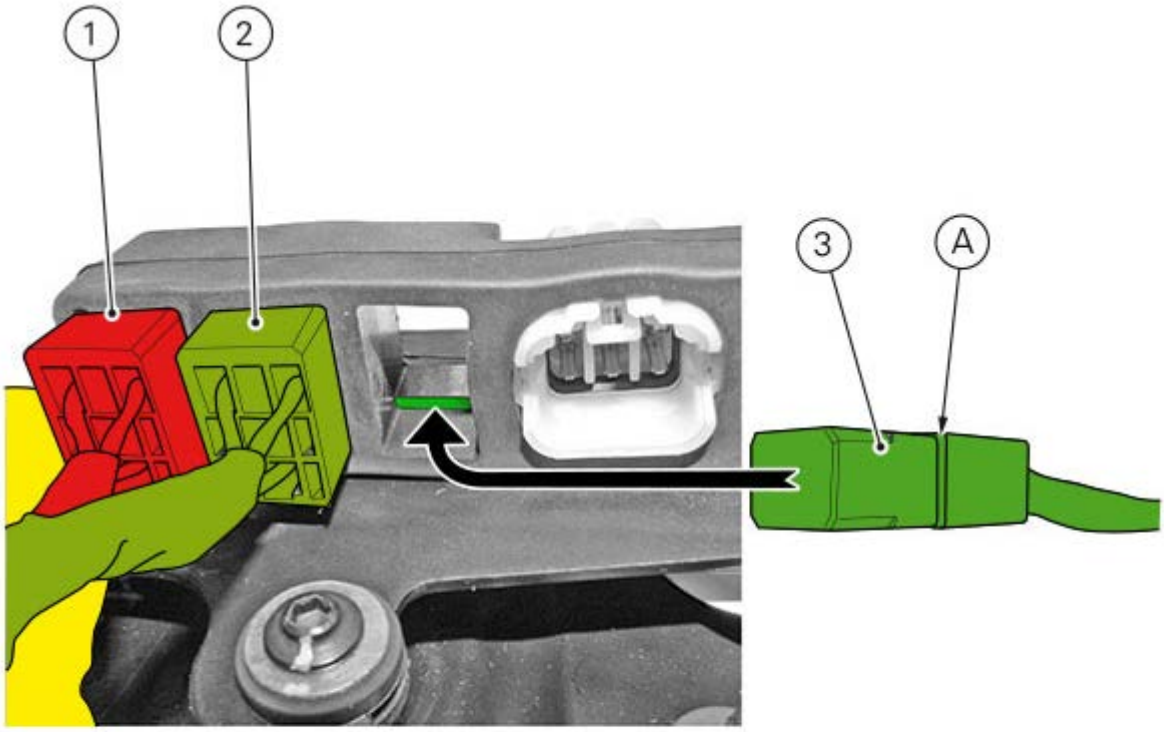


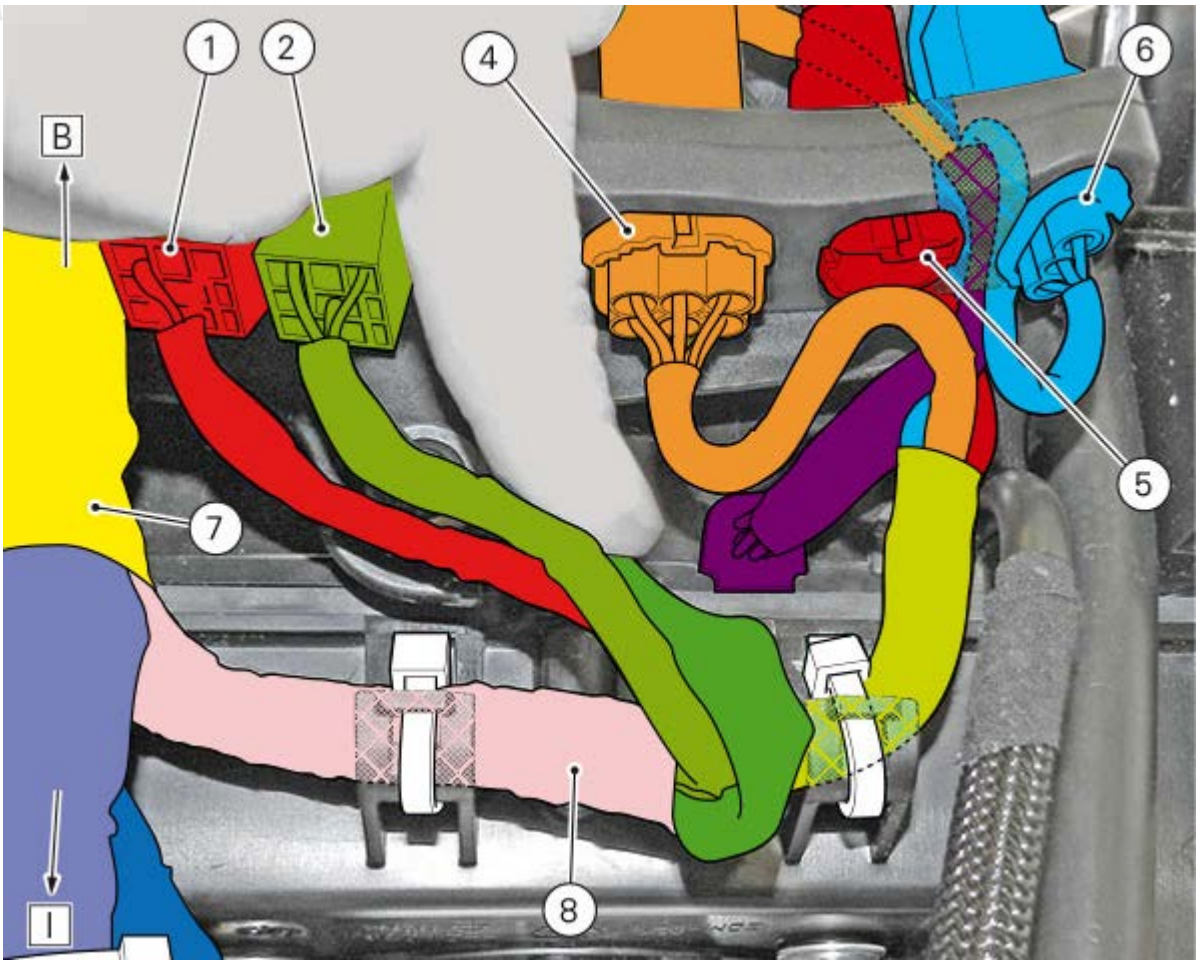
For the complete index of the wirings, divided by tables, refer to chapter "Routing of wiring on frame".

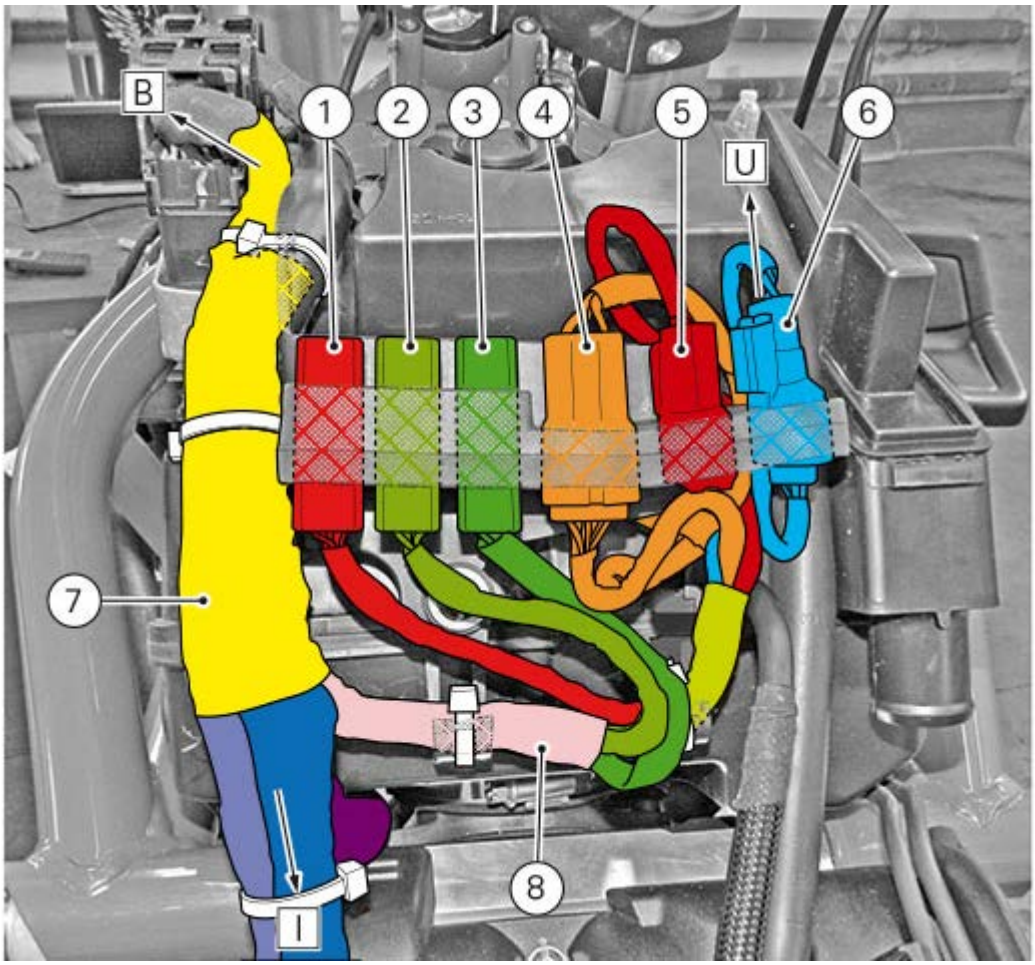
Table A

Branches on airbox

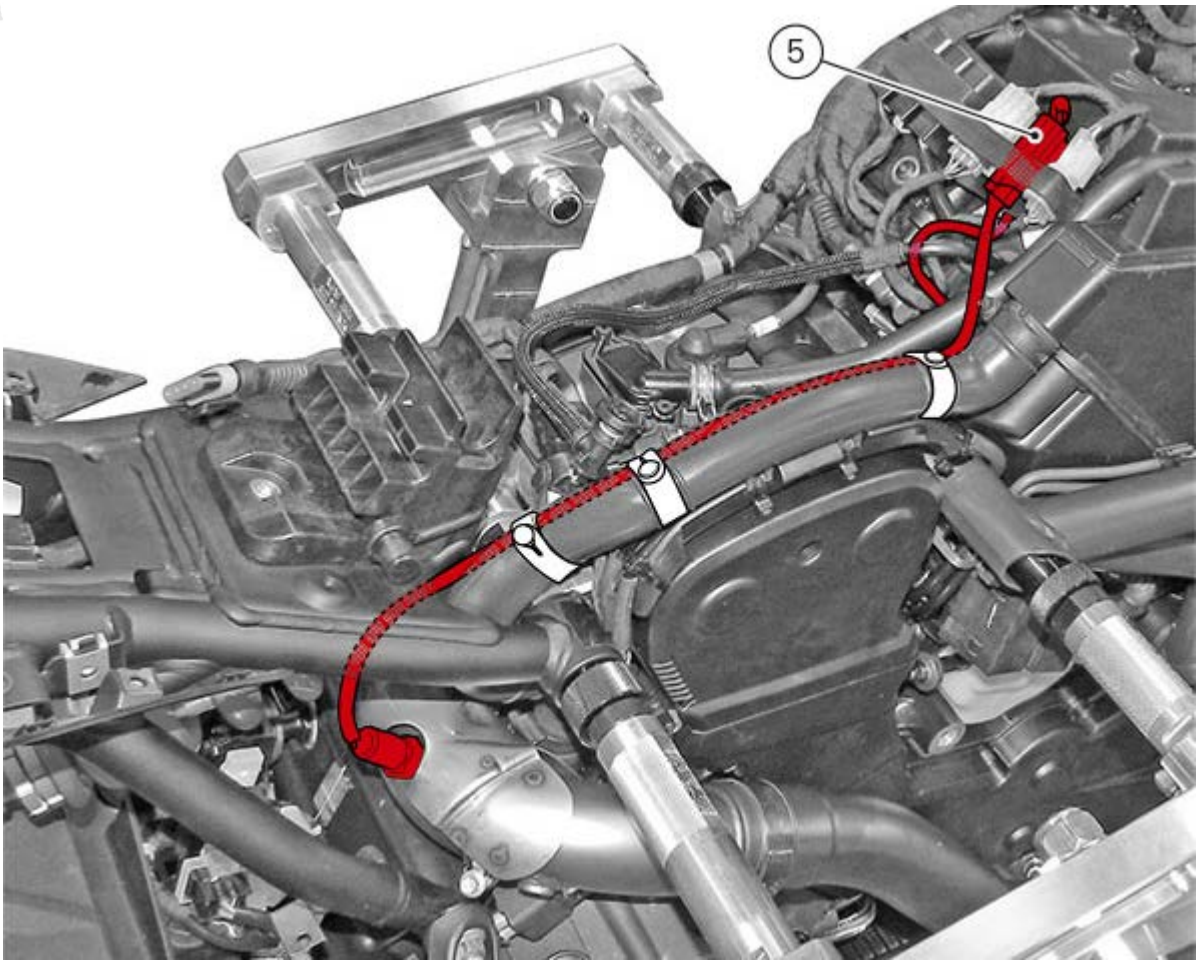
Fit the relays in the corresponding housing on bracket, aiming them so that edge (A) matches the highlighted recess.







Tie the vertical cylinder lambda sensor cable (5) to the blow-by pipe.



For the complete index of the wirings, divided by tables, refer to chapter "Routing of wiring on frame".

Routing of wiring on frame

TABLE	NAME	REF.	NAME
TABLES A	Branches on airbox	1	Fuel pump relay
		2	Injection relay
		3	Starter relay
		4	Potentiometer wiring / ride-by-wire (TPS/ETV)
		5	Vertical cylinder exhaust lambda sensor
		6	Injector wirings
		7	Main branch
		8	RH front main branch
TABLES B	Airbox LH side wiring branch	7	Main branch
		8	RH front main branch
		9	ECU 1 connection
		10	Ground jointing braided wiring branch
		11	ECU 2 connection
TABLES C	Airbox front main wiring branch	10	Ground jointing braided wiring branch
		11	ECU 2 connection
		12	Front main wiring central branch
		13	Airbox temperature sensor (TIA)
		27	Primary front branch of main wiring harness
TABLES D	Front branches in headlight rear area (EUROPE VERSION)	7	Main branch
		8	RH front main branch
		14	Immobilizer antenna cable
		15	Ignition injector (ignition switch)
		16	LH fan
		17	Secondary front branch of main wiring harness

		27	Primary front branch of main wiring harness
TABLE E	Front branches in headlight rear area (USA VERSION)	18	Instrument panel
		19	Front right turn indicator
		20	Right-hand switch
		21	Front brake switch
		22	Throttle control (APS)
		23	Front left turn indicator
		24	Left-hand switch
		25	Clutch switch
		26	Instrument panel temperature sensor
		28	Front light assembly
TABLE F	Front branches in LH light rear area (ALL VERSIONS)	22	Throttle control (APS)
		27	Primary front branch of main wiring harness
		28	Front light assembly
		29	Heated handgrip (12V) presetting
TABLE G	Front branches in RH light rear area (ALL VERSIONS)	22	Throttle control (APS)
		27	Primary front branch of main wiring harness
		28	Front light assembly
		29	Heated handgrip (12V) presetting
TABLE H	Front RH wiring branch	12	Front main wiring central branch
		30	RH fan
		31	Front speed sensor
		32	Secondary air
TABLE I	Vertical head LH side wiring branch	7	Main branch
		8	RH front main branch
		33	Lower branch
		34	Alarm (optional)

		35	Rear branch
		45	Vertical coil
TABLE J	Tank ground and fuel pump wiring	7	Main branch
		8	RH front main branch
		33	Lower branch
		34	Alarm (optional)
		35	Rear branch
		36	Tank ground cable
		37	Fuel pump wiring
TABLE K	Vertical head LH side wiring branch: temperature and ground sensor	33	Lower branch
		38	Engine temperature sensor
		39	Wiring ground
		40	Battery negative
		41	Lower main branch
TABLE L	LH side wiring branch: coils, pick-up	33	Lower branch
		38	Engine temperature sensor
		42	Vertical coil wiring
		43	Horizontal coil wiring
		44	Pick-up wiring
		45	Vertical coil
		46	Horizontal coil
TABLE M	Crankcase LH/lower cables	40	Battery negative
		41	Lower main branch
		47	Generator cable
		48	Starter motor / solenoid starter cable
		49	Side stand cable
		50	Horizontal cylinder exhaust lambda sensor
		52	Pressure switch
		53	Voltage regulator cable

TABLE N	Lower/front cable passage	41	Lower main branch
		48	Starter motor / solenoid starter cable
		49	Side stand cable
		50	Horizontal cylinder exhaust lambda sensor
		51	Horn
		52	Pressure switch
TABLE O	Electrical component compartment and box	40	Battery negative
		41	Lower main branch
		47	Generator cable
		48	Starter motor / solenoid starter cable
		53	Voltage regulator cable
		54	Electrical component box upper branch
		55	Exhaust valve motor wiring
		80	Battery positive
TABLE P	Electrical component box: solenoid starter	40	Battery negative
		48	Starter motor / solenoid starter cable
		54	Electrical component box upper branch
		56	Gear sensor wiring
		57	Solenoid starter (with 2 fuses of 30 A)
		58	Battery positive
		59	ABS Fuse (25 A)
		60	ABS Fuse (30A)
		80	Battery positive
		81	Solenoid starter/ABS positive branch
TABLE Q	Wiring for rear speed and rear stop sensor	35	Rear branch
		61	Rear stop sensor
		62	Rear speed sensor

TABLE R	Rear subframe and BBS control unit wiring	35	Rear branch
		63	BBS control unit wiring
		64	Branch for rear subframe wiring connection
		65	BBS control unit
TABLE S	Rear subframe	64	Branch for rear subframe wiring connection
		65	BBS control unit
		66	Tail light wiring branch
		67	Tail light cable
		68	Diagnostic socket wiring
		69	Rear guard wiring
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		70	Rear left turn indicator
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		6	Injector wirings
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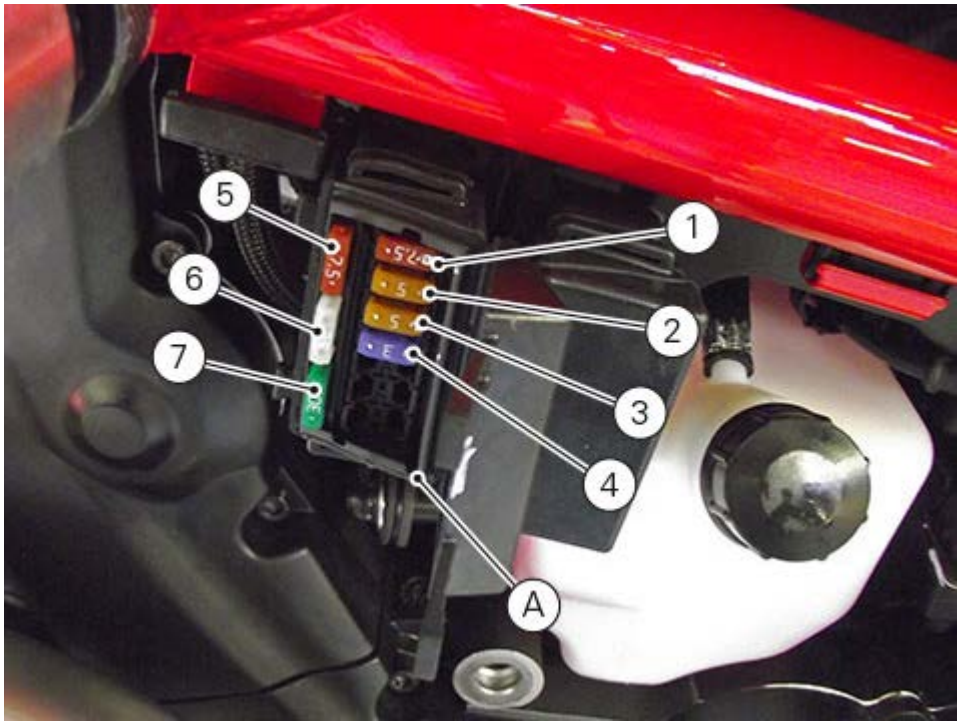
TABLES V	MAP Sensor, fuse boxes, ABS control unit	33	Lower branch
		41	Lower main branch
		43	Horizontal coil wiring
		44	Pick-up wiring
		75	MAP sensor
		76	Fuse wiring branch
		77	Rear fuse box
		78	Front fuse box
		79	ABS control unit wiring

Fuse box key

Fuse box (A)

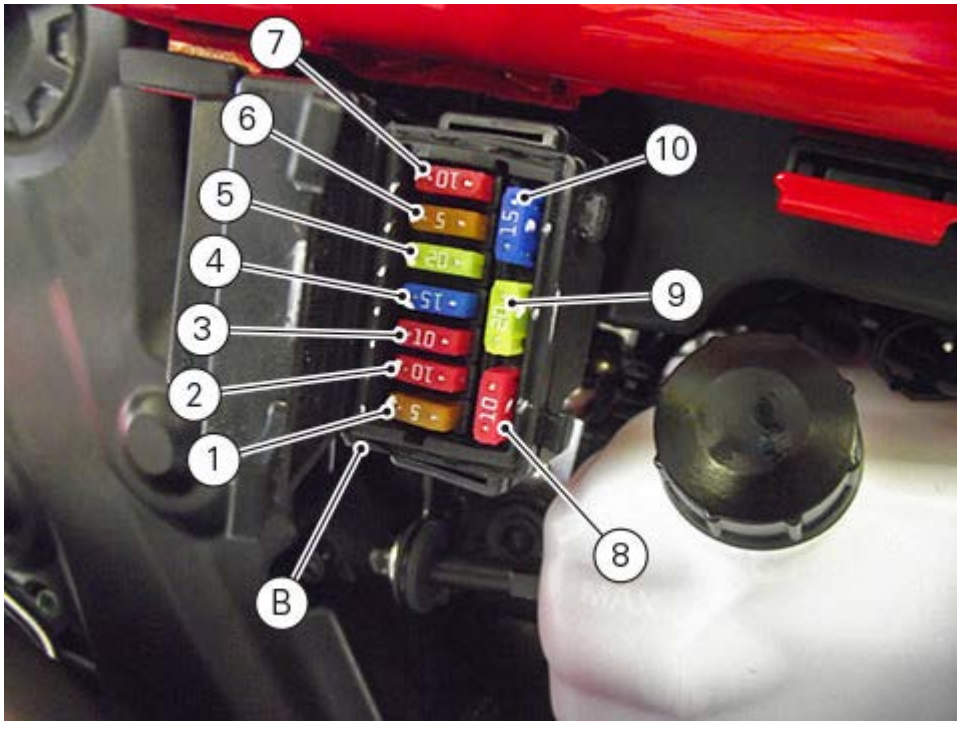
Fuse box (A) key		
Pos.	**El. item**	**Rat.**
1	Optional key	7.5 A
2	Alarm	5 A
3	Stop	5 A
4	Diagnostics	3 A
5	Spare	7.5 A
6	Spare	25 A
7	Spare	30 A



Fuse box (B)

Fuse box (B) key

Pos.	El. item	Rat.
1	Lights	5 A
2	Instrument panel	10 A
3	Key 1	10 A
4	Key 2	15 A
5	Relay	20 A
6	Control unit	5 A
7	BBS	10 A
8	Spare	10 A
9	Spare	20 A
10	Spare	15 A

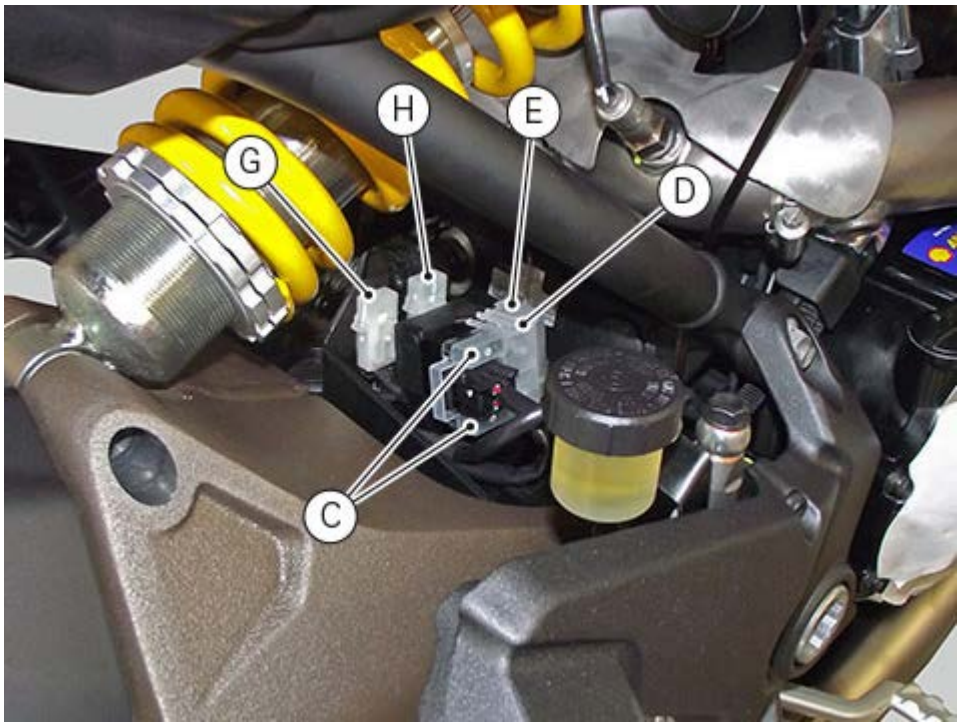


Main fuses

Main fuses key		
Pos.	**El. item**	**Rat.**
C		30A
C	Spare	30 A

ABS fuses

ABS fuse key		
Pos.	**El. item**	**Rat.**
G	ABS	25 A
H	ABS	30 A



Wire colour coding

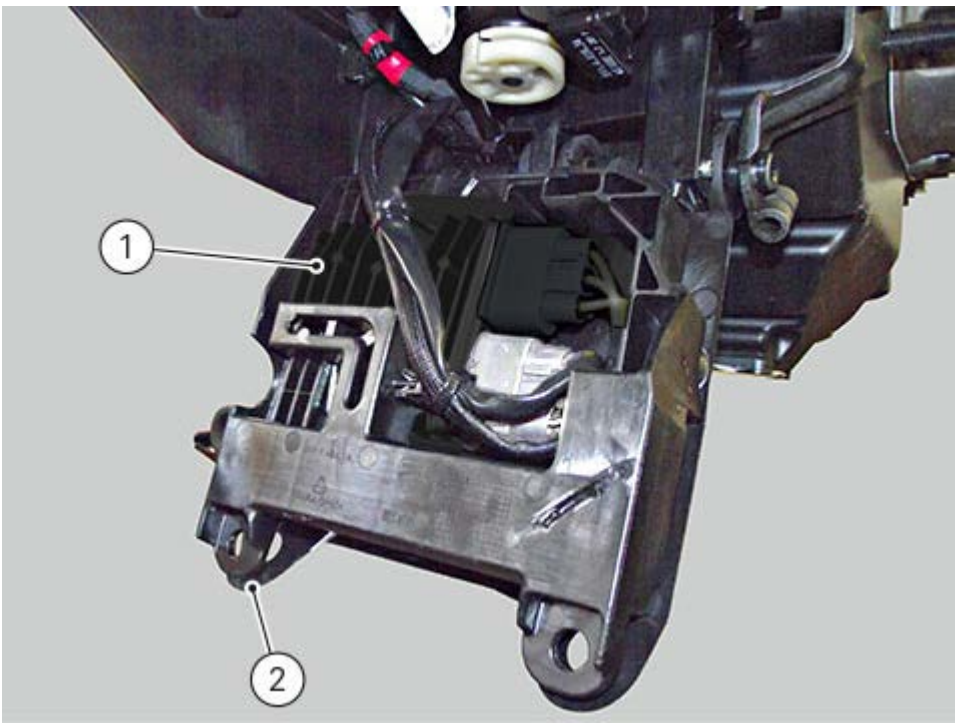
B Blue
W White
V Violet
Bk Black
Y Yellow
R Red
Lb Light blue
Gr Grey
G Green
Bn Brown
O Orange
P Pink

Injection /electric system diagram key

1 Ignition system (ignition switch)
2 LH fan
3 RH fan
4 Generator
5 Rectifier
6 Solenoid starter
7 Battery
8 Wiring ground
9 Exhaust valve motor
10 ABS control unit
11 Front fuse box
12 Rear fuse box
13 Front speed sensor
14 Rear speed sensor
15 Self-diagnosis/DDA
16 Rear right turn indicator
17 Tail light
18 Rear left turn indicator
19 Number plate light
20 BBS
21 Alarm (optional)
22 Oil pressure sensor
23 Gear sensor
24 Side stand switch
25 Clutch switch
26 Timing/rpm sensor
27 MAP sensor
28 Engine temperature
29 Ambient air temperature (TIA)
30 Horizontal exhaust lambda sensor
31 Vertical exhaust lambda sensor
32 Throttle twistgrip position sensor (APS)
33 Horizontal injector
34 Vertical injector
35 Potentiometer motor / ride-by-wire (TPS/ETV)
36 Secondary air actuator
37 Vertical coil
38 Horizontal coil
39 Fuel pump
40 Fuel pump relay
41 Injection relay
42 Control unit 2
43 Control unit 1
44 Left-hand switch
45 Front left turn indicator
46 Horn
47 Air temperature sensor
48 Instrument panel
49 Rear stop light
50 Front stop light
51 Front right turn indicator
52 Headlight
53 Right-hand switch
54 Starter relay
55 Heated handgrip power supply
56 ABS fuses
57 Immobilizer
58 Starter motor

Rectifier-regulator

Regulator (1) is located inside the wiring support (2) under the electrical components compartment.
The generator used on the Monster 821 has a rated power of 490 W at 14 V and consists of a fixed element (stator/generator), located in the generator cover and a mobile element (rotor/flywheel) fastened to the crankshaft.



The rectifier/regulator consists of an aluminium casing containing the diodes that rectify the current produced by the generator. It also contains an electronic device that regulates the current supplied by the generator in accordance with battery voltage.
If the battery is drained, the current has the value necessary to restore optimum operating conditions of the battery itself.
While, if the battery is fully charged, the current value will be lower.

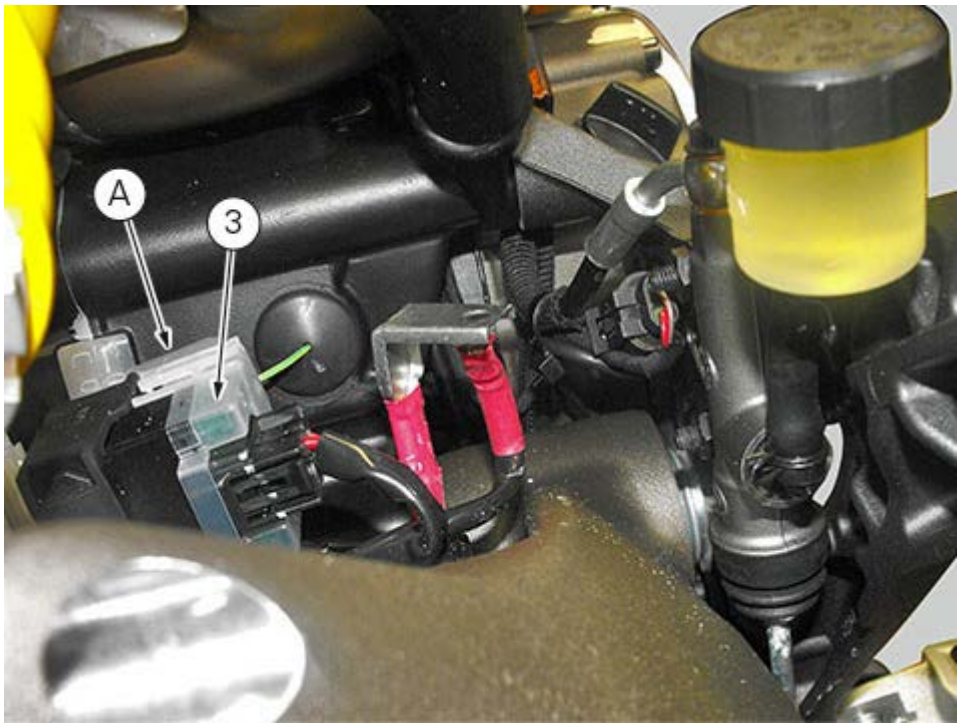
Important
Check the charging current by using the "DDS" diagnosis instrument.

Removing the regulator
To remove the regulator, see the procedure explained in chapter "Removing the electric components compartment".

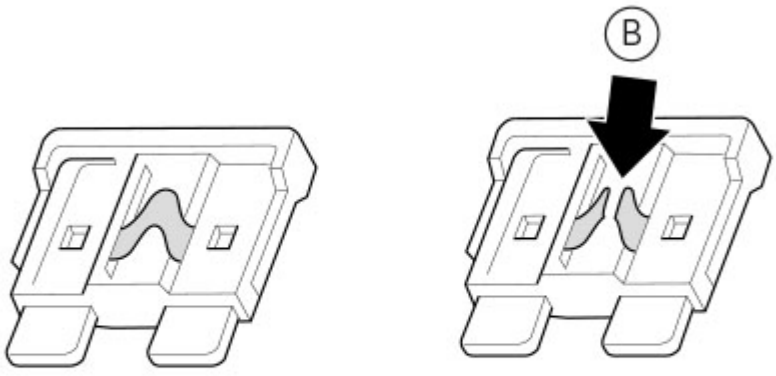
Important
Do not disconnect the battery cables when engine is running because this would cause irreparable damage to the regulator.

Refitting the regulator
To install the regulator on the vehicle, see the procedure explained in chapter "Refitting the electric components compartment".

REGULATOR FUSE
The regulator fuse (3) of 30 A is located inside solenoid starter (A), in the battery compartment and protects the electronic regulator.



A blown fuse can be identified by breakage of the inner filament (B).



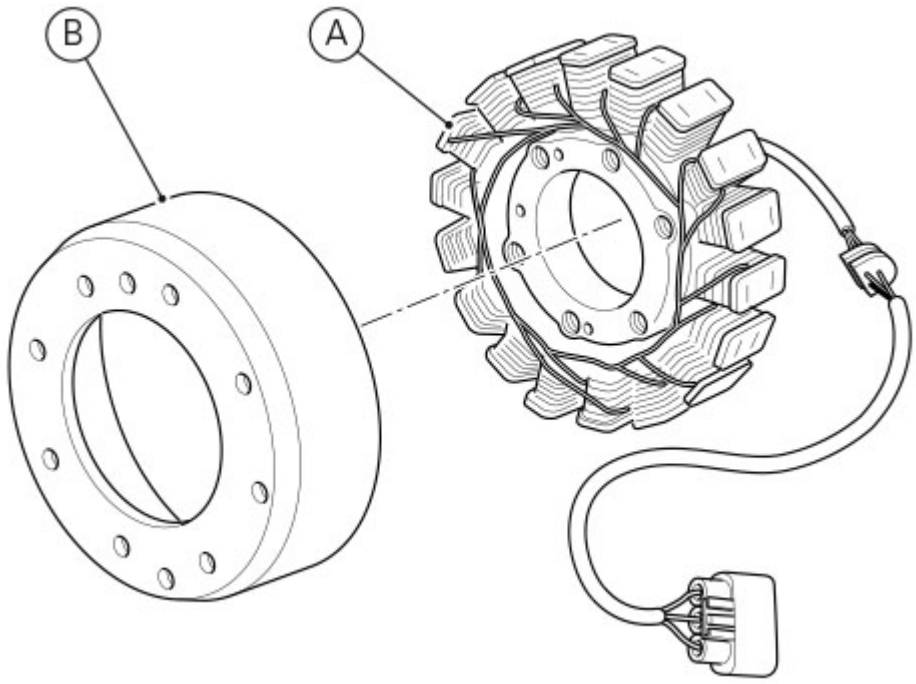
Important
Switch the ignition key to OFF before replacing the fuse to avoid possible short-circuits.

Warning
Never use a fuse with a rating other than the specified value. Failure to observe this rule may damage the electric system or even cause fire.

To access the regulator fuse, see paragraph "Solenoid starter".

Alternator / Generator

The generator used on the Monster 821 has a rated power of 490 W at 14 V and consists of a fixed element (stator/generator, A), located in the generator cover and a mobile element (rotor/flywheel, B) fastened to the crankshaft.



Rotor (B) is manufactured with strong permanent magnets and features a lot of pin pairs for each stator phase. This allows generating alternate voltage at a higher frequency compared to a standard generator. The result: at low rpm it is possible to generate higher current.

Important
Check the charging current by using the "DDS" diagnosis instrument.

To check the generator, measure the voltage at each end of the generator cable and check if it is compliant with the value indicated in the table (ambient temperature: 20 °C).

Attention
Before testing, disconnect the generator wiring from the electrical system when the ignition key is set to OFF.

Rpm	Active voltage	Minimum voltage	Maximum voltage
1500 rpm	29.8 V	18.9 V	24.5 V
2500 rpm	34.3 V	31.4 V	40.4 V

Values significantly lower than those indicated above can be due to:
- partially demagnetised rotor;
- short-circuited windings.

In the above cases the whole generator assembly (rotor and stator) should be replaced.
If checks have a favourable outcome, reconnect the generator to the regulator with ignition key on OFF.
Make sure that no cables are damaged or disconnected.

Removing the generator
Drain the engine oil (Changing the engine oil and filter cartridge).
Remove the front sprocket cover (Removing the front sprocket cover).
Slide out the gearchange mechanism (Removing the gear shift).
Drain the cooling system and release the case from the pipes (Removing the cooling system hoses and unions).
Remove the generator cover (Removing the generator cover), the stator (A) (Disassembling the generator

cover) and the rotor (B) (Removing the flywheel/generator assembly).

Refitting the generator

Fit the rotor (B), the stator (A) (Fitting the flywheel/generator assembly) and the generator cover (Fitting the generator cover).
Refit the cooling system pipes (Refitting the cooling system hoses and unions) and restore the fluid level.
Refit the gearchange mechanism in its seat (Refitting the gear shift).
Refit the front sprocket cover (Refitting the front sprocket cover).
Restore the engine oil level (Changing the engine oil and filter cartridge).

Battery

Battery safety rules

Warning
Before carrying out any operations on the battery, keep in mind the safety standards. When under charge, batteries produce explosive gases. Keep batteries away from heat sources, sparks or open flames.

Instructions for battery use
The battery is a sealed, maintenance-free type and therefore requires no special installation procedure.

Important
Never try to open the battery as it is sealed, it does not require maintenance operations or to be filled in with acid or other types of liquids. Consequently, it does not need any operation upon its installation on the vehicle.

Note
Always keep the battery clean. Apply grease around the battery terminals to prevent corrosion.

Warning
Never remove the valve cover located on top of the cover. If the block, cover or terminals are broken or if the valve cover has been tampered with, IT IS ABSOLUTELY NECESSARY TO REPLACE THE BATTERY.

Important
If the motorcycle is left unused for more than 30 days, remove the battery and store it in a safe, cool place.

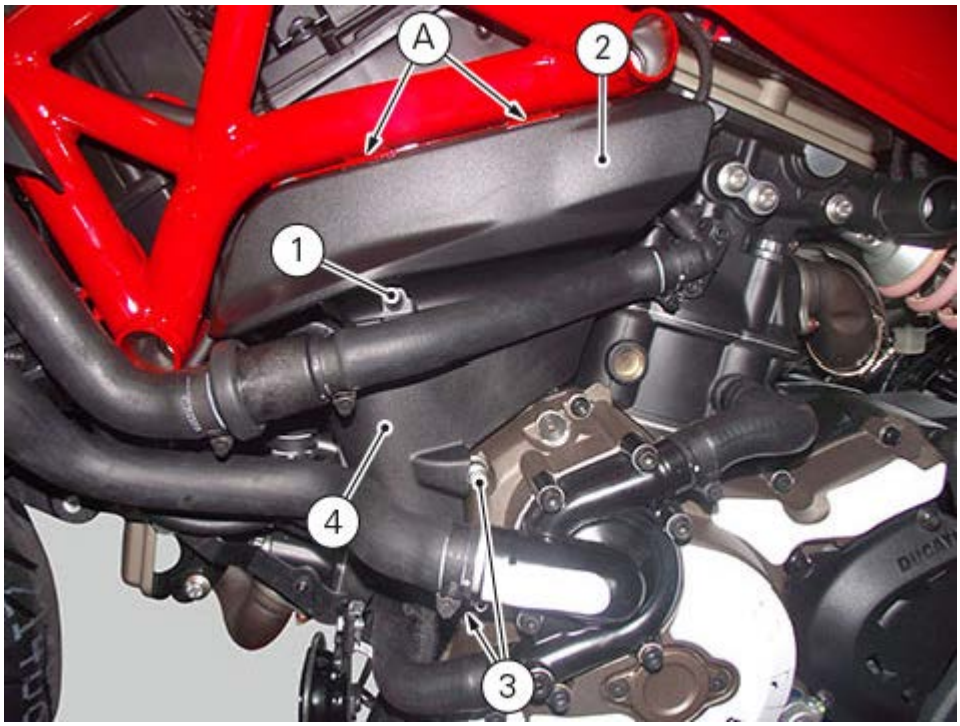
Warning
The battery gives off explosive gases; never cause sparks or allow naked flames and cigarettes near the battery. Check that during the battery charge, the area ventilation is adequate and that the ambient temperature is lower than 40 °C (104 °F). Do not try to open the battery: it does not require to be filled with acid or other types of fluids.

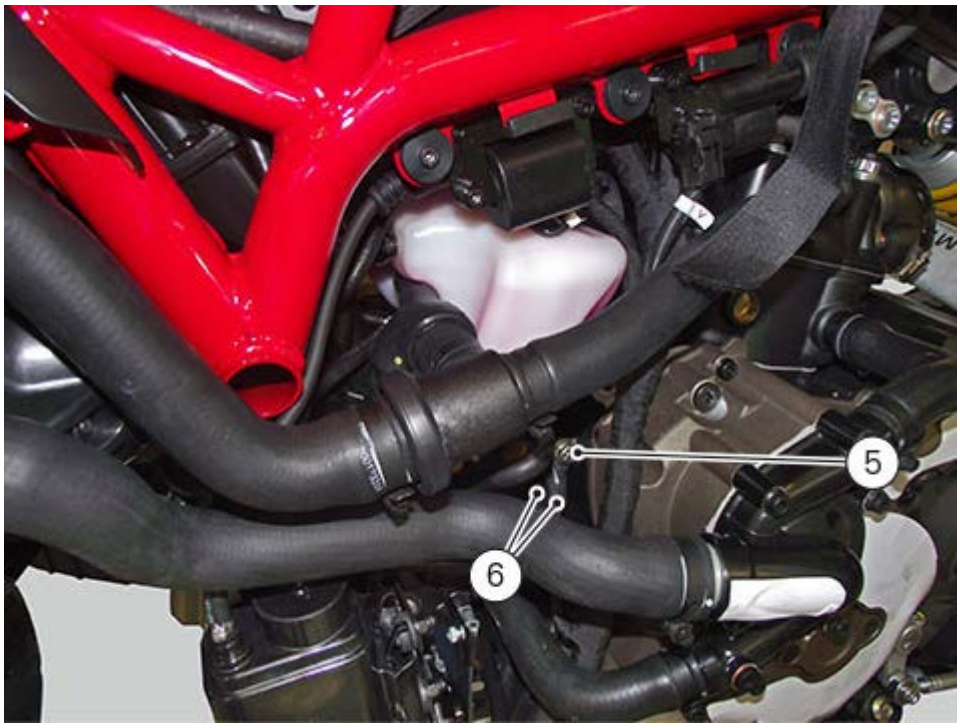
Always charge the battery before the first operation and after long storage periods – such as before selling the vehicle.

Removing the battery

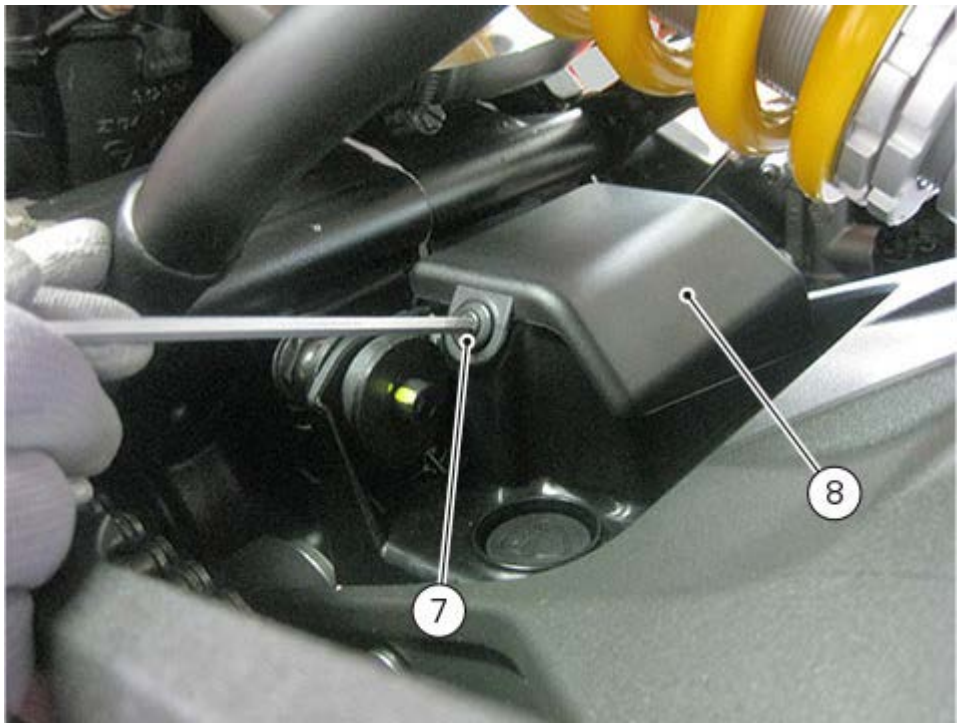
Loosen screw (1) and remove cover (2) by sliding it out of tabs (A).
Loosen the screws (3) and remove the cover (4).
Undo the screw (5) and disconnect the ground cables (6).

Warning
Insulate the ground cable ends you just removed to prevent them from touching the motorcycle.

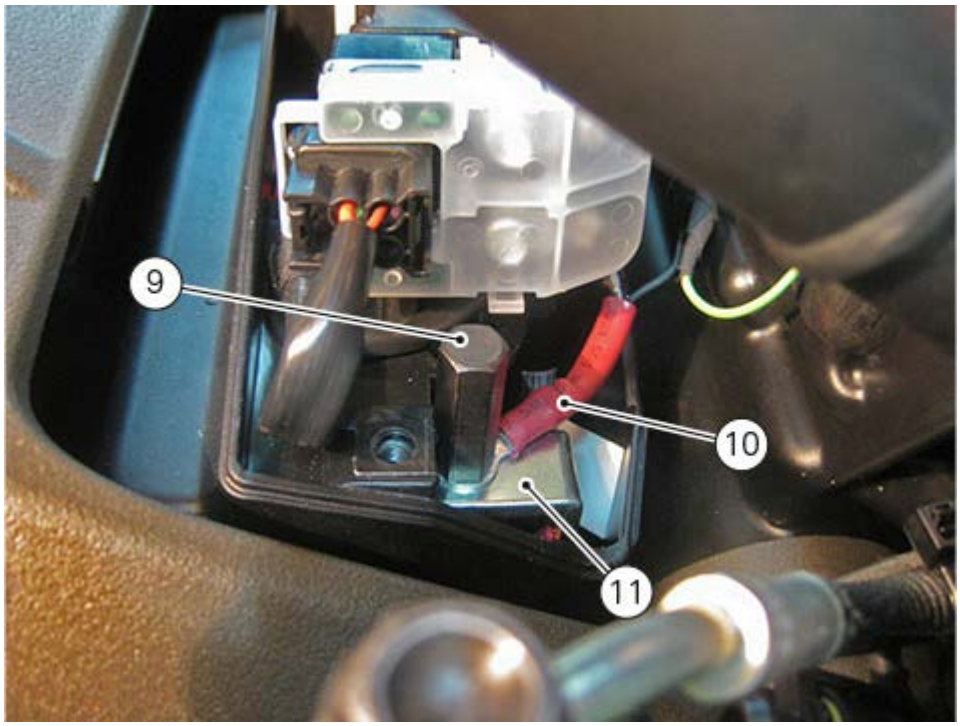




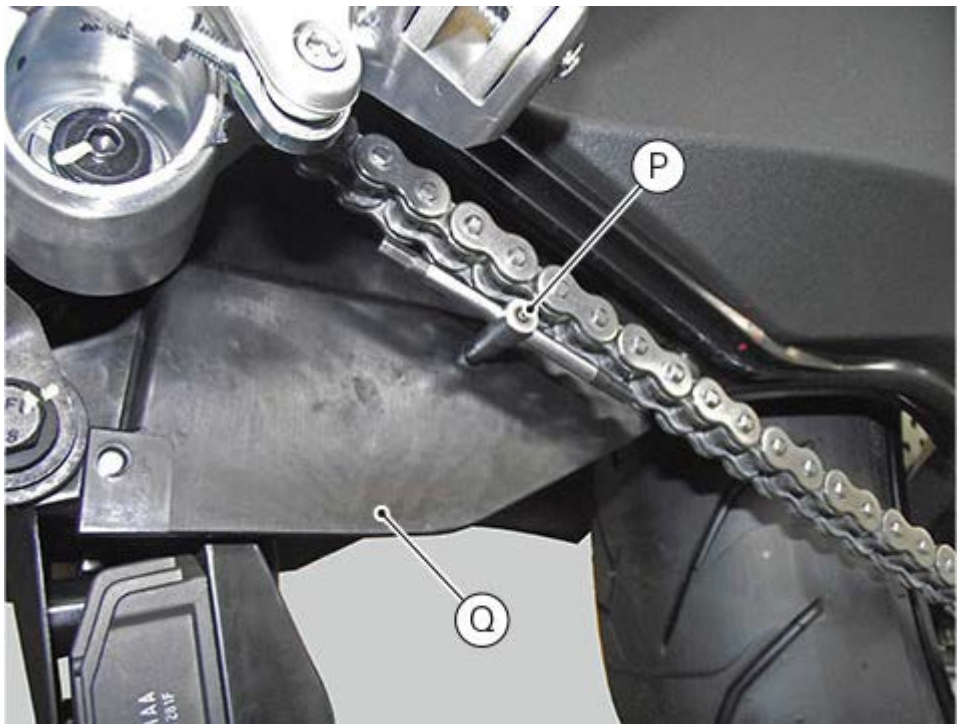
Loosen screws (7) on battery cover (8).



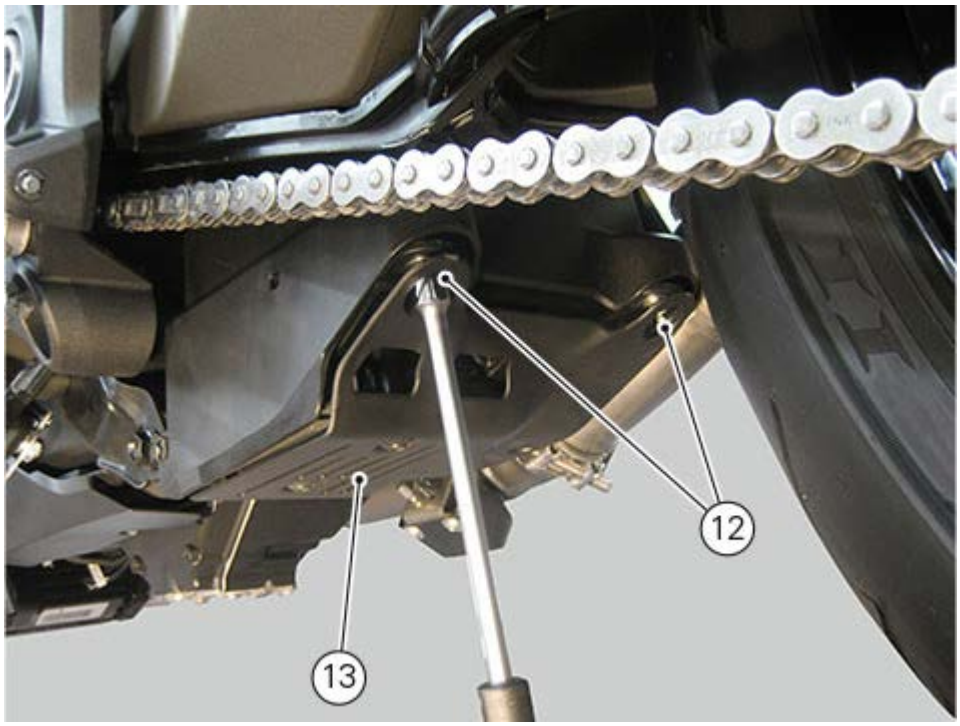
Loosen the special screw (9) retaining ABS positive cable terminals (10) and battery positive terminal (11) to battery positive pole.



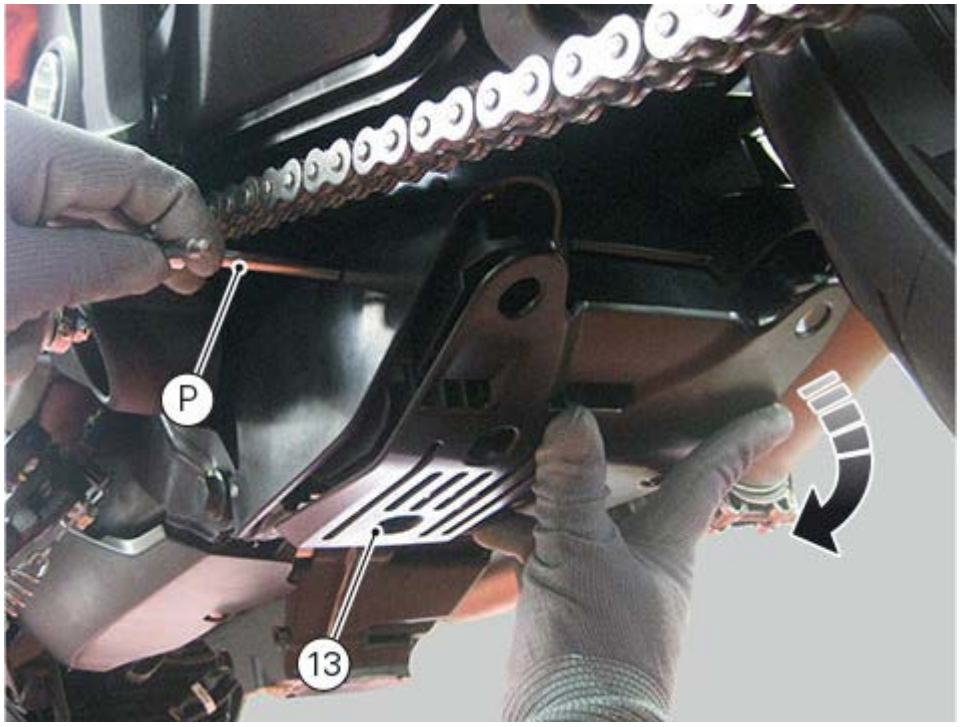
Fit a service pin (P) in the hole on electric components support (Q) to change the battery.

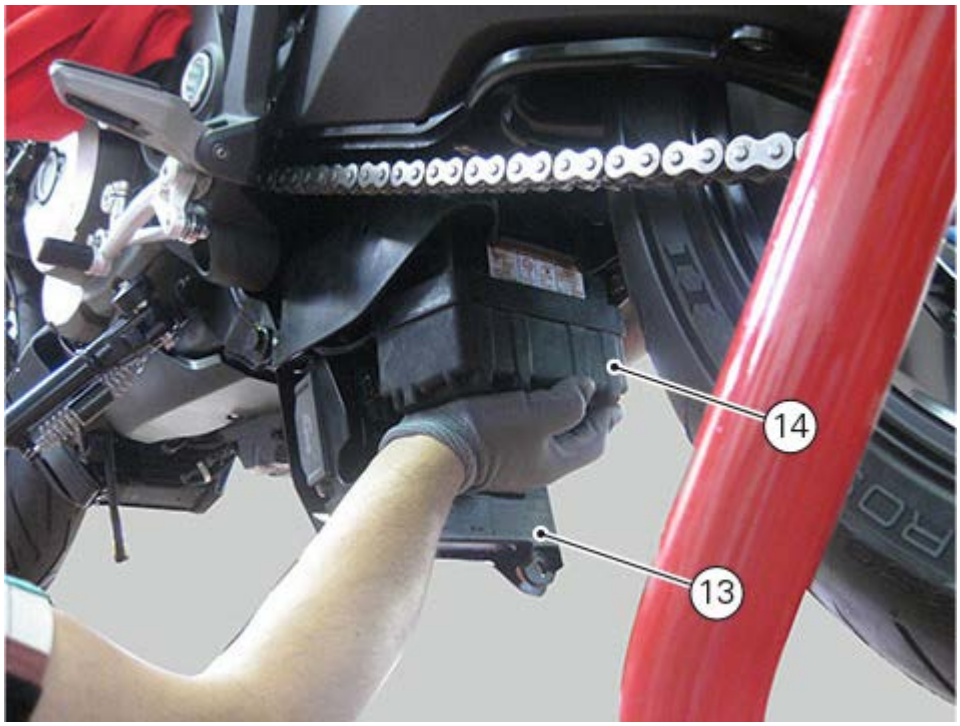


Loosen the screws (12) securing battery mount cover (13) to electric components support.

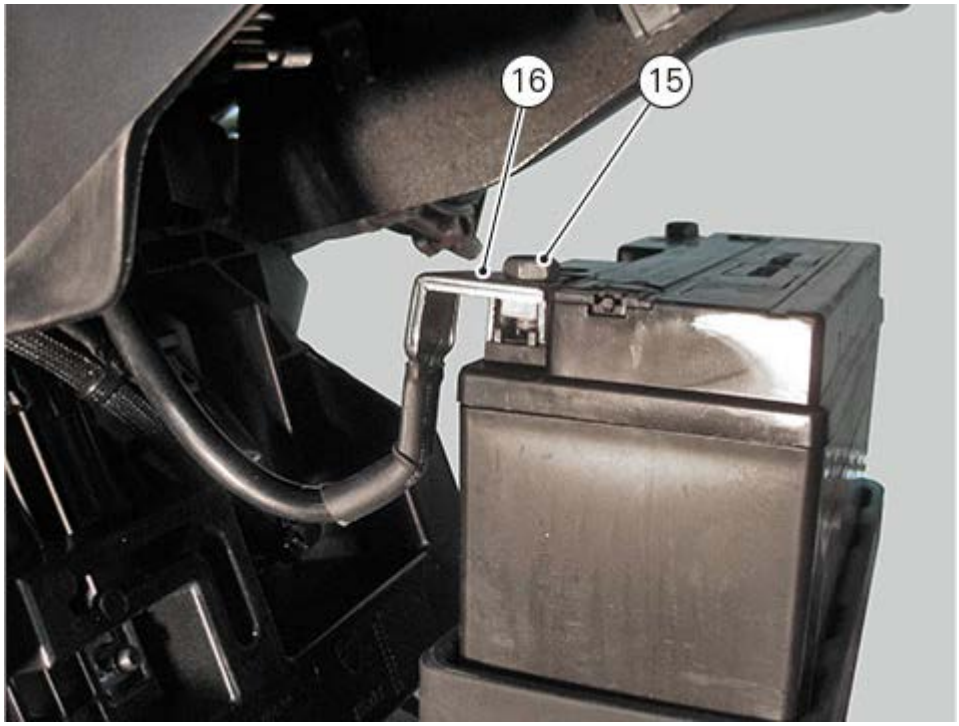


Turn battery mount cover (13) down and remove service pin (P) while supporting the battery (14) with your hand.
Slowly slide down battery (14), pay attention to the negative pole which is still connected to the wiring.



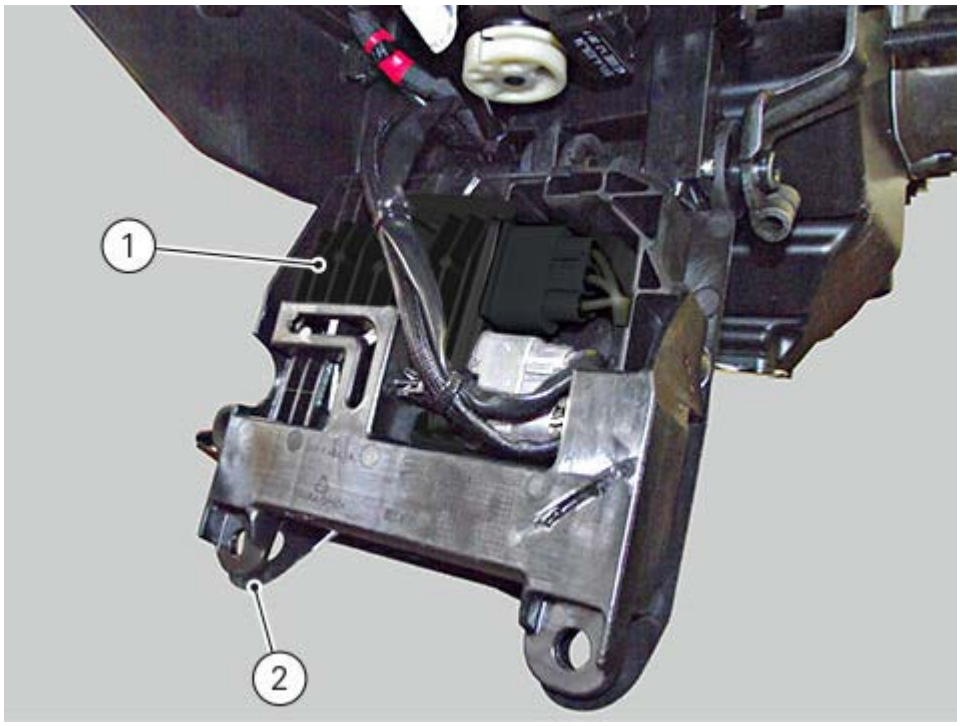


Loosen screw (15) securing negative cable (16) to battery negative pole and remove the battery.

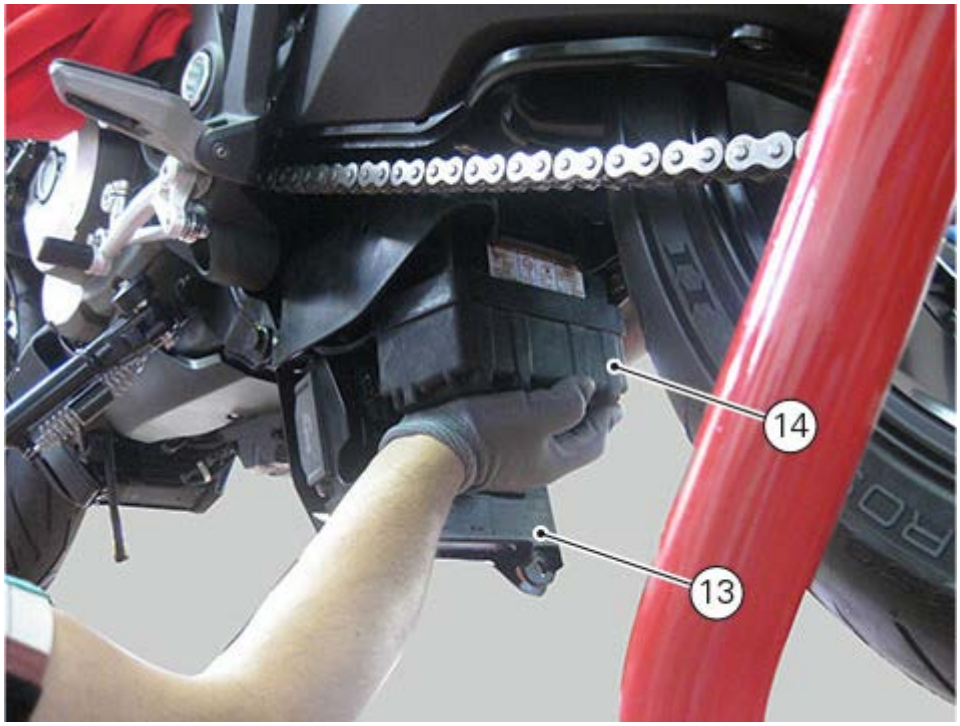


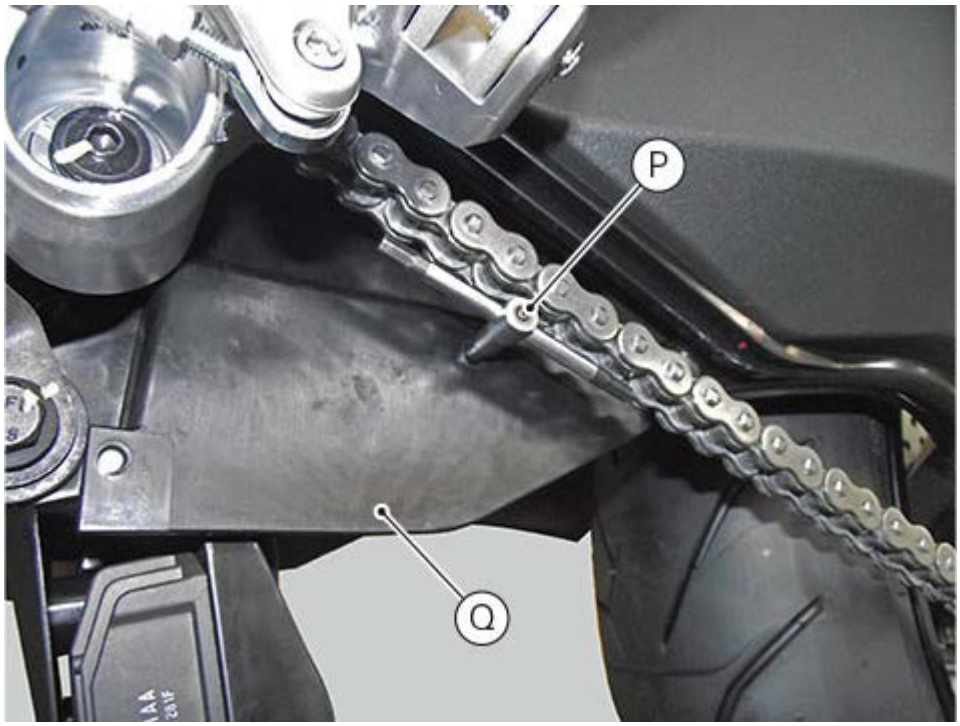
Refitting the battery

Fit the battery negative cable (16) on battery negative pole and fasten it by tightening screw to 10 Nm ± 10%.

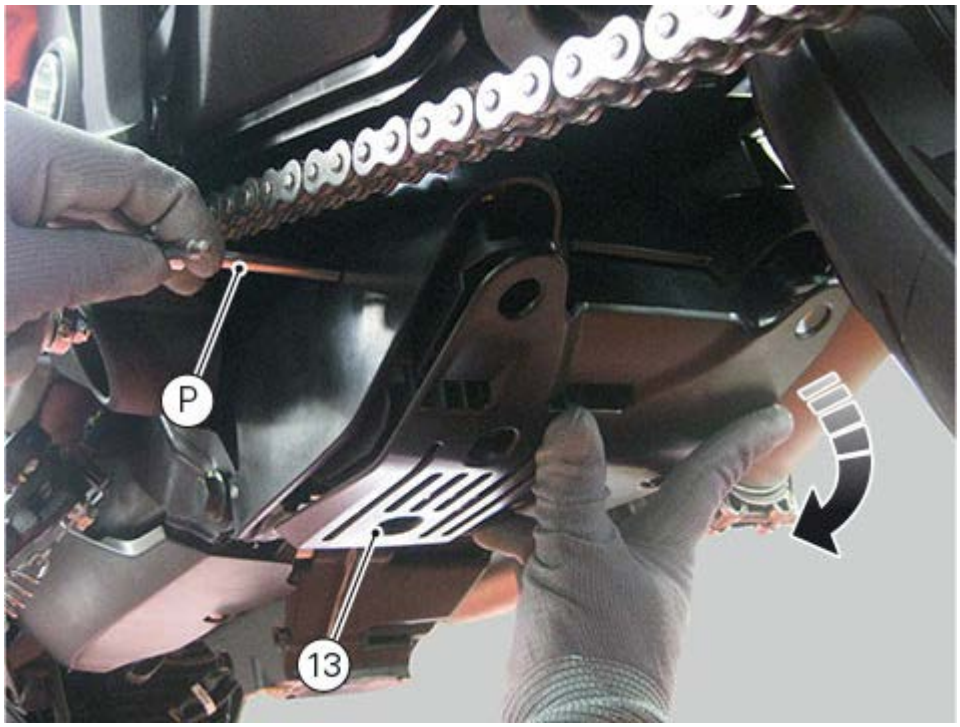


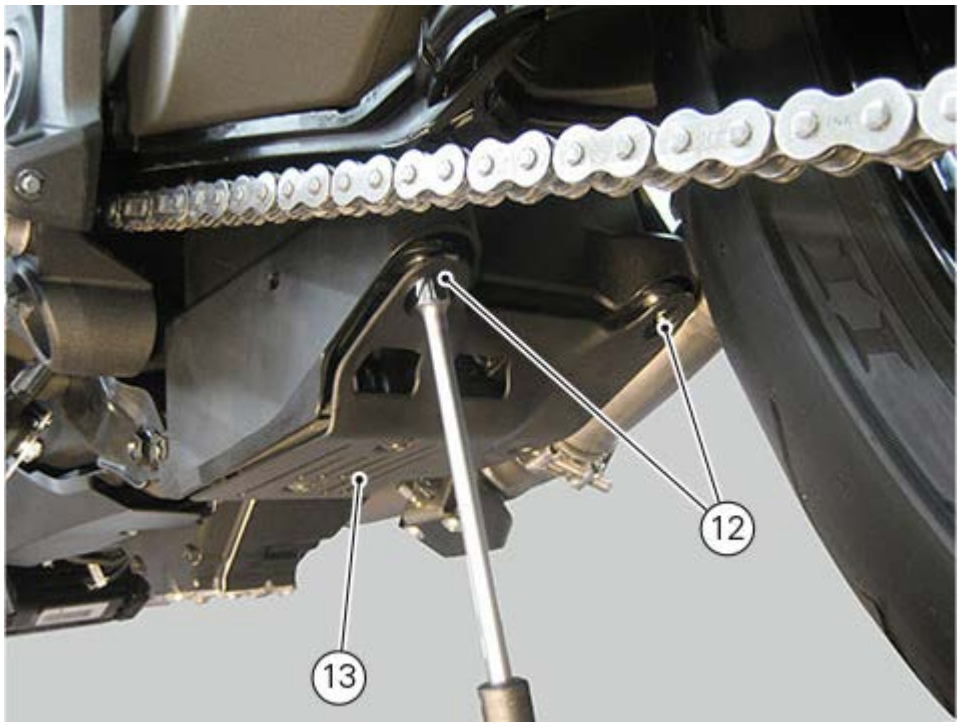
Install battery (14) in its seat, from swinging arm bottom side.
Once battery (14) is in place, fit service pin (P) in the hole on electric components support (Q) to support the battery.
Raise the battery mount cover (13) until it gets against the battery.



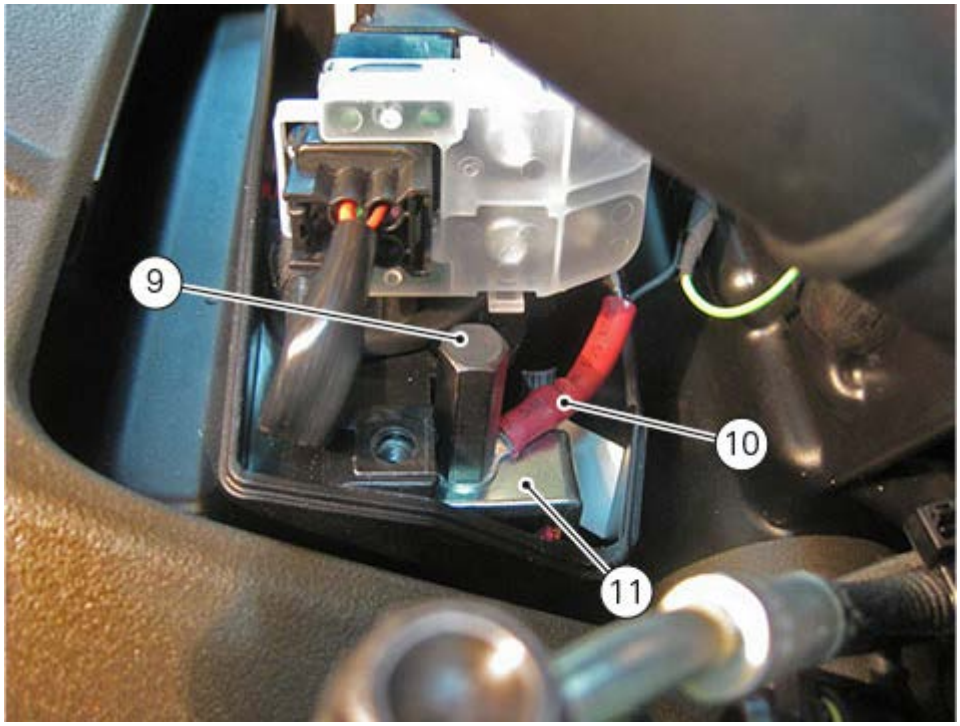


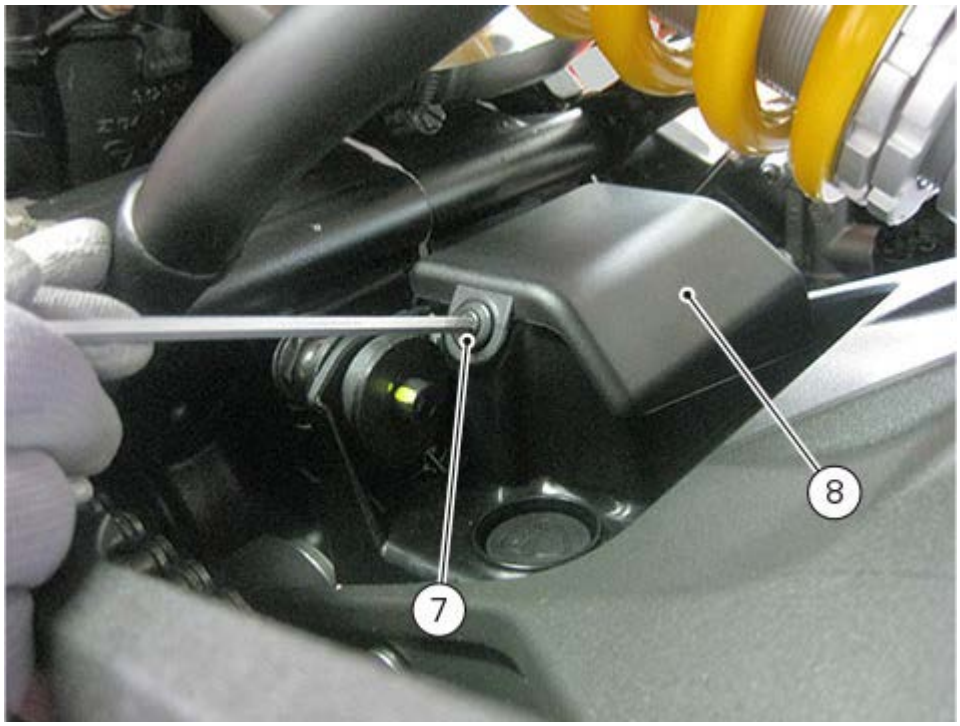
Slide out pin (P) and fasten battery mount cover (13) using the two screws (12) with relevant spacers; tighten them to 5 Nm ± 10%.



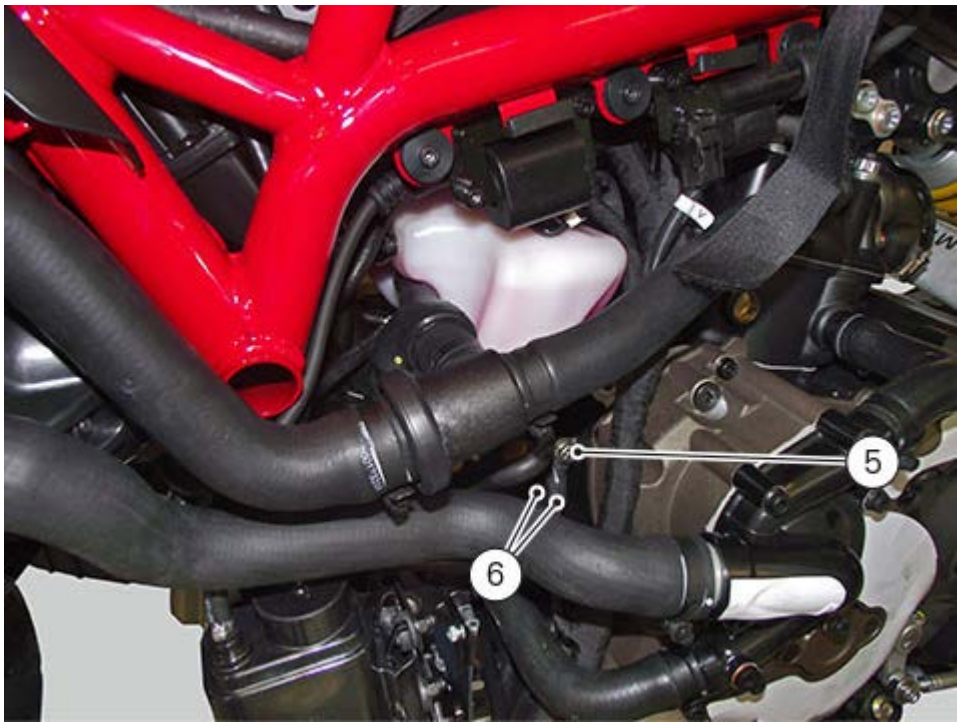


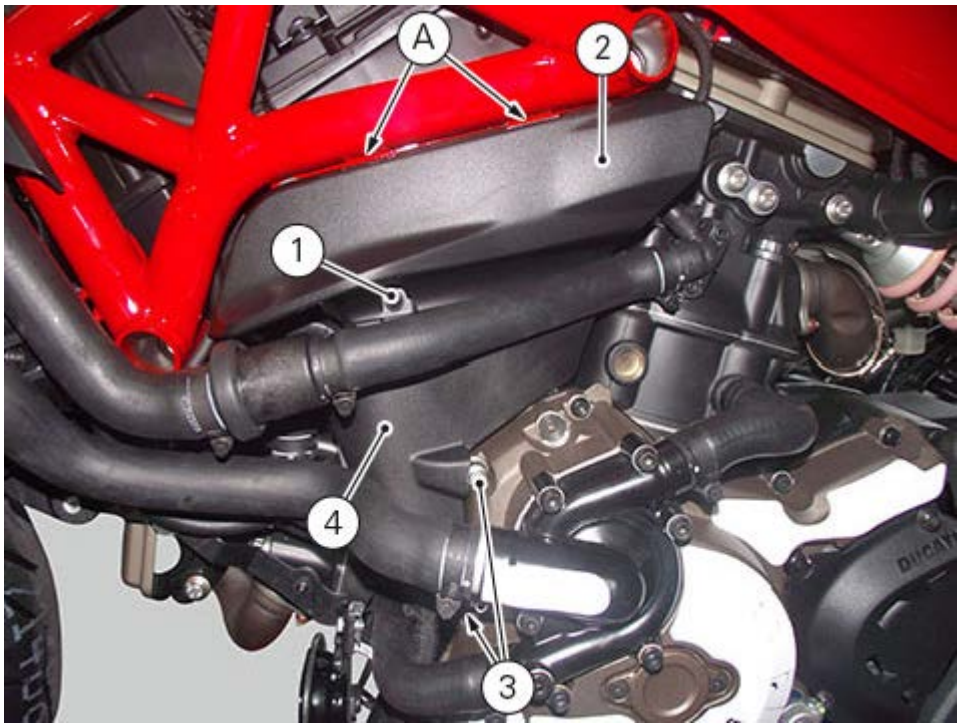
Fit the ABS positive cable (10) and battery positive cable (11) on battery positive pole and fasten it by tightening screw (9) to 10 Nm ± 10%.
Fit the battery cover (8) on electric components support.
Start screws (7) and tighten them to a torque of 4 Nm ± 10%.





Fit the ground cable (6) on motorcycle and fasten it by tightening screw (5) to 10 Nm ± 10%. Install cover (4) and tighten the screws (3) to a torque of 5 Nm ± 10%. Install cover (2) and tighten the screw (1) to a torque of 1 Nm ± 10%.



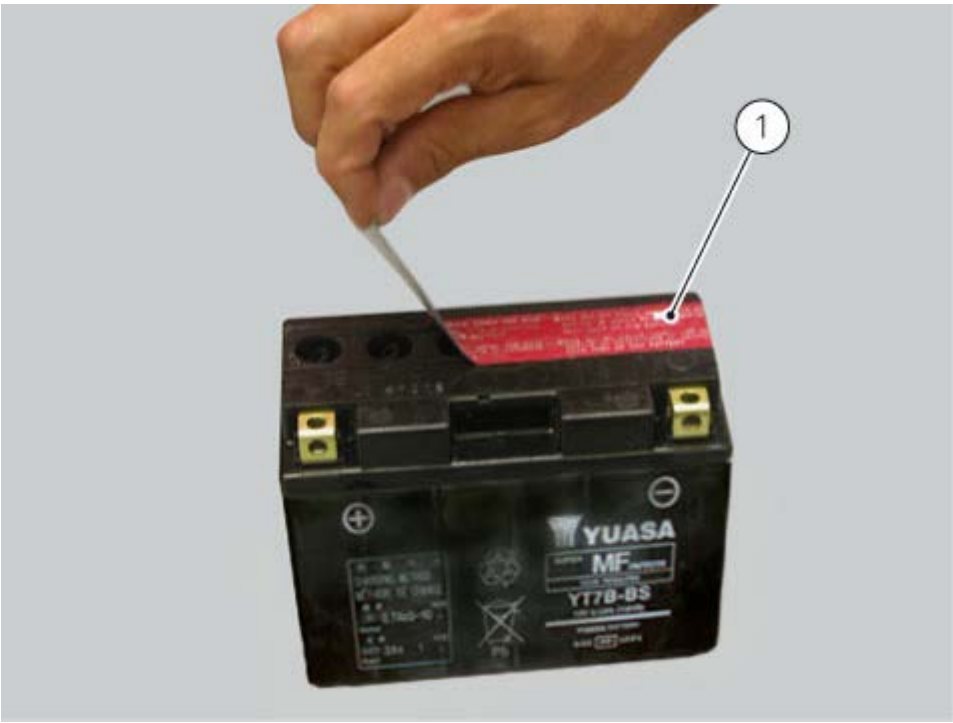


Topping up the electrolyte

Remove the battery (Battery).

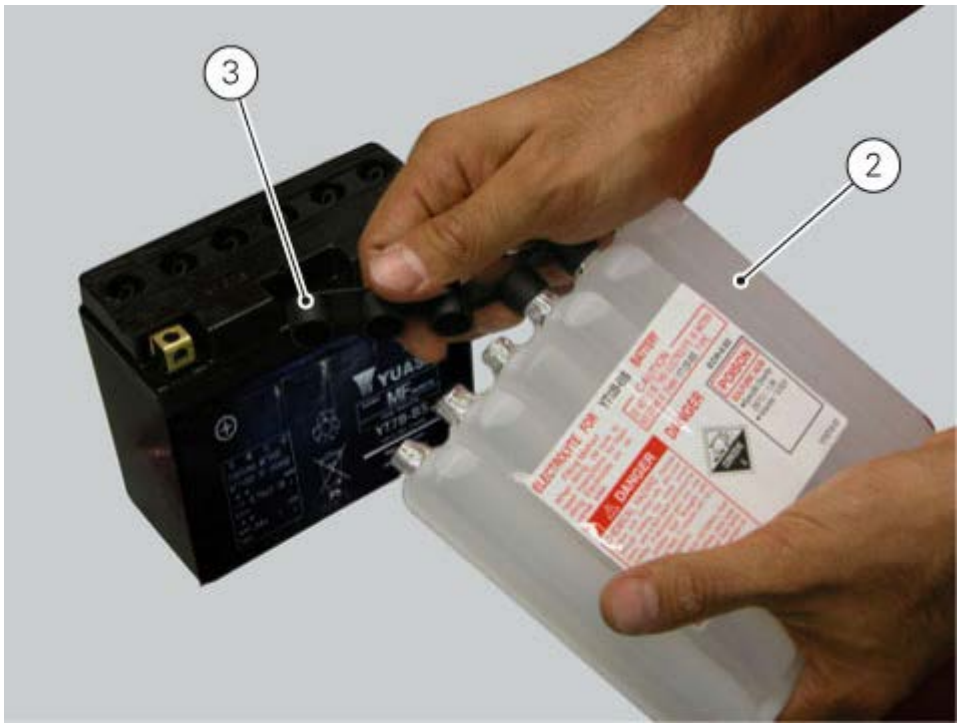
Warning
Before carrying out any operations on the battery, keep in mind the safety standards (General safety rules). The electrolyte in the battery is toxic and can cause burns if it comes into contact with the skin because it contains sulphuric acid. Wear protective clothing, a face-mask and goggles when adding electrolyte. If the fluid comes into contact with the skin, wash thoroughly with fresh water. If it comes into contact with the eyes, wash thoroughly with water for 15 minutes and consult an ophthalmologist. In the event of accidental ingestion, drink large quantities of water or milk, and continue with milk of magnesia, a beaten egg or vegetable oil. Do not allow sparks, flames, cigarettes or any other heat source to get near the battery, as it produces explosive gases. When recharging or using the battery indoors, make sure that the room is adequately ventilated. Do not inhale the gases produced during recharging. KEEP OUT OF REACH OF CHILDREN.

Place the battery on a flat surface. Remove the protective film (1).



Warning
Make sure that the electrolyte is of the specific type for your battery.

Remove the container with the electrolyte from the plastic bag.
Remove the cap strip (3) from the container (2).



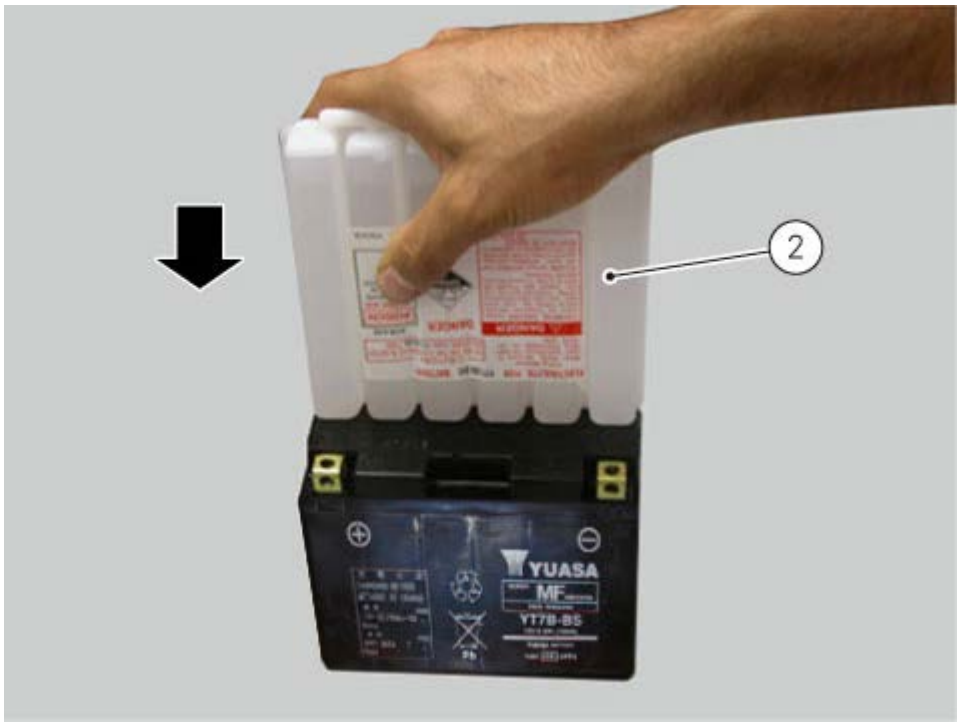
Important

Keep the cap strip (3) to hand because it will be used later to plug the battery cells.

Warning

Do not peel or perforate the sealed areas.

Place the electrolyte container (2) upside down. Align the six sealed elements with the six filler holes on the battery. Push the container (2) downwards with sufficient force to break the seals and allow the fluid to flow out.

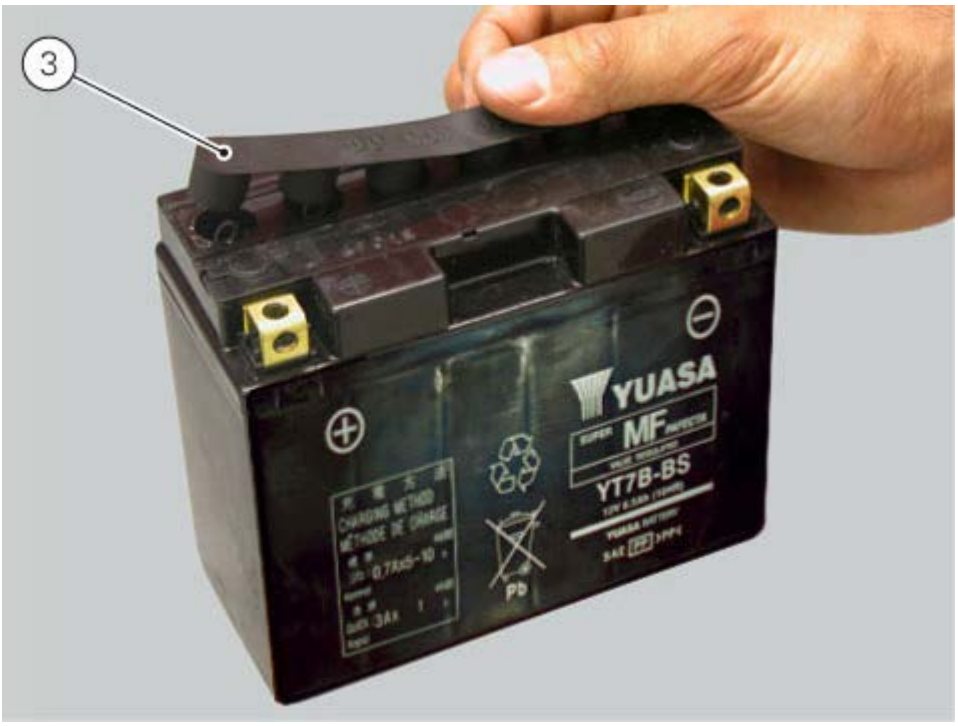


Note
Do not tilt the electrolyte container as this could interrupt the flow temporarily or even permanently.

Make sure that air bubbles emerge from all six filler holes. Leave the container in this position for at least twenty minutes.
If no bubbles emerge from one of the holes, tap gently on the bottom of the respective container.

Important
Never move the container away from the battery. Do not cut or puncture the container.

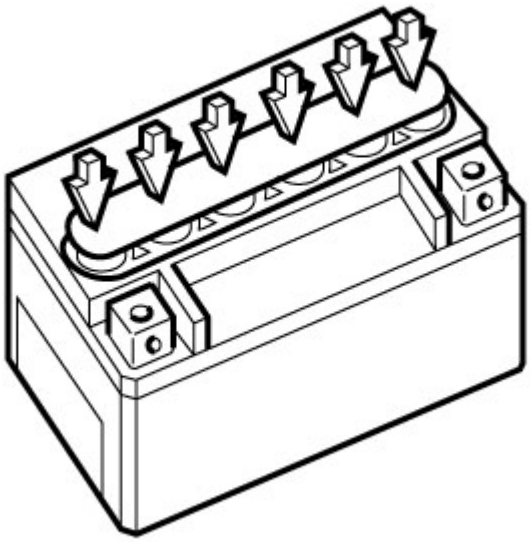
Make sure that all the electrolyte has flowed out. Carefully extract the container (2) from the battery.
Fit the cap strip (3) previously removed from the electrolyte container (2) to the battery, and ensure the caps plug off all filler holes.



3-12 Ah batteries: leave to stand for at least 30 min.
Over 12 Ah batteries: leave to stand for at least 1 hour.
Set the cap strip on the filler holes without securing it. Recharge the battery as described in the paragraph "Recharging the battery".

Note
When using an automatic battery charger, ensure that the charger current (ampere) is equal to or higher than the value of the standard charging system (STD) indicated on the battery itself.

Press firmly downwards with both hands until the caps are firmly in place (do not use a hammer).



Recharging the battery

Refer to the label on the battery showing the inspection intervals in order to determine when to test the voltage.

Charge the battery if the open circuit voltage is lower than 12.8 V. Leaving the battery discharged for more than one month could damage it. Check the battery charge with a voltmeter.
Always check the condition of the battery before recharging and 1 to 2 hours afterwards.

Warning

Pay careful attention to recharging times. Stop charging immediately if the battery becomes too hot to the touch. Leave to cool before resuming charging.

Use only constant-voltage battery chargers.
Check that battery terminals are properly connected to the battery charger.
To charge the battery, proceed as follows.

Type of charging	Volt	Ampere (A)	Time (Hours)
Normal	12	1.2	5-10

Use fast charging in emergencies only.

Storing the battery

If the battery voltage is less than or equal to 11.5V, it must be recharged.
Connect the battery charger to the battery.
Use a voltage of 16-17V.
If the ammeter shows no change, increase the voltage to maximum 25V.
Charge for 5 minutes.
If the ammeter shows a change, restore a voltage of 16-17V; otherwise replace the battery.

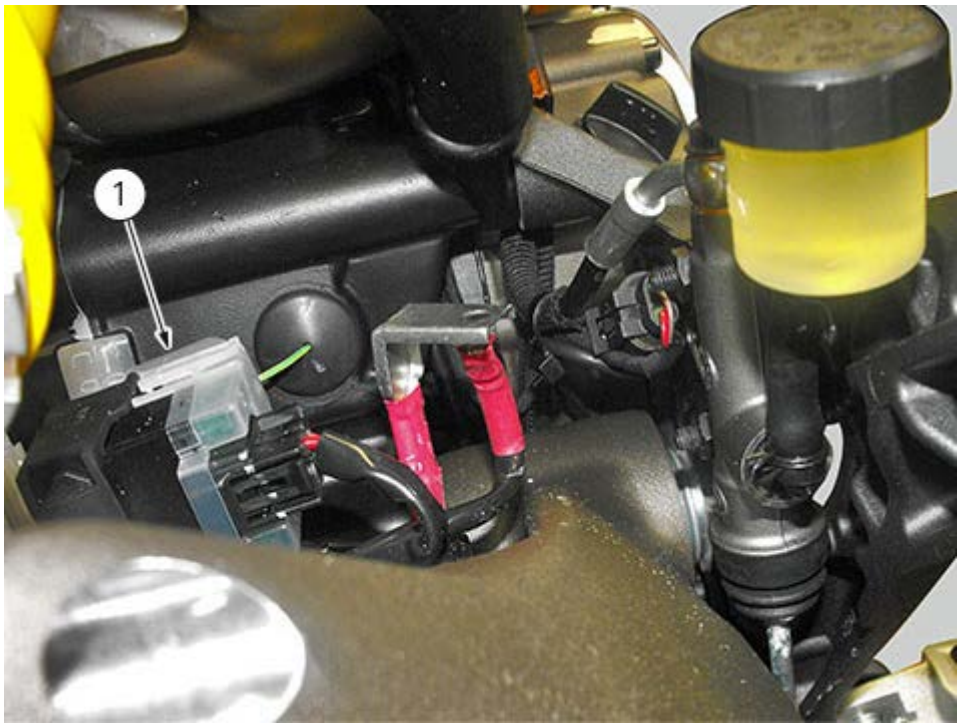
Checking the battery charging system

Perform checks on the system as indicated in the following paragraphs:

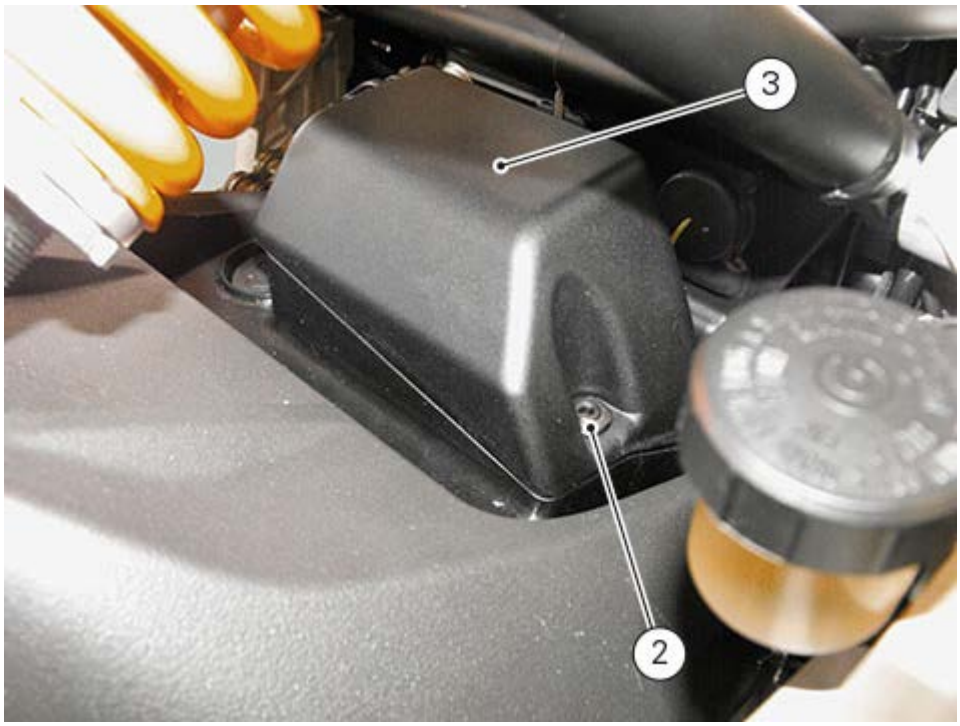
Recharging the battery
Topping up the electrolyte
Battery
Alternator
Rectifier-regulator

Solenoid starter

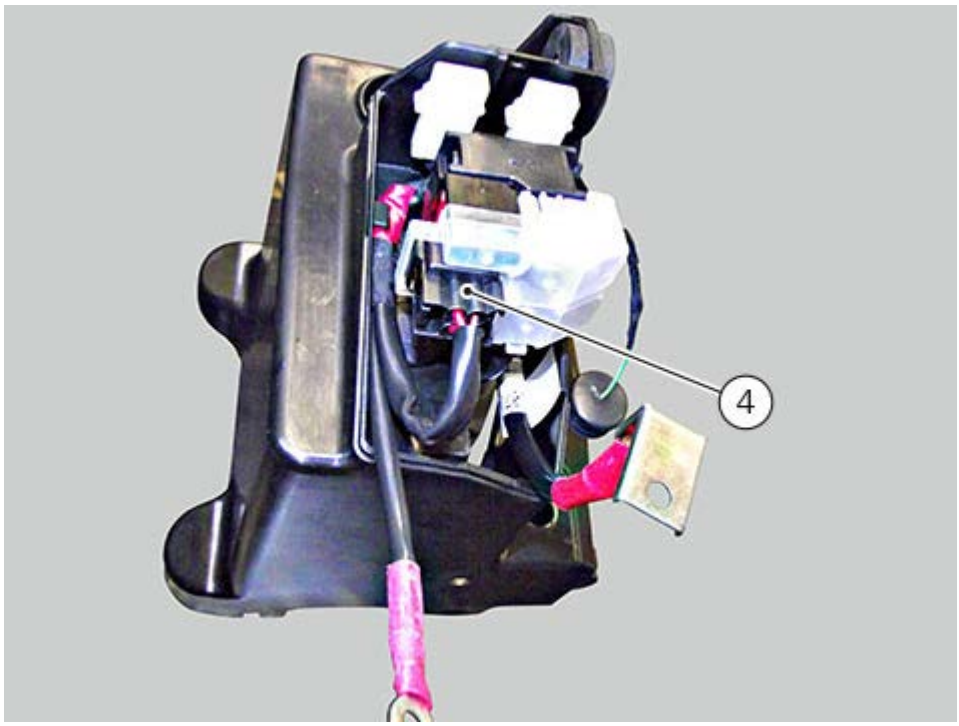
The solenoid starter (1) is mounted under the battery cover.



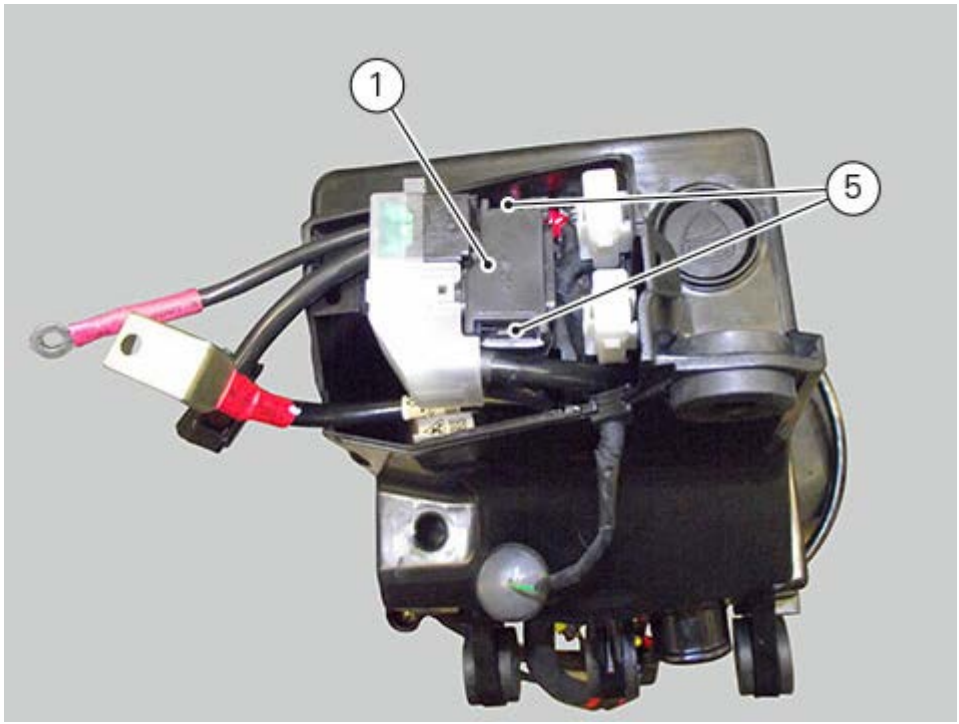
REMOVING THE SOLENOID STARTER
Loosen the two fastening screws (2) on cover (3) protecting the solenoid starter.



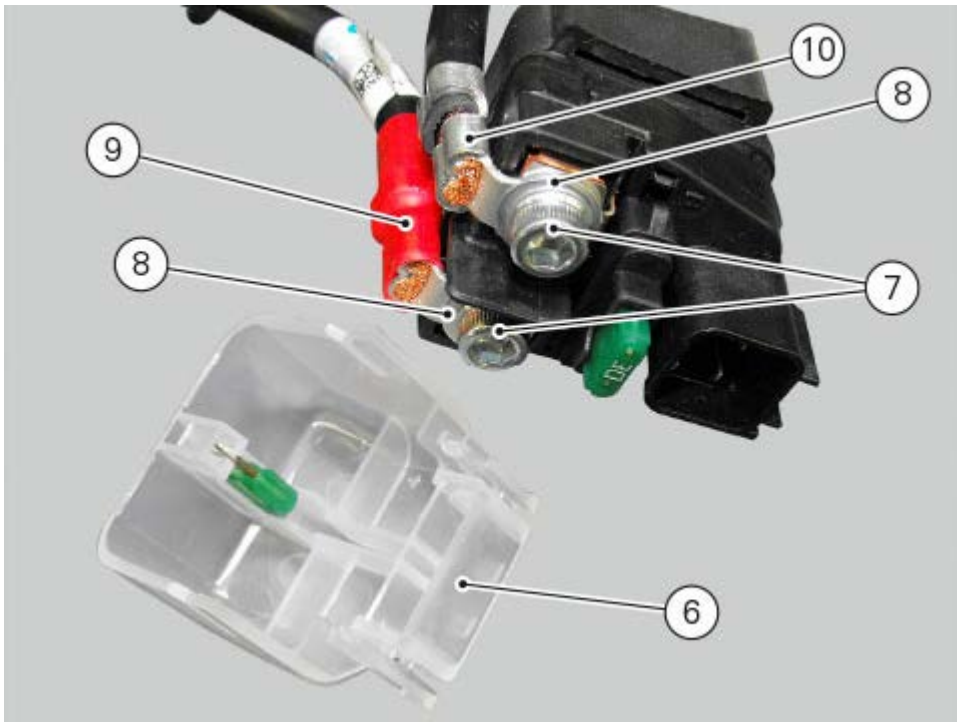
Disconnect regulator connector (4).



Remove the solenoid starter (1) by pulling it up and releasing it from fasteners (5).

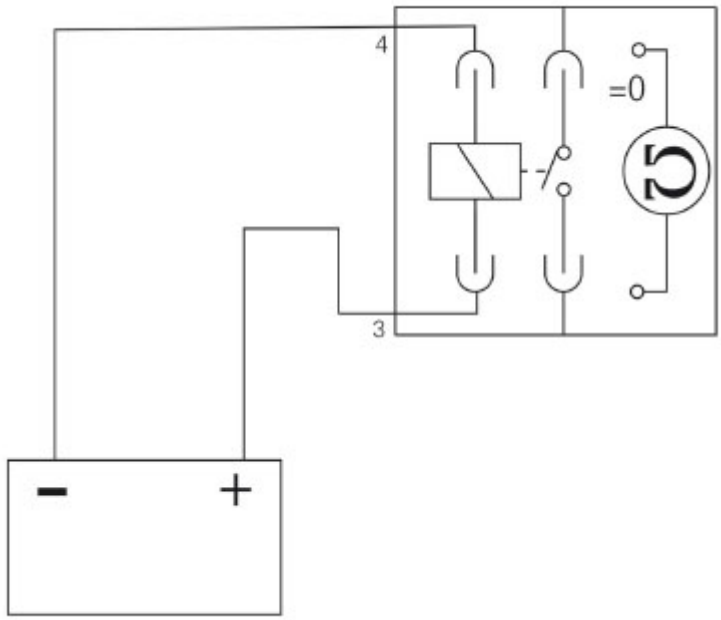


Slide out protection cap (6).
If necessary, loosen screws (7) and collect the relevant washers (8).
Release the starter motor solenoid starter cable (9) and the solenoid starter-battery cable (10).



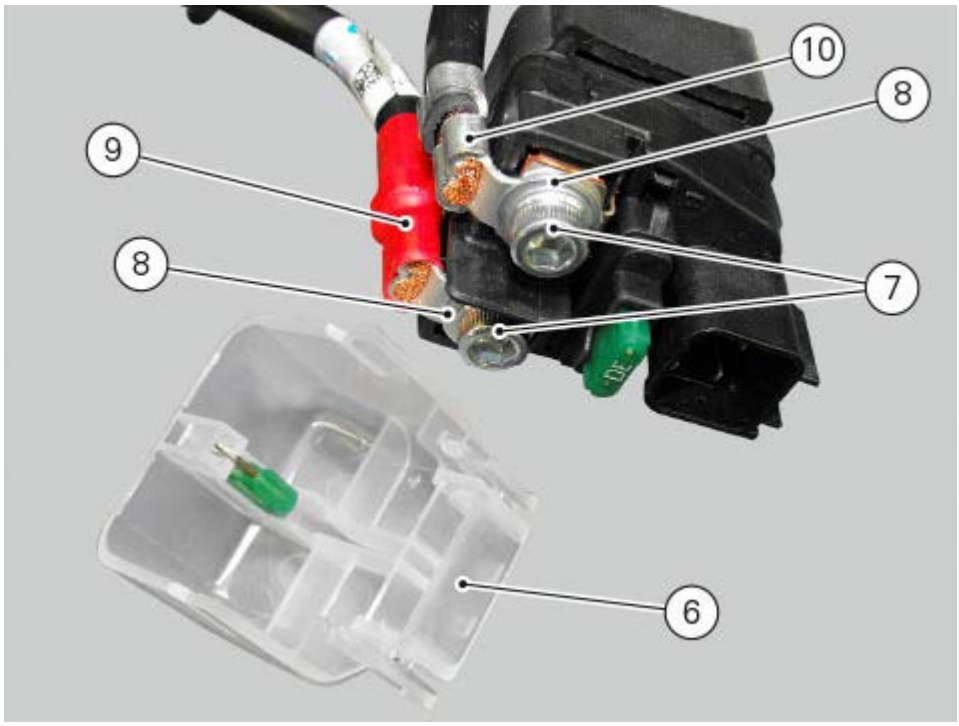
CHECKING OPERATION OF THE SOLENOID STARTER

Apply 12 V (battery voltage) across the positive terminal and negative terminal of the connector.
With a multimeter connected between the two poles (threaded pins) of the solenoid starter, check for electric continuity.
If there is no electric continuity, ensure that the terminals are not oxidised and apply water repellent spray.
Change the solenoid starter if the malfunction persists.

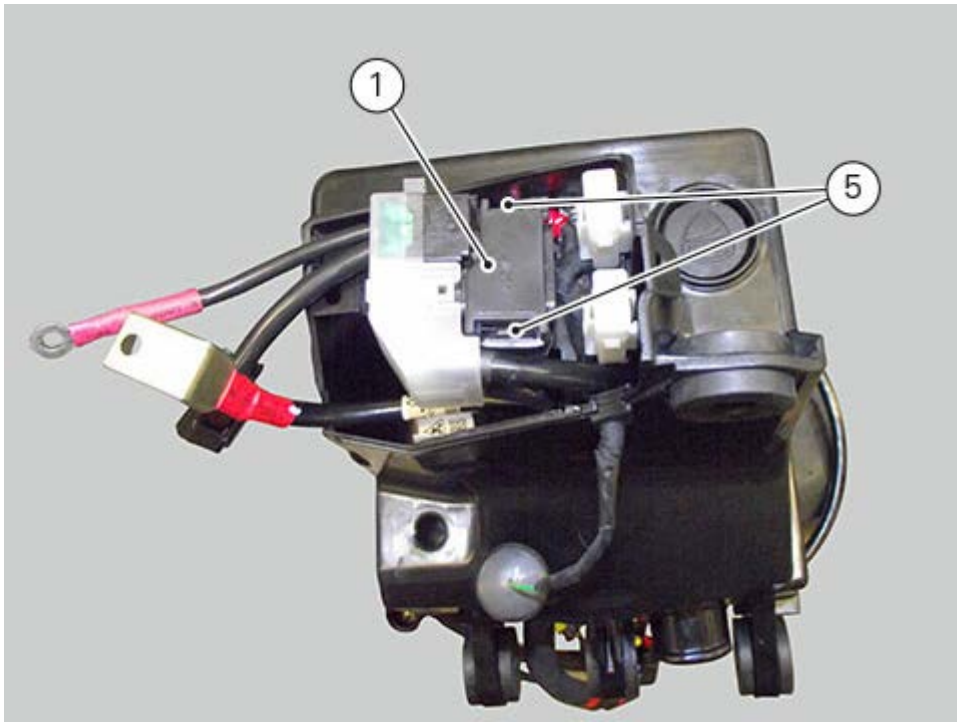


REFITTING THE SOLENOID STARTER

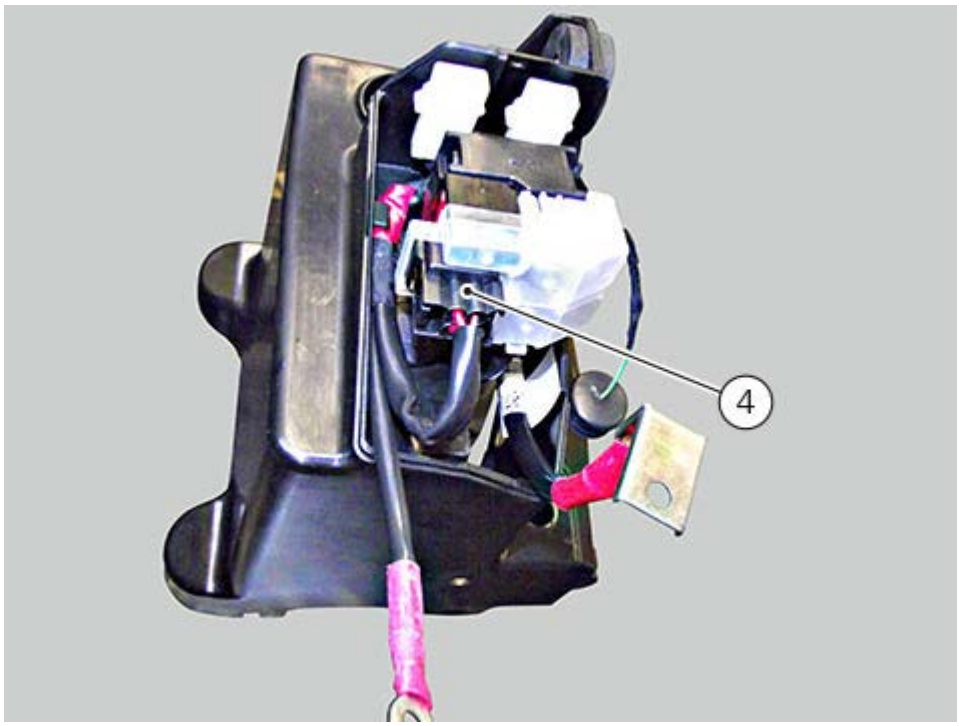
Lay down the starter motor-solenoid starter cable (9) and the solenoid starter-battery cable (10).
Position the two washers (8) and start screws (7).
Tighten the screws (7) to a torque of 10Nm ± 10%.
Refit protection cap (6).



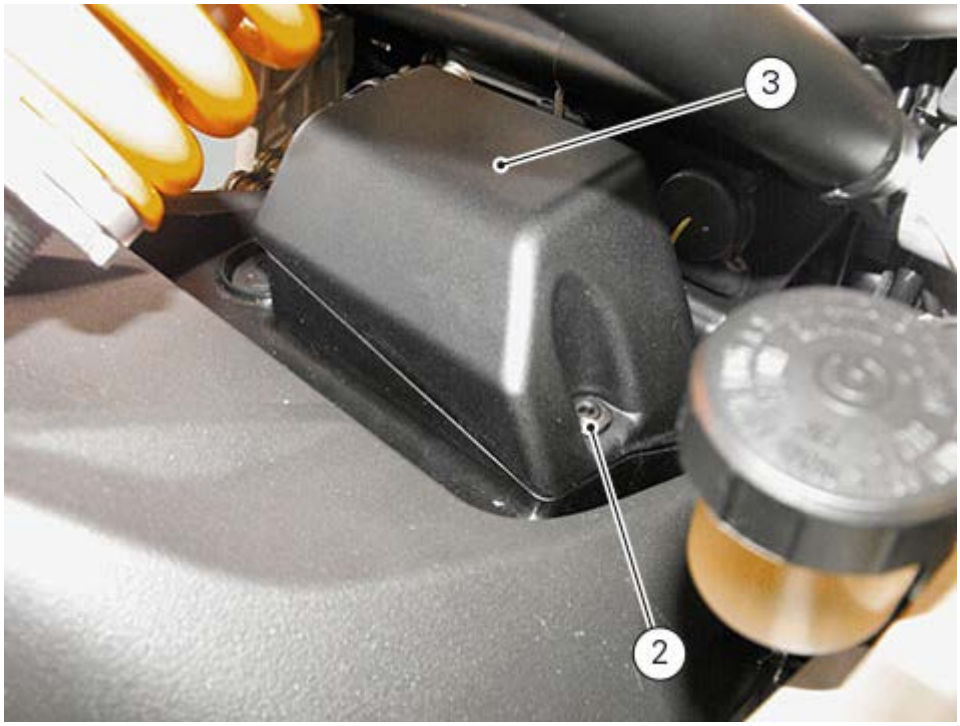
Engage solenoid starter (1) in retainers (5).



Connect the connector (4).



Position cover (3) and tighten the two screws (2) to a torque of 4 Nm ± 10%.



Starter motor

Electric features:
12 V / 0.7 kW

The starter motor is highly compact and reliable, therefore rarely raises any operating issue.
In case of faults:
- ensure that the starter motor wiring terminal is properly tightened under the nut and shows no sign of oxidation;
- if the terminal is properly tightened and free from oxidation, remove the starter motor and test it under no-load conditions (no load applied to the shaft).

Warning
Secure the starter motor to a test bench, making sure not to damage the casing.

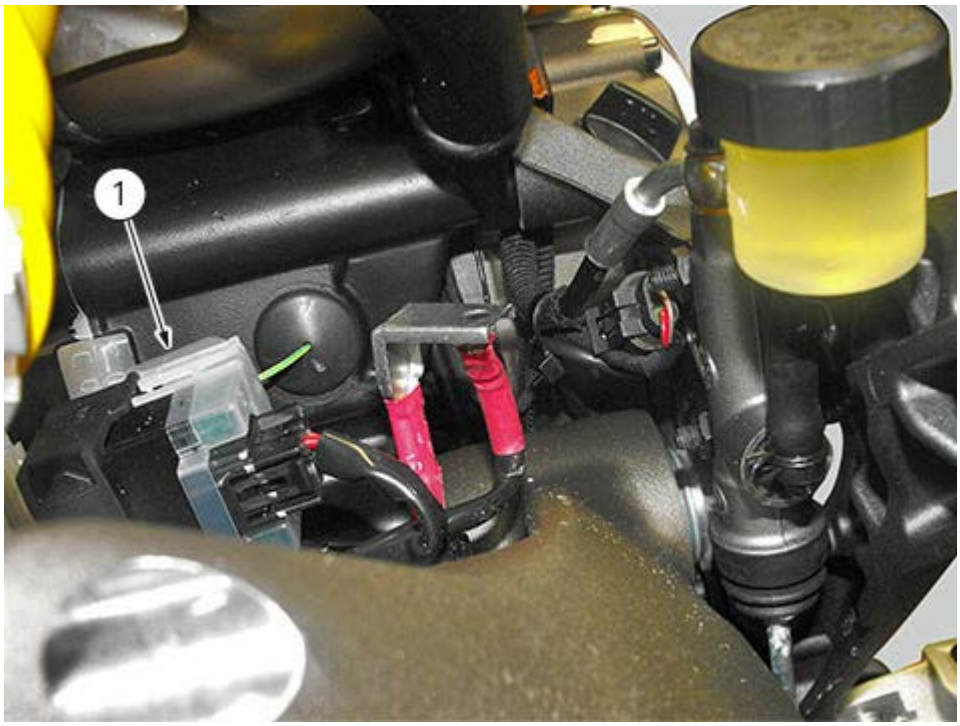
Warning
Use a fully charged 12 V battery for the test.

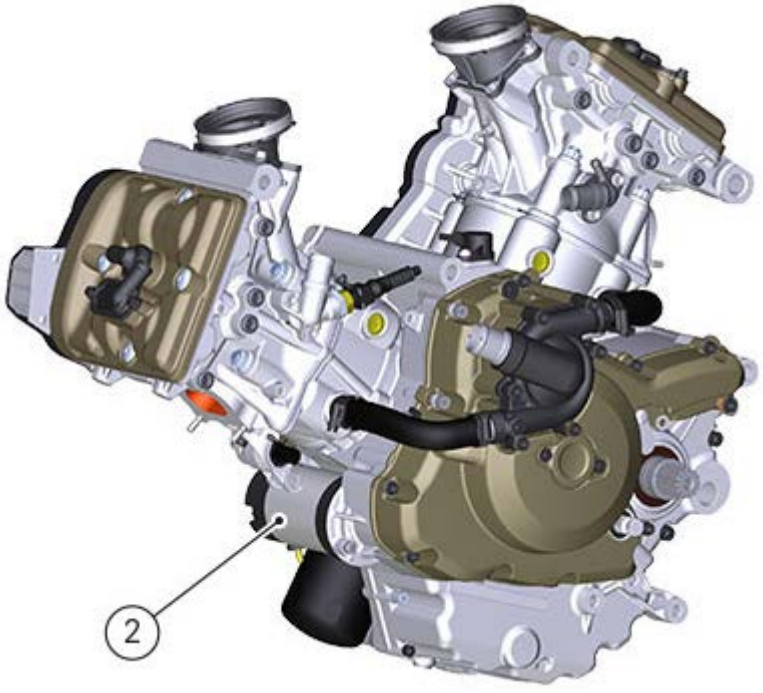
- Use battery-motor connection cables which are no longer than 70 cm and with the same cross-section as the cable on the vehicle itself;
- connect the negative terminal of the battery to an unpainted area of the starter motor casing and the positive terminal to its electrical terminal;
- the shaft of the starter motor should rotate freely and at a high speed.

Warning
Take care not to short-circuit the two cables connected to the battery.

Electric starting system

The electric starting system consists of a solenoid starter (1) and a starter motor (2).





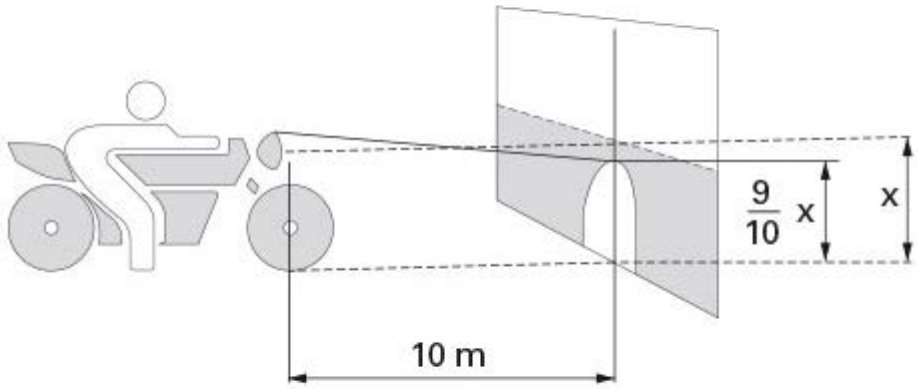
Aligning the headlight

Position the vehicle with tyres inflated at the indicated pressure (“Front wheel" and "Rear wheel”) and a person seating on the seat, perfectly perpendicular to his/her longitudinal axis.
Position the vehicle 10 metres from a wall or a screen.
On the wall or surface, draw a horizontal line at the same height from the ground as the centre of the headlight and a vertical line aligned with the longitudinal axis of the motorcycle.

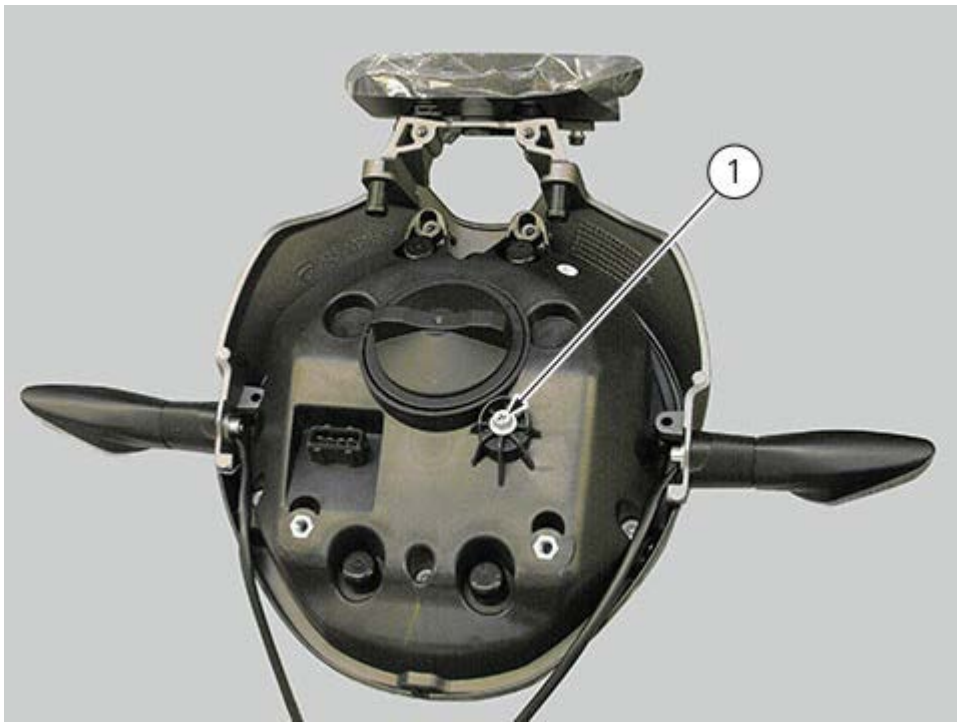
Note
If possible, perform this check in dim light.

Switch on the low beam. The height of the upper limit between the dark area and the lit area must not be more than 9/10 of the height from the ground of the headlight centre.

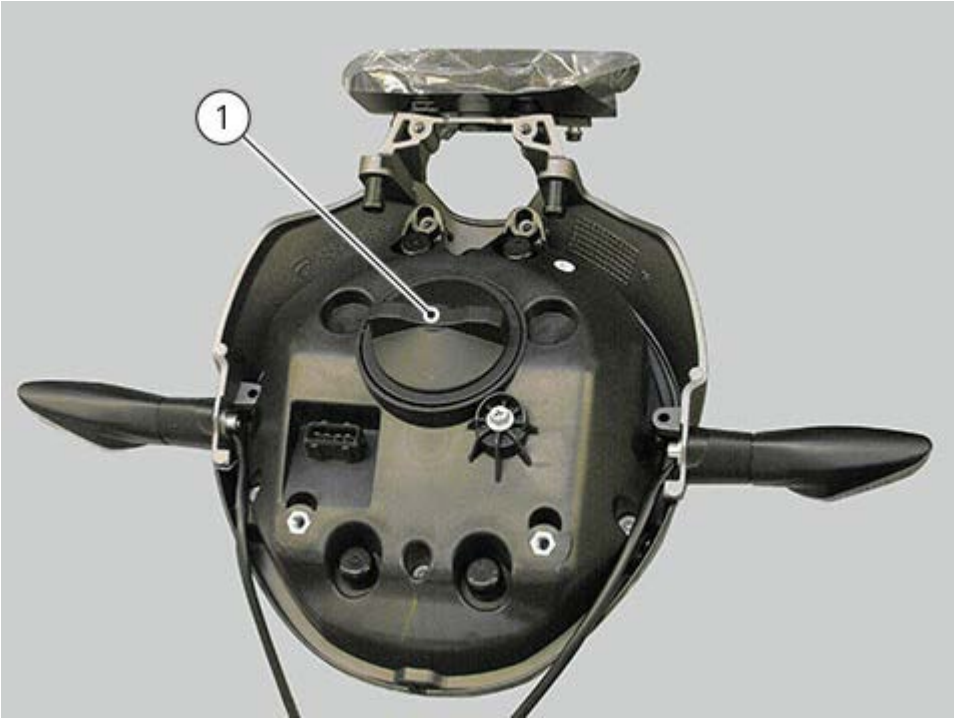
Note
This is the procedure specified by Italian regulations for checking the maximum height of the light beam. Please adapt said procedure to the provisions in force in your own country.



The vertical alignment of the headlight can be manually set by means of screw (1).
Turn clockwise to raise the beam, counter clockwise to lower it.



Remove the headlight (Removing the light assembly).
Unscrew cover (1).



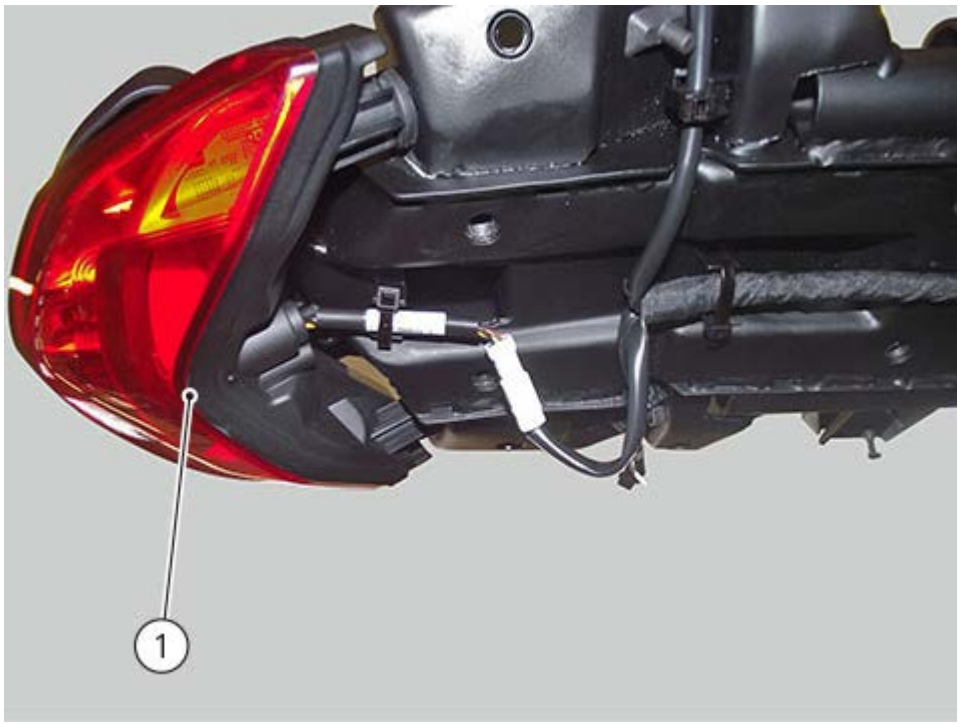
Low beam / High beam (3).
Release clip (2) and slide out the low/high beam bulb of headlight (3).

Parking light (4)

Note
LED parking light. When replacing the parking light, it will be necessary to replace the headlight.

Replacing the light bulbs — Tail light

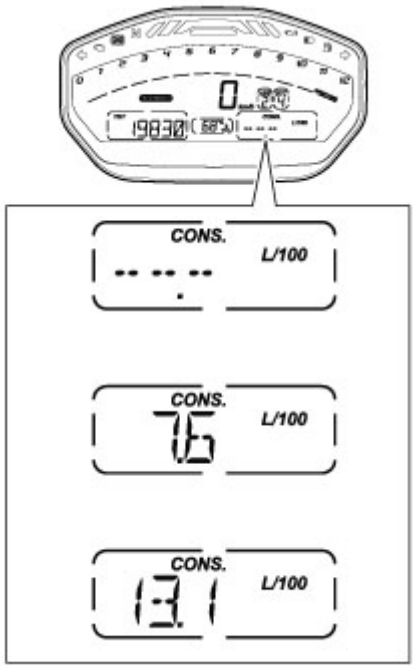
The tail light (1) on this motorcycle is an LED light.
In case of malfunctions or breakage, it will be necessary to replace the entire tail light (1) (Removing the tail light).



Instantaneous fuel consumption

The instrument panel calculates and displays the motorcycle instantaneous fuel consumption, the set unit of measurement and CONS. text.
The calculation is made considering the quantity of fuel used and the distance travelled during the last second.
Value is expressed in the set unit of measurement: litres / 100 km or mpg UK or mpg USA.
The active calculation phase only occurs when the engine is running and the motorcycle is moving (moments when the motorcycle is not moving when speed is equal to 0 and/or when the engine is OFF are not considered).
When the calculation is not made, a string of three dashes is displayed " - - . - " steadily as instantaneous fuel consumption.

Note
It is possible to change the units of measurement for "Consumption" (both average and instantaneous together) from L/100 to km/L through the Setting MENU, using the "SET UNITS" function.



VIN Code

The VIN code is an alphanumerical code with 17 characters that clearly identifies a vehicle (family, model, country, serial number, …).
This code can be stored in the instrument panel and read through the DDS 2 with suitable KWP2000 inputs.
When replacing one of the above control units, this information must be copied onto the new control unit using DDS 2.

Activations through DDS 2

The DDS 2 diagnosis instrument allows performing a series of activations to check some instrument panel functions and resetting parameters or warning lights.
After each activation, the instrument panel will restore its standard functions.

Note
The activations must be performed only with key turned to ON, engine off and battery voltage (higher than or equal to) ≥ 11.0 V.

ODOMETER VALUE
Odometer reading (mileage covered) stored in the instrument panel and BBS control units.
Should one of the two control units be replaced, the odometer information will have to be "copied" using the DDS 2.0 diagnosis instrument.
If the two odometer values stored in the Instrument Panel and BBS control units differ by more than 10 km from one another, dashes " - - - - " will be displayed on the Instrument Panel.

OIL SERVICE RESET
The "OIL SERVICE" reset allows disabling the relevant icon displayed on the instrument panel.
After the reset, the indication remains off until reaching the following mileage set for this service.

DESMO SERVICE RESET
The "OIL SERVICE" reset allows disabling the relevant icon displayed on the instrument panel.
After the reset, the indication remains off until reaching the following mileage set for this service.

PIN CODE RESET
This activation allows "erasing" the previously stored PIN CODE to enter a new one.

IMMOBILIZER (KEYS) RESET
This activation allows "erasing" the "keys" to reprogramme the Immobilizer System.
Upon receiving this request, the instrument panel resets the previously stored keys. Upon next Key-On, the Immobilizer System will be "virgin" and it will be possible to reprogramme new keys.

SPEED INDICATION ACTIVATION
This activation allows checking for instrument panel malfunctions or display problems of the speed indication.
Upon receiving this request, the instrument panel shows the following values for 5 seconds in this sequence:
- '50 km/h'
- '100 km/h'
- '299 km/h'.

ENGINE RPM INDICATION ACTIVATION
This activation allows checking for instrument panel malfunctions or display problems of the rpm indication.
Upon receiving this request, the instrument panel shows the following values for 5 seconds in this sequence:
- '1000 rpm'
- '5000 rpm'
- '11000 rpm'.

SECONDARY AIR SYSTEM ACTIVATION (AIS)
The secondary air system activation (AIS) function can be launched using the DDS 2 diagnosis instrument to check the system's correct operation.
The function is available in the "System Activation: engine electronics and special functions menu".
It must be performed with the engine running at idle speed and with a temperature reading on instrument panel above 80 °C.
The horizontal cylinder KO2 and/or vertical cylinder ΔKO2 values must be higher than 4%; if this is not the case, check the secondary air system of the vehicle.

WARNING LIGHT ACTIVATION CHECK
This activation allows checking for instrument panel malfunctions or activation problems of the warning lights.
Upon receiving the input, the instrument panel turns on all warning lights for 10 seconds.

Software remote update

If necessary, the instrument panel software can be updated through the DDS 2, which uses a suitable and dedicated communication protocol KWP2000.

LOW / HIGH BEAM
This function allows you to reduce current consumption from the battery, by managing headlight switching-on and off.

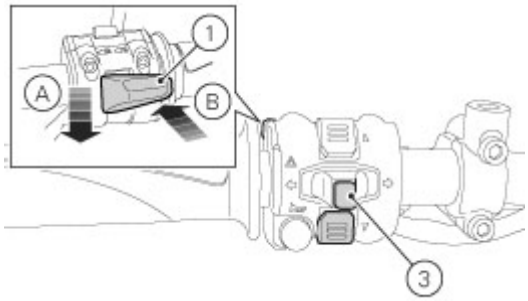
At Key-ON, the high beam and low beam lights are OFF, only the parking lights are turned on.
Once the engine is started, the low beam is turned on;

with engine running the standard operation of the lights is restored: it is possible to switch on and OFF the high beam using button (1) in position (A), or flash using button (1) in position (B).

If the engine is not started after Key-ON, it is still possible to turn on the low/high beam by pressing button (1) in position (A) on the left switch:
- the low beam lights are turned on the "first time" it is pressed;
- continue to press the button to switch from low to high beam.

If engine is not started within 60 seconds since the button was first pressed, the low and high beam lights are turned OFF.

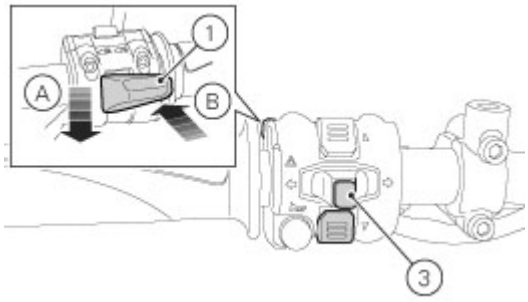
If the low beam or high beam was turned on before starting the engine (with the procedure described above), the headlight turns off automatically when starting the engine and will turn ON again when the engine has been completely started to save the battery charge.



TURN INDICATORS
Turn indicators are automatically controlled by the instrument panel.

After activating one of the two turn indicators, user can disable them using button (3) on the left switch.

If the turn indicator is not reset manually, the instrument panel will automatically switch it off after the motorcycle has travelled 500 m (0.3 miles) from when the turn indicator was activated.
The counter for the distance travelled for automatic deactivation is only activated at speeds below 80 km/h (50 mph).
If the calculation of the distance for automatic deactivation is activated and then the motorcycle exceeds a speed of 80 km/h (50 mph), the calculation will be interrupted and will restart when the speed returns below the indicated threshold.



Setting the units of measurement

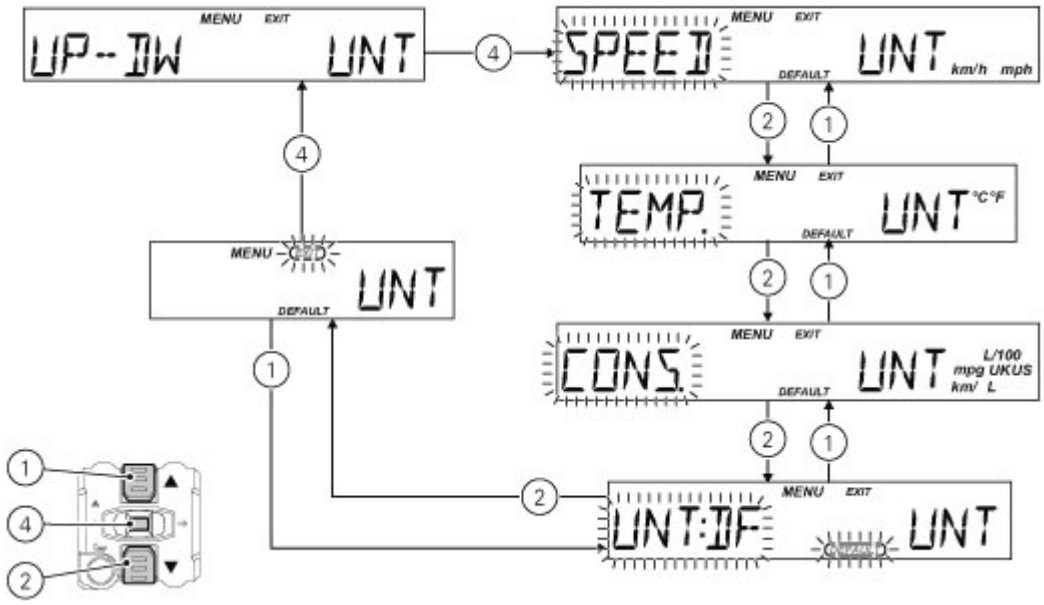
This function allows changing the units of measurement of the displayed values.
To manually set the units of measurement, you must enter the SETTING MENU.
Select "UNT" option, by pressing button (1) or (2).
Once function is highlighted, press CONFIRM MENU button (4).

When entering this function, use buttons (1) and (2) to select the parameter for which you want to set a new unit of measurement or to restore the default settings:
- SPEED;
- temperature (TEMP.);
- instantaneous fuel consumption (CONS.).

Besides the settings that can be modified, it is possible to select the "DEFAULT" box to restore the default units of measurement.

Note
The "UNT:DF" indication is only active if no unit of measurement has been modified and therefore, the instrument panel uses the units of measurement set by default.

To exit the menu and go back to the previous page, select "EXIT" and press button (4).



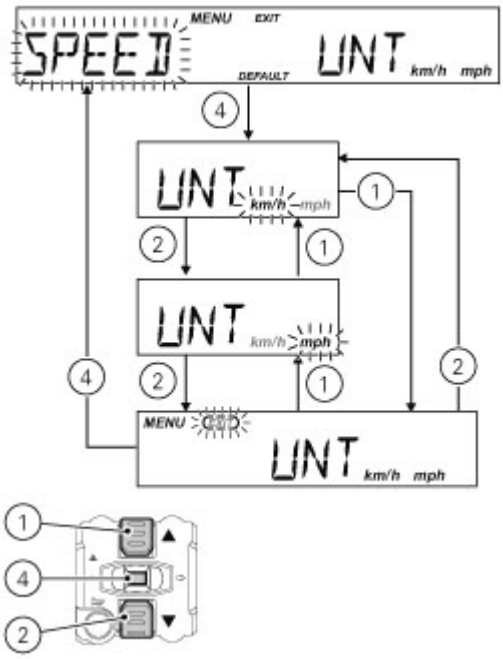
SETTING THE UNIT OF MEASUREMENT: "SPEED"
This function allows changing the unit of measurement of Vehicle speed, Odometer, Trip A, Trip B, Trip Fuel (when active) and Average speed.
To gain access to this function, enter the SETTING MENU, use buttons (1) and (2) to select UNT and press button (4).

Select SPEED option, by pressing button (1) or (2).
Once SPEED function (A) is highlighted, press CONFIRM MENU button (4).
When you enter the function, the current unit of measurement is displayed flashing, followed by the list of the possible units steady ON: km/h, mph.
Press buttons (1) and (2) to highlight the units of measurement one by one: in particular, use button (1) to highlight the following item and button (2) to highlight the previous item.
Once the required unit of measurement has been selected and then press the CONFIRM MENU button (4) to confirm the selected unit; then the selected unit of measurement is saved in the instrument panel and the SPEED indication starts flashing again.

Press button (1) to make the EXIT box flash; press button (4) to quit and go back to the previous window.

- Km/h: if this unit is set, the following values will have the same units of measurement:
1) TOT, TRIP A, TRIP B, TRIP FUEL: Km
2) Vehicle speed and SPEED AVG: Km/h

- mph: if this unit is set, the following values will have the same units of measurement:
1) TOT, TRIP1, TRIP2, TRIP FUEL: miles
2) Vehicle speed and SPEED AVG: mph



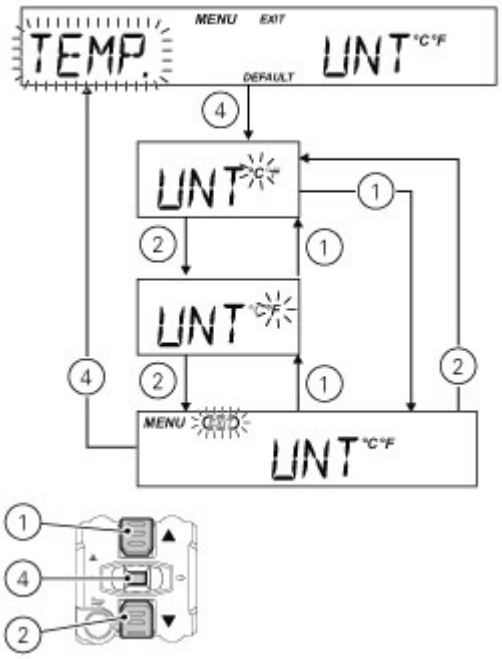
SETTING THE UNIT OF MEASUREMENT: "TEMPERATURE"
This function allows changing the unit of measurement of the engine coolant temperature and the Air Temperature.

To gain access to this function, enter the SETTING MENU, use buttons (1) and (2) to select UNT and press button (4).
Select "TEMP." option, by pressing button (1) or (2). After selecting the "TEMP." function (B), press CONFIRM MENU button (4).
When you enter the function, the current unit of measurement is displayed flashing, followed by the list of the possible units steady ON: °C, °F.
Press buttons (1) and (2) to highlight the units of measurement one by one: in particular, use button (1) to highlight the following item and button (2) to highlight the previous item.
Once the required unit of measurement has been selected and then press the CONFIRM MENU button (4) to confirm the selected unit; then the selected unit of measurement is saved in the instrument panel and the "TEMP." indication starts flashing again.

Press button (1) to make the "EXIT" trim flash;
press button (4) to quit and go back to the previous screen.

- °C: if this unit is set, the following values will have the same units of measurement:
1) Engine coolant temperature and T_AIR: °C

- °F: if this unit is set, the following values will have the same units of measurement:
1) Engine coolant temperature and T_AIR: °F



SETTING THE UNIT OF MEASUREMENT: "FUEL CONSUMPTION"
This function allows changing the units of measurement of the Average and Instant Fuel Consumption.

To gain access to this function, enter the SETTING MENU, use buttons (1) and (2) to select UNT and press button (4). Select CONS. option, by pressing button (1) or (2). After selecting the "CONS." function (C), press CONFIRM MENU button (4). When you enter the function, the current unit of measurement is displayed, followed by the list of the possible units: L / 100km, km / L, mpg (UK), mpg (USA).

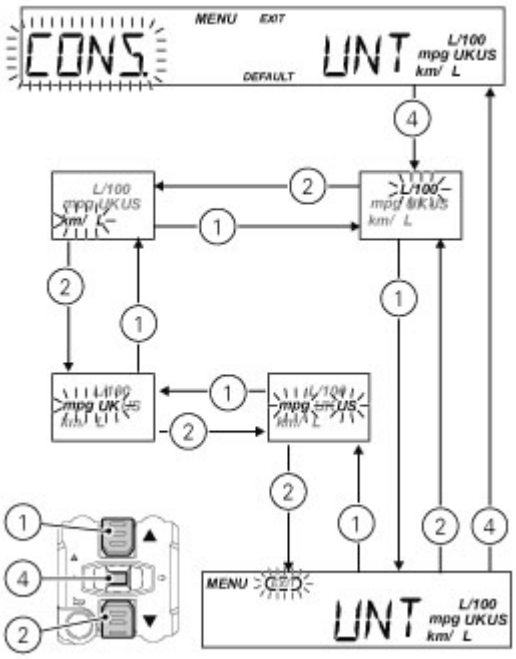
Press buttons (1) and (2) to highlight the units of measurement one by one: use button (1) to highlight the following item and button (2) to highlight the previous item. Select the required unit of measurement and then press the CONFIRM MENU button (4) to confirm the selected unit; then the selected unit of measurement is saved in the instrument panel and the "CONS." indication starts flashing again.

Press button (1) to make the EXIT box flash; press button (4) to quit and go back to the previous window.

- Km/l: if this unit is set, the following values will have the same units of measurement: 1) CONS. and CONS AVG: Km/l

- l/100: if this unit is set, the following values will have the same units of measurement: 1) CONS. and CONS AVG: l/100

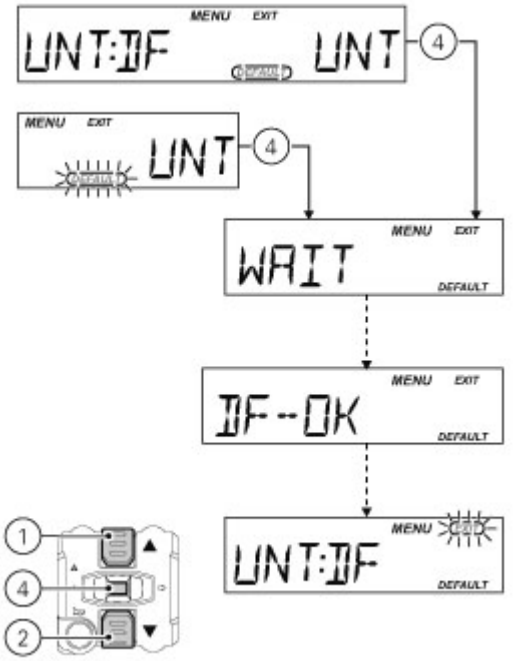
- UK MPG: if this unit is set, the following values will have the same units of measurement: 1) CONS. and CONS AVG: mpgal UK - MPG USA: if this unit is set, the following values will have the same units of measurement: 1) CONS. and CONS AVG: USA MPG



SETTING THE UNIT OF MEASUREMENT: "DEFAULT"
This function allows setting the DEFAULT units of measurement according to the vehicle version.
To gain access to this function, enter the SETTING MENU, use buttons (1) and (2) to select UNT and press button (4).

Press button (1) or (2) to make the "DEFAULT" box start flashing and then press button (4) for 2 seconds.
After 2 seconds the instrument panel sows "WAIT" for 2 seconds.
Then it shows "DF-OK" to indicate that the units of measurement have been reset.

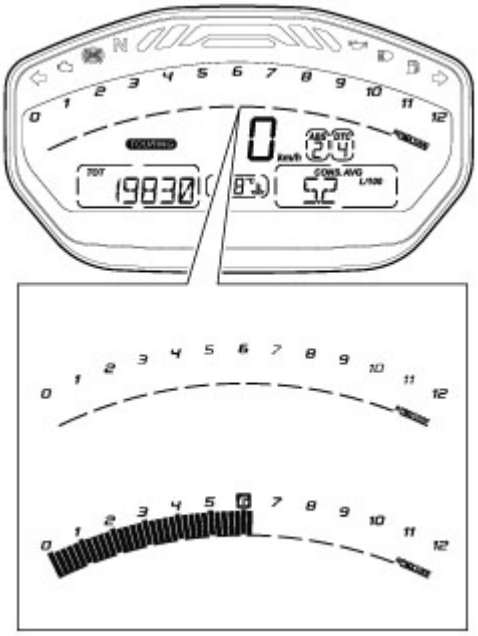
Note
When the current settings are the default ones, on the "DEFAULT" indication left side the display shows "UNT:DF".



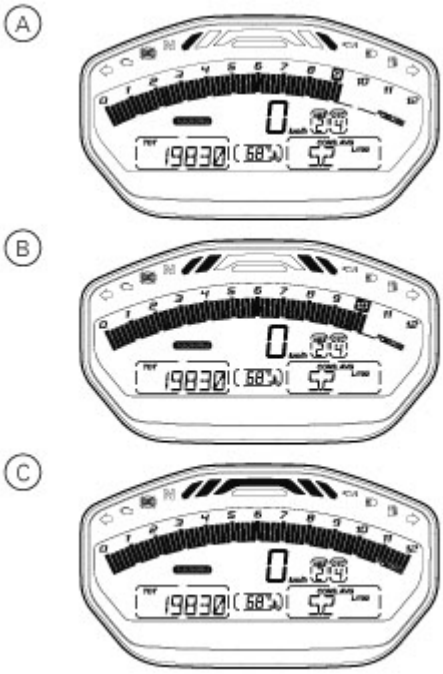
Engine rpm indication (RPM)

This function allows displaying engine rpm.

Instrument panel receives rpm value and displays it.
The information is displayed by the bargraph filling from the left to the right according to the engine rpm and with the negative display (switching OFF of the digit and switching on of its rectangle) of the digit of the relevant miles.



The thresholds before the rpm limiter are:
1st threshold 9900 rpm (A)
2nd threshold 10100 rpm (B)
When the rev limiter value (C) is reached, the warning lights start flashing.



Changing the PIN CODE

To change the existing PIN CODE and activate a new one, you must open the SETTING MENU.
Select "PIN" option, by pressing button (1) or (2).
Once function is highlighted, press CONFIRM MENU button (4).

Note
If upon accessing this function, the "N : " (New) and four flashing dashes "- - - -" are shown, it means that the PIN CODE has never been activated and it is necessary to do it.

When accessing the function, the display will show "O: " (old) followed by four flashing dashes "- - - -".

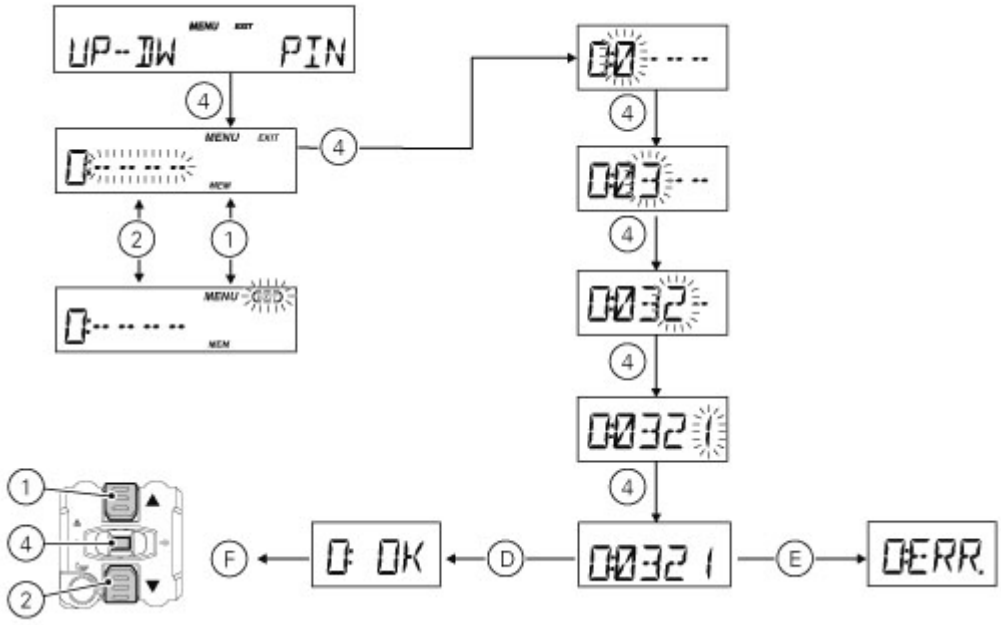
Note
To change the PIN CODE, you must know the already stored PIN.

To go back to the previous indication without modifying the PIN CODE, press button (2); as soon as the "EXIT" box starts flashing, press button (4) again.

Entering the "old" code

1) Press button (4) only one digit indicating "0" starts flashing;
2) Each time you press button (2) the displayed number increases by one (+ 1) up to "9" and then starts back from "0";
3) Each time you press the button (1) the displayed number decreases by one (- 1) up to "1" and then starts back from "0";
4) To confirm the number, press the button (4).

Repeat the procedures until you confirm all the digits of the PIN CODE.

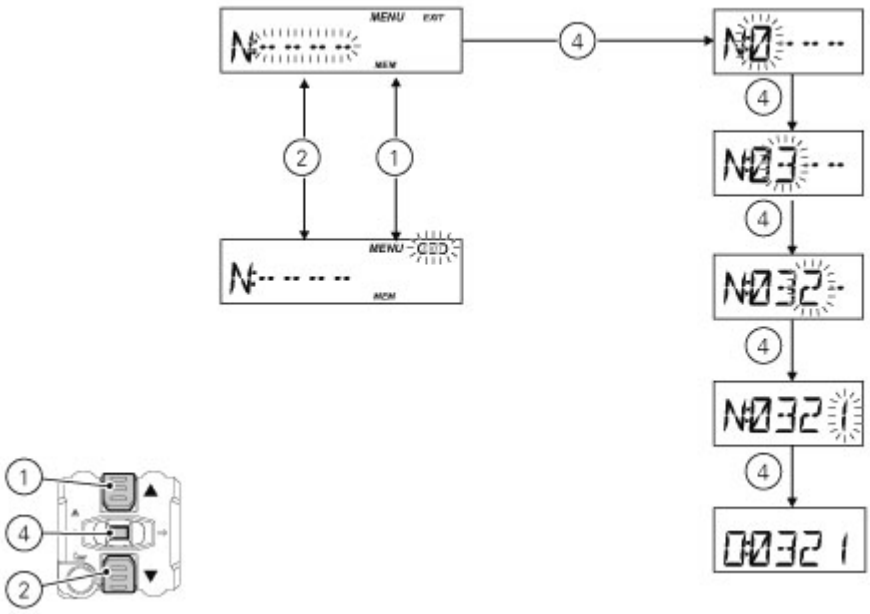


After pressing button (4) to confirm the fourth and last figure, the 4-digit code stops flashing.
Repeat the procedures until you confirm all the digits of the PIN CODE.

Entering the "new" code

1) Press button (4) only one digit indicating "0" starts flashing;
2) Each time you press button (2) the displayed number increases by one (+ 1) up to "9" and then starts back from "0";
3) Each time you press the button (1) the displayed number decreases by one (- 1) up to "1" and then starts back from "0";
4) To confirm the number, press the button (4).

Repeat the procedures until you confirm all the digits of the PIN CODE.



When you press button (4) to confirm the fourth and last digit, the instrument panel highlights the message "MEM" and the relevant box will start flashing.
To save the new setting, hold button (4) for 2 seconds while the message "MEM" is highlighted.

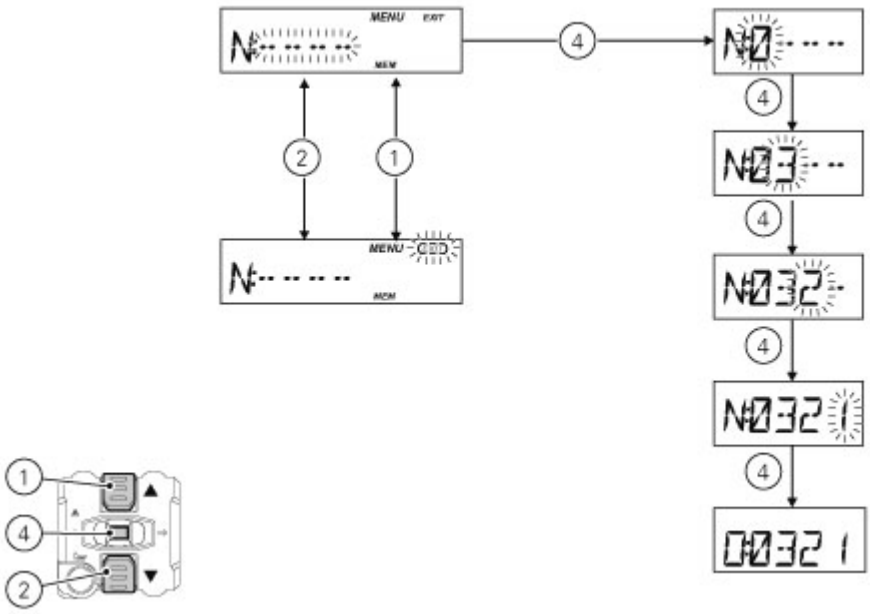
- If settings have been saved (D), the message "MEM" and the relevant box will be shown steady ON for 2 seconds, and then the "EXIT" box will start flashing.
- If settings have not been saved, the instrument panel will highlight again the string of four dashes "- - - - " of the new PIN to allow the rider to try again and enter a new code.

To quit, press button (4).

Note
You can change your PIN CODE an unlimited number of times.

VEHICLE RELEASE
This function allows starting the vehicle temporarily in case of an engine failed operation due to a malfunction of the immobilizer system.
If upon key-on an immobilizer ERROR occurs, the instrument panel automatically activates in MENU 1 the possibility to enter the four-digit PIN CODE previously memorised with the relevant function in the Setting Menu, PIN page.

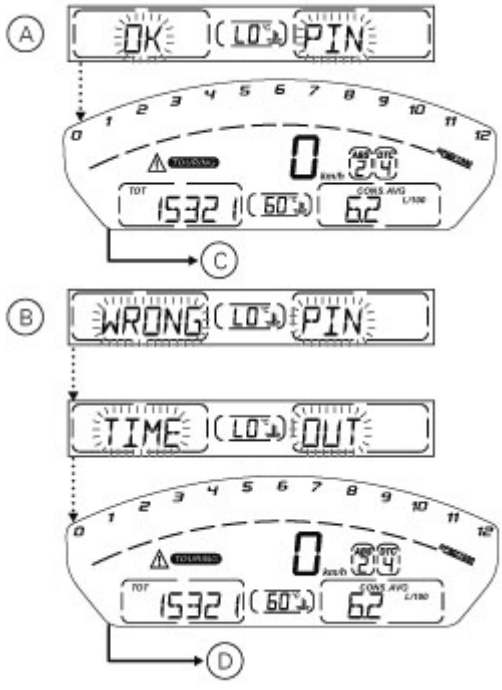
Entering the code:
1) Each time you press button (2), the displayed number increases from "0" to "9" and then returns to "0";
2) To confirm the number, press button (4);
3) Repeat the procedure until entering the fourth digit;
4) Press button (4) again to confirm.



It the code is correct, the instrument panel will show "OK" for 2 s (A).
If the code is incorrect, the instrument panel will show "WRONG" for 2 s (B) and return to the initial indication in order to enter the code (D) again.
After 2 seconds, the instrument panel will return to the "normal" view (with all indications active) (C).
From now on, it is possible to temporary start the engine.

Warning

There is no limit to the number of times the code can be re-entered; the instrument panel quits this screen automatically after 120 seconds indicating "TIME OUT" for 2 seconds and then it will show the "main screen".



Note

The vehicle can be started until a Key-Off is performed. If the problem still persists upon the next starting attempt, repeat the procedure from the beginning in order to start the motorcycle temporarily again.

Pin Code

This function allows enabling and then modifying a 4-digit PIN code to "temporarily" start the vehicle in case of Immobilizer system malfunction.
The PIN CODE is initially not present in the motorcycle, it must be activated by the user by entering his/her 4-digit PIN in the instrument panel, otherwise the motorcycle cannot be started temporarily in the case of a malfunction.
- To activate this function, refer to "Entering the PIN CODE" procedure.
- To change the PIN refer to "Changing the PIN CODE" procedure.
- In order to temporarily start the motorcycle in case of malfunction of the Immobilizer system, please refer to the "Vehicle Release" procedure.

Warning

The motorcycle owner must activate (store) the PIN code; if there is already a stored PIN, "reset" the function. To follow this procedure, check that the request is made by the real owner of the vehicle.

ENTERING THE PIN CODE
To activate the PIN CODE function and enter your own PIN CODE you must open the SETTING MENU.
Select "PIN" option, by pressing button (1) or (2).
Once function is highlighted, press CONFIRM MENU button (4).

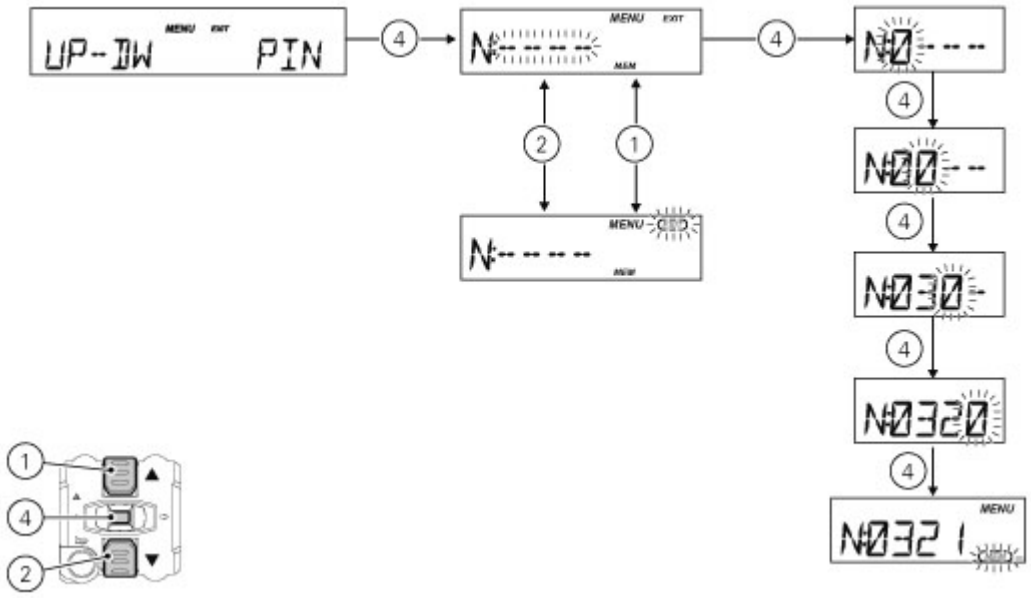
Note

If upon accessing this function, the "O : " (Old) indication is displayed together with four flashing dashes "- - - -", a PIN code is already stored and the Function is already active.

When accessing the function, the display will show "N:" (new) followed by four flashing dashes "- - - -".
To go back to the previous indication without activating a PIN CODE, press button (2).

Press button (4) again.

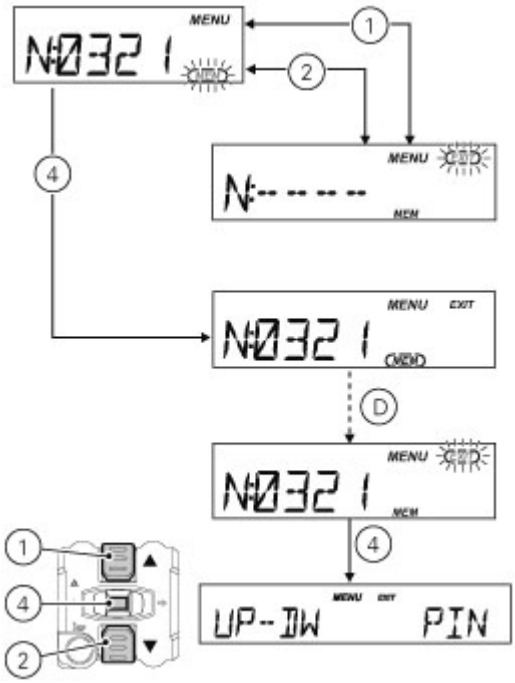
Entering the code:
1) Press button (4): only one digit indicating "0" starts flashing;
2) Each time you press button (2) the displayed number increases by one (+ 1) up to "9" and then starts back from "0";
3) Each time you press the button (1) the displayed number decreases by one (- 1) up to "1" and then starts back from "0";
4) To confirm the number, press the button (4).
Repeat the procedures until you confirm all the digits of the PIN CODE.



When you press button (4) to confirm the fourth and last digit, the instrument panel highlights the message "MEM" and the relevant box.
To memorise the entered PIN, keep button (4) pressed for 2 seconds.
If settings have been saved (D), the message "MEM" and the relevant box will be shown steady ON for 2 seconds, and then the "EXIT" box will start flashing.
Once the first PIN CODE is stored, this menu page is no longer available and is replaced by the page for

changing the PIN CODE.

To quit, press button (4).



Clock setting

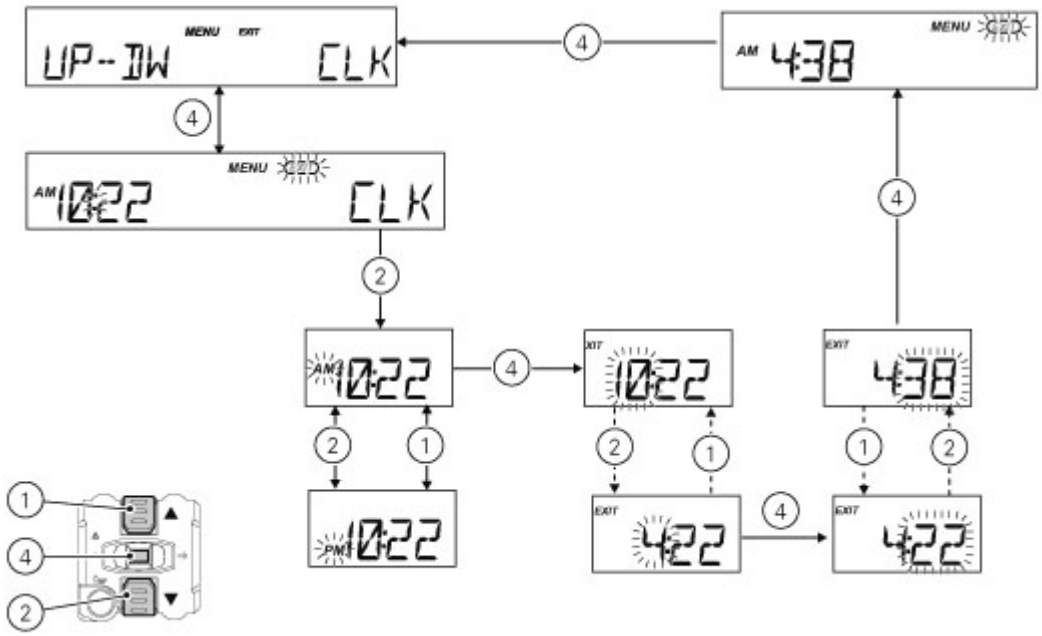
This function allows setting the clock.
To view this function, enter the Setting Menu, use button (1) or (2) to select "CLK" and press button (4).

To access the setting function, keep button (2) pressed for 3 seconds.
After 3 seconds it is possible to set the clock as follows:
- the "AM" indication starts flashing;
- if you press button (2) the "PM" indication starts flashing;
- if you press button (1) you will return to the previous step (if it is 00:00, when switching between "AM" to "PM", 12:00 will be displayed);
- press button (4) to shift to hour setting, hours will start flashing;
- each time you press button (2), the digit will increase by one hour: If you hold button (2) down, the number increases cyclically in steps of one hour every second (when the button is held depressed, the hours do not flash);
- pressing button (4) gives access to the minute setting mode; minutes start to flash;
- each time you press button (2), the digit will increase by 1 minute. If you hold button (2) pressed, the count increases cyclically in steps of 1 minute every second;
- if button (2) is kept pressed for more than 5 seconds, steps increase in steps of 1 every 100 ms (seconds will not flash while button (2) is pressed).

To confirm (store) the new set time press button (4).
The EXIT box starts flashing, press button (4) to go back to the setting menu.

Note
In case of battery off, when the Voltage is restored and upon next Key-On, clock will have to be set again, i.e. it will automatically start counting from 00:00.

To quit, press button (4).



LAP

This function allows enabling/disabling LAP (lap time) function.

To open the LAP function menu, enter the Setting Menu.
Select LAP option, by pressing button (1) or (2).
Once the function is highlighted, press button (4) and enter the LAP Menu.
When accessing this function, the status of the currently set LAP function is displayed ("ON" or "OFF") on the left side of MENU 1.

By pressing button (2) the LAP function indication starts flashing and the other relevant available option is displayed. So, as a consequence:
- if the indication was OFF, it will become ON flashing;
- if the indication was ON, it will become OFF flashing.

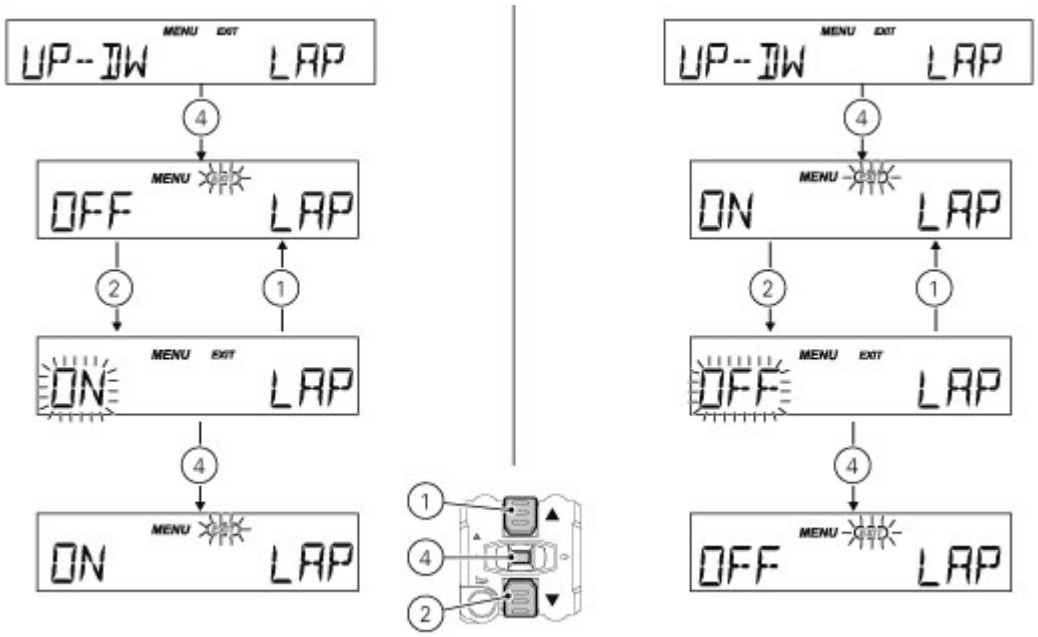
To enable or disable the LAP function, press button (4) when the indication is flashing:
- storing the OFF condition, LAP function will be disabled;
- storing the ON condition enables the LAP function to record the LAPs.

When enabling the Function (ON), to confirm its activation the display will show also the LAP indication with the box on top left, under the rev counter.
To exit, press button (4) when the EXIT indication box flashes.

Note
When the LAP function is active, the FLASH button takes on the dual function of high beam "FLASH" and finish line control and storage for the LAP timer (new lap start indication).

Note
Upon Key-OFF, the "LAP" function status is saved to restore it upon next Key-ON.

Note
When the battery is off, if the LAP function is active (ON), it is automatically disabled.



STORED LAPs DISPLAYING
To view the stored LAPs, you must enter the SETTING MENU.
Select "LAP" option, by pressing button (1) or (2).
Once function is highlighted, press CONFIRM MENU button (4).

Press buttons (1) and (2) to select "DATA" (flashing) and press button (4) to confirm.

The instrument panel displays:
A) the number of maximum RPM reached in the recorded lap;
B) the maximum speed reached in the recorded LAP;
C) the recorded lap time (for instance 2:05:84) with the indication of the MINUTES, SECONDS and

HUNDREDTH OF A SECOND;
D) the number of the displayed lap (for instance no. 1).

Press buttons (1) and (2) to highlight stored LAPS one by one, in particular:
- press button (2) to view the following LAP;
- press button (1) to view the previous LAP.

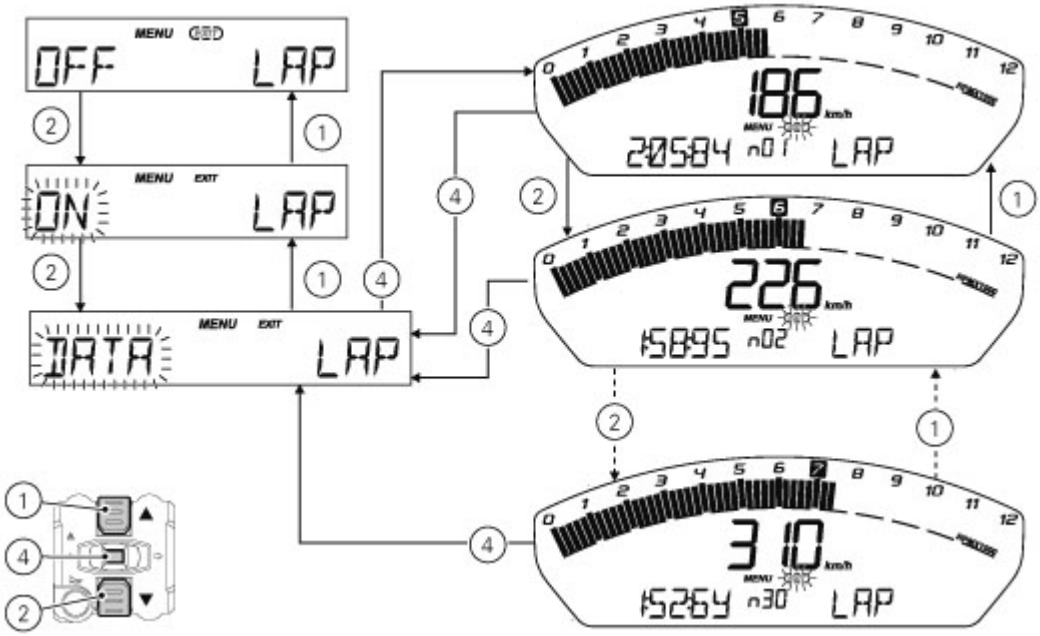
To exit the menu and go back to previous page, select EXIT and press button (4).

Note
The MAX stored speed is the one shown on the display (increased by 5%).

Note
If the MAX speed reading exceeds 299 Km/h (186 mph) while the information is stored, the speed that was reached is still displayed (example: 316 Km/h).

Note
If there is no reading in the memory, the 30 times are shown, with the display showing "-.--.-", MAX rpm = 0 and MAX speed = - - -.

Note
If while recording the LAP the engine reaches the threshold that precedes the rev limiter or rev limiter threshold, the relevant Over_Rev light will turn on when displaying the stored times.



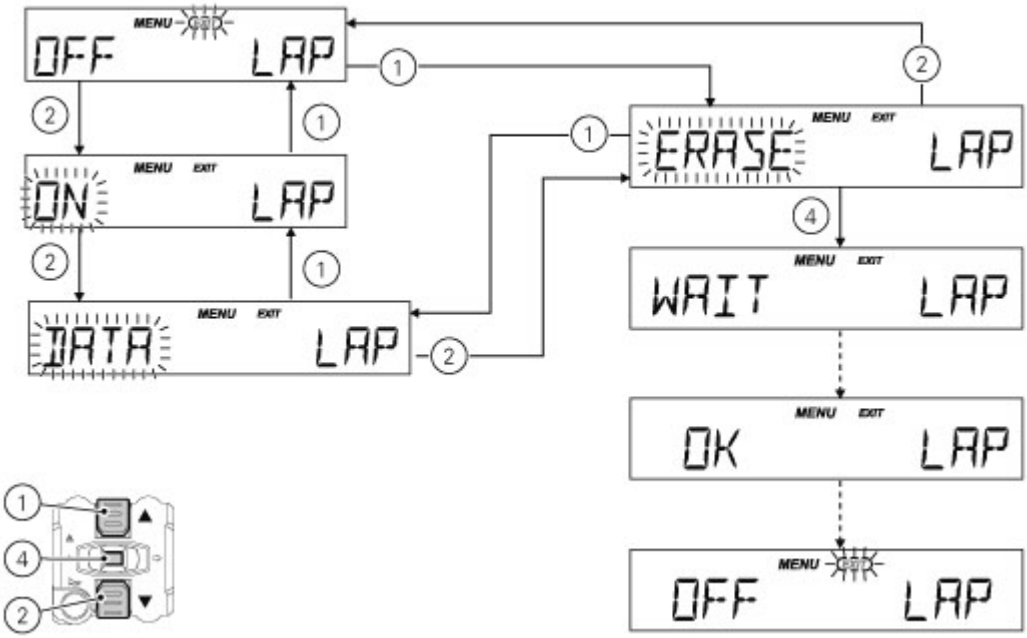
ERASING STORED LAPs
To erase the stored LAPs, you must enter the SETTING MENU.
Select "LAP" option, by pressing button (1) or (2).
Once function is highlighted, press CONFIRM MENU button (4).

Press buttons (1) and (2) to select "ERASE" (flashing) and keep button (4) pressed for 3 seconds to confirm.
After 3 seconds, the instrument panel shows the message "WAIT" for 2 seconds, followed by "OK" to indicate that the Laps have been erased.

Note

If the stored times are deleted while the LAP function is active, it will be automatically deactivated.

To quit, press button (4).



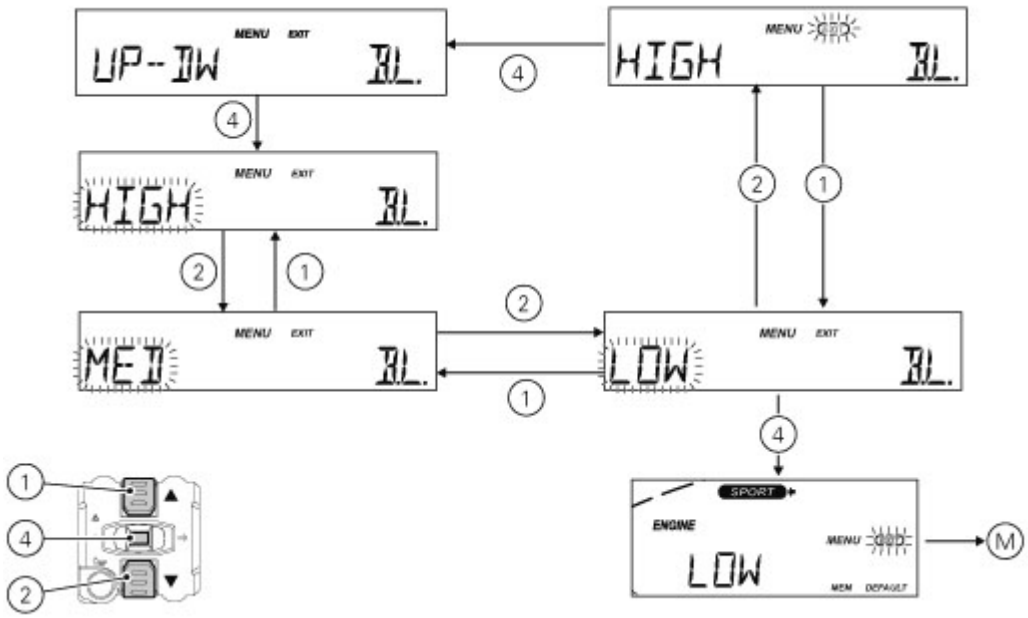
Backlighting adjustment

This function allows adjusting the backlighting intensity.
To set the backlighting, enter the SETTING MENU, use buttons (1) and (2) to select "B.L." and press button (4) to confirm.
When accessing the function, the current mode is highlighted with flashing writing, whereas MENU and EXIT are steady on.

Use buttons (1) and (2) to select the desired brightness level (HIGH, MED, LOW) and press button (4) to confirm.
Settings:
- **HIGH**: to set the display backlighting maximum brightness - recommended in conditions of strong ambient light.
- **MED**: to set the display backlighting medium brightness (70%) - recommended in conditions of medium/low ambient light.
- **LOW**: to set the display backlighting minimum brightness (50%) - recommended in conditions of low ambient light and/or during the night.

After confirming, the "EXIT" box will start flashing.
To exit the menu and go back to the previous page, select "EXIT" and press button (4).

Note
In the event of an interruption of the power supply from the Battery, when power is restored, at the next Key-On, the backlighting will always be set by default to maximum brightness.



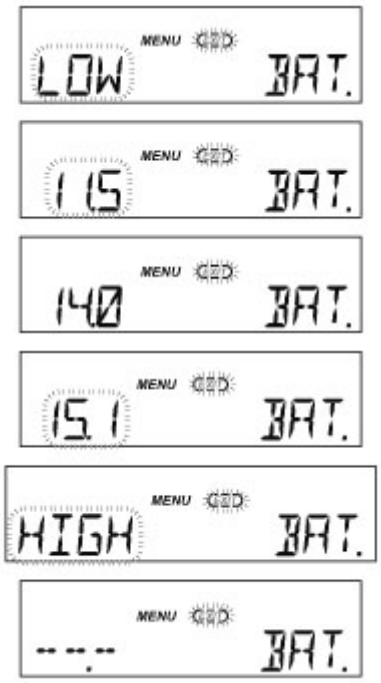
Battery voltage

This function allows you to check the motorcycle battery voltage.

Enter the SETTING MENU. Select the BAT. (Battery) option by pressing button (1) or (2).
Once function is highlighted, press CONFIRM MENU button (4) and access the BAT. (Battery).

The information will be displayed as follows:
- if battery voltage is between 11.8 V and 14.9 V the reading will be displayed steady;
- if battery voltage is between 11.0 V and 11.7 V the reading will be displayed flashing;
- if battery voltage is between 15.0 V and 16.0 V the reading will be displayed flashing;
- if the battery voltage is equal to or lower than 10.9 Volt, the "LOW" message starts flashing;
- if the battery voltage is equal to or higher than 16.1 Volt, the "HIGH" message starts flashing.

If the instrument panel is not receiving battery voltage value, a string of three dashes "- - -" is displayed.
To quit the menu and go back to Setting Menu main page, select EXIT and press button (4).



Customising the Riding Mode: Restoring default settings

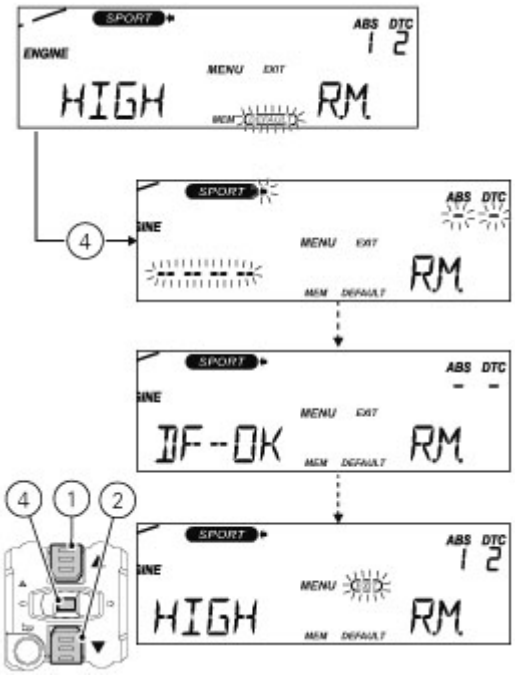
This function allows restoring all default values set by Ducati for the parameters relating to each riding mode.

Enter the SETTING MENU. Select the R.M. (Riding mode) option by pressing button (1) or (2). Once function is highlighted, press CONFIRM MENU button (4) and enter the R.M. (Riding mode) Menu.

Select the desired riding mode (SPORT, TOURING or URBAN), by pressing button (1) or (2). After selecting the riding mode (arrow next to the flashing riding mode), press the MENU CONFIRMATION button (4).

Select DEFAULT (DEFAULT box flashing) by pressing button (1) or (2).
Once desired parameter is highlighted, keep CONFIRM MENU button (4) pressed for 3 seconds.

After 3 seconds the arrow on the right side of the Riding Mode starts flashing and the display shows flashing "dashes" (for 2 seconds) instead of all parameters (ENGINE, DTC and ABS).
The display shows "DF-OK" for 2 seconds to indicate that the default parameters have been reset.
After 2 seconds, the "EXIT" trim starts to flash automatically.
Press button (4) to quit and go back to the Setting Menu.

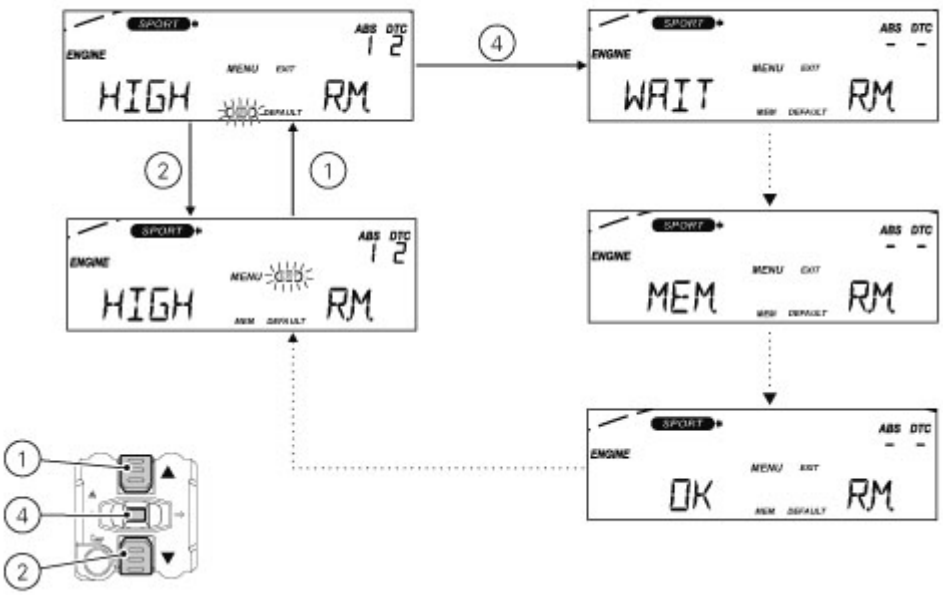


Customising Riding Mode: restore default settings (ALL DEFAULT)

This function allows restoring all default values set by Ducati for the parameters relating to each riding mode (SPORT, TOURING or URBAN).

Enter the SETTING MENU. Select the R.M. (Riding mode) option by pressing button (1) or (2).
Once function is highlighted, press CONFIRM MENU button (4) and enter the R.M. (Riding mode) Menu.
Select the DEFAULT box by pressing button (1) or (2).

Once the desired indication is selected, press CONFIRM MENU button (4) for 3 seconds.
After 3 seconds, the three arrows on the Riding Mode right side will flash (for 2 seconds); then the display will show "DF-OK" for 2 seconds, indicating that the default parameters have been restored.
After 2 seconds, the "EXIT" trim starts to flash automatically.
Press button (4) to quit and go back to the Setting Menu.



Customising the Riding Mode: ABS setting

This function disables or sets ABS level for the selected riding mode.
Enter the SETTING MENU.
Select the R.M. (Riding mode) option by pressing button (1) or (2).
Once function is highlighted, press CONFIRM MENU button (4).
You open the R.M. (Riding mode) Menu.

Select the desired riding mode (SPORT, TOURING or URBAN), by pressing button (1) or (2).
After selecting the desired riding mode (arrow beside the flashing riding mode), press the MENU CONFIRMATION button (4).
You open the selected riding mode customisation Menu.
Select the parameter to be customised (ABS), by pressing button (1) or (2).
Once the desired parameter is highlighted, press CONFIRM MENU button (4).

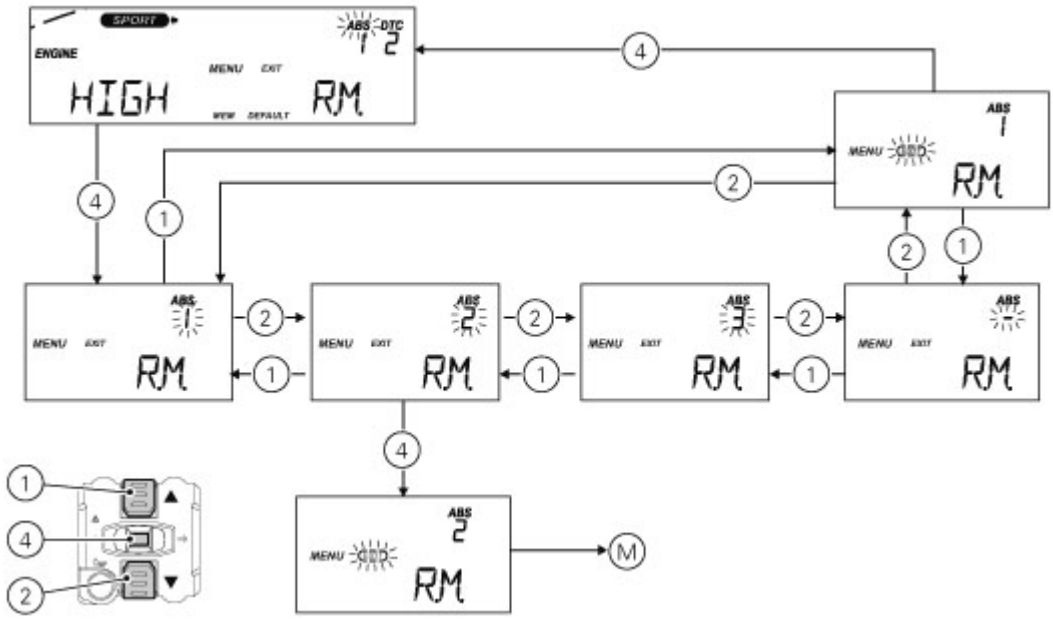
When entering the function, the currently set ABS level or status starts flashing.
Use buttons (1) and (2) to select the new desired intervention level (from 1 to 3) or the symbol " – " (that identifies the "OFF" status) and press button (4) to confirm.
The value will become automatically steady and the message "EXIT" will be highlighted.

To exit the menu and go back to previous page, select "EXIT" and press button (4). The instrument panel will go back to the previous level and it will be possible to start the "Parameter storage" procedure (M).

Note
To save the new ABS parameter setting follow the procedure "Storing Riding Mode settings" described in paragraph "Parameter storage". If the user quits the Riding Mode customisation menu without performing the storing procedure, the just-selected settings will be lost.

Note
By setting "–" (Off), the ABS will be disabled and the relevant warning light will start flashing.

Important
Important: When setting the ABS OFF, Ducati recommends paying particular attention to the braking and riding style.




0 1 2 3 4 5 6 7 8 9 10 11 12
0
km/h
24
19830
68
52

Customising the Riding Mode: DTC level setting

This function disables or sets DTC level for the selected riding mode.
Enter the SETTING MENU.
Select the R.M. (Riding mode) option by pressing button (1) or (2).

Once function is highlighted, press CONFIRM MENU button (4).
In the R.M. (Riding Mode) menu, select the desired riding mode (SPORT, TOURING or URBAN), by pressing button (1) or (2).
After selecting the desired riding mode (arrow beside the flashing riding mode), press the MENU CONFIRMATION button (4).

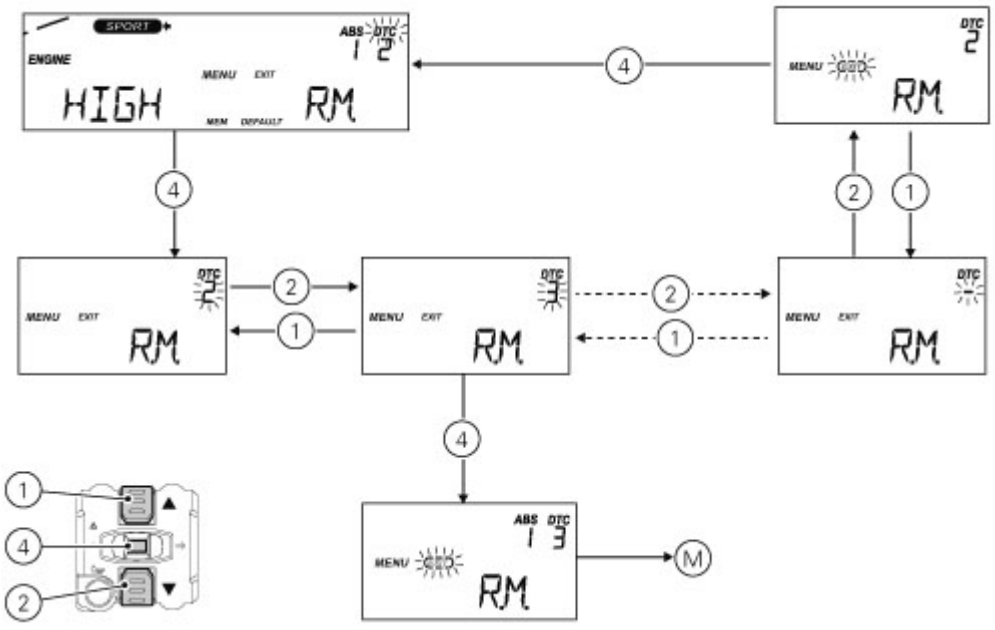
You open the selected riding mode customisation Menu. Select the parameter to be customised (DTC), by pressing button (1) or (2).
Once the desired parameter is highlighted, press CONFIRM MENU button (4).
When entering the function, the currently set DQS level or status starts flashing.
Use buttons (1) and (2) to select the new desired intervention level (from 1 to 8) or the symbol " – " (that identifies the "OFF" status) and press button (4) to confirm.
The confirmed value will become automatically steady and the message "EXIT" will be highlighted.
To exit the menu and go back to the previous page, select "EXIT" and press confirmation button (4).
Now it is possible to perform the "Parameter storage" procedure (M).

Attention

To save the new DTC parameter setting, follow the procedure "Storing Riding Mode settings" described in "Parameter storage". If the user quits the Riding Mode customisation menu without performing the storing procedure, the just-selected settings will be lost.

Note

By setting "– " (Off), the DTC will be disabled.



Customising the Riding Mode: Engine Setting

This function customises engine power associated with each riding mode. Enter the SETTING MENU. Select the R.M. (Riding Mode) option by pressing button (1) or (2). Once function is highlighted, press CONFIRM MENU button (4).

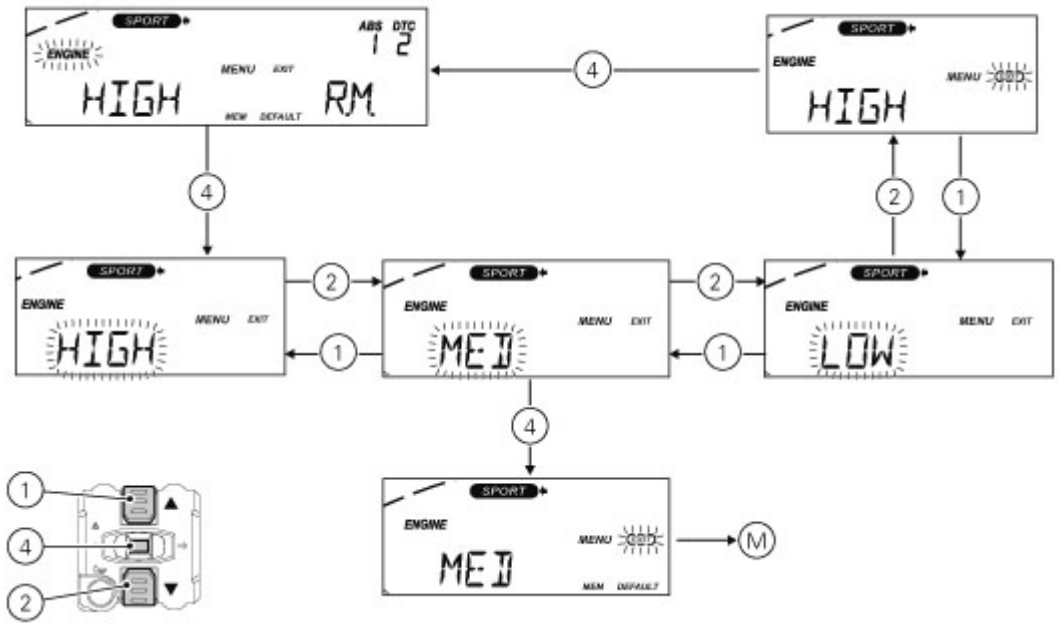
Access R.M. (Riding mode) Menu. Select the desired riding mode (SPORT, TOURING or URBAN), by pressing button (1) or (2). After selecting the desired riding mode (arrow beside the flashing riding mode), press the MENU CONFIRMATION button (4) and enter the personalisation Menu to modify the selected riding mode.

Select the parameter to be customised (ENGINE), by pressing button (1) or (2). Once the necessary parameter is highlighted, press the CONFIRM MENU button (4): the currently set engine power (HIGH, MED or LOW) starts flashing on the display. Select the new desired engine power using buttons (1) and (2) and press button (4) to confirm the selection. The value will become automatically steady and the message "EXIT" will be highlighted.

To exit the menu and go back to previous page, select "EXIT" and press button (4). The instrument panel will go back to the previous menu level and it will be possible to start the "Parameter storage" procedure (M).

Note

To save the new ENGINE parameter setting, follow the procedure "Storing Riding Mode settings" described in paragraph "Parameter storage". If the user quits the Riding Mode customisation menu without performing the storing procedure, the just-selected settings will be lost.

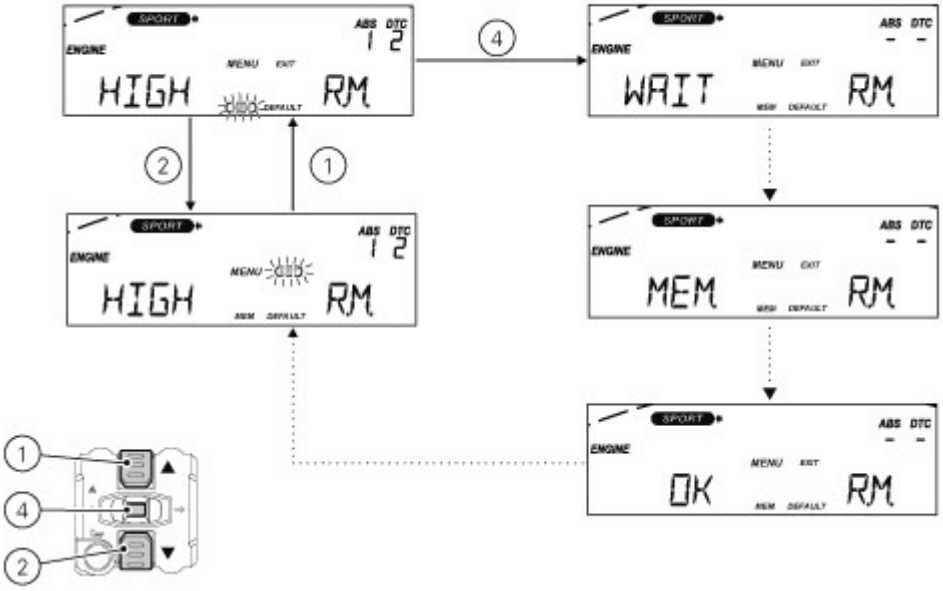


Customising Riding Mode: Parameter storage

After changing a Riding Mode parameter (ENGINE, DTC and/or ABS), to make the change effective, it is necessary to save it before quitting the customisation menu.
It is possible to save the parameters set for each riding mode.
To save the parameter settings of a Riding Mode, it is necessary to gain access to the SETTING MENU, use buttons (1) and (2) to select the message "R.M." (Riding Mode) and press button (4). Then use buttons (1) and (2) to select the riding mode to change and press button (4). Then use buttons (1) and (2) to select "MEMORY" (flashing) and keep button (4) pressed for 2 seconds; then the display will show "WAIT" (for 2 other seconds) followed by "MEM" and "OK" to confirm that the new parameters have been memorised.
Any parameter change made is saved and remains in the memory also after a Battery-OFF. If you highlight "EXIT" and press button (4) you quit the sub-menu and go back to previous page.

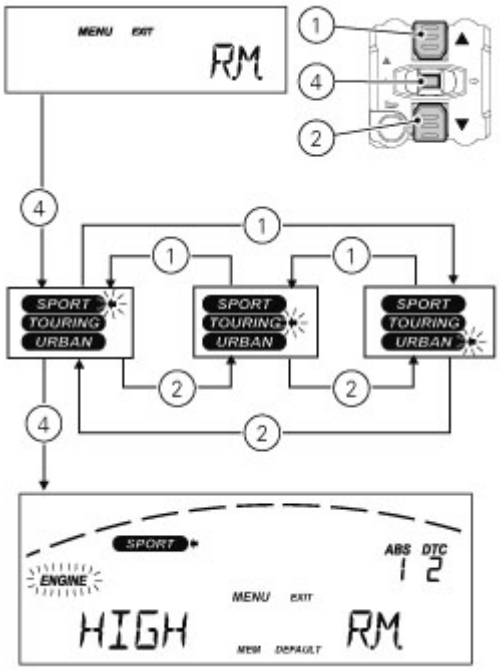
Warning

Changes should only be made to the parameters by people who are experts in motorcycle set-up; if the parameters are changed accidentally, use the "DEFAULT" function to restore factory settings.



SELECTING AND CUSTOMISING THE RIDING MODES
All settings of every riding mode can be customised.
Enter the SETTING MENU.
Select the R.M. (Riding mode) option by pressing button (1) or (2).
Once function is highlighted, press CONFIRM MENU button (4).
Access R.M. (Riding mode) MENU.
After entering the function, the display shows the three available riding modes (SPORT, TOURING or URBAN).

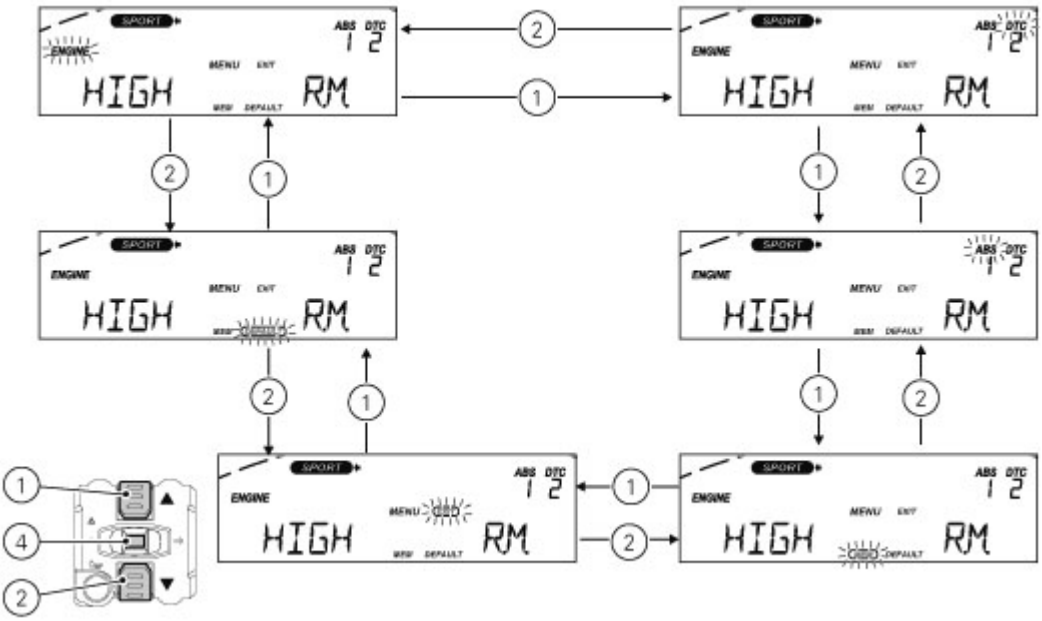
Press buttons (1) and (2) to select the riding mode to be customised (the arrow beside flashes):
- Press the CONFIRM MENU button (4) to customise the selected riding mode;
- if you highlight "EXIT" and press button (4) you quit the sub-menu and go back to previous page.



The parameters that can be customised for every riding mode are the following:
- ENGINE
- DTC
- ABS
- DEFAULT (to restore the parameters set by Ducati for each riding mode).

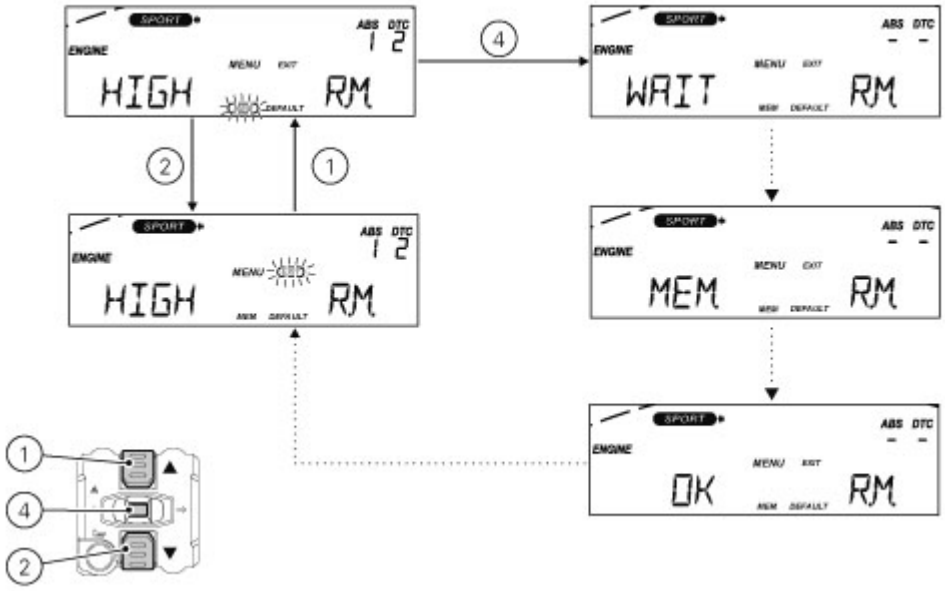
When entering the customisation menu of the selected riding mode the ENGINE parameter is automatically highlighted (the relevant parameter flashes) and it is possible to scroll the menu items by pressing buttons (1) and (2) to select all available information (the selected parameter flashes) in the following sequence:
- ENGINE
- DTC
- ABS
- MEMORY
- EXIT
- DEFAULT

If you highlight "EXIT" and press button (4) you quit the sub-menu and go back to previous page.



SAVING THE CUSTOMISED RIDING MODES
After changing a riding mode parameter (ENGINE, DTC and/or ABS), to make the change effective, it is necessary to save it before quitting the customisation menu.
It is possible to save the parameters set for each riding mode.

To save the parameter settings of a Riding Mode, it is necessary to gain access to the SETTING MENU, use buttons (1) and (2) to select the message "R.M." (Riding Mode) and press button (4).
Select the riding mode to be modified and press button (4) with buttons (1) and (2).
Then use buttons (1) and (2) to select "MEMORY" (flashing parameter) and keep button (4) pressed for 2 seconds; then the display will show "WAIT" (for 2 other seconds) followed by "MEM" and "OK" to confirm that the new parameters have been memorised.
Any parameter change made is saved and remains in the memory also after a Battery-OFF.
If you highlight "EXIT" and press button (4) you quit the sub-menu and go back to previous page.



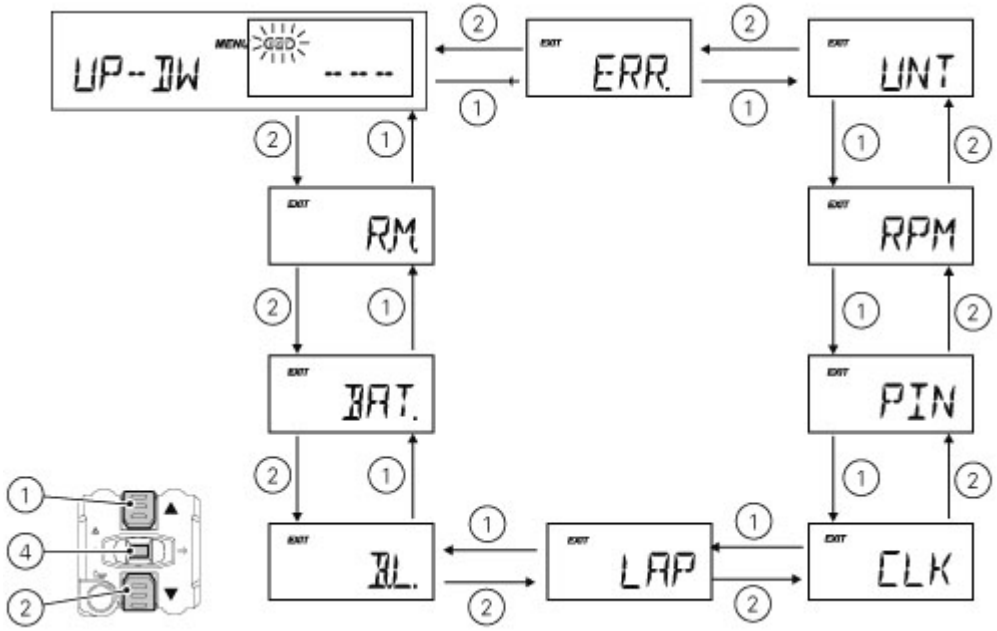
Setting MENU

This menu allows enabling, disabling and setting some motorcycle functions.
To enter the SETTING MENU it is necessary to hold button (2) for 2 seconds, with Key-ON and motorcycle actual speed ≤ (lower than or equal to) 20 km/h: within this menu, it is no longer possible to view any other function.

The SETTING MENU displays the following functions:

- Riding mode (R.M.)
- Battery (BAT.)
- Back light (B.L.)
- LAP (LAP)
- Clock (CLK)
- PIN code (PIN)
- RPM (RPM)
- Units setting (UNT)
- Errors (ERR.) (only if active errors are present)

For safety reasons, the setting menu can be accessed only when vehicle speed is below or equal to 20 Km/h; if this menu is accessed and vehicle speed is above 20 Km/h, the instrument panel will automatically quit it and shift back to main screen.
Press buttons (1) and (2) to highlight all customisable parameters: in particular, use button (1) to highlight the following item or button (2) to highlight the previous item.
After highlighting the required parameter, press button (4) to open the corresponding MENU page.
If function is not available or temporarily disabled, the MENU page can not be opened.
To quit the SETTING MENU you shall highlight "EXIT" and press CONFIRM MENU button 4.



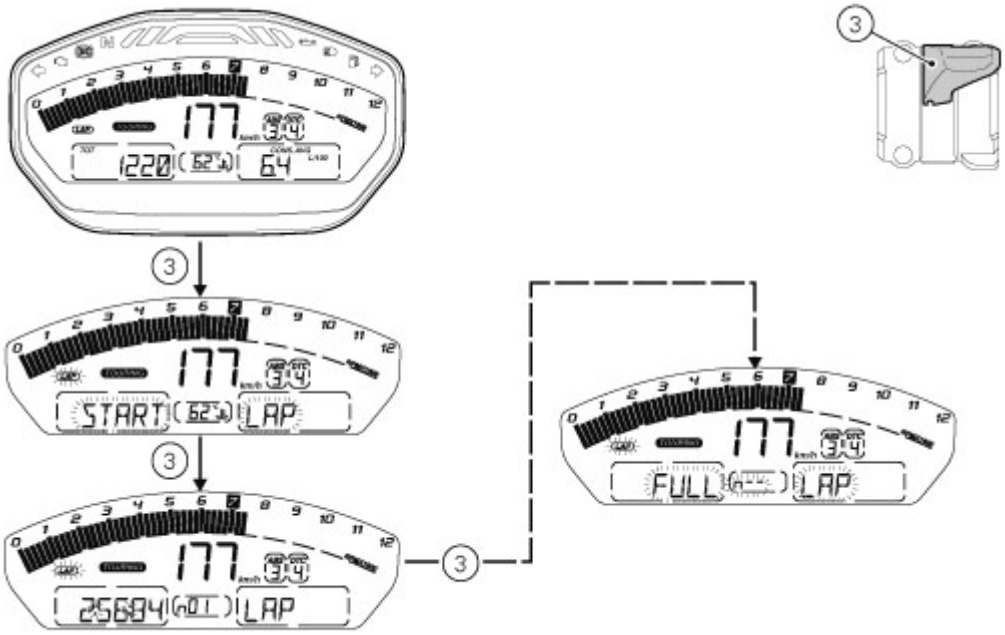
LAP time

Note
LAP function information is available when the function is active.

When the LAP function is active and the FLASH button (3) is pressed, the messages "LAP" and "START LAP" will blink in menu 1 for 4 seconds and the function will be automatically displayed again.
Whenever FLASH button (3) is pressed, the display shows the time of the just ended lap with a resolution of one hundredth of a second (" 0'00''00") for 10 seconds and the LAP number instead of the engine coolant temperature indication.
After 10 seconds, the display will automatically show the function that was displayed before pressing the FLASH button (3).
When storing the 30th LAP, the LAP function is stopped and upon any further press on the FLASH button (3), the instrument panel will display the FULL - - LAP flashing message for 4 seconds until the times are reset.

Warning
When the LAP function is active, the FLASH button takes on the dual function of high beam "FLASH" and finish line control and storage for the LAP timer (new lap start indication).

Note
The TRIP FUEL function always has top priority over the LAP function: in case of activation of the TRIP FUEL function with active LAP function, the LAP timer view is automatically removed and TRIP FUEL information is displayed instead.



LAP recording
With the LAP function "active", it is possible to record the Lap time.
To record the lap time it is necessary to activate the LAP TIME function through the Setting Menu in the LAP page.

After activating this function, it is possible to record the lap time as follows:
- the first time the rider presses button (3), the "timer" of the first lap starts and "START LAP" will be displayed flashing for 4 seconds in MENU 1: then the previous function will be displayed automatically;
- from this moment, whenever button (3) is pressed, the instrument panel will show automatically the lap time in MENU 1 for 10 seconds and the LAP "number" instead of the "Engine coolant temperature" indication: after 10 seconds it will display the previous function.
30 laps max. can be recorded.

If the instrument panel "memory" is full, whenever button (3) is pressed, the instrument panel does not record any lap time and "FULL -- LAP" will be displayed flashing for 4 seconds until lap times are reset. This indication will be displayed until all times are reset with the LAP erase function in the Setting Menu (ERASE).
When the LAP function is set disabled, the current lap is not stored. If the LAP function is enabled and

vehicle is suddenly stopped (Key-Off), function will be automatically disabled and the current lap time is not recorded, (even if timer was active).
If the time is never "stopped", it will roll over upon reaching 9 minutes, 59 seconds and 99 hundredths; the lap timer starts counting from 0 (zero) and will keep running until the function is disabled.
If however the LAP function is switched on and the memory has not been cleared, but fewer than 30 laps have been saved (e.g. 18 recorded laps) the Instrument Panel records any left lap until memory is full (for instance: 12 further laps can be recorded).

In this function only the lap times being recorded are displayed; other data are anyway recorded (MAX speed, MAX rpm and limiter if reached), which can be later displayed with the "Stored LAPs displaying" function (LAP REC) in the Setting Menu.

Displayed errors description

Displayed error	Description
CAN LINE	CAN line BUS OFF
UNK-D	Control unit not acknowledged by the system - wrong SW
ABS	ABS control unit faulty communication / operation
BBS	BBS control unit faulty communication / operation
	BBS control unit general malfunction
	Exhaust valve motor malfunction
DSB	DSB control unit faulty communication / operation
IMMO	Key missing
	Key not recognised
	Antenna not working
ENG.	ECU control unit faulty communication / operation
	ECU control unit general malfunction
	Throttle position sensor malfunction
	Throttle motor or relay malfunction
	Pressure sensor malfunction
	Engine coolant temperature sensor malfunction

	Intake duct air temperature sensor malfunction
	Injection relay malfunction
	Ignition coil malfunction
	Injector malfunction
	Engine rpm sensor malfunction
	Lambda sensor or Lambda sensor heater malfunction
	Motorcycle starting relay malfunction
	Secondary air sensor malfunction
FUEL	Reserve NTC sensor malfunction
SPEED	Front and/or rear speed sensor malfunction
BATT.	Battery voltage too high or too low
STAND	Side stand sensor not working
FAN	Electric cooling fan malfunction
T_AIR	Ambient air temperature sensor malfunction

Note
The message "FAN" can be displayed also in case of BBS control unit malfunction and its faulty communication with fans. Pay attention to engine temperature indication.

ERROR ICONS TABLE

WARNING LIGHT	ERROR MESSAGE	ERROR
	BBS	Black-Box control unit

	ABS	ABS control unit
	DSB	Instrument panel control unit
	IMMO	Immobilizer antenna
	ENG.	Engine control unit
	CAN	Can Bus OFF
	UNK-D	Software compatibility
	FAN	Cooling fan
	BATT.	Battery voltage
	T-AIR	Air temperature sensor
	STAND	Side stand sensor
	SPEED	Speed sensor
	FUEL	Low fuel sensor

 Note

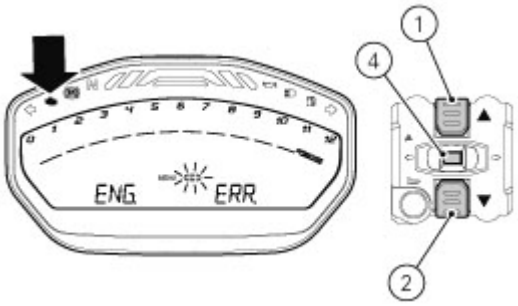
The message "FAN" can be displayed also in case of BBS control unit malfunction and its faulty communication with fans. Pay attention to engine temperature indication.

Error warnings

To view the present errors, it is necessary to enter the Setting Menu, select "ERR." using buttons (1) and (2) (that, in case of active errors, is the first available page) and press button (4).

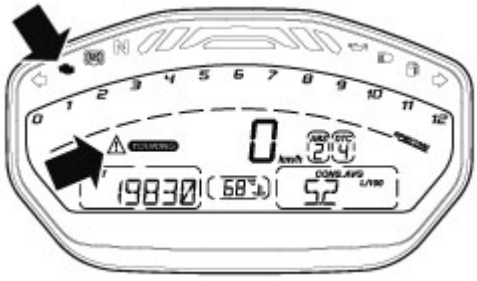
The instrument panel displays:
- the writing "ERR." steady ON;
- the error type indication steady ON and
- the EXIT steady ON and its box flashing.

If several errors are active, the corresponding indications will be displayed one after the other, each remaining on display for 3 seconds.
When an error is triggered the EOBD light turns on as well.



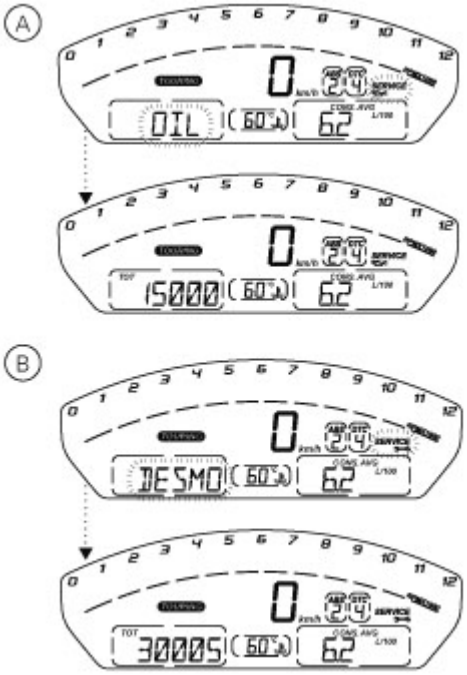
Errors

The instrument panel manages error warnings in order to allow the rider to identify any abnormal motorcycle behaviour in real time.
Upon Key-ON, if there are active errors the instrument panel turns the EOBD light and Warning symbol ON and activates the Error page of the SETTING MENU.
During standard motorcycle operation, upon the activation of an error the instrument panel turns the EOBD light and Warning symbol ON and activates the Error page of the SETTING MENU.



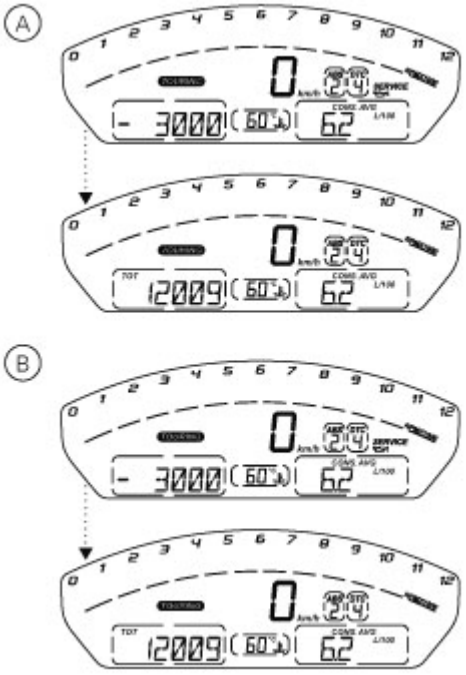
"OIL SERVICE" or "DESMO SERVICE" warning

When the service threshold is reached, the warning for the type of service required is triggered: OIL SERVICE (A) or DESMO SERVICE (B).
The indication includes displaying for 5 seconds the flashing message "SERVICE", the Oil or Desmo symbol as well as the message "OIL" or "DESMO" upon each Key-ON; after 5 seconds, both the message "SERVICE" and the Oil or Desmo symbol become steady until Key-OFF or until a reset is performed.



The message "OIL SERVICE" or "DESMO SERVICE" countdown

After OIL SERVICE zero indication first reset (at 1,000 km - 600 mi), the instrument panel activates the countdown of the kilometres (or miles) left before the following service operation: OIL SERVICE (A) or DESMO SERVICE (B).
The kilometre count indication is shown upon Key-ON for 2 seconds; when there are 1,000 km (600 miles) left before the next service operation, the indication turns on upon every Key-ON for 5 seconds.
In other words, upon Key-ON the message "SERVICE", the Oil or the Desmo symbol are displayed together with the indication of the kilometres left before the following service operation.



"OIL SERVICE" zero warning

The first maintenance indication is OIL SERVICE zero, enabled for 5 seconds upon each key-on when the odometer counter reaches the first 1,000 km (600 mi).
The indication includes displaying for 5 seconds the flashing message "SERVICE", the Oil symbol and the message "OIL" upon each Key-ON; after 5 seconds, both the message "SERVICE" and the Oil symbol become steady until Key-OFF or until a reset is performed.

Service Indication (SERVICE)

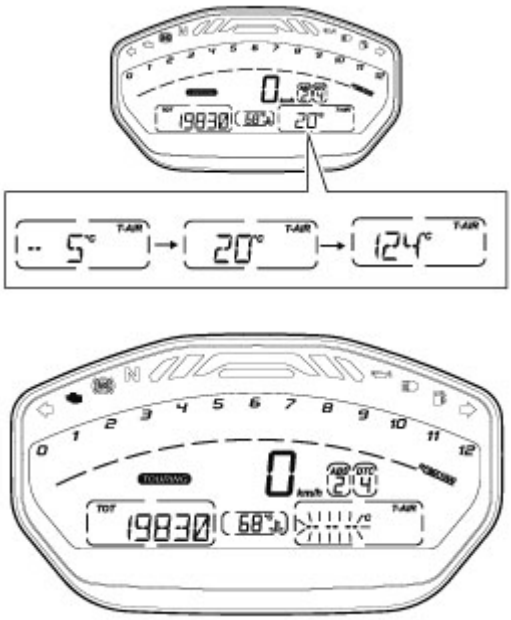
It indicates the need to have the vehicle inspected (service).

Note
When the motorcycle is stopped, the engine heat could influence the displayed temperature.

Ambient air temperature

The instrument panel displays the ambient temperature in the set unit of measurement (°C or °F), followed by the set unit of measurement and the message "T-AIR".
The temperature value is displayed when ranging from -39 °C to +124 °C (or -38 °F ÷ +255 °F).
For any different temperature (below -39 °C (-38 °F) or above +124 °C (+255 °F)) a string of three dashes " - - - " is steadily displayed, followed by the unit of measurement.
If the air temperature sensor is in fault, the instrument panel will show three flashing dashes " - - - " as air temperature value, followed by the unit of measurement and the EOBD light will turn on.

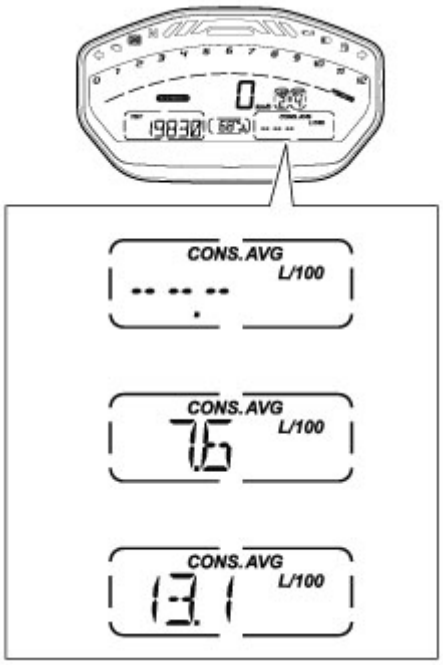
Note
When the motorcycle is stopped, the engine heat could influence the displayed temperature.



Average fuel consumption

The instrument panel calculates and displays the motorcycle average fuel consumption, the set unit of measurement and CONS. AVG.
The calculation is made considering the quantity of fuel used and the distance travelled since TRIP A was last reset.
When TRIP A is reset, the value is reset and the first value available is displayed 10 seconds after the reset.
During the first 10 seconds, when the value is not yet available, the display will show a string of three dashes "- - . - " steadily as average fuel consumption.
Value is expressed in the set unit of measurement (litres / 100 km or mpg UK or mpg USA).
The active calculation phase occurs when the engine is running and the motorcycle is stopped: (moments when the motorcycle is not moving and the engine is OFF are not considered).

Note
It is possible to change the units of measurement for "Consumption" (both average and instantaneous together) from L/100 to km/L through the Setting MENU, using the "SET UNITS" function.

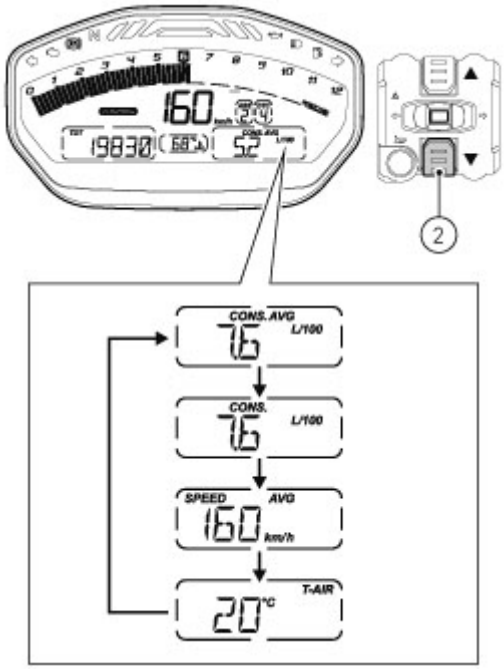


Functions: Menu 2

MENU 2 functions are:

- Average fuel consumption (CONS. AVG);
- Instant fuel consumption (CONS.);
- Average speed (SPEED AVG);
- Ambient air temperature;

By pressing button (2) it is possible to view the functions of MENU 2.

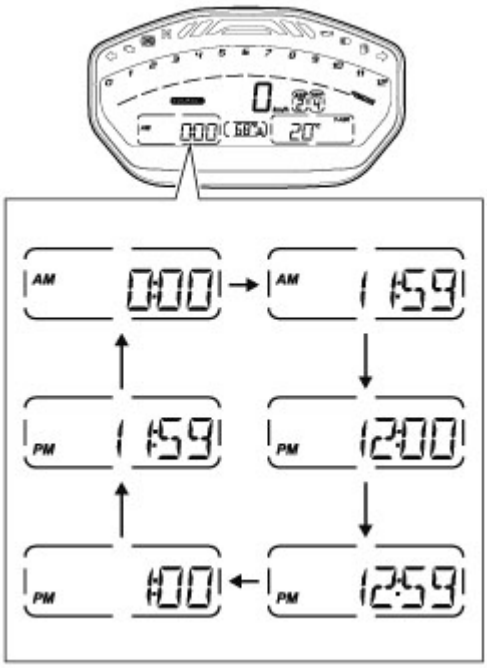


Clock

The instrument panel receives information about the time to be displayed.
The instrument panel shows the time in the following format:

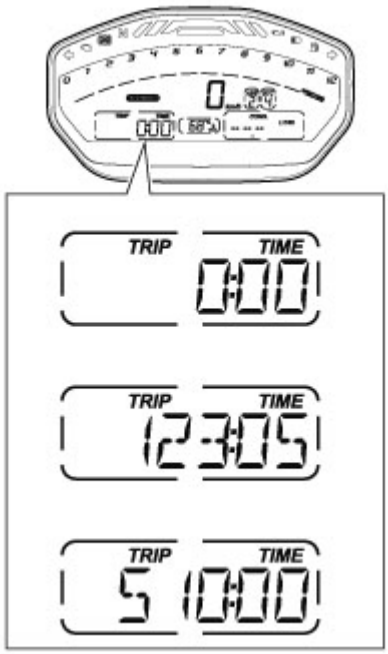
- hh (hours) : mm (minutes);
- with the message AM (for values ranging between 0:00 and 11:59), or PM (for values ranging between 12:00 and 12:59 and between 1:00 and 11:59).

In case of power supply interruption (faulty battery), the clock is reset and starts automatically from "0:00".



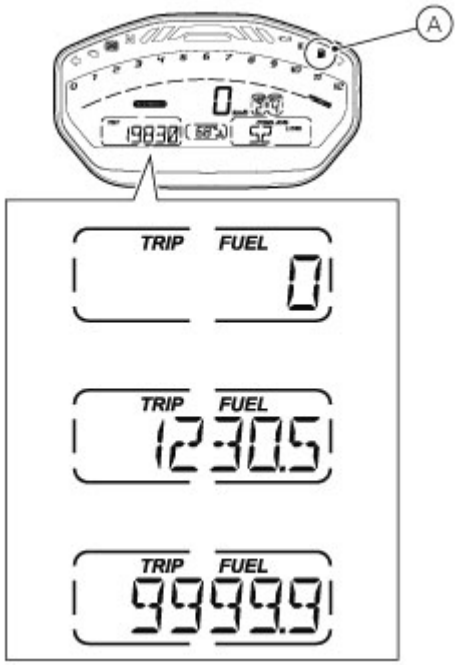
Trip time

The instrument panel calculates and displays the trip time as hhh:mm followed by TRIP TIME.
The calculation considers the time since TRIP A was last reset.
When TRIP A is reset, this value is reset as well.
The time count active phase occurs when the engine is running and the motorcycle is stopped (the time is automatically stopped when the motorcycle is not moving and the engine is OFF and restarts when the counting active phase starts again).
When the reading exceeds 511:00 (511 hours and 00 minutes), the meter is reset and automatically starts counting from 0 again.



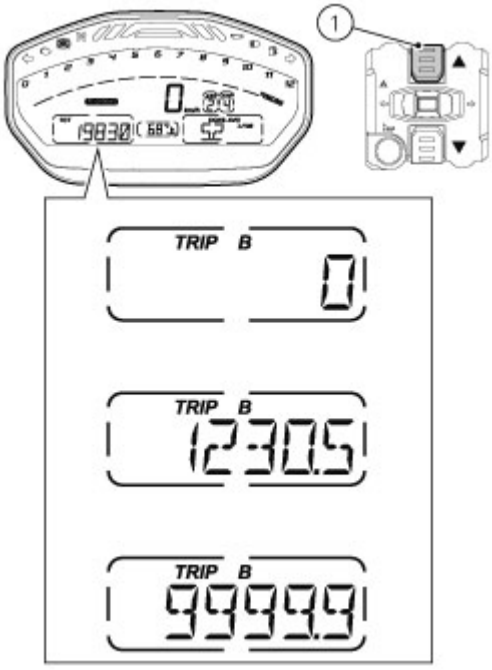
Partial fuel reserve counter (TRIP FUEL)

The fuel trip meter counts and displays the distance covered by the motorcycle on reserve (since the low fuel light turns on) with the set unit of measurement (km or mi).
When the Low Fuel Light turns on, the display automatically shows the TRIP FUEL function, regardless of the currently displayed function; then, it is possible to toggle through the other Menu 1 functions.
Trip fuel reading remains stored even after Key-Off until the motorcycle is refuelled. Count is interrupted automatically as soon as fuel is topped up to above minimum level.
When the reading exceeds the maximum value of 9999.9 km or 9999.9 mi, distance travelled is reset and the meter automatically starts counting from 0 again.



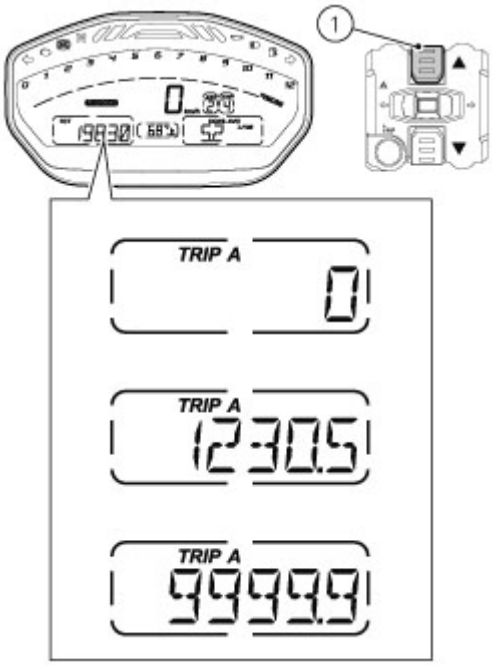
Trip Meter 2 (TRIP B)

The trip meter counts and displays the partial distance covered by the motorcycle with the set unit of measurement (km or mi).
When the reading exceeds the maximum value of 9999.9 km or 9999.9 mi, distance travelled is reset and the meter automatically starts counting from 0 again.
While the trip meter is displayed, press button (1) for 3 seconds to reset TRIP B.
The TRIP B counter is automatically reset in case the system unit of measurement is changed manually or if the power supply is interrupted (faulty battery): the counter will then start back from zero, considering the new units of measurement.



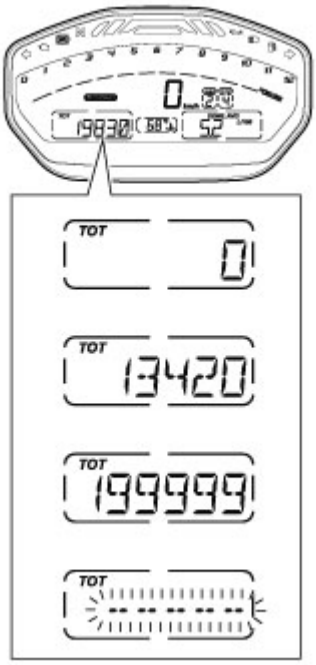
Trip Meter 1 (TRIP A)

The trip meter counts and displays the partial distance covered by the motorcycle with the set unit of measurement (km or mi).
When the reading exceeds the maximum value of 9999.9 km or 9999.9 mi, distance travelled is reset and the meter automatically starts counting from 0 again.
While the trip meter is displayed, press button (1) for 3 seconds to reset TRIP A.
When TRIP A is reset, the average fuel consumption, average speed and trip time data are reset as well.
The TRIP A counter is automatically reset in case the system unit of measurement is changed manually or if the power supply is interrupted (faulty battery): the counter will then start back from zero, considering the new units of measurement.



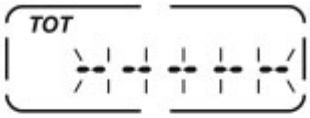
Odometer (TOT)

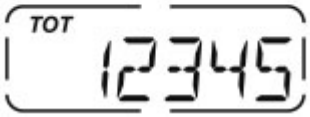
The odometer counts and displays the total distance covered by the motorcycle with the set unit of measurement (km or mi). The odometer number (in km or miles) is displayed with the message TOT and the indication of the unit of measurement.
When the maximum value is reached (199999 km or 199999 mi) the instrument panel will permanently display said value.
The odometer value is saved permanently and cannot be reset under any circumstances.
The reading is not lost in case of a power OFF (Battery OFF).



Note
Upon Key-ON, the instrument panel always shows the Odometer indication for 10 seconds, then shows the user's settings page.

ODOMETER UPDATE
This function allows copying the km value saved in the odometer when replacing the instrument panel or the Black Box (BBS) control unit.
When replacing the instrument panel or the Black Box (BBS) control unit, it is necessary to copy the km value to the new control unit using the DDS 2. Diagnosis Instrument.
Until this procedure is not performed, the instrument panel display will show some flashing dashes " -----“ instead of the "Odometer" value.
The procedure is successfully completed when the display shows the odometer value.



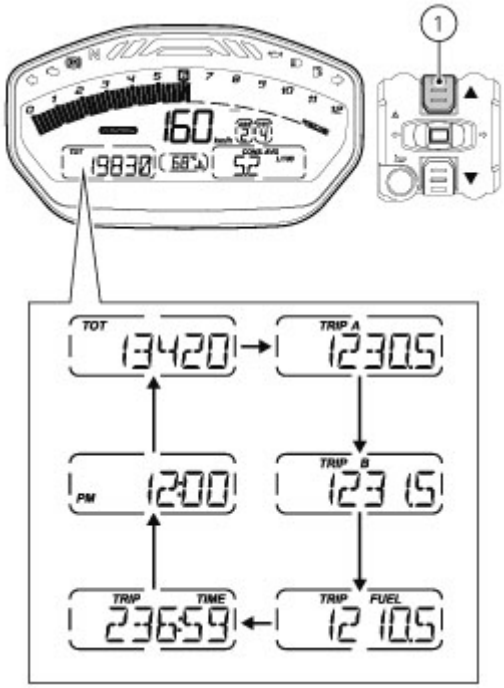


Menu 1 functions

MENU 1 functions are:

- Odometer (TOT);
- Trip meter A (TRIP A);
- Trip meter A (TRIP B);
- Partial fuel reserve counter (TRIP FUEL);
- Trip time (TRIP TIME);
- Clock;

By pressing button (1) it is possible to view the functions of MENU 1.

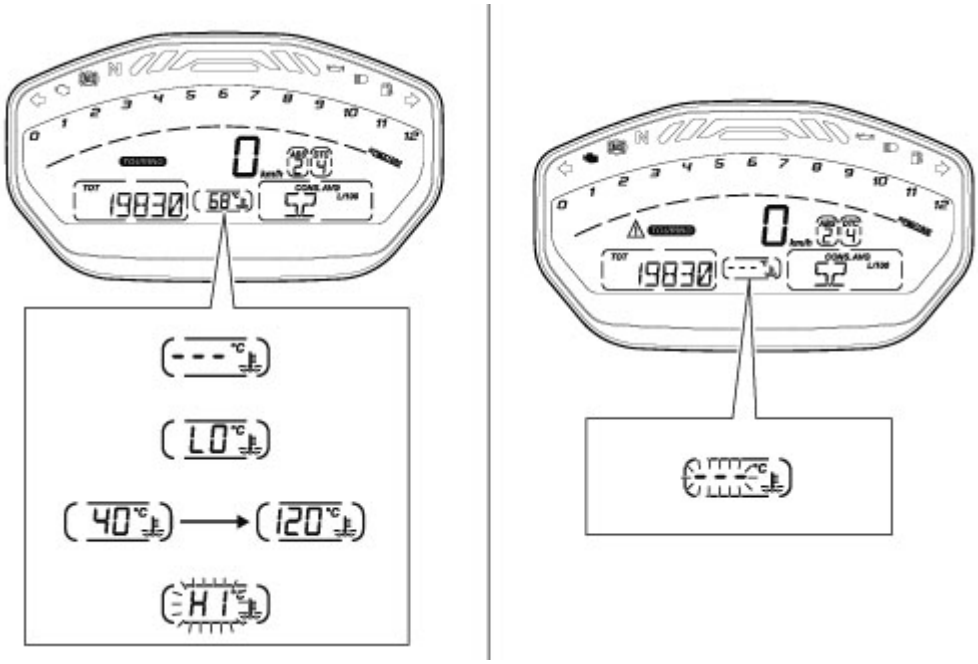


Engine coolant temperature

The instrument panel receives information about the engine temperature (already calculated in °C) and displays the value in the set unit of measurement (°C or °F), followed by the unit of measurement and the engine temperature symbol.
The temperature display range goes from 40 °C to +120 °C (+104 °F ÷ +248 °F).
If reading is:

- <= (lower than or equal to) -40 °C (-40 °F), a string of flashing dashes " - - - " is displayed;
- within the range -39 °C (-38 °F) to +39 °C (+102 °F), "LO " is displayed steadily;
- within the range +40 °C (+104 °F) to +120 °C (+248 °F), it is displayed steadily;
- >= (higher than or equal to) +121 °C (+250 °F), "HI" is displayed flashing.

If the coolant temperature sensor is in fault, a string of flashing dashes "- - -" is displayed with the set unit of measurement and the EOBD light turns on.
If the instrument panel is not receiving coolant temperature value, a string of steady dashes "- - -" is displayed, followed by the unit of measurement.

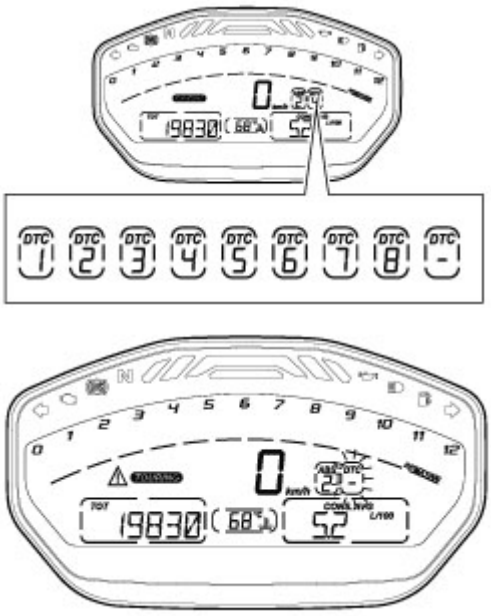


Warning
In the CHINA version the engine coolant temperature indication IS NOT ACTIVE.

DTC

The instrument panel displays DTC status as follows:

- if DTC is active, DTC lettering and the Traction Control intervention level number (1 to 8);
- if DTC is not active, the message "DTC" and the rectangle with the steady symbol "- -";
- If the DTC or the Black Box control unit feature an error, the message "DTC" and the rectangle with the flashing symbol "- -".



Warning

DTC is a rider aid that can be used both on the track and the road. The system is designed to make riding easier and to enhance safety, but in no way relieves the rider of the obligation to drive responsibly and to maintain a high standard of riding in order to avoid accidents, whether caused by his own errors or those of other road users, through making emergency manoeuvres, in accordance with the prescriptions of the road traffic code.

The rider must always be aware that active safety systems have a preventive function. The active elements help the rider control the motorcycle, making it as easy and safe to ride as possible. The presence of an active safety system should not encourage the rider to ride at speeds beyond the reasonable limits, not in accordance with the road conditions, the laws of physics, good riding standards and the requirements of the road traffic code.
The following table indicates the most suitable level of DTC intervention for the various riding modes as well as the default settings in the "Riding Modes" that can be selected by the rider.

DTC	RIDING MODE	USE	DEFAULT
1	TRACK	Track use for expert riders. System permits sliding sideways.	NO
2	SPORT	Sport style on the road and on the track, for experienced riders. System permits sliding sideways.	It is the default level for the "SPORT" Riding Mode
3	SPORT	Sport road style for experienced riders. System permits sliding sideways.	NO
4	TOURING	Fast touring style.	It is the default level for the "TOURING" Riding Mode
5	TOURING	Touring style.	NO
6	URBAN	"Very safe" style on any kind of path.	It is the default level for the "URBAN" Riding Mode

7	RAIN	For riding on slightly wet or moist road. Compatible with ENGINE LOW setting.	NO
8	HEAVY RAIN	For riding on wet road. Compatible with ENGINE LOW setting.	NO

Tips on how to select the sensitivity level

Warning

The 8 levels of the DTC system your motorcycle is equipped with were calibrated with original equipment tyres (make, model and size). The use of tyres of different size to the original tyres may alter the operating characteristics of the system.

Motorcycle original equipment: (front 120/70ZR17 - rear 180/60ZR17).

- Pirelli Diablo Rosso II.

In the case of minor differences, such as for example, tyres of a different make and/or model than the OE ones, but with the same size (front 120/70ZR17 - rear 180/60ZR17), it may be sufficient to simply select the suitable level setting from those available in order to restore optimal system operation.
If tyres of a different size class are used or if the tyre size differs significantly from the original tyres, it may be that the system operation is affected to the point where none of the 8 available level settings will give satisfactory results.
In this case it is advisable to deactivate the traction control system.
If level 8 is selected, the DTC system will kick in at the slightest hint that the rear wheel is starting to spin.

Between level 8 and level 1 there are other intermediate levels.
DTC intervention decreases from level 8 to level 1.
Levels 1, 2 and 3 allow both spinning and skidding of the rear wheel out of a corner: these levels are recommended only for expert riders, in particular level 1 is designed for track use.

The choice of the correct level mainly depends on the following parameters:

1 The tyre/asphalt grip (type of tyre, amount of tyre wear, the road/track surface, weather conditions, etc.);
2 The characteristics of the path/circuit (bends all taken at similar speeds or at very different speeds):
3 The riding mode (whether the rider has a "smooth" or a "rough" style).

Level depends on grip conditions: the choice of level setting depends greatly on the grip conditions of the track/circuit (see below, tips for use on the track and on the road).

Level depends on type of track: if the track/path features bends all taken at similar speeds, it will be easier to find a level suitable for all bends; while a track/path with bends all requiring different speeds will require a DTC level setting that is the best compromise for all bends.

Level depends on riding style: The DTC will tend to kick in more with a "smooth" riding style, where the motorcycle is leaned over further, rather than with a "rough" style, where the motorcycle is straightened up as quickly as possible when exiting a turn.

Tips for use on the track

We recommend that level 6 is used for a couple of full laps (to allow the tyres to warm up) in order to get used to the system. Then try levels 5, 4, etc., in succession until you identify the DTC sensitivity level that suits you best (always try each level for at least two laps to allow the tyres to warm up).
Once you have found a satisfactory setting for all the corners except one or two slow ones, where the system tends to kick in and control too much, you can try to modify your riding style slightly to a more "rough" approach to cornering i.e. straighten up more rapidly on exiting the corner, instead of immediately trying a different level setting.

Tips for use on dry road

Activate the DTC, select level 6 and ride the motorcycle in your usual style; if the level of DTC sensitivity seems excessive, try levels 5, 4, etc., until you find the one that suits you best.
If changes occur in the grip conditions and/or circuit characteristics and/or your riding style, and the level setting is no longer suitable, switch to the next level up or down and proceed to determine the best setting (e.g. if with level 5 the DTC intervention seems excessive, switch to level 4; alternatively, if on level 5 you cannot perceive any DTC intervention, switch to level 6).

Tips for use on wet road

Level 7 is recommended when road is slightly wet or damp and level 8 on wet road.

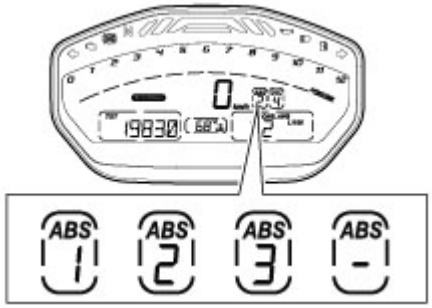
It is also recommended to select ENGINE LOW in these conditions.

ABS

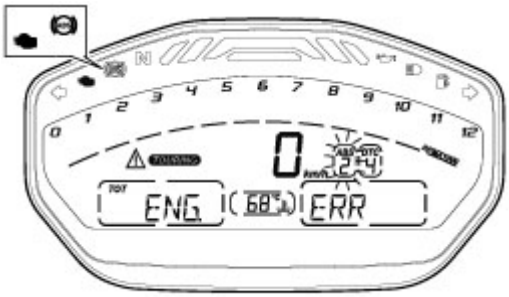
The motorcycle is equipped with ABS, the instrument panel indicates ABS status (on or off) by switching off, on or flashing the ABS warning light.
The instrument panel displays:

- if the ABS is active, the message ABS with the set intervention level number (1 to 3);
- if the ABS is not active, the message "ABS" and the rectangle with the steady symbol "- - ";
- if the ABS is in error, the message "ABS" and the rectangle with the flashing symbol "- - ";

The EOBD light turns on and the warning symbol is displayed together with the relevant error.



If the instrument panel does not receive information, the ABS warning light turns on.



The following table indicates the most suitable level of ABS intervention for the various riding types as well as the default settings in the "Riding Mode" that can be selected by the rider:

ABS	RIDING MODE	CHARACTERISTIC	DEFAULT
OFF		The ABS is disabled	NO
1	TRACK/SPORT	Typical use conditions: road or track use, in excellent grip conditions. The ABS in this mode controls both wheels, but NO anti lift-up* control is active. This calibration focuses on braking power.	It is the default level for the "SPORT" Riding Mode
2	SPORT/TOURING	Typical use conditions: road use, in excellent grip conditions. The ABS in this mode controls both wheels and anti lift-up* controls are active. This calibration focusses on braking power and yet keeps good stability under braking and lift-up* control.	It is the default level for the "TOURING" Riding Mode
3	ALL/URBAN/WET CONDITION	Typical use conditions: any riding condition. The ABS in this mode controls both wheels and anti lift-up* controls are active. This calibration focusses on maximum vehicle stability and lift-up* prevention, yet keeping good maximum deceleration performance.	It is the default level for the "URBAN" Riding Mode

* rear wheel lifting up upon maximum deceleration

Tips on how to select the sensitivity level

Warning

The levels of the ABS system your motorcycle is equipped with were calibrated with original equipment tyres.
The use of tyres of different size and characteristics to the original tyres may alter the operating characteristics of the system thus making it unsafe. It is recommended not to install tyres of different size than the ones approved for your vehicle.

Motorcycle original equipment: (front 120/70ZR17 - rear 180/60ZR17).

- Pirelli Diablo Rosso II;

In the case of minor differences, such as for example, tyres of a different make and/or model than the OE ones, but with the same size (front 120/70ZR17 - rear 180/60ZR17), it may be sufficient to simply select the suitable level setting from those available in order to restore optimal system operation.
If tyres of a different size class are used or if the tyre size differs significantly from the original tyres, it may be that the system operation is affected to the point where none of the 3 available level settings will give satisfactory results.
In this case it is advisable to deactivate the traction control system.
Selecting level 3, the ABS will intervene to ensure a very stable braking, good lift-up control, the motorcycle keeps a good alignment during the whole braking. Settings between level 3 and level 1 privilege more and more the braking power rather than stability and lift-up control; level 1 provides no lift-up control.
The choice of the correct level mainly depends on the following parameters:

1 The tyre/asphalt grip (type of tyre, amount of tyre wear, the road/track surface, weather conditions, etc.).
2 The rider's experience and sensitivity: expert riders can tackle a lift-up in trying to reduce the stopping distance to a minimum, while less expert riders are recommended to use settings 2 and 3, that will help them keeping the motorcycle more stable even in emergency braking.

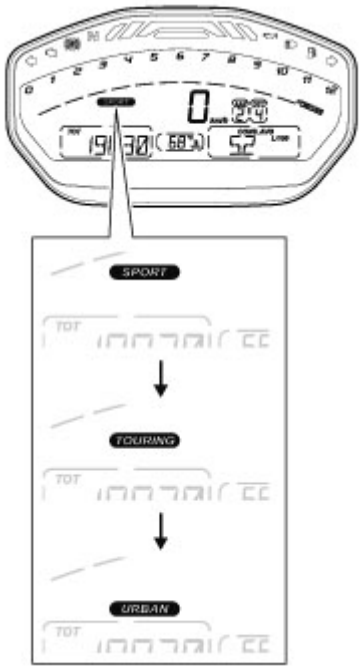
RIDING MODE

This function indicates the "Riding mode" set in the vehicle; each riding mode can be changed using the "Setting Riding Mode" function.

It is possible to set three different riding modes: SPORT, TOURING and URBAN.
Every Riding Mode contains the following parameters, set by Ducati or customised by the user through the setting function pages:

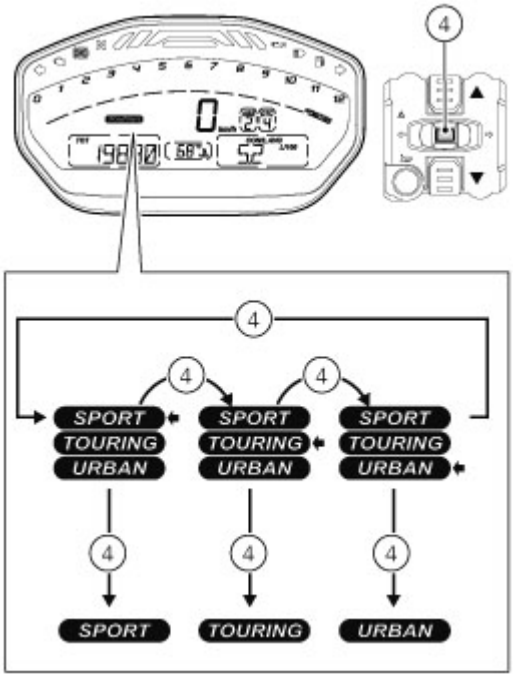
- a specific level of intervention for the DTC traction control (1, 2, 3, 4, 5, 6, 7, 8, OFF);
- a specific engine power that will change the engine power;
- a specific ABS calibration (1, 2, 3, OFF).

Warning
Ducati recommends changing the Riding mode when the motorcycle is stopped. If the riding mode is changed while riding, be very careful (it is recommended to change the Riding mode at a low speed).



"RIDING MODE CHANGE" FUNCTION
This function allows changing vehicle riding mode.
Press the CONFIRM MENU button (4) to change the riding mode.
The display shows the three riding modes (SPORT, TOURING and URBAN).
Each time you press button (4), the instrument panel makes a Riding Mode name flash and shifts the arrow to the right side of the name to indicate the selected Riding Mode.
After selecting the desired riding mode, confirm it by keeping the CONFIRM MENU (4) button pressed for two seconds.

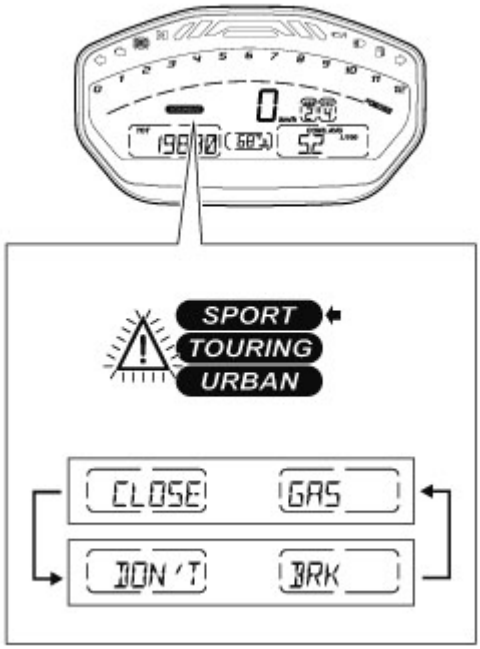
Warning
It is not possible to open the menu for selecting the riding mode, if button (4) is in the position for activating the turn indicators (to the left or right).



Once the desired riding mode is highlighted, if the CONFIRM MENU button (4) is not pressed within 10 seconds, the new riding mode selection is not stored and the standard screen is displayed.

When system requests rider to confirm the riding mode change, the procedure will output an error if:
- the throttle twistgrip is open, brakes are activated and the motorcycle is not still; in this case "CLOSE GAS" and "DON'T BRK" warnings flash on the display in MENU 1 and MENU 2, by alternating each writing every second.

If within 5 seconds the throttle is not closed, the brakes are not released or the motorcycle is not stopped (zero speed), the procedure for changing riding mode will not be completed and the Standard screen is displayed.



Note
If the change of riding mode is associated with the ABS change of state from "ON" to "OFF" or vice-versa, the instrument panel also starts the procedure for disabling or activating the ABS, respectively, upon confirmation of the selected riding mode.

Note
If at least one error is present upon Riding Mode change, priority is given to messages "CLOSE GAS" and "DON'T BRK", and the relevant Warning symbol will flash.

Motorcycle speed

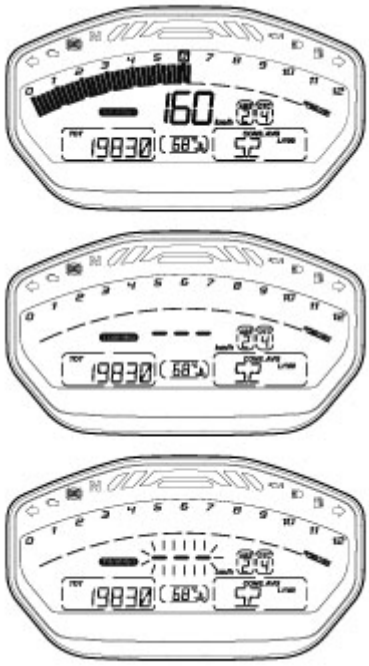
This function allows displaying the vehicle speed (km/h or mph according to the specific application).

The instrument panel receives information about the actual motorcycle speed (calculated in km/h) and displays the value increased by 5%, converted in the set unit of measurement (km/h or mph).

The max. displayed speed is 299 km/h (186 mph).

A string of dashes "- - -" is displayed with the set unit of measurement if:

- speed is higher than 299 km/h or 186 mph or if instrument panel is not receiving the speed value ("- - -" steady ON);
- the rear speed sensor is in fault (flashing "- - -").



DISPLAYED FUNCTIONS

The functions displayed in the standard screen are the following:

Main information

- Motorcycle speed
- Engine rpm indication (RPM)
- Riding Mode
- ABS
- DTC
- Engine Coolant temperature
- MENU 1 displays the following functions:
  - Odometer (TOT)
  - Trip meter A (TRIP A)
  - Trip meter B (TRIP B)
  - Partial fuel reserve counter (TRIP FUEL)
  - Trip time (TRIP TIME)
  - Clock
  - LAP time (only if active)
- MENU 2 displays the following functions:
  - Average Fuel Consumption (CONS. AVG)
  - Instantaneous fuel consumption (CONS.)
  - Average speed (SPEED AVG)
  - Ambient air temperature (AIR)

Additional information

- Service indication (SERVICE)
- ERROR indication
- LAP

FUNCTIONS THAT CAN BE MODIFIED BY THE USER

The functions within the Setting Menu that can be modified by the user are the following:

- Riding mode customisation (RIDING MODE): this menu allows customisation of:
  - ABS setting (ABS)
  - DTC level setting (DTC)
  - Engine setting (ENGINE)
  - Restoring the default settings of all Riding Modes (ALL DEFAULT)
  - Restoring the default settings of a single Riding Mode (DEFAULT)
- Battery voltage (BATTERY)
- Backlighting regulation (BACK LIGHT)
- Display backlighting (BACK LIGHT)
- LAP (LAP time activation and displaying)
- Clock setting (CLOCK)
- PIN (enter/change PIN CODE)
- Engine rpm indication (RPM)
- Unit setting (Speed — Temperature — Fuel consumption) (UNT)
- ERRORS (error indication - active only if one or more errors are active)

Parameter setting/displaying

Upon key-on, the instrument panel:
- turns on the display backlighting;
- activates the rev counter which increases from 0 to 11000 and decreases back to 0;
- activates the vehicle speed digits and shows a counting from 0 to 300 and then back to 0;
- turns on the warning lights from the outer to the inner ones.

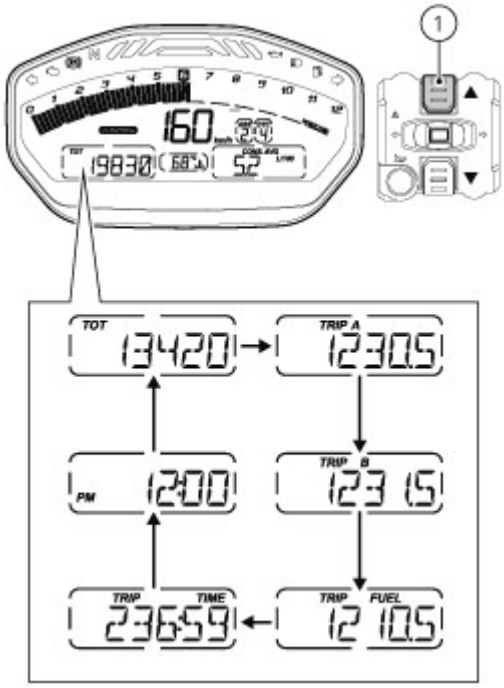
At the end of the check, the instrument panel displays the main screen ("standard screen") showing the available functions and turns on the warning lights, if necessary.

During this first check stage, if the motorcycle speed exceeds 10 km/h (actual speed), the instrument panel will stop:
- the display check routine and display the standard screen containing updated information;
- the warning light check routine and leave ON only the warning lights that are actually active at the moment.

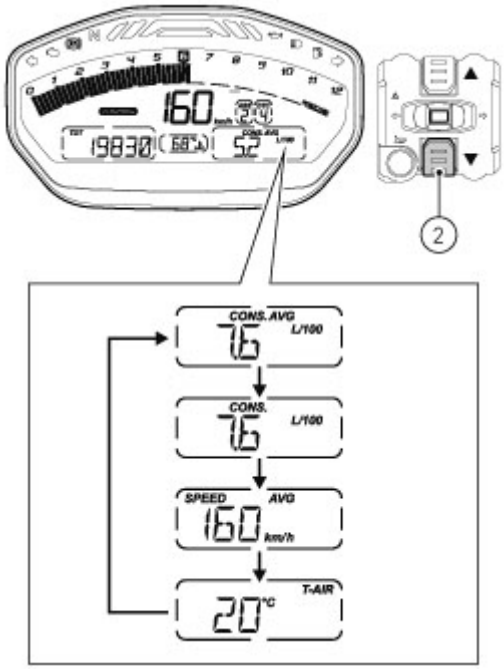
Data displayed on the main screen are as follows:
1) Rpm bargraph.
2) Vehicle speed.
3) MENU 1 (Odometer, Trip A, Trip B, Trip Fuel, Trip Time, Clock, Lap time - only if active).
4) MENU 2 (Average fuel consumption, Instant fuel consumption, Average speed, Ambient air temperature).
5) Engine coolant temperature.
6) Set Riding Mode.
7) DTC level indication ON or DTC OFF indication.
8) ABS ON/OFF indication.
9) "LAP ON" indication (if fitted).
10) SERVICE indication (only if active).
11) Error presence indication (only if at least one error is present).

From the main screen, press button (1) on LH switch to view Menu 1 information.
- Odometer (TOT);
- TRIP A;
- TRIP B;
- TRIP FUEL (when function is active);

- TRIP TIME;
- Clock.



From the main screen, press button (2) on LH switch to view menu 2 information.
- Average Fuel Consumption (CONS. AVG);
- Instantaneous fuel consumption (CONS.);
- Average speed (SPEED AVG);
- Air temperature (T-AIR).



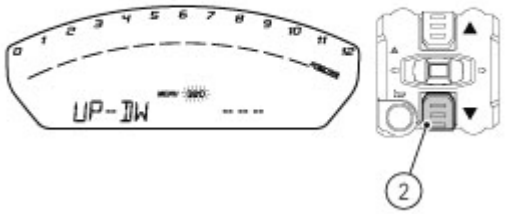
The instrument panel stores Menu 1 and Menu 2 settings in use upon KEY-OFF.
On the following KEY-ON, previously stored Menu 1 e Menu 2 pages are displayed.
In case of sudden and unexpected power OFF, the instrument panel displays the default settings for Menu 1 and Menu 2 upon the following KEY-ON; in particular:
- Menu 1 default page = Odometer (TOT);
- Menu 2 default page = Average fuel consumption (CONS.AVG).

Upon KEY-ON, for every display layout, instrument panel shows for 10 seconds in Menu 1 the "Odometer" page and then shows the page saved upon previous KEY-OFF.
When the standard screen of set layout is displayed, hold the button (2) for 3 seconds, when actual motorcycle speed is lower than or equal to 20 km/h, to enter the Setting menu, where you can set any function.

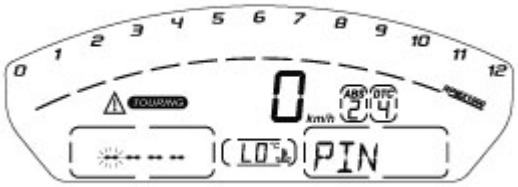
Important

You can enter the SETTING MENU only if vehicle actual speed is lower than or equal to 20 km/h.

Within the SETTING MENU, if vehicle actual speed exceeds 20 km/h, the instrument panel automatically quits the menu and shows the standard screen.



If upon key-on and at the end of the check an Immobilizer ERROR occurs, the instrument panel automatically activates in MENU 1 the possibility to enter the four-digit PIN CODE previously memorised with the PIN function in the Setting Menu.

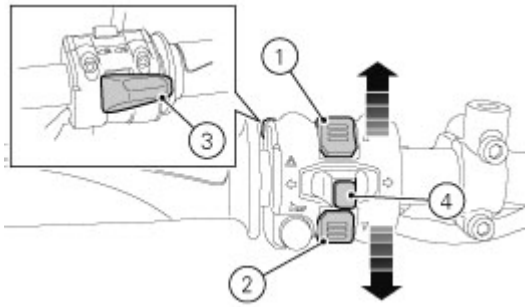


Function buttons

Control switch (SET UP) (SET DOWN) (1) (2)
Buttons used to display and set instrument panel parameters.

Flash switch (PASSING) (3)
The high-beam flash button may also be used for LAP functions.

Turn indicator switch (TURN) (4)
The turn indicators cancel button may also be used in the instrument panel for the CONFIRM MENU function, for selecting the riding mode.
Push this button for 3 seconds to the left side to activate the "Hazard" function (all 4 turn indicators).



Riding Mode
The rider can choose from 3 different preset bike configurations (Riding Modes) and pick the one that best suits his/her riding style or ground conditions. The Riding Modes allow user to instantly change the engine power delivery (Power Mode), ABS, DTC settings and instrument panel graphics.
Available Riding Modes: Sport, Touring and Urban. Within every Riding Mode, the rider can customise any settings.

Power Mode
The Power Modes are the different engine maps the rider can select to change power level and delivery to suit his/her own riding style and surface conditions.
There are three Power Modes, one for each Riding Mode:

- LOW, with 'soft' power delivery;
- MED, with 'soft' power delivery;
- HIGH, with 'instant' power delivery.

Ride by Wire (RbW)
The Ride by Wire system is the electronic device that controls throttle opening and closing. Since there is no mechanical connection between the throttle twistgrip and the throttle bodies, the ECU can adjust power delivery by directly affecting throttle opening angle.
The Ride by Wire system allows you to obtain different power level and delivery according to the selected Riding Mode (Power Mode), but even to accurately control the engine brake (EBC), thereby helping to control the rear wheel slipping (DTC).

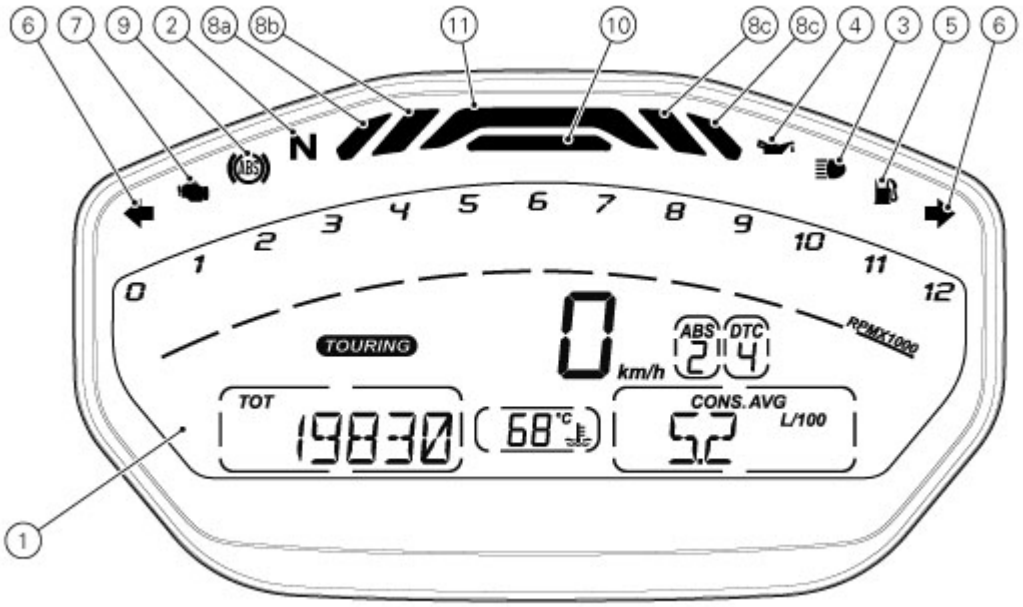
Ducati Traction Control (DTC)
The Ducati Traction Control system (DTC) supervises the rear wheel slipping control and settings vary through eight different levels that are programmed to offer a different tolerance level to rear wheel slipping. Each Riding Mode features a pre-set intervention level.
Level eight indicates system intervention whenever a slight slipping is detected, while level one is for very expert riders because it is less sensitive to slipping and intervention is hence softer.

Anti-lock Braking System (ABS) 9ME
ABS 9ME system is a two-channel latest-generation system that actuates combined braking with anti lift-up function for the rear wheel so as to guarantee not only a reduced stopping distance, but also a higher stability under braking.
The system features 3 levels, one associated to each Riding Mode.

Acronyms and abbreviations used in the manual

ABS
Antilock Braking System
BBS
Black Box System
CAN
Controller Area Network
DDA
DUCATI Data Acquisition
DSB
Dashboard
DTC
DUCATI Traction Control
ECU
Engine Control Unit
E-LOCK
Electronic Main Switch Set
GPS
Global Positioning System

Instrument panel



1) Display.
2) NEUTRAL LIGHT N (GREEN).
Comes on when in neutral position.
3) HIGH BEAM LIGHT (BLUE).
It turns on to indicate that the high beam lights are on and when the flasher is activated.
4) ENGINE OIL PRESSURE LIGHT (RED).
Comes on when engine oil pressure is too low. It must turn on at "KEY-ON", but must turn OFF a few seconds after the engine has started. It may shortly come on when the engine is hot, however, it should go out as the engine revs up.

Important
If the ENGINE OIL light stays ON, stop the engine or it may suffer severe damage.

5) FUEL WARNING LIGHT (AMBER YELLOW).
Comes on when fuel is low and there are about 2.5 litres of fuel left in the tank.
6) TURN INDICATOR LIGHTS (GREEN).
Illuminates and flashes when the turn indicator is in operation.
7) "ENGINE/VEHICLE DIAGNOSIS - EOBD" LIGHT (AMBER YELLOW).
It turns on in the case of "engine" and/or "vehicle" errors and in some cases will lock the engine.
8) GENERAL WARNING LIGHTS (RED).
the lights (8a) turn on when RPM value reaches the first threshold before the rpm limiter kicks in;
the lights (8b) turn on when RPM value reaches the second threshold before the rpm limiter kicks in;
9) ABS LIGHTS (AMBER YELLOW).
This turns on to indicate that ABS is disabled or not functioning.

Engine OFF / speed below 5 Km/h		
Light OFF	**Light flashing**	**Light steady on**
-	ABS disabled with the menu function "ABS"	ABS enabled, but not functioning yet
Engine on / speed below 5 Km/h		
Light OFF	**Light flashing**	**Light steady on**
-	ABS disabled with the menu function "ABS"	ABS enabled, but not functioning yet
Engine on / speed above 5 km/h		
Light OFF	**Light flashing**	**Light steady on**

ABS enabled and functioning	ABS disabled with the menu function "ABS"	ABS disabled and not functioning due to a problem

10) DTC INTERVENTION (AMBER YELLOW).

	DTC
No intervention	Light OFF
Spark advance cut	Light steady ON
Injection cut	Light steady ON

11) OVER REV / IMMOBILIZER / ANTI-THEFT SYSTEM (RED)

	Over rev
No intervention	Light OFF
First threshold (N RPM before the limiter kicks in)	Light steady ON
Limiter	Light ON flashing

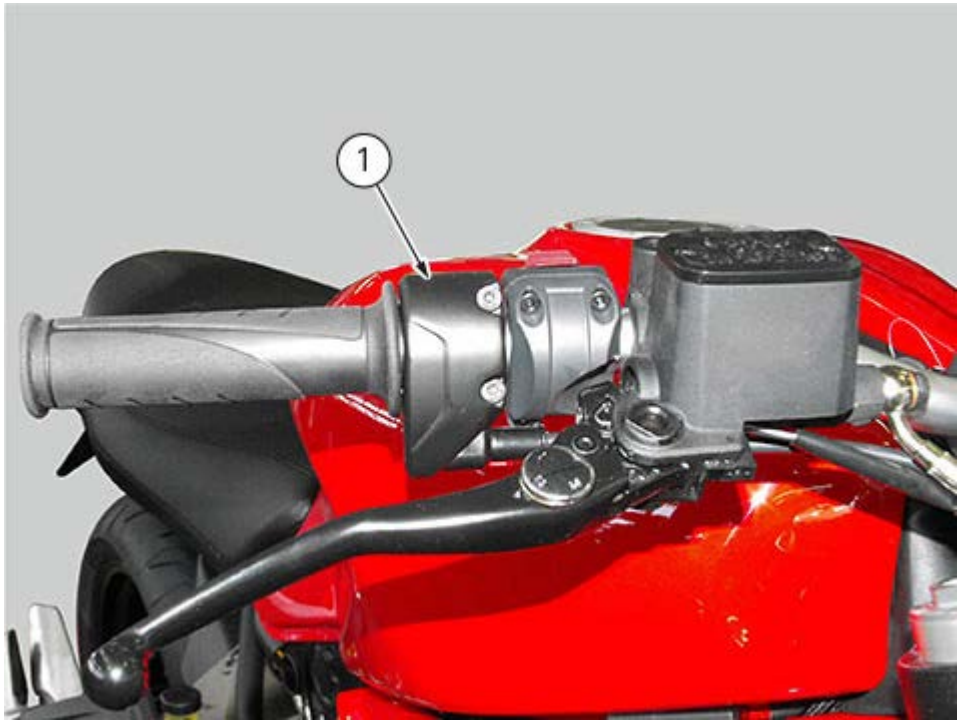
Note

Each calibration of the Engine Control Unit may have a different setting for the thresholds that precede the rev limiter and the rev limiter itself.

	Immobilizer
Key-ON status	Light OFF
Key-OFF status	Light ON flashing
Key-OFF status for over 12 hours	Light OFF

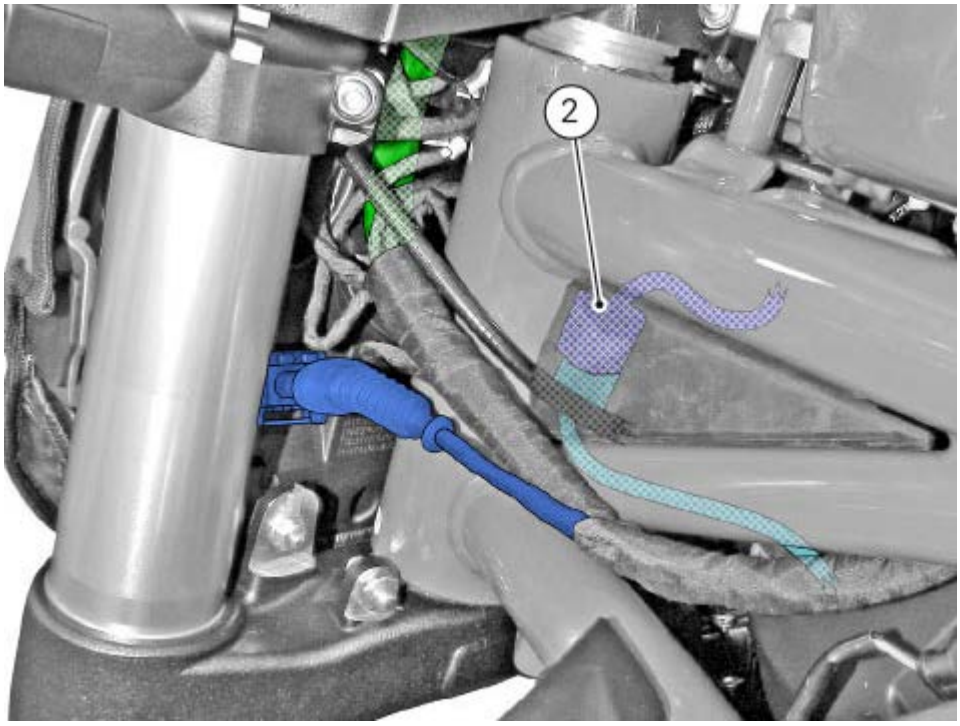
Accelerator Position System (APS)

The Acceleration Position Sensor (APS) (1) or throttle twistgrip sensor, is a potentiometer that generates an electric input sent to the control unit which receives information on:
- throttle twistgrip position;
- activation dynamics.

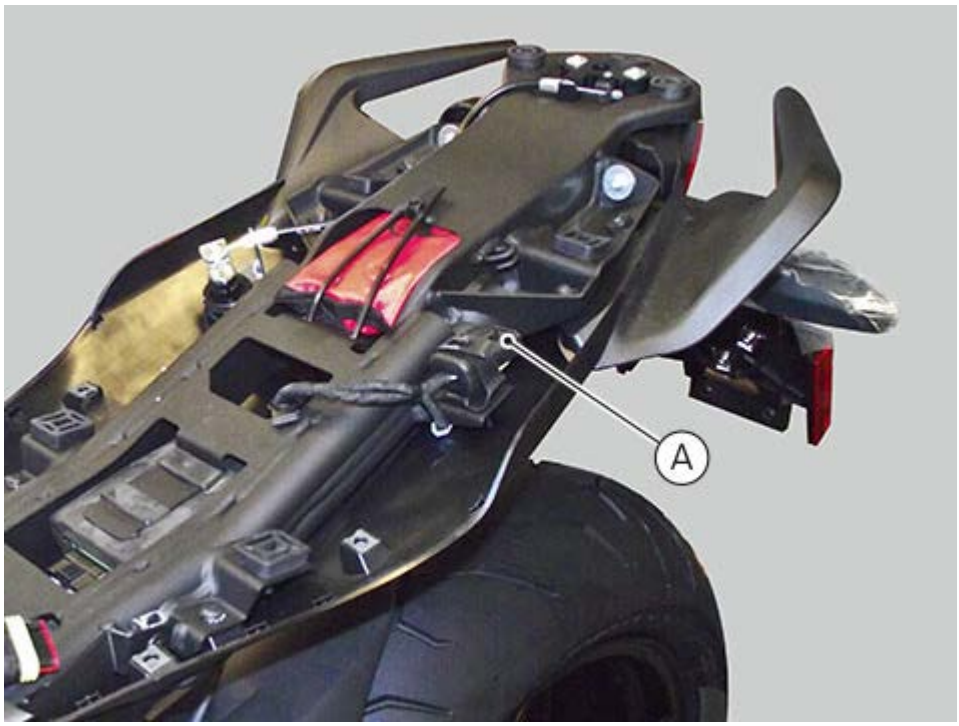


This input allows acting on the ride-by-wire system to obtain a better and smoother power supply, directly "corrected" by the control unit.
To remove the APS, follow the instructions in chapter "Removing the throttle control".

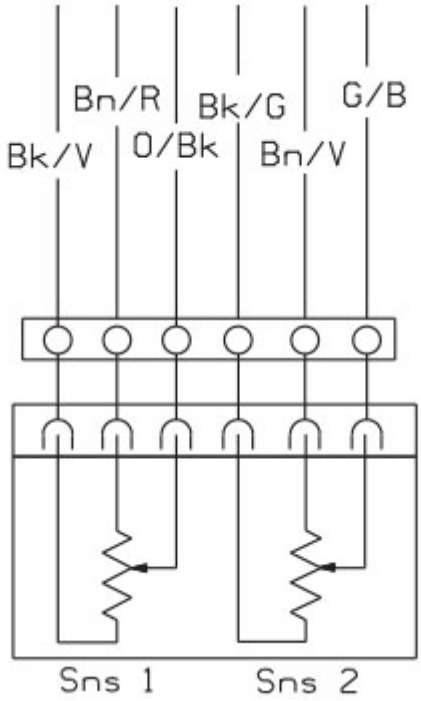
APS connector (2) to the wiring.



To check the APS correct operation, connect the DDS 2 diagnosis instrument to the control unit diagnostic socket (A), located on the rear subframe, on the left side; remove the seat to reach it.



Electric diagram



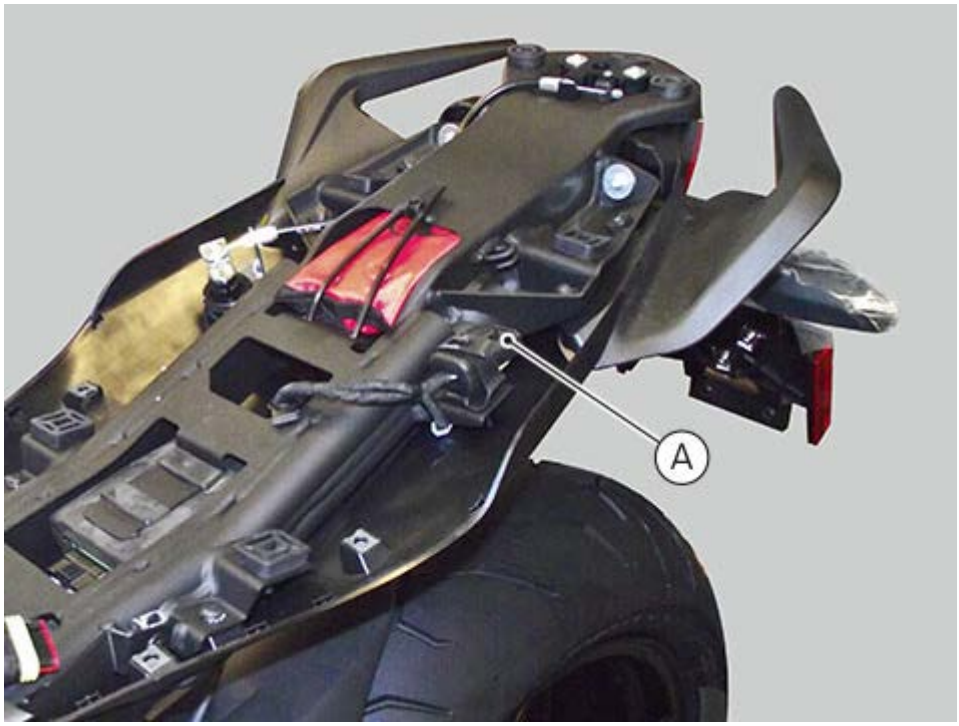
CAN line

This model utilises a CAN line (Controller Area Network) which has made it possible to greatly simplify the layout of the electrical system and consequently reduce its overall weight.
The CAN line is connected to two nodes: the instrument panel and the engine control unit.
Thanks to this communication line no sensor doubles are required as sensor signals are shared by both electronic units.
Sensors are connected to closer electronic unit (instrument panel or engine control unit), which sends the signals to the network to be processed by the control units.
CAN line consists of two wires for digital signal transfer; they both carry precise and perfectly decipherable data.
The instrument panel and the engine control unit, which are connected to the CAN line, are fitted with special hardware which acknowledges whether a pulse sequence includes pertaining data to be processed by the computing unit.

Ducati Traction Control (DTC)

The traction control is managed by the BBS.
Thanks to the front speed sensor (1) and to the rear speed sensor (2), the control unit can control vehicle traction according to the speed difference between the two wheels.

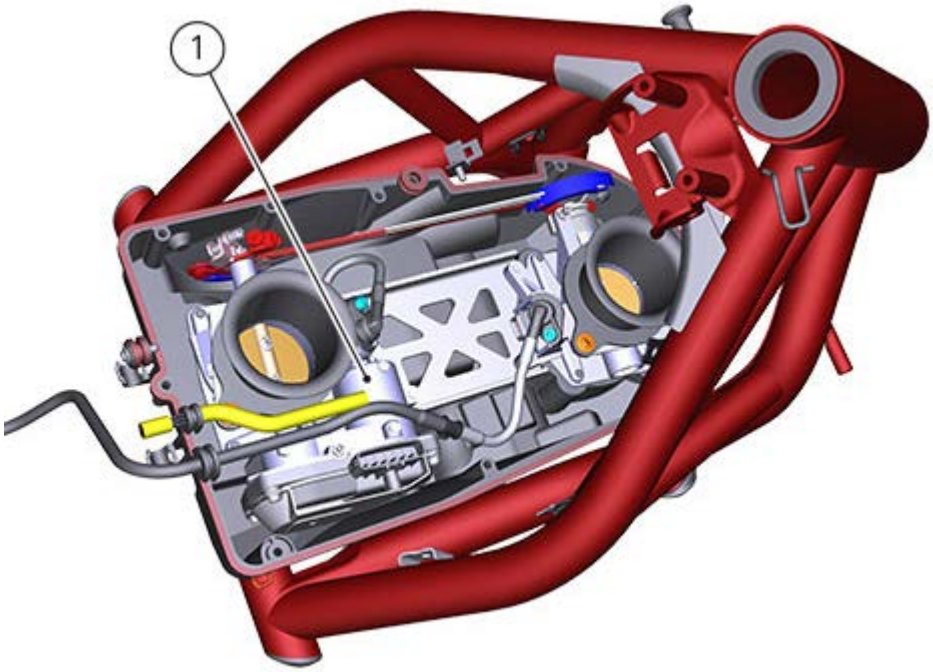
To check its correct operation, connect the DDS 2 diagnosis instrument to the control unit diagnostic socket (A), located on the rear subframe, on the left side; remove the seat to reach it.



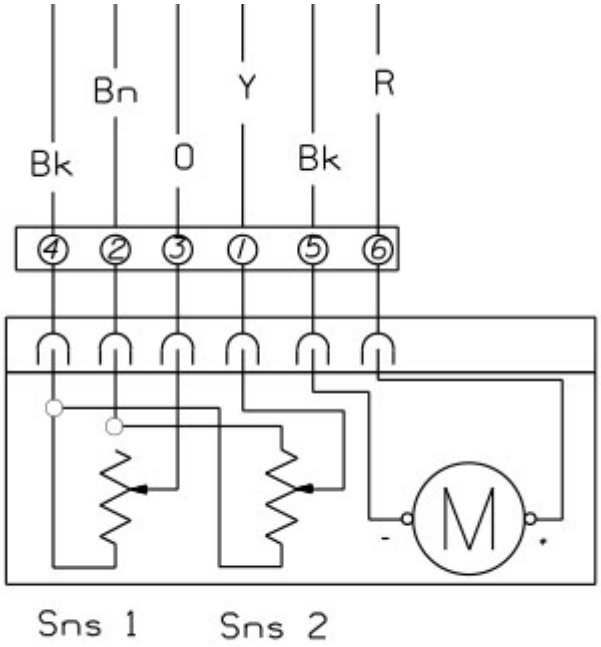
To remove and refit the speed sensors, refer to chapters "Replacing the front phonic wheel sensor" and "Replacing the rear phonic wheel".

Electronic Throttle Valve (ETV)

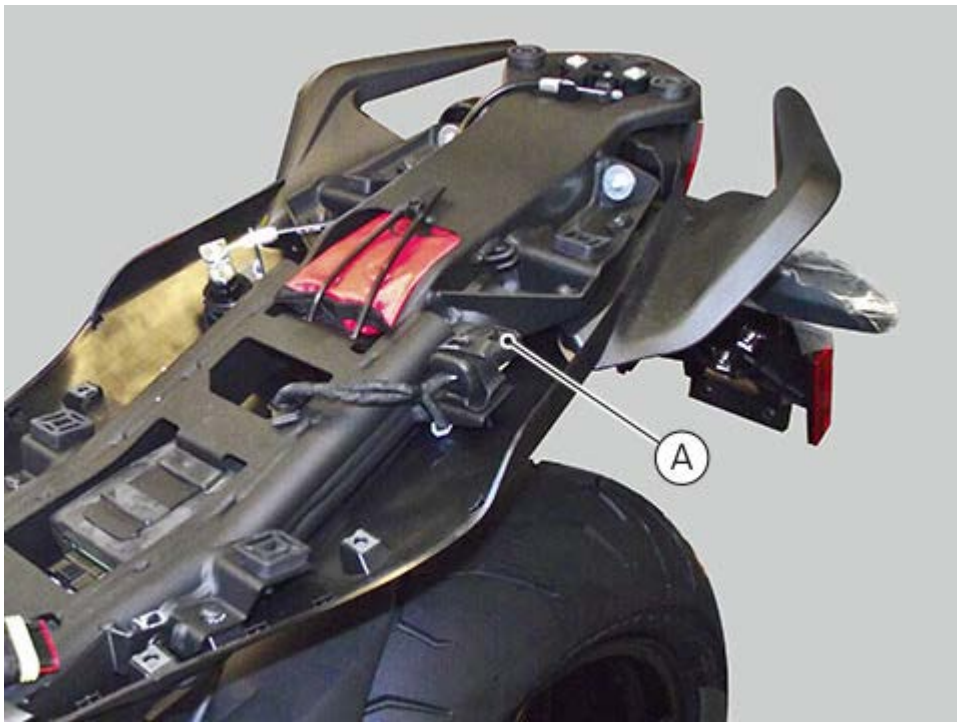
The ETV (1) is the motor that controls the throttle valve opening and closure and is located on the throttle body. In case of failure it is not possible to replace only the ETV, but it is necessary to replace the complete throttle body.
Once replaced, reset the TPS as described in chapter "Throttle position potentiometer".



Electric diagram

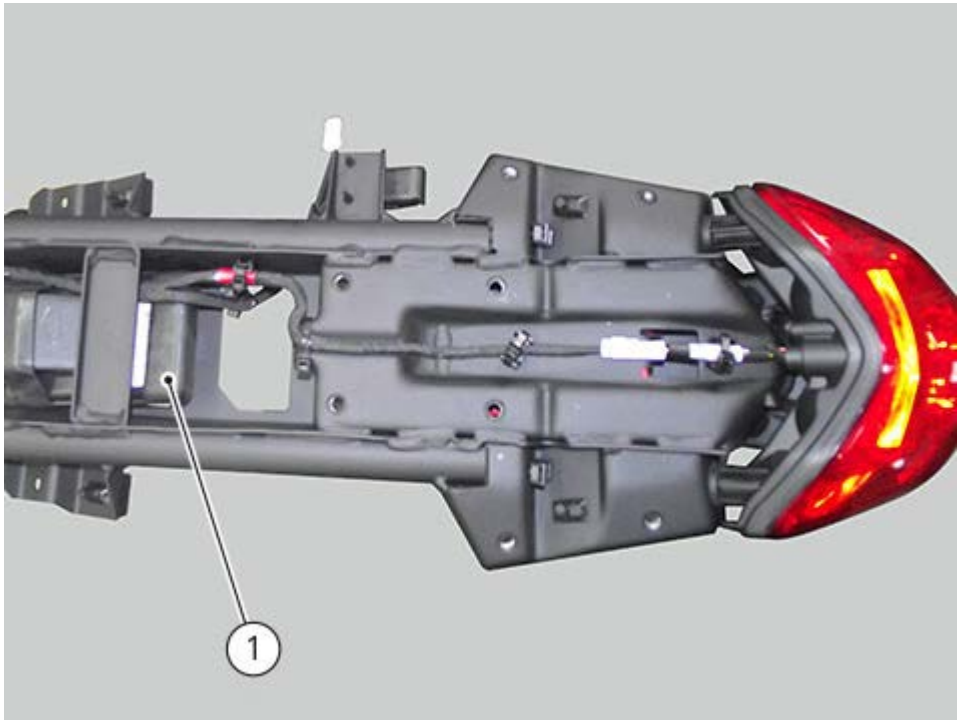


To remove and refit the ETV, refer to chapters "Removing the airbox and throttle body" and "Refitting the airbox and throttle body". To check the ETV correct operation, connect the DDS 2 diagnosis instrument to the control unit diagnostic socket (A), located on the rear subframe, on the left side; remove the seat to reach it.



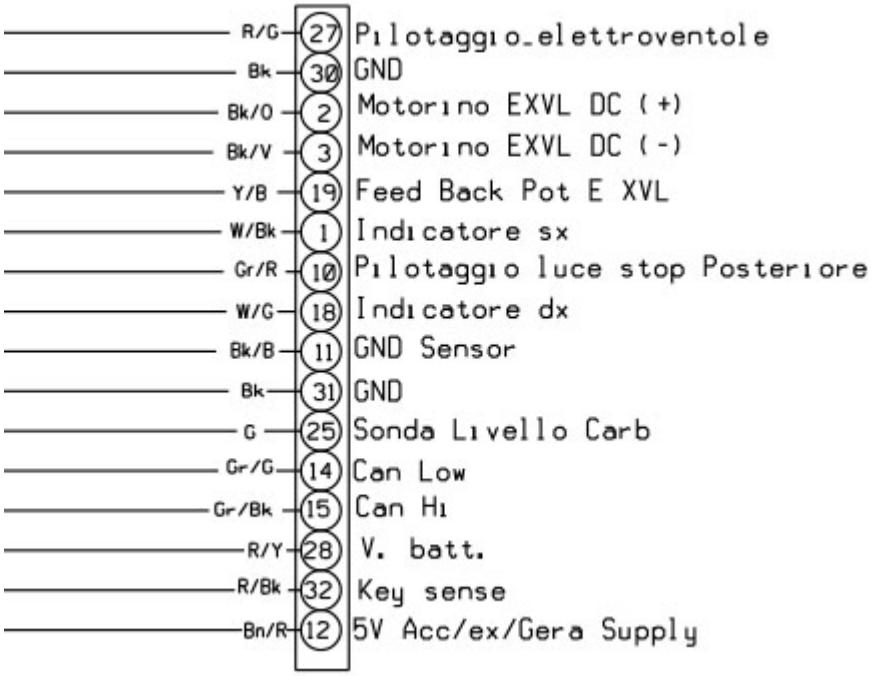
Black Box System (BBS)

The Black Box System (1) or central electronics (with integrated DTC system for traction control) is located under the seat.

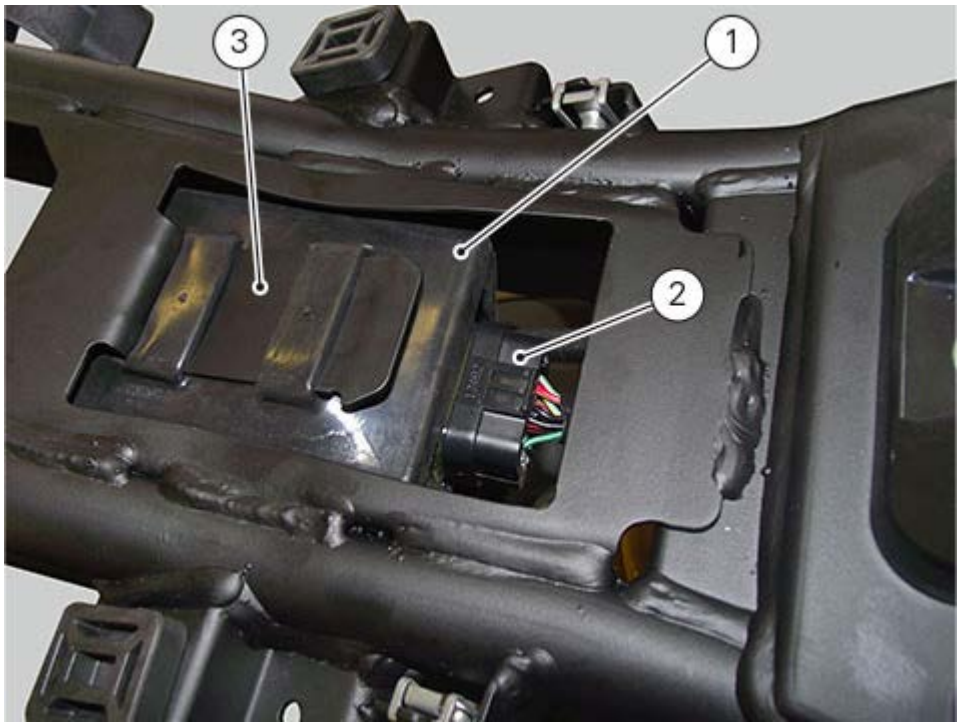


The BBS (1), like the instrument panel (DSB – Dashboard) is connected to sensors and actuators. The BBS shares on the network all information sent by the sensors, processes it and controls the actuators accordingly. Beside this, the BBS stores all malfunction errors recorded by the control units.
The BBS software features the DTC function to control the engine power and prevent the driving wheel from slipping upon acceleration.

Electric diagram

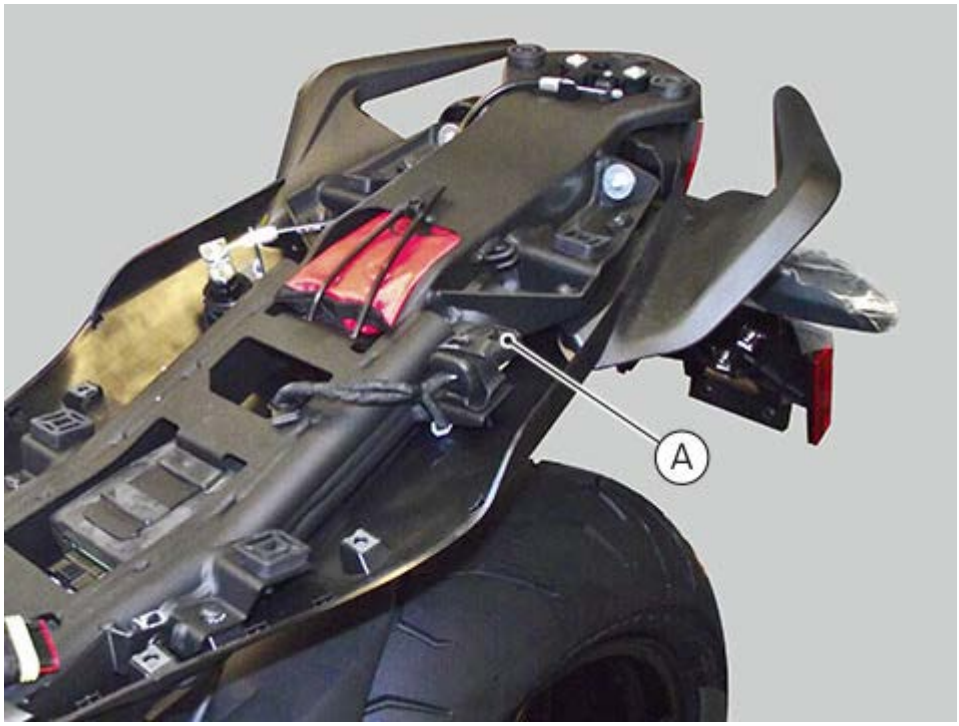


REMOVAL PROCEDURE
To remove the BBS (1), remove the seat and disconnect connector (2). Slide out BBS (1) from the rear side, from support (3) on the rear subframe.



REFITTING PROCEDURE
Refitting is the reverse of removal.

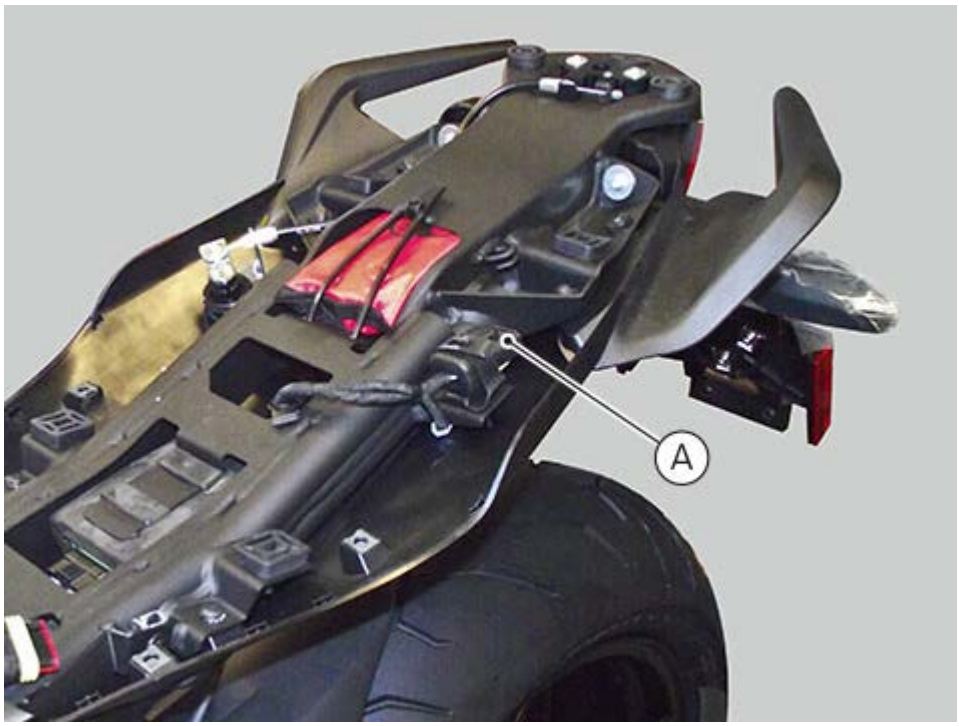
CONTROLS
To check its correct operation, connect the DDS 2 diagnosis instrument to the control unit diagnostic socket (A), located on the rear subframe, on the left side; remove the seat to reach it.



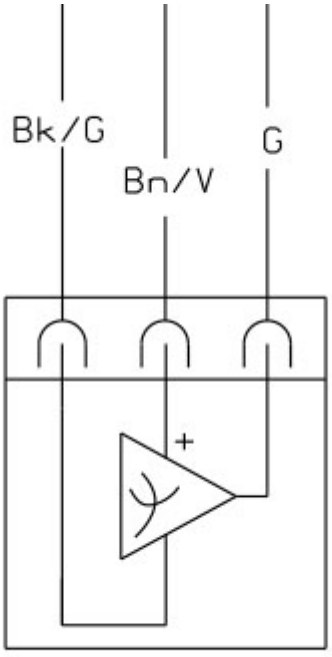
Map Sensor

The Map sensor (Manifold Absolute Pressure) (1) measures the air pressure to calculate the exact quantity of fuel to be injected.
The control unit processes the intake air pressure value and the external temperature value to calculate the quantity of intake air in the cylinders and, based on the preset stoichiometric ratio, determines the correct quantity of fuel to be delivered to the injectors.
The air/fuel ratio is therefore always excellent.

To check the MAP sensor (1) correct operation, connect the DDS 2 instrument to the control unit diagnostic socket (A), located on the rear subframe, on the left side; remove the seat to reach it.



Electric diagram



REMOVAL / REASSEMBLY

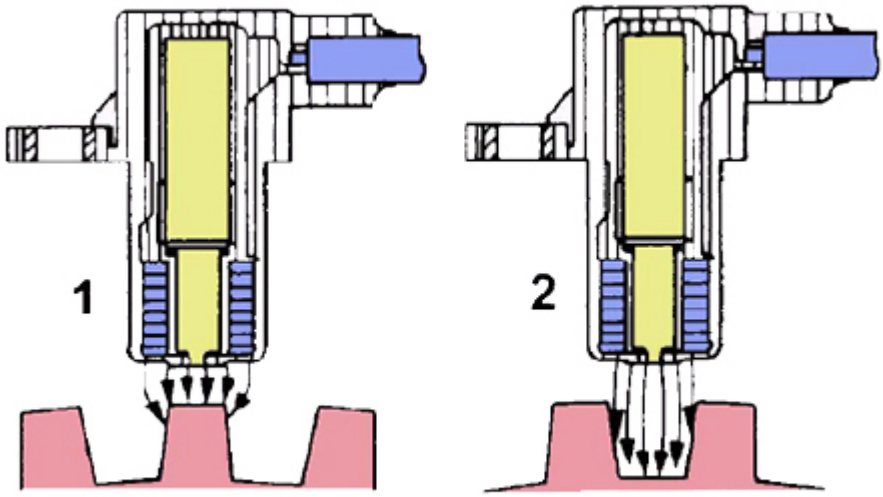
To remove and refit the MAP sensor (1), refer to chapters "Removing the airbox and throttle body" and "Refitting the airbox and throttle body".


1

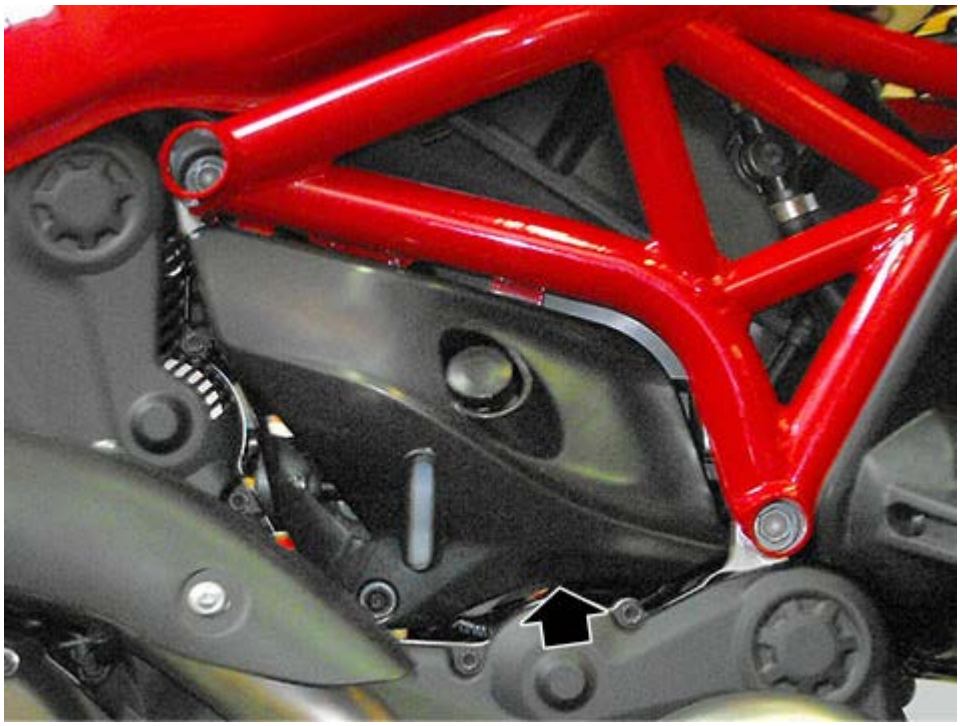
Timing/rpm sensor

The engine rpm sensor (1) is an inductive sensor that detects the teeth of a phonic wheel by means of an alternate signal proportional to the teeth passage speed.
The toothed pulley usually features "Xn teeth with a gap of two teeth" as reference for the first cylinder TDC.

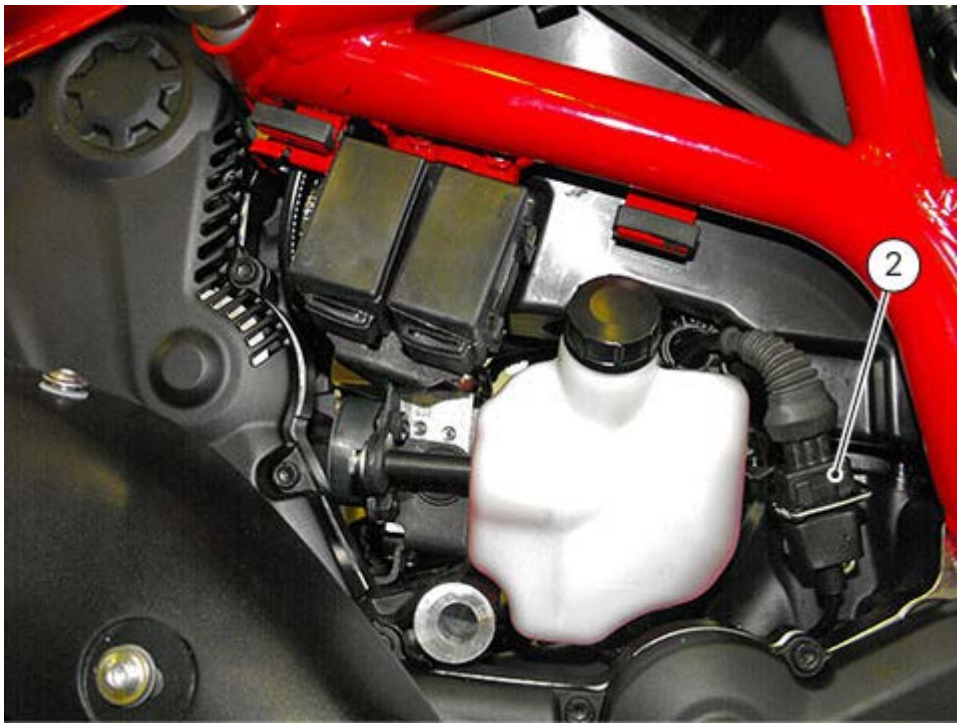
Position 1: the pick-up sensor detects the "full area" (i.e. the tooth);
Position 2: the pick-up sensor detects the "empty area" (i.e. the gap between the teeth).



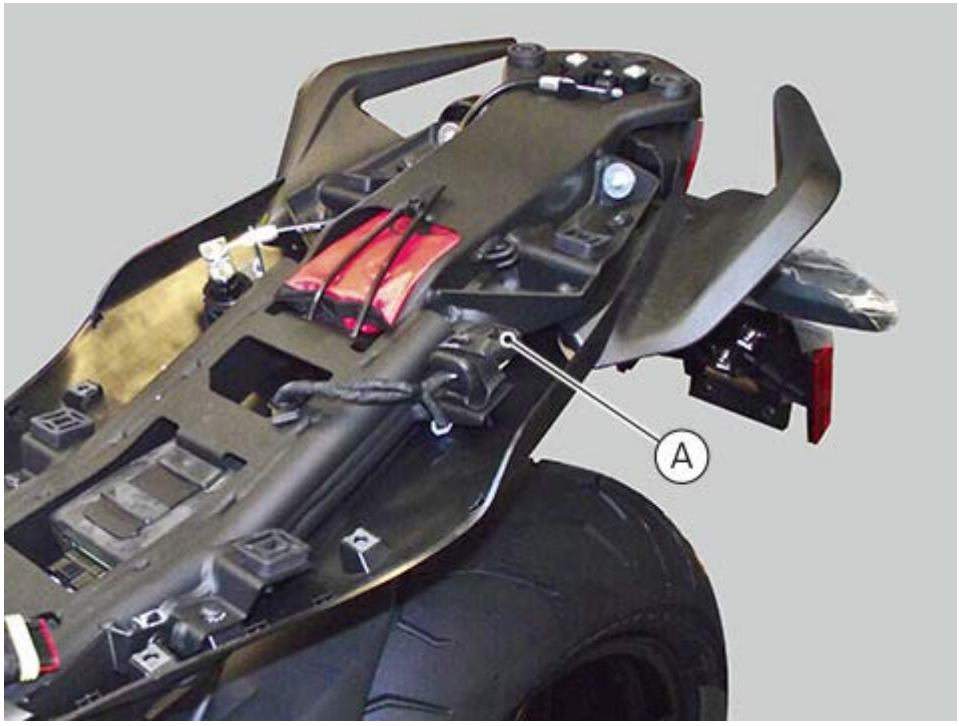
The engine rpm sensor (pick-up sensor) is located on the engine right side, under the RH side cover.



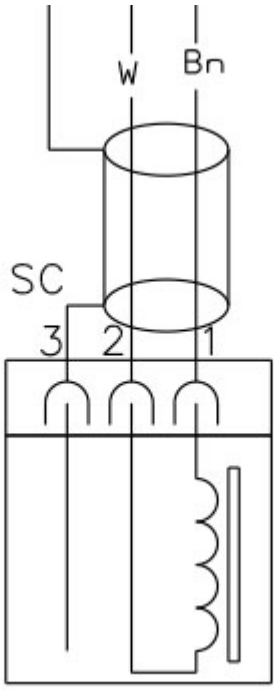
To reach connector (2) of pick-up sensor (1), work as described in chapter "Removing the water tank".



To check the rpm/timing sensor (pick-up sensor) correct operation, connect the DDS 2 diagnosis instrument to the control unit diagnostic socket (A), located on the rear subframe, on the left side; remove the seat to reach it.

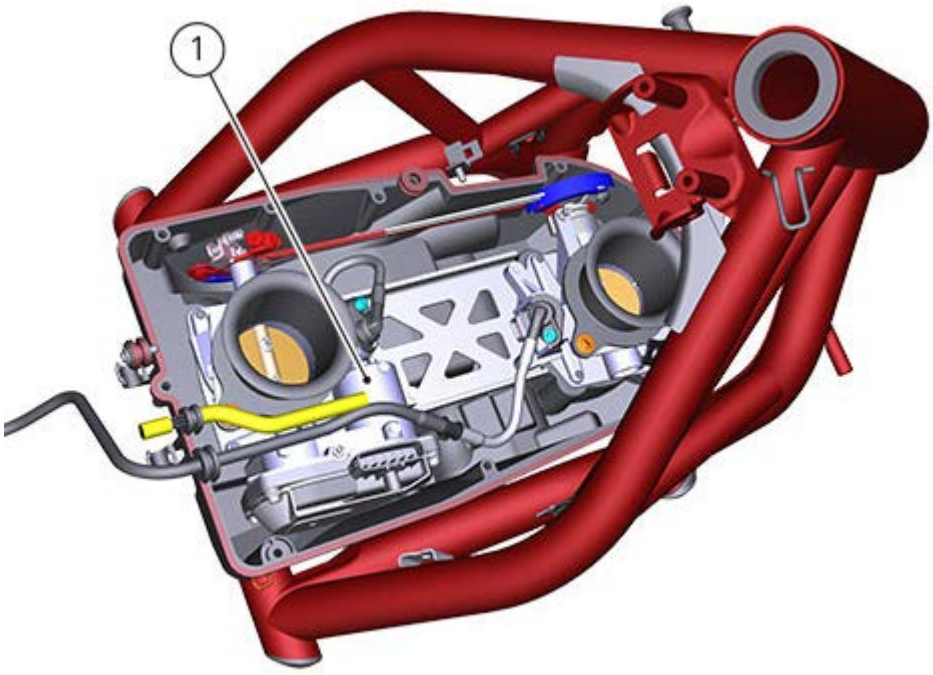


Electric diagram

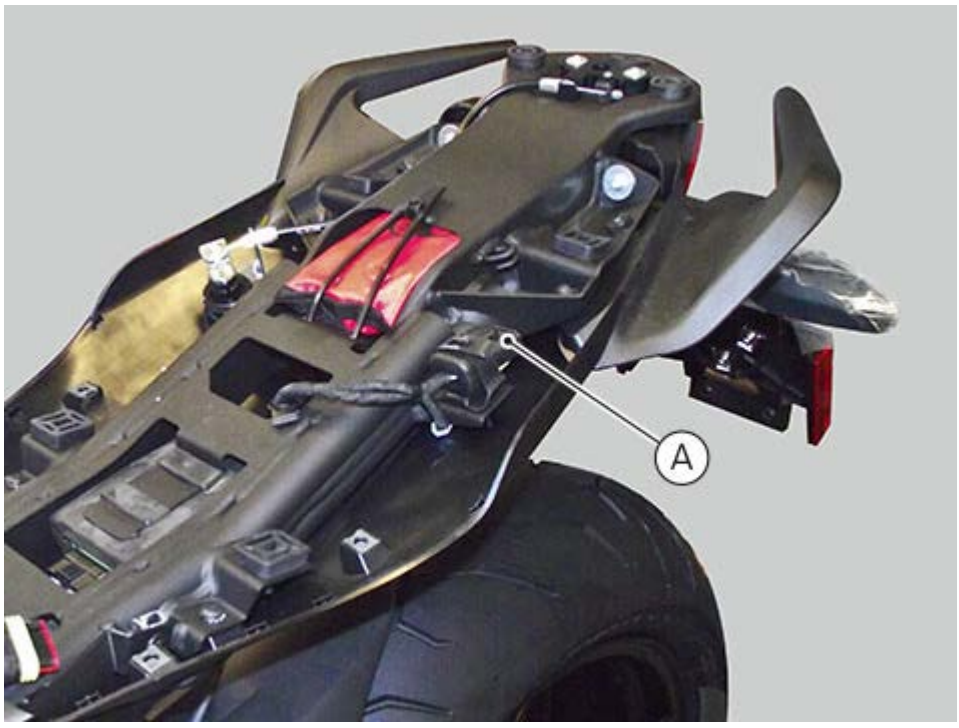


Throttle position potentiometer (TPS)

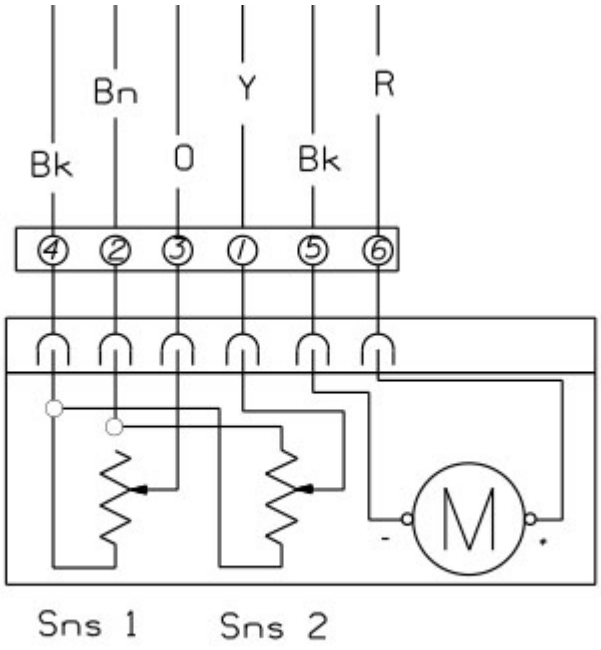
The TPS (Throttle Position Sensor) (1) is a potentiometer installed on the throttle body, integrated in the ETV.
The TPS sends information to the control unit about the exact position of the throttle.
In case of failure it is not possible to replace only the TPS, but it is necessary to replace the complete throttle body.
The ETV (Electronic Throttle Valve) works on the throttle position.



To remove and refit the TPS, refer to chapters "Removing the airbox and throttle body" and "Refitting the airbox and throttle body".
To check the TPS correct operation, connect the DDS 2 diagnosis instrument to the control unit diagnostic socket (A), located on the rear subframe, on the left side; remove the seat to reach it.



TPS electric diagram

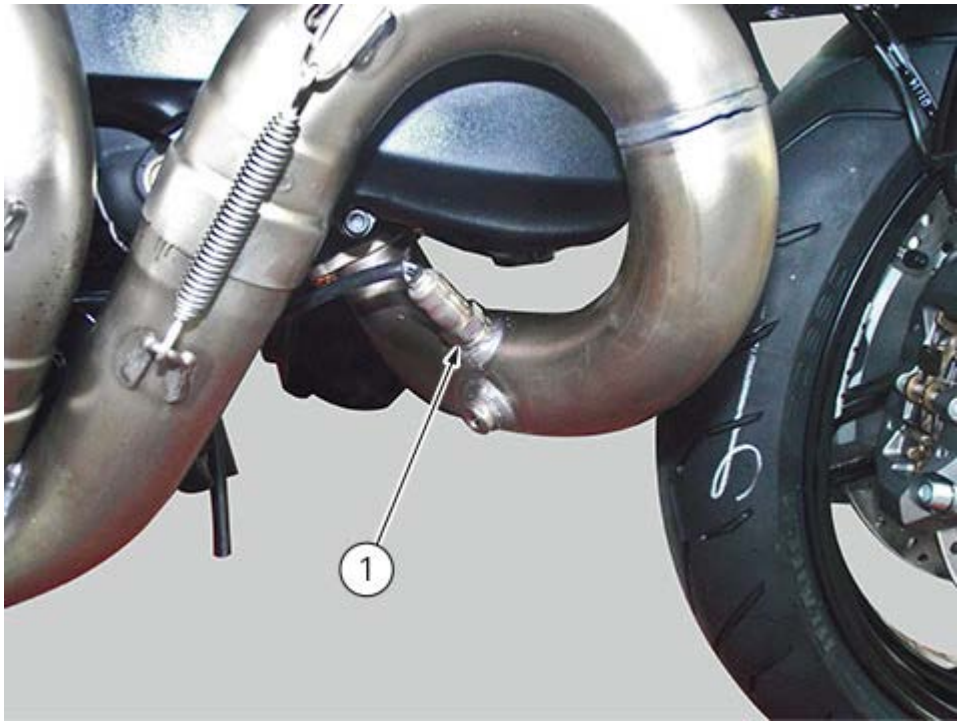


To diagnose the ETV, see chapter "Electronic Throttle Valve (ETV)“

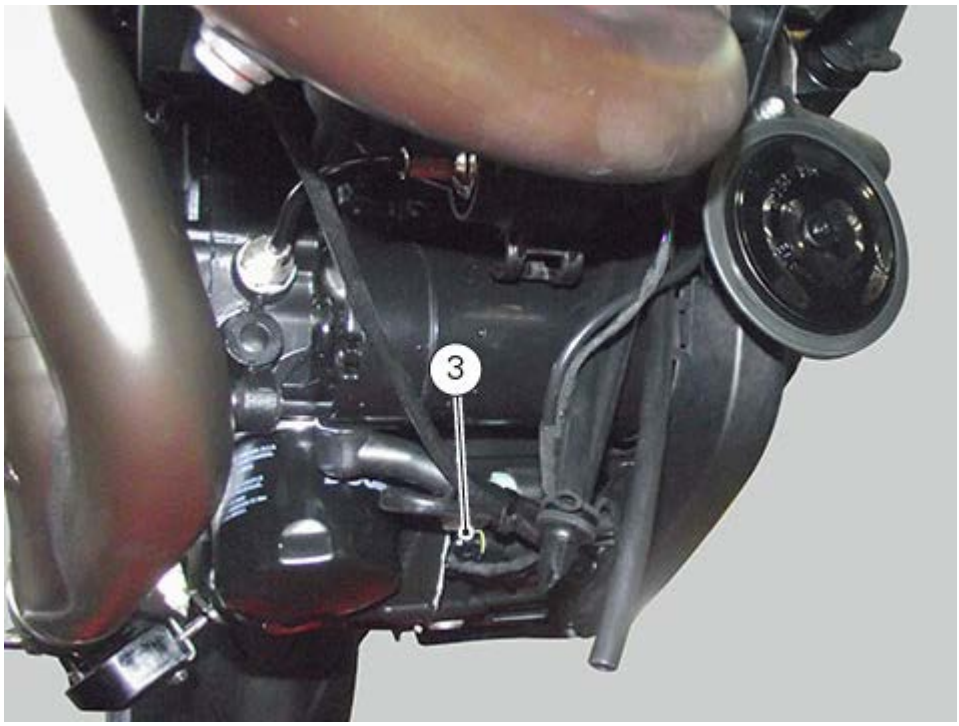
Lambda sensor

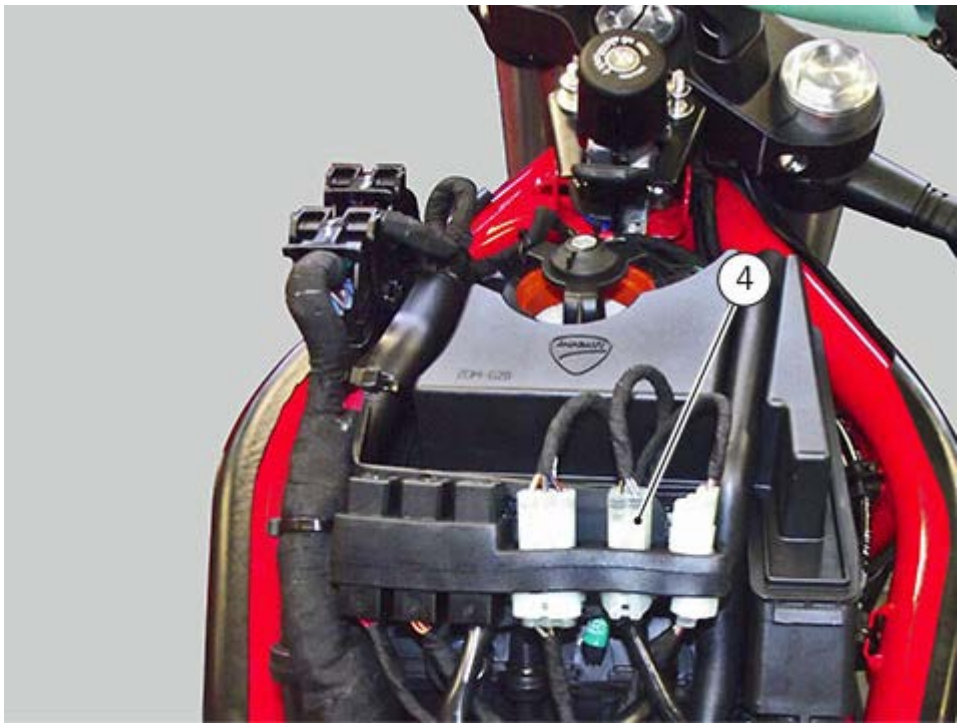
The lambda sensor detects the presence of unburned fuel in the exhaust gases, processes the information sent to the control unit and allows keeping the mixture ratio (air kg/fuel kg) within the best efficiency range for the catalytic converter.

The vehicle is provided with two lambda sensors, one per cylinder:
- lambda sensor (1) for horizontal cylinder exhaust;
- lambda sensor (2) for vertical cylinder exhaust.

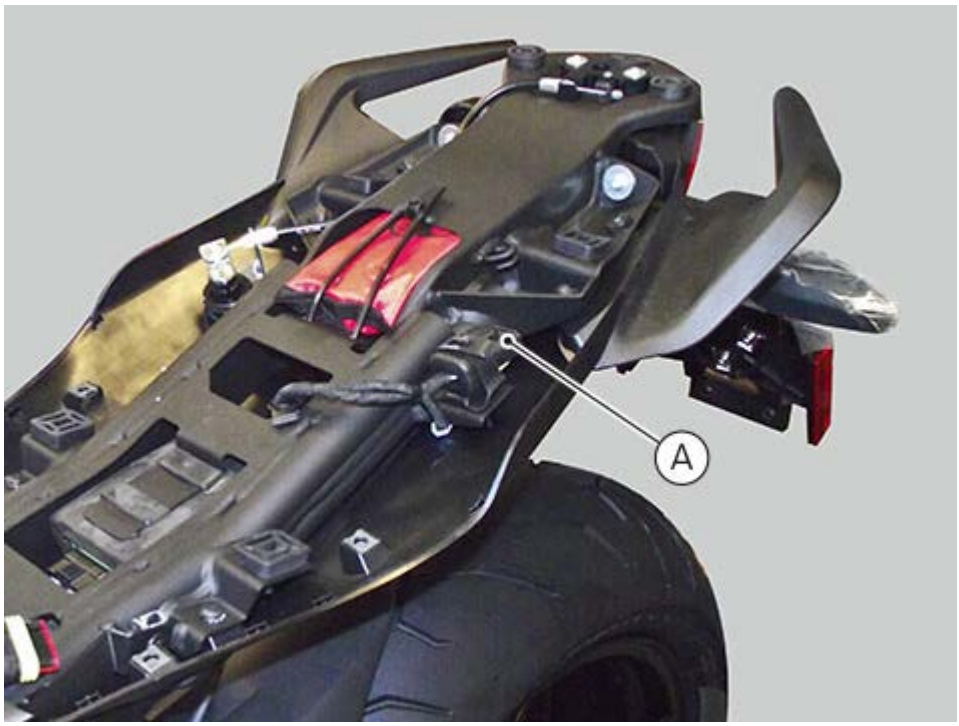


If it is necessary to reach the lambda sensor connectors, consider that:
- connector (3) of the horizontal cylinder lambda sensor is located on the vehicle front and lower side;
- connector (4) of the vertical cylinder lambda sensor can be reached by lifting the fuel tank as indicated in chapter "Removing the fuel tank" (to lower the tank, follow the instructions provided in chapter "Refitting the fuel tank").

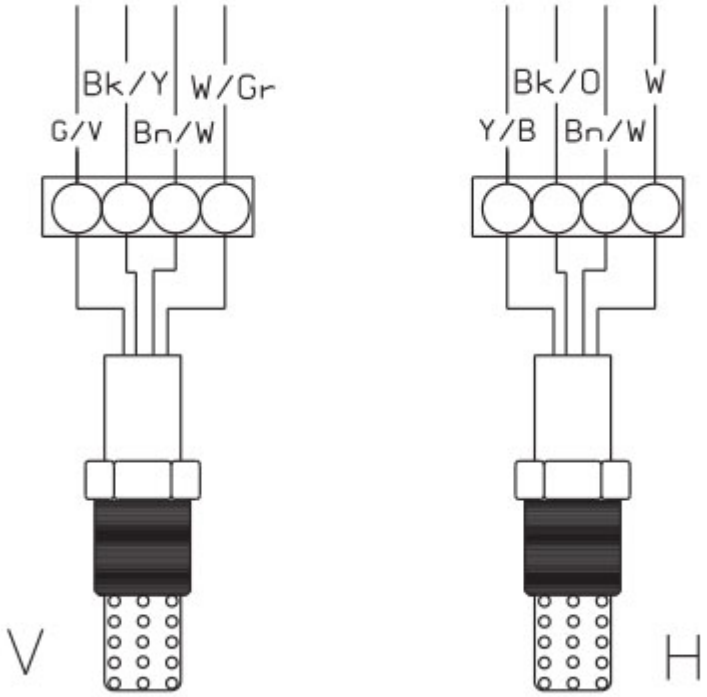




To check the lambda sensor correct operation, connect the DDS 2 diagnosis instrument to the control unit diagnostic socket (A), located on the rear subframe, on the left side; remove the seat to reach it.

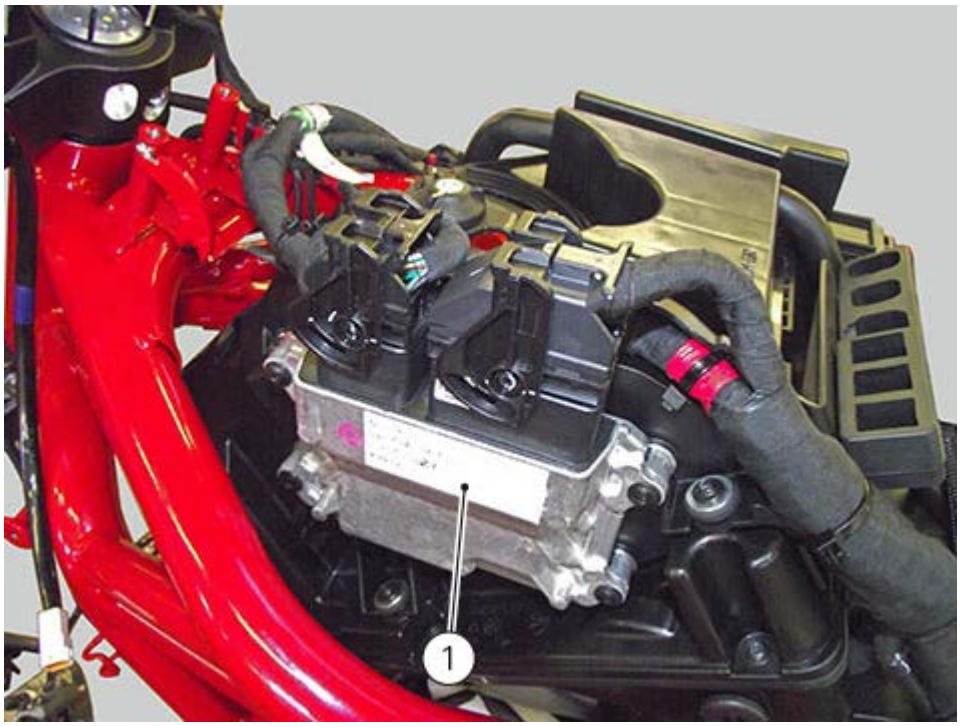


Electric diagram



Electronic control unit

The engine control unit (1) is an electronic digital microprocessor-based unit.



The ECU control unit (1) controls both the injectors and the coils, thus controlling fuel injection and ignition in accordance with the engine operating conditions detected by the following sensors:
- absolute pressure sensor (measures the barometric pressure);
- air temperature sensor (measures intake air temperature);
- engine temperature sensor (measures the coolant temperature);
- timing/rpm sensor (for engine rotation speed and the position of each cylinder relative to TDC);
- throttle position sensor (measures the throttle opening angle).

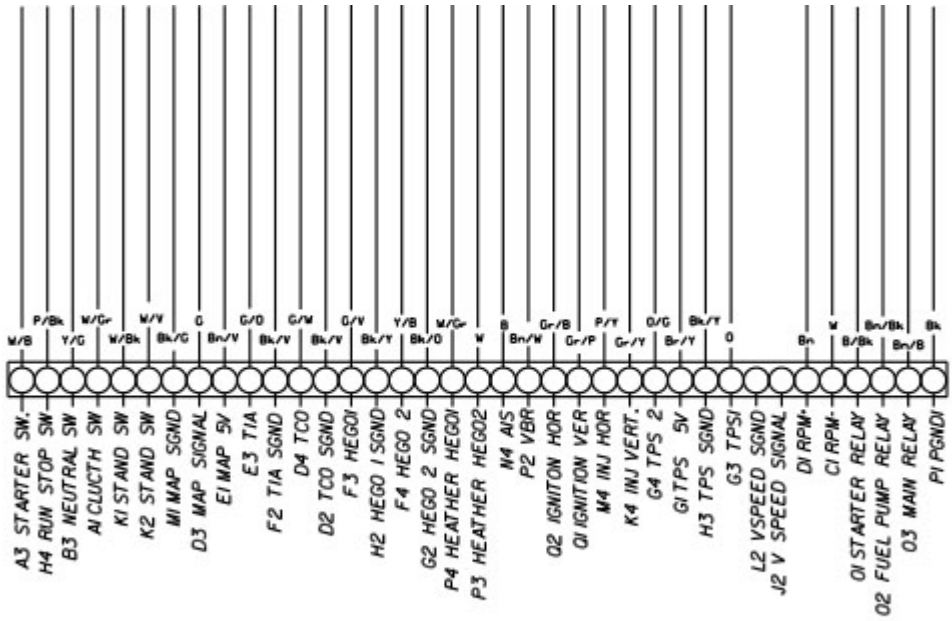
The ECU also monitors battery voltage so that it can adjust injector opening time and ignition coil charging time accordingly.

The ECU determines the following values:
- quantity of fuel delivered to each cylinder;
- injector closing time and therefore injection timing relative to the end of the intake stroke for each cylinder;
- spark advance.

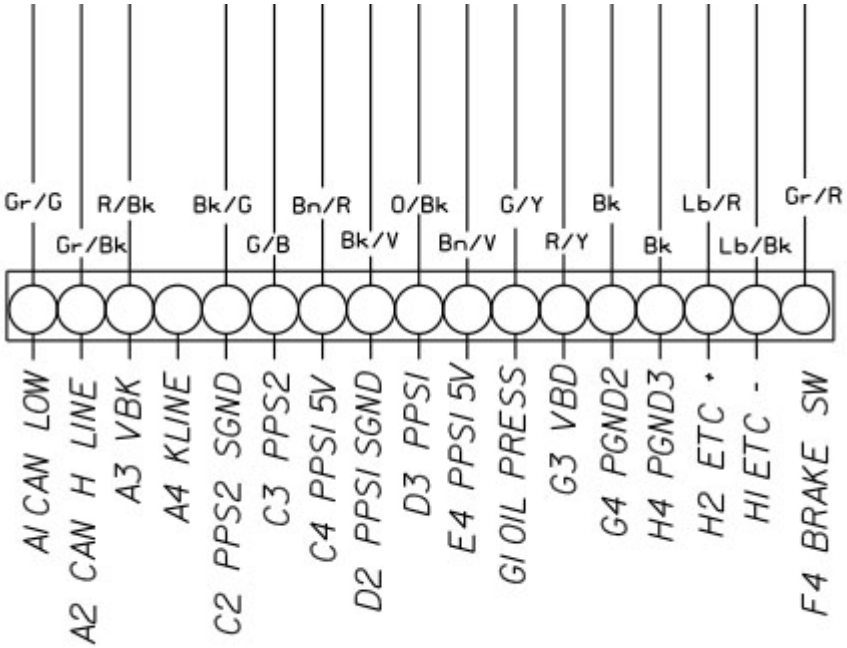
Important

The maps, which include spark advance values, injection times, crankshaft angle for injector closing and all correction curves as a function of temperature and atmospheric pressure values, are stored in the Flash Eprom of the ECU. The above values are preset by the Manufacturer after testing the motorcycle under different riding conditions. These settings cannot be changed.

Electric diagram:
ECU 1 connector



ECU 2 connector



REMOVAL / REASSEMBLY

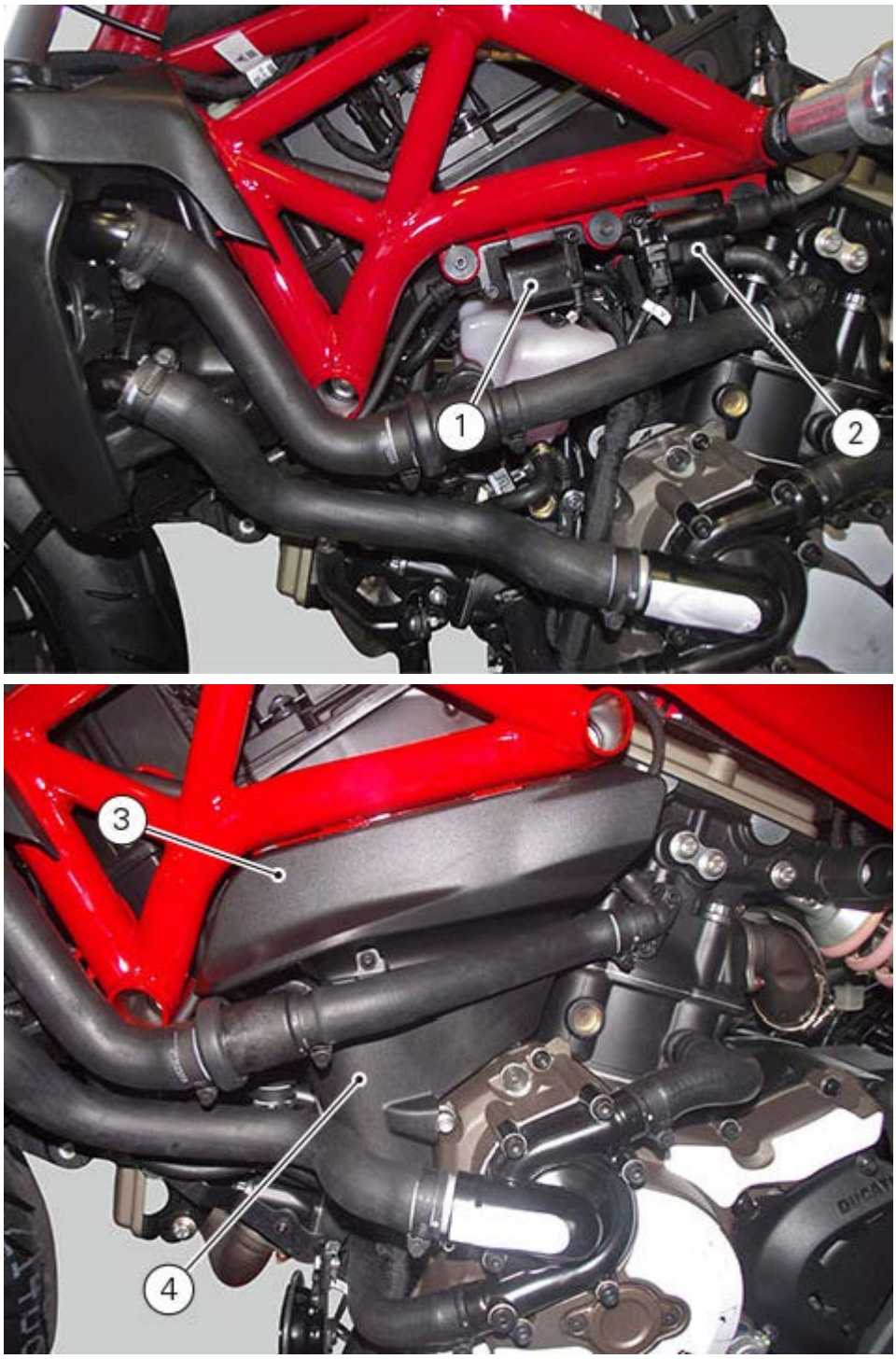
To remove and refit the ECU control unit refer to chapters "Removing the airbox and throttle body" and "Refitting the airbox and throttle body".

Coils

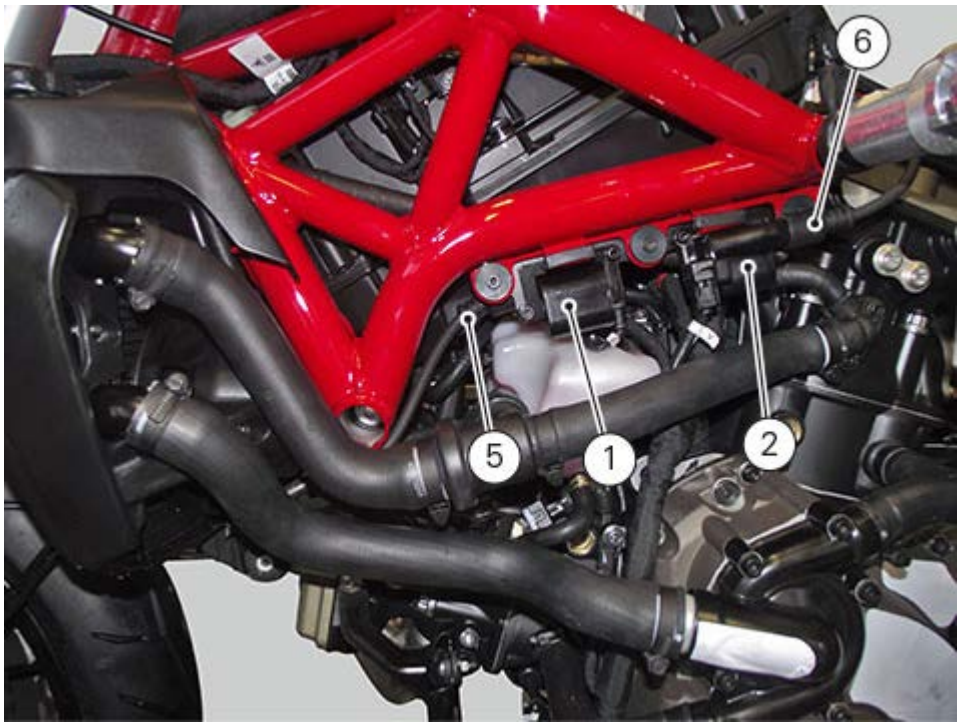
The ignition coil increases the input voltage of the current alternator and brings the voltage to a value that allows the spark creation in the spark plug.
The vehicle features two coils, one for the horizontal cylinder (1) and another for the vertical cylinder (2), located under the LH covers (3) and (4).

REMOVAL PROCEDURE

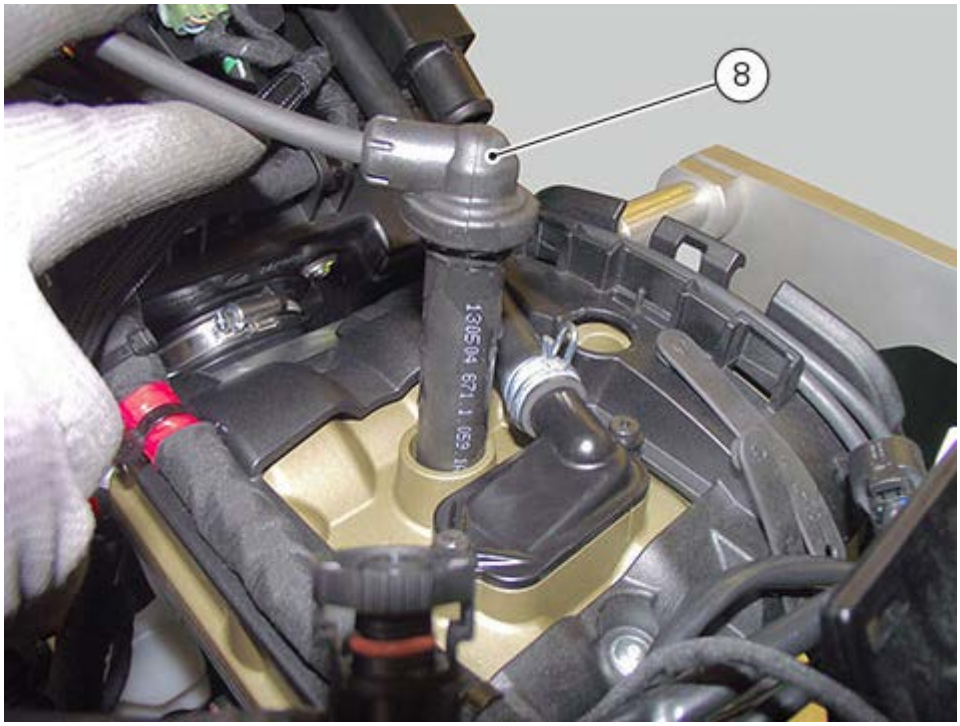
To reach the coils, remove the LH covers (3) and (4) as indicated in paragraph "Removing the water tank".

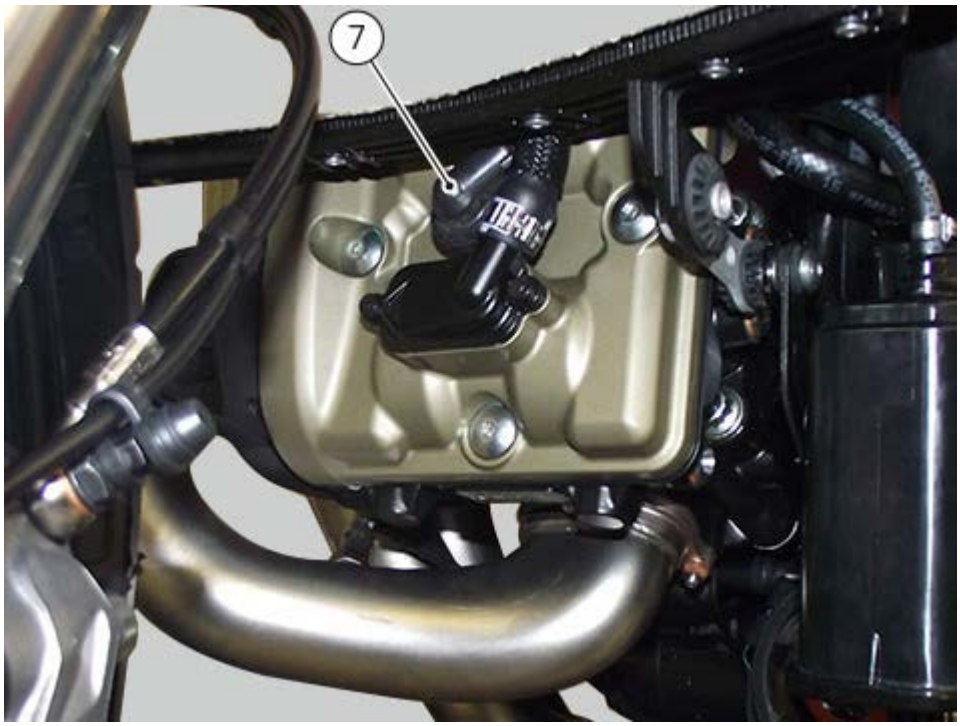


Disconnect connectors (5) and (6) of the horizontal cylinder (1) and vertical cylinder (2) coils.



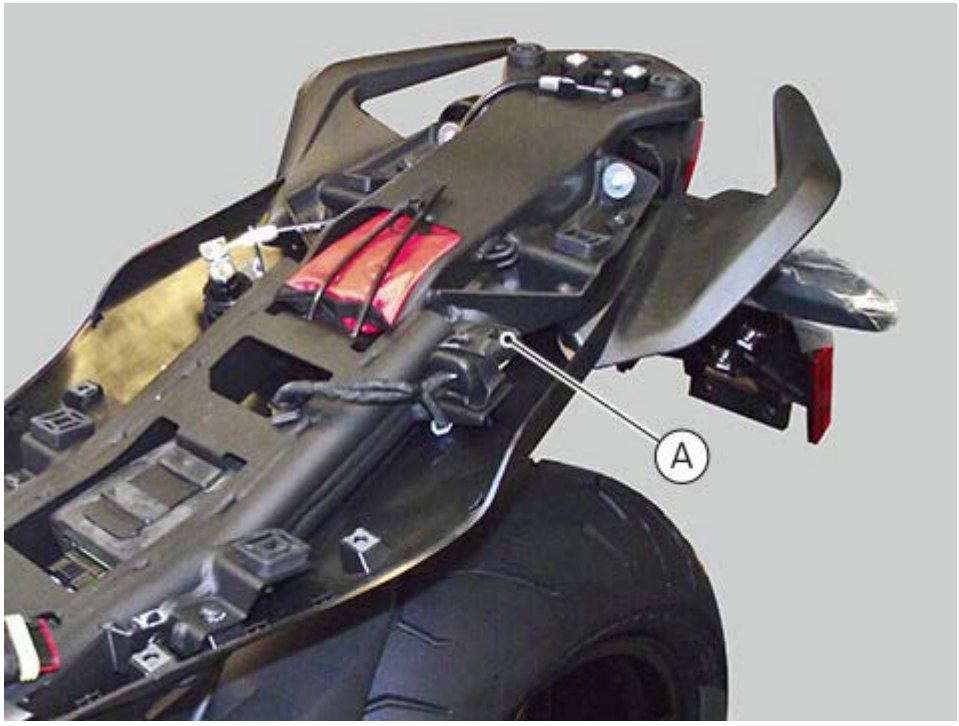
If necessary, disconnect the caps of the horizontal head (7) and vertical head (8) after removing the seat.



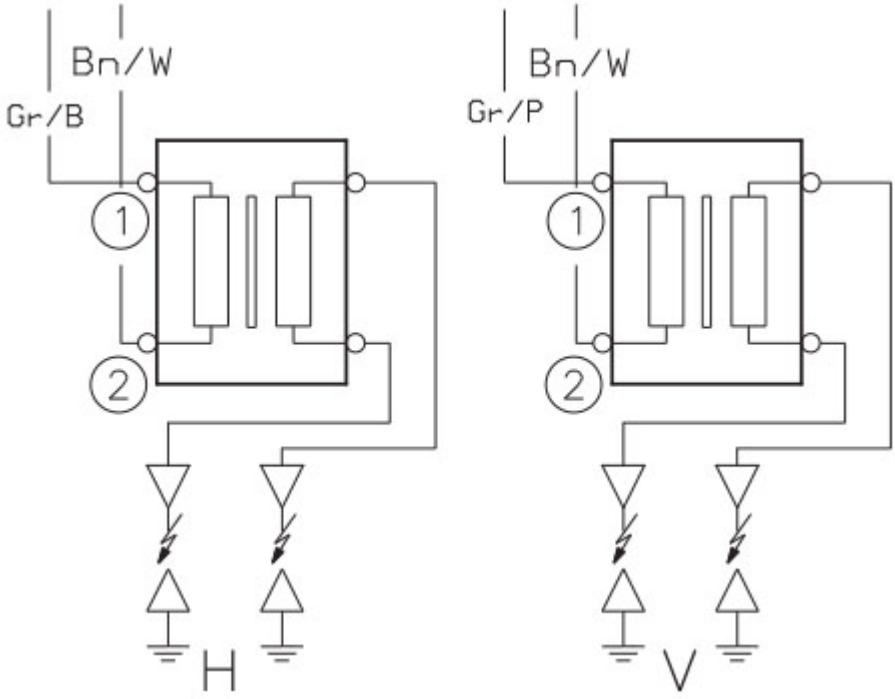


CONTROLS

To check its correct operation, connect the DDS 2 diagnosis instrument to the control unit diagnostic socket (A), located on the rear subframe, on the left side; remove the seat to reach it.



Electric diagram



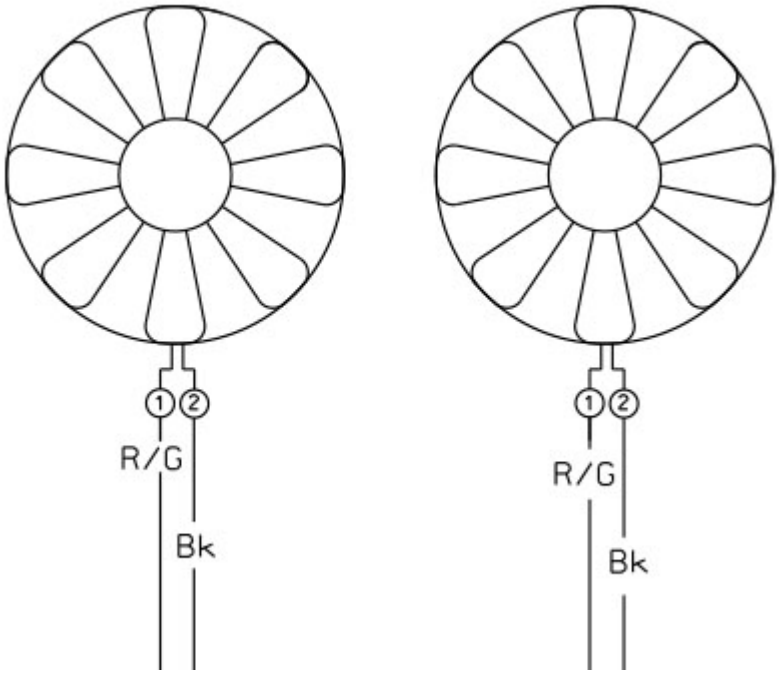
Solenoid valves

The LH and RH solenoid valves are located on the rear side of the radiator and improve the coolant cooling when the temperature is high.
The solenoid valve activation parameters are defined by the water temperature sensors and controlled by the thermostat.
The operating parameters are indicated in chapter "Cooling system".

REMOVAL / REASSEMBLY
To work on the solenoid valves, move the radiator from the front side as described in chapters "Removing the radiator" and "Refitting the radiator".

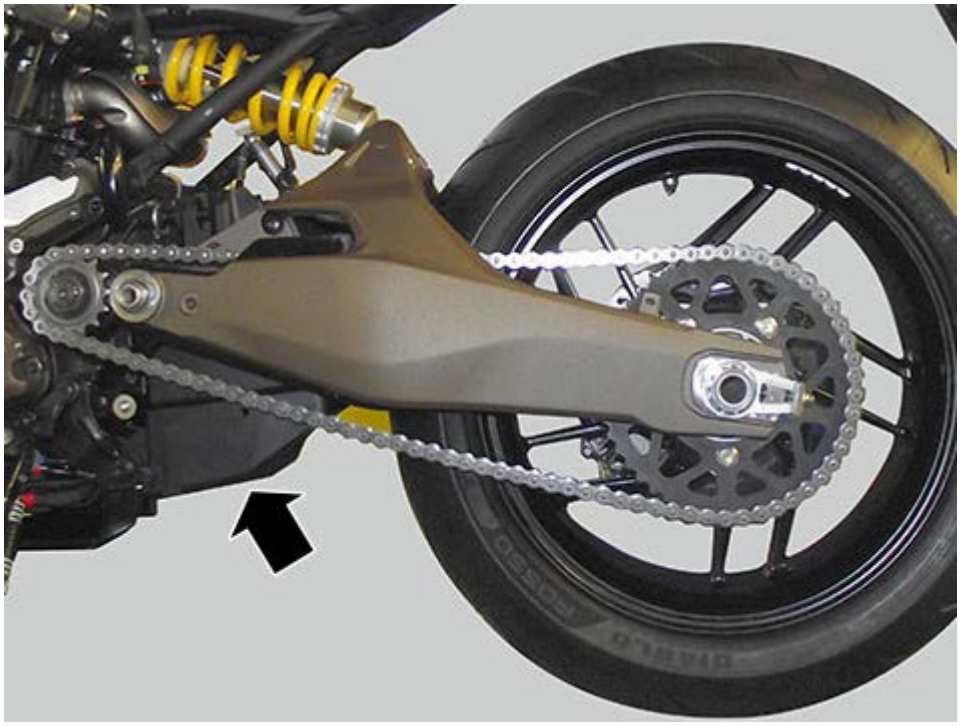
CONTROLS
With a multimeter connected between the two poles (threaded pins) of the solenoid starter, check for electric continuity.
If there is no electric continuity, ensure that the terminals are not oxidised and apply water repellent spray.
Change the solenoid valve if the malfunction persists.

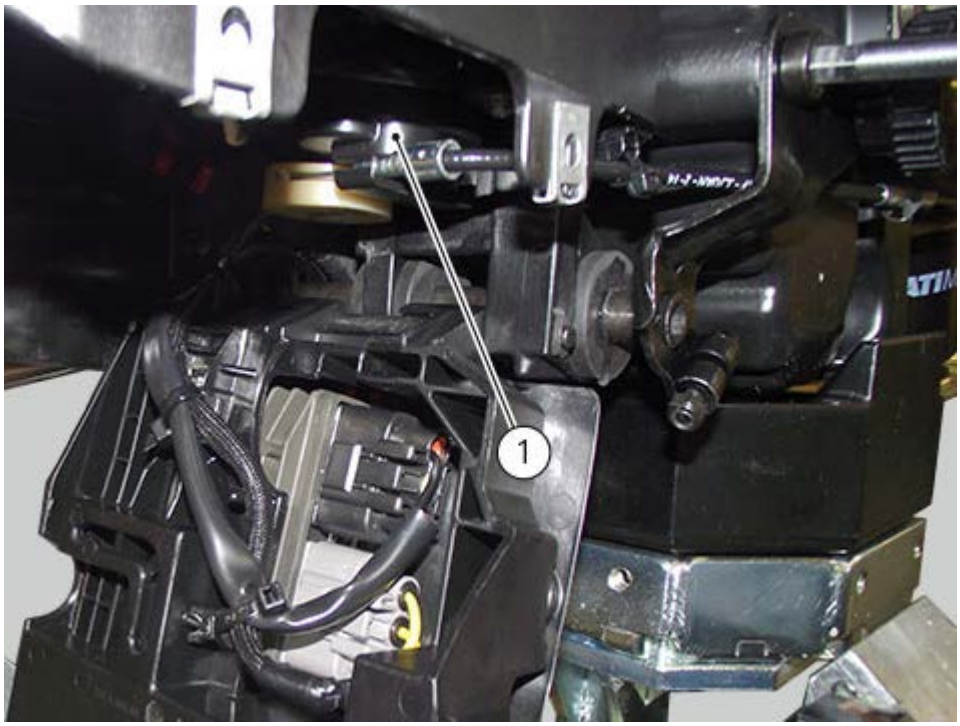
Electric diagram



Exhaust valve motor

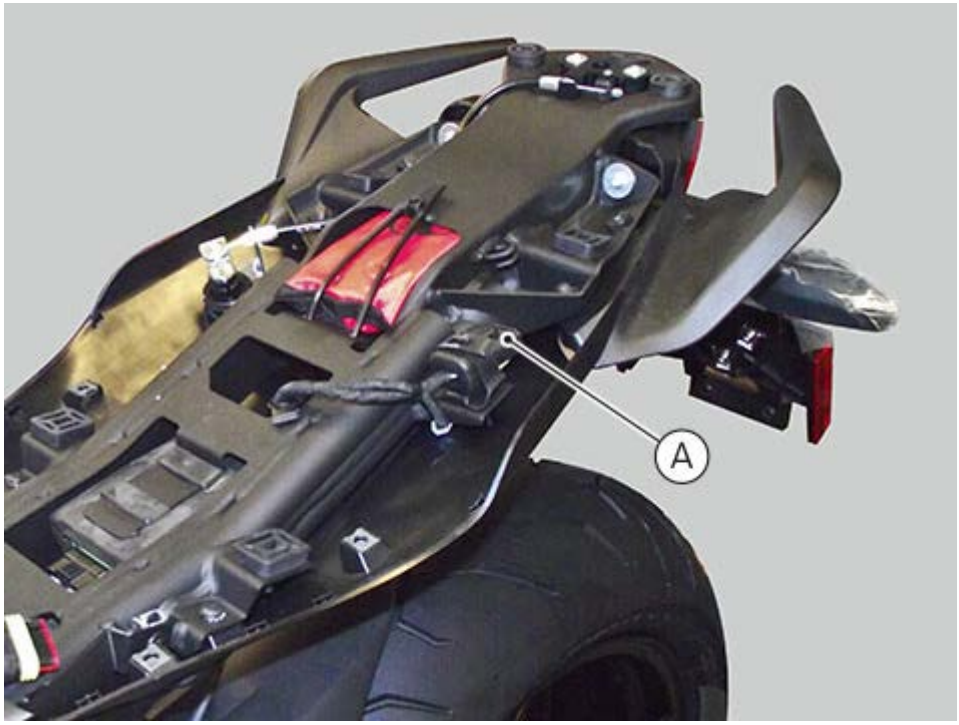
The exhaust valve motor (1) is connected to the main electric system braided hose and is located inside the lower electrical components compartment.
To reach it, follow the instructions in chapter "Removing the electric components compartment".



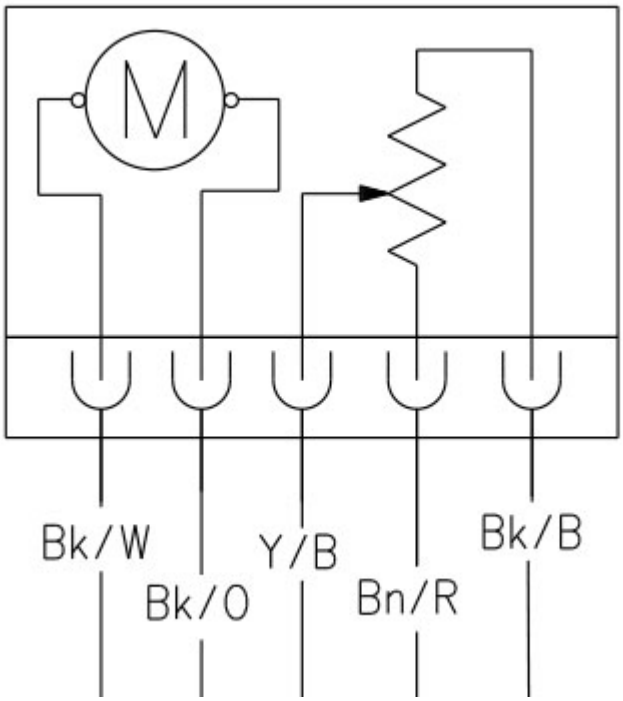


CONTROLS

To check the valve operation, connect the DDS 2 instrument to the control unit diagnostic socket (A), located on the rear subframe, on the left side; remove the seat to reach it.



Electric diagram



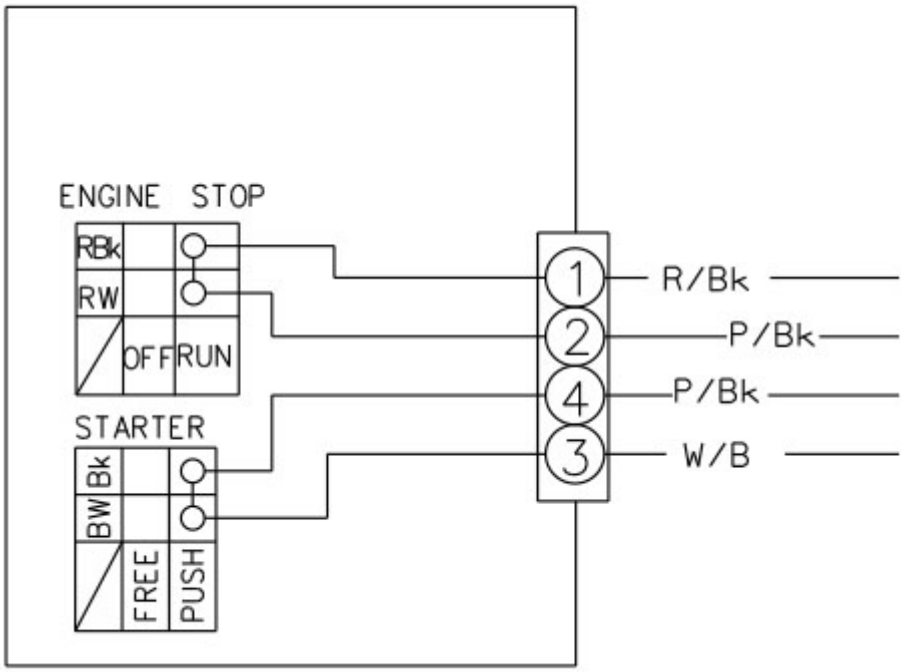
In the event of a fault, the internal connections of the device must be checked in all operating conditions. It is therefore necessary to disconnect the main wiring switch connector and perform the check using an analogue or digital multimeter.

Note
The same test may be done using the "DDS 2" diagnosis instrument.

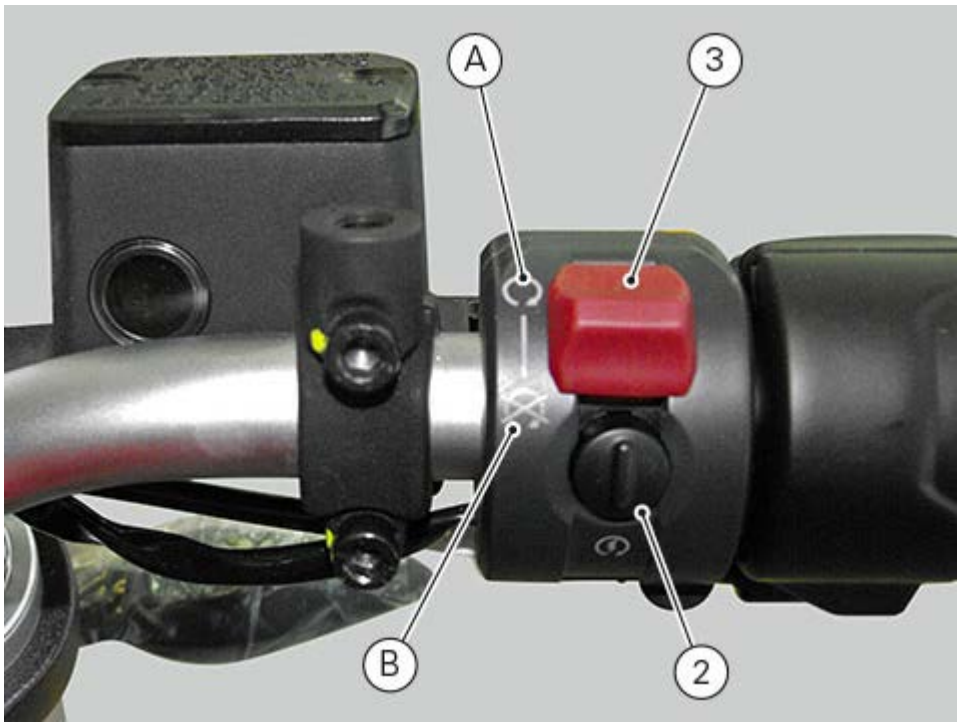
RIGHT-HAND SWITCH CONTROL

Remove the RH handgrip as described in chapter "Removing the handlebar".
Loosen screws (1) and remove the right-hand switch by disconnecting it from the main connection. 6_0105
The colours mentioned in the following descriptions refer to the colour of the wires from the switch and not to the colour of the main electric system wires.

Electric diagram



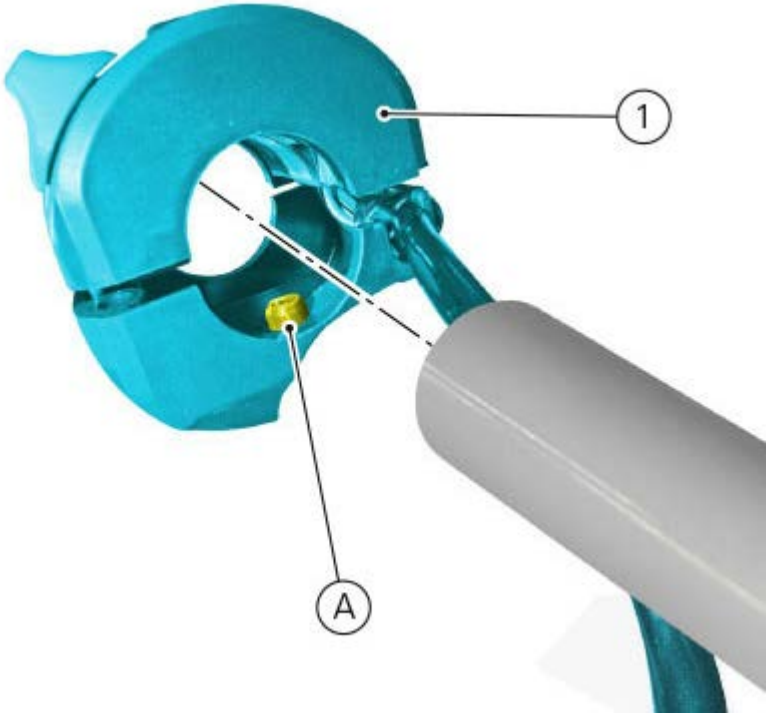
CONTROLS ON RIGHT-HAND SWITCH

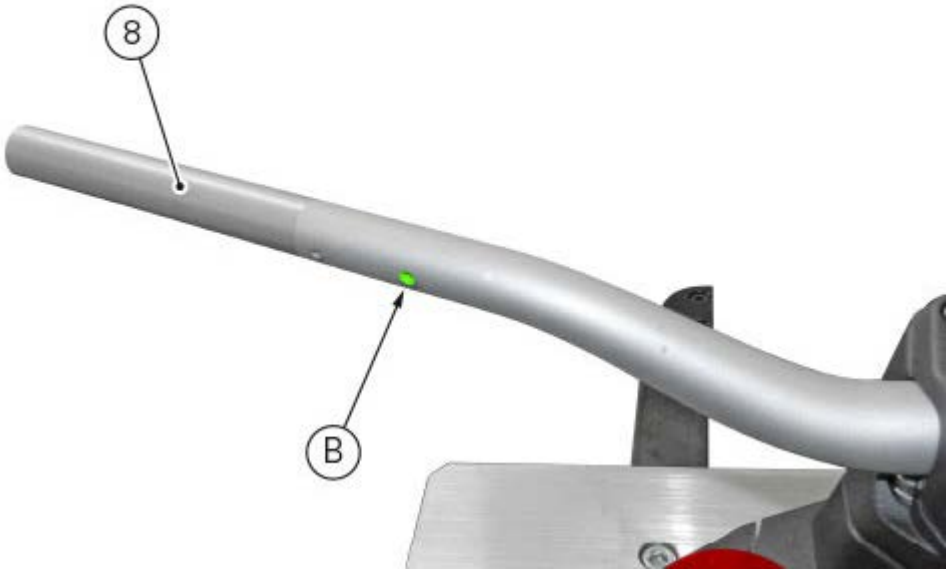


Engine stop button
Using a multimeter, check for continuity between the Red/White and Red/Black wires:
- when button (3) is in RUN position (A), there should be electrical continuity between the two wires;
- when the button is in the OFF position (B), there should be no electrical continuity between the two wires.
If these conditions are not met, the engine stop switch is not working correctly and must be replaced.

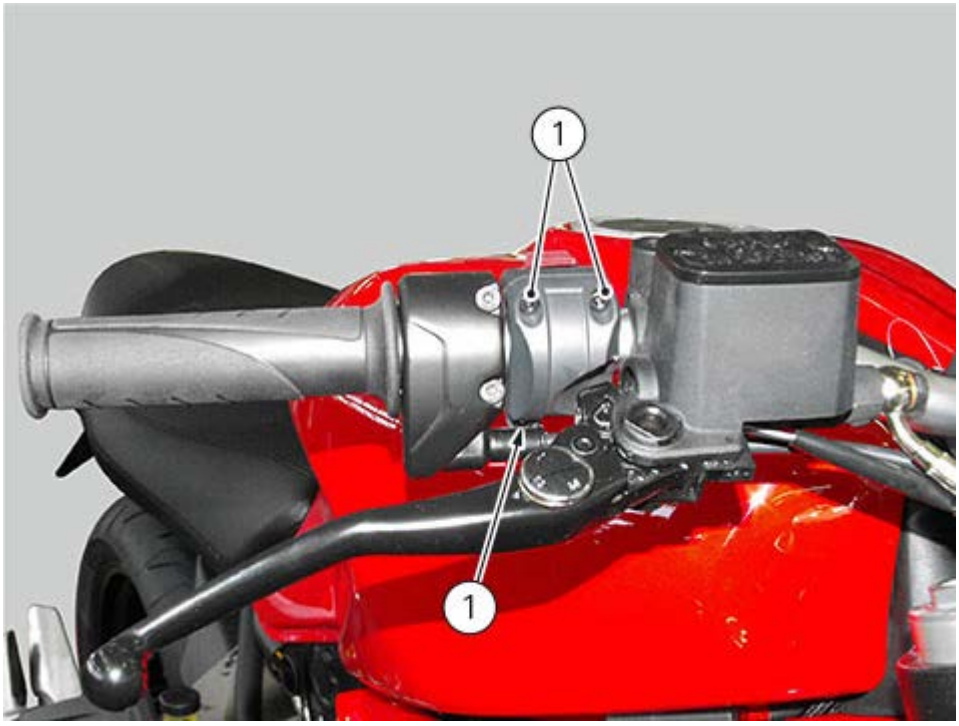
Starter button
Proceed as described for the engine stop button and check for continuity between the Blue/White and Black wires when the starter button (2) is pressed.
If there is no continuity, the starter button is faulty and must be replaced.
Colours mentioned in the descriptions refer to the colour of wires from the switch and not to the colour of the main electric system wires.

REFITTING THE RIGHT-HAND SWITCH
Connect the right-hand switch to the main connection and position it on the handlebar.
Fasten the switch by tightening screws (1) to a torque of 1.3 Nm ± 10% following the 1-2-1 sequence starting from the upper screws.
Switch position is mandatory: pin (A) must be inserted inside handlebar (8) hole (B).





Refit the LH handgrip as described in chapter "Refitting the handlebar".

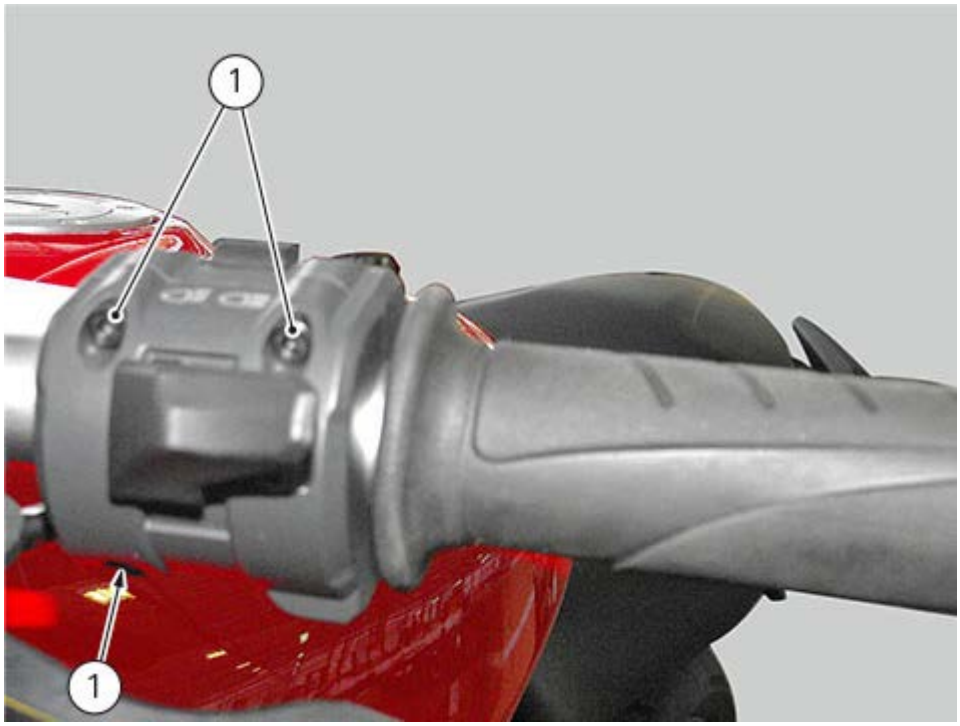


Left-hand switch

In the event of a fault, the internal connections of the device must be checked in all operating conditions. It is therefore necessary to disconnect the main wiring switch connector and perform the check using an analogue or digital multimeter.

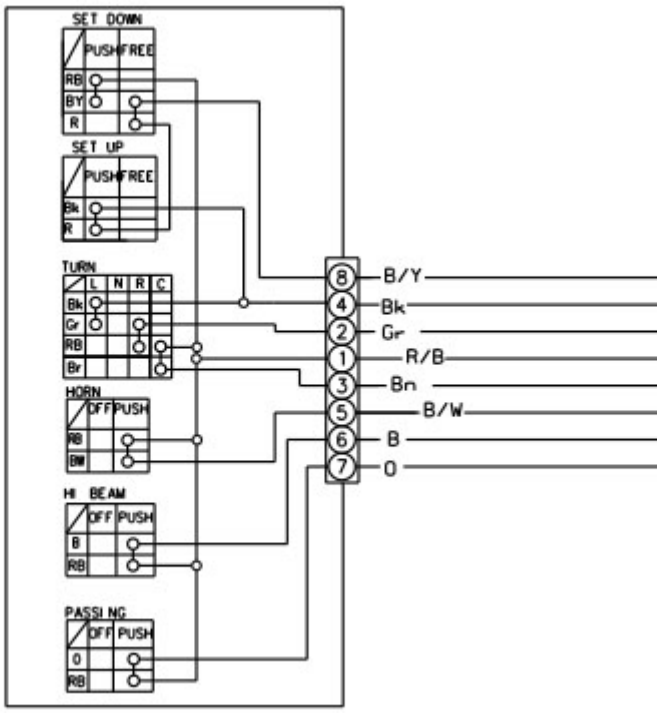
Note
The same test may be done using the "DDS 2" diagnosis instrument.

LEFT-HAND SWITCH CONTROL
Remove the LH handgrip as described in chapter "Removing the handlebar".
Loosen the screws (1) and remove the left-hand switch.

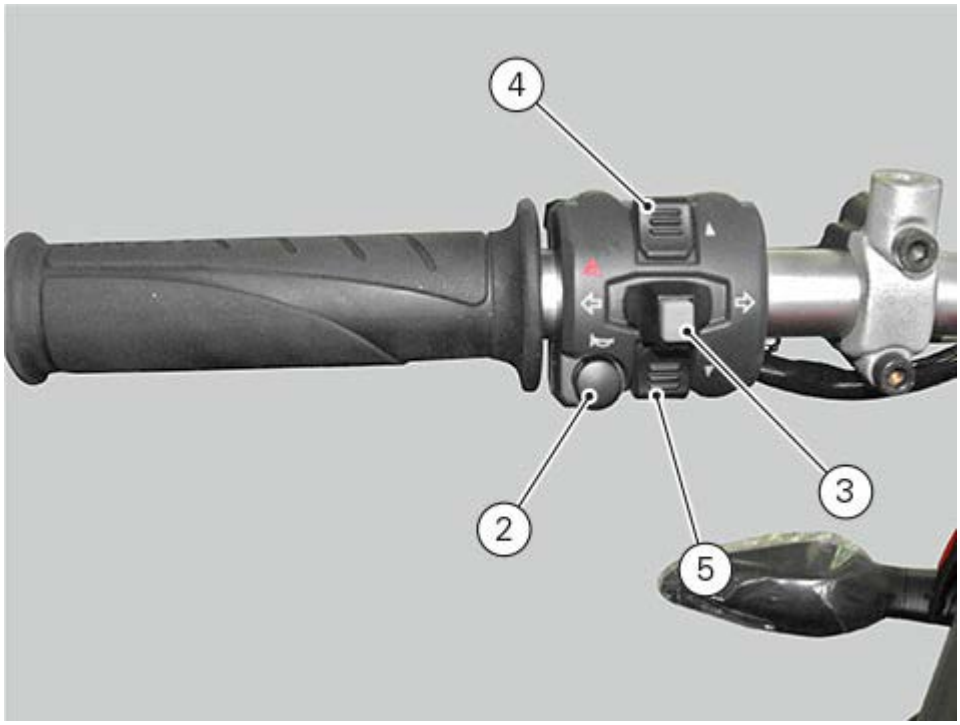


The colours mentioned in the following descriptions refer to the colour of the wires from the switch and not to the colour of the main electric system wires.

Electric diagram



CONTROLS ON LEFT-HAND SWITCH



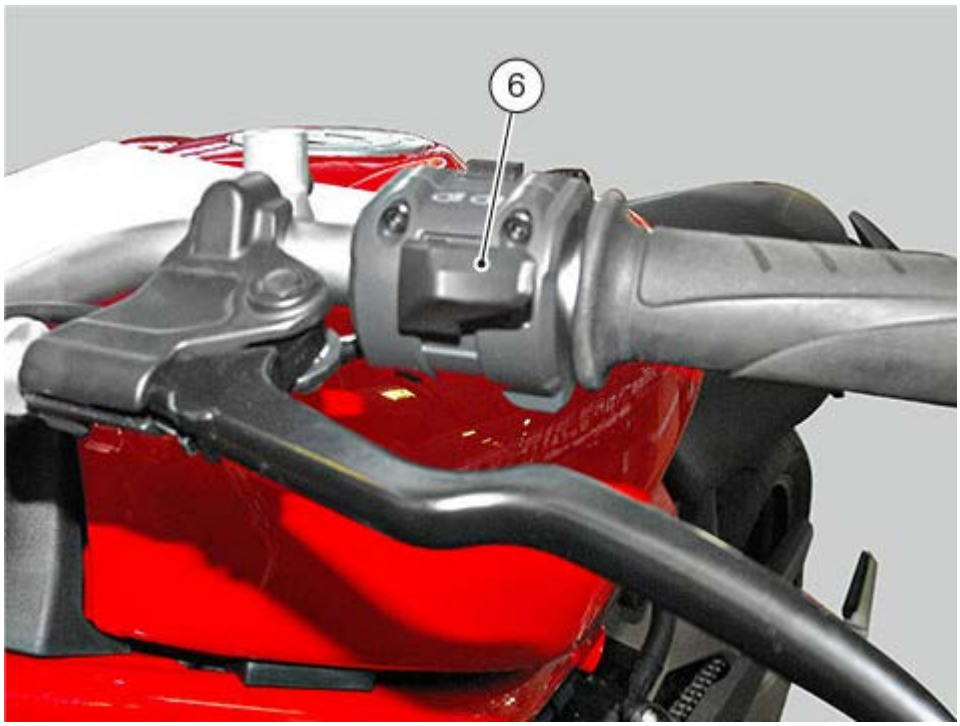
HORN button (2)
Connect the terminals of a multimeter to the Red/Blue and White/Blue cables to check for electric continuity, which must be available when HORN is pressed.
- When the HORN button is pressed, the resistance value read by the multimeter should be close to zero and, if available, a continuity beep should be heard.
- When the HORN button is not pressed, the resistance value should be infinity (there is no continuity as the electrical contacts inside the push-button are open) and no continuity beep should be heard, if provided.
If these conditions are not met, the device must be replaced.

Turn indicator switch (TURN) (3)
The turn indicators cancel button may also be used in the instrument panel for the CONFIRM MENU function, for selecting the riding mode.
Push this button for 3 seconds to the left side to activate the "Hazard" function (all 4 turn indicators).
Connect the multimeter to the Red/Blue and Grey wires arriving from the turn indicator switch and check for electrical continuity when operating the right turn signal.
Repeat the above procedure for the left turn indicator, but connect the multimeter to the Black and Grey wires.

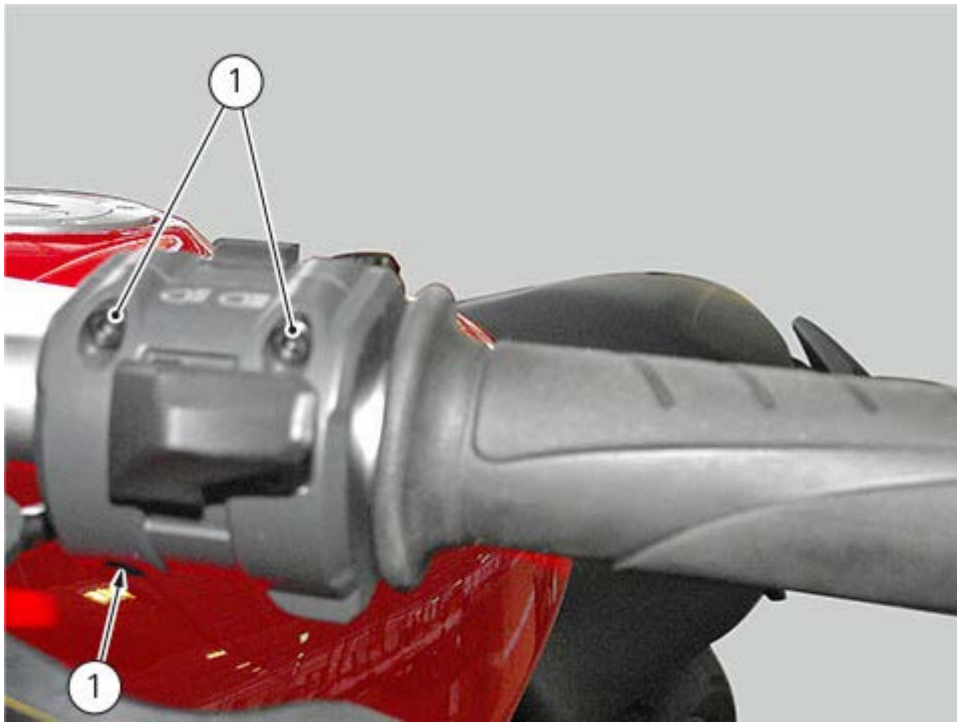
Control switch (SET UP) (SET DOWN) (4) (5)
Buttons used to display and set instrument panel parameters.
Connect the multimeter to the Red and Black wires arriving from the instrument panel function selector switch and check for electrical continuity when pressing button (4).
Repeat the same procedure, press button (5) and connect the multimeter to the Red/Blue and Blue/Yellow wires.

Low beam and high beam (Hi Beam) (6)
Test using the same procedure, applying the probes of the meter to the Red/Blue and Blue wires and moving switch down.

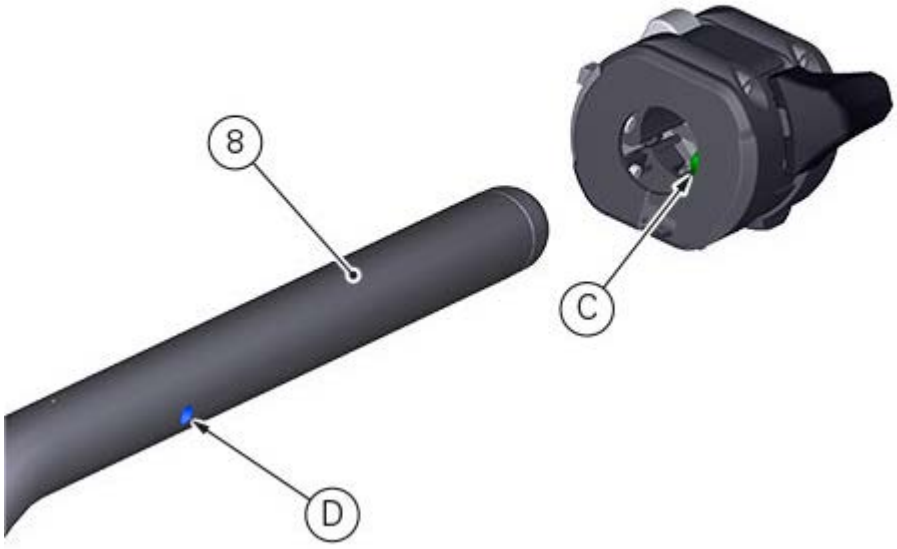
Flash switch (PASSING) (6)
The high-beam flash button may also be used for LAP functions.
Check for continuity between the Red/Blue and Orange wires.
Unlike the Hi Beam, switch (6) should be pressed.



REFITTING THE LEFT-HAND SWITCH
Connect the left-hand switch to the main connection and position it on the handlebar.
Fasten the left-hand switch by tightening screws (1) to a torque of 1.3 Nm ± 10% following the 1-2-1 sequence starting from the upper screws.



Left-hand switch position is mandatory: pin (C) must be inserted inside hole (D) of handlebar (8).

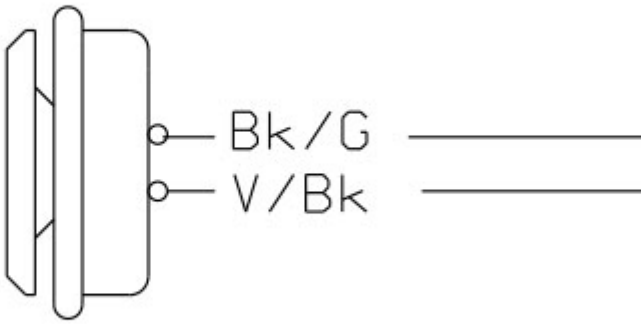


Refit the LH handgrip as described in chapter "Refitting the handlebar".

Horn

Supply 12 V (battery) to the two fastons.
With a multimeter connected between the two poles (threaded pins) of the solenoid starter, check for electric continuity.
If there is no electric continuity, ensure that the terminals are not oxidised and apply water repellent spray.
Change the horn if the malfunction persists.

Electric diagram



Checking the fuses

Electric components are protected by eleven fuses located in the two fuse boxes. In each fuse box (A) and (B) there are three spare fuses.
Above the solenoid starter there are two 30 A fuses (C), whereas on its sides there are two ABS fuses: a 25 A (G) and a 30 A one (H).

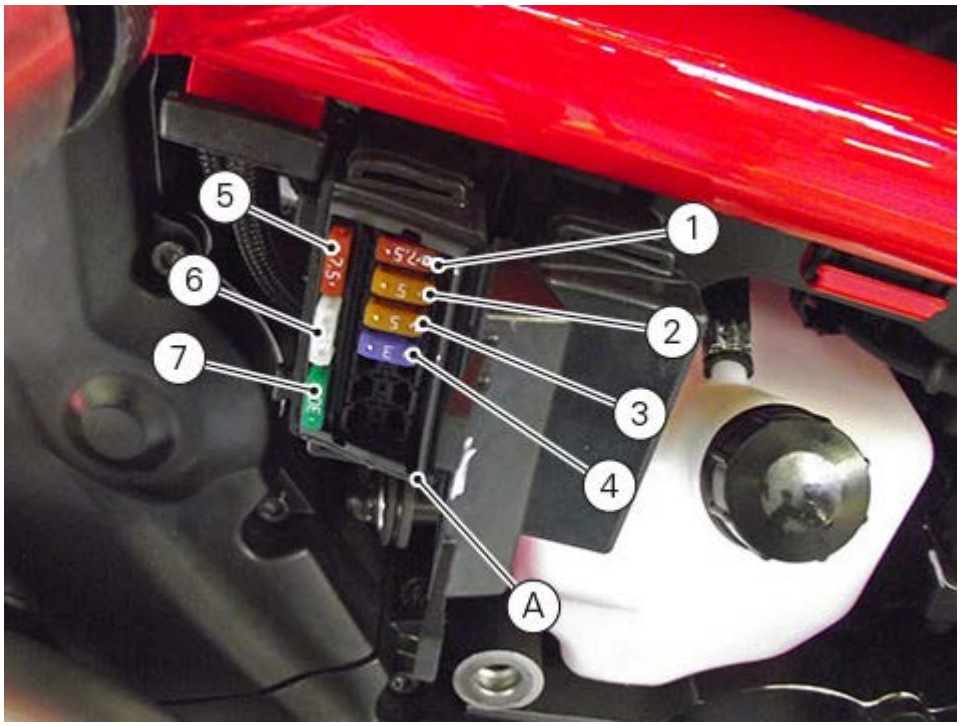
FRONT FUSE BOXES (A) and (B)

The fuse boxes (A) and (B) are located on the RH central side, under the RH side cover.
Remove the RH side cover as indicated in paragraph "Removing the water tank". To expose the fuses, lift the box protective covers. Mounting position and ampere capacity are marked on box cover.

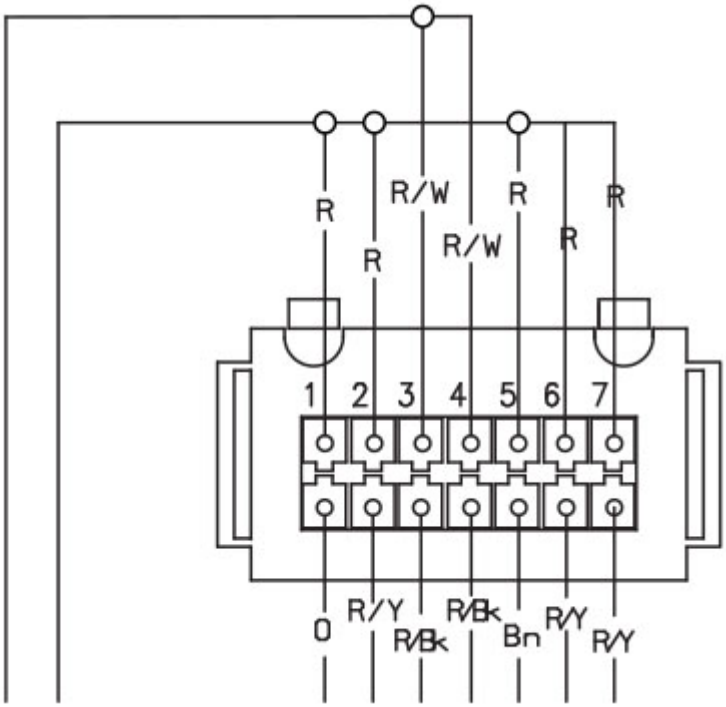
Refer to the table below to identify the circuits protected by the various fuses and their ratings.

Front fuse box

Fuse box (A) key		
Pos.	**El. item**	**Rat.**
1	Optional key	7.5 A
2	Alarm	5 A
3	Stop	5 A
4	Diagnostics	3 A
5	Spare	7.5 A
6	Spare	25 A
7	Spare	30 A



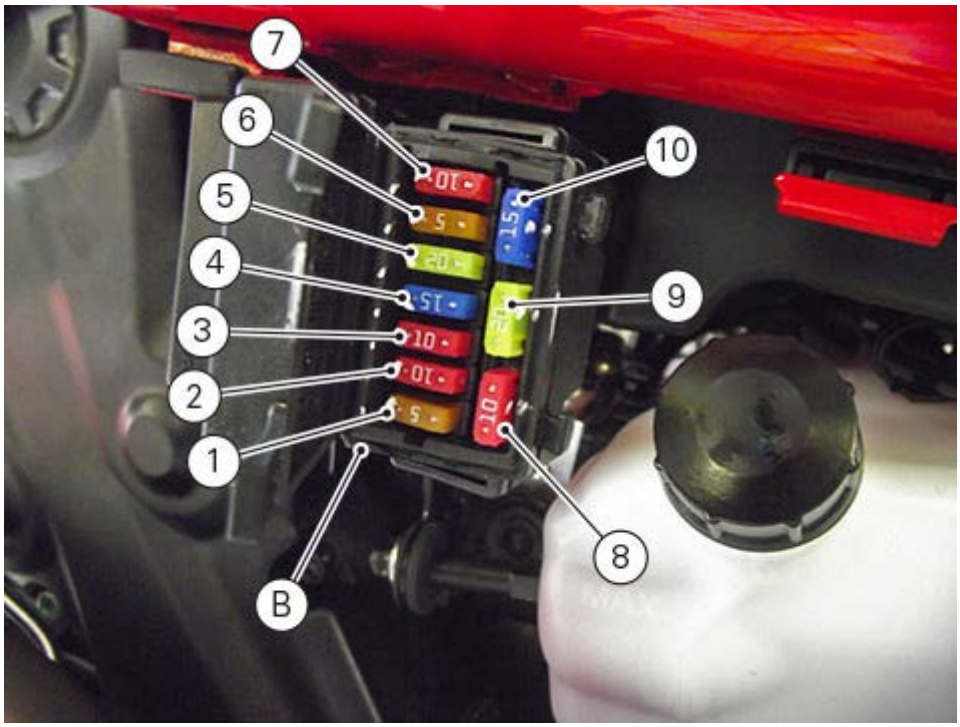
Electric diagram



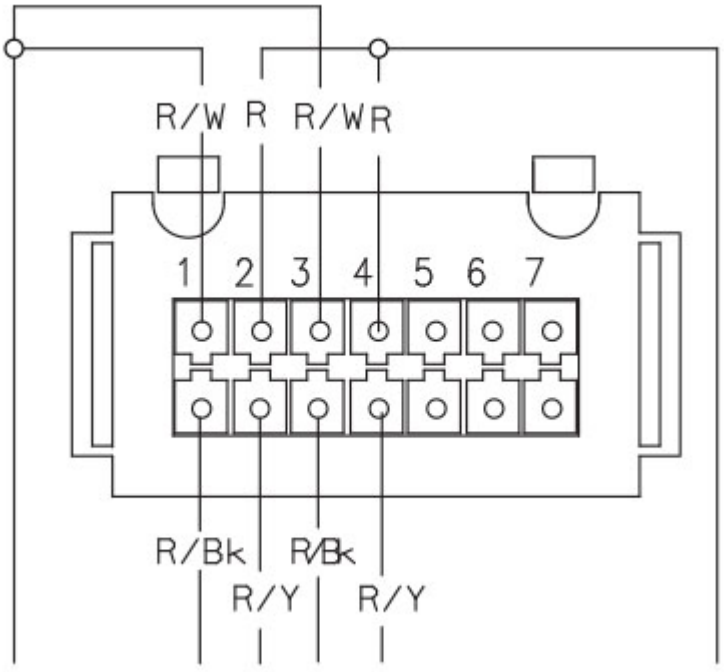
Rear fuse box

Fuse box (B) key		
Pos.	**El. item**	**Rat.**
1	Lights	5 A
2	Instrument panel	10 A

3	Key 1	10 A
4	Key 2	15 A
5	Relay	20 A
6	Control unit	5 A
7	BBS	10 A
8	Spare	10 A
9	Spare	20 A
10	Spare	15 A

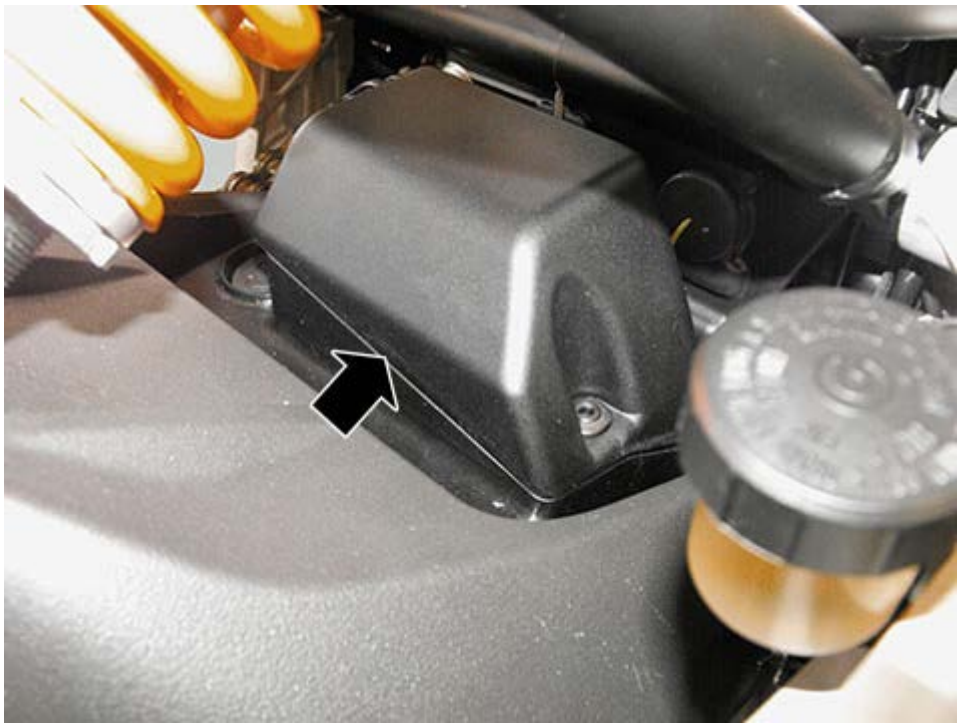


Electric diagram



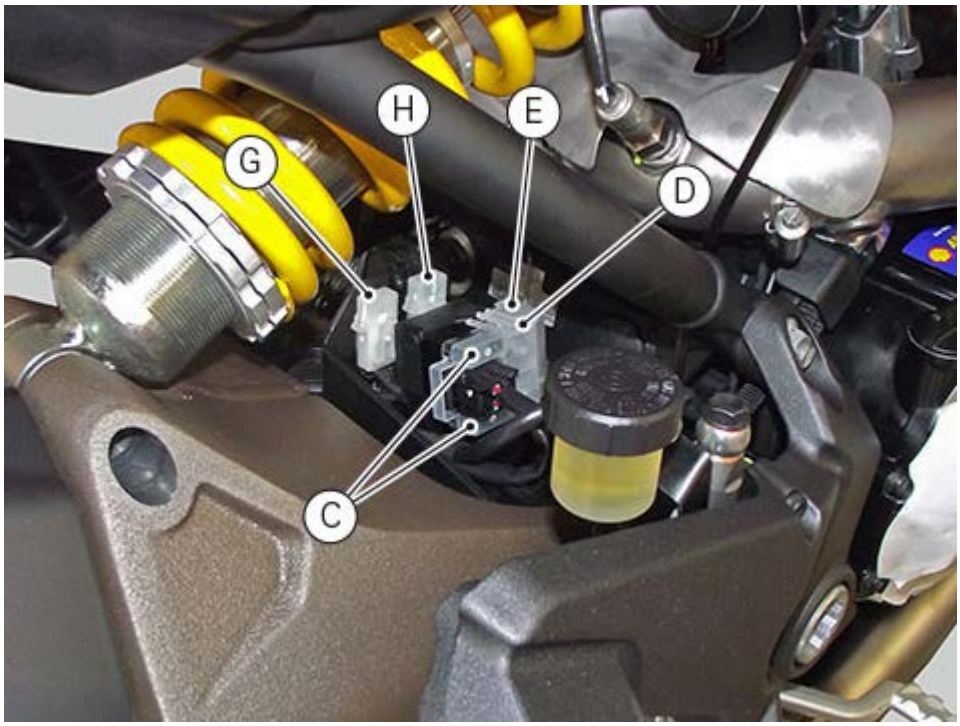
MAIN FUSES and ABS

To reach the main fuses and the ABS fuses, remove the battery compartment cover, as described in paragraph "Solenoid starter".



The two main fuses (C) (one is the spare fuse) are located on solenoid starter (D).
Remove protection cap (E) of both fuses.

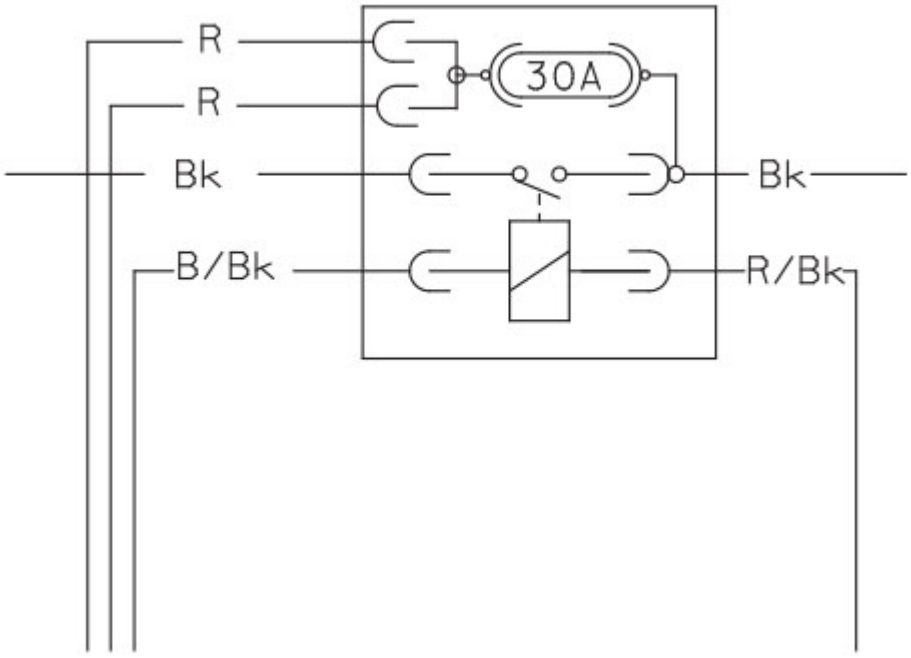
Near the solenoid starter there are also the two ABS fuses: a 25 A (G) fuse and a 30 A (H) one.



Main fuses

Main fuses key		
Pos.	**El. item**	**Rat.**
C		30A
C	Spare	30 A

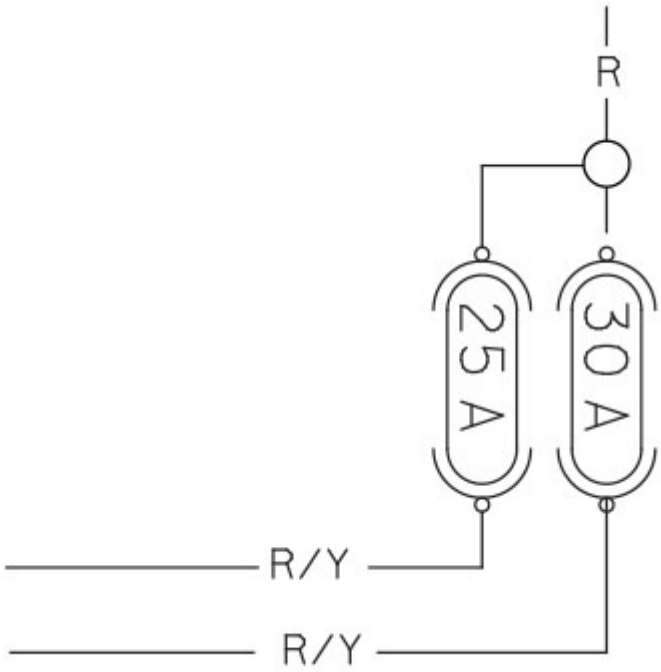
Electric diagram



ABS fuses

ABS fuse key		
Pos.	**El. item**	**Rat.**
G	ABS	25 A
H	ABS	30 A

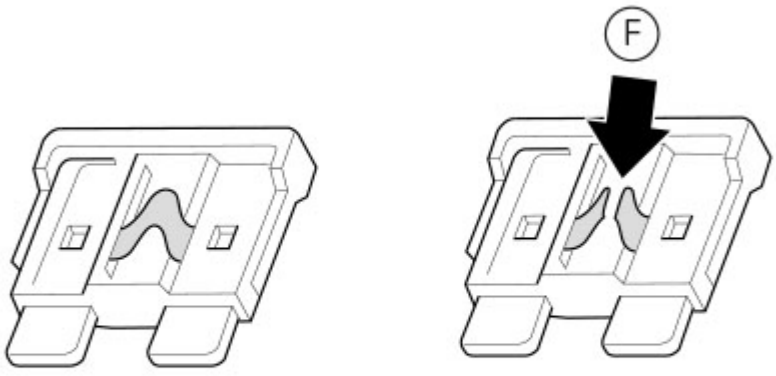
Electric diagram



Important

Before replacing a damaged fuse with a new one of the same rating, identify the cause of the problem.

A blown fuse can be identified by breakage of the inner filament (F).

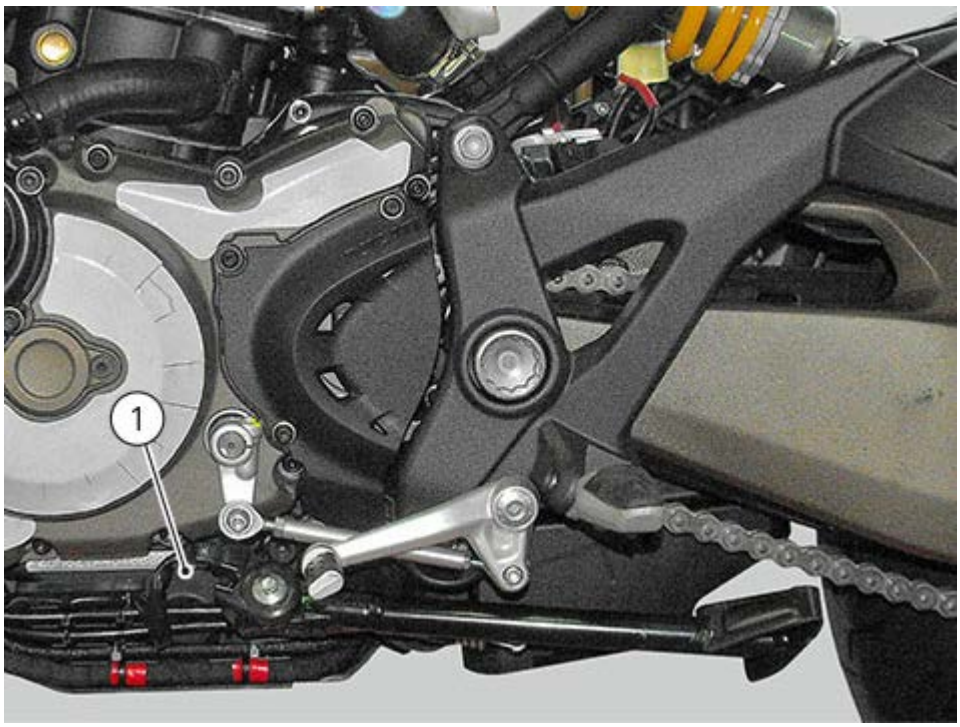


Important
Switch the ignition key to OFF before replacing the fuse to avoid possible short-circuits.

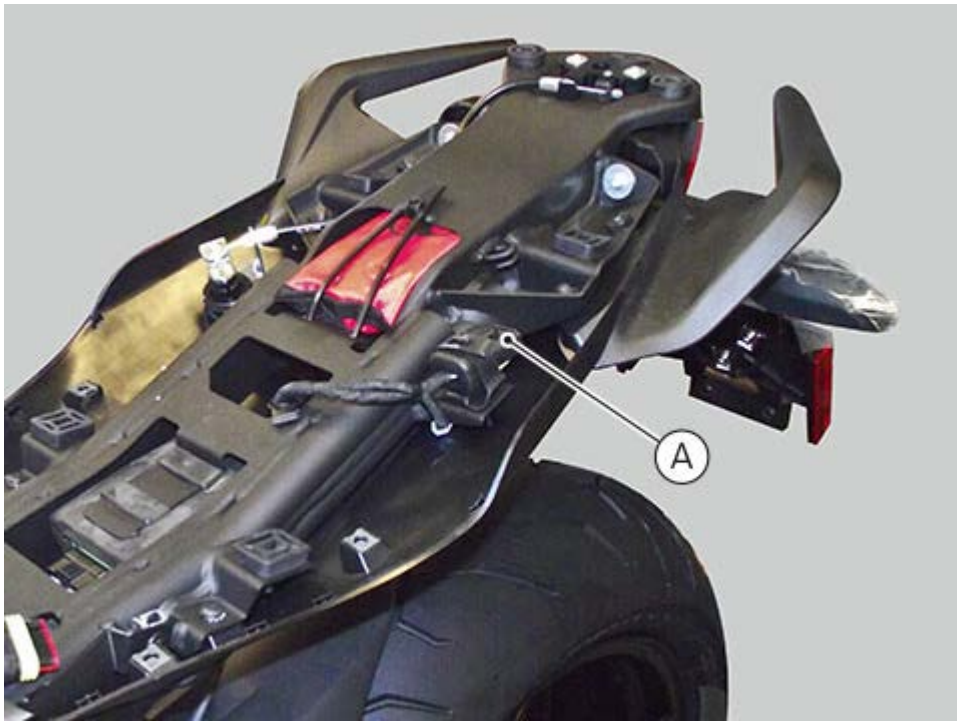
Warning
Never use a fuse with a rating other than specified. Failure to observe this rule may damage the electric system or even cause fire.

Side stand switch

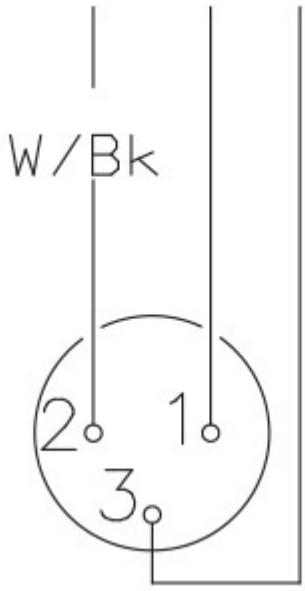
The side stand switch (1) is located on the side stand ball joint and provides the side stand position information to the control unit.
The detected signal is output to the control unit, which shares it with the instrument panel through the CAN line.



To check operation of switch (1), connect the DDS 2 instrument to the control unit (A) diagnosis socket located on the rear subframe, on the left side; remove the seat to reach it.



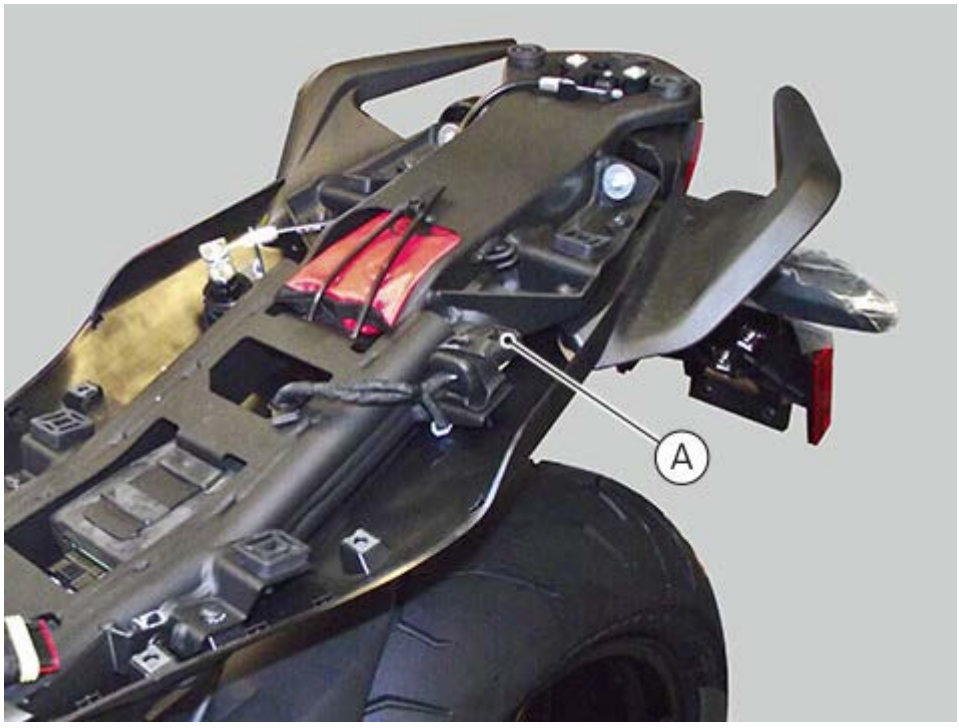
Electric diagram



Air temperature sensor

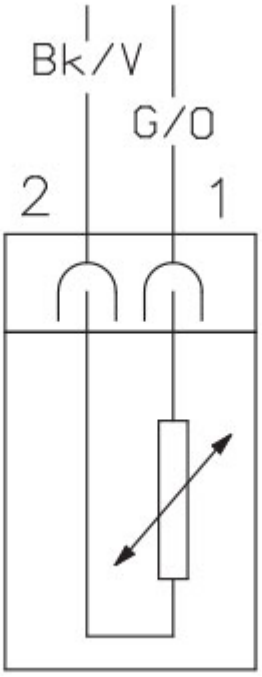
The air temperature sensor (1), located on vehicle central part, detects the ambient temperature.
The detected signal is sent to the control unit, that shares it through the CAN line with the instrument panel; this allows performing map corrections if necessary.

To check operation of sensor (1), connect the DDS 2 instrument to the control unit (A) diagnosis socket located on the rear subframe, on the left side; remove the seat to reach it.



After selecting the proper items on the DDS 2 menu, read the external air temperature value among the different displayed parameters and compare it with the actual value. Change the sensor if reading is incorrect.

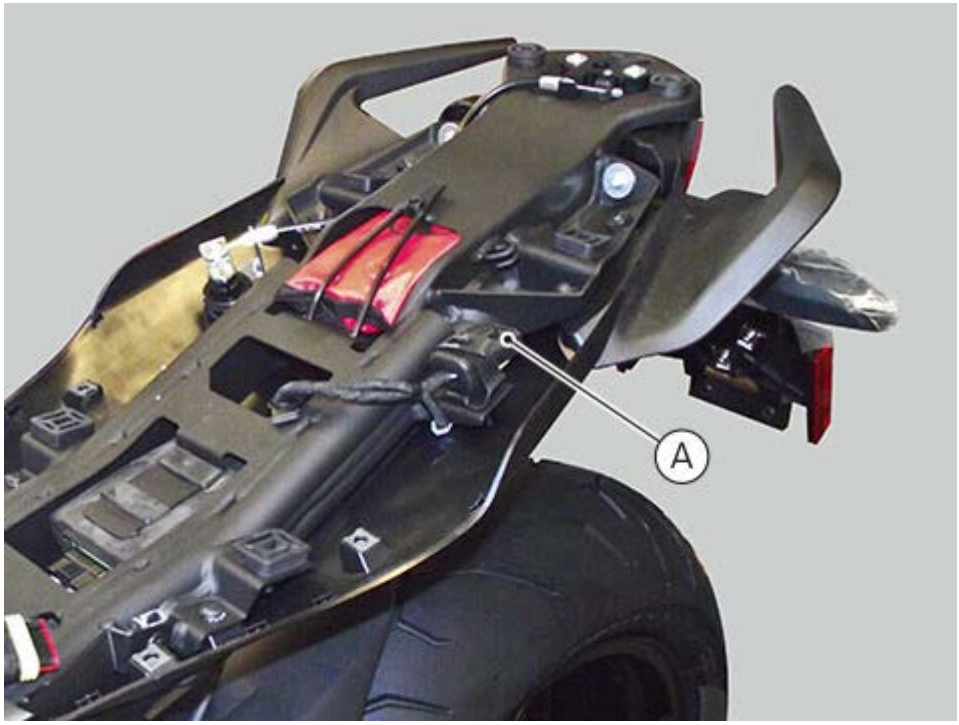
Electric diagram



Engine temperature sensor

The coolant temperature sensor (1) outputs the electric signal to the engine control unit, which shares it with the instrument panel through the CAN line.

To check the MAP sensor (1) operation, connect the DDS 2 instrument to the control unit diagnostic socket (A), located on the rear subframe, on the left side; remove the seat to reach it.

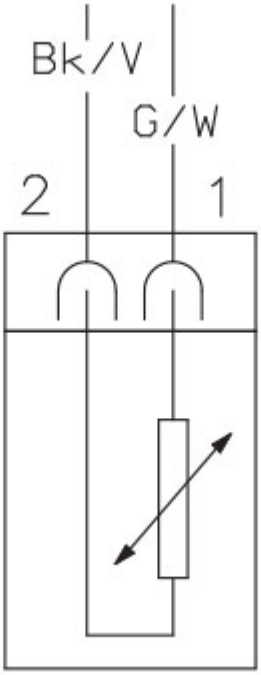


After selecting the proper items on the menu, read the engine coolant temperature value among the different displayed engine parameters:
- with cold engine, the air temperature detected with the DDS 2 shall be similar to the coolant one;
- with hot engine and cooling fan just triggered, coolant temperature value shall be similar to the one required for activating the electric fan.

Should the outcomes of these tests be negative, replace the engine coolant temperature sensor.
Should the DDS 2 detect an error such as "coolant temperature sensor short circuit or open circuit" inside the control unit memory, check the electric system parts connecting sensor to control unit.

If this section of the electric system is not faulty (no open circuit, no short circuits, no short circuit to ground), replace the sensor.

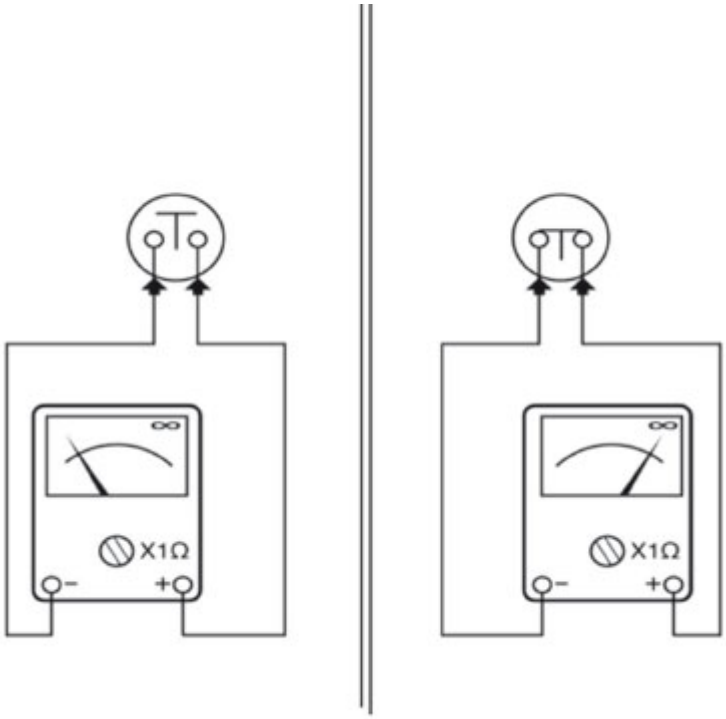
Electric diagram



Clutch switch

The clutch switch (1) is located on the clutch lever lower side.

CLUTCH SWITCH CONTROL
To check operation of the front (1) STOP switch, use a multimeter: when the front brake lever is operated, there must be electric continuity between the terminals of the corresponding switch.
No electric continuity should be available when brakes are not operated.

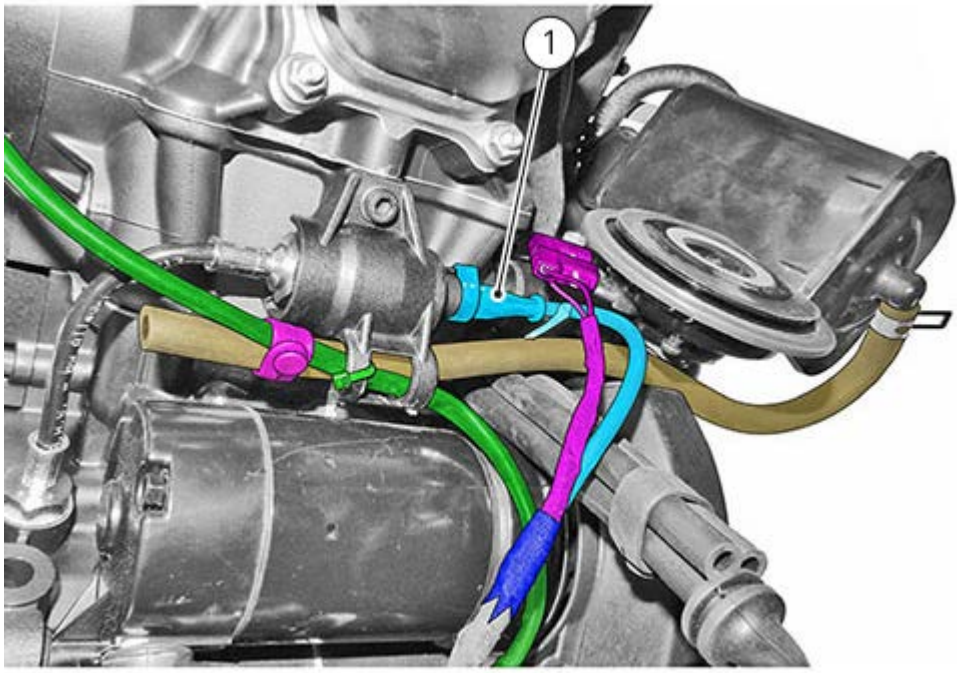


If these tests fail to produce positive results, the part in question must be replaced.

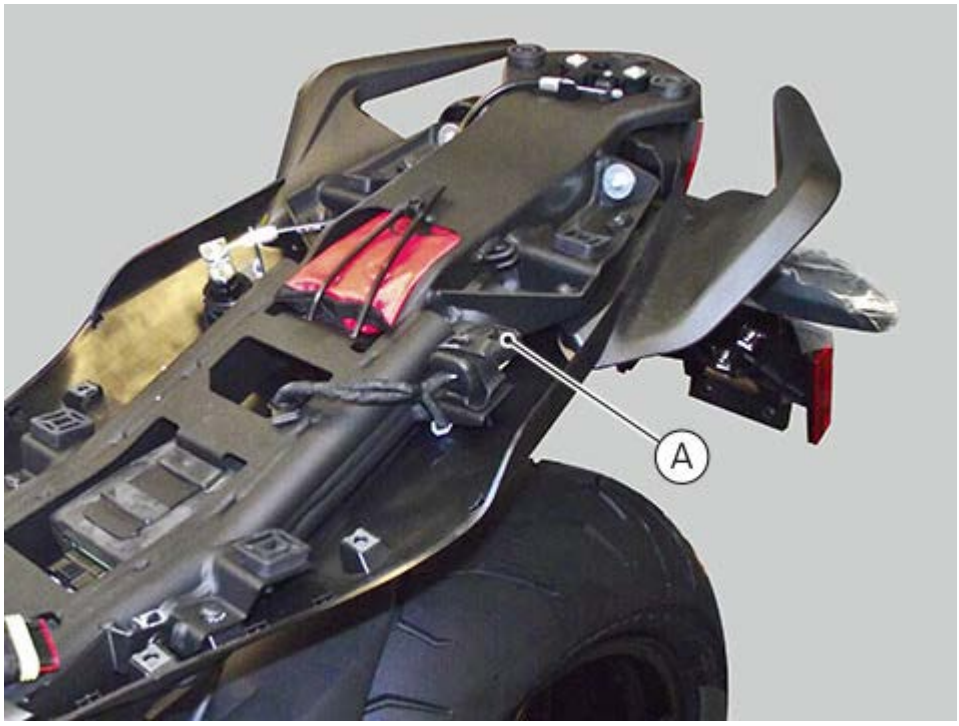
Electric diagram

Oil pressure sensor

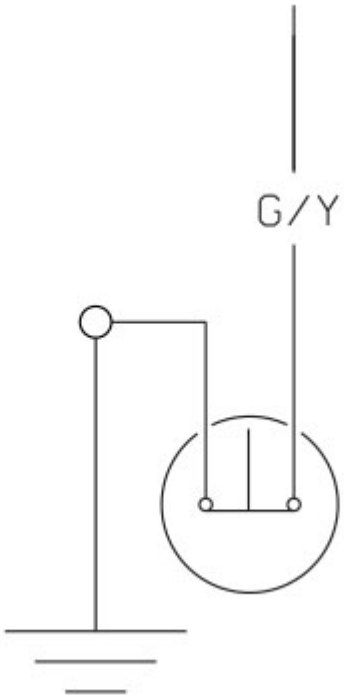
The oil pressure sensor (pressure switch) (1) is located on the front lower area.



To test the operation of the engine oil pressure sensor (1), proceed as follows.
Use the diagnosis instrument DDS 2 to check that oil pressure in the engine lubrication circuit complies with the specified values.
If the engine oil pressure value is outside the specified range, check the lubrication circuit components and service as necessary.
Switch on the instrument panel (ignition key turned to ON) without starting the engine, disconnect the electrical terminal from the pressure sensor and connect it to ground:
- if the warning light does not illuminate, this means the sensor is defective and must be replaced;
- if the warning light illuminates, start the engine;
- if the warning light does not turn off, check the DDS 2 system by connecting to connector (A) located on the rear subframe, LH side; to reach it, remove the seat.

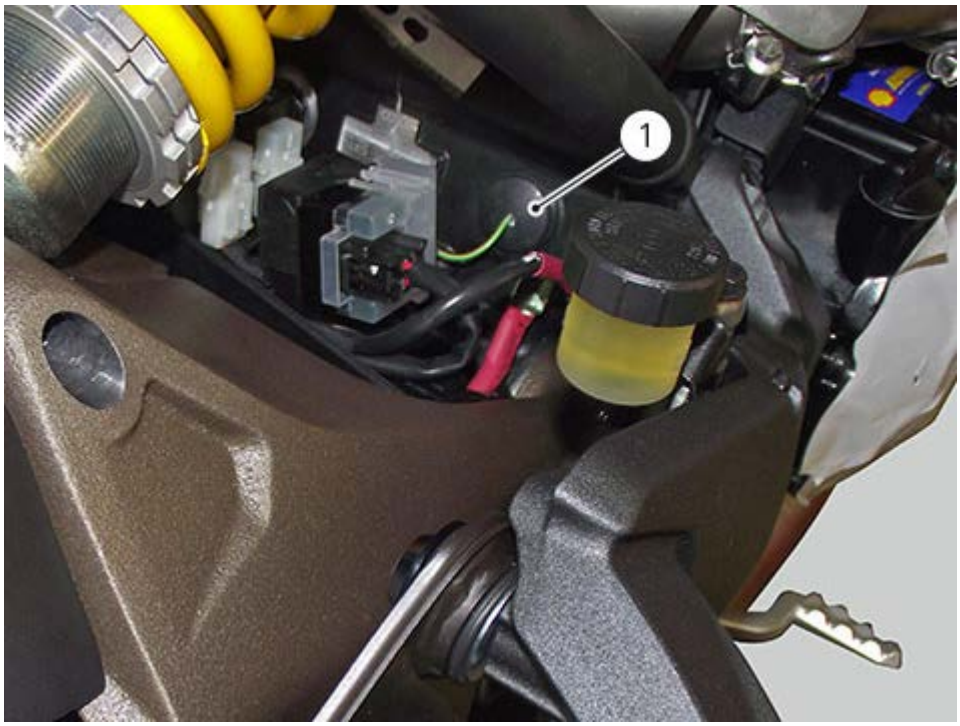


Electric diagram

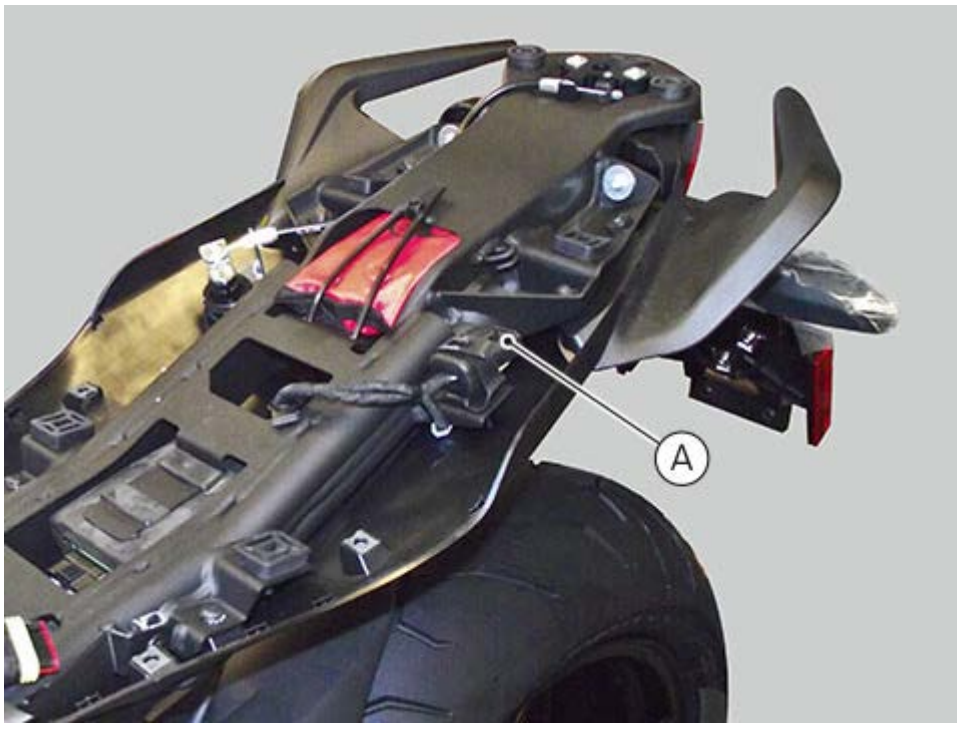

G/Y

Gear/neutral sensor

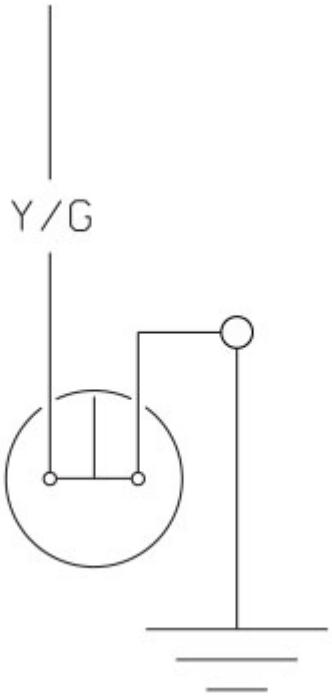
The gear sensor (1) is positioned on the vehicle rear RH side, near the solenoid starter.



To check operation of the gear sensor (1), connect the DDS 2 to the system through connector (A) located on the rear subframe, on the left side; remove the seat to reach it.

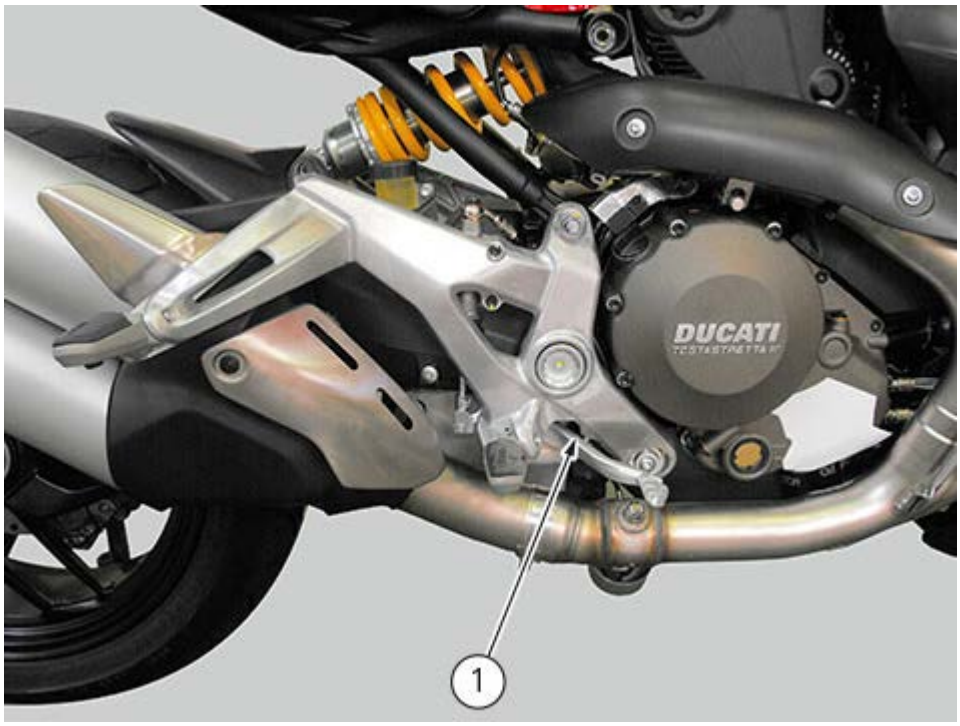


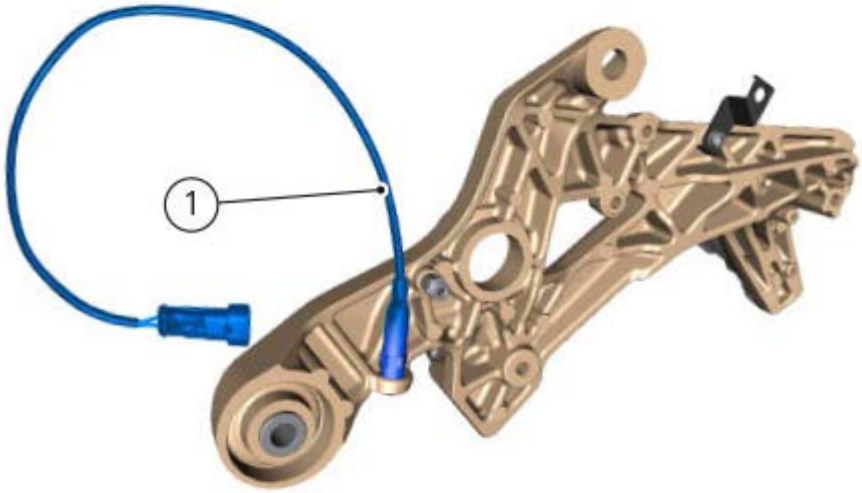
Electric diagram


Y/G

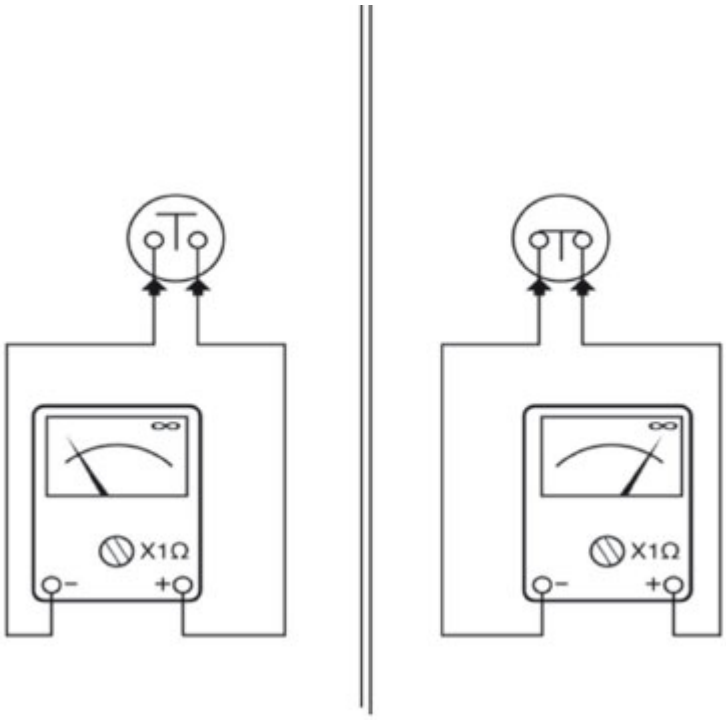
Rear stop switch

The rear STOP switch (1) is located inside the RH footpeg holder plate.



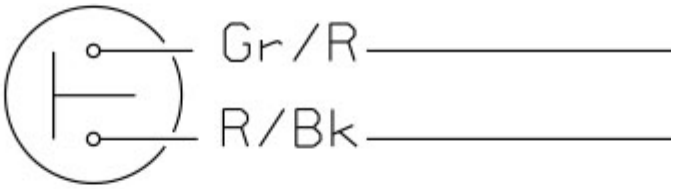


REAR STOP SWITCH CONTROL
To check operation of the rear (1) STOP switch, use a multimeter: when the rear brake lever is operated, there must be electric continuity between the terminals of the corresponding switch.
No electric continuity should be available when brakes are not operated.



Electric diagram

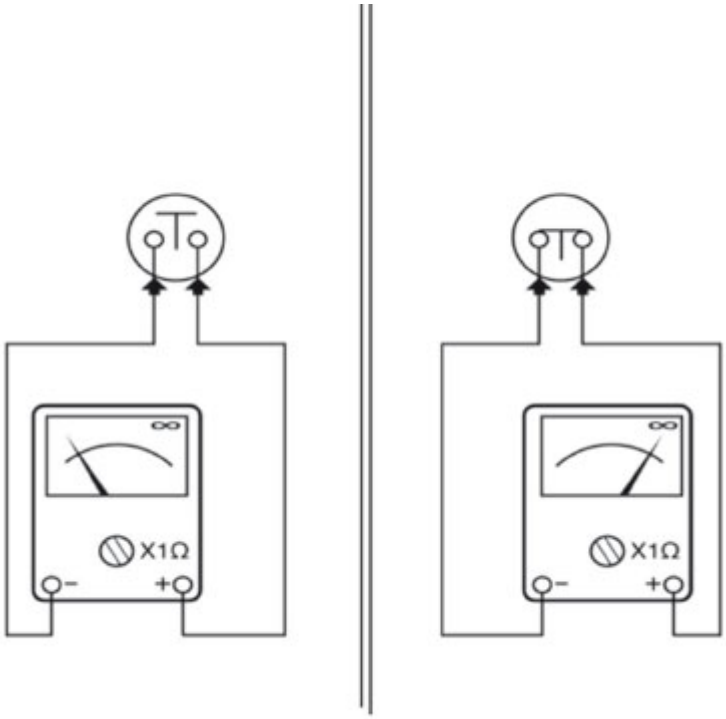
If these tests fail to produce positive results, the part in question must be replaced.



Front stop switch

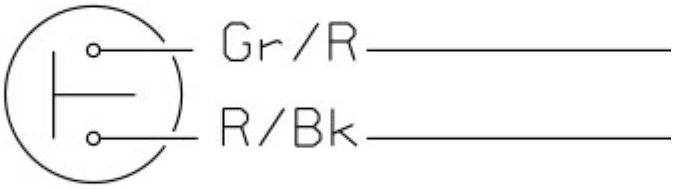
The front STOP switch (1) is located on the front lever front side.

FRONT STOP SWITCH CONTROL
To check operation of the front (1) STOP switch, use a multimeter: when the front brake lever is operated, there must be electric continuity between the terminals of the corresponding switch.
No electric continuity should be available when brakes are not operated.



Electric diagram

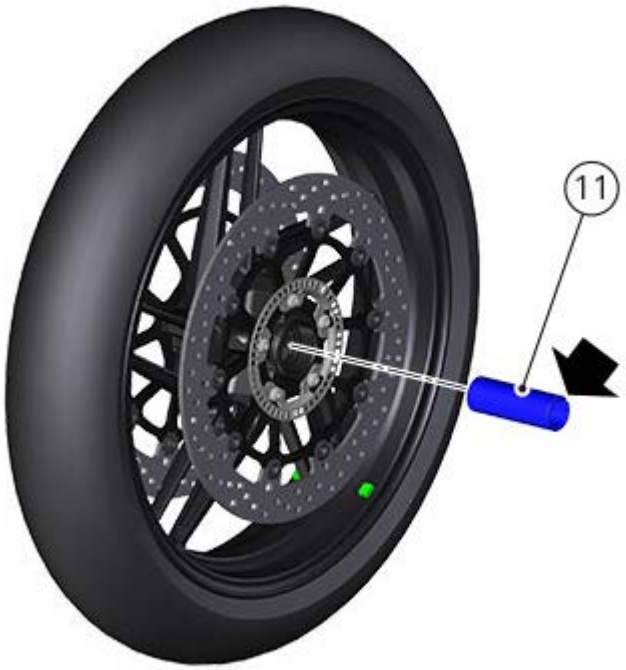
If these tests fail to produce positive results, the part in question must be replaced.


Gr/R
R/Bk

Refitting the front wheel

When all the necessary inspections have been completed, refit the wheel as follows.
Insert inner spacer (11).

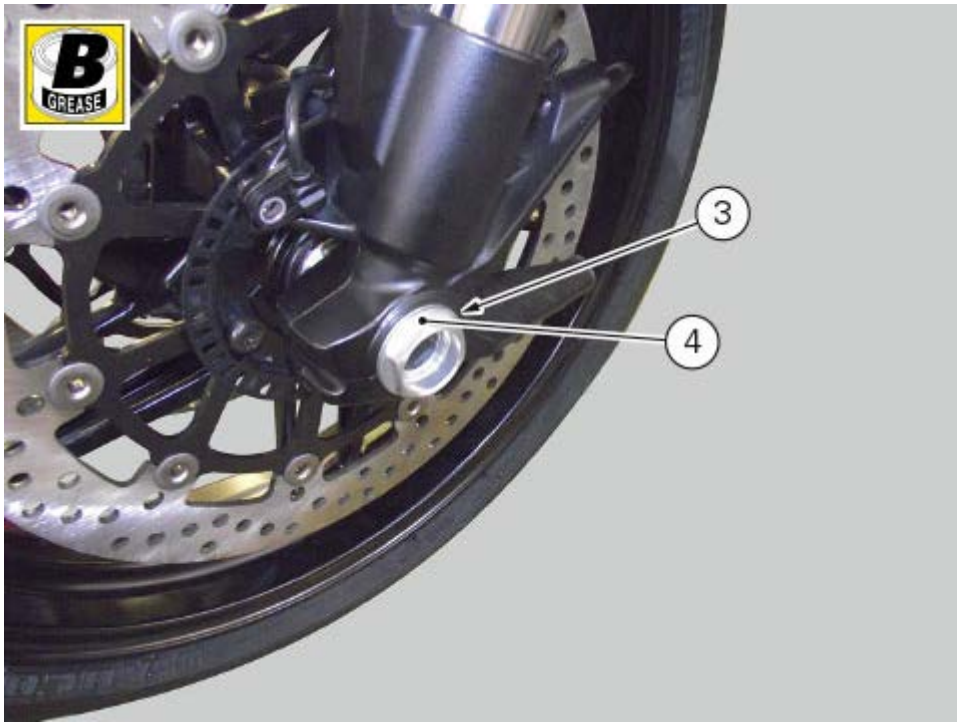
Important
The service hole on the internal spacer must be positioned on the wheel left side.



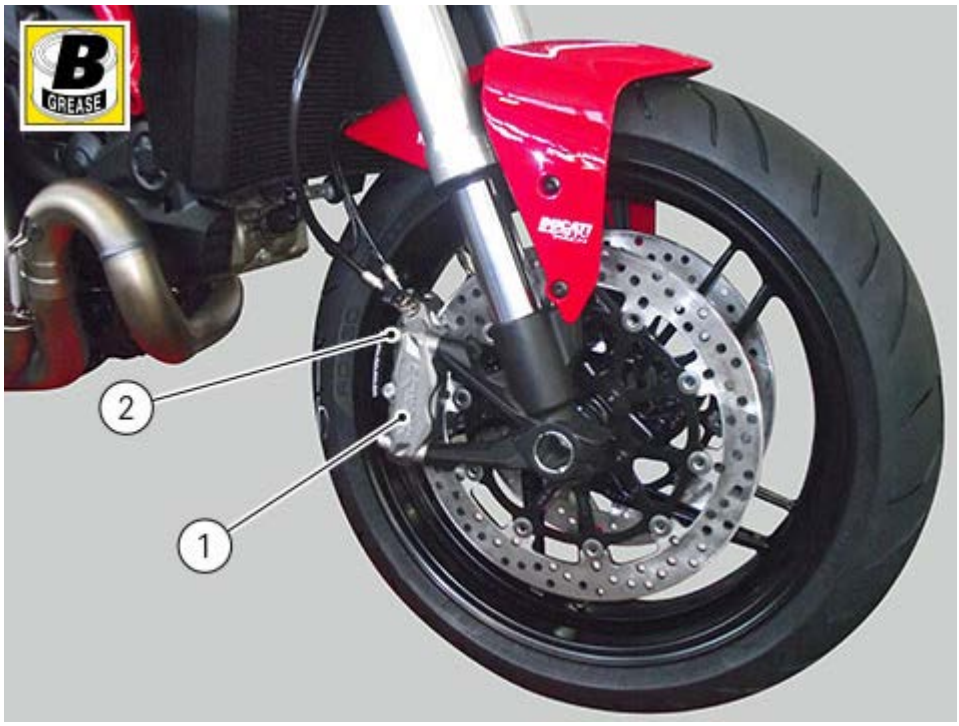
Duly lubricate and insert bearings (10), seals (9) and spacers (7) on wheel hub left-hand side and (8) on wheel hub right-hand side.

Fit the complete wheel between the fork legs.
Lubricate the shank and thread of the wheel shaft (6).
Take pin (6) fully home into the wheel hub.

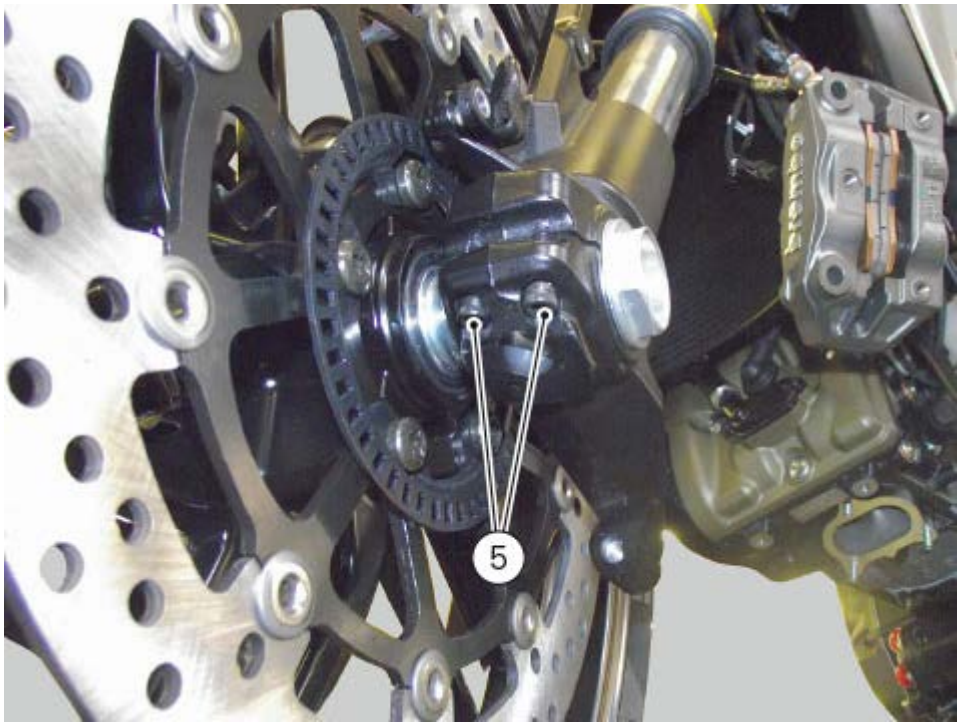
Fit the washer (3) on the end of the wheel shaft.
Grease thread and underhead of the locking nut (3) and then screw it on.
Tighten nut (4) to a torque of 63Nm ± 5%.



Apply grease to the threads and underside of the screws (2).
Tighten the two screws (2) securing brake callipers (1).
Operate the front brake lever two or three times.
Hold the lever pulled towards the handgrip and simultaneously tighten the screws (2) to a torque of 45Nm ± 5%.



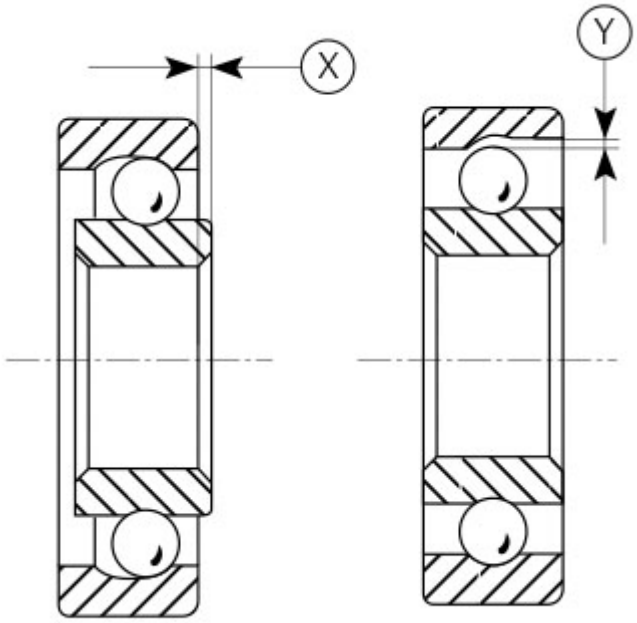
Before tightening the screws (5), lower the bike to the ground and push up and down on the handlebar to load the suspension; so the fork legs will become properly seated onto the wheel shaft.
Tighten the screws (5) to a torque of 10Nm ± 5%, following a 1-2-1 sequence.



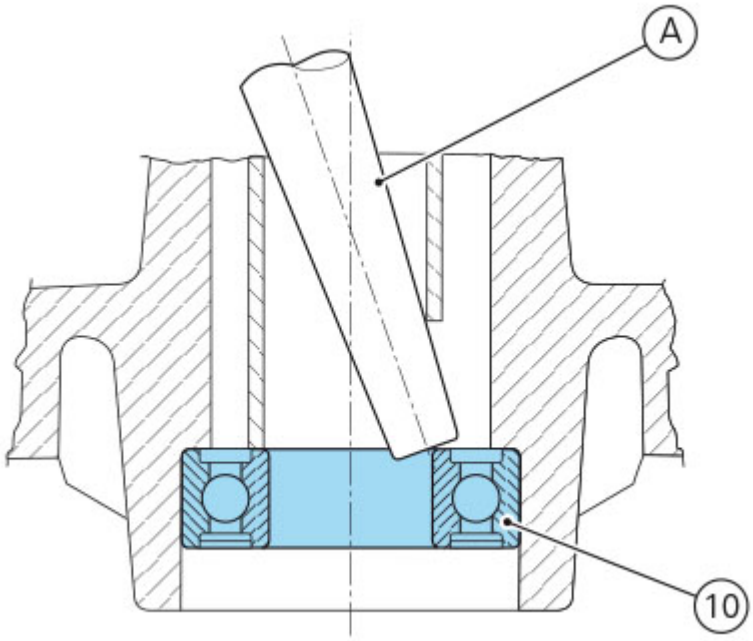
Overhauling the front wheel

Wheel bearings

Before checking the dimensions, check for wear on wheel hub bearings. Check for wear by hand after cleaning and degreasing the bearings in their seats.
Turn the internal ring and check that the internal balls move freely: any irregularity indicates deformations like those indicated in values "X" and "Y".
An excessive wear can cause vibrations and instability of the vehicle and therefore it is necessary to replace the bearing.



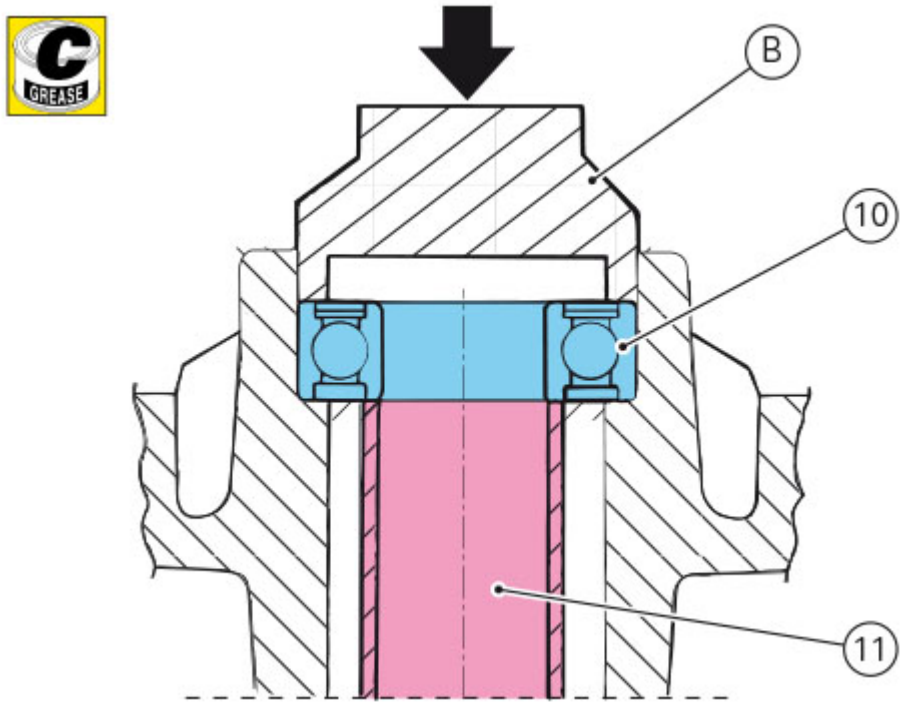
To remove the bearings (10) and the dust seals (9) from the wheel hub follow the instructions below.
Position a drift (A) against the inner ring of the bearing (10).
Tap with a hammer until removing the bearing (10).
Apply the drift at different points to facilitate the removal.



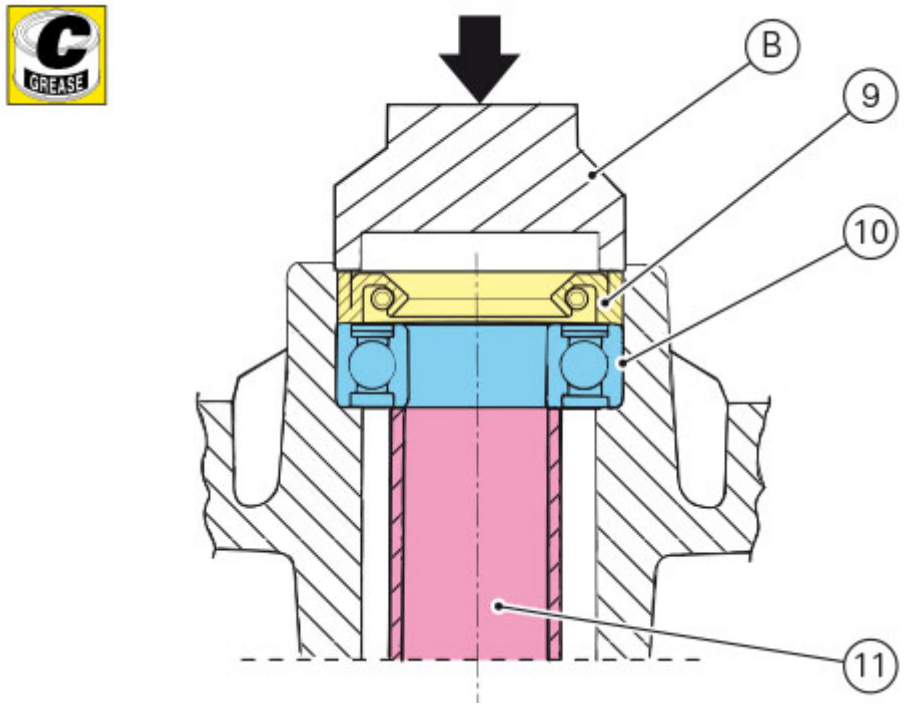
Important
Once removed, the used bearings and sealing rings must not be refitted.

Before fitting new bearings, check that the seat is clean and free from scoring and damage.

Grease the bearing seat and then push the new bearing into its seat.
Using a tubular drift (B) that only bears on the outer ring of the bearing (10) to drive the latter fully into its seat.



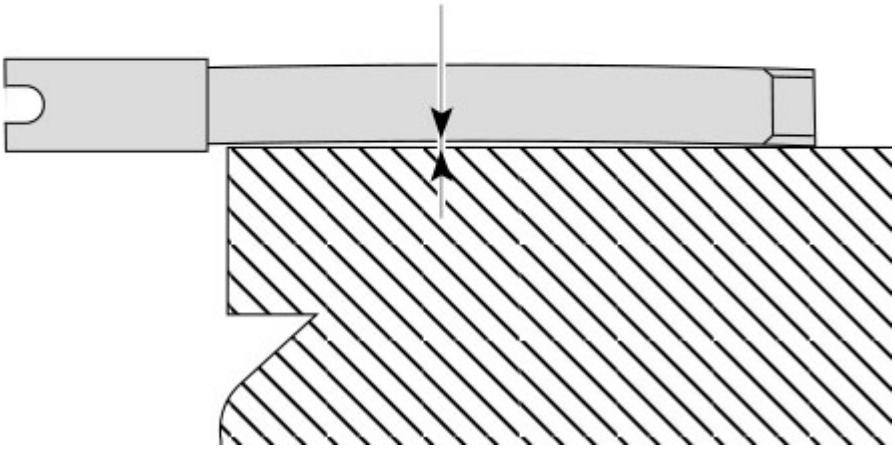
Use the same method to install the dust seals (9).
Ensure that spacer (11) is fitted between the two wheel hub bearings.



Note
Wheels must be rebalanced after repair, maintenance and overhaul operations.

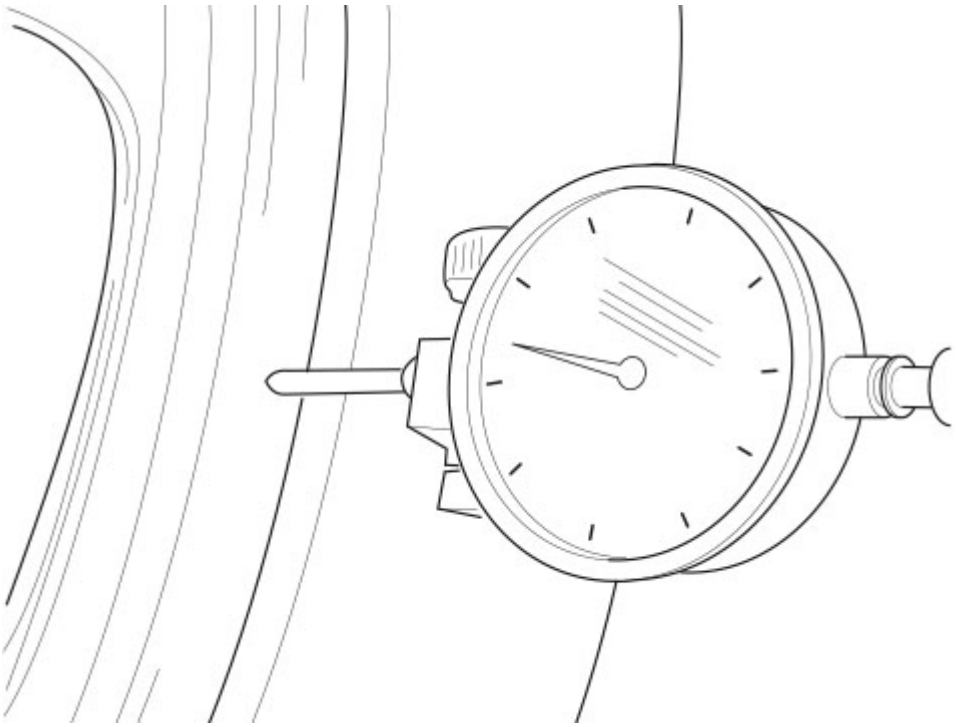
Inspecting the wheel shaft

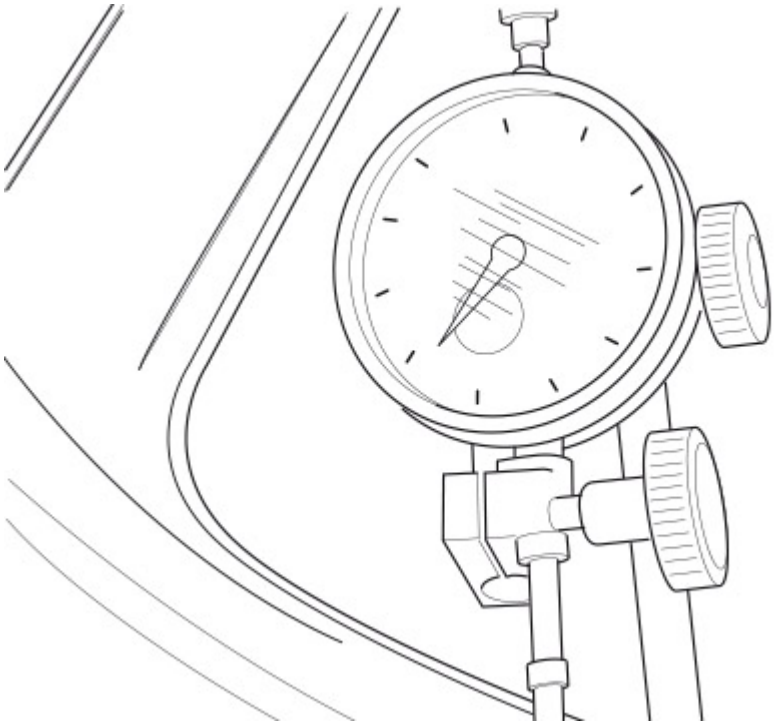
Check the wheel shaft for straightness.
Turn the shaft on a reference surface and measure maximum distortion using a feeler gauge, comparing it with the reference values (Front wheel).
If non conforming, replace wheel shaft.



Overhauling the wheel rim

After you have checked the bearings, check the rim as follows.
Visually inspect the rim for cracks, scoring and deformation: change the rim if damaged.
Insert the shaft in the wheel and position it on two fixed reference blocks.
Using a dial gauge, measure rim runout and out-of-round with respect to the shaft axis.



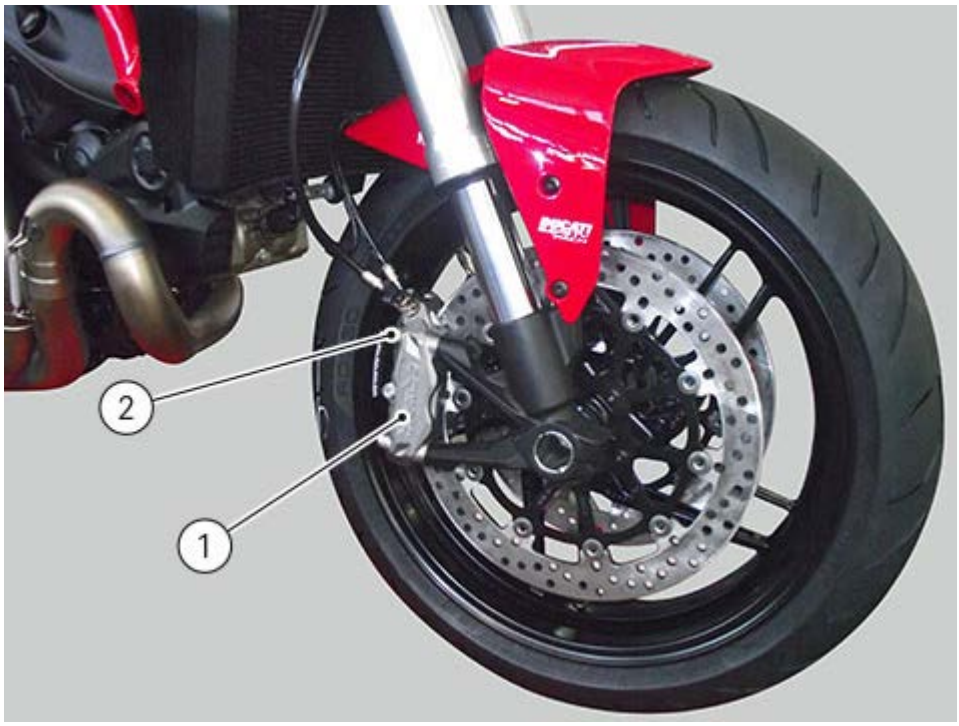


If the values measured are not within the tolerance limits, replace the wheel (Front wheel).

Removing the front wheel

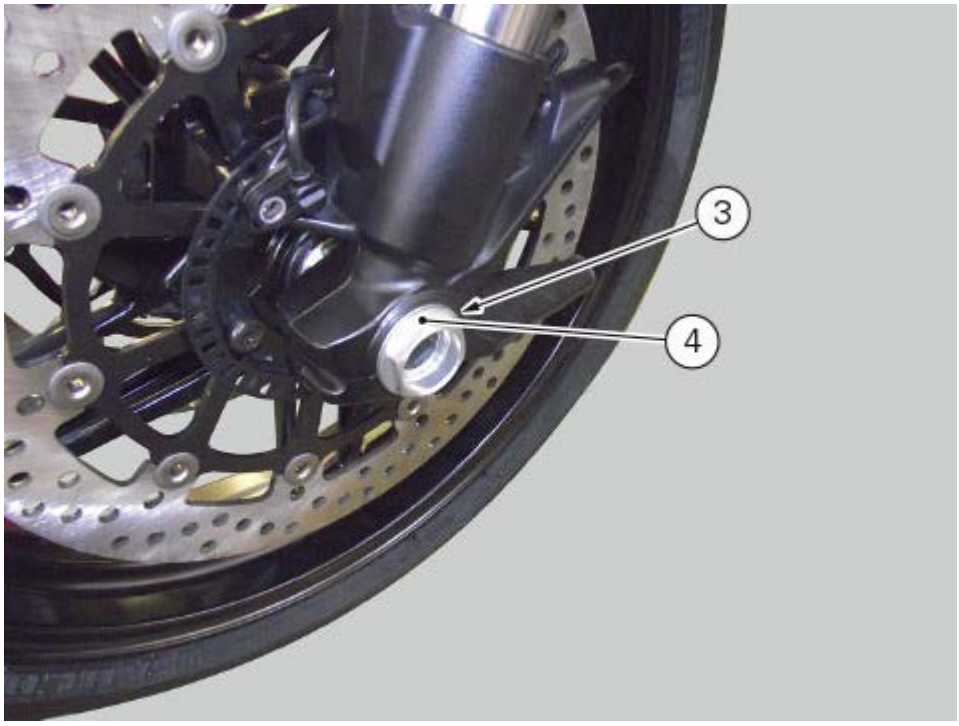
Warning
The following procedure refers to one version of the vehicle, but applies to both of them.

Support the bike so that the wheel to be removed is raised from the ground.
Working on both sides, remove front brake callipers (1) by loosening the two screws (2) securing the calliper to the fork leg without disconnecting them from the hoses.



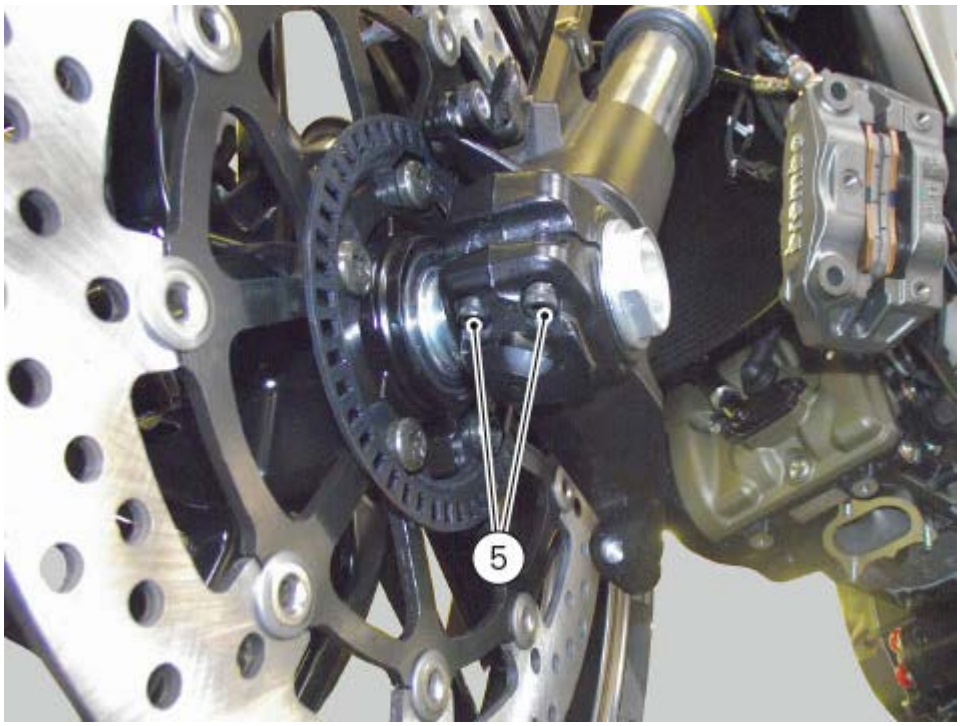
Warning
Do not operate the brake lever when the callipers are removed. This can cause the brake pad pistons to come out.

Loosen and remove nut (4) on wheel shaft left side.
Collect washer (3).



Working on both sides, loosen screws (5) securing pin on fork legs.

Working from the left-hand side, use a plastic mallet to drive the wheel shaft (6) out from the opposite side and remove it.



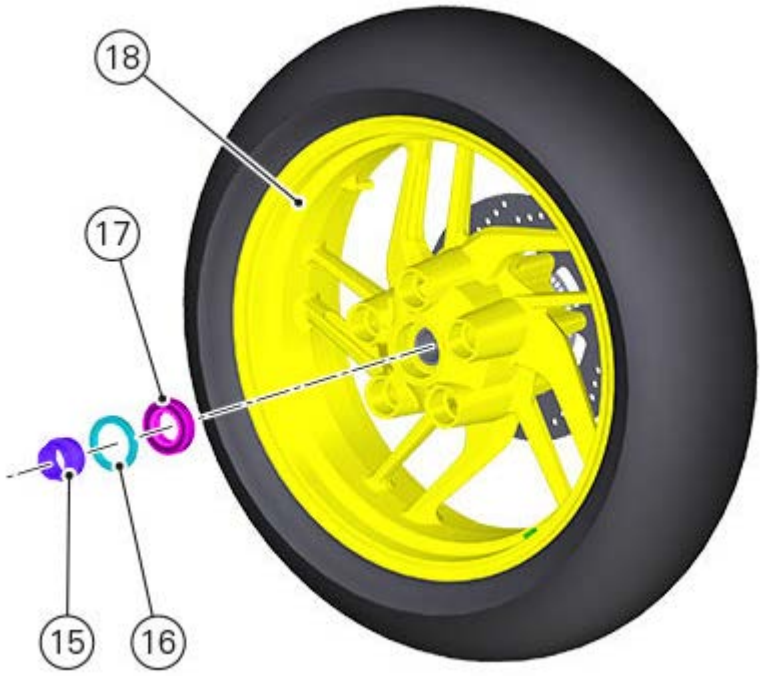
Slide out wheel and keep spacers (7) on left-hand and (8) on right-hand sides.
If necessary, working on both sides, remove dust seals (9) and bearings (10).
Remove the inner spacer (11).


8
9
10
11
10
9
7

Refitting the rear wheel

CHAIN SIDE (LH side)

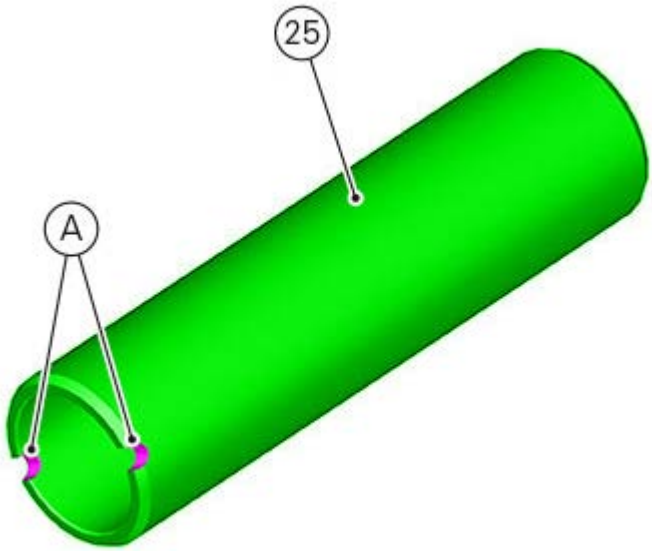
If removed, fit a new bearing (17) and seal (16) on the rear rim (18), LH side.
Insert flange spacer (15).



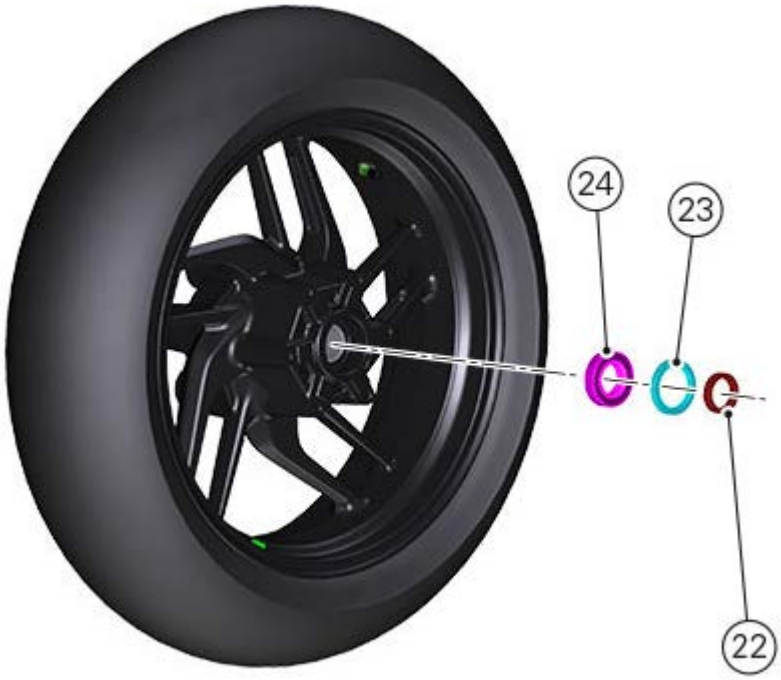
Refit the complete rear sprocket (Refitting the rear sprocket).

RIGHT SIDE (brake side)

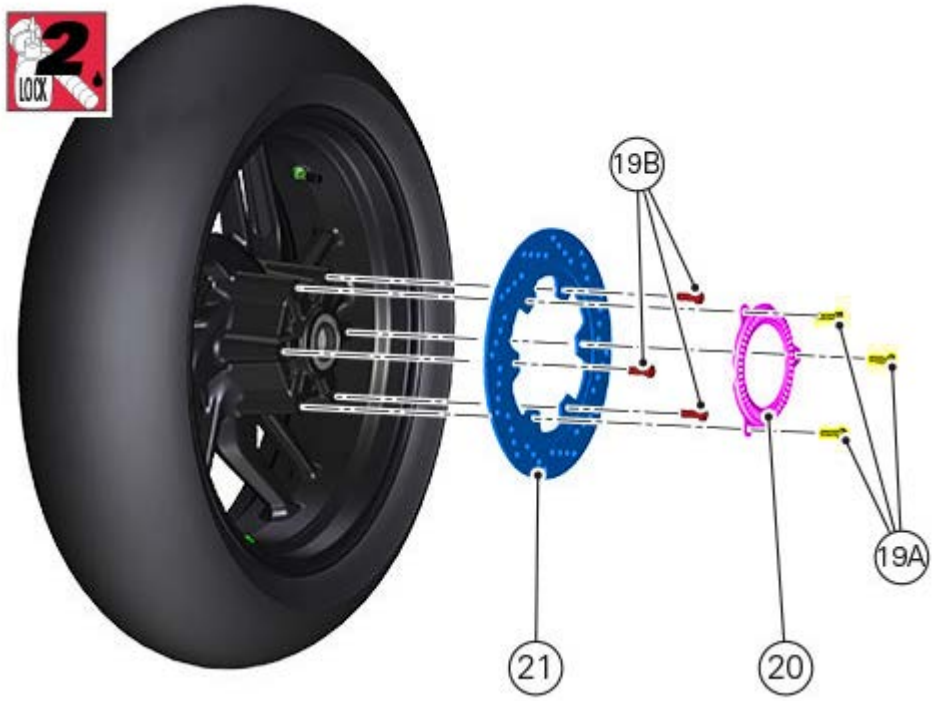
Insert pin (25) with service hole (A) facing the chain side.



Fit bearing (24), seal (23) and bearing spacer (22).



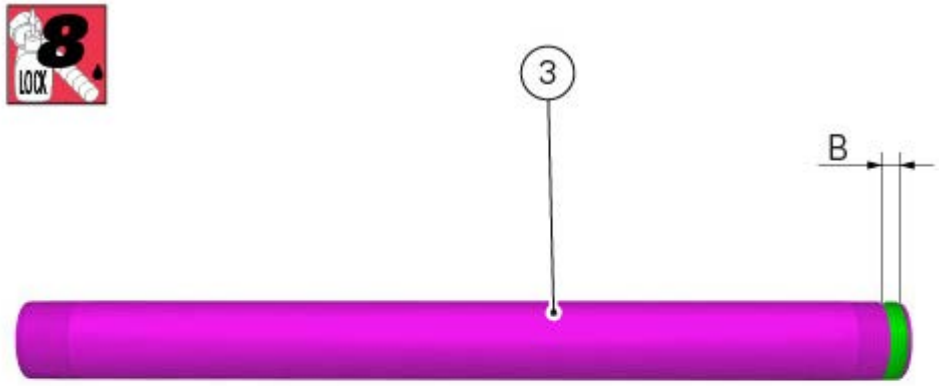
Position the rear brake disc (2) on the rim and tighten the three screws (19B) to a torque of 25 Nm ± 5%, after applying the indicated product.
Position the phonic wheel (20) on the brake disc and tighten the three screws (19A) to a torque of 25 Nm ± 5%, after applying the indicated product.

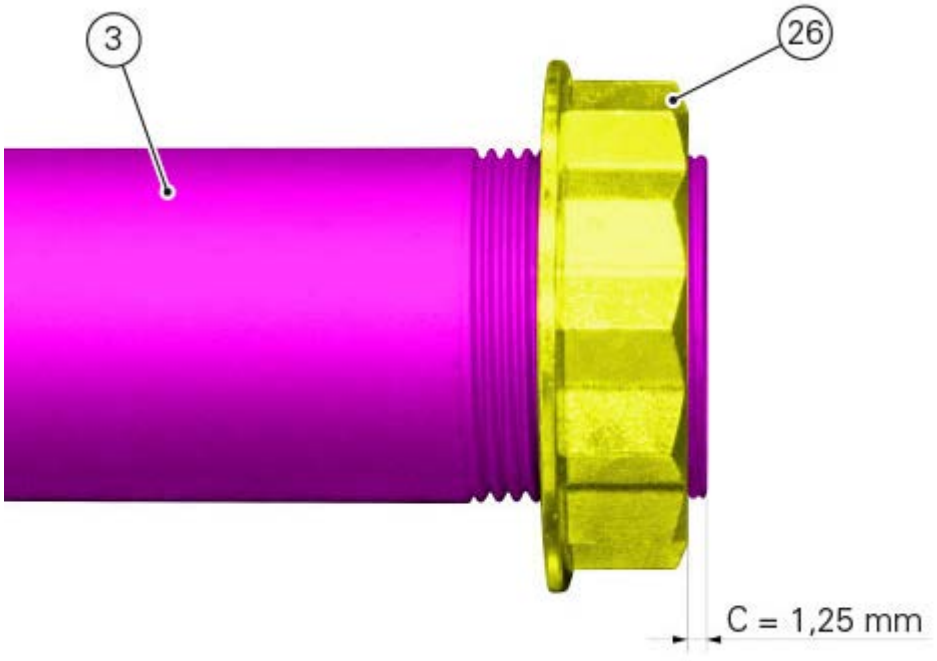


GENERAL INFORMATION

In case it has been necessary to replace the rear wheel shaft, reassemble it as indicated:
- Apply indicated product on the left-hand thread of the new rear wheel shaft (3): smear product on area "B" until having C=1.25 mm of uncovered thread, as indicated.
- Manually screw the LH nut (26) until reaching the defined value (C=1.25 mm of uncovered shaft thread).

Warning
Wait a sufficient time for the applied sealant to cure (approximately 12 hours).





- Lubricate the shaft with the indicated product and insert it from the LEFT side.
Start RH nut (2).

Reposition the chain on the rear sprocket.

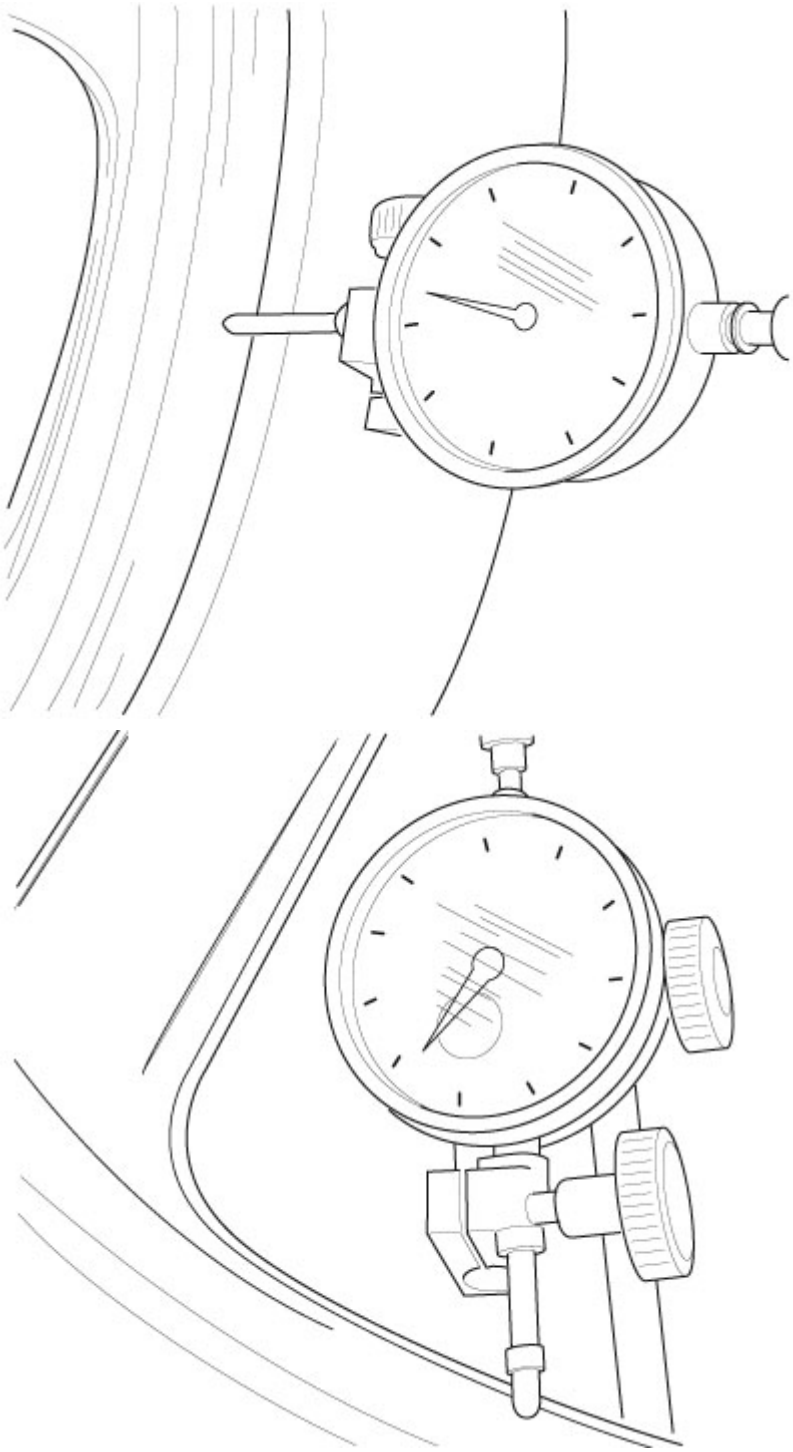
Tension the chain (Adjustment of chain tension).
Tighten nut (2) to a torque of 180Nm ± 5%.
Refit the rear brake calliper (1) on the disc (Refitting the rear brake calliper).

Important
IT IS IMPORTANT TO ADJUST THE CHAIN TENSION BEFORE TIGHTENING THE REAR WHEEL NUT.


B
GREASE
2
1

Overhauling the wheel rim

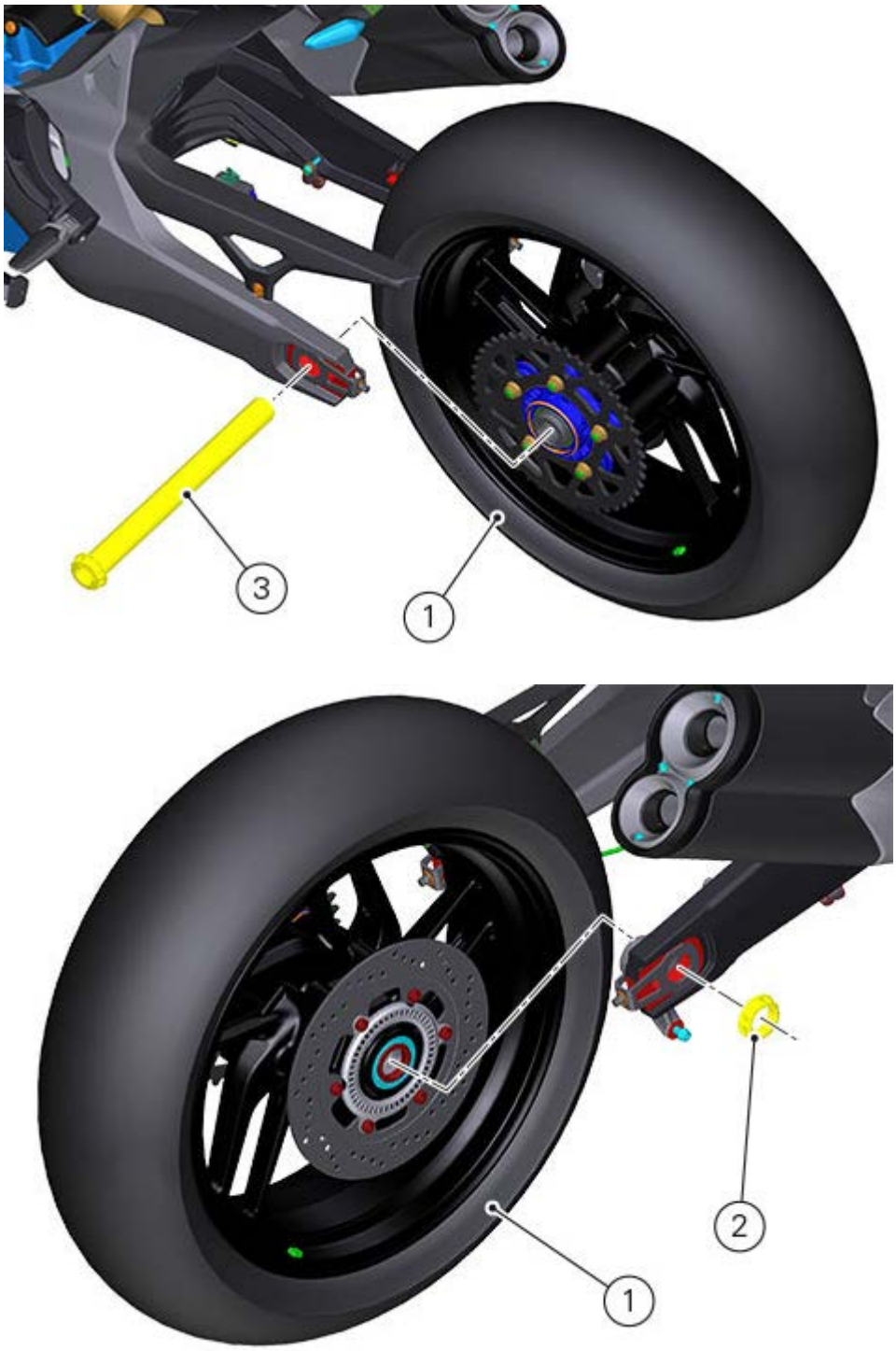
Inspect the wheel rim as follows.
Visually inspect the rim for cracks, scoring and deformation: change the rim if damaged.
Using a dial gauge, duly supported, measure rim runout and out-of-round relative to the shaft axle.
If the values measured are not within the tolerance limits, replace the wheel.



Removing the rear wheel

Properly support the motorcycle with the service stand and engage the first gear.
Remove the rear brake calliper (1) (Removing the rear brake calliper).
Using a suitable socket, loosen the wheel right nut (2).

Slide out wheel shaft (3) from the vehicle LH side.
Release the chain from the rear sprocket and remove the wheel (4).

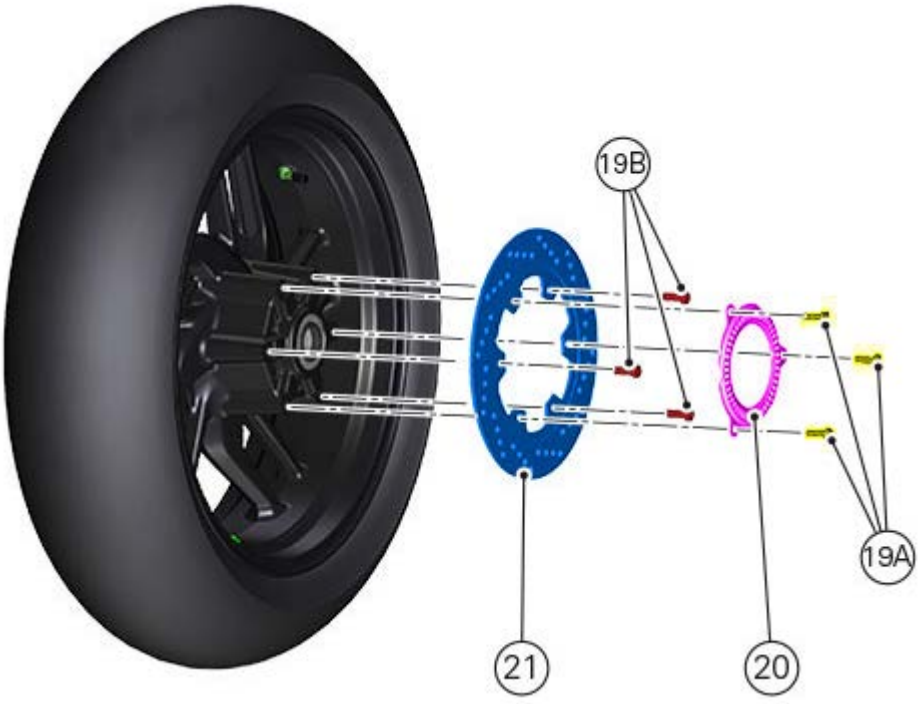


Collect spacer (5) from the rear sprocket side.

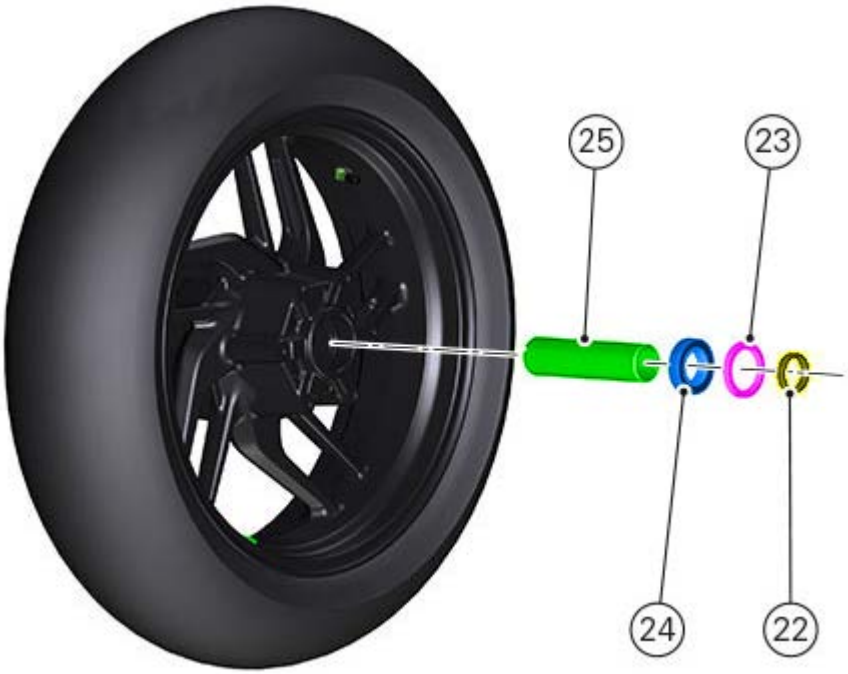
If it is necessary to disassemble the rear wheel (4), proceed as described below.

LEFT SIDE (CHAIN SIDE)
Remove the complete rear sprocket (Replacing the rear sprocket).

RIGHT SIDE (BRAKE SIDE)
Loosen the three screws (19A) and slide out the phonic wheel (20).
Unscrew the three screws (19B) and remove the rear brake disc (21).



Remove the RH internal spacer (22) seal (23) and the RH bearing (24).
Remove the inner spacer (25).

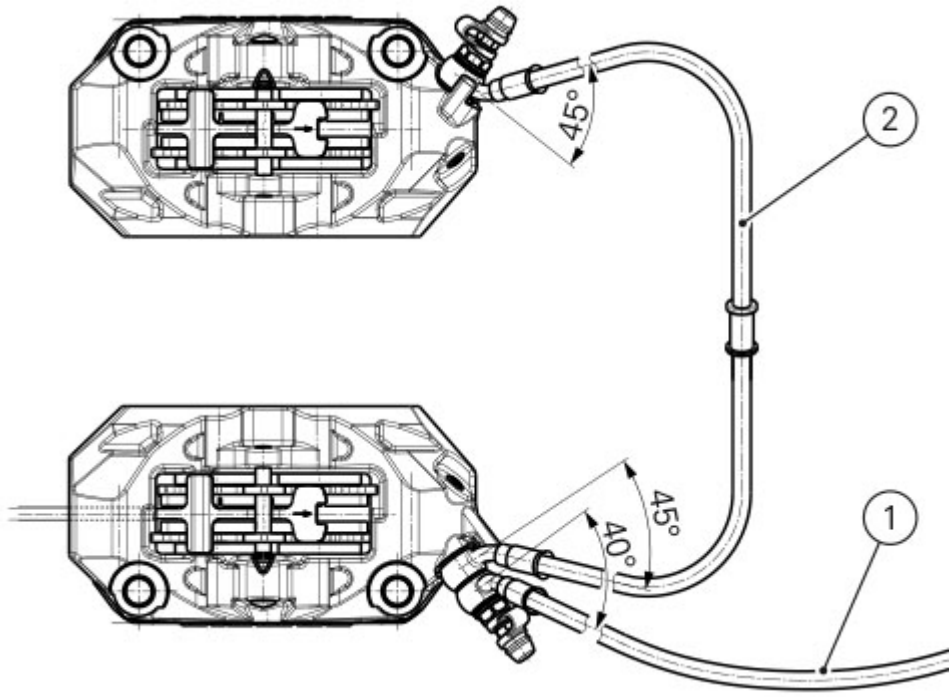


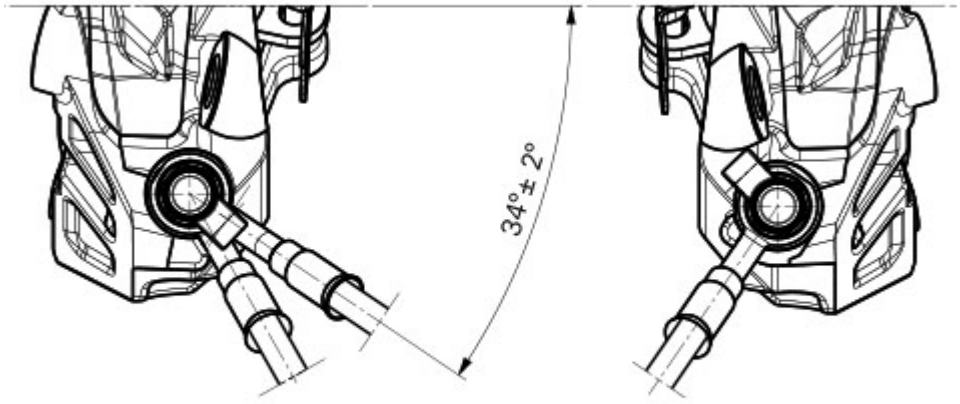
Refitting the front brake system

Refit the front brake master cylinder (Refitting the front brake master cylinder).
Upon the system refitting, pay attention to the orientation of the hose unions on the master cylinder and on the callipers.

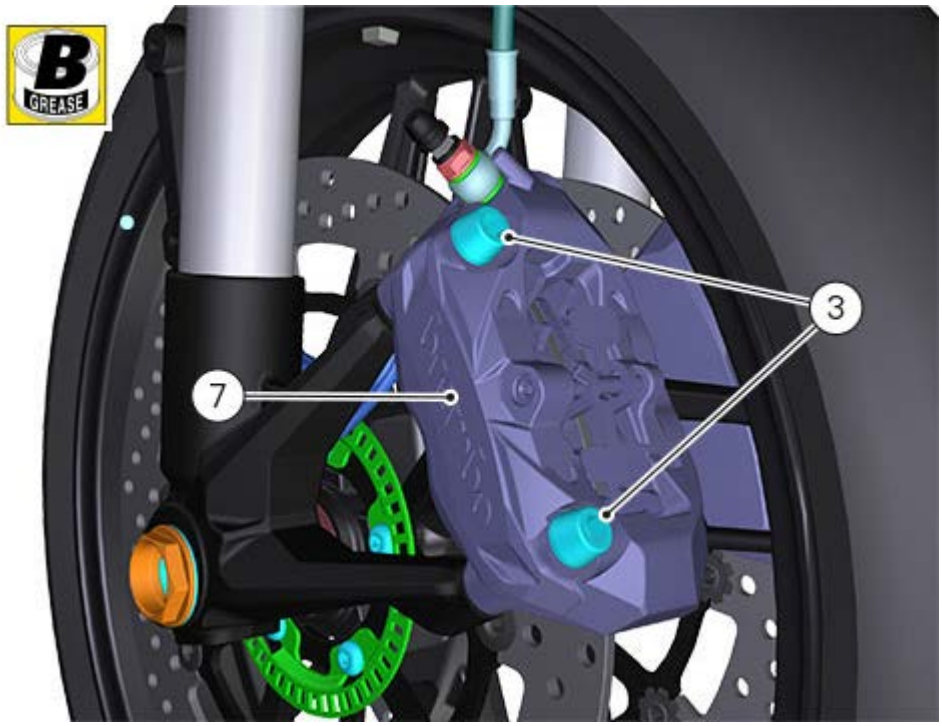
Warning
If incorrectly positioned, hoses can affect brake operation and foul moving parts. Position the component as shown in the figure.

Position calliper-master cylinder hose unions (1) on front brake callipers.
Position RH calliper — LH calliper hose unions (2) on front brake callipers.

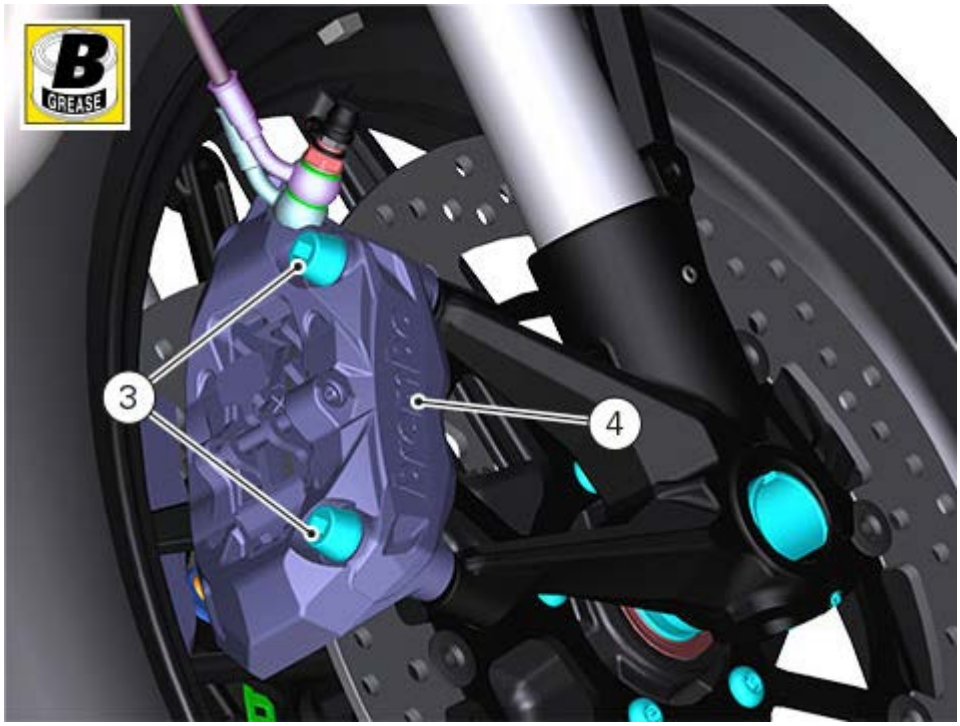




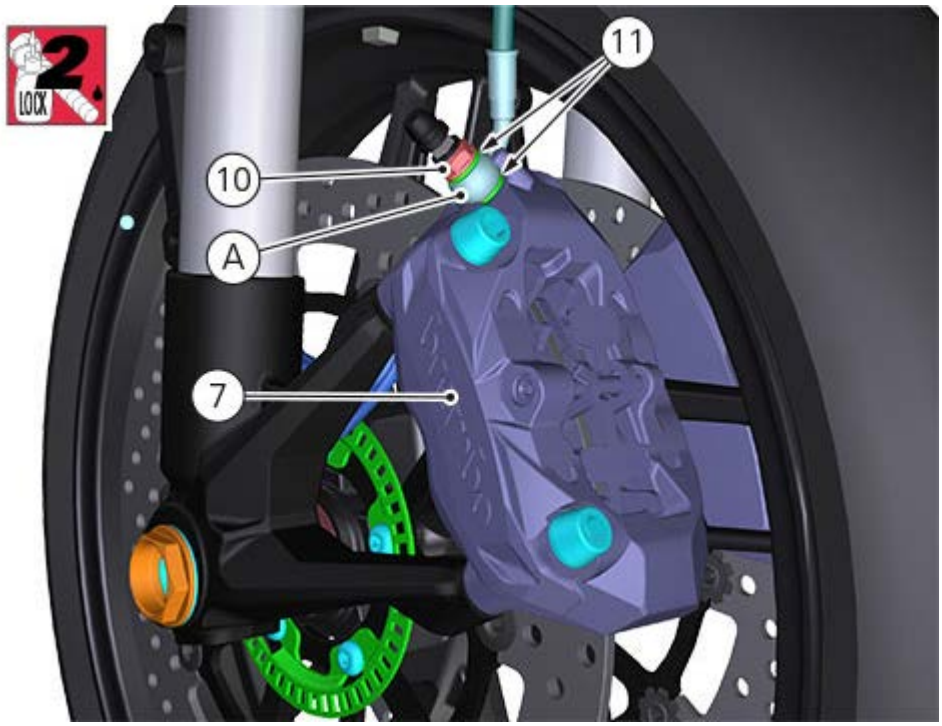
Working on the LH calliper (7), pre-tighten screws (3) to a torque of 2 Nm ± 10% after having applied the specified product.



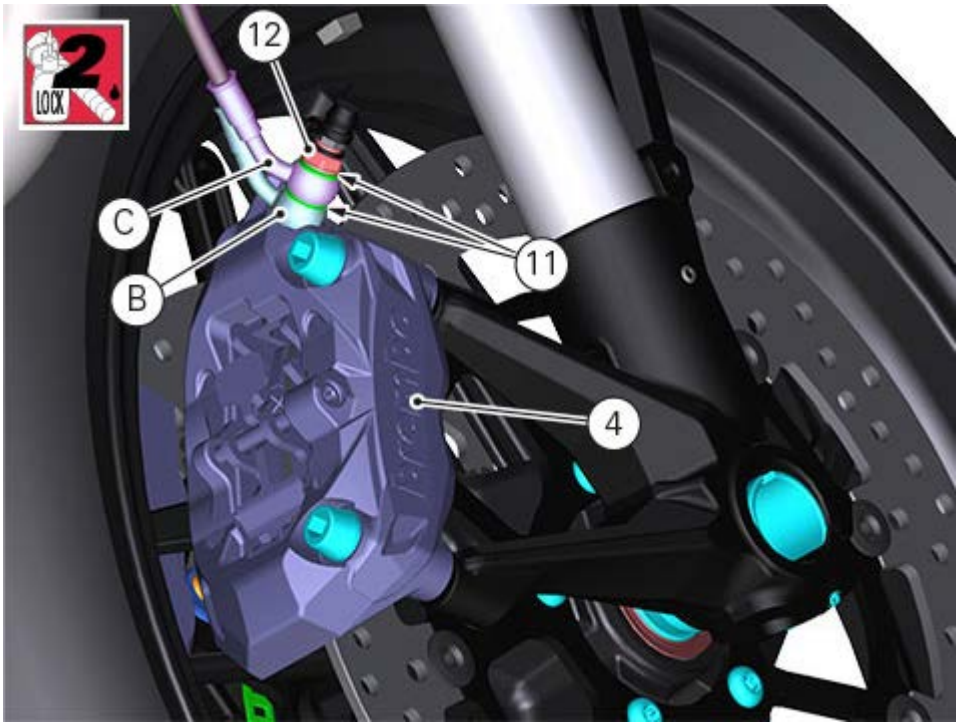
Perform the same operation on the RH front calliper (4) and the relevant screws (3).



After positioning hose (2) connecting LH — RH calliper (end (A)) and washer (11) on the RH calliper (4), tighten special screw (10) to a torque of 10 Nm ± 10%, after applying the indicated product.

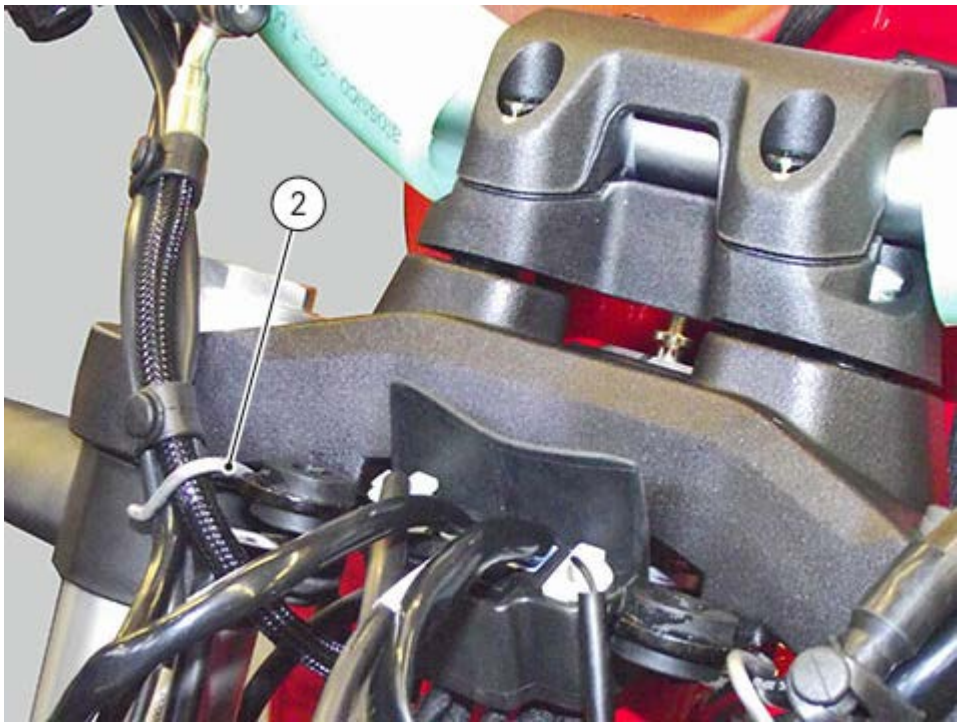


Position on LH calliper (7), hose (2) connecting RH — LH calliper (end (B)), washer (11), hose (1) connecting master cylinder — RH calliper (C), washer (11) and tighten special screw (12) to a torque of 10 Nm ± 10% after applying the indicated product.

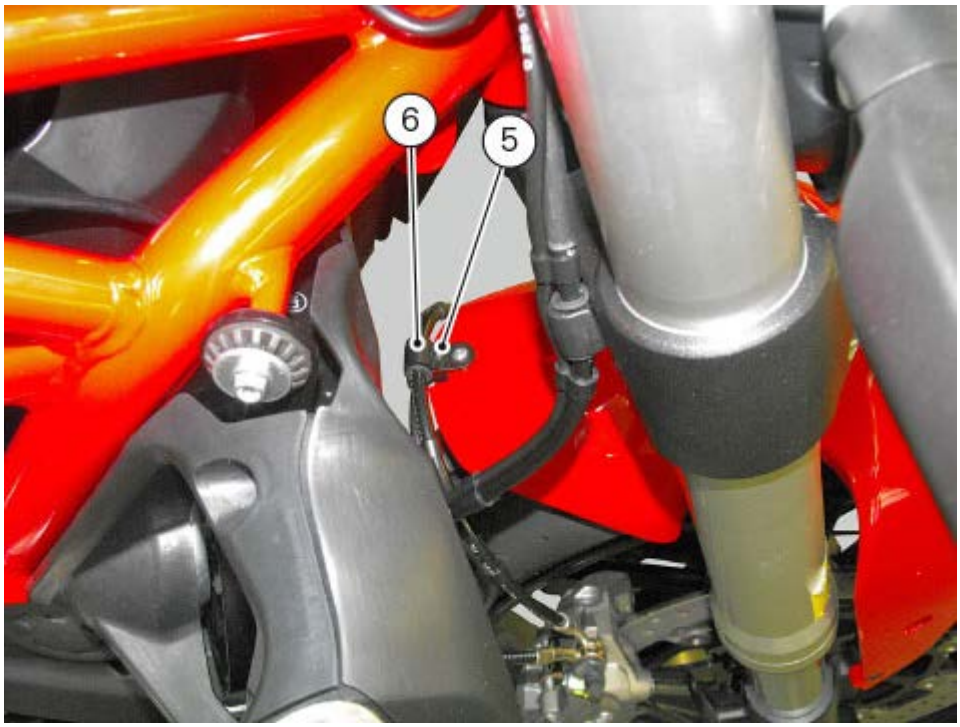


Tighten screws (3) on the front LH (7) and RH (4) callipers to a torque of 45 Nm ± 5%.

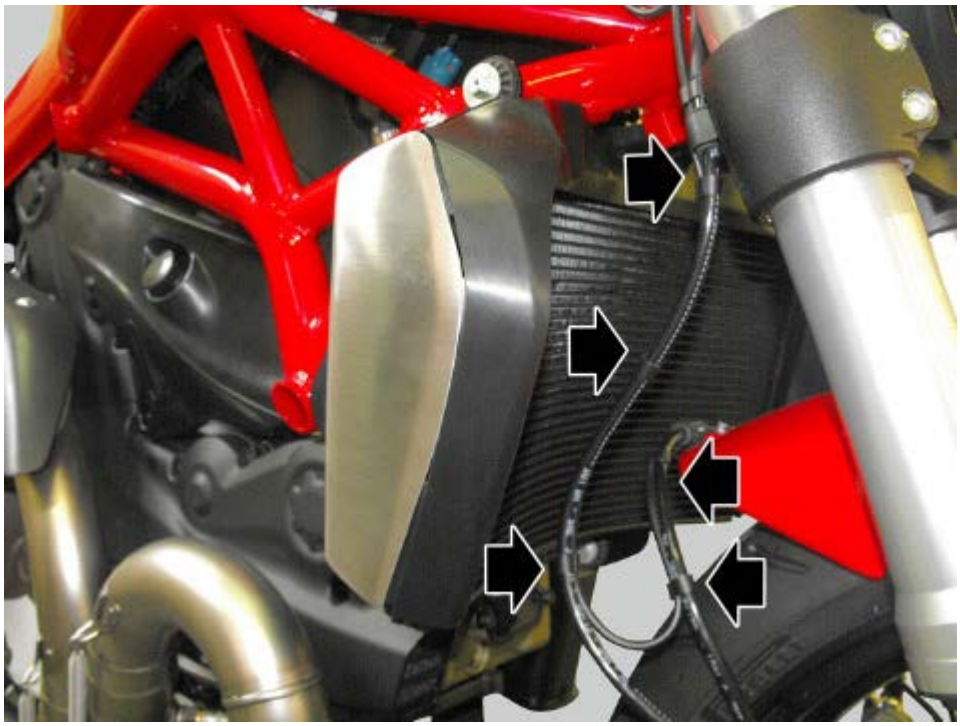
Slide the brake calliper — master cylinder hose (1) and the ABS cable inside cable ring (2).



Fix calliper — master cylinder hose (1) and ABS sensor cable (9) inside cable ring (6), and tighten this latter with screw (5).



Re-arrange hoses and secure them inside cable rings as shown in the figure.



Refitting the brake discs

Before refitting the brake disc to the wheel, clean all contact surfaces thoroughly and apply the indicated product on the threads of retaining screws (1) and (5).
Fit the phonic wheel (3) and disc (2) working on the LH side.
Tighten the screws (1) retaining the brake disc (2) to the wheel following a cross pattern.
Tighten the screws (1) to a torque of 30 Nm ± 5%.

Working on the RH side, fit brake disc (4) and tighten screws (5) to a torque of 30 Nm ± 5% following a cross pattern.

Refit the wheel on the motorcycle (Refitting the front wheel).

Overhauling the front brake components

Important

The brake callipers manufacturer advises against servicing the brake callipers due to the safety critical nature of this component. Incorrect overhaul of this component could endanger rider safety.

Operations should be limited to replacement of the pads, fasteners and the bleed valve assembly.
The brake disc must be clean, without any signs of rust, oil, grease or dirt and no deep scoring.
To check the brake discs for wear follow the data detailed in chapter "Technical data".

Removing the brake discs

The front brake discs consist of an inner carrier, which is mounted to the wheel, and an outer rotor. Both parts must be replaced together as a pair.

Remove the front wheel (Removing the front wheel).

To remove the LH brake disc (2), loosen screws (1) and slide it out together with phonic wheel (3).

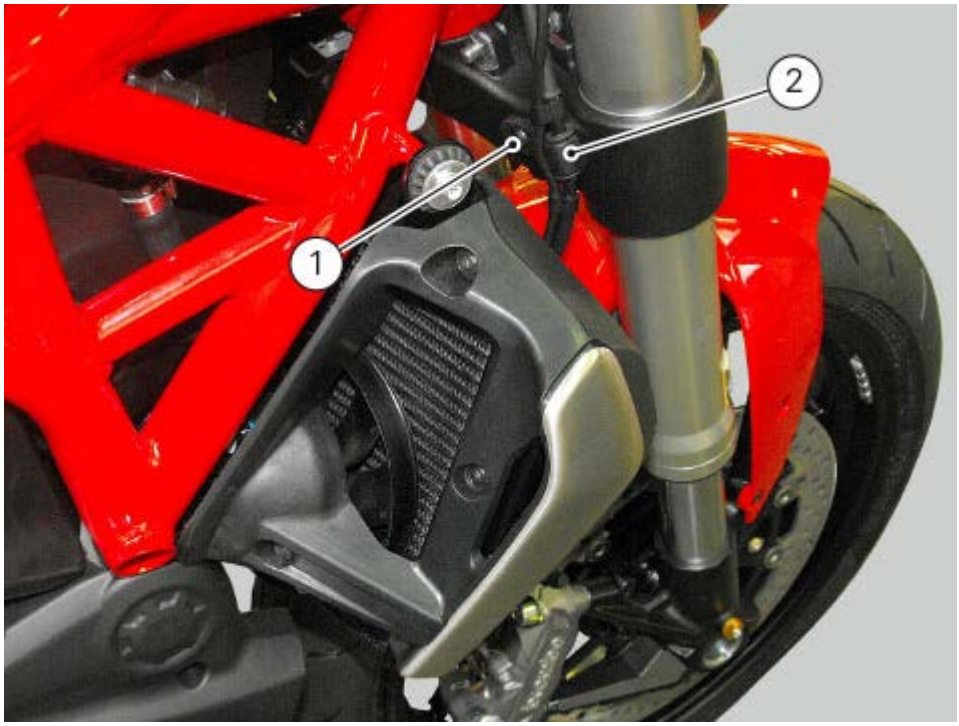
To remove the RH brake disc (4), loosen screws (5) and slide it out.

Removing the front brake system

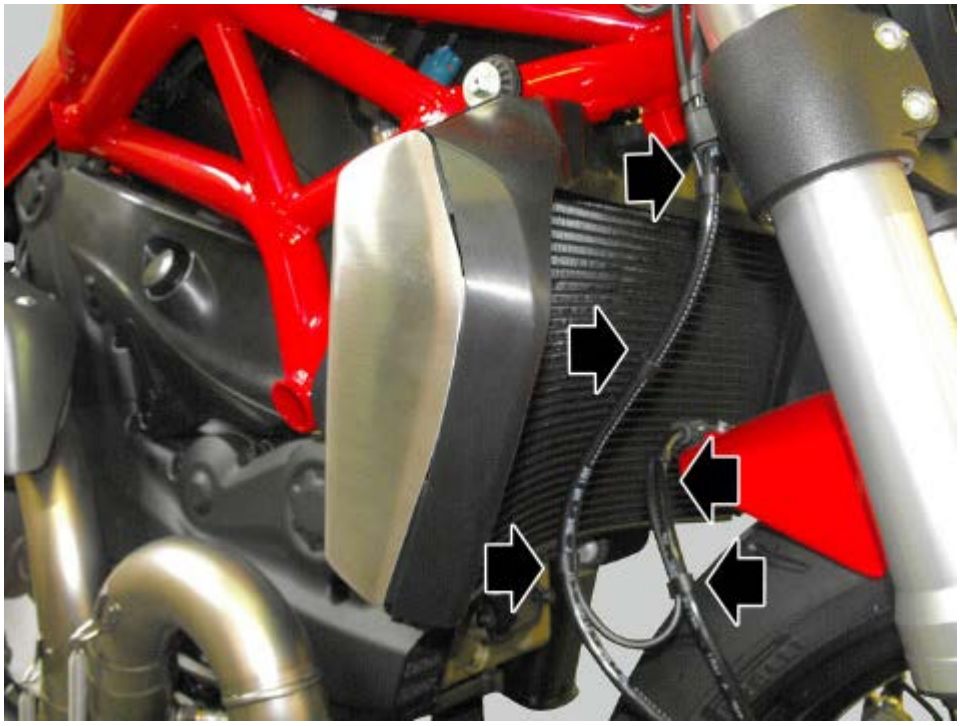
Drain the front braking system (Changing the front brake system fluid).
Remove the RH rear-view mirror (Removing the rear-view mirrors).
Remove the front brake master cylinder (Removing the front brake master cylinder).

For the front ABS brake system, please also refer to Sections "ABS system operation information" and chapters "System components" and "ABS component maintenance".

Loosen screw (1) and release cables from bracket (2) positioned on bottom yoke.

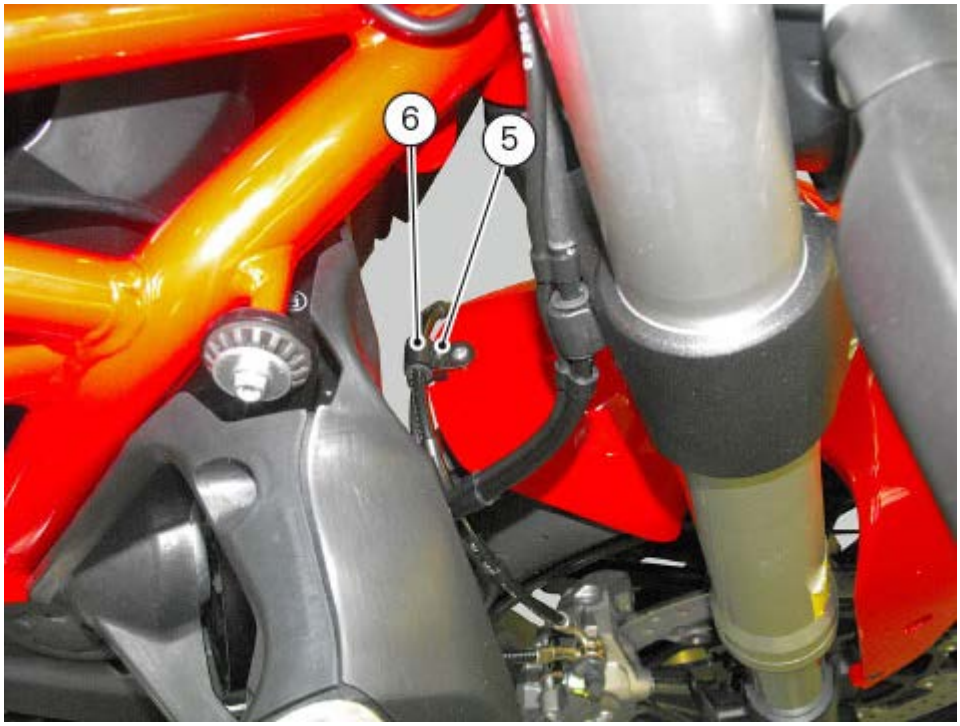


Release front brake hoses from cable rings.



Loosen the two retaining screws (3) securing the left front brake calliper (4) to the fork leg.
Repeat the same procedure on RH brake calliper (7).

Loosen screw (5) and release brake hoses from cable rings (6).

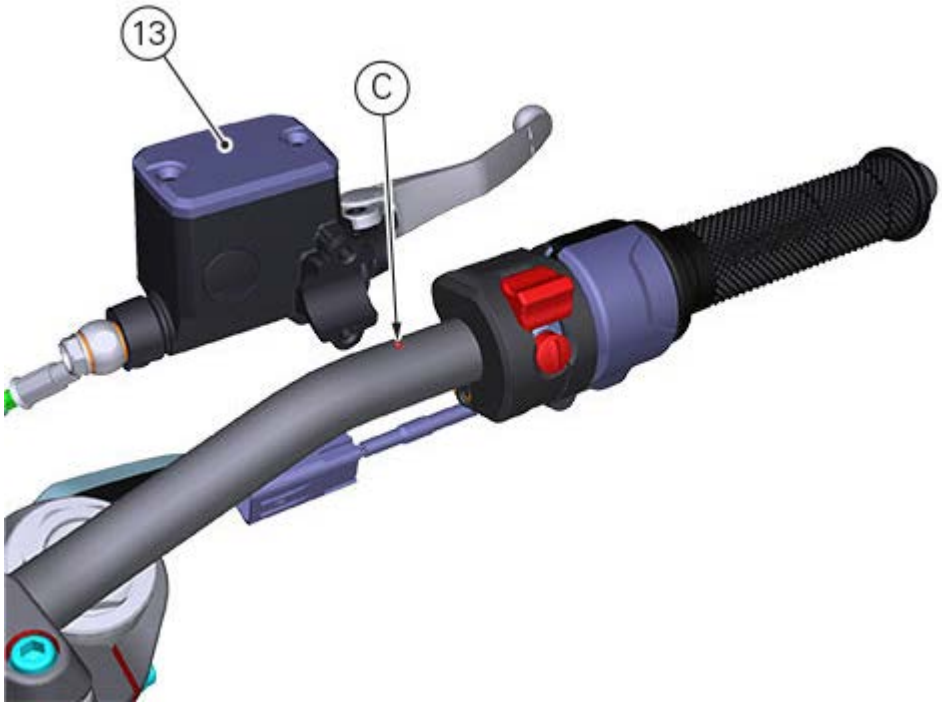


 Warning
Brake fluid is corrosive and will damage paint. Avoid contact with eyes and skin. In case of accidental contact, wash thoroughly with water.

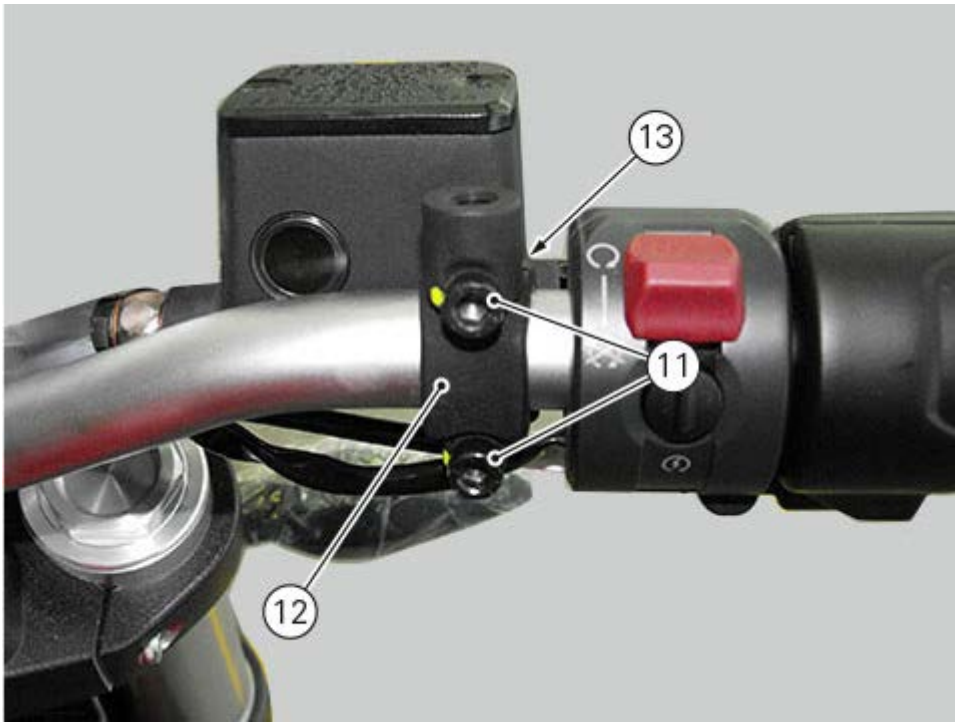
For all maintenance operations (wear check and replacement of brake pads, front braking system fluid change, rear braking system fluid change etc.) see also chapter, "Maintenance operations".

Refitting the front brake master cylinder

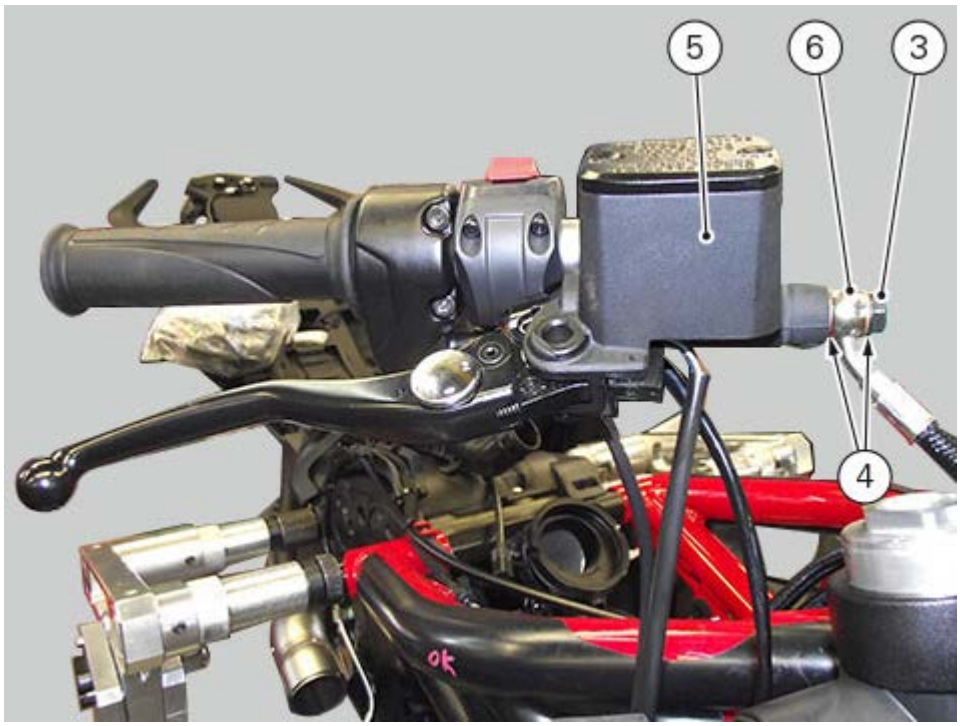
Insert the front brake master cylinder unit (13) on the right side of the handlebar so that the clamp internal edge matches with the mark (C).



Position clamp (12) and start the screws (11).
Tighten the fastening screws (14) to the specified torque of 10Nm ± 10% following the sequence 1-2-1 starting from the upper screw.



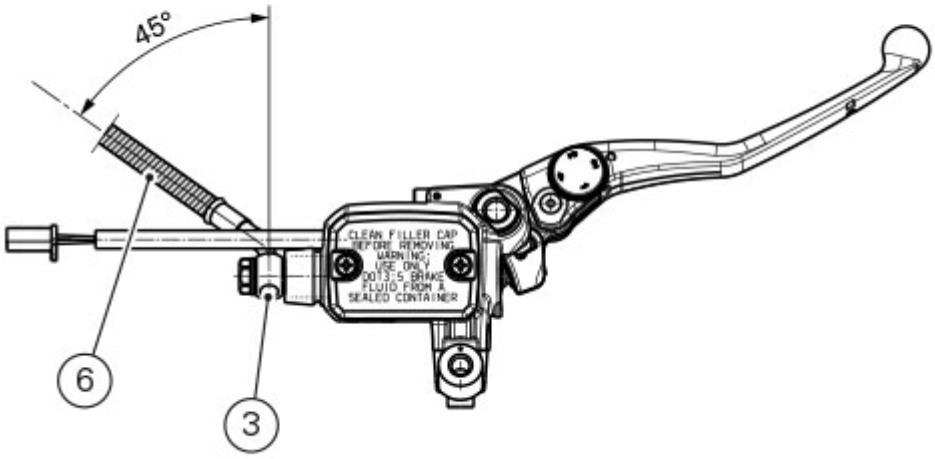
Position the hose (6) and sealing washers (4) on the master cylinder unit (5) and secure with the special screw (3), without tightening.

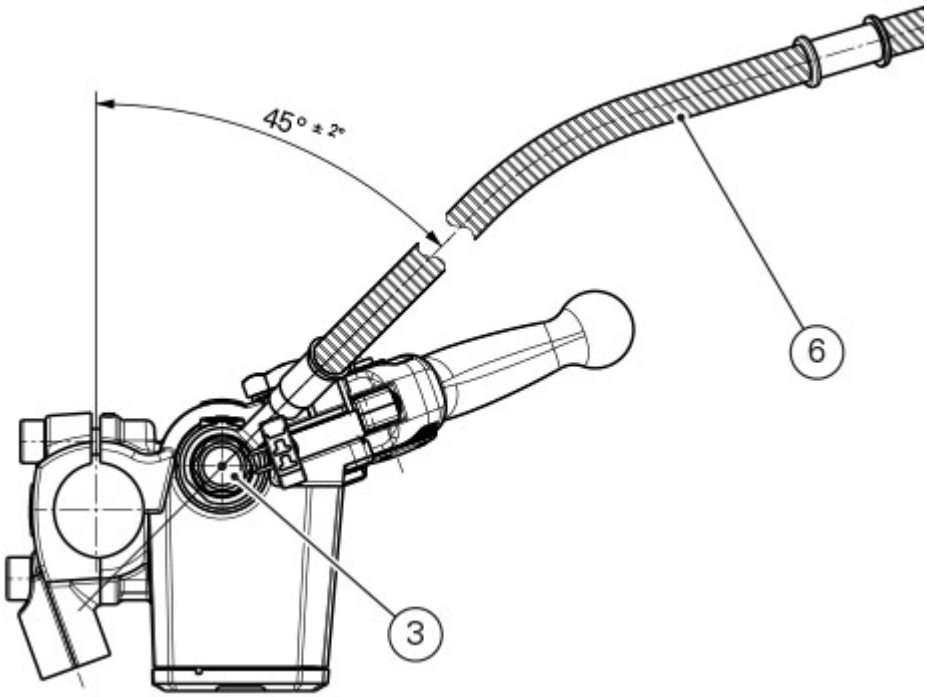


Warning

An incorrectly positioned hose can cause system faults and interfere with moving parts.

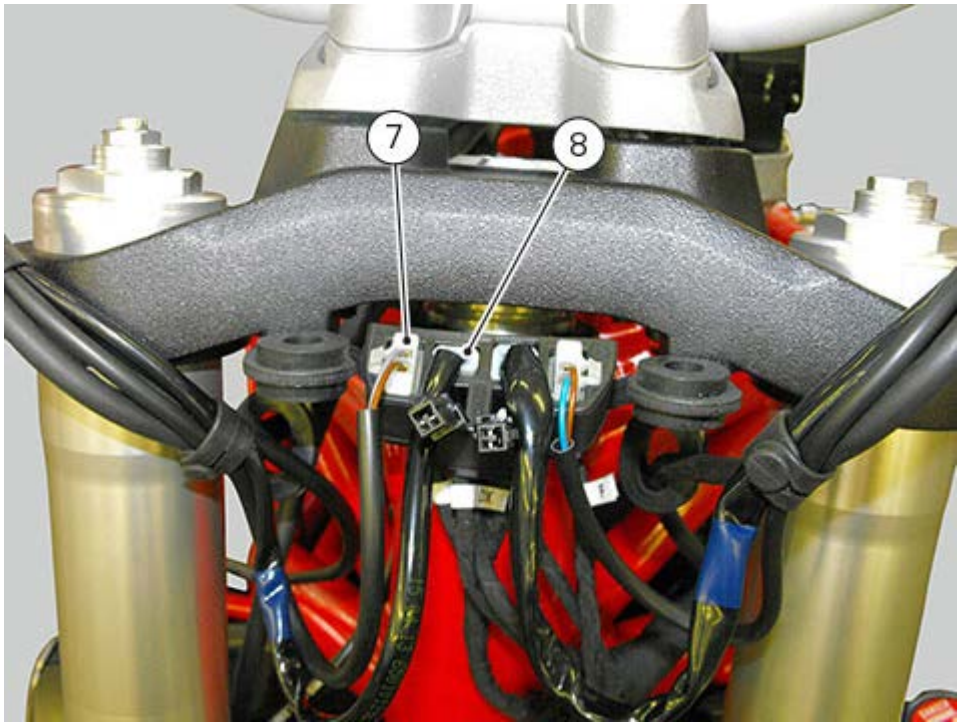
Aim the hose (6) as shown in the figure and then tighten the special screw (3) to a torque of 23Nm ±10%.

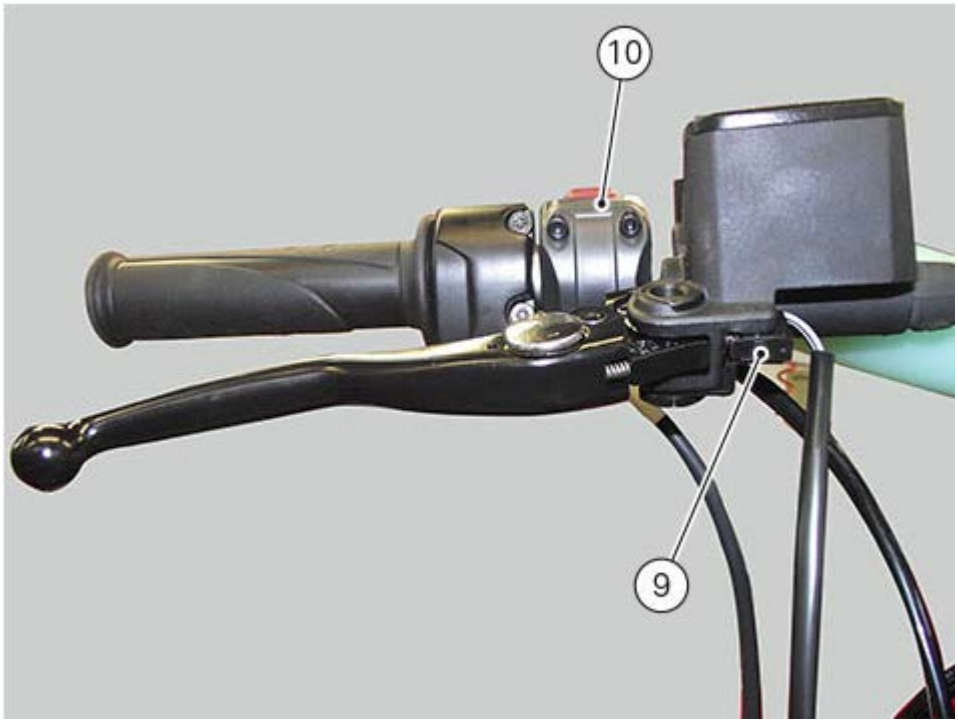




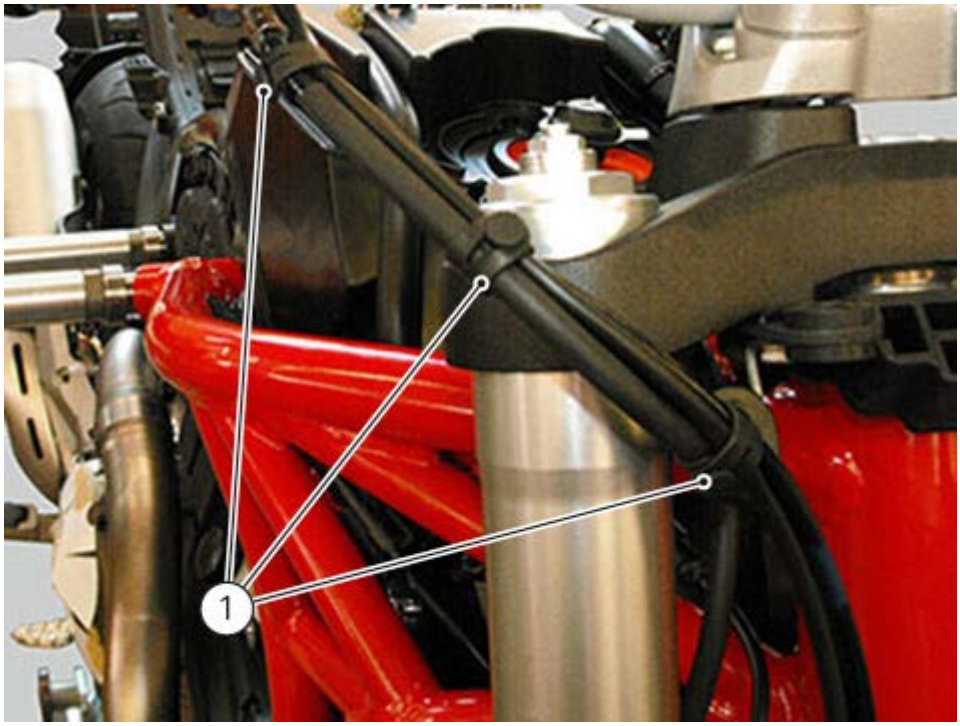
For the positioning of the hose (6) and retaining ties as well as of removed cables and wirings, see Section "Routing wiring/hoses".

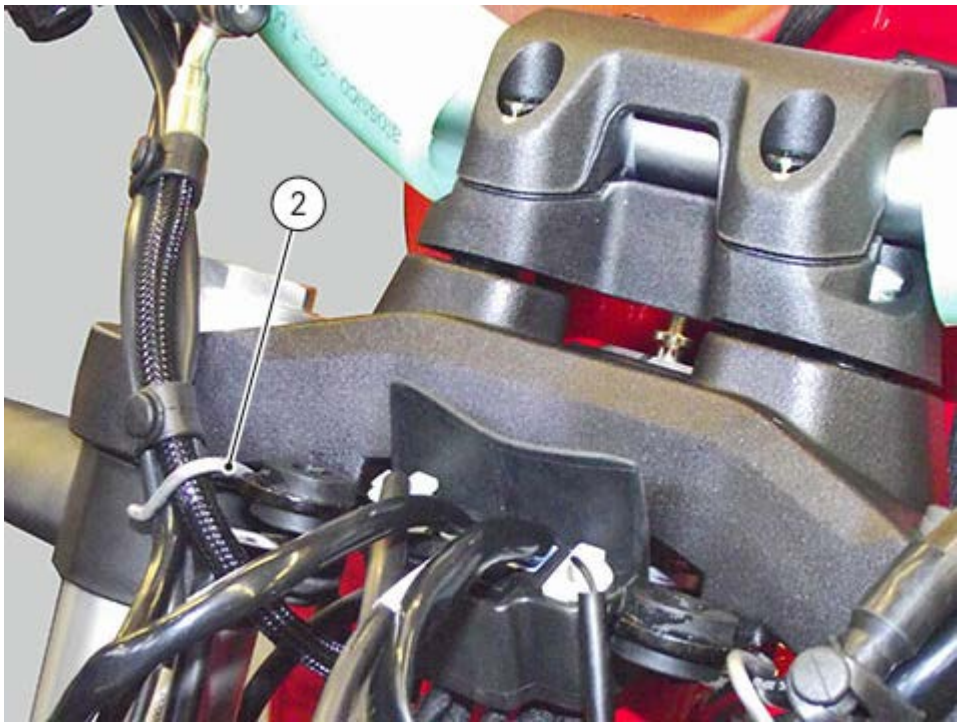
Connect micro-metric sensor connector (7) of front brake (9).
Connect connector (8) of the RH switch (10).





Block the wirings with the three clips (1) and make sure they pass through cable rings (2).





Refit the light assembly (Refitting the light assembly).
Fill the front brake system (Changing the front brake system fluid).

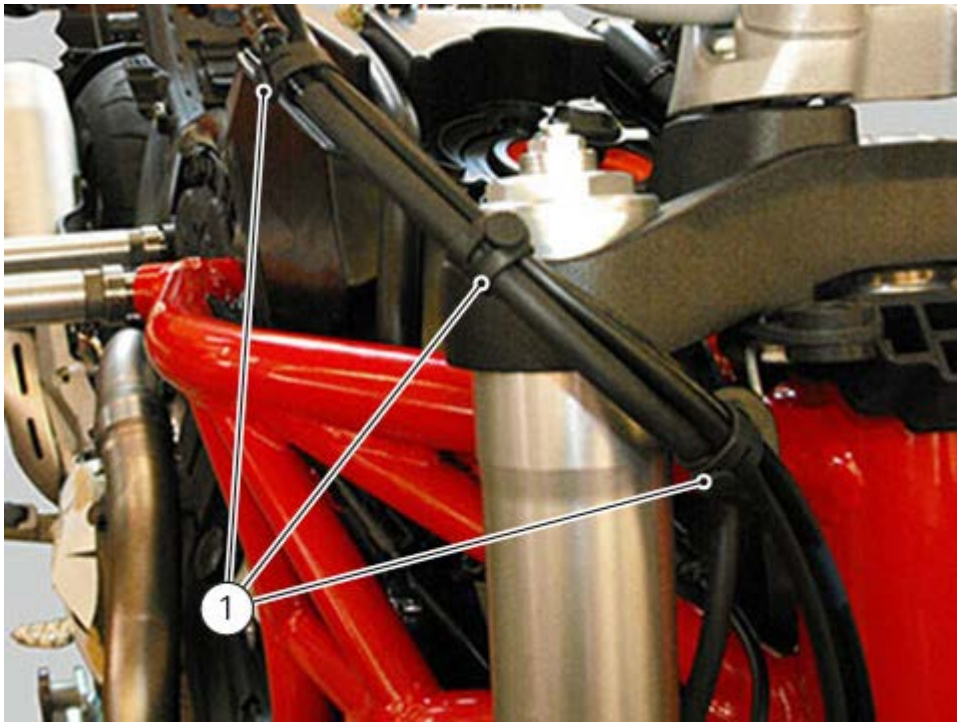
Removing the front brake master cylinder

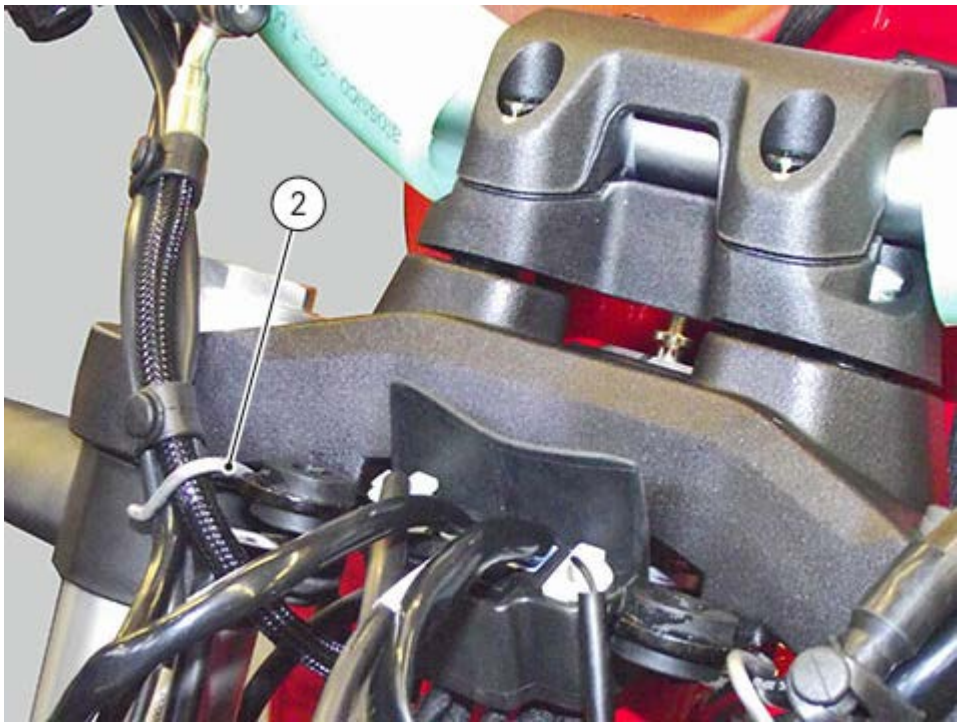
Warning

The brake master cylinder manufacturer advises against servicing the brake master cylinder due to the safety critical nature of this component. Incorrect overhaul can endanger rider and passenger safety. Maintenance operations on these units are limited to replacement of the following parts: control lever, fluid reservoir assembly and relative fasteners and master cylinder fasteners.

Remove the light assembly (Removing the light assembly).
Drain the front brake system (Changing the front brake system fluid).
Remove the RH rear-view mirror (Removing the rear-view mirrors).

Release pipes and wirings from clips (1) and cable rings (2).

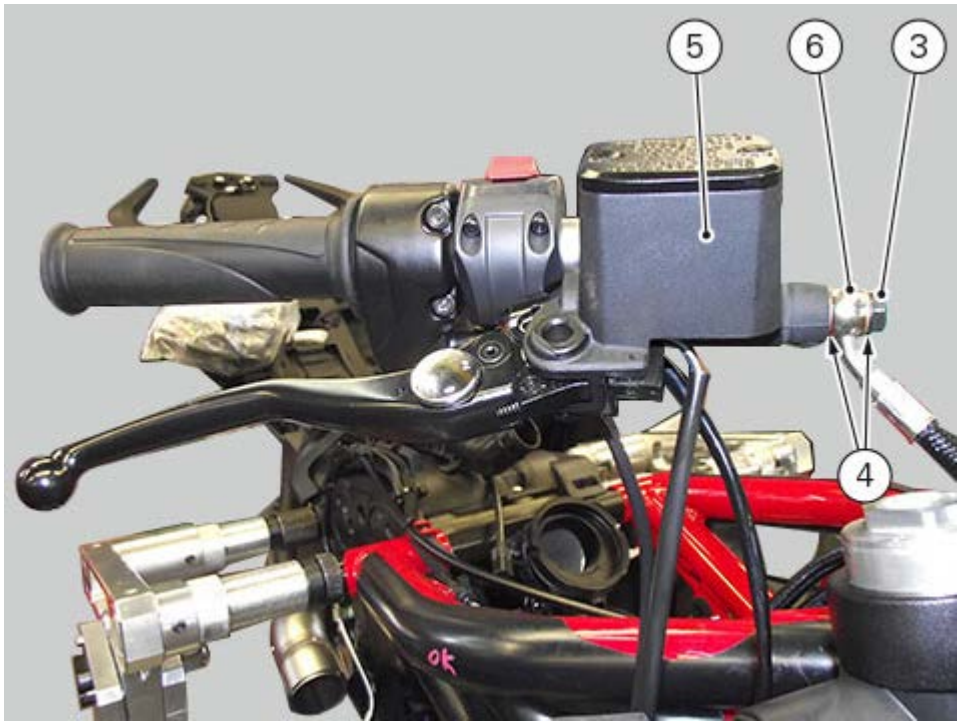




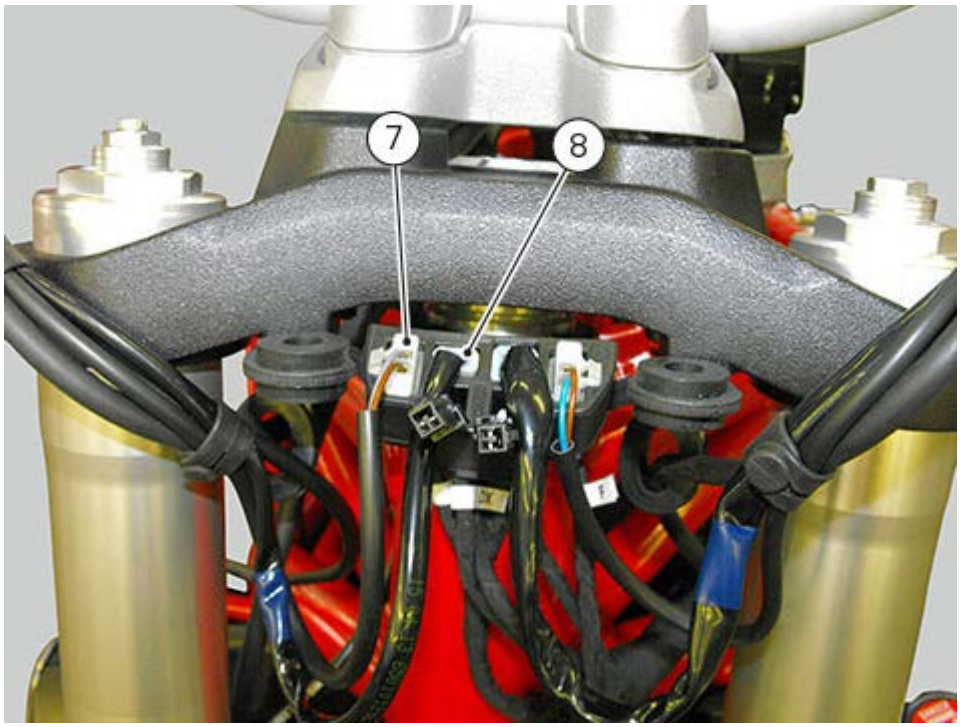
For the front ABS brake system, please also refer to sections "ABS system operation information" and chapters "System components" and "ABS component maintenance".

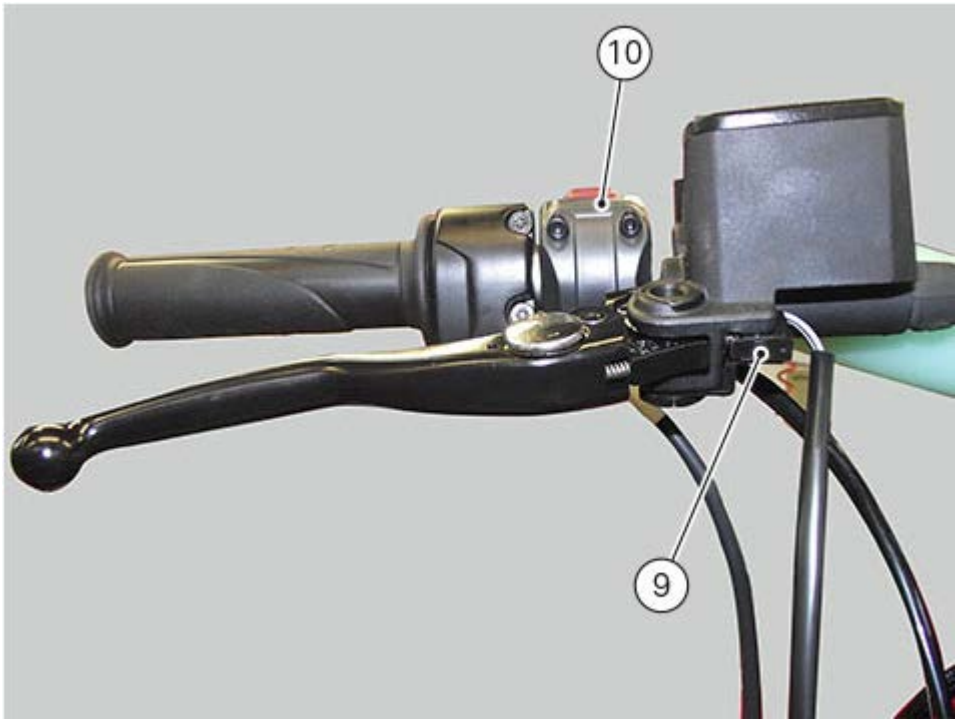
Undo the special screw (3), collecting the sealing washers (4) to release the front brake master cylinder

unit (5) from hose (6).

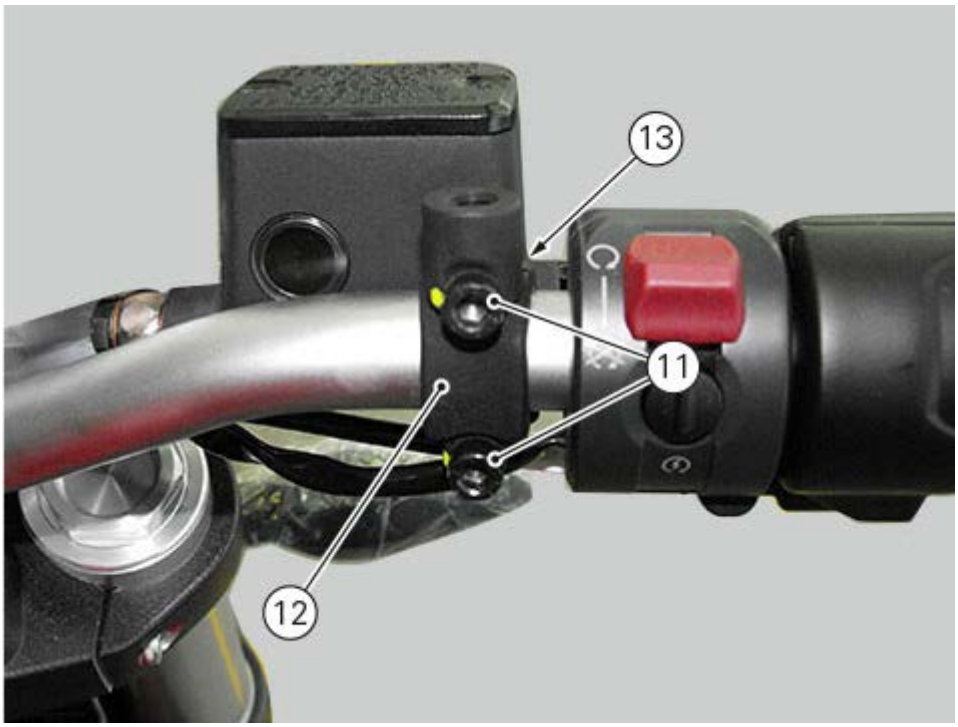


Disconnect connectors (7) and (8) from front brake micro-metric sensor (9) and right-hand switch (10).





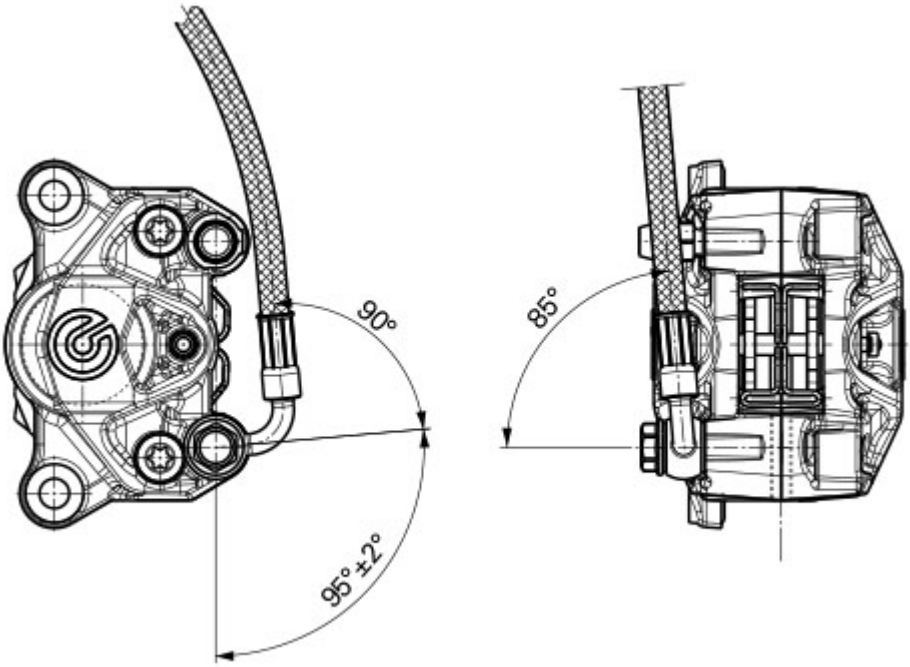
Undo the screws (11) securing the clamp (12), and then remove the front brake master cylinder assembly (13) from the handlebar.



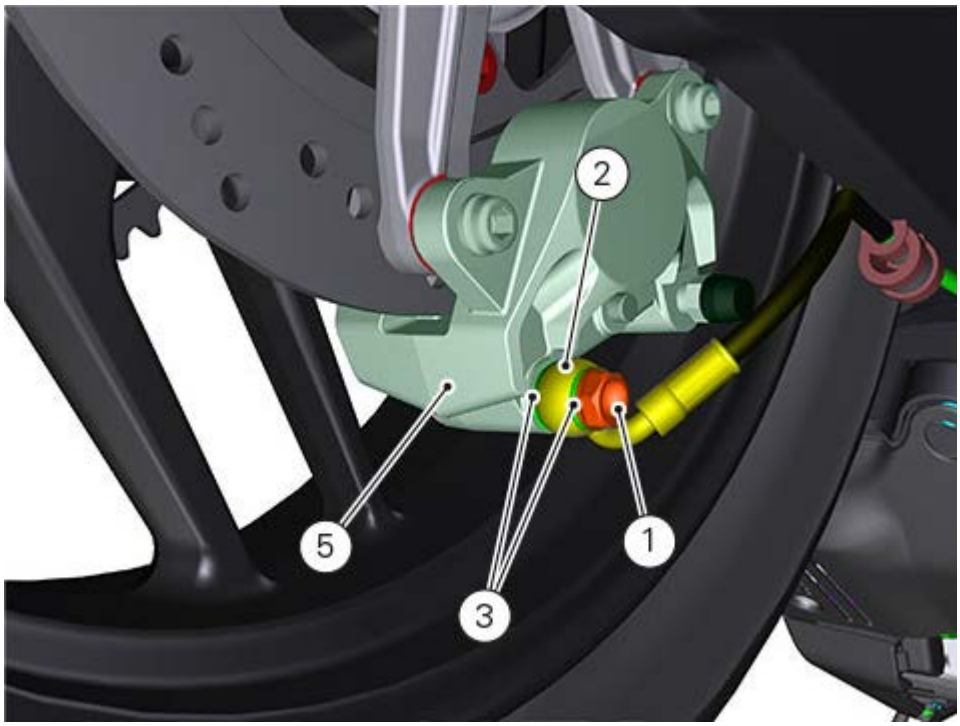
Refitting the rear brake calliper

If the brake lines are replaced or if one of the rear brake system components has been removed, make sure that the hose unions on the master cylinder and the calliper are correctly positioned.

Warning
If incorrectly positioned, hoses can affect brake operation and foul moving parts. Position the component as shown in the figure.



Remember to fit the copper gaskets (3) to the hose end union when reconnecting the brake line to the brake calliper (5).

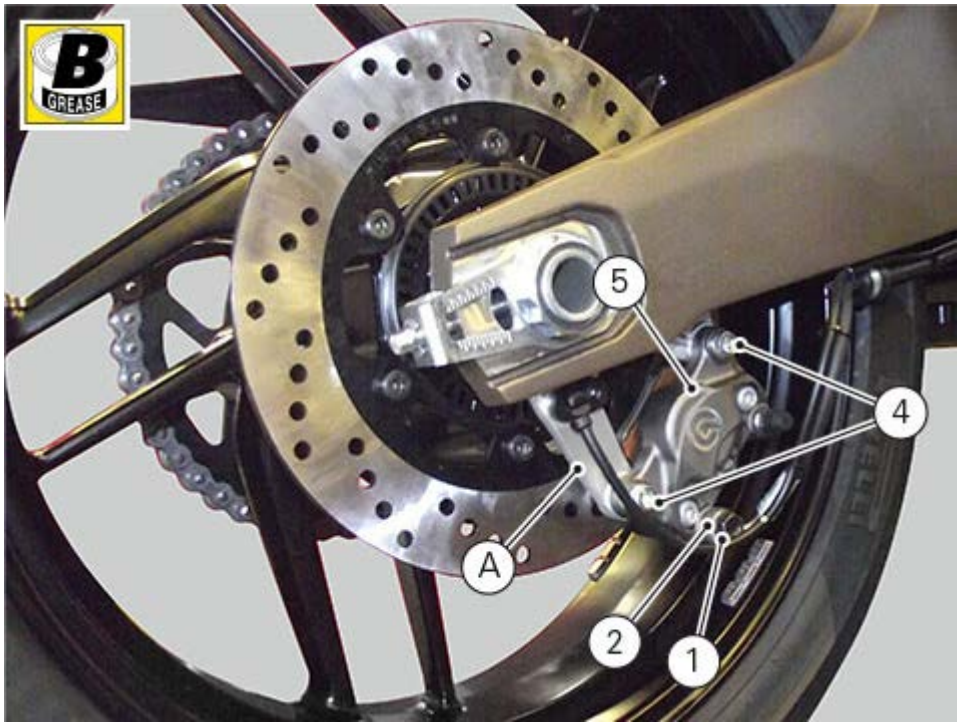


After having aimed the hose union, tighten special screw (1) with pre-applied threadlocker to the torque of 23 Nm ± 10%.
If the speed sensor (6) is removed, fit it to the calliper holder plate with the spacer (8), and tighten the screw (7) to a torque of 7 Nm ± 10%.

Note

The gap between sensor and the brake disc retaining screw must be within 0.6 and 2.2 mm.

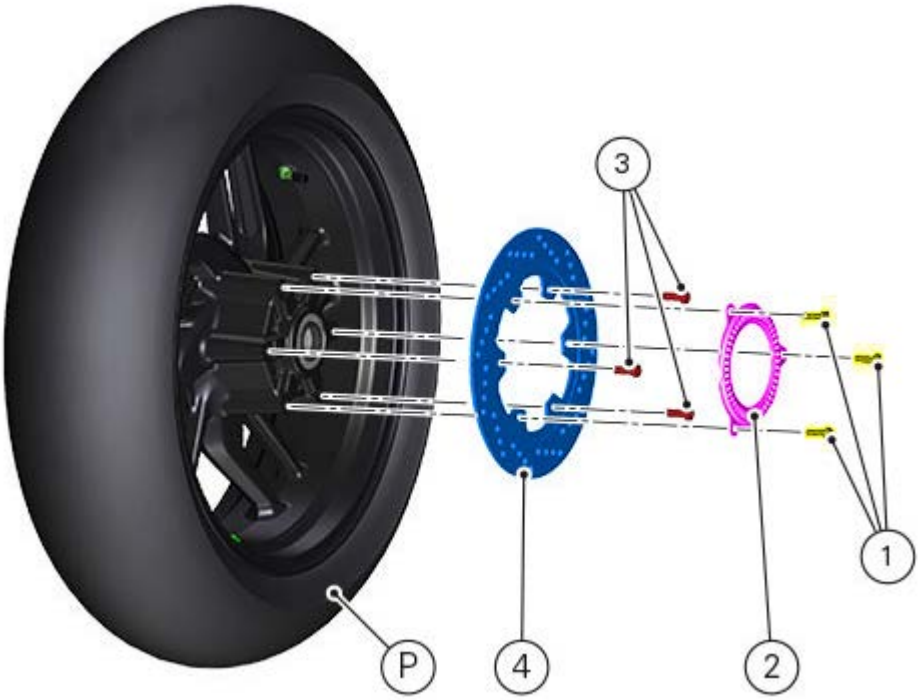
Insert the rear brake calliper (5) on the brake disk, aligning it with the holes of calliper holder plate (A). Apply the specified product on screws (4) and tighten them to a torque of 25Nm ± 5%.



Check and adjust phonic wheel sensor air-gap (Adjusting the phonic wheel sensor Air-Gap).

Removing the rear brake disc

Remove the rear wheel (P) (Removing the rear wheel).
Remove the three fixing screws of phonic wheel (2) and slide it out.
Remove the three screws (3) retaining the rear disc (4) and slide it out.

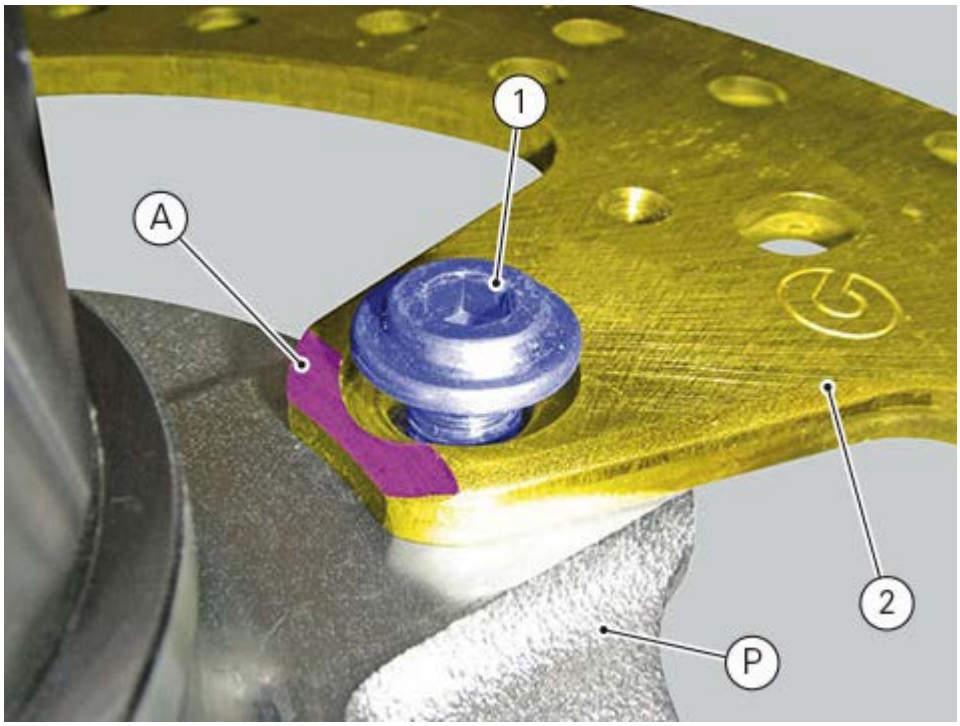


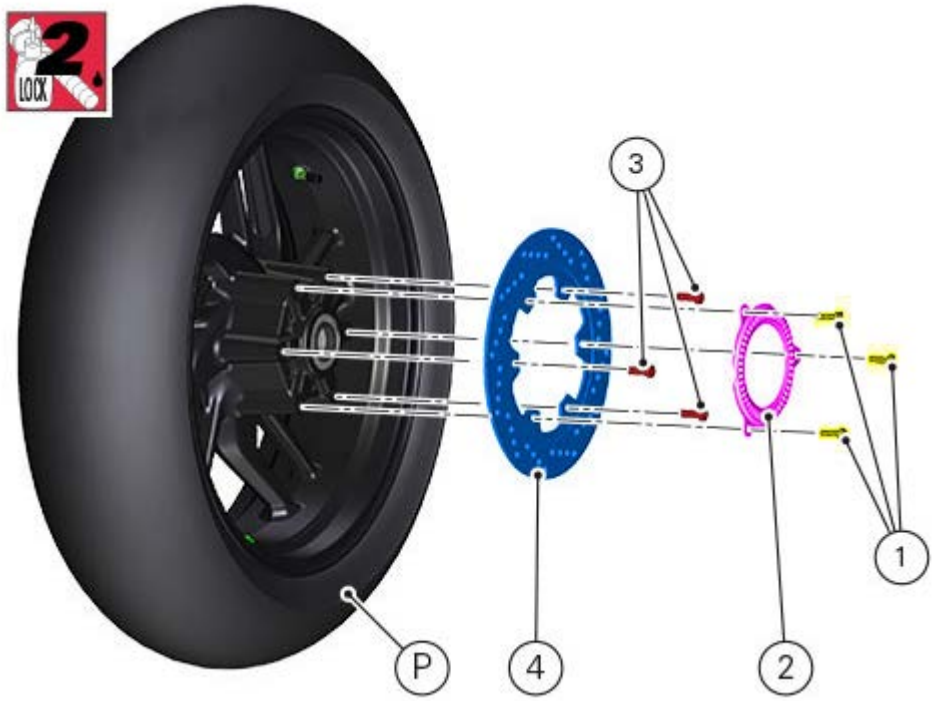
Checking the brake disc
The brake disc must be perfectly clean, with no rust, oil, grease or other dirt and no deep scoring.
To check the wear limit of the brake disc, refer to chapter "Hydraulic brakes".

Refitting the brake disc
Position rear brake disc (4) on rear wheel (P), aiming it with chamfered sides (A) facing upwards.
Fasten the disc by starting screws (3) after applying indicated threadlocker.

Note
Pay attention to align screw heads to the corresponding seats on brake disc.

Tighten the screws (1) to 25 Nm ± 5%, following a 1-2-3 sequence.
Position the phonic wheel (7) on brake disc (4), aiming it as shown in the figure.
Fasten phonic wheel (4) starting screws (3) after applying recommended threadlocker.
Tighten the screws (3) to 25 Nm ± 10%, following a 1–2–3 sequence.
Refit the rear wheel (P) (Refitting the rear wheel).

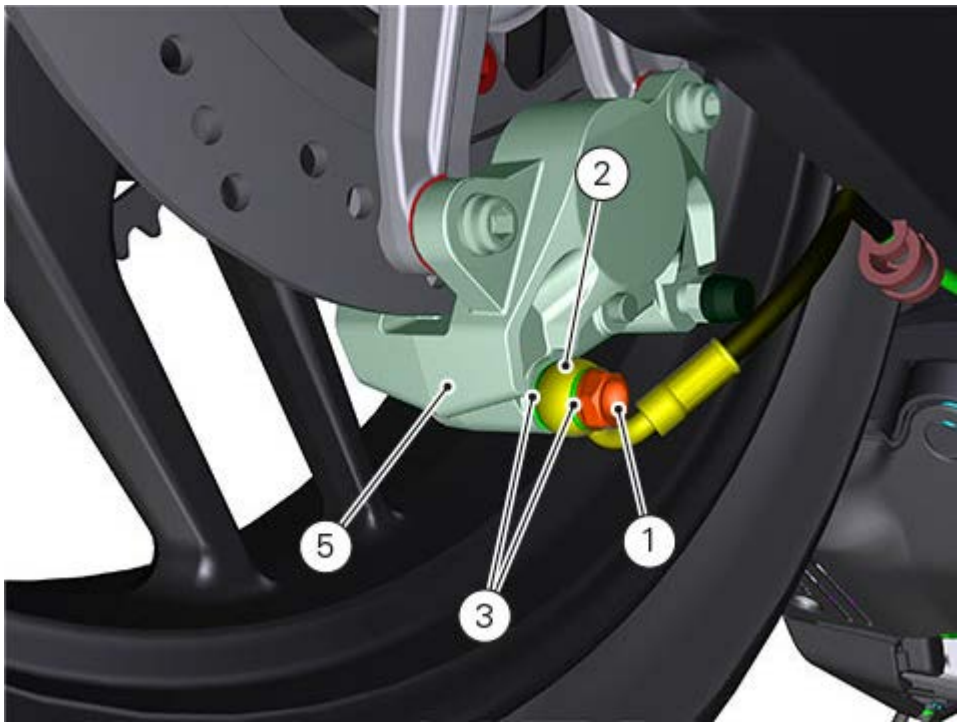

1
A
2
P


2.
LOCK
3
1
P
4
2

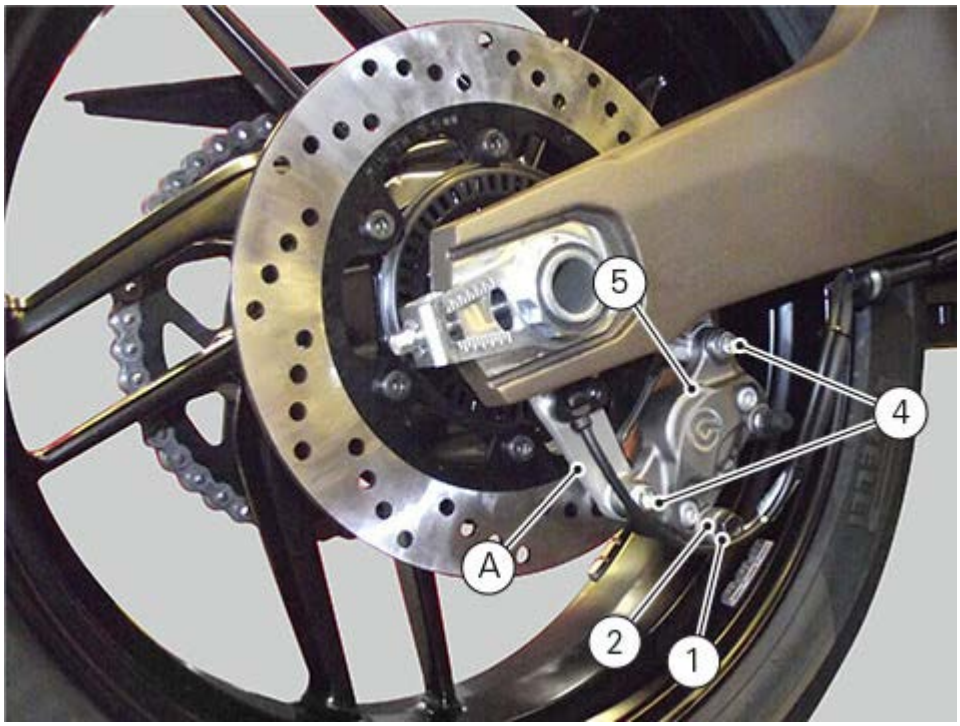
Removing the rear brake calliper

Drain the rear braking system (Changing the rear brake system fluid).
For the ABS brake system, please also refer to Sections "ABS system operation information" and chapters "System components" and "ABS component maintenance".

Undo and remove the special screw (1) securing the hose (2) to the rear brake calliper and the corresponding washers (3).
Remove the hose (2).



Undo the two fastening screws (4) securing the rear brake calliper (5) to the calliper holder bracket, and remove the brake calliper (5).
If it is necessary to remove the calliper holder plate (A), refer to section "Removing the swinging arm".
To replace the brake pads follow instructions in the paragraph "Checking brake pad wear and replacing rear brake pads".

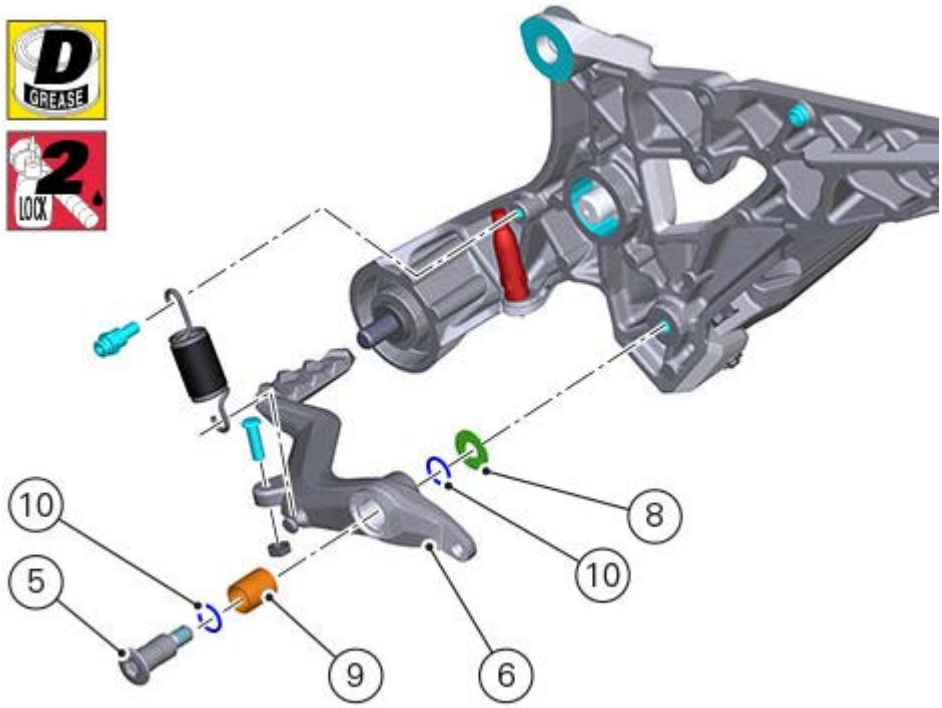


To remove the speed sensor (6), undo the fastening screw (7) paying attention to the spacer defining the air-gap (8).

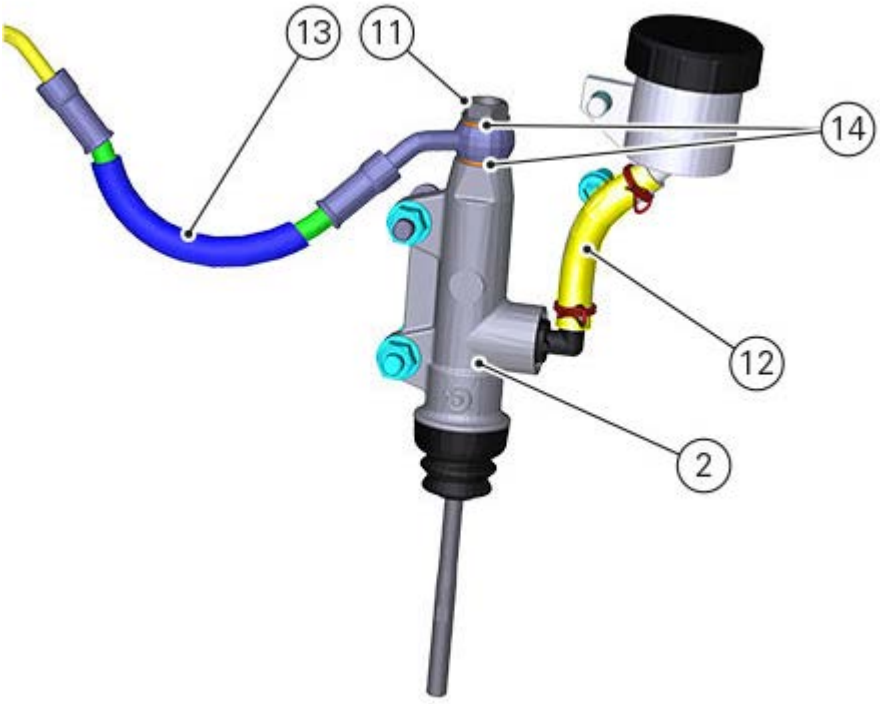

7
8
6

Refitting the rear brake control

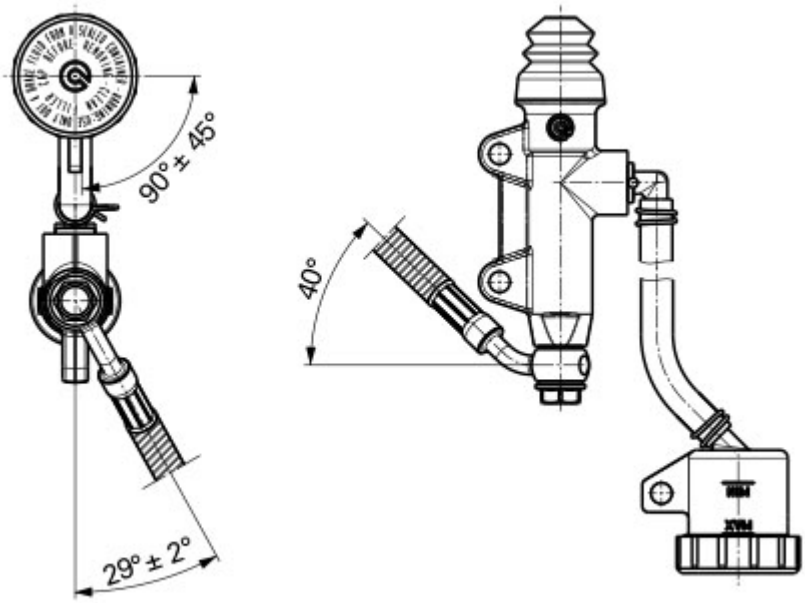
Apply special grease on the inner surface of the bush (9) and threadlocker on the shaft (5).
Fit O-ring (10) on shaft (5).
Insert shaft (5) on brake control lever (6), fit the other O-ring (10) and washer (8).



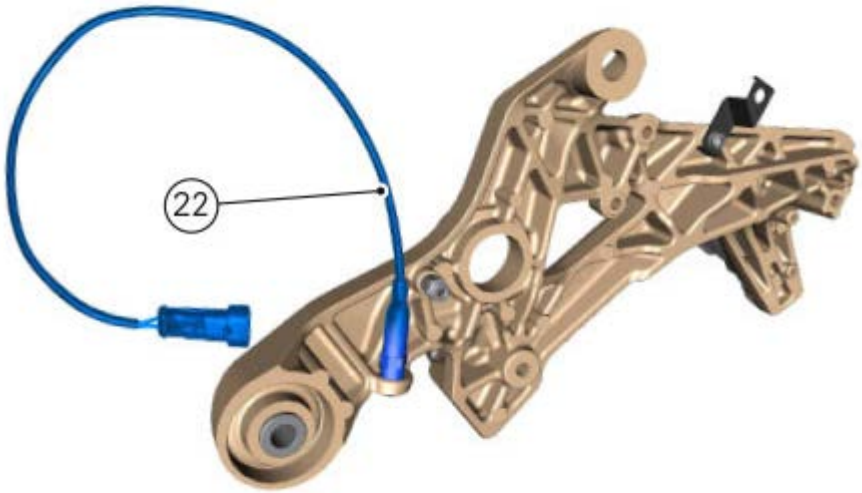
Reconnect hose (13), locating seals (14) on both sides of the hose union, and secure it with the special screw (11).
Tighten special screw (11) to a torque of 23 Nm ± 10%.
Make sure that hoses (12) and (13) are duly positioned and not twisted.

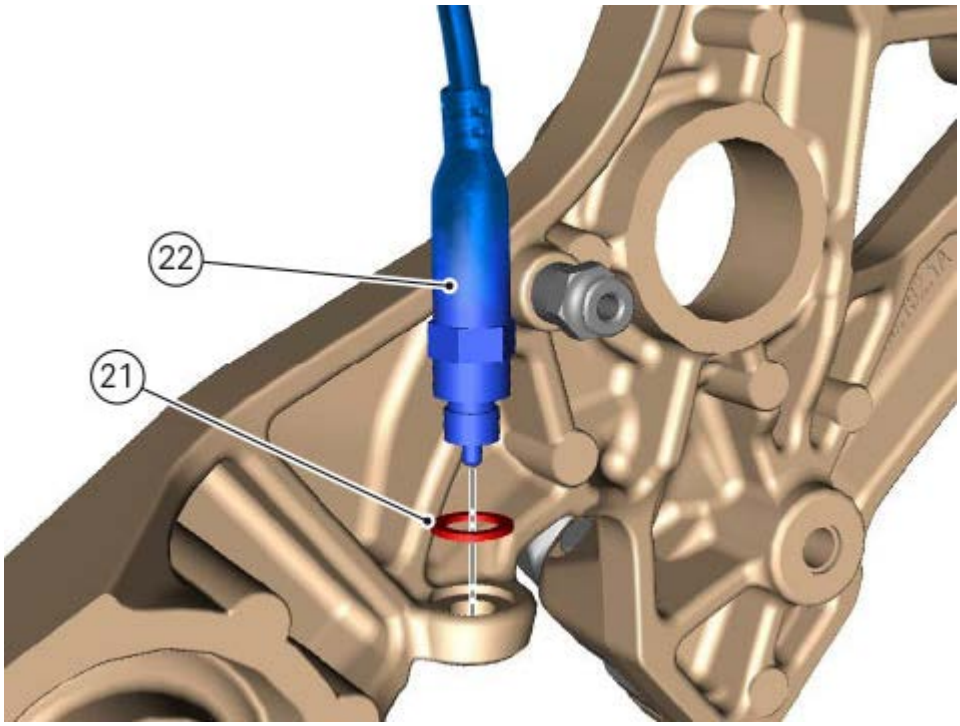


Note
Pay particular attention to the hoses routing and their position on the rear brake master cylinder.

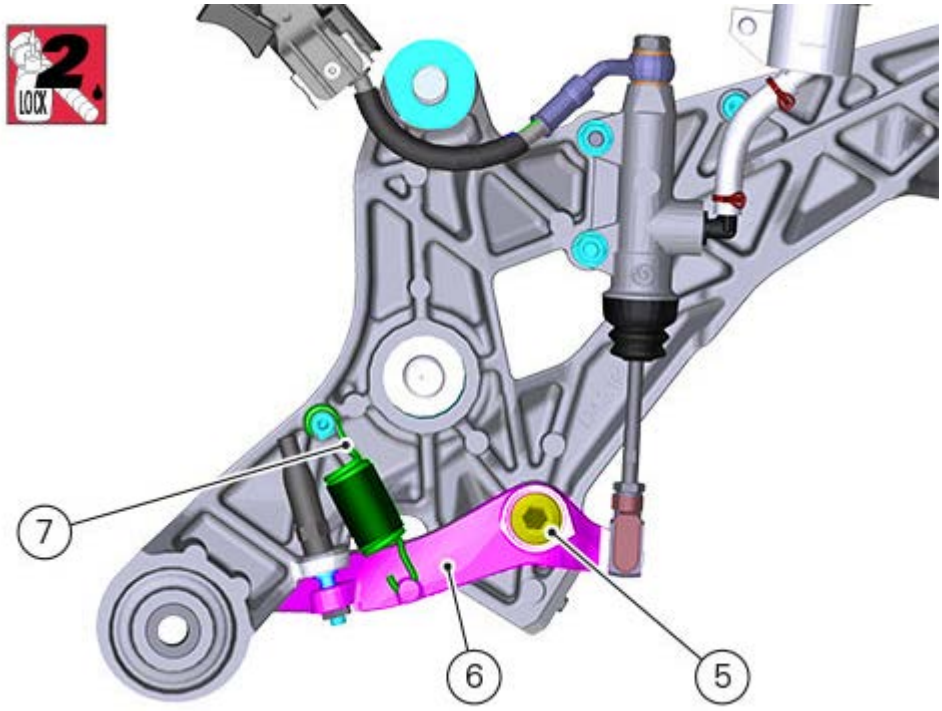


If previously removed, refit washers (21) and tighten rear brake sensor (22) to a torque of 5 Nm ± 10% on plate.

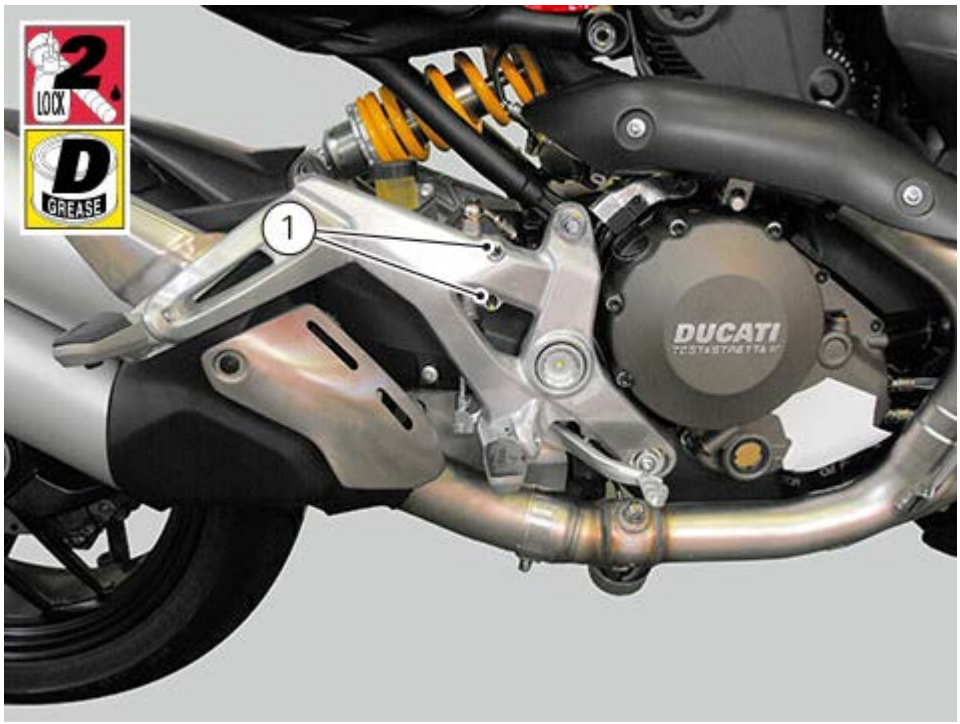


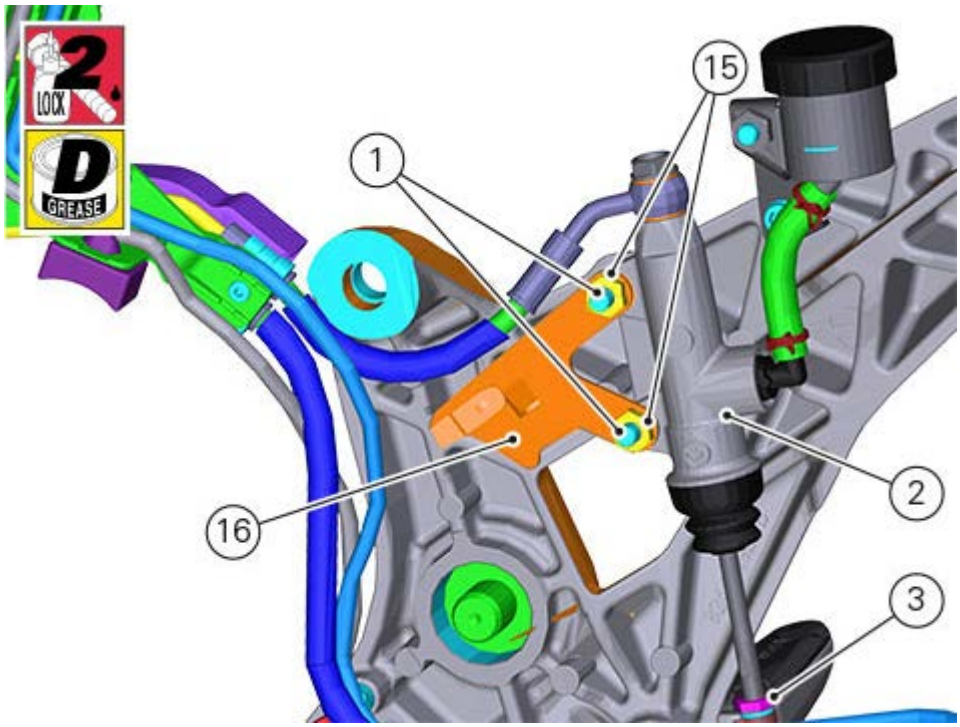


Apply the recommended threadlocker on shaft (5).
Fit brake lever (6) with spring (7) starting shaft (5).
Tighten shaft (5) to a torque of 24 Nm ± 10% after having applied the specified product.

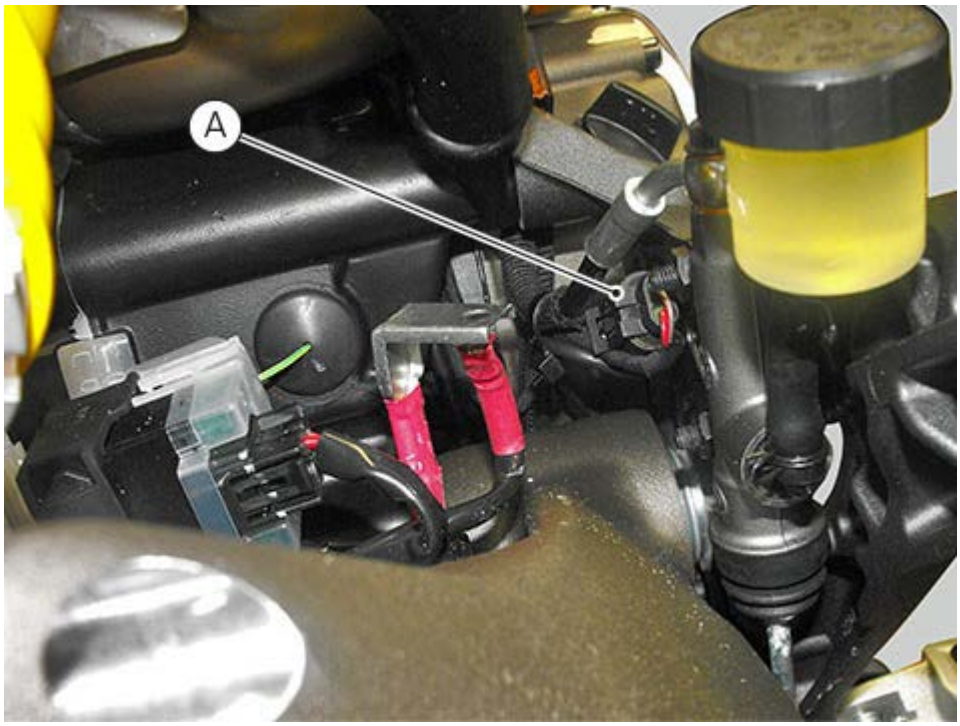


Apply the specified threadlocker to screws (1).
Fit rear brake master cylinder (2) and stop sensor connector support bracket (16) on vehicle, starting retaining screws (1) inside nuts (15).
Insert the rod (3) inside the master cylinder (2), after applying the recommended grease.
Tighten screws (1) to a torque of 10 Nm ± 10% after having applied the specified product.





Connect rear stop switch (A) to main wiring.

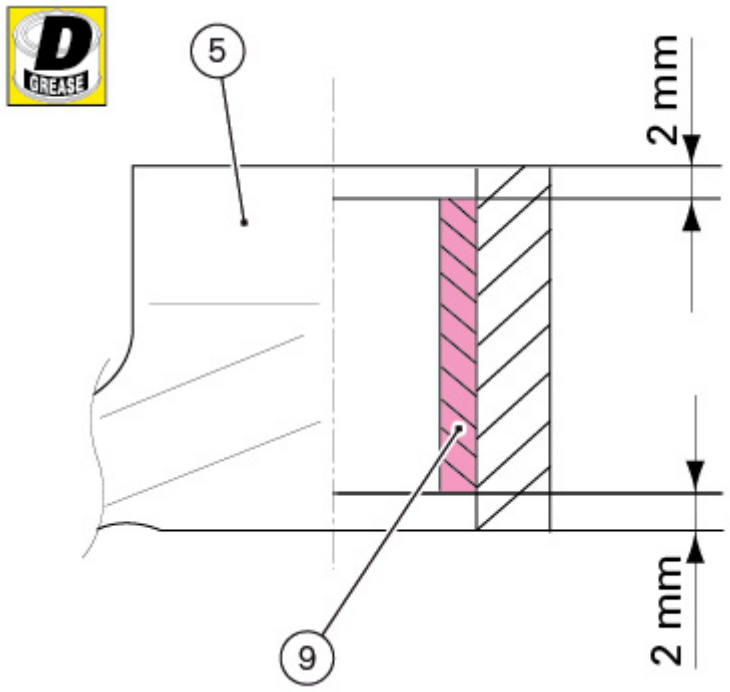


Fill the rear brake system (Changing the rear brake system fluid).
If released from the clips, position hoses and wirings as described in "Routing wiring/hoses".

Disassembling the rear brake control

The brake master cylinder is supplied only as a complete unit; internal components cannot be replaced.
To disassemble the master cylinder's outer parts, follow the indications given in chapter "Removing the rear brake control".
If the bush (9) inside the brake pedal (5) needs to be replaced, grease the external surface and fit the new bush using a press to insert it. The bush must be placed at 2mm from the pedal external face.

Disassemble the system components by referring to chapter "Removing the rear brake control"



After performing an operation on the rear brake control, check the brake pedal position following the instructions detailed in Section "Adjusting the position of the gear pedal and rear brake pedal".

Removing the rear brake control

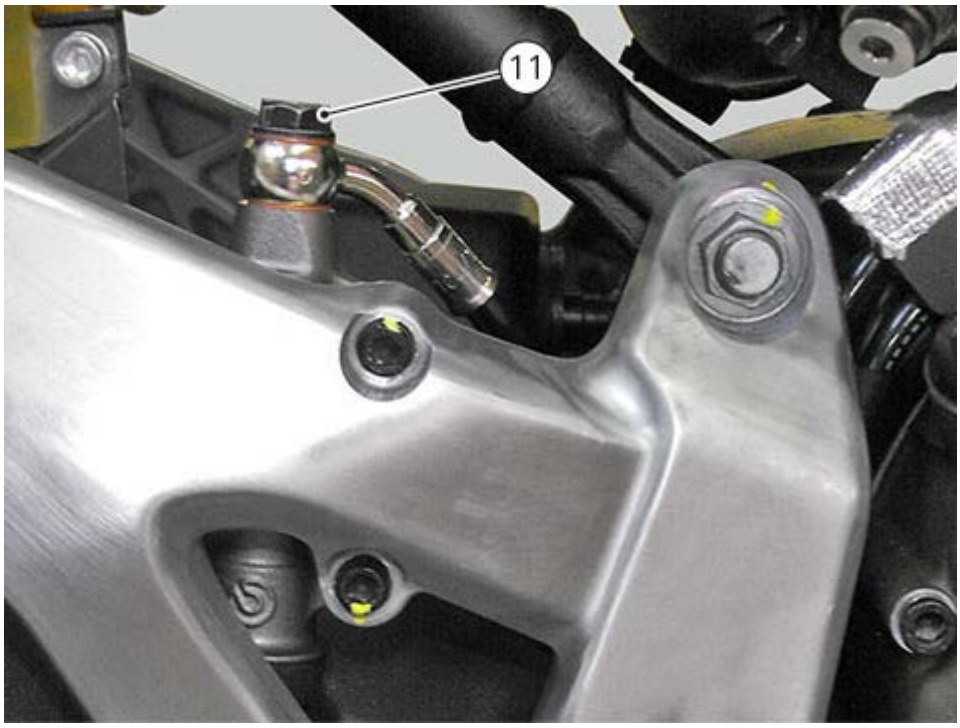
Warning

The brake master cylinder manufacturer advises against servicing the brake master cylinder due to the safety critical nature of this component. Incorrect overhaul can endanger rider and passenger safety. Maintenance operations on these units are limited to replacement of the following parts: control lever, fluid reservoir assembly and relative fasteners and master cylinder fasteners.

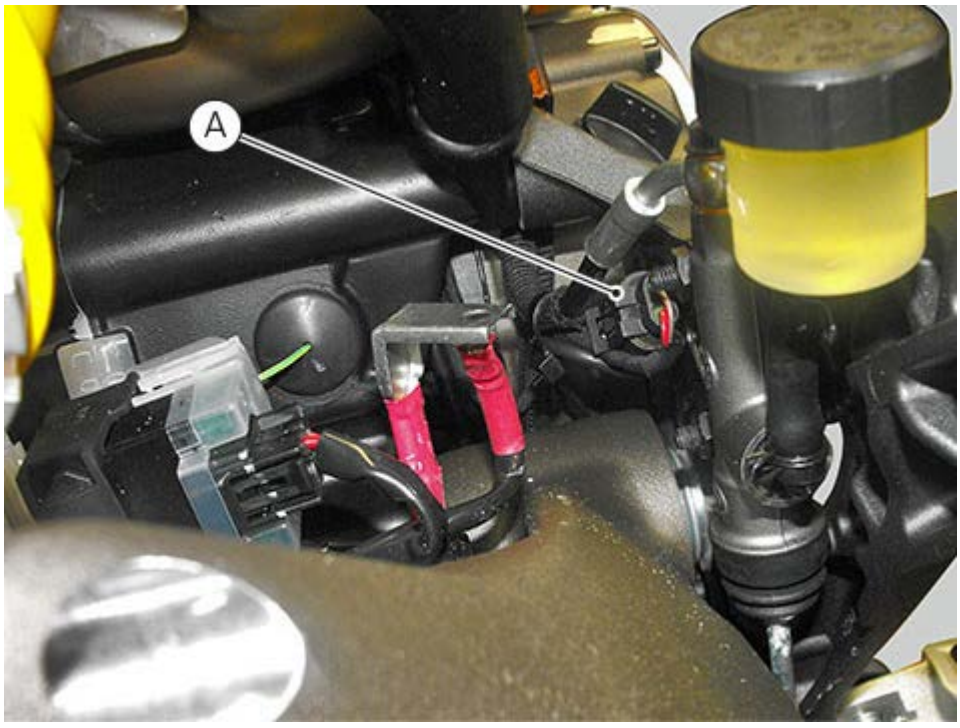
Drain the rear braking system (Changing the rear brake system fluid).
Remove the RH footpeg holder plate (Removing the footpeg holder plates).

For the front ABS brake system, please also refer to Sections "ABS system operation information" and chapters "System components" and "ABS component maintenance".

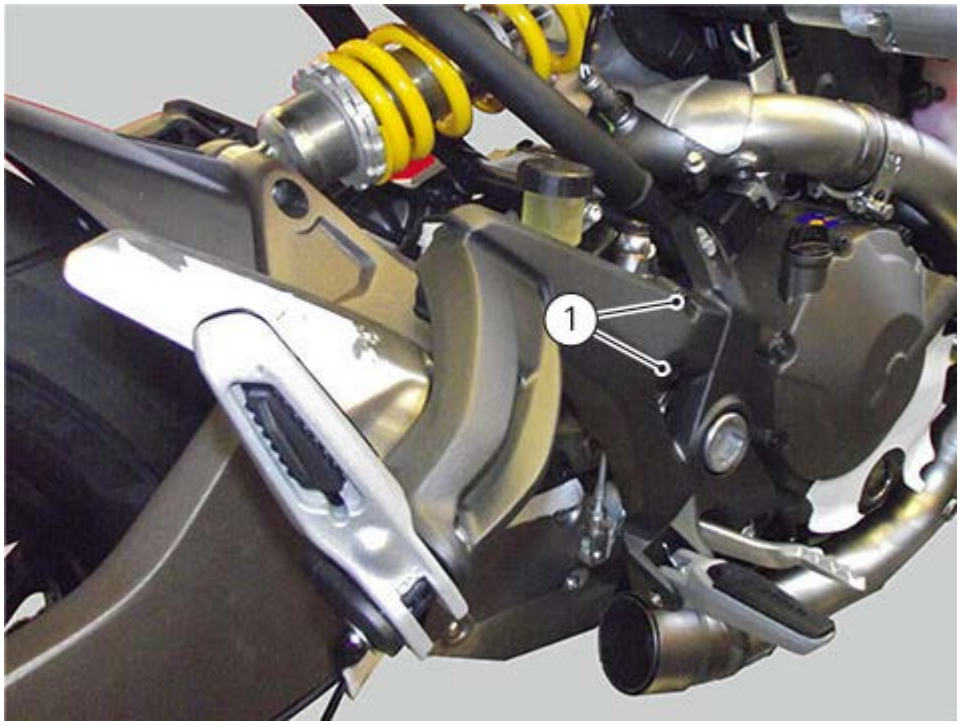
Loosen special screw (11).

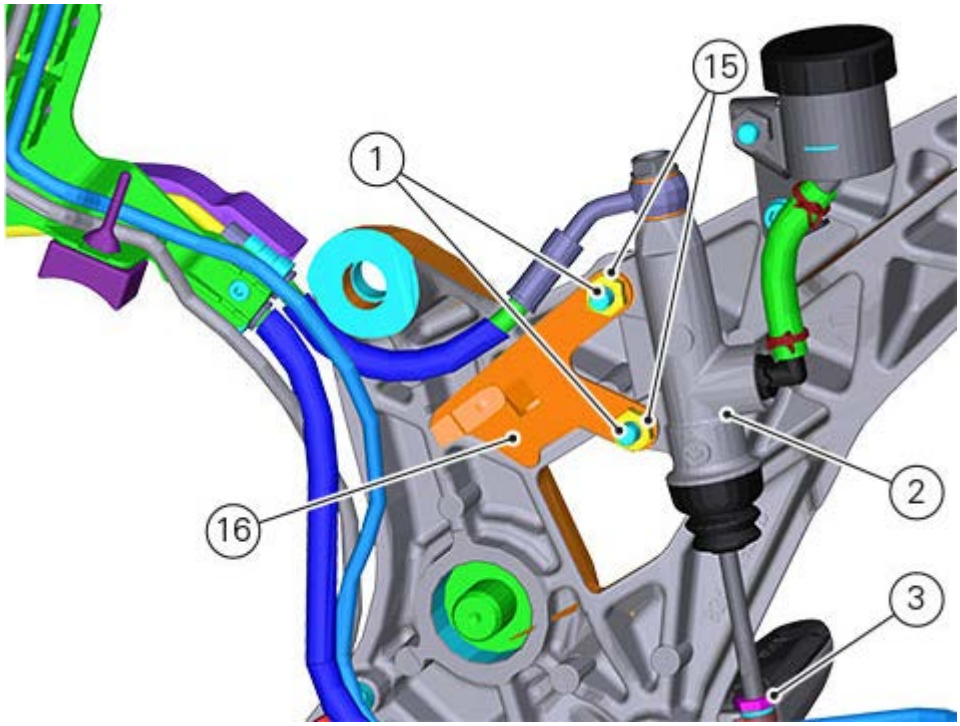


Disconnect rear stop switch (A) from main wiring.

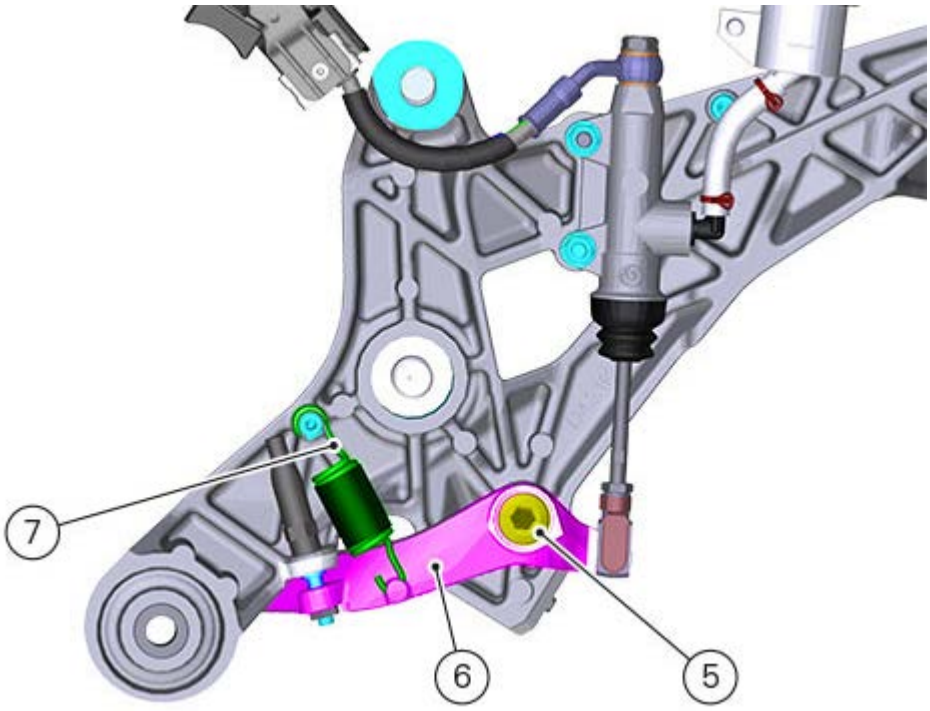


Loosen rear brake master cylinder (2) fastening screws (1) and keep nuts (15) and stop connector support (16).
Slide out rear brake master cylinder (2) by loosening adjuster nut (3).

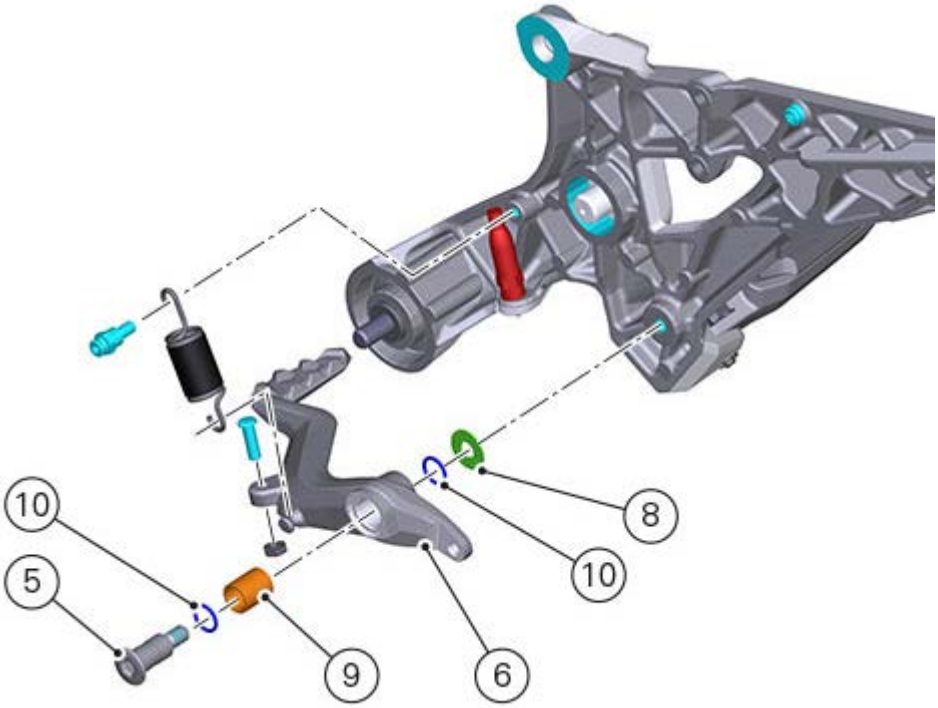




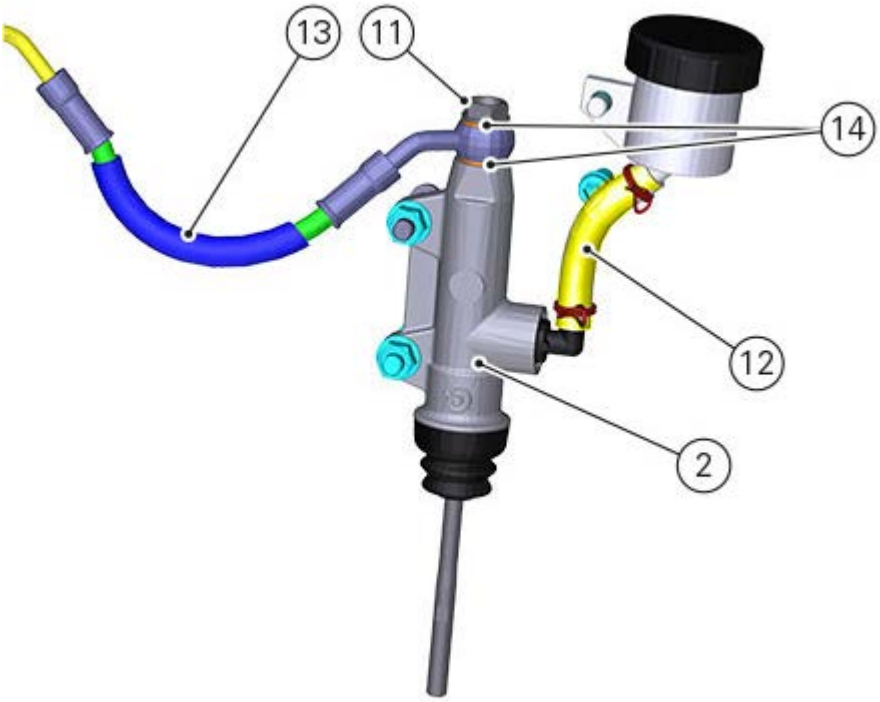
Undo pin (5) securing the brake lever (6), collecting spring (7).



Slide out the brake lever (6) and collect pin (5), washer (8), bushing (9) and O-ring (10).



Undo the special screw (11) from master cylinder (2) by removing the hose clip (12); slide out hose (13), collecting the seals (14).
Remove rear brake master cylinder (2) from vehicle.



ABS system deactivation

ABS (Antilock Braking System) intervention can be customised and possibly disabled. To set and disable ABS, refer to "Settings and displaying".

Warning

If the vehicle front wheel remains off the ground for a prolonged period while the vehicle is moving, the speed difference detected between the two wheels causes an ABS fault (warning light activated) and makes it impossible for the control unit to establish a reference speed.

ABS system operation information

The operation of the system is based on the analysis of the speed signals for front and rear wheels; the system is automatically deactivated if either of these signals is missing.

Note
In the event of the ABS control unit detecting a fault in the ABS electronic management system, it activates the specific fault warning indicator on the instrument panel and restores conventional braking functionality without ABS.
Hydraulic faults in the brake system and faults not directly related to the ABS system (e.g.: worn brake pads) cannot be detected by the ABS control unit.

Important
The operation of the system is based on the values read for the front and rear wheel speeds; take great care not to damage the phonic wheels and relative speed sensors when removing the wheels or when working close to these components; the phonic wheels damage may compromise the operation of the system and cause dangerous malfunctions.

ABS diagnosis

The diagnostic function of the ABS ascertains the functionality of the main system components via hardware/software tests, but cannot modify the operating parameters of the ABS strategy.
From the model menus of the DDS2.0 diagnosis software, select MONSTER family, then model 821, and then select bike model year and press Global Scan button.
Now connect tester to bike CAN diagnostic socket, to locate connector refer to the video displayed in screen showing the diagnostic connector position on bike.
Wait for the correct configuration to be loaded and, when requested, switch the vehicle to key-on state.
Tester communicates to the different control units present on bike, ABS control unit included; wait for the scan to be completed.
Among the displayed information a "dot" icon is shown: based on its colour, it refers to validated errors inside the different control units.
In particular, if errors are stored, icon will be yellow or if errors are currently present, icon will be red, while if no errors are present, icon will be green.
To make a deeper analysis of the ABS control unit, select ABS control unit and SELF-DIAGNOSIS or, as an alternative, make a double selection on the same item with your mouse.
Once in this configuration, a number of parameters and states of the ABS control unit and information concerning the control unit itself may be selected and displayed.
The INFO menu allows reading the software version loaded on the control unit as well as other information.

Select the function "View parameters and states"

This function allows the tester to display the following ABS system parameters and states:

Viewable parameters

Front wheel speed	The speed value for the front wheel is displayed in Km/h.
Rear wheel speed	The speed value for the rear wheel is displayed in Km/h.
System voltage value	The system voltage value, measured across the terminals of the ABS unit, is displayed in Volts

Viewable states

Hydraulic pump motor state	Indicates if the electric motor of the hydraulic pump inside the ABS unit is functioning or not.
Valve relay state	Displays the state of the main valve relay inside the ABS unit.
Rear inlet valve state	Displays the state of the normally open EV1 rear inlet valve (OFF if open, ON if closed).
Front inlet valve state	Displays the state of the normally open EV4 rear inlet valve (OFF if open, ON if closed)

Front outlet valve state	Displays the state of the normally closed AV4 rear outlet valve (OFF if closed, ON if open).
Switch status ABS	Displays state of the analogue input of the ABS unit for the strategy switch off request (1 state to Uz, 0 state to GND).

Select the function "View errors"

This tester function provides the user with information concerning the error list in the ABS control unit memory, indicating if errors are stored or current. The following codes are given after a short description of the diagnosis type: MEM, indicating that the error has been stored previously by the ABS control unit but has not been detected in the current test session. ATT, indicating that the error is current and has been detected during the current test session.

Note
While ATT indicates that the error has been found during the current test session, it does not necessarily indicate that the error is actually active at the time of indication. For example: disconnecting the front wheel speed sensor causes the code ATT to be displayed after the error description, but the code continues to be displayed even once the cause of its activation has been eliminated by reconnecting the sensor, as the ABS will only check sensor operation again after the next key-off/key-on cycle. As a result, always perform a key-on/key-off cycle after any work on the ABS system, interrupting and re-establishing communication between the diagnostic instrument and the ABS control unit before checking the updated ABS error list again.

The abbreviations for all the errors displayed are given as follows:

Error code	Errors	Description
C0032	Front Speed Sensor Error	Front speed sensor signal Open circuit/short circuit to GND/short circuit to Uz of front wheel speed sensor
C0031	Front speed sensor signal - Plausibility	Front speed sensor fault - Plausibility
C003E	Rear Speed Sensor Error	Rear speed sensor signal Open circuit/short circuit to GND/short circuit to Uz of rear wheel speed sensor
C003D	Rear speed sensor signal - Plausibility	Rear speed sensor fault - Plausibility
C1000	Plausibility of difference between front and rear wheel speeds	Front and rear wheel speed difference (WSS_GENERIC)
C1001	Valve relay fault	Valve relay fault (Failsafe relay)
C1002	Front inlet valve fault	Front inlet valve (1) fault
C1003	Front outlet valve fault	Front outlet valve (2) fault
C1004	Rear inlet valve fault	Rear inlet valve (1) fault
C1005	Rear outlet valve fault	Rear outlet valve (2) fault
C1006	ABS pressure sensor fault	Hardware fault
C1007	ABS pressure sensor fault	Offset fault
C1008	ABS pressure sensor fault	Power supply fault
C0020	ABS general malfunction	ABS pump motor fault
C100A	ABS general malfunction	ABS unit power circuit fault

C100B	ABS general malfunction	ABS electronic control unit fault
U0121	ABS control unit communication error	No Frame – Frame Counter
U0315	ABS control unit Compatibility Error	ABS control unit not compatible

Select the function "ABS system information"

This tester function displays the identification data for the ABS system, such as Software version and BARCODE
e.g.:
Software Version 6789
Barcode Data: HQOJM98200RA

Operating principle

The Ducati ABS brake system manages the front and rear brake systems separately. The operating mechanism consists of a pulse generator (phonic wheel), with a ring of slots, fitted onto each wheel. There are HALL sensors on LH fork leg bottom end and on rear brake calliper holder plate. With vehicle running, they read the slots on the phonic wheel thereby detecting instant wheel speed. These sensors output data to ABS ECU, which contains a software with a special control algorithm developed by Ducati. The software compares the vehicle average speed with the instant wheel speed reading and assesses any slipping condition. If control values are exceeded when the rider commands a certain pressure on brake calliper, the control unit shall hydraulically control the braking system, which is nearly locked up. The system can modulate pressure at the calliper through a set of solenoid valves which first prevent any further increase of hydraulic pressure (**1** valve closing), and then make the pressure decrease (**2** valve opening). The **2** valve is opened in a series of pulses (with less than 10 milliseconds between successive pulses), to reduce pressure in steps. When the wheel begins to turn again in response to the diminished braking force applied and its rotation speed reaches the reference value, the **2** release valve will be closed. Simultaneously, the inlet valve **1** is reopened, restoring normal operation of the brake system. The ABS control unit can monitor and modulate brake force in the three following different conditions: dry road surface (high grip), wet or slippery road surface (poor grip) and uneven road surface. ABS functionality is disabled at vehicle speeds lower than 5 km/h.

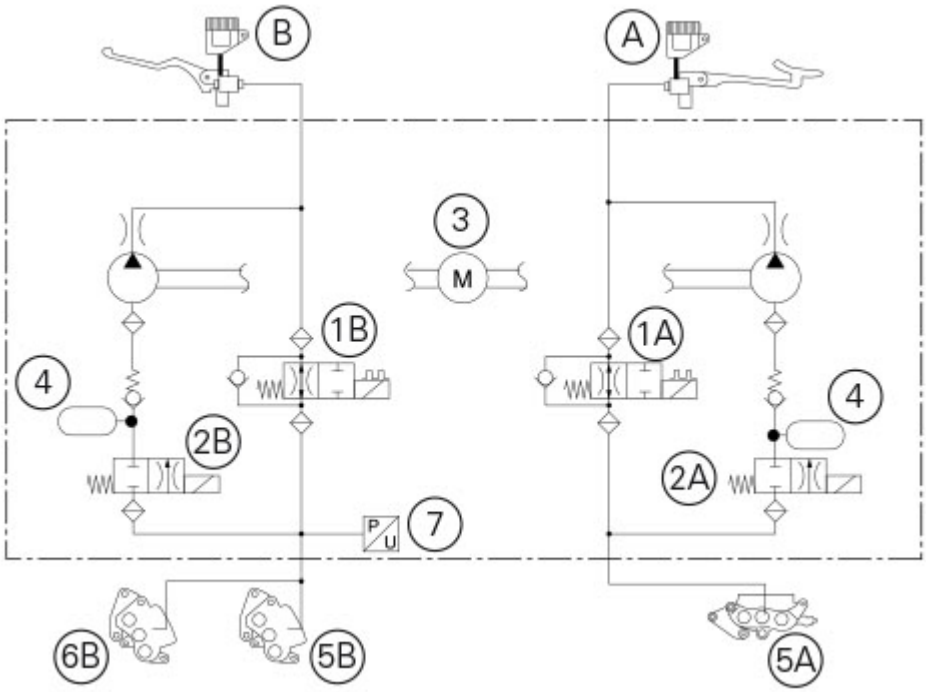
The hydraulic component of the ABS system consists of a primary circuit (from the cylinder to the control unit and from the control unit to the calliper) and a secondary circuit (completely within the control unit). Please find below a chart explaining ABS hydraulic operation.

Key to ABS hydraulic system colours:
Green: oil delivery
Light blue: oil return

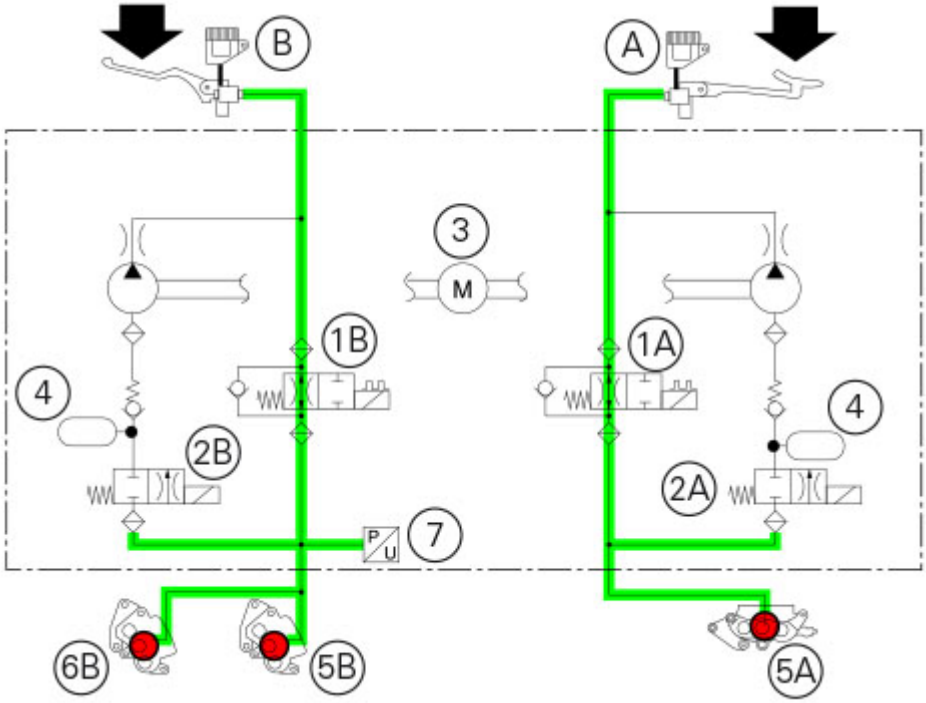
Key to ABS hydraulic system

A	Rear brake master cylinder
B	Front brake master cylinder
1A	Rear brake calliper inlet valve
1B	Front brake calliper inlet valve
2A	Rear brake calliper exhaust valve
2B	Front brake calliper exhaust valve
3	Master cylinder
4	Little tanks
5A	Rear calliper
5B	Left front calliper
6B	Right front calliper
7	Pressure transducer

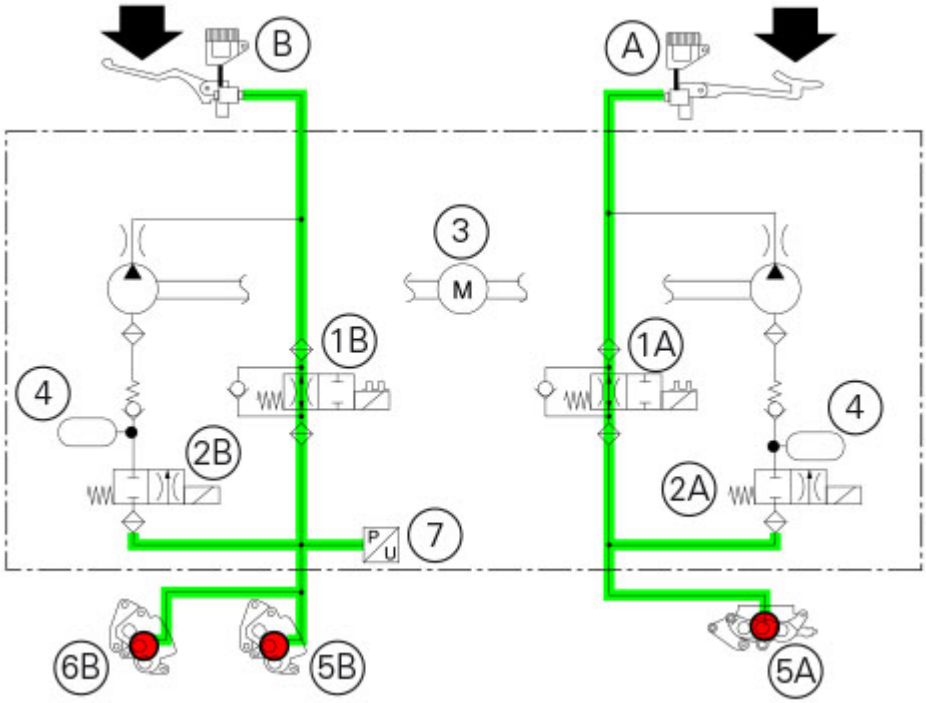
Brake system diagram.



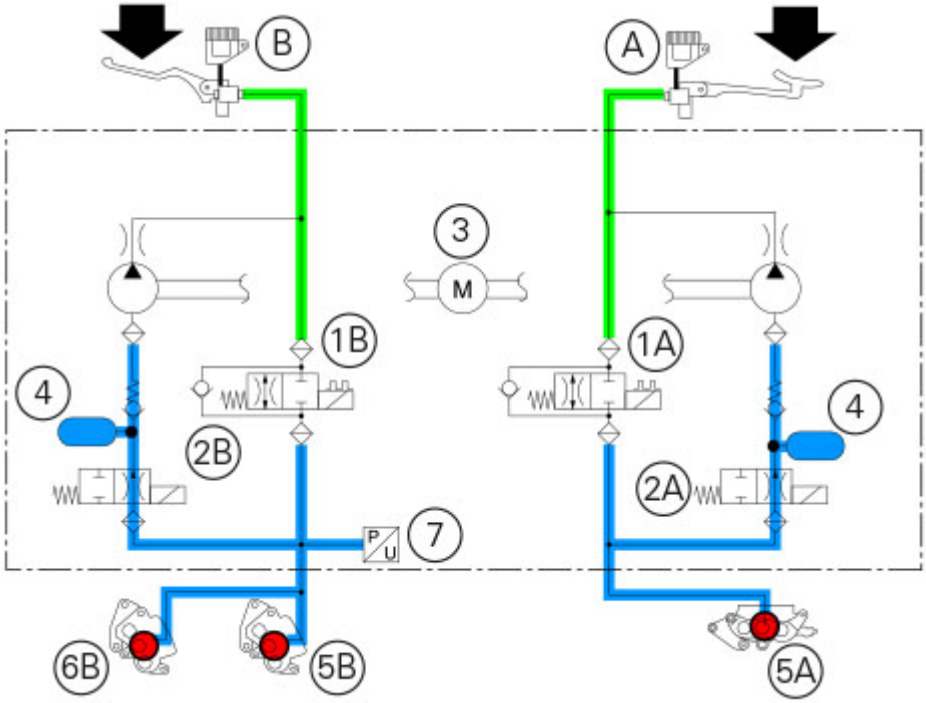
Braking without ABS.



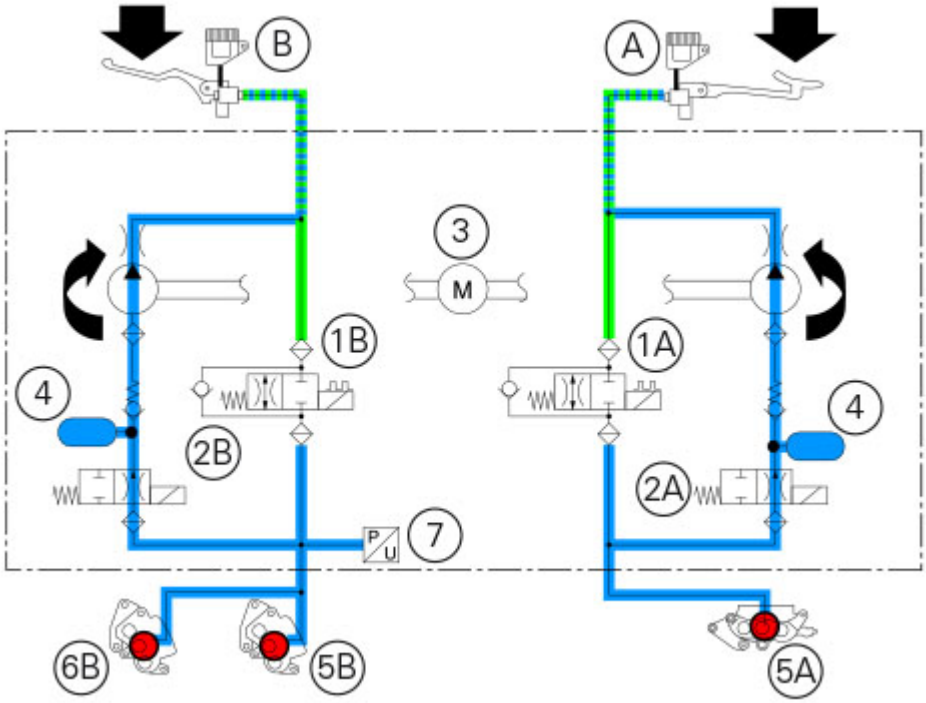
ABS 1 modulation: braking.



ABS 2 modulation: pressure partial reduction on callipers.



ABS 3 modulation: pressure total reduction on callipers.

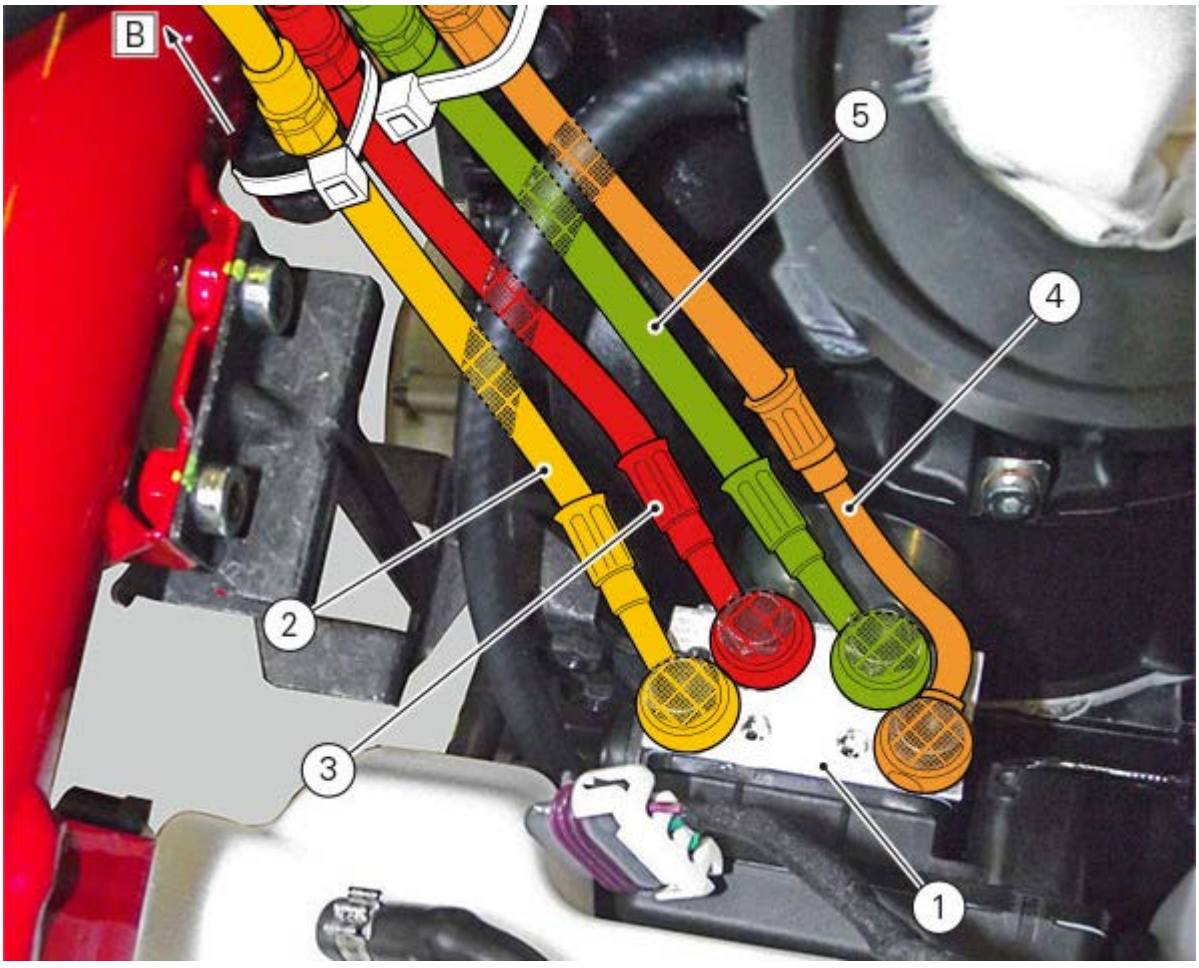


Routing wiring harnesses/hoses

The routing of the ABS system wiring has been optimised to ensure the minimum obstruction.
Each section is designed to prevent interference with parts that might damage wires or cause operating failures when riding.

Table	Position	Description
Table A	1	ABS control unit
Table A — Table B — Table D — Table F — Table G	2	Front brake calliper hose
Table A — Table B — Table C — Table D — Table E	3	Front brake master cylinder
Table A — Table B — Table C —Table L — Table M — Table N	4	Rear brake calliper hose
Table A — Table B — Table I — Table L — Table N	5	Rear brake master cylinder
Table F — Table G — Table H	6	Hose from right front calliper to left calliper
Table F — Table G — Table H	7	Front speed sensor cable
Table I — Table L — Table M	8	Rear speed sensor cable

Table A



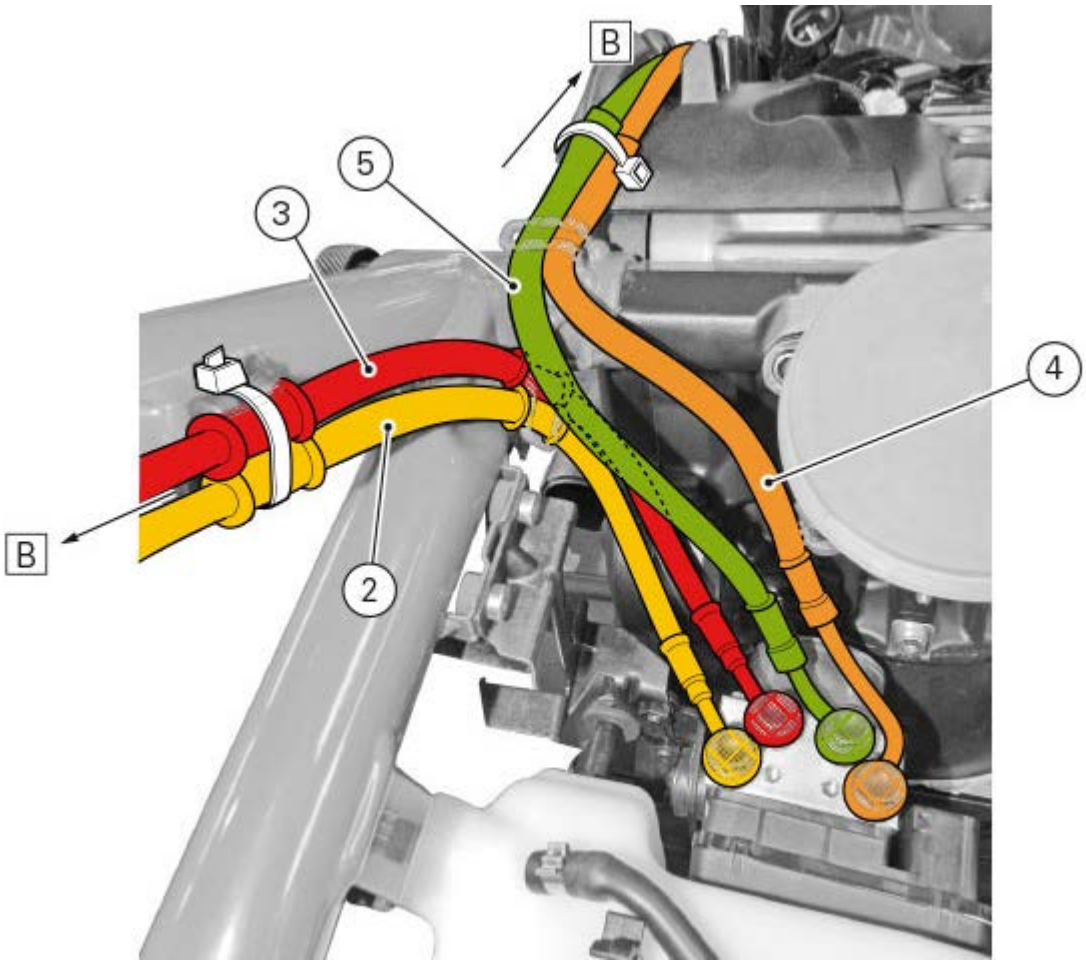


Table B

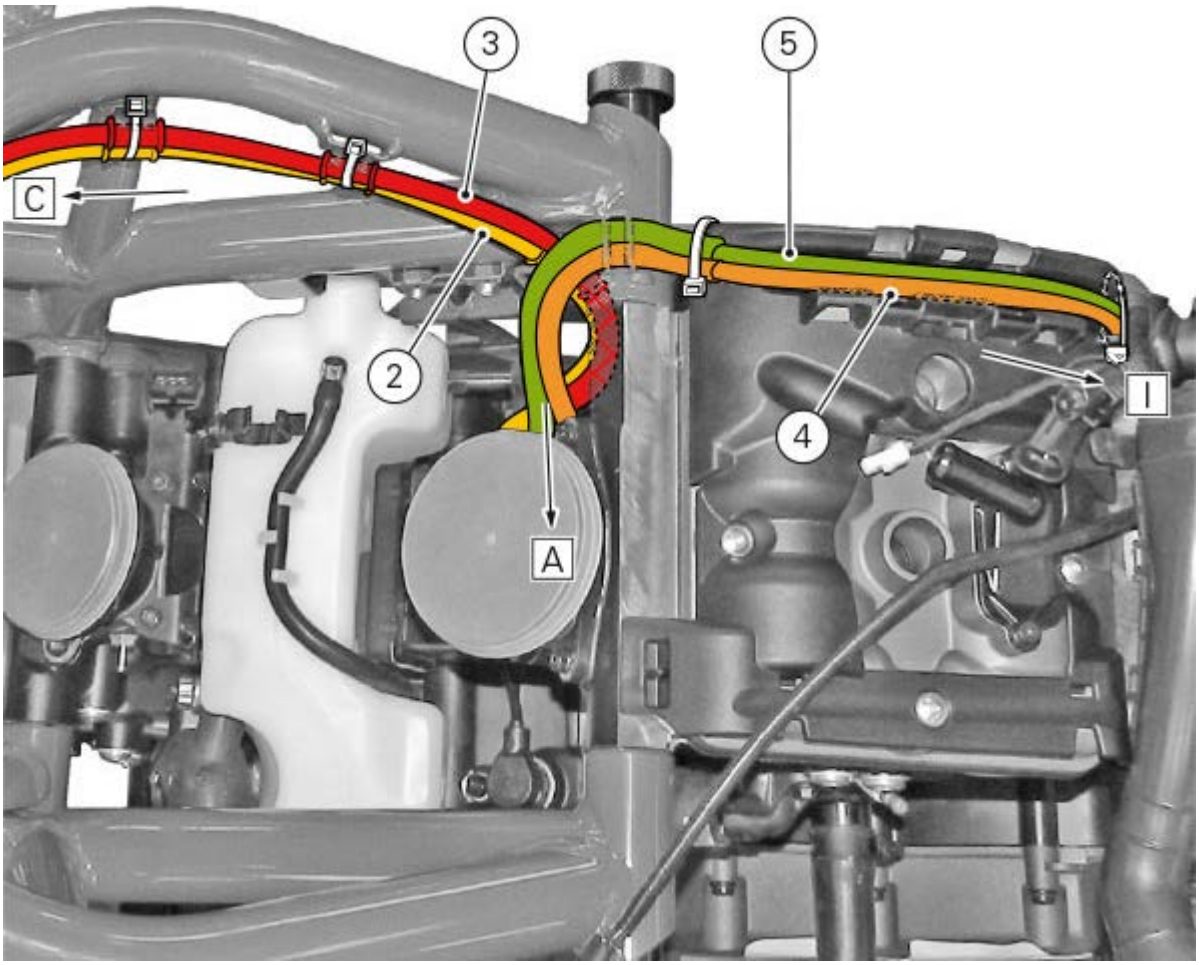
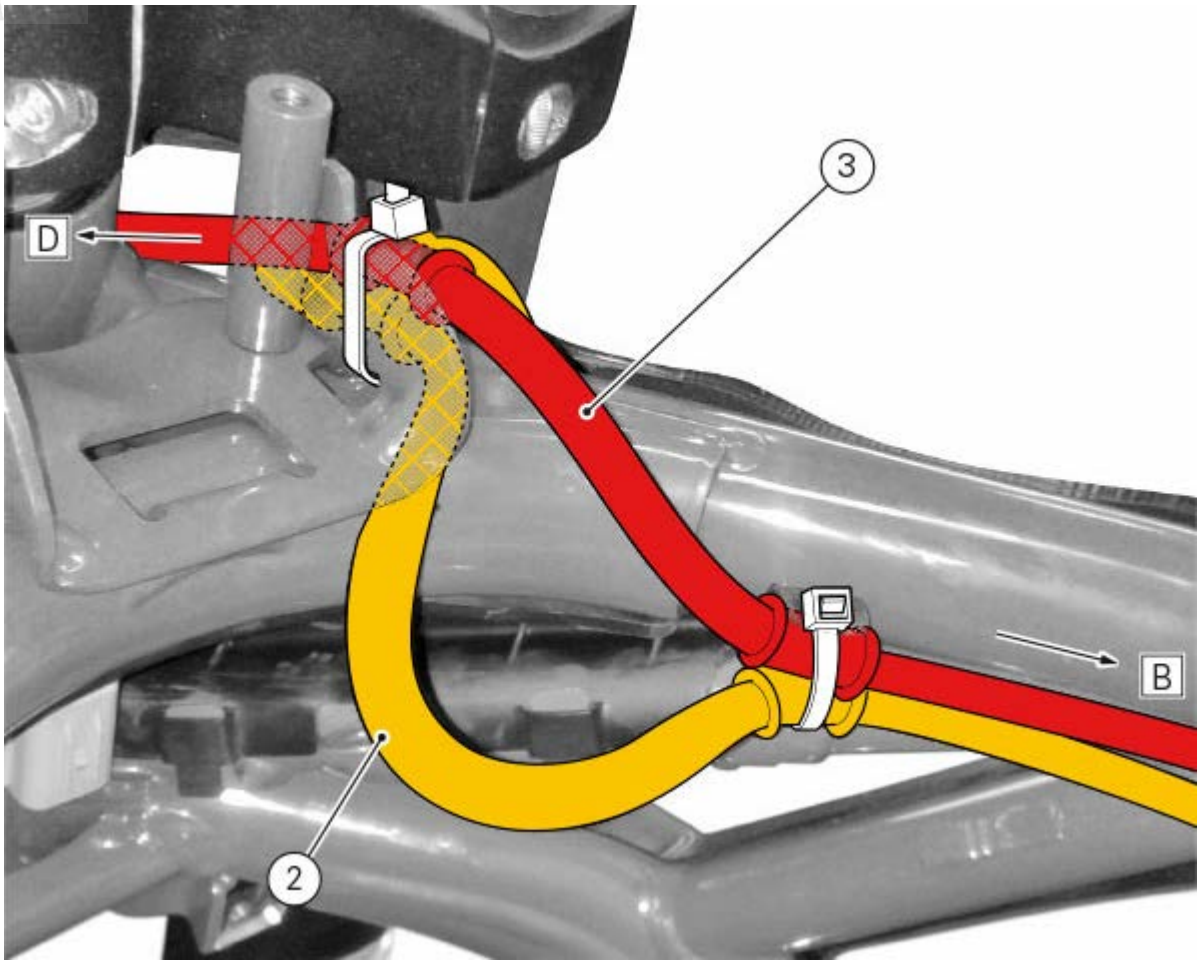


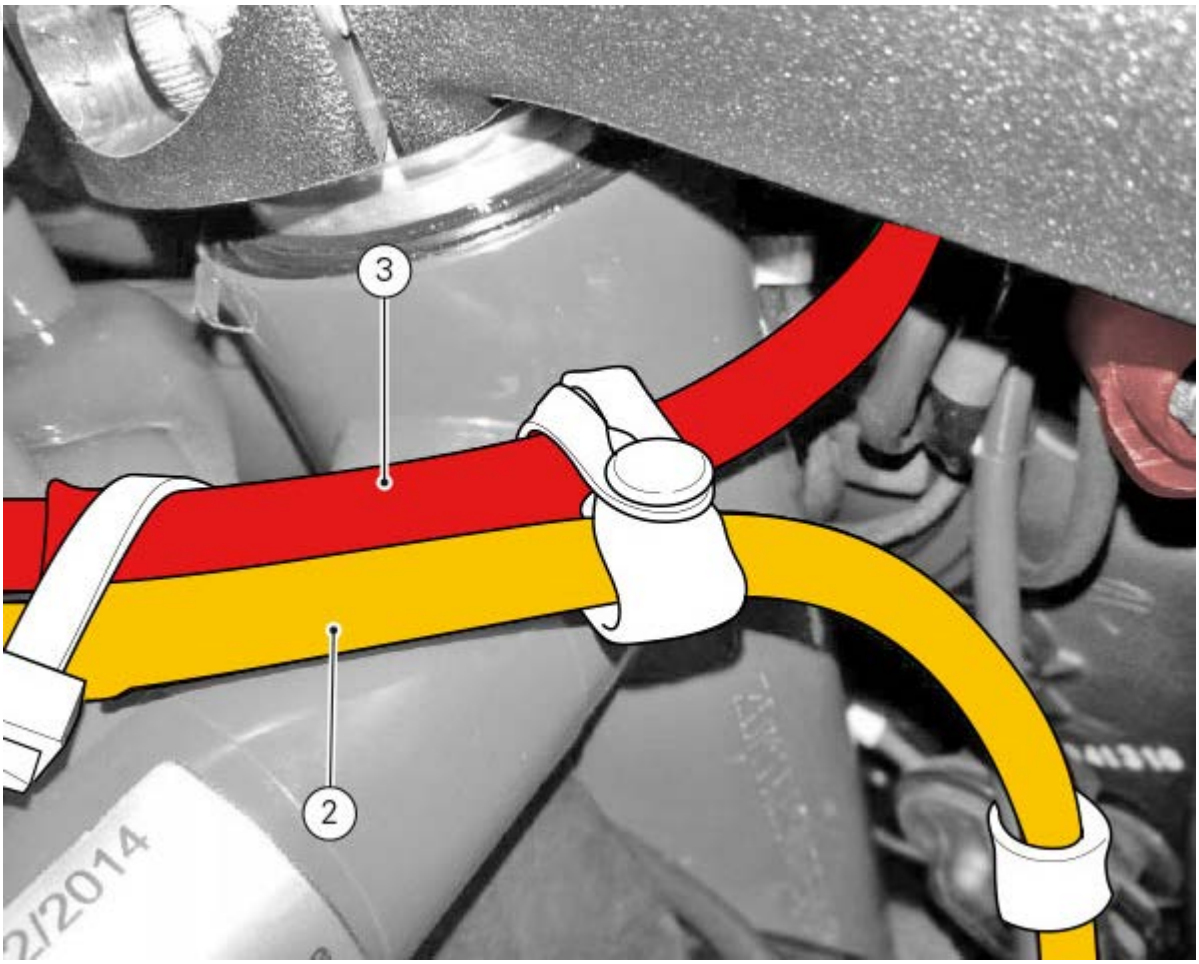
Table C



Attention

Check, with the handlebar fully right, that hoses do not contact the steering head.

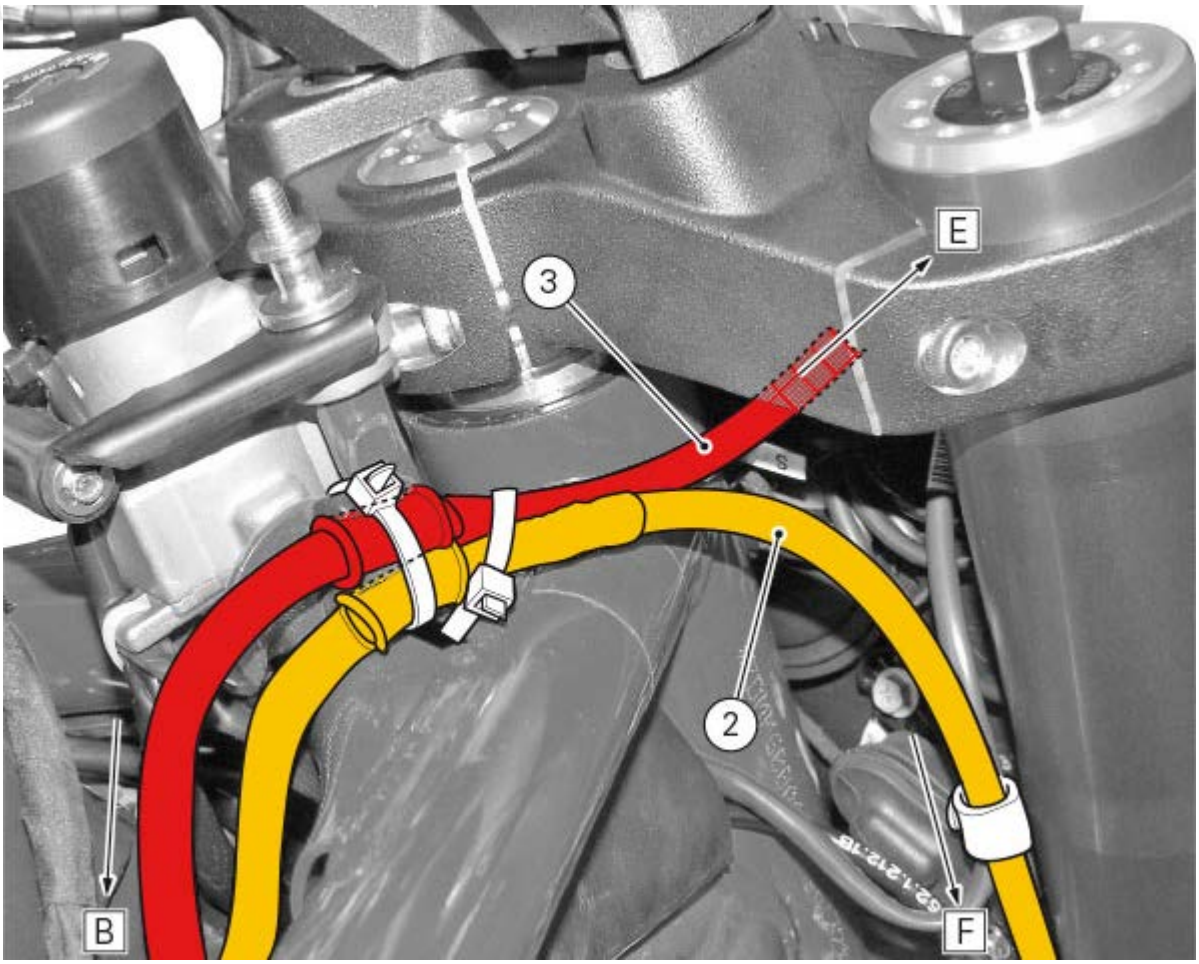
Table C (USA VERSION ONLY)



Attention

Check, with the handlebar fully right, that hoses do not contact the steering head.

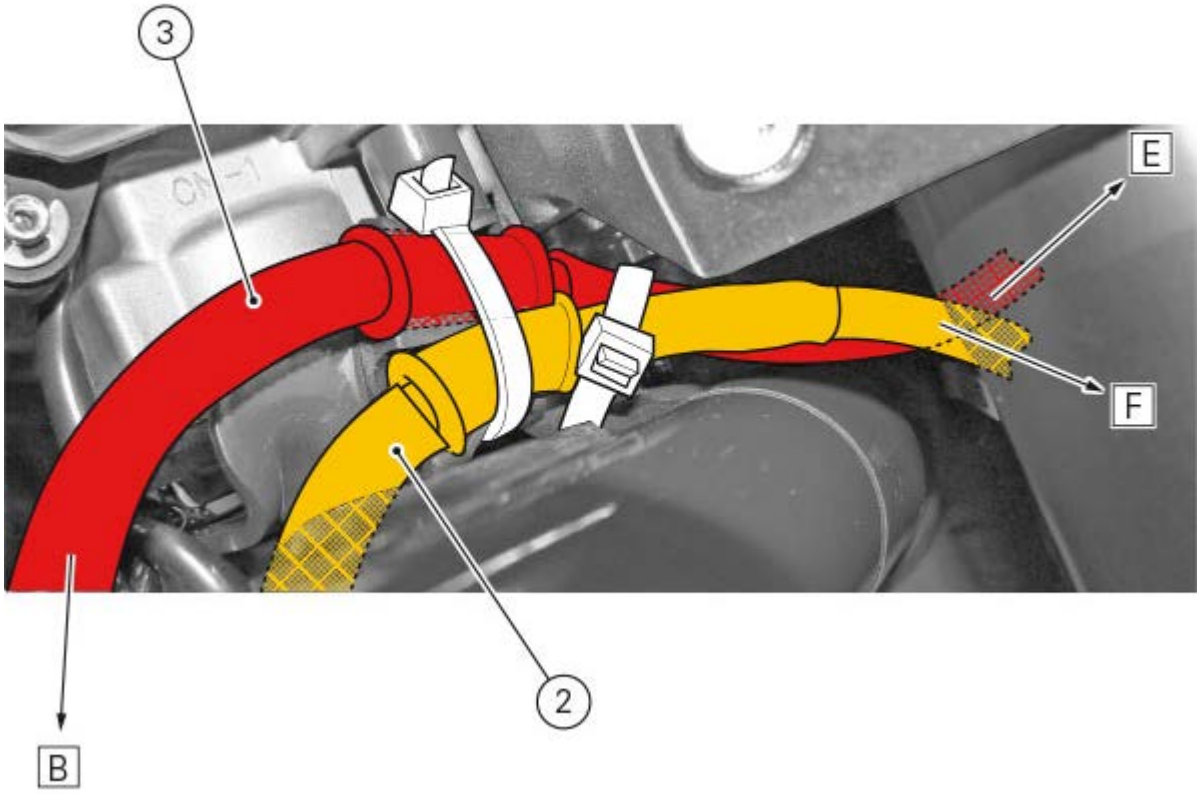
Table D



Warning

Make sure the rear brake calliper/control unit hose and the front brake master cylinder/control unit hose, with handlebar completely to the right, do not touch the steering head, as shows.

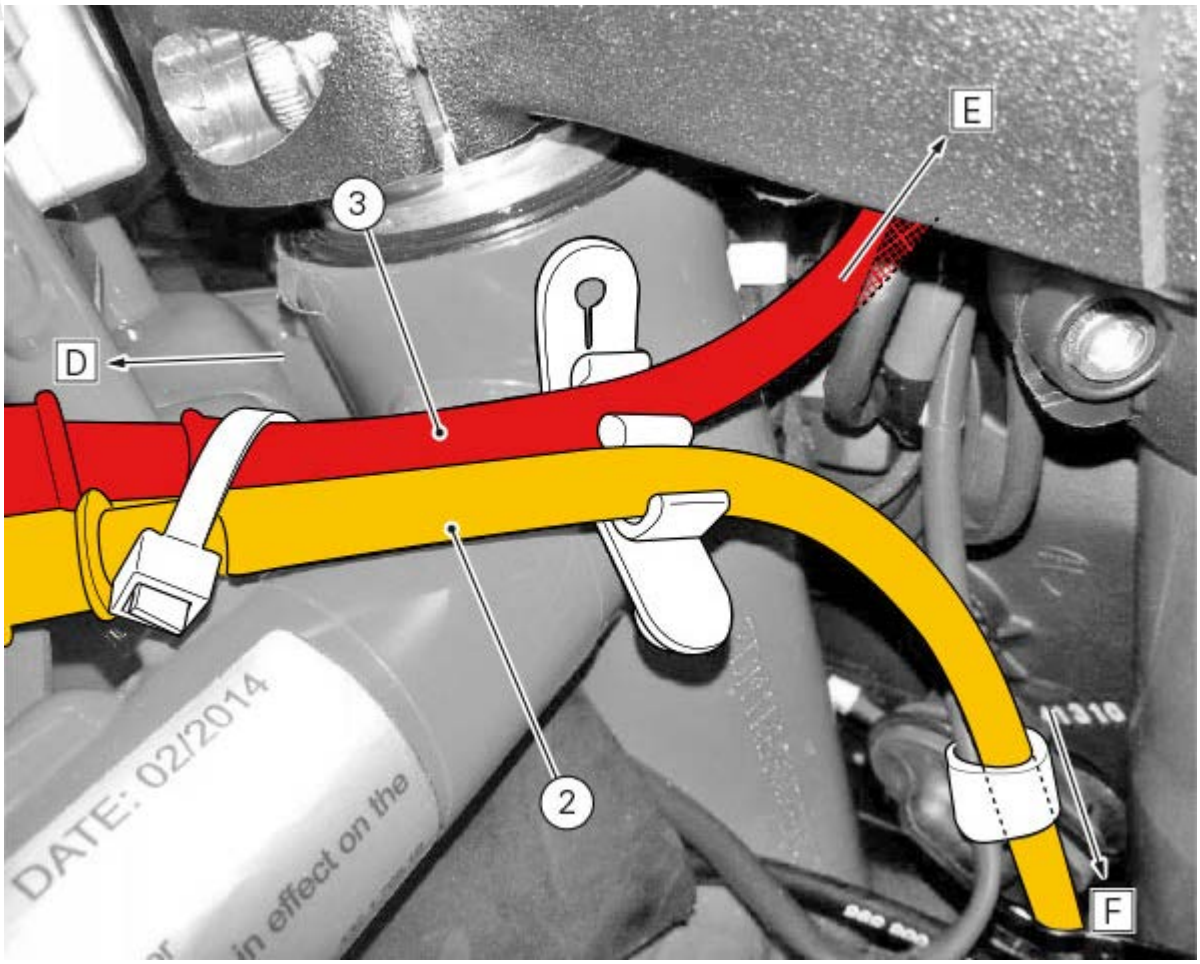
If the wiring is correct but the problem is detected, adjust the steering as indicated in chapter "Steering angle adjustment".



(USA VERSION ONLY)

Warning
After ties are installed and the handlebar is completely to the right, check that the front brake calliper/control unit hose does not touch the right turn indicator support clamp, as shown.

If the wiring is correct but the problem is detected, adjust the steering as indicated in chapter "Steering angle adjustment".



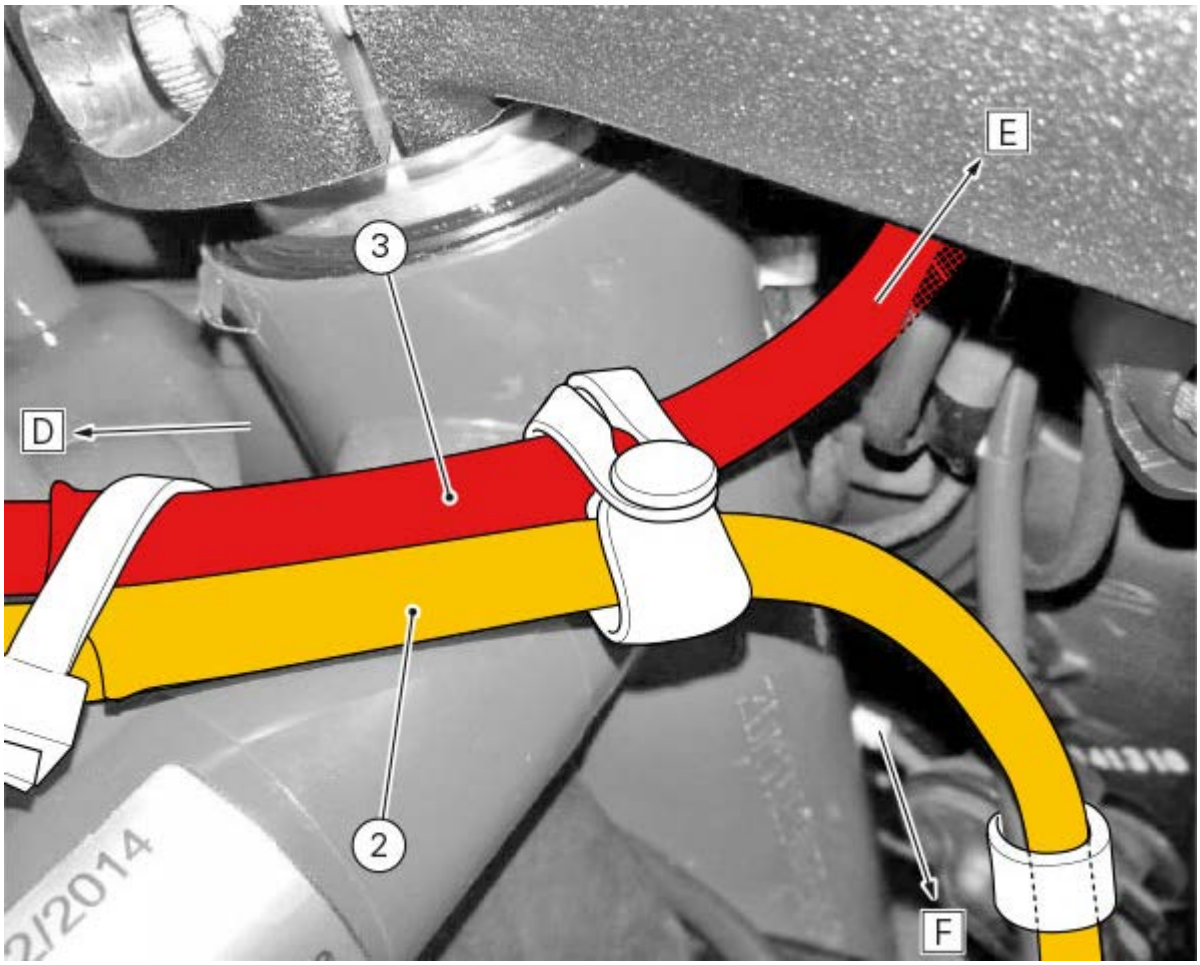
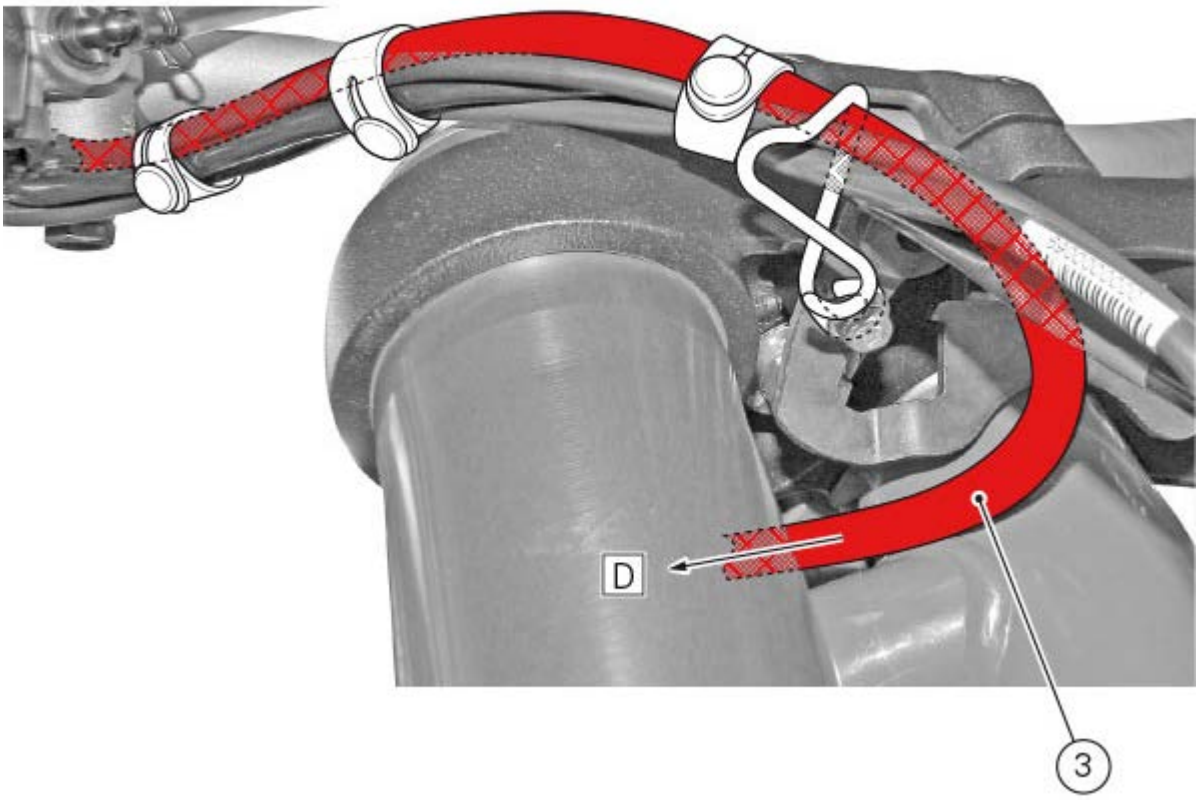


Table E



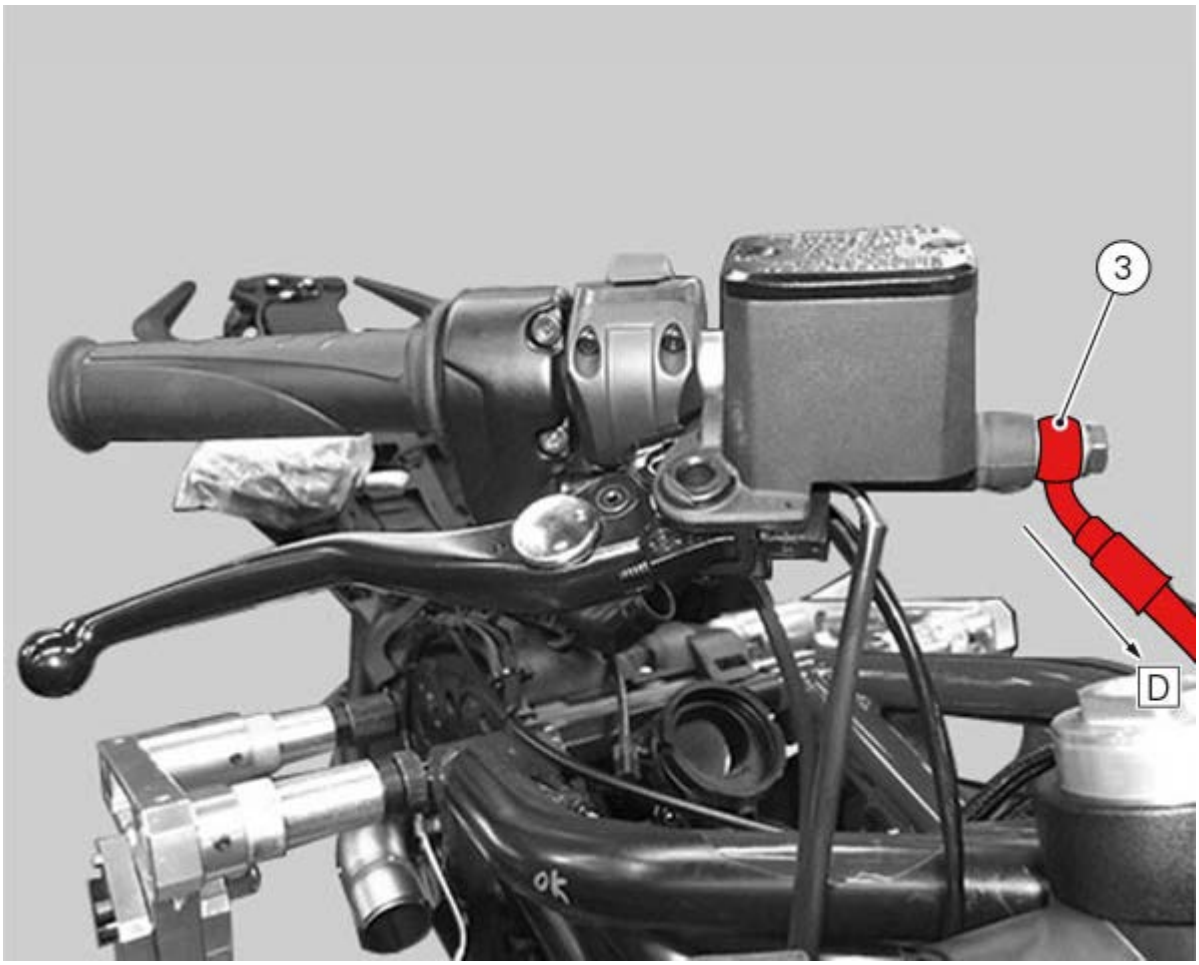


Table F

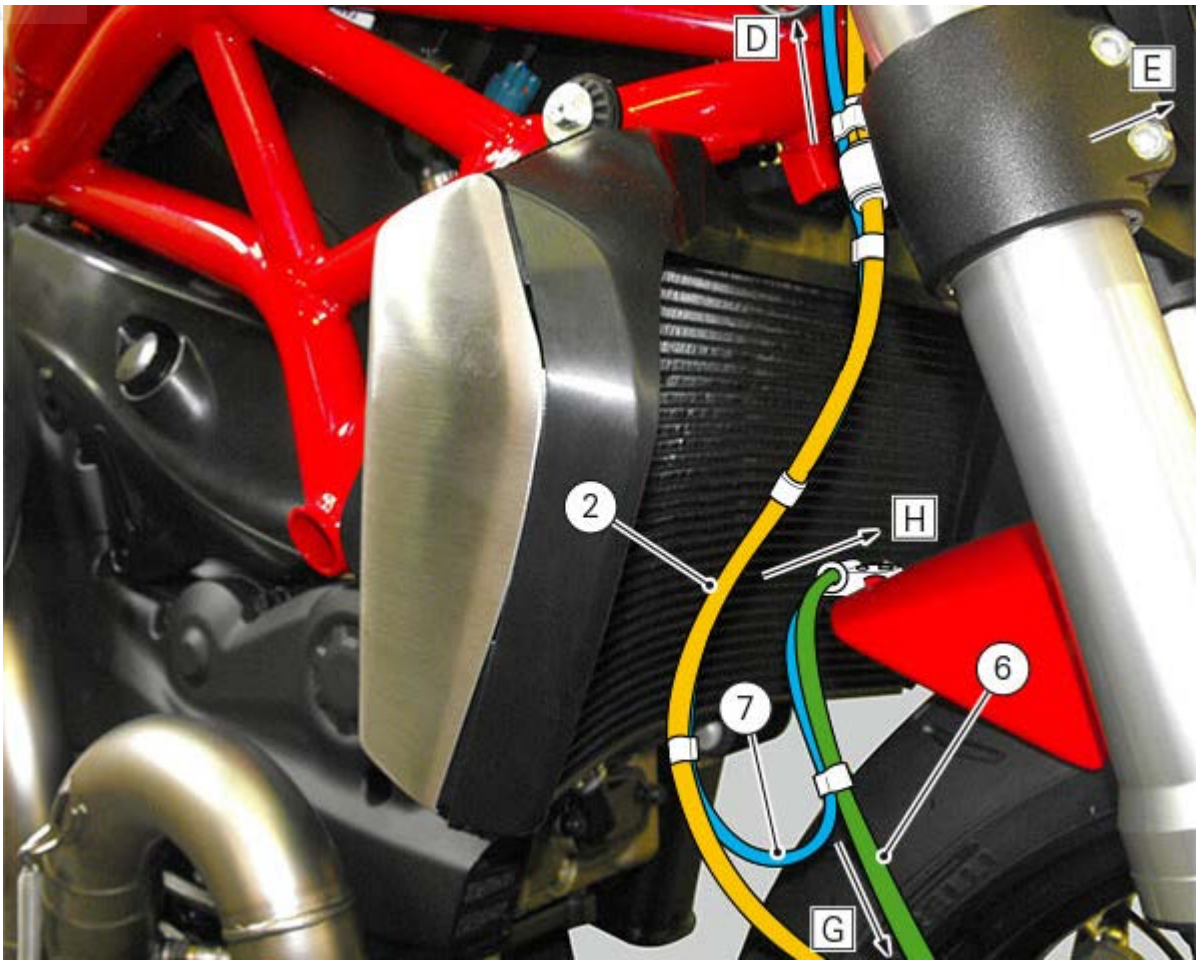


Table G

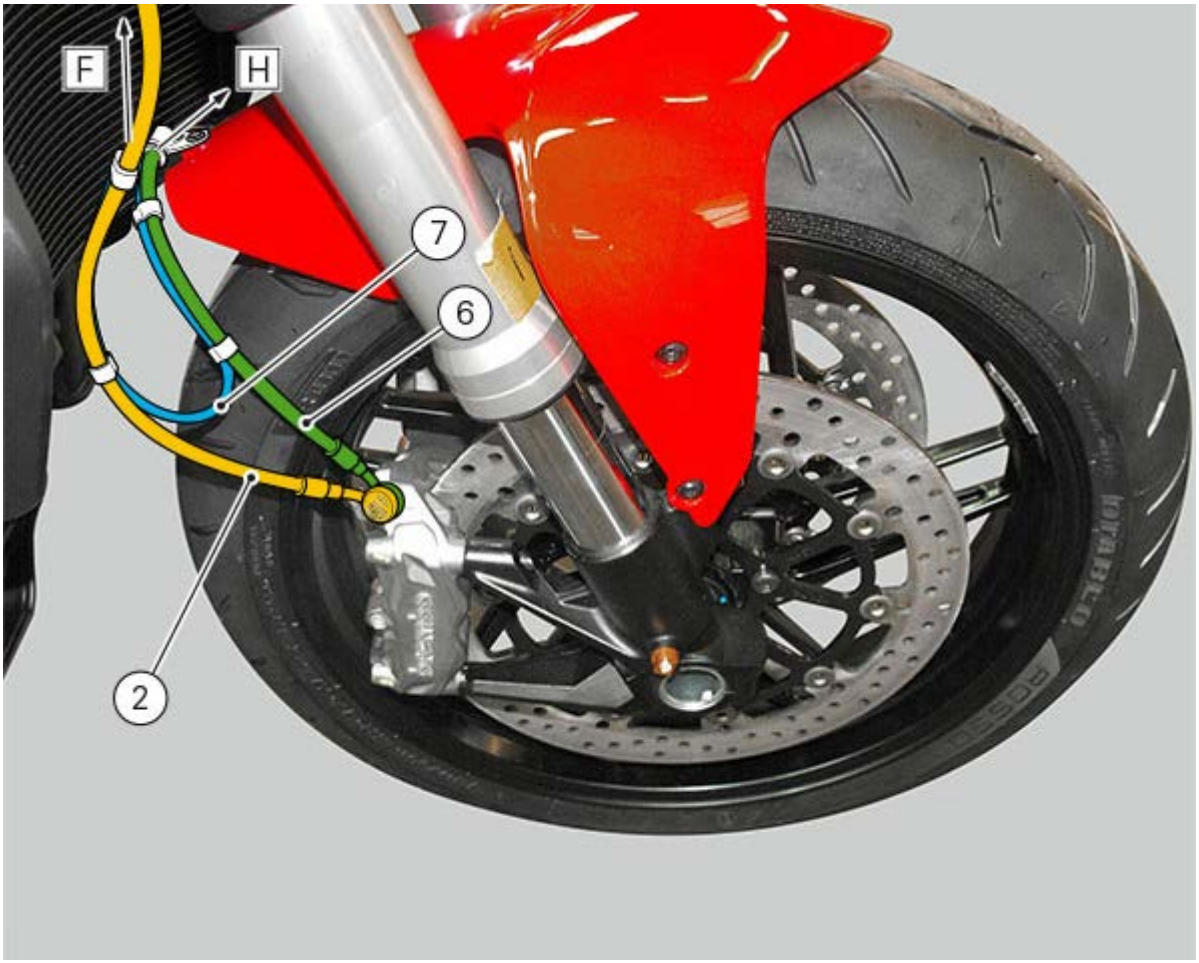


Table H

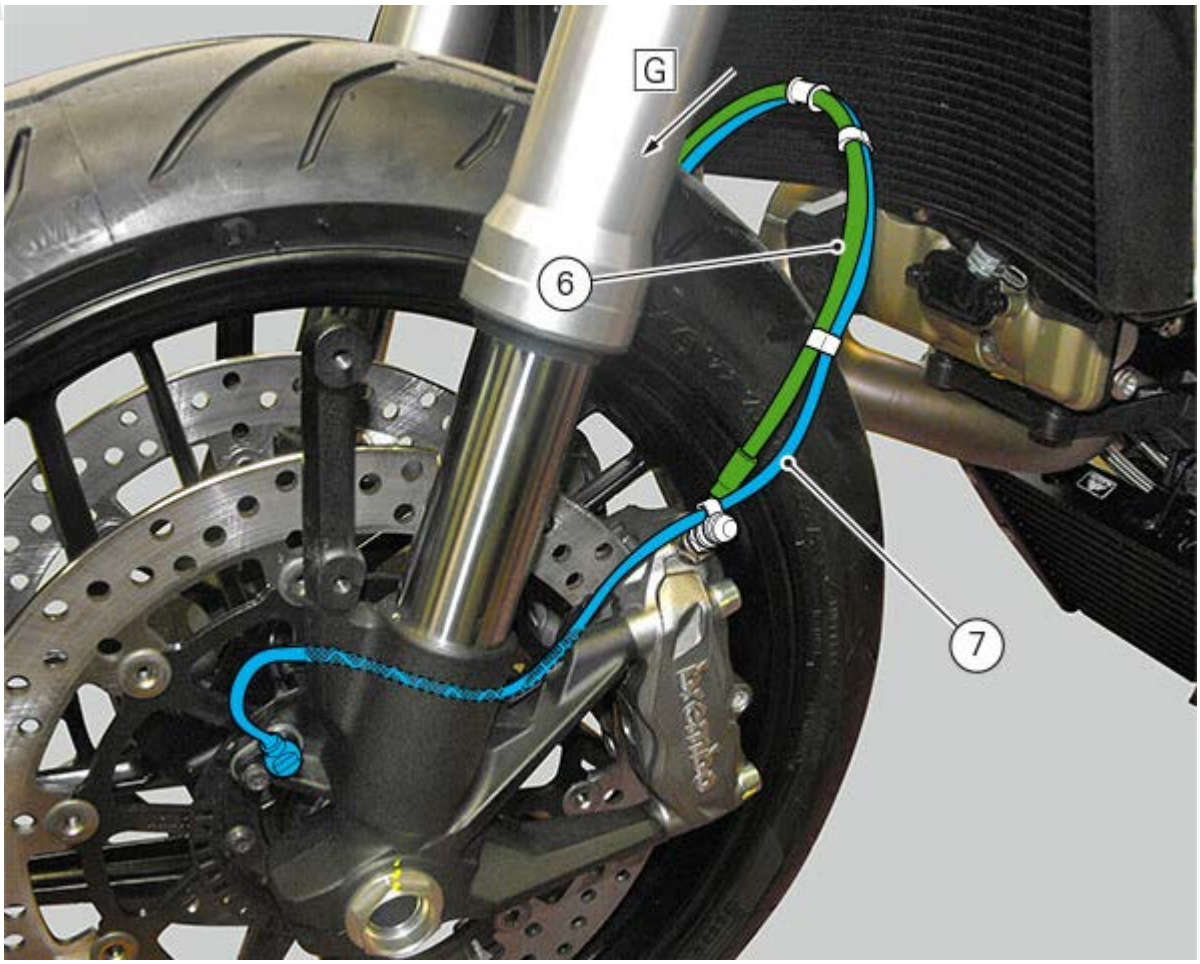
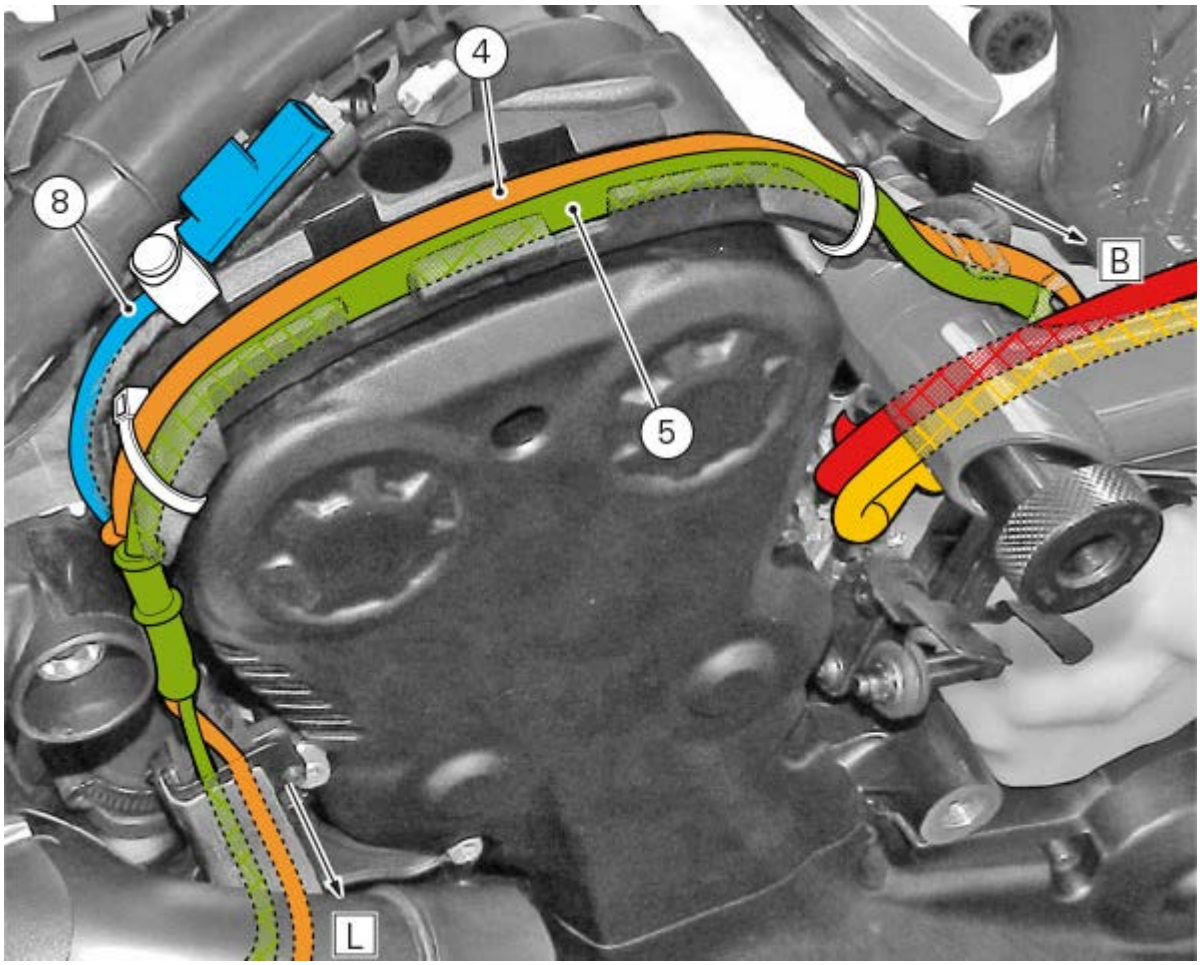


Table I



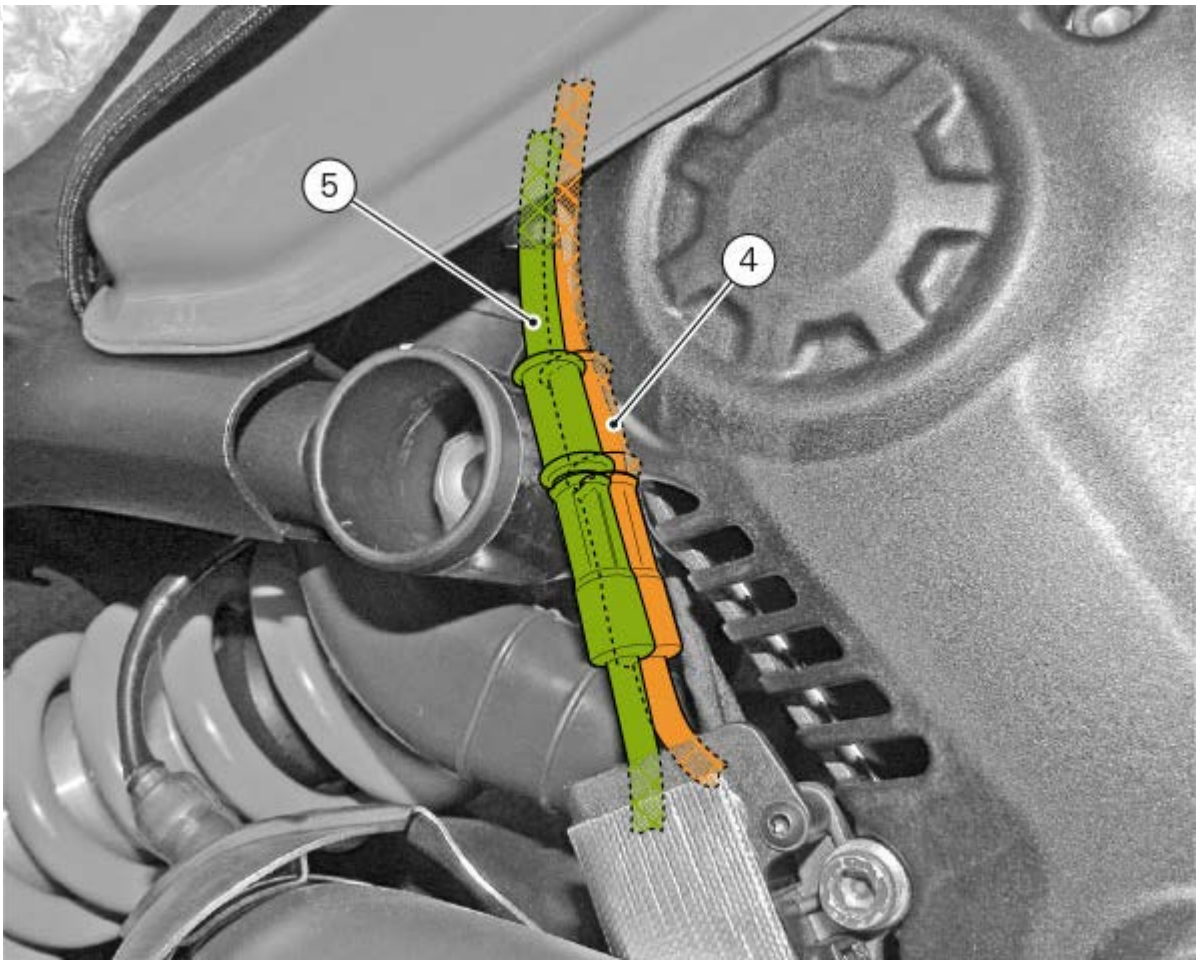
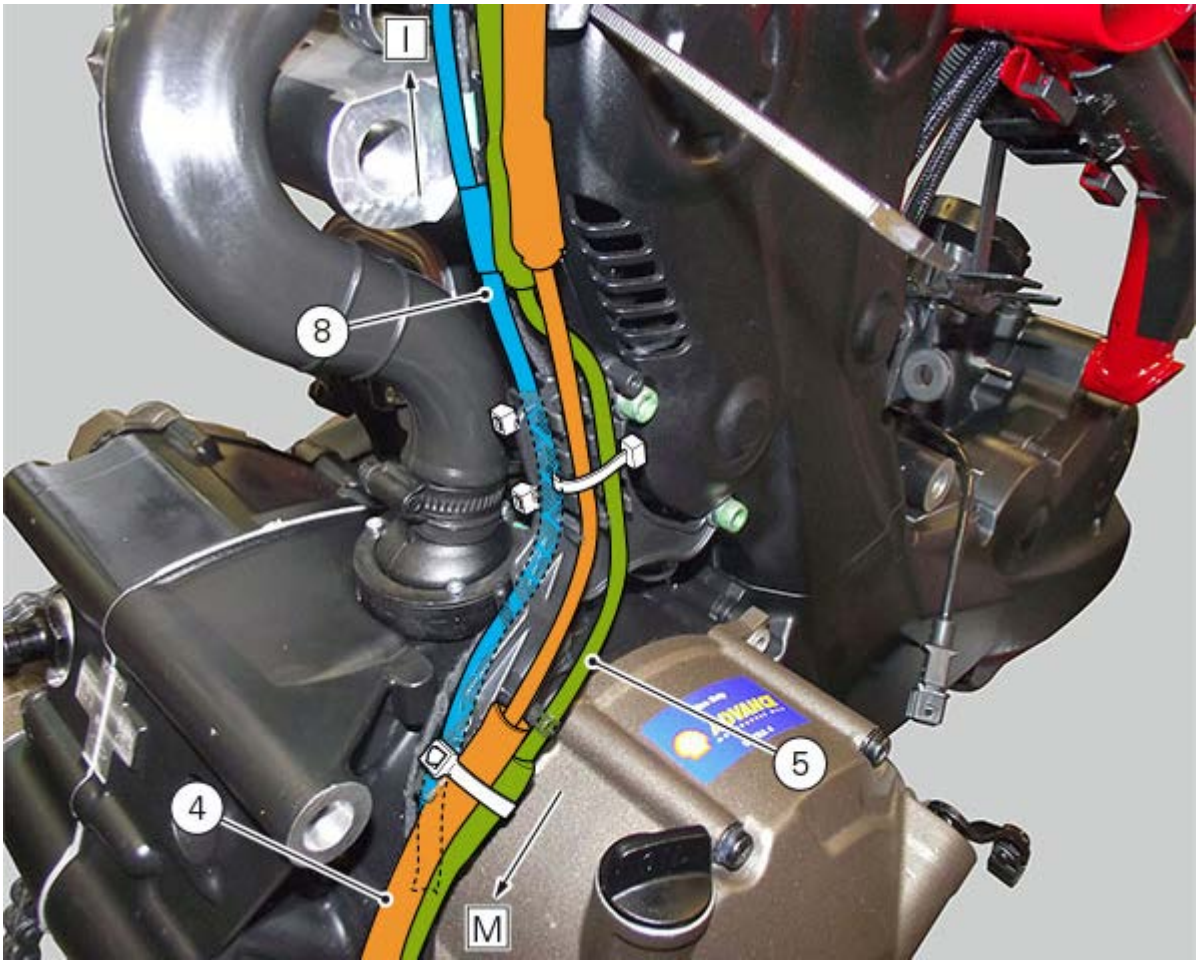


Table L



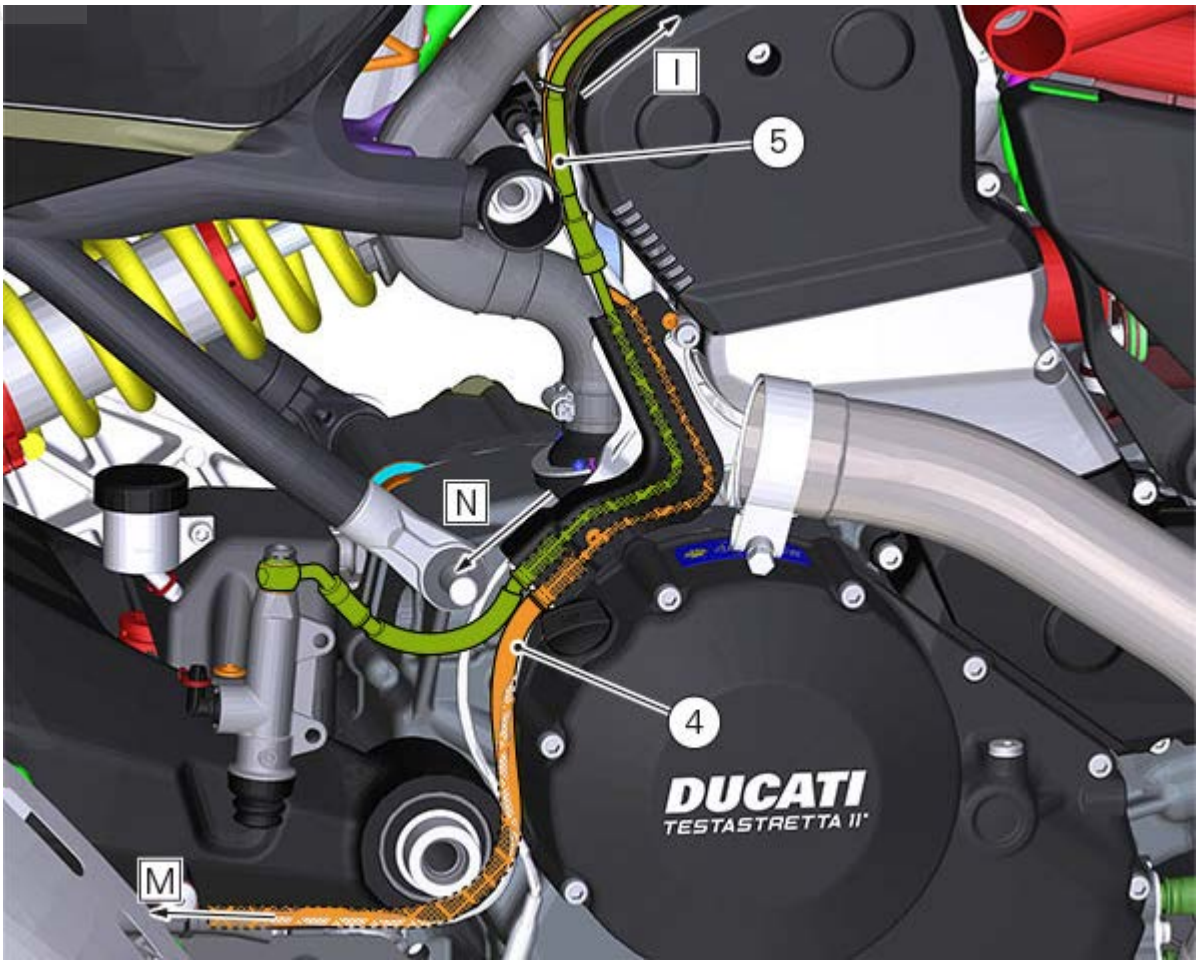


Table M

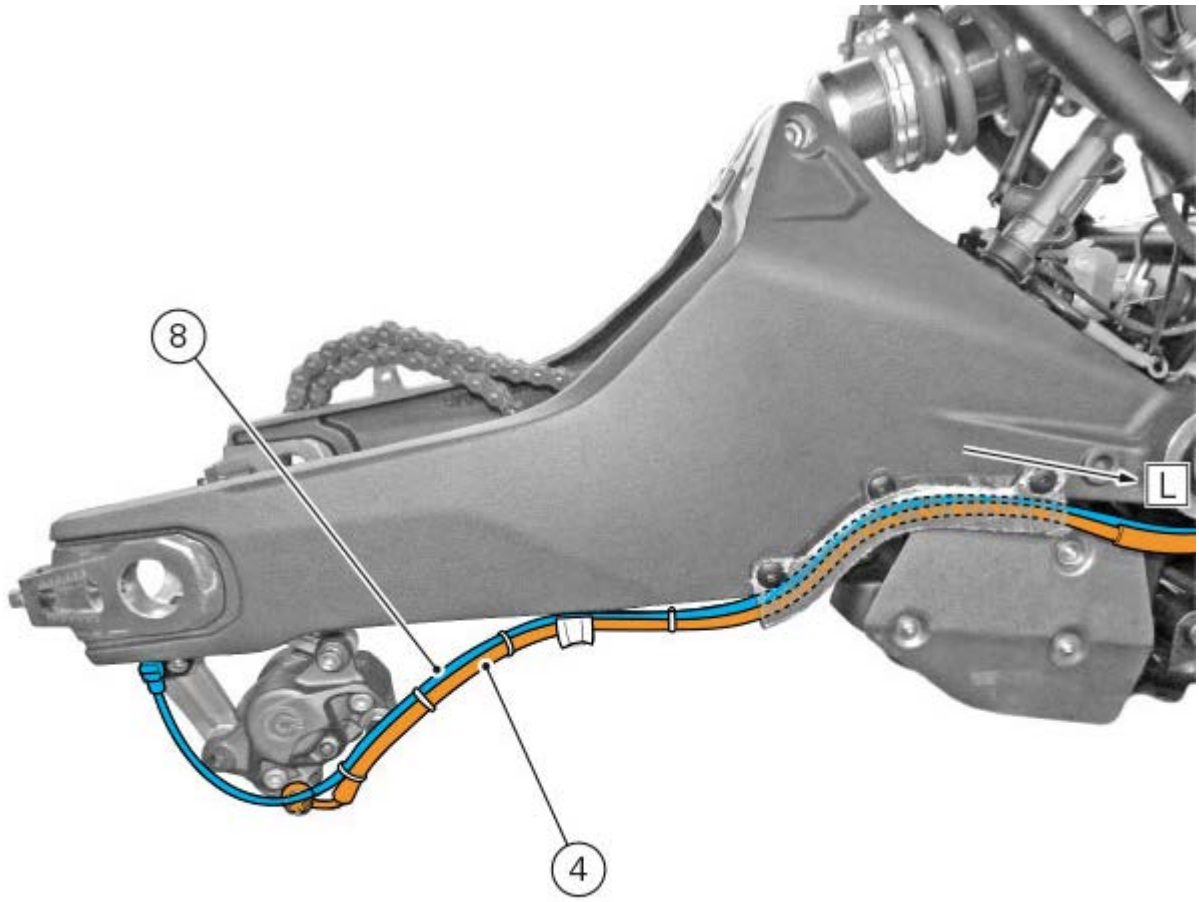


Table N

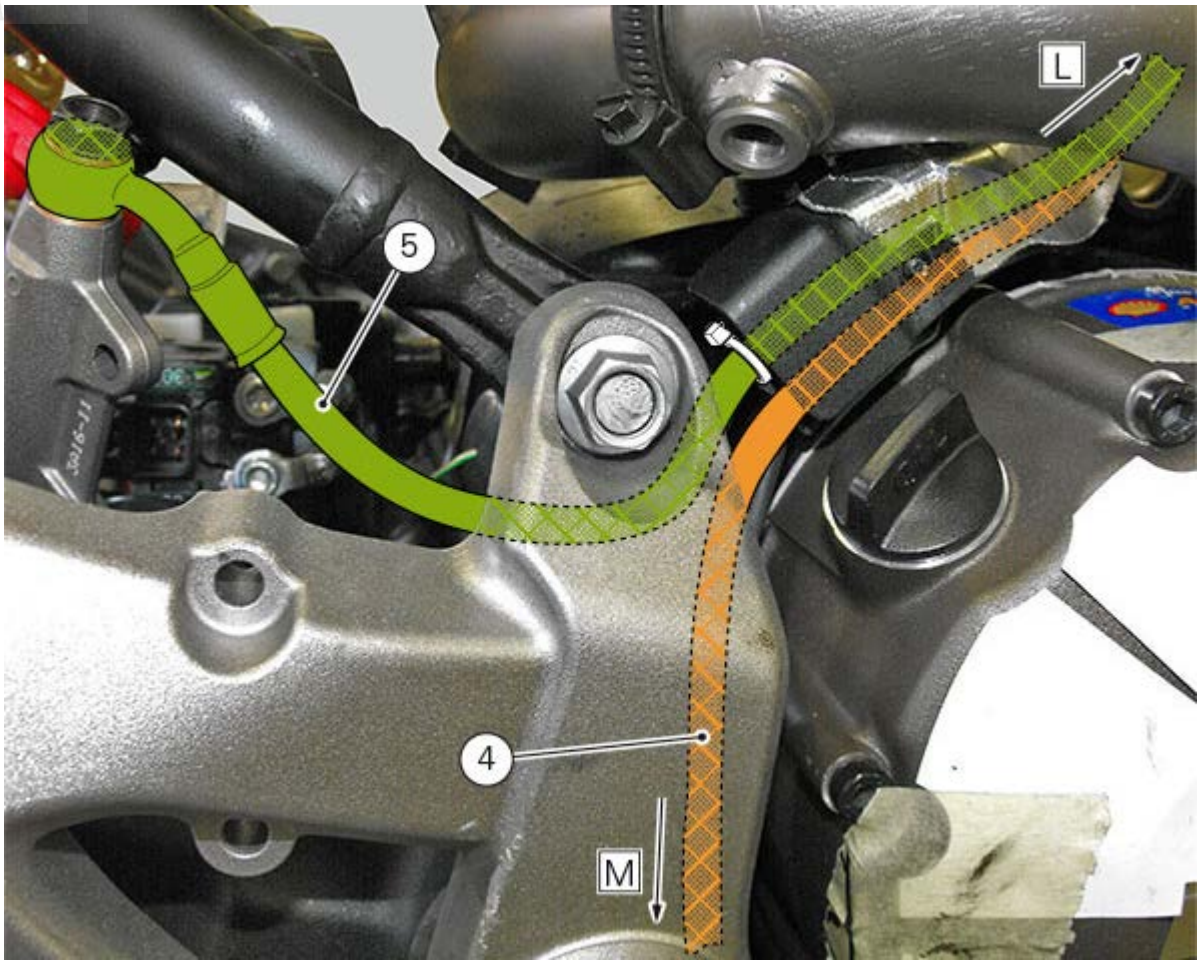


Table O

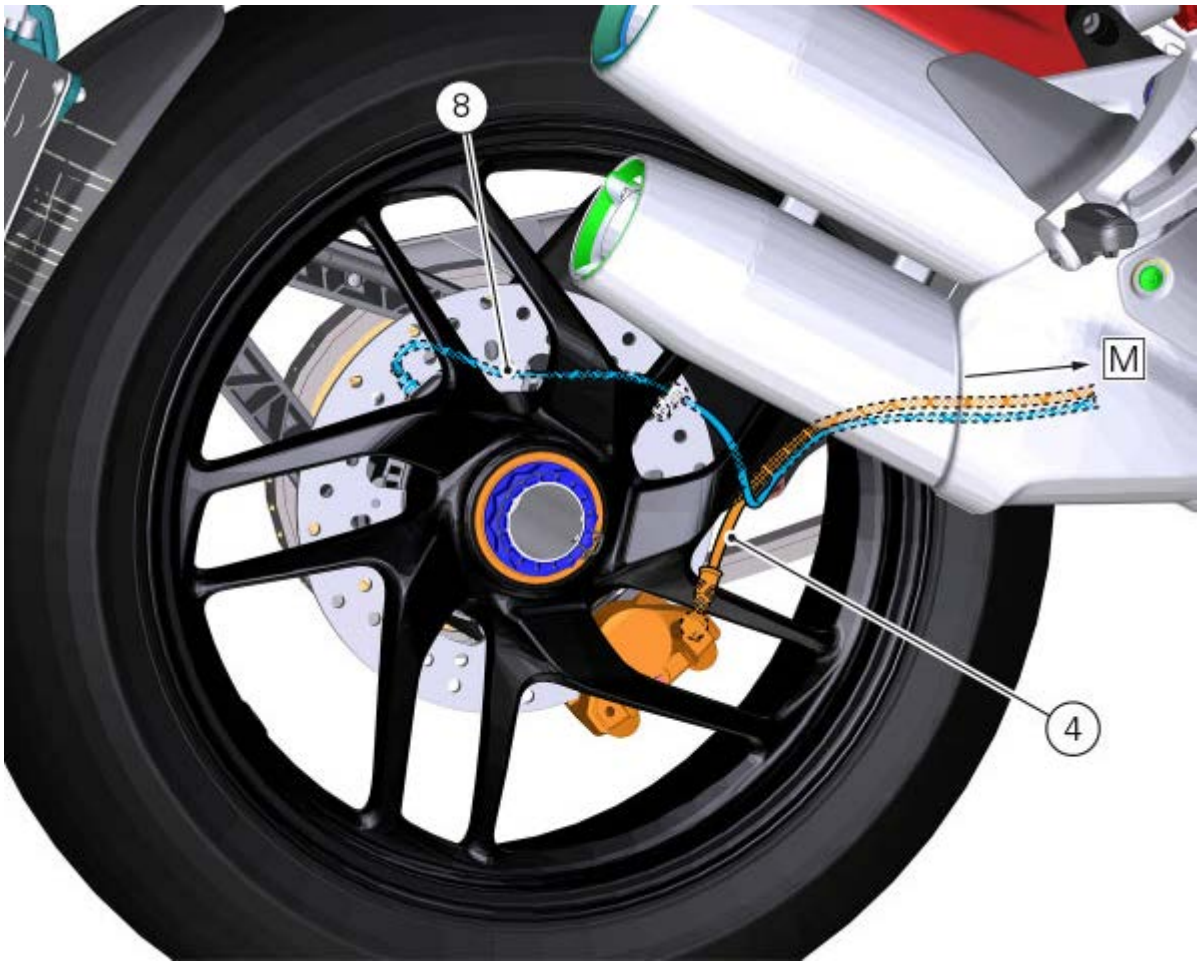
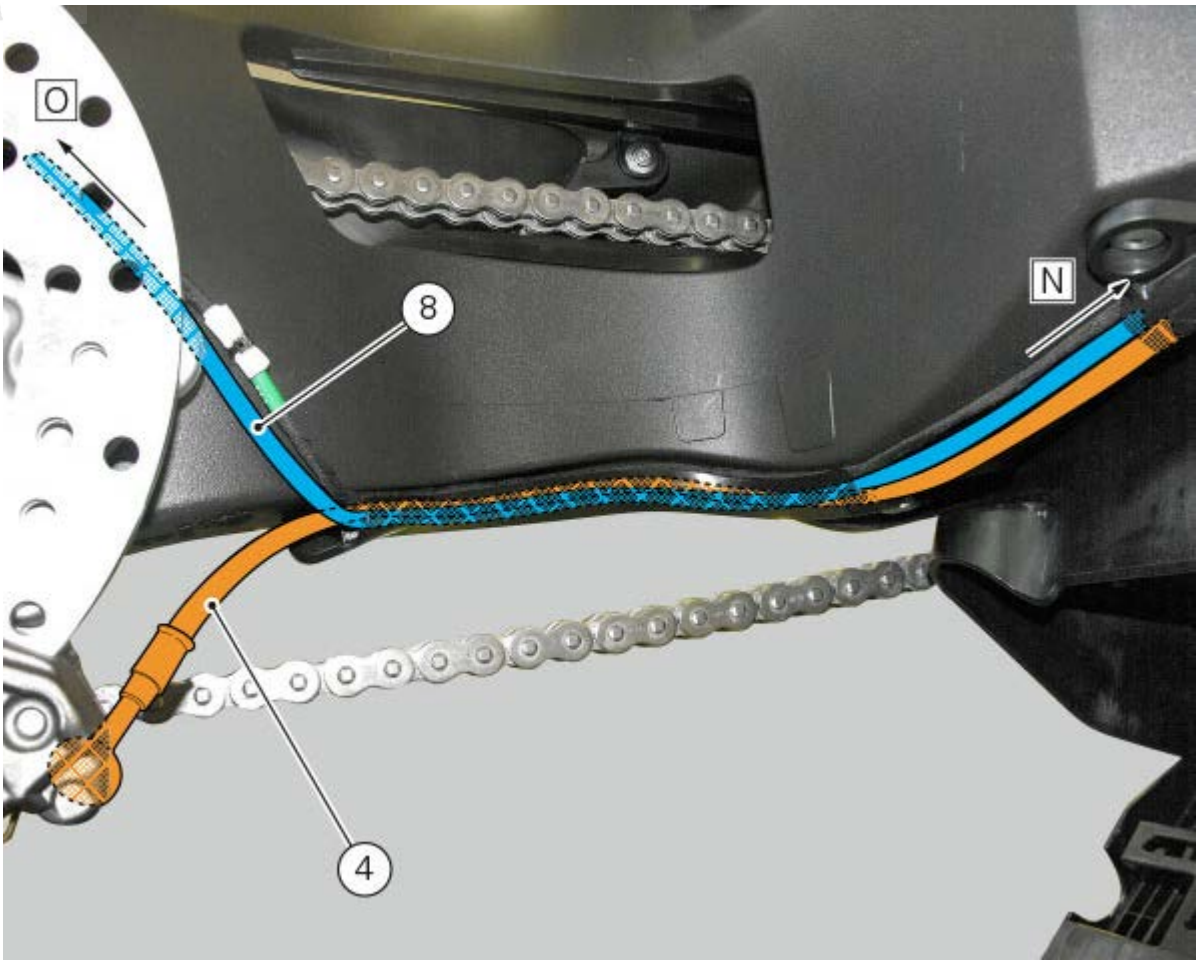
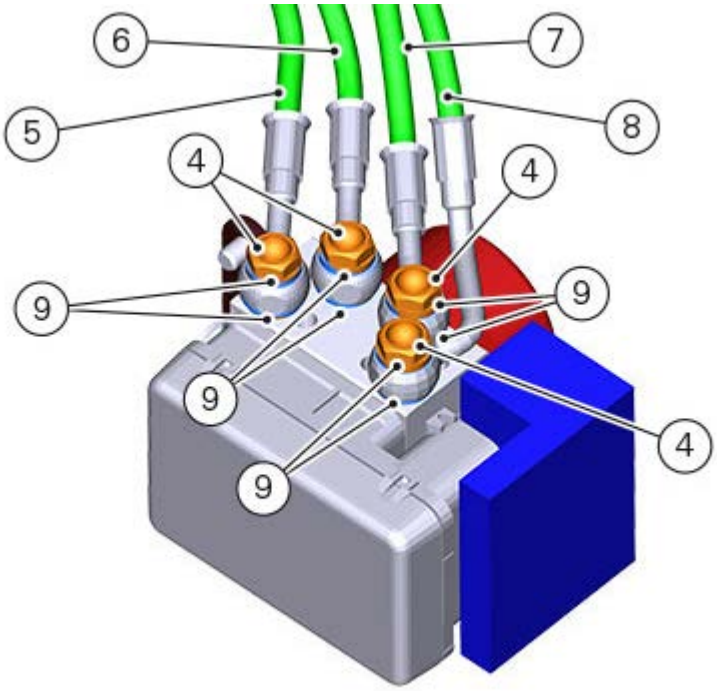


Table P

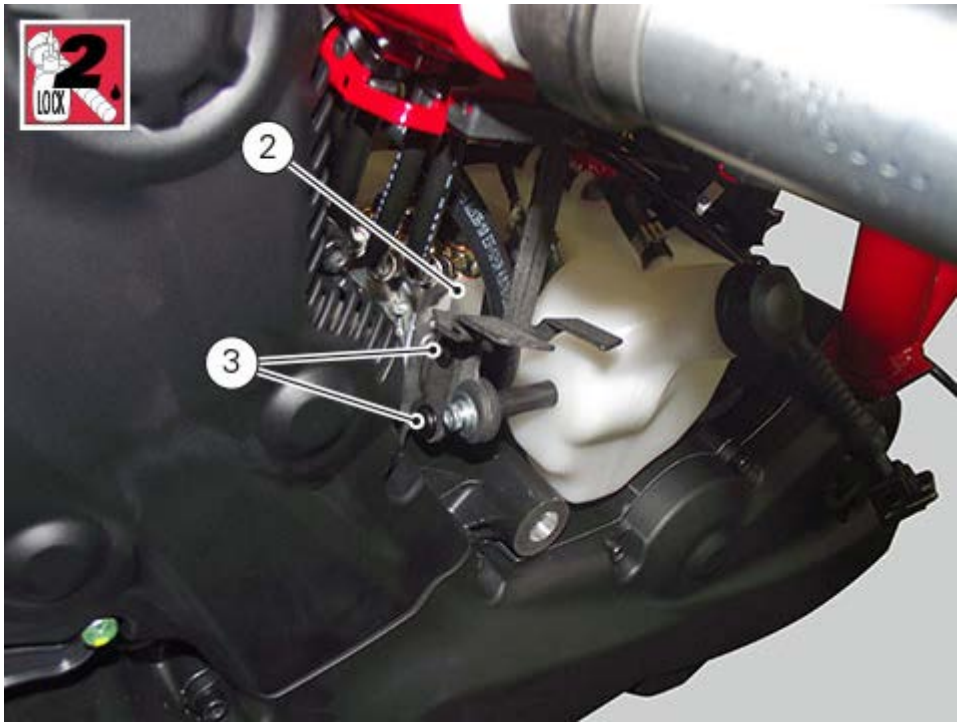


Refitting the ABS control unit

Hoses (8), (7), (6) and (5) must be secured in place using new sealing washers (9) on unions.
Tighten the four special screws (4) fastening hoses (5), (6), (7) and (8) to a torque of 23 Nm ± 10% on ABS control unit (2).

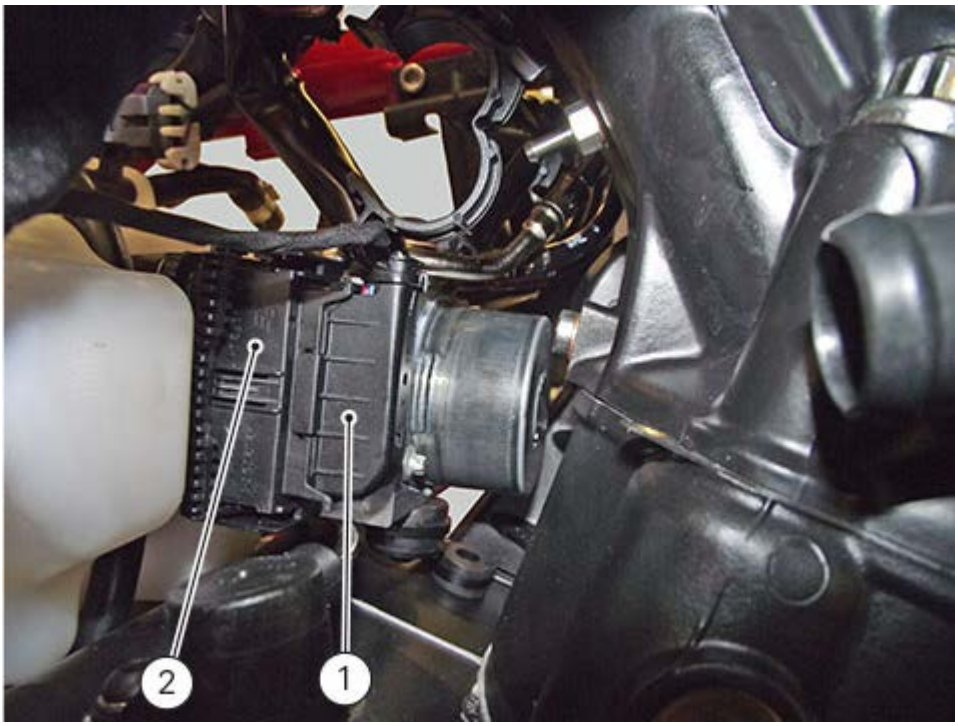


Position ABS control unit (2) on vehicle and route hoses as described in "Routing wiring harnesses/hoses".
Tighten screws (3) to a torque of 6.8 Nm ± 1 Nm after having applied the specified product.

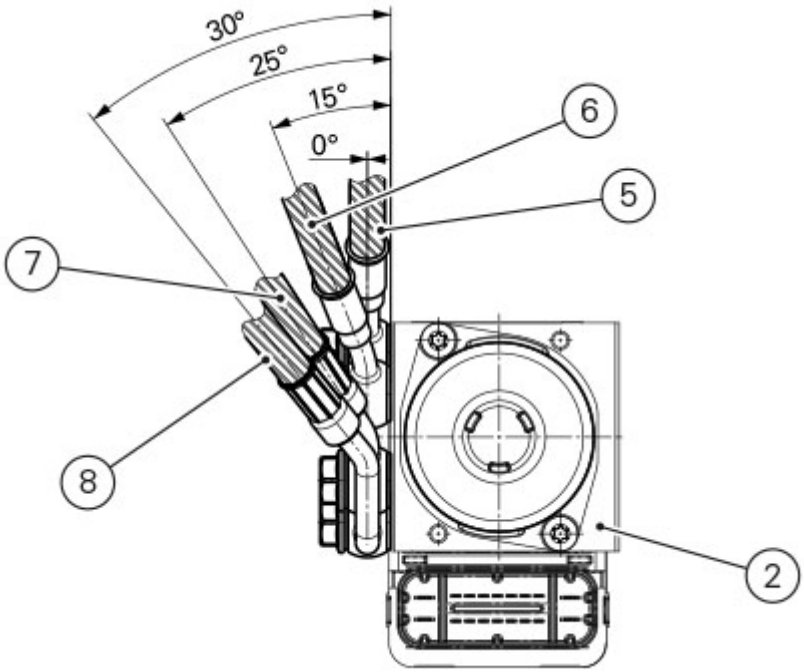


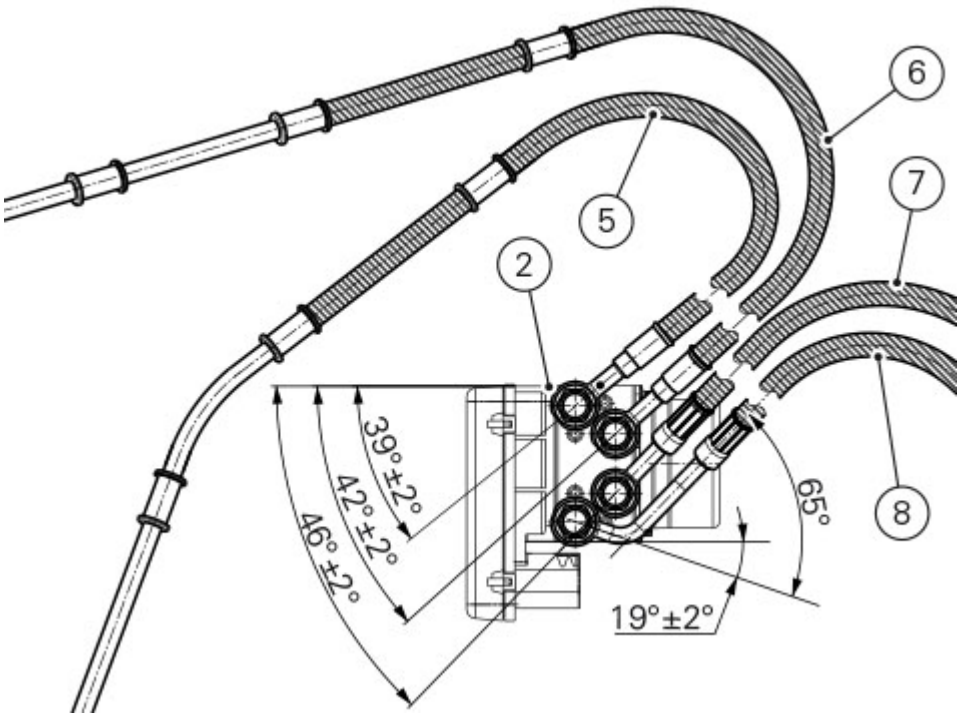
Important
If the ABS hydraulic control unit has been replaced, it will be supplied with the secondary circuit already filled with fluid. Control unit must thus be assembled and the system filled and drained as a traditional system.

Connect ABS control unit (2) connector (1).



Make sure that hoses are routed as shown in the figure so as to avoid damages or malfunctions to both system and vehicle.



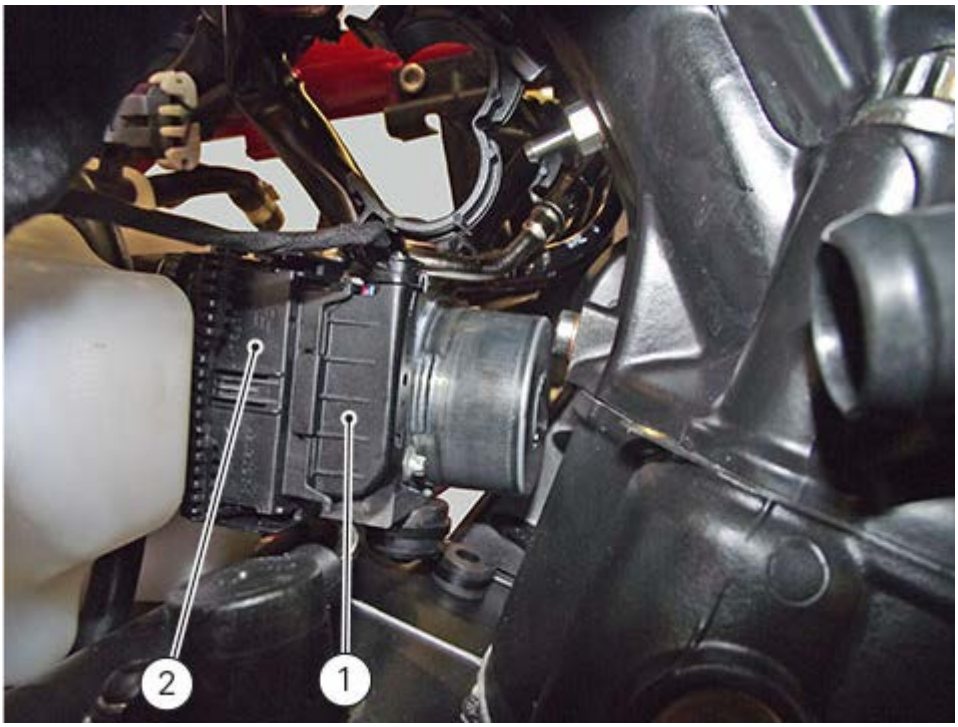


Refit the airbox and the throttle body (Refitting the airbox and throttle body).
Refit the fuel tank (Refitting the fuel tank).
Refit the seat (Refitting the seat).
Fill and bleed the brake system (Changing the fluid in the front brake system, Changing the fluid in the rear brake system).

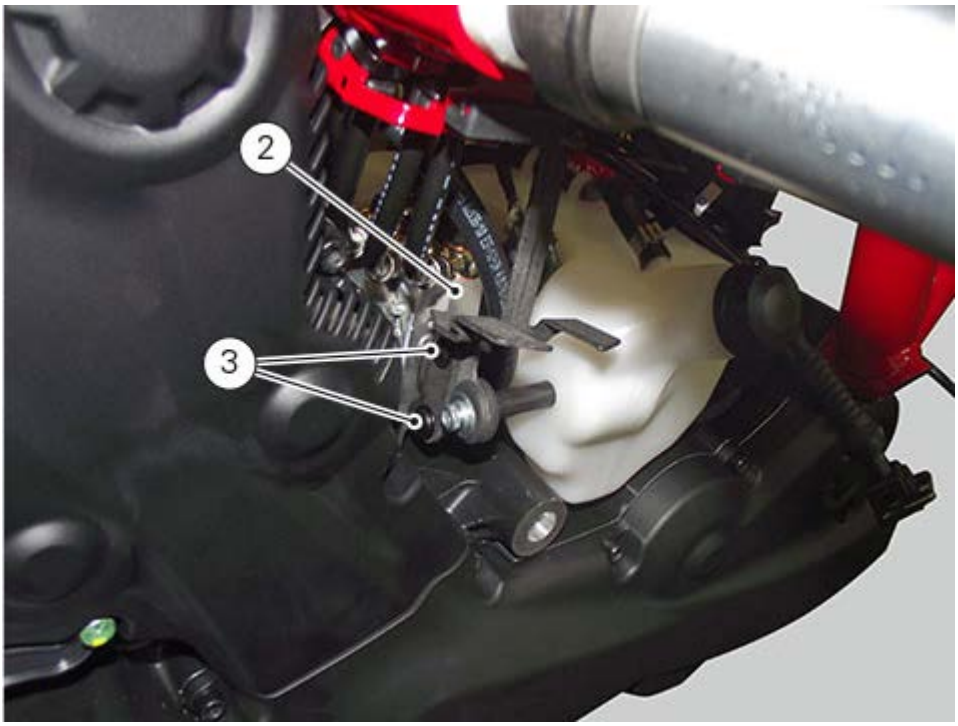
Removing the ABS control unit

Remove the seat (Removing the seat).
Remove the fuel tank (Removing the fuel tank).
Remove the airbox and the throttle body (Removing the airbox and throttle body).
Remove the RH and LH side covers (Removing the water tank).
Remove the wiring cover and the vertical head tubes (Removing the camshafts).

Drain off the hydraulic fluid from brake system hoses, by disconnecting these from the calliper and master cylinder, (Changing the front brake system fluid, Changing the rear brake system fluid).
Disconnect ABS control unit (2) connector (1), lift unit from the vehicle.



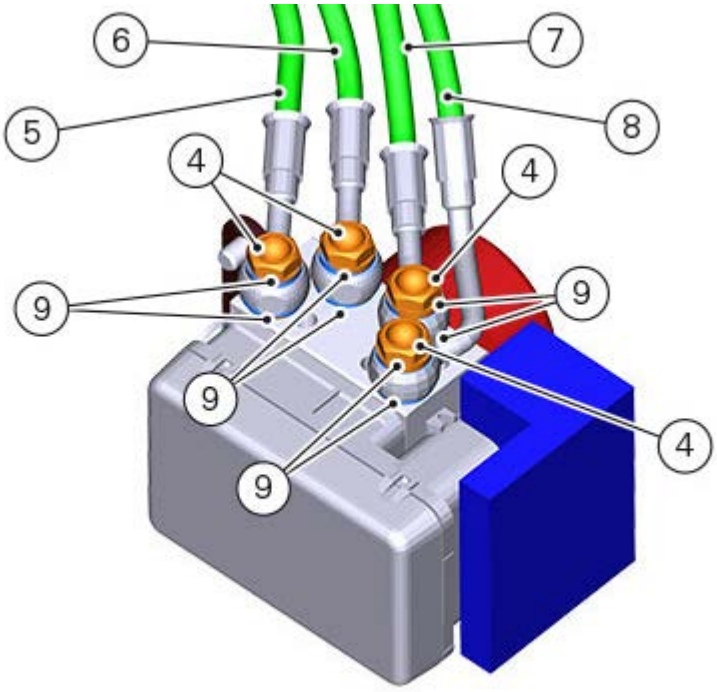
Loosen the two screws (3) and remove the control unit (2).



Loosen the four special screws (4) retaining pipes (5), (6), (7) and (8), on ABS control unit (2), by removing the seals (9).

Warning

Whenever removed, seals must be replaced by new ones of the same type on refitting.



Important

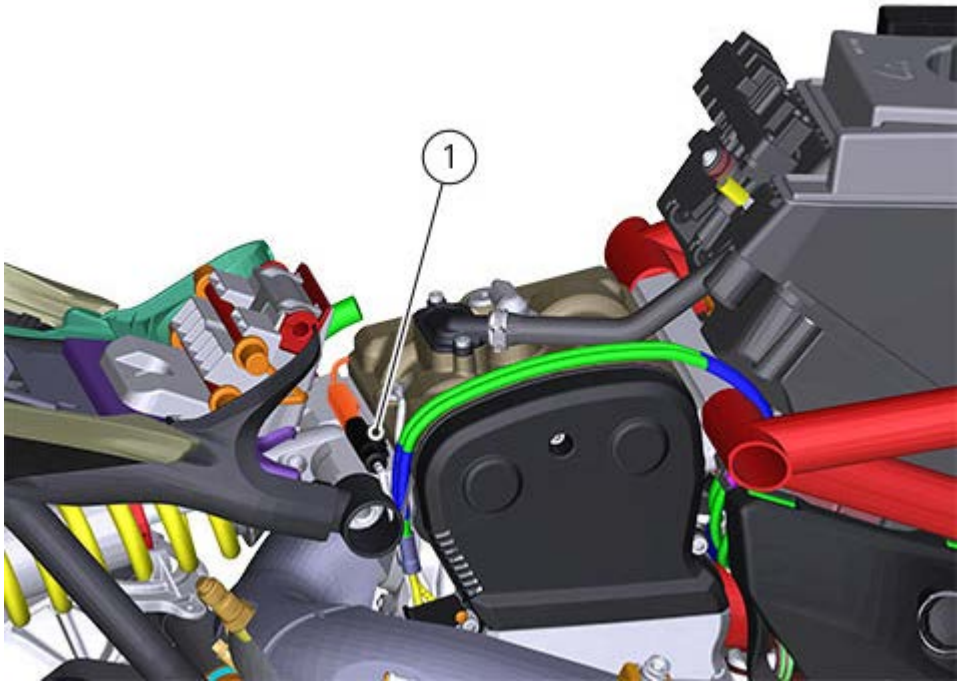
Do not open the ABS control unit: if faulty, replace it.

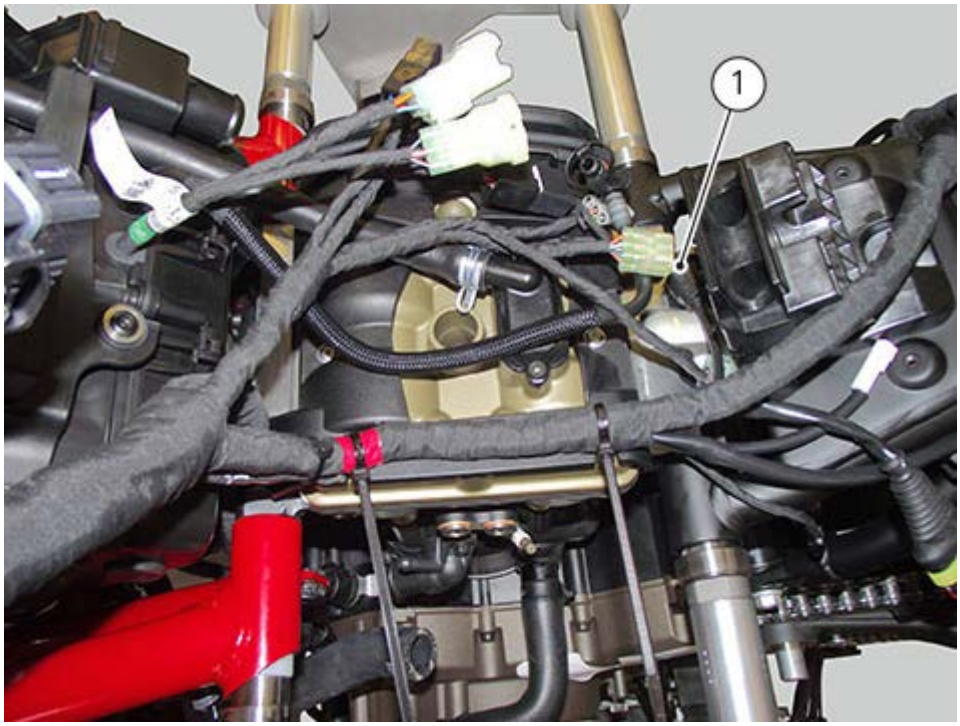
Should it be necessary to replace one or several hoses, refer to "Routing wiring harnesses / hoses" of this section.

Changing the rear phonic wheel sensor

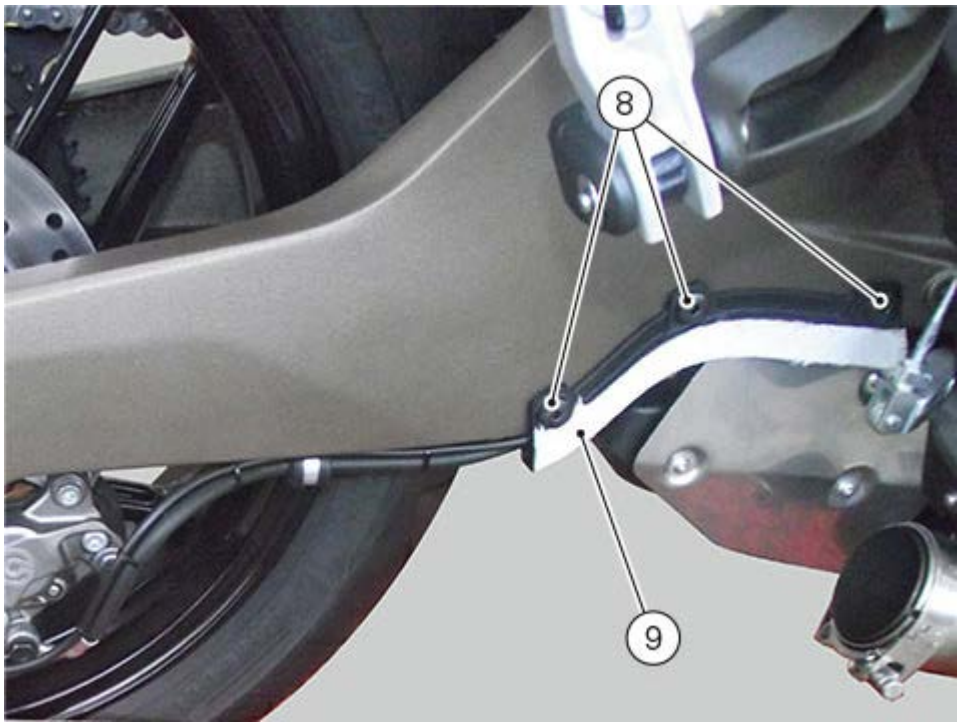
Remove the seat (Removing the seat).
Remove the vertical exhaust system (Removing the exhaust system)

Disconnect connector (1) of rear ABS sensor from main wiring.

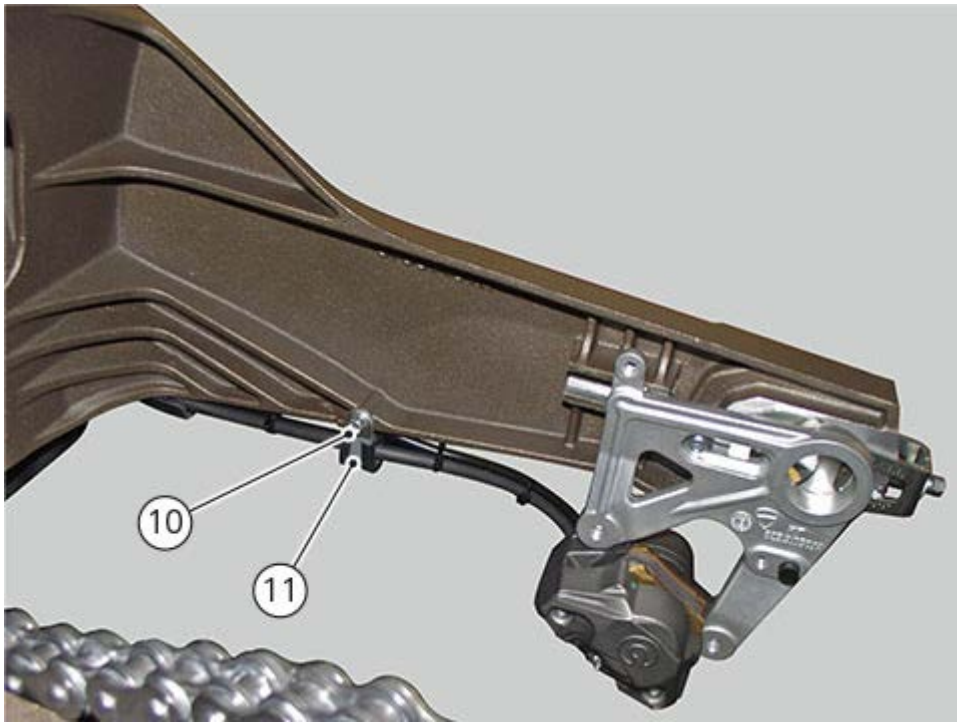




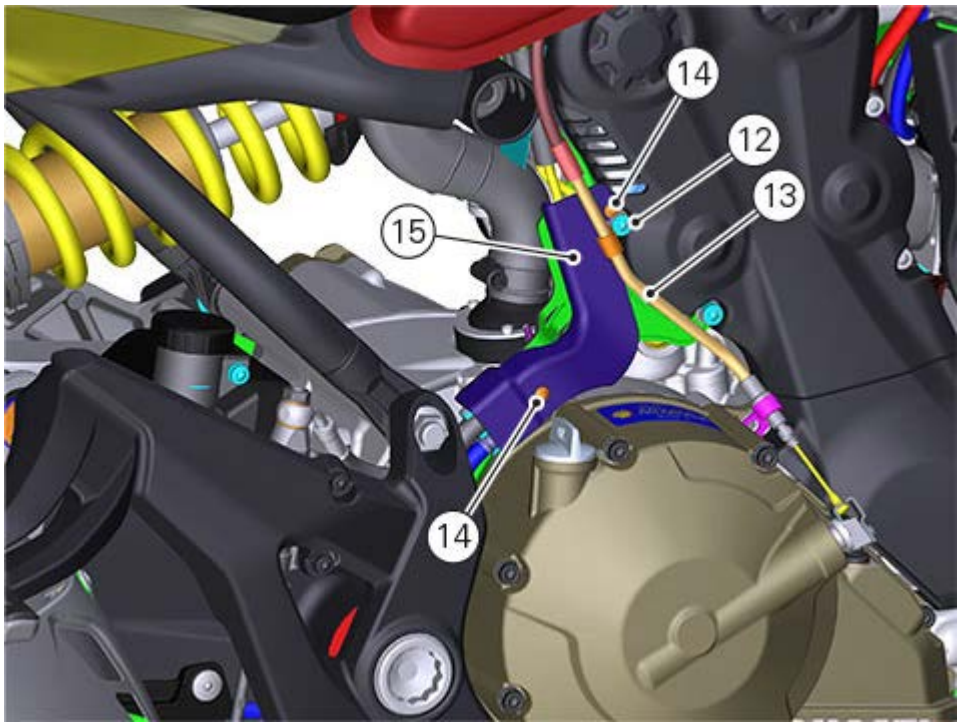
Loosen and remove the three screws (8) and protection (9), by releasing the brake line and the rear ABS sensor cable.



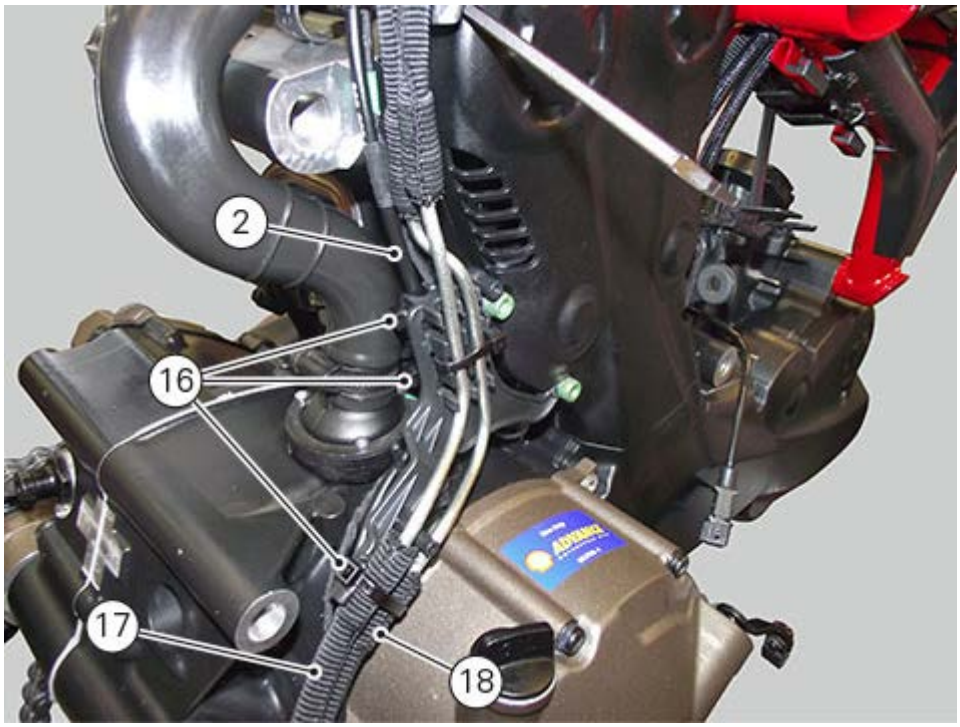
Remove screw (10) and release the cable from cable ring (11).



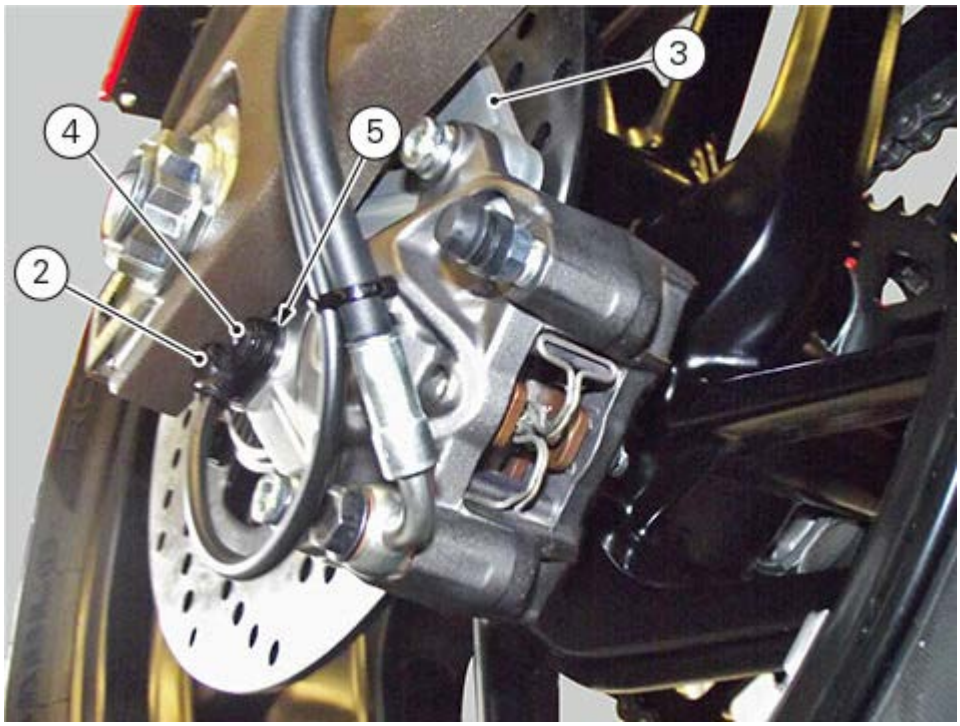
Loosen screw (12) and release clutch cable (13) from the retainer.
Loosen the two screws (14) and remove cover (15).



Remove the three ties (16) and release the ABS sensor cable (2), the rear brake master cylinder hose (17) and the rear brake calliper hose (18).



Release the rear ABS sensor cable (2) by removing the rear ABS sensor from its seat on rear calliper holder plate (3), loosen retaining screw (4) and collect calibrated sealing washer (5).
Check air gap between new rear ABS sensor and rear phonic wheel (6) as explained under section "Adjusting the AIR-GAP of phonic wheel sensor".
Fasten the sensor to the calliper holder plate by tightening screw (4) to a torque of 7 Nm ± 10%.

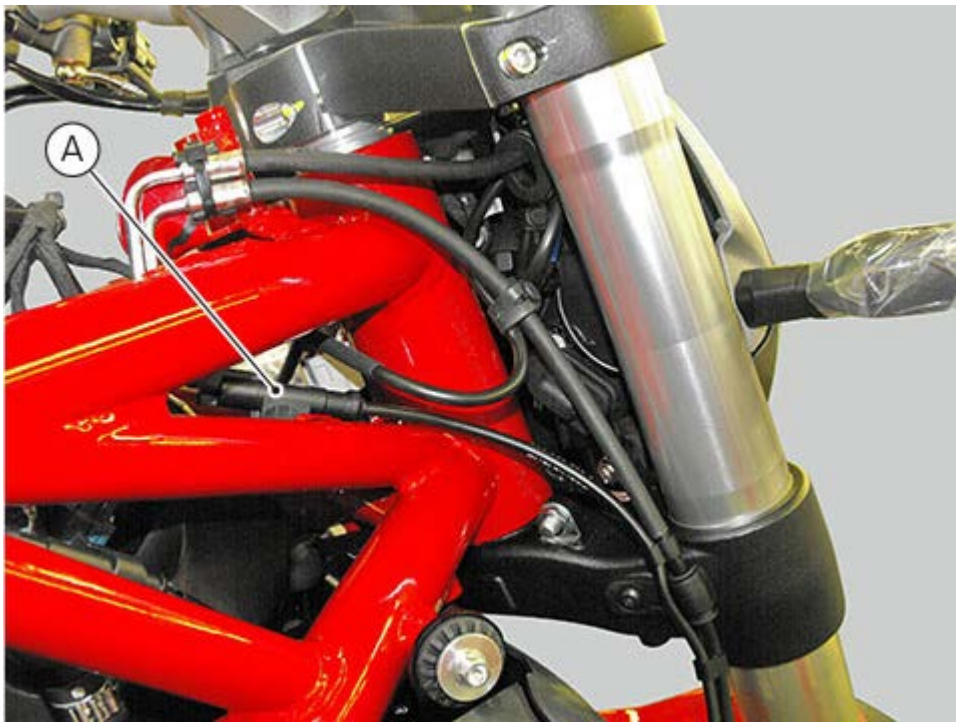


Connect connector (1) to main wiring.
Fasten all clips retaining rear ABS sensor cable (2): refer to tables under Section "Routing wiring harnesses / hoses".

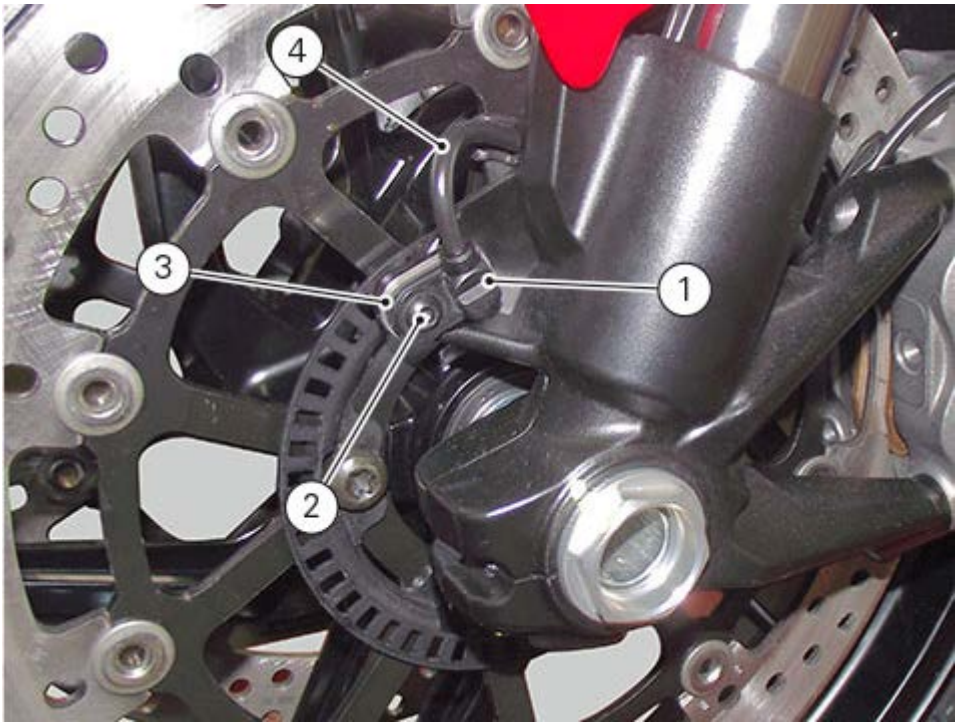
Refit the vertical exhaust system (Refitting the exhaust system).
Refit the rider seat (Refitting the seat).

Changing the front phonic wheel sensor

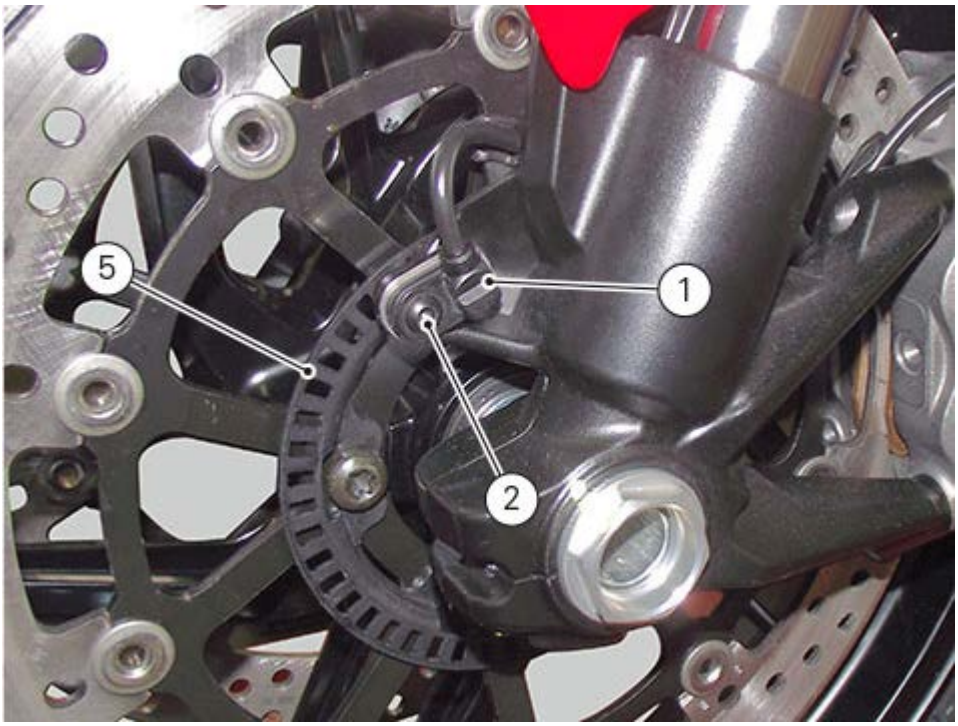
Disconnect front ABS sensor (1) connector (A) from main wiring.



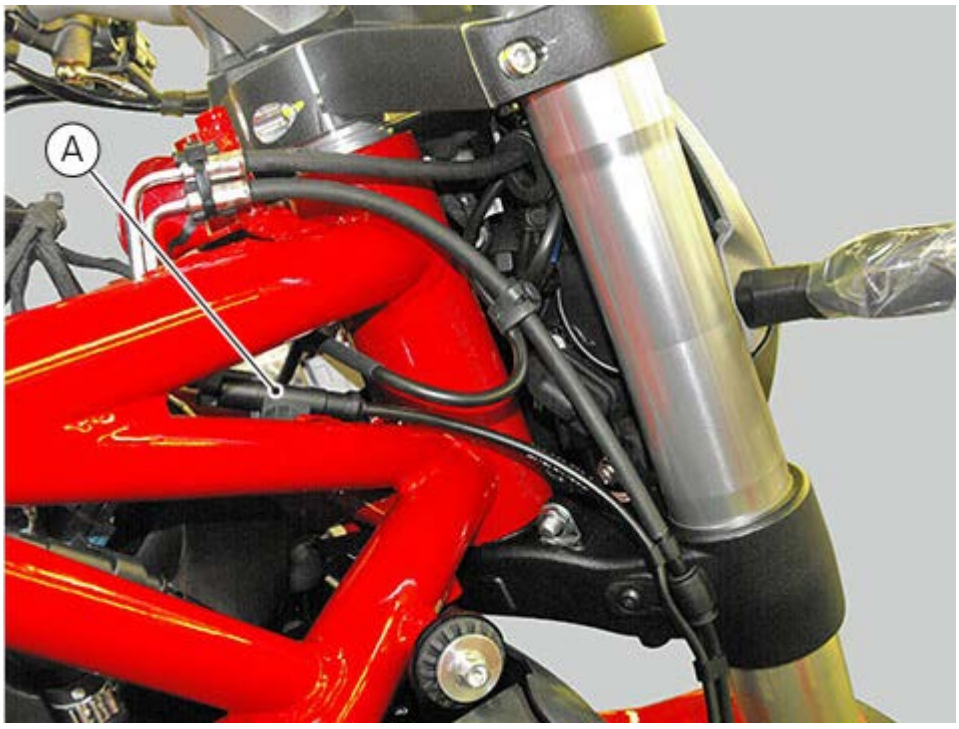
Open all clips retaining front ABS sensor cable (1): refer to tables under Section: "Routing wiring harnesses / hoses".
Undo the retaining screw (2), and remove front ABS sensor (1) with calibrated gasket (3), sliding cable (4) out from cable grommet.



Before refitting, make sure that contact parts between front ABS sensor (1) and its seat are free of damage and perfectly clean. Fit the new front ABS sensor (1) on its seat inserting the screw (2).
Check air gap between front ABS sensor (1) and front phonic wheel (5) as explained under Section "Adjusting the AIR-GAP of phonic wheel sensor.".
Tighten the screw (2) to a torque of 7Nm ± 10%.



Connect the connector (A) to main wiring.
Fasten all clips retaining front ABS sensor cable (1): refer to tables under section "Routing wiring harnesses / hoses".



Bleeding of the ABS hydraulic system

If brake controls feel "spongy" due to the presence of air bubbles in the system, bleed as usual, as described in sections "Changing the front brake system fluid" and "Changing the rear brake system fluid".
Before bleeding a brake master cylinder, move back the calliper pistons as indicated in (Changing the fluid in the front brake system, Changing the fluid in the rear brake system) to let any air build-up in the ABS control unit flow into the master cylinder.
Purge must be carried out by means of the corresponding unions (A) placed on the callipers and the brake master cylinders.

Important
Do not undo the special screws securing the pipe unions on the ABS hydraulic control unit, unless control unit replacement is necessary.

Important
If the ABS hydraulic control unit has been replaced, it will be supplied with the secondary circuit already filled with fluid. Control unit must thus be assembled and the system filled and drained as a traditional system.

Adjusting the AIR-GAP of phonic wheel sensor

Important

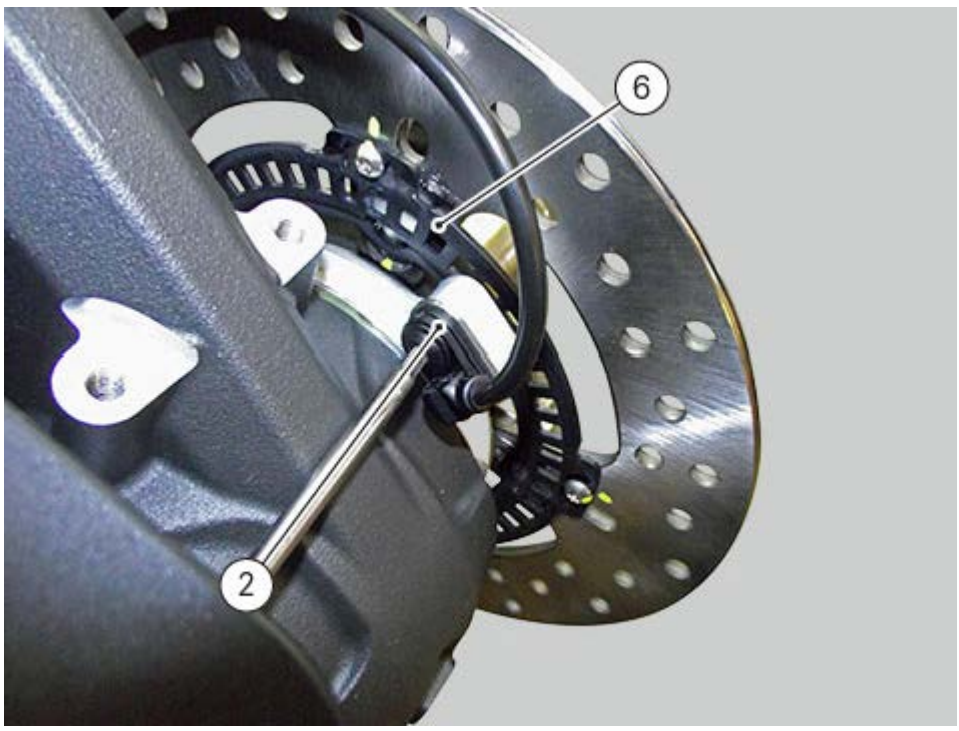
The following procedure applies both to the front and the rear adjustment.

The adjustment must be performed in any case of maintenance that foresees:
- replacing or refitting the wheel,
- replacing or refitting phonic wheel (5) or (6),
- replacing or refitting the brake discs,
- replacing or refitting the speed sensor (1) or (2),
- (front) replacing or refitting the sensor holder bracket,
- (rear) replacing or refitting of the calliper holder plate,

once components are installed.

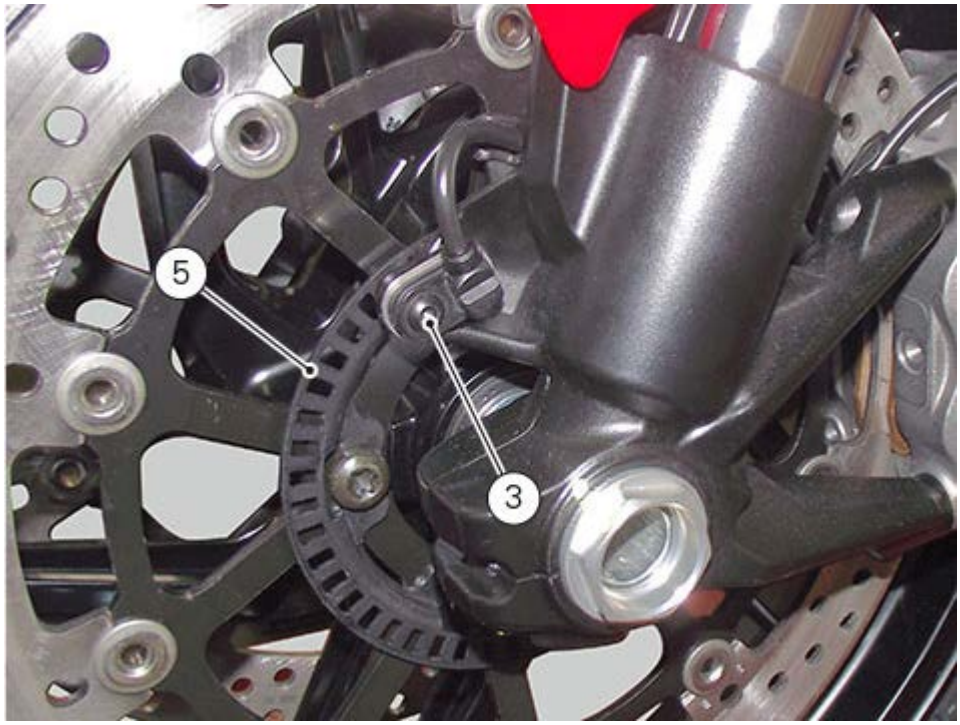
The AIR-GAP between ABS sensor and phonic wheel must be within 1.3 mm ÷ 1.9 mm.

For this purpose, use a feeler gauge to check the air-gap; then, carry out three measures of the air-gap, one every 120° of wheel turn.



If the difference between the minimum and maximum values measured is higher than 0.40 mm, replace the phonic wheel.
Once verified that such difference is lower than or equal to 0.40 mm, perform the shimming procedure of the speed sensor (1) or (2) using suitable calibrated shims (B), after tightening the front (3) or rear (4) retaining screw of the relevant ABS sensor to a torque of 7 Nm ± 10%.
The shims used are of 0.2 mm or 0.5 mm.
Use them as required to reach the correct shimming.

Warning
Shim pack shall never exceed 3 mm.

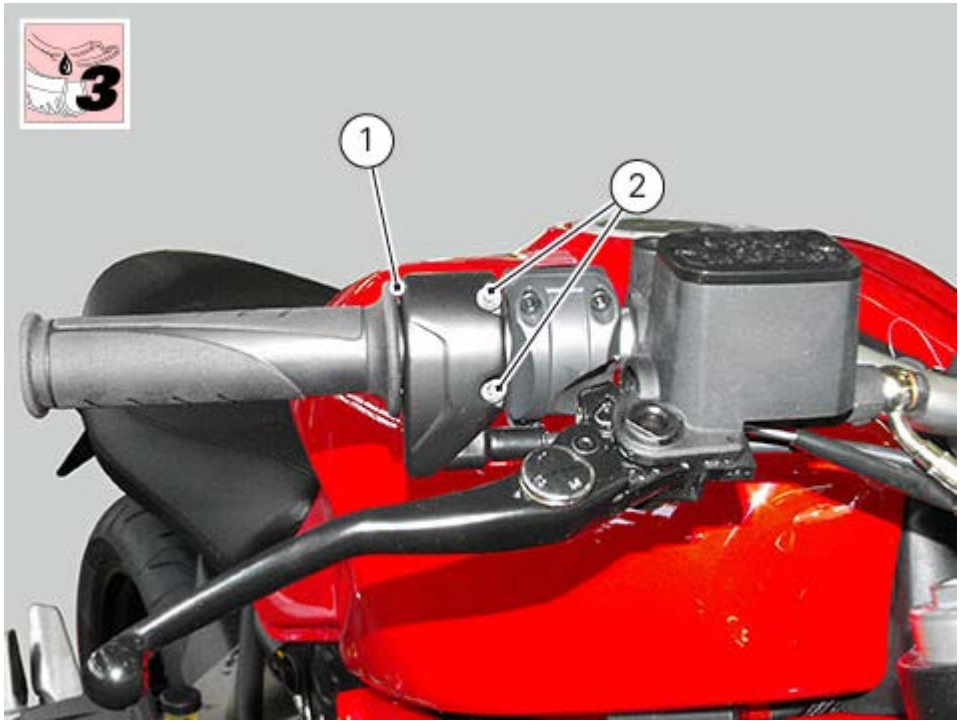


Phonic wheels cleaning

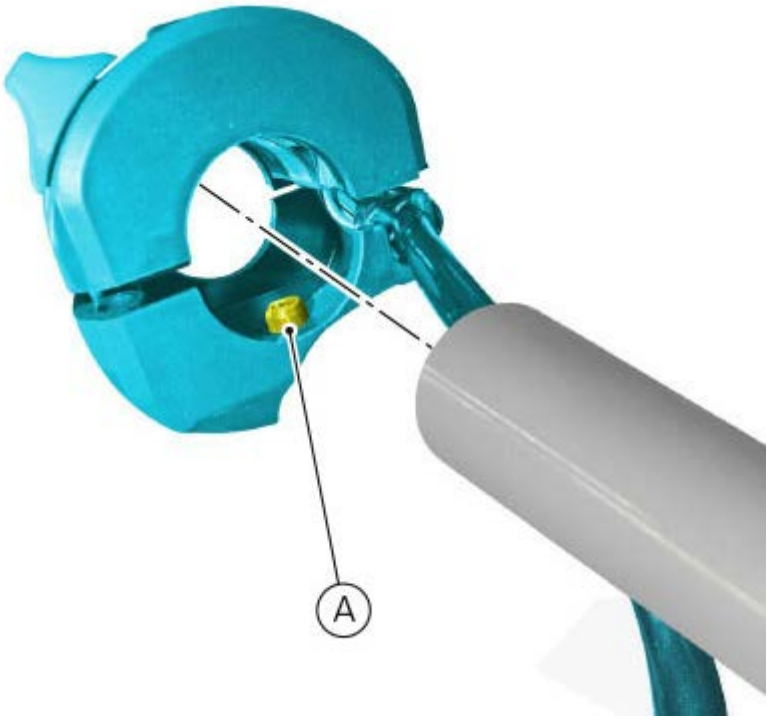
It is important to check that both phonic wheels (5) and (6) are always clean.
Otherwise, gently remove any possible dirt deposits with a cloth or metal brush.
Avoid using solvents, abrasives and aiming air or water jets directly on the phonic wheel (5) or (6).

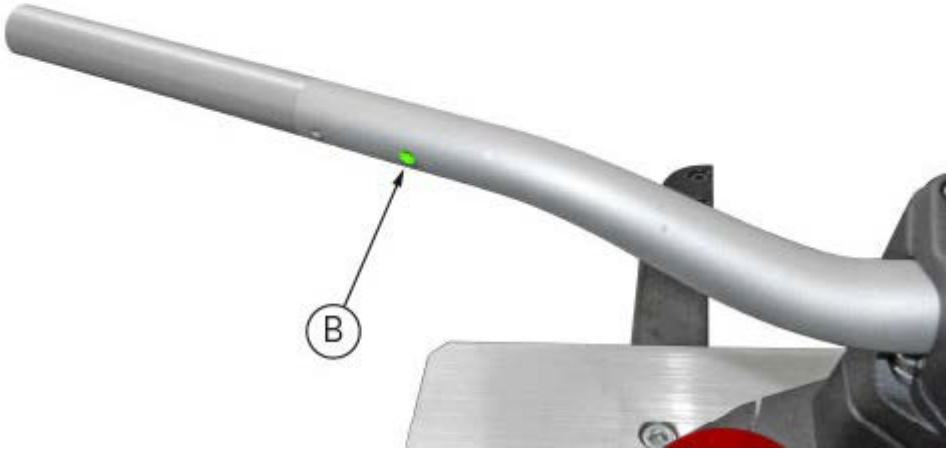
Refitting the throttle control

Lubricate the handlebar on the handgrip seat with the specified product.
Position throttle control (1) on handlebar.
Tighten screws (2) to the recommended torque of 4.5 Nm ± 0.5, following a 1-2-1 sequence and starting from upper screws.

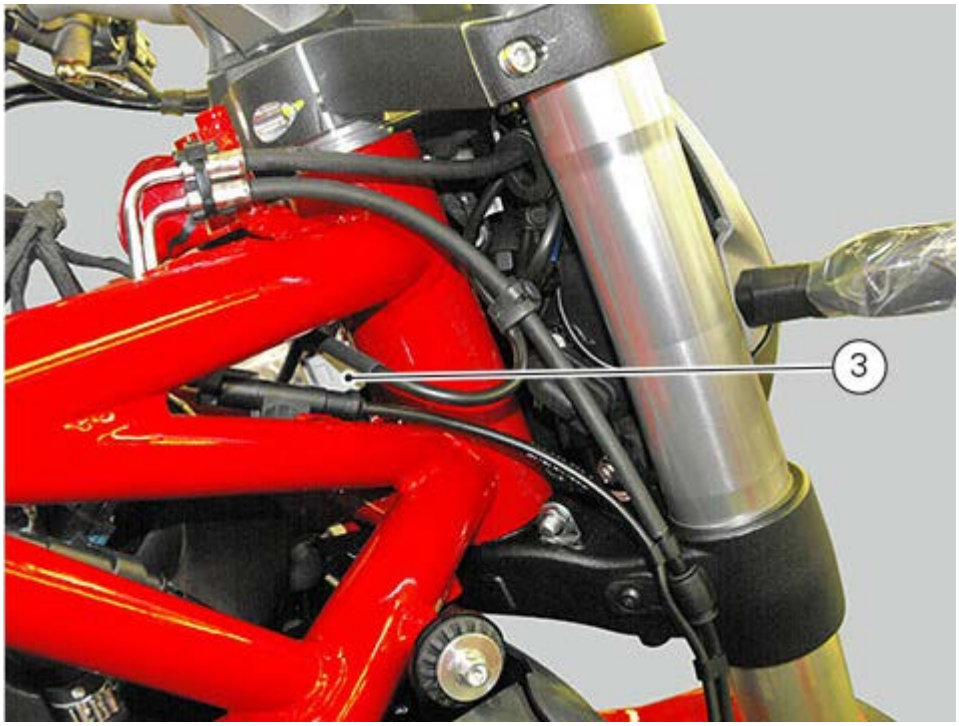


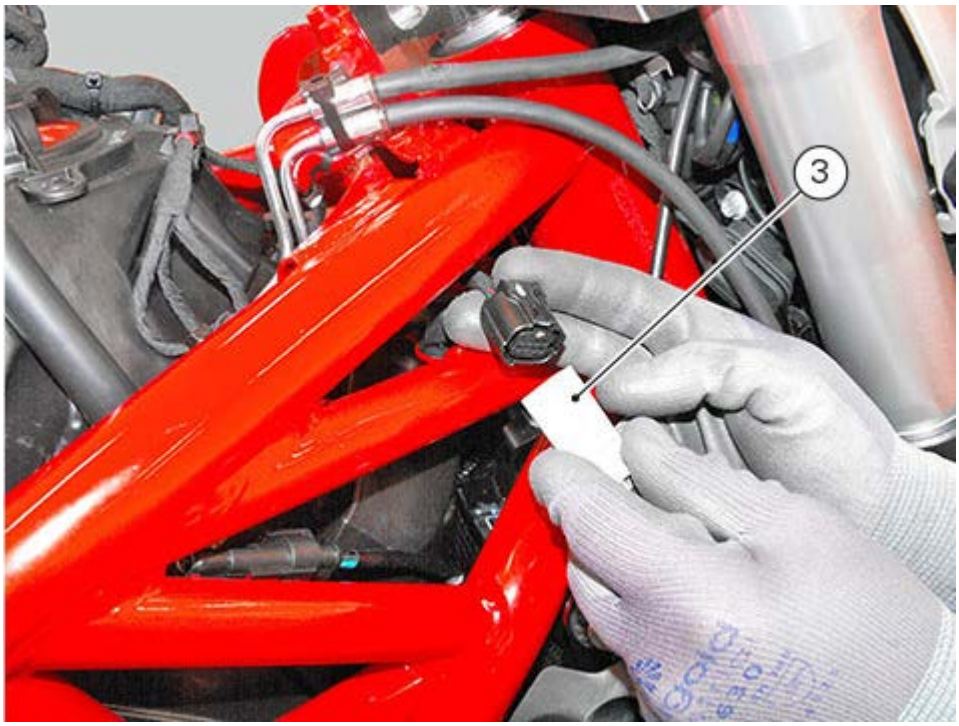
Throttle control and handgrip positions are mandatory: pin (A) must be inserted inside handlebar hole (B).





Duly route throttle control wiring, as described in "Routing wiring on frame" and, once connector (3) is duly connected, insert it inside the special tab on steering tube back side (central position).





Refit the RH rear-view mirror (Refitting the rear-view mirrors).

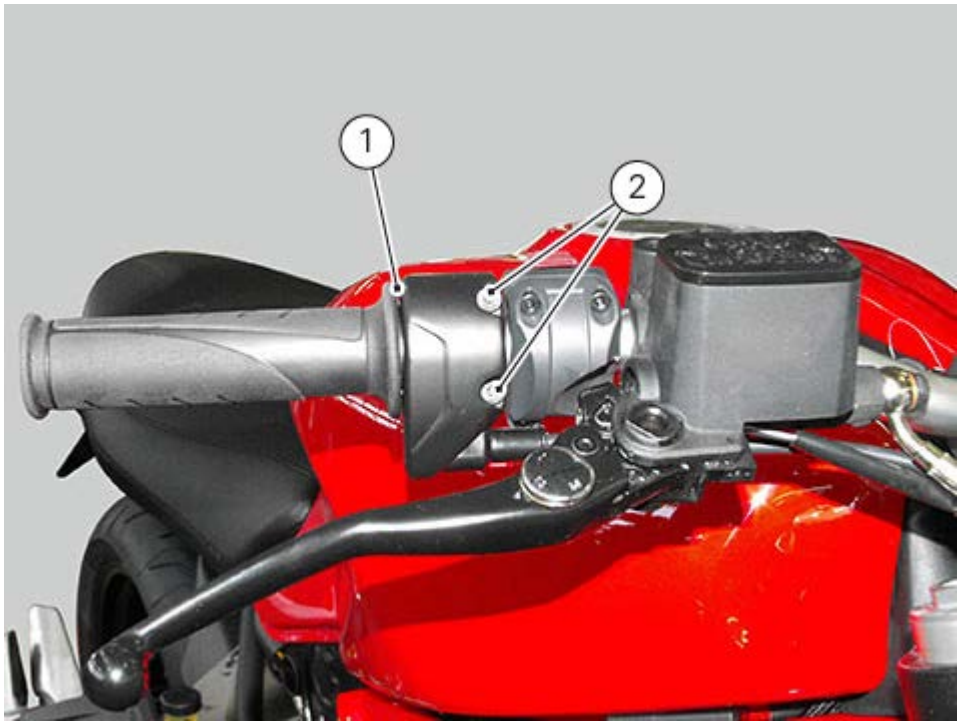
Note

The APS values for the "fully-closed" position stored inside the ECU do not need to be reset.

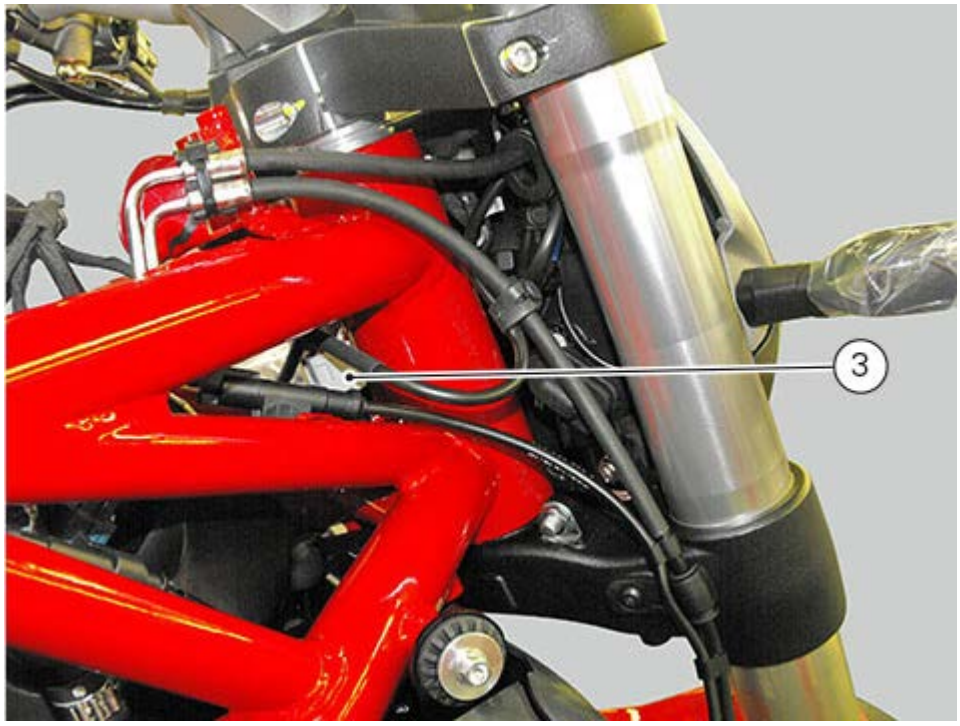
Removing the throttle control

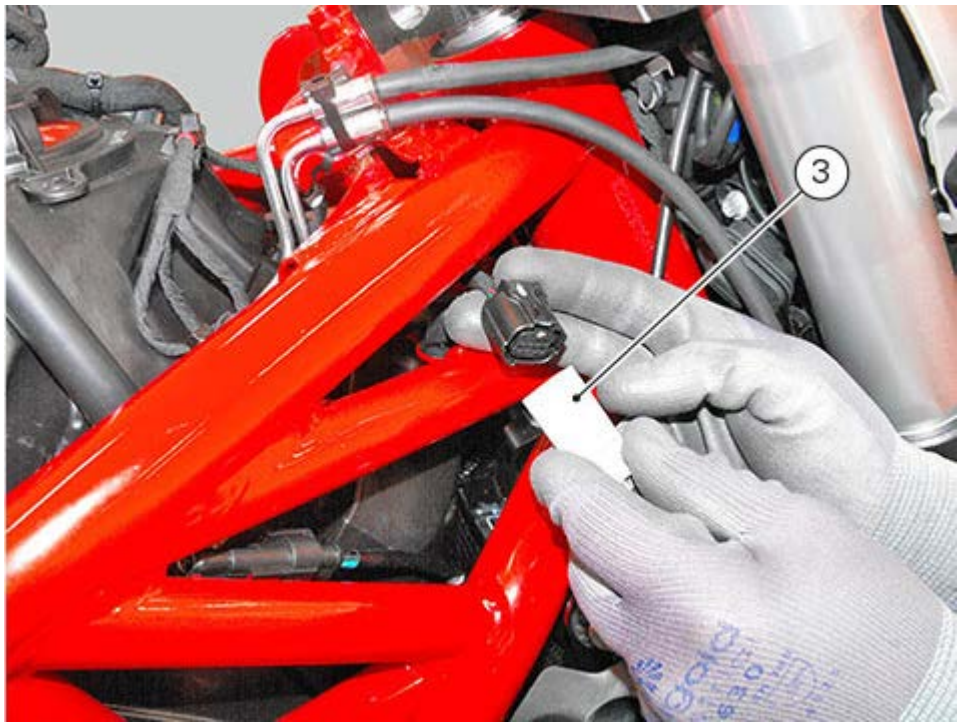
Remove the RH rear-view mirror (Removing the rear-view mirrors).
Loosen screws (2), and remove the handgrip and throttle control (1).

Note
Do not remove screws so as not to affect throttle control operation.



Disconnect throttle connector (3), which is located behind steering tube, in central position.
To make removal easier, after having released it from retainer on steering tube, slide it out from vehicle right side.

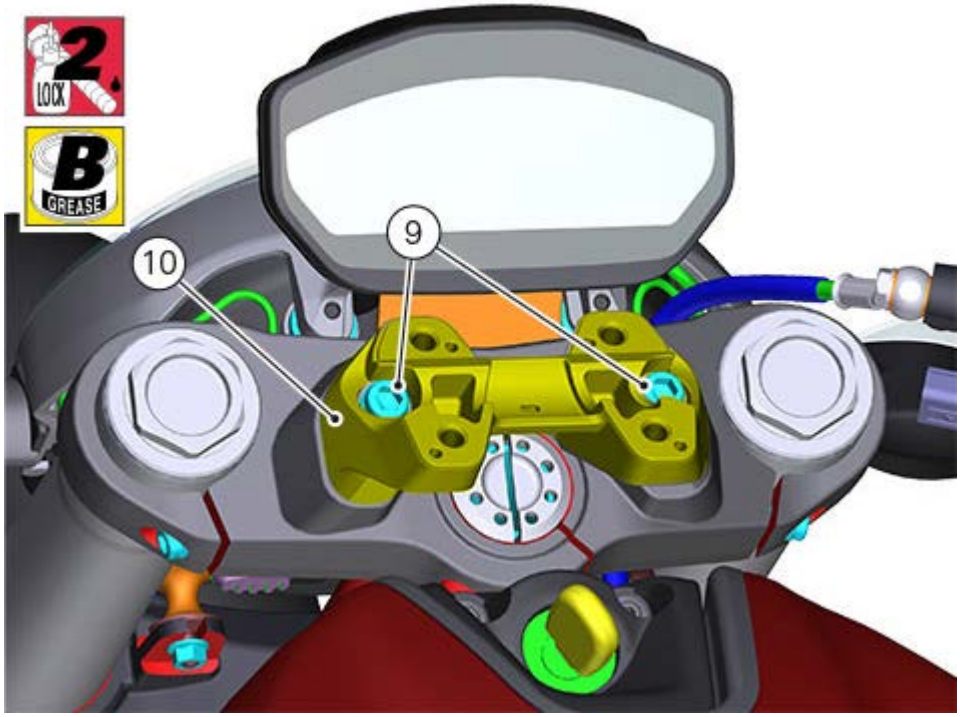


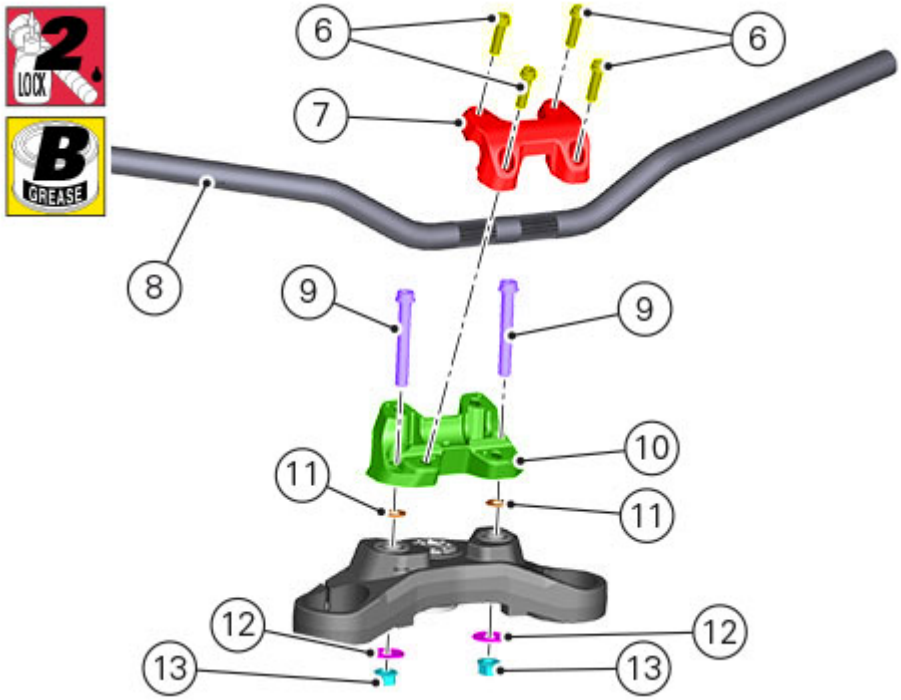


Slide out throttle control.

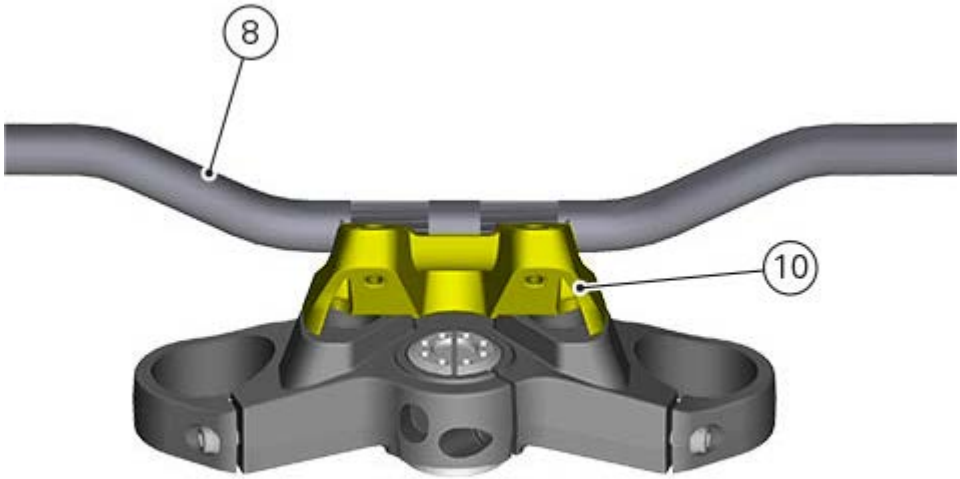
Refitting the handlebar

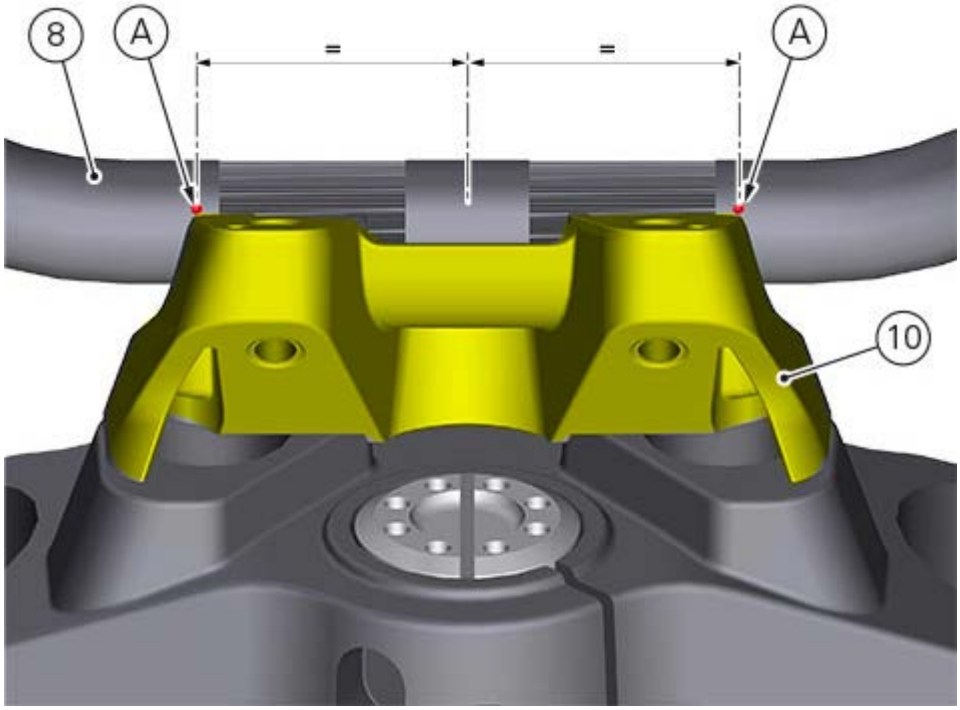
Position washers (11) on the steering plate.
Apply the specified product to the underside of the screws (9).
Insert the screws (9) on the stud bolt (10).
Apply the recommended threadlocker on the thread in view of screws (9).
Fit stud bolt (10) by starting screws (9).
Tighten screws (9) on nuts (13) with washer (12) to a torque of 45 Nm ± 5%, following a 1-2-1 sequence.



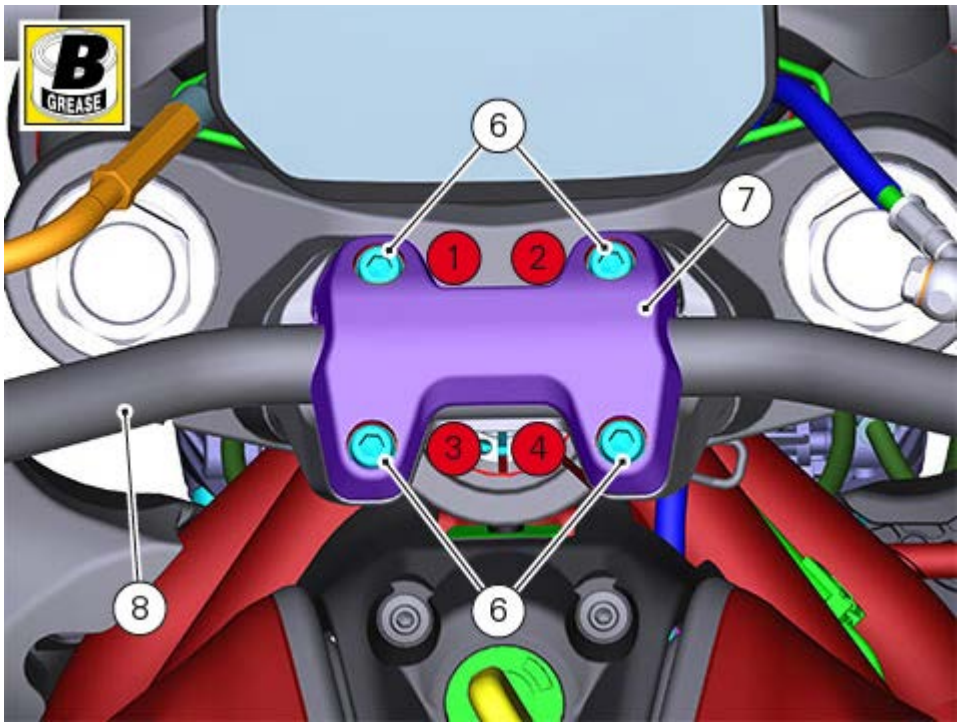


Position handlebar (8) in its seat on the stud bolt (10).
Reference points (A) on handlebar must be at the same distance from stud bolt (10) and flush with the stud bolt surface.

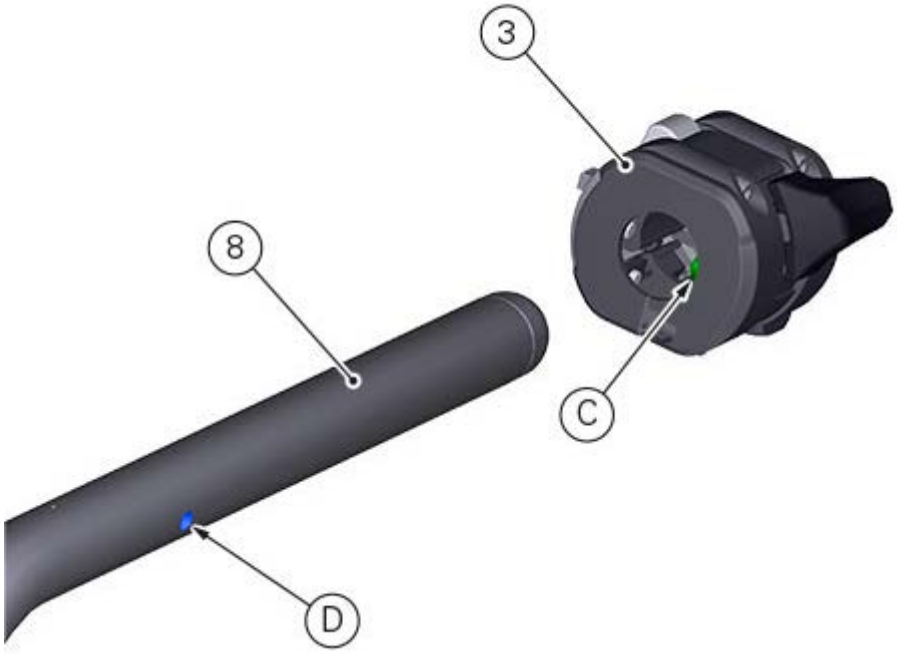




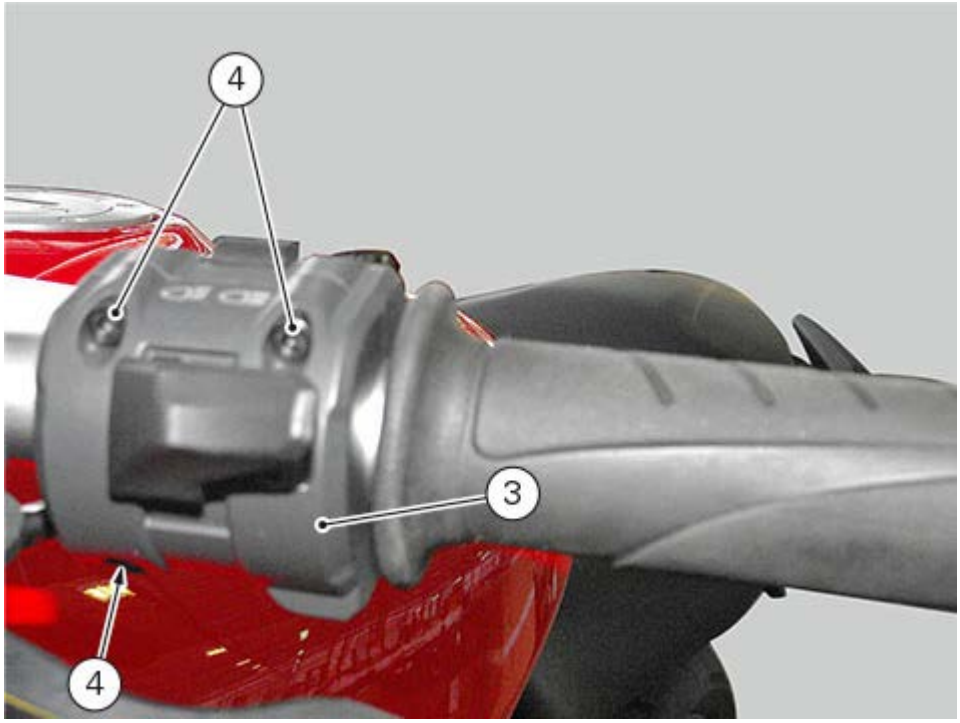
Apply the specified product to screws (6).
Refit U-bolt (7) by starting screws (6) paying attention to their position.
Tighten screws (6) to a torque of 25 Nm ± 5%, following a 1–2–3–4–3 sequence.

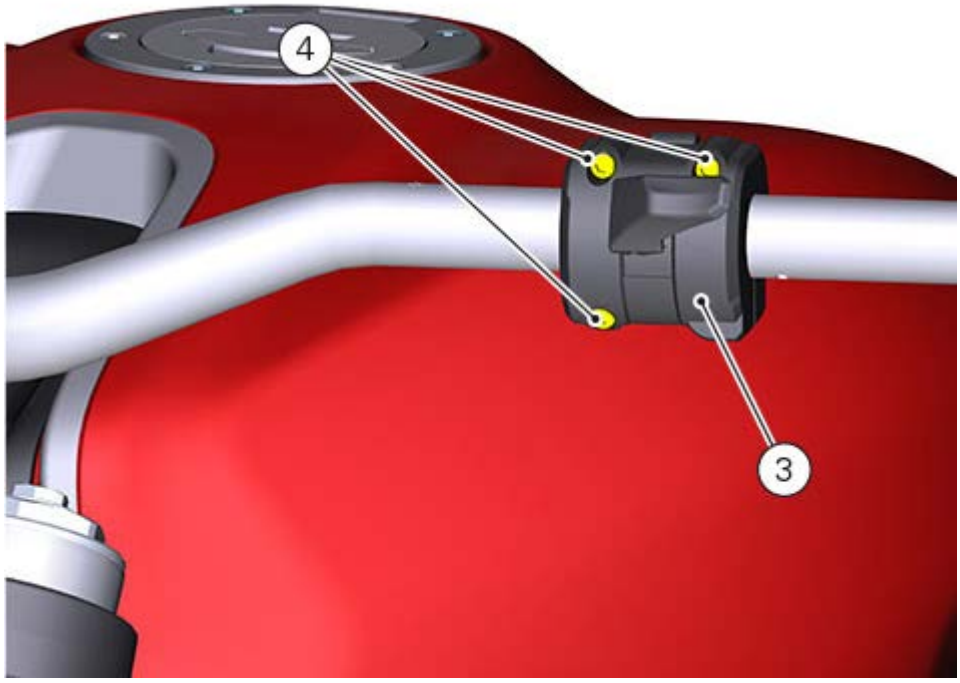


Fit the left-hand switch (3) working on the LH side.
Left-hand switch (3) position is mandatory: pin (C) must be inserted inside handlebar (8) hole (D).



Fit left-hand switch (3) and tighten screws (4) to a torque of 1.3 Nm ± 10%, starting from the upper screws and following a 1–2–1 sequence.





If removed, refit the clutch assembly (Refitting the clutch assembly)

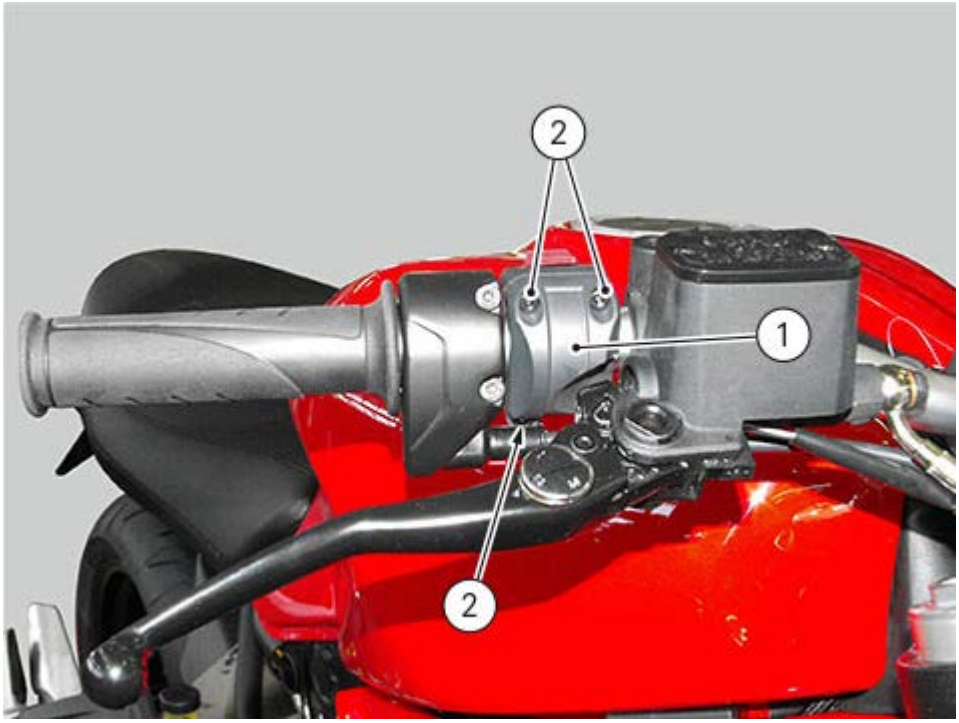
Important

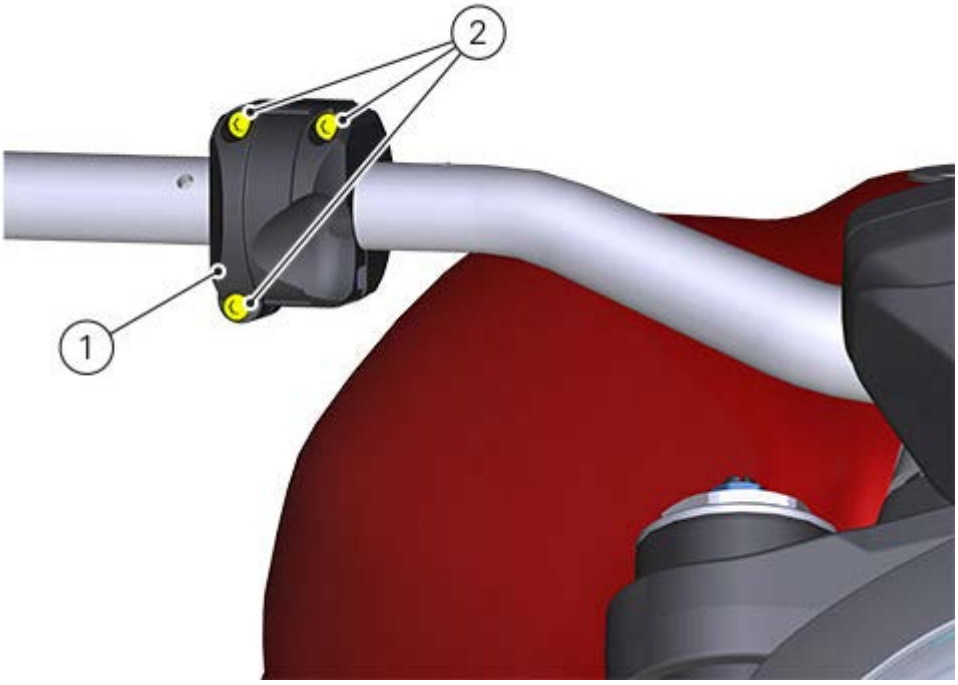
The distance between LH handgrip and switch must be of 10.5 mm.

Lubricate the LH handgrip seat (5) with the indicated product and fit it on the handlebar.

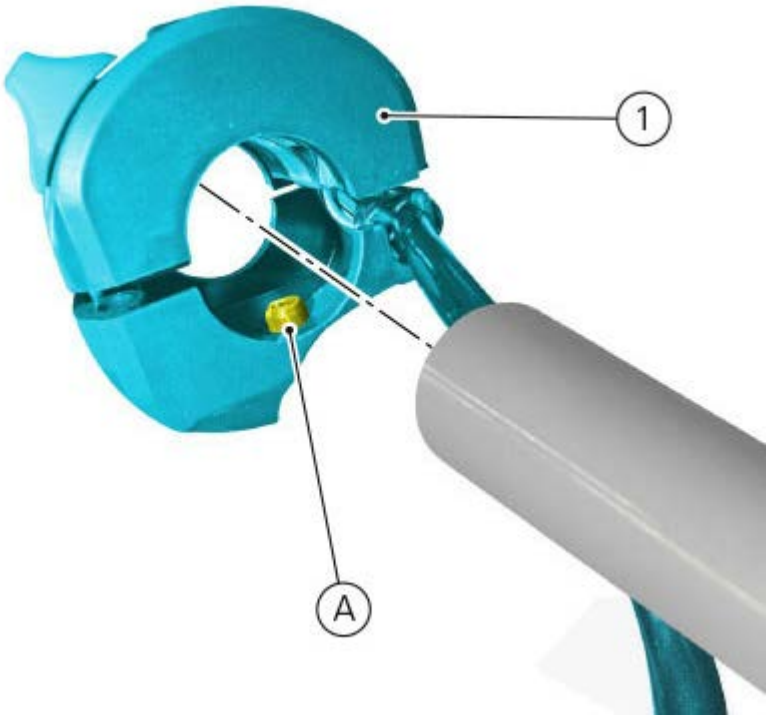
If removed, refit counterweight (15).

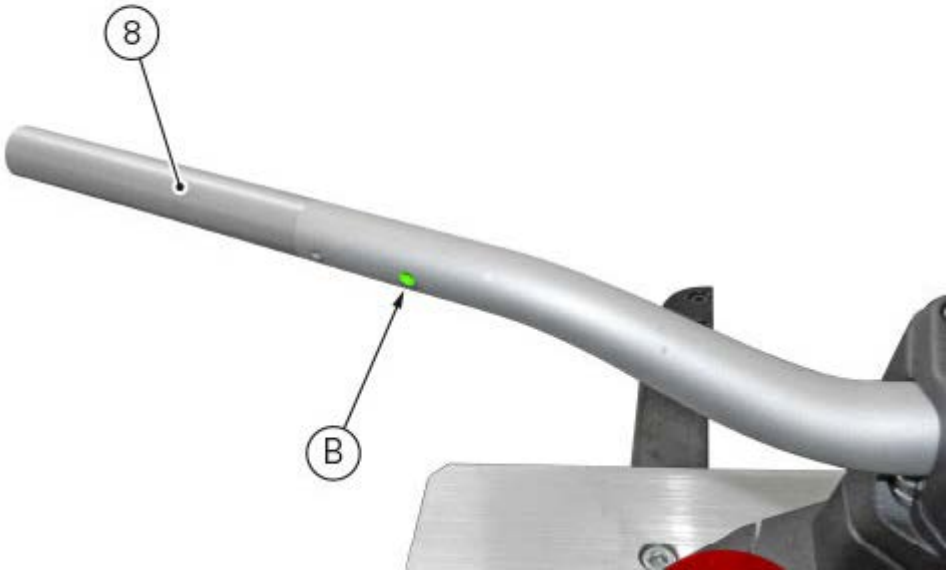
Refit right-hand switch (1) and tighten screws (2) to a torque of 1.3 Nm ± 10%, starting from the upper screws and following a 1–2–1 sequence.



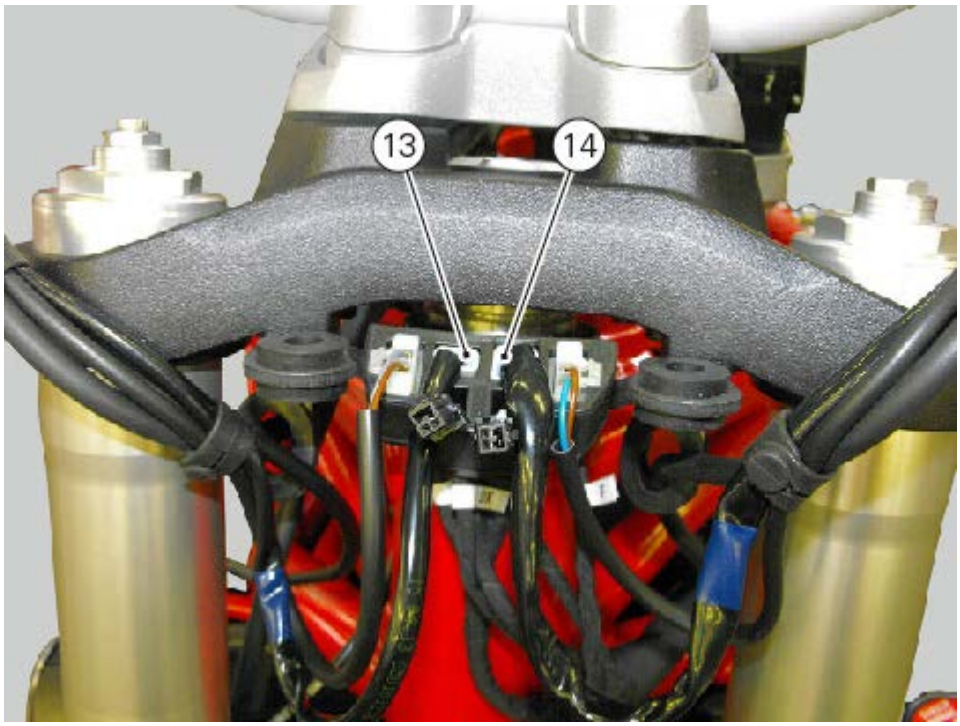


Take special care when fitting switch (1).
Switch position is mandatory: pin (A) must be inserted inside handlebar (8) hole (B).





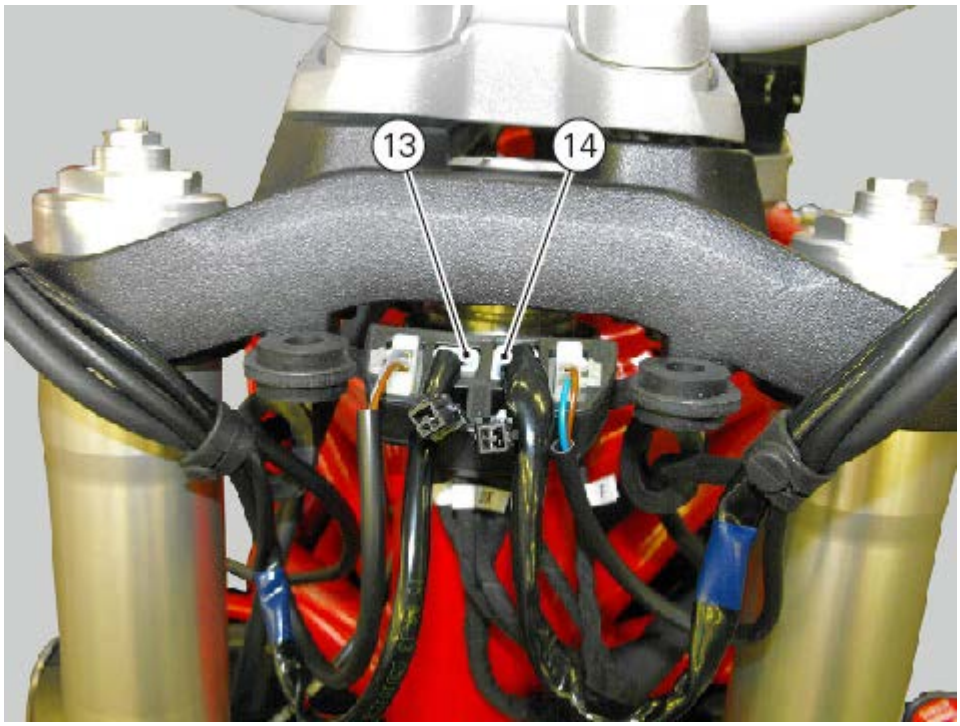
Refit the throttle control (Refitting the throttle control).
Connect right-hand switch connector (13) and left-hand switch connector (14).



Refit the front hydraulic brake master cylinder (Refitting the front hydraulic brake master cylinder).
Refit the rear-view mirrors (Refitting the rear-view mirrors).
Fit ties and rearrange front wirings and headlight (Refitting the light assembly).

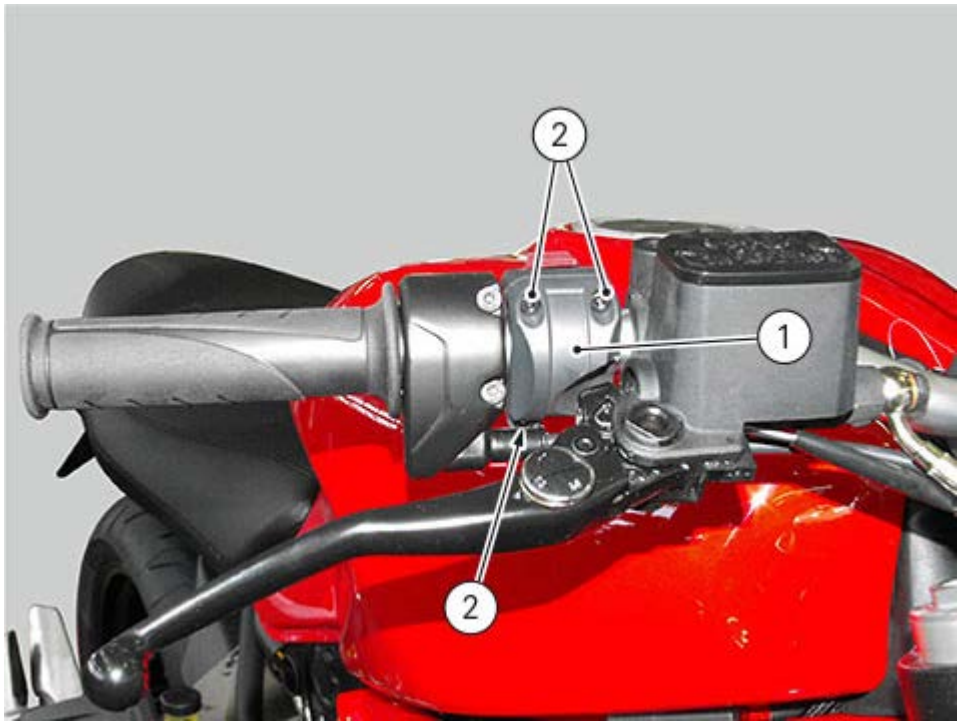
Removing the handlebar

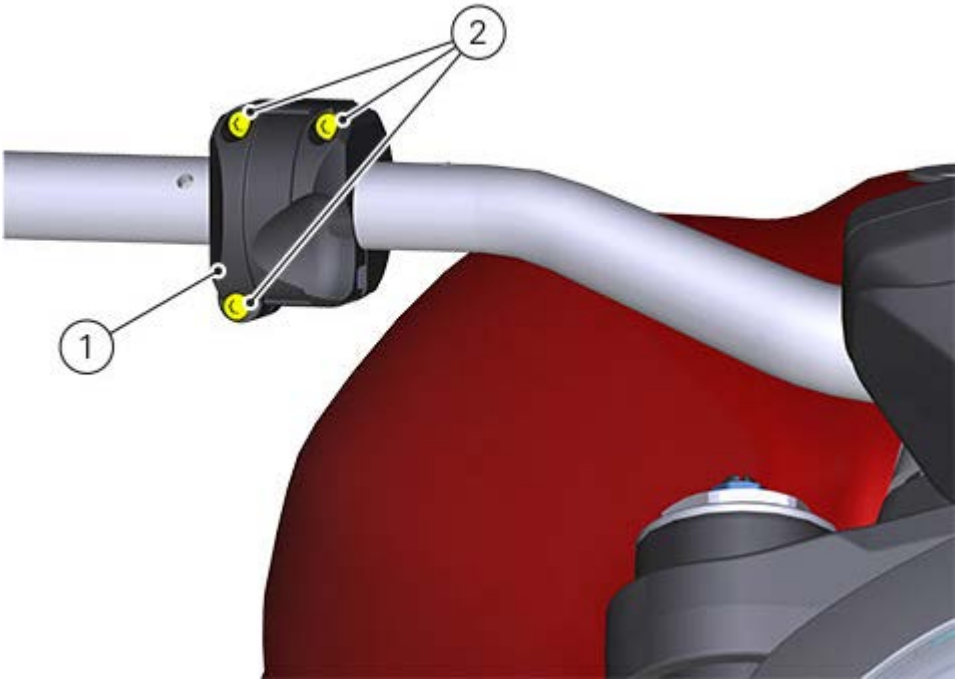
Remove the rear-view mirrors (Removing the rear-view mirrors).
Release the headlight (Removing the light assembly).
Remove the throttle control (Removing the throttle control).
Remove the front brake master cylinder (Removing the front brake master cylinder).
Remove the clutch control (Removing the clutch assembly).
Disconnect right-hand switch connector (13) and left-hand switch connector (14).



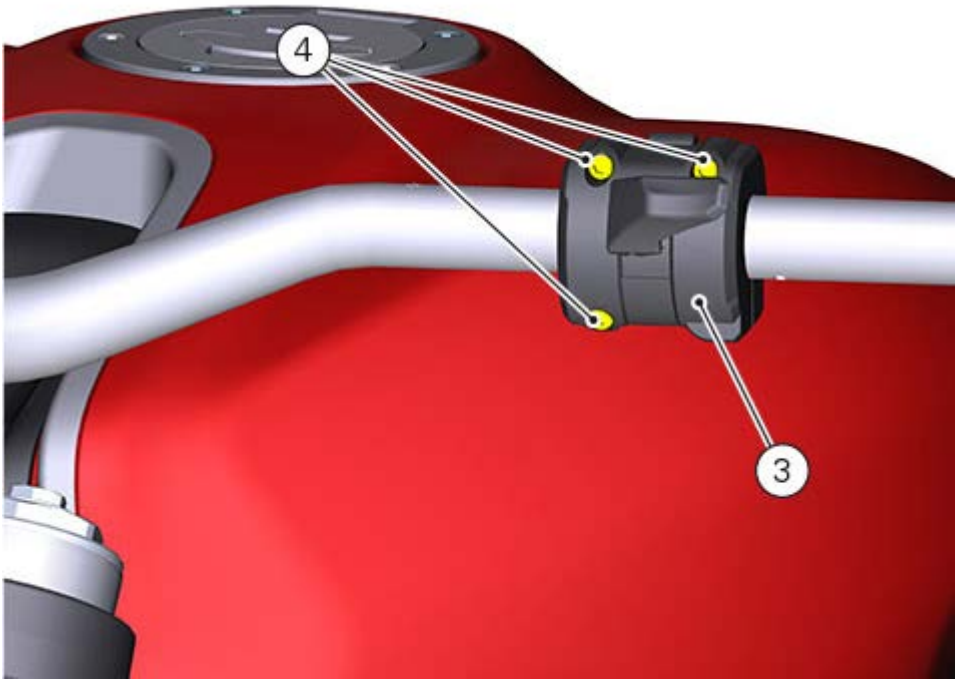
Undo the screws (2), and remove right-hand switch connector (1).

Note
Do not remove screws so as not to affect switch operation.





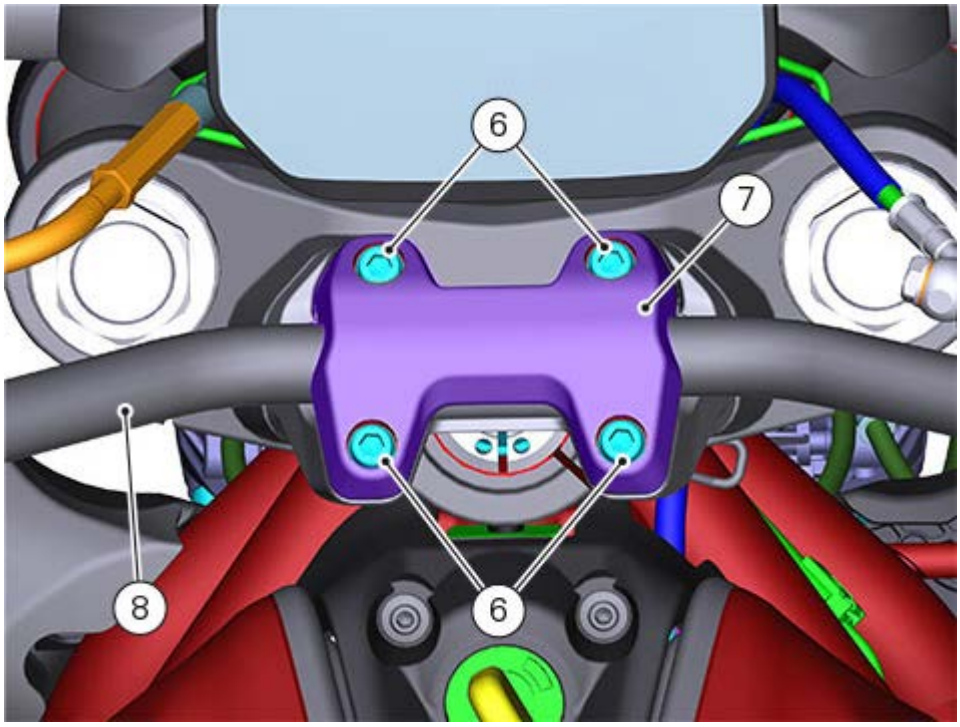
Undo the screws (4), and remove left-hand switch connector (3).



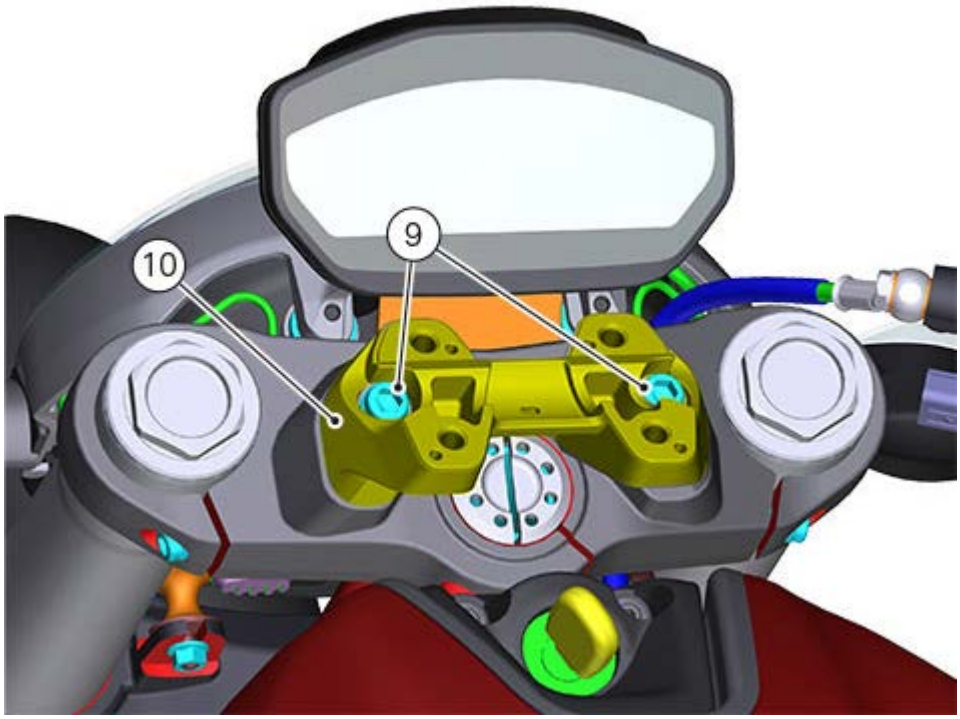
Removing the left handgrip

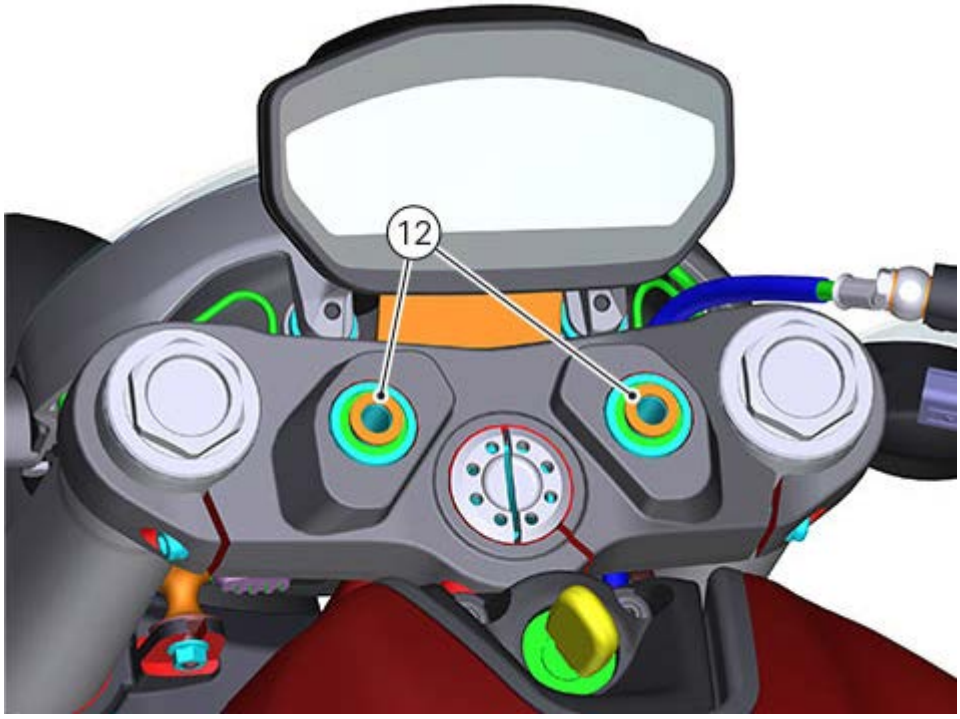
If necessary, slide out counterweight (15) of the handlebar.
Then slide out left handgrip (5) with the help of an air jet paying attention not to damage it.

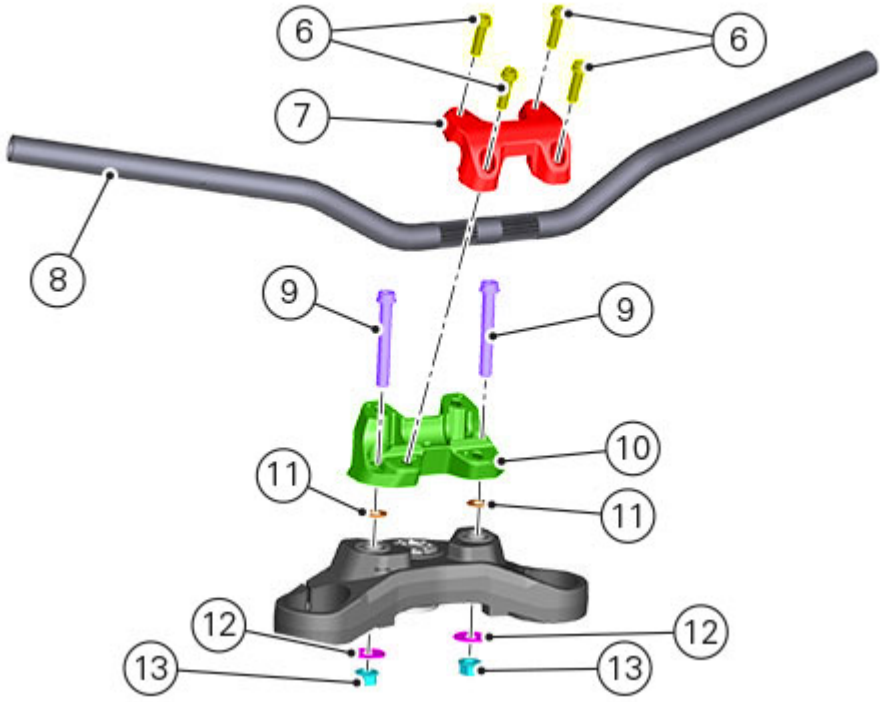
Undo and remove the screws (6).
Remove U-bolt (7) securing the handlebar.
Remove the handlebar (8).



Remove the steering head (Removing the steering tube components)
Undo screws (9) holding nuts (12) and remove stud bolt (10) from the steering head.
Collect upper (11) and lower (13) washers.

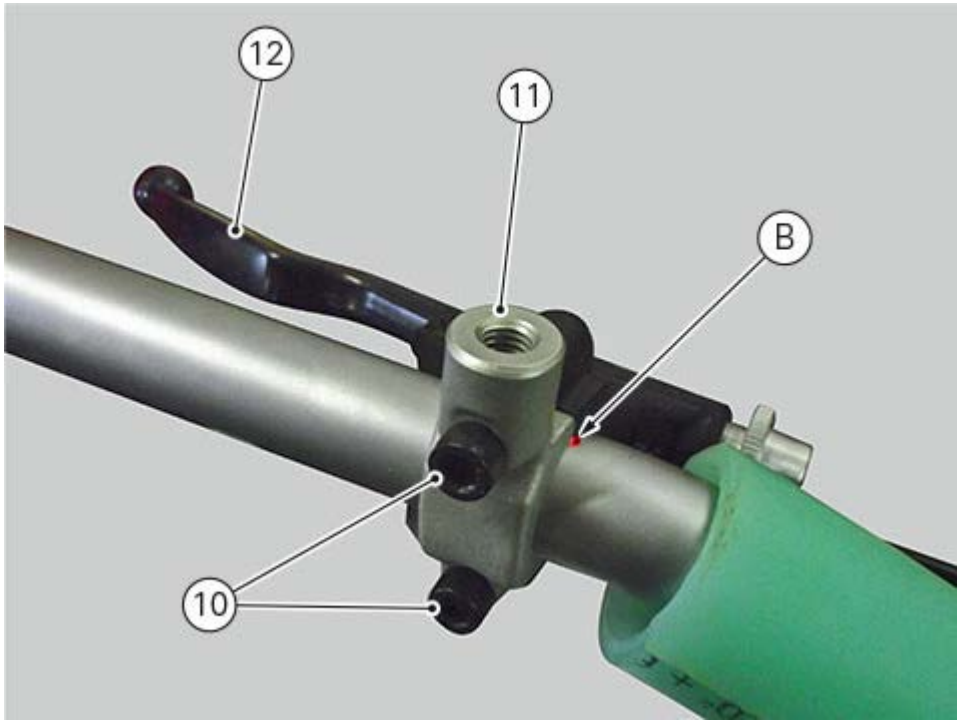


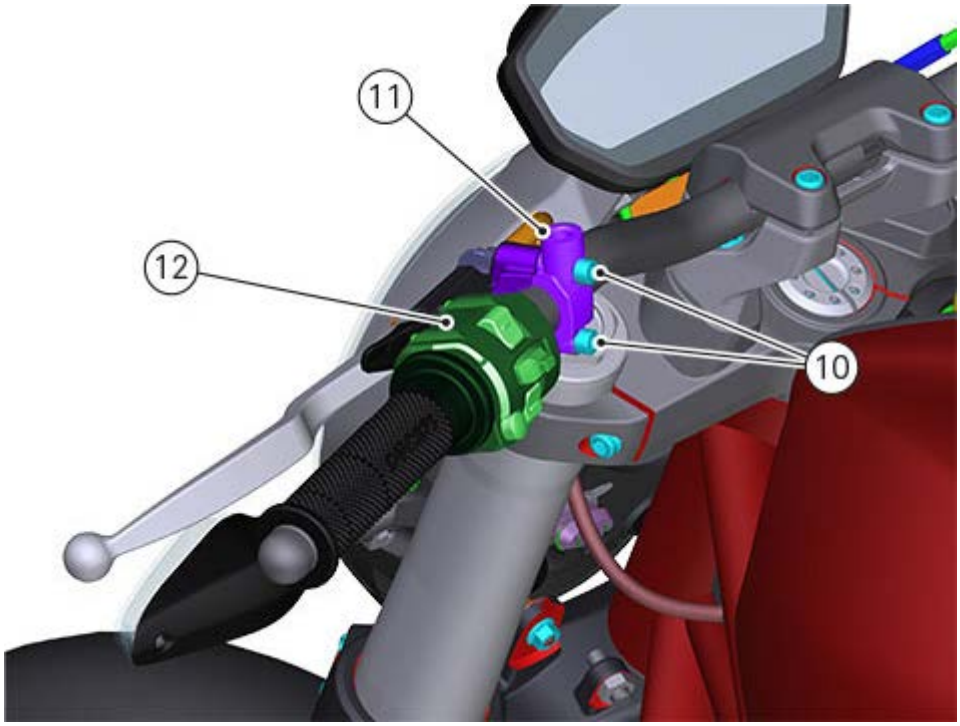




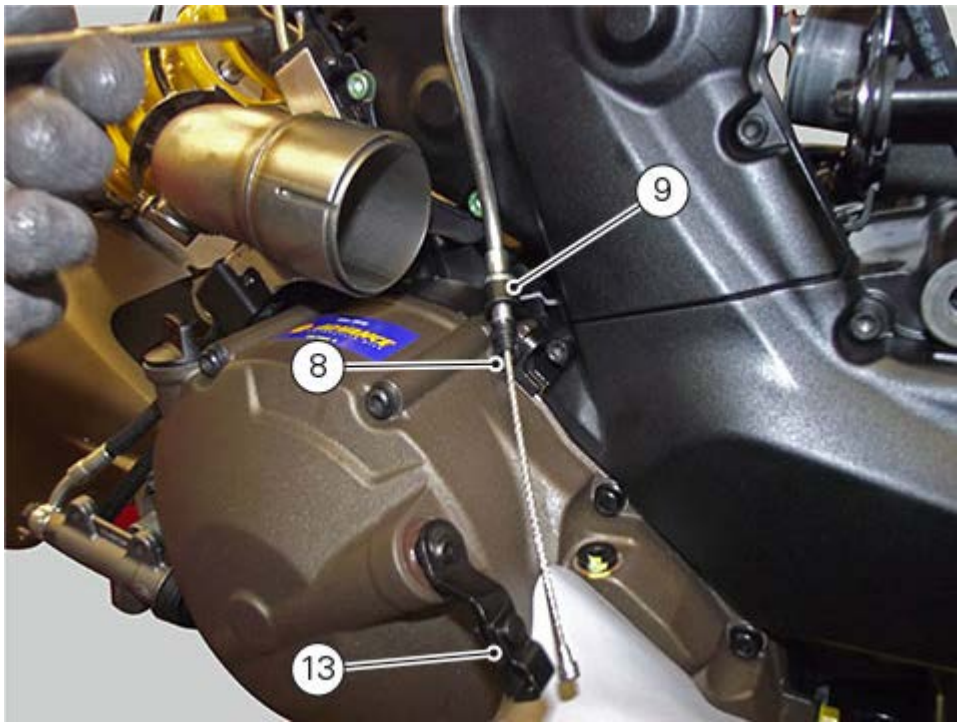
Refitting the clutch assembly

If removed, position clutch lever (12) and U-bolt (11) on the handlebar and by respecting reference (B), tighten the two screws (10) to a torque of 6-7 Nm ± 10%, following the 1(UP)-2-1 sequence.

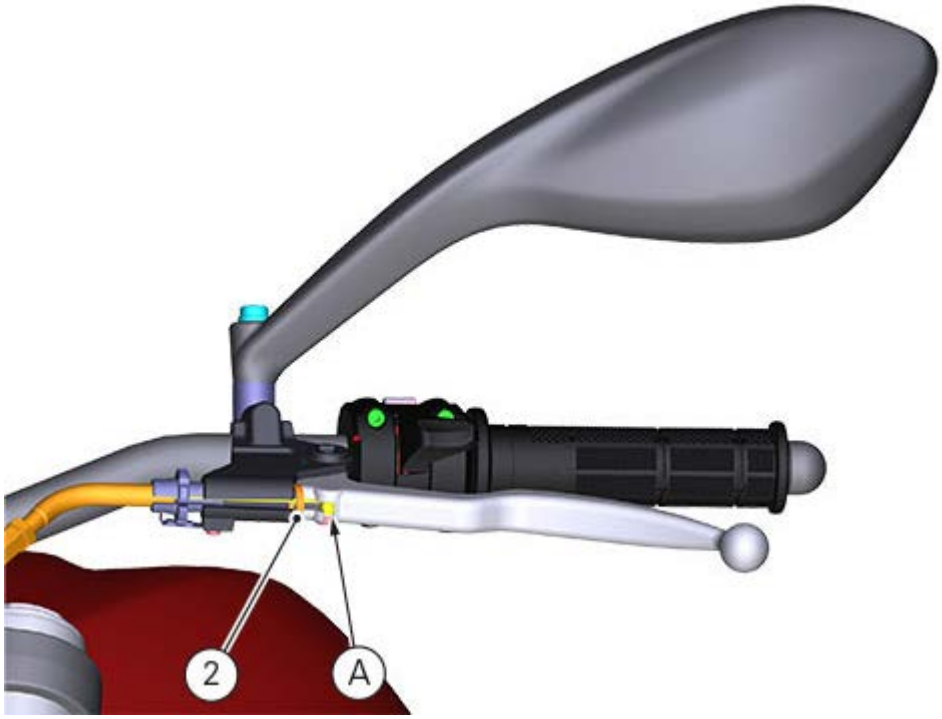




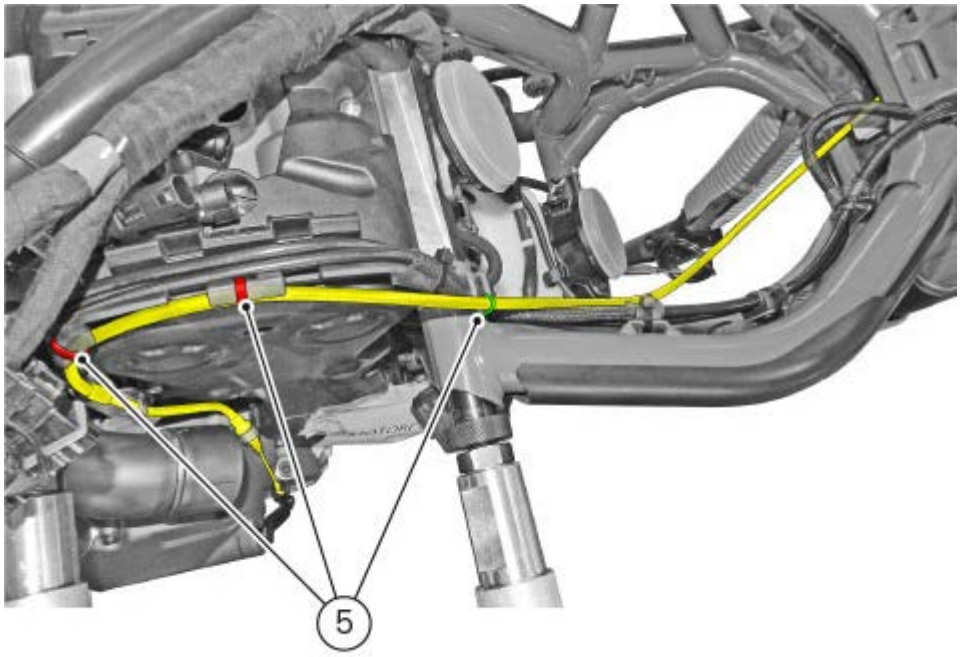
Reposition the clutch cable on leverage (13) and tighten screws (8) and (6) to a torque of 10 Nm ± 10% to fix the cable to the relevant cable rings (9) and (7).

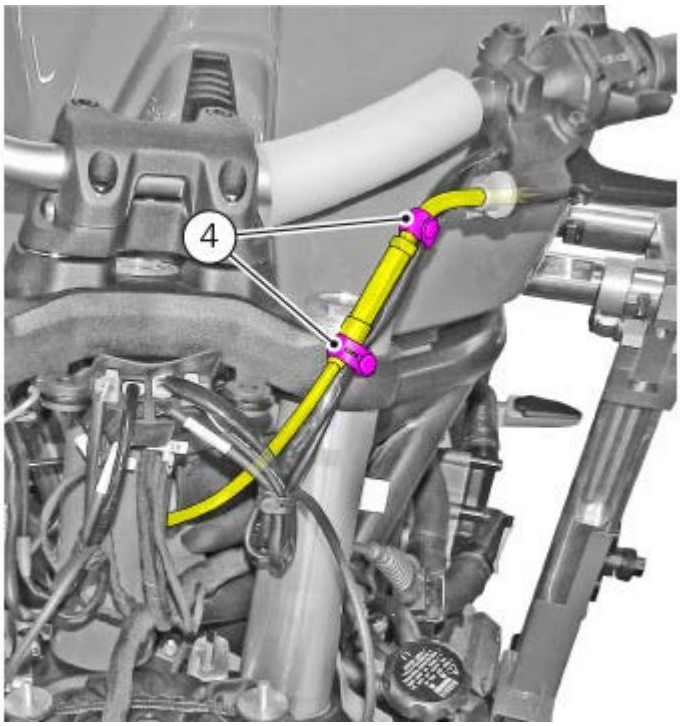


Fit nipple (A) in the clutch lever and fix the cable on the vehicle using tie (2).



Lay the clutch cable on the vehicle and fix it with ties (5) and (4).



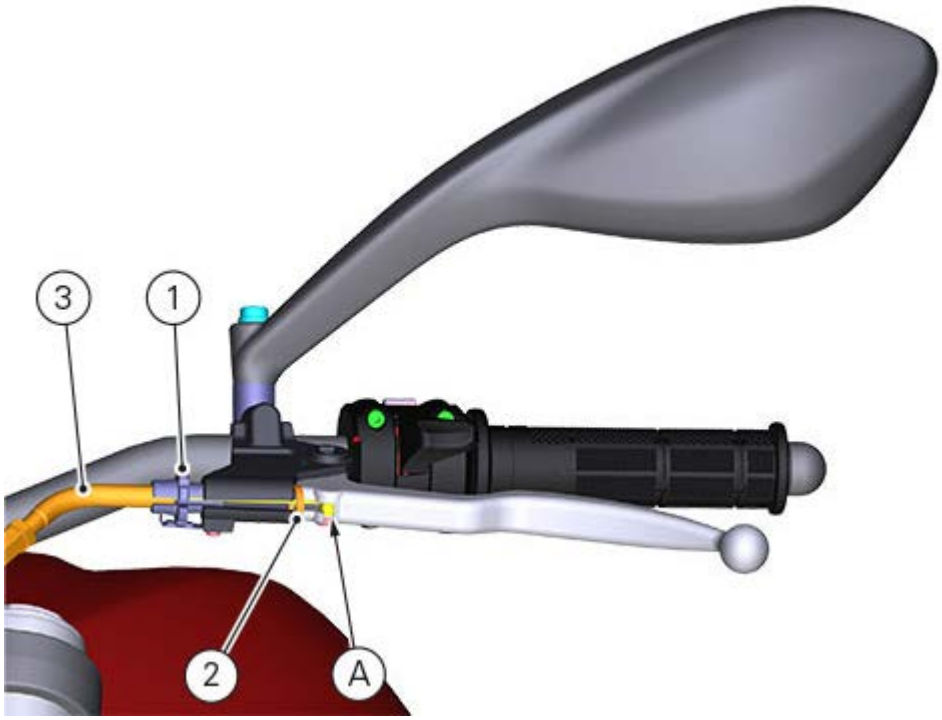


Adjust the clutch control cable (Adjusting the clutch control cable).
Refit the light assembly (Refitting the front light assembly).
Refit the vertical head exhaust system (Refitting the exhaust system).
Refit the LH rear-view mirror (Refitting the rear-view mirrors).

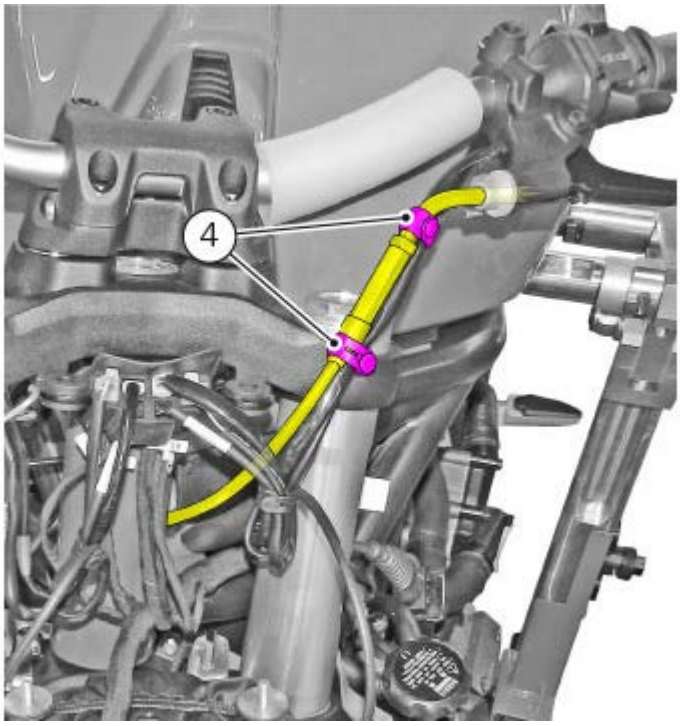
Removing the clutch assembly

Remove the LH rear-view mirror (Removing the rear-view mirrors).
Remove the light assembly (Removing the light assembly).

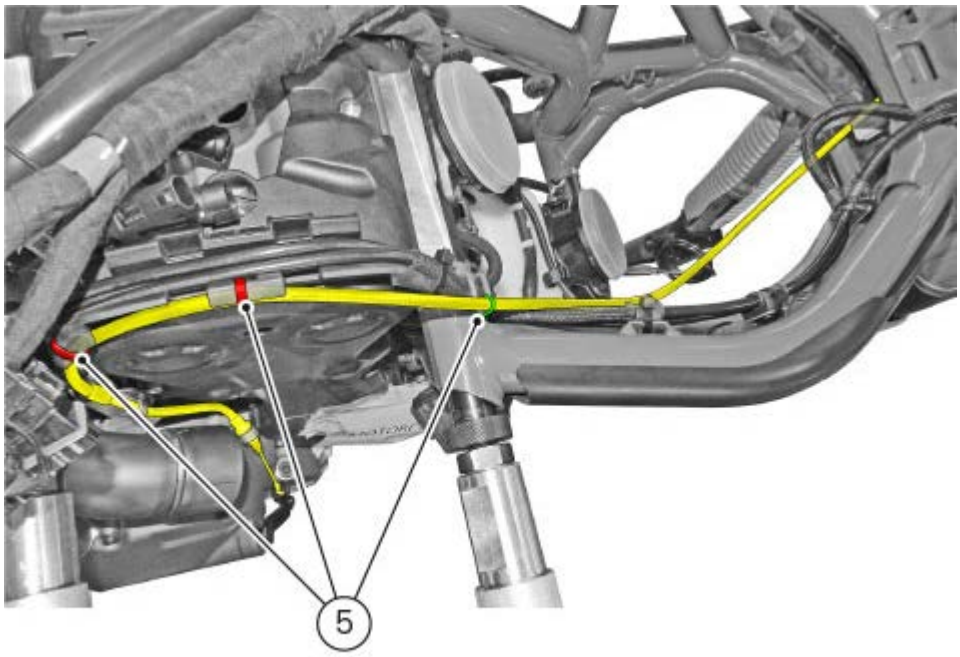
Loosen clutch adjuster (1).
Remove clamp (2).
Slide out nipple (A) and cable (3) from the handlebar clutch control assembly.



Release the cables from the two ties (4).



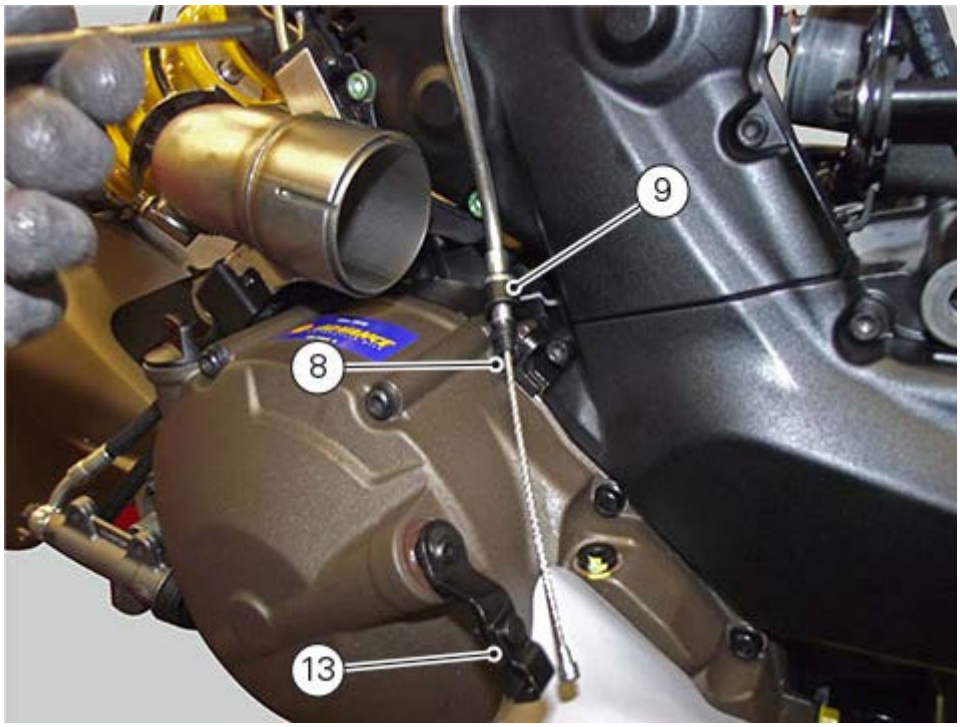
Work on the wiring passage on the front RH side of the frame and the vertical head to remove the three ties (5).



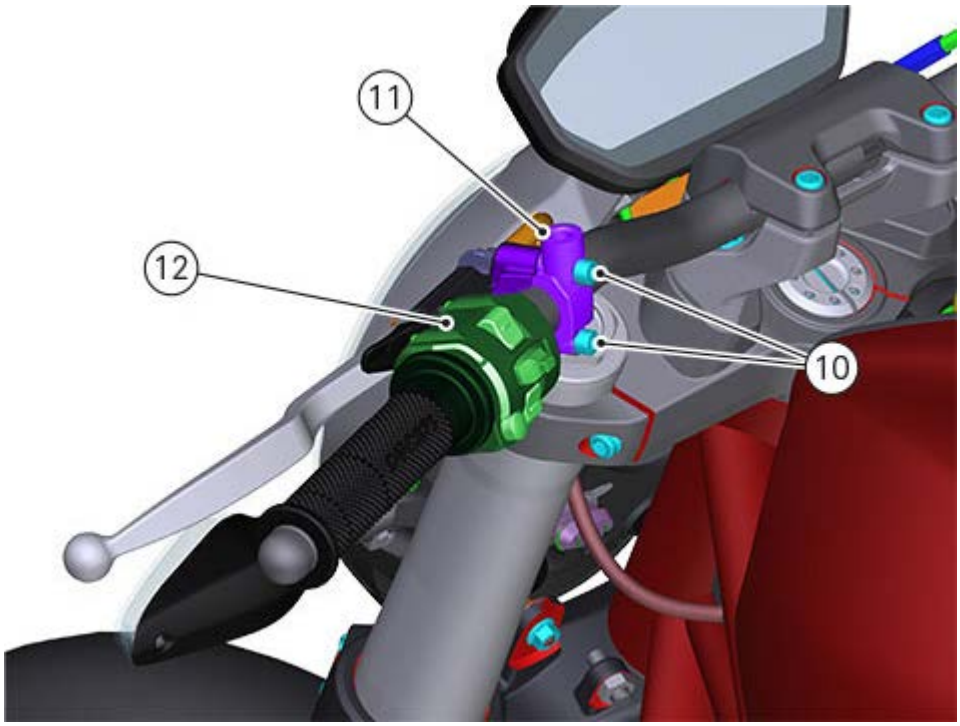
Remove the vertical head exhaust system (Removing the exhaust system).

Loosen screw (6) and release the clutch cable from cable ring (7).

Loosen screw (8) and release the clutch cable from cable ring (9).
Slide the clutch cable out of leverage (13) and remove it from the vehicle.

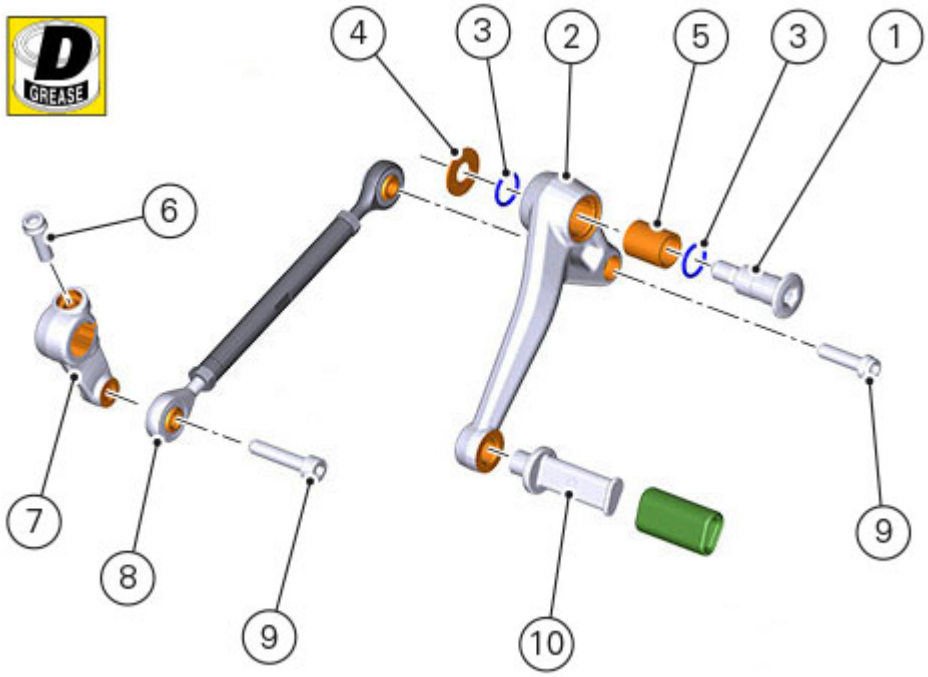


If necessary, remove the two screws (10) and slide out U-bolt (11) and clutch lever (12).

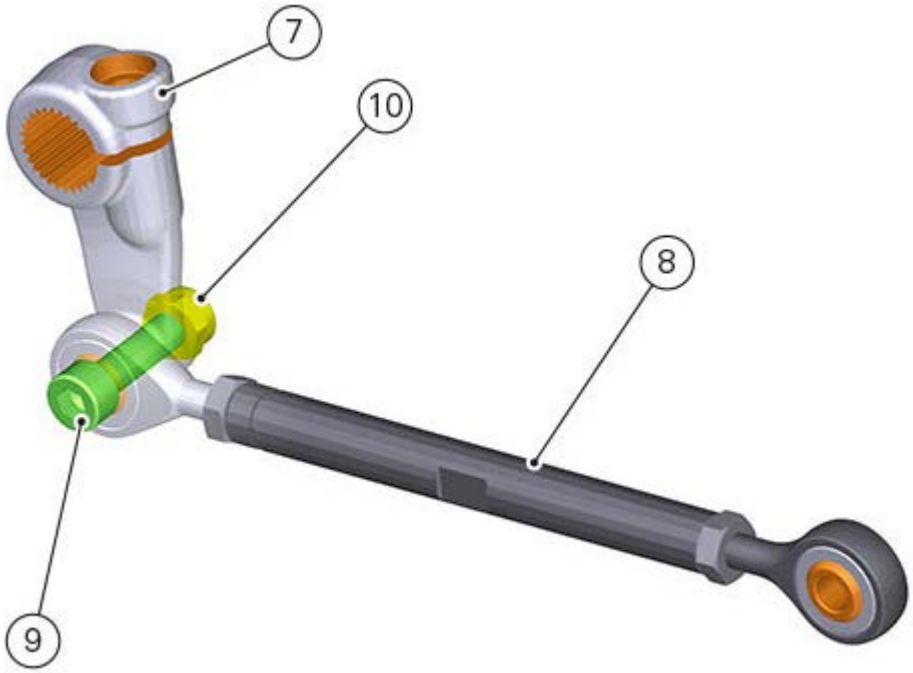


Refitting the gear change control

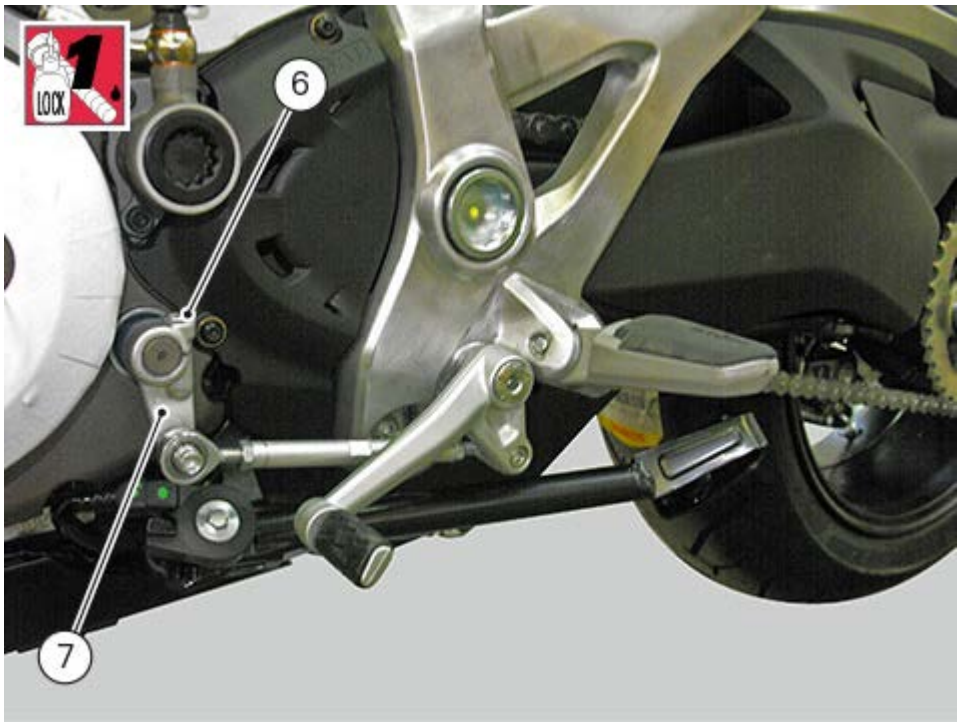
Apply the threadlocker on shaft (1).
Install O-ring (3) onto shaft (1).
Grease screw collar (1) with the specified grease.
Insert the shaft (1) in the gear lever (2), and insert the other O-ring (3) and the washer (4).
Fit the gear lever on the footpeg holder plate by inserting and tightening the shaft (1) to the specified torque of 23 Nm ± 10%.



Fit lever (7) on gear transmission rod assembly (8), starting screw (9).
Tighten the screw (9) to a torque of 10Nm ± 10%.

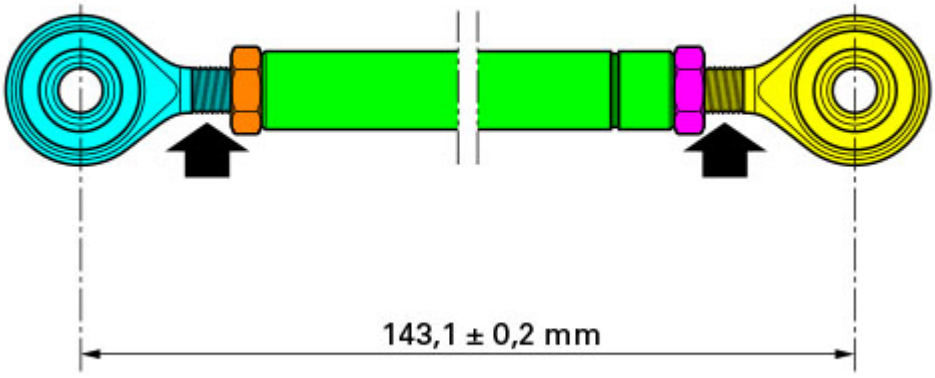


Fit the gear change unit inserting the lever (7) on the gear control pin, apply threadlocker on the screw (6) and insert it on the lever (7).
Tighten the screw (6) to a torque of 10Nm ± 10%.



Check the correct position of linkage (7) with respect to the gearchange lever (8) as shown in the figure.

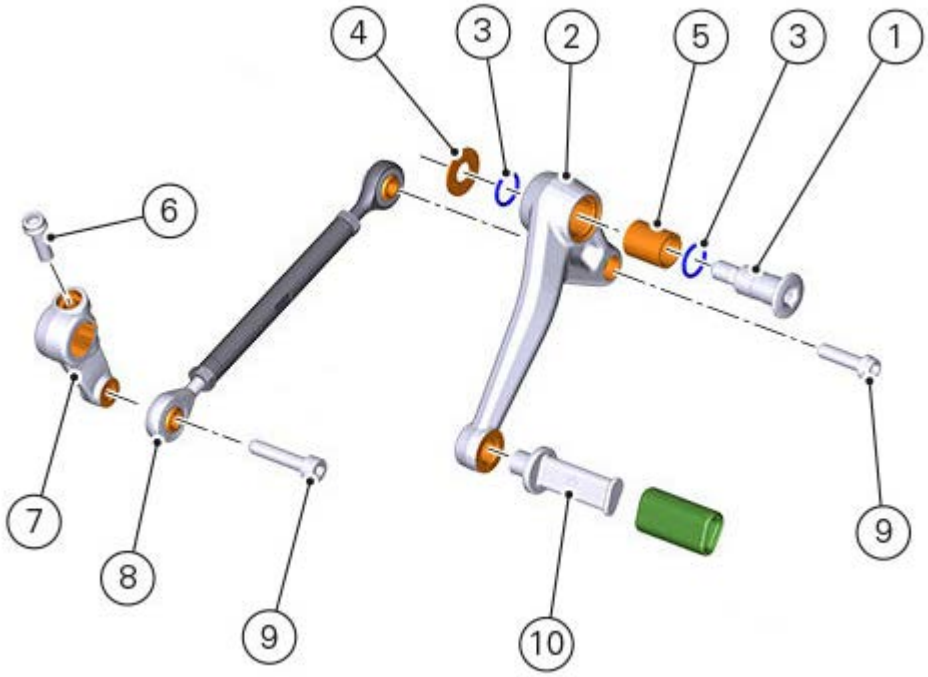
Adjust transmission rod (8) according to the following specifications and applying the indicated threadlocker, working as indicated under "Adjusting the position of the gearchange pedal and rear brake pedal".



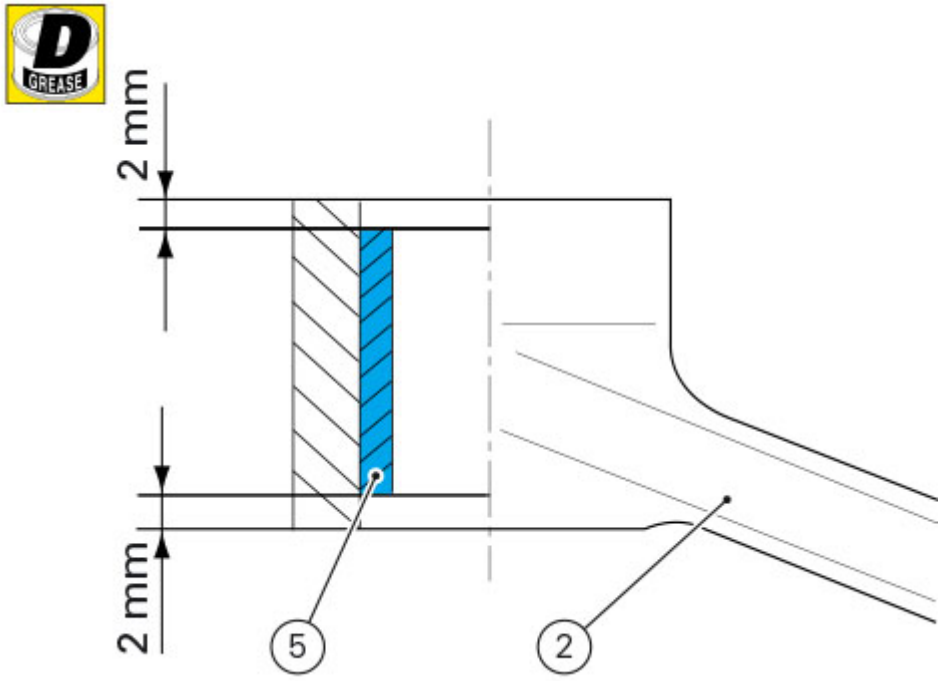
Then tighten transmission rod retaining nuts to a torque of 10 Nm ± 10%.

Disassembling the gear change control

Refer to the exploded view for indications on disassembly and replacement of unit components.



If the bush (5) inside the pedal (2) needs replacing, grease the external surface and drive the new bush into place using a press. The bush must be seated 2 mm below the outer face of the pedal.



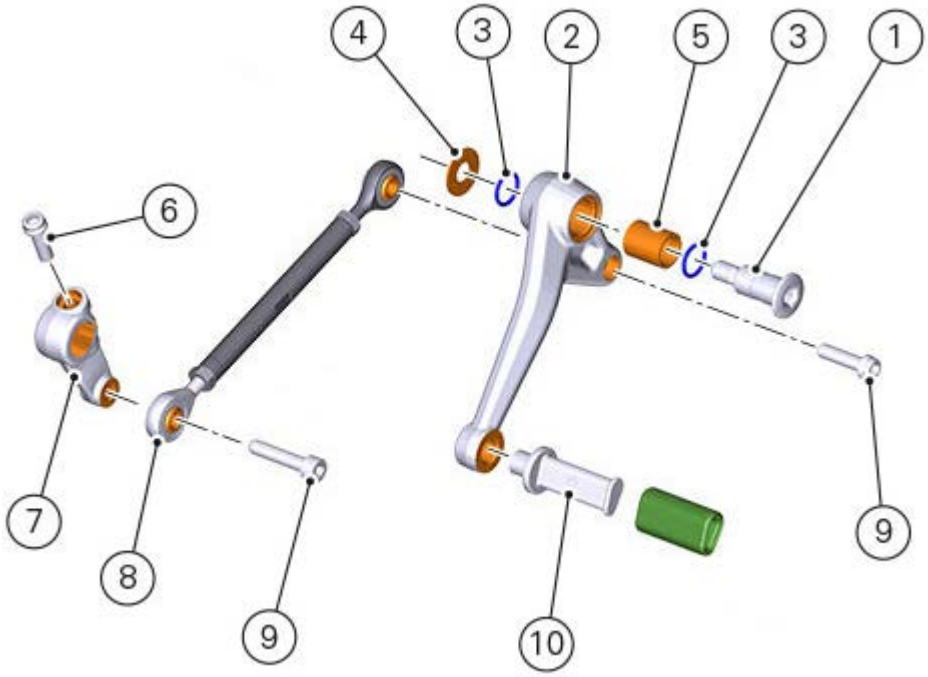
Warning

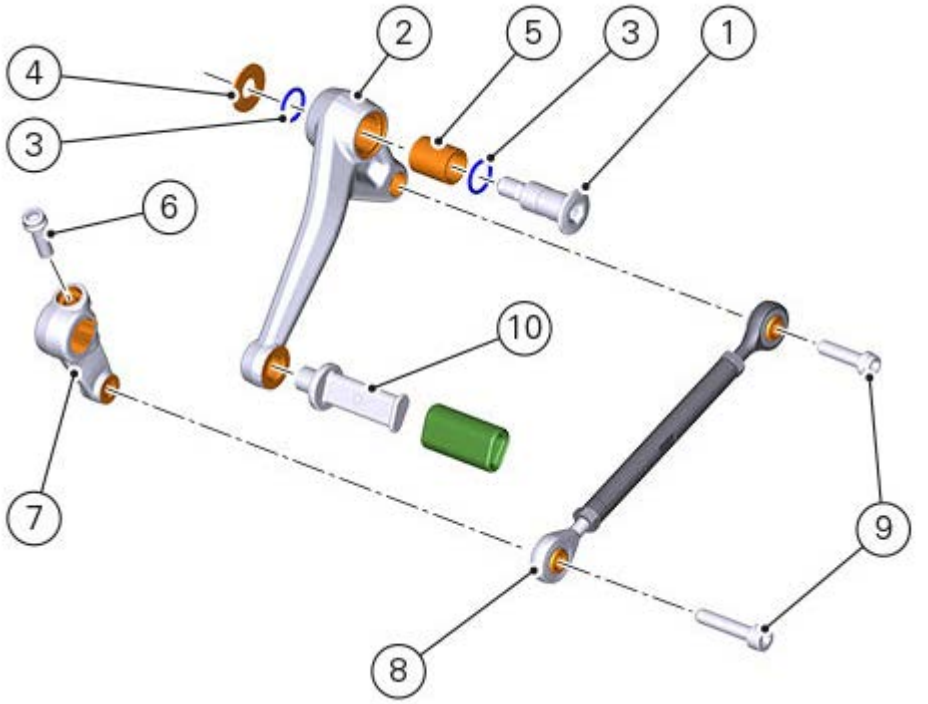
After working on the gear change control, check the position of the gear pedal.

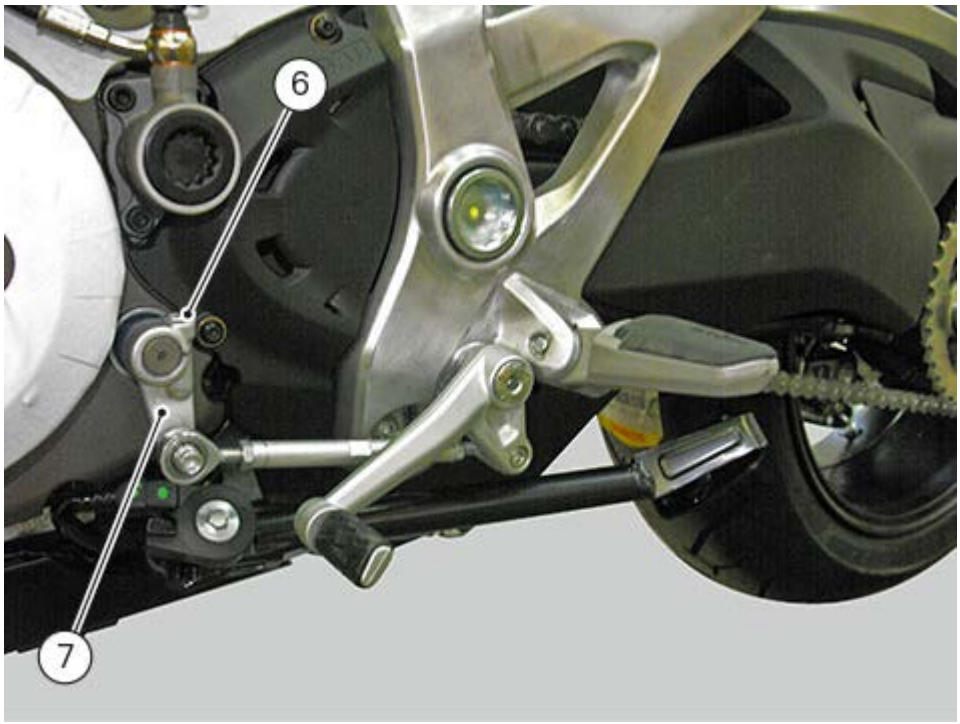
To adjust the gear pedal position, follow the instructions under Section "Adjusting the position of the gear and rear brake pedals.".

Removing the gear change control

Loosen and remove the pin (1) securing the gear pedal (2), and collect the O-rings (3), the washer (4) and bush (5).
Undo and remove the screw (6) securing the gear lever (7) to the gearbox shaft.
Remove the lever (7) complete with the gear control assembly.



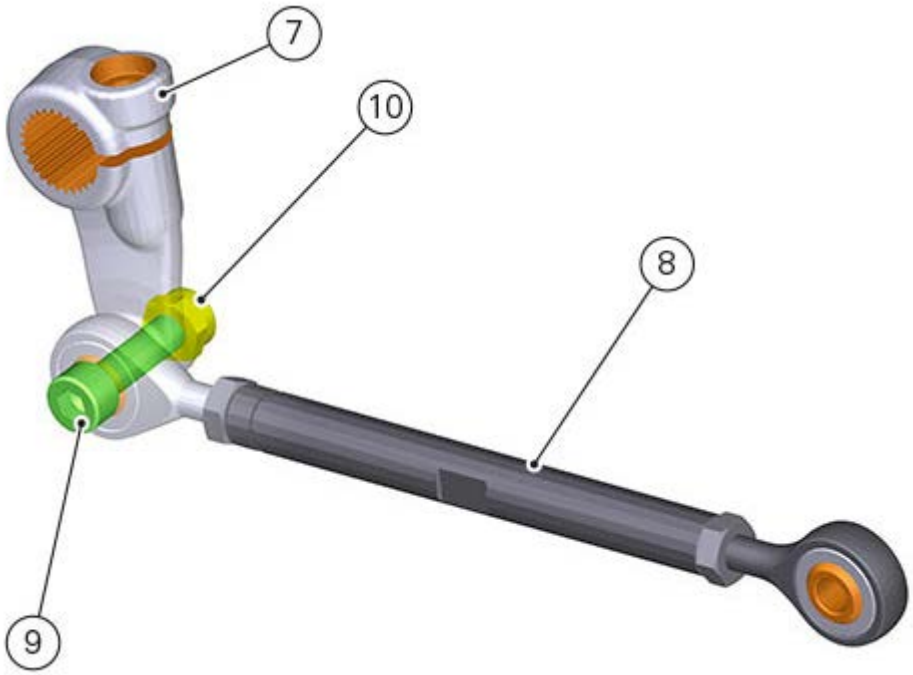




Note

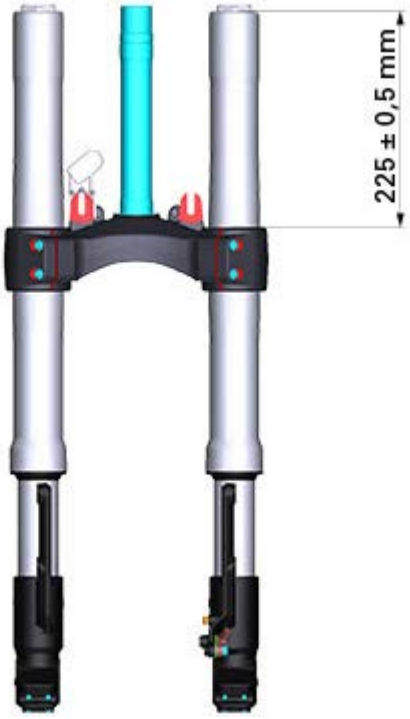
Mark the position of lever with respect to the gear selector shaft.

To remove lever (7) from gear transmission rod assembly (8), loosen nut (10) of screw (9) then slide out transmission rod (8) and lever (7).



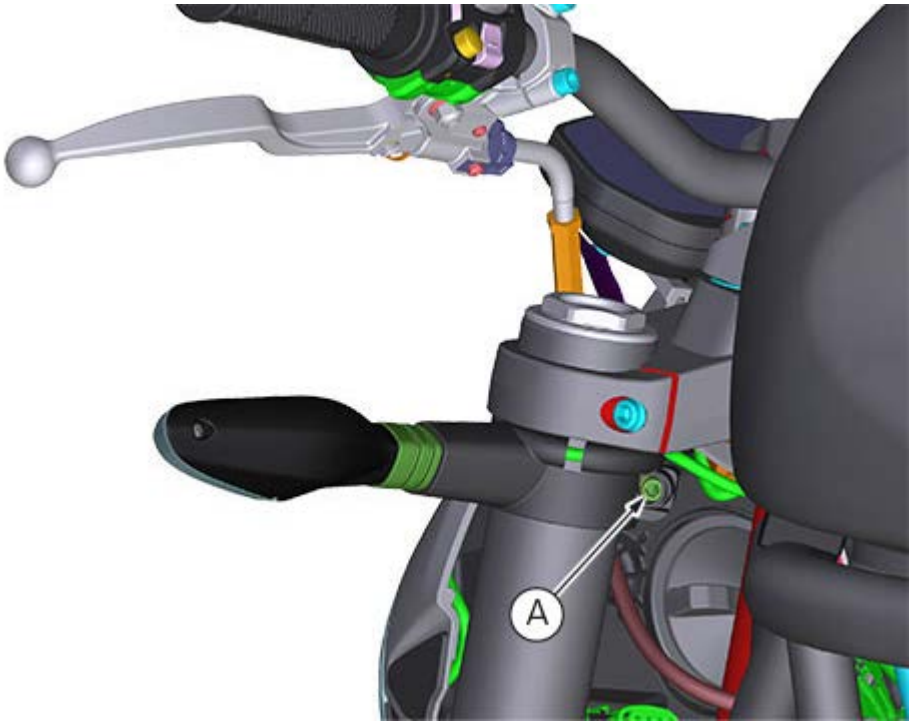
Refitting the front fork

Refit the fork legs setting them at the indicated height to the bottom yoke.



Warning
The difference in height between the two fork legs must be no greater than 0.1 mm.

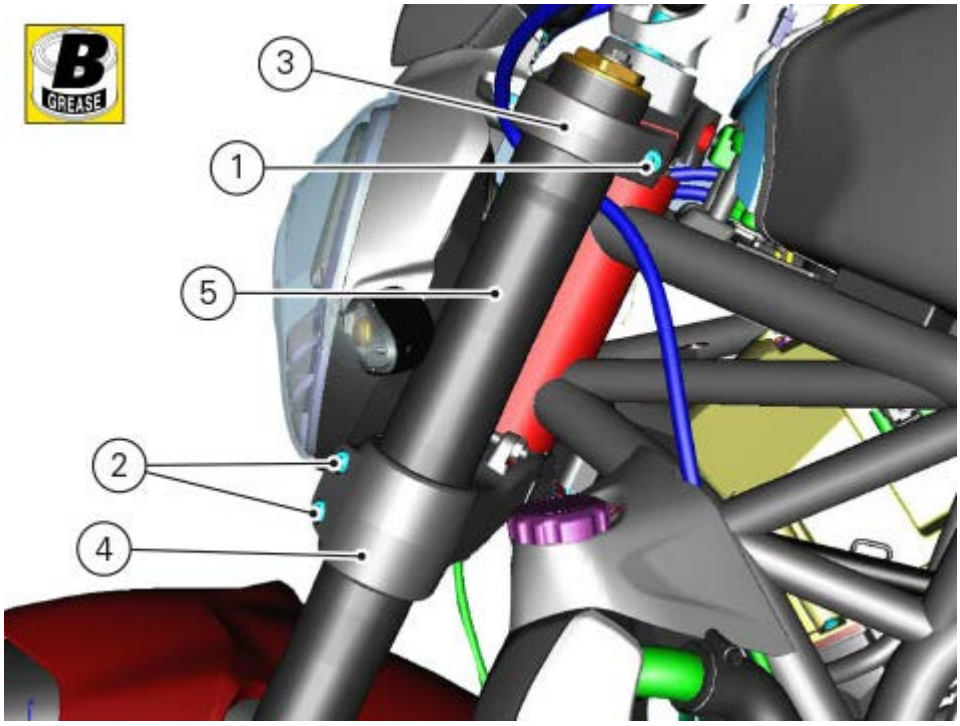
(FOR USA VERSION ONLY) Position the turn indicators on the fork legs (Refitting the light assembly) and tighten screws (A) to a torque of 5 Nm ± 10%.

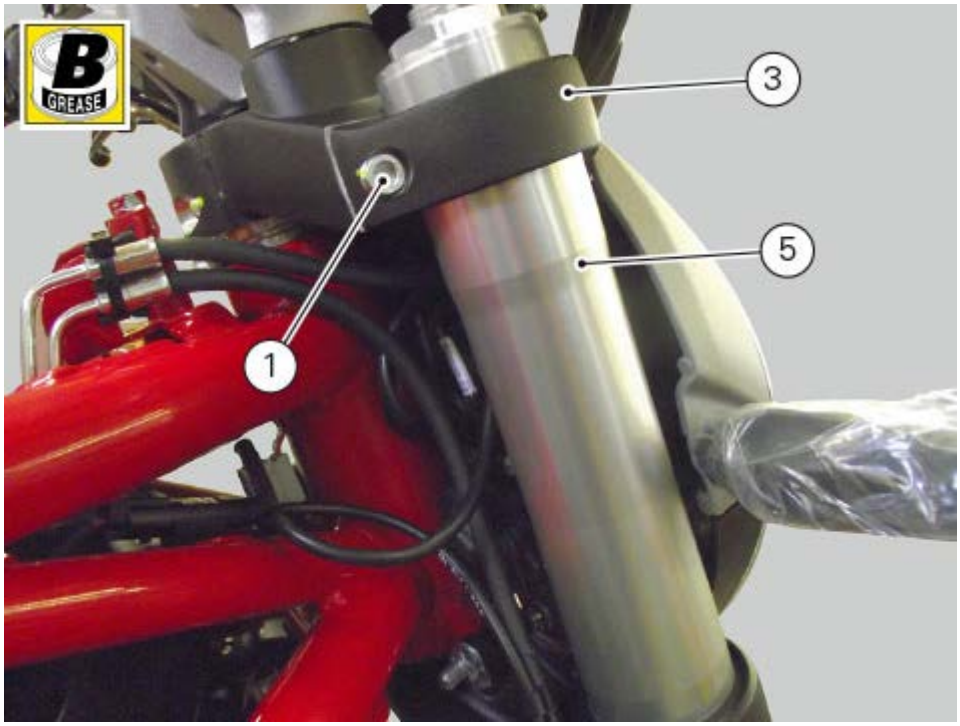


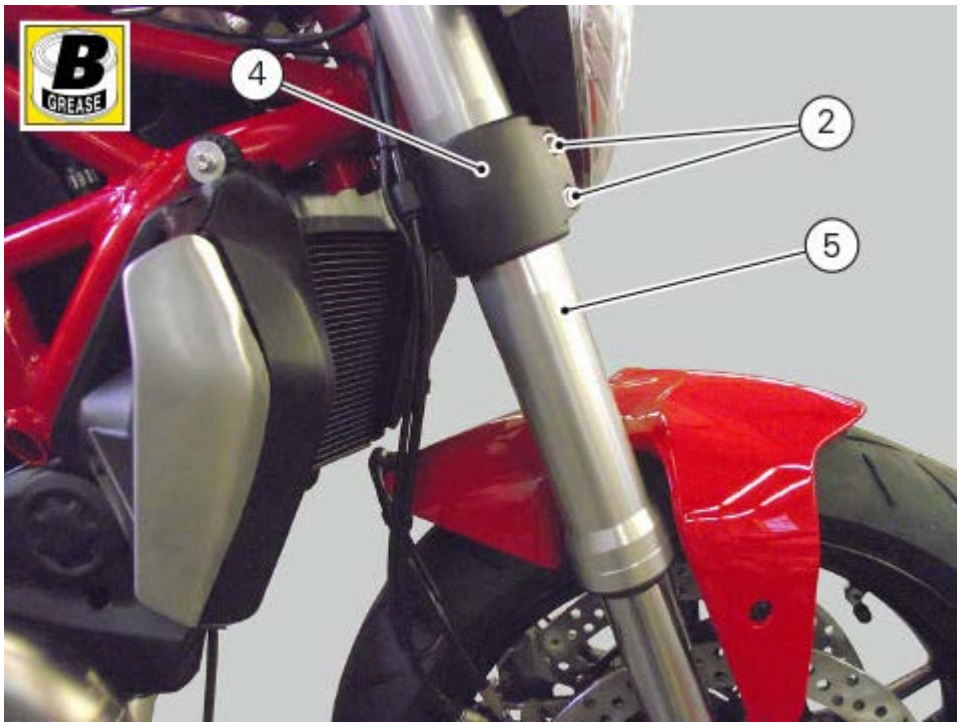
Position fork legs (5) on bottom yoke (4) and steering head (3).
Fasten fork legs by tightening screws (1) to 24 Nm ±5% and screws (2) to 22 Nm ± 5% retaining bottom yoke (4) and steering head (3): tighten screws (2) in a 1-2-1 sequence.
Tighten one leg at a time.

Important
If the screws were removed upon disassembly, smear their threads with the specified grease before

tightening.







Refit any parts removed from the frame.
Refit the front mudguard (Refitting the front mudguard).
Refit the front wheel (Refitting the front wheel).

To adjust the forks refer to section "Adjusting the front fork".

Warning
Do not use the motorcycle when front mudguard is not in place since this part supports the brake lines and avoids that they interfere with the wheel under braking.

Remove the front wheel (Removing the front wheel)
Remove the forks (Removing the front fork).

REMOVING THE LEFT FORK

Vice the fork (1) and pay attention to protect the sleeve.

Apply some adhesive tape on the hexagon flat to prevent any damage.
Slacken the top plug (2).

Take the outer sleeve (1) down.

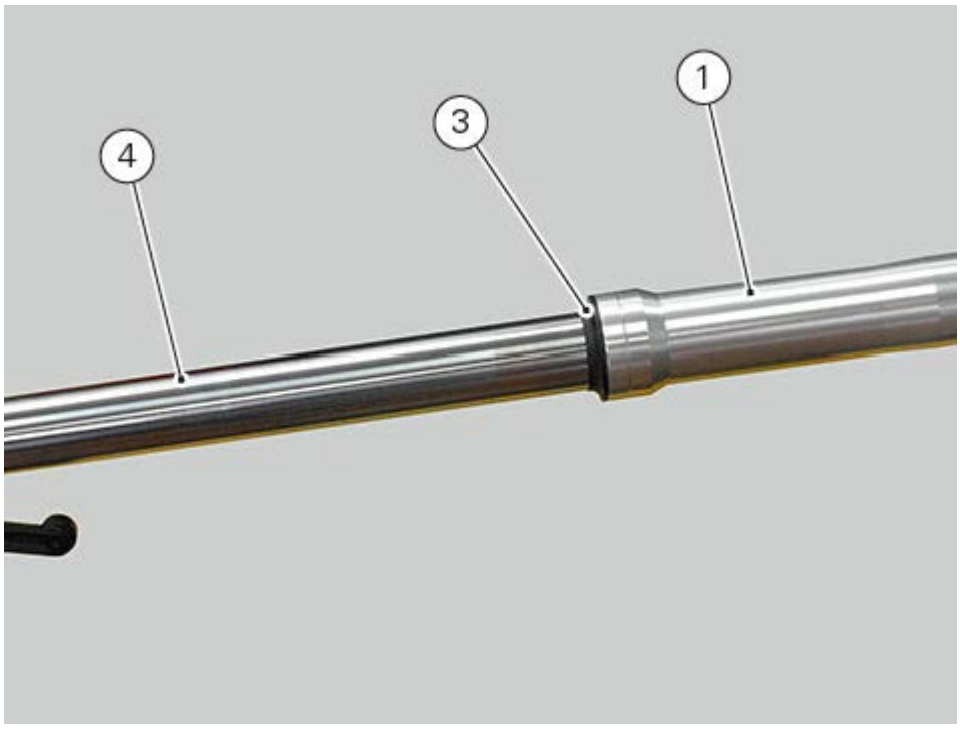
Drain all fluid from the sleeve.
To help draining, move damper rod a few times, then leave sleeve upside-down until fluid has completely drained.

Important

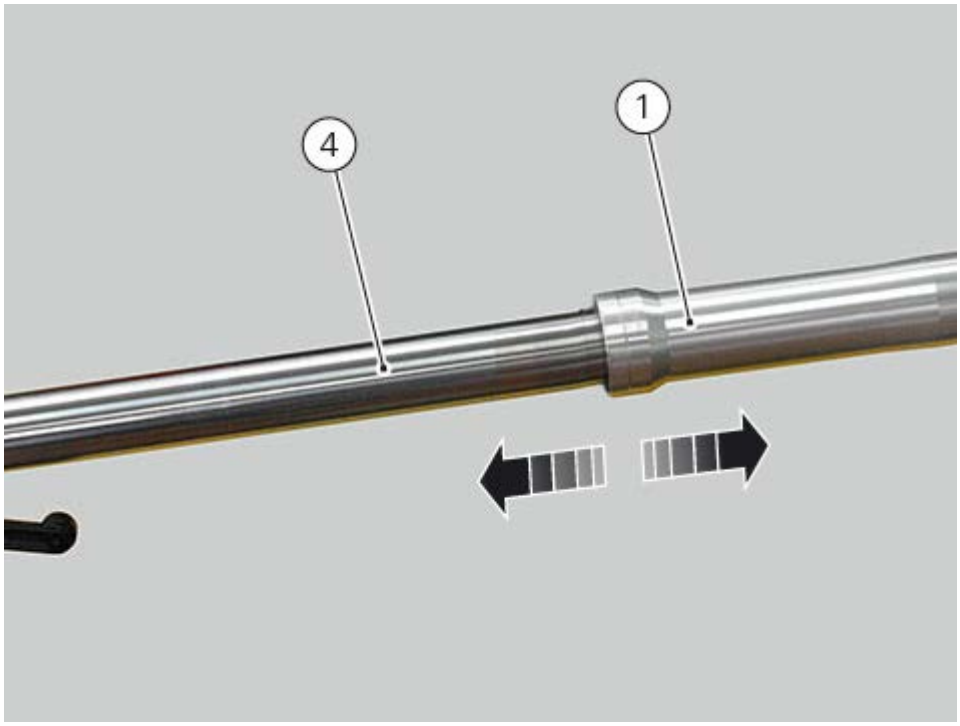
Draining all fluid from the fork is very important. This because, due to fork construction and design, it is not possible to measure the air volume from fluid surface to fork edge when filling the fork with fluid.

Set the fork in the vice and clamp the bottom end. Use the suitable protection plates to avoid any damage. Remove the fork plug (2) and detach it from damper rod assembly.

Remove dust seal (3) from outer sleeve (1) and leg (4).



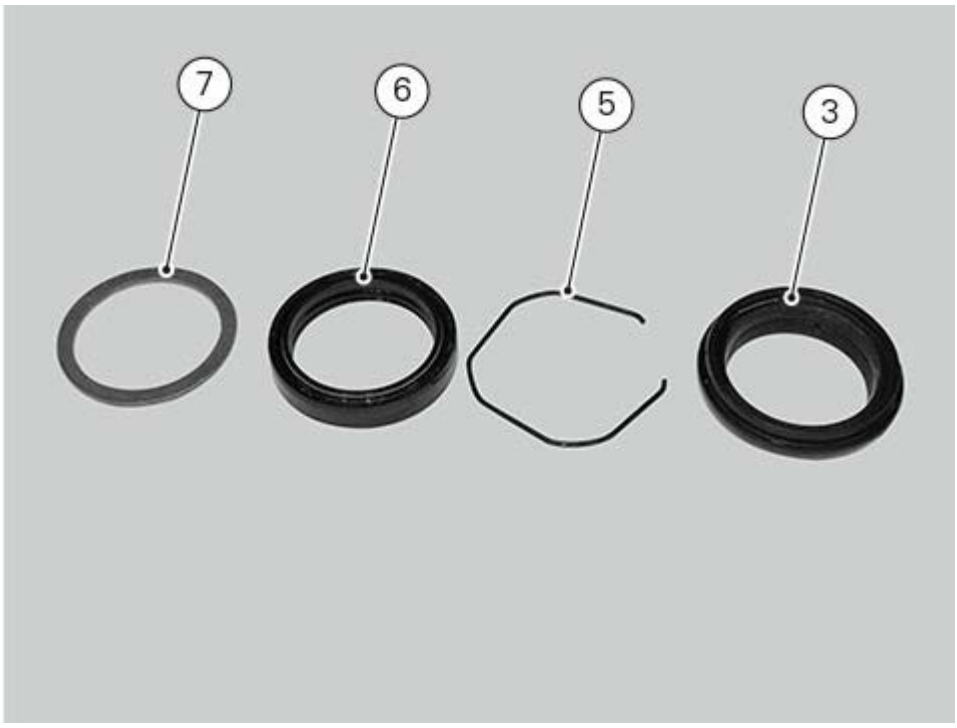
Slide out outer sleeve (1) from fork leg (4) by hitting several times to counter-hold the sliding bushing resistance.



Using suitable tools, remove snap ring (5), oil seal (6) and shim (7).

Important

Protect the sleeve with rubber before vicing it to avoid any damage.

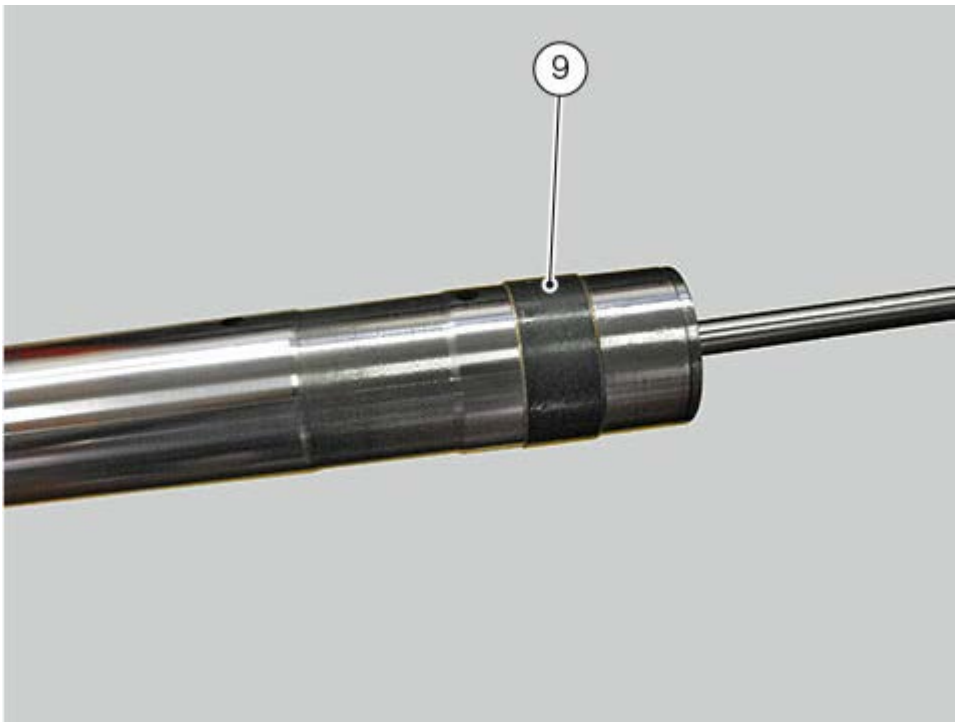


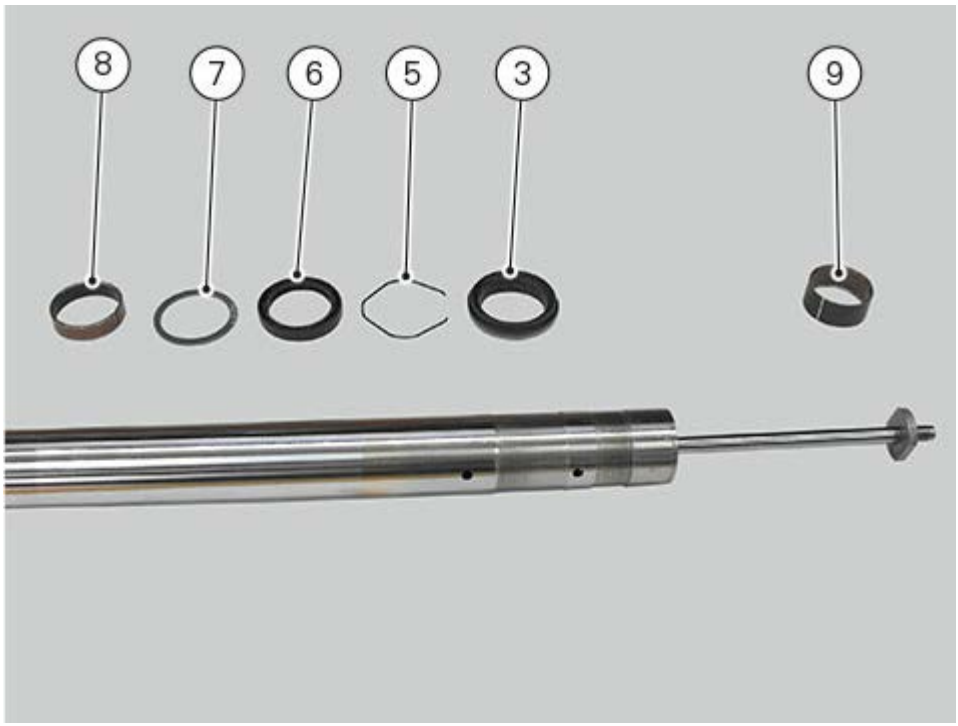
Remove bushing (8).

Important

To help bushing removal, heat up the outer sleeve in the areas of the bushings up to a temperature of 100°.

Work on fork leg and remove bushing (9).



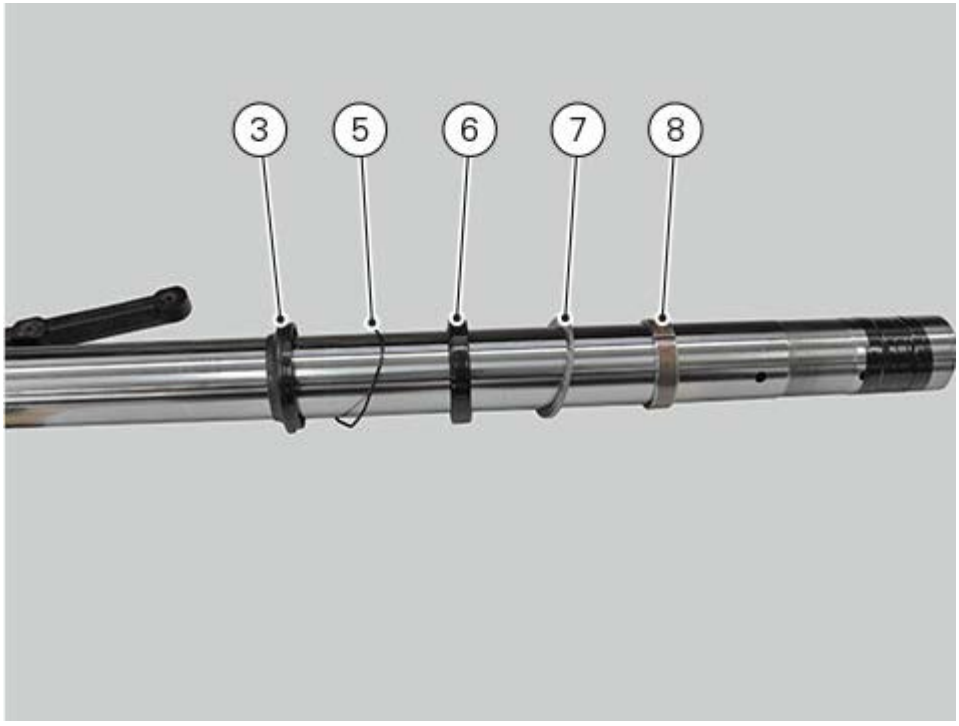


REFITTING THE LEFT FORK

Protect bushing seat with some adhesive tape.

Lubricate fork leg with fork oil and install, in this sequence:

- Dust seal (3);
- Snap ring (5);
- Oil seal (6);
- Shim (7);
- Bushing (8).

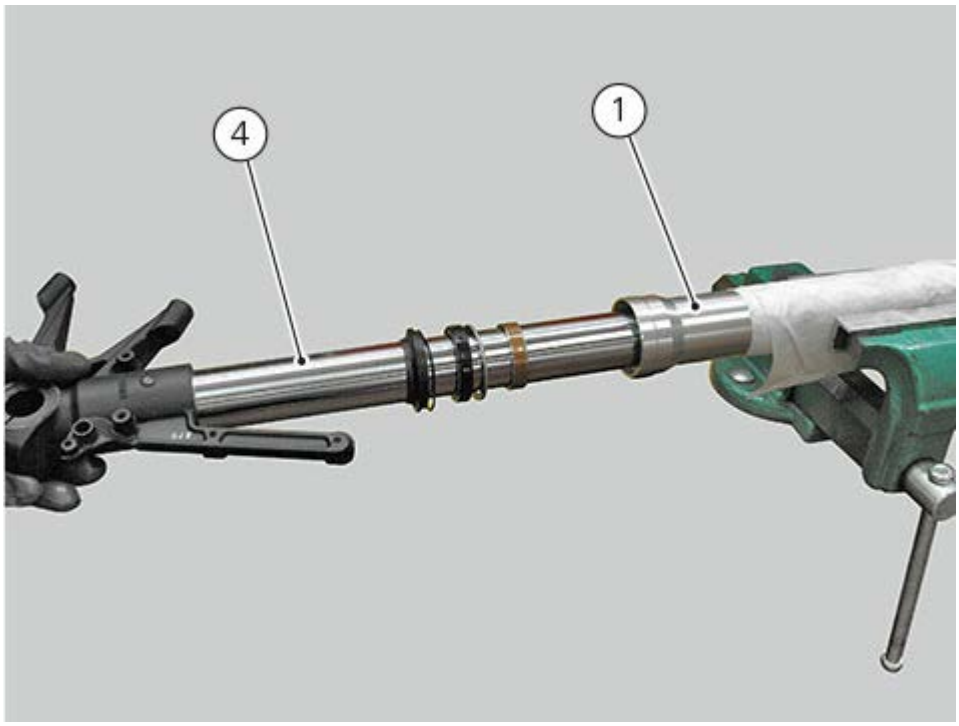


Note

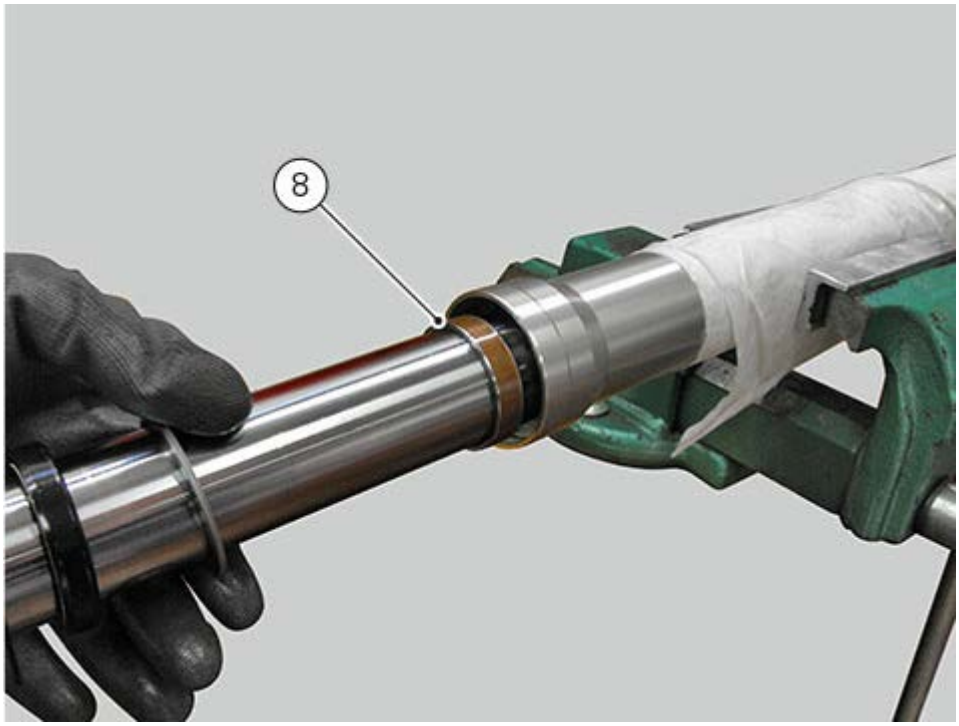
Pay attention to the direction of installation of oil seal, spring must face outward.

Remove the adhesive tape previously applied.
Fit the sliding bushing (9) in its housing.

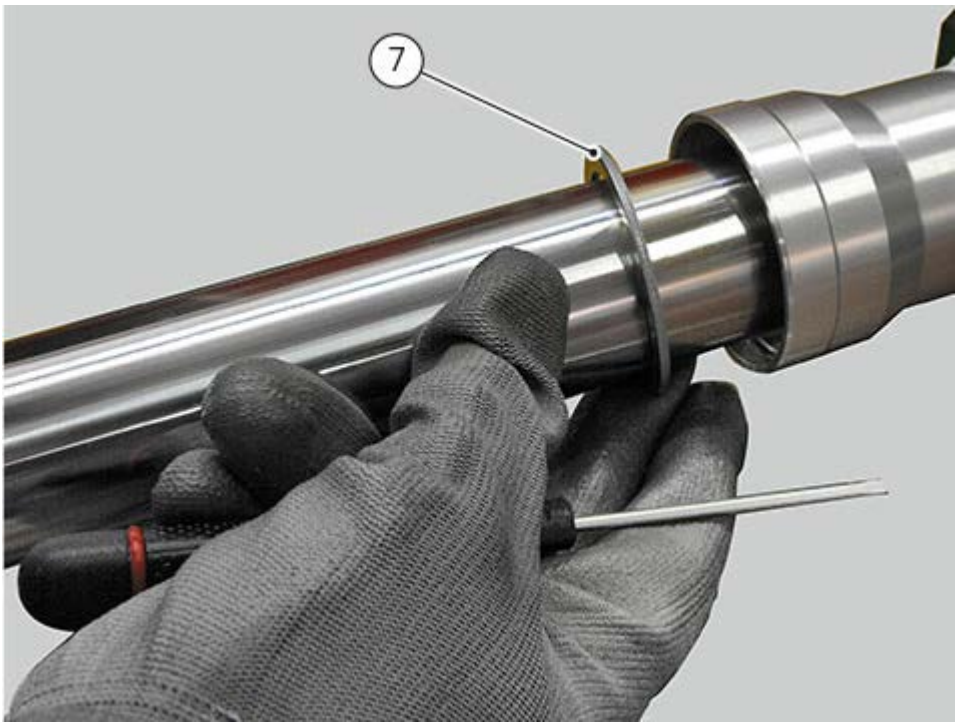
Fit leg (4) into the outer sleeve (1).



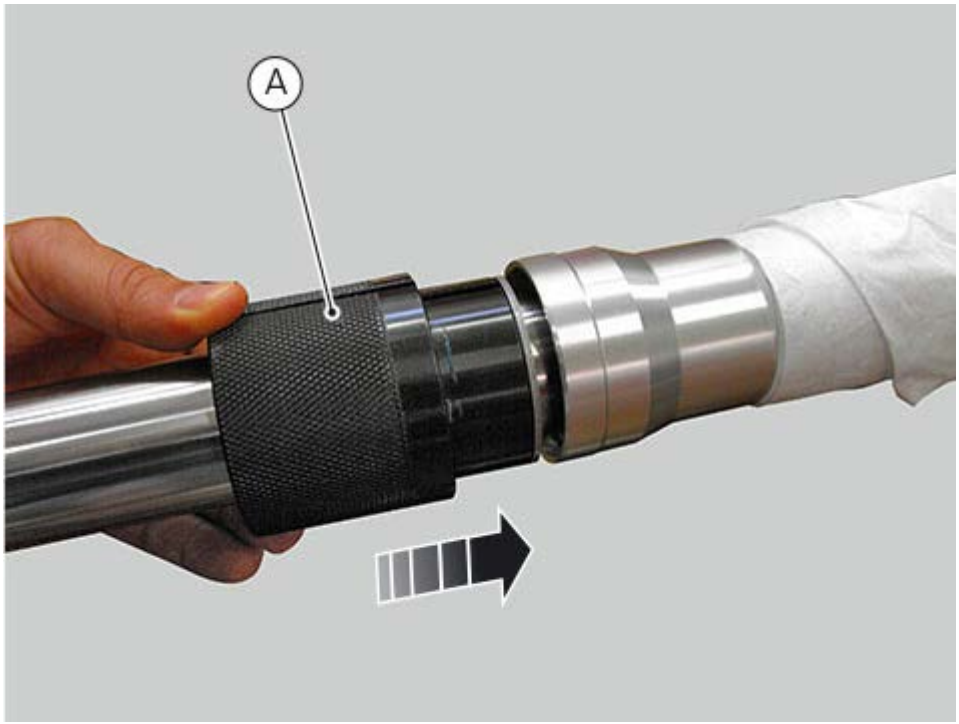
Install bushing (8) in its housing.



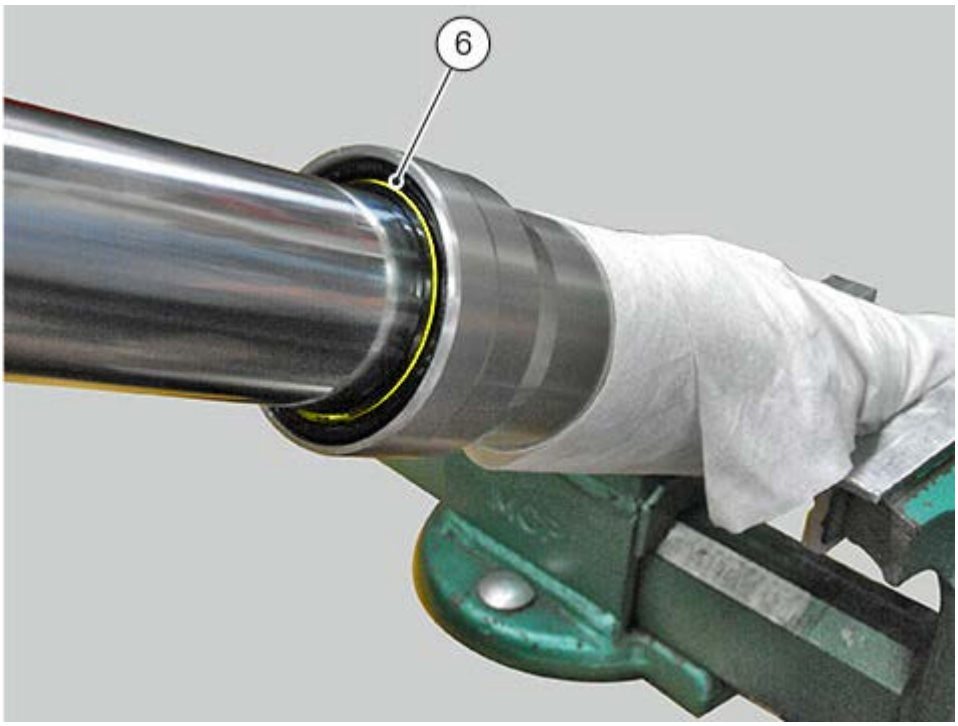
Fit shim (7) on bushing.



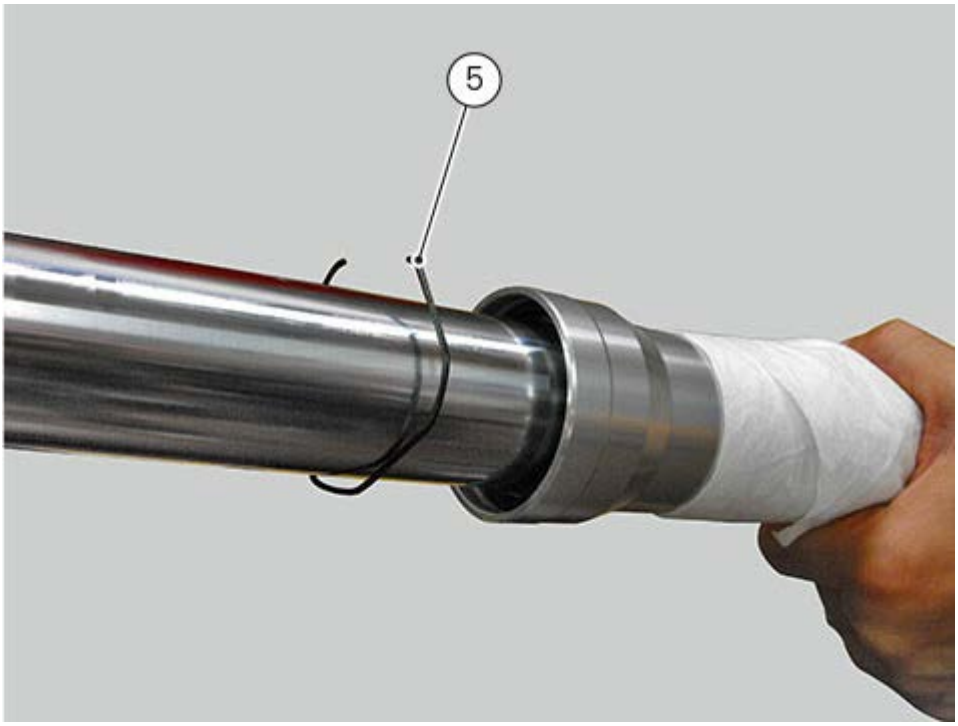
With tool (A) part no. **88713.1096** push bushing/shim assembly fully home.

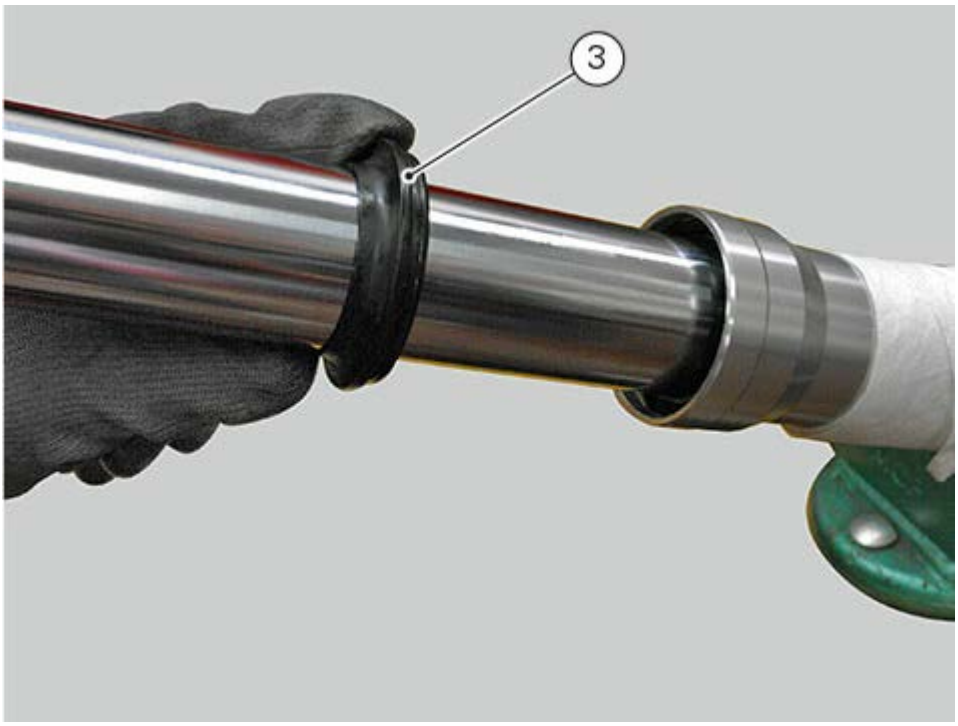


Then, using the same tool, install oil seal (6).



Fit snap ring (5) and dust seal (3).

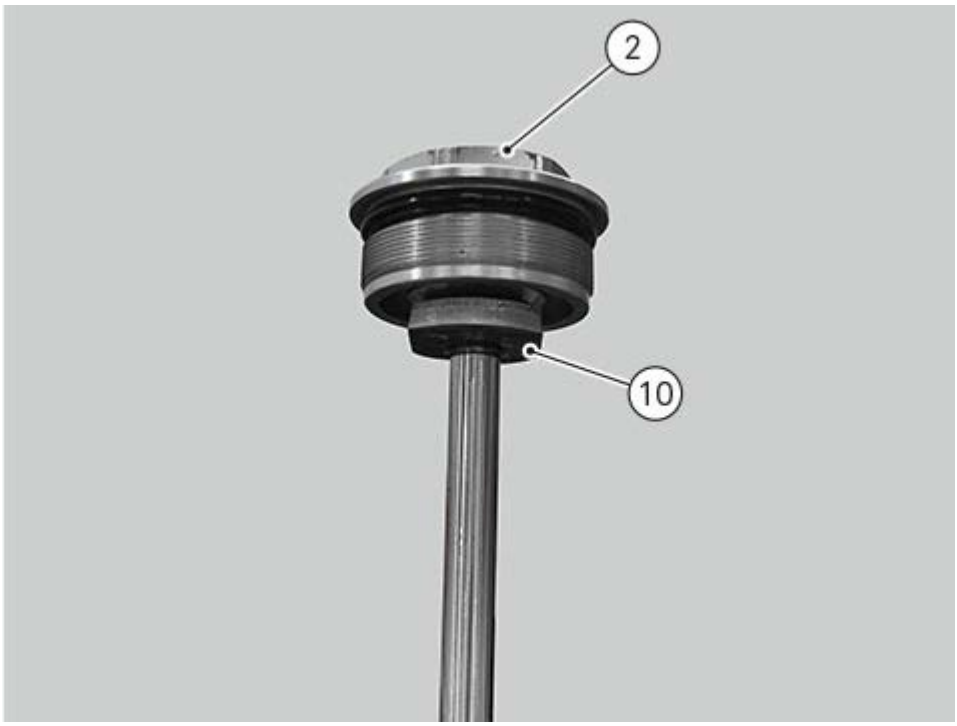




Warning
The right and left legs contain a different quantity of fluid.

Fill in the left leg with 394 cc (Front suspension).

Tighten plug (2) and take lock nut (10) fully home.



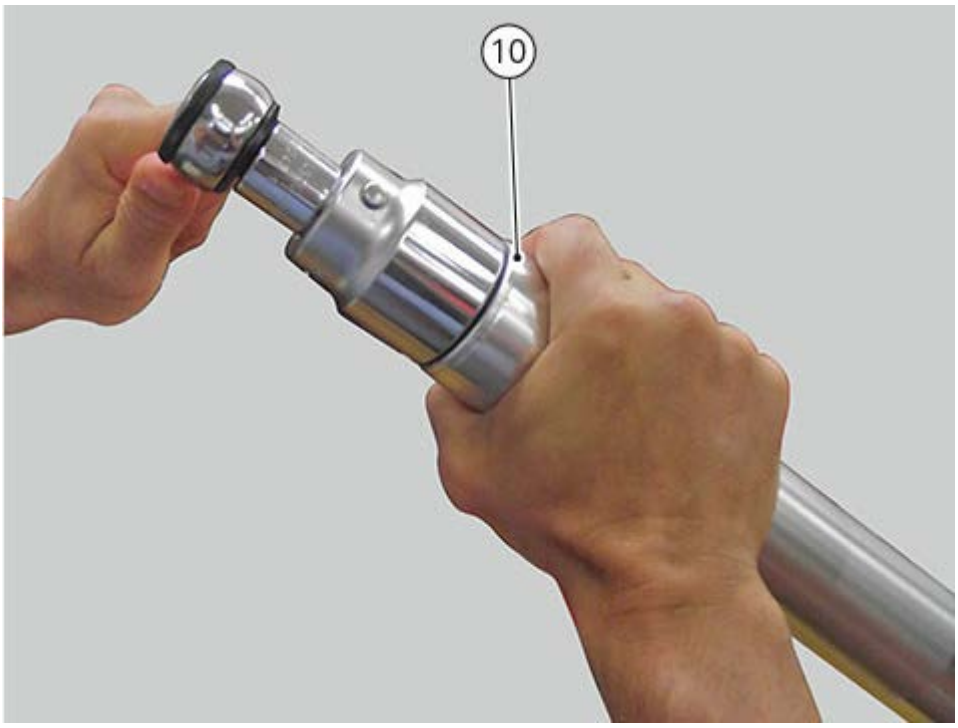
Apply some adhesive tape on the hexagon flat to prevent any damage.

Tighten plug (2) on lock nut (10).

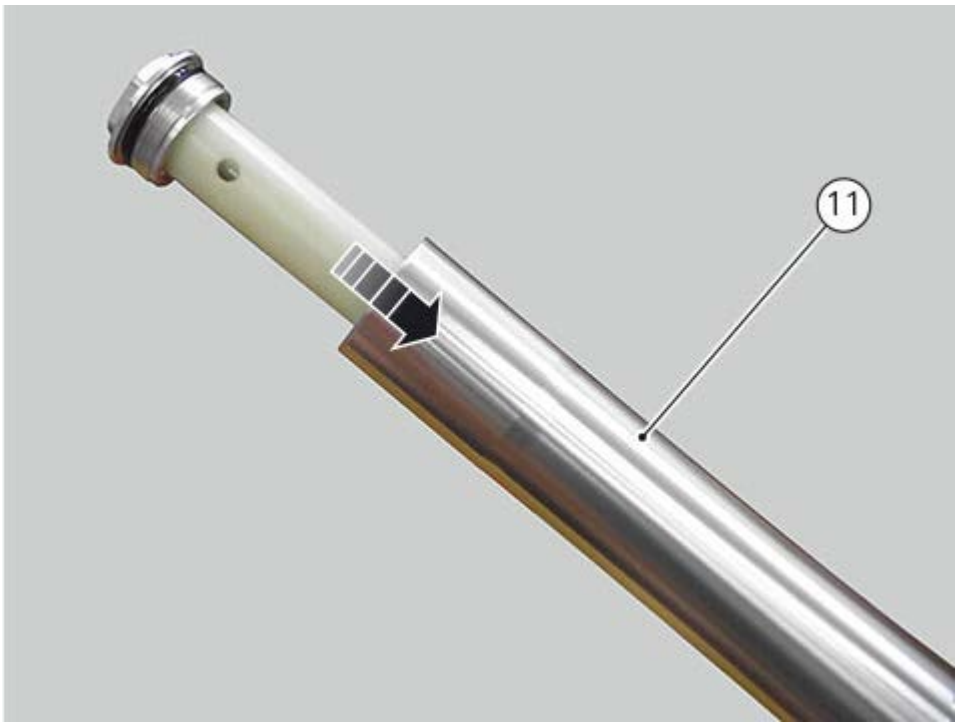
Tighten plug (2) on sleeve (1).

REMOVING THE RIGHT FORK

Vice the fork and pay attention to protect the sleeve.
Apply some adhesive tape on the hexagon flat to prevent any damage.
Fit the top plug (10).

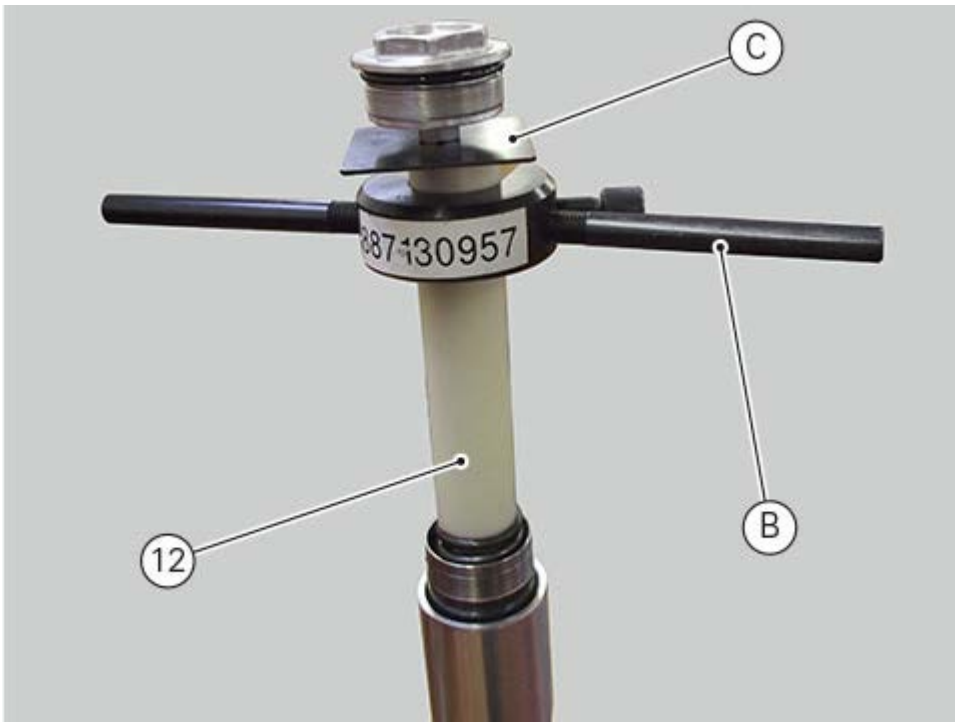


Take the outer sleeve (11) down.

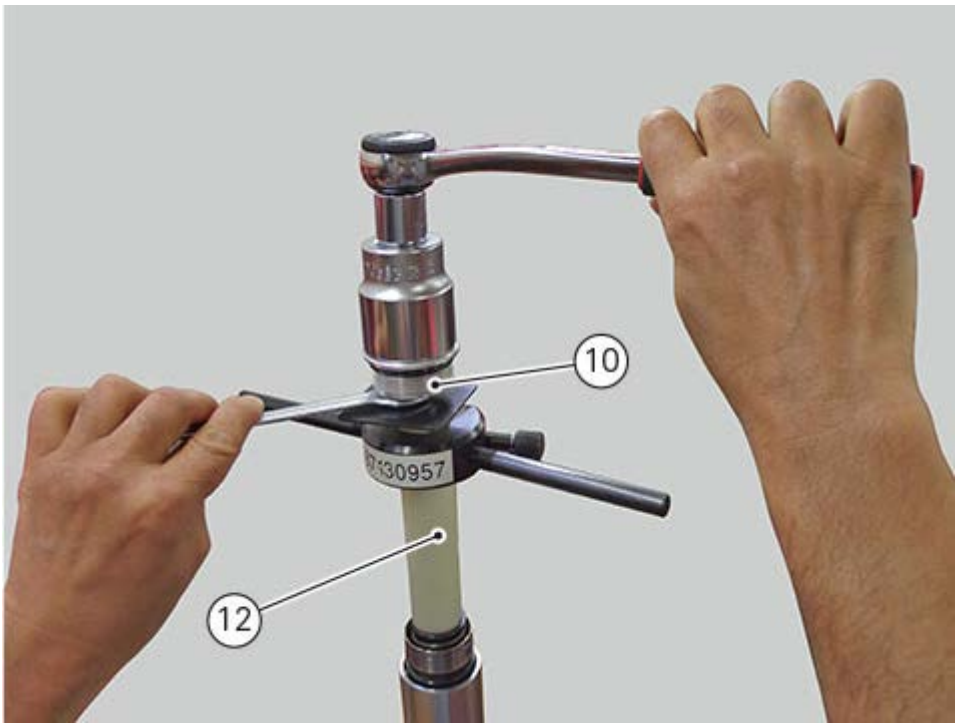


Drain the oil from the fork.

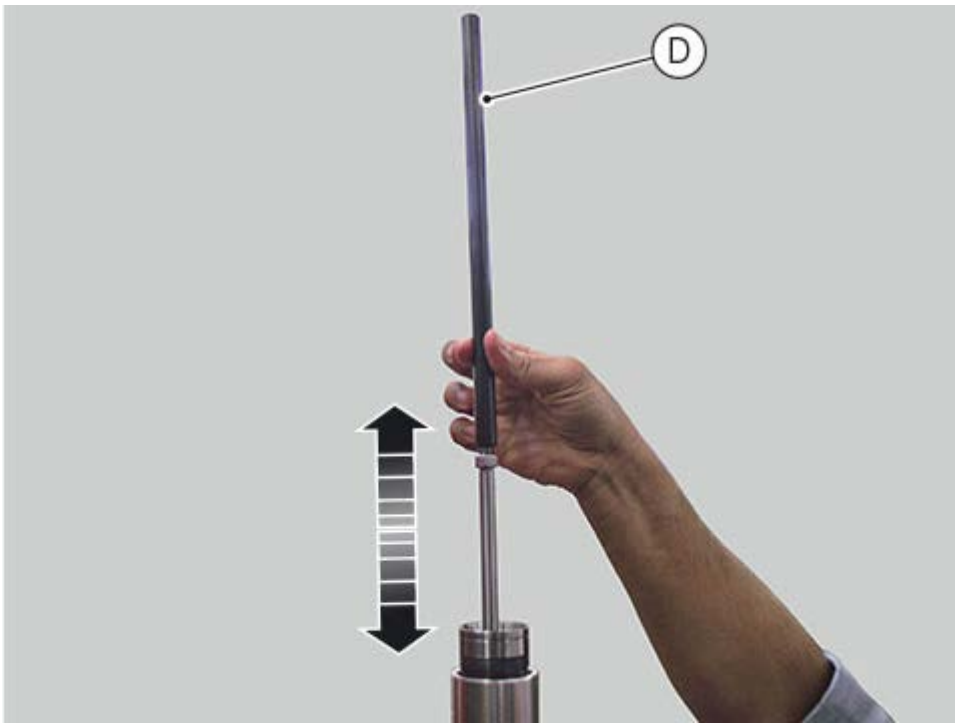
Use tool (B) part no. **88713.0957** in the preload tube.
Use a suitable tool to lower the preload tube and insert under the nut the tool (C) with part no. **88713.0957**.



Unscrew plug (10) and remove it from damper rod.
Remove the preload plug (12).



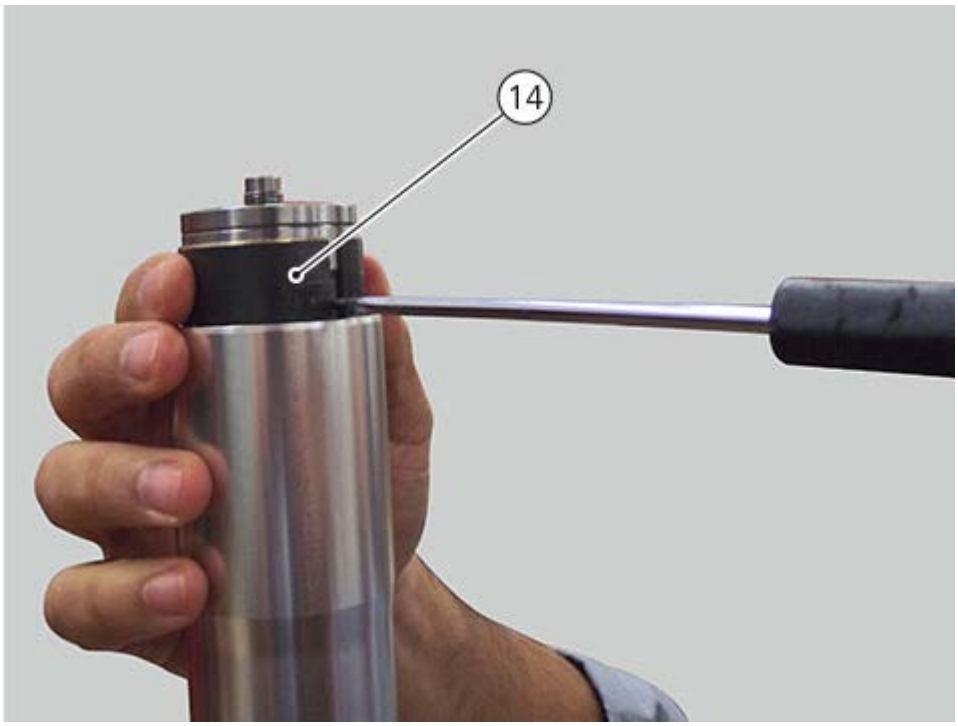
Be careful when removing the fork plug; the preload plug could pop out because of the spring (13) strength.
Remove spring (13).
Using tool (D) part no. **88713.0950** move damper rod a few times to drain all the fluid and leave the sleeve upside-down until the fluid has completely drained.



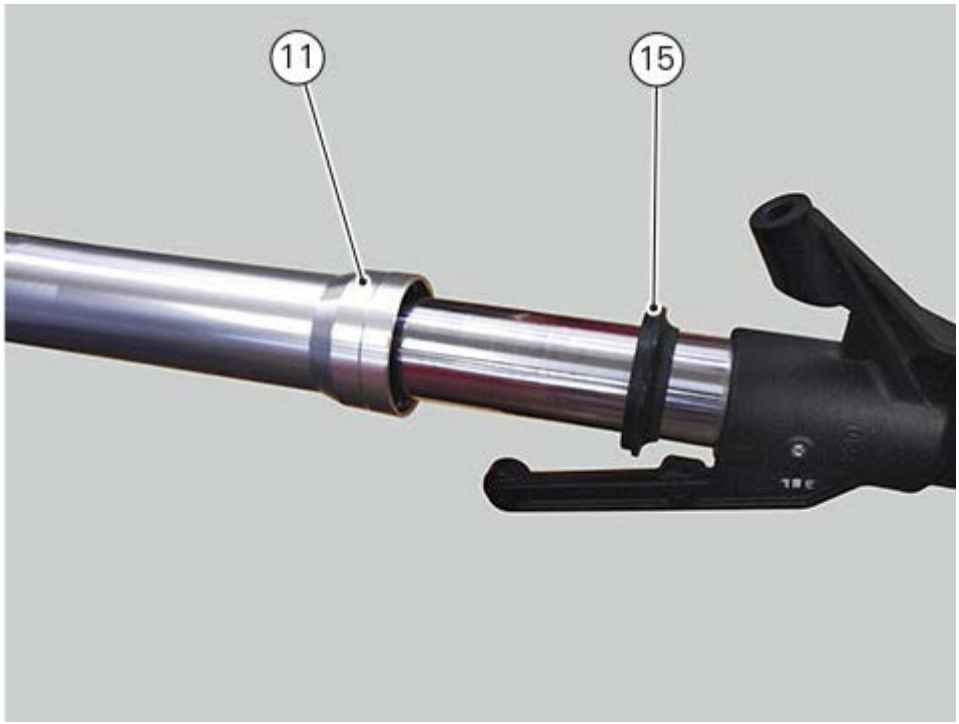
Important

Draining all fluid from the fork is very important. This because, due to fork construction and design, it is not possible to measure the air volume from fluid surface to fork edge when filling the fork with fluid.

Remove the sliding bushing (14) from the leg.

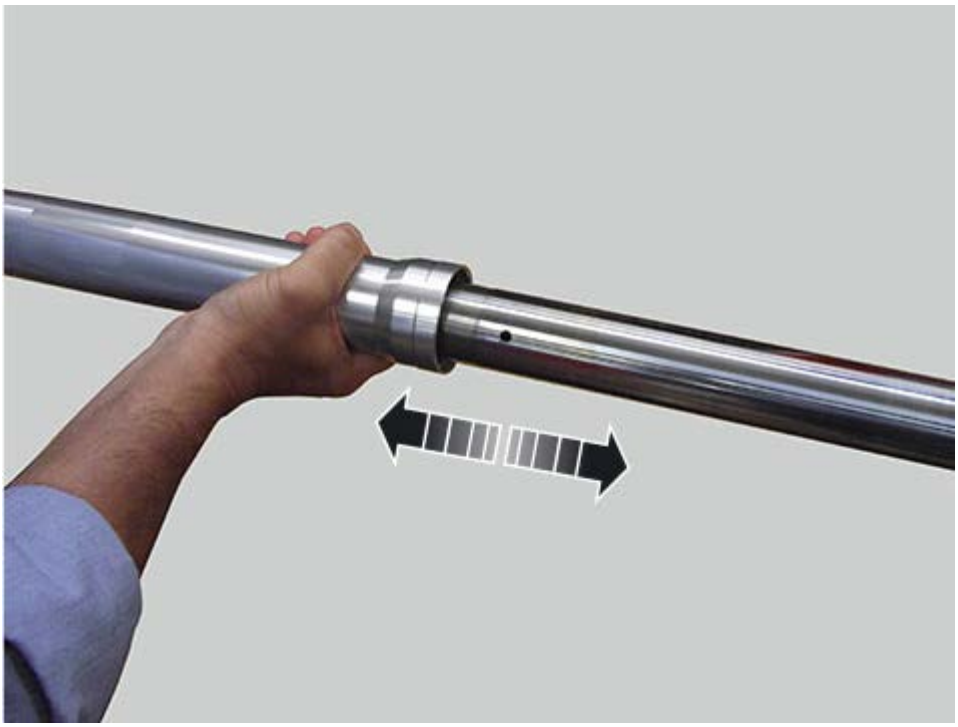


Remove dust seal (15) from outer sleeve (11).



Remove snap ring (16).

Slide out outer sleeve (11) from fork leg (17) by hitting several times to counter-hold the sliding bushing resistance.

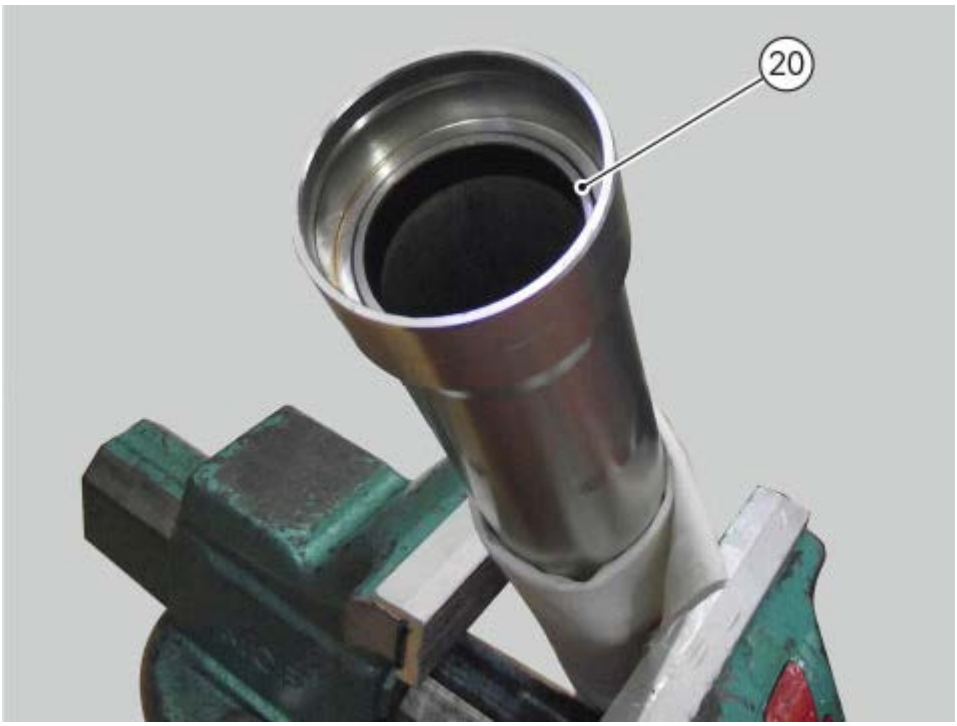


Remove oil seal (18) and shim (19).

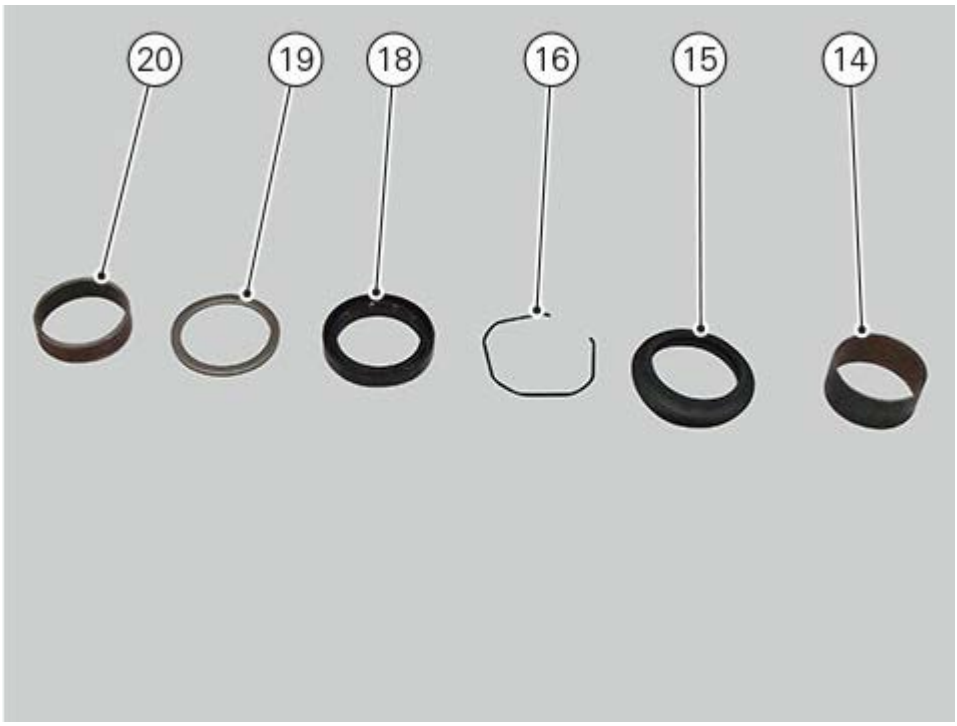
Remove bushing (20).

Important

To help bushing removal, heat up the outer sleeve in the areas of the bushings up to a temperature of 100°.


20


BOSCH



REFITTING THE RIGHT FORK

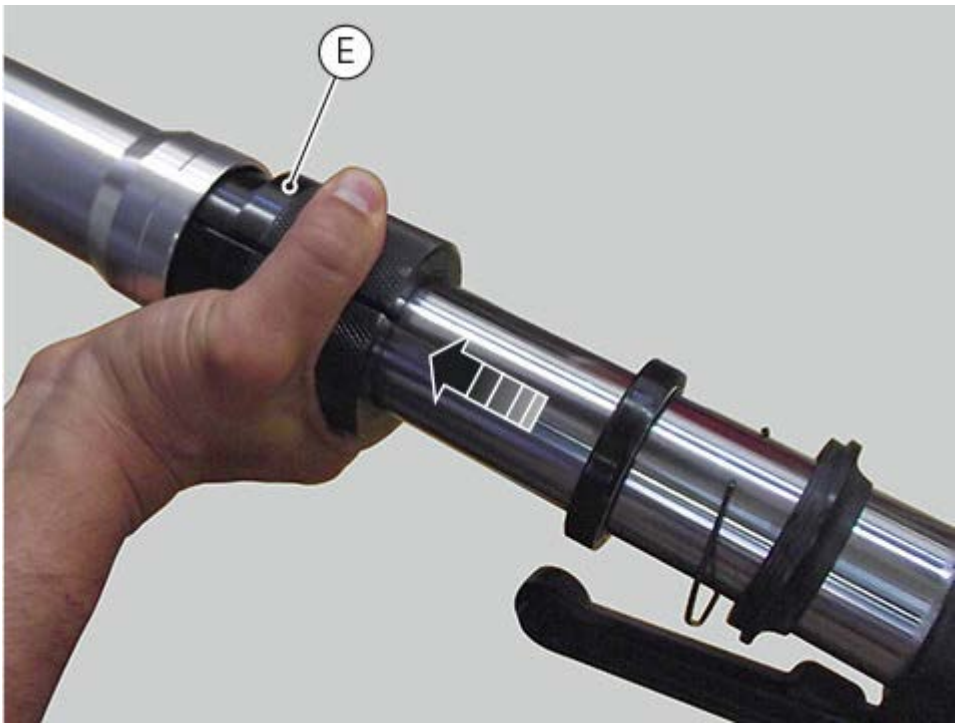
Protect bushing seat with some adhesive tape.

Lubricate fork leg with fork oil and install, in this sequence:

- Dust seal (15);
- Snap ring (16);
- Oil seal (18);
- Shim (19);
- Bushing (20).

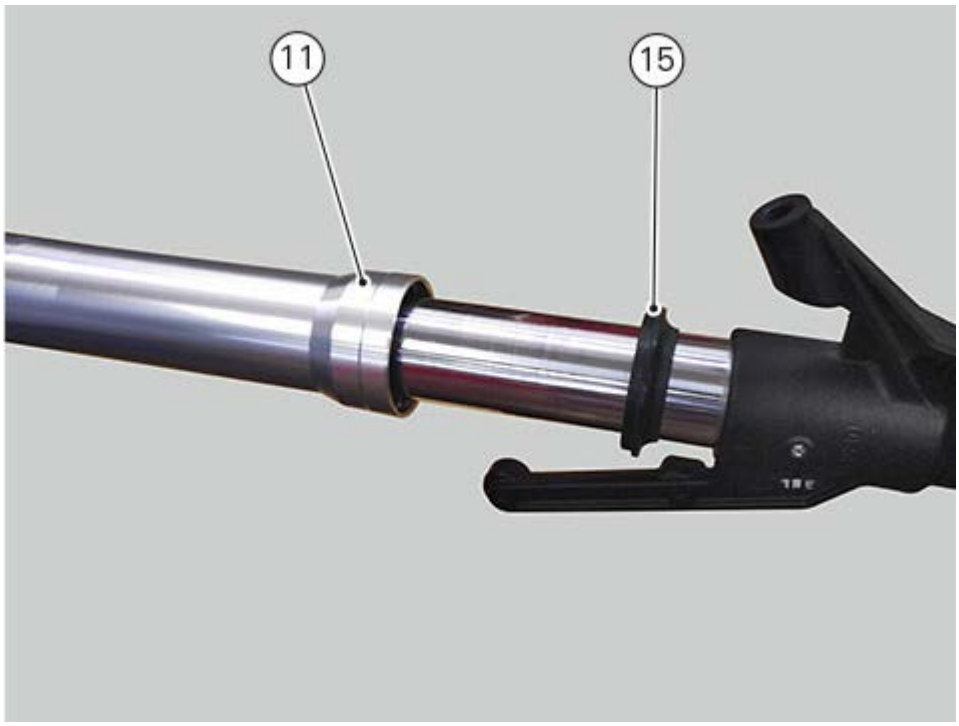
Note
Pay attention to the direction of installation of oil seal, spring must face outward.

Fit leg into the sleeve.
Install bushing (20) in its housing.
Fit shim (19).
With tool (E) part no. **88713.1096** push bushing/shim assembly fully home.

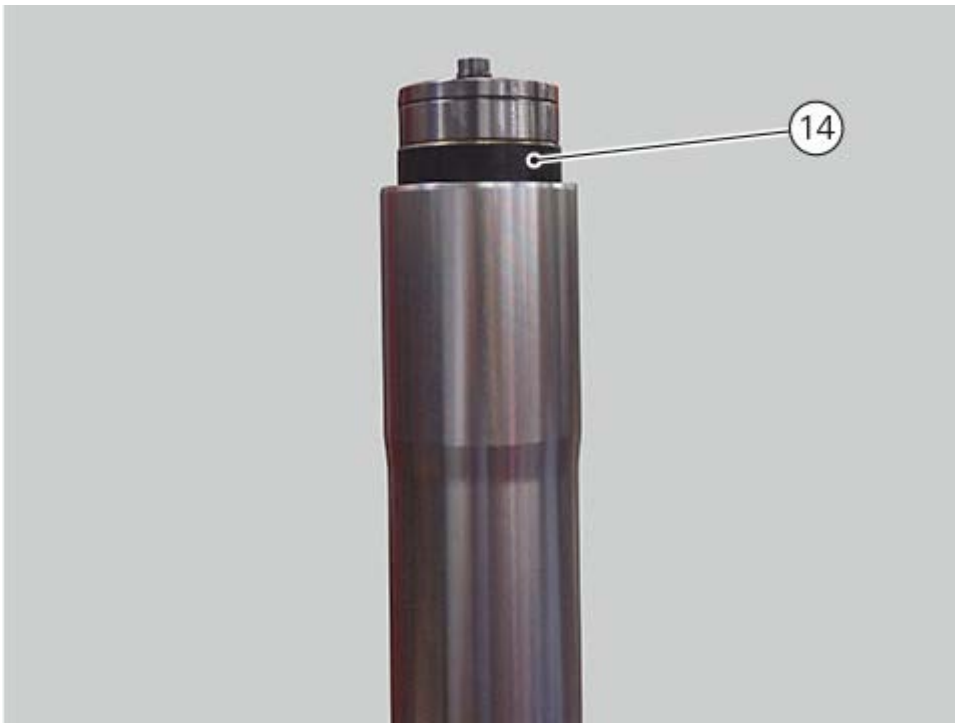


Insert oil seal (18) following the same procedure.

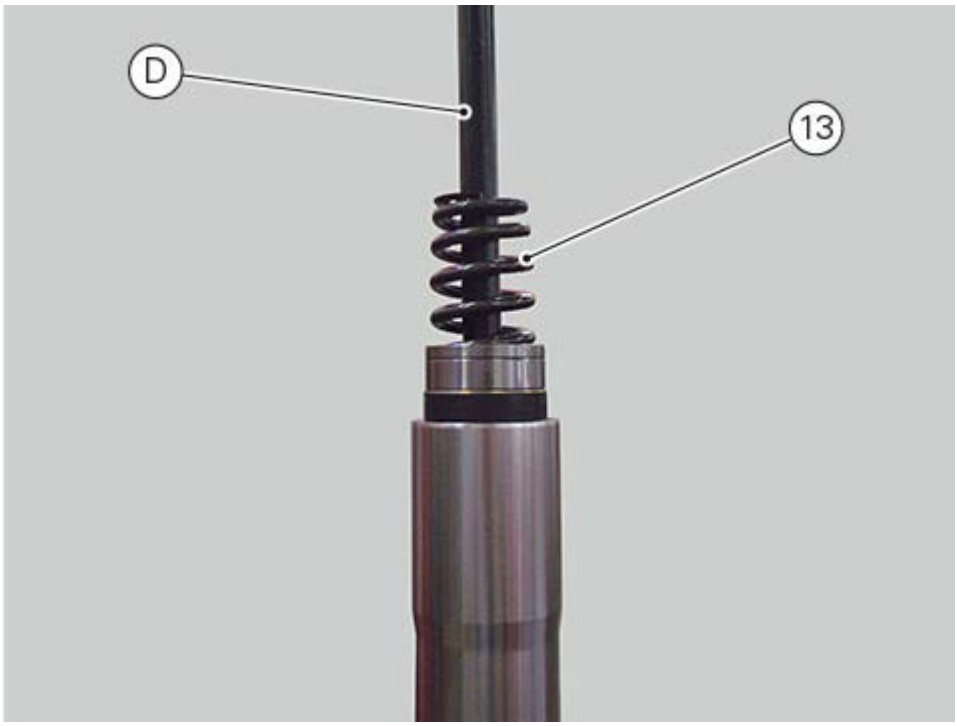
Fit snap ring (16) and dust seal (15).



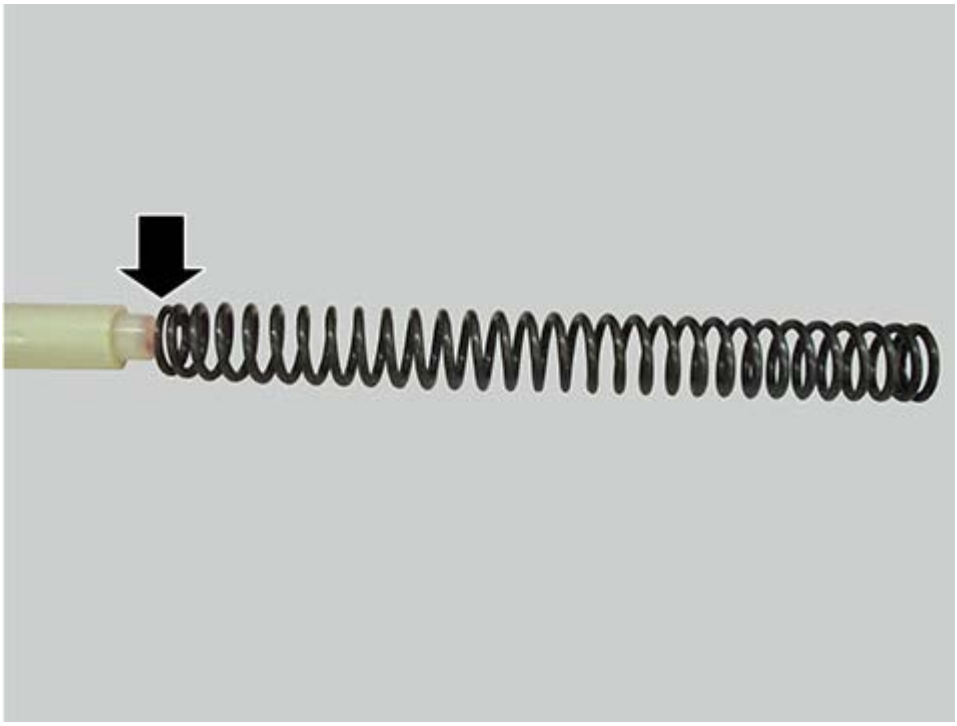
Remove the adhesive tape.
Insert bushing (14).



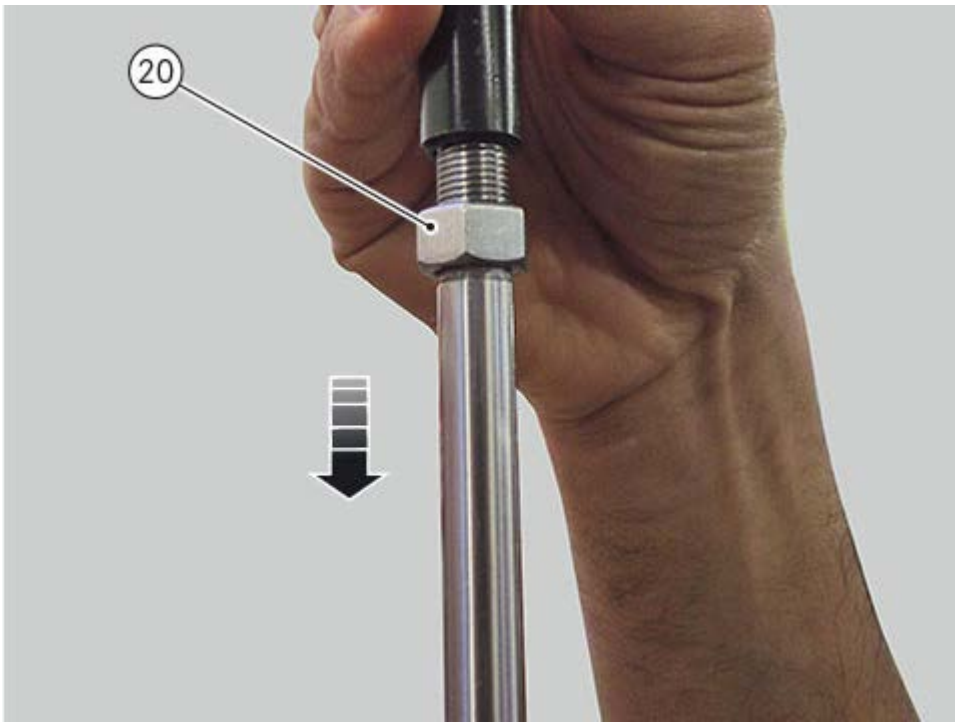
Insert in the damper rod tool (D) part no. **88713.0950** and the spring (13).



Warning
The spring must be positioned as indicated.

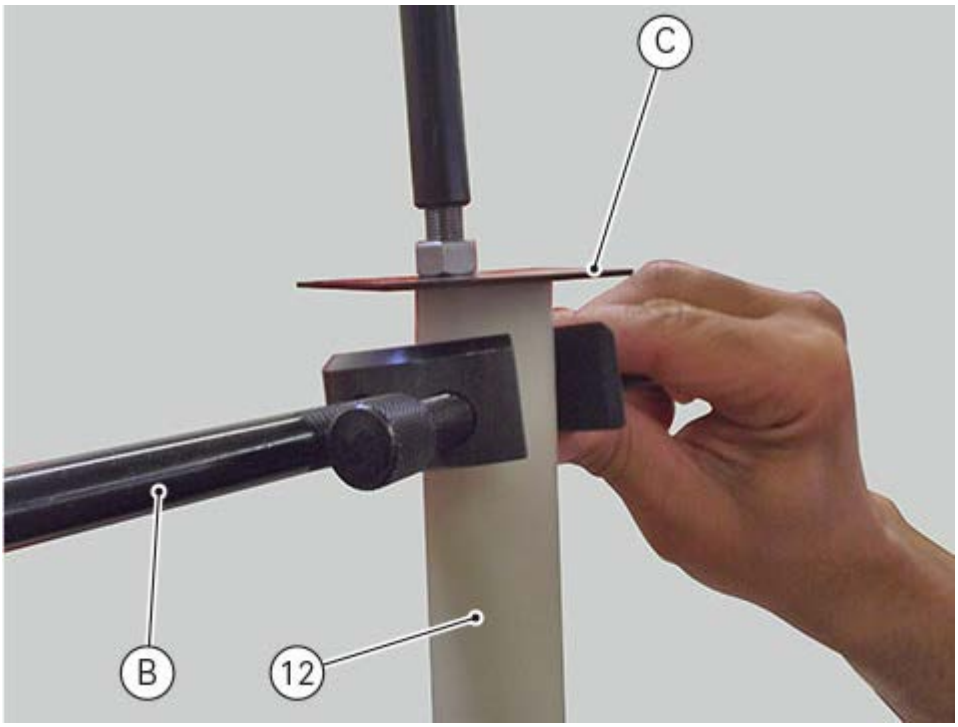


Bring the lock nut (21) fully home.

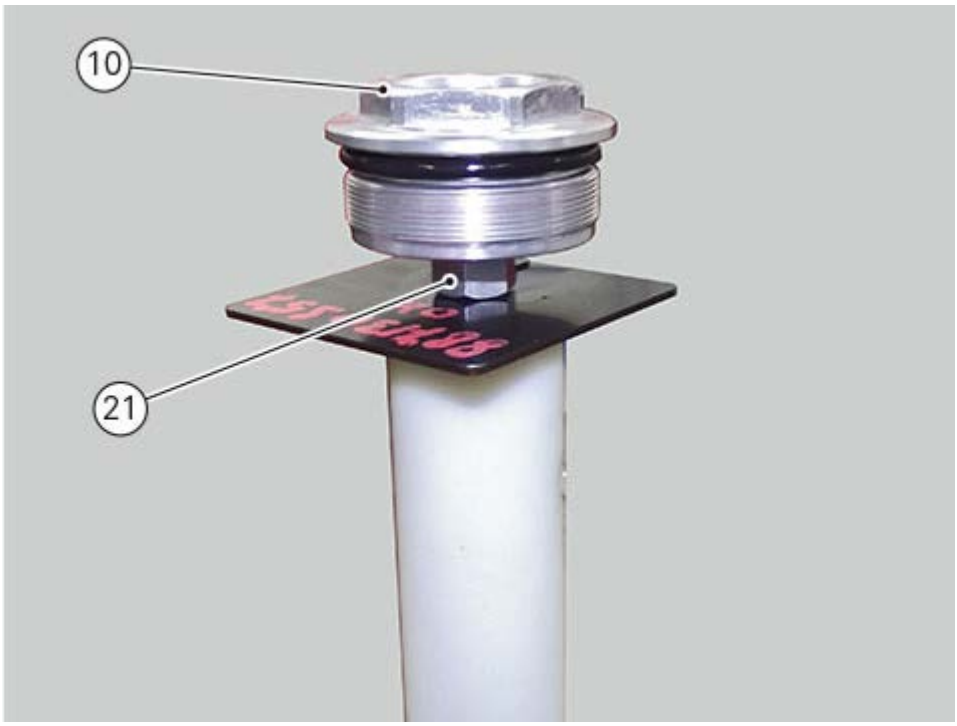


Warning
The right and left legs contain a different quantity of fluid.

Fill in the right leg with 521 cc of fluid (Front suspension) and operate the damper rod several times to make filling easier.
Insert preload tube (12) on the spring and using tool (B) part no. **88713.0957** insert the other tool (C) part no. **88713.0957** to reach the damper rod upper part.

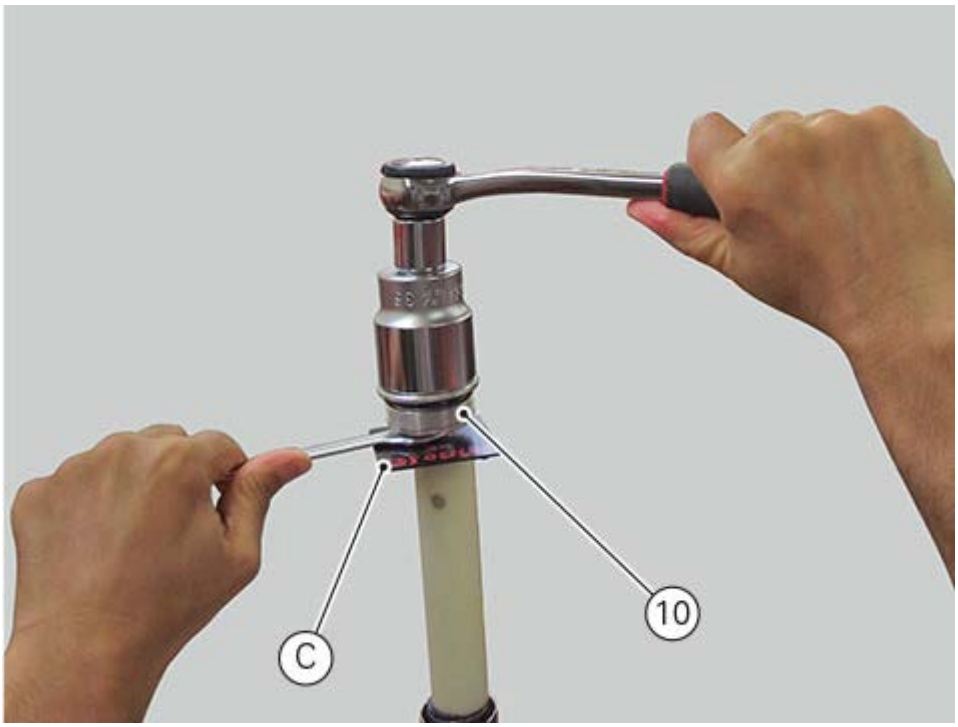


Tighten plug (10) fully home and screw lock nut (21).



Tighten plug (10) on lock nut (21).

Remove tool (C) part no. **88713.0957**.



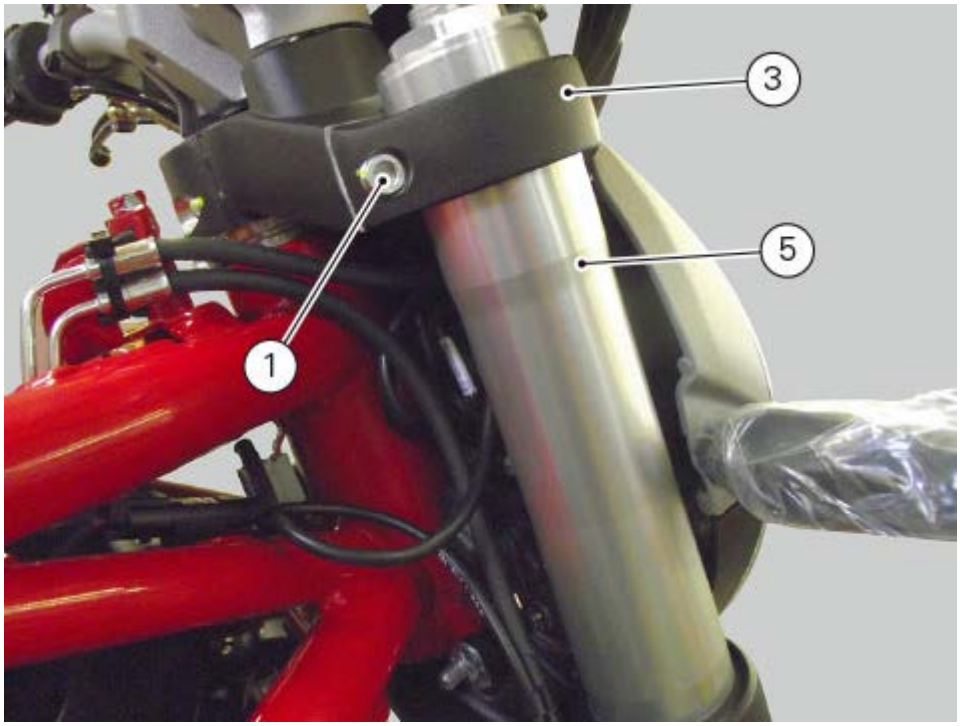
Tighten plug (10) on sleeve (11).

Removing the front fork

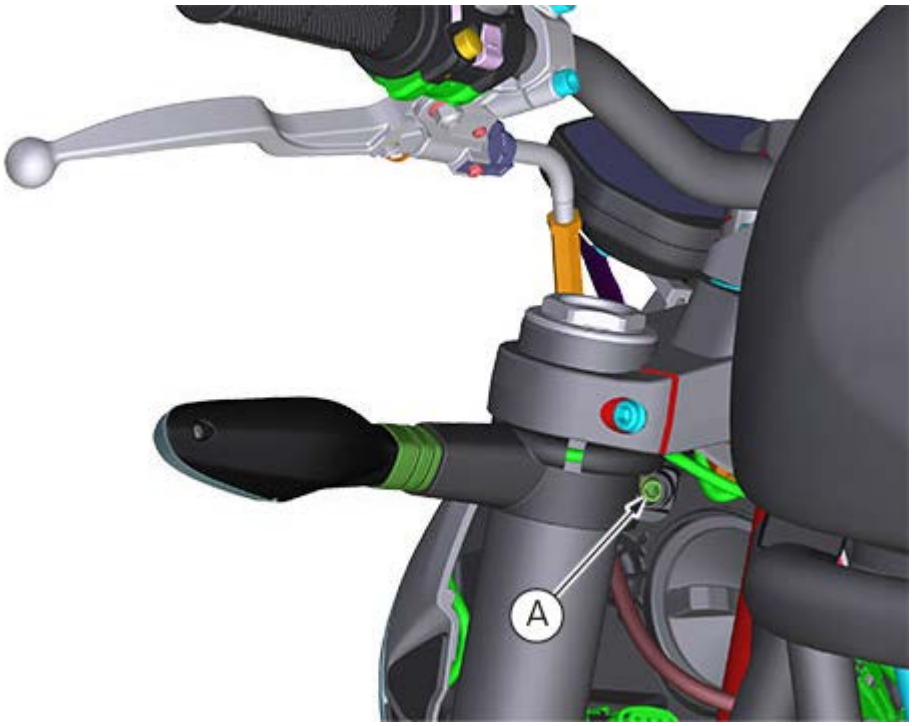
Before removing the concerned part, you must first remove the following parts:

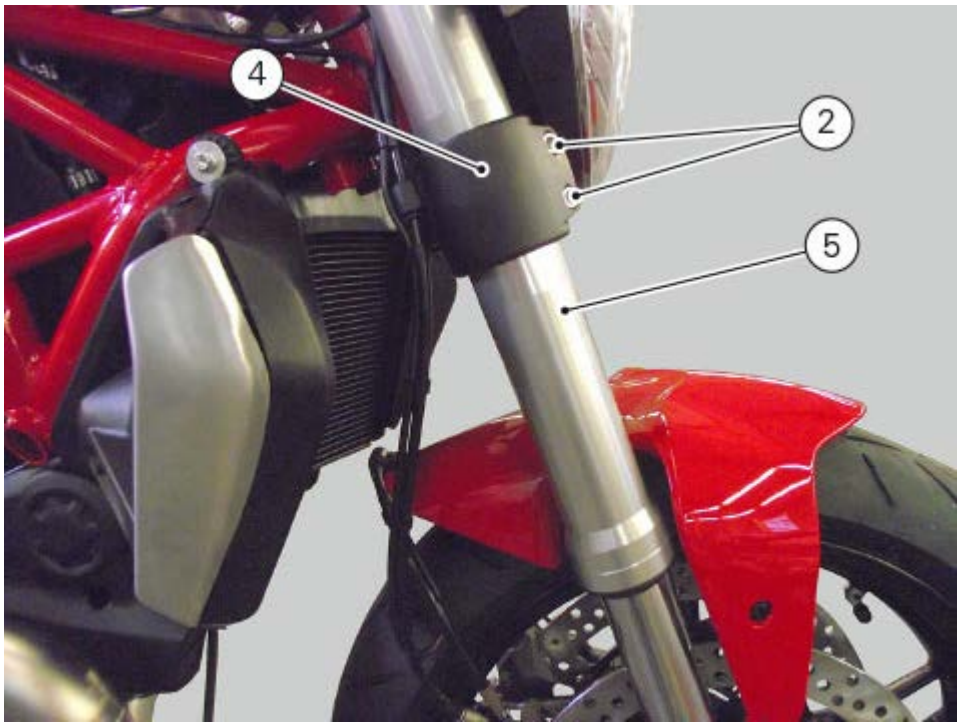
- front brake callipers (Removing the front brake system);
- front mudguard (- Removing the front mudguard);
- front wheel (Removing the front wheel).

Loosen the screws (1) holding the fork legs (5) to the steering head (3).



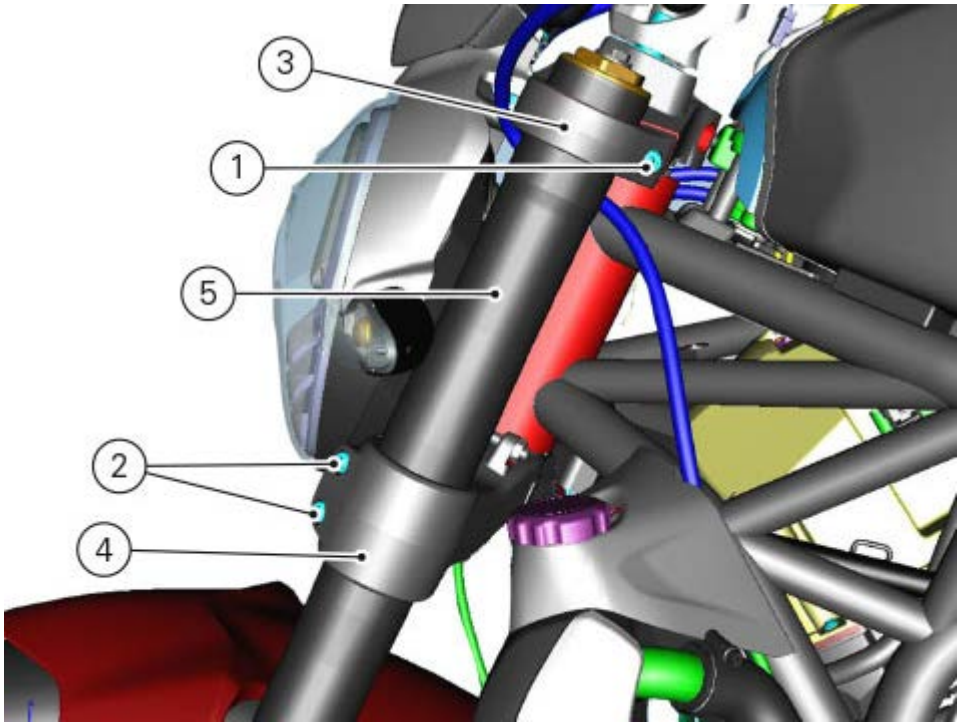
FOR USA VERSION ONLY
Working in the same way on both legs, loosen screw (A) that retains the turn indicator.
Loosen the screws (2) that retain fork legs (5) to bottom yoke (4).
Slide the fork legs (5) downwards in order to remove turn indicators from above.
Perform the overhaul operations where necessary, as described in section "Overhauling the front fork".

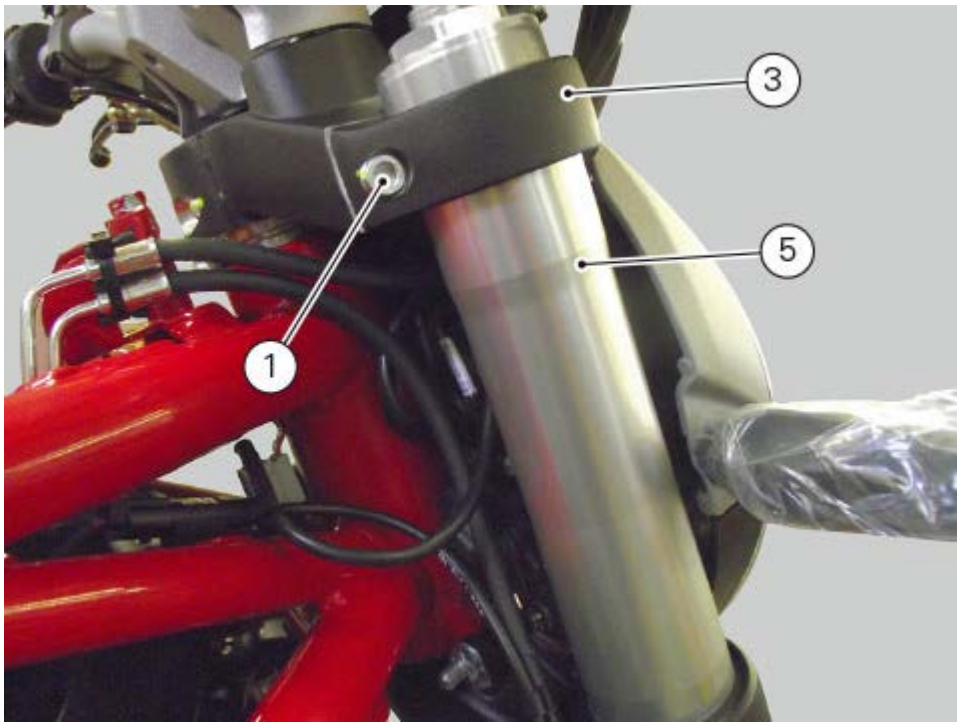


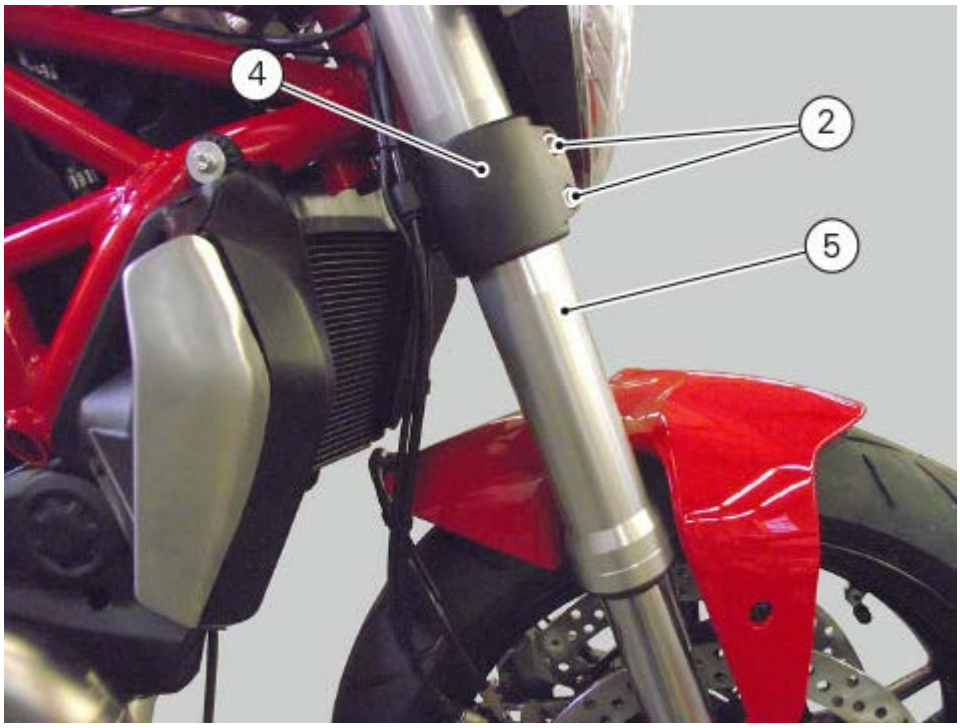


OTHER VERSIONS

Loosen the screws (2) securing the fork legs to the bottom yoke (4).
Slide legs (5) downwards.
Perform the overhaul operations where necessary, as described in section "Overhauling the front fork".







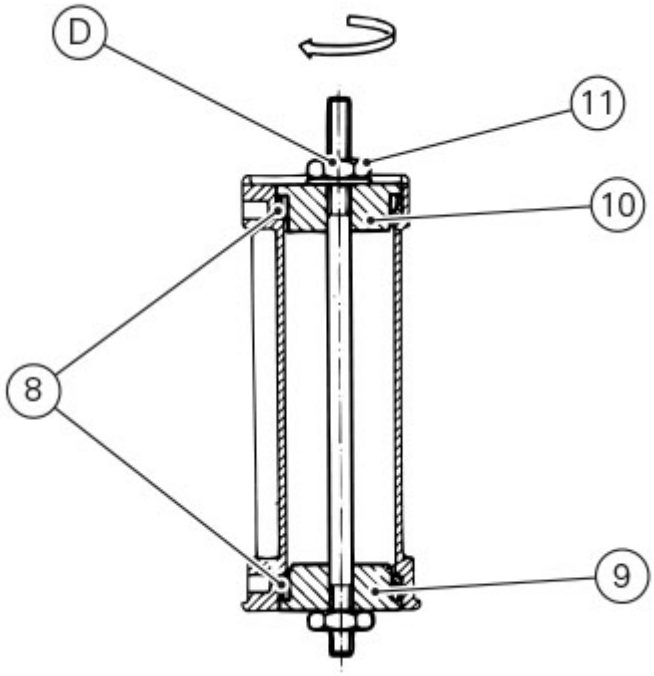
Refitting the steering tube components

Important

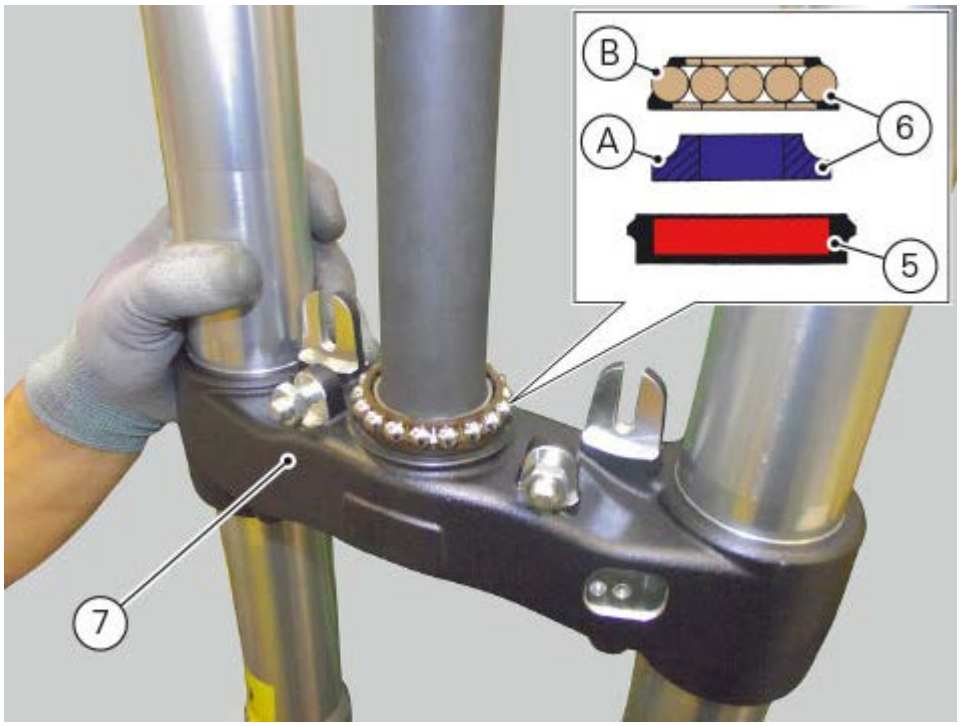
The steering tube bearings are identical but in no case may their components be swapped during refitting.

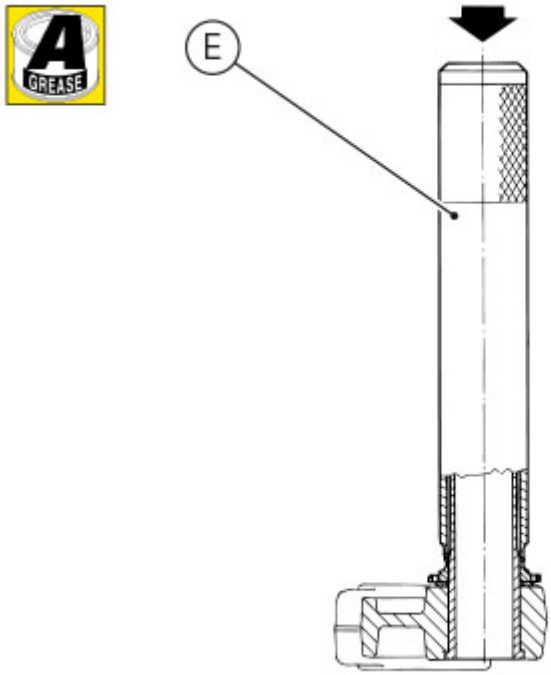
Clean all contact surfaces and lubricate with the recommended grease.
To fit the outer rings (8) of bearings (6) to the steering tube, use tool (D) no. **88713.1062**;
Proceed as follows:

- heat the steering tube to 150 °C;
- fit the outer rings (8) in their seats on the steering tube;
- fit the fixed bush (9) with threaded hole of the tool into the lower ring;
- fit the other movable bush (10) into the upper end of the tool and drive it fully home against the upper bearing race;
- tighten the nut (11), and use a wrench to seat the outer rings (8) fully in the steering tube;
- leave the tool fitted until the steering tube has cooled down to ensure that bearings are properly seated.



Insert the sealing ring (5) (with the rim facing upwards) and the inner ring (A) of the bottom bearing (6) onto the steering shaft after heating it for about 10 minutes to 120 °C.
Insert drift (E) part no. **88713.1072**.
Push the inner ring (A) on the sealing ring (5), manually pushing for at least 10-15 seconds.
Lubricate the inner ring (A) with the recommended grease.
Fit the ball race (B) on the steering shaft with the smaller diameter of the cage facing upwards, and grease the ball race.
Insert the steering shaft into the steering tube, and push it in until it is axially seated.

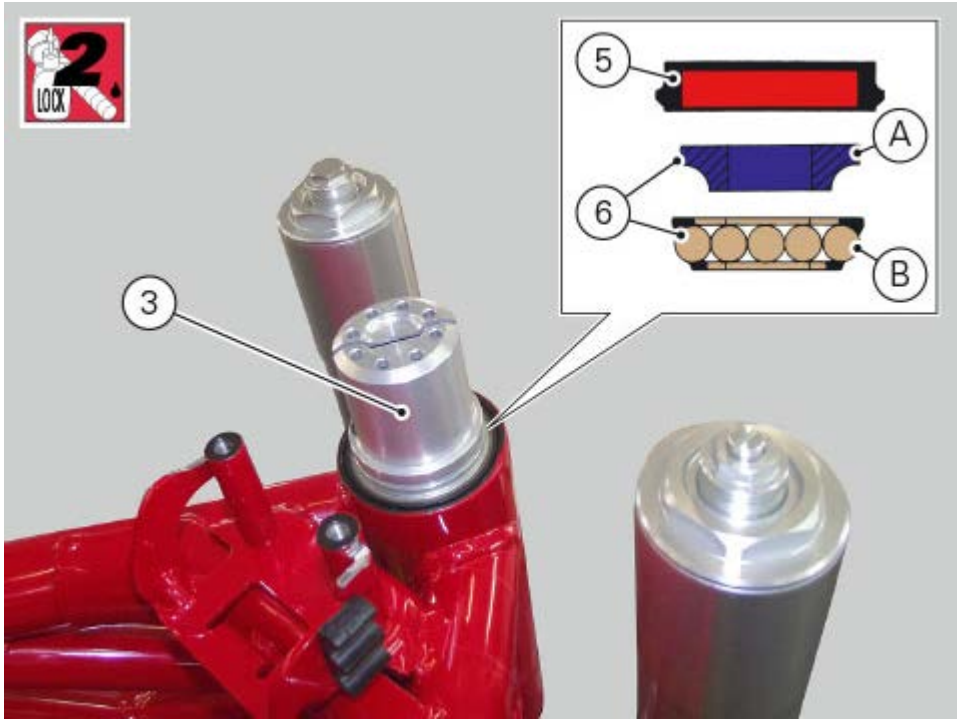


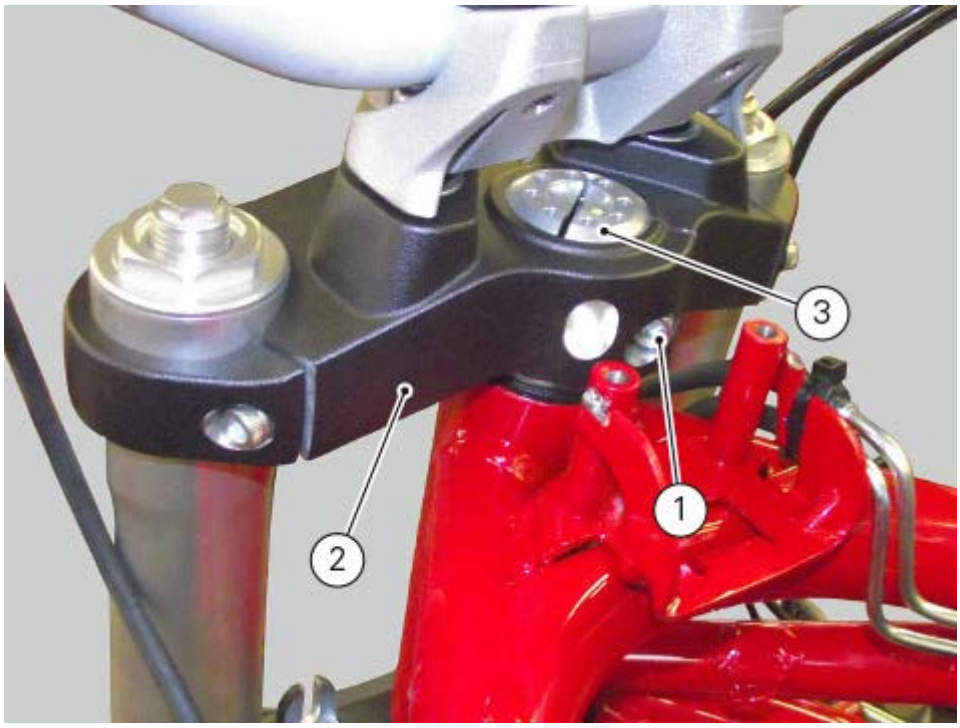


Fit the bottom yoke assembly to frame.
Grease the ball race (B) and fit it to the upper outer ring (8) of the frame.
Fit the inner ring (A) of the upper bearing (6) to the steering head, with the larger diameter side of the race facing upwards.
Install the sealing ring (5) with the flat side facing upwards.

Tighten the adjuster ring nut (3) by hand until it seats against the sealing ring (5).
Fit on ring nut (3) the special bush (C) part no. **88713.1058** and fit the torque wrench on it.
Apply the specified threadlocker on thread and tighten adjuster ring nut (3) to 30 Nm ± 5%.

Fit the steering head (2) on the ring nut (3), aligning the fork leg seats with the corresponding seats on the bottom yoke.
Refit the fork legs. Grease screw (1) with the specified product.
Tighten screw (1) on steering head to a torque of 18Nm ± 5%.





Refit the handlebar and the U-bolts (Refitting the handlebar).
Refit the light assembly (Refitting the light assembly).
Refit turn indicators (**USA VERSION, ONLY**) (Refitting the light assembly).
Refit fork legs (Refitting the front fork).
Refit the front wheel (Refitting the front wheel).
Refit tank and ignition switch (Refitting the fuel tank).

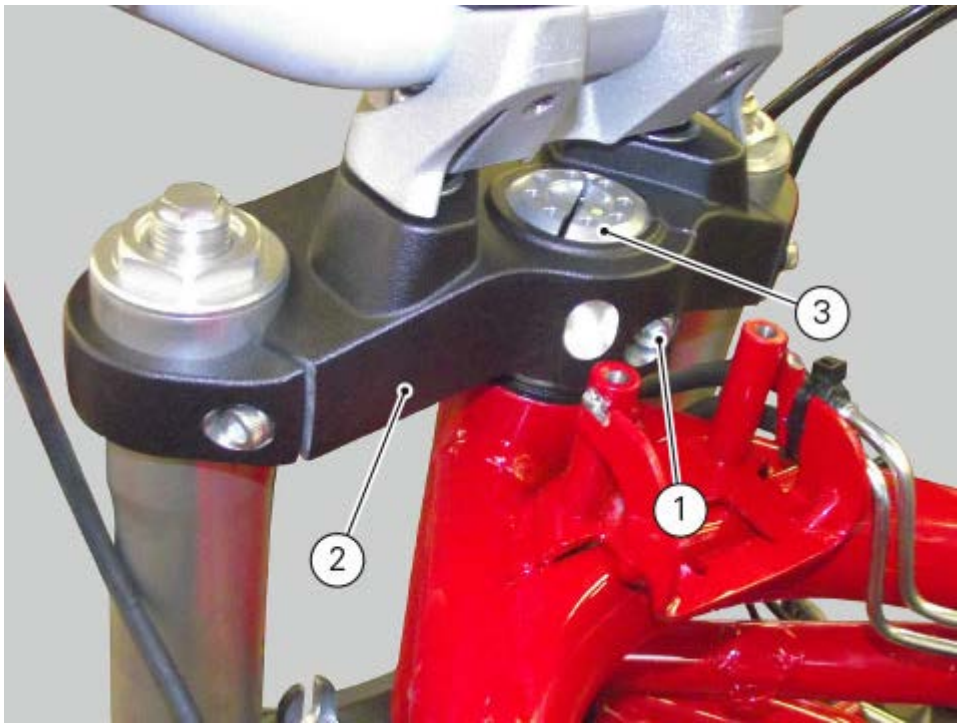
Removing the steering tube components

Remove the front brake callipers (Removing the front brake system).
Remove the front wheel (Removing the front wheel).
Remove ignition switch and tank (Removing the fuel tank).
Remove fork legs (Removing the front fork).
Remove turn indicators (**USA VERSION, ONLY**) (Removing the light assembly).
Remove the light assembly (Removing the light assembly).
Remove the handlebar and the U-bolts (Removing the handlebar).

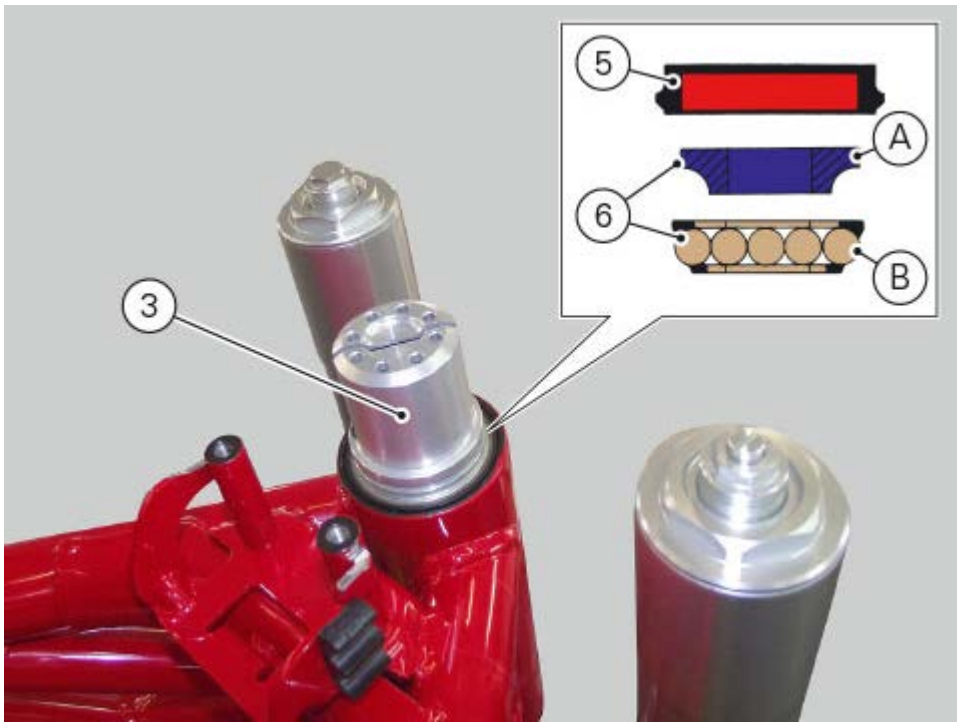
Warning

All parts fitted to the steering head and bottom yoke, including wiring and hoses, can remain on the motorcycle provided they do not hinder the following operations.

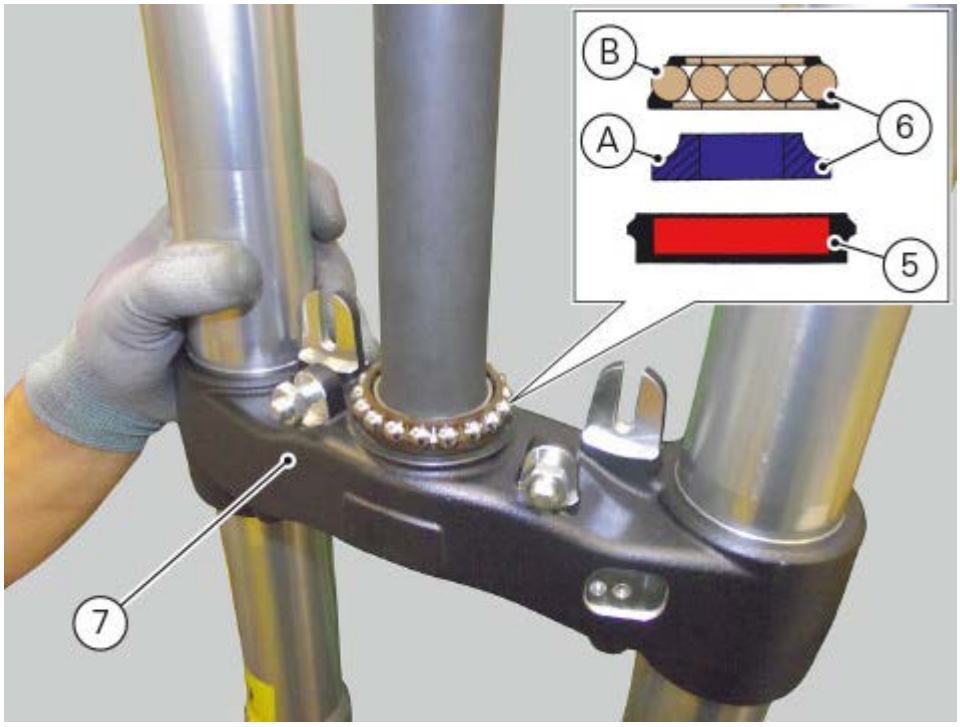
Loosen the screw (1) securing the steering head (2) to the ring nut (3).
Remove the steering head (2).



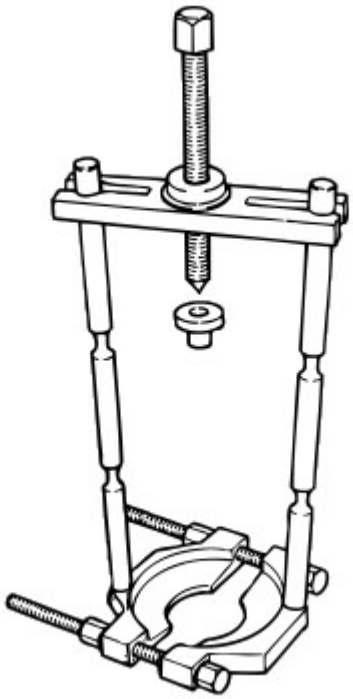
With tool (C) part no. **88713.1058** loosen the ring nut (3) and unscrew it from the steering shaft.
Slide the sealing ring (5), the inner ring (A) and the ball race (B) of the upper bearing (7) off the steering shaft.



Remove the bottom yoke (7) complete with the steering shaft from the frame tube.
Remove the ball race (B) of the lower bearing (6).
The inner ring (A) of the lower bearing (6) and the sealing ring (5) will remain on the steering shaft.



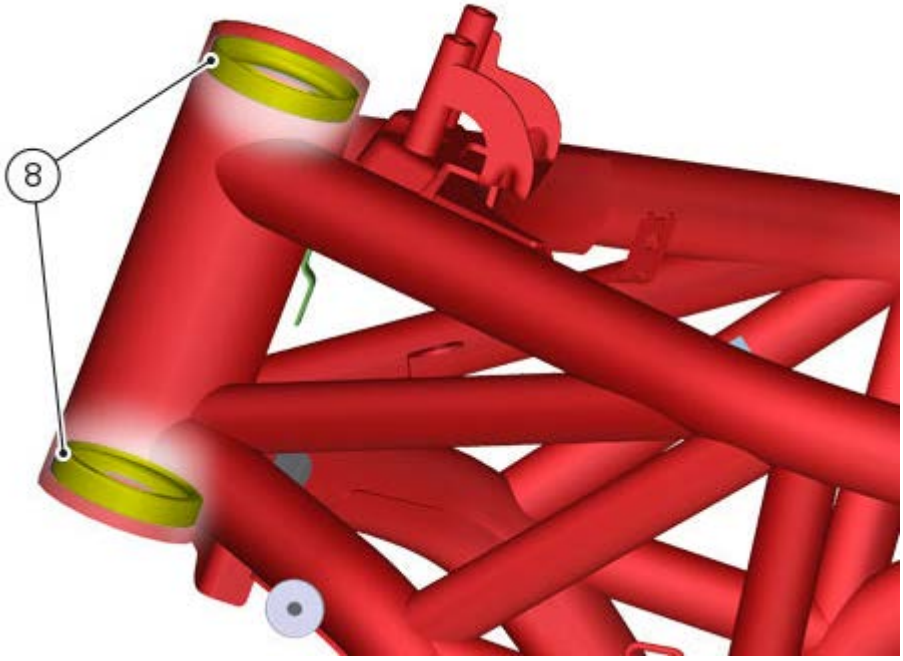
Using a universal puller (see figure), remove the inner ring (A) from the steering shaft, taking care not to damage the seat.



Important

The removed seals and bearings shall not be reused and must be replaced with similar new components.

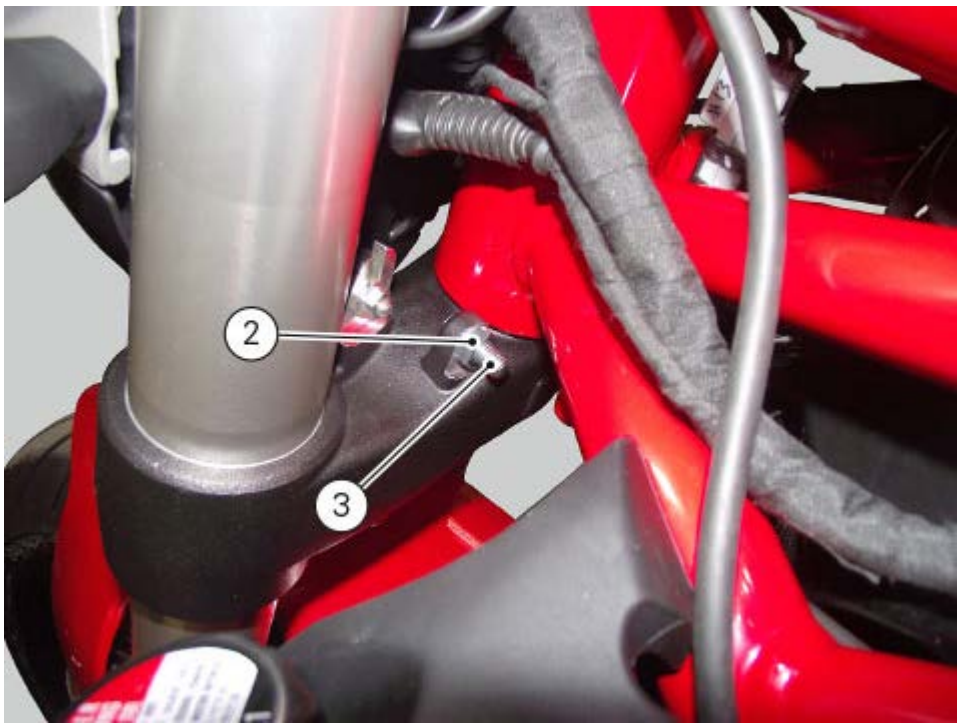
Using a suitable punch, remove the outer bearing races (8) from the steering tube. Proceed with extreme care to avoid damaging the seats.



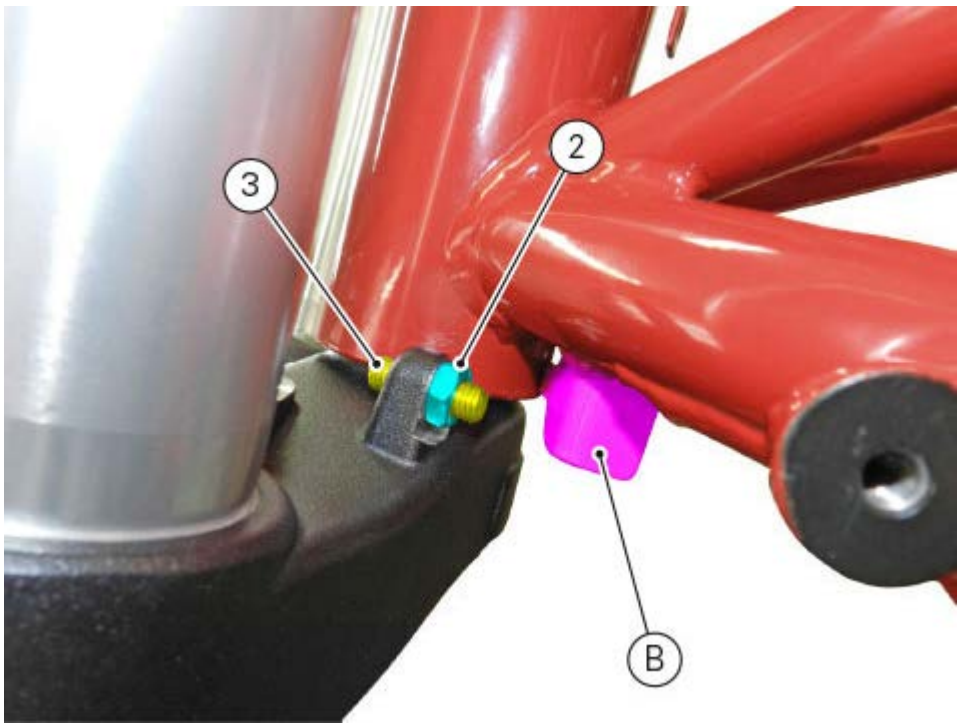
Steering angle adjustment

Important
The steering adjustment must be performed with tank duly fixed and in its definitive position.

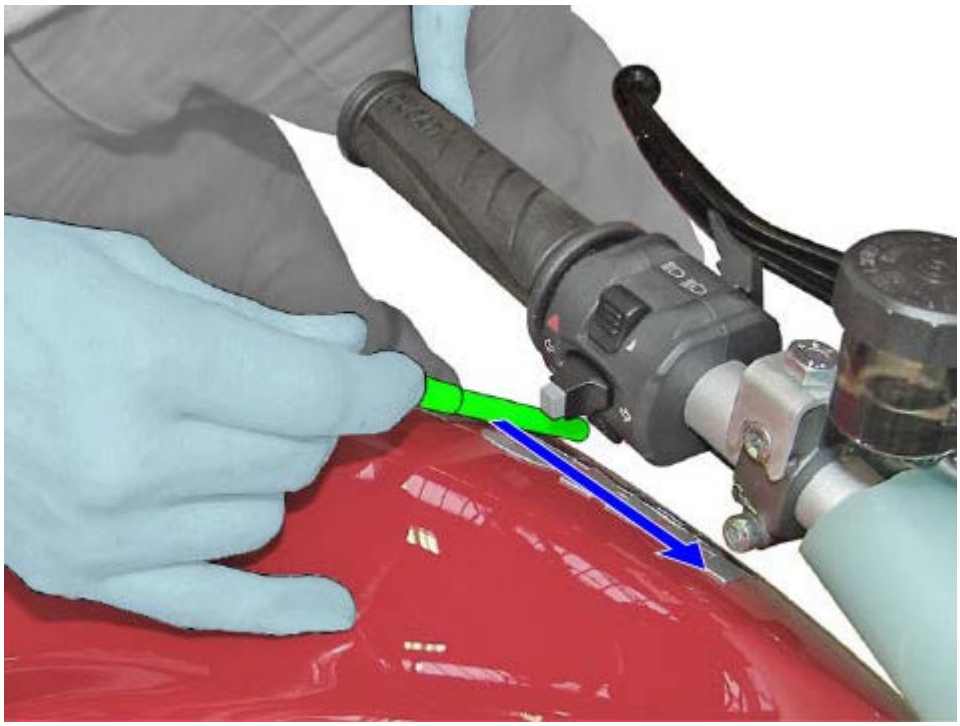
Loosen the nuts (2).



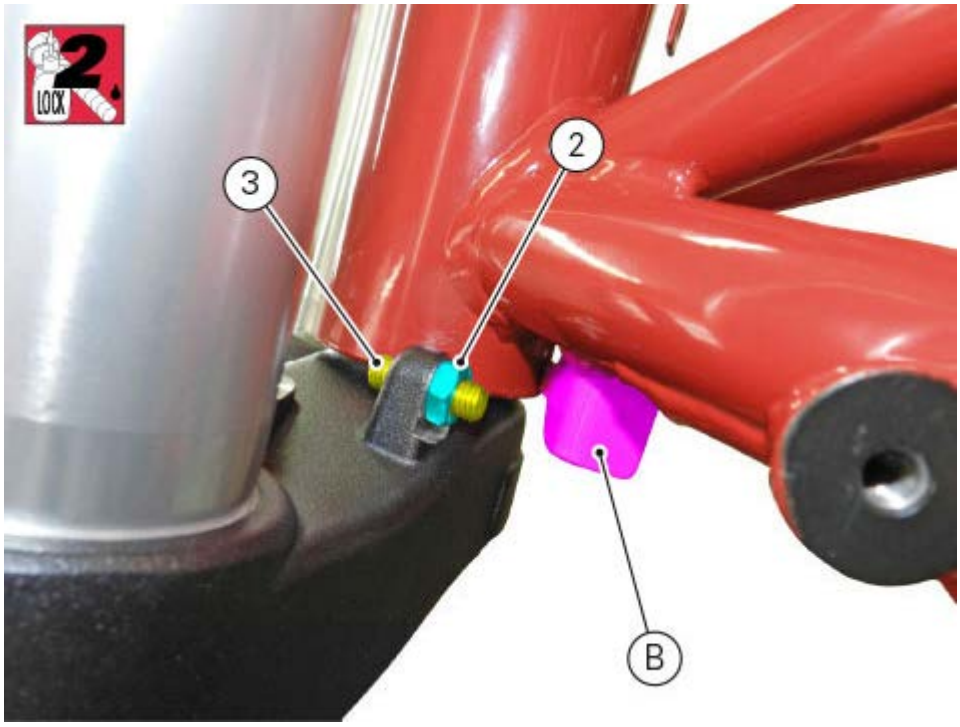
Turn the handlebar completely to the left and bring the LH dowel (3) fully against bracket (B).



Screw nuts (2) on steering adjuster dowels (6) (without tightening).
Check that the distance between complete handlebar and tank is always within 9 mm and 11 mm (blue arrow).
Work on dowel (3) until complying with the relevant specification.



Then loosen dowel (3).
Apply indicated product on the LH dowel thread and tighten nut (2) to a torque 18 Nm ± 10%, by holding dowel (3).

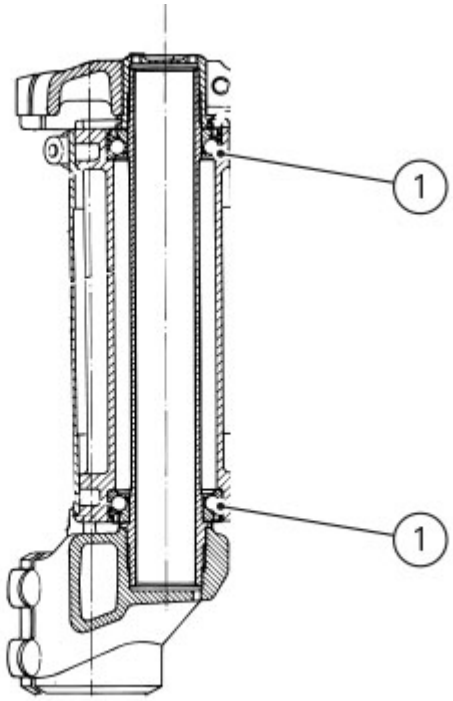


Follow the same procedure on the vehicle RH side.

Adjusting the steering head bearing clearance

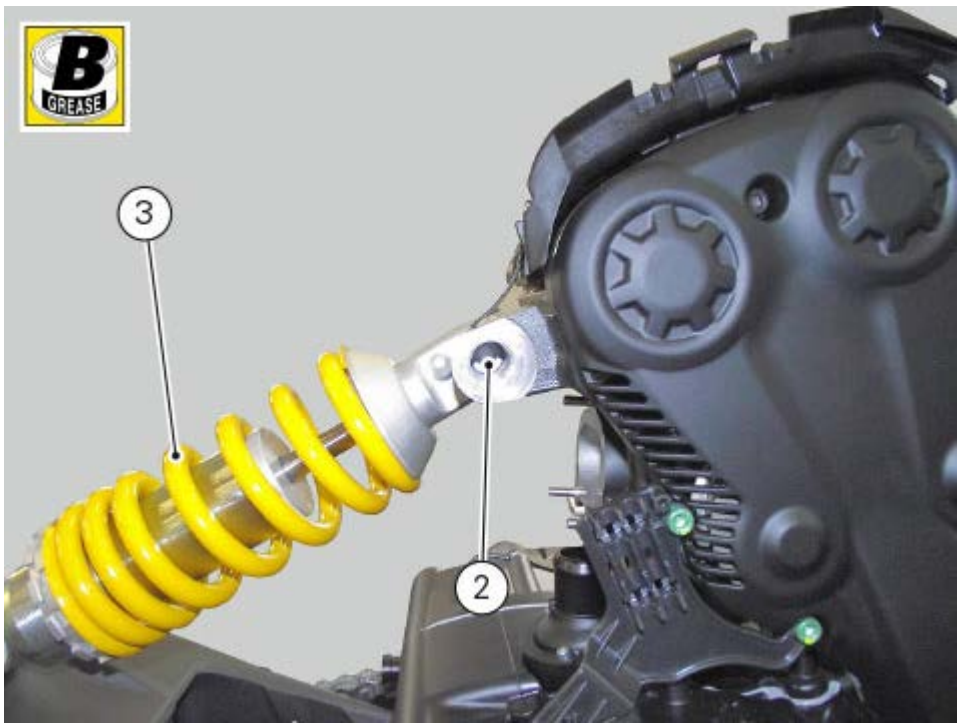
Adjust steering bearing clearance as explained under section "Adjusting the steering head bearing clearance" in the vehicle maintenance manual.

If the problems found are not solved, check the wear of steering bearings (1) and replace them, if necessary, as described in paragraph "Removing the steering tube components".



Refitting the rear suspension

Apply the specified product on thread and underside of top screw (2) and bottom screw (4).
Insert the shock absorber upper part inside vertical head support by starting screw (2)
Insert the shock absorber lower end inside swinging arm by starting screw (4).
Tighten the screws (2) and (4) to a torque of 42 Nm ± 5%.

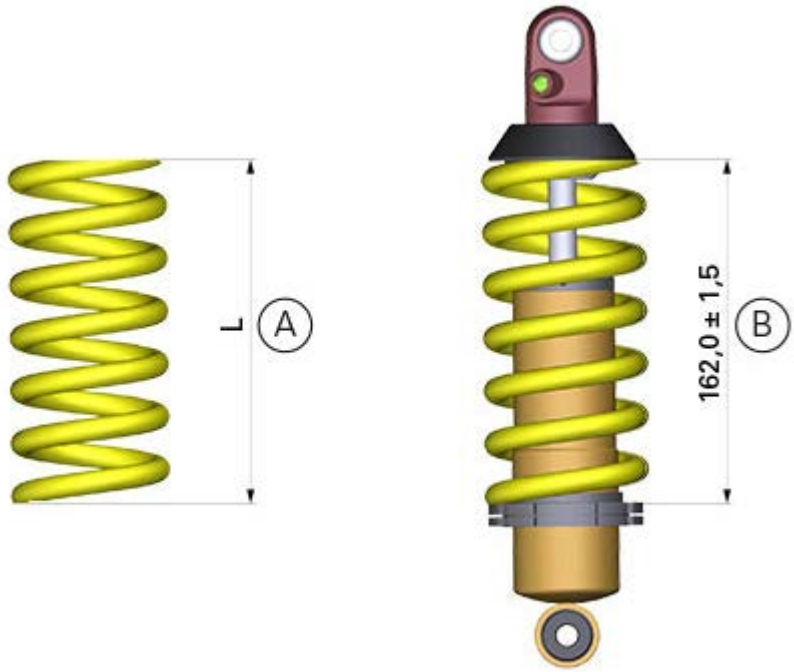


Tighten the screw (1) applying the specified product, and tighten it to a torque of 150 Nm ± 5%.

Refit the exhaust silencer (Refitting the silencer).
Refit the rear wheel (Refitting the rear wheel).

Spring preload

A Spring free length
B Length of installed spring = 162.0 mm ± 1.5



The four different settings were defined based on average parameters (dressed rider weighing 80-90 kg, dressed passenger weighing 70-80 kg): "Default", "Sport", "Comfort", "Rider+Passenger".
Adjustment range
- rebound: 0÷5 turns;
- preload: 10÷20 mm.

"Default" setting
- rebound: 1.5 turns (from fully closed position).
- preload: 15 mm (from fully uncompressed).

"Sport" adjustments
- rebound: 0.5 turns (from fully closed position).
- preload: 15 mm (from fully uncompressed).

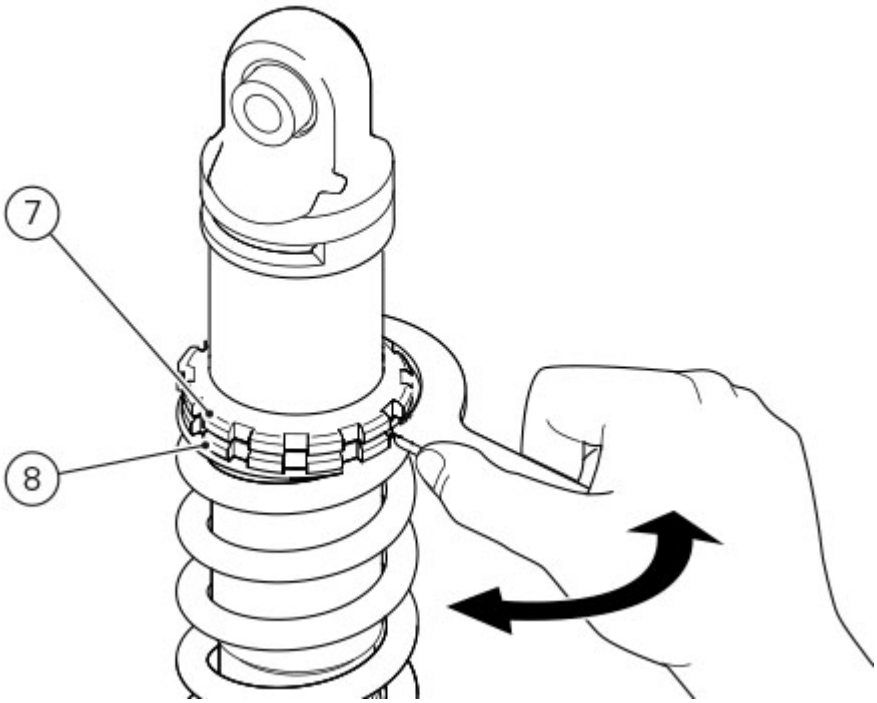
"Comfort" adjustments
- rebound: 2.5 turns (from fully closed position).
- preload: 15 mm (from fully uncompressed).

"Rider+Passenger" adjustments
- rebound: 1.5 turns (from fully closed position).
- preload: 19 mm (from fully uncompressed).

When adjusting the spring preload you move the spring seat.
This will decrease or increase the initial spring force, which will lower or raise the motorcycle rear ride height.
The spring preload is fundamental for the suspension correct operation.
If the preload is incorrectly set, any other adjustments will not help to get the intended performance from the suspension

How to Set the Spring Preload
Mechanical Adjuster

Use a C-spanner.
Loosen lock nut (7).
Move the lower spring ring nut (8) to the desired position.
Turn clockwise to increase the preload, turn counter clockwise to decrease it.



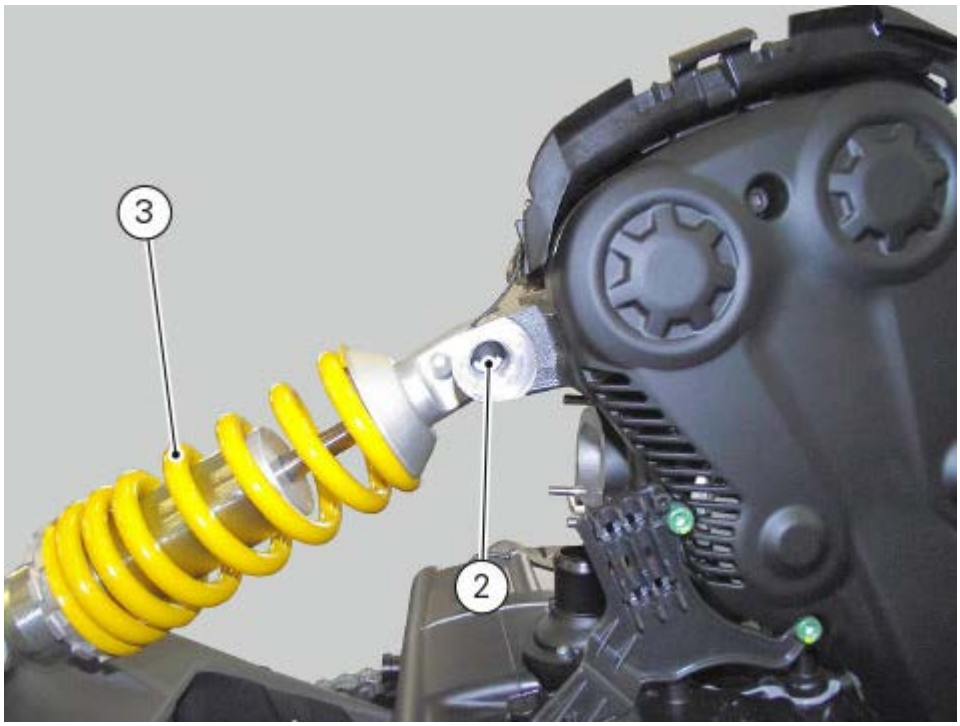
Removing the rear shock absorber

Remove the rear wheel (Removing the rear wheel).
Remove the exhaust silencer (Removing the silencer).

Support the rear side of the vehicle in a suitable way.

Working on both sides, loosen and remove special retaining screw (1) on rear subframe.

Loosen and remove the upper retaining screw (2) on rear shock absorber (3).

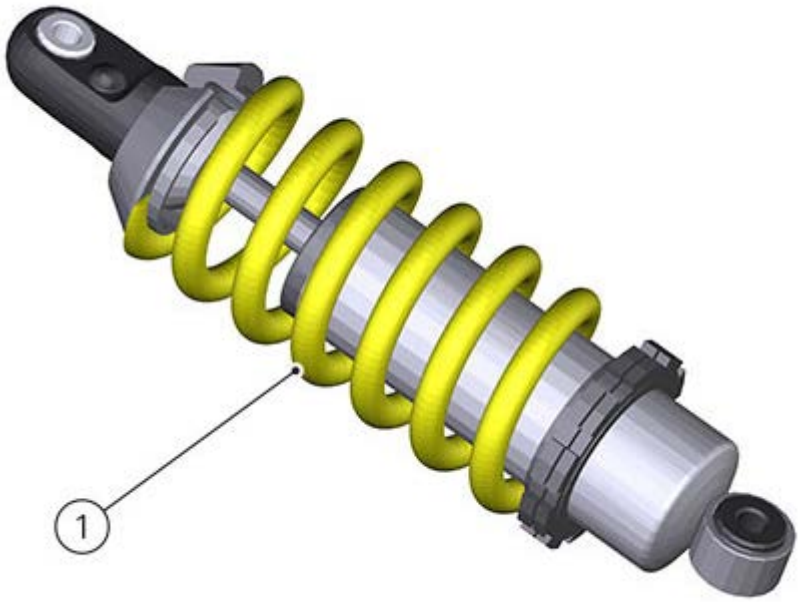


Loosen and remove lower screw (4) and slide out rear shock absorber (3).

Rear suspension system

The rear suspension system uses a hydraulic monoshock (1) adjustable for compression rebound and spring preload.
Rebound can be adjusted by working on screw (2).
Preload can be adjusted by working on ring nut and lock ring nut (3).

Shock absorber pivots onto the swinging arm at the bottom, and onto the vertical head at the top.
The whole system gives the motorcycle excellent stability.
For rear shock absorber adjustment, refer to section "Adjusting the rear shock absorber".



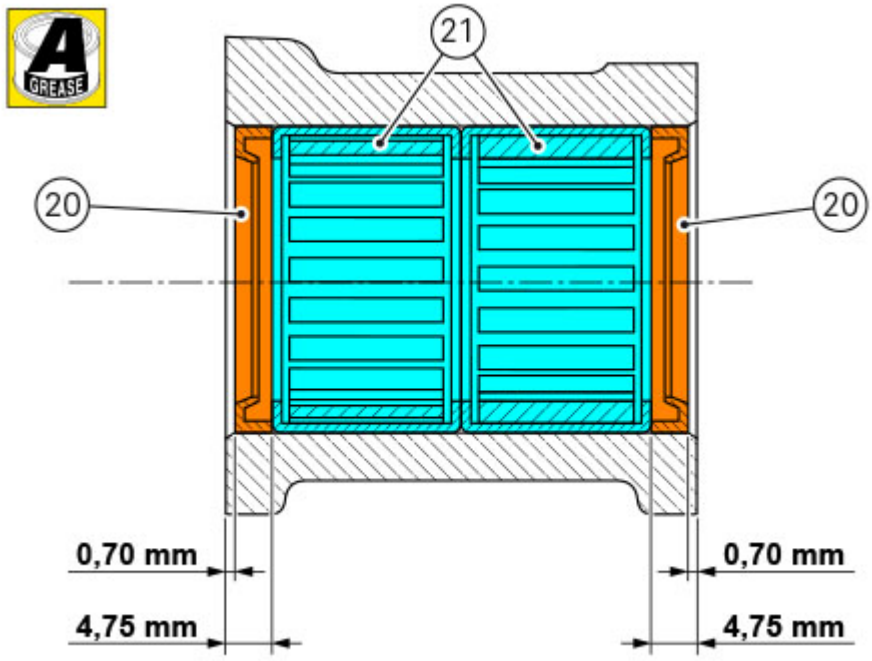
Refitting the rear swinging arm

Working on swinging arm left side, lubricate roller bearing cage seat with the specified product. Using a suitable tool, insert the two roller bearing cages (21) and seals (20).

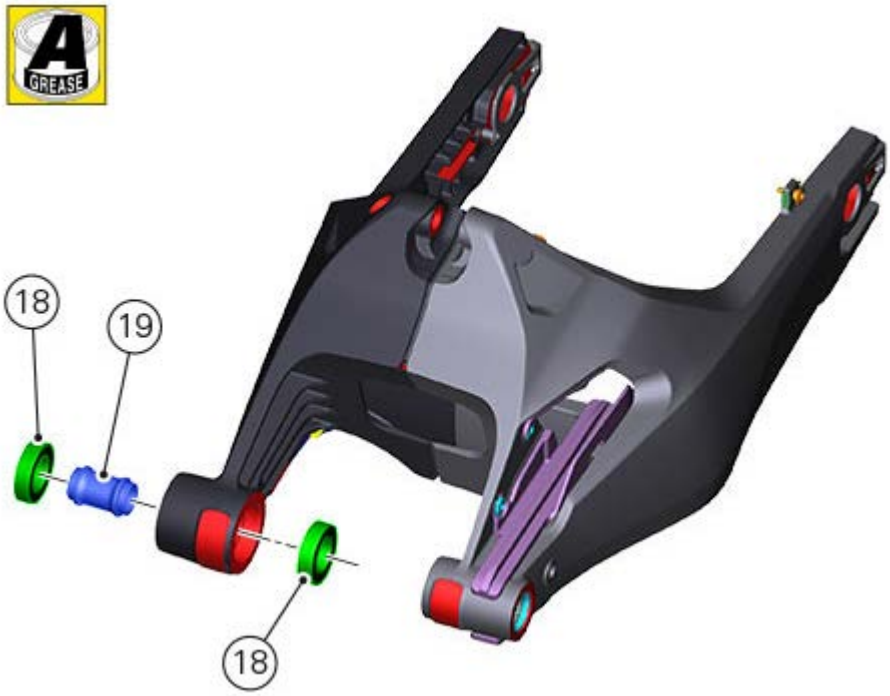
Warning
Roller bearing cages must be inserted so that the marks are facing outwards.

Warning
Seals must be inserted with the flat surface facing outwards.

Check the position of the seal rings.

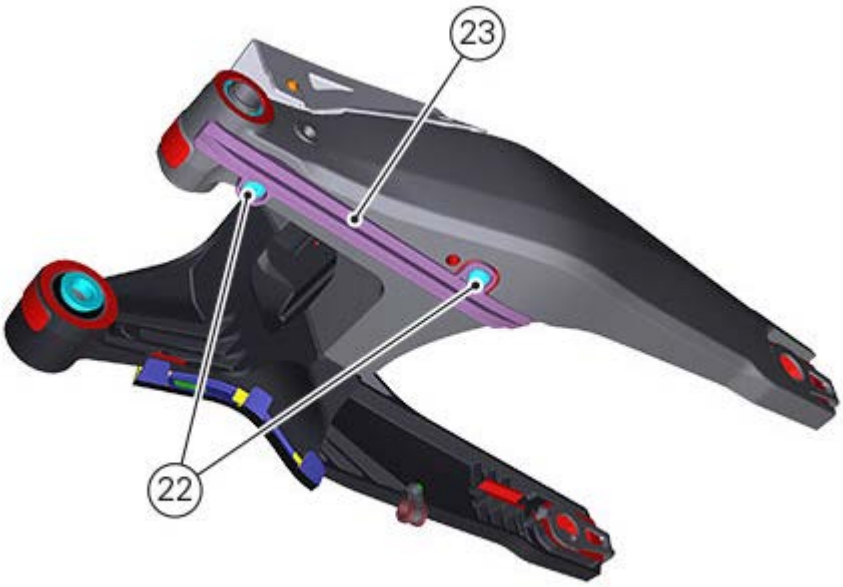


Working on swinging arm right arm, lubricate bearing seats with the specified product and insert inner spacer (19) and the two bearings (18) with a suitable tool.

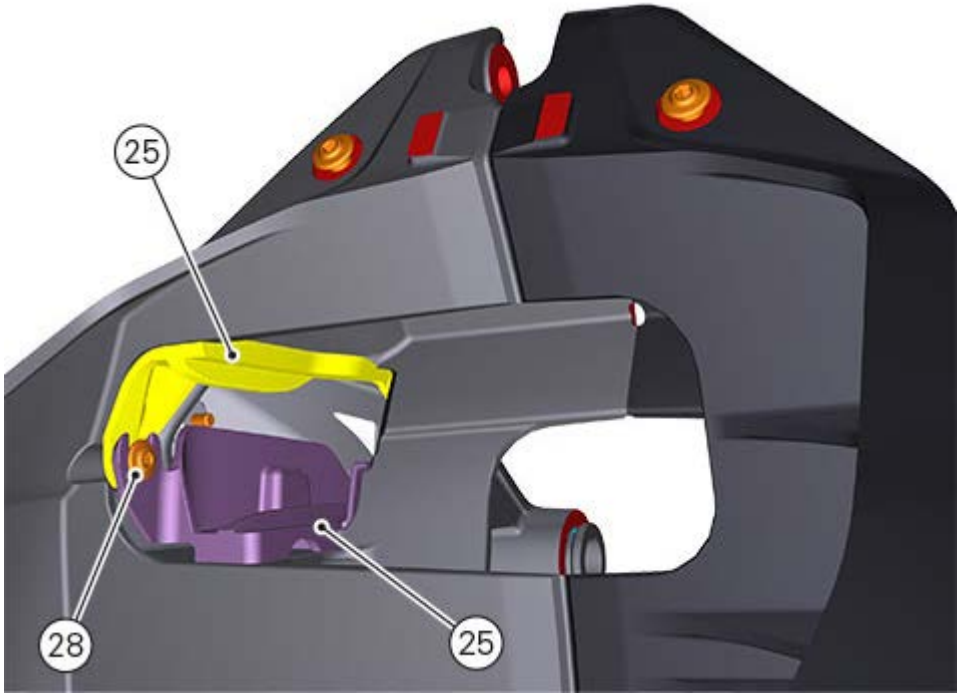


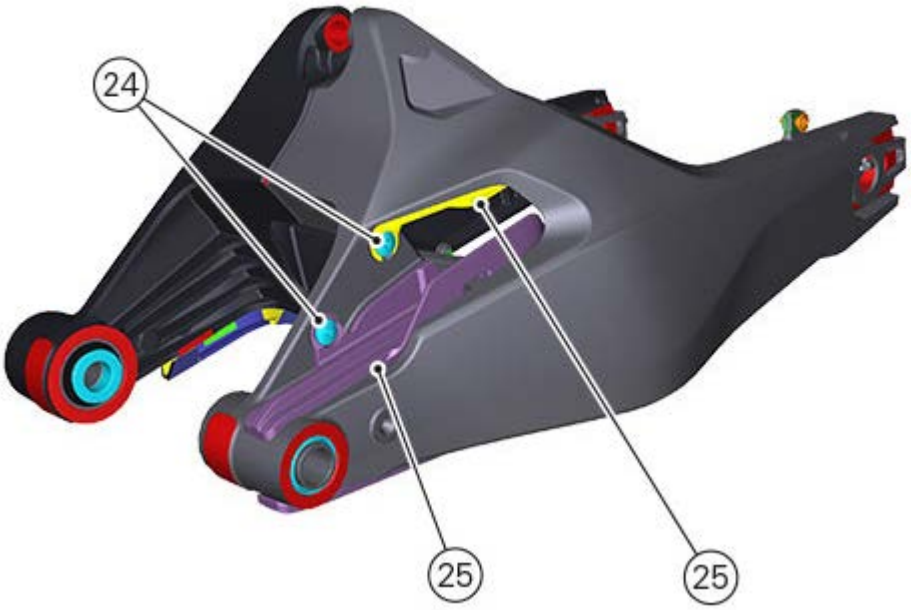
Fit the RH (17) and the LH (16) spacer on the relevant swinging arm sides.

Position the lower chain sliding shoe (23) and fix it with the two screws (22) by tightening them to a torque of 5 Nm ± 10%, respecting the "front-rear" sequence.

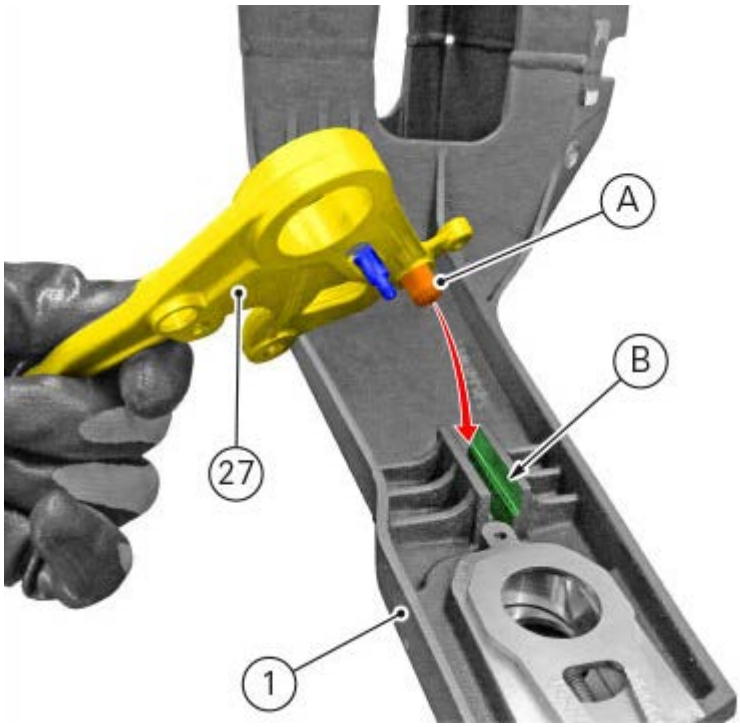


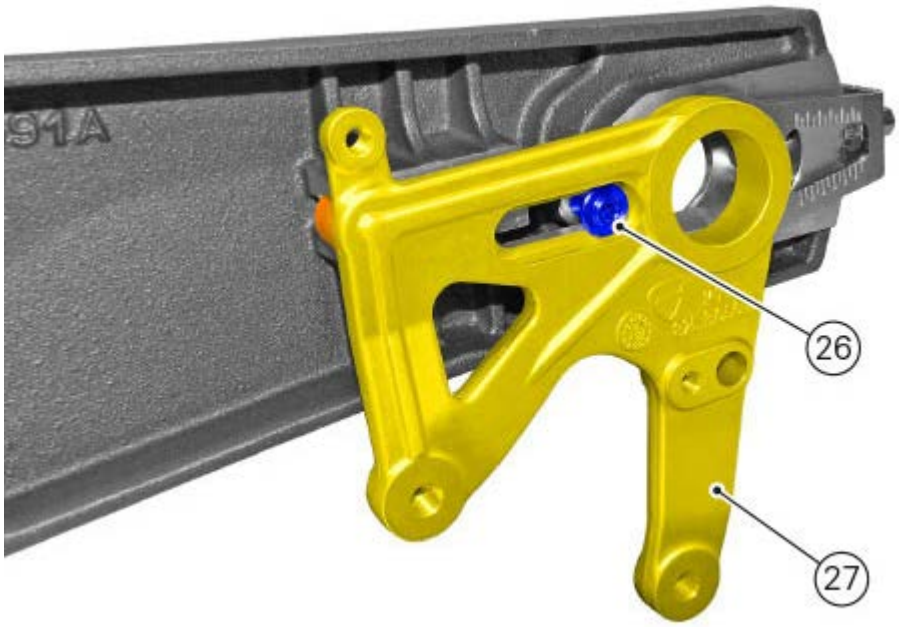
Fit the two upper chain sliding shoes (25) in their correct position and fix them to the swinging arm by tightening screws (24) and (28) to a torque of 5 Nm ± 10%.



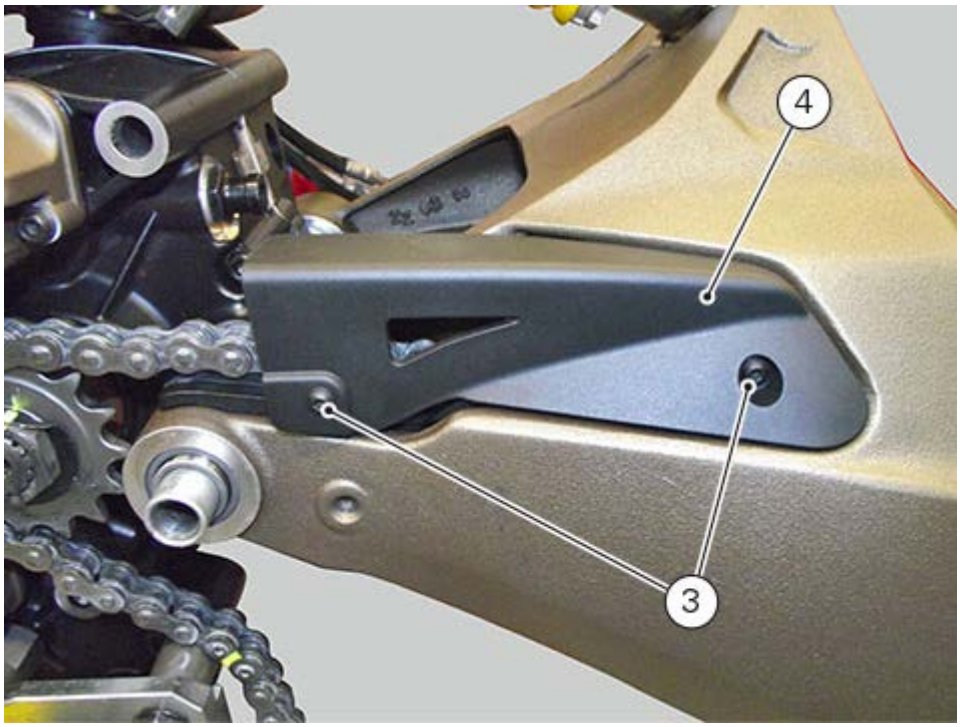


If previously removed, refit the calliper holder plate (27) paying attention to pin (A) insertion in seat (B). Tighten the screw (26) to a torque of 6Nm ± 10%.

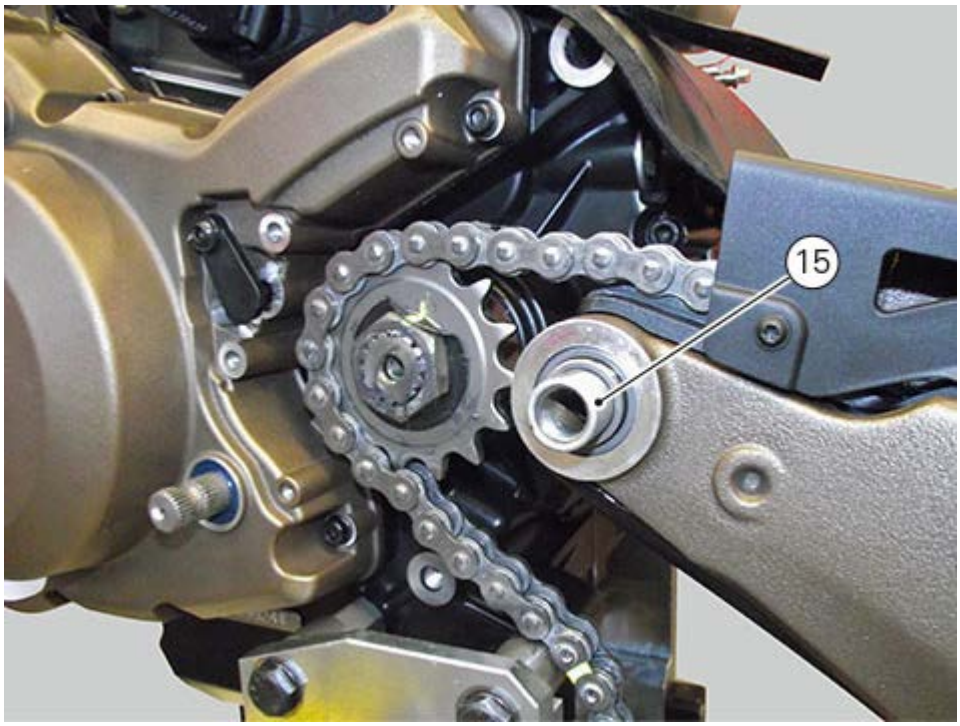




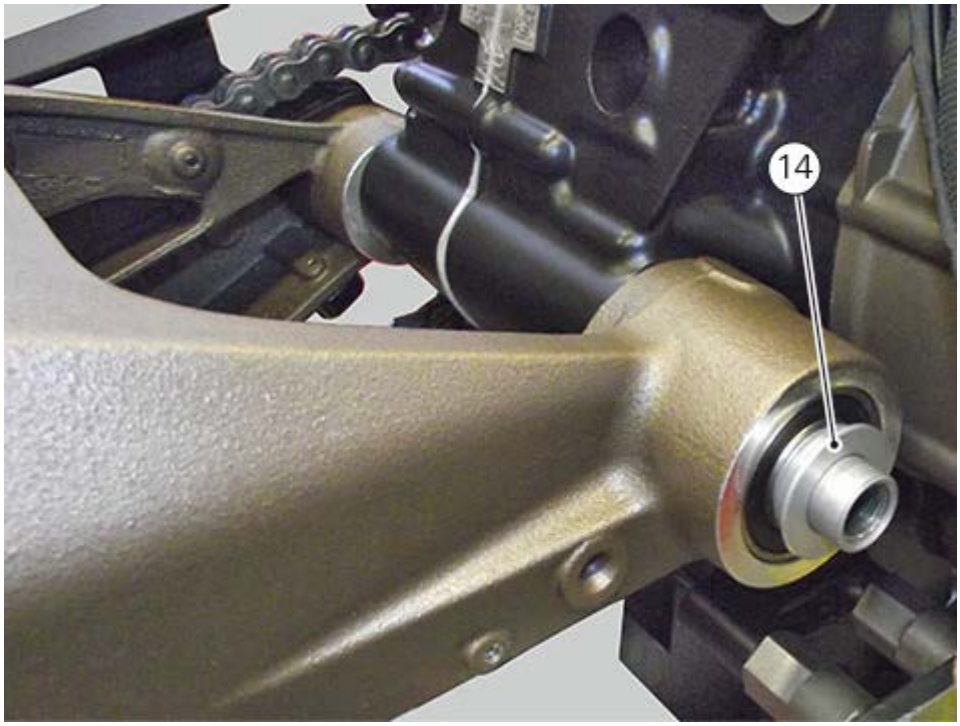
Only in the **AUSTRALIA** version, if removed, position chain guard (4) and tighten the two screws (3) to a torque of 1.2 Nm ± 10%.



Position swinging arm on engine and secure it in place with pin (15), to be inserted from the left side.



Working on the right side, fit spacer (14).



Refit the rear wheel (Refitting the rear wheel).
Refit the rear mudguard (Refitting the rear mudguard).
Refit the rear brake system (Refitting the rear brake control).
Refit the ABS sensor (Refitting the rear wheel), restore the relevant wire routing (Routing wiring harnesses / hoses) and check the air-gap (Adjusting the phonic wheel sensor AIR-GAP) .
Fix the rear shock absorber (Refitting the rear suspension).
Refit the RH and LH footpeg holder plates (Refitting footpeg holder plates).
Refit the exhaust silencer (Refitting the silencer).

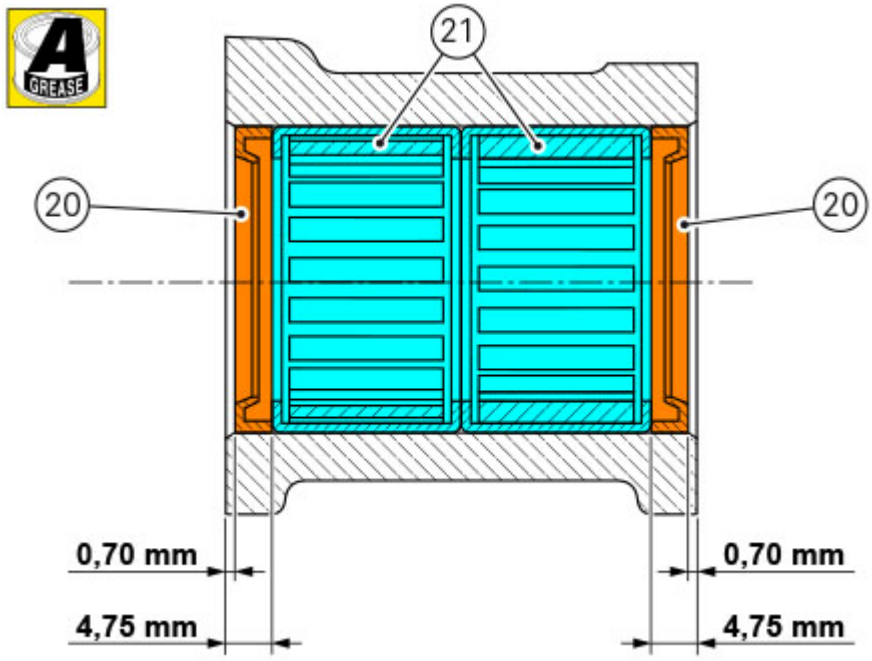
Overhauling the rear swinging arm

When fitting the seal rings, apply the indicated product (Refitting the rear swinging arm).

Warning

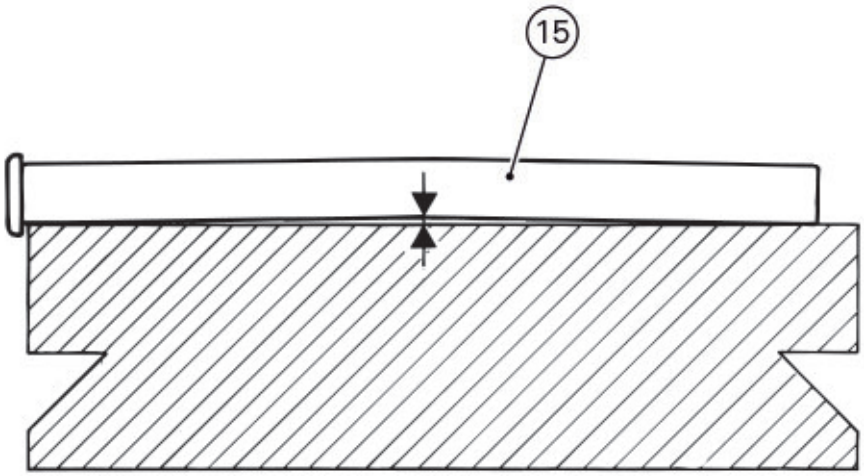
Seals must be inserted with the flat surface facing outwards.

Check the position of the seal rings.



Inspecting the swinging arm shaft

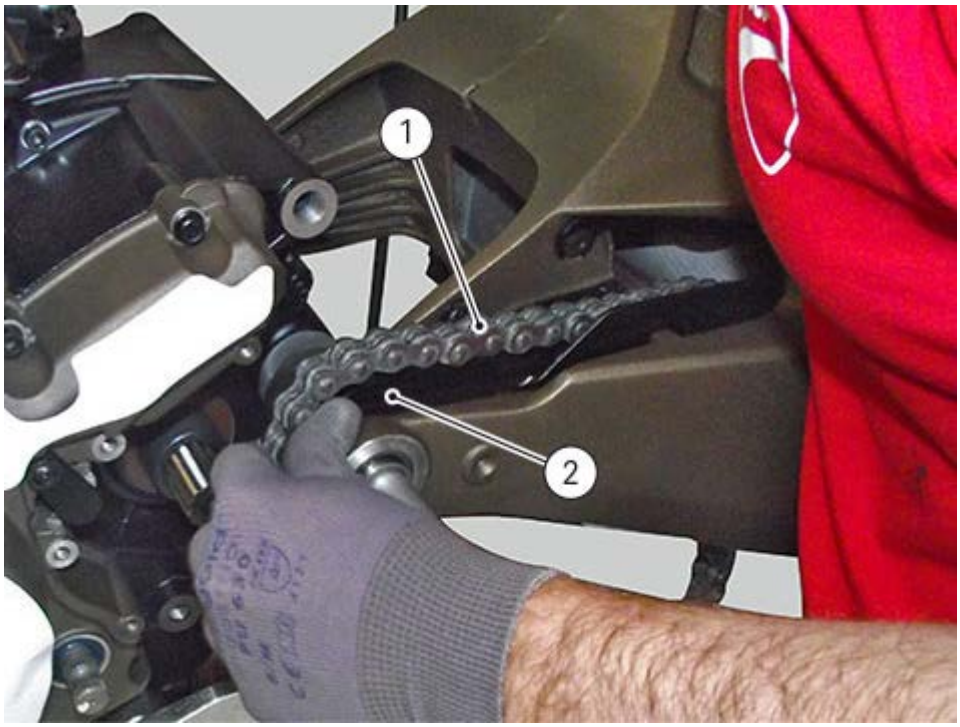
Before refitting the swinging arm shaft (15), check it carefully for distortion.
Turn the shaft on a reference surface and measure distortion using a feeler gauge.
Replace swinging arm shaft (8) if the measured value is different from the one specified in section "Rear wheel".



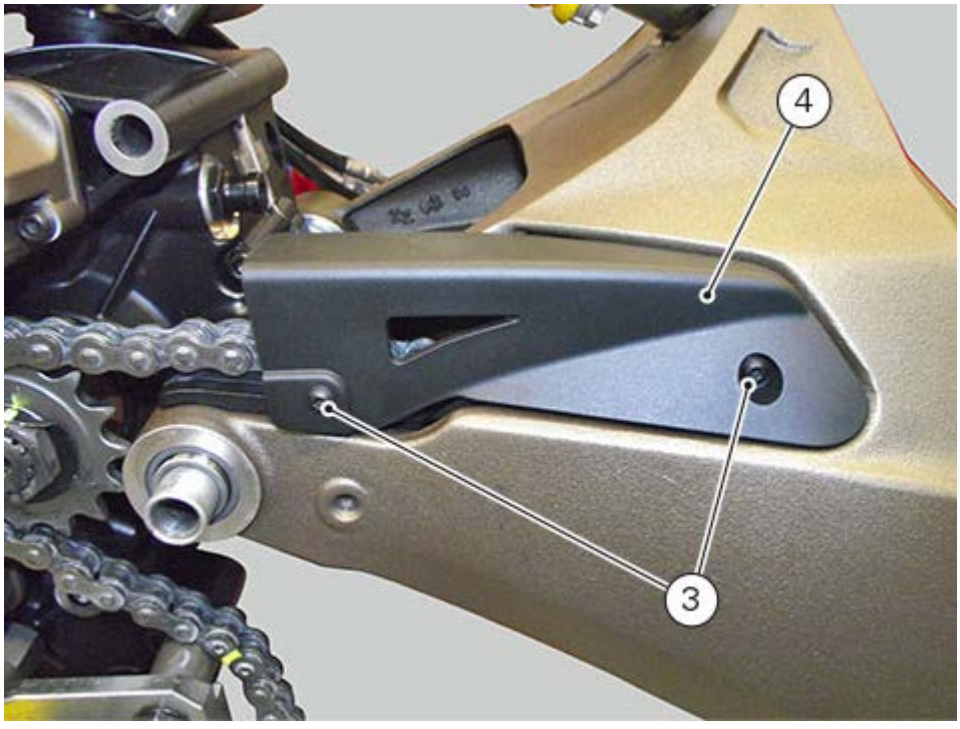
Removing the swinging arm

Before removing the concerned parts, you must first carry out the following operations.
Remove the exhaust silencer (Removing the silencer).
Remove the footpeg holder plates (Removing the footpeg holder plates).
Remove the rear mudguard (Removing the rear mudguard).
Remove the rear brake calliper (Removing the rear brake calliper).
Remove the rear wheel (Removing the rear wheel).
Release the rear shock absorber bottom part (Removing the rear shock absorber).

Slide out chain (1) from sprocket (2).

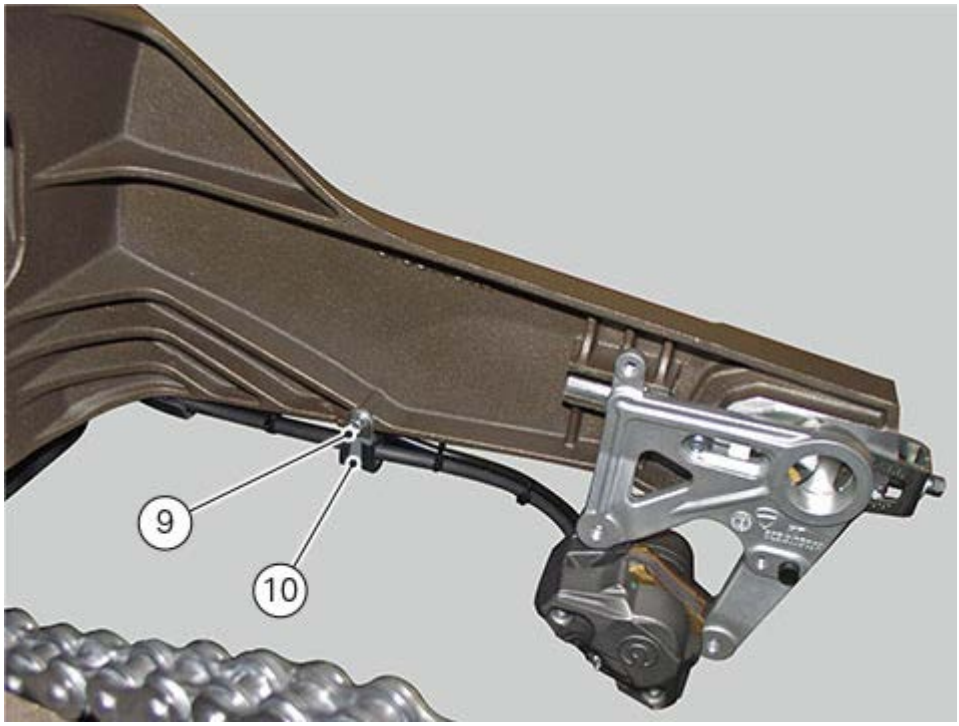


Only for the AUSTRALIA version, if necessary, loosen the two screws (3) and remove chain guard (4) from the chain sliding shoe.

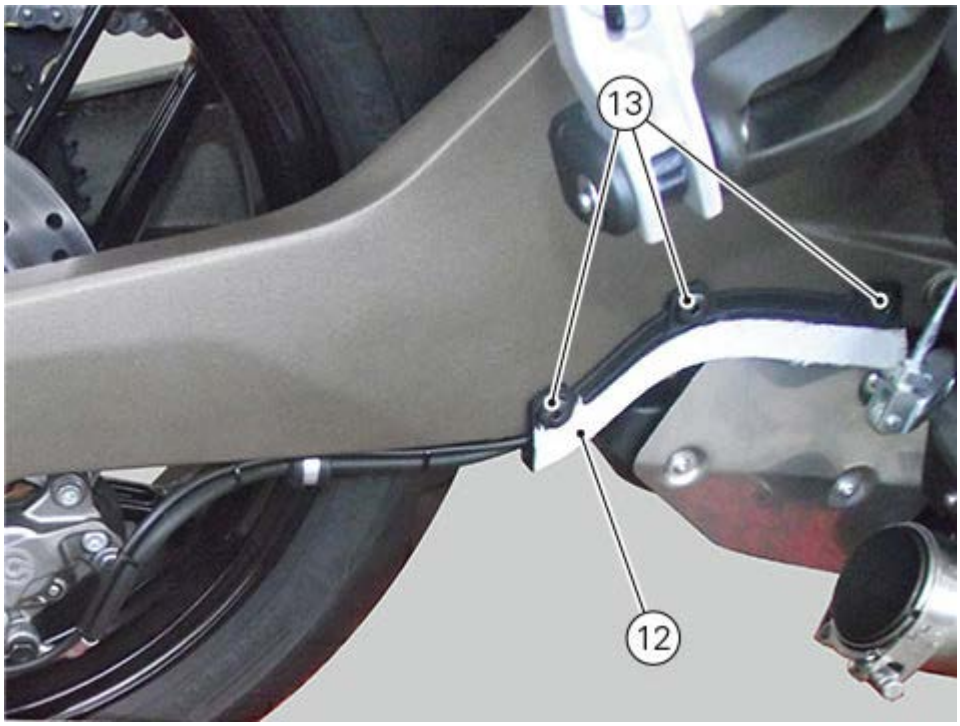


Undo screw (6) of the speed sensor and remove sensor (7) by recovering shims (8).

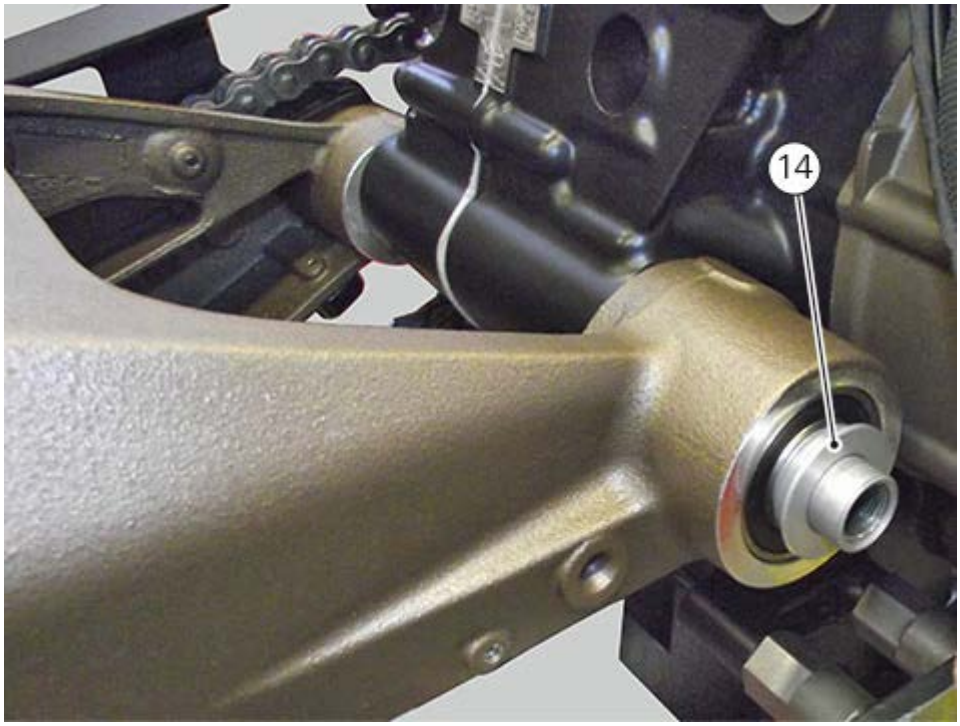
Loosen screw (9) and release the swinging arm from cable ring (10).



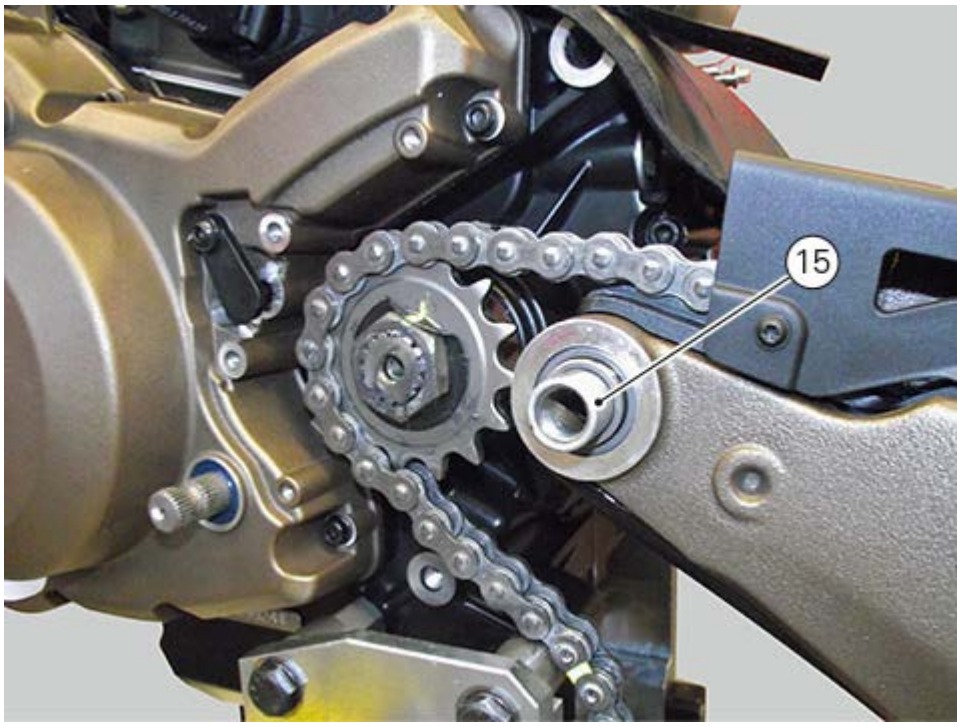
Release the swinging arm from cable ring (12) by loosening the three screws (13).



Working on the right side, slide out bush (14).

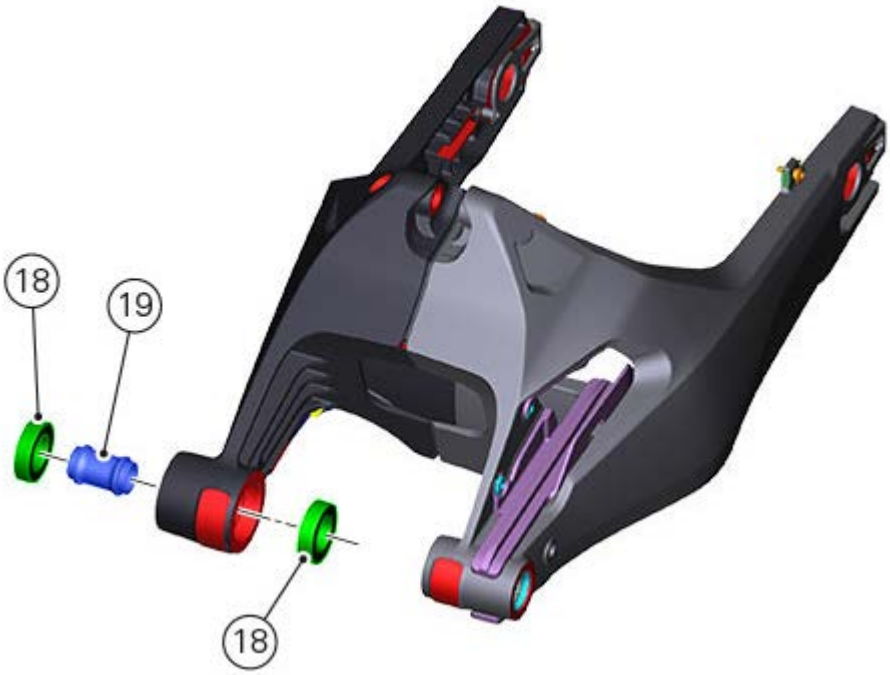


Slide out swingarm shaft (15) from the vehicle LH side.



Working on the swinging arm LH internal side, slide out the LH spacer (16).
Working on the swinging arm RH internal side, slide out the RH spacer (17).

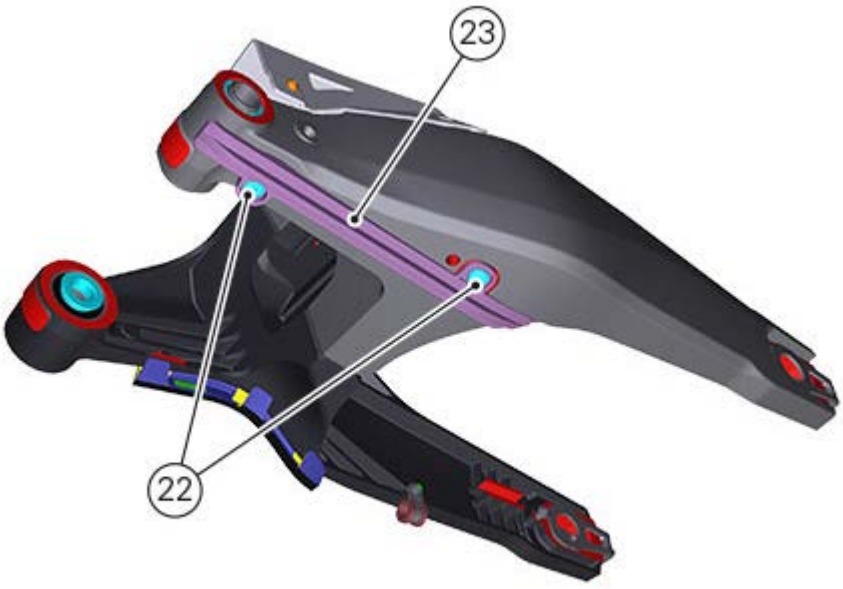
Check the bearing movement; make sure it emits no noise and that it has no interferences.
If necessary, work on the swinging arm RH side with the suitable puller and remove bearings (18) and spacer (19) as indicated.



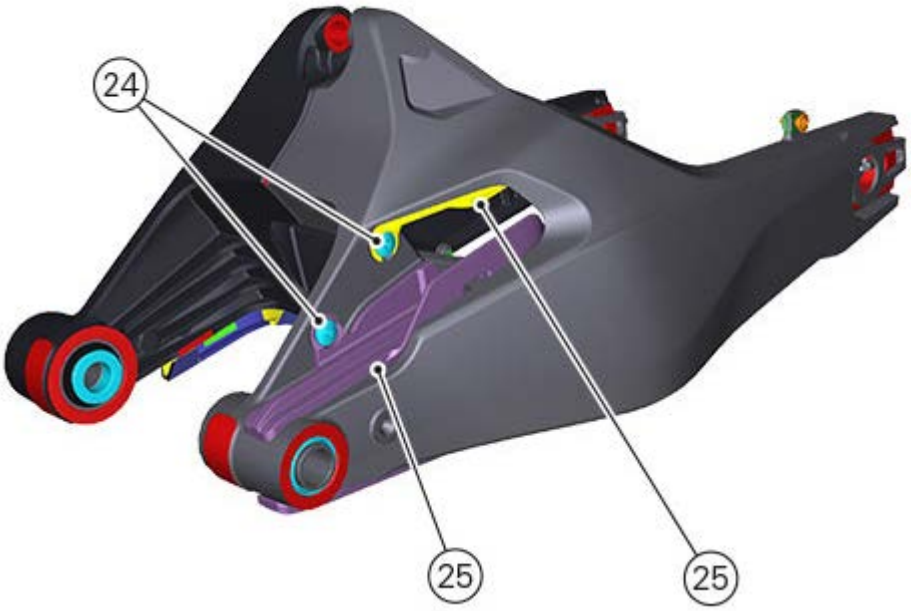
If necessary, working on the swinging arm LH side, slide out the two seal rings (20) and use the suitable puller to remove the roller bearing cage (21).

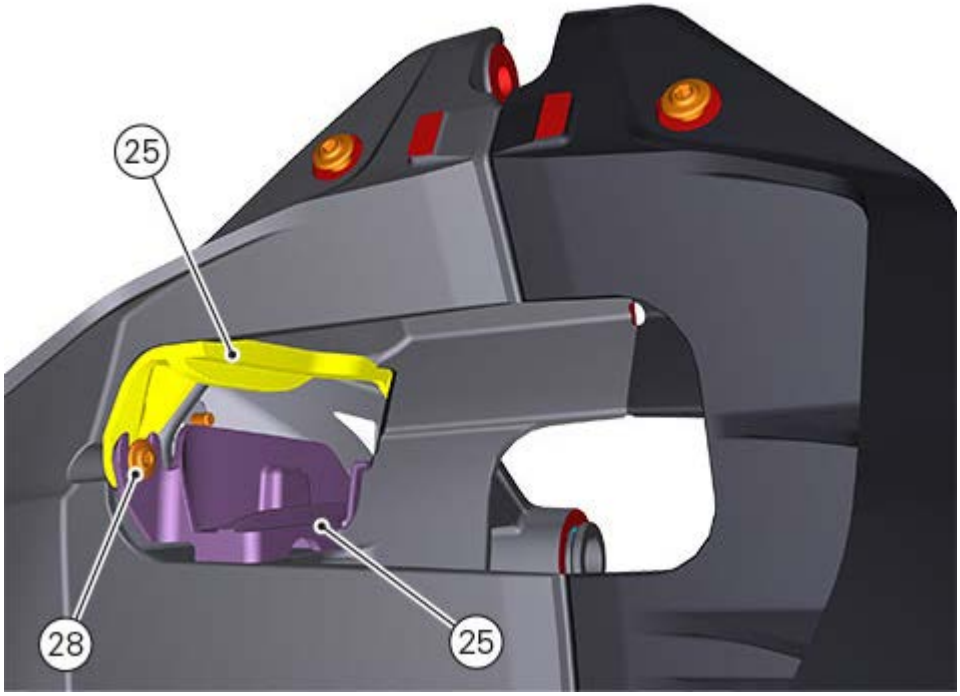
If necessary, remove the chain sliding shoes as follows.

Lower chain sliding shoe
Loosen the two screws (22) and remove sliding shoe (23).

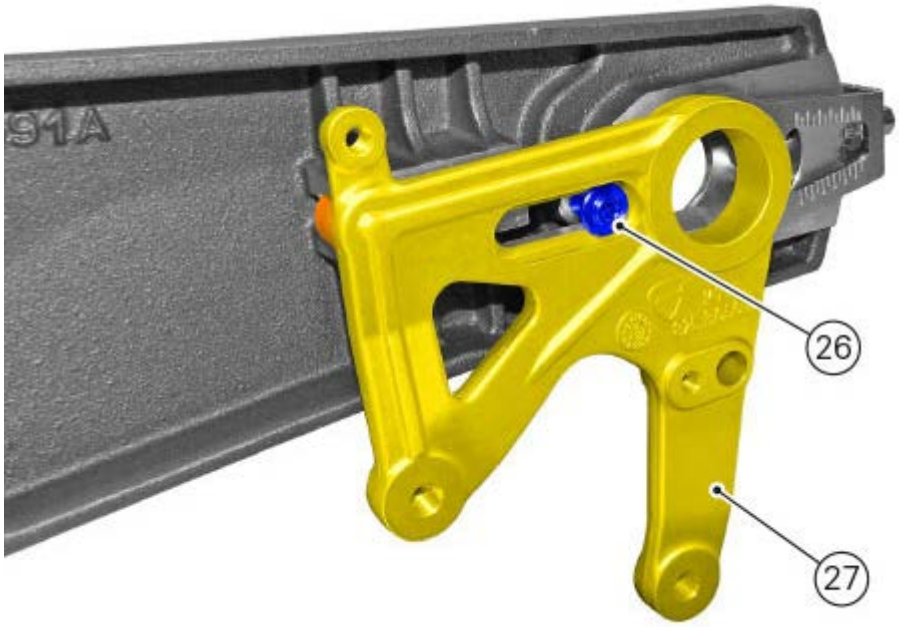


Upper chain sliding shoes
Loosen the two screws (24) and screw (28) and remove the two upper sliding shoes (25).





If necessary, loosen screw (26) and remove the calliper holder plate (27) from the swinging arm RH side.



Lubricating the chain

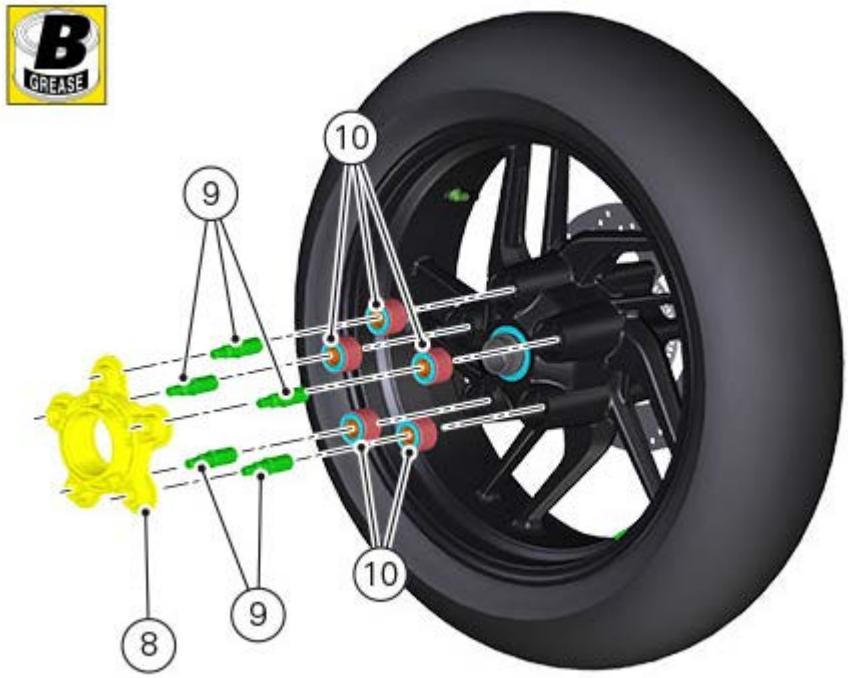
O-ring chains have sealed, life-lubed link studs and bushes.
However, these chains need to be lubricated at regular intervals to protect metal parts of the chain and the O-rings.
Lubrication also serves to keep the O-rings soft and pliable to ensure the maximum sealing efficiency.
Using a brush, apply a thin protective layer of high-density gearbox oil along the entire length of the chain both inside and outside.

Washing the chain

Chains with O-rings must be washed in oil, diesel fuel or paraffin.
Do not use fuel, trichloroethylene or other solvents which will damage the rubber O-rings. For the same reason use only sprays specifically formulated for use with O-ring chains.

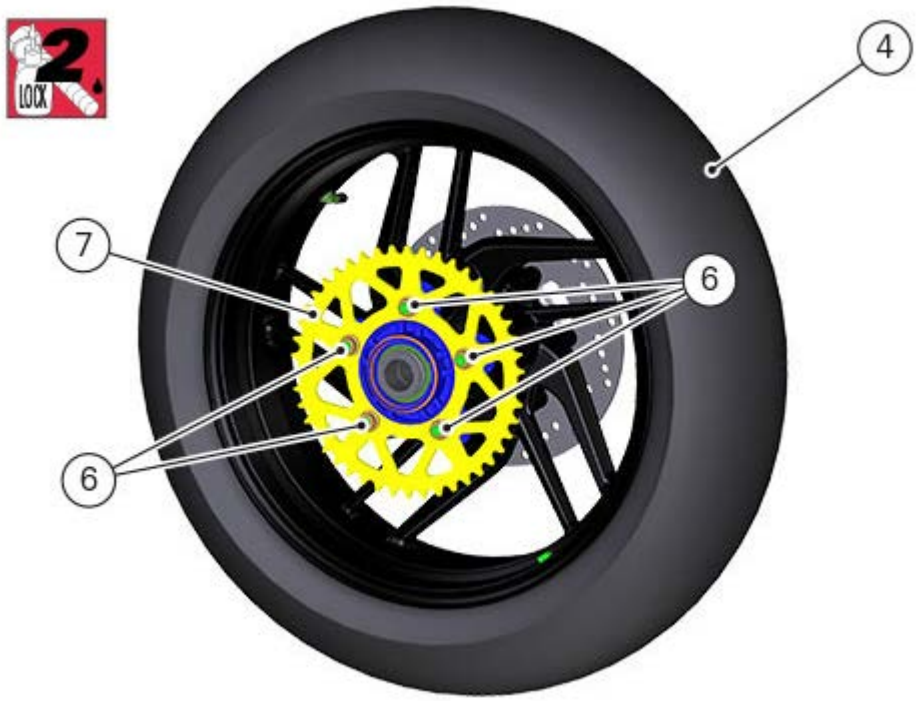
Refitting the rear sprocket

Lubricate the pins (9) ends of the rear sprocket flange (8) with the indicated product.



Place rear sprocket flange (8) inside vibration damping pads (10) located in the rear rim.
Fit bearing (14), spacer (13), bearing (12) and snap ring (11).

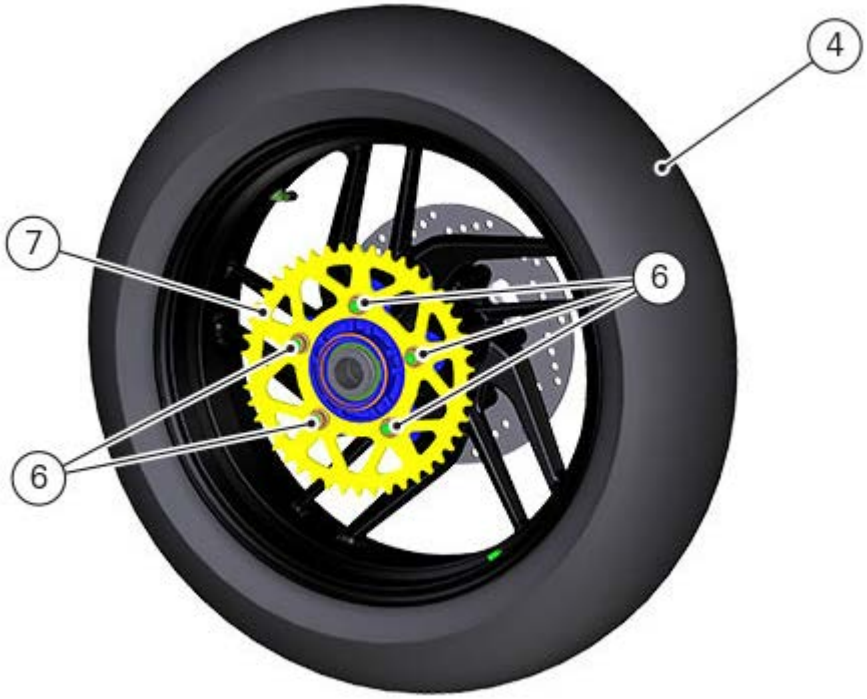
Fit rear sprocket (7) on flange (8).
Position the rear sprocket/flange group on the rear rim, tighten the five nuts (6) to a torque of 44 Nm ± 5% following a cross pattern.



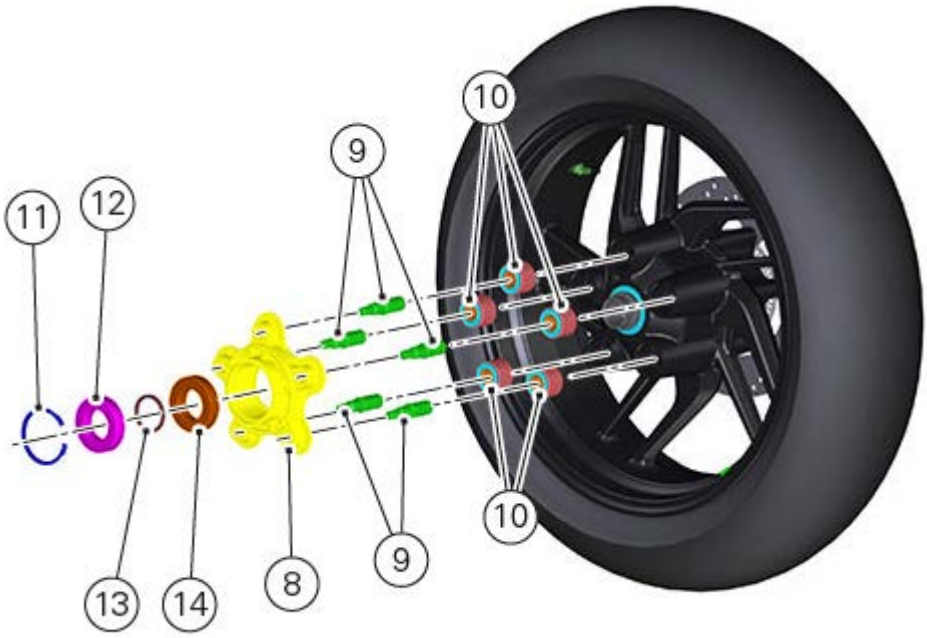
Check for wear as described under section "Inspection of the final drive".
Refit the rear wheel (Refitting the rear wheel).

Replacing the rear sprocket

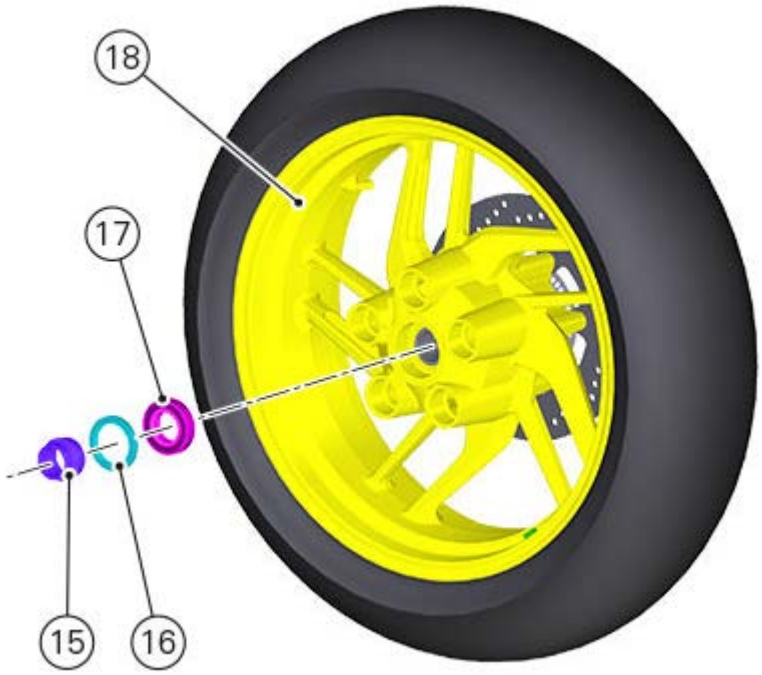
Remove the rear wheel (Removing the rear wheel).
Loosen five nuts (6) and slide out rear sprocket (7).



Remove the rear sprocket flange (8) with pins (9) and vibration damping pads (10).
If necessary, remove snap ring (11), bearing (12), spacer (13) and bearing (14).

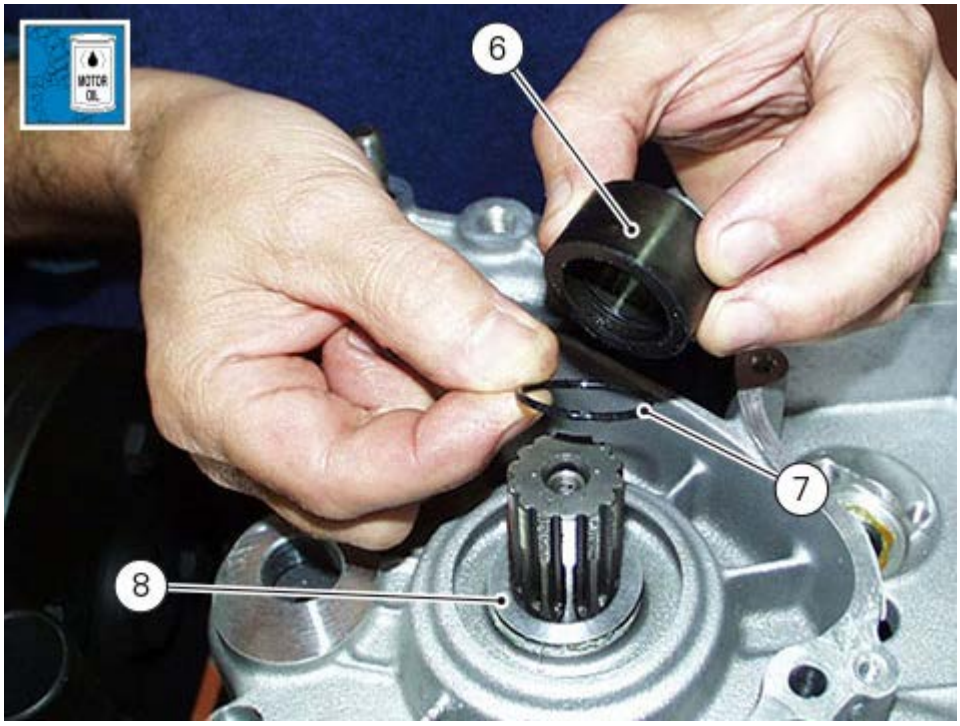


Remove spacer (15), seal (16) and bearing (17) from the rear rim (18).

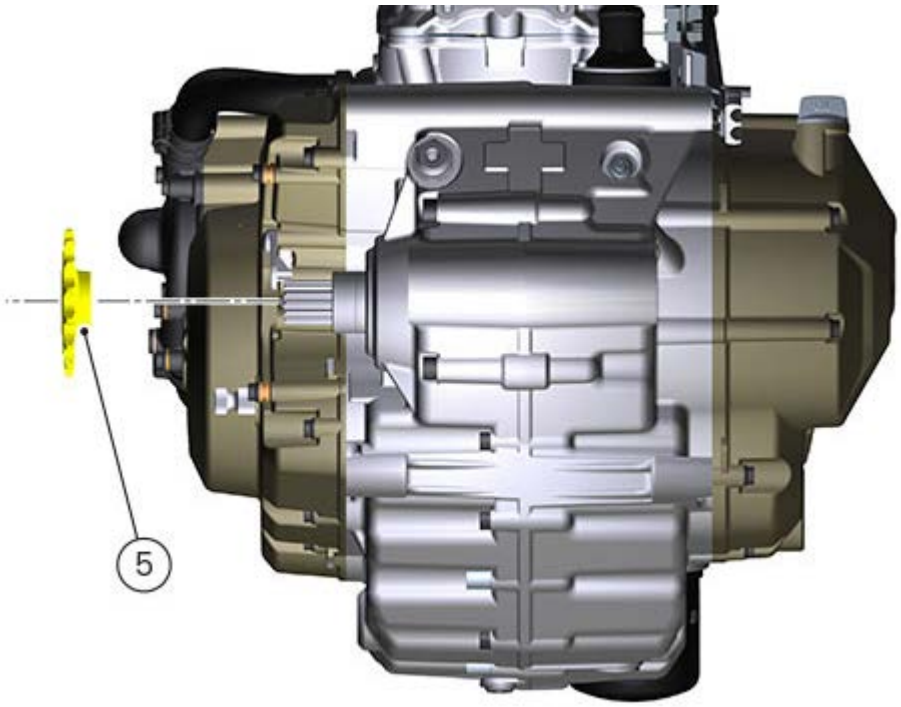

18
17
15
16

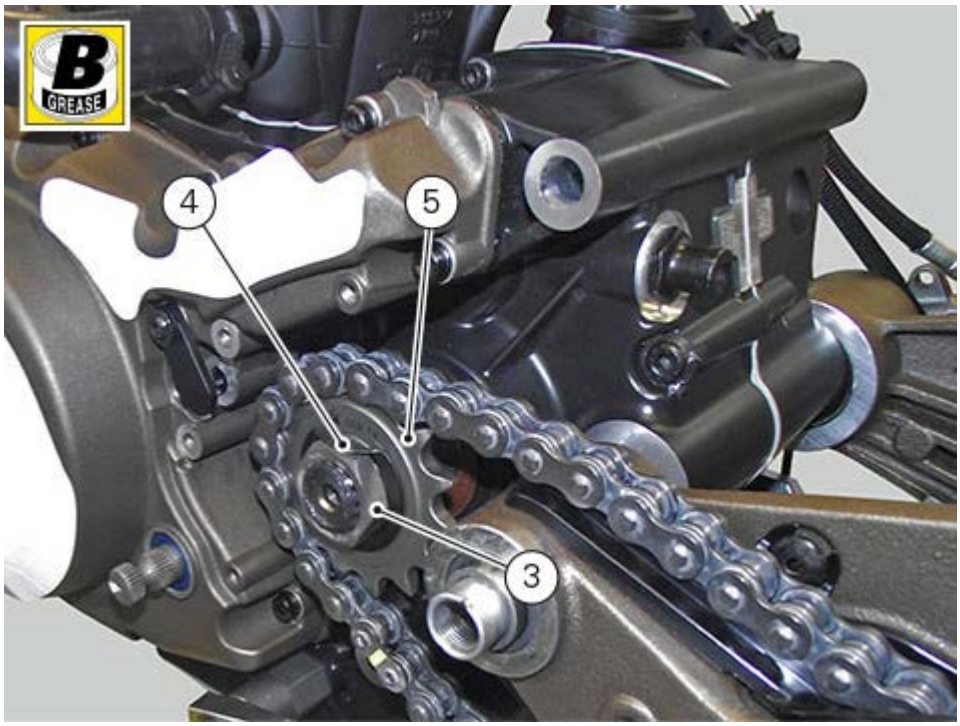
Refitting the front sprocket

Check that the spacer (6) is installed on the gearbox secondary shaft.
Refit the ring (8).
Grease the O-ring (7), and install it on the front sprocket spacer (6).
Fit the spacer, from the O-ring side, on the secondary shaft and drive it fully home against the inner ring of the bearing.



Check that the splines of the gearbox secondary shaft and the sprocket are in perfect condition.
Fit the front sprocket (5) on the gearbox secondary shaft, orienting it as shown. Fit lockwasher (4).
After having applied the recommended threadlocker, tighten the nut (3) to a torque of 186 Nm ± 5%.
Bend the washer (4) over the nut.



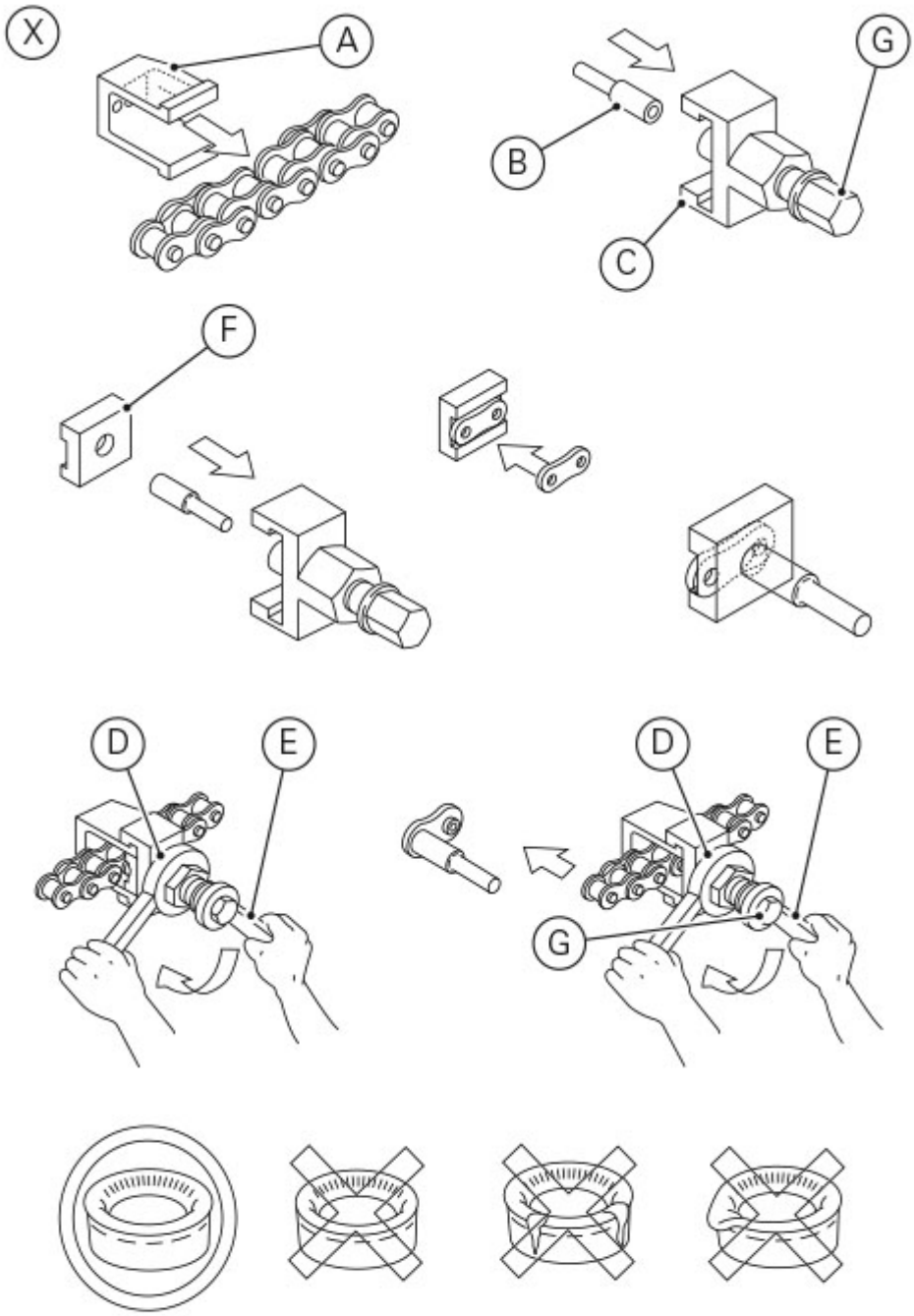


Fit the chain and close it using the tool (X) no. **88713.1344**, which was used to open the chain.
The tool consists of a holder (A), a punch (B), a body (C), two wrenches (D) and (E) and a plate holder (F).
Connect the two ends of the chain with the external link, and manually fit the plate onto the pins.

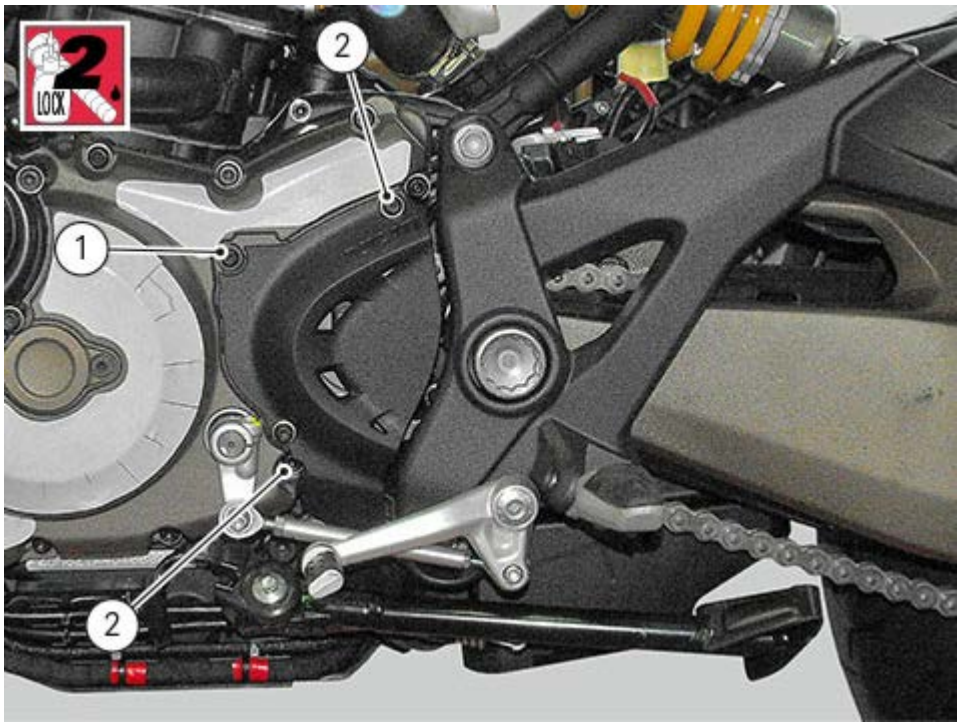
Warning
Lubricate the pins abundantly; try to avoid touching them with your hands.

Fit the holder (A) onto the external link.
Fit the punch (B) into the body (C) and the plate holder (F).
Fit the body (C) onto the holder (A) which holds the chain in position.
Manually turn the bolt (G) until the plate holder (F) is seated against the plate itself.
Use wrenches (D) and (E) to turn the bolt (G) clockwise until the chain pin is in contact with the holder (F).
Remove the holder (A) from the tool.
Manually turn the bolt (G) until the punch (B) is brought into contact with the pin to be riveted, taking care that they are aligned.
Use wrenches (D) and (E) to turn the bolt clockwise until the punch (B) is seated against the chain plate.
To complete riveting, repeat the entire procedure with the second pin.

Warning
Carefully check the two pins: the figure shows the correct result of the procedure.

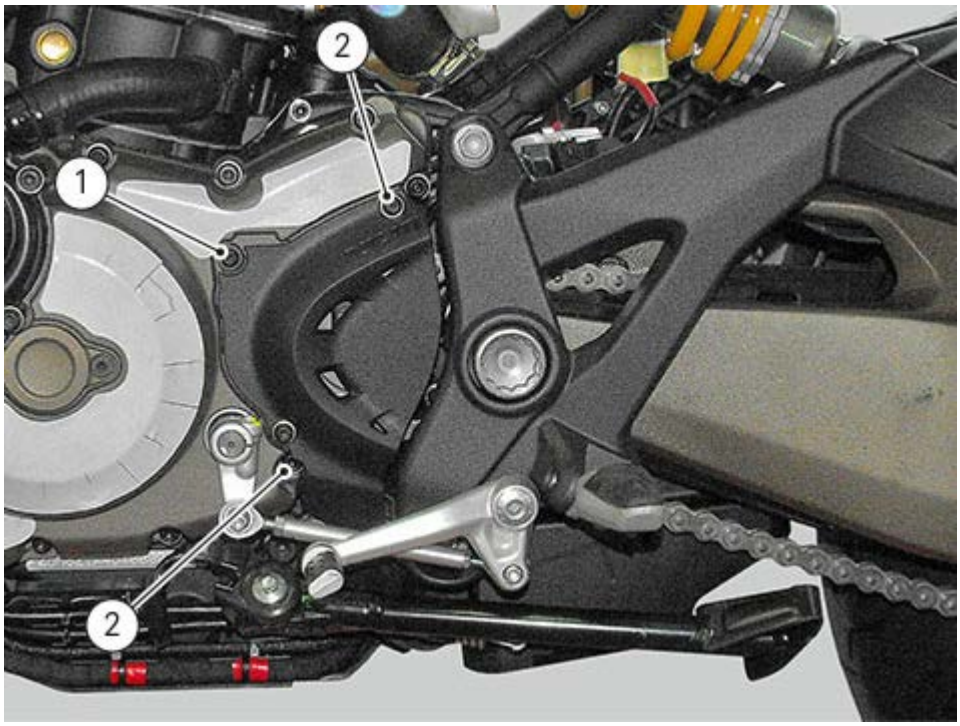


Tension the chain (Adjustment of chain tension).
Apply the recommended threadlocker to the screws (2).
Fit the sprocket cover (1) and tighten the screws (2) to a torque of 6 Nm ± 10% after having applied the specified threadlocker.

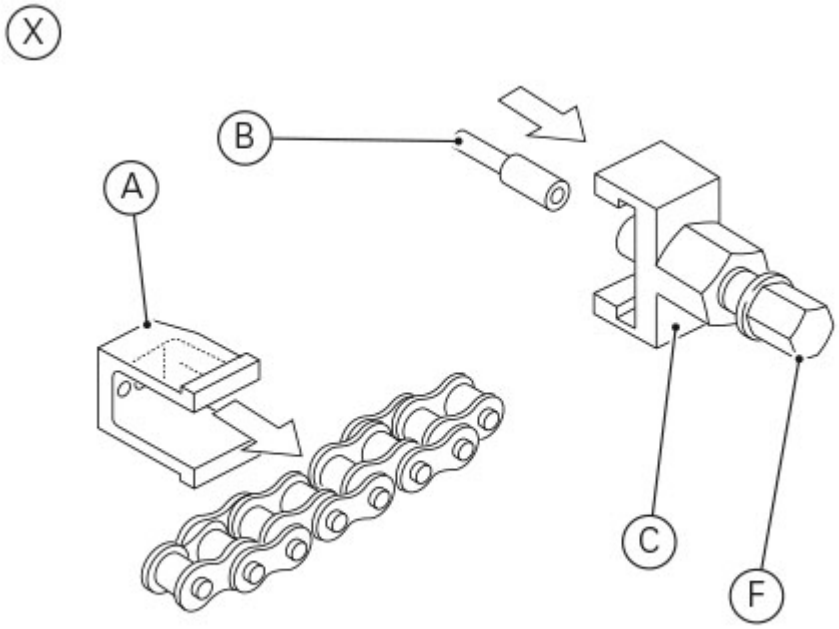


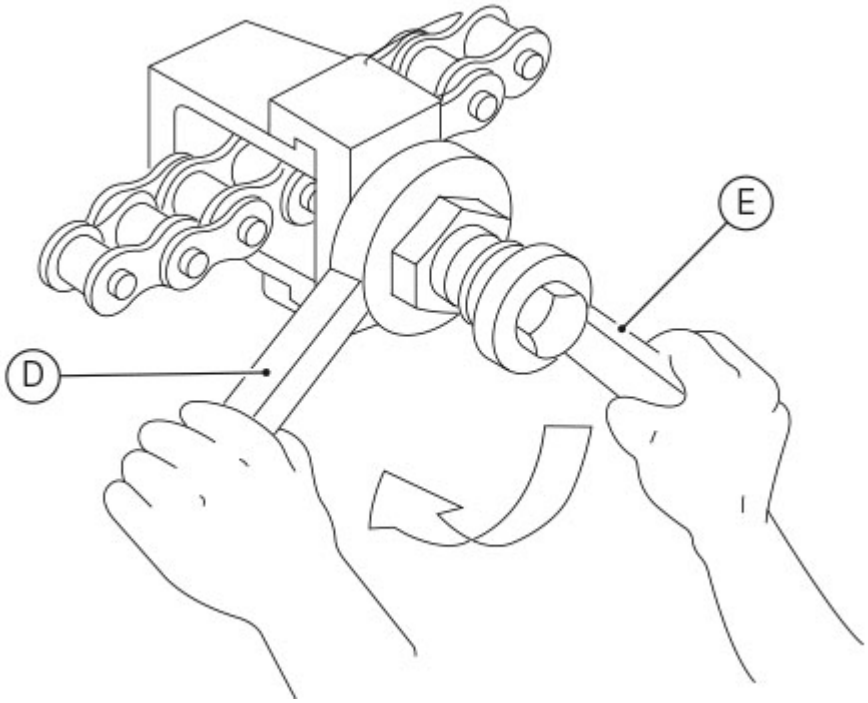
Removing the front sprocket

Undo the screws (2), and remove the chain cover (1).
Slacken the chain (Adjusting the chain tension).



Remove the chain using tool (X) part no. **88713.1344**.
The tool consists of a holder (A), a punch (B), a body (C) and two wrenches (D) and (E).
Fit the link to be opened into the holder (A).
Fit the punch (B) into the body (C) and manually undo the screw until the punch no longer protrudes.
Fit the holder (A) and the link into the body (C).
Manually turn the bolt (F) on body (C) so that the punch (B) gets against the pin, taking care that they are aligned.
Fit the hexagon wrench (D) into the hexagonal part of the body (C) and the wrench (E) onto the bolt.
Turn clockwise the bolt (F) until the pin comes out.

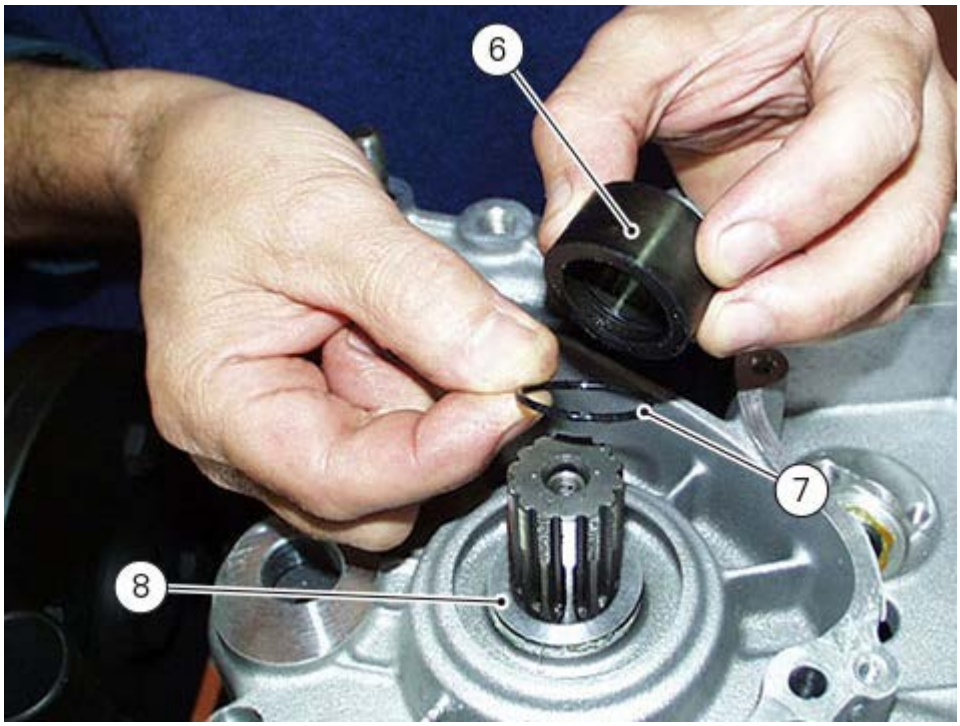




Remove the chain.
Engage the first gear and loosen nut (3).
Remove the nut (3) and the lockwasher (4) on the sprocket.
Remove the front sprocket (5) from the gearbox secondary shaft.

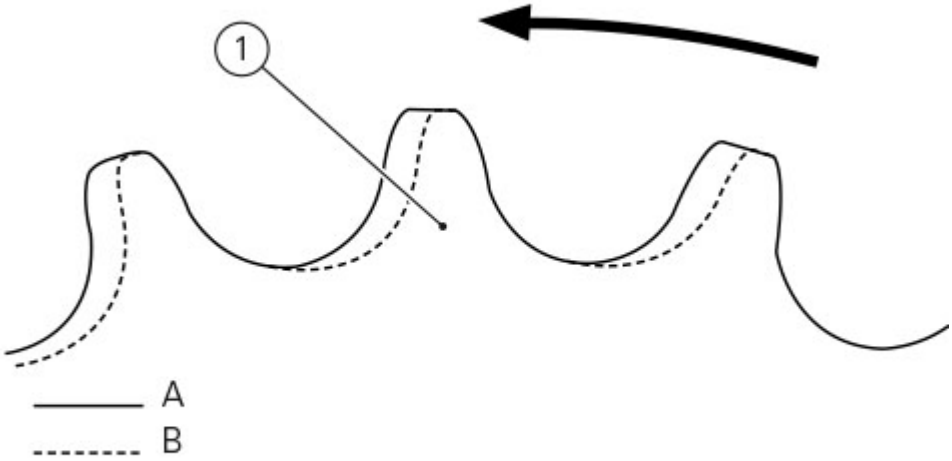
Remove the spacer (6) with O-ring (7) and washer (8) from the gearbox secondary shaft.

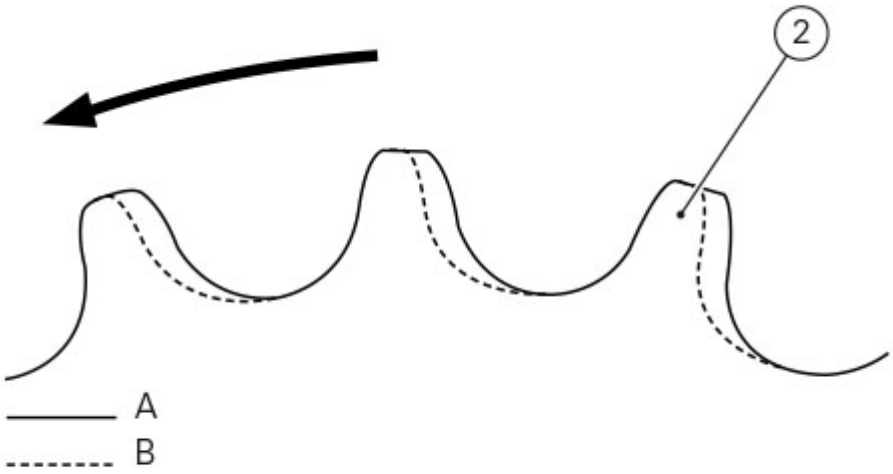
Important
The O-ring must be renewed upon removal.


6
7
8

Inspection of the final drive

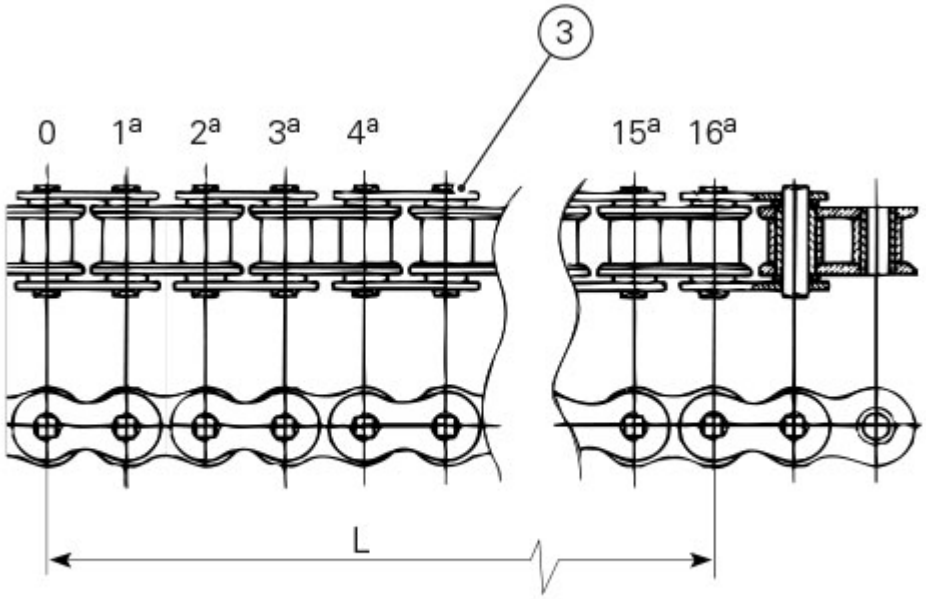
To check the final drive wear, visually check the front sprocket (1) and the rear sprocket (2). If the teeth are worn as shown in the figure (dotted line), the final drive must be replaced.





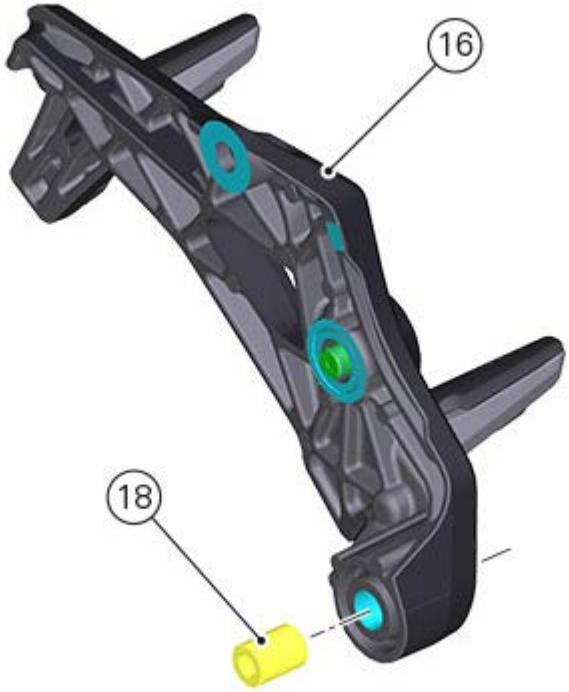
Important

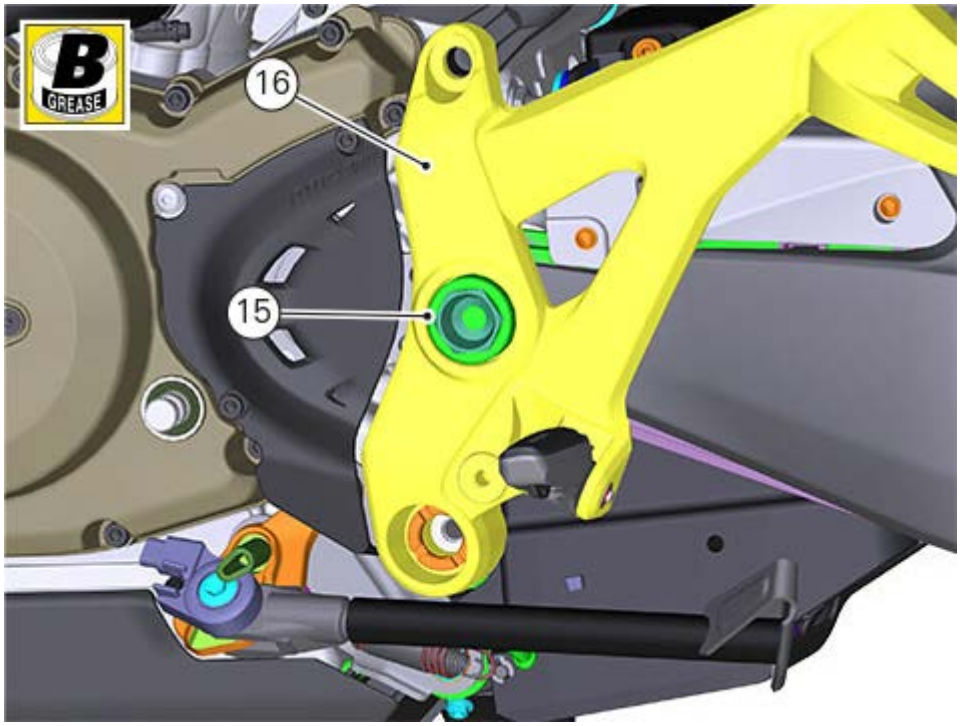
Make sure that the rear sprocket, front sprocket and chain are all replaced together as a set.



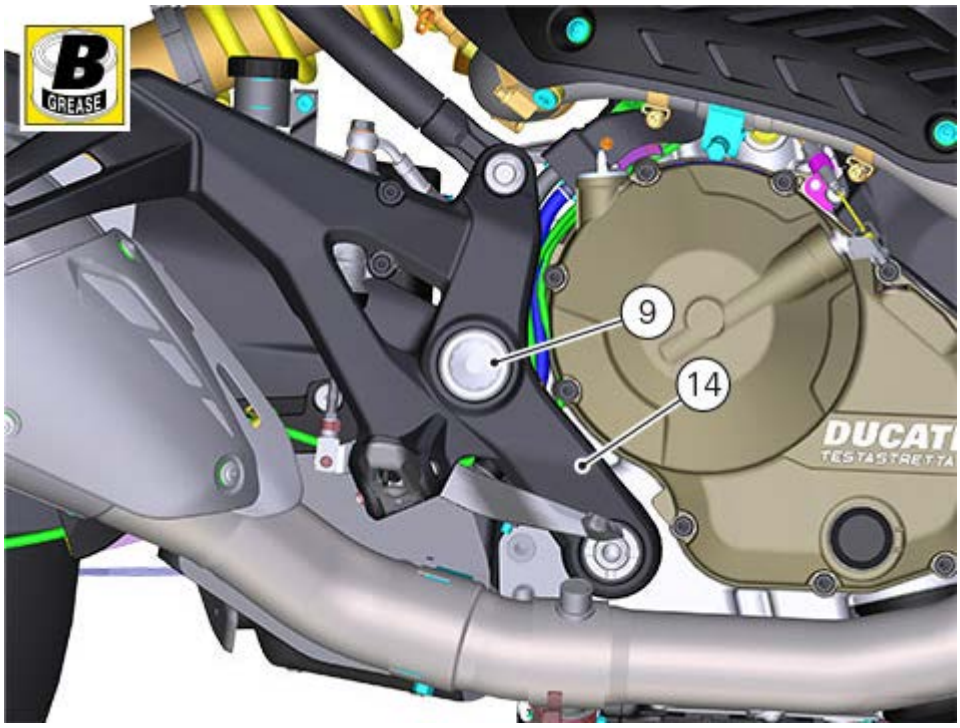
Refitting the footpeg holder plate

Working on the LH footpeg holder plate (16), refit the gear change control (Refitting the gear change control), fit spacer (18) in its seat and fit the footpeg holder plate on the vehicle.
After applying the indicated product on the thread and on the underhead, start screw (15).

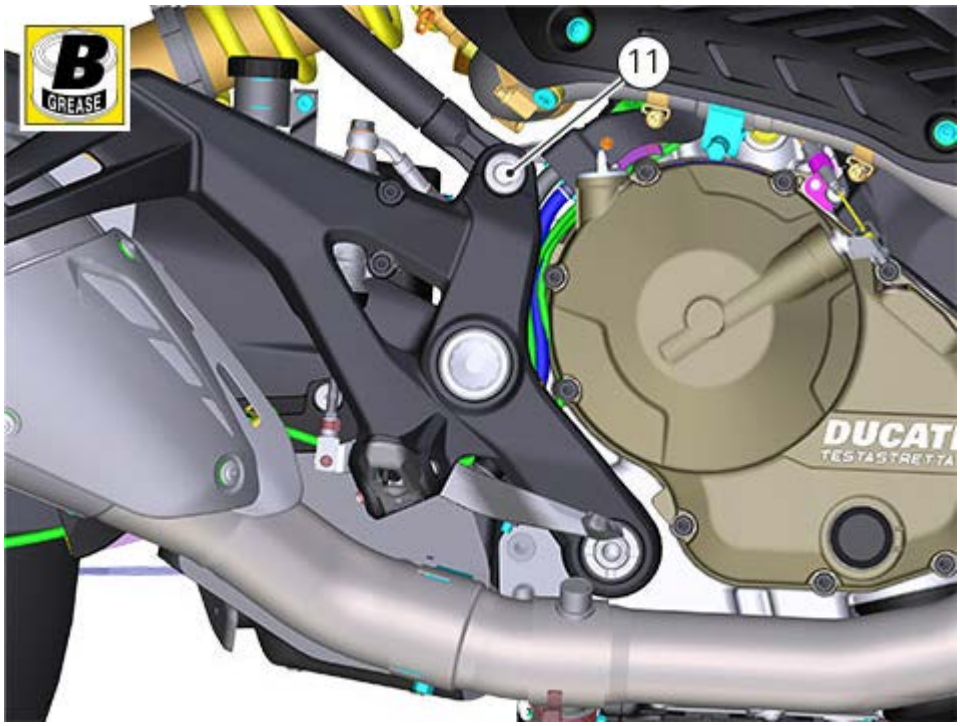


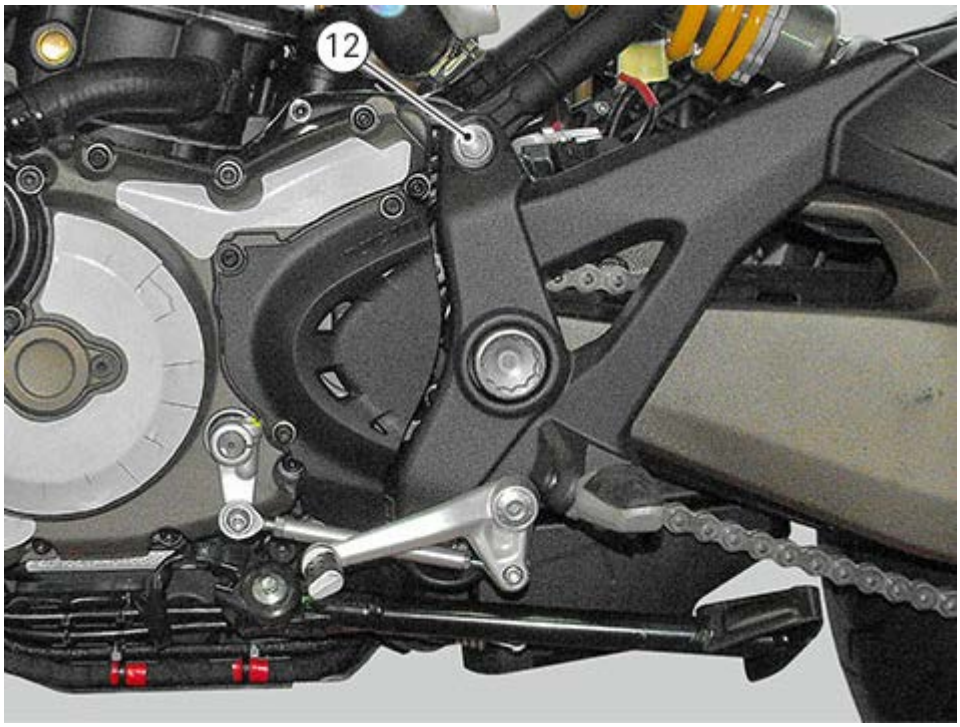


Working on the RH footpeg holder plate (14), refit the complete rear brake control (Refitting the rear brake control), fit spacer (17) in its seat and fit the footpeg holder plate on the vehicle.
After applying the indicated product on the thread and on the underhead, start screw (9).



Apply the specified product to nut (11).
Fit pin (12) from the LH side and lock it with nut (11).
Tighten nut (11) and pin (12) to a torque of 60 Nm ± 5%.



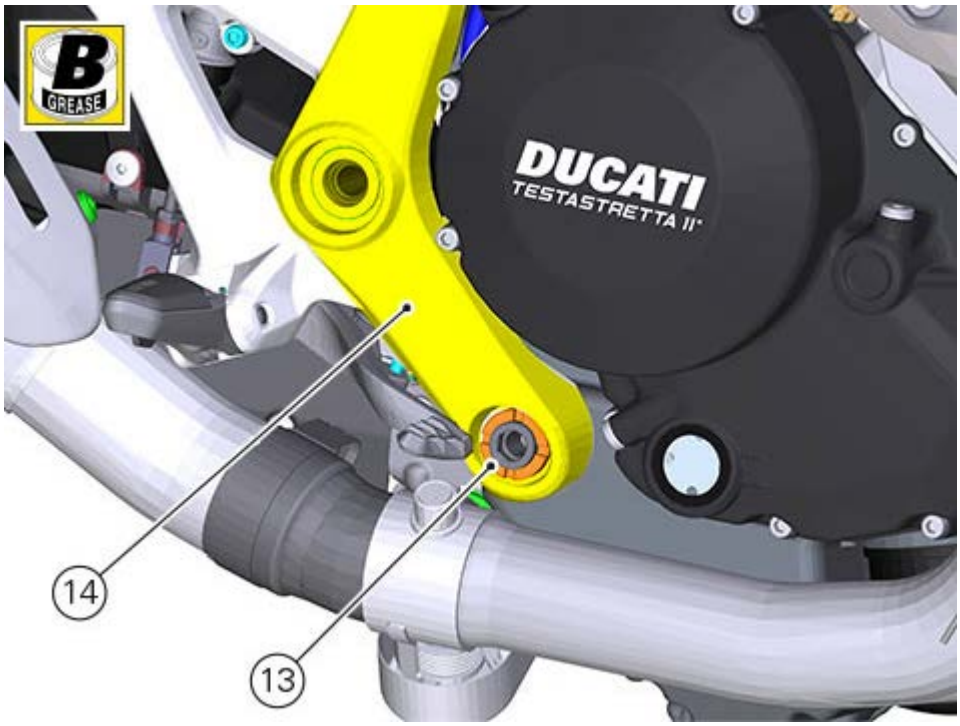


Tighten screws (9) and (15) to a torque of 72 Nm ± 5%.

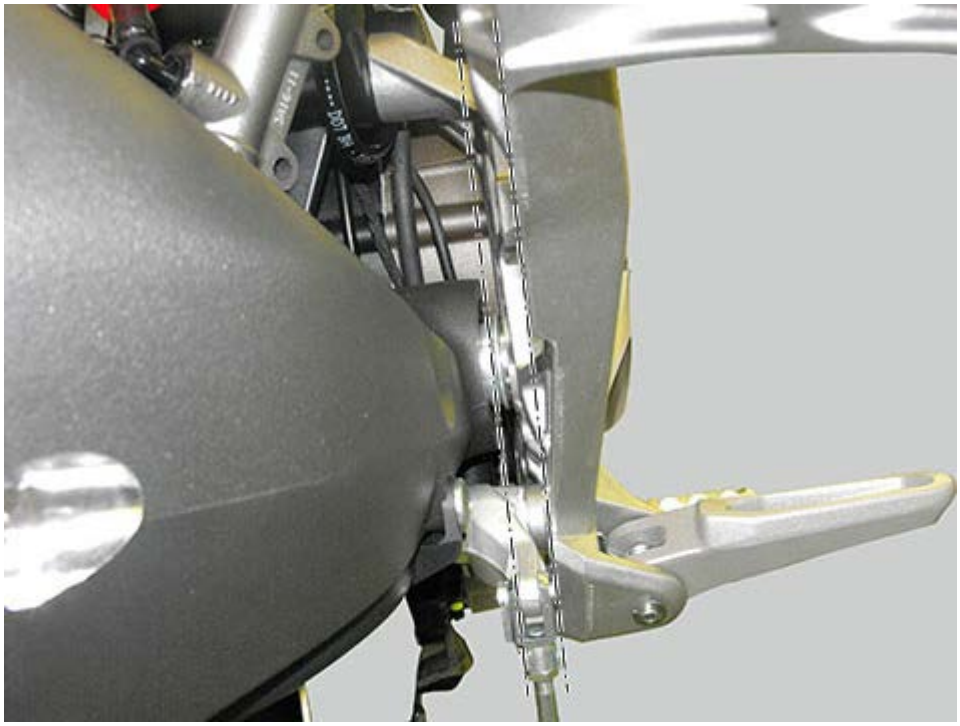
Warning

The following operations describe the procedure for one plate, but must be carried out for both of them so as to ensure that footpeg holder plates are correctly and safely secured in place.

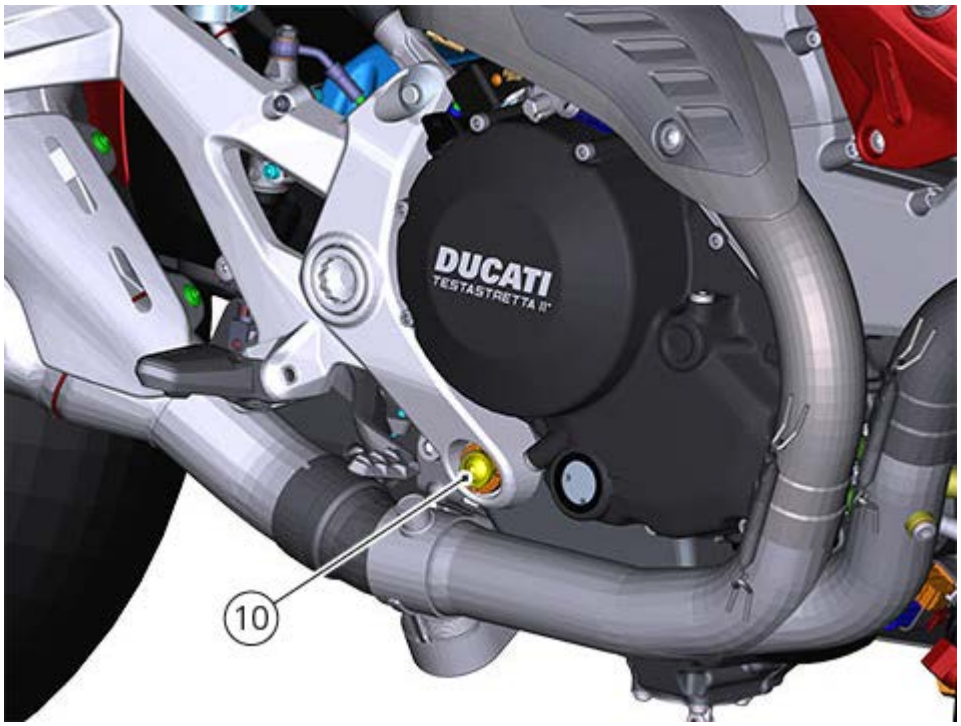
Working on RH plate (14), after having applied the specified product, fit adjuster (13) and screw it with a pre-torque of 0.6 Nm ± 10%.



Make sure that footpeg holder plate and swinging arm are duly aligned.



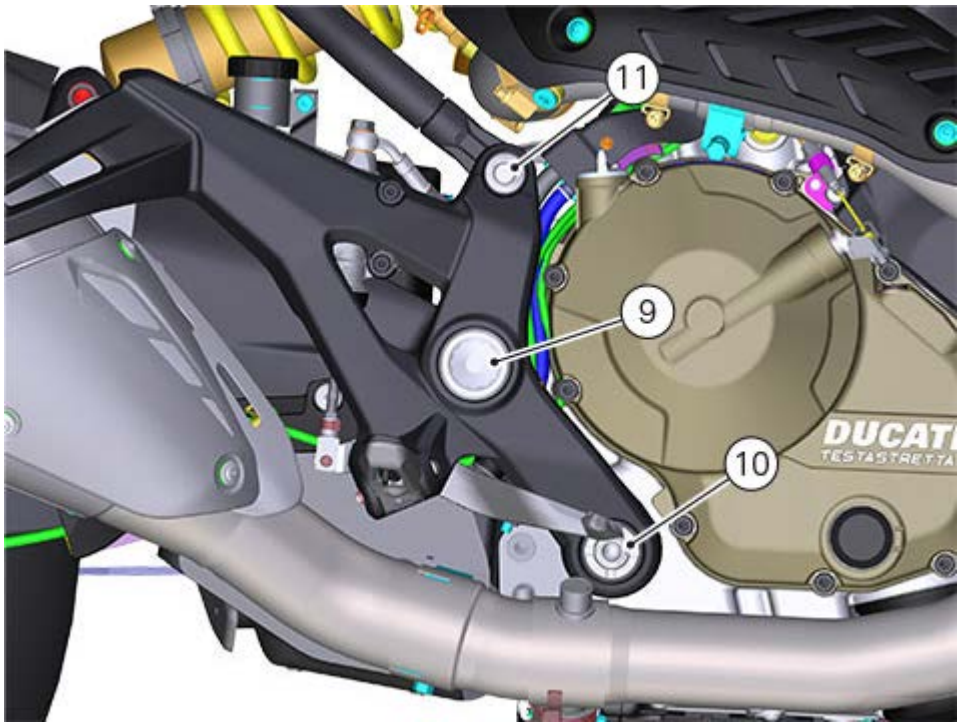
Lubricate and tighten adjuster ring nut (13) to a torque of 80 Nm ± 5%.
Fix adjuster (13) by tightening screw (10) to a torque of 45 Nm ± 5%.



Repeat the procedure on LH plate.

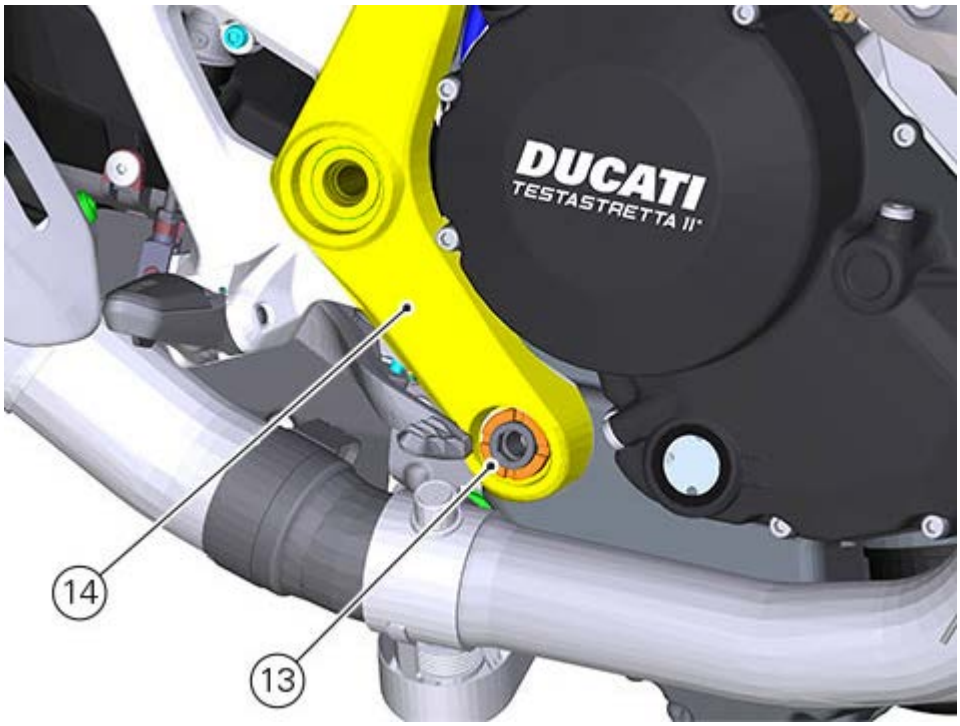
Removing the footpeg holder plate

Remove the complete rear brake control, by releasing RH footpeg holder plate from brake master cylinder, reservoir and lever as well as from wirings and hoses (Removing the rear brake control).
Loosen screw (9) on vehicle RH side.
Loosen screw (10) and nut (11) on RH plate.

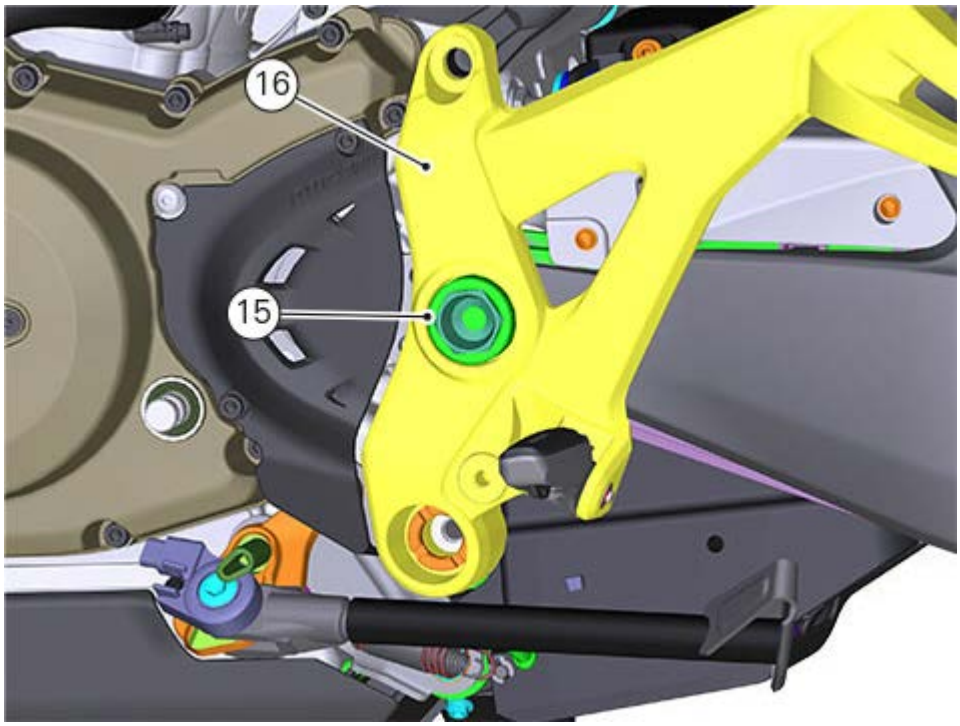


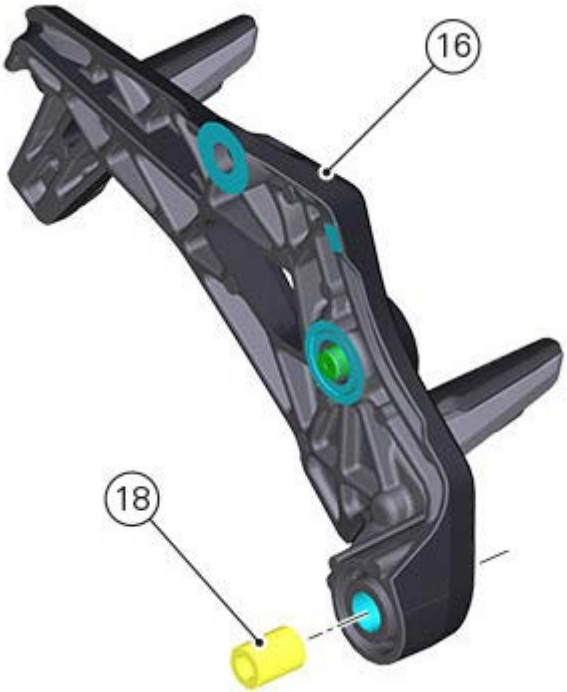
Slide out pin (12) from the LH side.

Working on the right side, loosen and remove adjuster (13).
Then remove the RH footpeg holder plate (14) recovering the internal spacer (17).



Working on LH plate, remove gear shift (Removing the gear shift) and loosen screw (15).
Then remove the LH footpeg holder plate (16) and recover spacer (18).

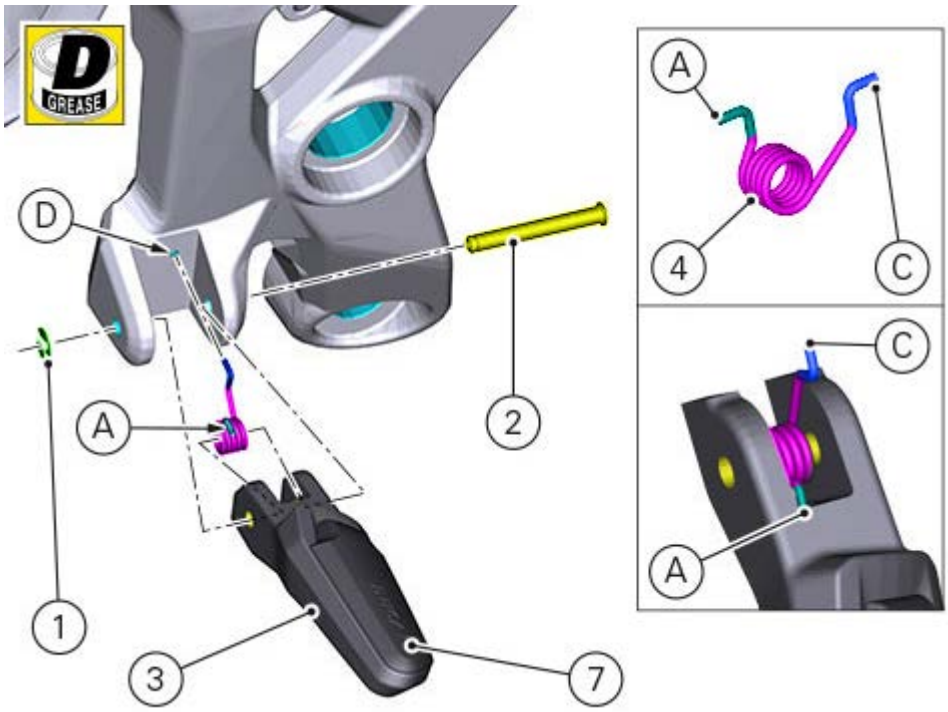


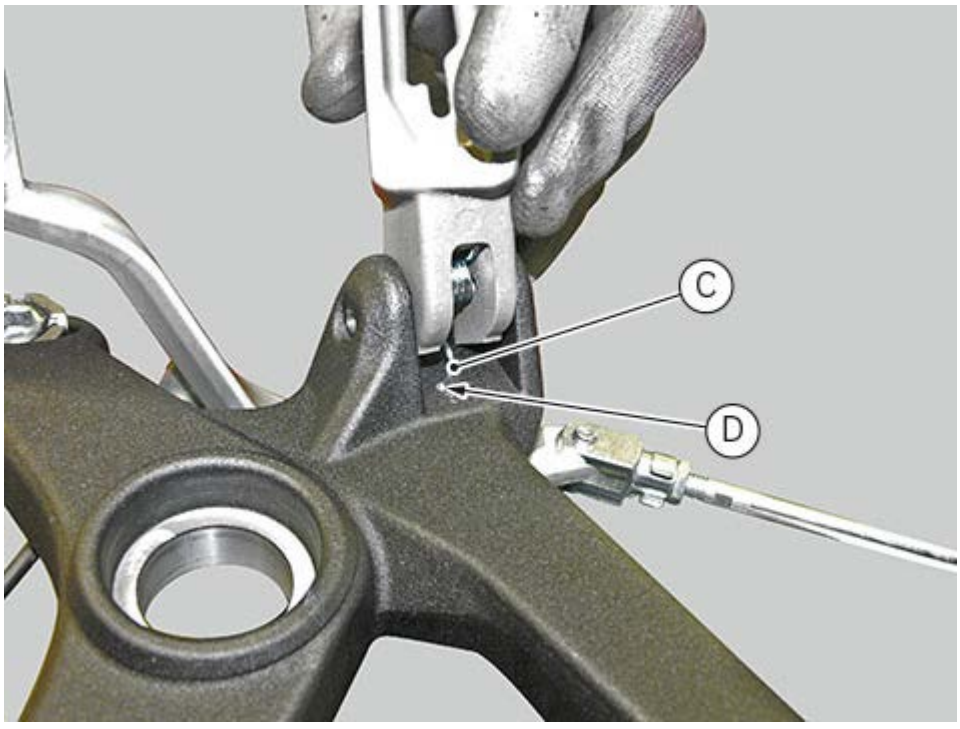


Refitting the front footpegs

Note
The refitting of the front RH footpeg is described in detail; the LH footpeg can be removed following the same procedure.

Position spring (4) so that the end (A) rests on the footpeg (3).
Position footpeg (3) inserting the end (C) of spring (4) in the hole (D) of the frame plate.
Fit pin (2) as shown.
Lock pin (2) using circlip (1).
If previously removed, refit the footpeg rubber block (7).



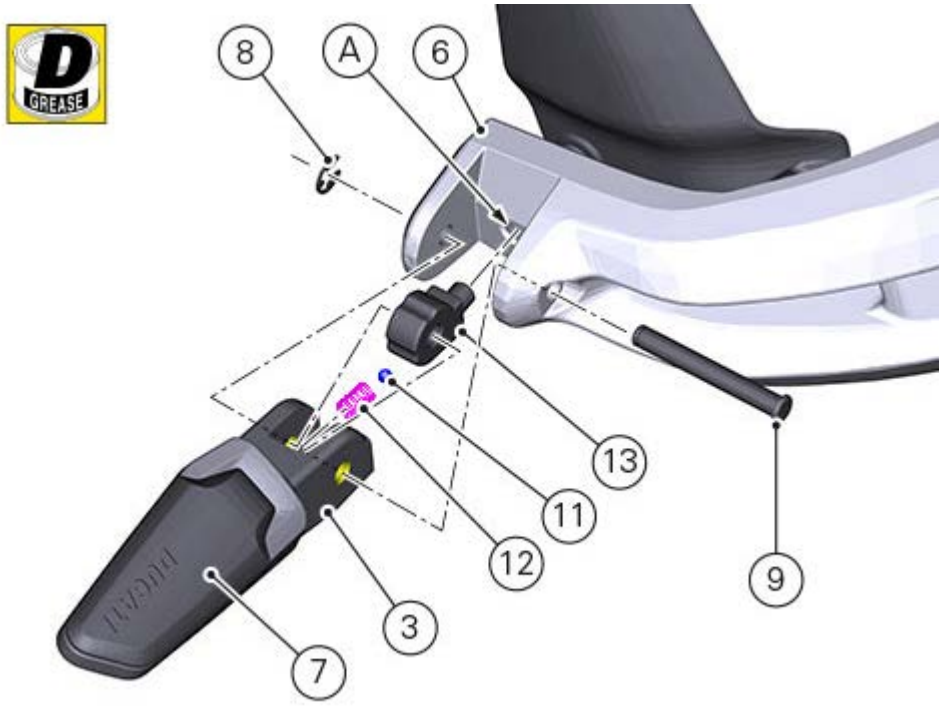


Refitting the rear footpegs

Note
Refitting of the rear RH footpeg is described in detail; the LH footpeg can be removed following the same

procedure.

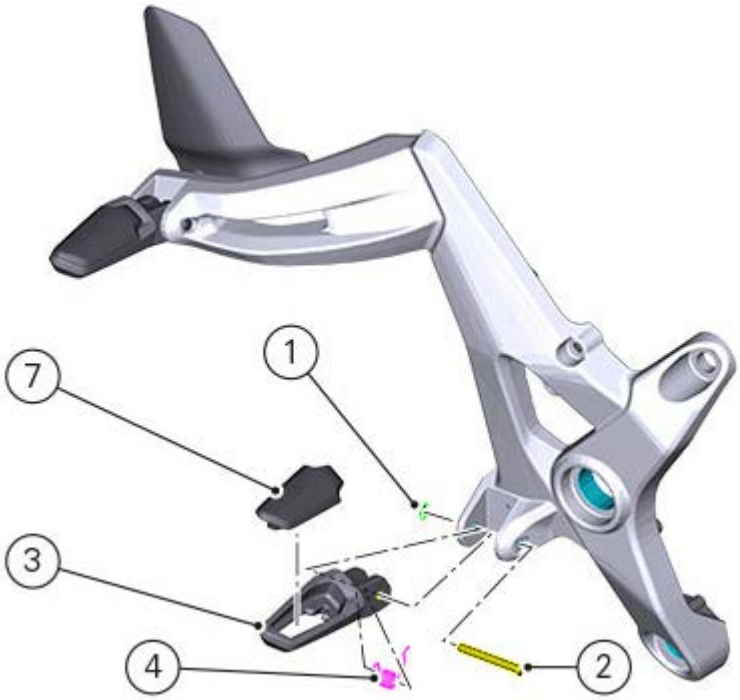
Insert spring stopper (13) into the hole (A) of the rear RH footpeg holder plate (6) as shown. If necessary, smear pin (B) retaining spring (13) with recommended grease in order to keep it in the correct position.
Insert the spring (12) into the special hole of the footpeg (3).
Fit the ball (11) on the spring (12).
Fit the footpeg (3) to rear RH footpeg holder plate (6) fitting pin (9), positioning parts as shown.
Fasten pin using circlip (8).
If previously removed, refit the footpeg rubber block (7) and insert buffers (B) into the corresponding grooves on footpeg (3), pressing until teeth on footpeg rubber block (7) snap beyond footpeg profile.



Removing the footpegs

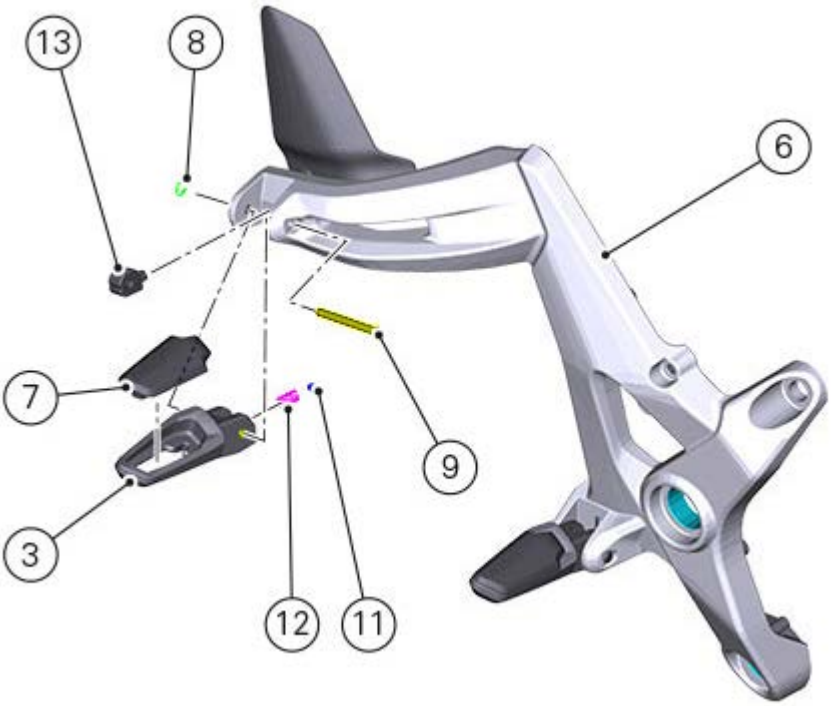
Removing the front footpegs

Remove the circlip (1) thereby releasing the pin (2).
Slide out pin (2), while supporting the footpeg (3).
Slide out footpeg (3) from its seat and collect spring (4).
If necessary, remove the footpeg rubber block (7).

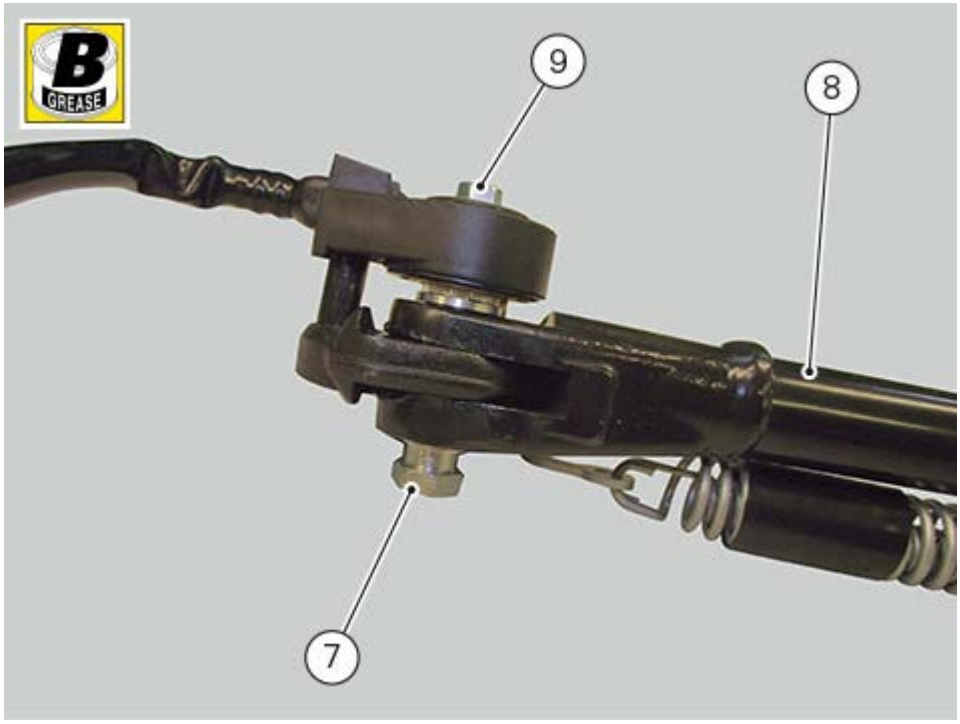


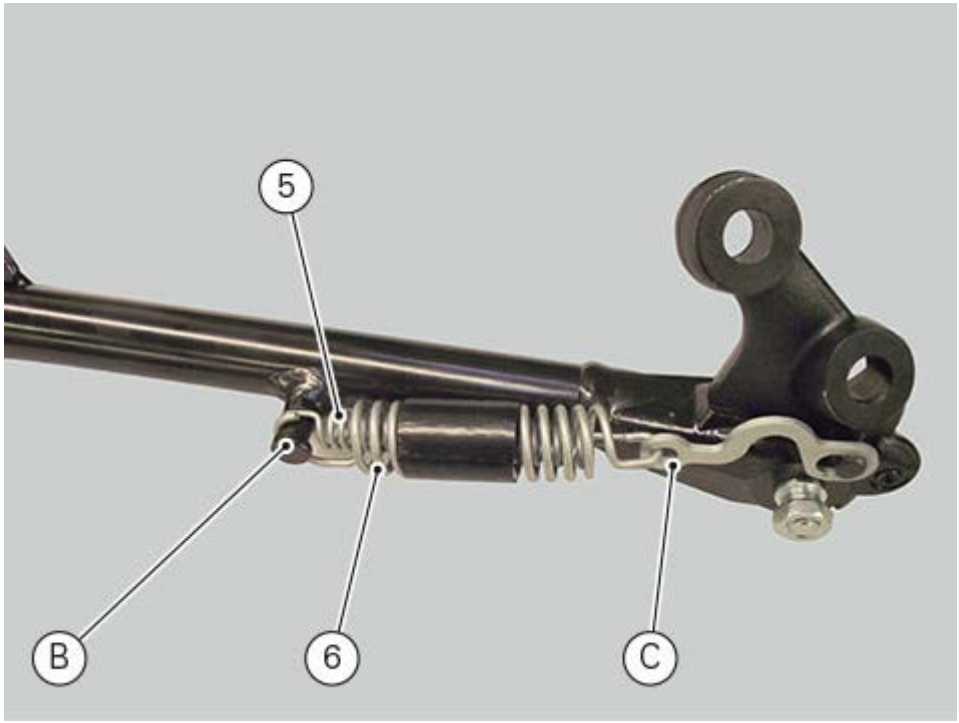
Removing the rear footpegs

If necessary, remove the rubber cap (7).
Remove the circlip (8) thereby releasing the pin (9).
Slide out pin (9) from frame (6), holding the footpeg (3) and making sure that the ball (11) and the spring (12) are not released.
Slide out footpeg (3) from its seat and collect spring (12) and ball (11).
Remove the spring stopper (13).

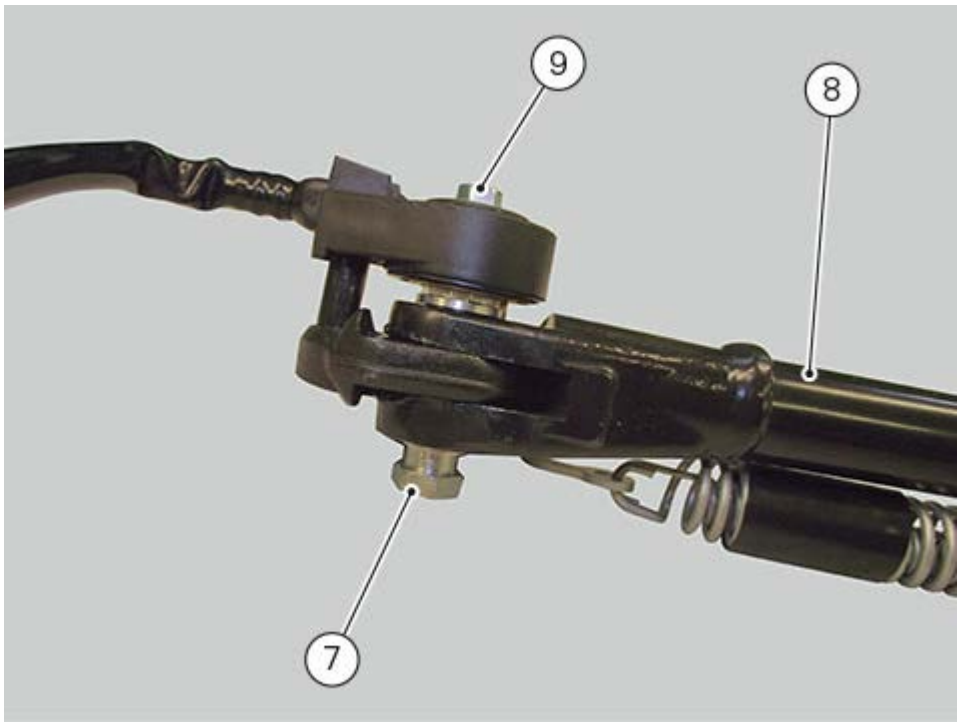


Reassembling the side stand
Grease the side stand leg (8) with the specified product and fit it to the bracket (3). Secure it with the pin (7) and the nut (9).
Tighten nut (9) to a torque of 24Nm ± 10%.
Position the side stand return springs (5) and (6) and attach them to fasteners (B) and (C) on bracket and stand.

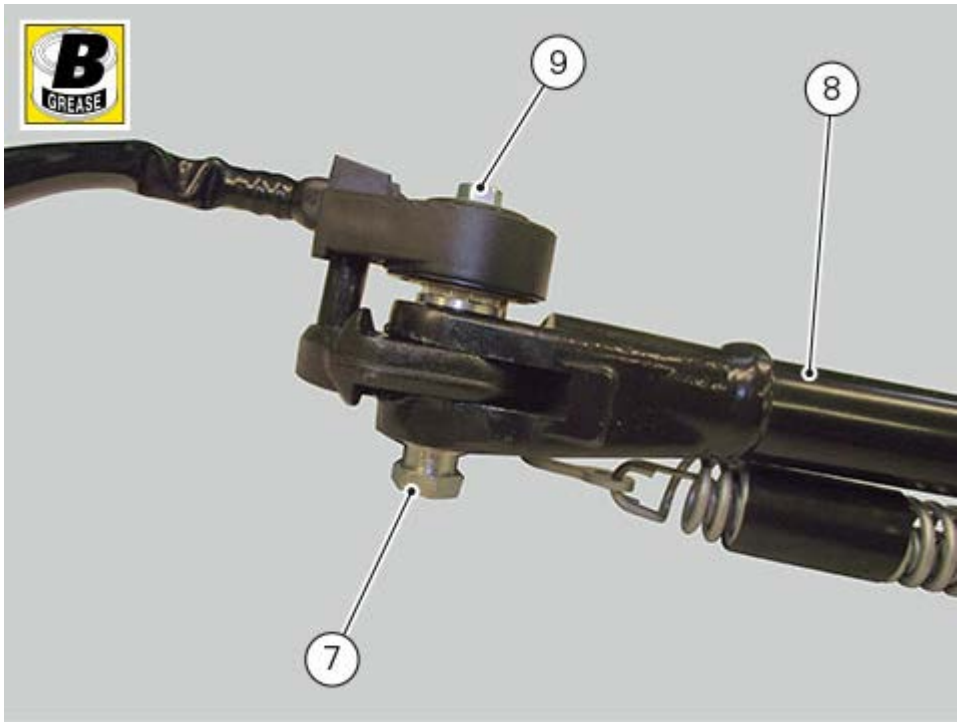




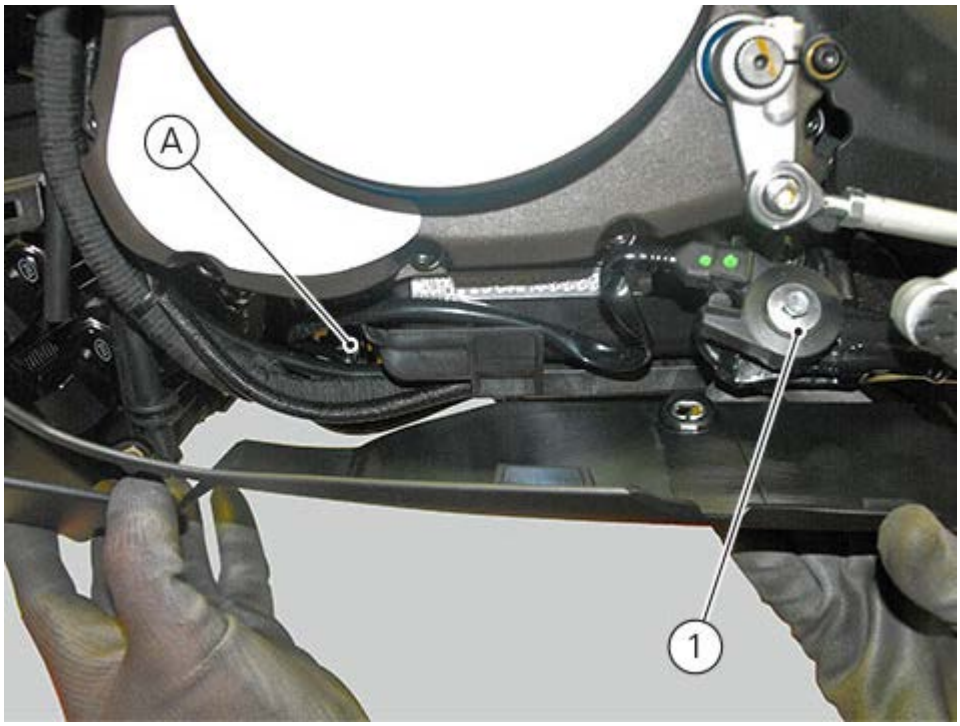
Place the switch (1) on the plate, on its pin (7).
Fit the retaining screw (4) with the specified threadlocker and tighten to a torque of 5 Nm ± 10%.



Refitting the side stand
Position the side stand support bracket (3) to the frame and fit the two screws (2) smeared with the specified threadlocker.
Tighten the screws (2) to a torque of 36Nm ± 10%.



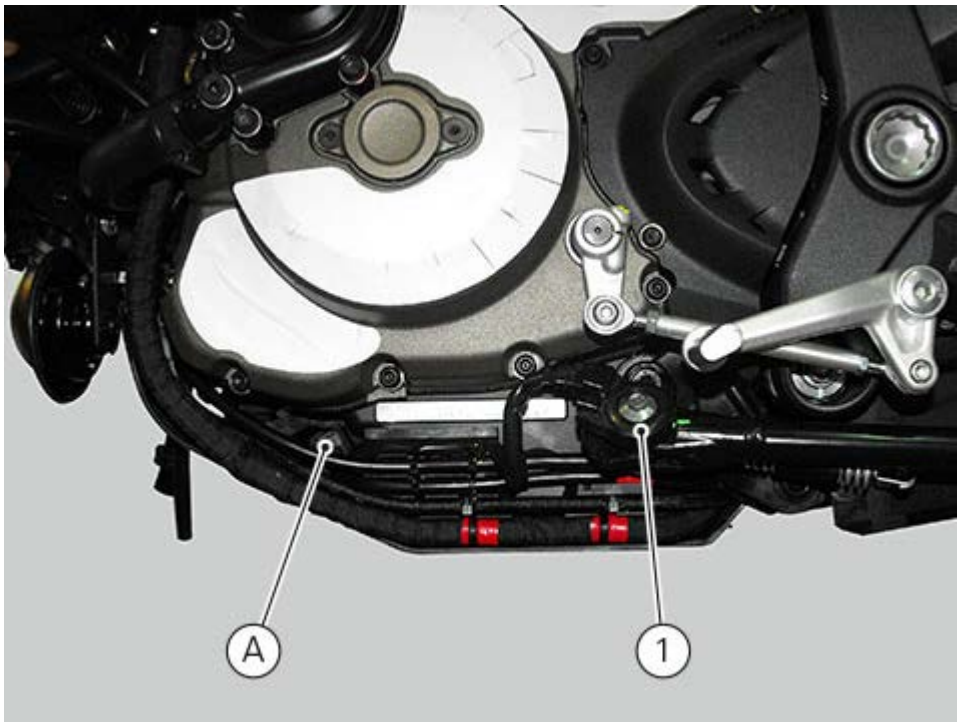
Connect the side stand switch connector (A) to the main wiring.
Refit the front sprocket cover (Refitting the front sprocket cover).
To position stand switch wiring, refer to page "Routing of wiring on frame".



Refit the left wiring cover (Closing the crankcase halves).

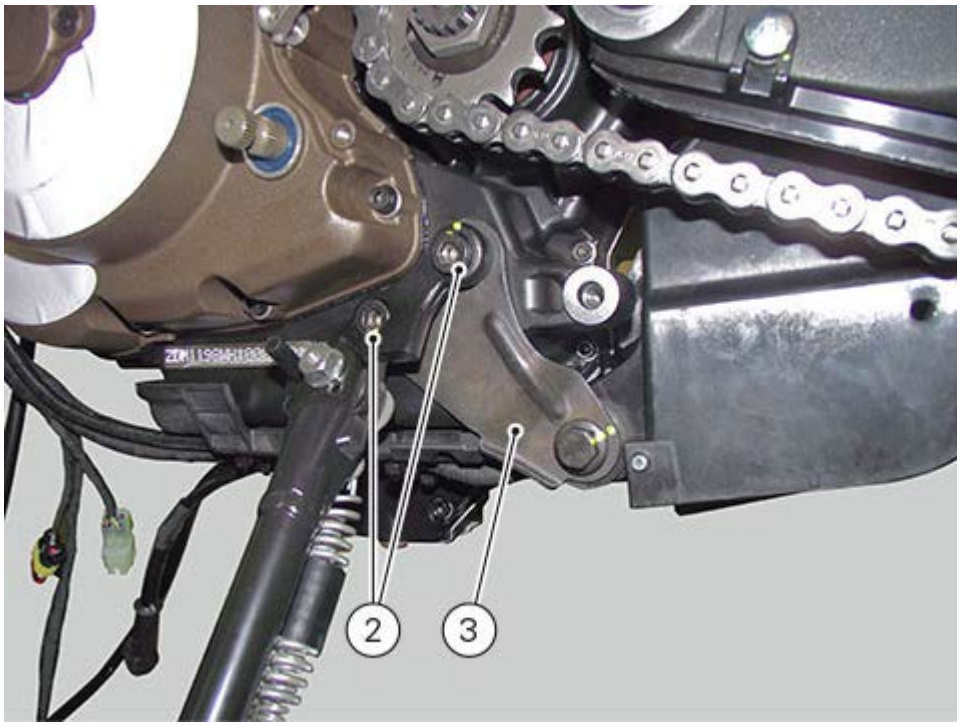
Removing the side stand

Remove the left wiring cover (Separating the crankcase halves).
Disconnect connector (A) of the stand switch (1) from the main wiring.

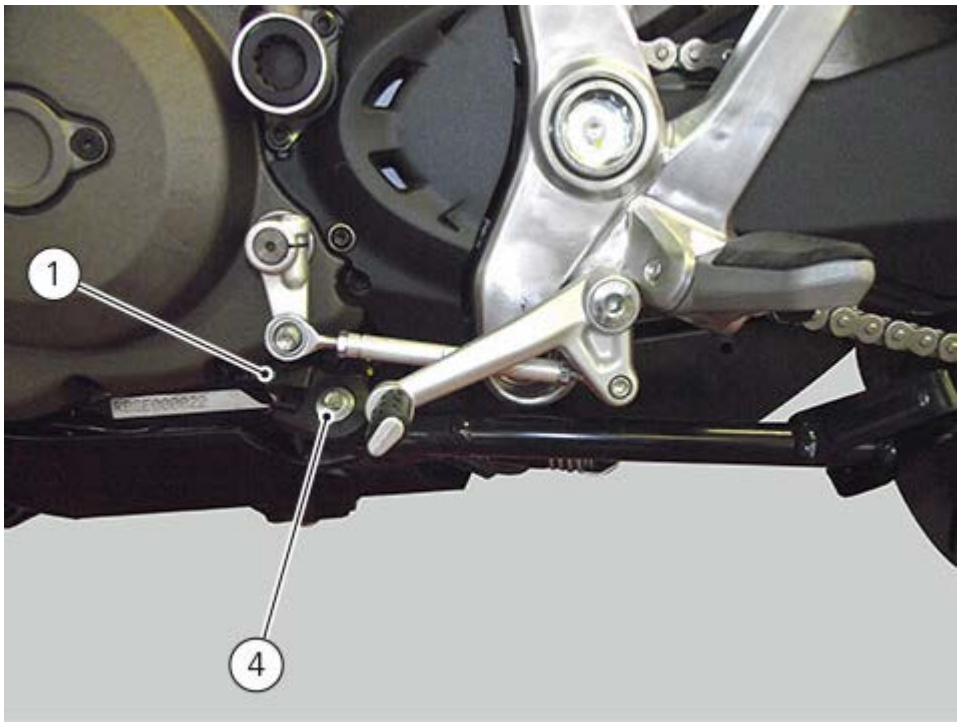


Remove the front sprocket cover (Removing the front sprocket cover).

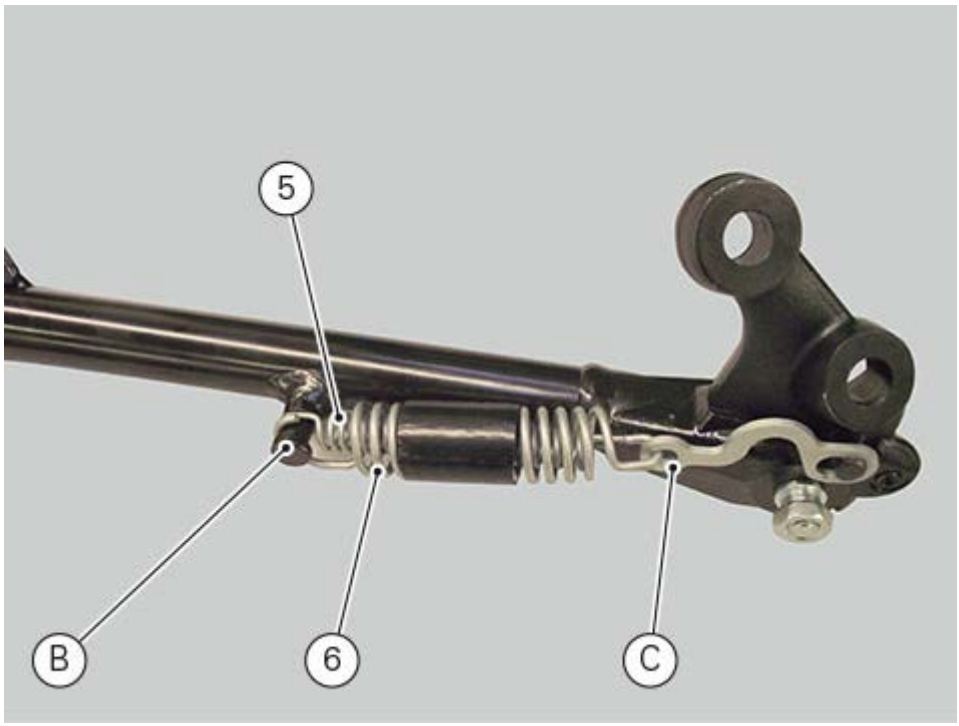
Undo the two fastening screws (2) of the side stand support plate (3) to the engine and remove the complete side stand.

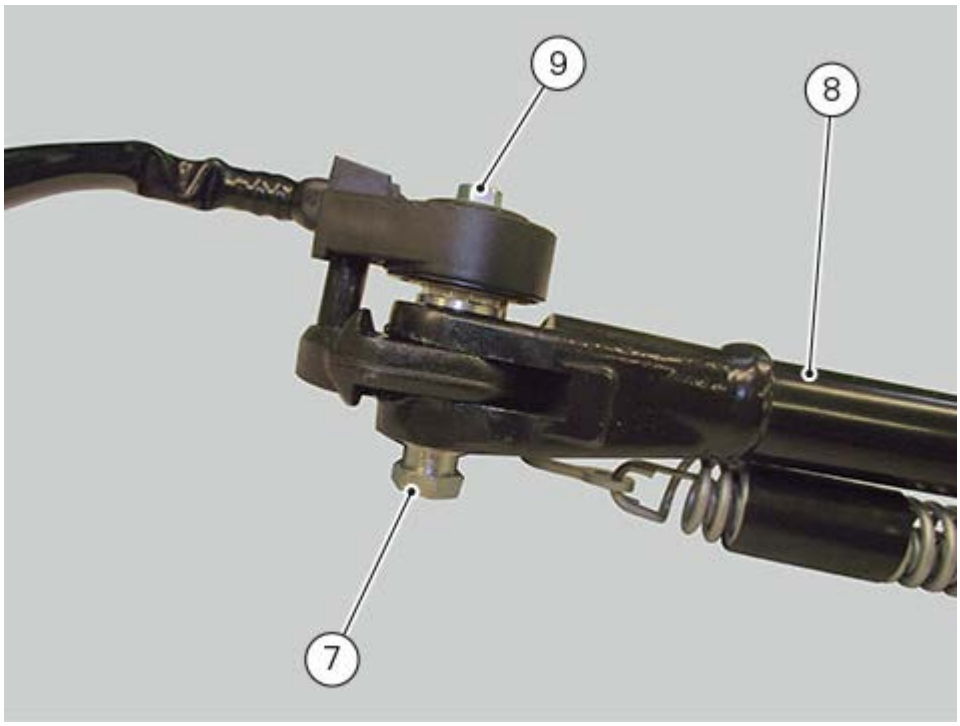


Disassembling the side stand
Undo the retaining screw (4) and remove the side stand switch (1).



Release stand return springs (5) and (6) disengaging them from retainers (B) and (C).
Unscrew the pin (7) securing the side stand to the bracket and remove side stand (8) and nut (9).





Inspecting the side stand

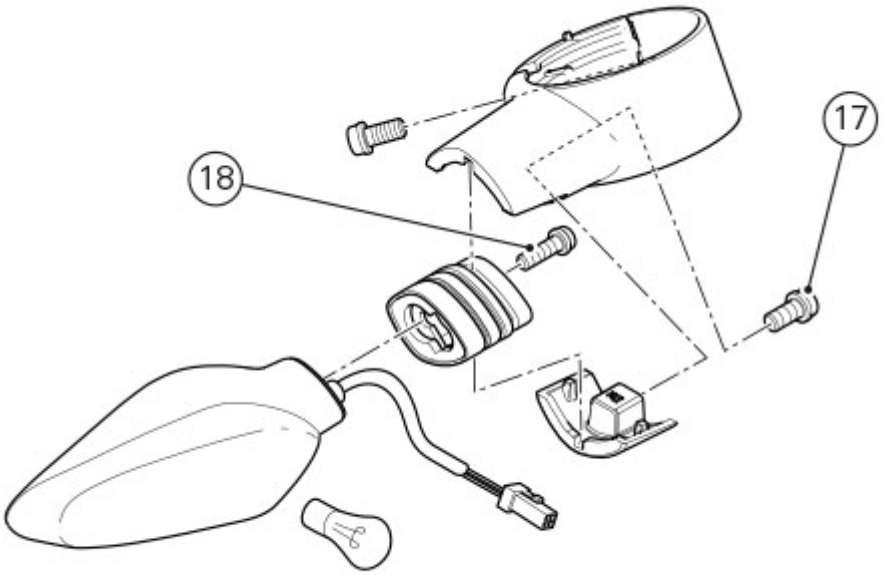
Fit the side stand to the plate and check that there is no excessive clearance. Ensure that the ends of the side stand are not bent with respect to the shank.
A side stand which shows signs of deformation or breakage must be replaced immediately.

Refitting the light assembly

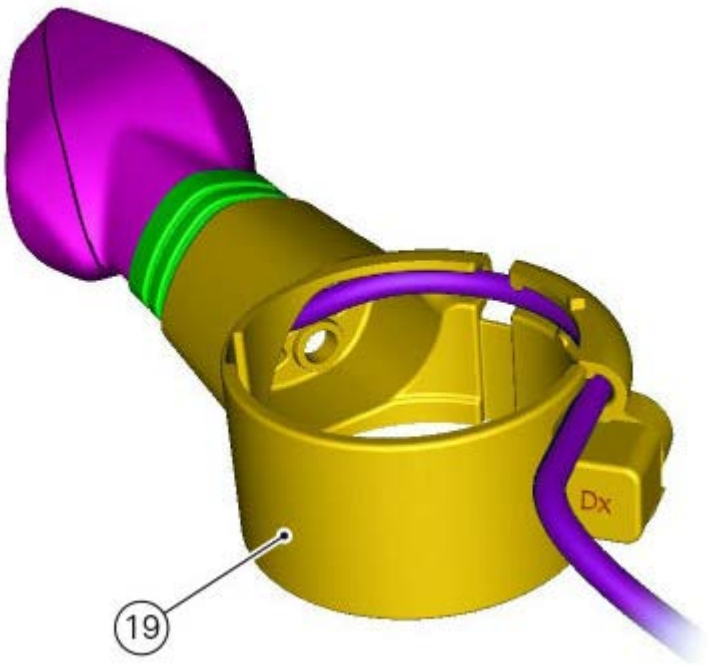
FRONT LIGHT ASSEMBLY

If previously removed, refit front turn indicators as described.

Refitting the turn indicators (USA VERSION, ONLY)
The operations describe the procedure for one turn indicator, but apply to both of them.
If previously disassembled, re-assemble turn indicator by tightening screws (18) and (17) to a torque of 5 Nm ± 10%, taking care to insert lower cover (20) support (19) and (C) edges (B) inside spacer (20) groove (D).



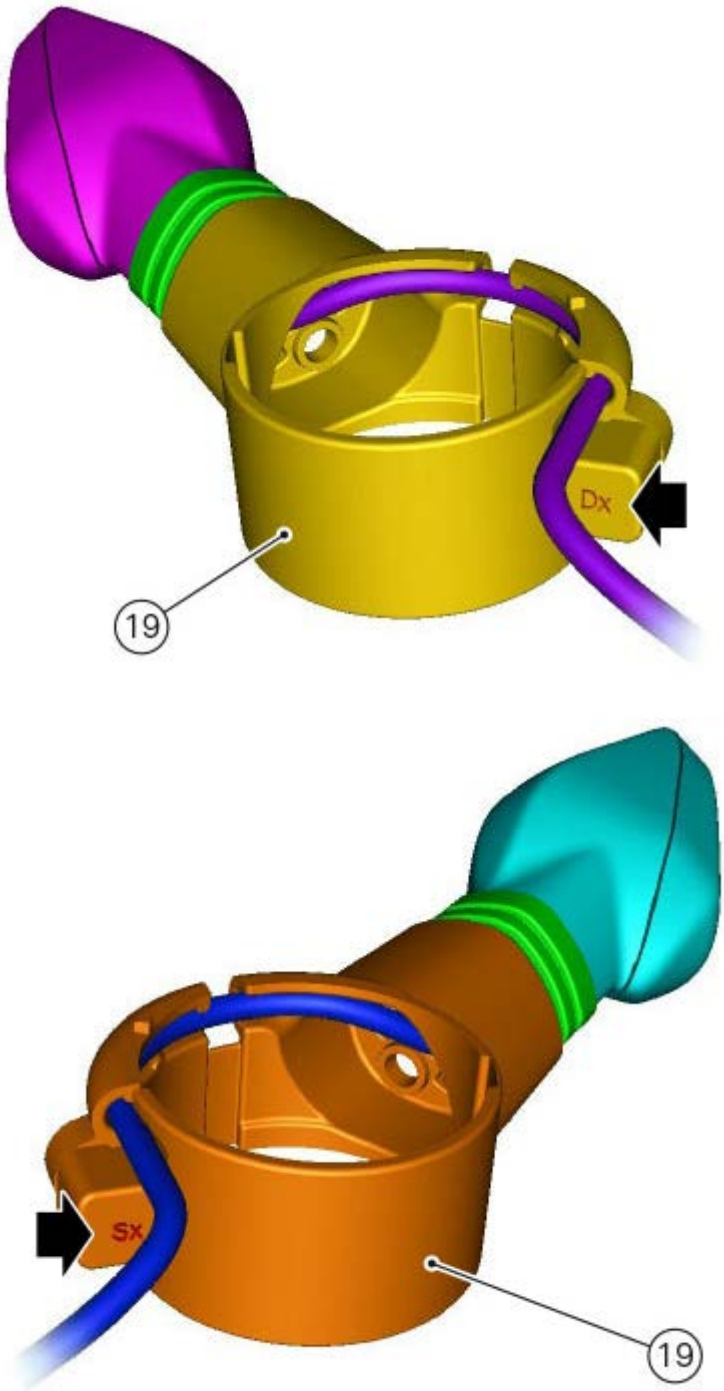
Duly route wiring.

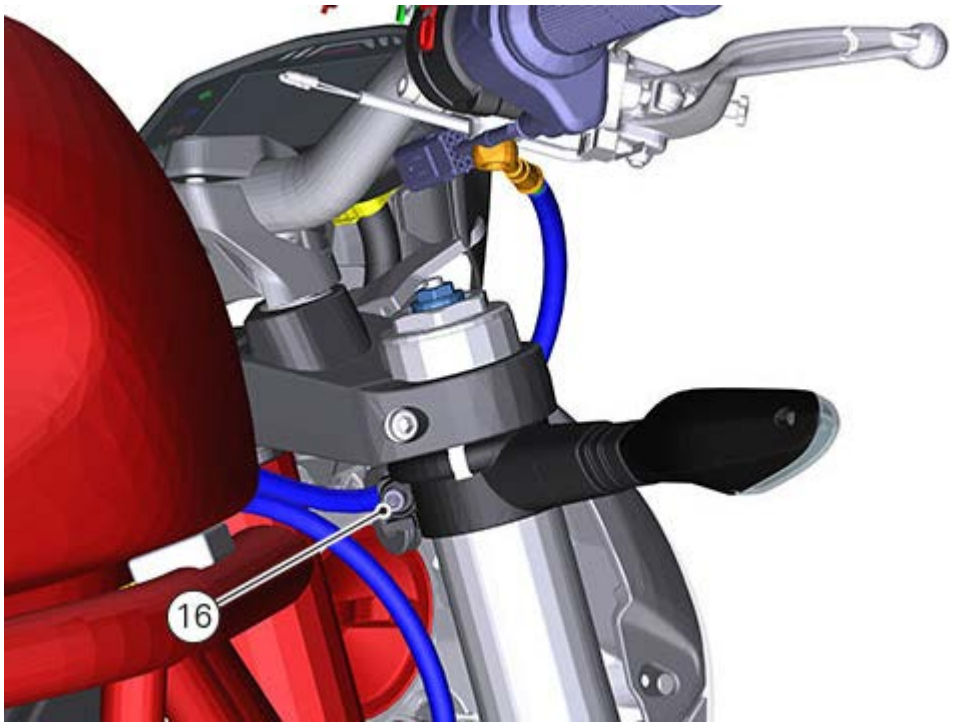


Important
Do not invert the positions of the supports having a specified positioning direction on vehicle

Fit the complete turn indicator on the relevant fork leg, and tighten screw (16) fully home, then loosen it by

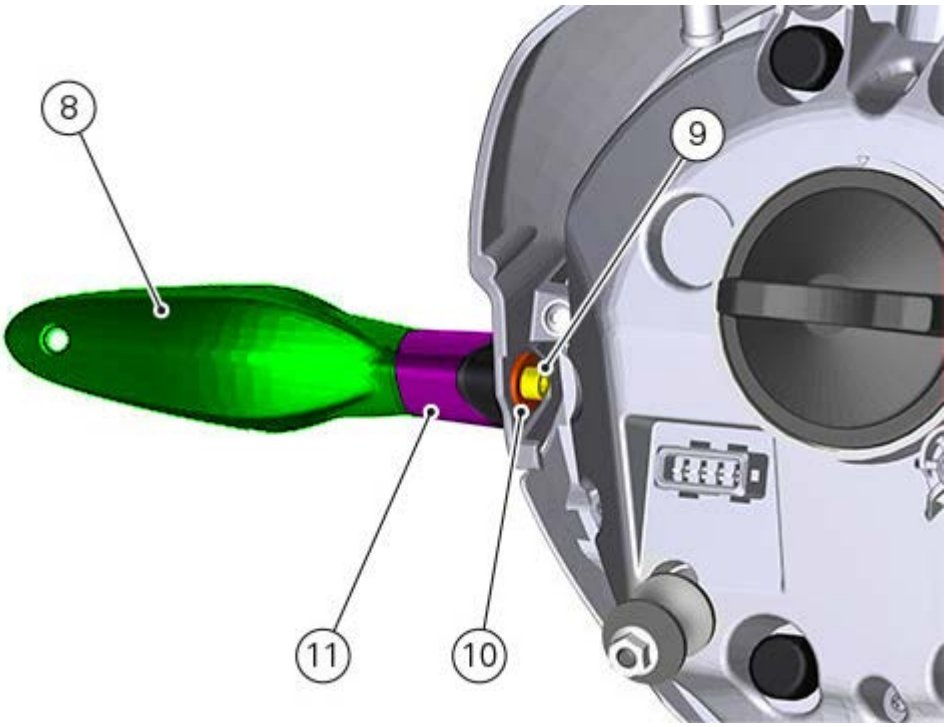
two complete turns (360°+360°).

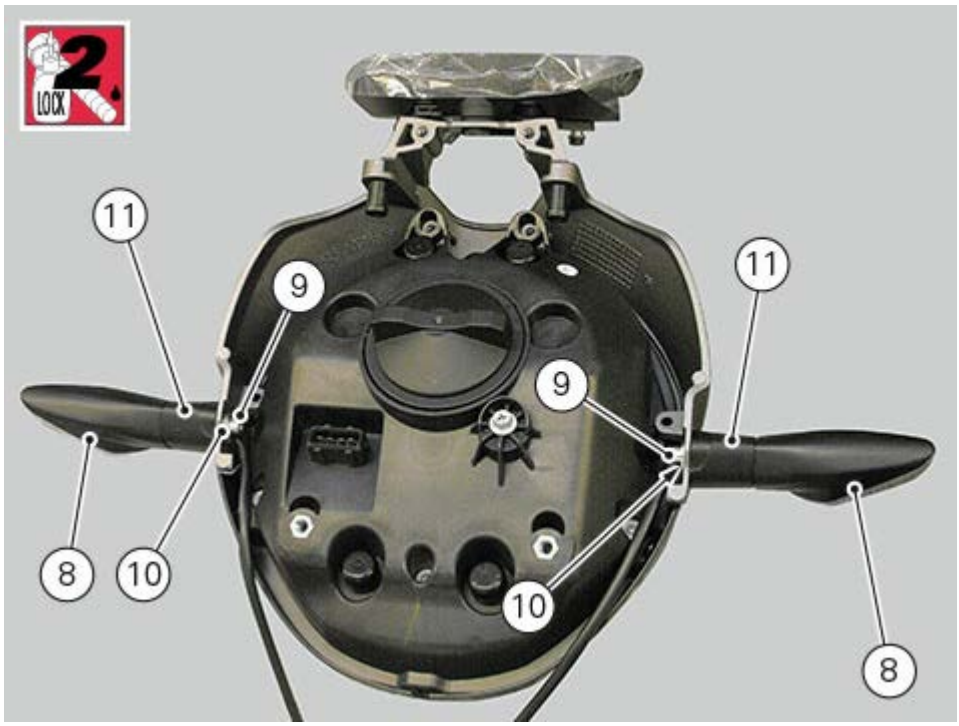


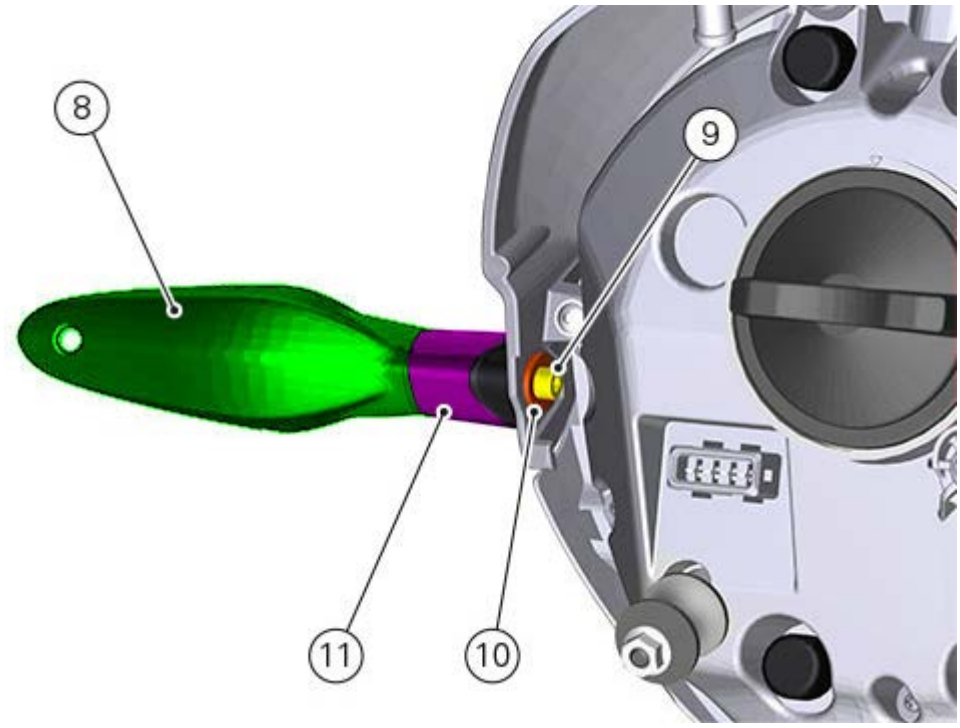


Refit fork leg on steering head (Refitting the front fork).

Refitting the turn indicators
The operations describe the procedure for one turn indicator, but apply to both of them.
Fit turn indicator (8), complete with collar (11) and plate (10), duly inside its seat.
Tighten screw (9) to a torque of 3 Nm ± 10% after having applied the specified threadlocker.

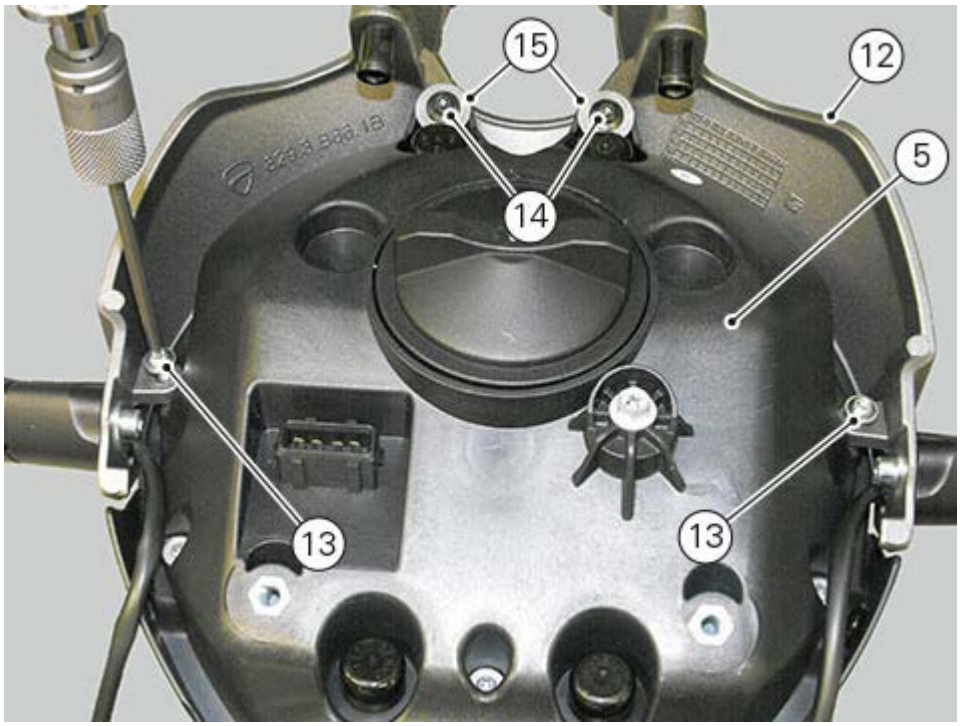




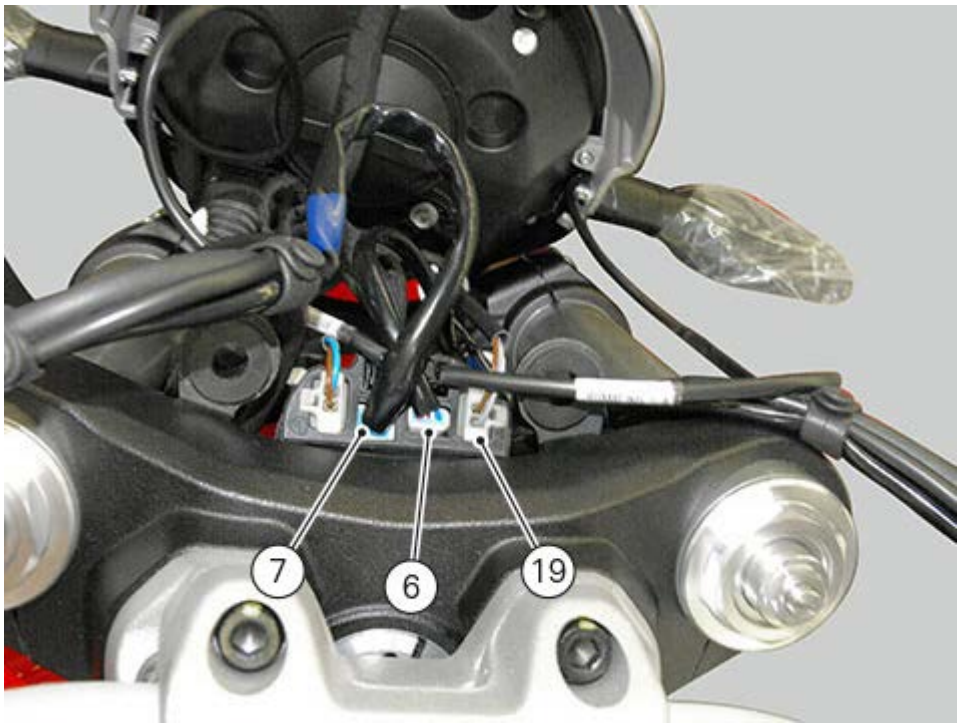


If previously removed, refit the headlight.

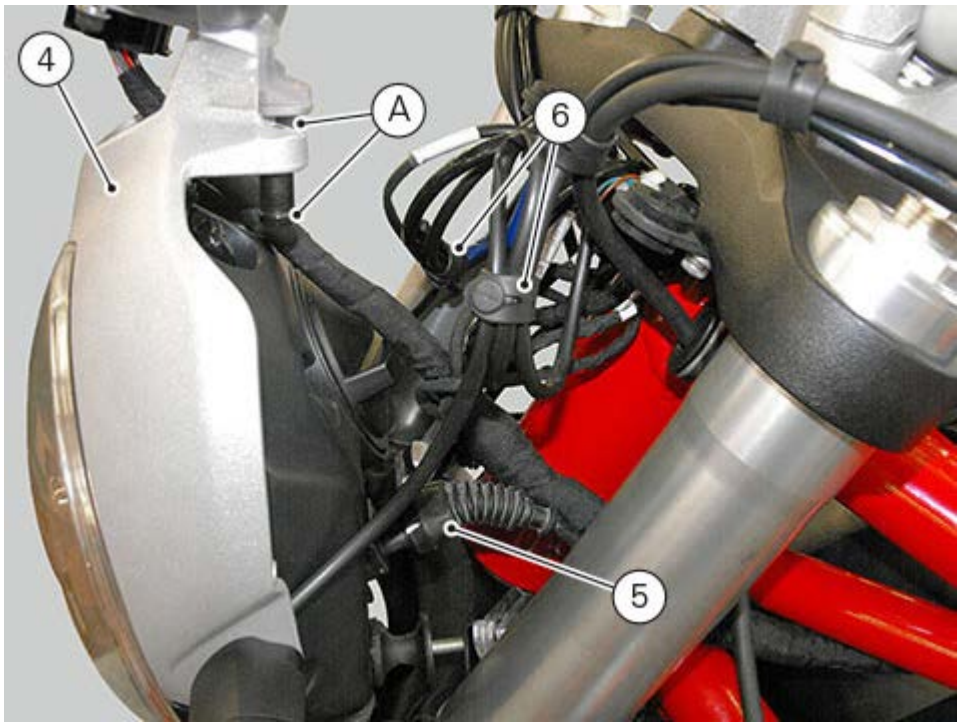
Refitting the headlight
Fit the headlight (5) inside the support cover (12), and secure it in place by tightening screws (13) to a torque of 8 Nm ± 10%.
Position spacers (15) and tighten screws (14) to a torque of 5 Nm ± 10%.



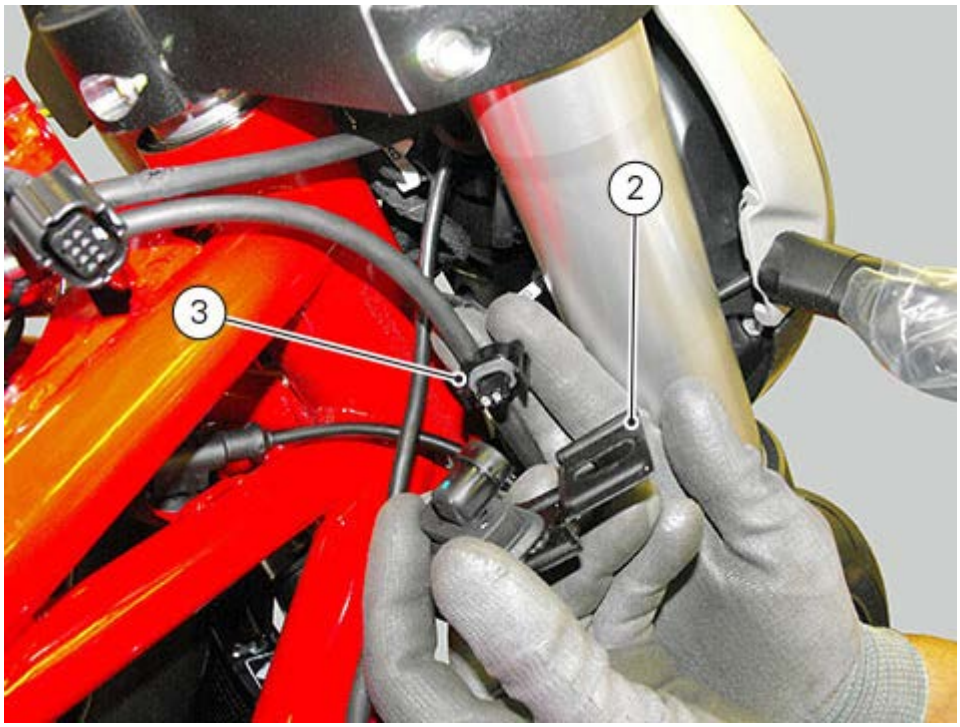
Connect RH (6) and LH (7) turn indicator connectors.
Fit connectors inside the rubber support (19), as specified.

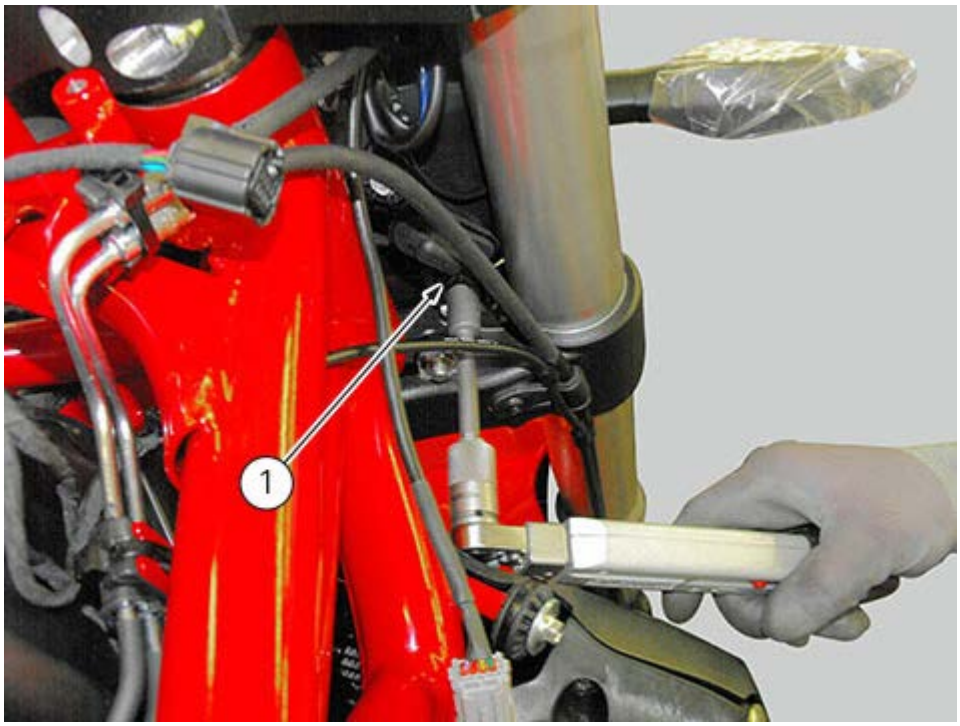


Connect the headlight connector (5).
Fit the front light assembly (4) to vehicle, securing it in place with pins (A).
Slide wirings inside cable rings (6), as specified.

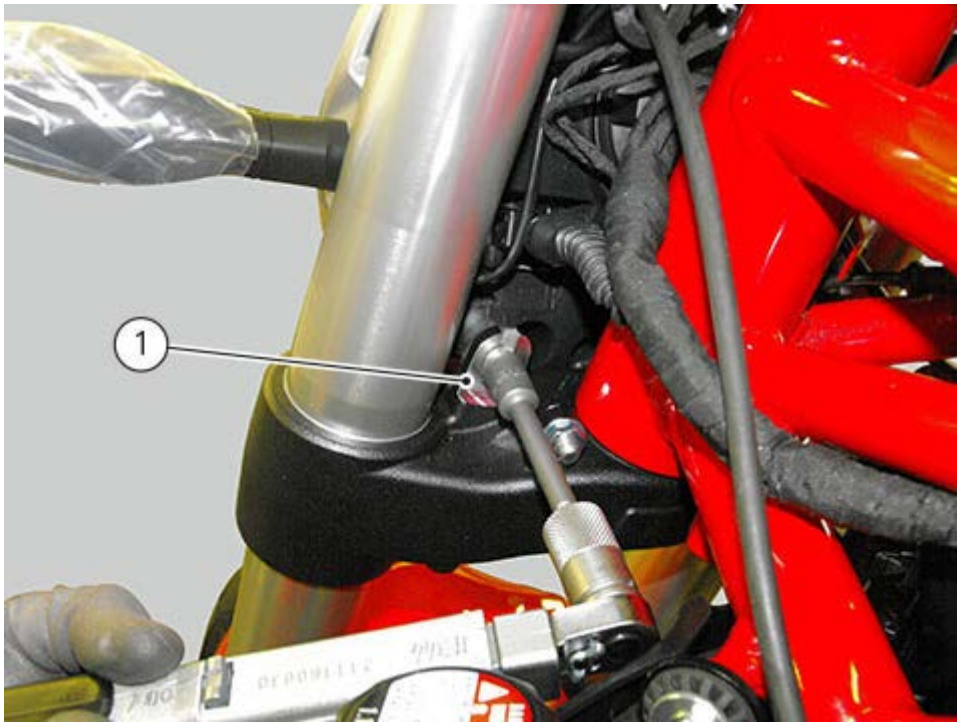


Connect temperature sensor (3), and secure it to vehicle (on RH side) using the special bracket (2). Tighten nuts (1) to a torque of 8 Nm ± 10%.





Working on vehicle left-hand side, tighten nut (1) to a torque of 8 Nm ± 10%.

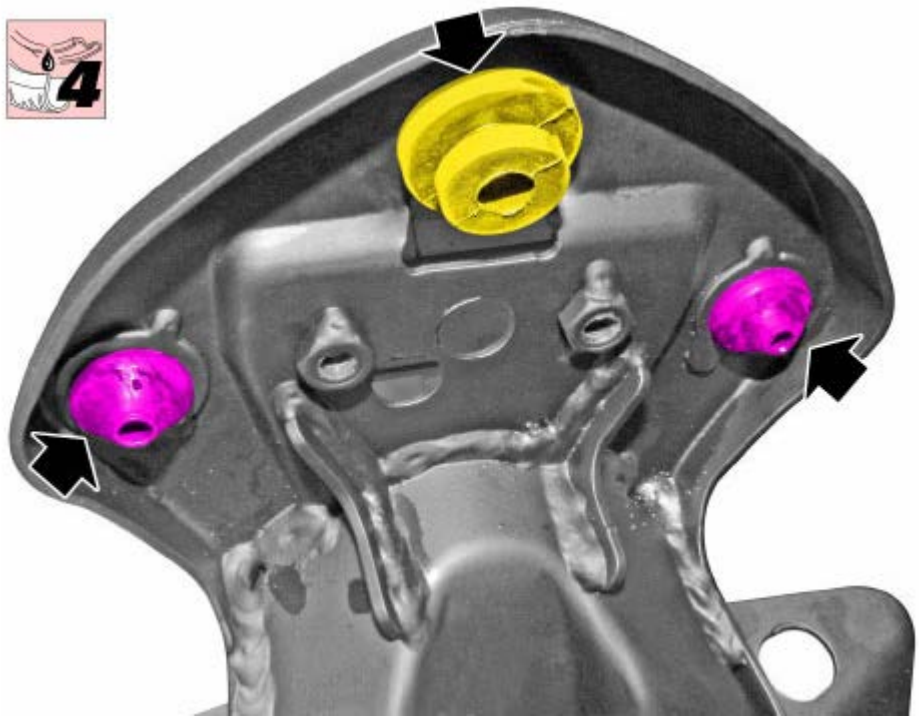


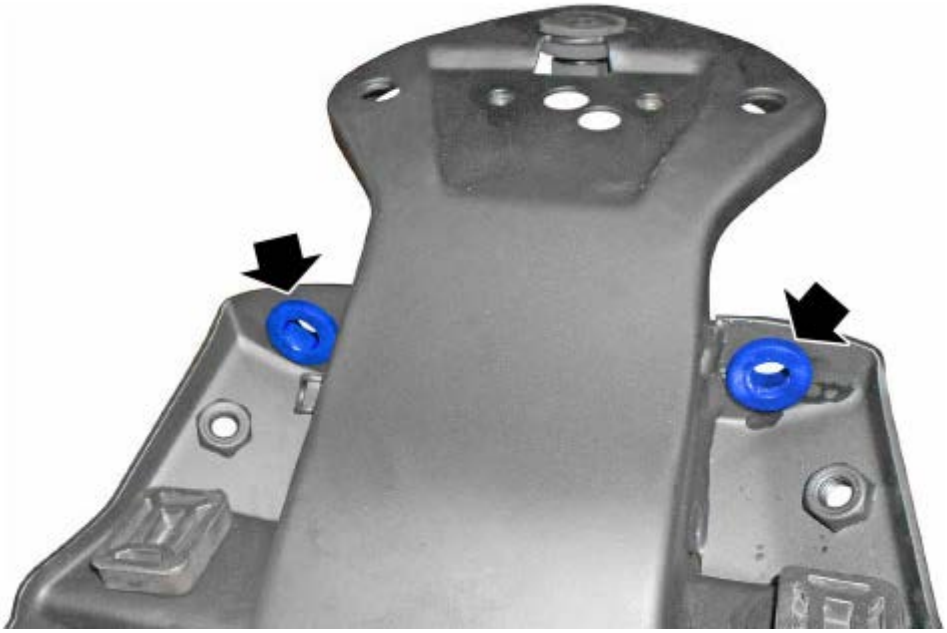
Refit the instrument panel (Refitting the instrument panel).

Refitting the rear subframe

For refitting the rear subframe, follow the procedure described in "Removing the rear subframe" in reverse order.

If removed, smear the vibration damping pads with the indicated product, before fitting them on the vehicle.





Slide out the rubber gaiter of rear subframe connector (4) from the rear side by at least 25 mm.
Release connector (5) from the rubber gaiter to allow a correct connection with connector (4).
Once connected, refit the two rubber gaiters and fix the rear subframe wiring with two ties (A).

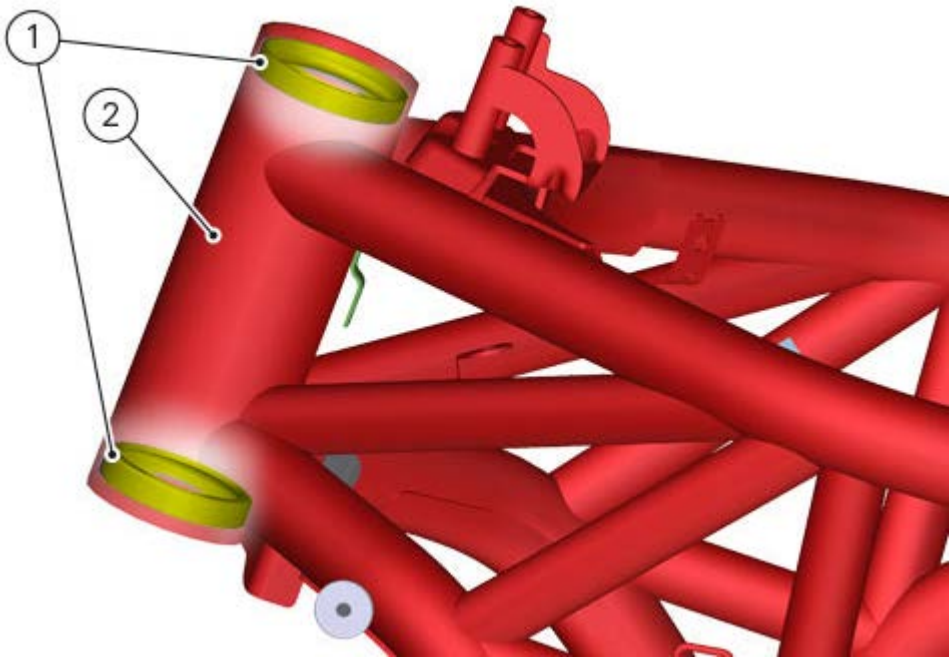
Refit the tail light (Refitting the tail light).
Connect the seat release mechanism (Refitting the seat release mechanism).
Refit the seat bottom cover (Refitting the seat bottom cover).
Refit the rear grab handles (Refitting the rear grab handles).
Refit the side panels (Refitting the seat).
Only for the **AUSTRALIA version**, refit the splash guard together with the number plate holder (Refitting the number plate holder) and the tail light (Refitting the tail light).
Check and if necessary restore the correct position of the wirings as described in paragraph "Routing of wiring on frame".
Refit the seat (Refitting the seat).

Refitting the structural parts and frame

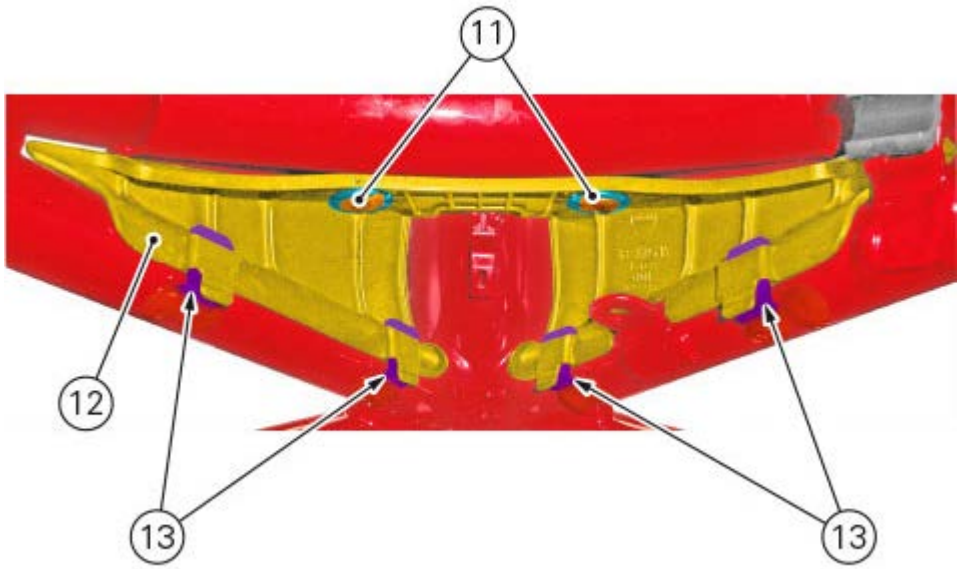
If previously removed, refit frame and rear subframe components, as described.

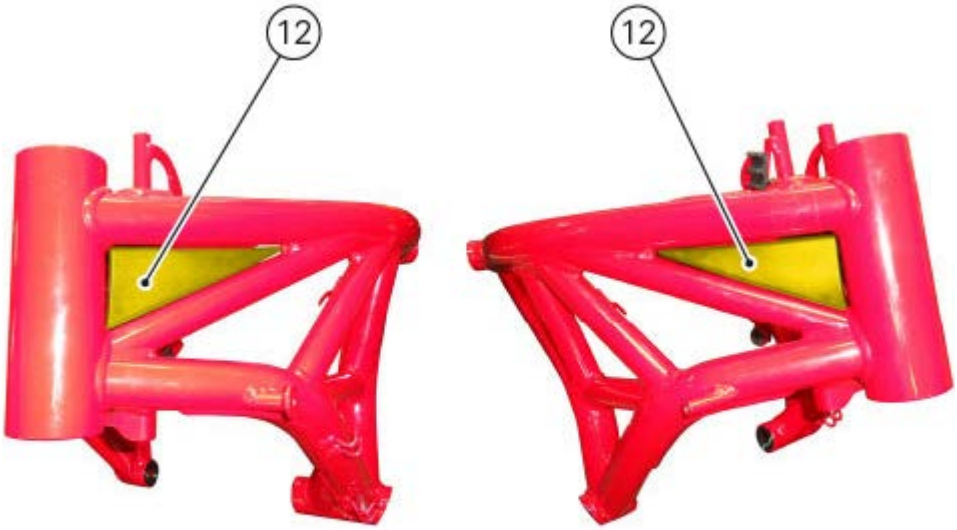
FRAME

Make sure that the two outer rings (1) in the steering tube (2) are fitted.

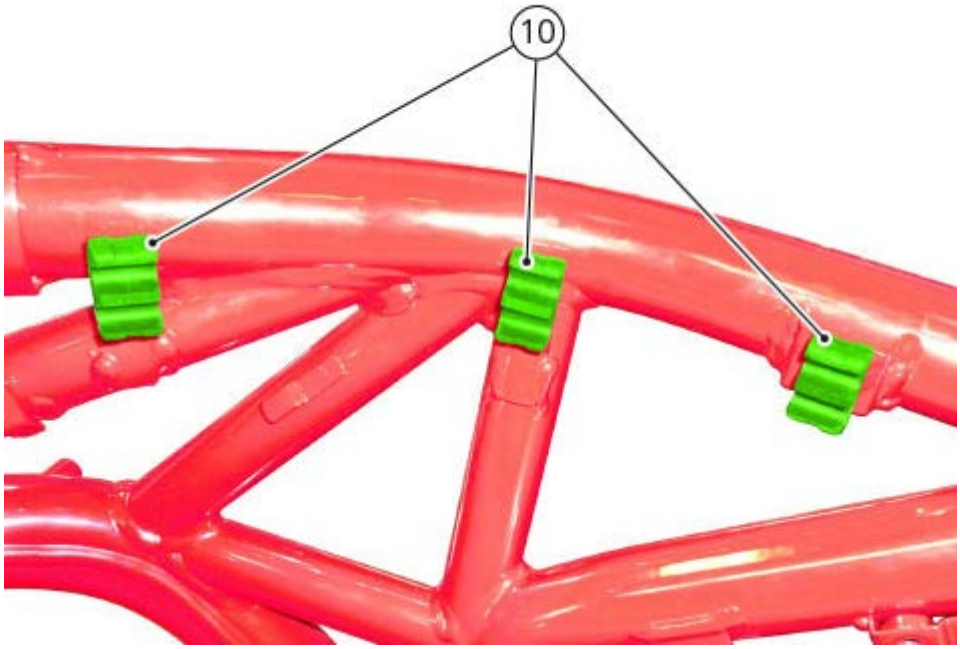


Refit steering tube protection (12) by engaging it on tabs (13) and refit the two retainers (11).

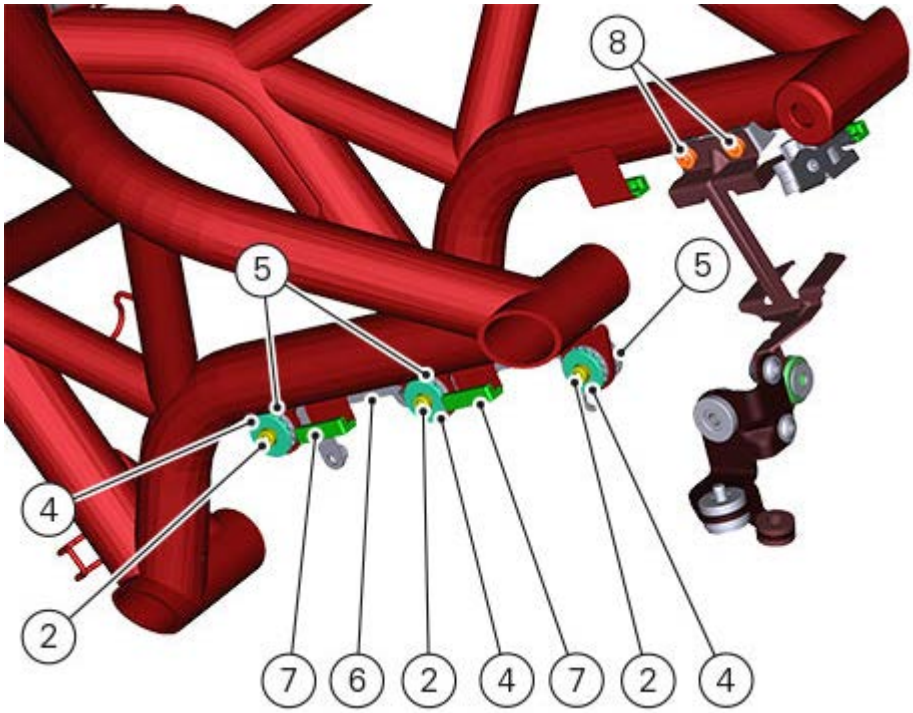


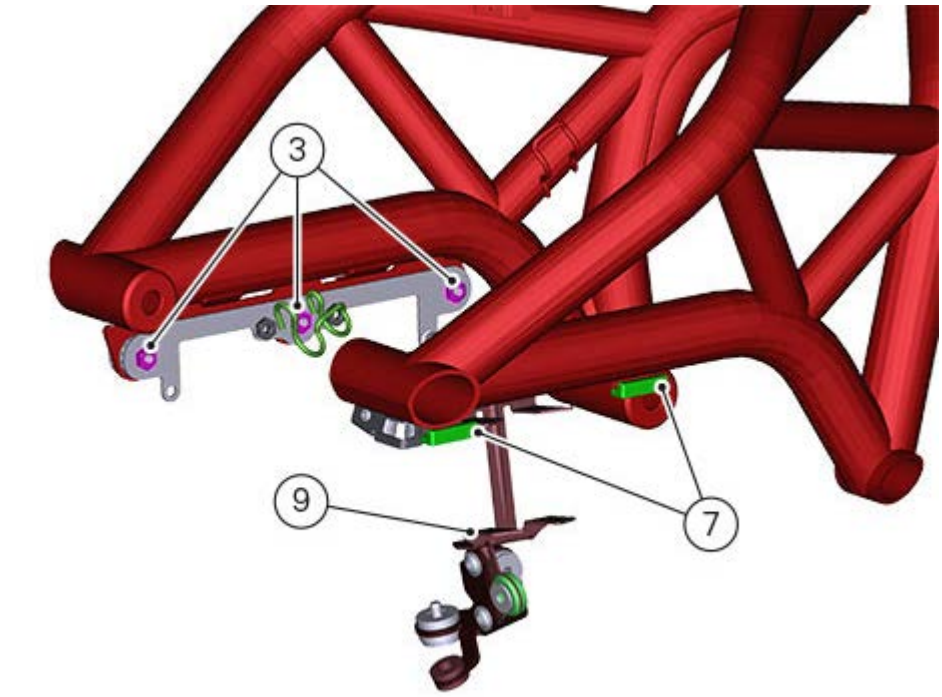


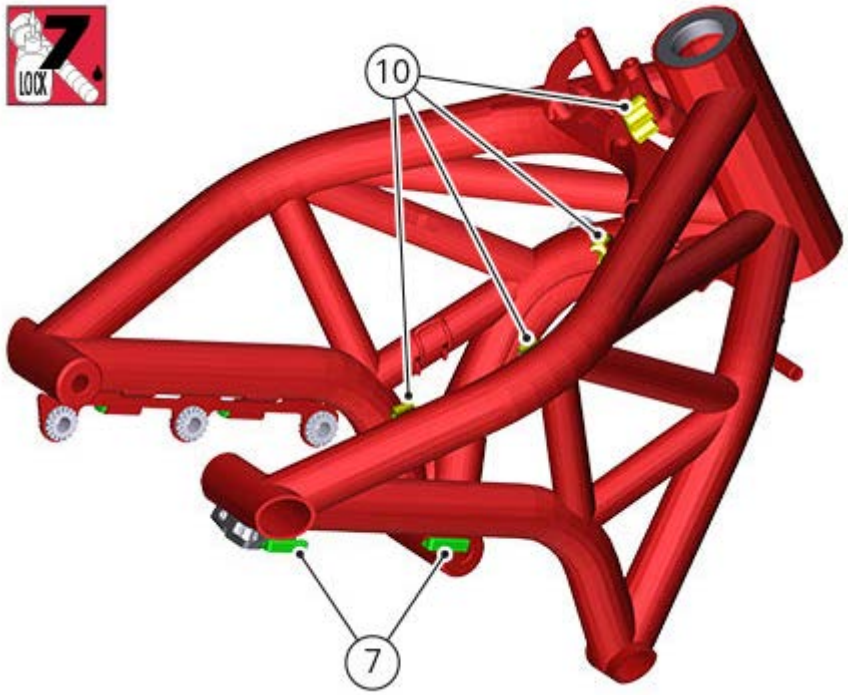
Position hose grommets (10) on the frame after having applied the indicated product.



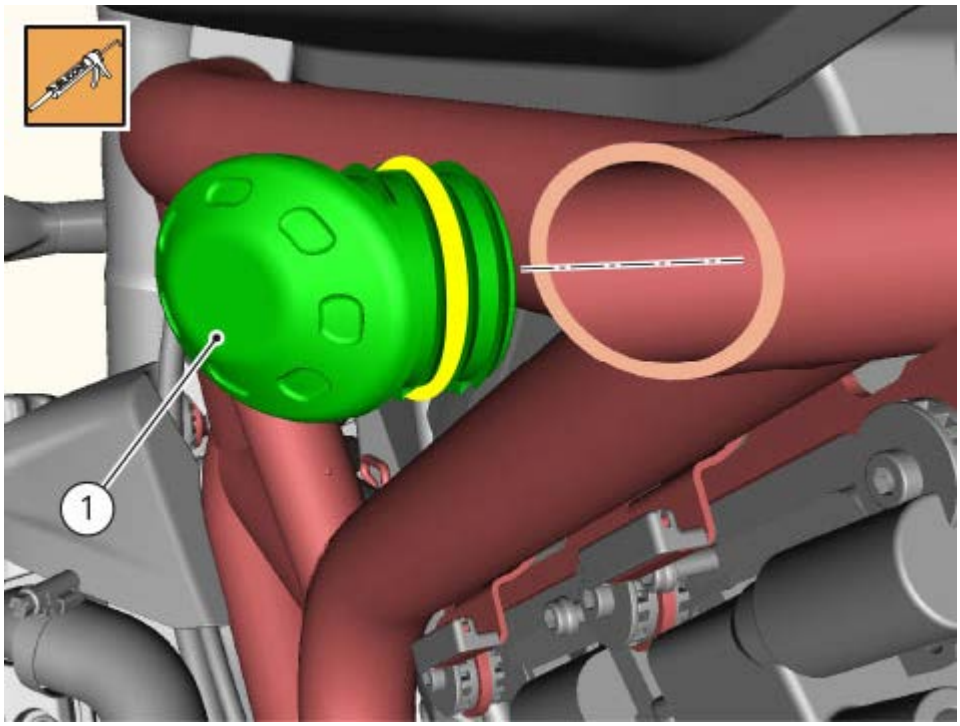
Fit ABS support bracket (9), and secure it to frame by tightening the two screws (8).
Fit vibration damping pads (5), washers (4) and coil support bracket (6).
Secure bracket (6) in place by tightening screws (2) with nuts (3) on frame inner side, to a torque of 6 Nm ± 10%
Working on vehicle outer side, fit the four vibration dampers (7) into their seats.

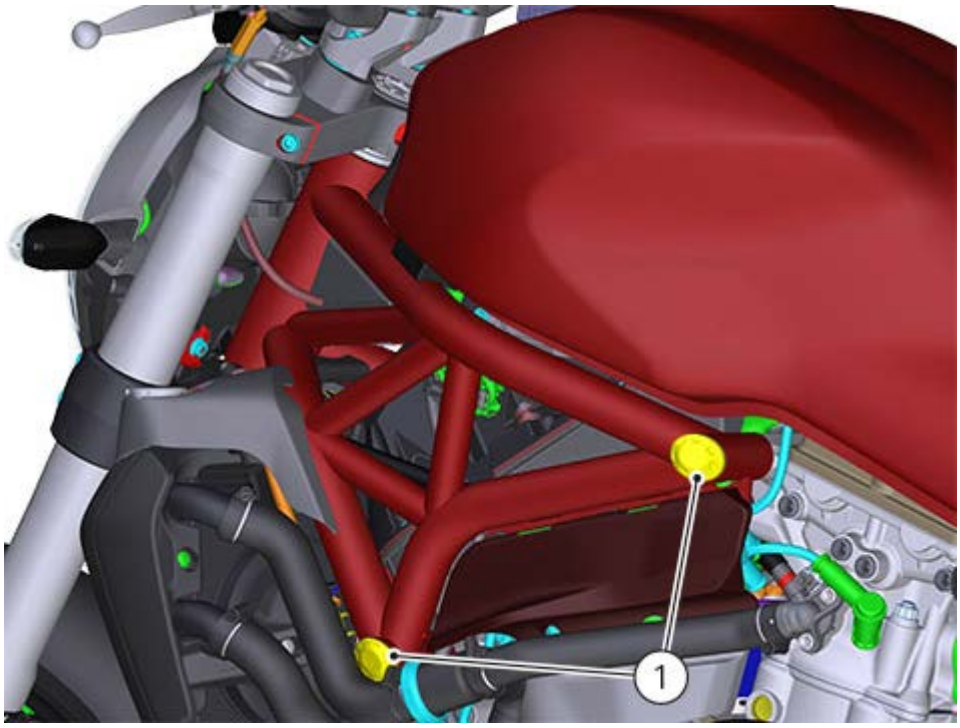






Apply the specified binding and isolating product all around plug (1) groove, by filling it.


1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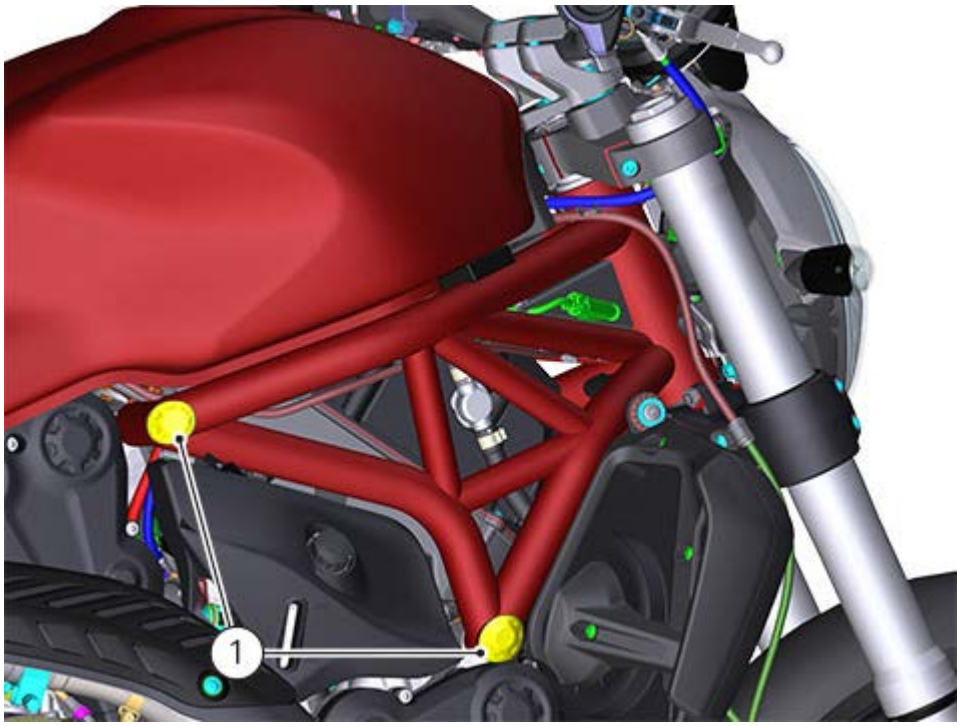
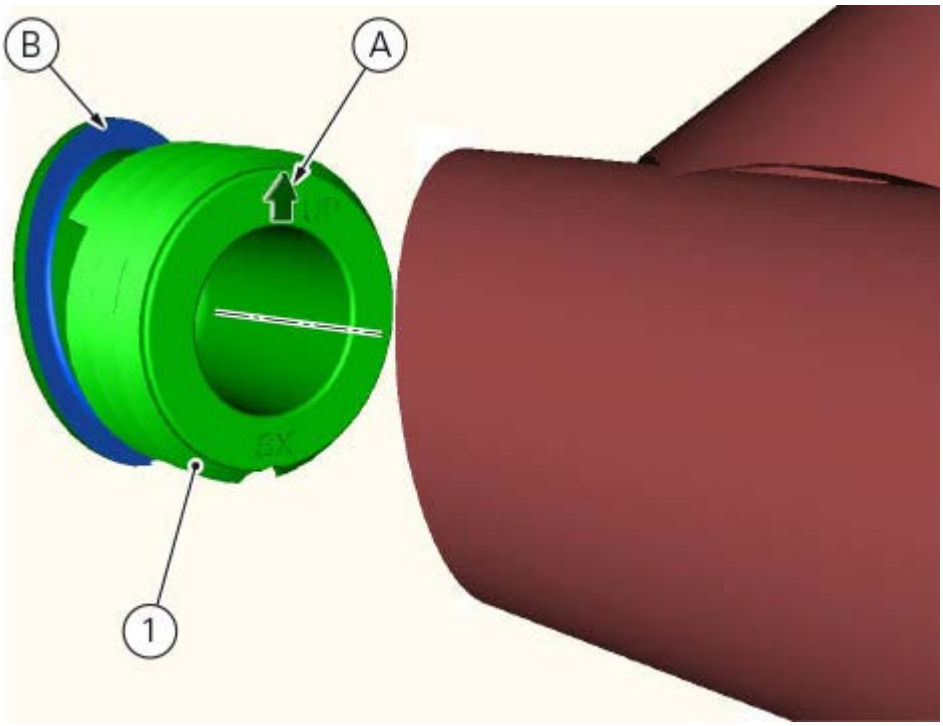


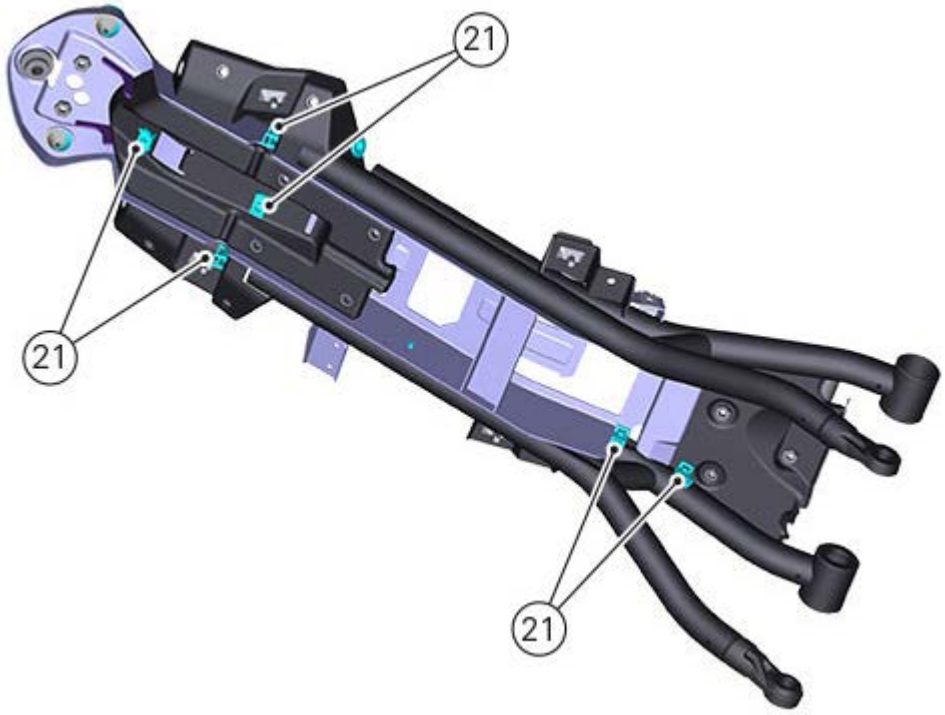
When inserting the front right plug (1) make sure it is positioned as shown, i.e. with side (M) between the frame and the radiator cover.

Working on both sides of frame and paying special attention to the positioning direction (A) (arrow up), insert plugs (1) inside frame, making sure to drive surface (B) fully home.

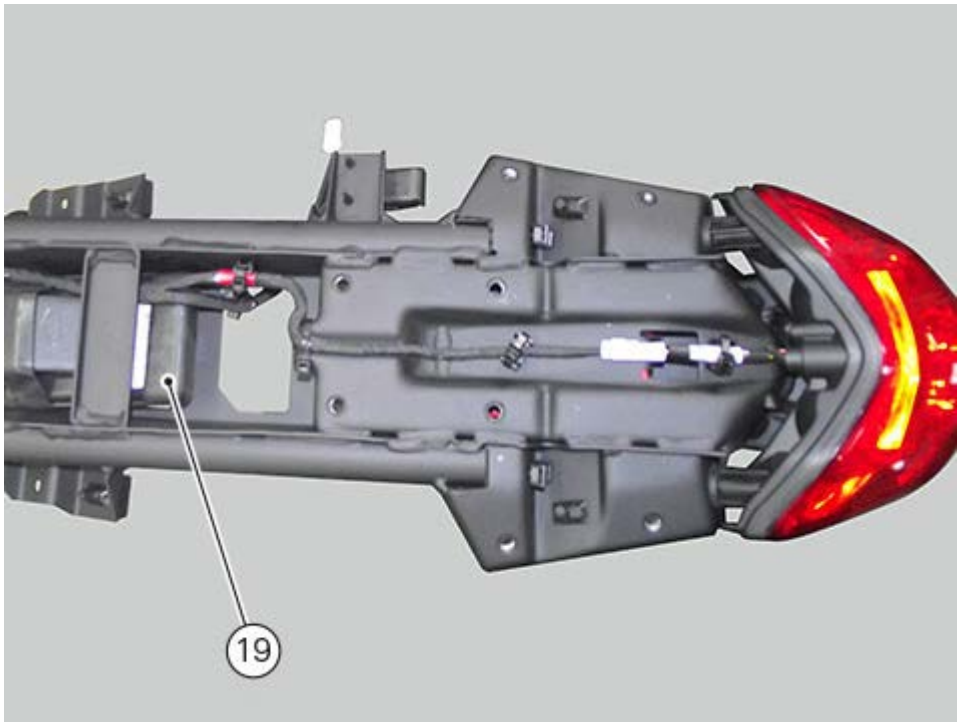


REAR SUBFRAME

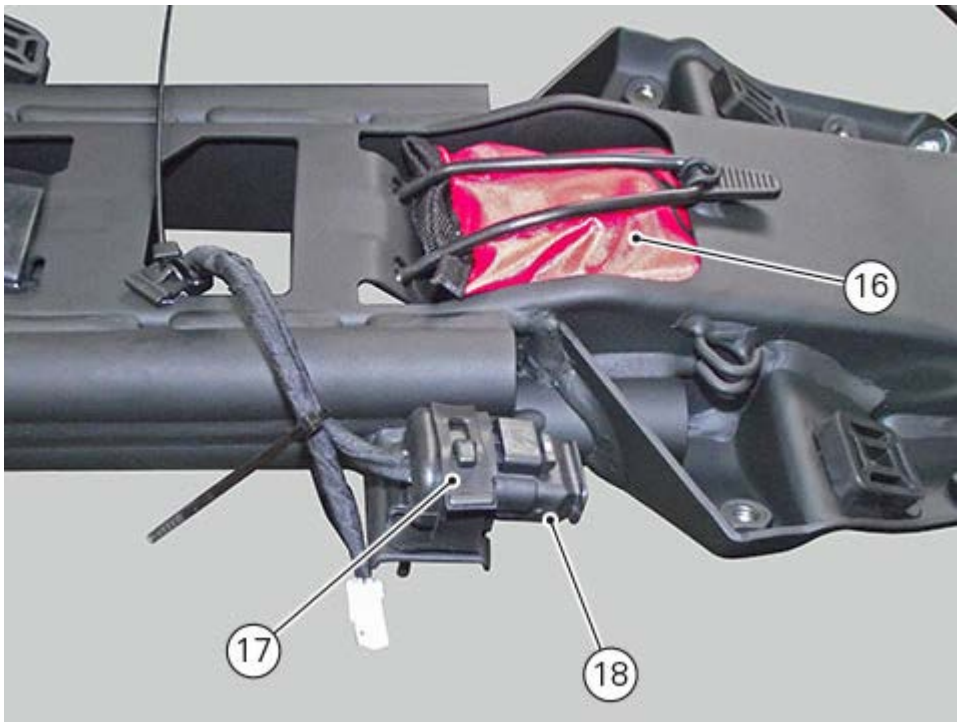
Refit the four rubber blocks (20) and cable rings (21).



Refit the seat release mechanism (Refitting the seat release mechanism).
Refit the black box control unit (19) on the subframe with the relevant vibration damping support.



Refit retainer (17) of diagnostic socket (18).
Reposition the tool box (16) and fasten it with the rubber band.



Refit the rear subframe(Refitting the rear subframe).
Refit tail light (Refitting the tail light) and the number plate holder (Refitting the number plate holder).
For the **AUSTRALIA version**refit the splash guard together with the number plate holder (Refitting the number plate holder) and the tail light (Refitting the tail light).

REFITTING THE COMPONENTS

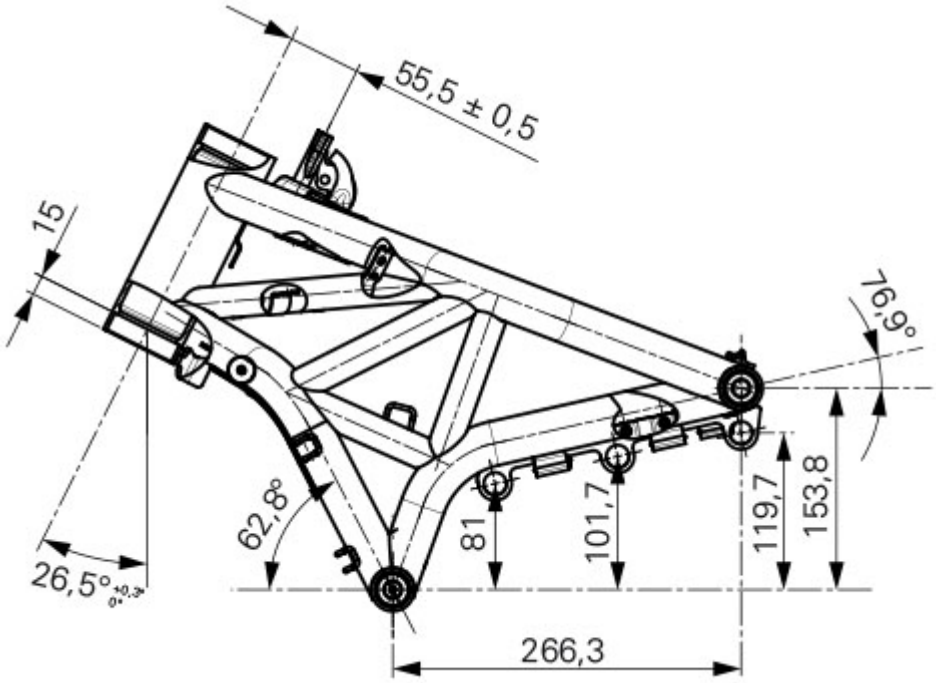
Once frame and rear subframe preliminary operations have been completed, refit all removed components, following the procedure described in "Removing structural components and frame" in reverse order.

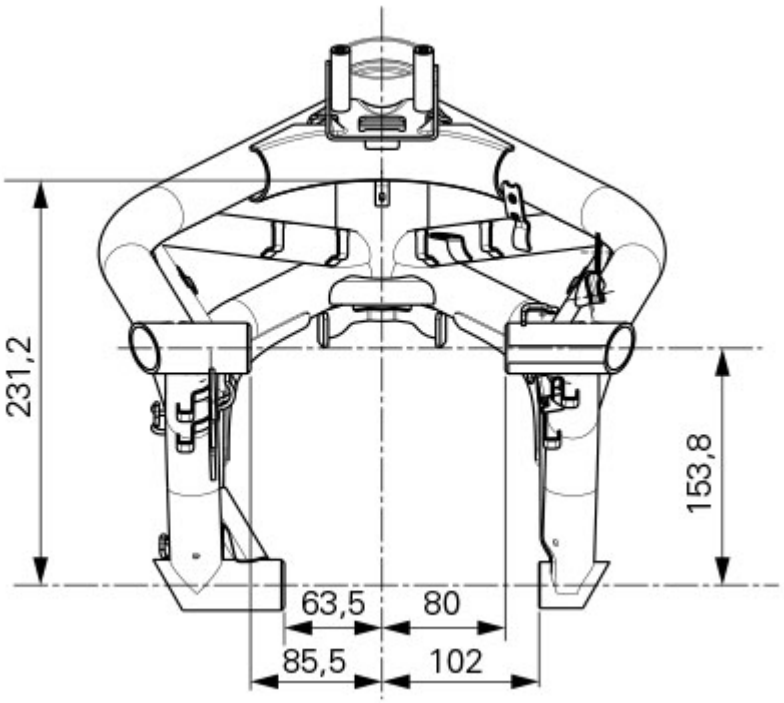
FRAME

Compare the dimensions of the frame with the values indicated here to determine whether it needs to be re-aligned or replaced.

Important
Damaged frames must be changed, not repaired. Any work carried out on the frame can give rise to potential danger, infringing the requirements of EC directives concerning manufacturer's liability and general product safety.

Frame overall dimensions (mm)





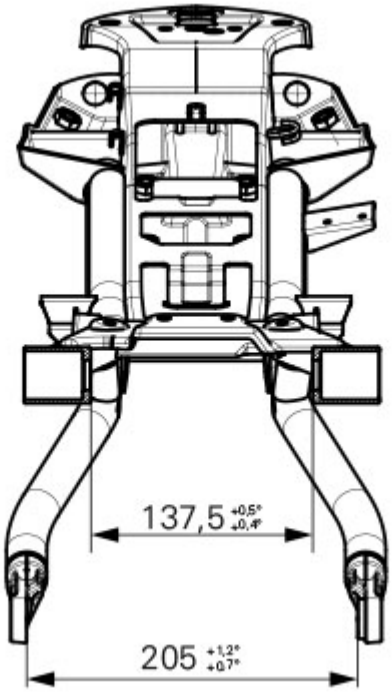
REAR SUBFRAME

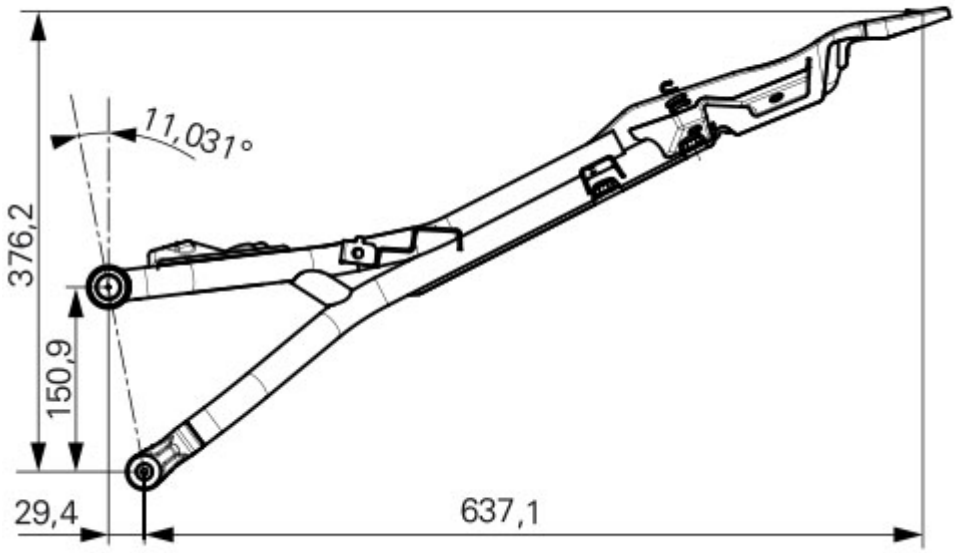
Compare the dimensions of the frame with the values indicated here to determine whether it needs to be re-aligned or replaced.

Important

Damaged frames must be changed, not repaired. Any work carried out on the frame can give rise to potential danger, infringing the requirements of EC directives concerning manufacturer's liability and general product safety.

Subframe overall dimensions (mm)





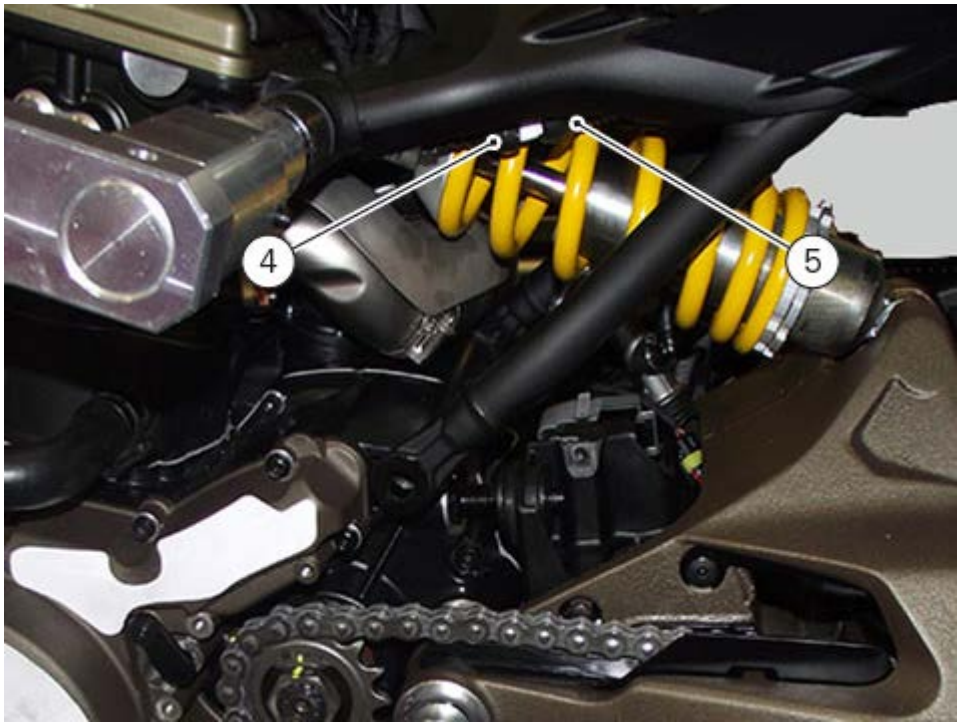
Removing the rear subframe

Remove the seat (Removing the seat).
Remove the rear grab handles (Removing the rear grab handles).
Disconnect the seat release mechanism (Removing the seat release mechanism).
Remove tail light (Removing the tail light) and the number plate holder (Removing the number plate holder).

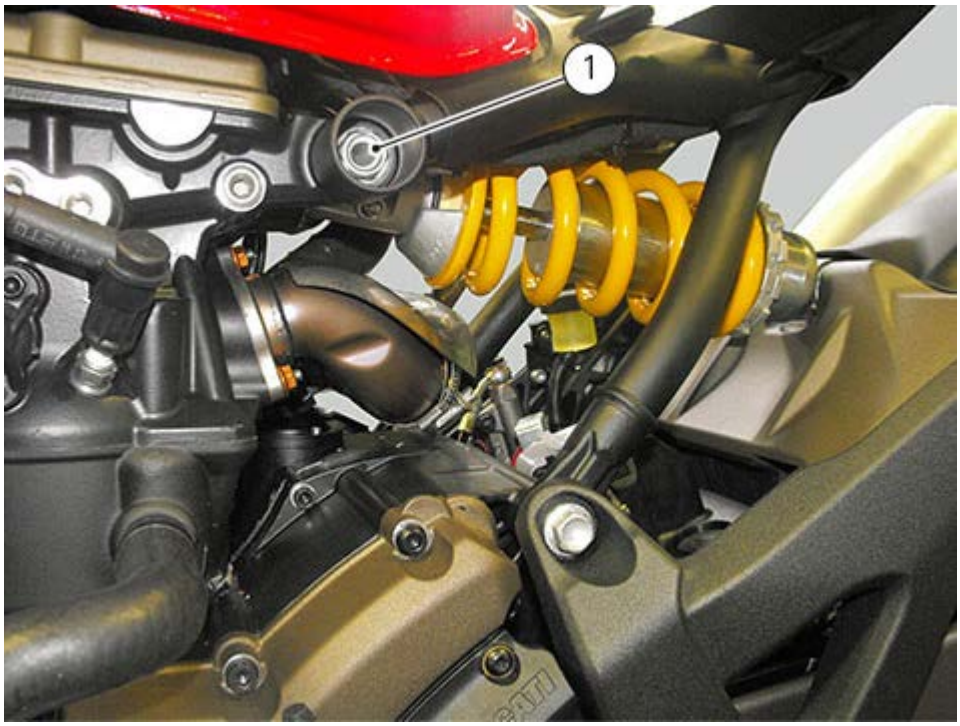
Only on the **AUSTRALIA version**, remove also the splash guard together with the number plate holder (Removing the number plate holder) and the tail light (Removing the tail light).

Remove the side panels (Removing the seat).
Remove the seat bottom cover (Removing the seat bottom cover).

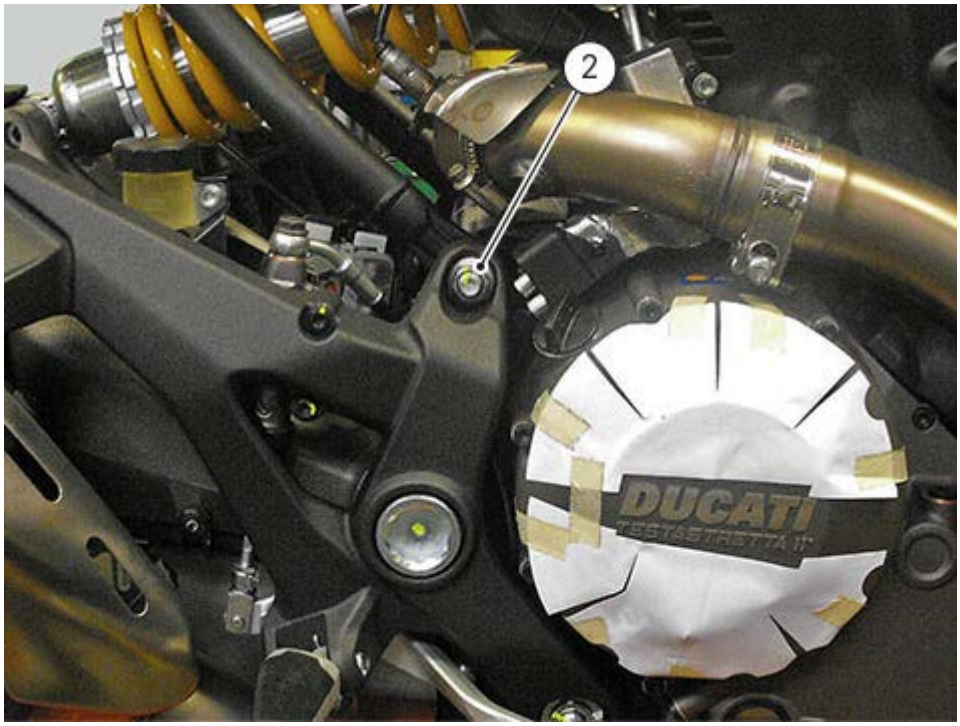
Release connectors (4) and (5) of the rear subframe wiring branch from ties (A) and disconnect them.



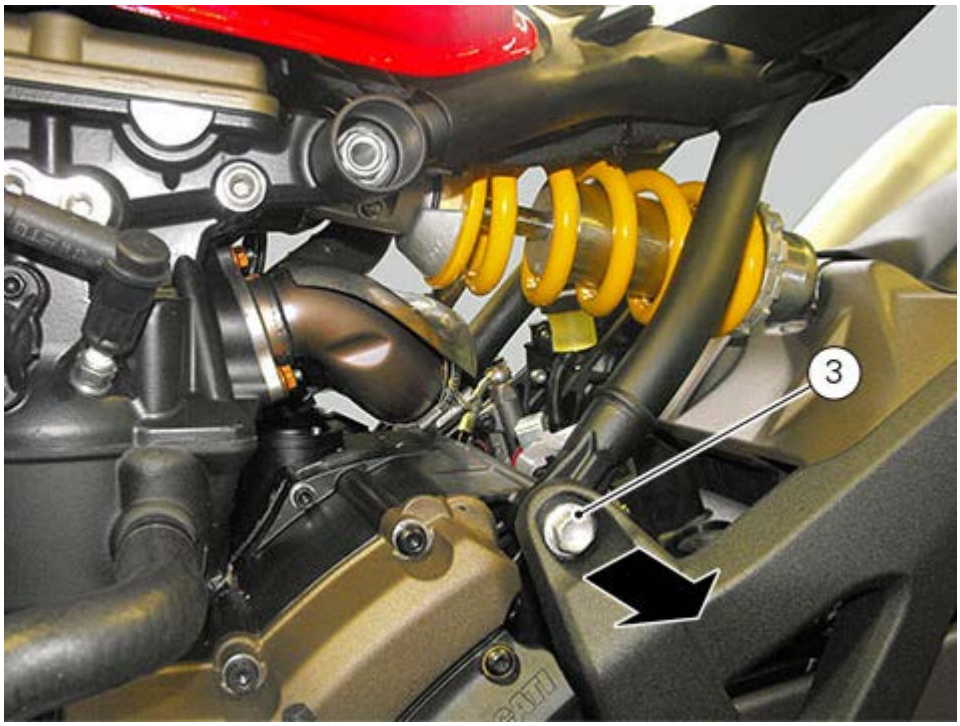
Working on both sides, loosen the two upper special screws (1).



Working on the right side, loosen retaining nut (2).



Working on the lift side, slide out pin (3).

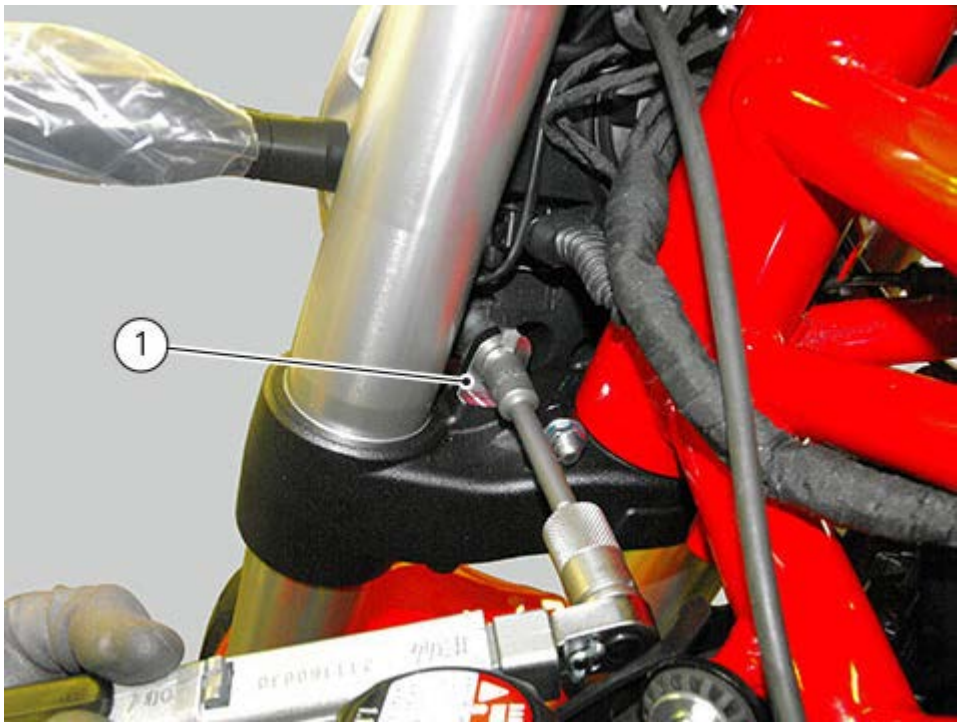


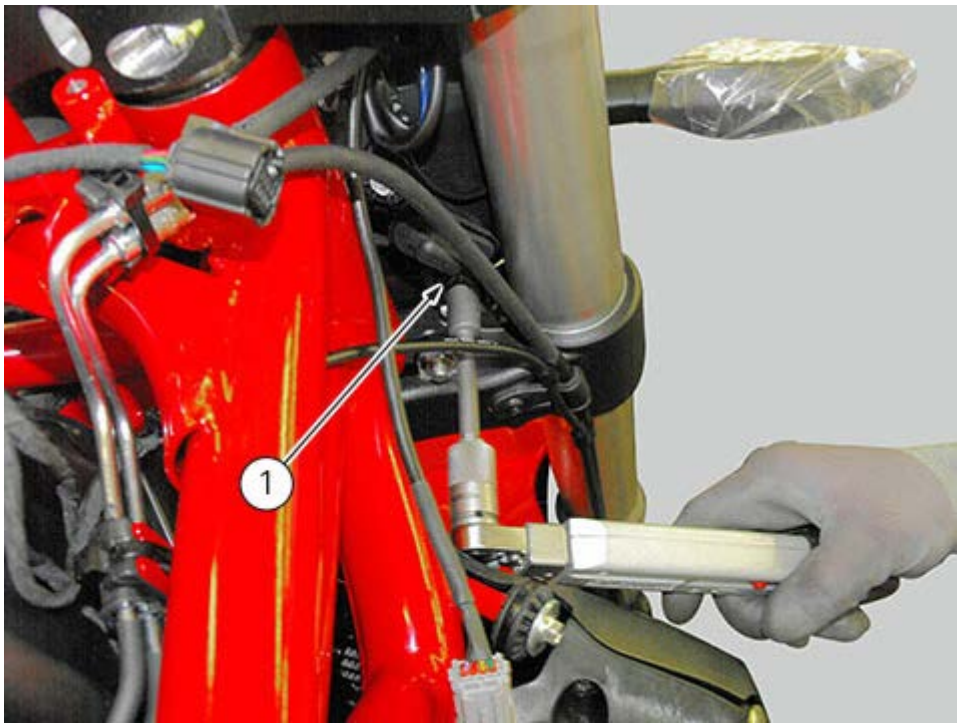
Remove subframe.

If necessary, remove the subframe structural components, follow the instructions indicated in paragraph "Removing structural components and frame"

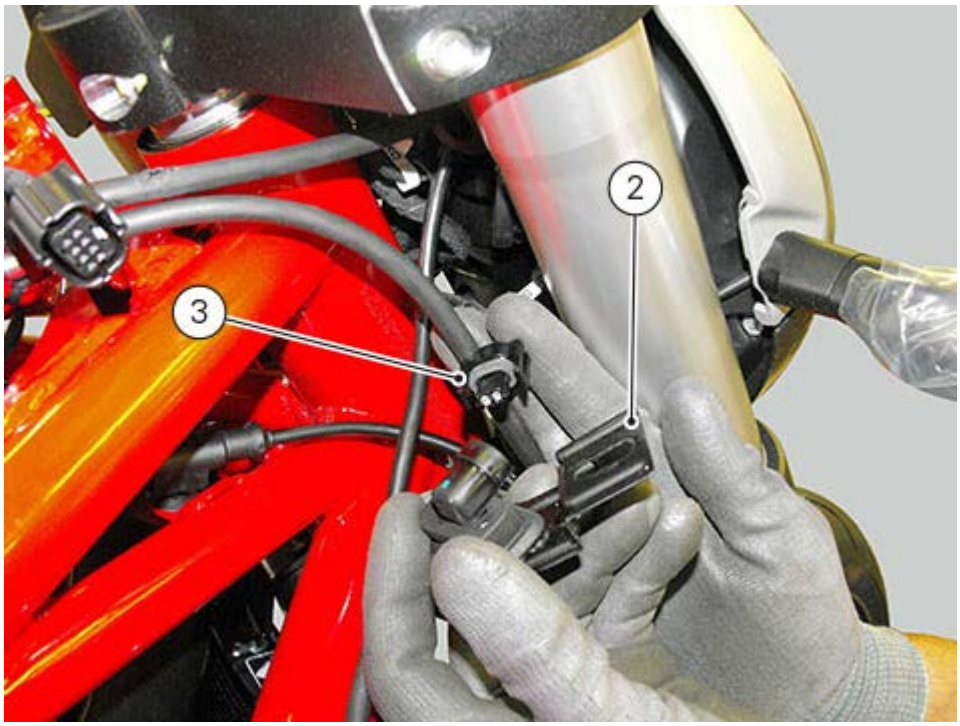
Removing the light assembly

Remove the instrument panel (Removing the instrument panel assembly).
Loosen nuts (1) of light assembly lower fasteners on bottom yoke.

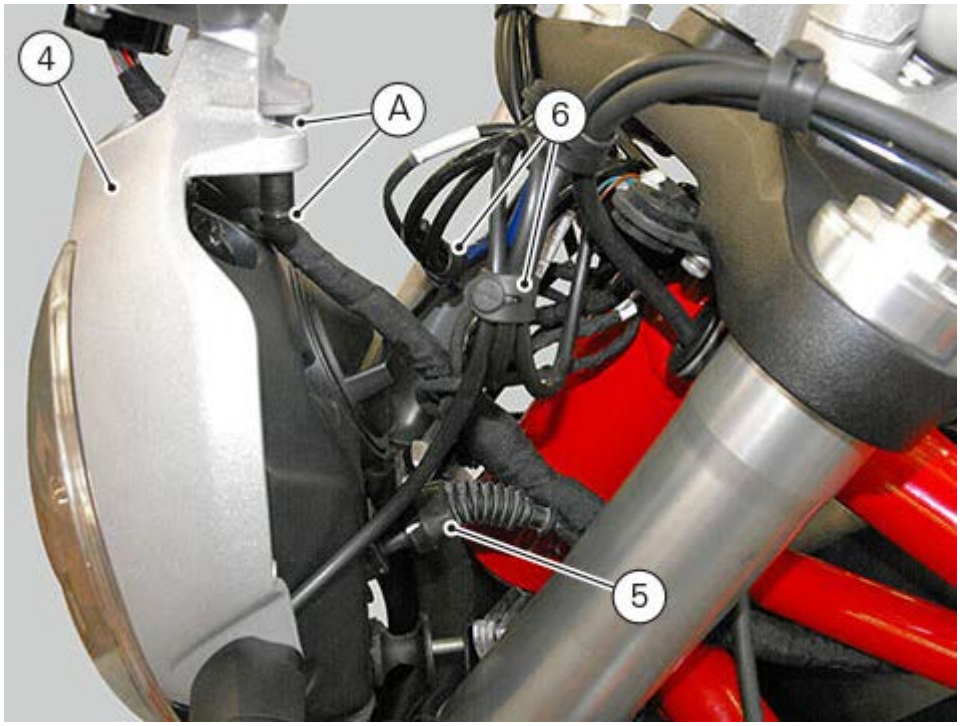




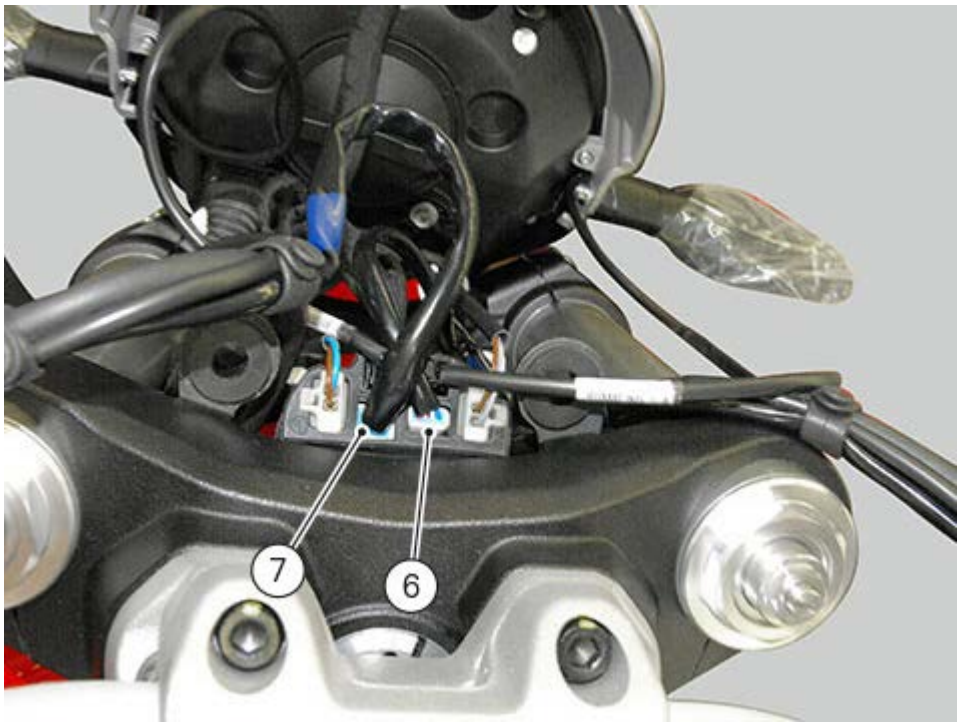
Collect temperature sensor connector (3) bracket (2) on the RH side, which is secured in place by RH nut (1) you have just removed.
Disconnect temperature sensor connector (3).



Slide out light assembly (4) pins (A) pulling it up and duly supporting the light assembly, then disconnect headlight connector (5).
Release wirings from cable rings (6).

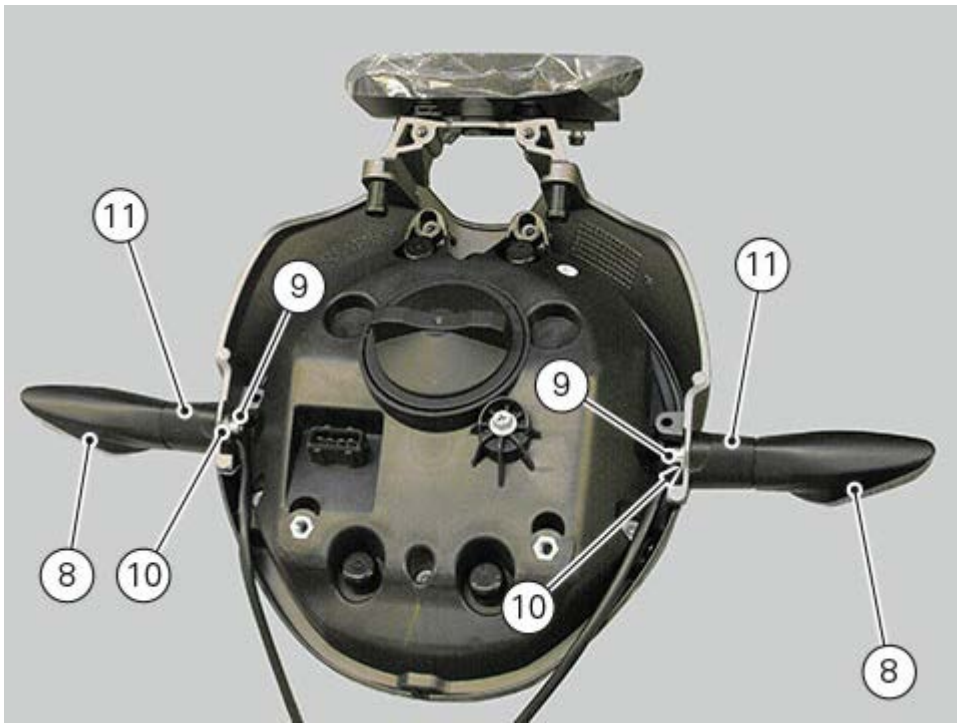


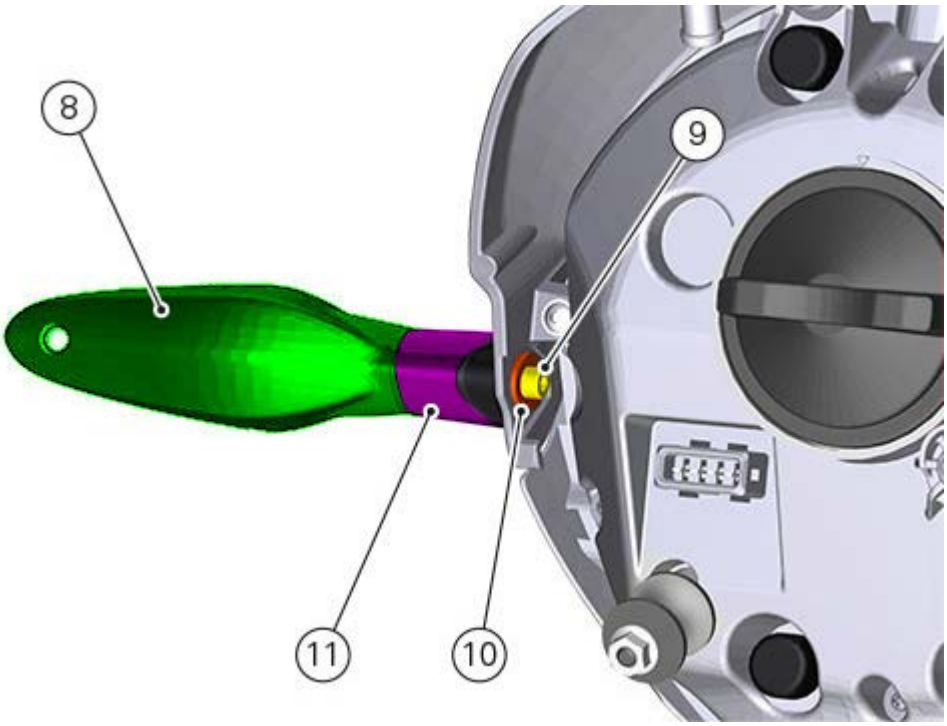
Slide out RH (6) and LH (7) turn indicator supports, then disconnect them.



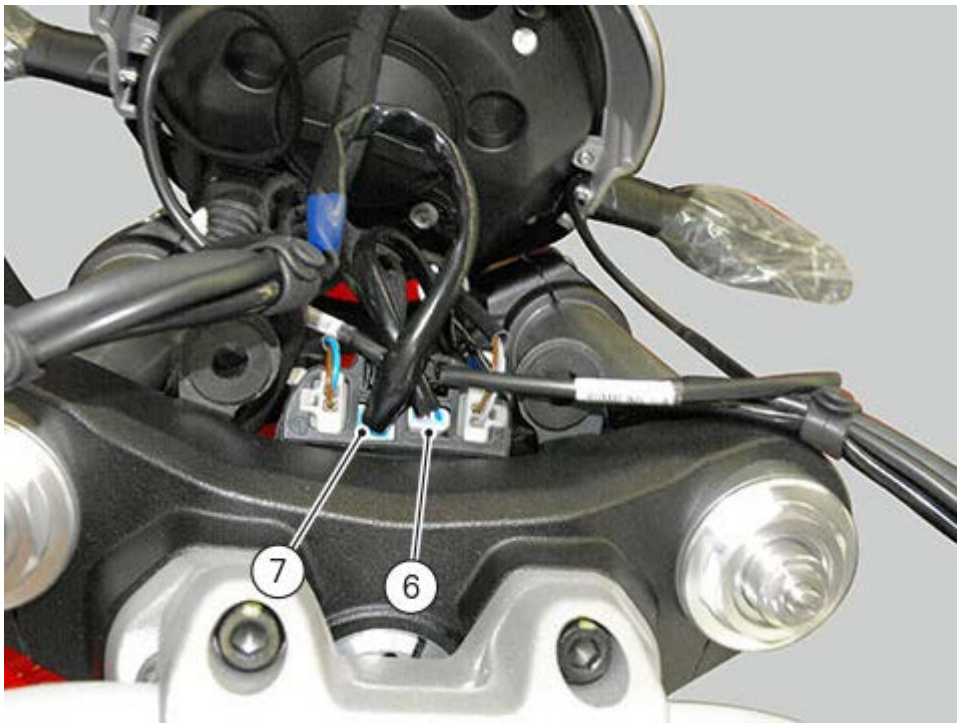
Remove the light assembly.

Removing the turn indicators (NOT FOR USA VERSION)
To remove turn indicators (8), loosen screws (9) and collect plates (10).
Slide out turn indicator (8) from the outside together with wiring and spacer (11).

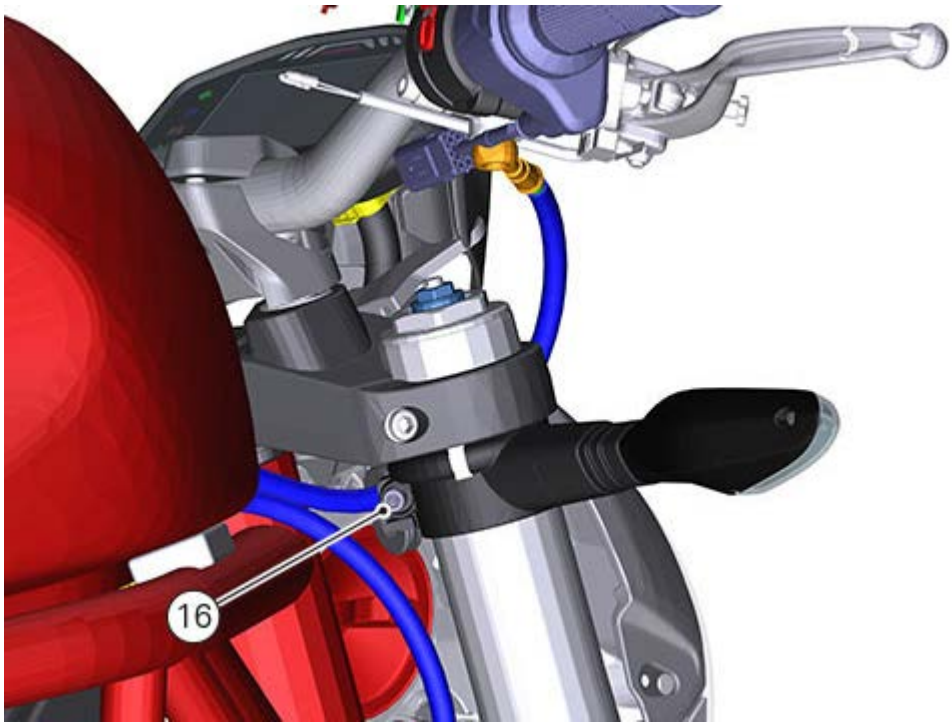




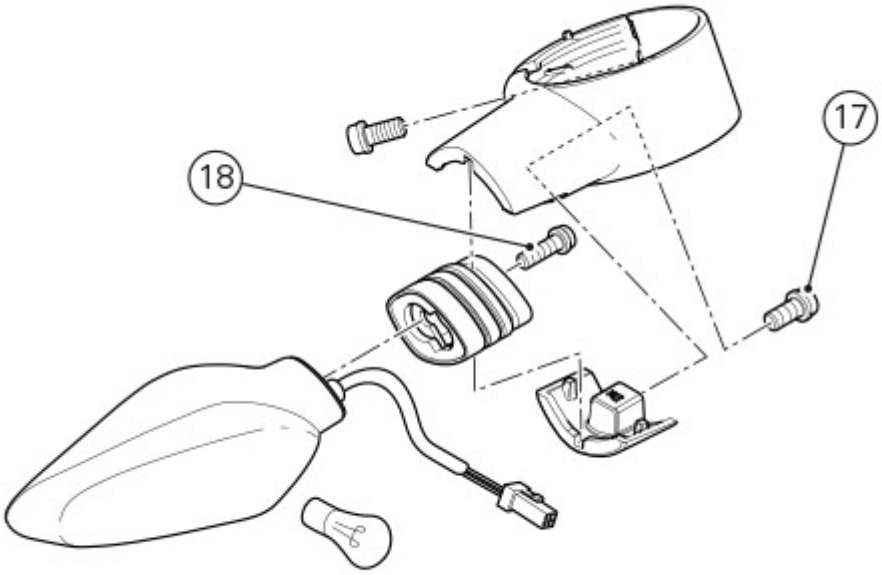
Removing the turn indicators (USA VERSION, ONLY)
Disconnect turn indicator connectors (6) and (7).



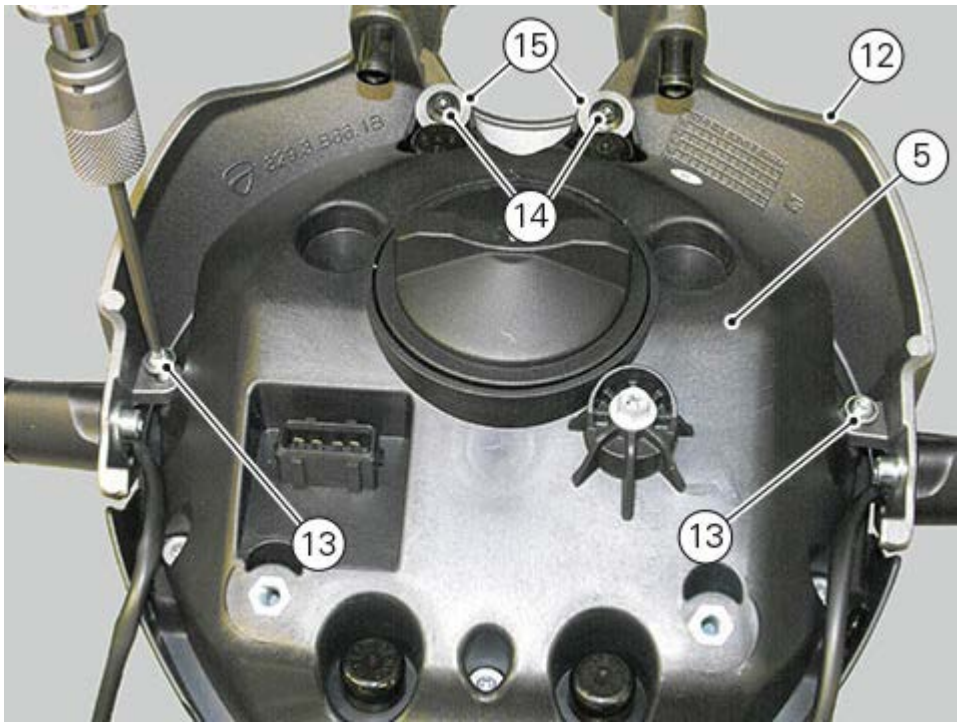
Working in the same way for both turn indicators, loosen screw (16).



Release fork legs and slide out turn indicators (Removing the front fork).
If necessary, disassemble turn indicators by loosening screws (17) and (18).



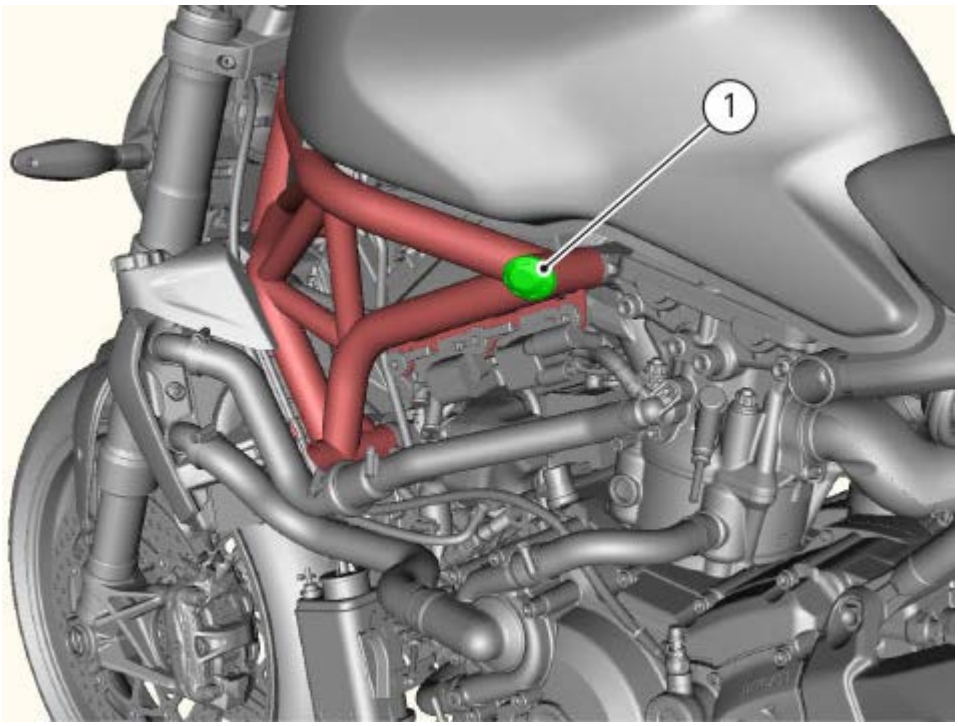
Removing the headlight
To release headlight (5) from support cover (12), loosen screws (13).
Loosen screws (14) and collect spacers (15).



Removing structural components and frame

Before carrying out dimensional checks on frame and rear subframe, remove all the fitted superstructures, referring to the removal procedures outlined in the relevant sections of this manual.

Working in the same way on both sides, remove plugs (1) from frame.



Hereinafter is a list of the components to be removed, in a logical sequence.
Remove the seat (Removing the seat).
Remove the instrument panel (Removing the instrument panel assembly).
Remove the fuel tank (Removing the fuel tank).
Remove the airbox, the throttle body, the blow by and the oil breather pipe (Removing the airbox and throttle body).
Remove the supply system and the injectors from the intake manifolds (Removing the airbox and throttle body).
Remove the throttle control cable (Removing the throttle control).
Remove the secondary air system pipes and valve (Removing the secondary air system).
Disconnect spark plug caps and remove the exhaust assembly (Removing the exhaust system).
Release rear shock absorber from engine (Removing the rear shock absorber).
Drain the lubrication system (Changing the engine oil and filter cartridge).
Drain the coolant (Changing the coolant).
Remove the cooling system hoses and unions from the engine block (Removing cooling system hoses and unions).
Remove the water radiator lower retainer from the engine (Removing the water radiator).
Disconnect the starter motor/solenoid starter cable (Refitting the starter motor).
Remove the gear shift (Removing the gear shift).
Remove the footpeg holder plates (Removing the footpeg holder plates).
Remove the clutch slave cylinder (Removing the clutch assembly).
Remove the front sprocket (Removing the front sprocket).
Remove the side stand (Removing the side stand).
Remove the electrical component compartment (Removing the electrical component compartment).
Release the braking system hoses and the ABS control unit from frame and subframe (Routing wiring harnesses / hoses).

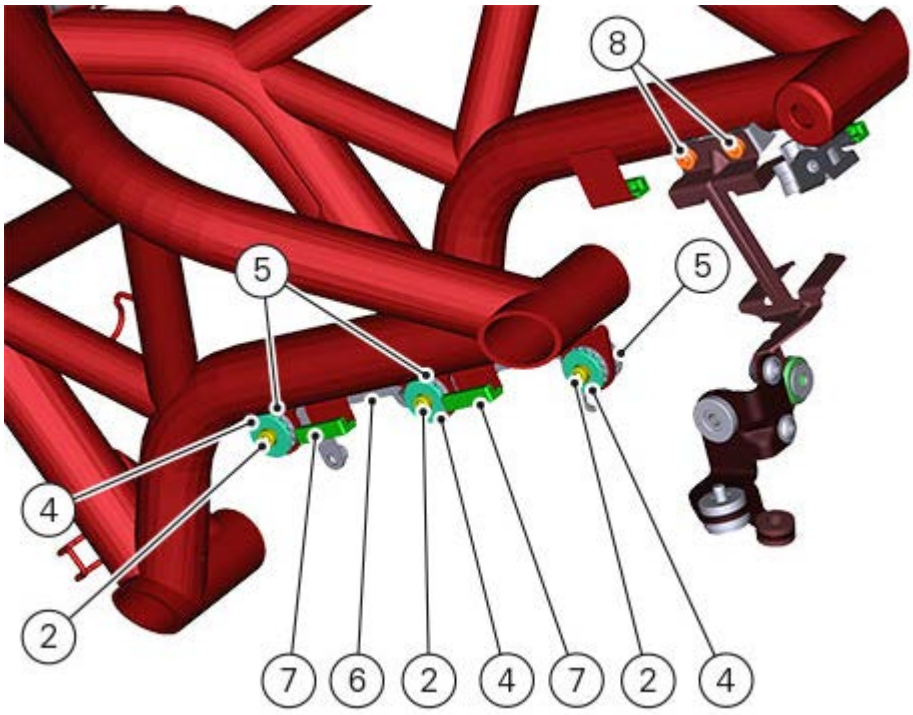
Disconnect wiring connectors on the engine block.
Remove the engine block from frame.

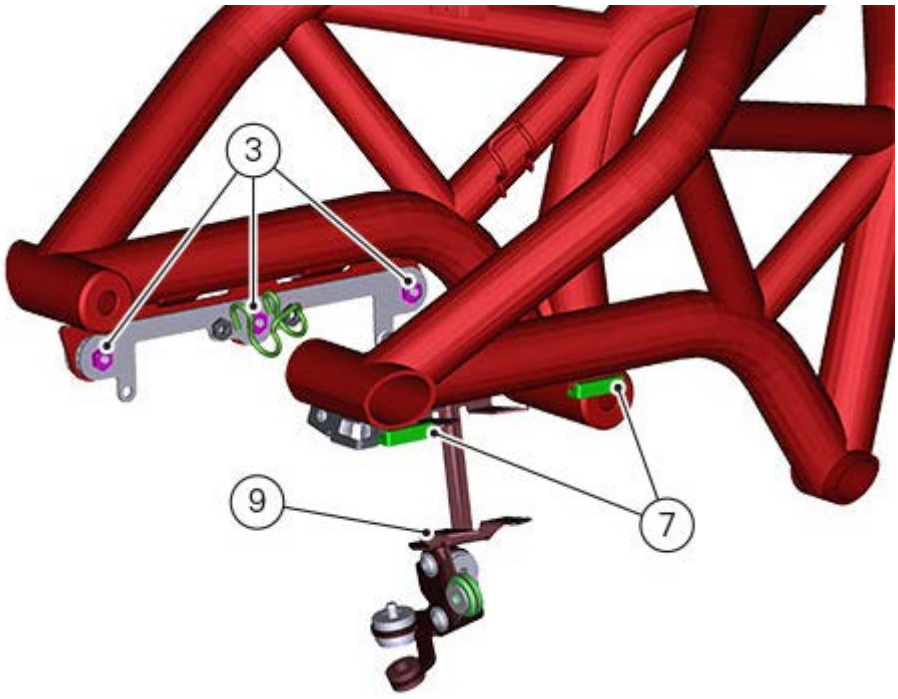
To remove frame, remove also:
- the handlebar (Removing the handlebar);
- the front wheel (Removing the front wheel);
- the forks (Removing the front fork);
- the front light assembly (Removing the light assembly).

Then remove the last components from frame and subframe.

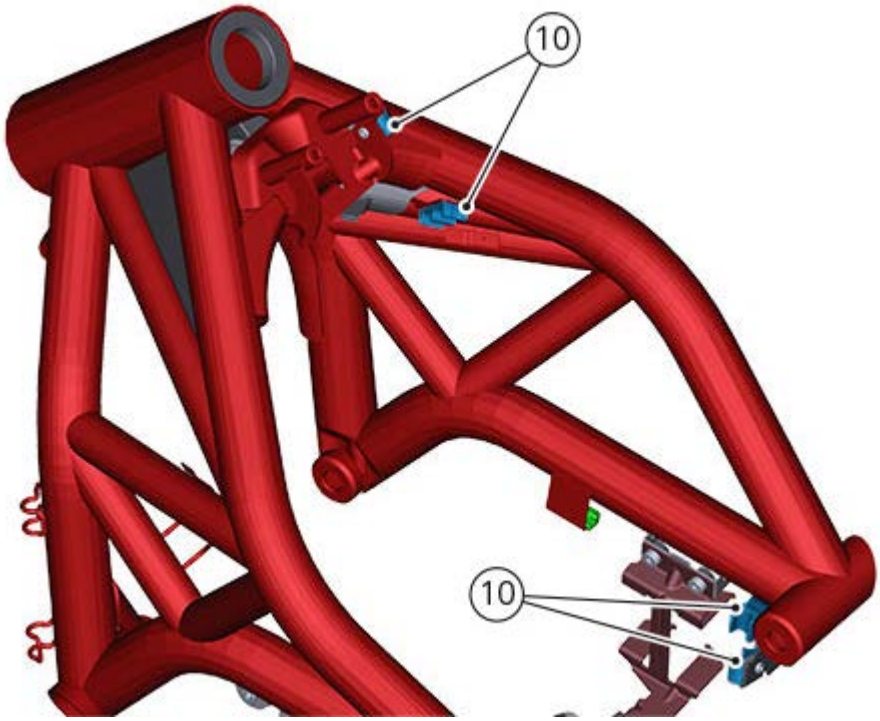
FRAME

Loosen the three screws (2) and collect, on frame inner side, the three corresponding nuts (3).
Slide out washers (4), vibration damping pads (5) and remove coil support bracket (6).
Slide out the four rubber blocks (7), working on both vehicle outer sides.
Then loosen screws (8) and remove ABS support bracket (9).

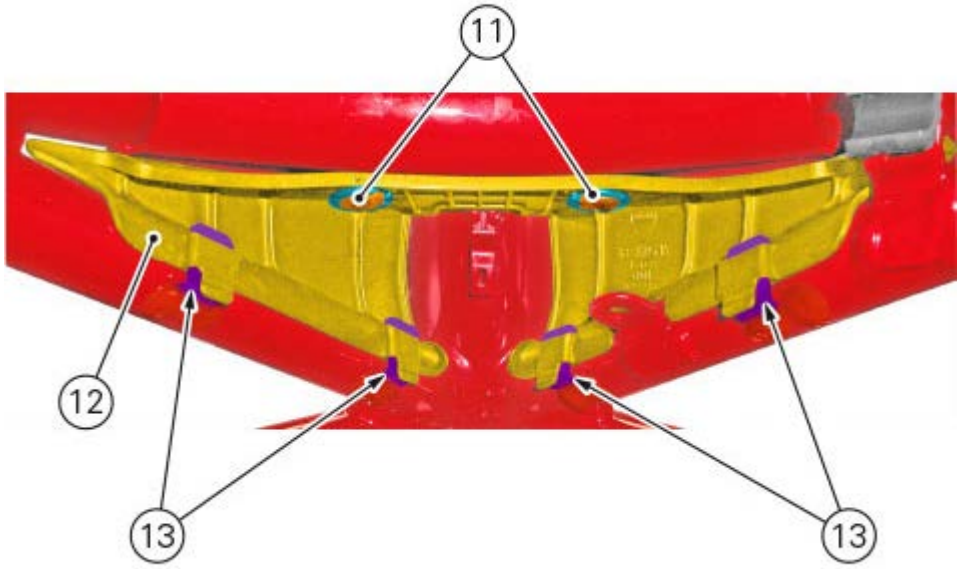


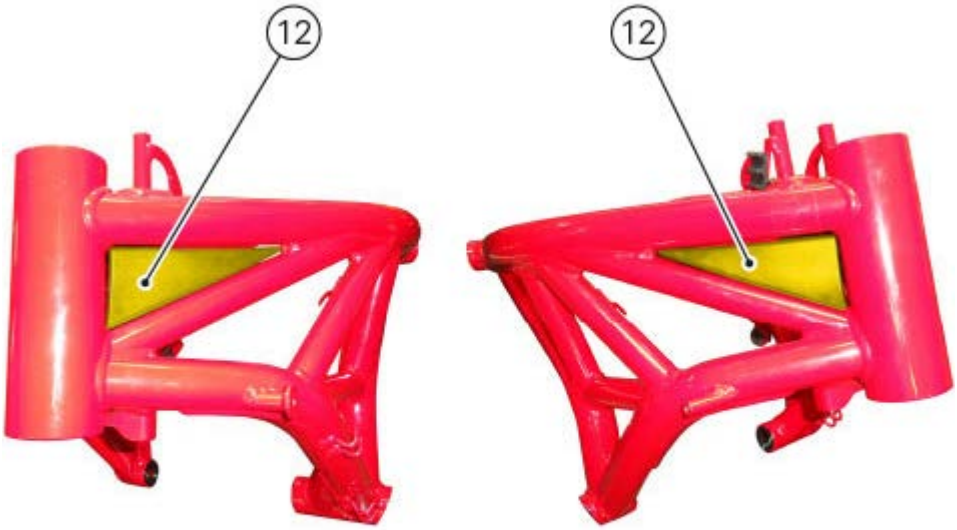


Release frame from cable rings (10).



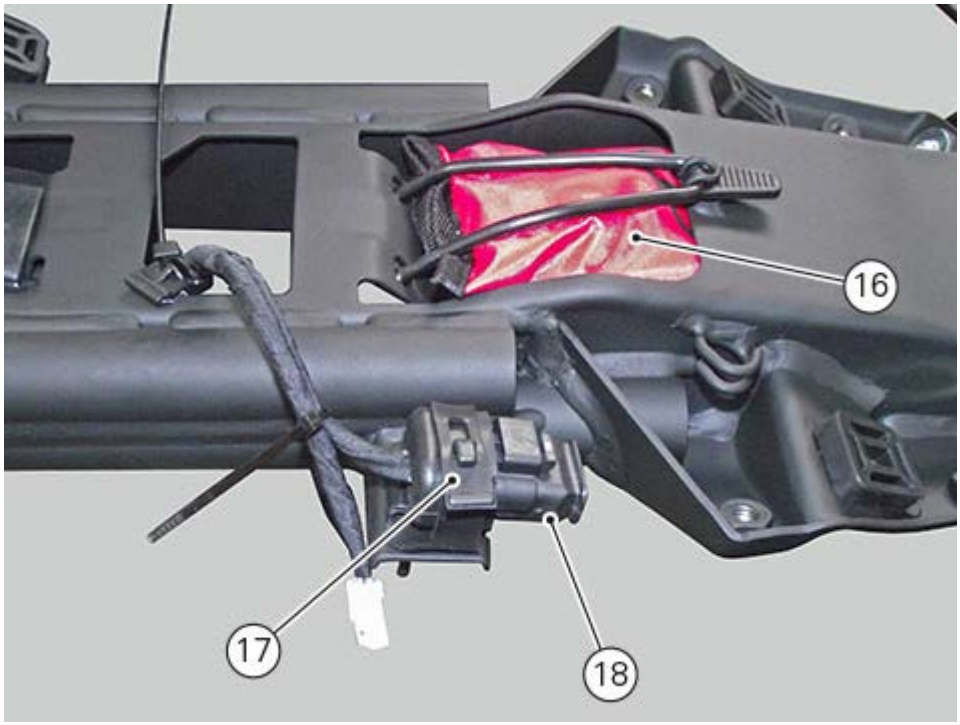
If necessary, remove the two retainers (11) and slide out frame steering tube protection (12) by releasing it from tabs (13).



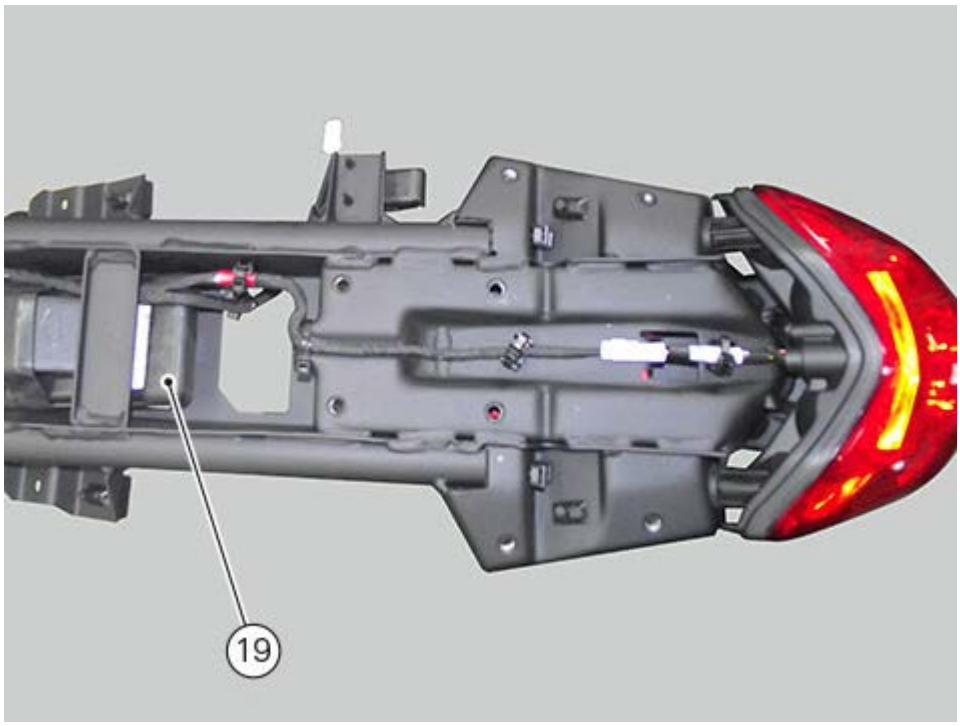


REAR SUBFRAME

Remove the rear subframe (Removing the rear subframe).
If not previously removed, remove tail light (Removing the tail light) and the number plate holder (Removing the number plate holder).
Release tool box (16) from the supporting rubber band and slide it out.
Open clip (17) and release the diagnostic socket (18).

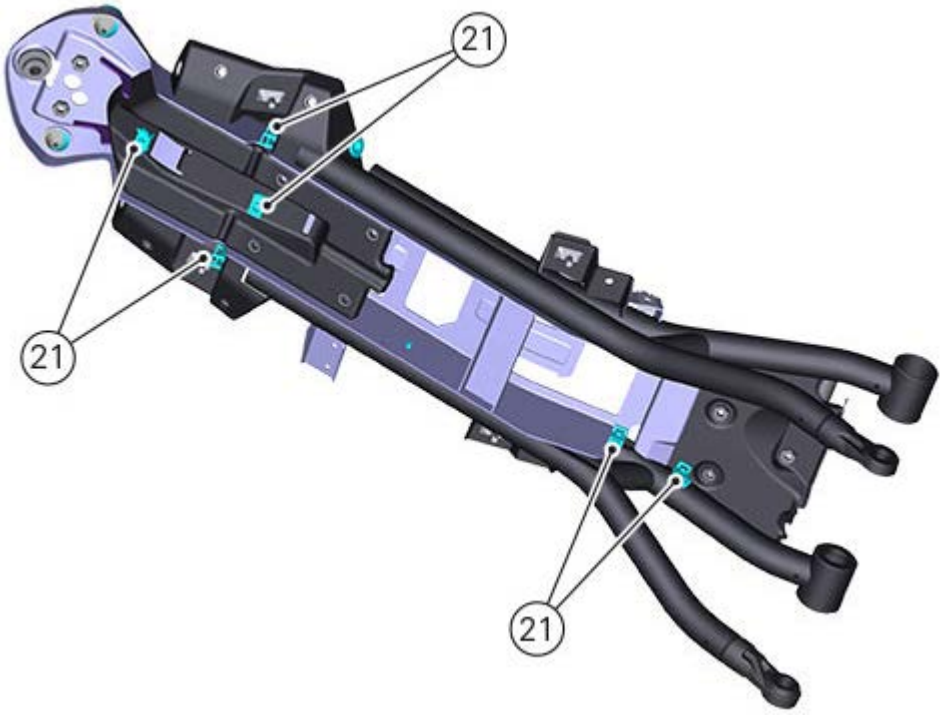


Slide out the black box control unit (19) with the relevant vibration damping support.



Remove the seat release mechanism (Removing the seat release mechanism).

If necessary, remove the four rubber blocks (20) and cable rings (21).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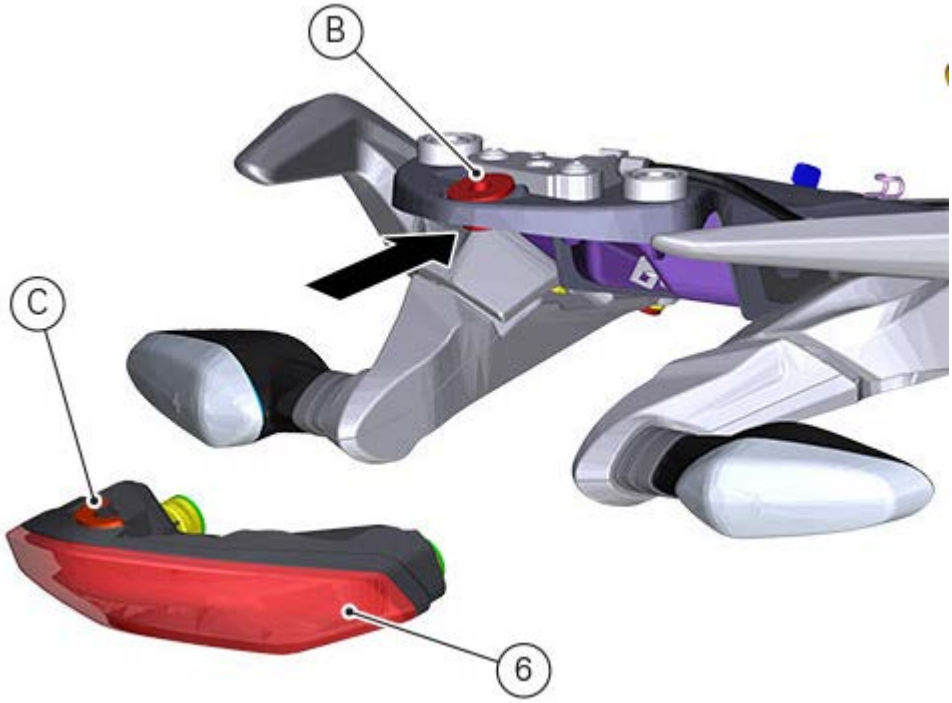
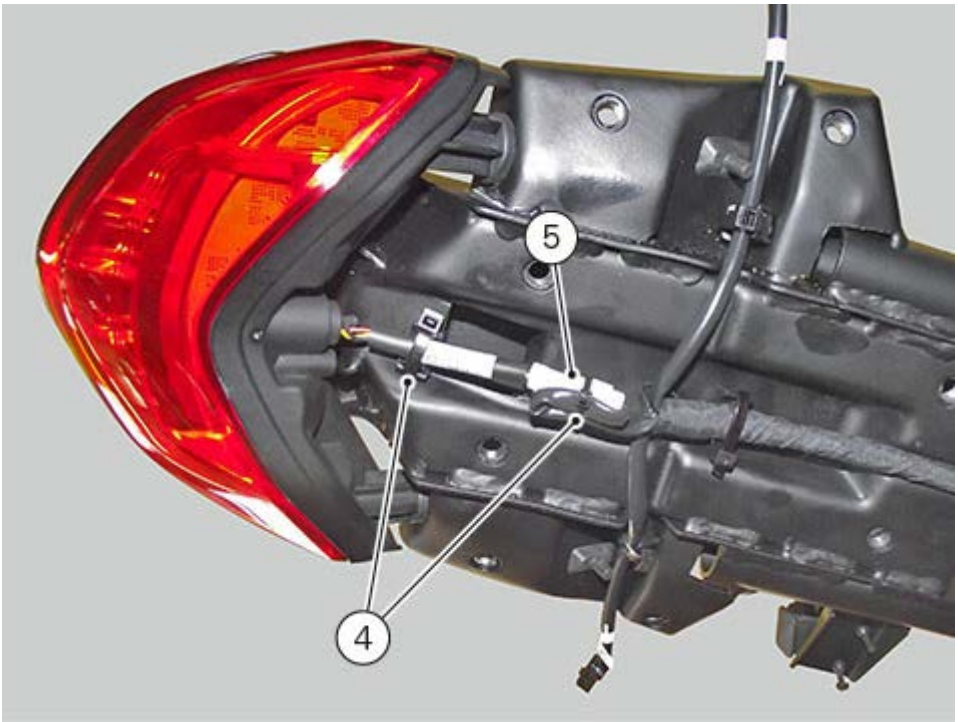
21
21

Refitting the tail light

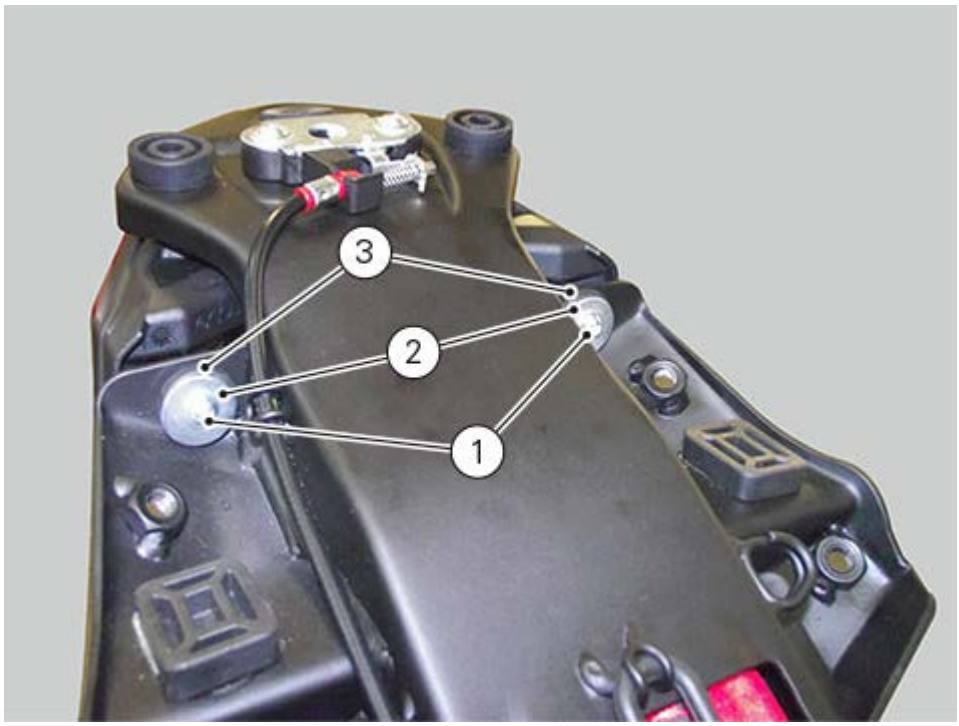
Fit tail light (6) to subframe, mating light recess (C) with vibration damper (B).



Connect connector (5) and secure wiring in place with two ties (4).



Fit washers (2) on rubber elements (3) and tighten screws (1) to a torque of 3Nm ± 10%.



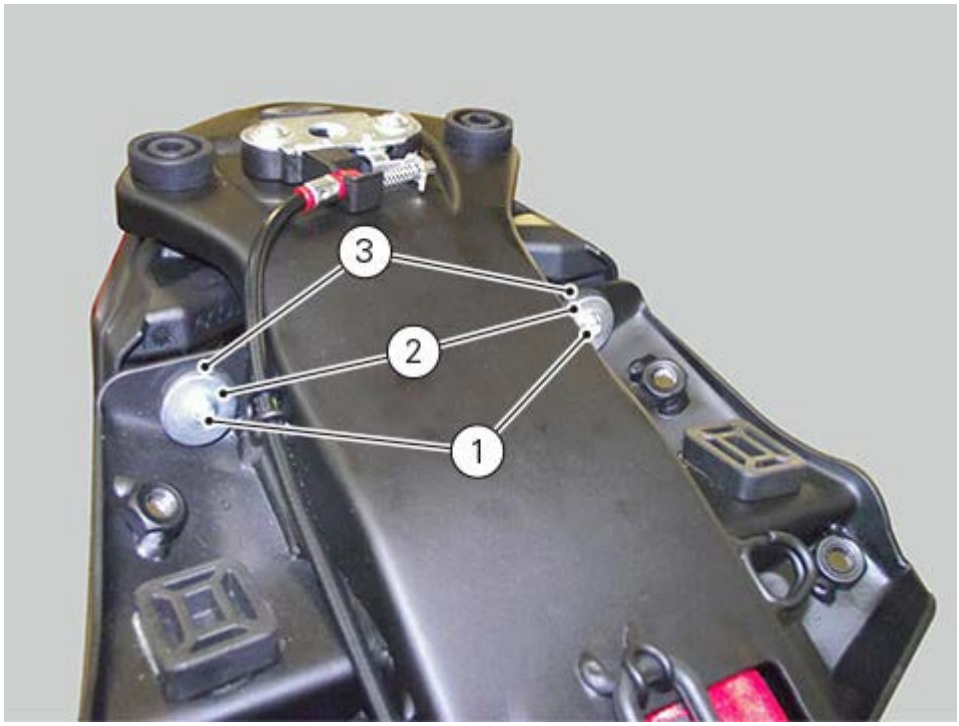
Refit the seat bottom cover (Refitting the seat bottom cover).
Refit the rear grab handles (Refitting the rear grab handles).
Refit the number plate holder (Refitting the number plate holder).
Refit the seat (Refitting the seat).

Removing the tail light

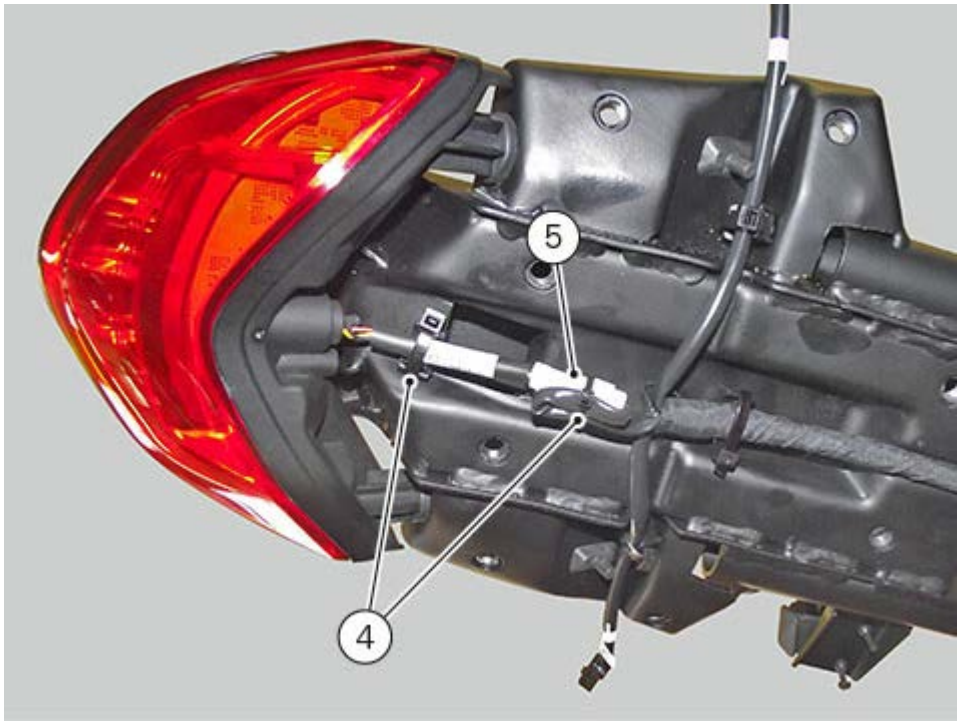
Remove the seat (Removing the seat).
Remove the number plate holder (Removing the number plate holder).
Remove the seat bottom cover (Removing the seat bottom cover).

Remove the rear grab handles (Removing the rear grab handles).

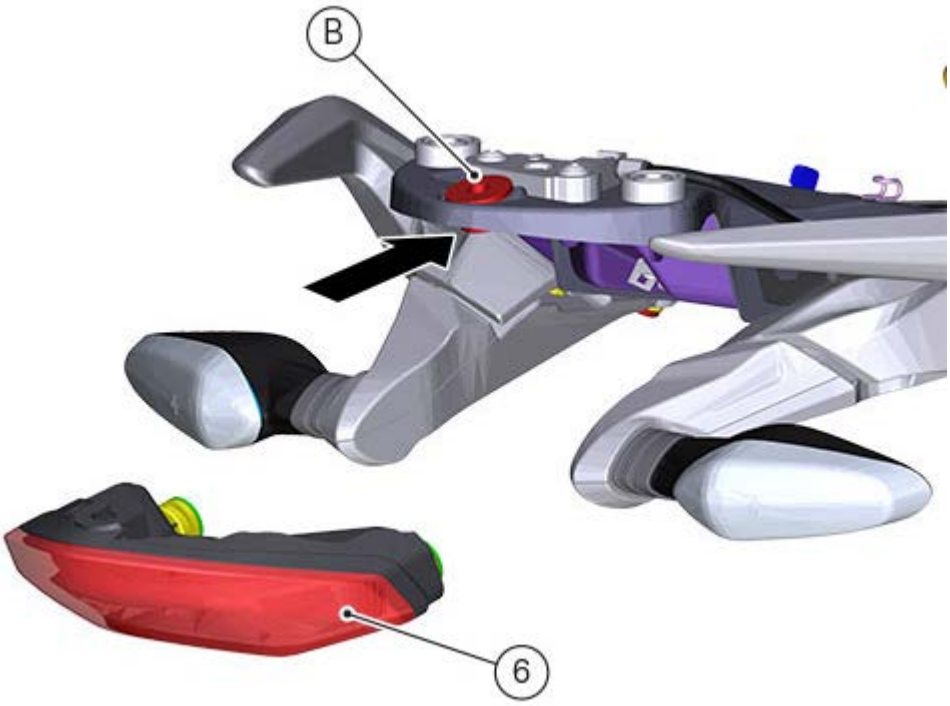
Loosen and remove the two screws (1) and collect washers (2).
Check the conditions of the rubber elements (3).



Remove ties (4) and disconnect tail light connector (5).

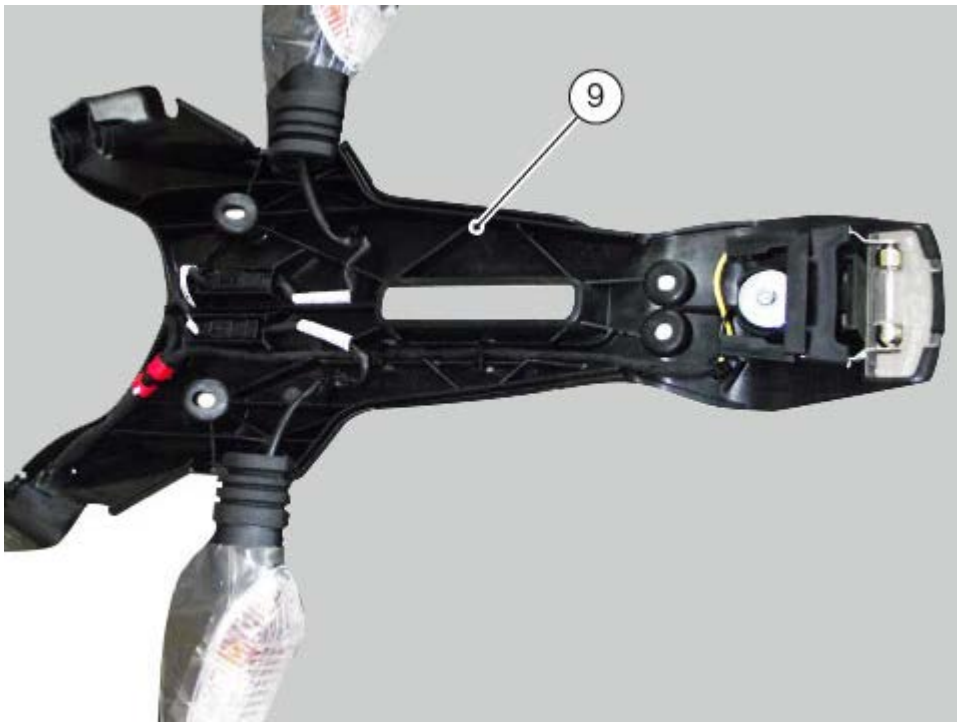


Slide tail light (6) out of vibration damper (B), working from behind.



Refitting the number plate holder

Check the correct position of ties and wirings on the number plate holder (9), as described in chapter "Routing of wiring on frame".

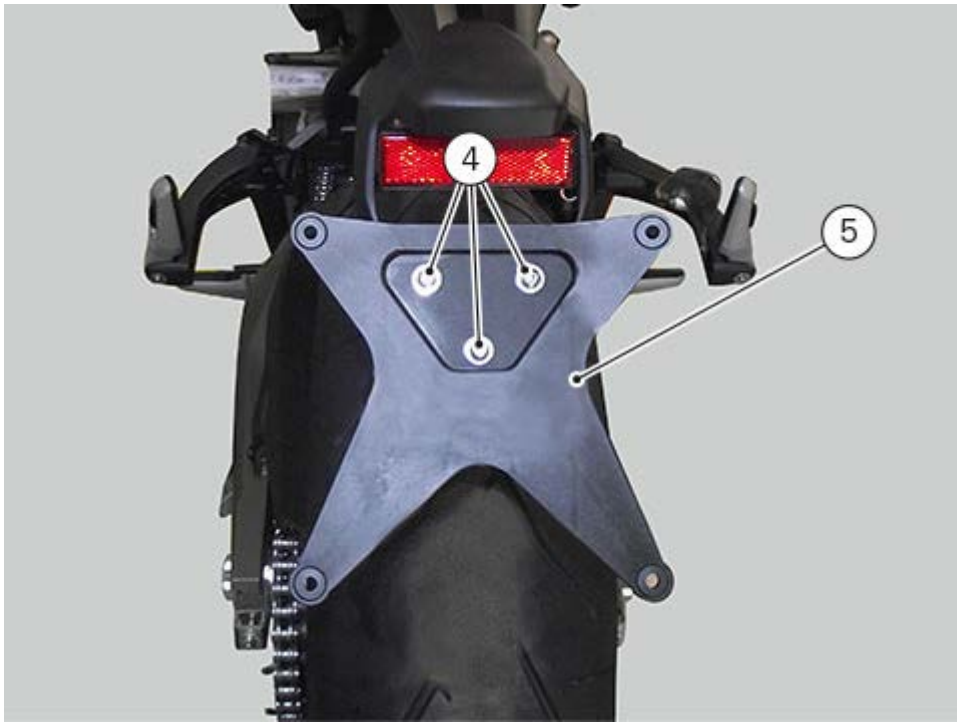


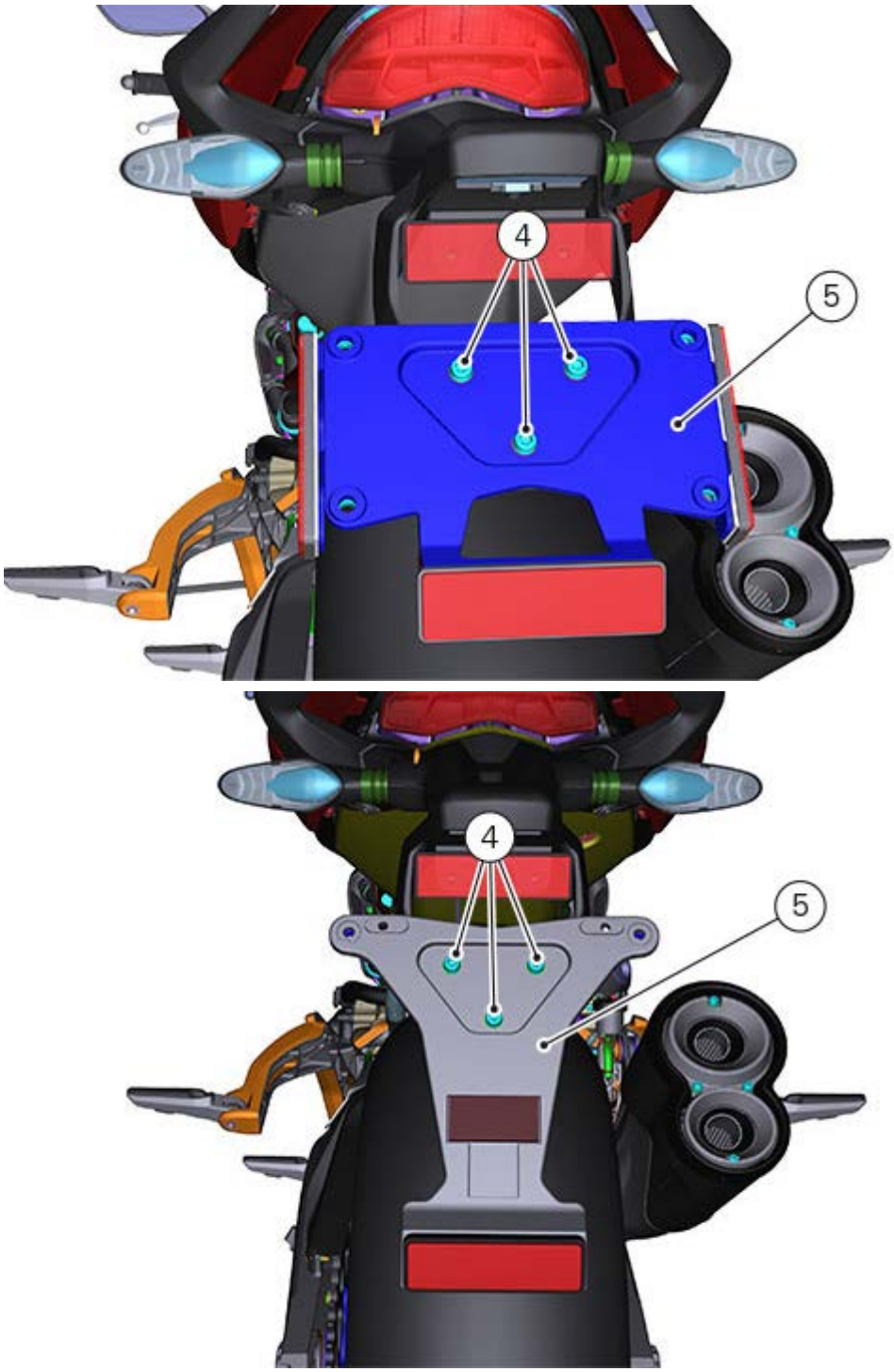
Reassemble the number plate holder by coupling the lower part (8) with the upper part (9) and tighten the four screws (7) to a torque of 3.5 Nm ± 10%.

Note
Proceed as described according to the vehicle version.

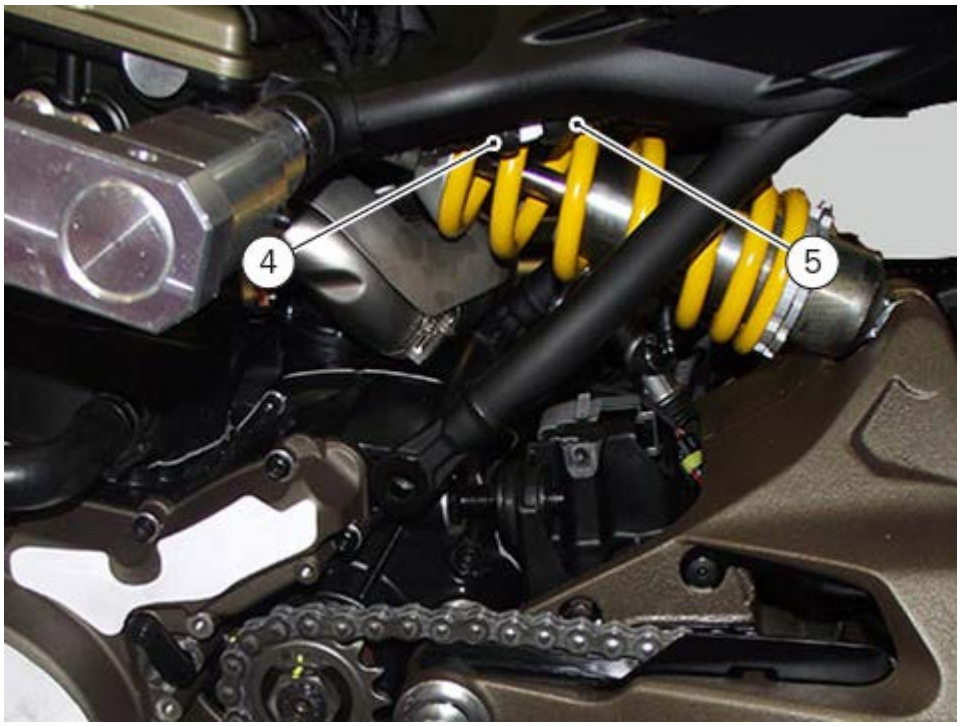
EUROPE / USA / CHINA / BRAZIL VERSIONS

Position number plate holder (5) and tighten the three screws (4) to a torque of 5 Nm ± 10%.

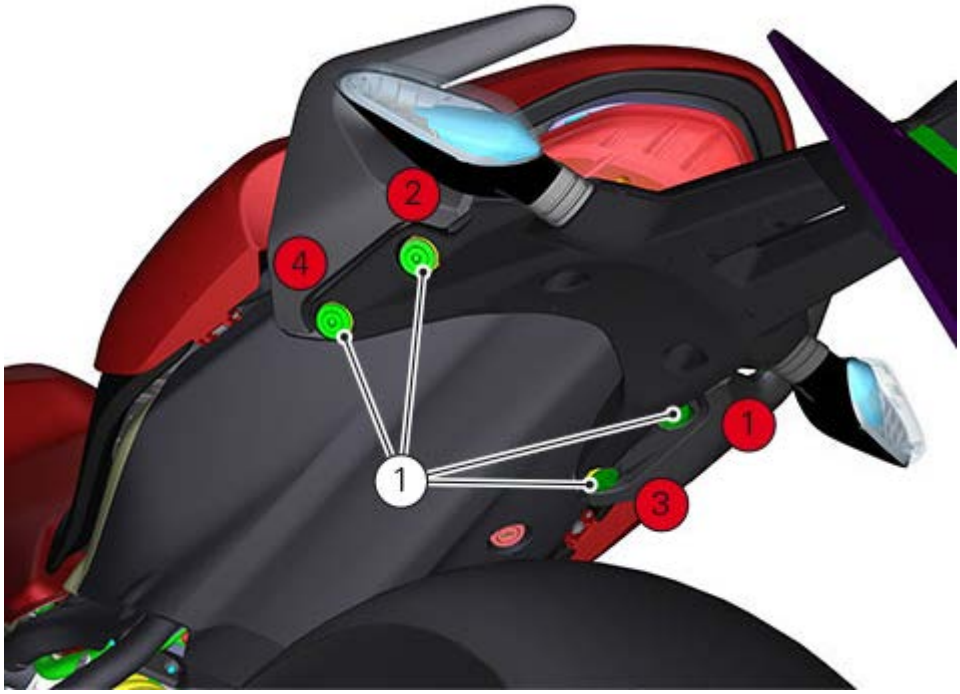




If disconnected, when repositioning the number plate holder, connect connectors (4) and (5) of the rear wiring.

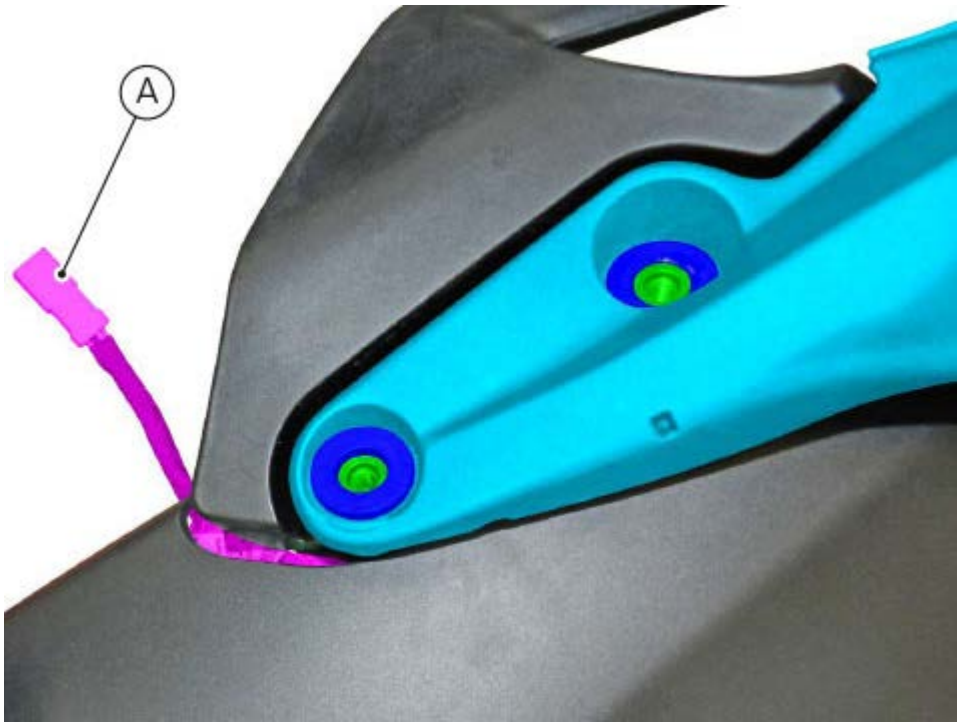


Position number plate holder (9) and tighten the four screws (1) to a torque of 5 Nm ± 10%, following a cross pattern, in the indicated sequence.



Pay attention to the position of number plate holder wiring (A).

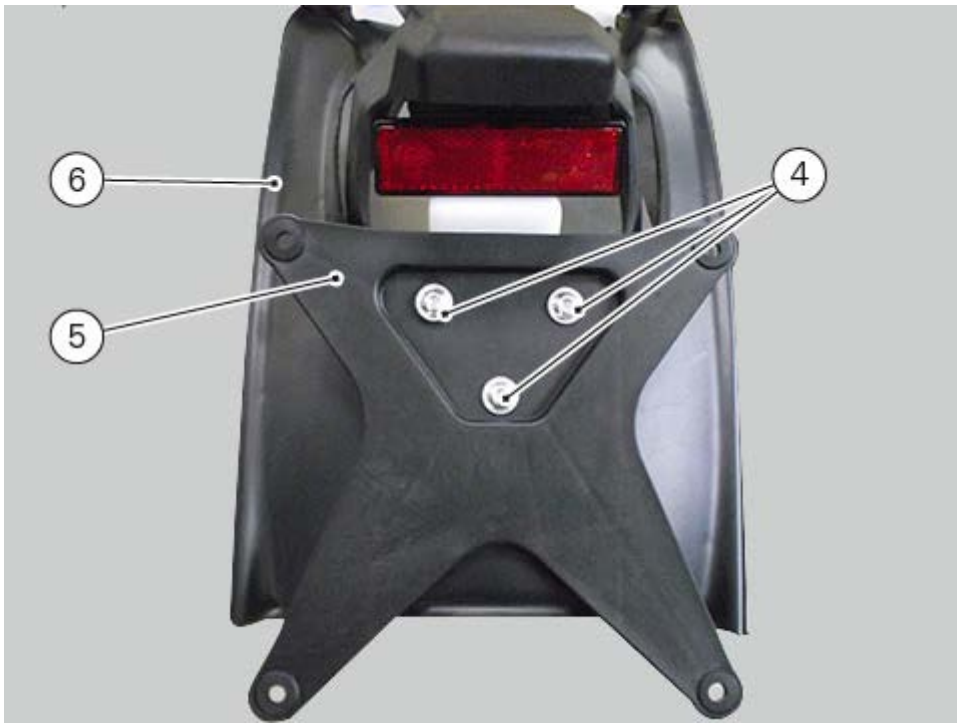
Warning
Check the correct position of the number plate holder wiring position, on the grab handle LH side.



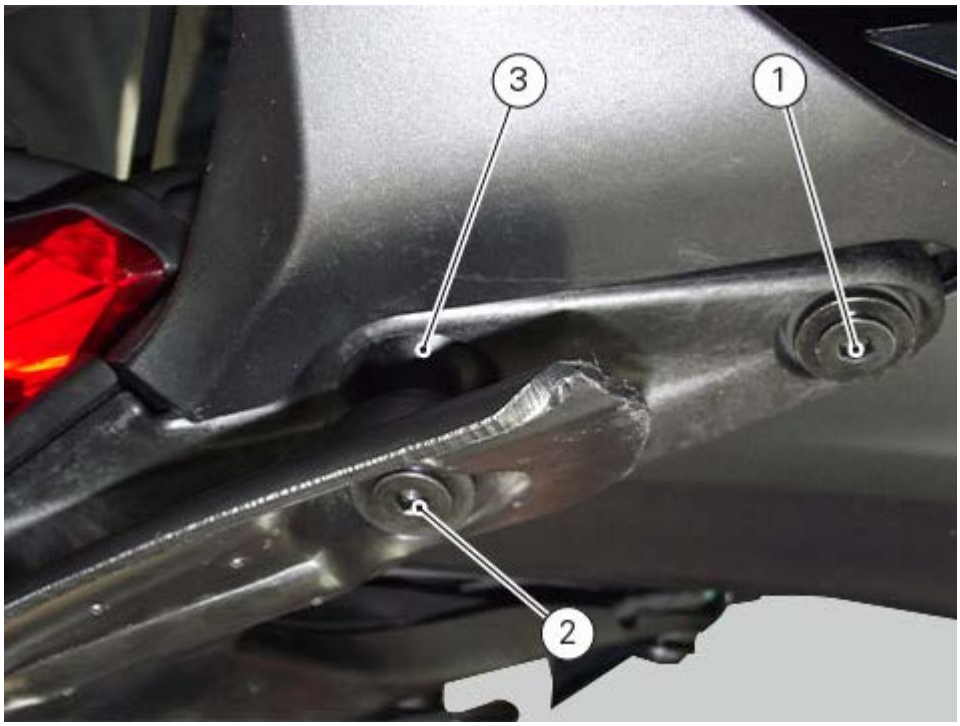
Refit the seat (Refitting the seat).

AUSTRALIA VERSION

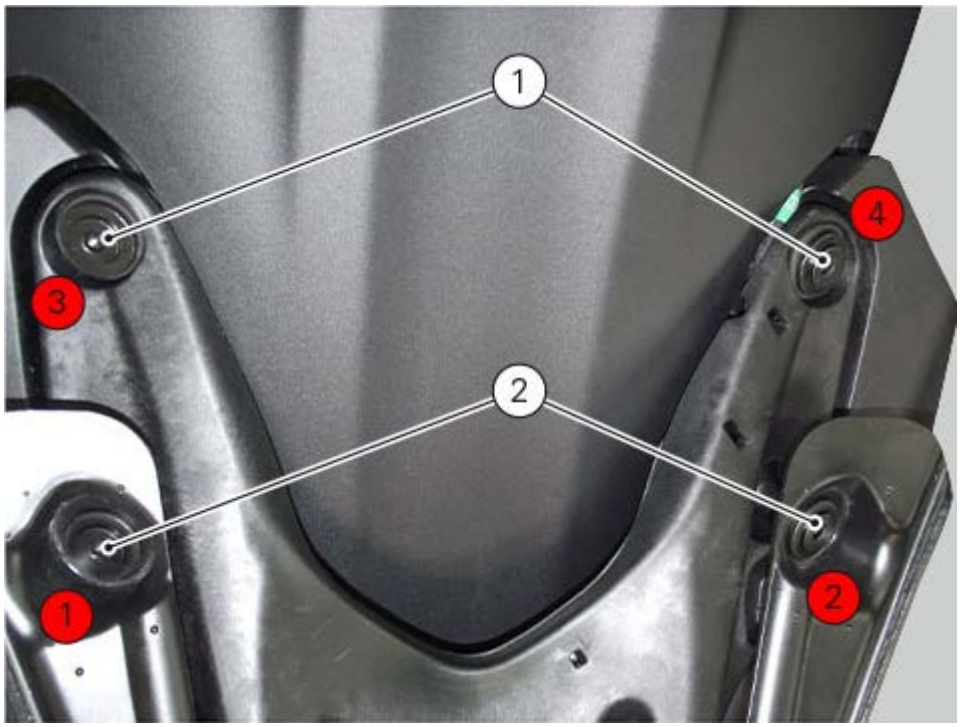
Position the lower splash guard (6), number plate holder (5) and tighten the three screws (4) to a torque of 5 Nm ± 10%.

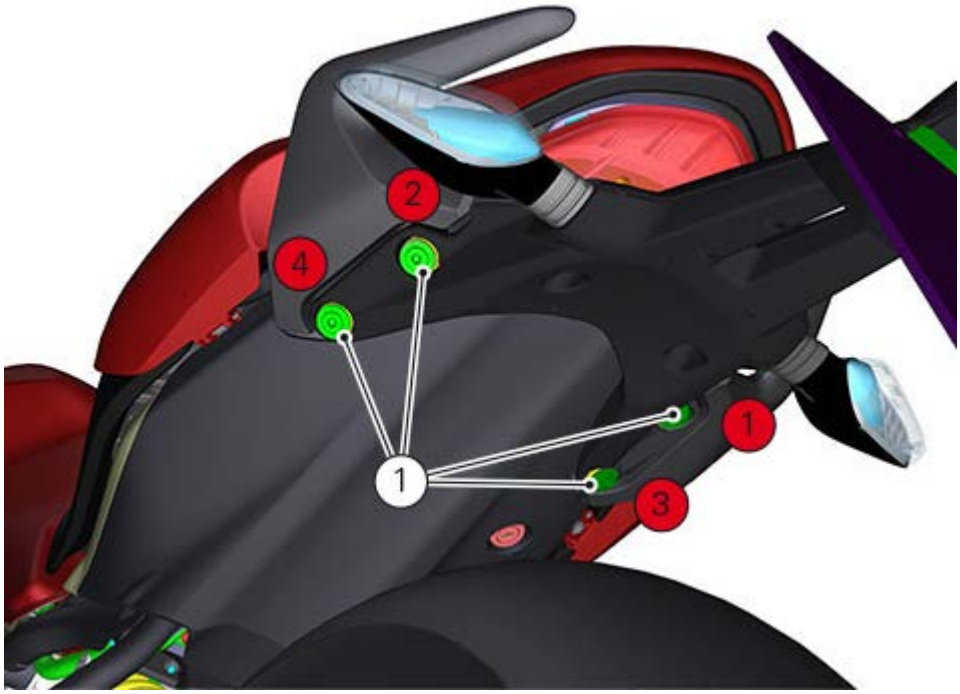


Working on both sides, position spacers (3).



Fix the number plate holder by tightening the two screws (2) and the two screws (1) to a torque of 8 Nm ± 10%, following the indicated sequence.

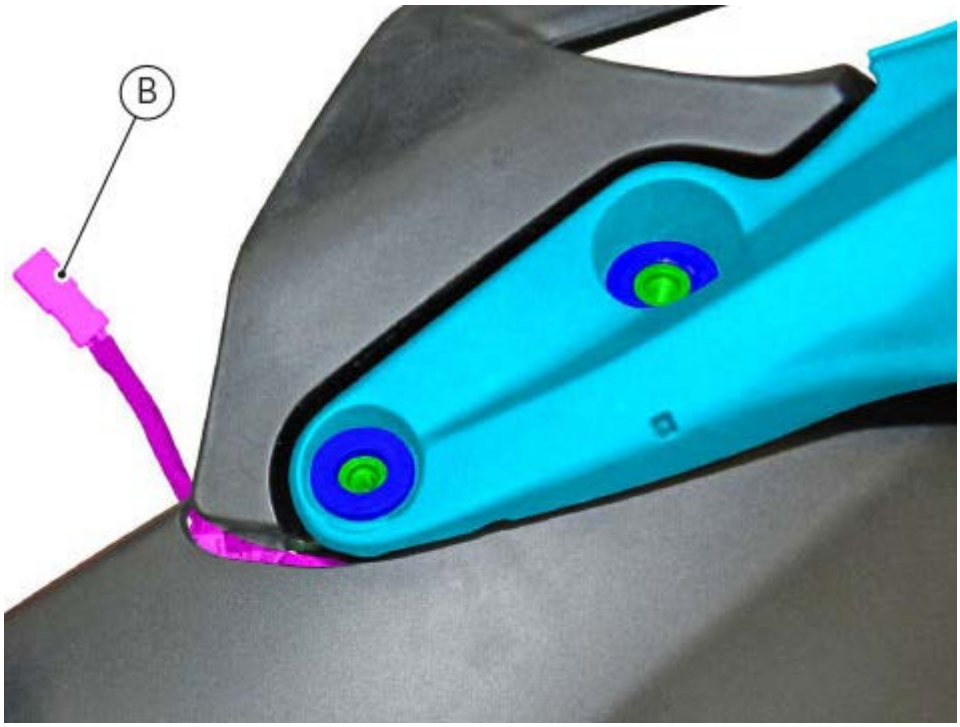




Pay attention to the position of number plate holder wiring (B).

Warning

Check the correct position of the number plate holder wiring position, on the grab handle LH side.

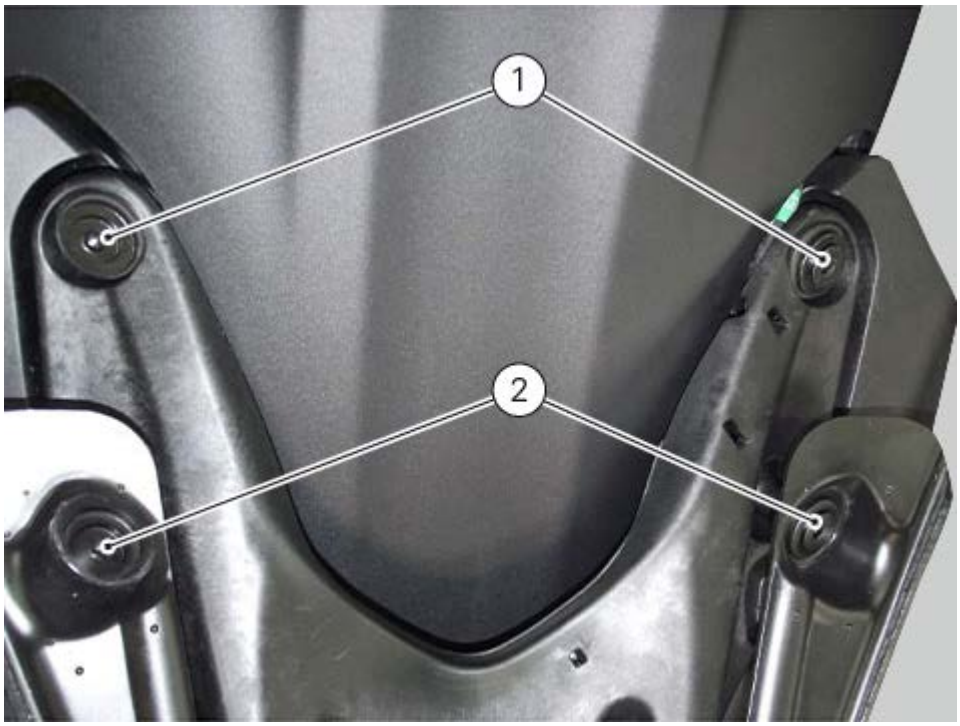


Removing the number plate holder

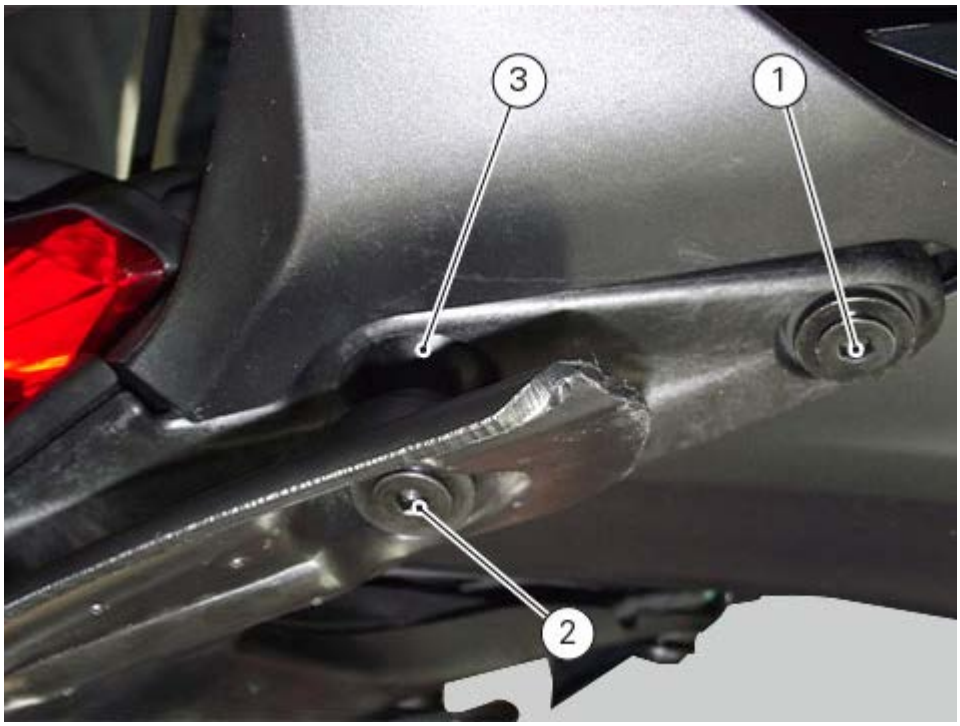
Remove the seat (Removing the seat).

AUSTRALIA VERSION

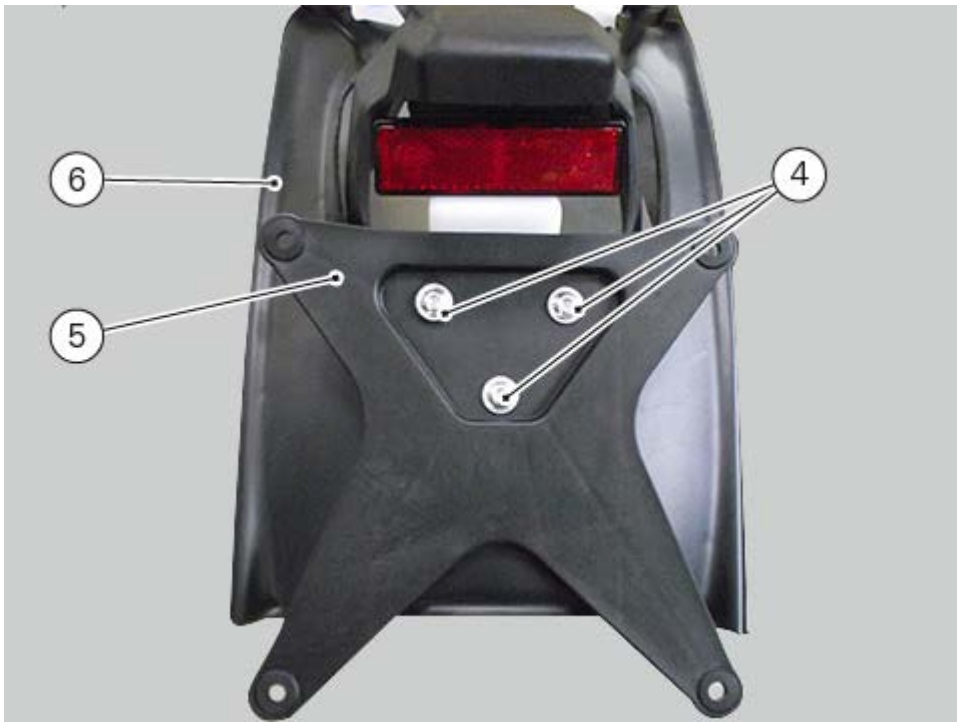
Loosen the two screws (1) and the two screws (2).



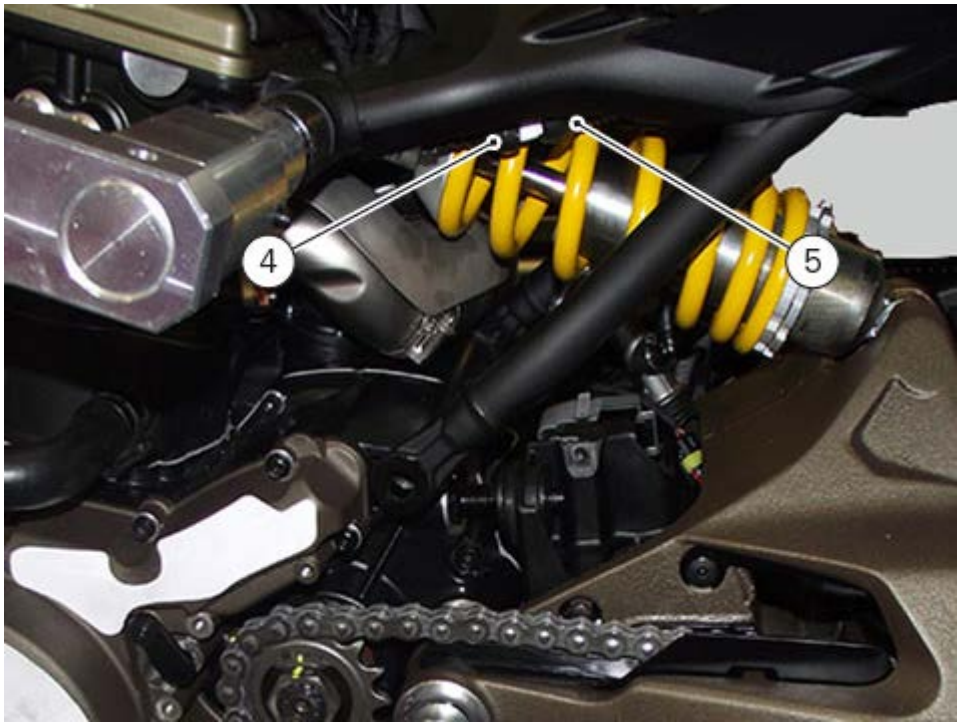
Working on both sides, recover the two spacers (3).



After removing the number plate, loosen the three screws (4) and slide out number plate holder (5) from the rear side and the lower splash guard (6) from the lower side.

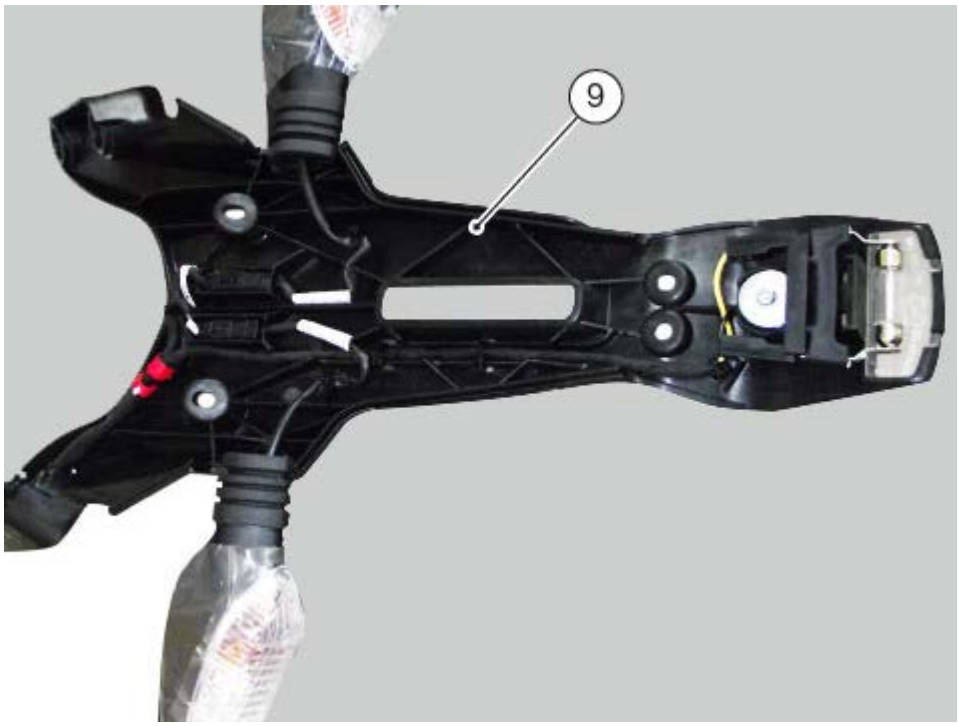


If necessary, disconnect connectors (4) and (5) of the rear wiring.



To disassemble the number plate holder, loosen the four screws (7) and separate the lower number plate holder (8) from the upper one (9).

If necessary, it is now possible to work on the components fixed on the number plate holder (9): wirings, rear turn indicators and number plate light.

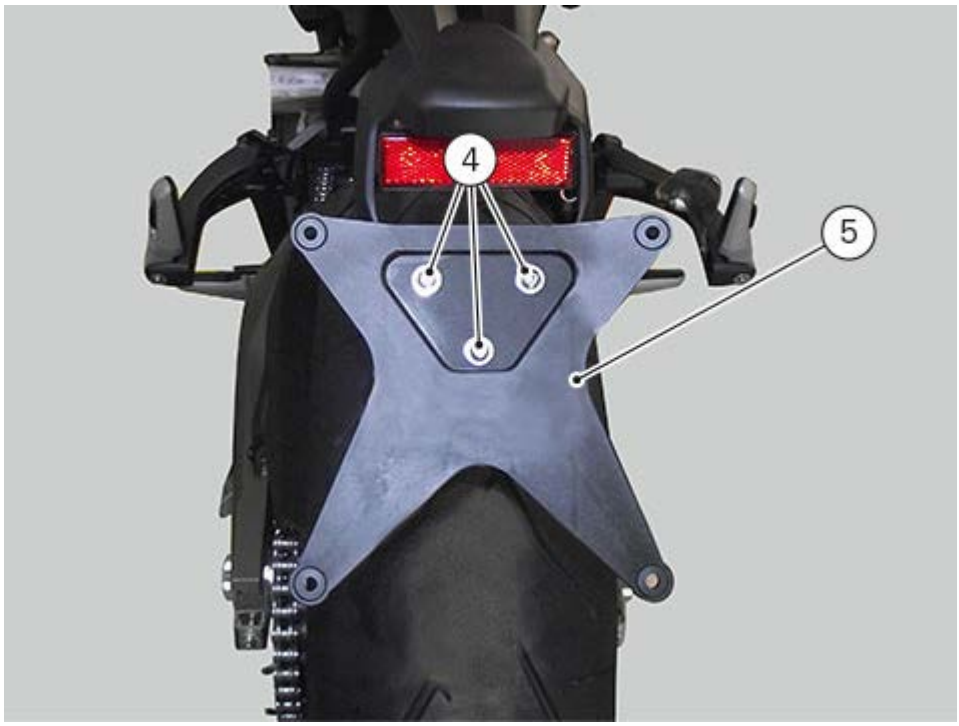


ALL VERSIONS (excluding AUSTRALIA)

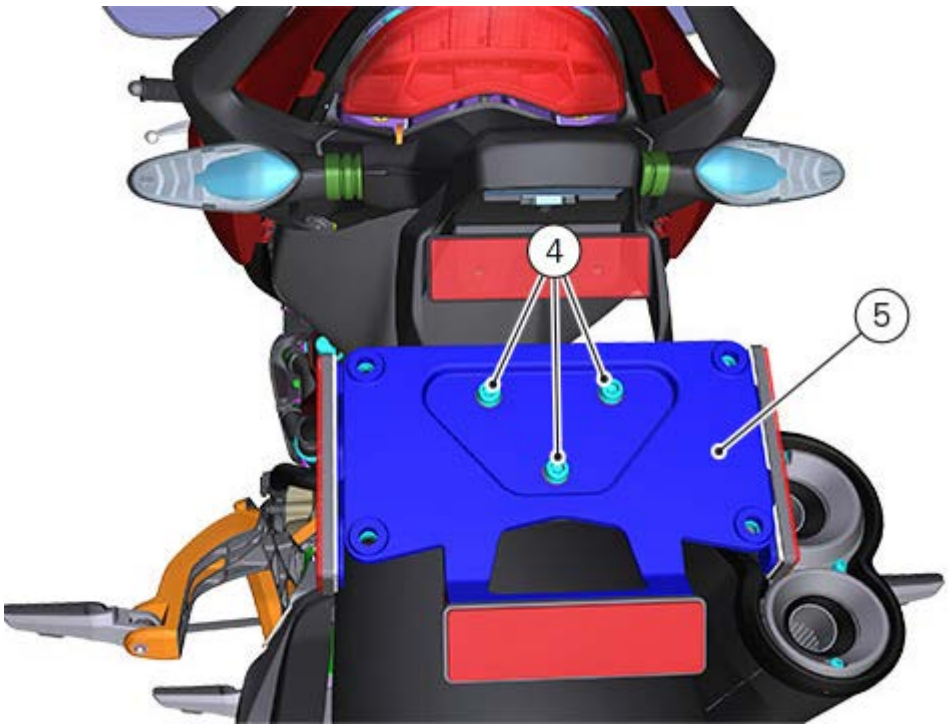
Undo the four screws (1).

After removing the number plate, loosen the three screws (4) and slide out number plate holder (5) from the rear side.

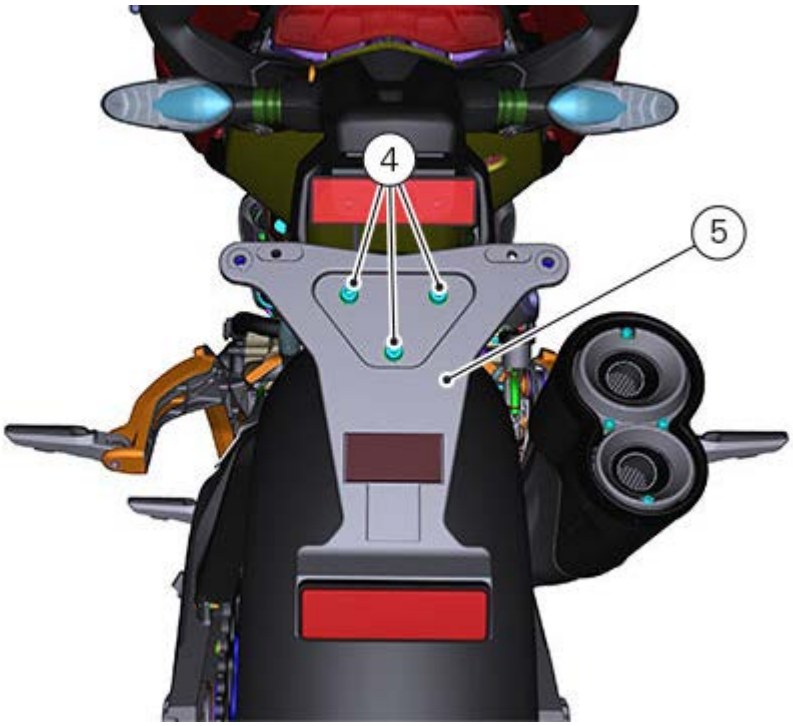
Europe version



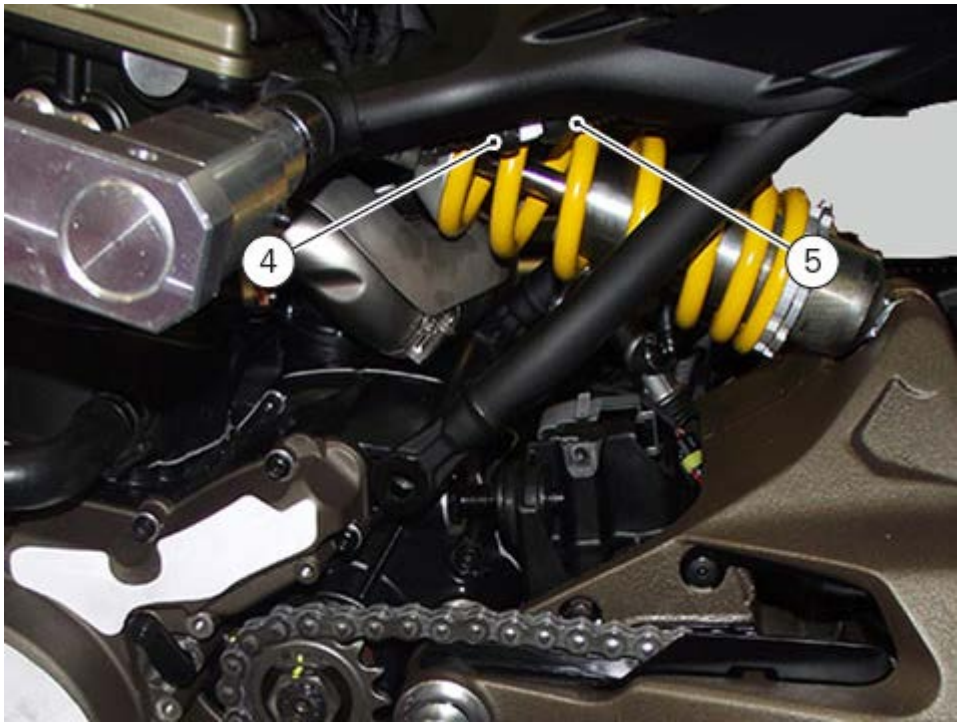
USA version



China / Brazil version

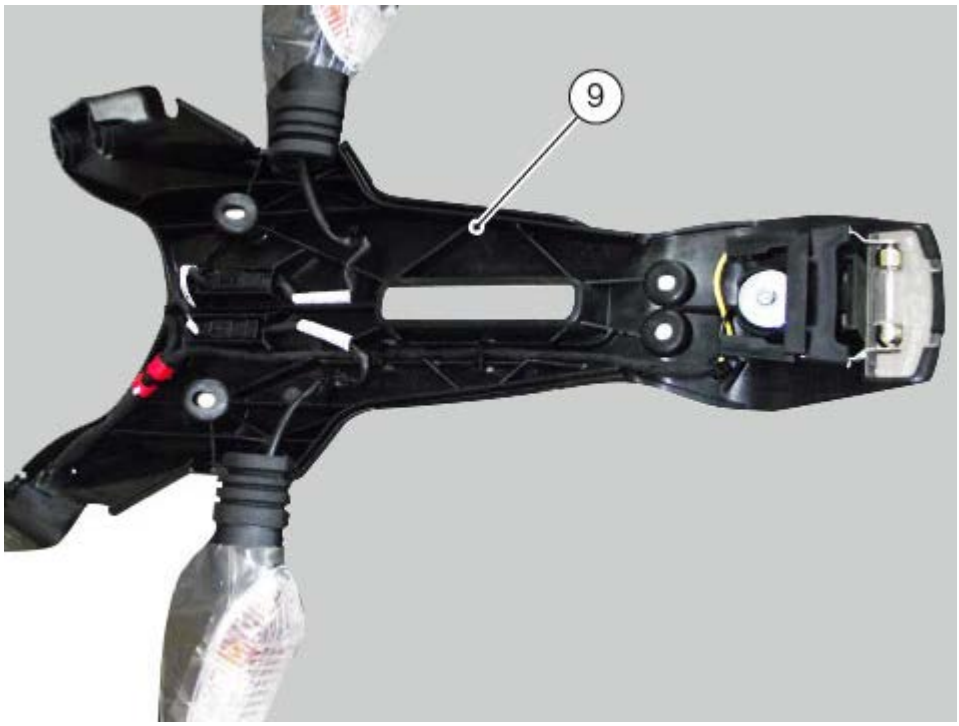


If necessary, disconnect connectors (4) and (5) of the rear wiring.



To disassemble the number plate holder, loosen the four screws (7) and separate the lower number plate holder (8) from the upper one (9).

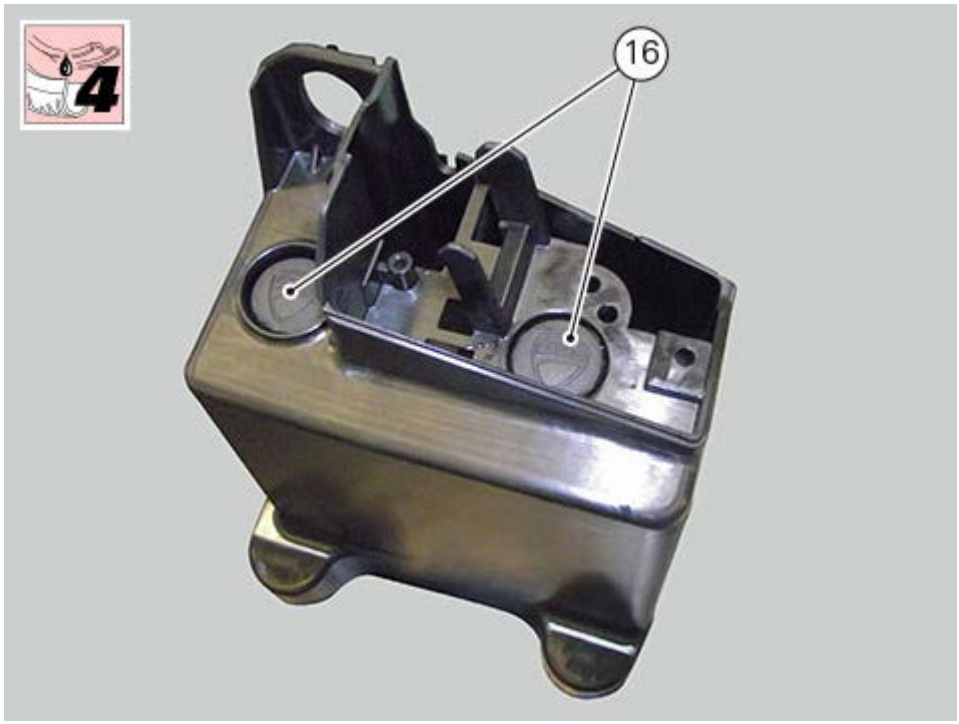
If necessary, it is now possible to work on the components fixed on the number plate holder (9): wirings, rear turn indicators and number plate light.

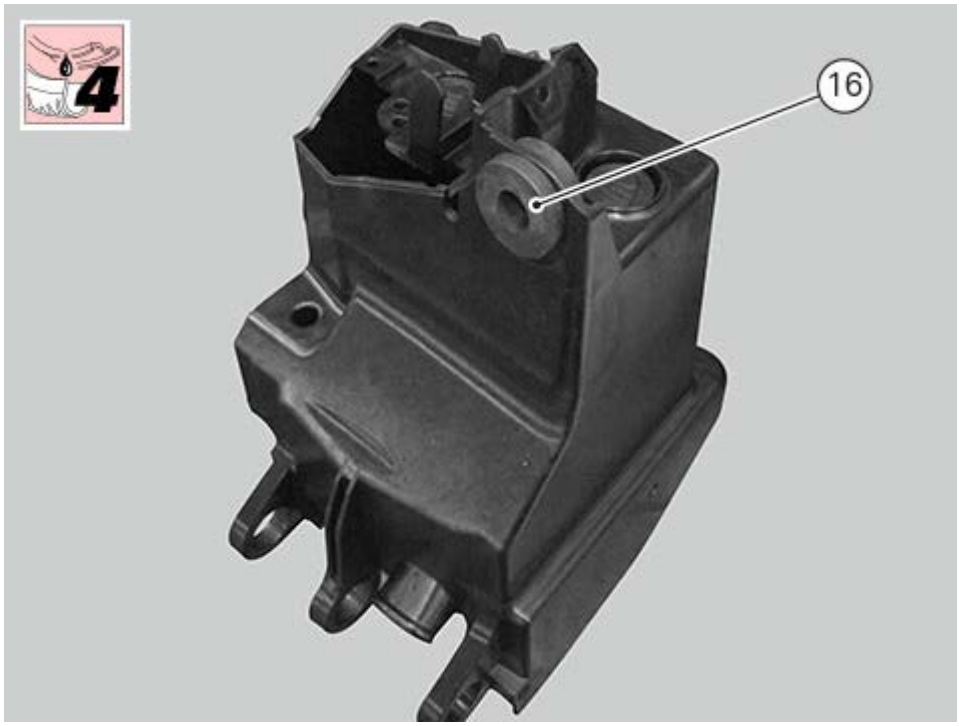


Refitting the electric components compartment

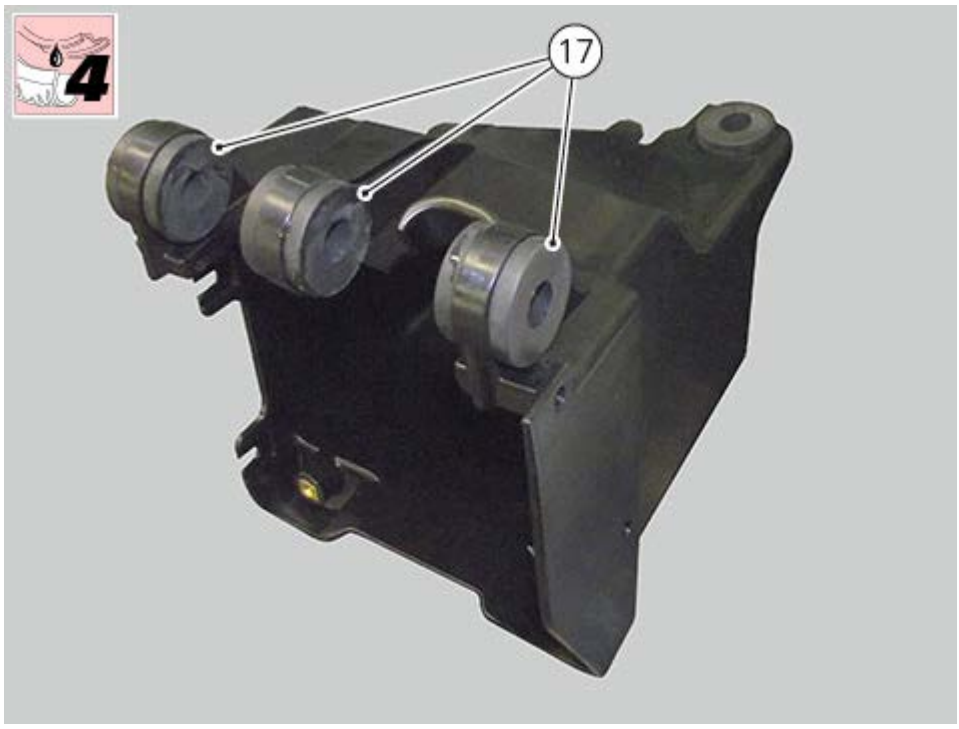
If previously removed, re-assemble the battery mount, as specified.

Fit upper vibration dampers (16) using the specified product.

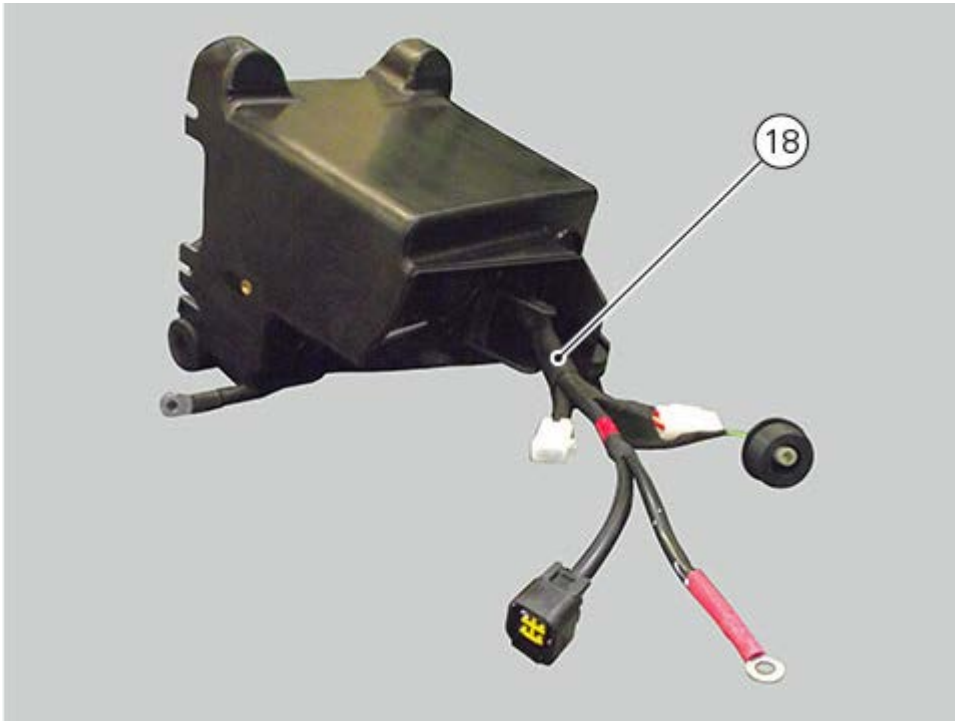




Smear vibration dampers (17) with the specified product before fitting them.

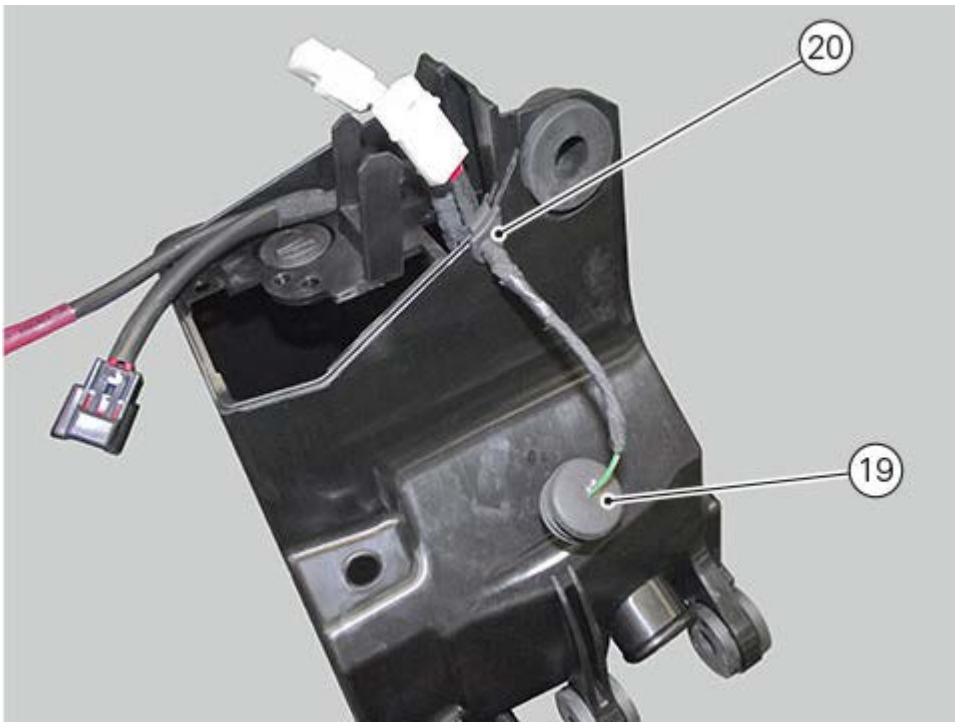


Fit and secure in place wiring (18), as shown in the figure.

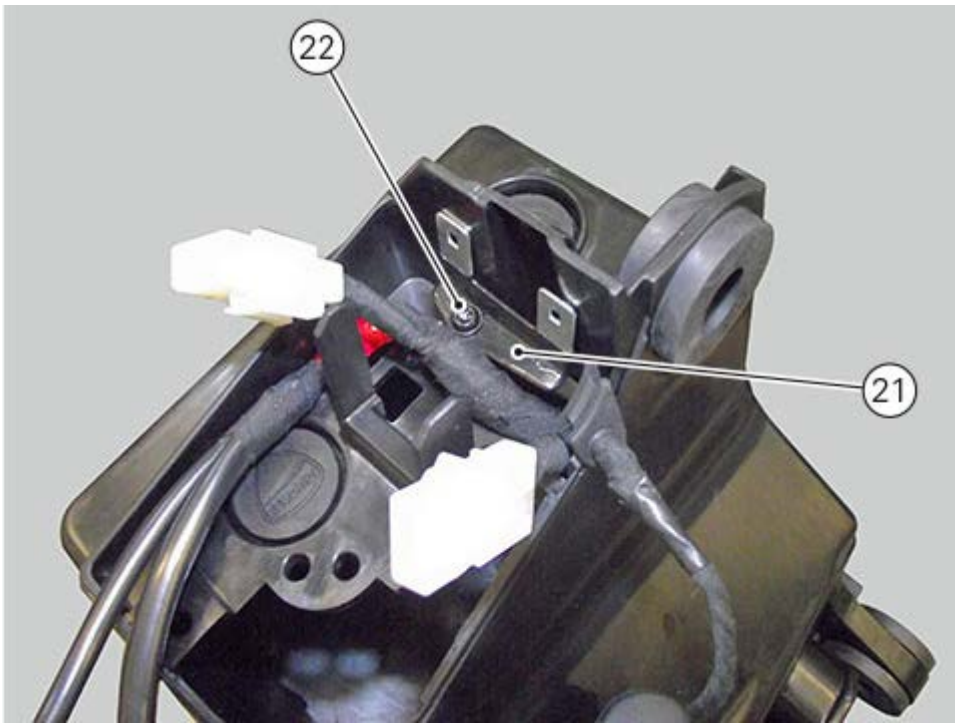


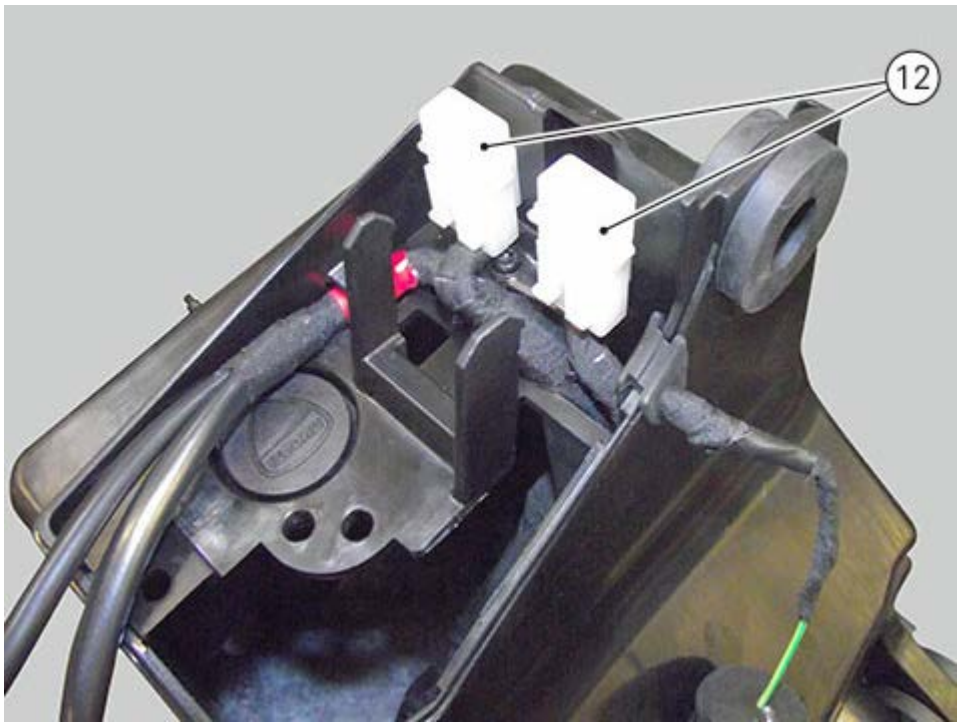
For wiring correct routing, refer to "Routing of wiring on frame".

Fit neutral sensor cable (19) securing it in place with seal (20).

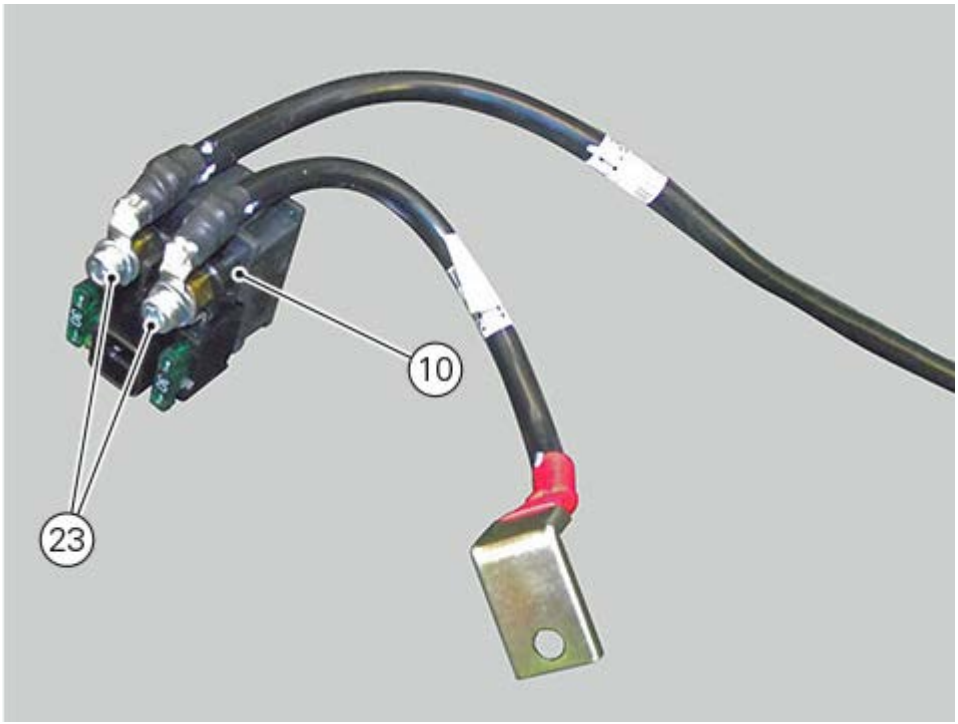


Fit ABS fuse holder (21) by tightening screw (22).
Position the two ABS fuses (12).

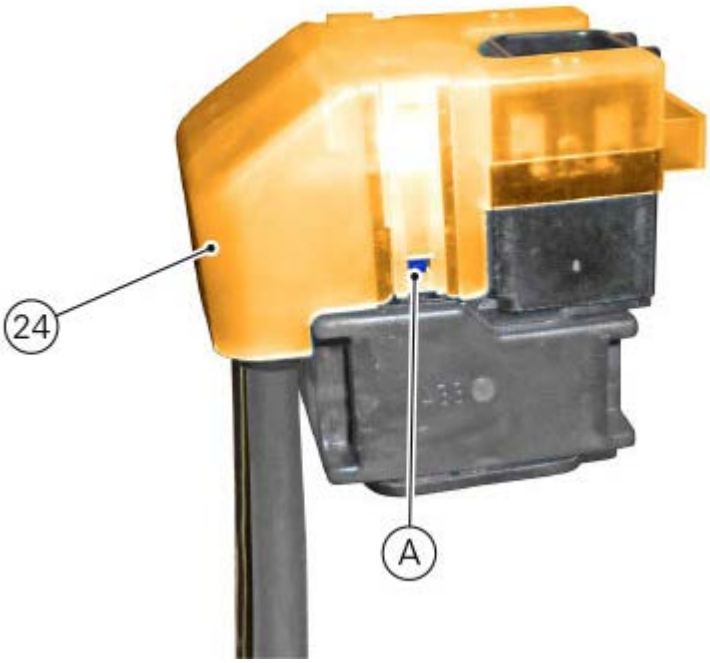


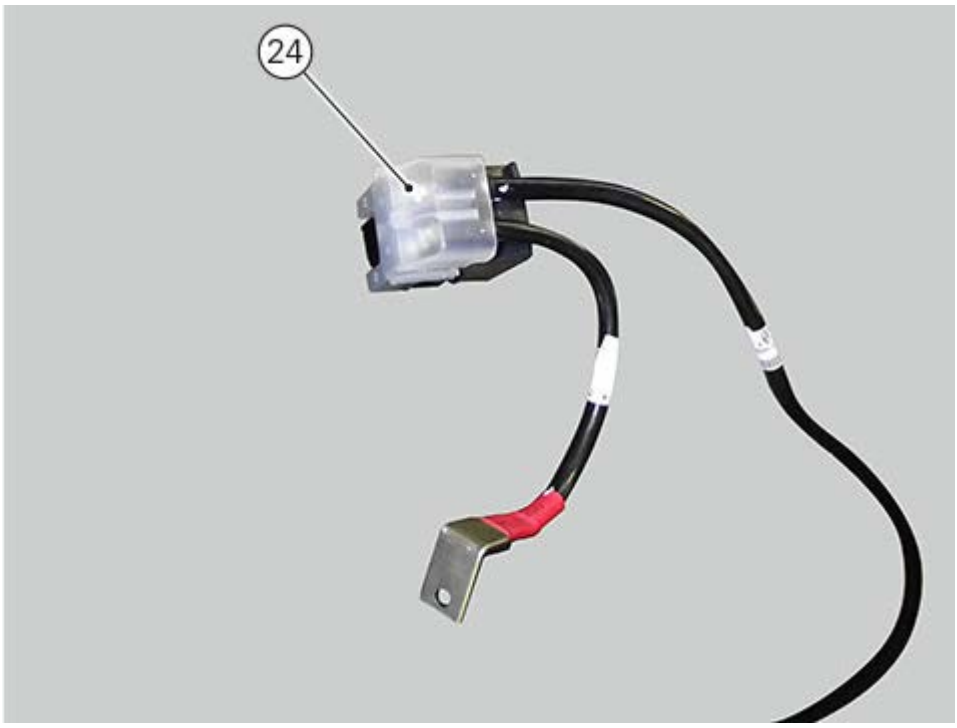


Connect cables to solenoid starter, tightening the two screws (23) to a torque of 5Nm.

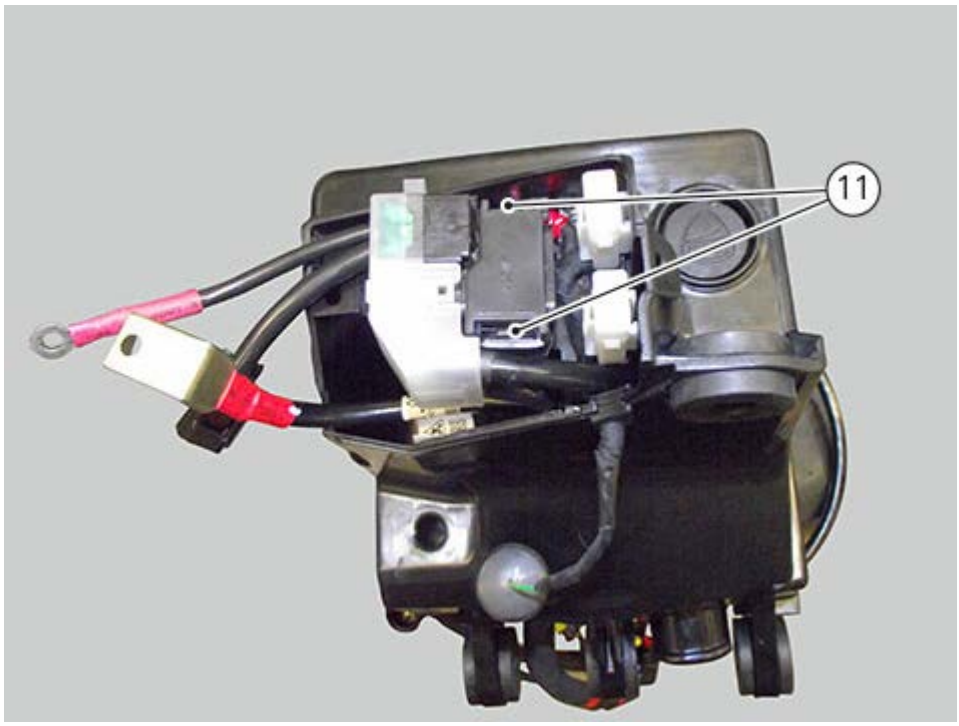


Install protection lid (24) by engaging it inside tab (A).

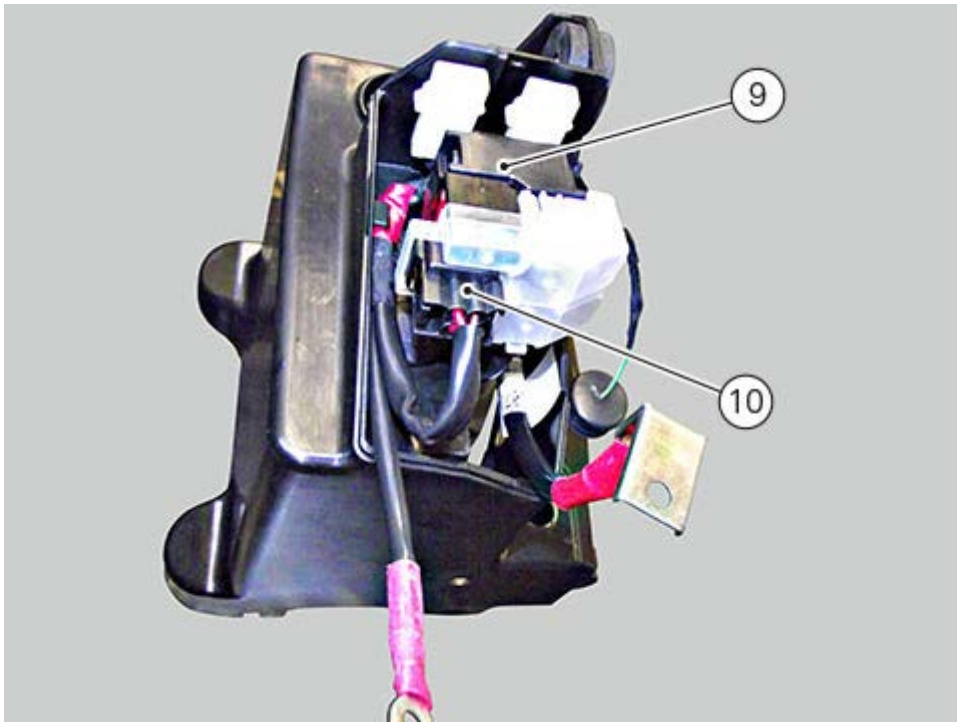




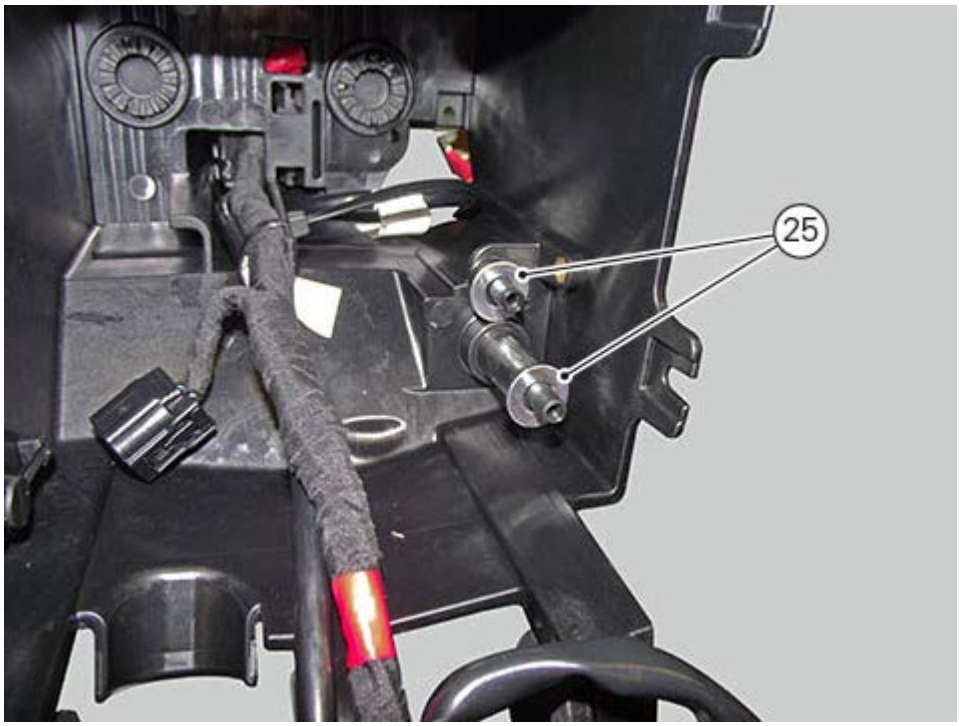
Fit solenoid starter (9) by securing it in place through the relevant fasteners (11).



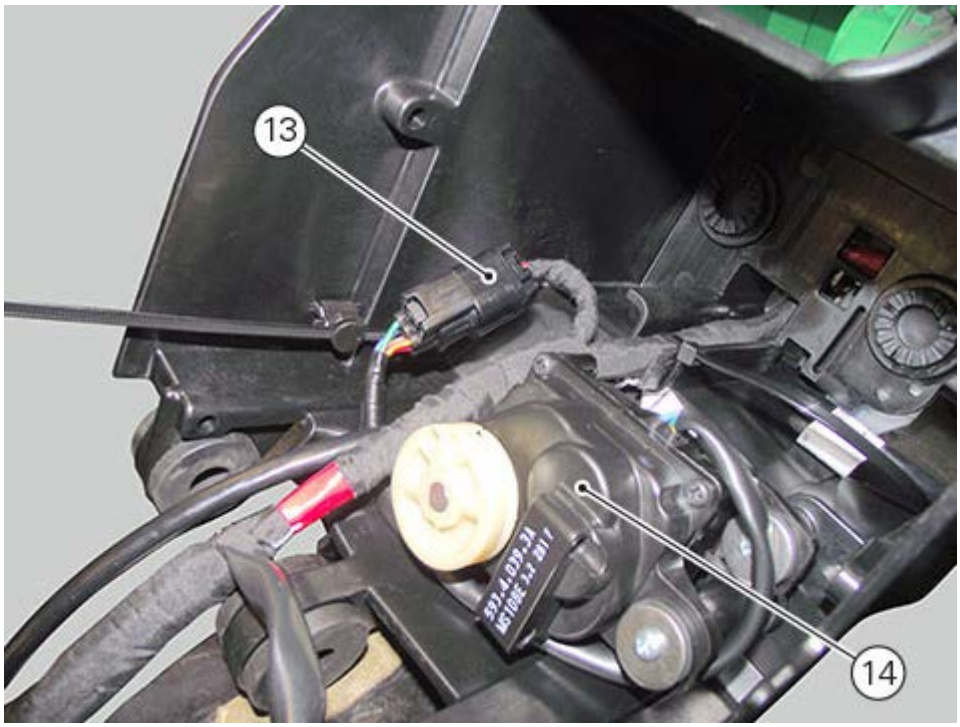
Connect connector (10) of the solenoid starter (9).

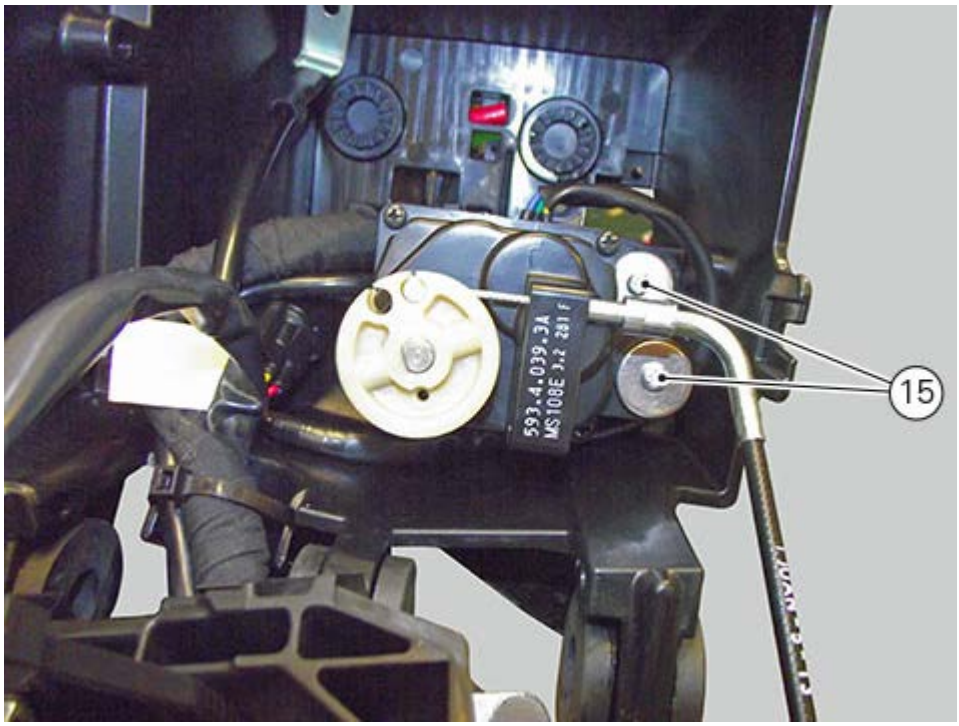


Working on the opposite side, fit the two washers (25).

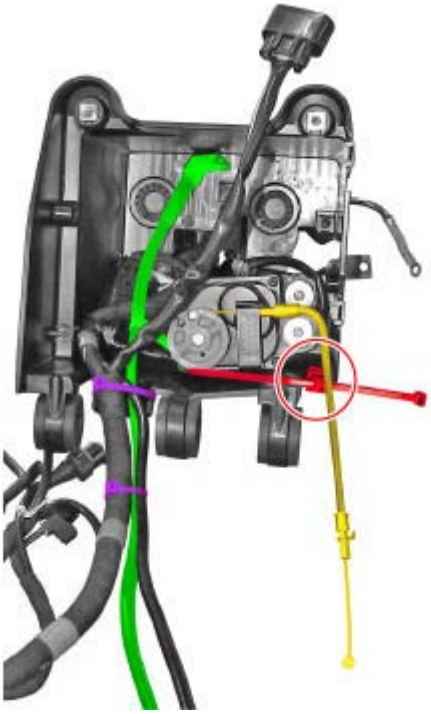


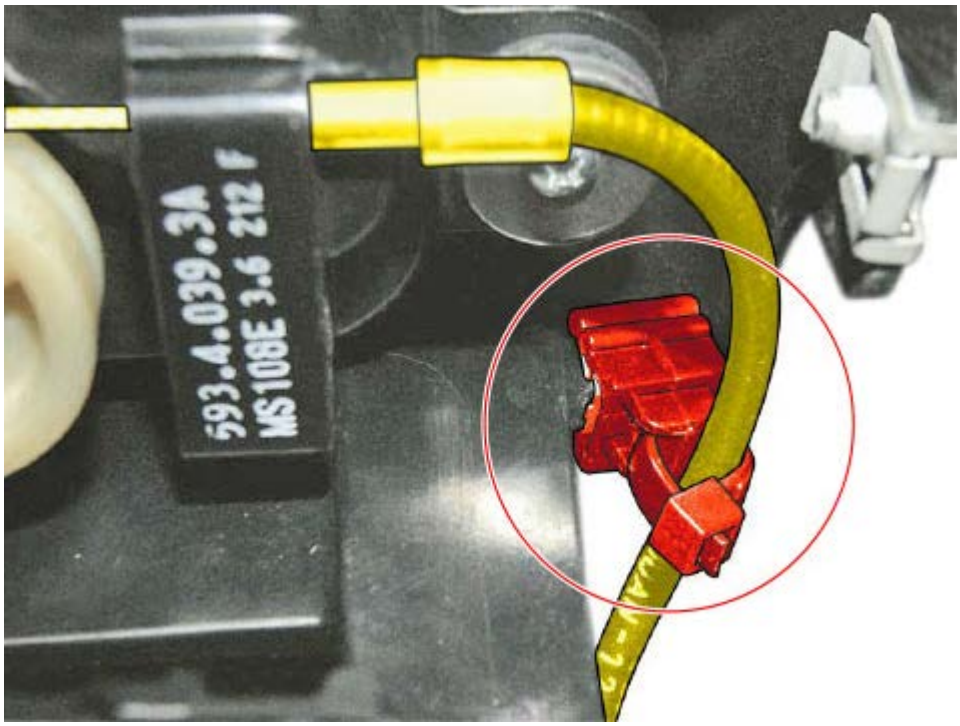
Fit exhaust valve motor (14), connect connector (13) and secure motor in place with screws (15), to be tightened to a torque of 3.5 Nm ± 10%.



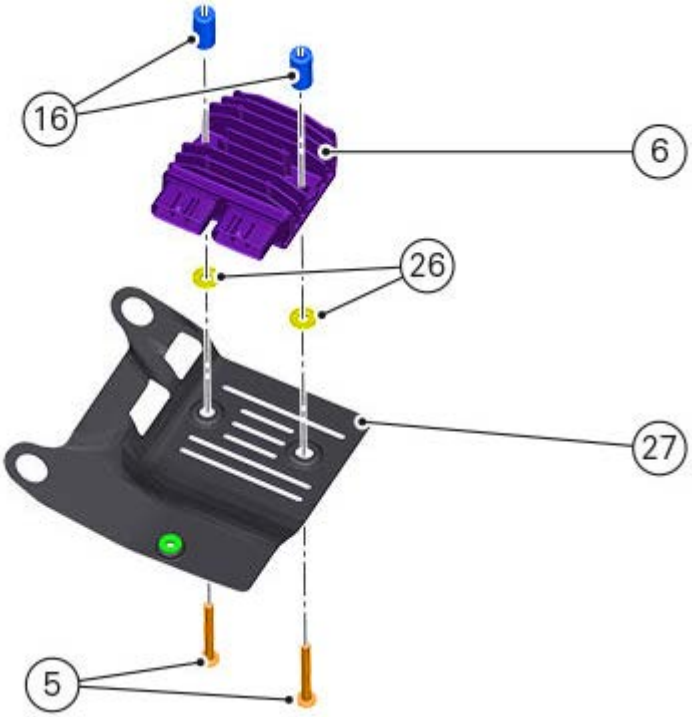


Tie the exhaust valve motor cable as indicated.

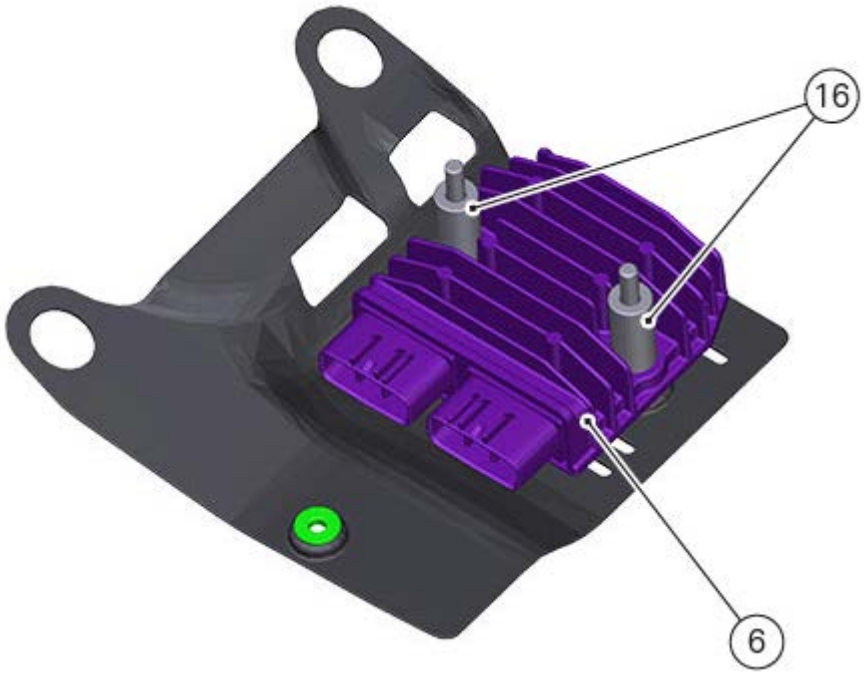




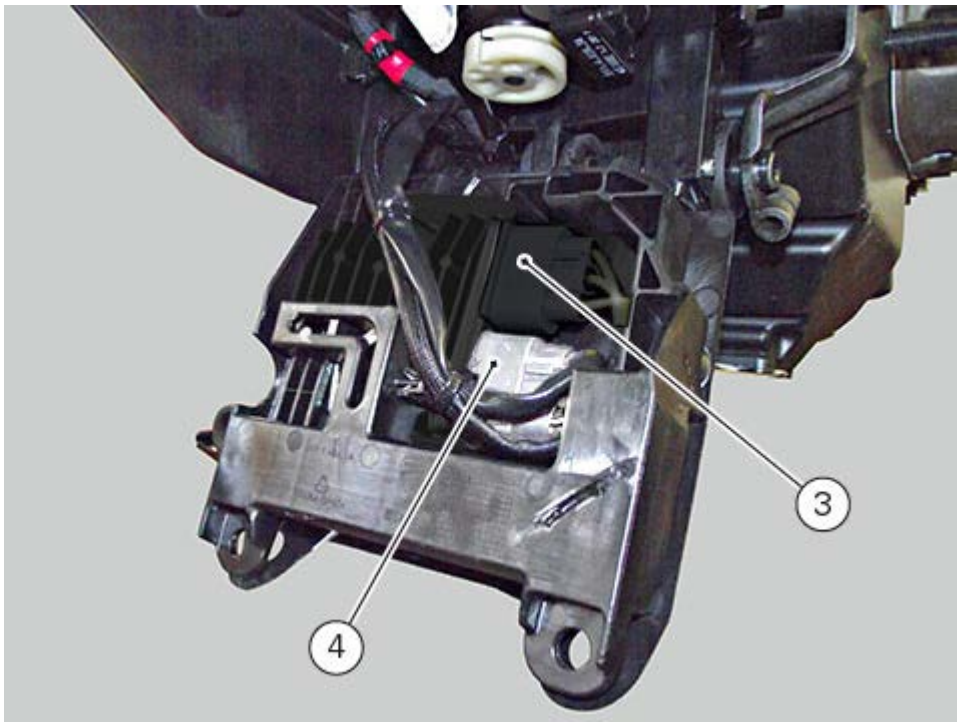
Connect the exhaust valve motor cable (Refitting the exhaust system).
Fit the two spacers (26) on cover (27).



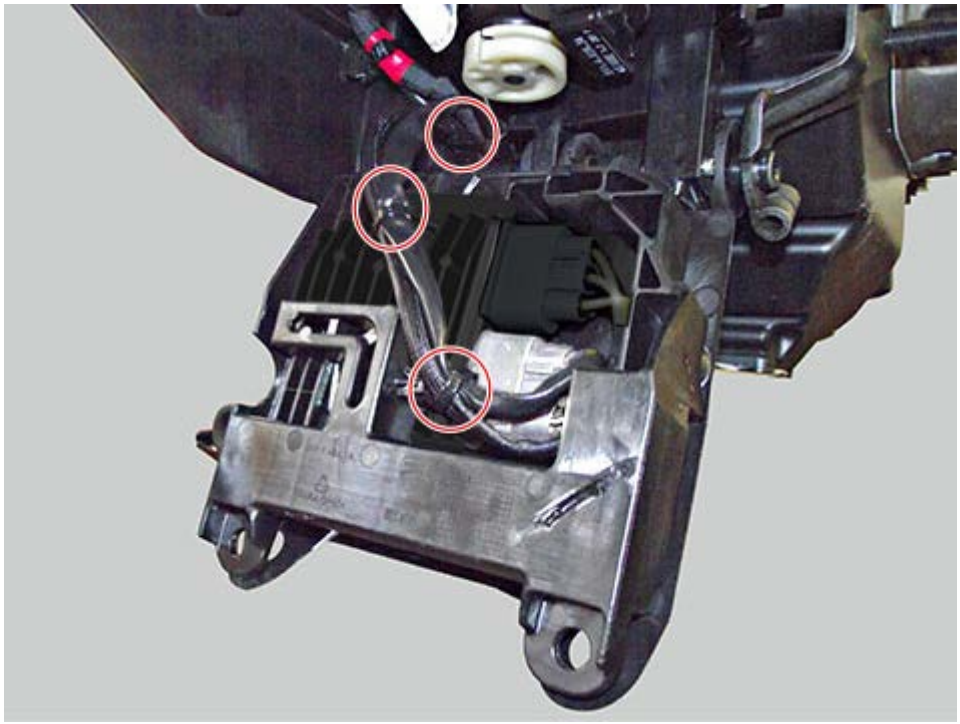
After having fitted the two spacers (16), close cover (27) and secure voltage regulator (6) in place with the two screws (5), battery mount cover.
Tighten the two screws (5) to a torque of 8 Nm ± 10%.



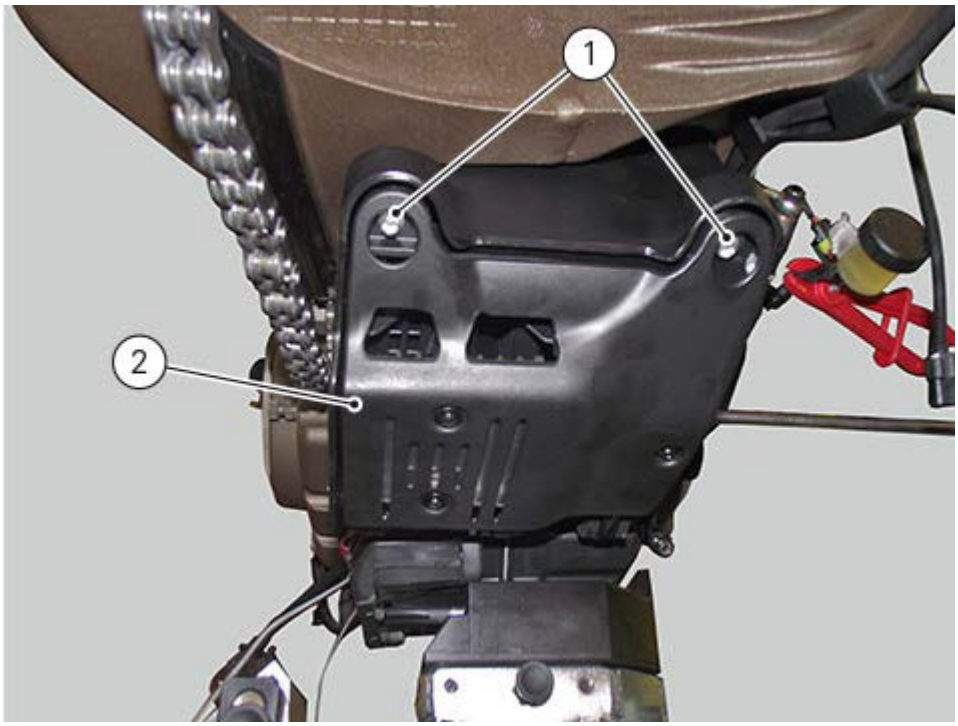
Open cover (27) and connect the two regulator connectors (3) and (4).



Check that the voltage regulator wiring is properly tied.



Route wirings as specified in chapter "Routing of wiring on frame".
Fit the battery (Battery).
Tighten the two screws (1) to a torque of 5 Nm ± 10% and the screw (2) to a torque of 3 Nm ± 10%.

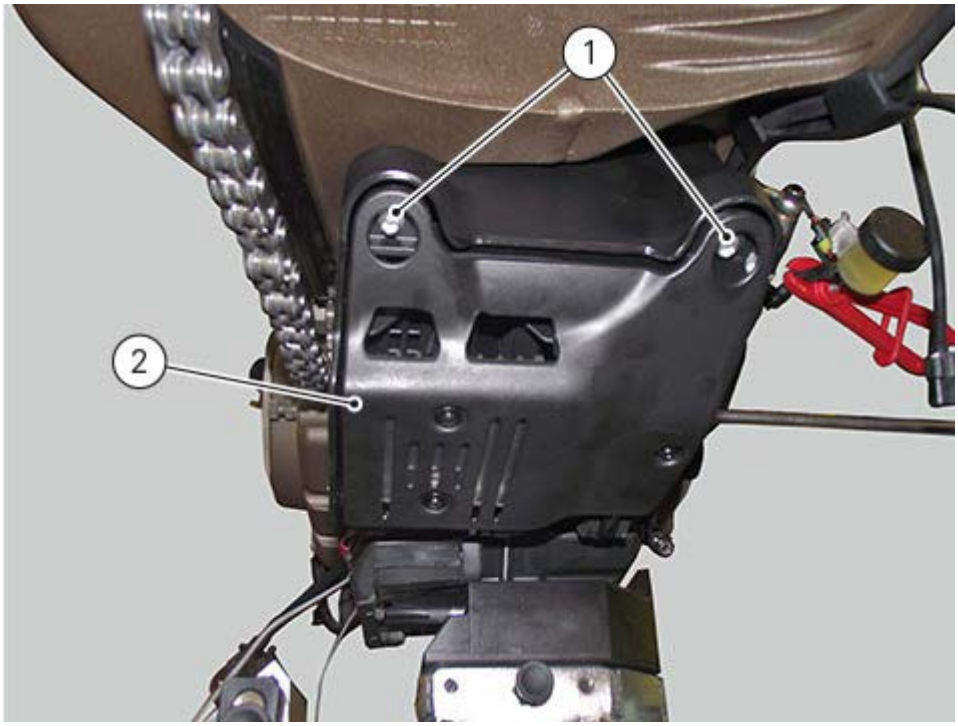

1
2

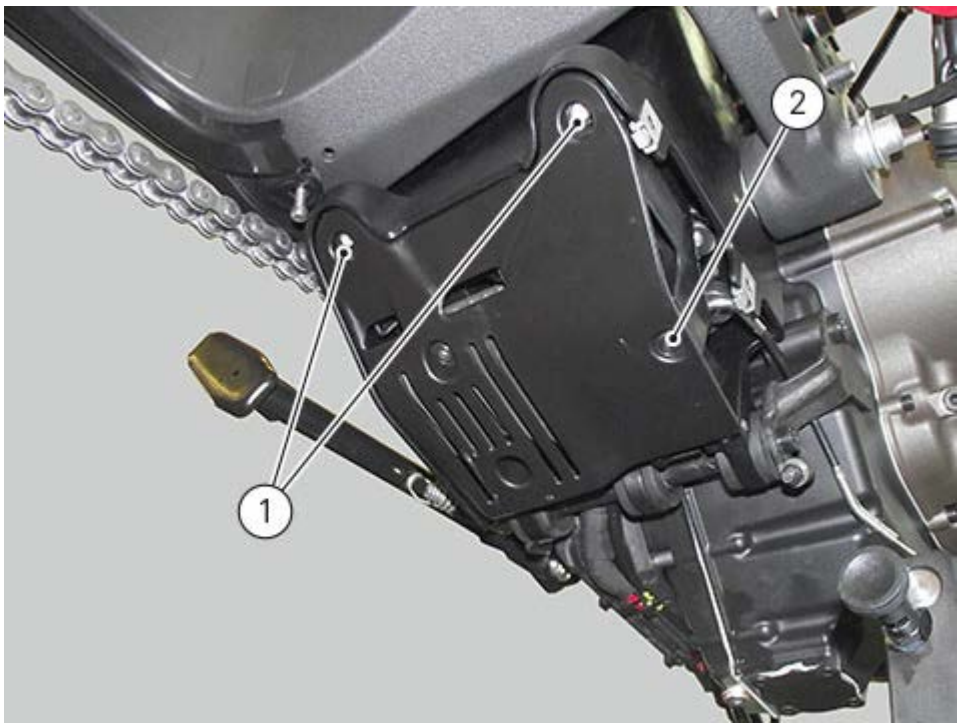
Removing the electric components compartment

Loosen the two screws (1) and screw (2).

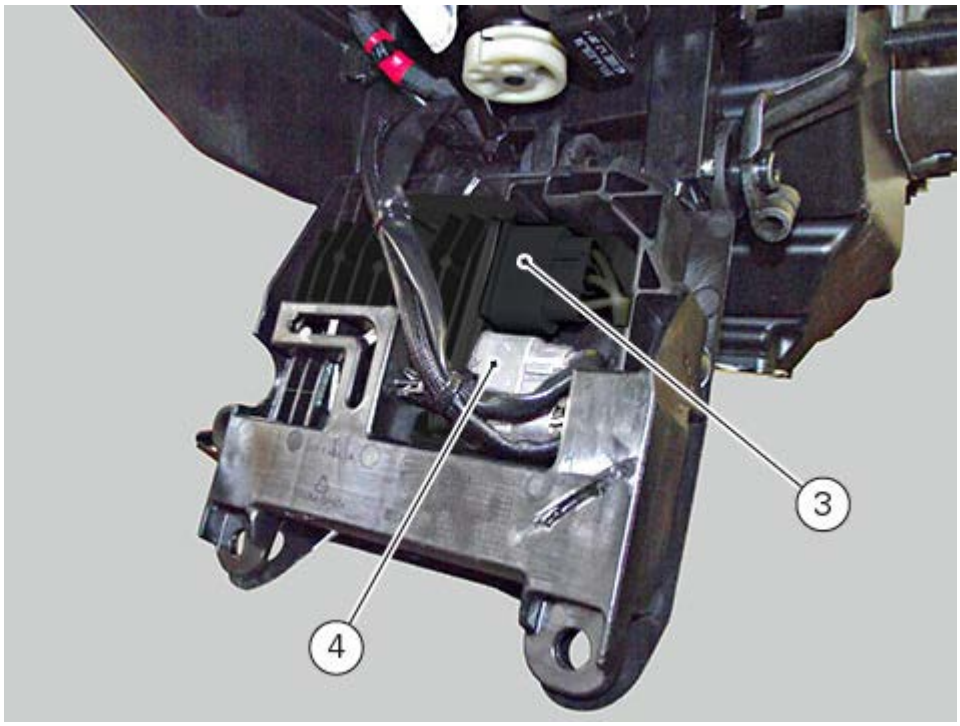
Warning
Hold wiring support while loosening screws since it opens and battery might thus slide down.

Remove the battery (Battery).

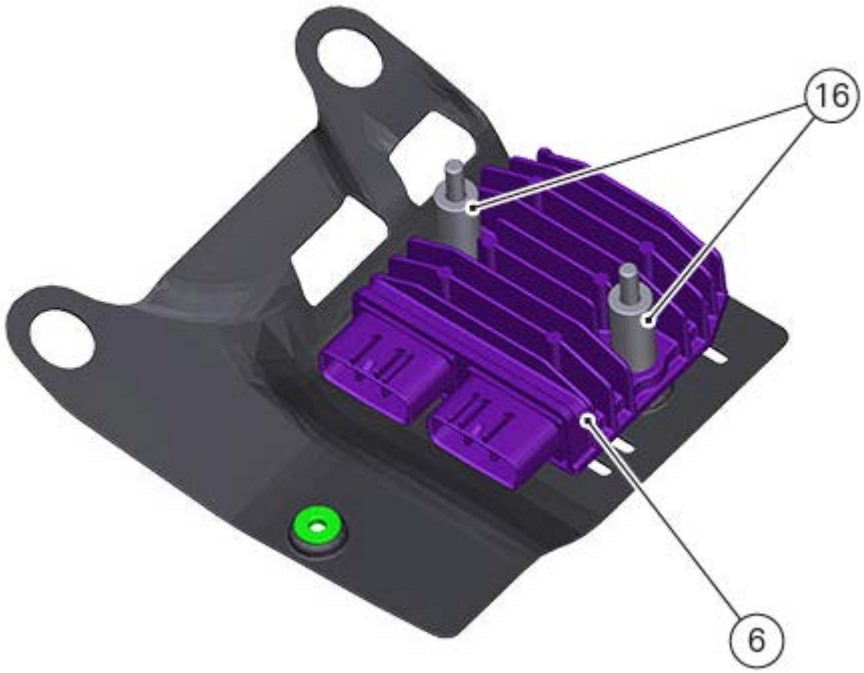




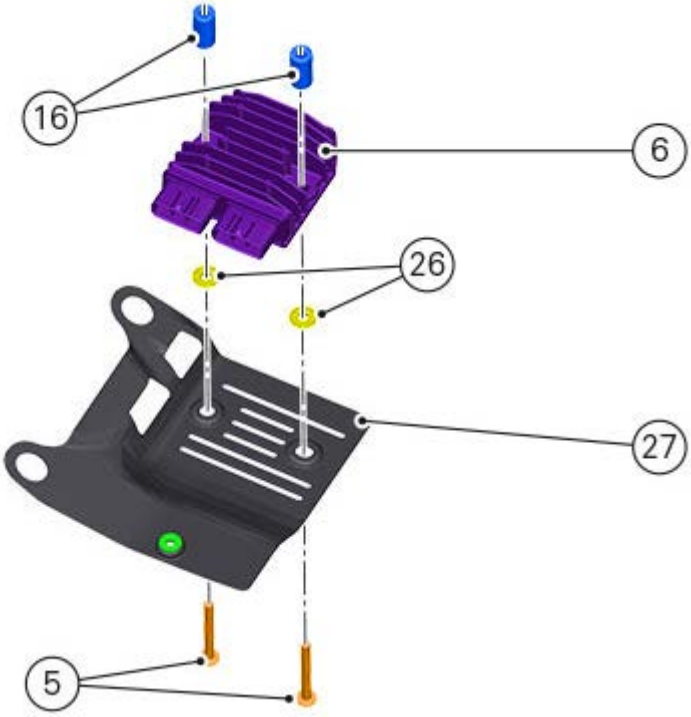
Disconnect the voltage regulator connector (3) and the generator connector (4).



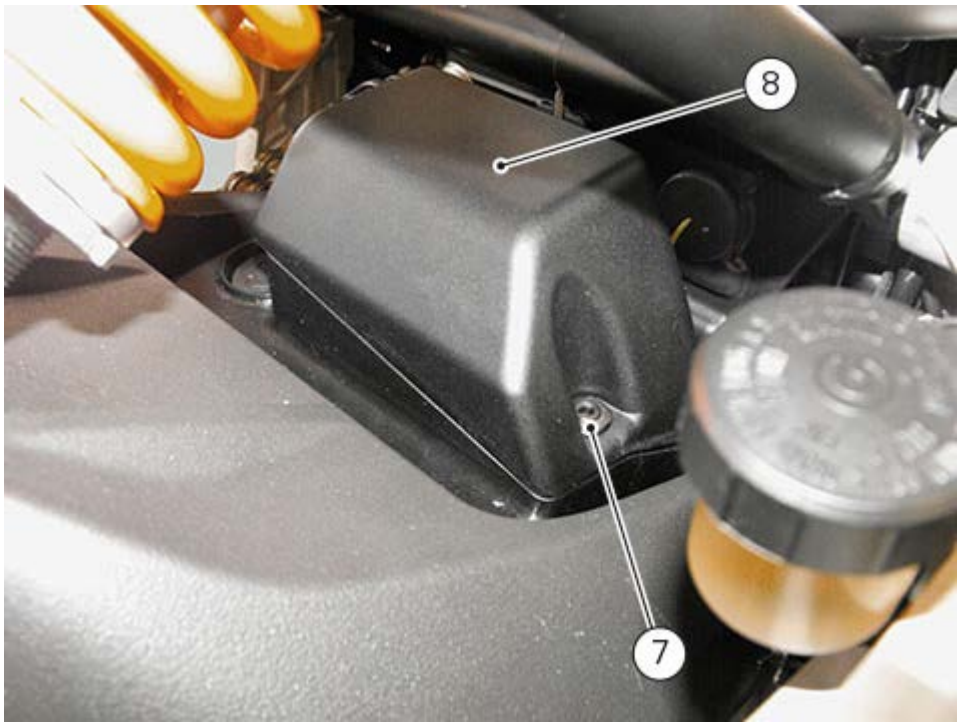
Working on the opposite side, loosen the two fastening screws (5), collect spacers (16) and remove regulator (6).



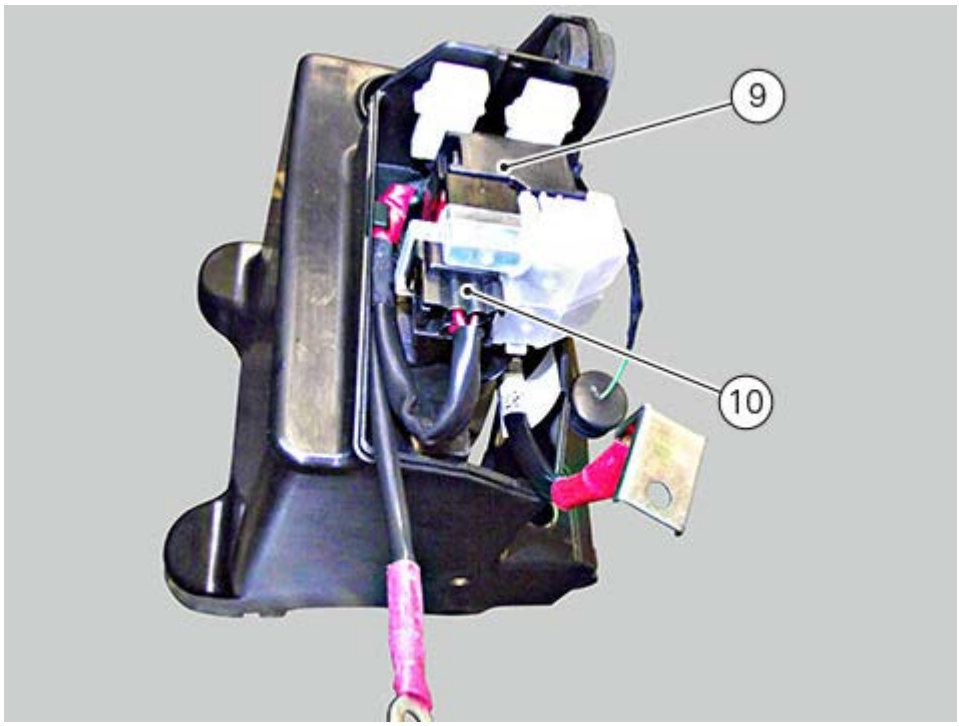
Collect lower spacers (26).



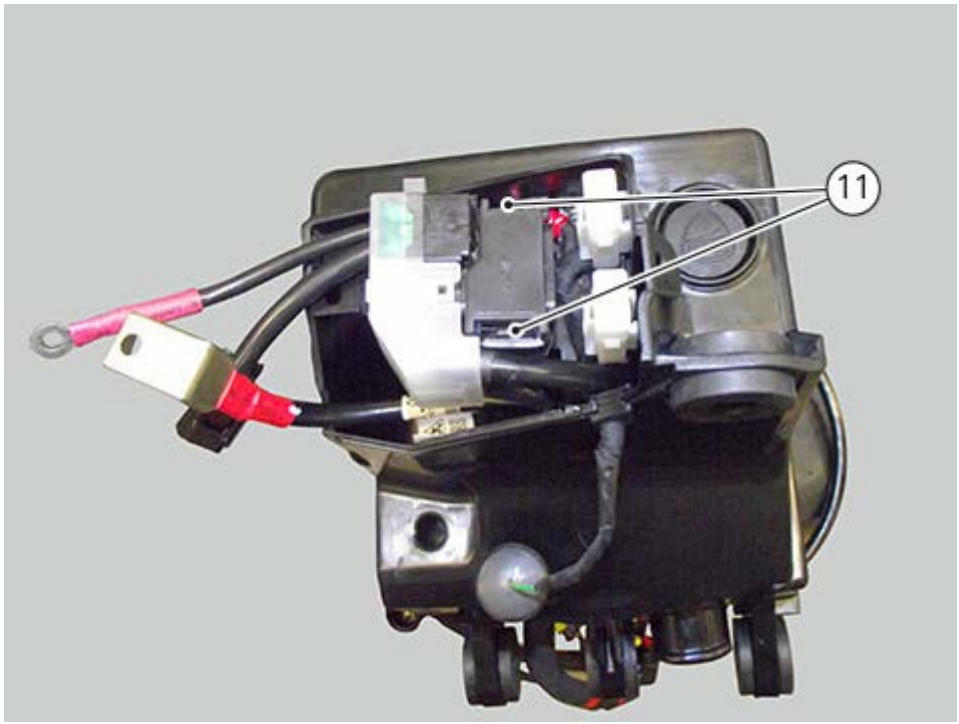
Loosen the two fastening screws (7) on cover (8) protecting the solenoid starter and the two ABS fuses.



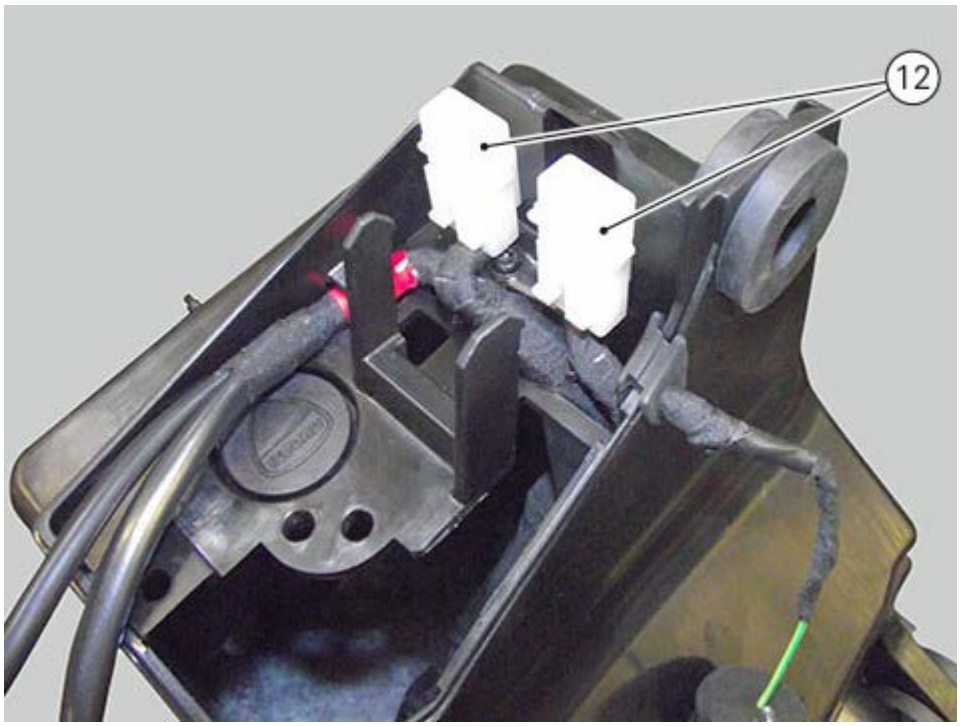
Disconnect the regulator connector (10).



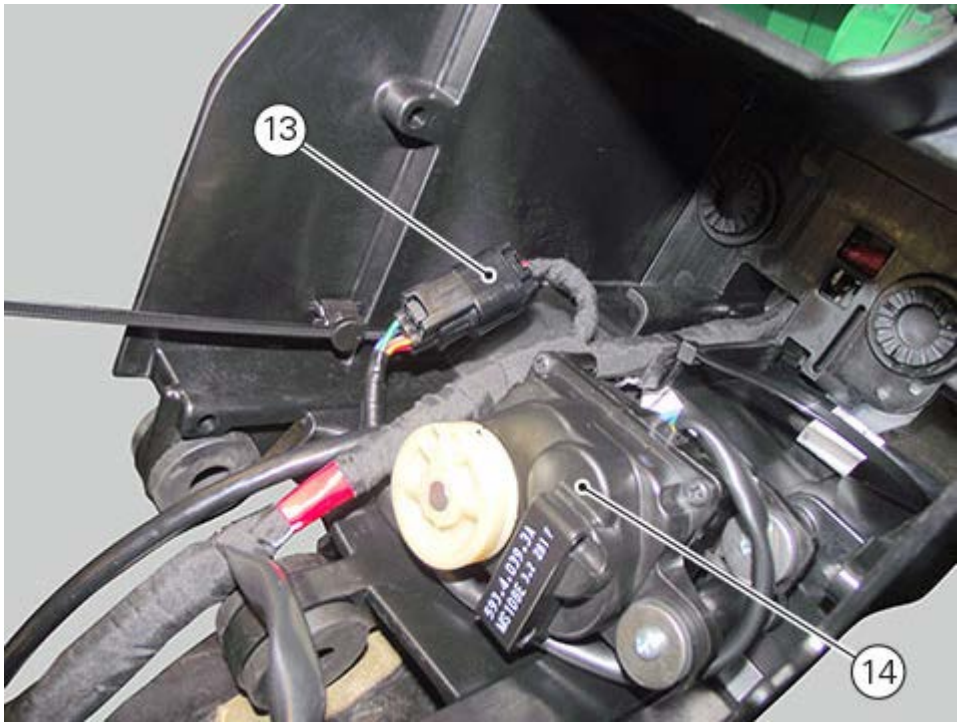
Remove the solenoid starter (10) by pulling it up and releasing it from fasteners (11).



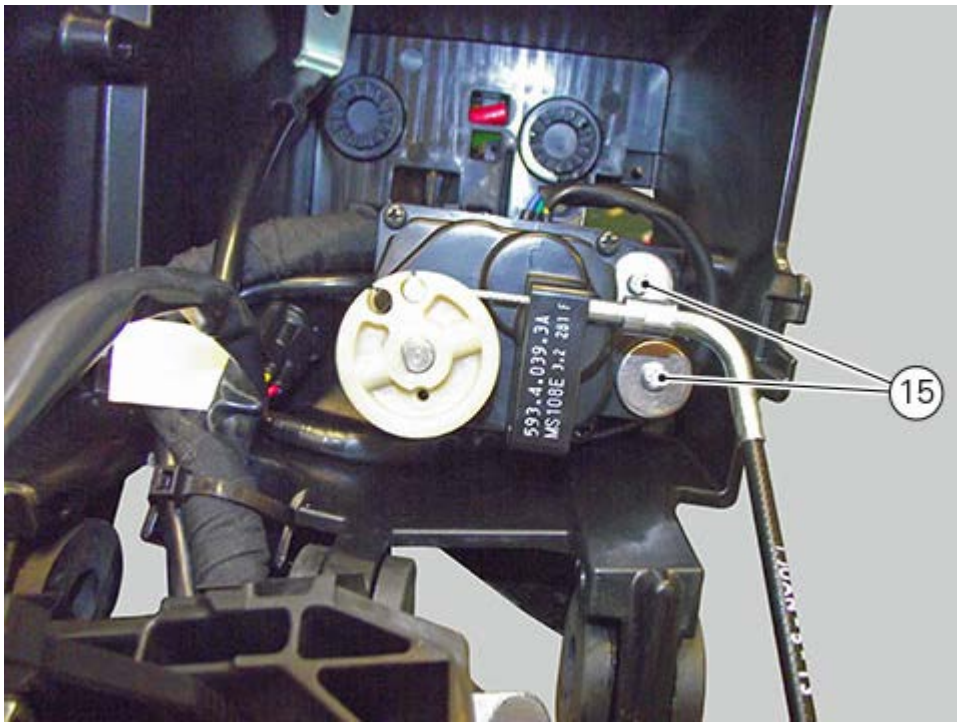
If necessary, remove the two ABS fuses (12).



Disconnect connector (13) of the exhaust valve motor (14).

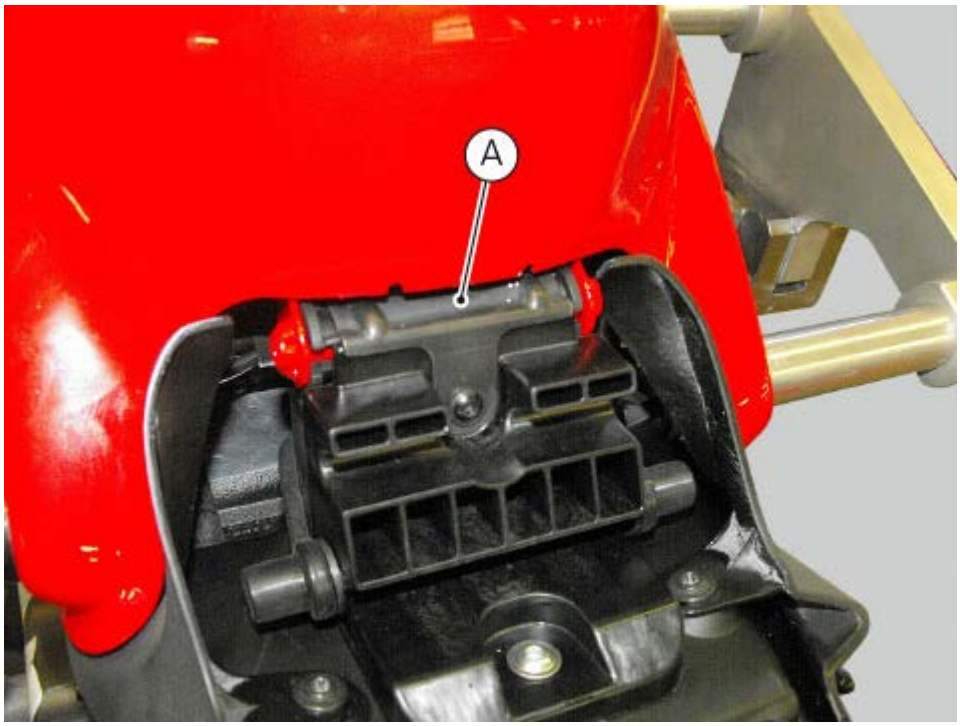


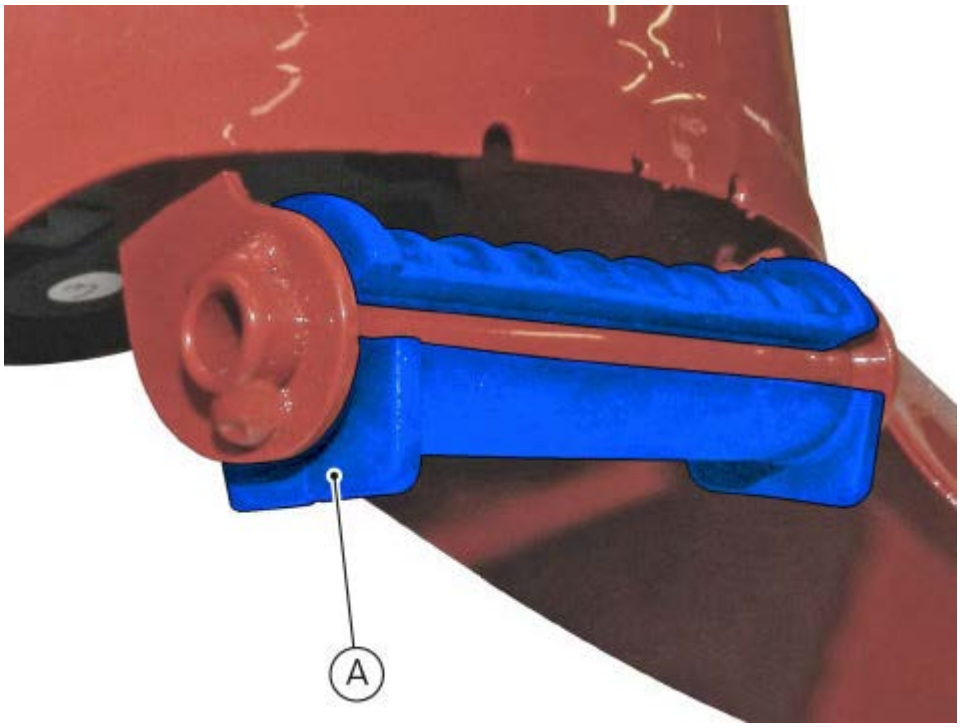
Remove the exhaust valve (Removing the exhaust valve).
Loosen the screws (15) and remove the exhaust valve motor.



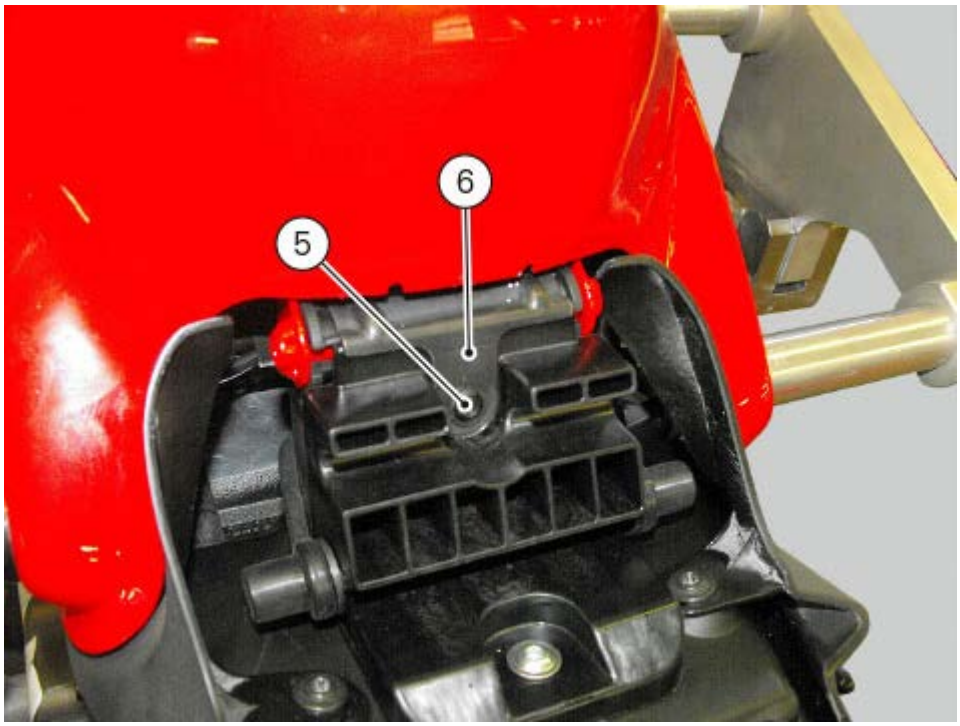
Refitting the fuel tank

Make sure that rubber block (A) is correctly positioned.



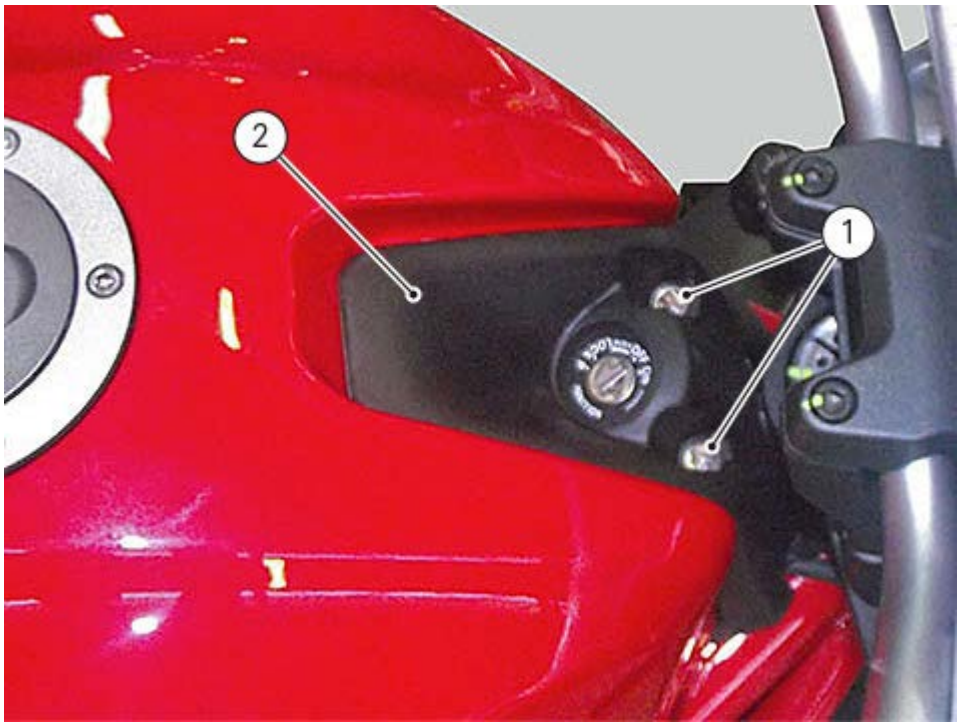


Position the tank.
Close bracket (6) and tighten the screw (5) to a torque of 5 Nm ± 10 %.



Engage elastic (3) on knob (4).

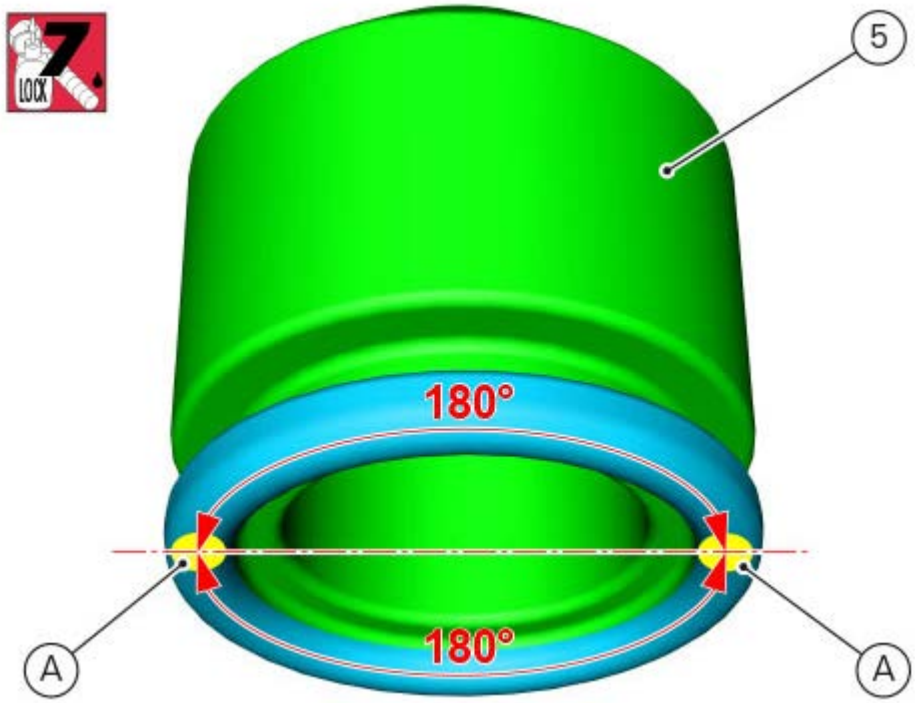
Position the ignition switch cover (2) and tighten the two nuts (1) to a torque of 7 Nm ± 10 %.



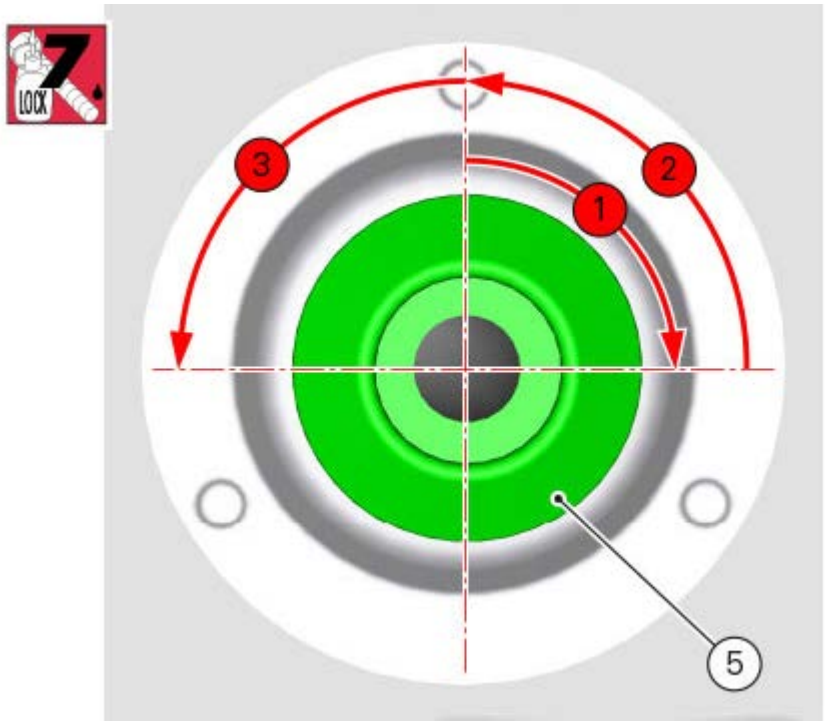
Refit the seat (Refitting the seat).

Refitting the fuel tank flange

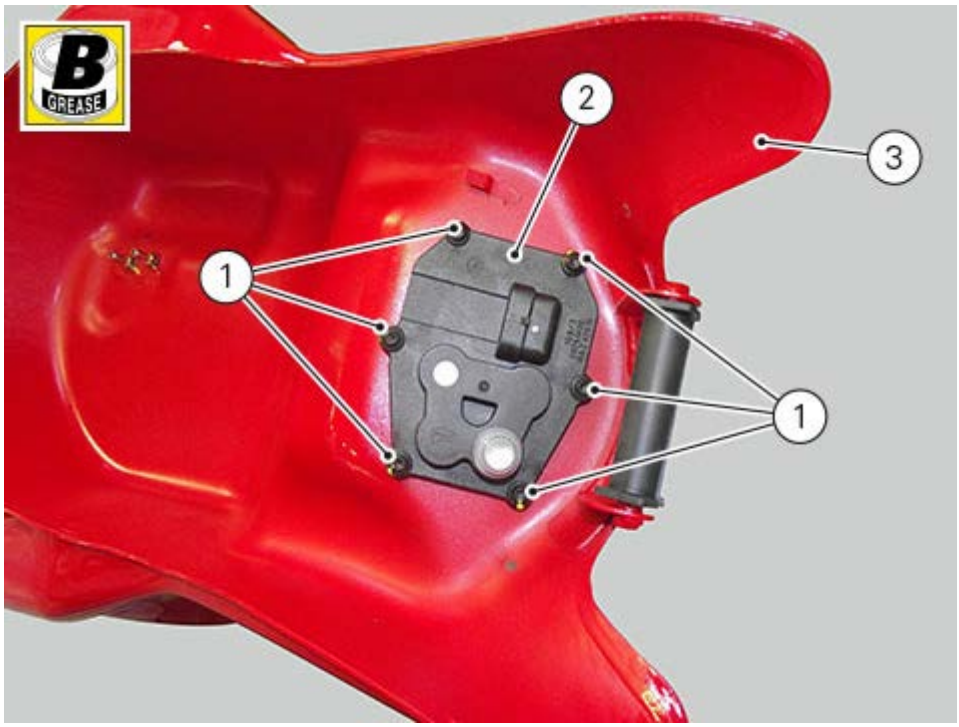
If breather cap (5) has been removed, apply the specified product in the two points (A), 180° one from the other.



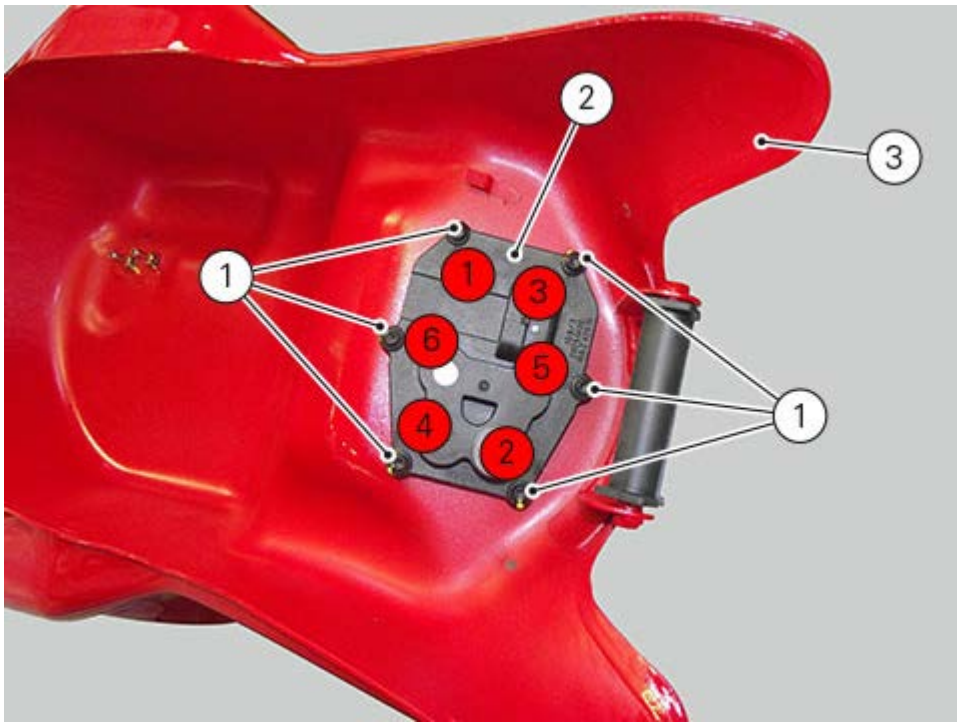
Fit breather cap (5) fully home in the fuel tank indicated hole.
Rotate the cap in the 1-2-3 sequence shown in the figure to evenly distribute the adhesive product previously applied on the two points (A) of the lower profile:
1 - rotate cap (5) by approximately 90° clockwise;
2 - bring cap (5) back to its original position;
3 - rotate cap (5) by approximately 90° counter clockwise.



Apply the recommended product to the thread and underhead of screws (1) and start them on the fuel pump nozzle (2).



Tighten the screws (1) to a torque of 5 Nm ± 10%, following the sequence shown in the figure.

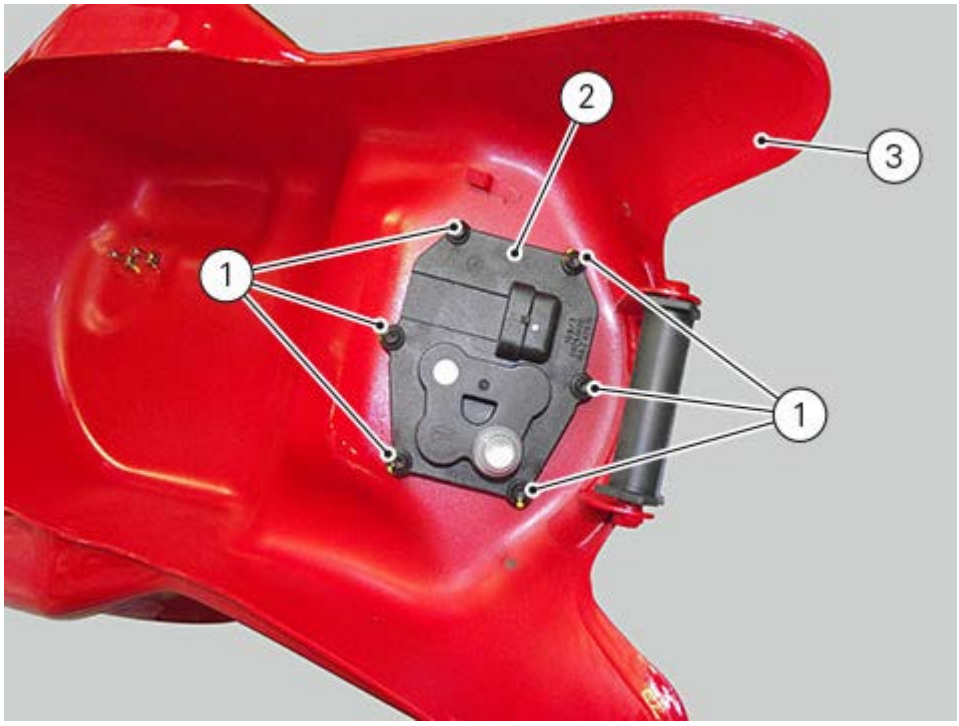


Refit the fuel tank (Refitting the fuel tank).
Refit the seat (Refitting the seat).

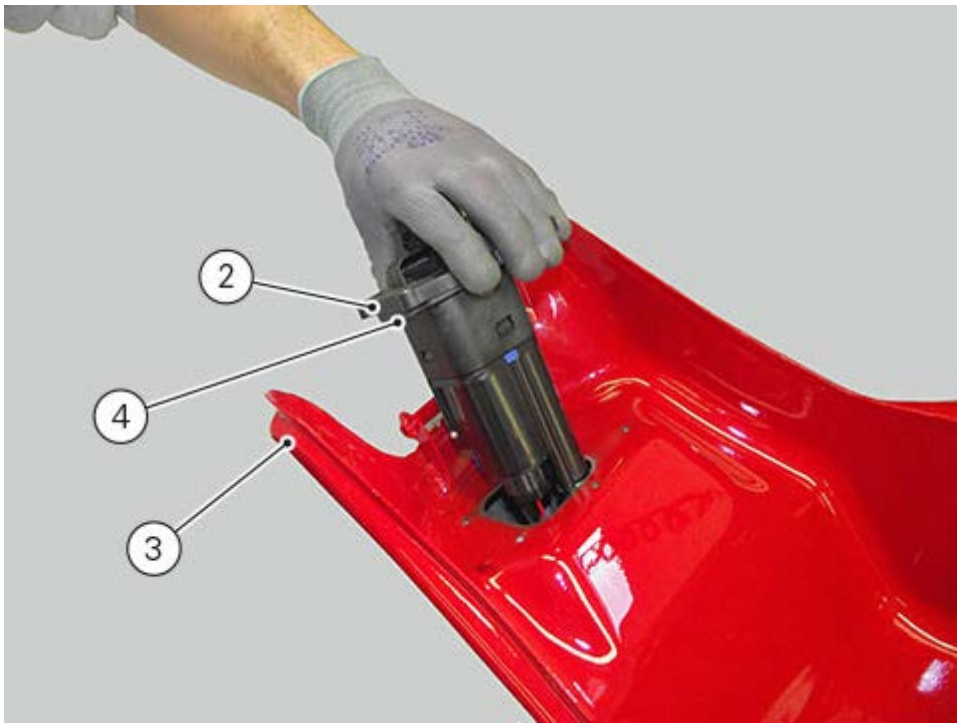
Removing the fuel tank flange

Remove the seat (Removing the seat).
Remove the fuel tank (Removing the fuel tank).

Loosen the six retaining screws (1) of tank flange (3).



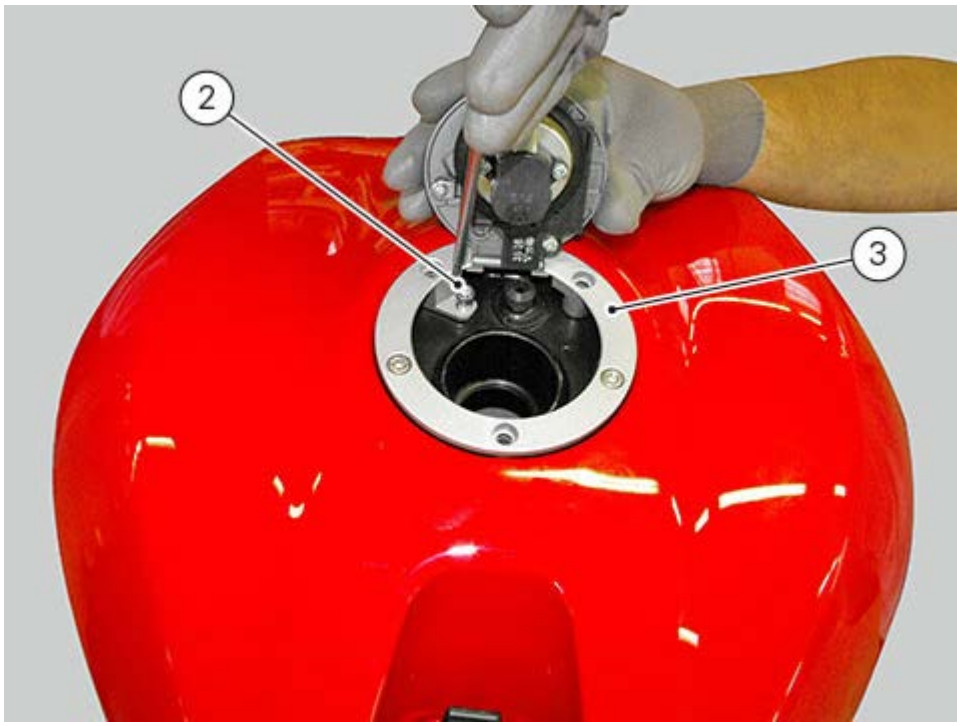
Slide fuel pump (2) out of tank (3) and collect gasket (4).



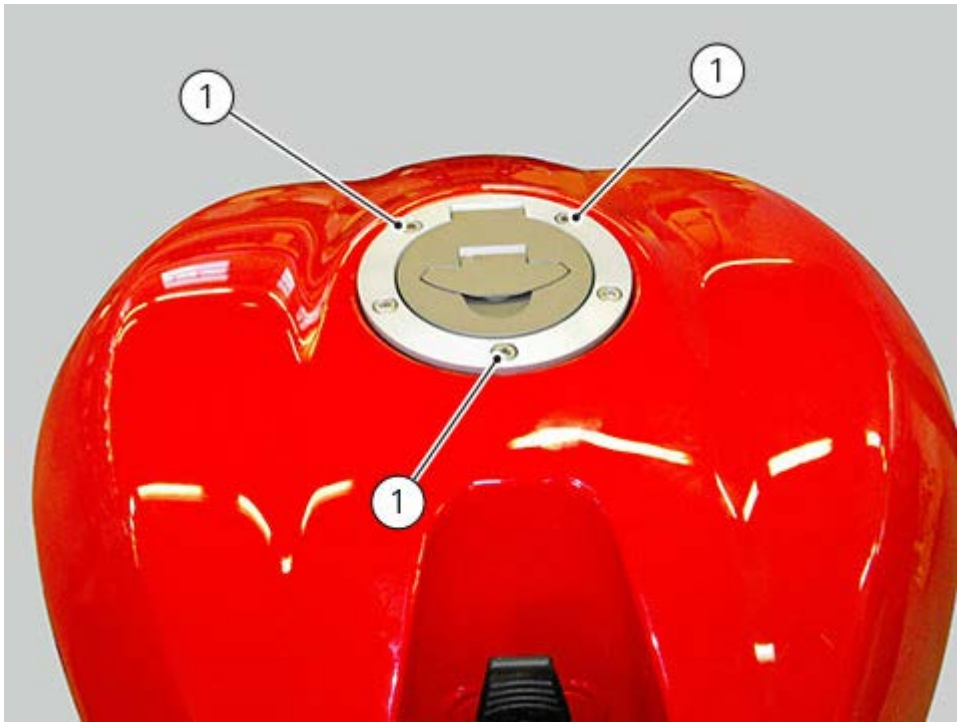
Before refitting, carefully remove any deposits or scale from all parts.

Refitting the tank filler plug

Place tank filler plug (3) and tighten the internal screw (2) to a torque of 4 Nm ± 10%.

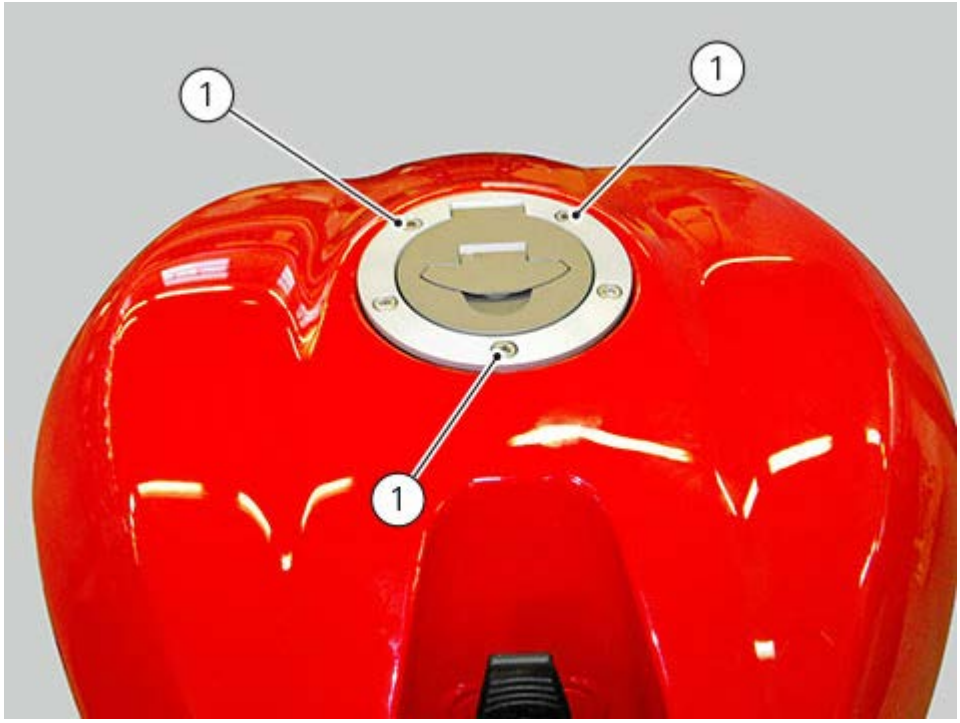


Tighten the plug three retaining screws (1) to a torque of ± 4 Nm 10%.

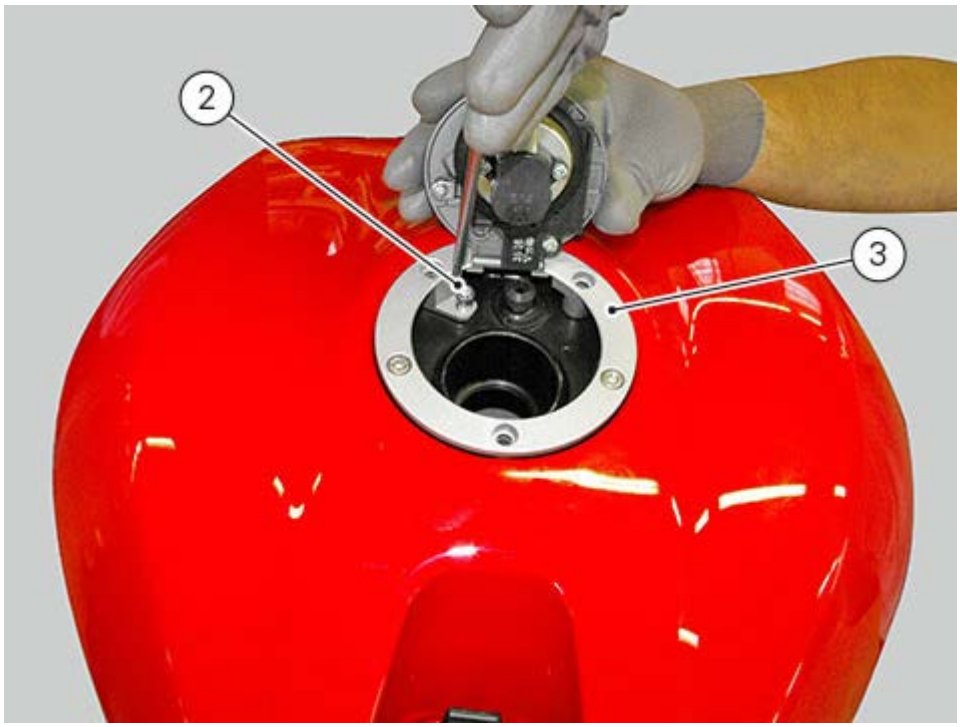


Removing the tank filler plug

Loosen and remove the plug three securing screws (1).

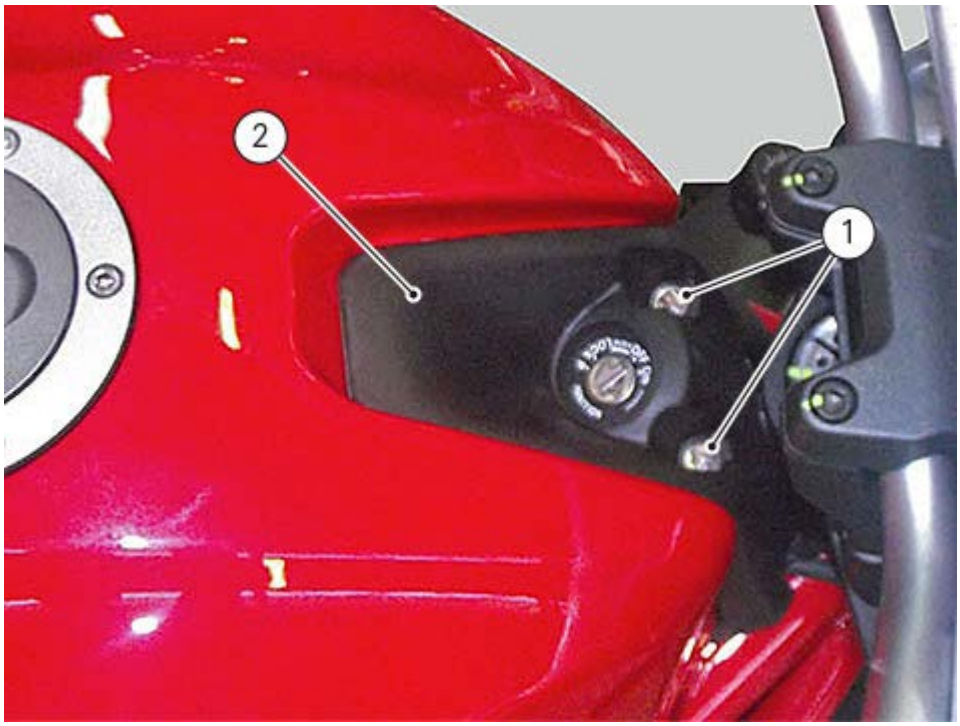


Open the tank plug.
Loosen and remove the inner screw (2) and remove tank filler plug (3).



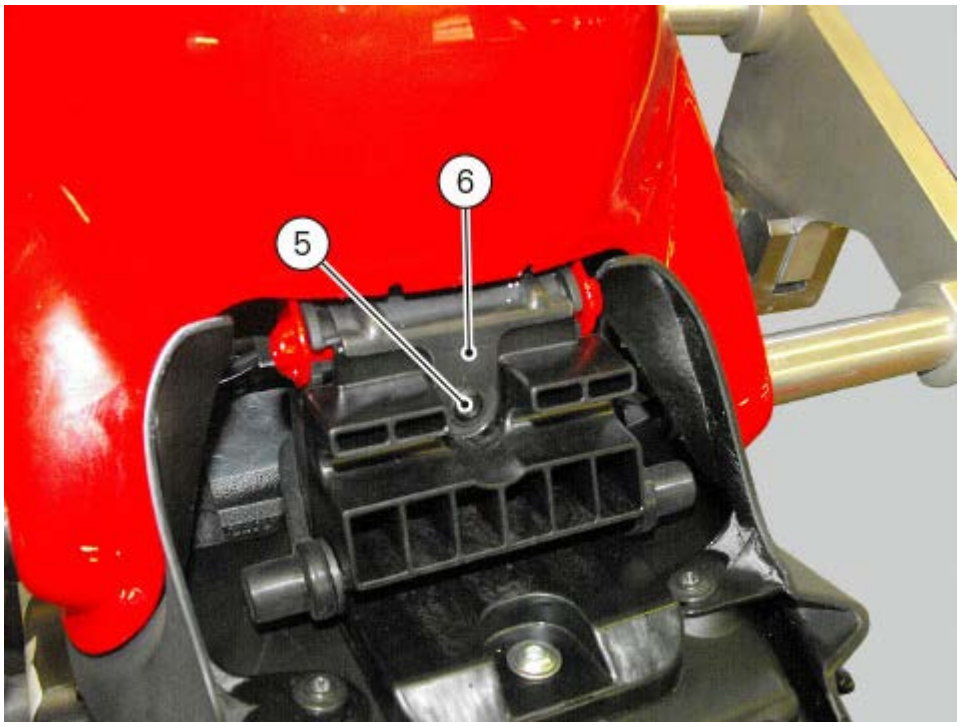
Removing the fuel tank

Remove the seat (Removing the seat).
Loosen special nuts (1) and remove the ignition switch cover (2).

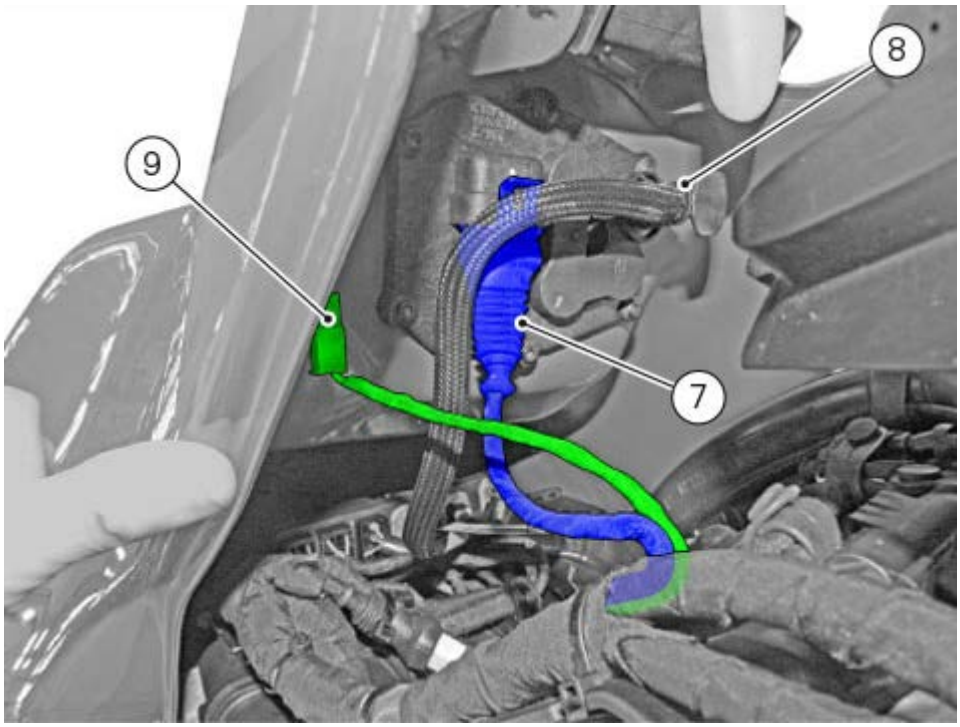


Slide elastic (3) out of knob (4).

Remove screw (5) and slide tank retaining flange (6) out.



Lift the tank and disconnect the pump connector (7) and the quick-release coupling (8) from the flange and the tank ground connector (9).

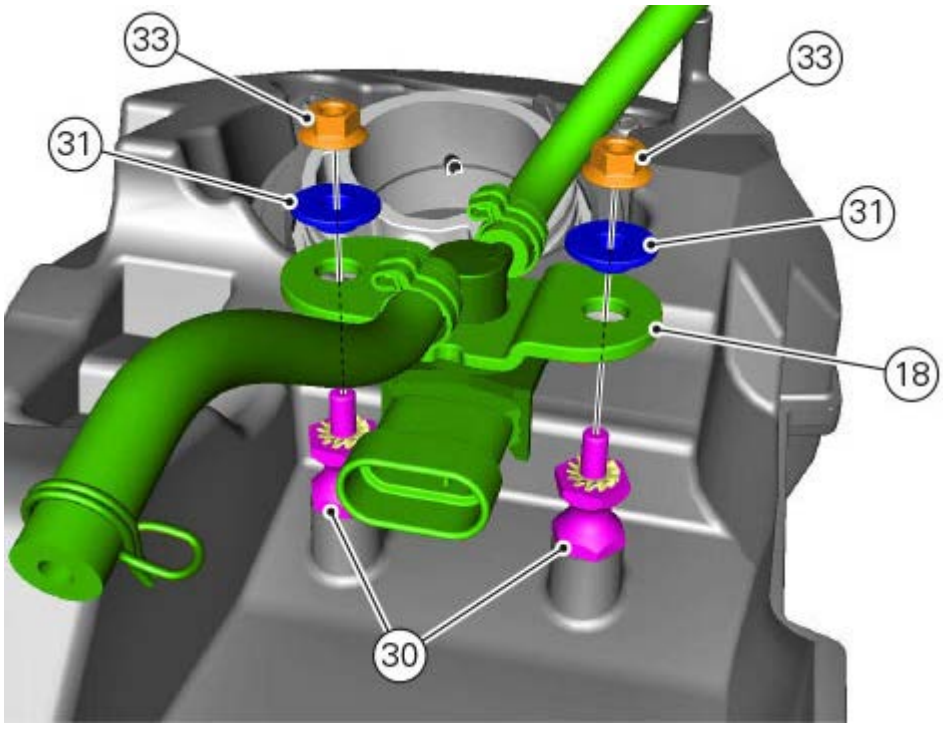


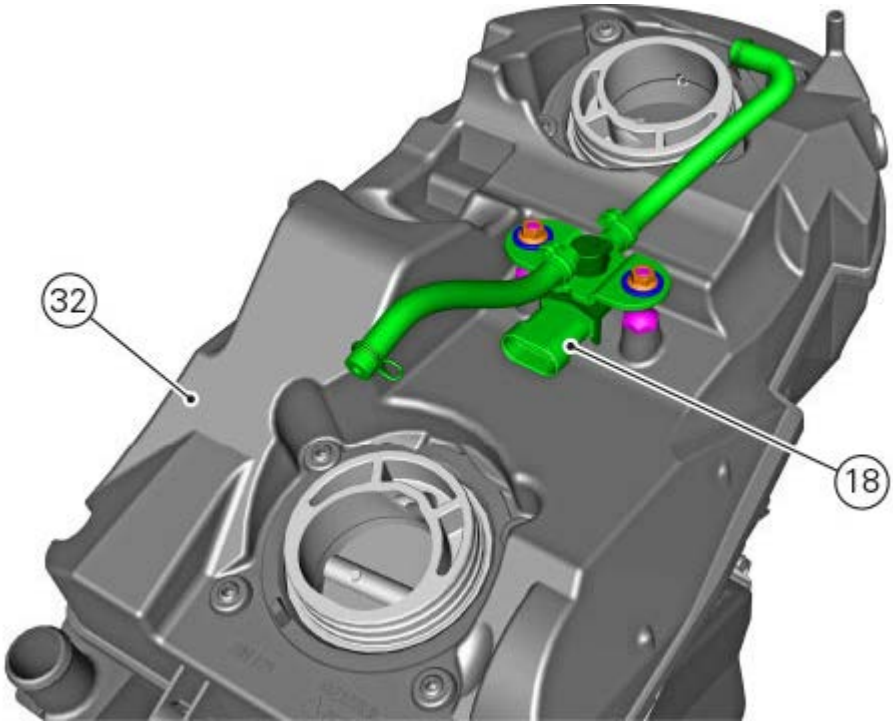
Remove the fuel tank.

REFITTING THE THROTTLE BODY

IF previously removed, refit the following components.
Position the MAP sensor assembly (18) as shown in the figure.

Fully screw the two silent blocks (30).
Fit two spacers with collar (31) in the relevant holes of the map sensor unit (18), positioning them as indicated.
Install the map sensor assembly (18) onto airbox lower cover (32), insert it on threaded pins of the two previously fitted silent blocks (30) and fasten them by starting two nuts (33).
Tighten the two nuts (33) to a torque of 6 Nm ± 10%.

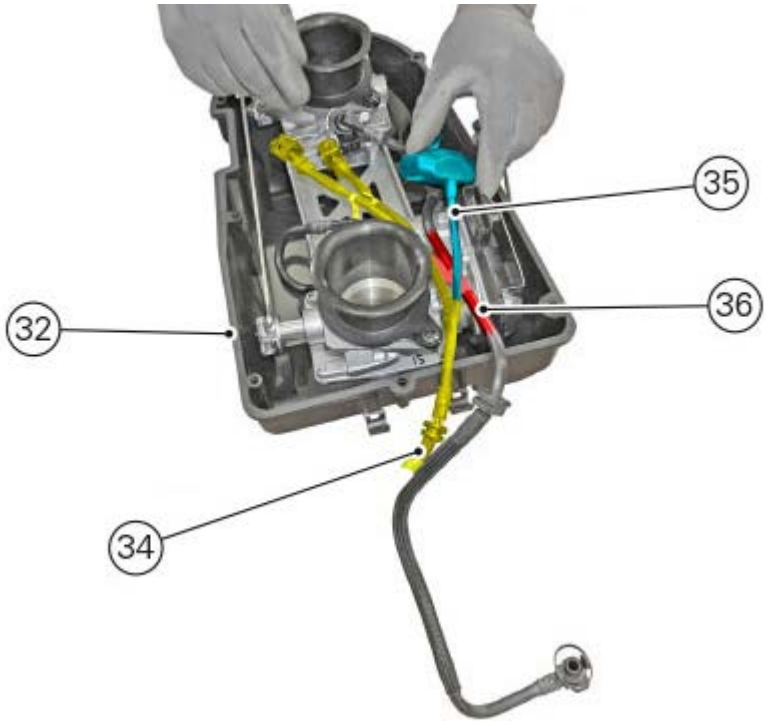




Lay down wiring (34) inside airbox lower cover (32), letting potentiometer (35) wiring branch slide onto fuel pipe set – throttle body (36).

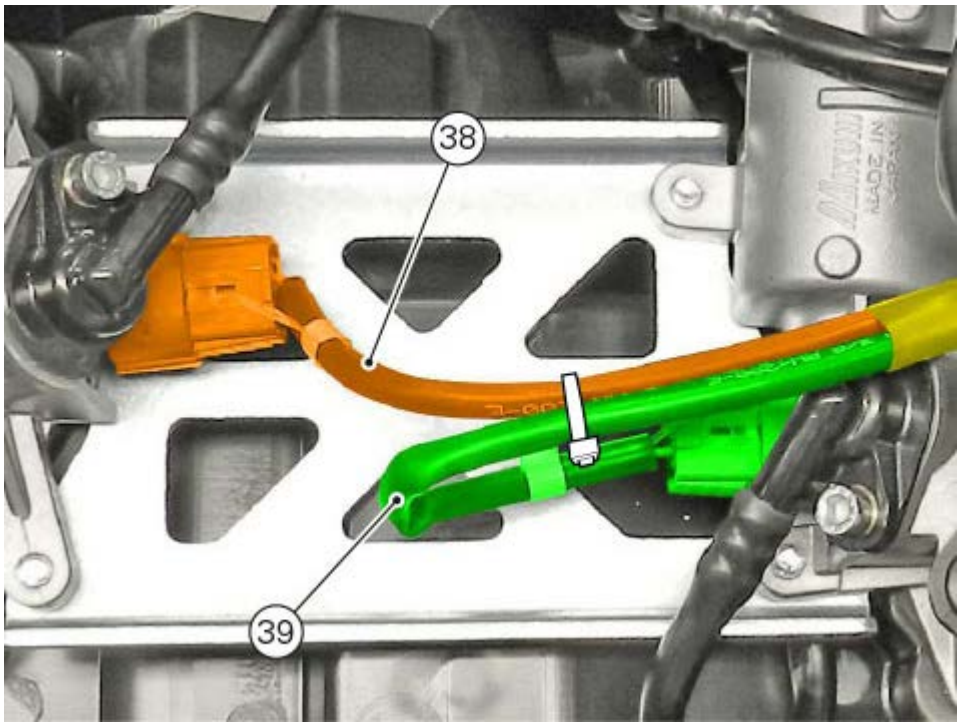
Important
The potentiometer wiring branch must not be squeezed between fuel pipe set and the surface of the

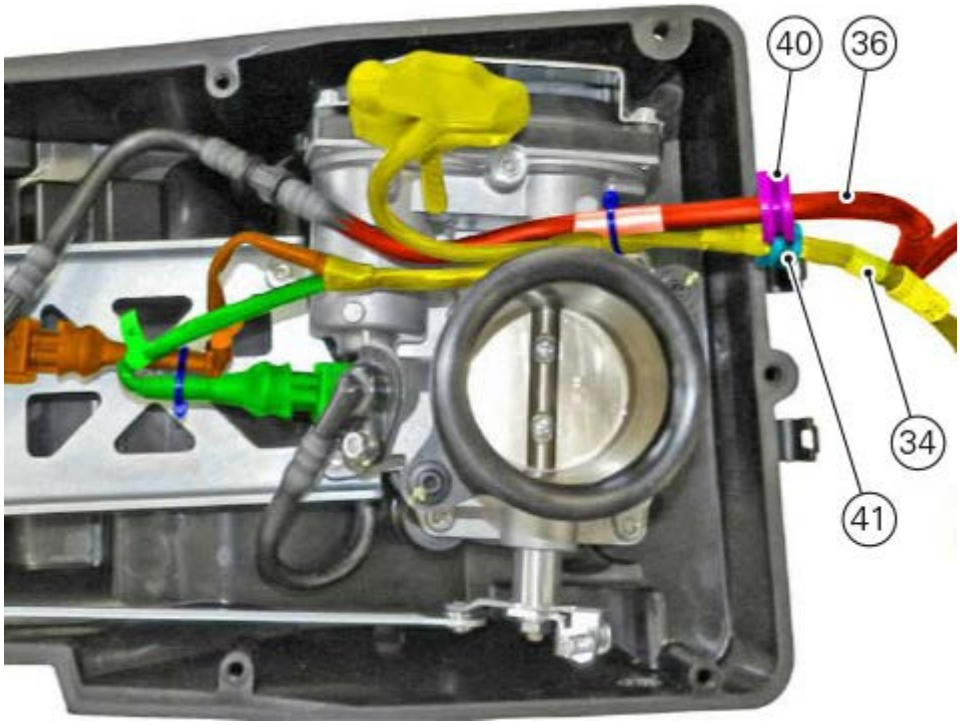
throttle body.



Connect connector (37) of the potentiometer wiring branch (35).

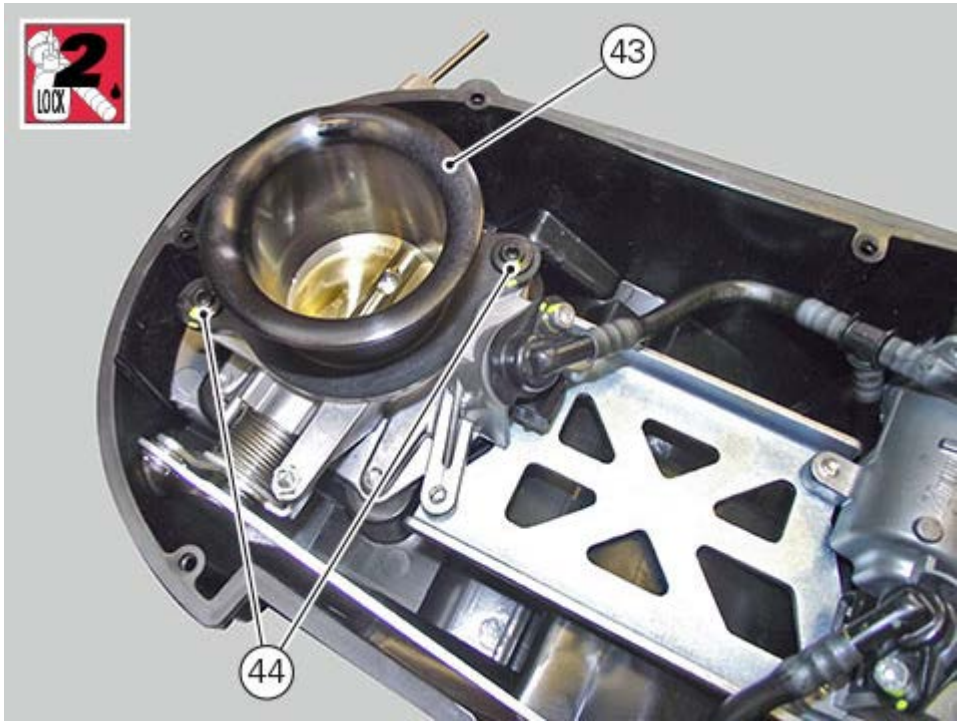
Connect the grey connector (38) of horizontal injector wiring branch and the black connector (39) of vertical injector wiring branch to the corresponding injectors.

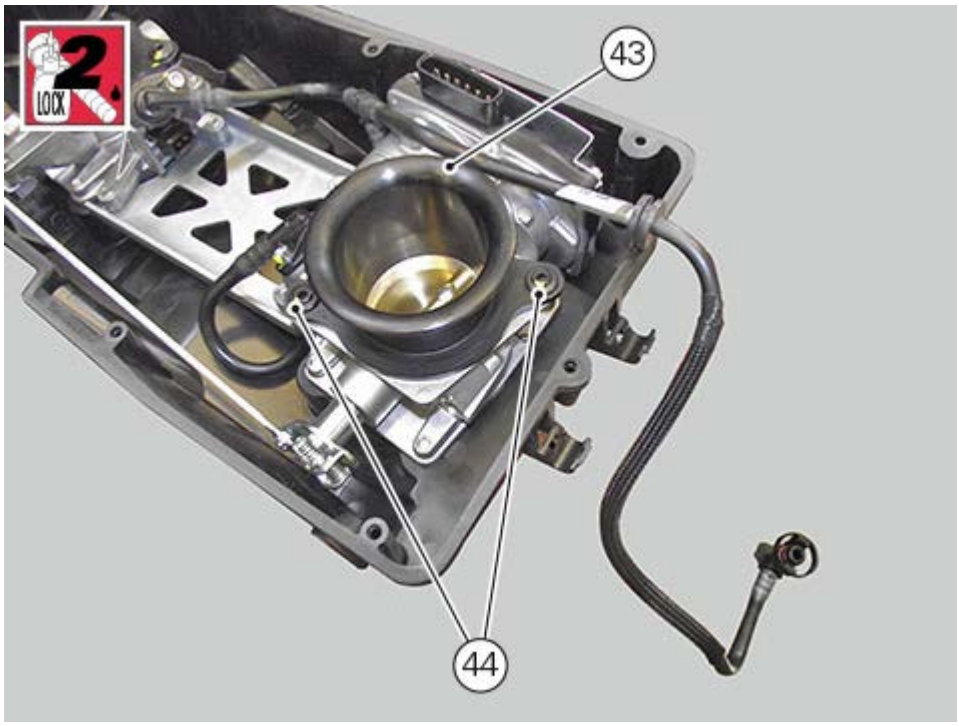




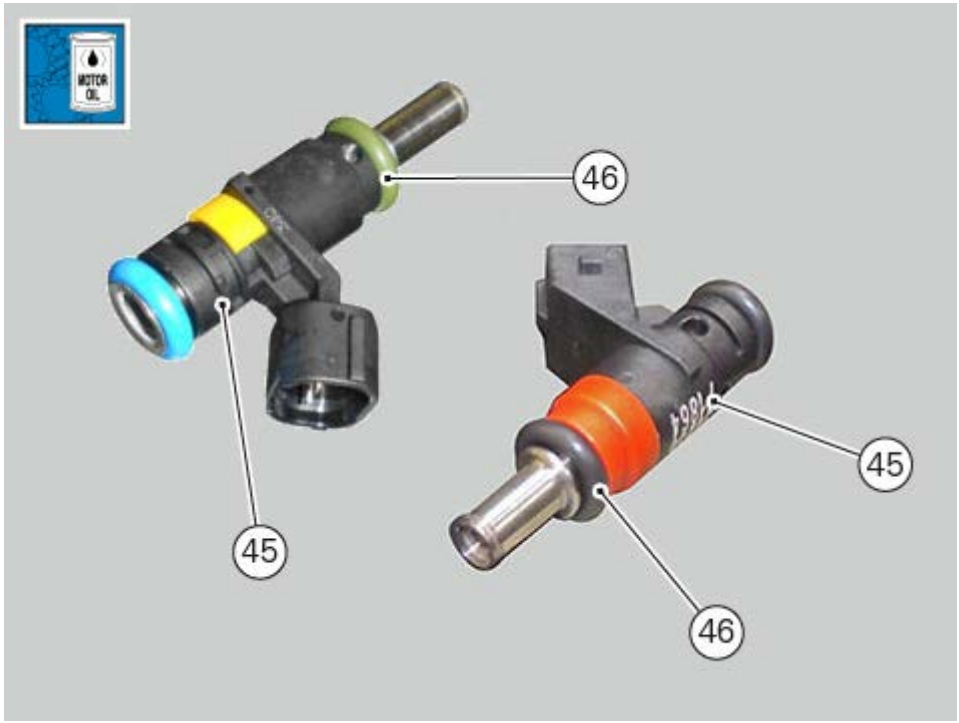
Fit the two gaskets (42) on the two intake funnels (43).

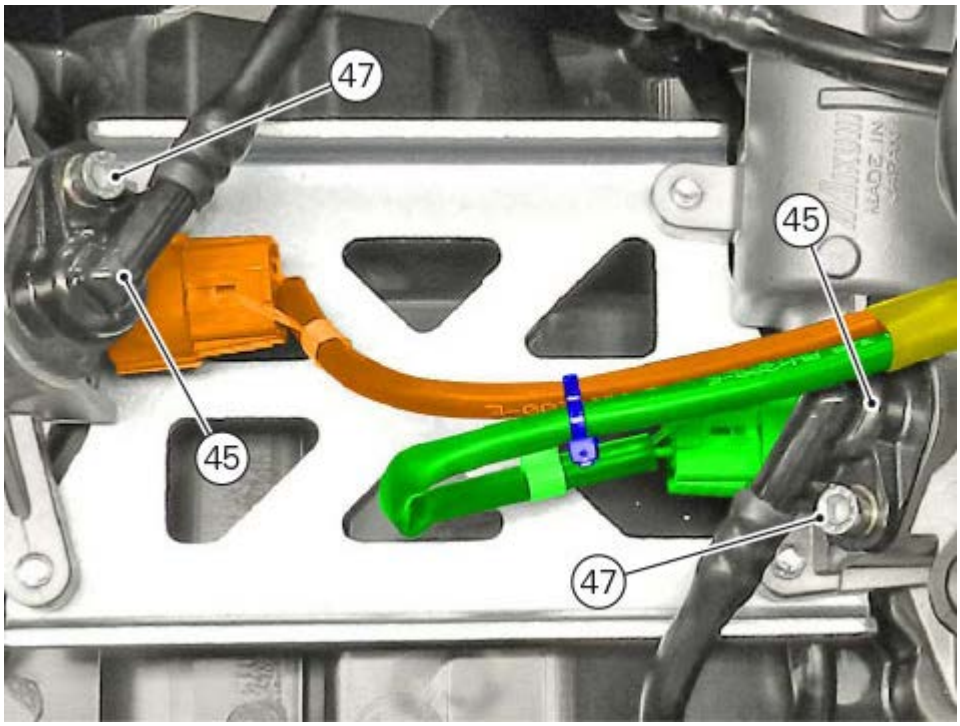
Position the two intake funnels (43) on the throttle body and fix them by tightening the four screws (44) to a torque of 5 Nm ± 10%.
If you do not use new screws (with pre-applied threadlocker), apply the specified threadlocker.



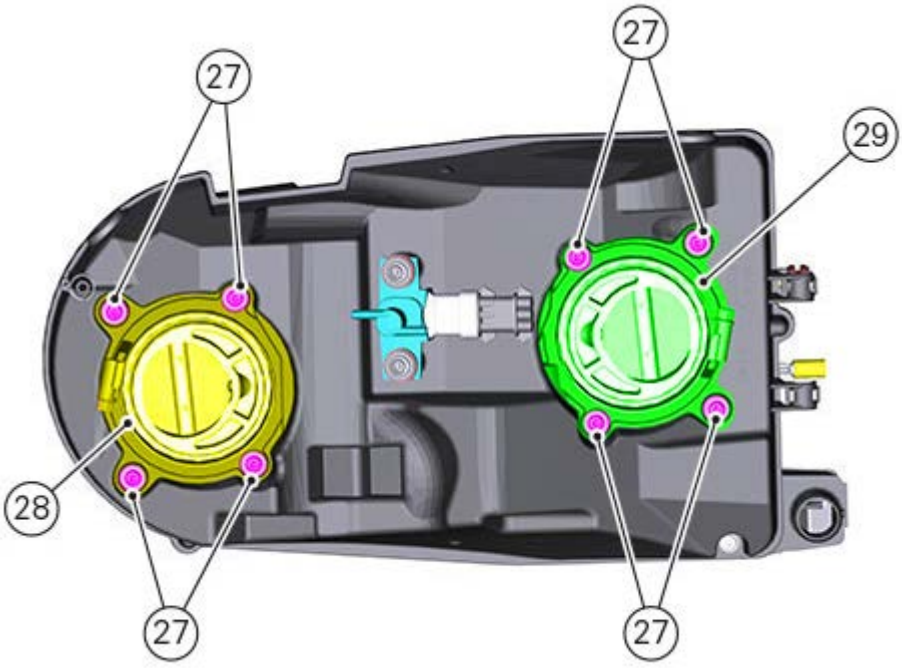


If previously removed, insert injectors (45) in their seats on the intake manifolds having care not to damage O-ring (46) lubricated with the specified product.
Working on both injectors, tighten the screw (47) to a torque of 5 Nm ± 10%.



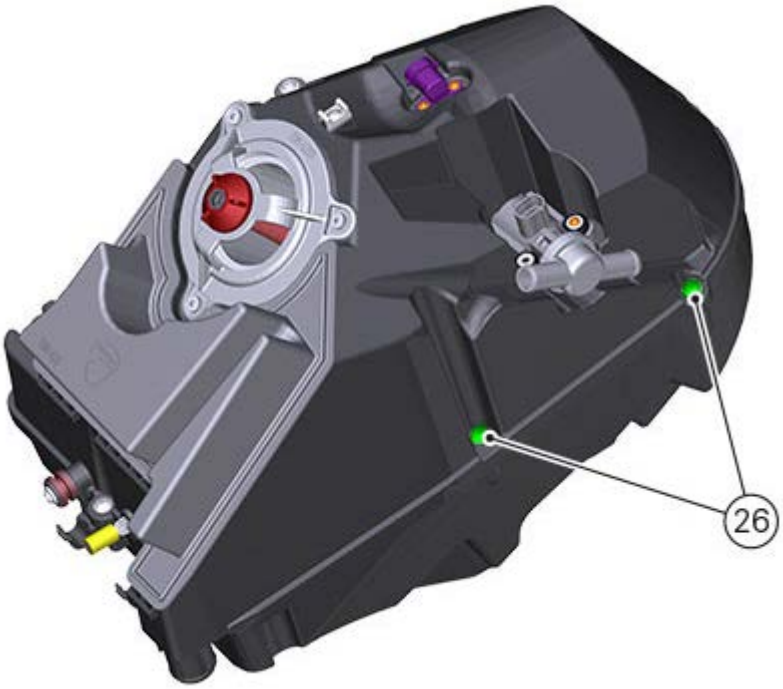


Tighten the eight screws (27) to a torque of 10 Nm ± 10% to fasten throttle bodies (28) and (29). Route the wiring as specified in chapter "Routing of wiring on frame".

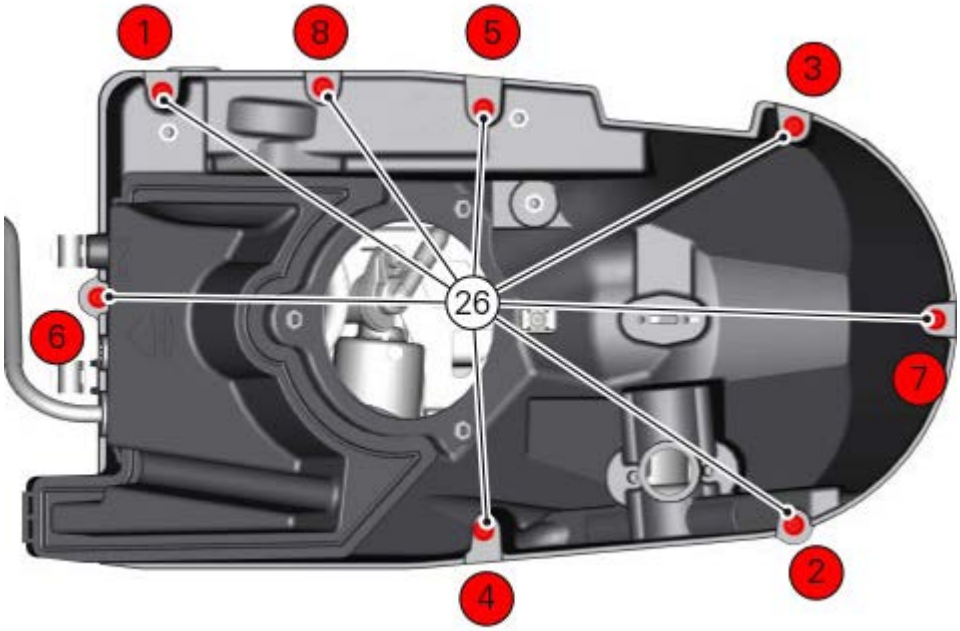


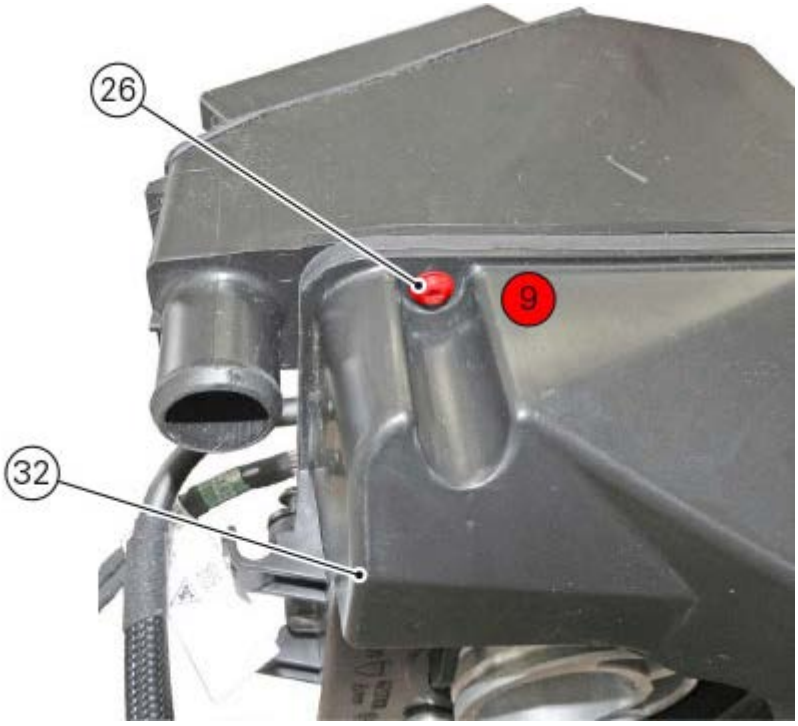
Position the airbox upper cover and start the nine screws (26).


26
26


26

Tighten the nine screws (26) to a torque of 3 Nm ± 10% following the indicated sequence: 1-2-3-4-5-6-7-8.



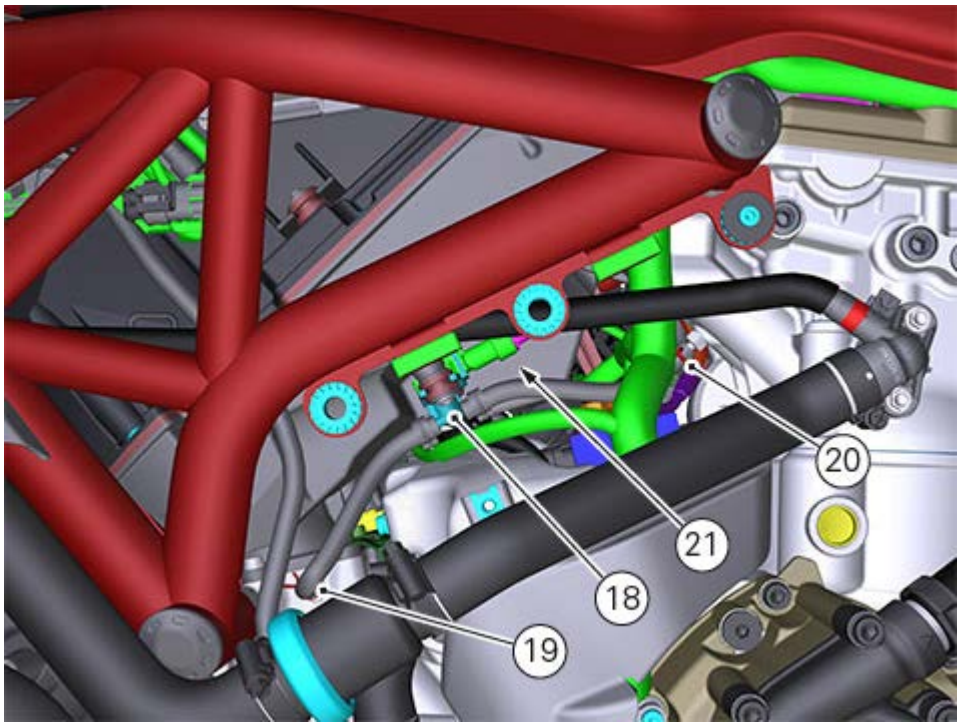


Complete the fitting procedure of the air filter.

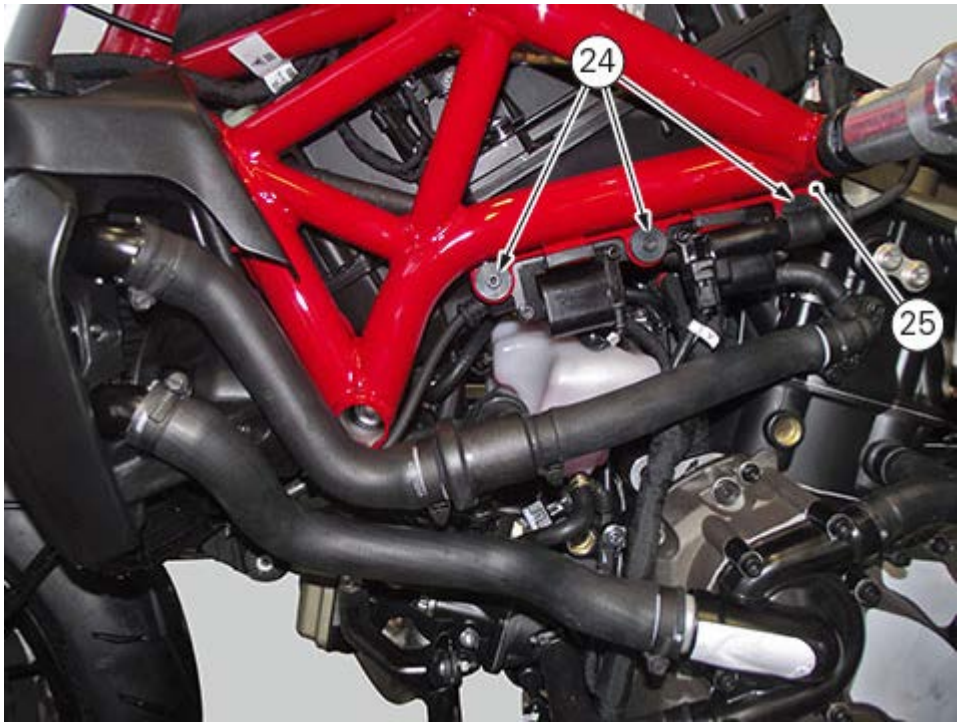
Note
It is not necessary to reset the TPS values for the "fully closed" position. The ECU performs an automatic check upon each key-on.

REFITTING THE AIRBOX

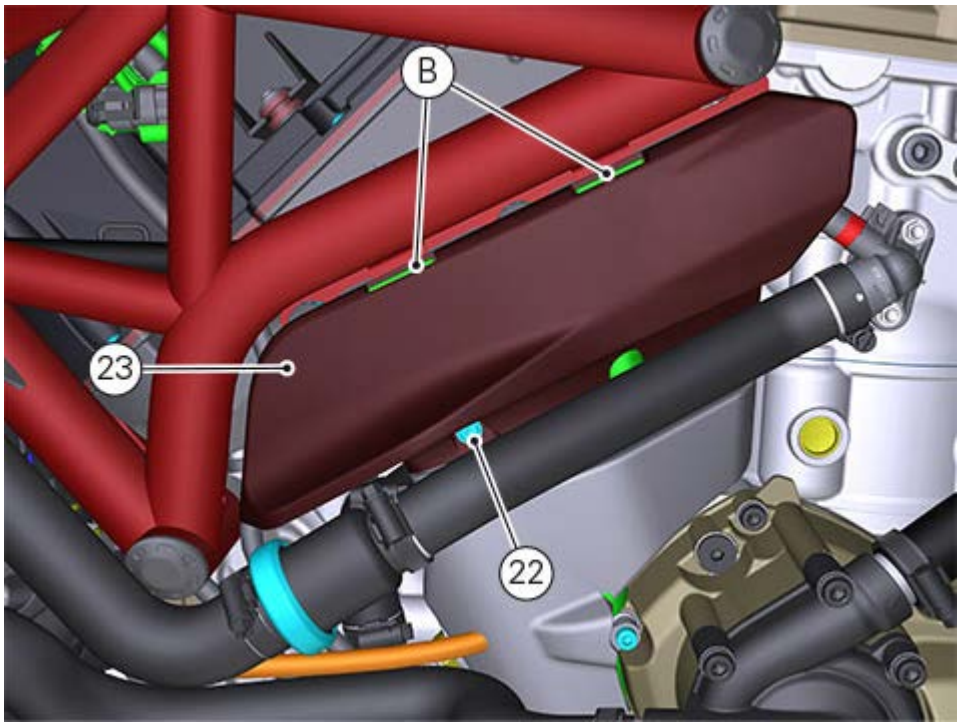
Connect the two pipes of MAP sensor (18) to the vertical and horizontal cylinder and fix them with clamps (19) and (20).
Connect the connector (21).



Position coil support (25) complete with coils and tighten the three screws (24) to a torque of 6 Nm ± 10%.

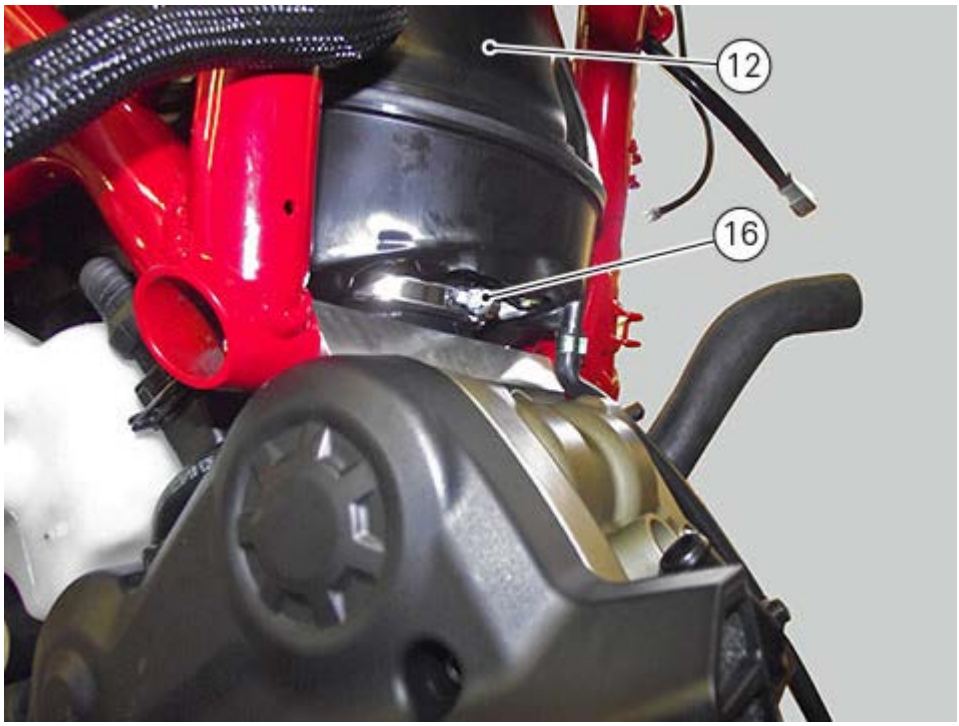


Position the upper cover (23) on tabs (B) and fasten it by tightening screw (22) to a torque of 3 Nm ±10%.

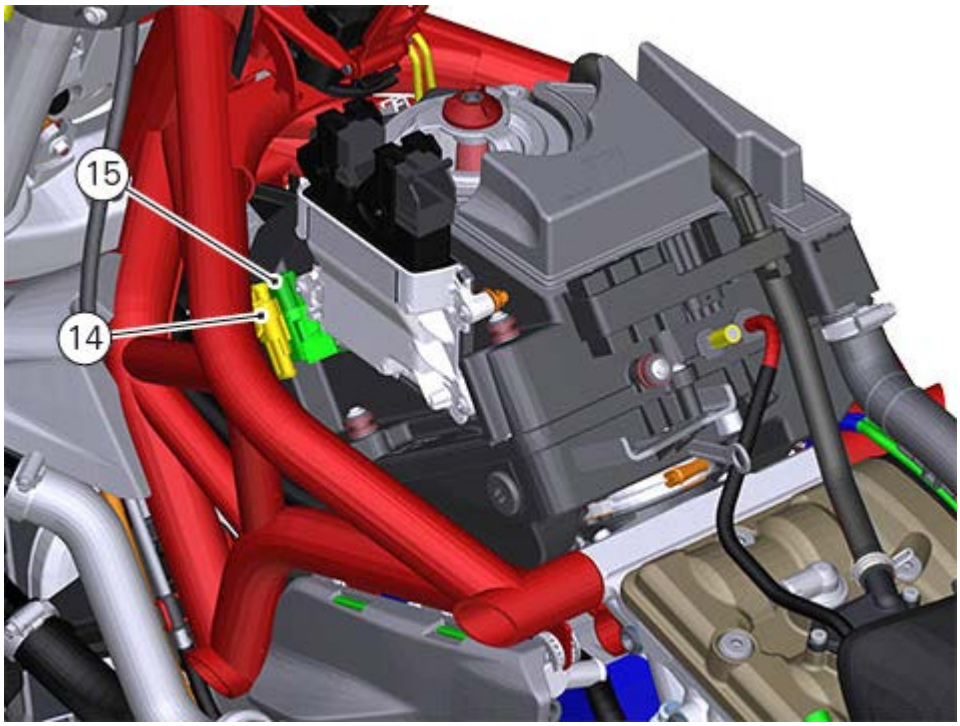


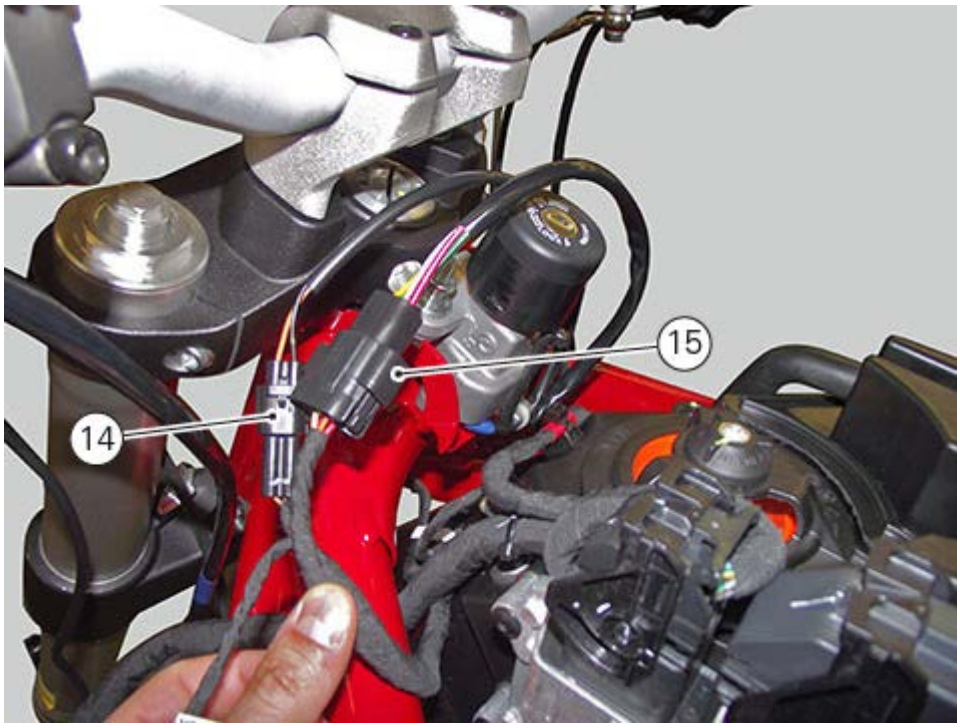
Working on the vertical cylinder, tighten clamp (17) that retains the throttle body to air box (12).

Working on the horizontal cylinder, tighten clamp (16) that retains the throttle body to air box (12).

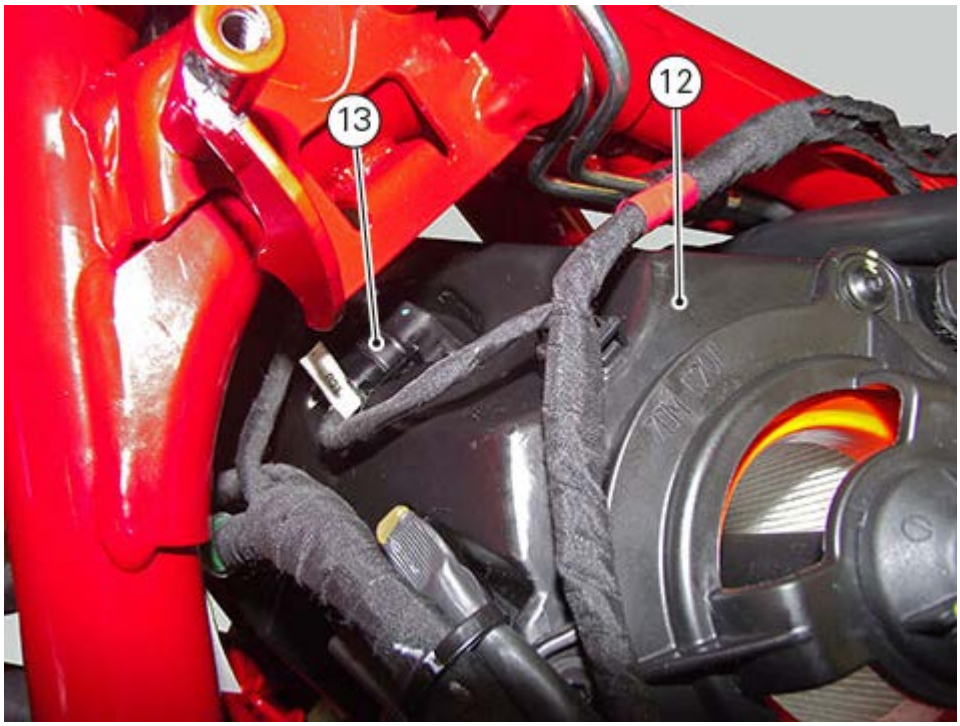


Connect the immobilizer antenna (14) and ignition switch (15) connectors.

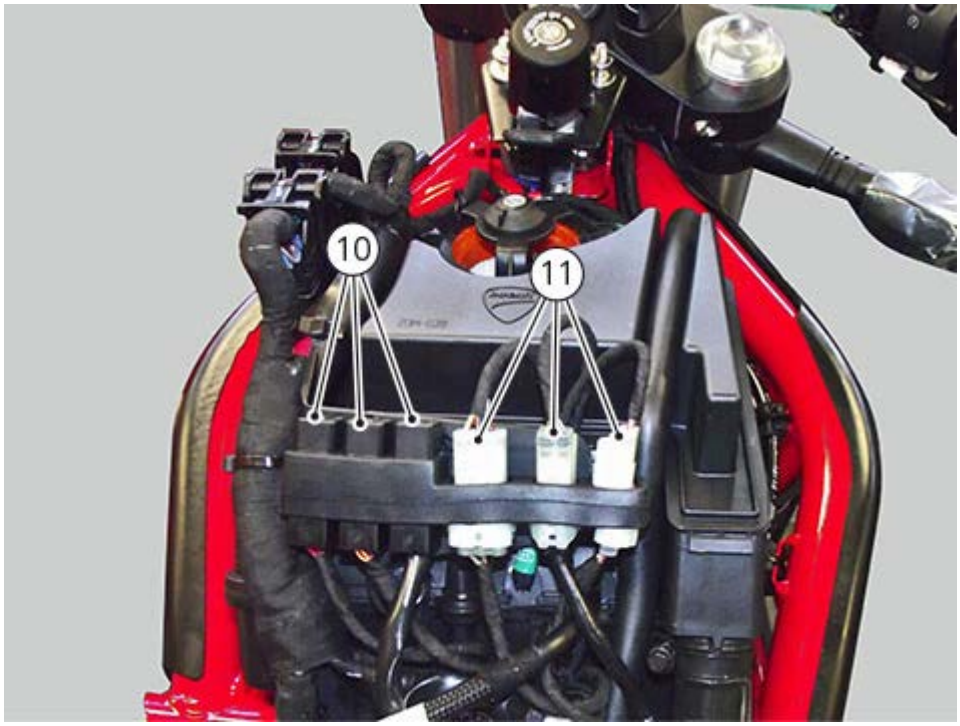




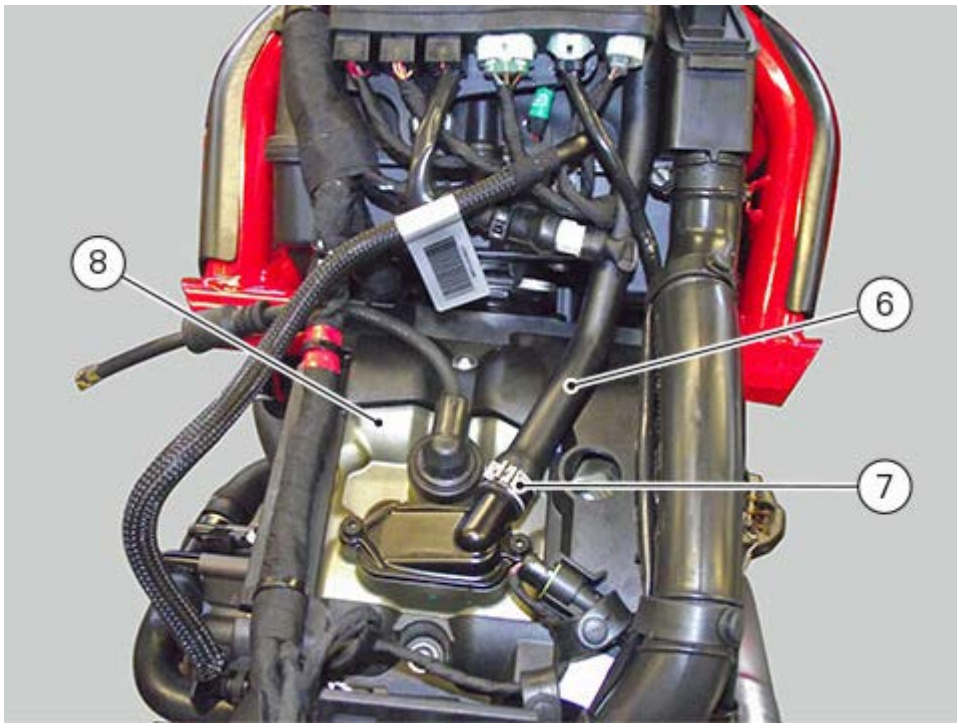
Working on the airbox (12) front side, connect the air temperature sensor connector (13).



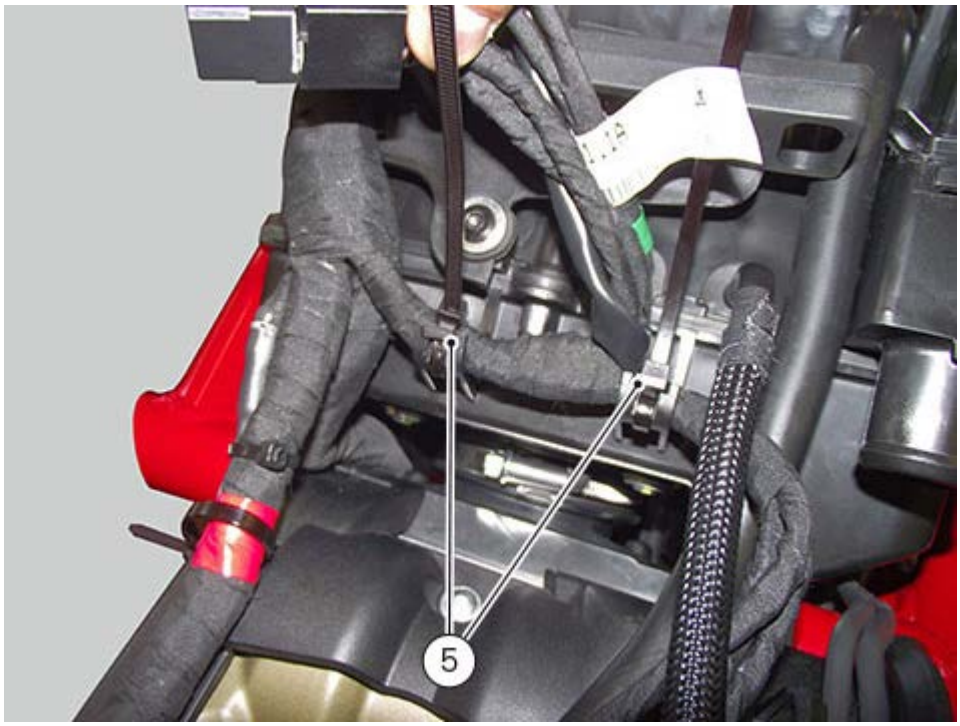
Refit the three relays (10) and connect connectors (11).

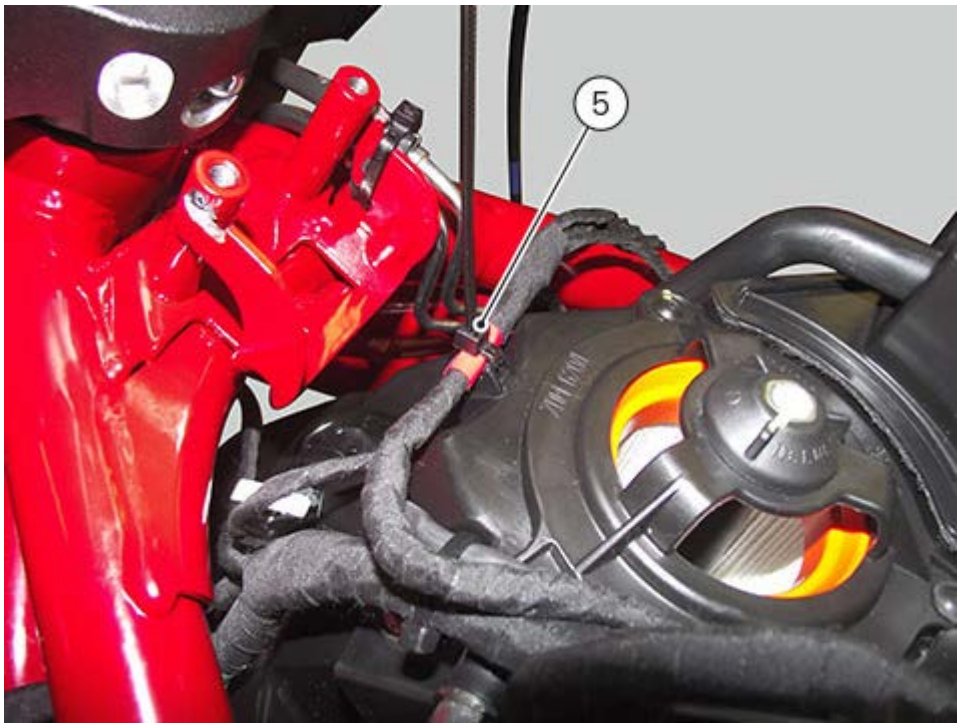


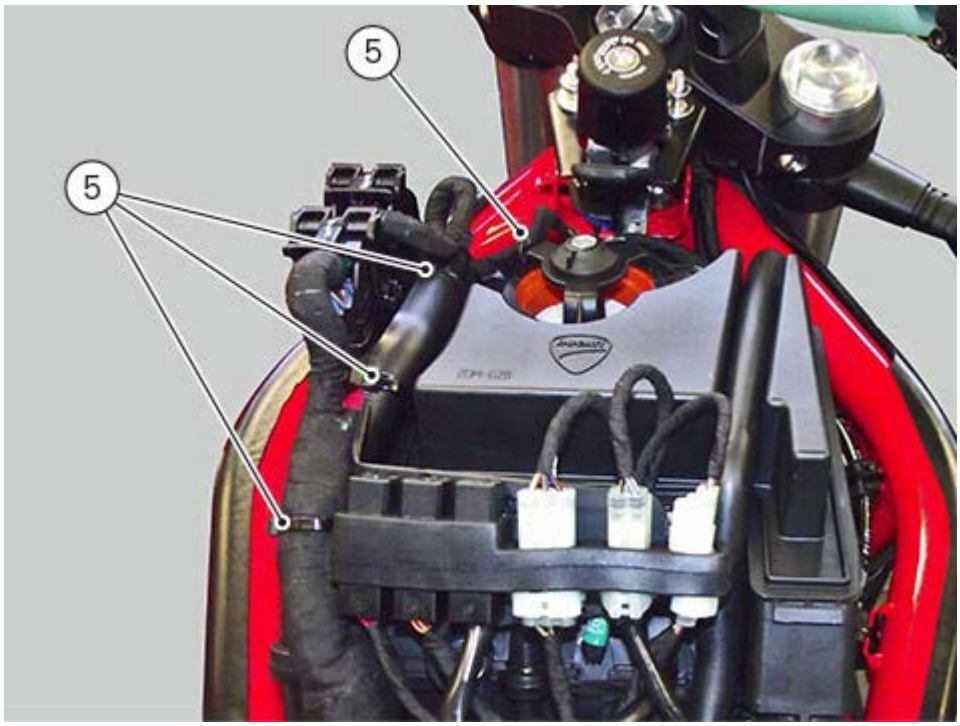
Tighten clamp (7) to fix the secondary air system pipes (6) on the vertical head (8) and the horizontal head (9).



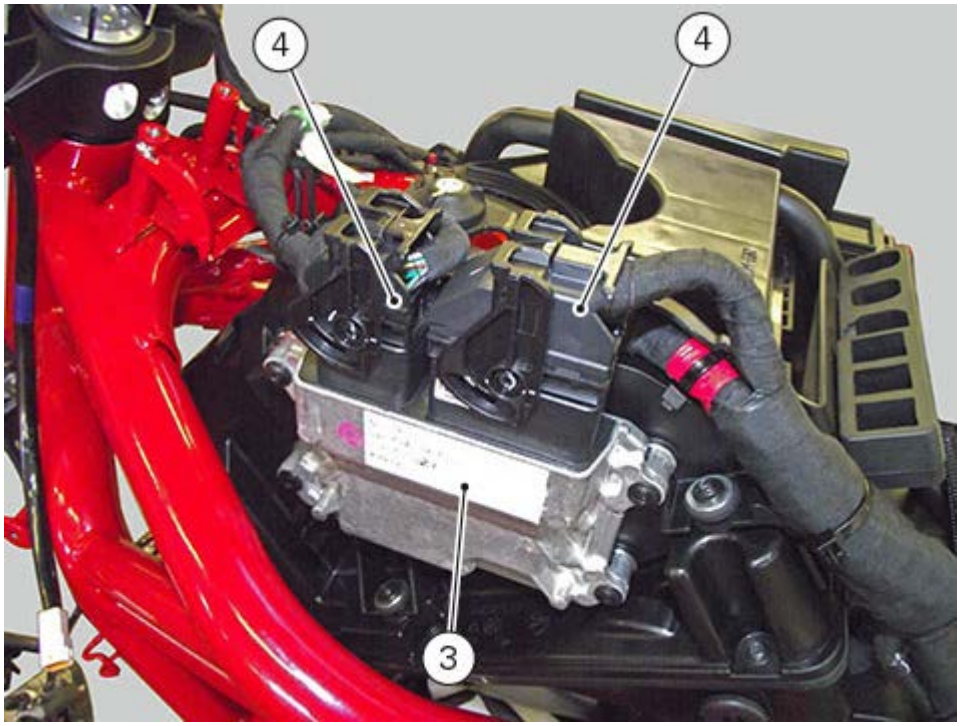
Use ties (5) to fix the main wiring to the airbox.



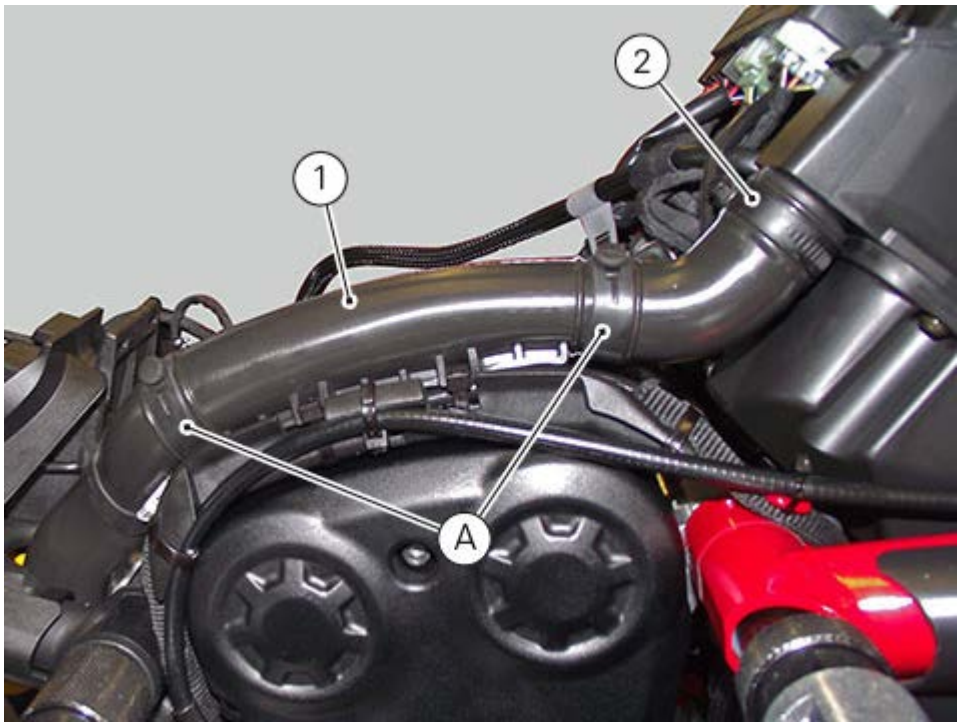




Connect control unit (3) by connecting connectors (4).



Connect the blow-by pipe (1) by fastening it with clips (A) and tightening clamp (2).



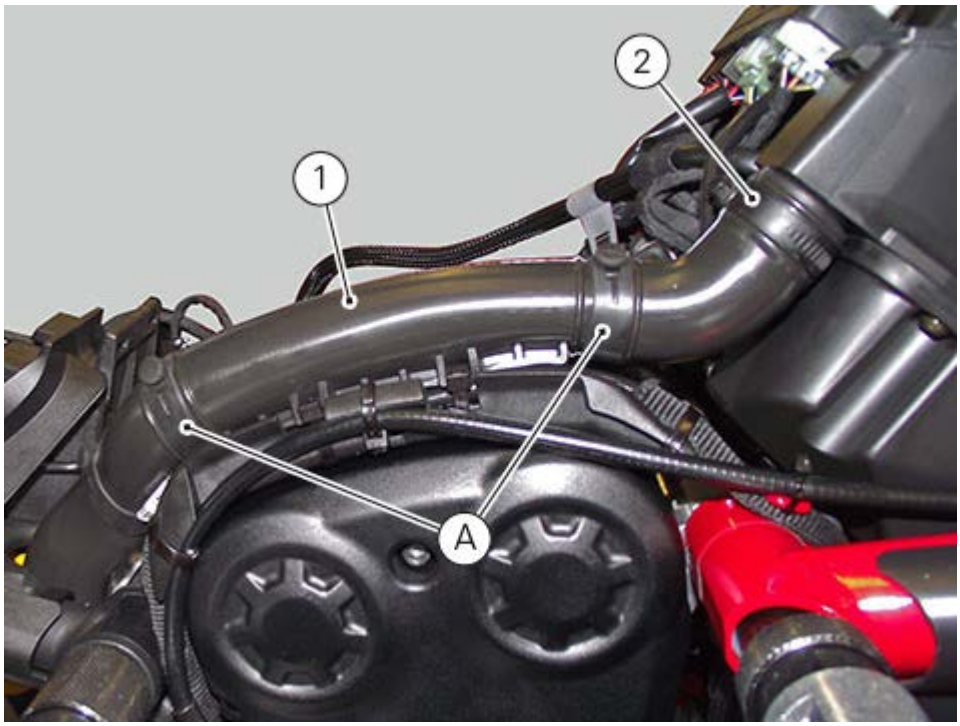
Refit the fuel tank (Refitting the fuel tank).
Refit the seat (Refitting the seat).

Removing the airbox and throttle body

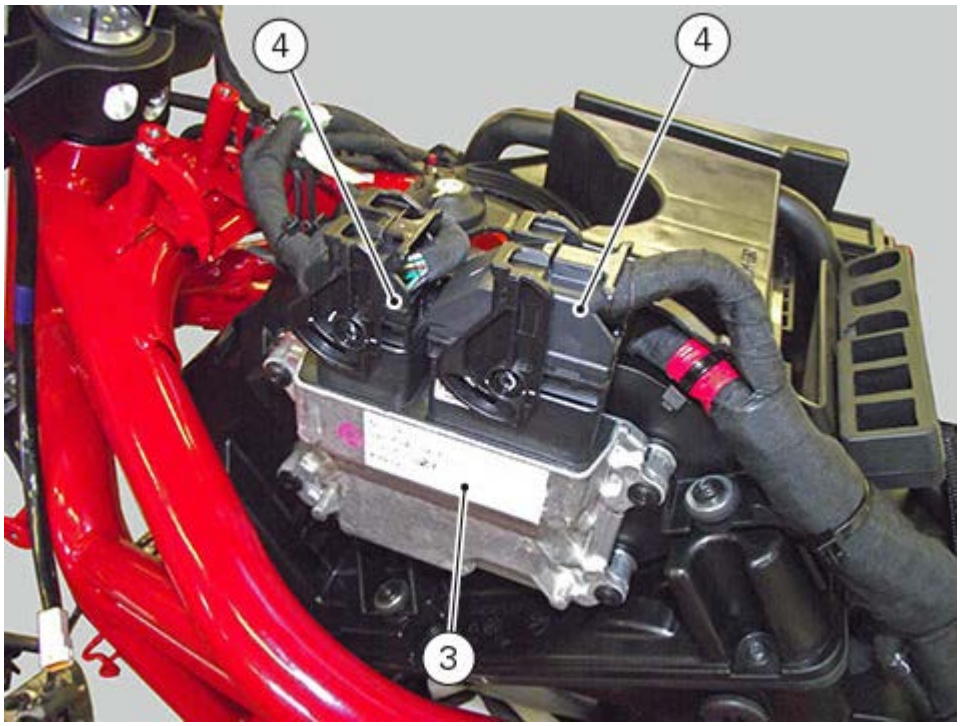
REMOVING THE AIRBOX

Remove the fuel tank (Removing the fuel tank).

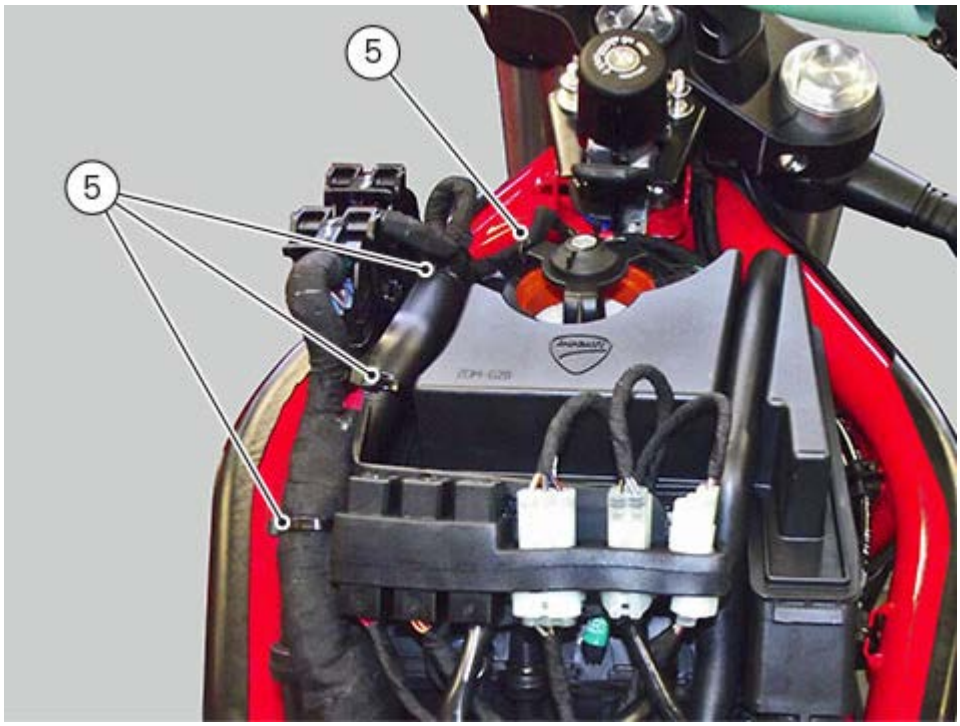
Disconnect the blow-by pipe (1) by releasing it from clips (A) and loosening clamp (2).

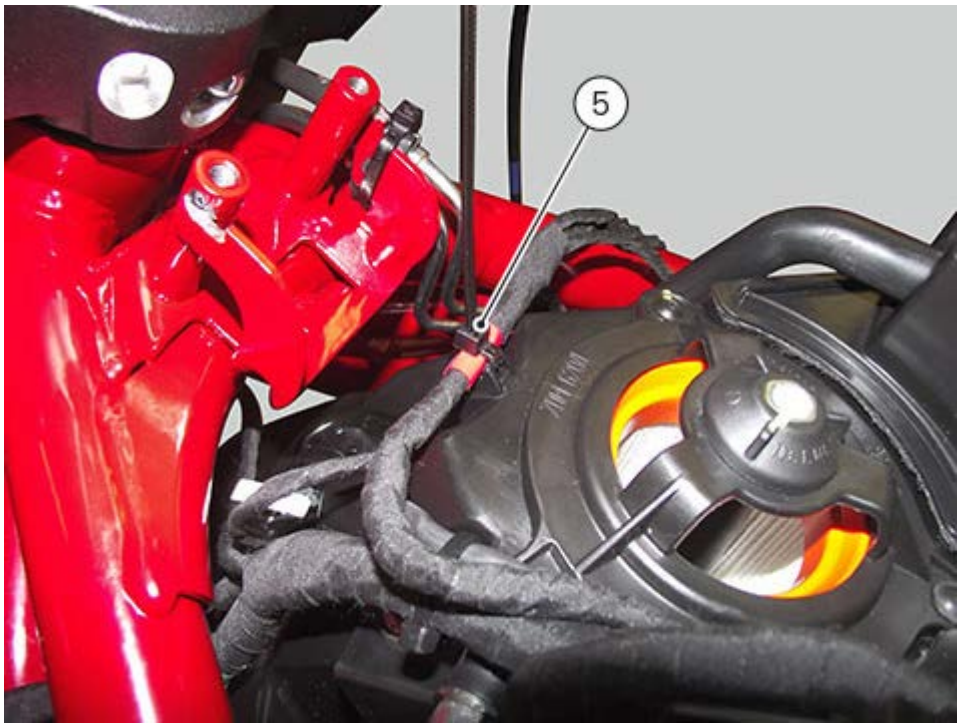


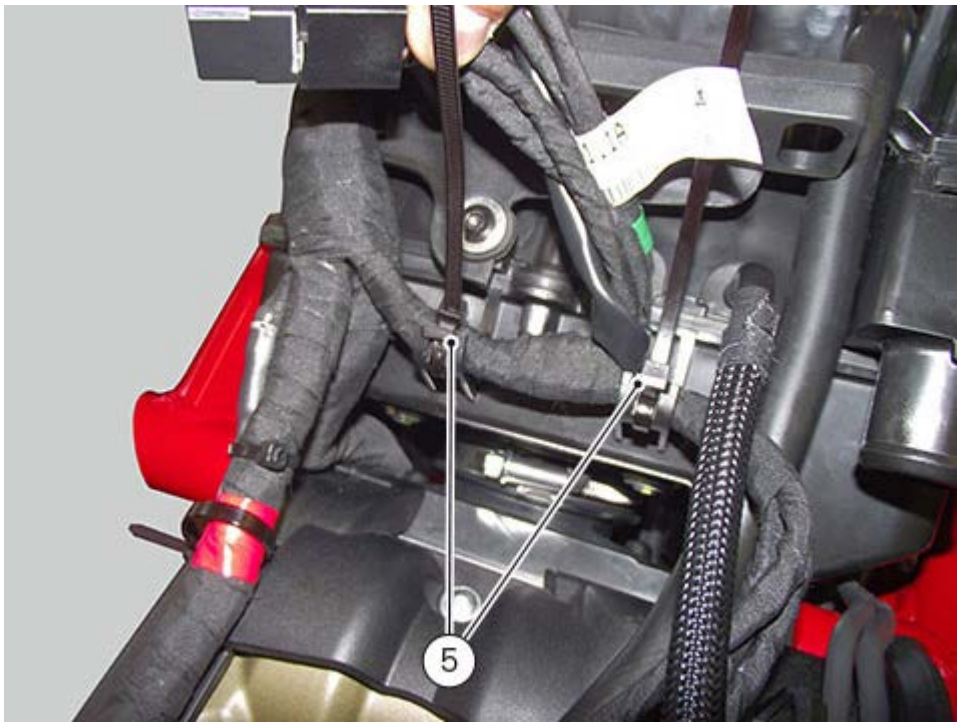
Disconnect control unit (3) by removing connectors (4).



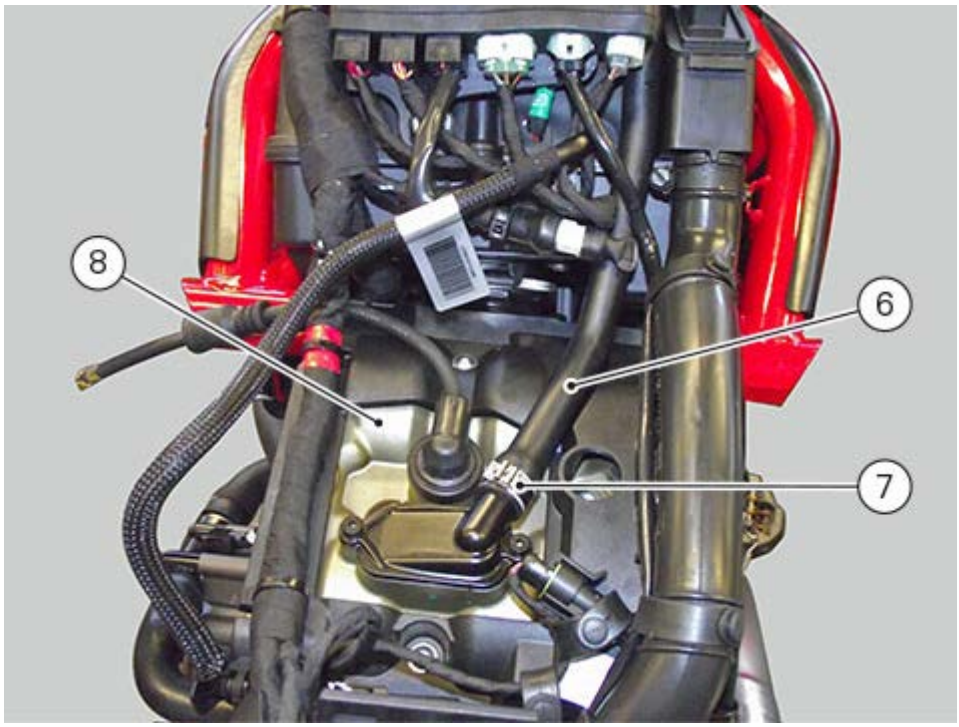
Remove ties (5) to release the main wiring from the airbox.



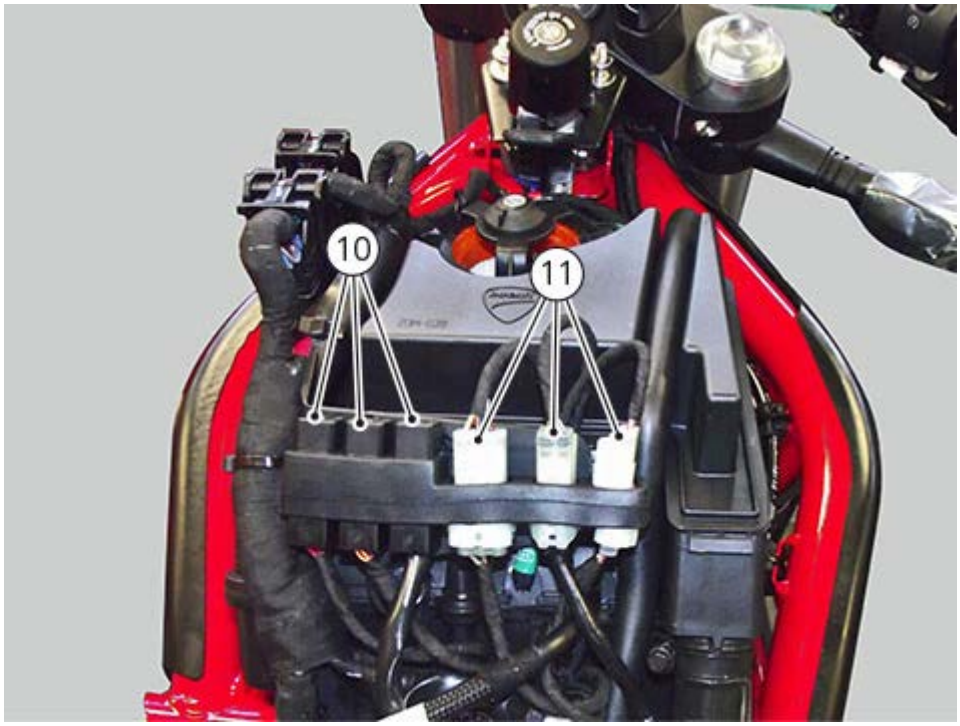




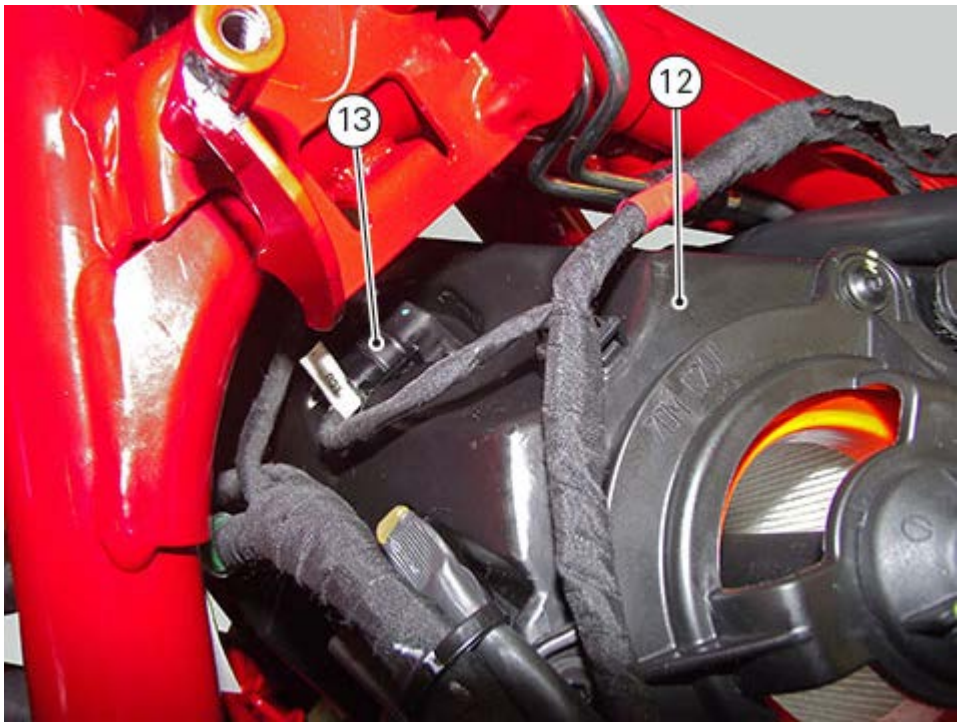
Loosen clamp (7) to disconnect the secondary air system pipes (6) from the vertical head (8) and the horizontal head (9).



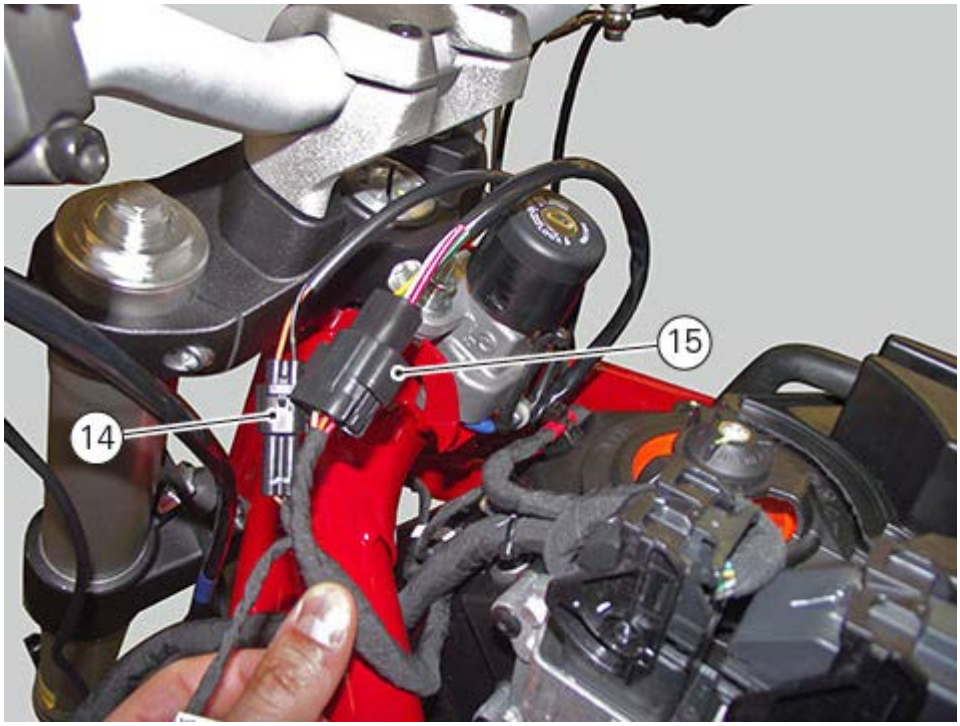
Remove the three relays (10) and disconnect connectors (11).

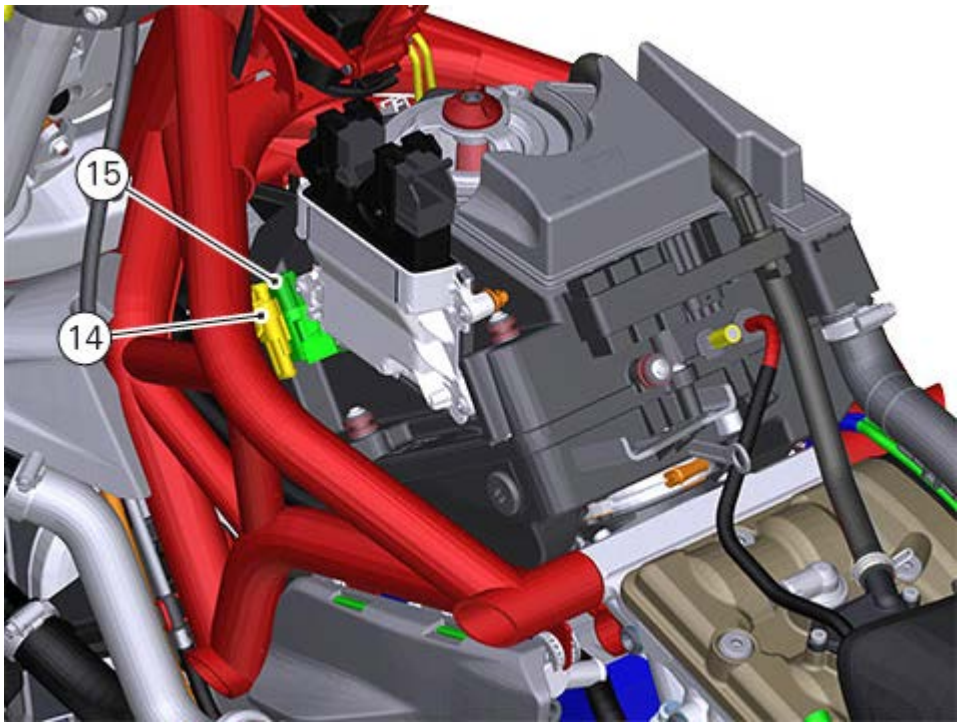


Working on the airbox (12) front side, disconnect the air temperature sensor connector (13).

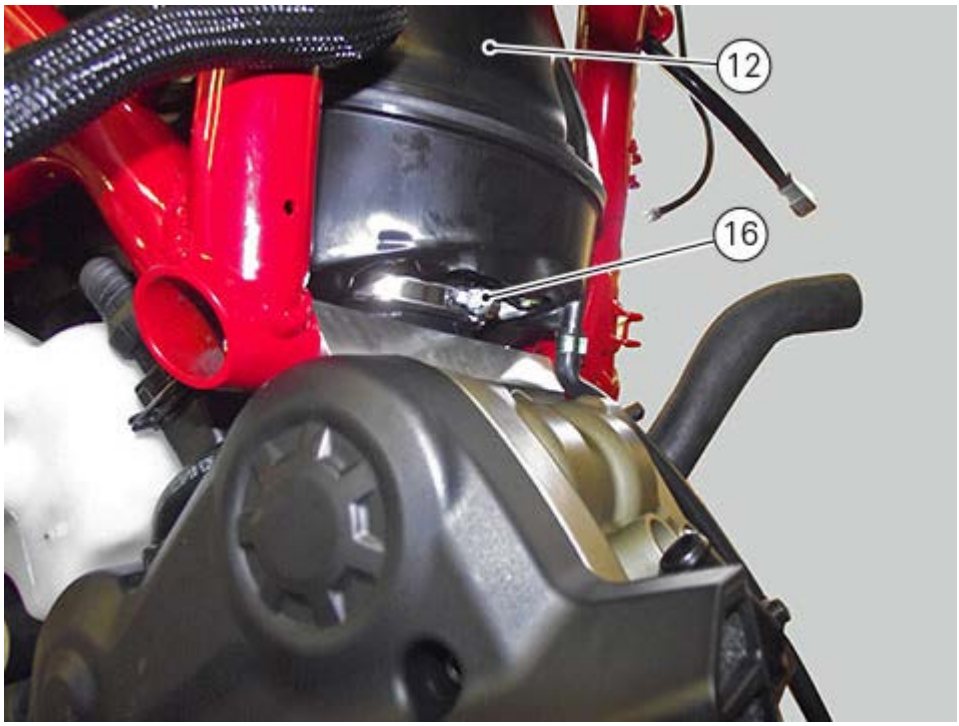


Disconnect the immobilizer antenna connectors (14) and ignition switch (15).



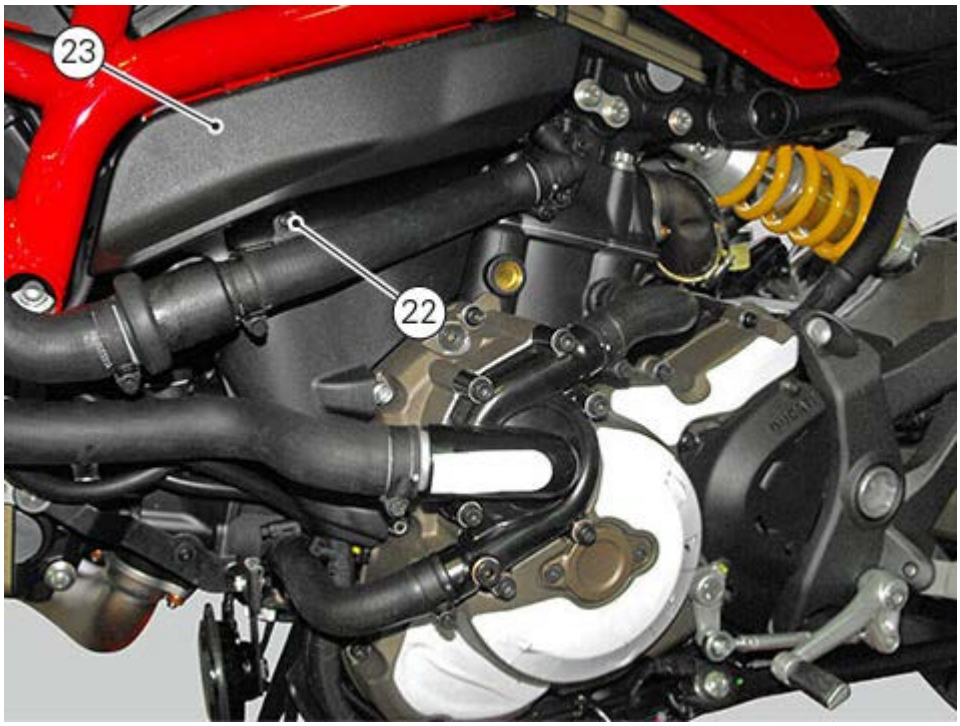


Working on the horizontal cylinder, loosen clamp (16) that retains the throttle body to air filter (12).

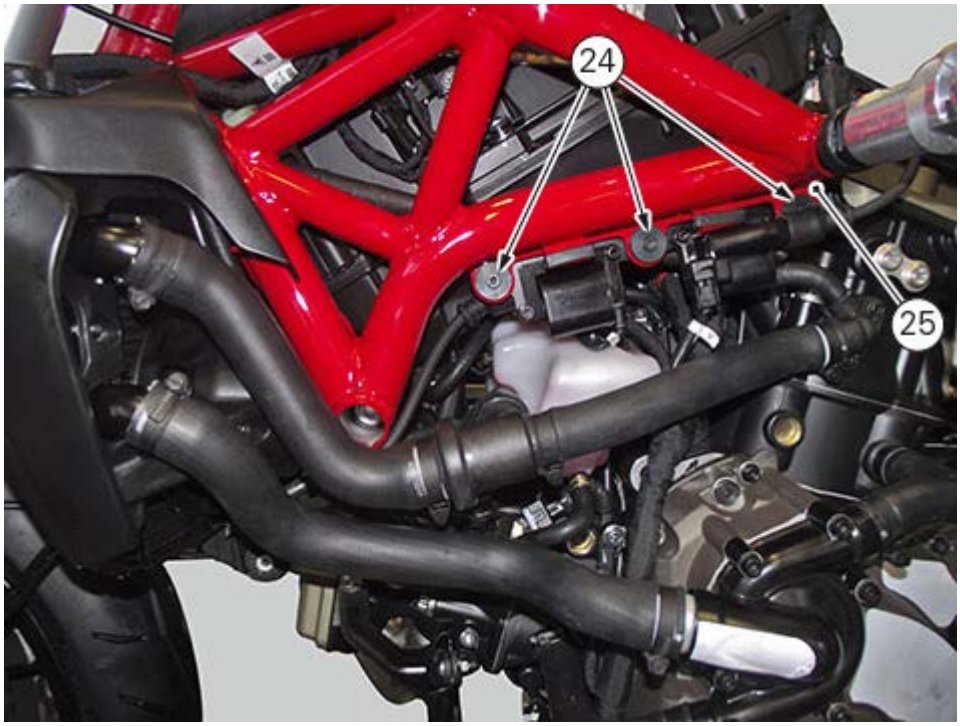


Working on the vertical cylinder, loosen clamp (17) that retains the throttle body to air box (12).

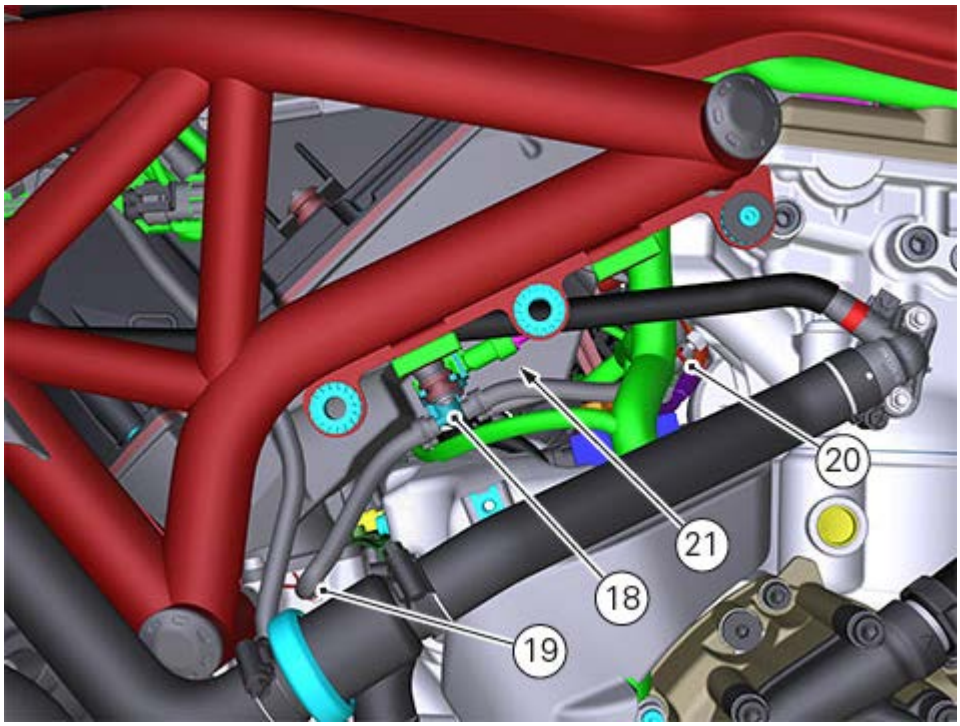
Working on the left side, loosen the screw (22) and remove the top cover (23) by pulling it up.



Loosen the three screws (24), slide the coil support (25) downwards together with the coils.



Disconnect the two pipes of MAP sensor (18) from the vertical and horizontal cylinder by loosening clamps (19) and (20).
Disconnect the connector (21).

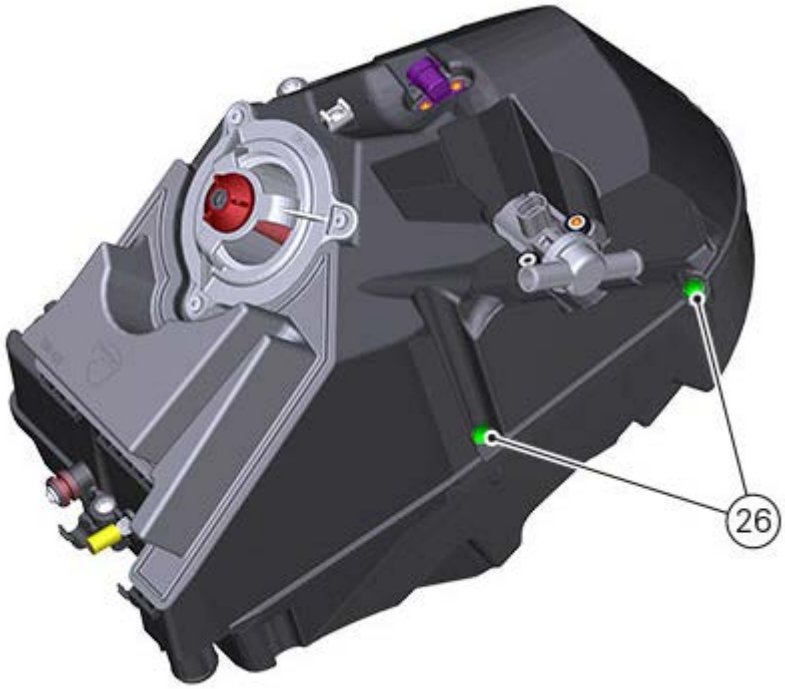


Remove the airbox from the frame.

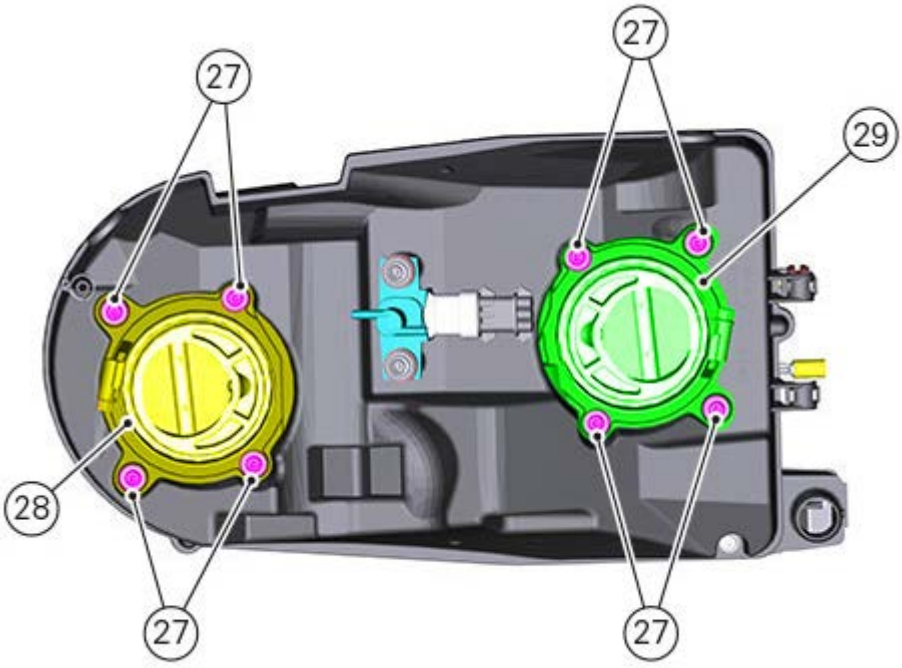
REMOVING THE THROTTLE BODY

Loosen the nine screws (26) retaining the airbox upper cover and remove the latter from the airbox.


26


26

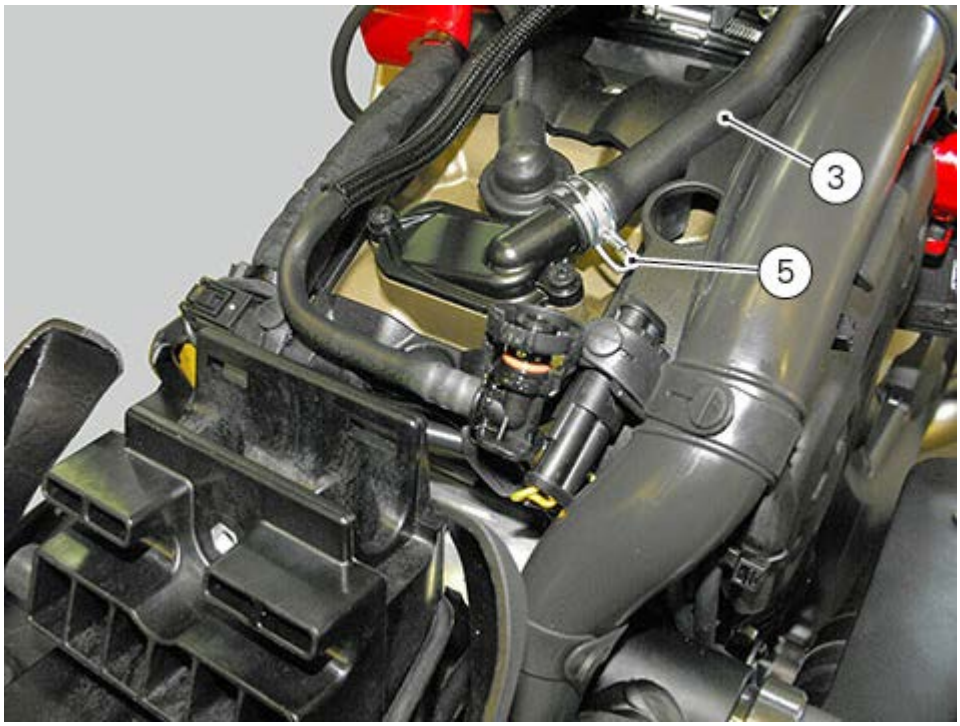
Loosen the eight retaining screws (27) of throttle bodies (28) and (29).

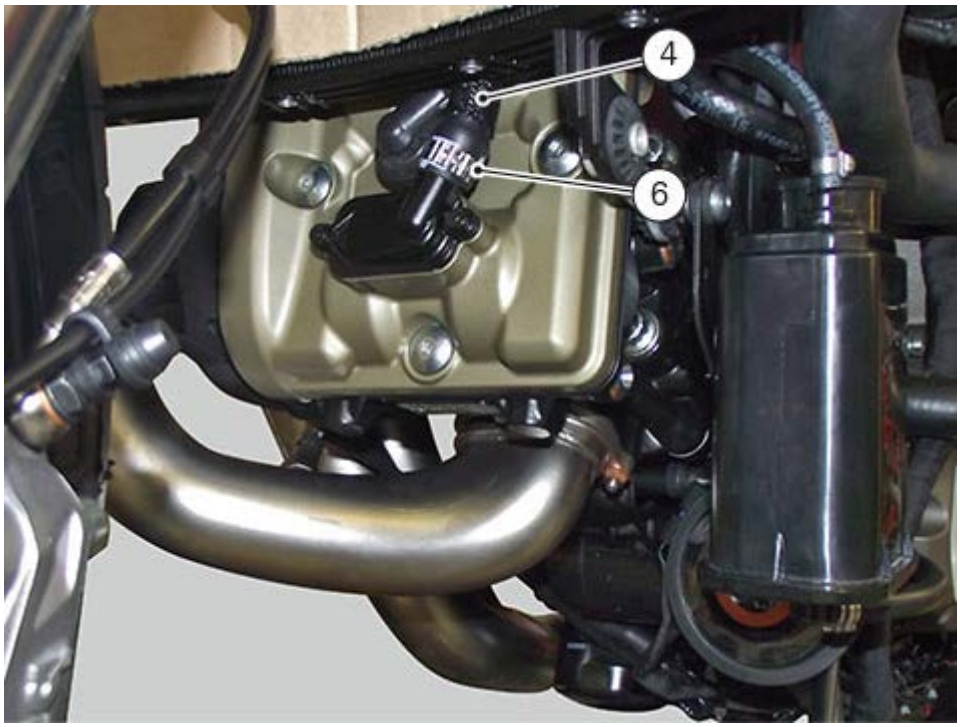


Remove the two throttle bodies.

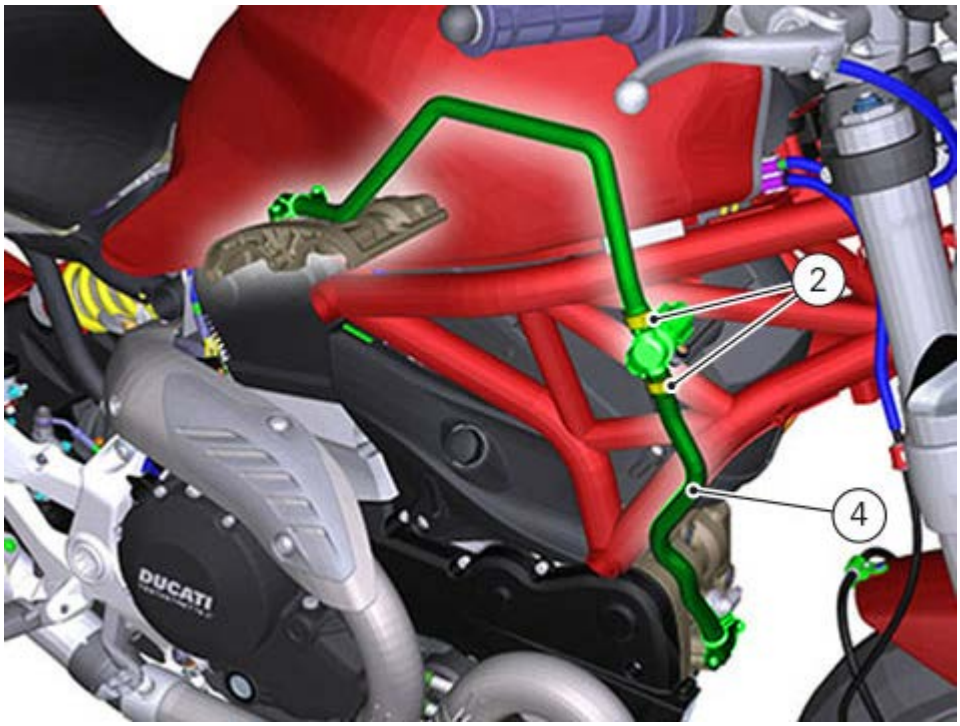
Refitting the secondary air system

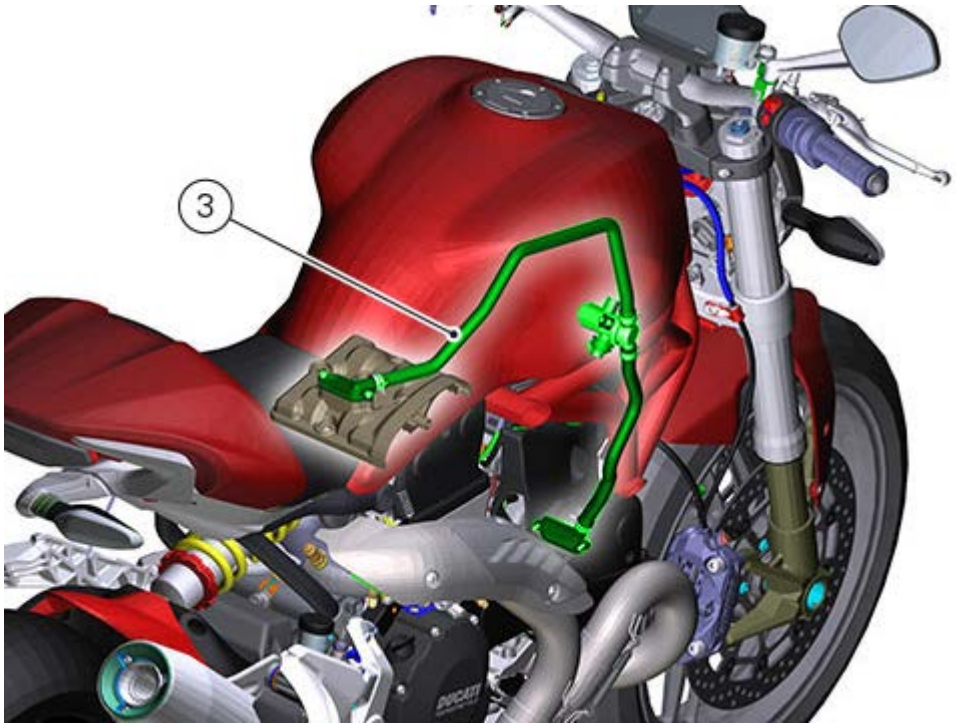
Fit horizontal head (4) and vertical head (3) hoses, securing them with the relevant clamps (6) and (5).



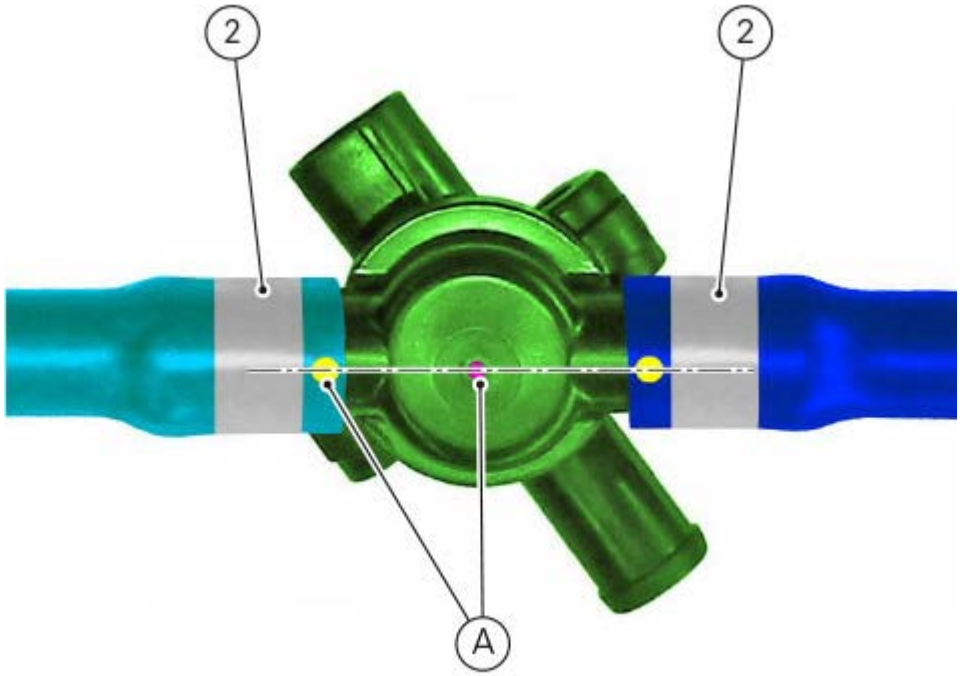


Fix hoses (3) and (4) to the secondary air system by means of two new ties (2).

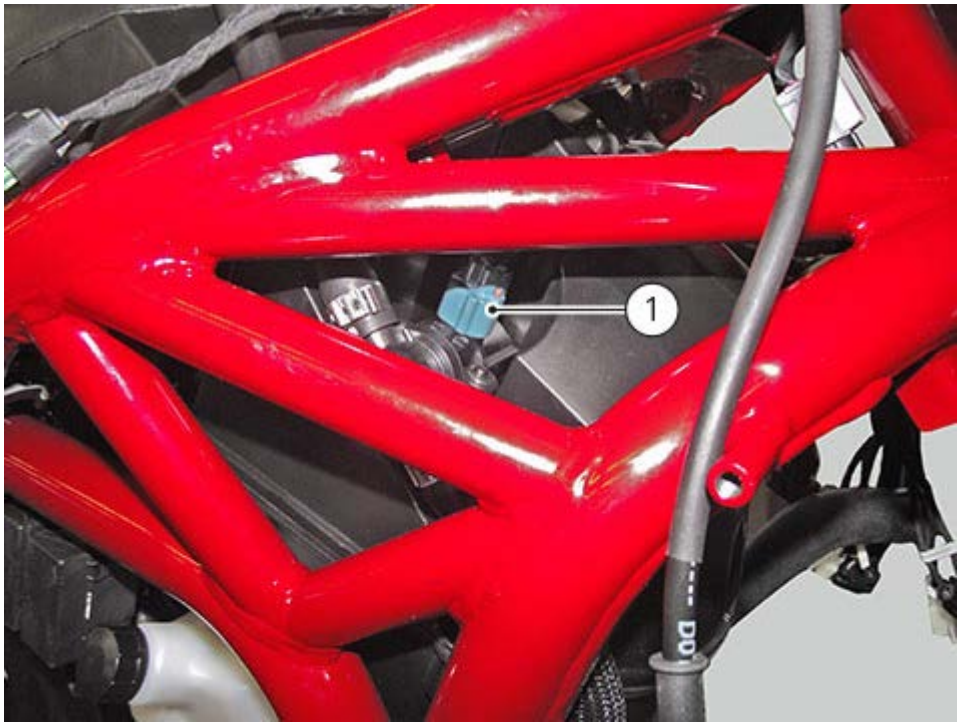




Make sure references (A) on hoses and actuator are aligned.



Connect the actuator connector (1).



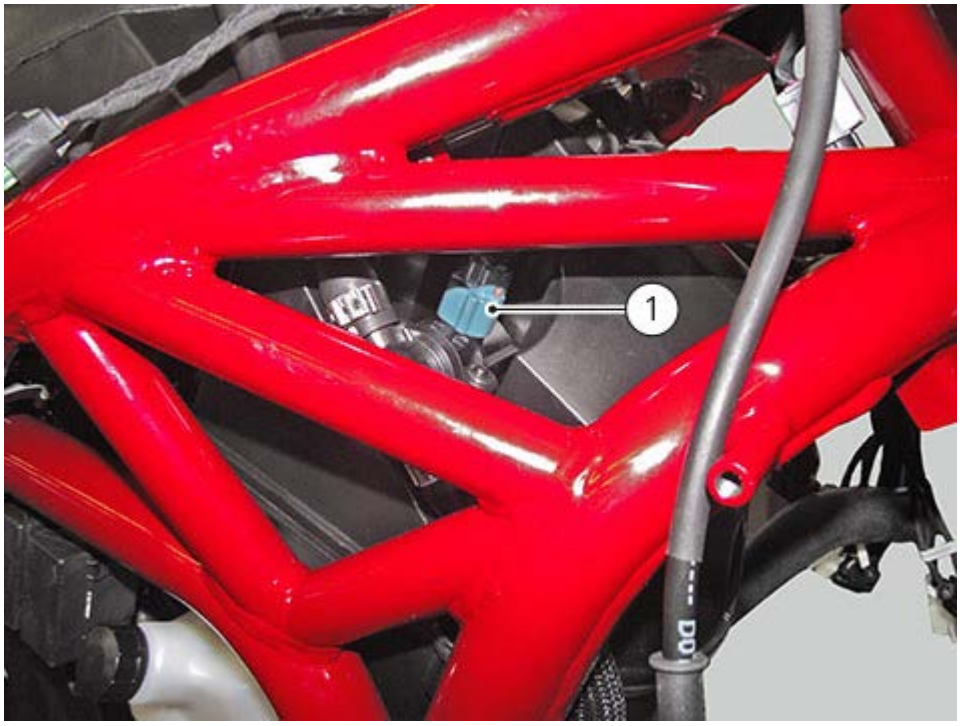
Note
Upon refitting, pay attention to the fitting correct position.

Refit the fuel tank (Refitting the fuel tank).
Refit the seat (Refitting the seat).

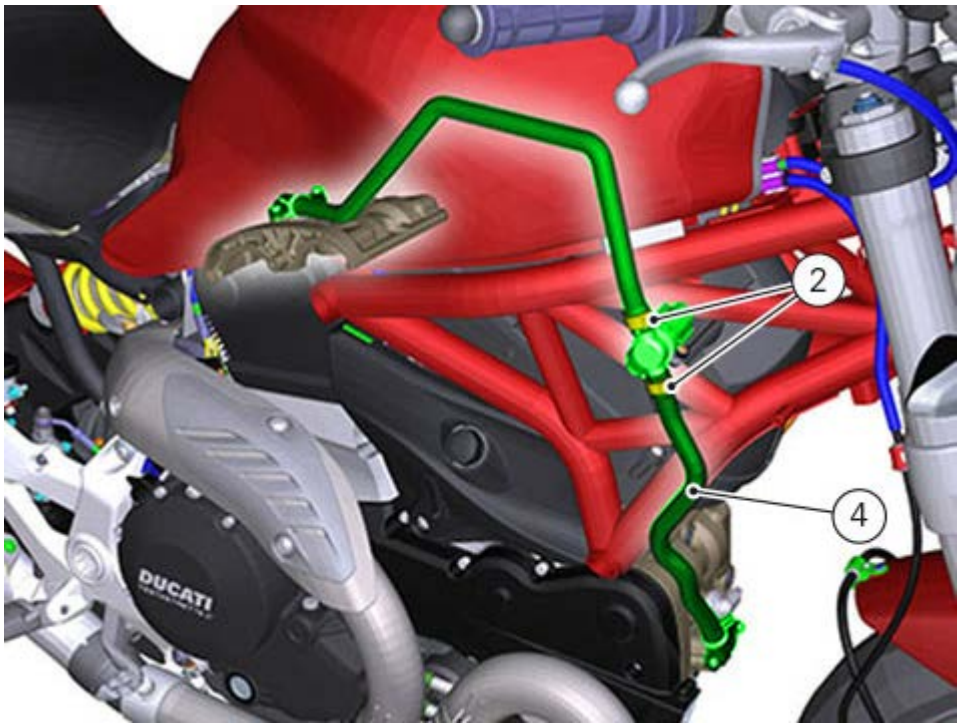
Removing the secondary air system

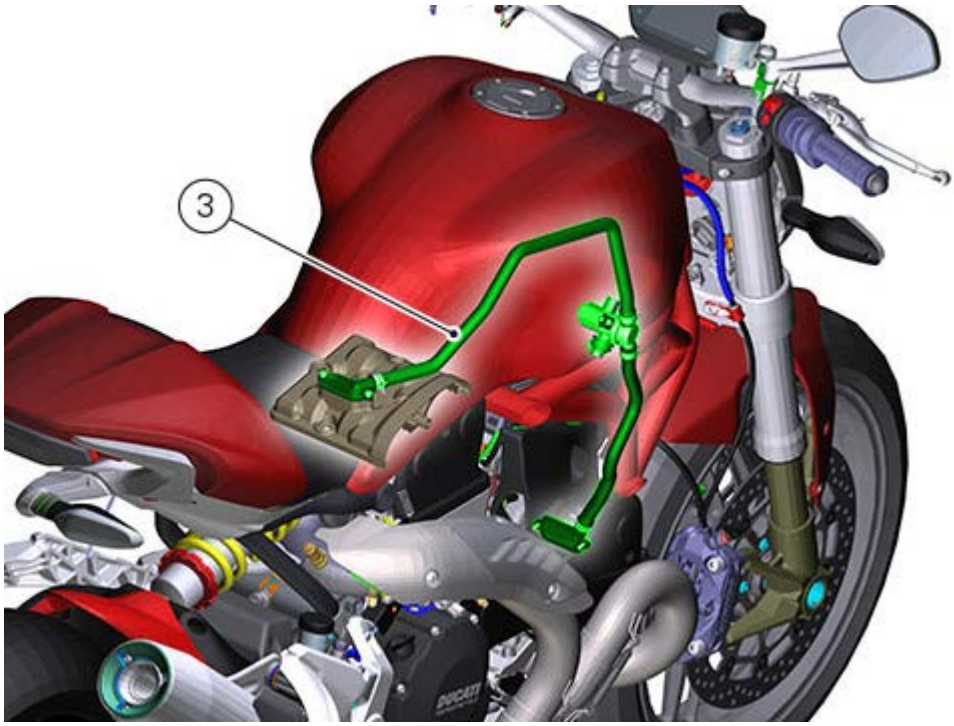
Remove the seat (Removing the seat).
Remove the fuel tank (Removing the fuel tank).

Disconnect connector (1) from the actuator.

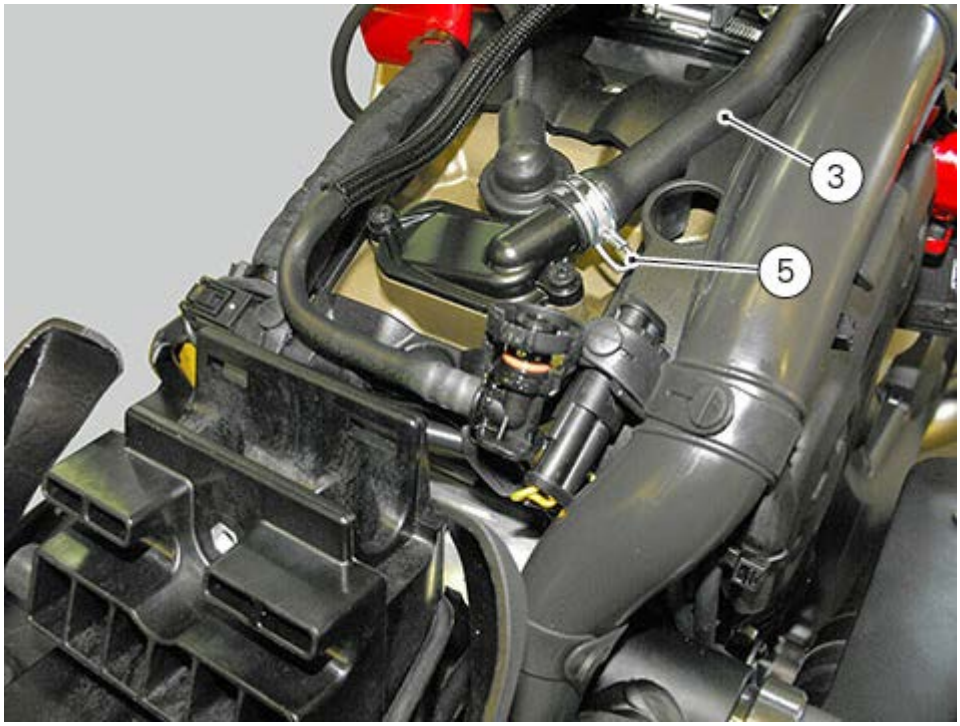


Slide out clamps (2) and hoses (3) from horizontal and vertical head (4).

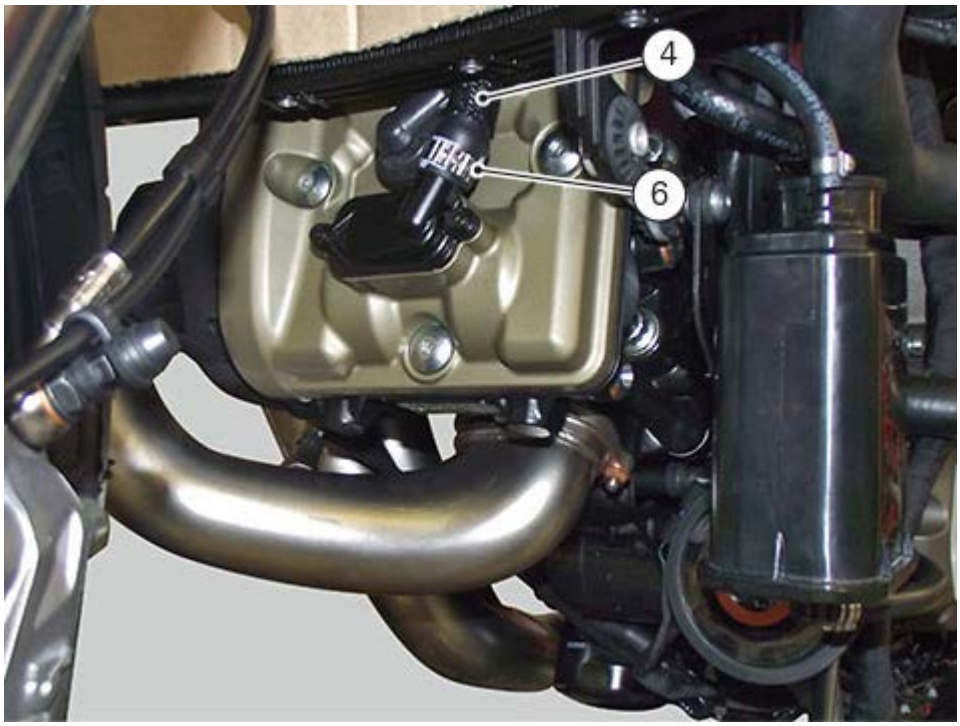




Slide out clamp (5) and remove the secondary air system hose (3) from the vertical head.

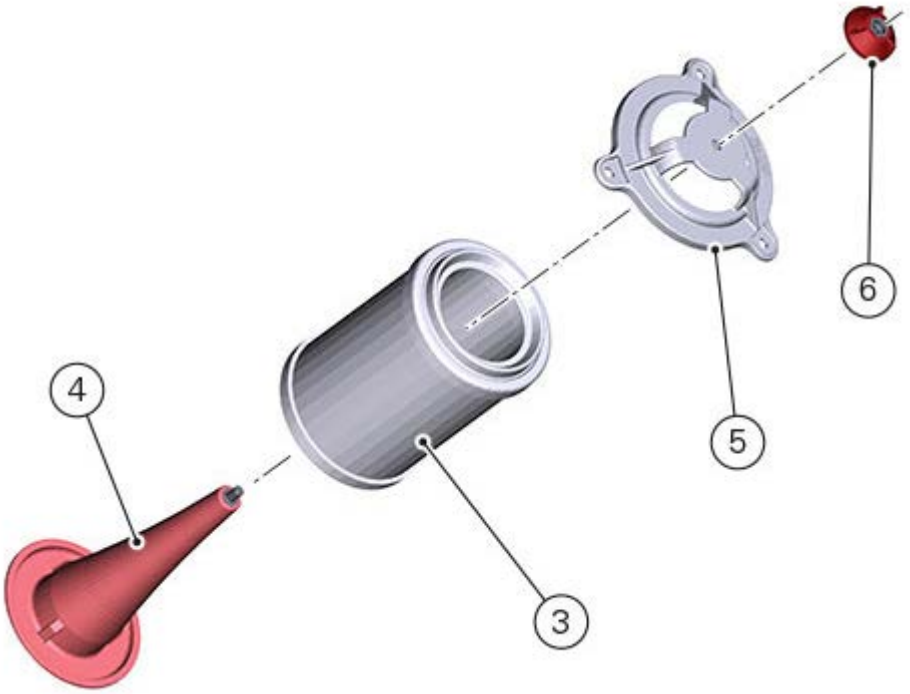


Repeat the operation on the horizontal head, disengaging clamp (6) and removing hose (4).



Refitting the air filter

Insert filter (3) in support (4) with the indications written on the filter edge facing upwards. Position filter cover (5) and start ring nut (6).

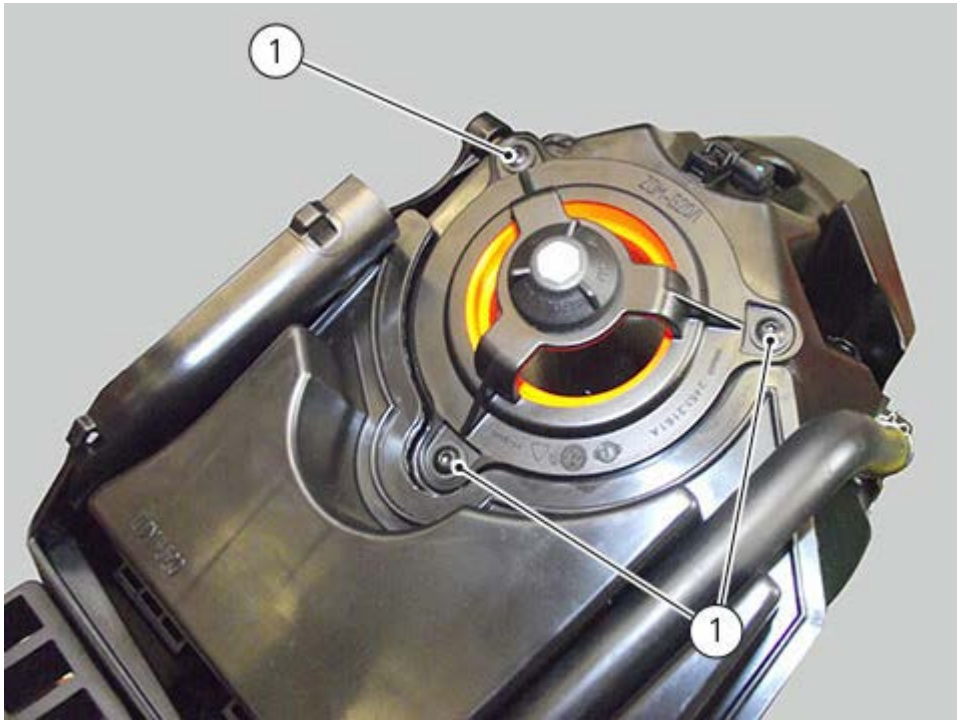


Tighten ring nut (6) to a torque of 6 Nm ± 10%.

Removing the air filters

Remove the fuel tank (Removing the fuel tank).

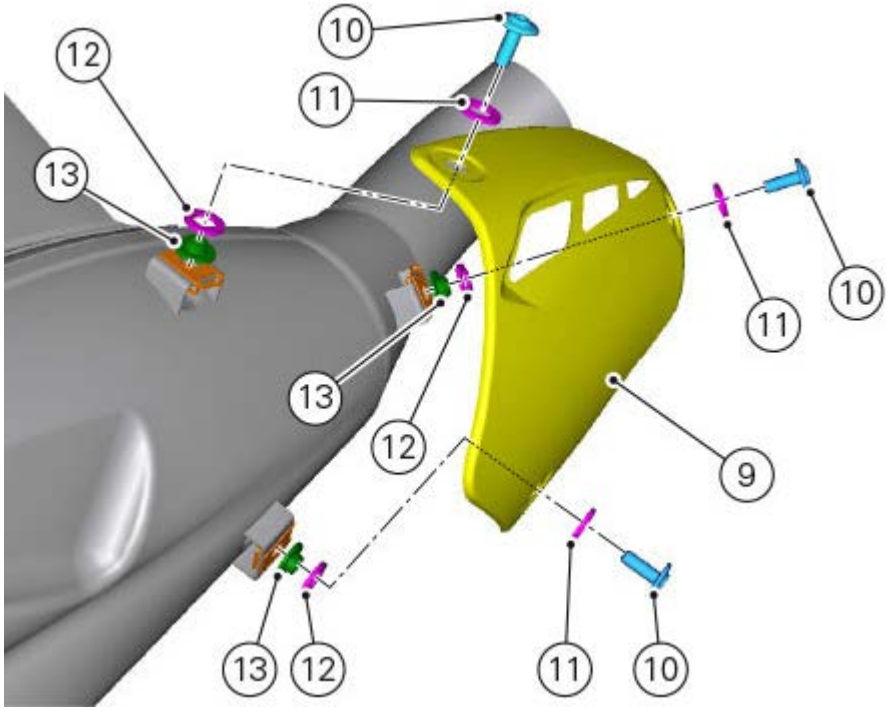
Loosen and remove the three securing screws (1).



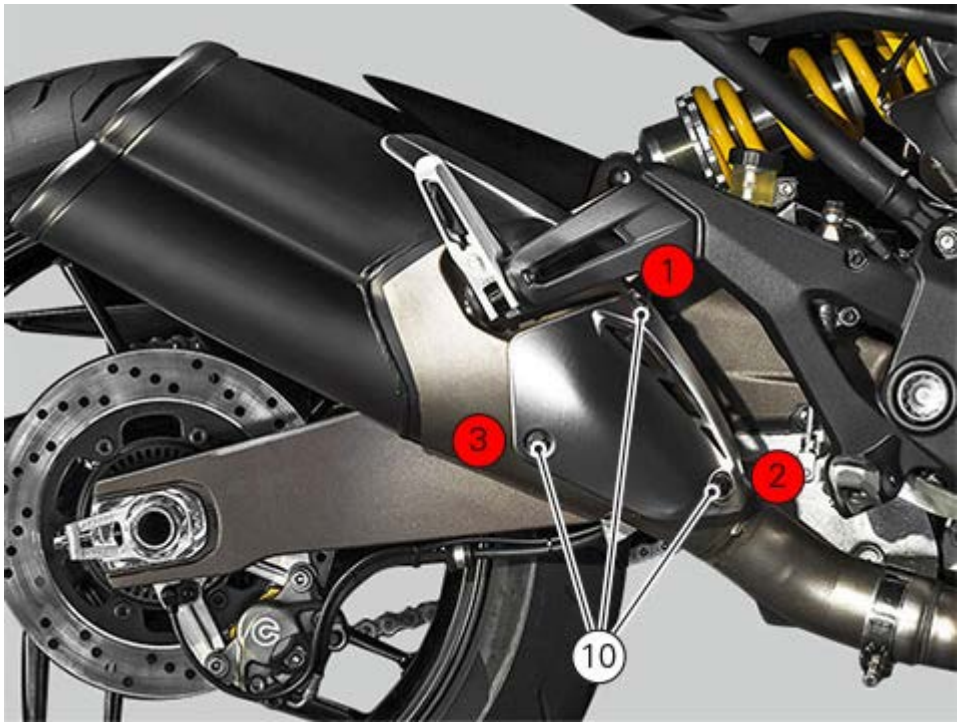
Slide out filter (2).

Refitting the silencer

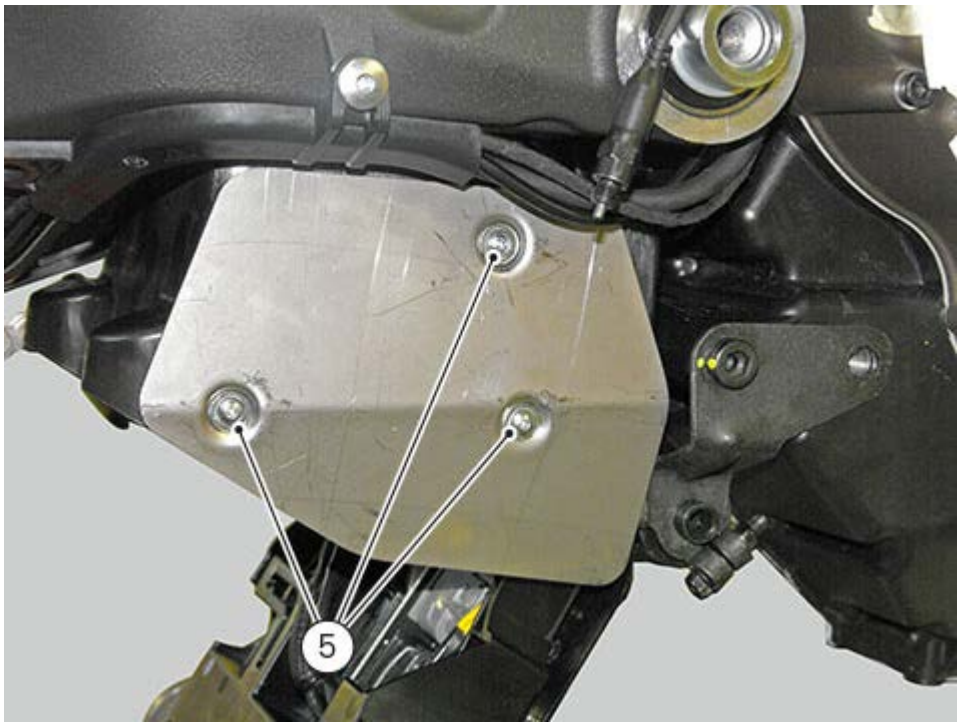
If previously removed, refit the heat guard as indicated:
- position spacers (13) and aramid washers (12);
- position heat guard (9) in its seat;
- position the aramid washers (11) and start the three screws (10).



Tighten the three screws (10) to 4 Nm ± 10%, following a 1-2-3 sequence.

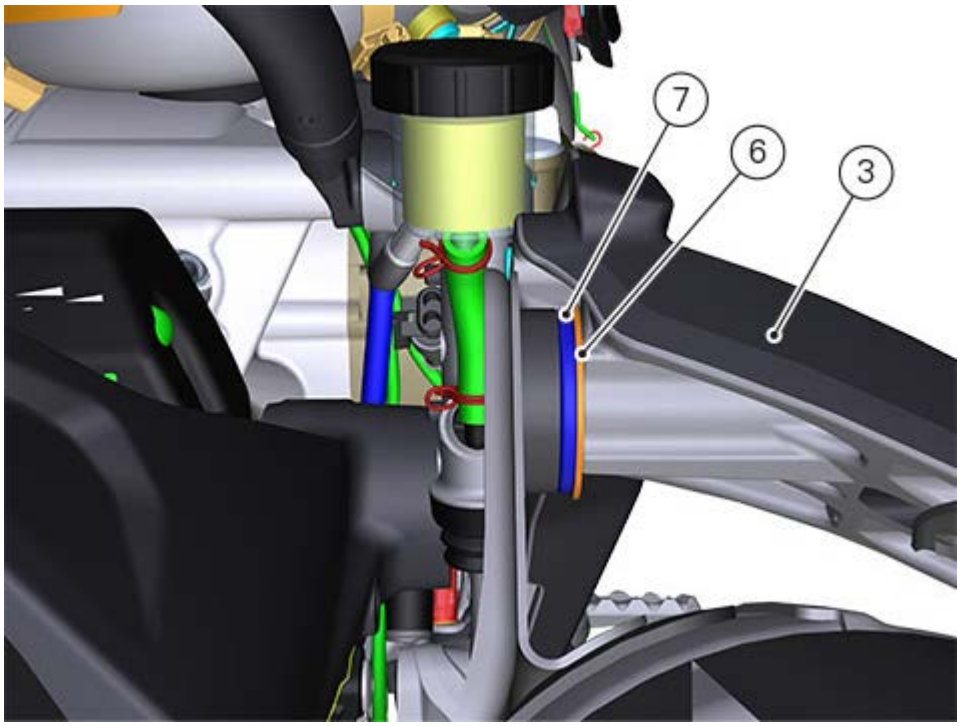


If previously removed, secure the battery box heat guard to the electric component support by tightening screws (5) to a torque of 3.5 Nm ± 10%.

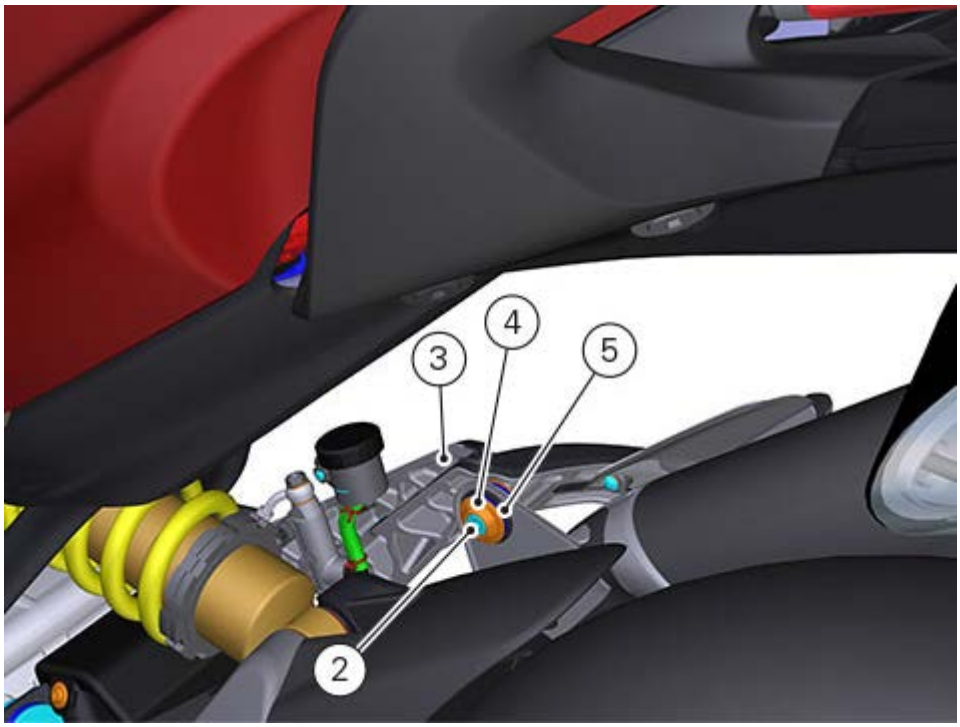


Position the silencer (20).

Position silent block (7) and washer (6) on the silencer bracket external side, against the RH footpeg holder plate (3).



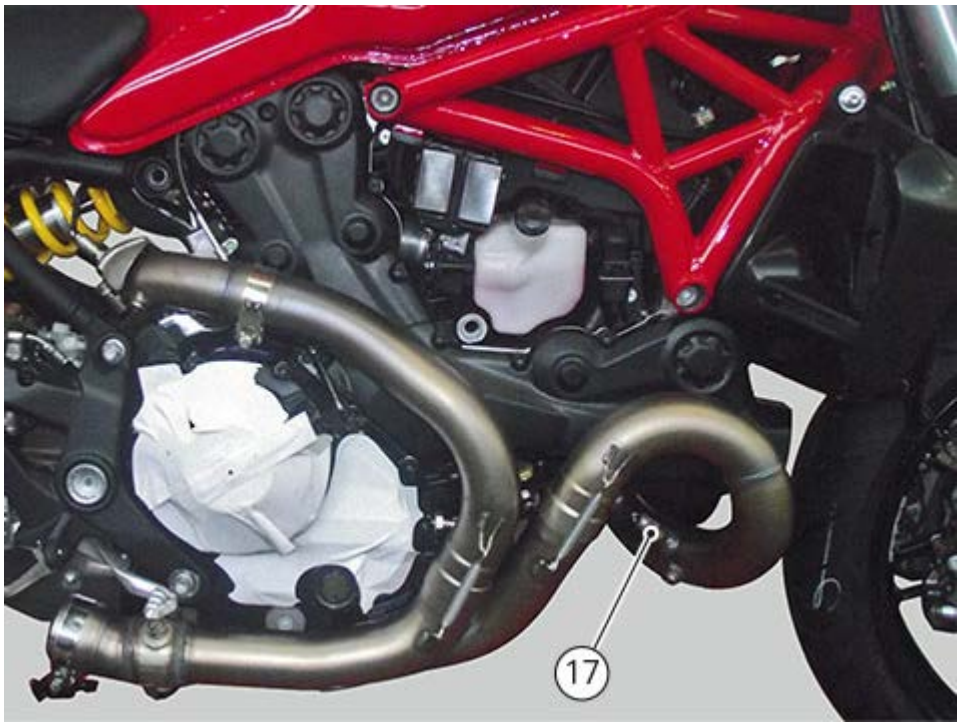
After positioning silent blocks (5) and bushing (4) on the silencer bracket internal side, start screw (2). Then tighten screw (2) to the RH footpeg holder plate (3) to a torque of 20 Nm ± 10%.



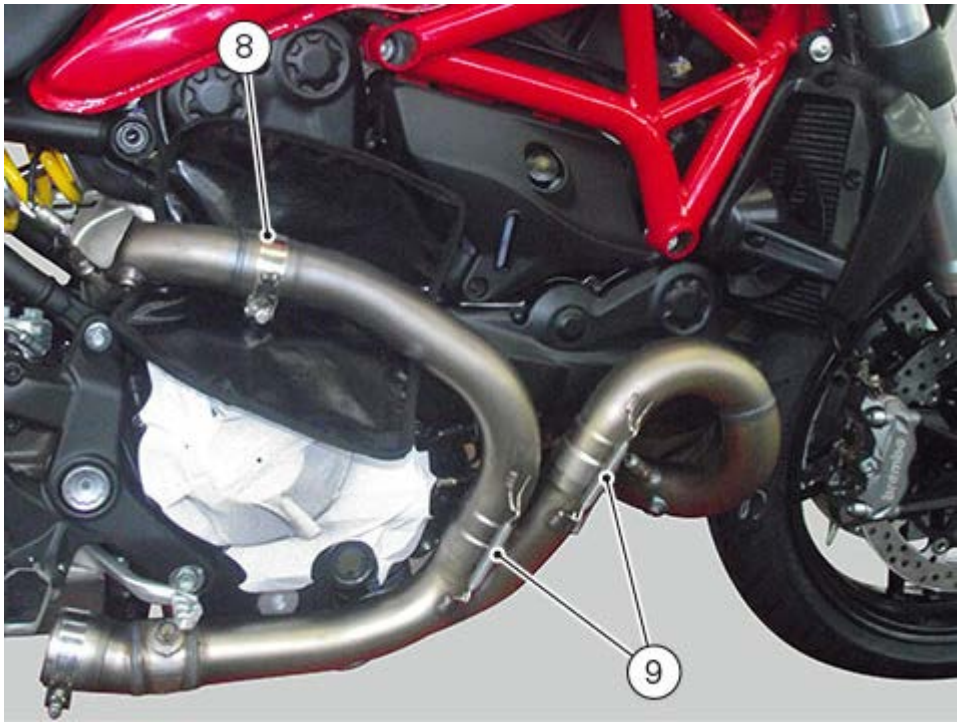
Note

Upon coupling with the manifold, push the primary of the vertical head exhaust as much as possible towards the engine.

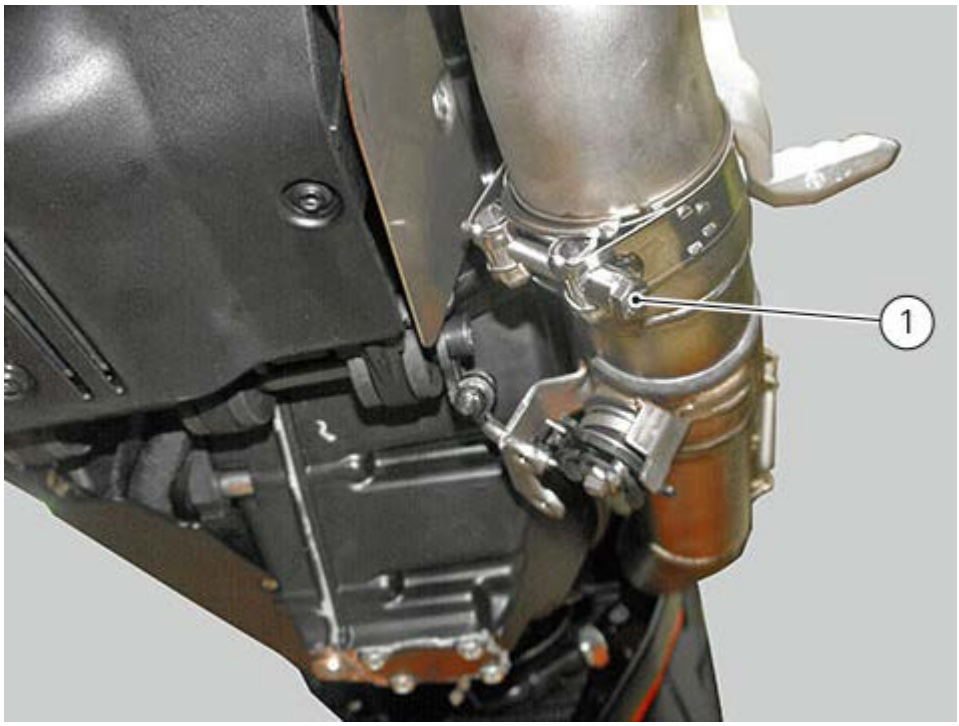
Fix the lambda sensor of the horizontal cylinder (17) to a torque of 25 Nm ± 10%.



Tighten clip (8) to a torque of 18 Nm ± 10%.



Tighten clip (1) to a torque of 18 Nm ± 10%.

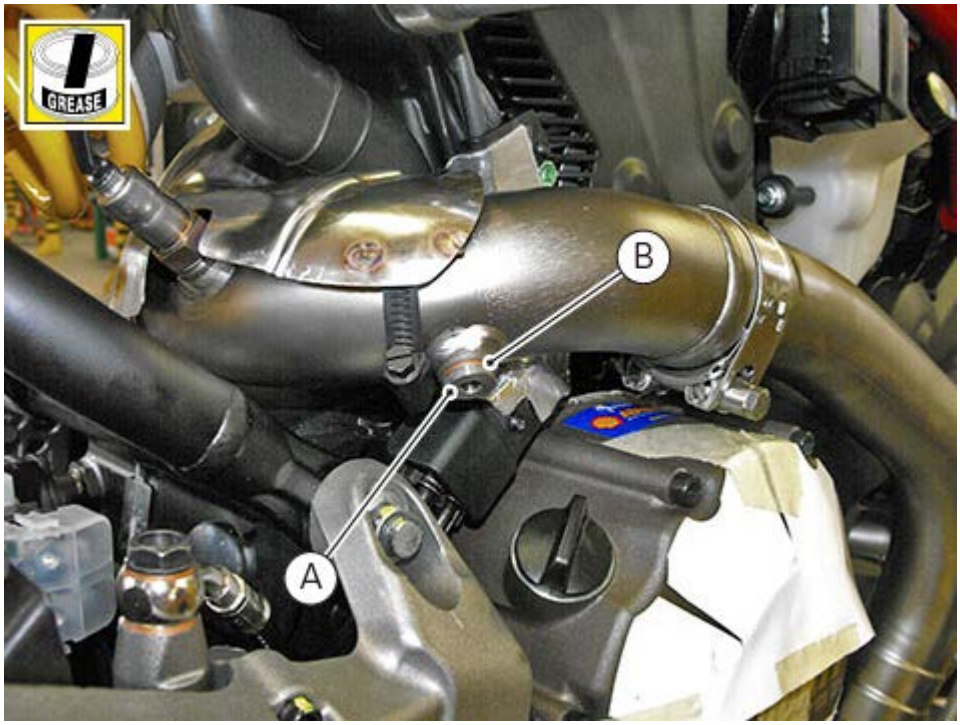


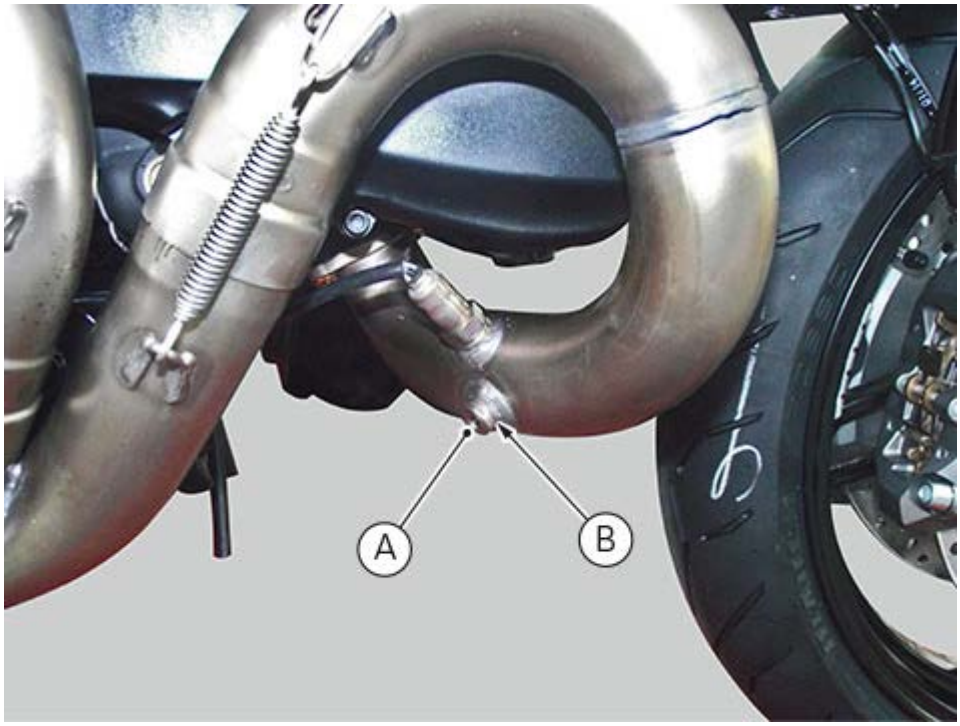
Note

Upon coupling with the manifold, push the primary of the vertical head exhaust as much as possible towards the engine.

Refitting the exhaust system

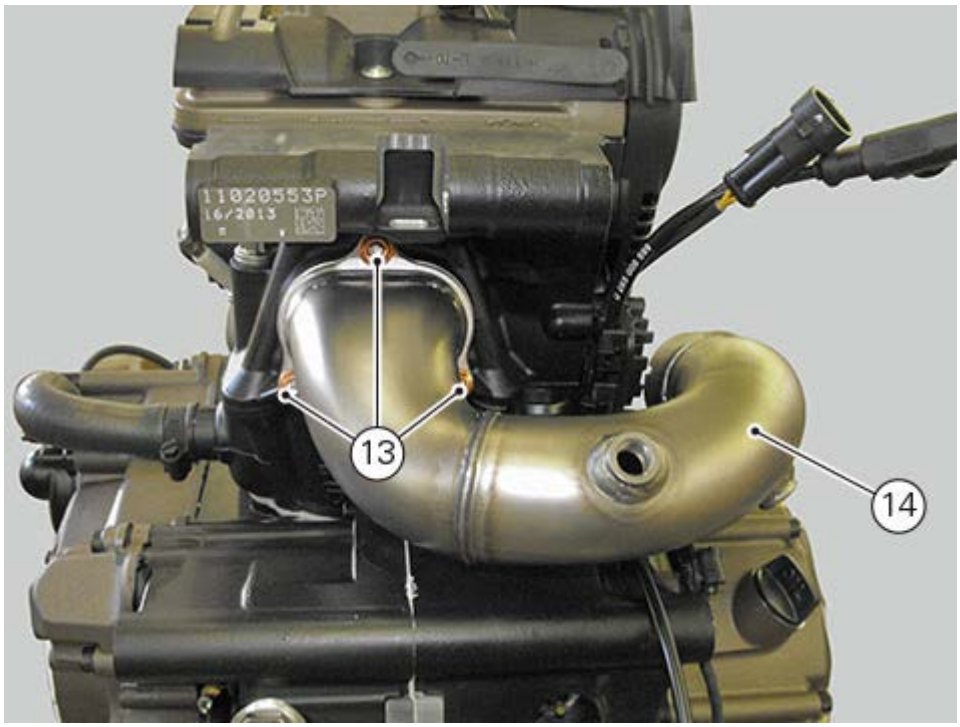
If previously removed, fit exhaust plugs (A) by applying the specified product.
Tighten plugs (A) to a torque of 25 Nm ± 10% with copper washers (B).





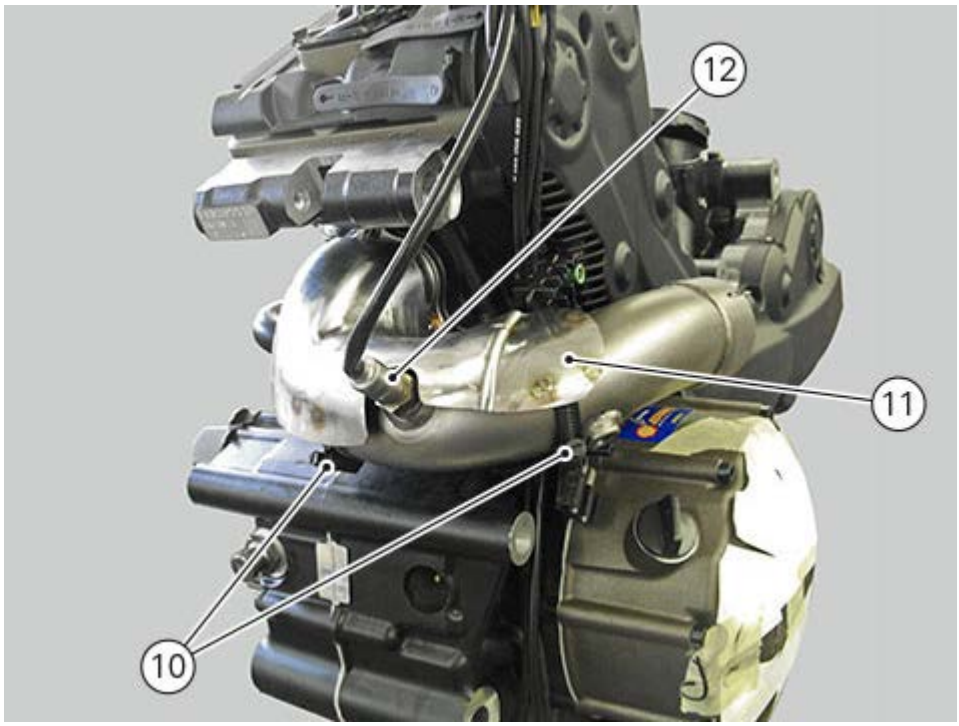
Position exhaust (16) in the horizontal cylinder and tighten the three screws (15) to a torque of 10 Nm ± 10%.

Position exhaust (14) in the vertical cylinder and tighten the three screws (13) to a torque of 10 Nm ± 10%.

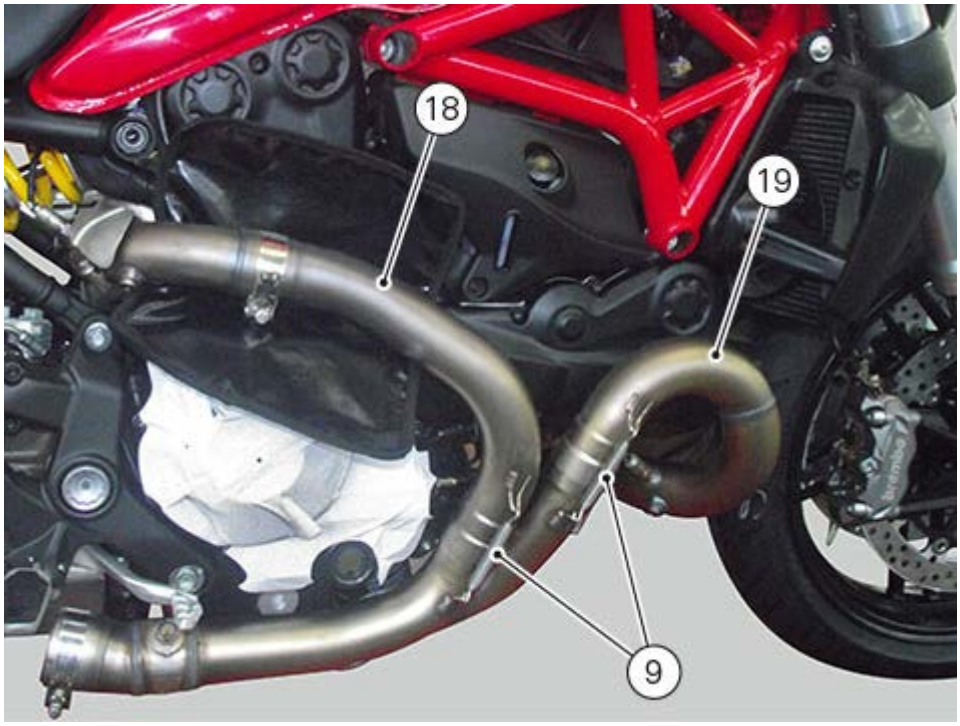


Position the lambda sensor and tighten it to a torque of 25 Nm ± 10%.
Insert heat guard (11) by tightening the two clamps (10).

Note
Position the clamp head in the highest point.

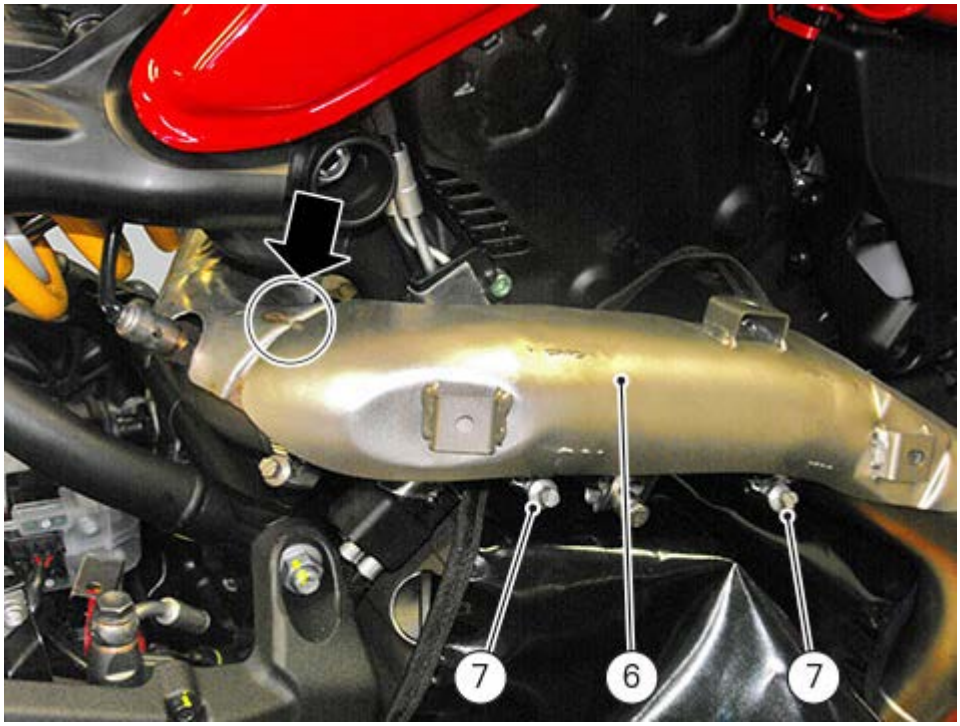


Insert the two primary pipes of exhaust (18) and (19) and fix them by means of two springs (9).

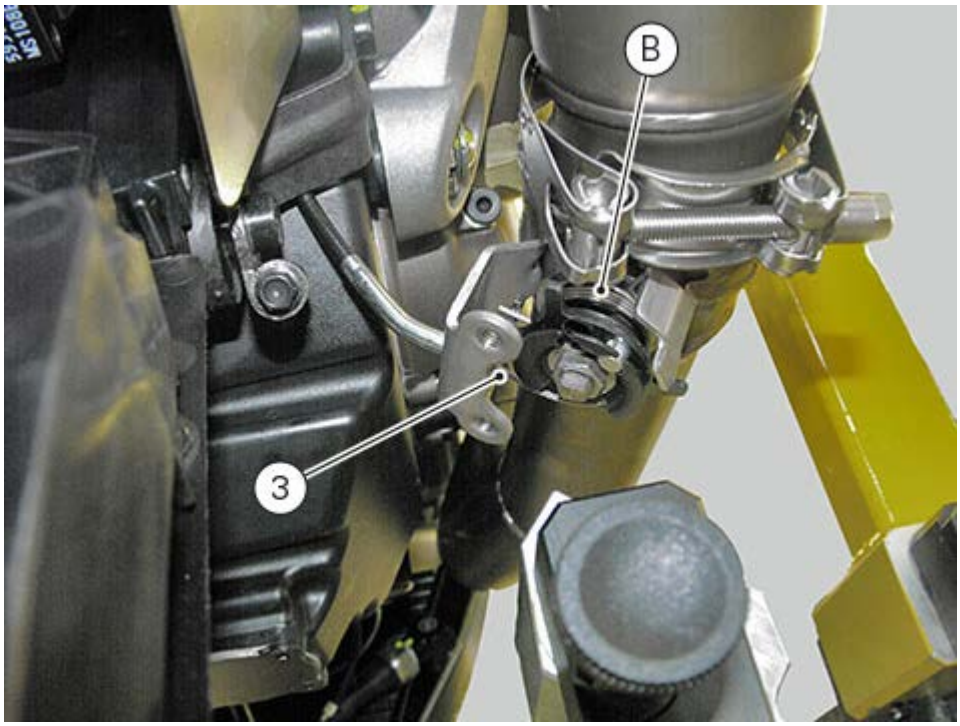


Refit the silencer (20) (Refitting the silencer).

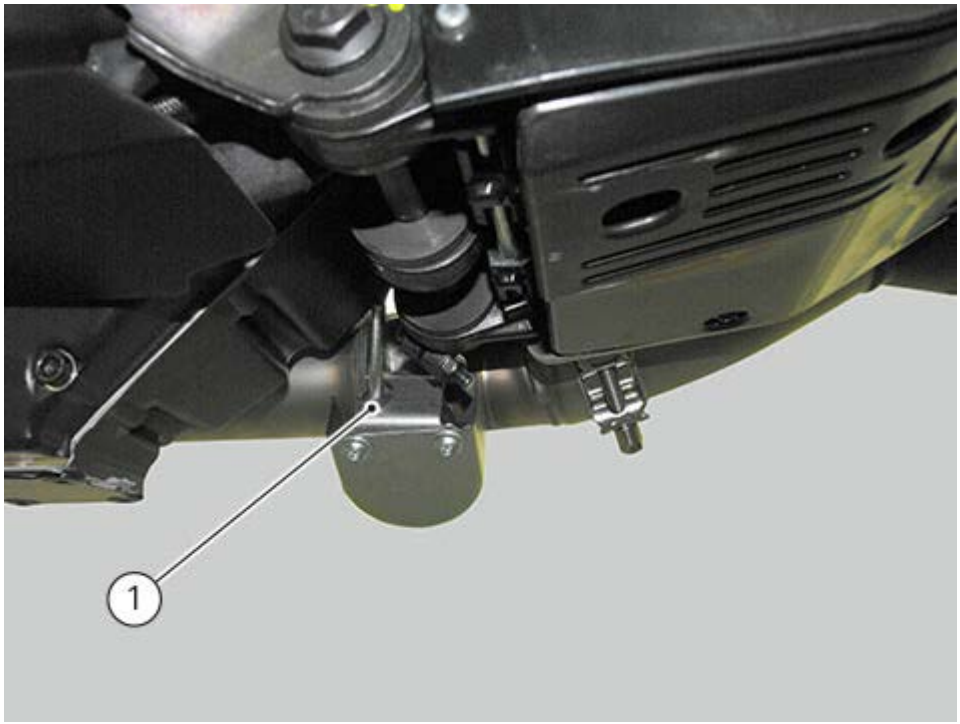
Position heat guard (6) as shown in the figure and tighten clamps (7) to a torque of 10 Nm ± 10%.



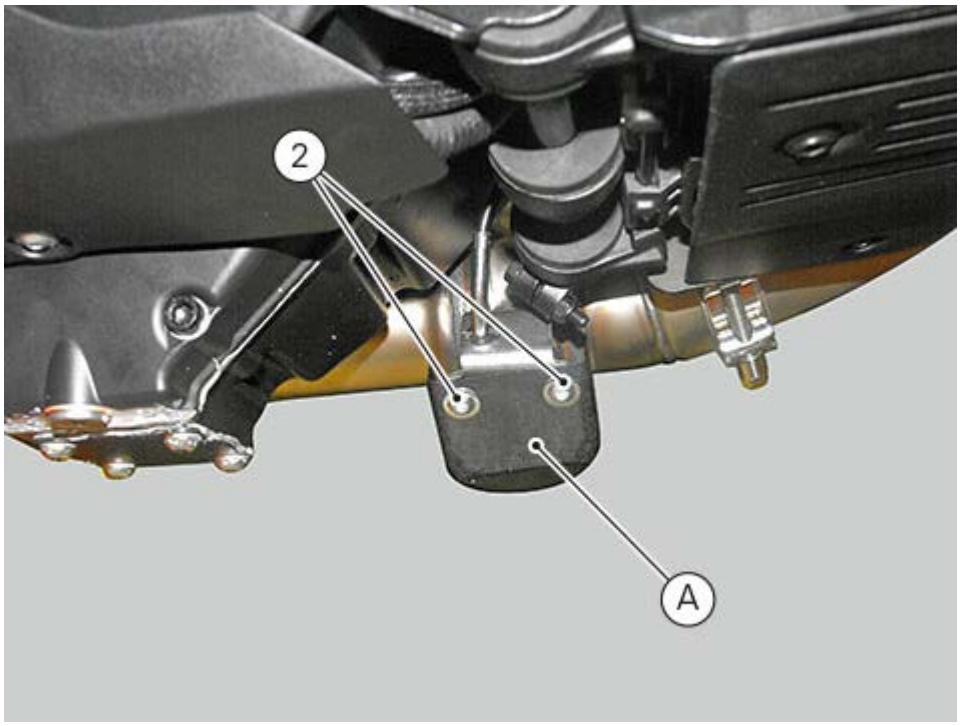
Insert cable (3) in the exhaust valve by rotating pulley (B).



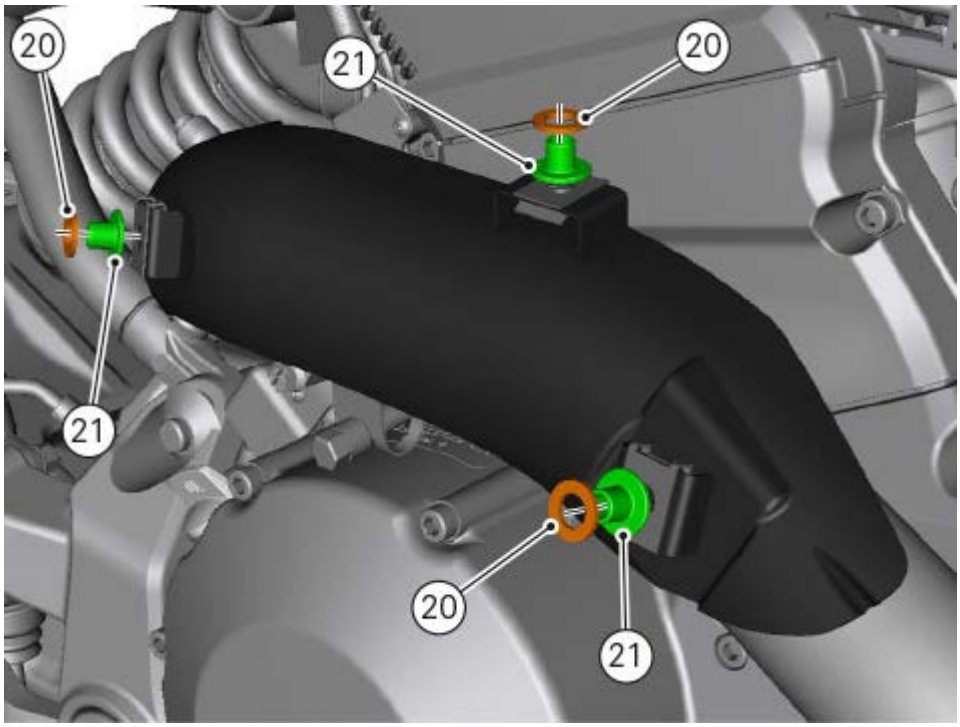
Secure the control cable with circlip (1).



Fit the exhaust valve cover (A) and tighten screws (2) to a torque of 8 Nm ±10%.

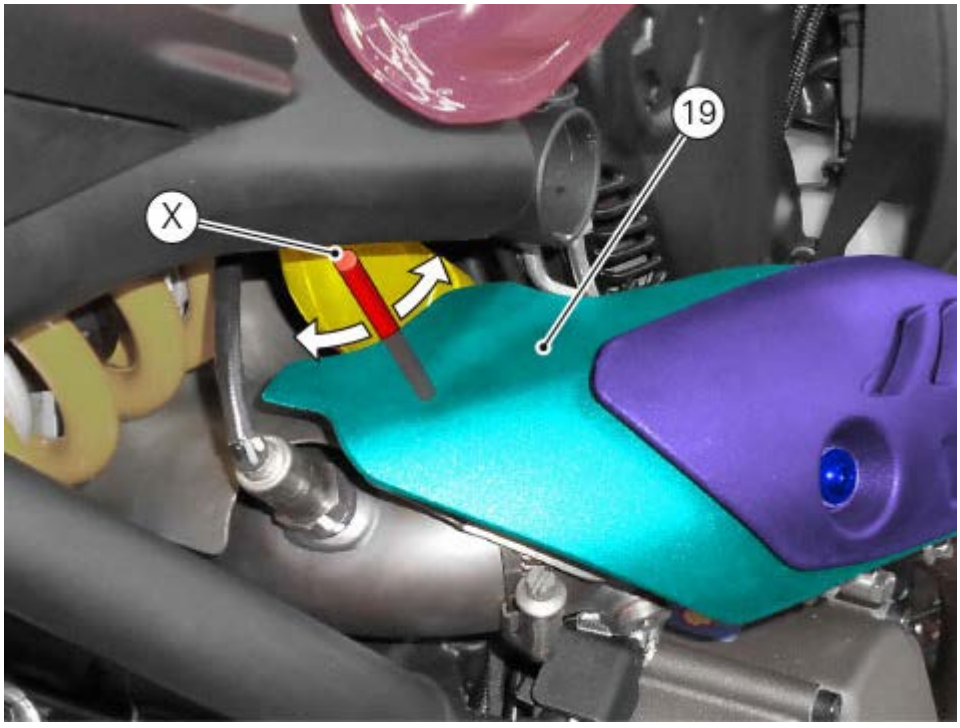


Position the internal vertical primary heat guard (19).
Position spacers (21) and aramid washers (20).



Position the vertical primary heat guard (5) and aramid washers (18).
Tighten the three screws (4) to a torque of 10 Nm ± 10%.

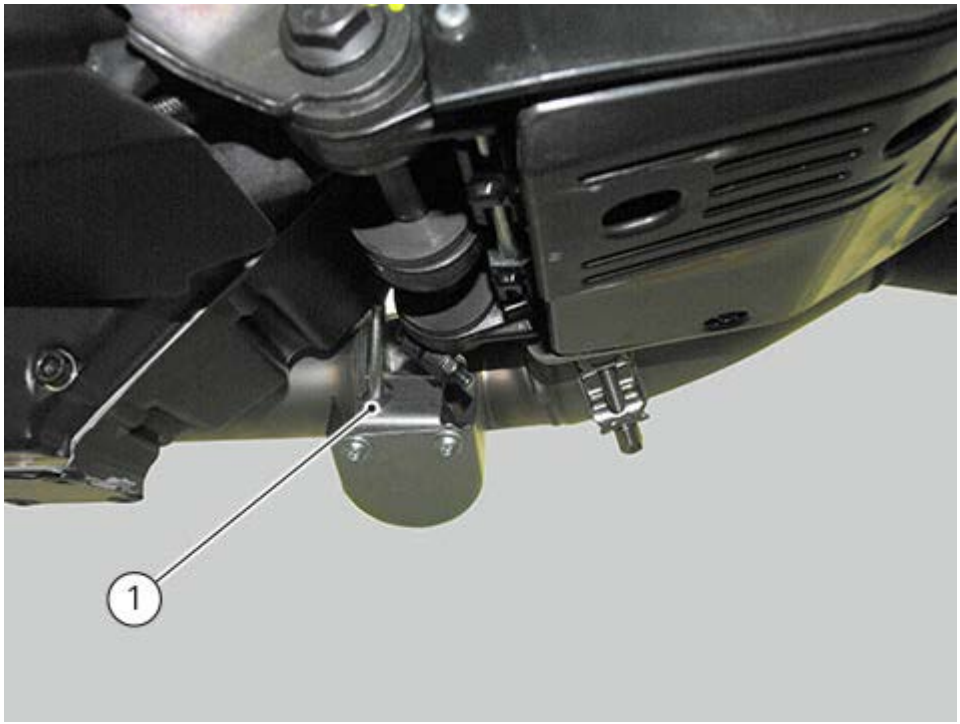
Use a calibrated feeler gauge (X) to check the correct distance between heat guard (19) and the blow-by pipe:
such distance must not exceed 5 mm.
If this is not the case, reposition the heat guards and the clamps.

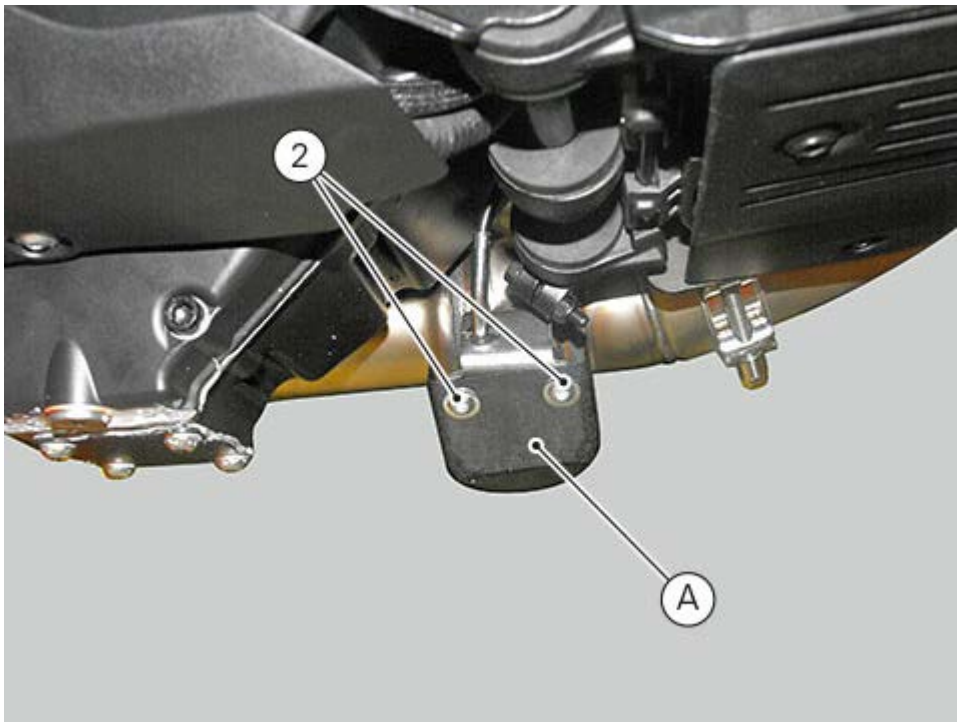


Removing the exhaust system

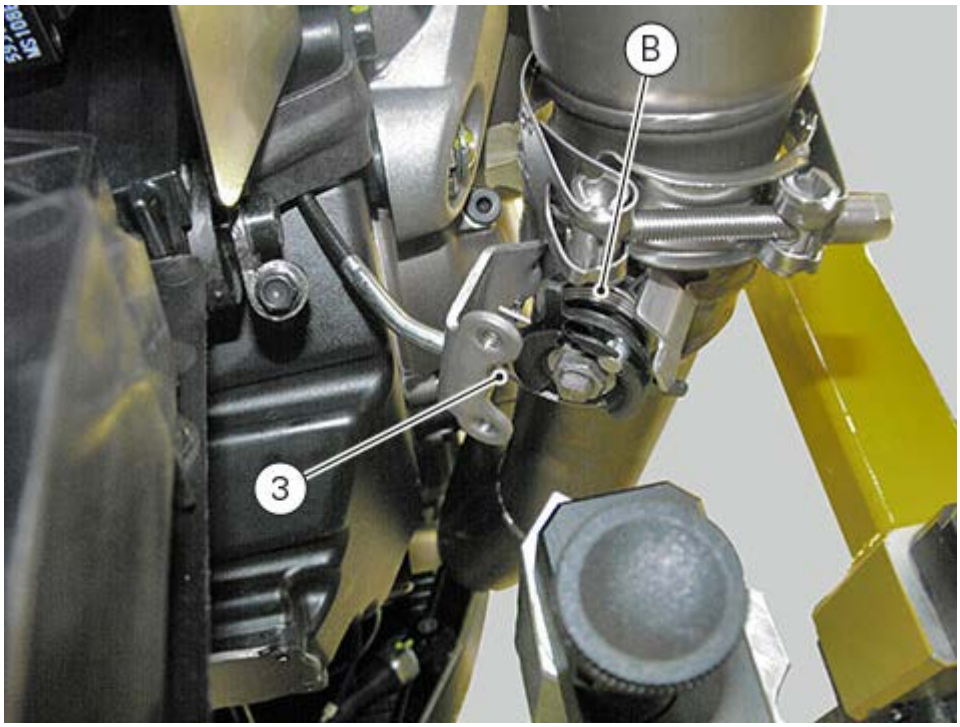
Remove the silencer (Removing the silencer).

Remove circlip (1).
Remove guard (A) by loosening the two retaining screws (2).



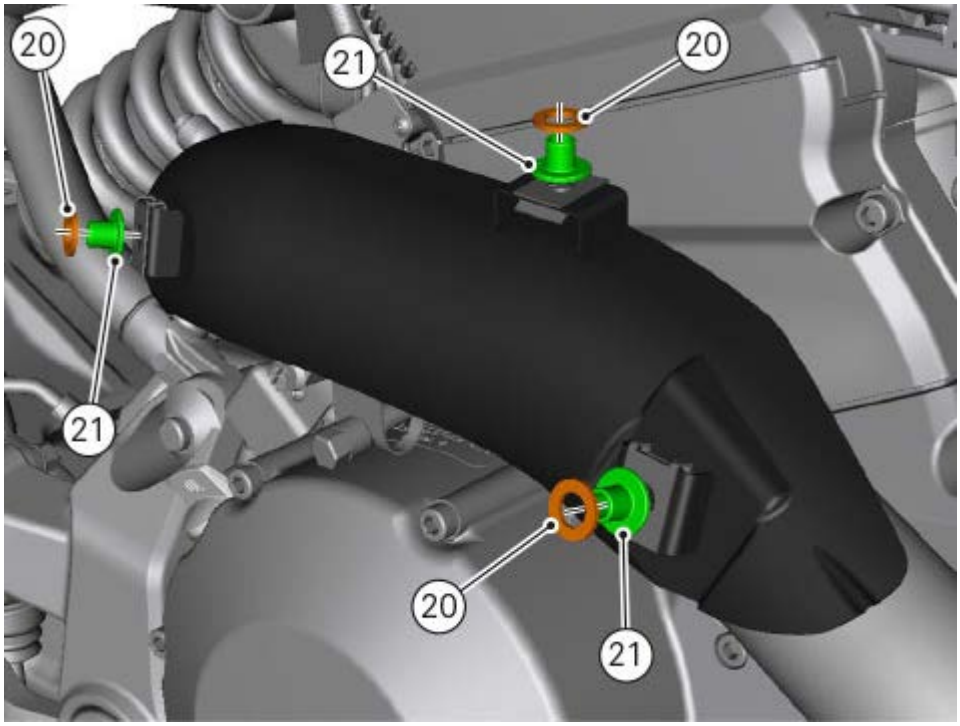


Turn the pulley (B) of the exhaust valve to facilitate the control cable (3) exit.
Slide out from the pulley (B) the control cable (3).

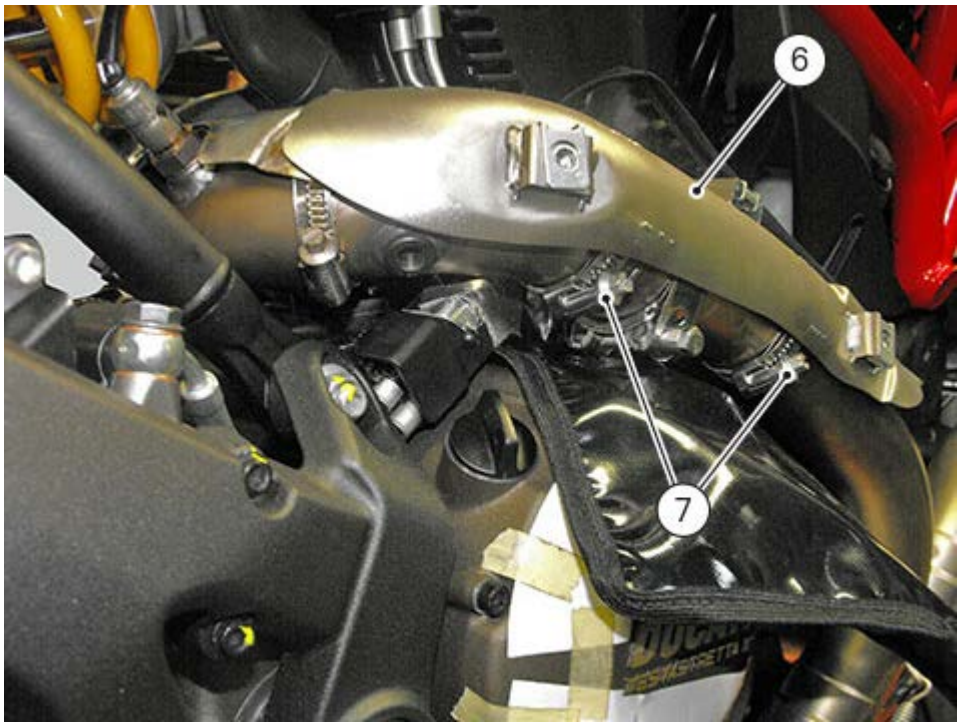


Remove the upper retaining screw of the rear shock absorber and lower the swinging arm.
Loosen the three retaining screws (4) of the heat guard and collect the relevant upper aramid washers (18).
Remove the external vertical primary heat guard (5) and the vertical primary heat guard (19).

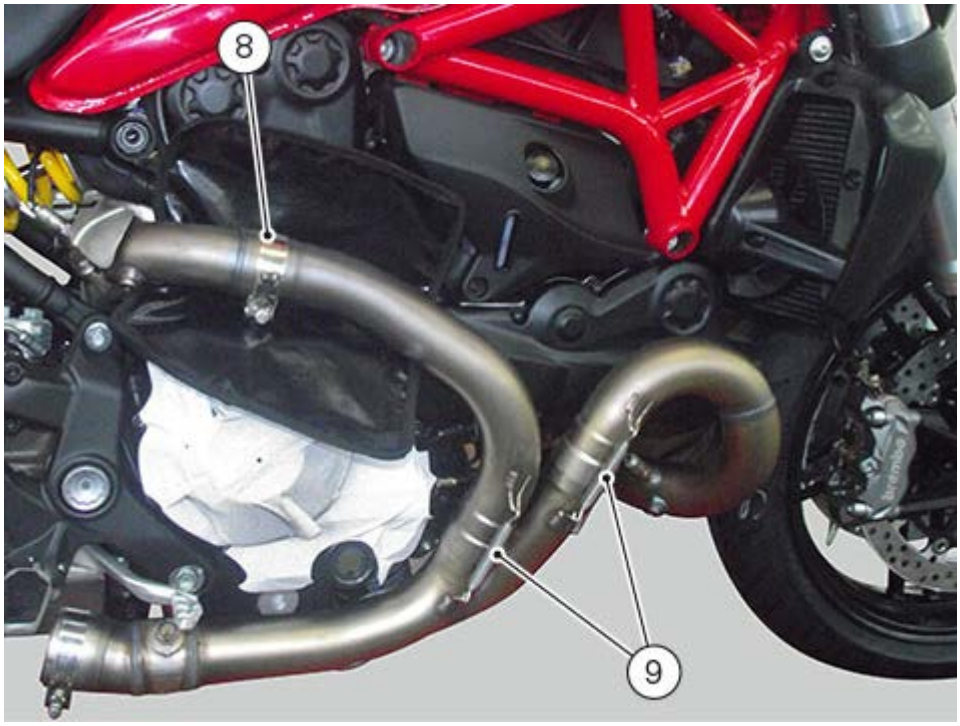
Collect the three lower aramid washers (20) and the relevant spacers (21).



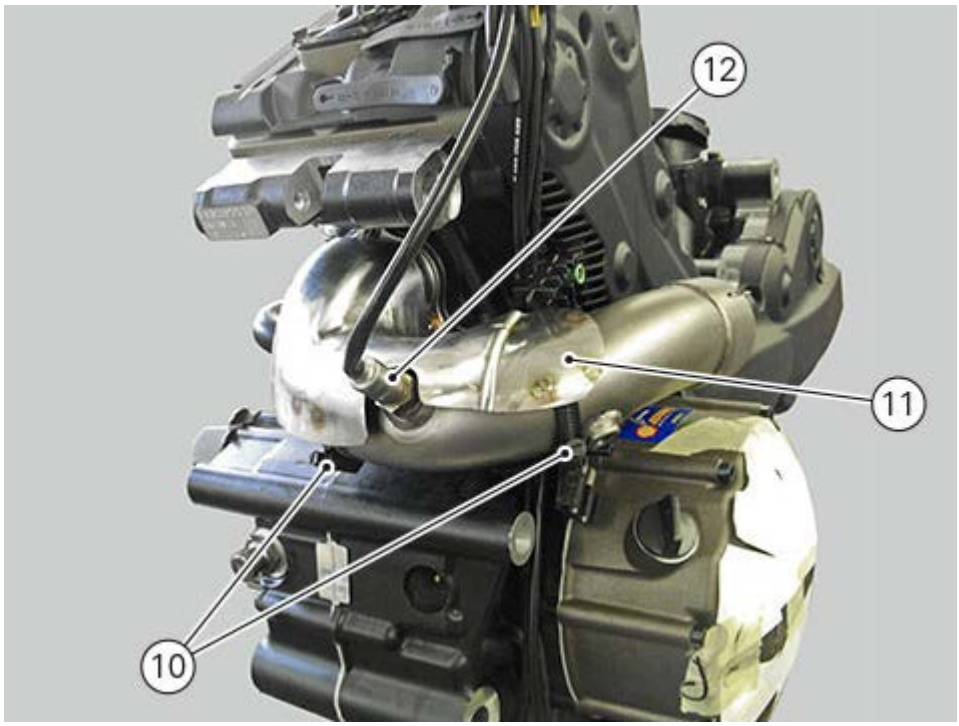
Undo clamps (7) and remove the heat guard support (6).



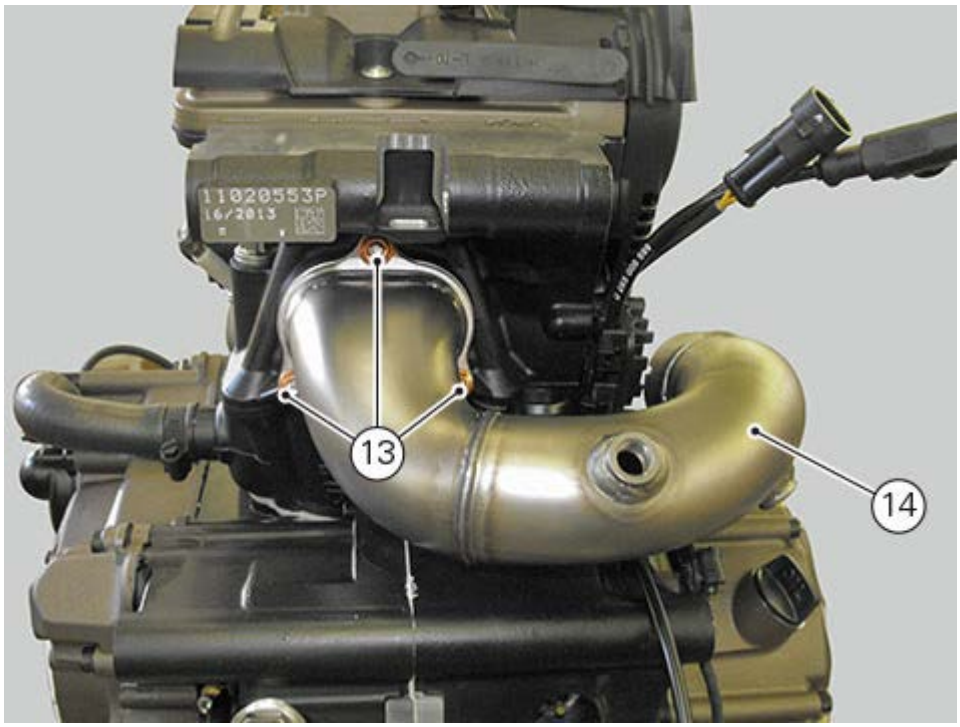
Loosen clamp (8) and remove the two retaining springs (9).



Loosen the two clamps (10) and remove heat guard (11) of the vertical head exhaust.
Remove lambda sensor (12).

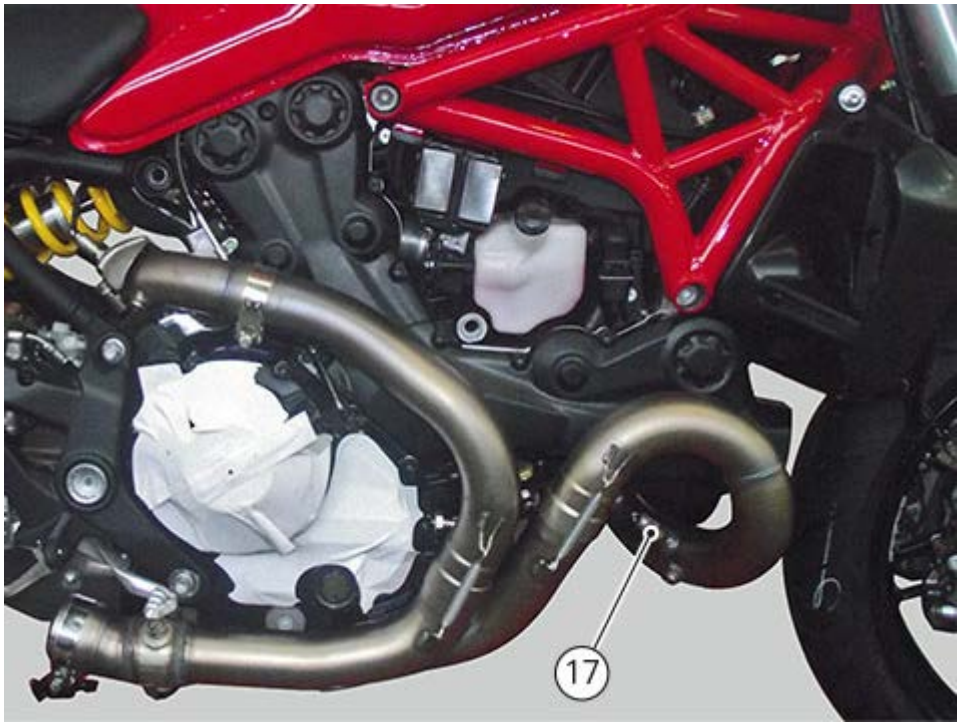


Loosen the three screws (13) of the vertical cylinder manifold (14).
Remove manifold (14).



Working on the horizontal cylinder, loosen the three retaining screws (15) of manifold (16).

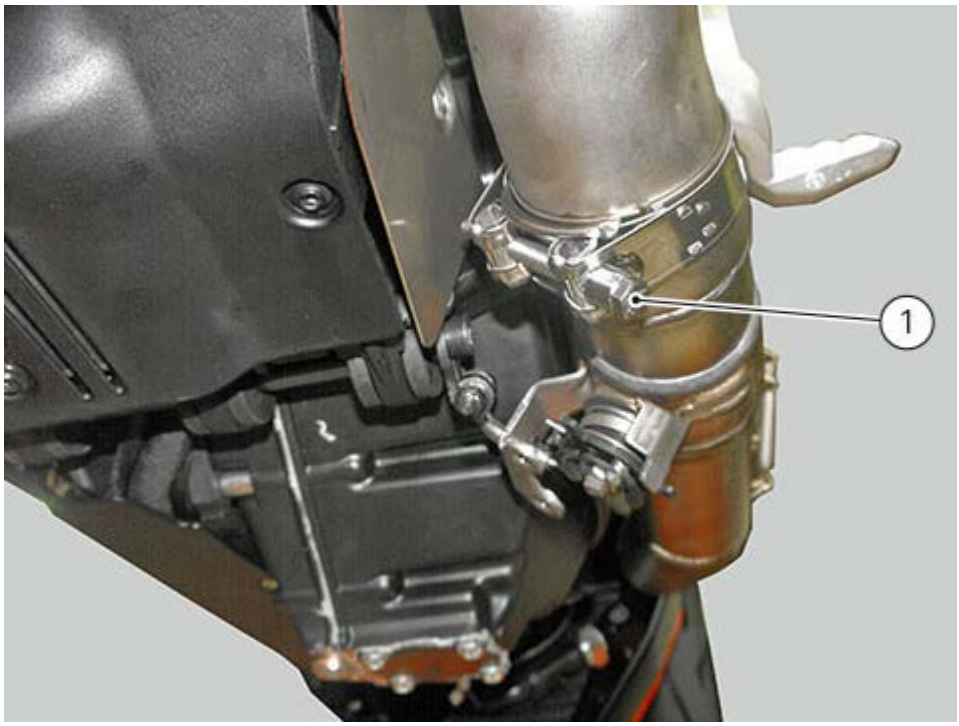
Remove lambda sensor (17).



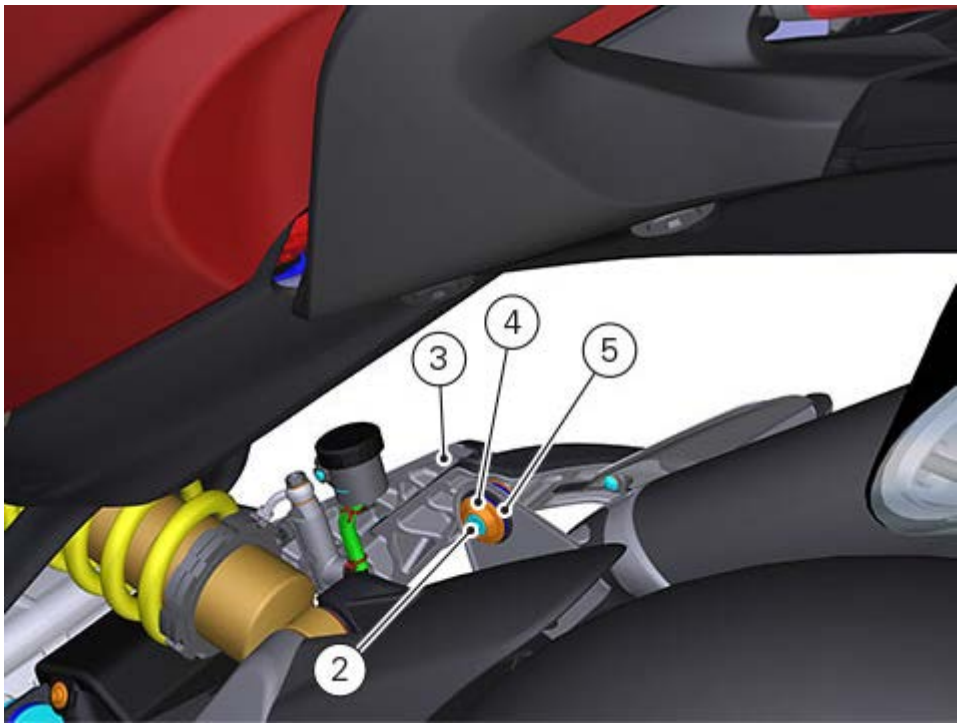
Remove the exhaust.

Removing the silencer

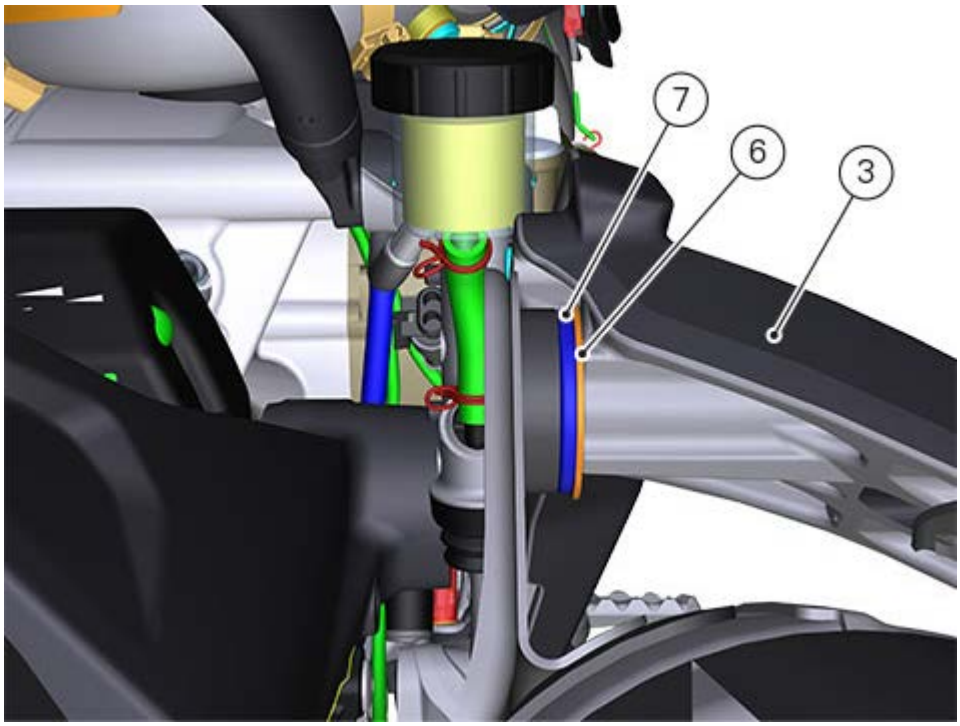
Loosen the clamp (1).



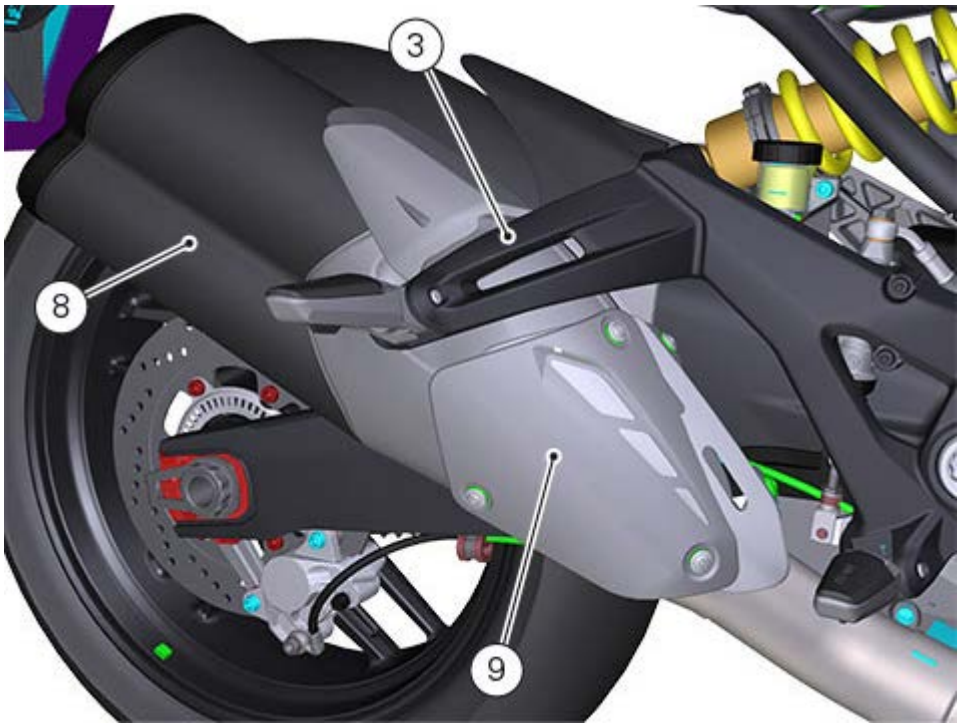
Loosen screw (2) that retains the silencer to the RH footpeg holder plate (3) and collect bushing (4) and silent block (5).



Collect washer (6) and silent block (7) from the tightening opposite side.

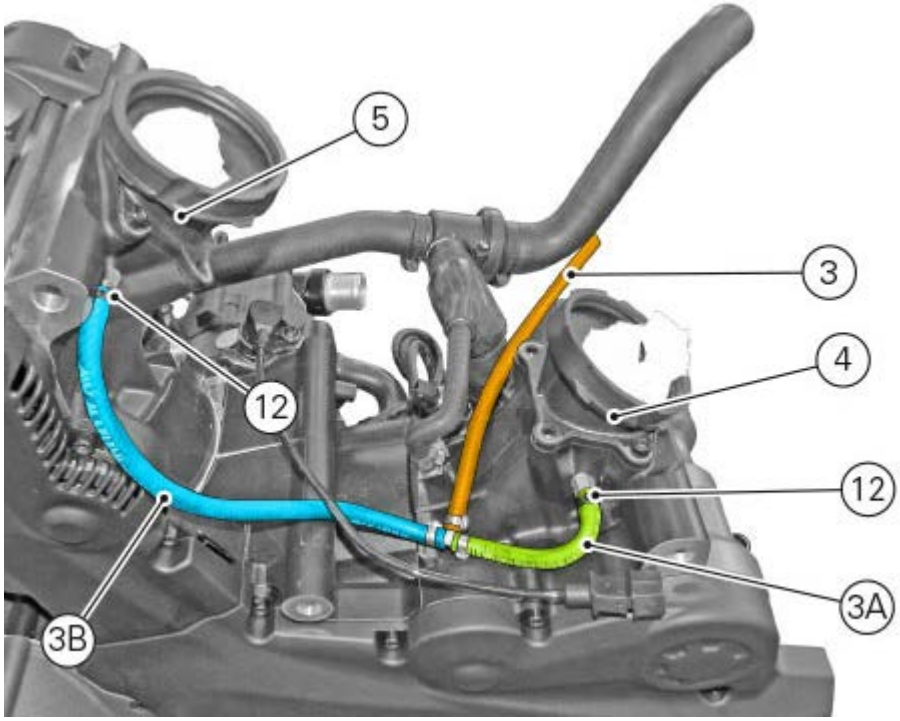


Remove silencer (8) by sliding it from the rear side and having care not to damage heat guard (9) which may touch the RH footpeg holder plate (3).

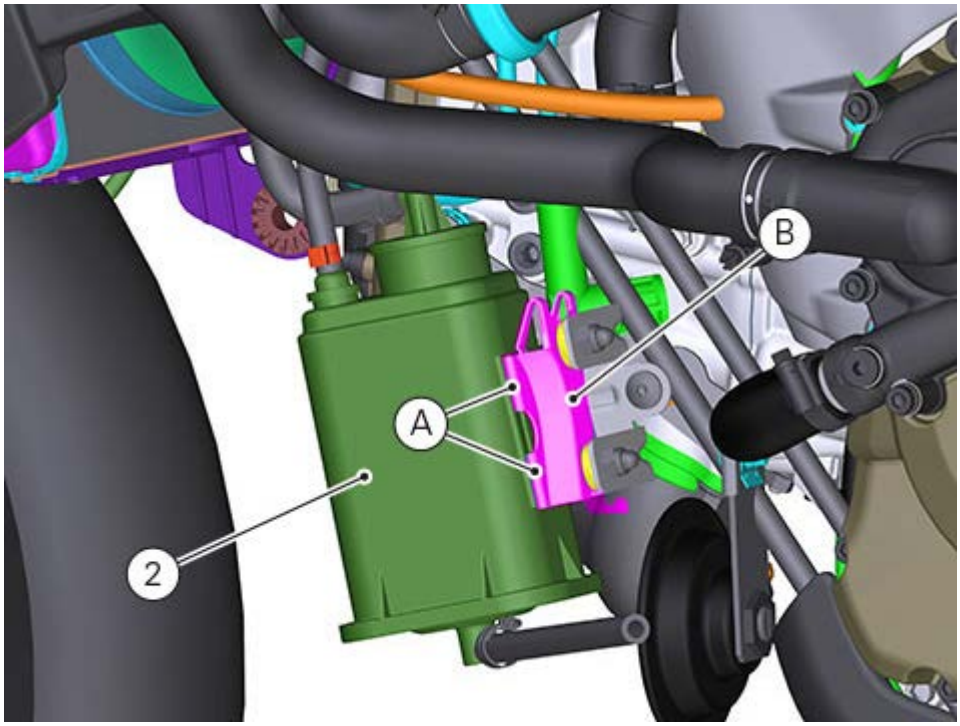


Refitting the Canister filter

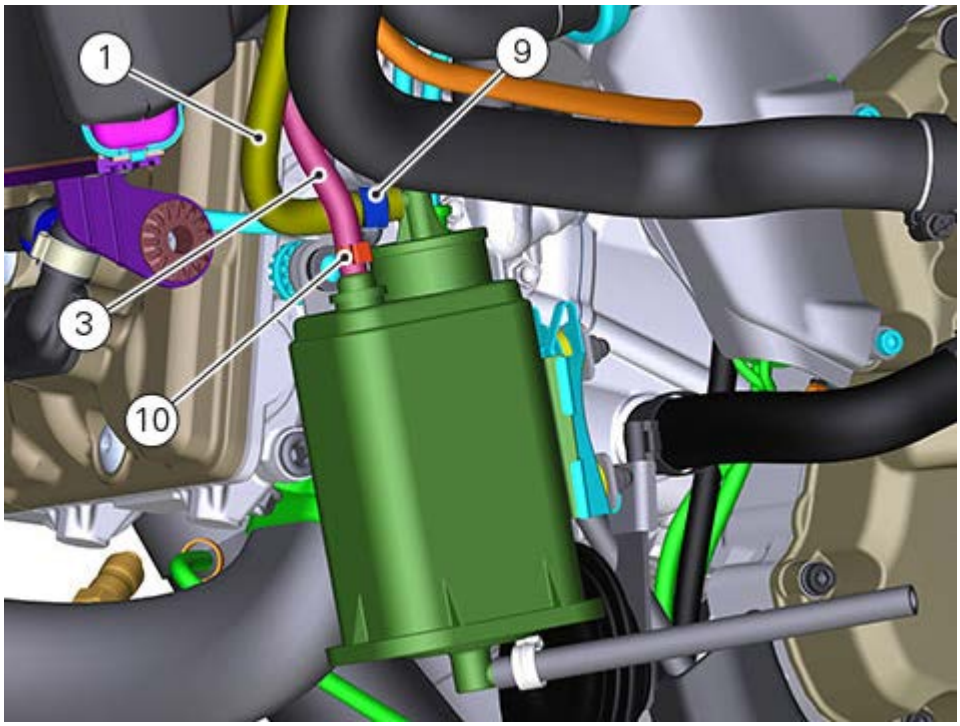
Fit hoses (3A) and (3B) onto intake manifolds (3) and (4) and secure them with clamps (12).



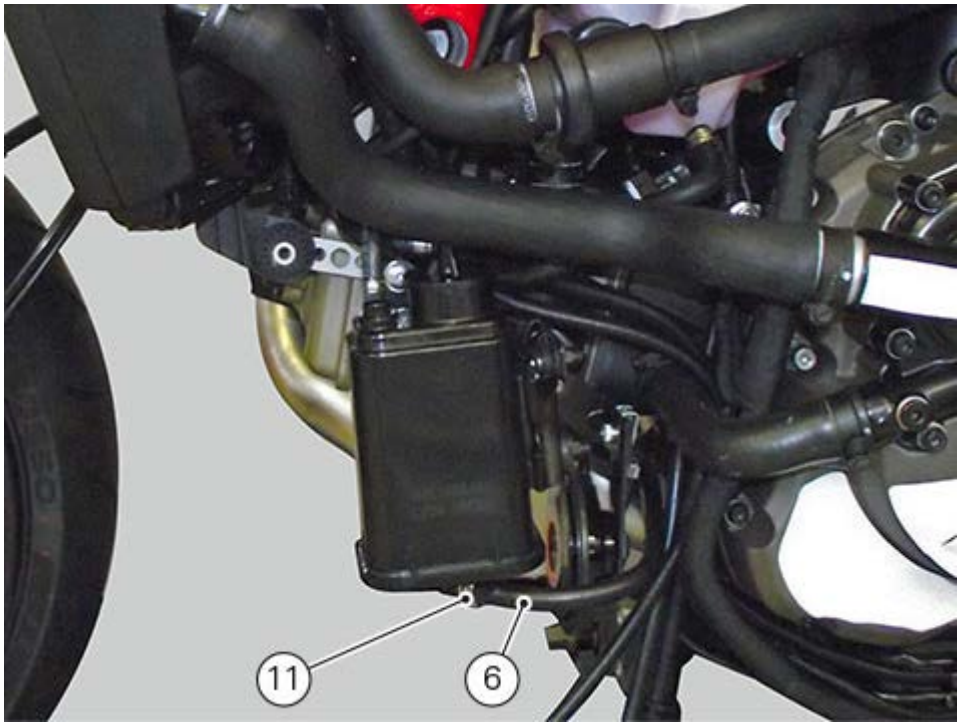
Fit canister filter (2) from the top. It must be fitted into plate (B) guides (A).



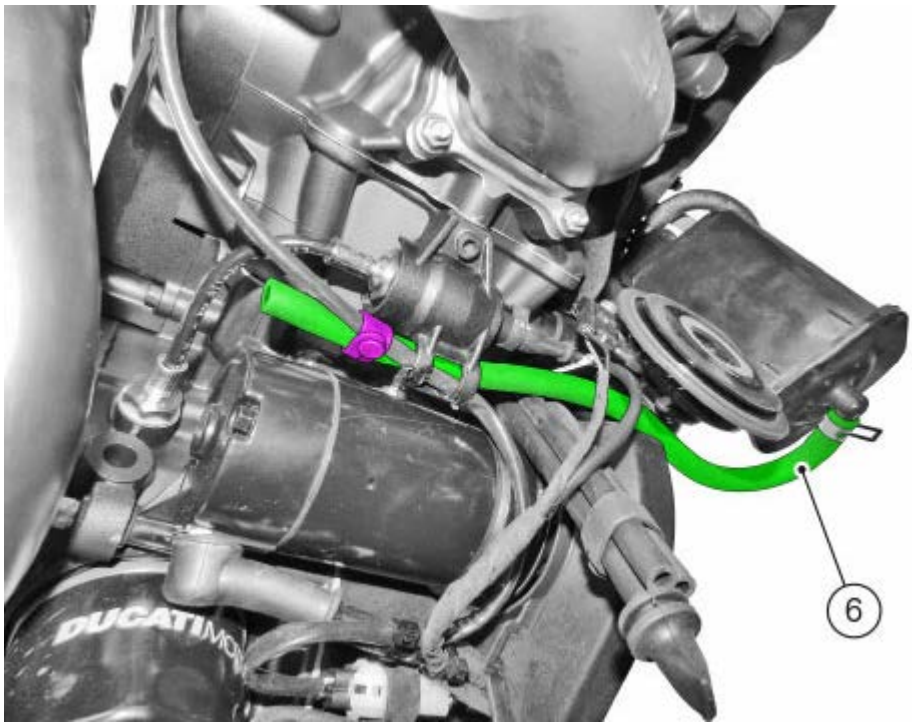
Connect hose (3) to the canister filter by tightening it with clamp (10).
Connect hose (1) by tightening it with clamp (9).



Connect hose (6) to the canister filter by tightening it with clamp (11).



Check the pipe correct position as shown in the figure.

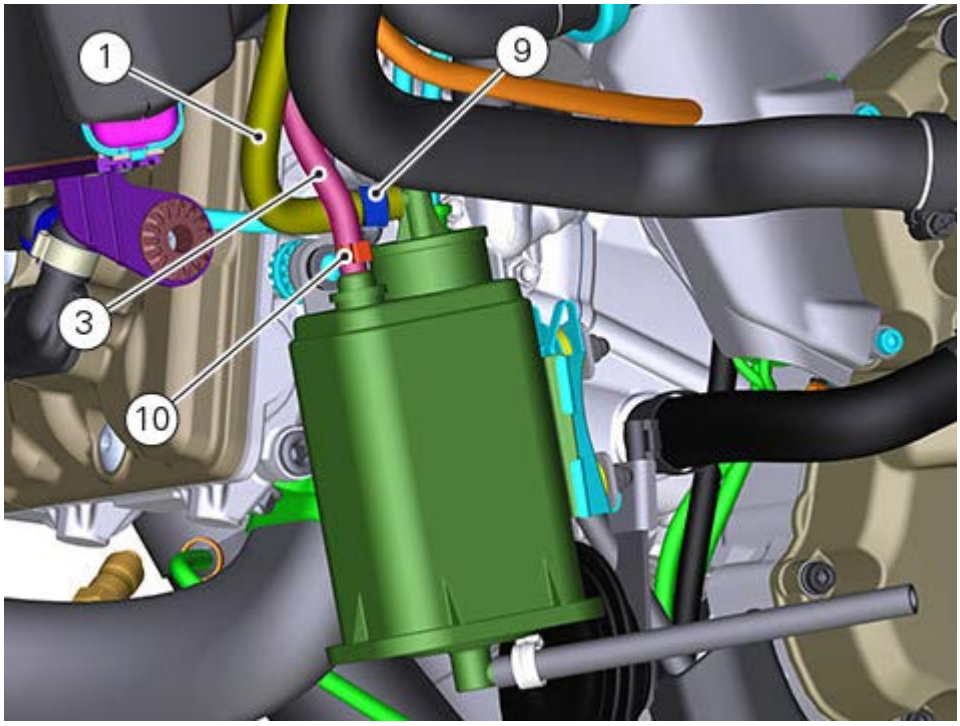


Refit the water tank (Refitting the water tank).

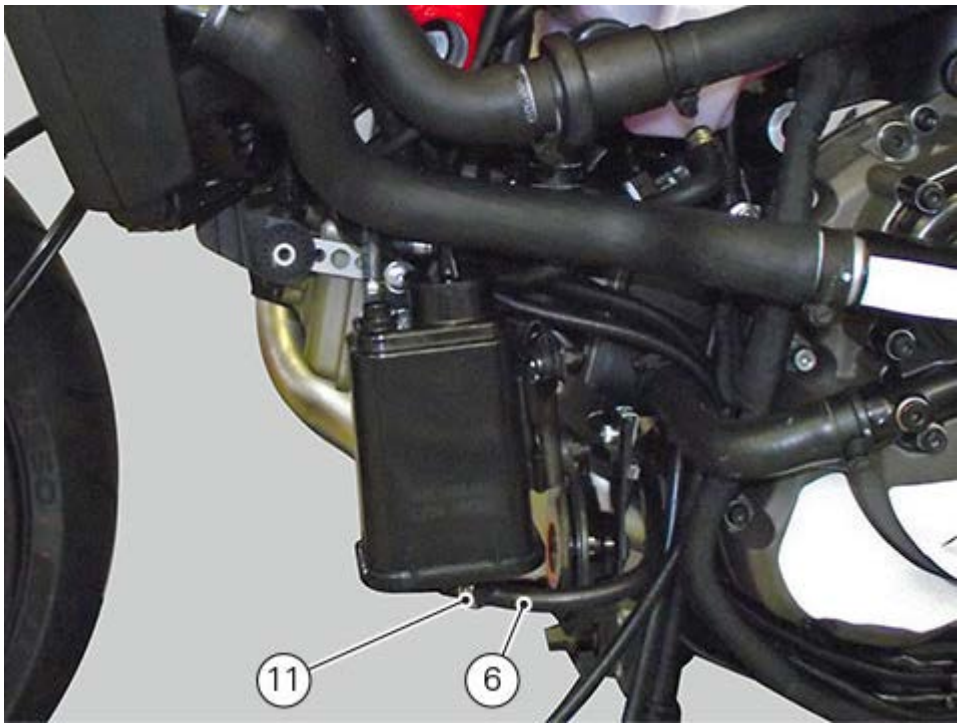
Removing the canister filter

Remove the RH side cover (Removing the water tank).

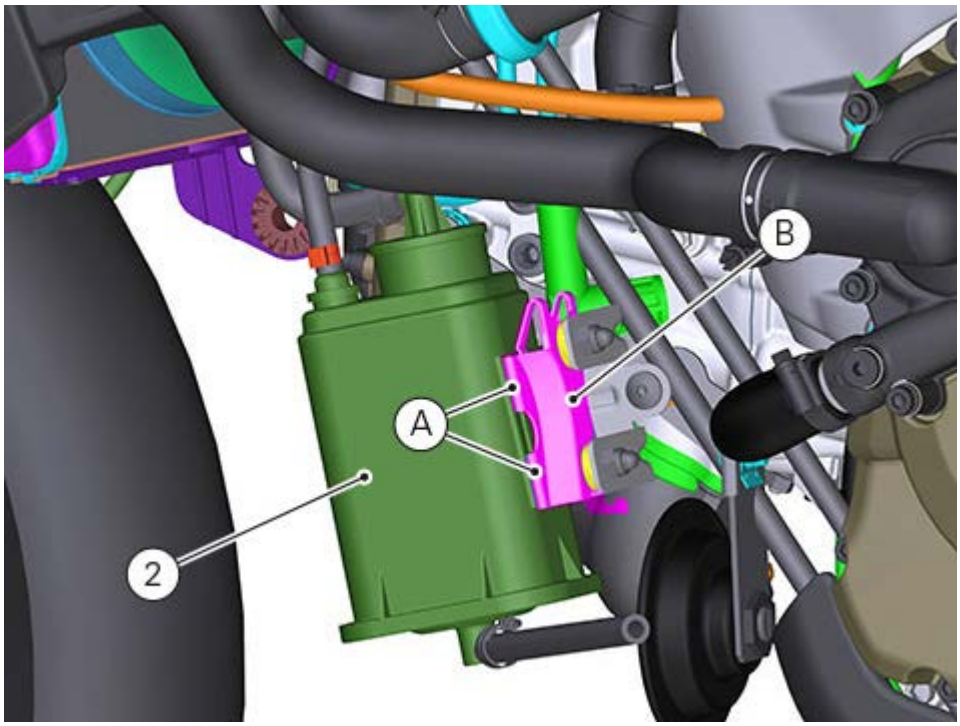
Disconnect the hose (1), removing the clip (9).
Disconnect the hose (3), removing the clip (10).



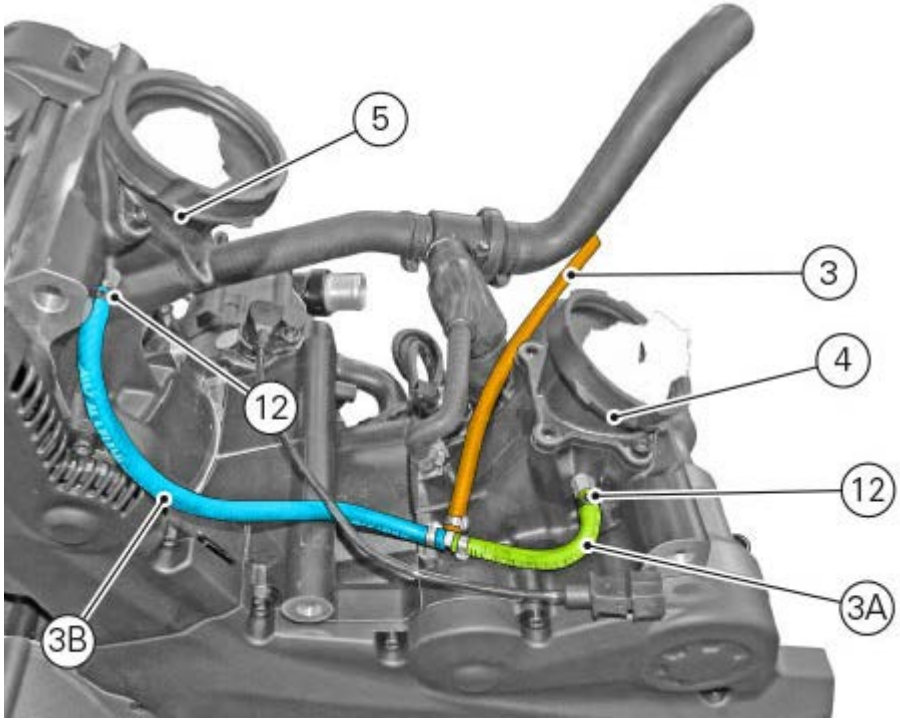
Disconnect the hose (6), removing the clip (11).

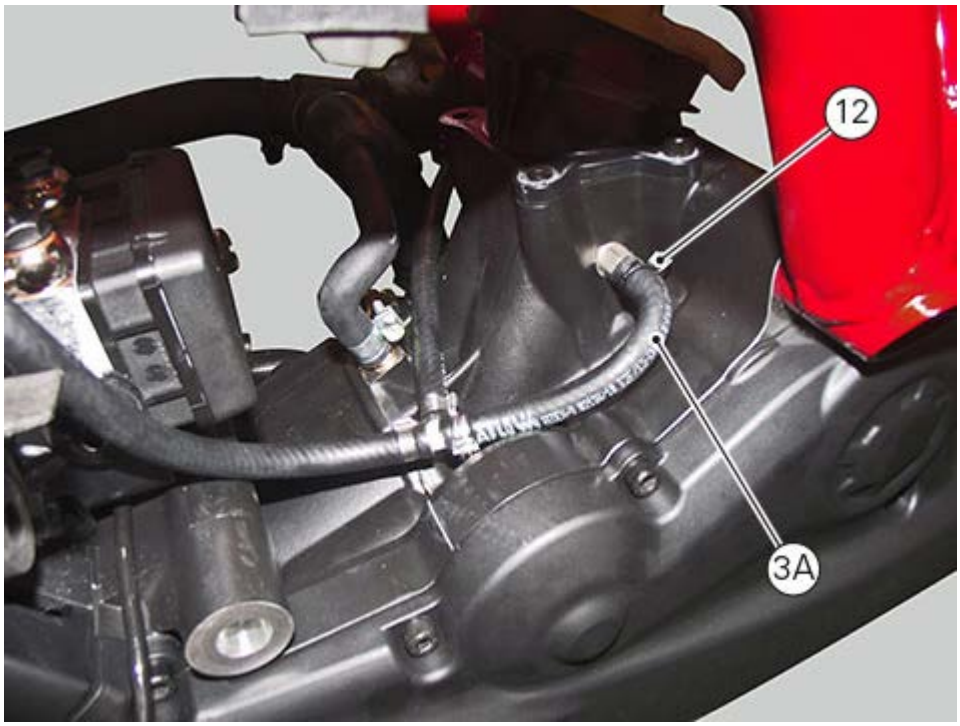


Remove canister filter (2) by sliding it upwards on the plate (B) guides (A).



To remove hoses (3A) and (3B) that convey vapours to the intake manifolds (4) and (5), remove the clamps (12), and slide out the hoses (3A) and (3B) from the intake manifolds.

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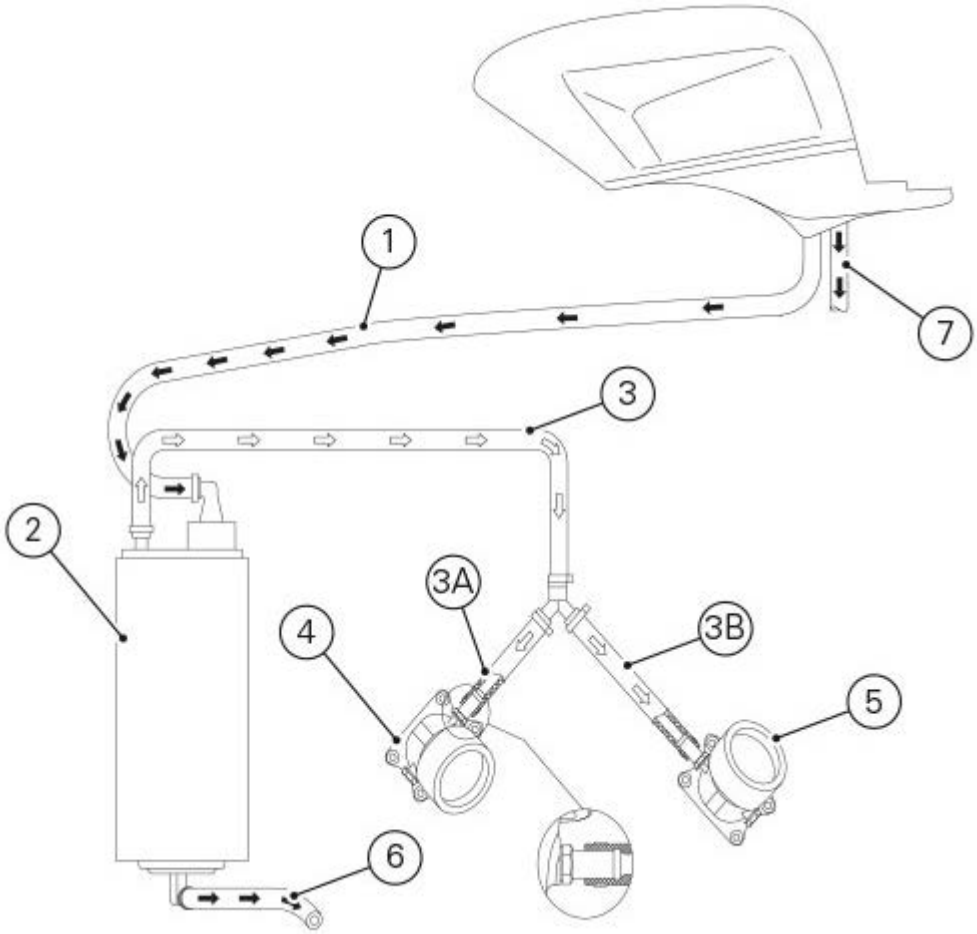
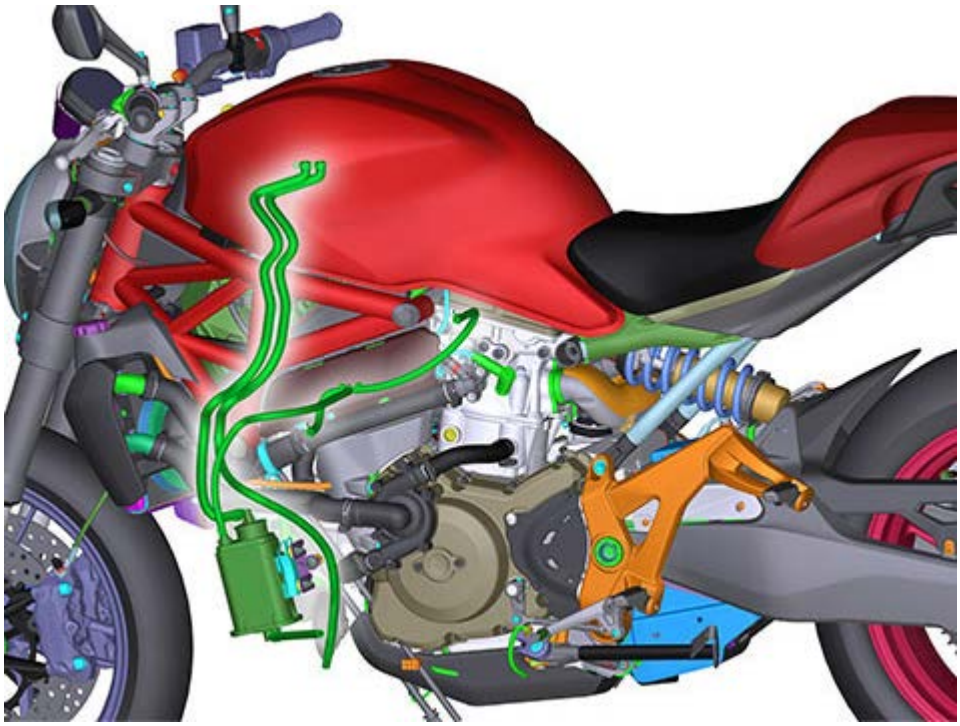
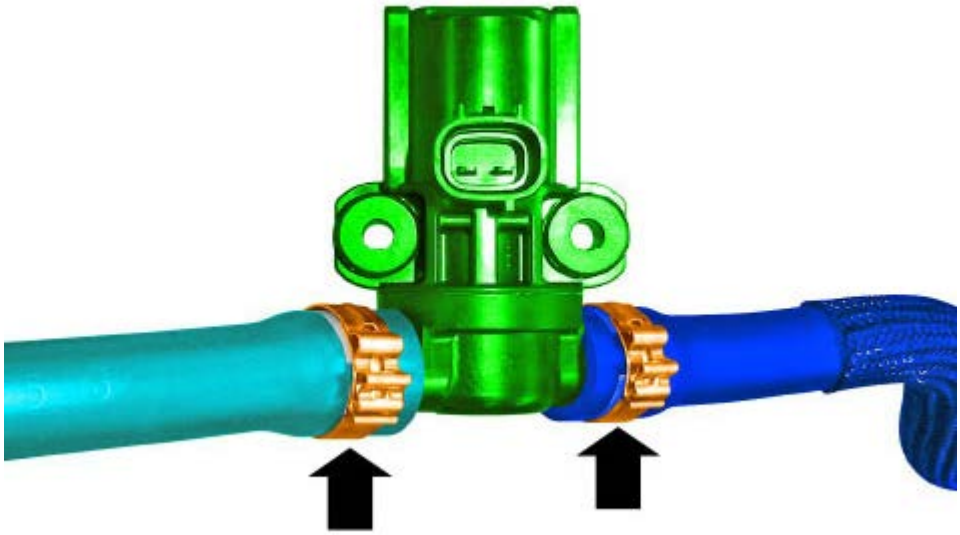
Canister filter system

The US and Canada versions are equipped with a supplementary recirculation system for the vapour released by the fuel tank.
The Canister filter prevents the direct release of such vapour into the atmosphere.
The breather pipe (1) coming from the tank is connected to the Canister filter (2) and the vapours, once filtered, are conveyed to intake manifolds (4) and (5) through pipe (3).
The canister breathing occurs through pipe (6).
The tank (7) drain pipe discharges on the ground as in the other versions.





Check the pipe clamp tightening.

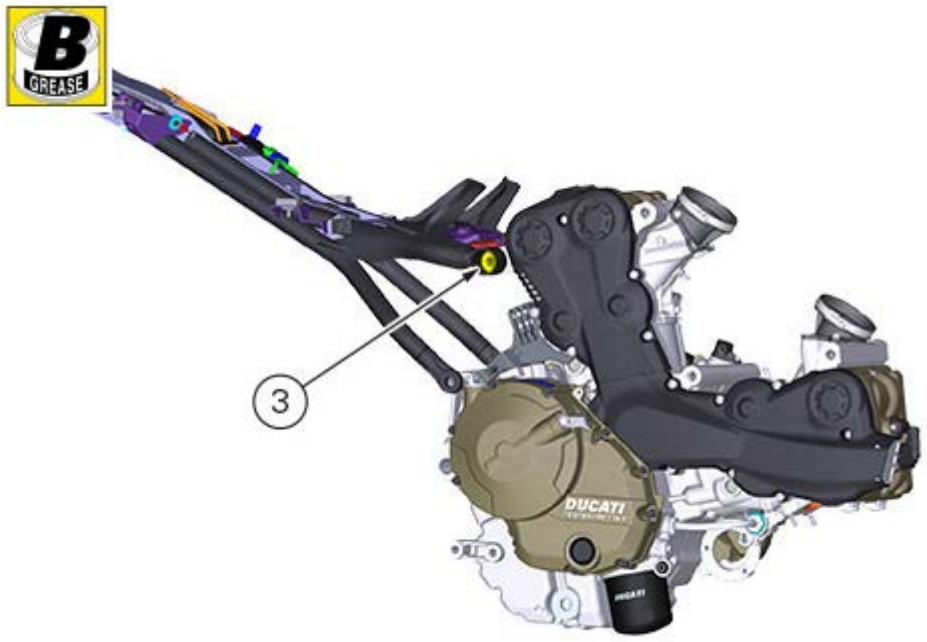


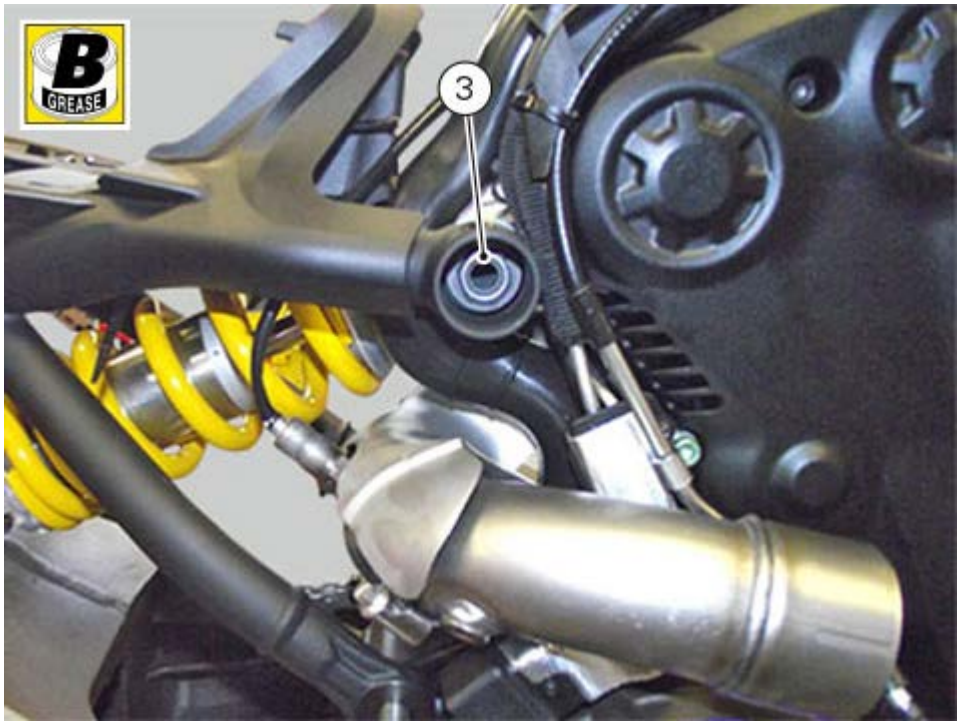
Refitting the engine

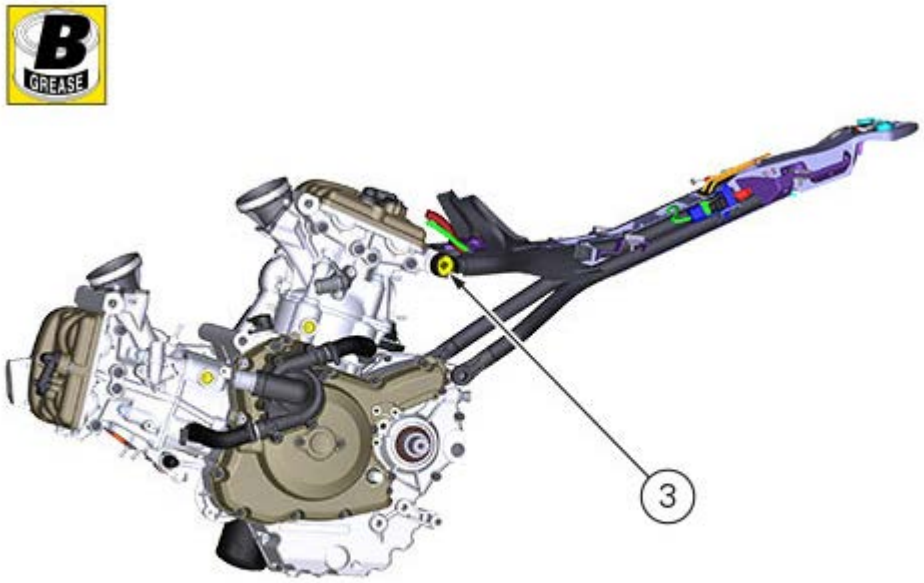
Position engine on support part no. **88713.3396**.
Refitting is the reverse of removal (Removing the engine).

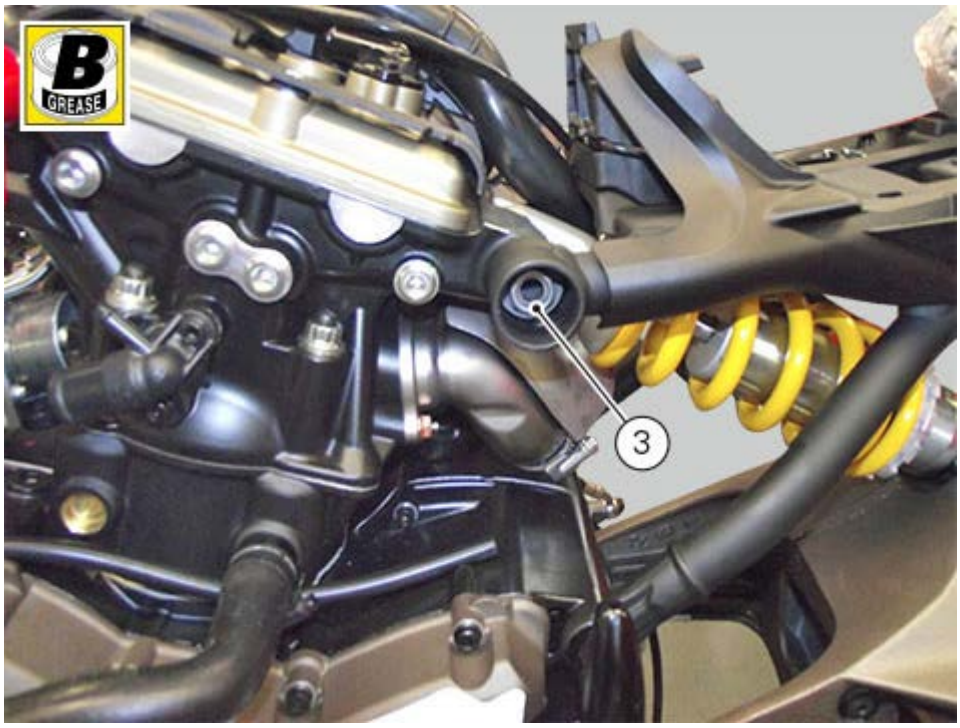
For hoses and wiring harnesses routing, refer to paragraphs "Routing wiring harnesses/hoses" and "Routing of wiring on frame".
Refit the removed parts by performing the steps shown in the specific sections of the manual in reverse order.

Refit the rear shock absorber (Refitting the rear suspension).
Place the rear subframe (Refitting the rear subframe) and start the two special screws (3) after applying the specified product.



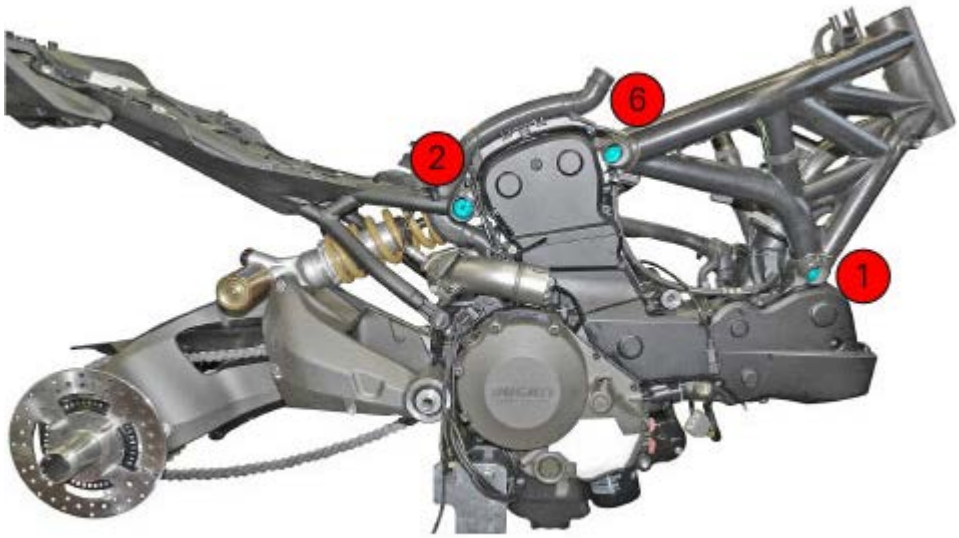


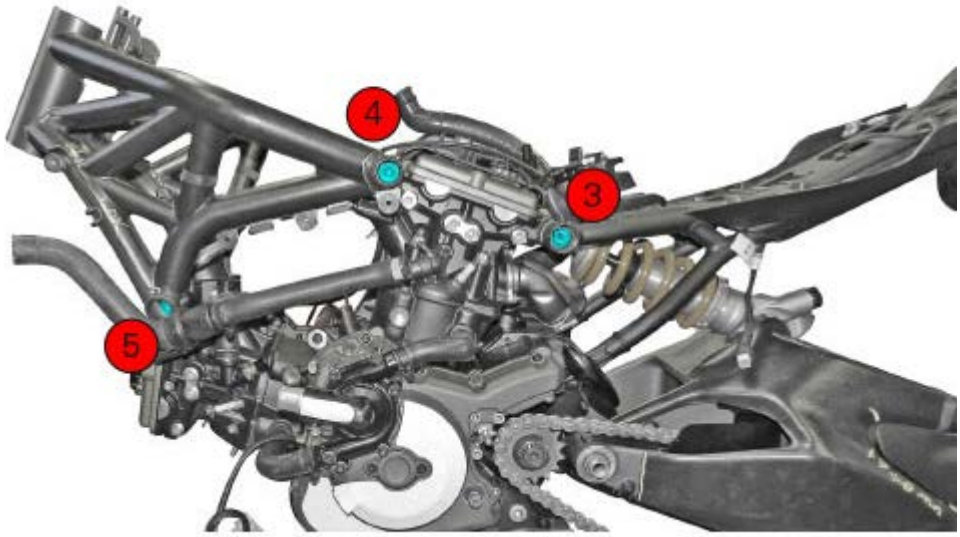




Note

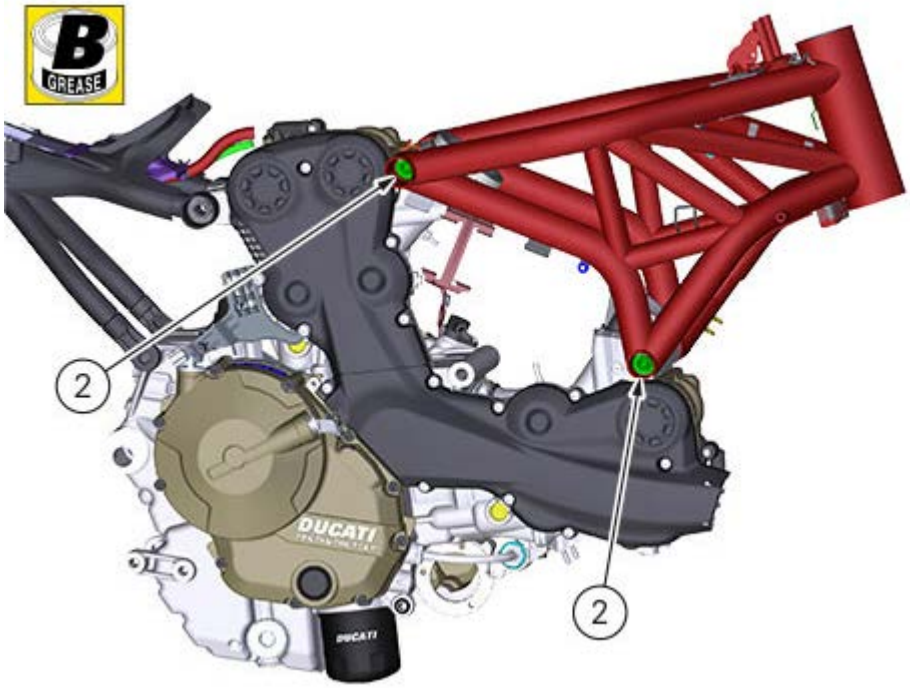
To refit frame and subframe, before tightening, do screws fully home finger tight and then loosen them by one full turn (approx. 360°).





Tighten the screws (3) to a torque of 150 Nm ± 5% following the indicated sequence.

Position frame, complete with front end, on engine; duly support it after applying the specified threadlocker on screw (2) threads and underheads, and start them on the relevant nuts (1). Complete the tightening procedure of screws (2) with the relevant nuts (1) to a torque of 90 Nm ± 5% by following the indicated sequence.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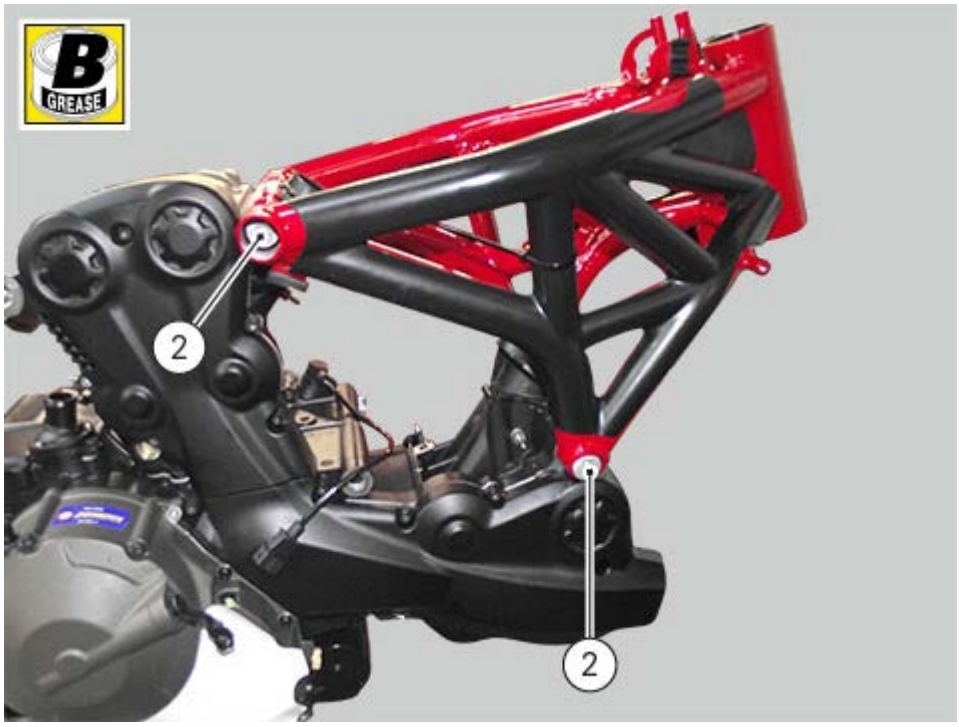
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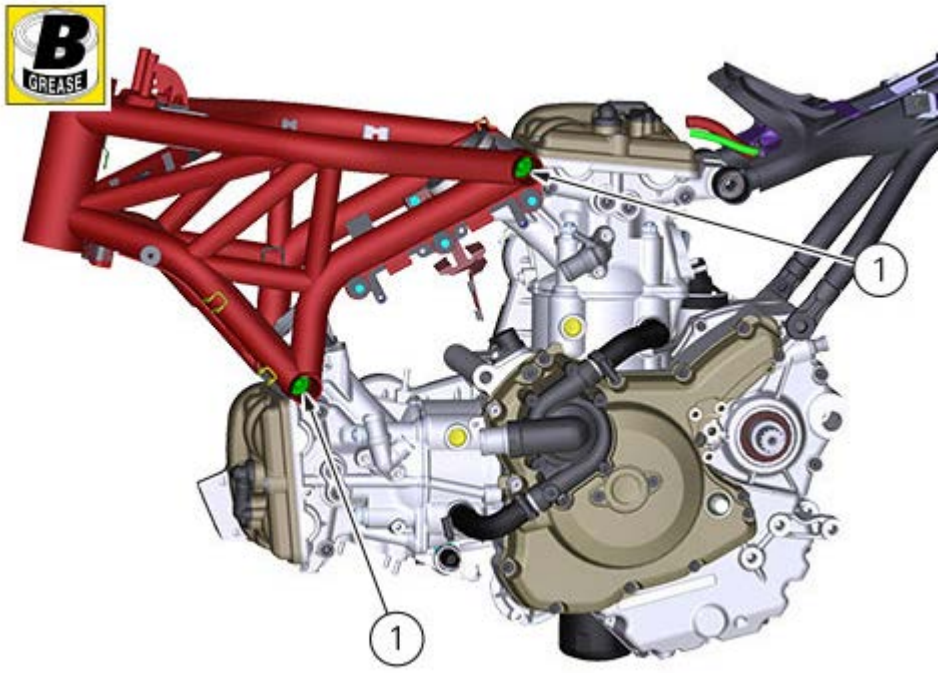
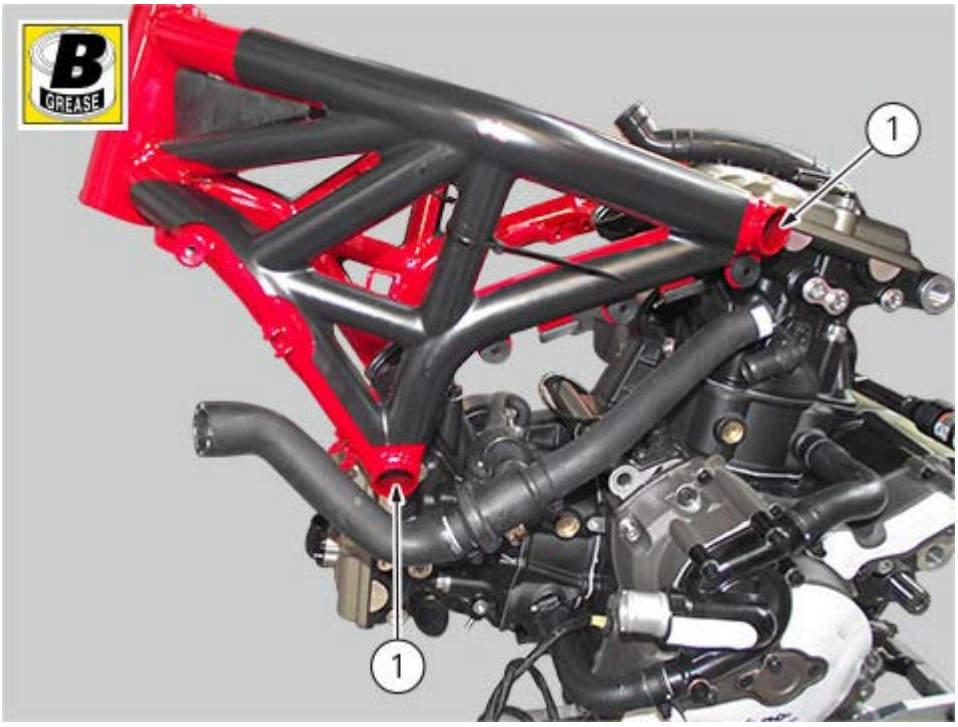




Fit protection plugs on frame (Refitting structural components and frame).
Connect the wiring connectors on the engine block (Routing of wiring on frame).
Refit the front sprocket (Refitting the front sprocket).
Refit the rear swinging arm (Refitting the rear swinging arm) complete with rear wheel and refit the braking system (Refitting the rear brake calliper).
Refit hoses (Routing wiring harnesses/hoses) and rear ABS braking system (Adjusting the phonic wheel sensor AIR-GAP).
Connect the starter motor/solenoid starter cable (Refitting the starter motor).
Refit the clutch cable lever on clutch cover (Refitting the clutch cover), by correctly repositioning wirings and hoses (Routing of wiring on frame).
Fit the electrical components compartment on engine (Refitting the electrical component compartment) and reconnect wiring connectors (Routing of wiring on frame).
Refit lower wiring cover, on the left side (Routing of wiring on frame).
Refit the complete exhaust system (Refitting the exhaust system, Refitting silencer).
Refit the side stand (Refitting the side stand).
Refit the footrest holder plates (Refitting the footrest holder plate), complete with rear brake assembly and gearchange lever assembly.
Reconnect coil and spark plug cables (Routing of wiring on frame).
Refit the secondary air system pipes and valve (Refitting the secondary air system).

Refit the water tank (Refitting the water tank).
Refit the complete water radiator on engine front side (Refitting the water radiator).
Refit the cooling system hoses and unions on the engine block (Refitting the cooling system hoses and unions).
Connect the throttle control cable (Refitting the throttle control).
Connect injector connectors to intake manifolds, and refit the supply system, the oil breather pipe, then refit the blow-by, the throttle body and the complete airbox (Refitting the airbox and throttle body).
Refit the Canister filter pipes on the manifolds and restore the filter retainers on the horizontal head (USA and Canada versions only) (Refitting the canister filter).
Refit the exhaust heat guard on the right side (Refitting the exhaust system, Refitting the silencer).
Refit the water tank cover, the front sprocket cover, the coil cover on frame left side, the left wiring cover (Closing the crankcase).
Refit the fuel tank (Refitting the fuel tank).
Refit the seat (Refitting the seat).
Restore fluid levels:
— fill the cooling system up to the requested level (Checking coolant level), with recommended fluid;
— fill the lubrication system (Changing the engine oil and filter cartridge);
— check rear brake system fluid level and top up, if necessary (Changing the rear brake system fluid).
Carry out standard checks and settings:
— adjust chain tension (Adjusting the chain tension);
— adjust the phonic wheel sensor AIR-GAP (Adjusting the phonic wheel sensor AIR-GAP);
— adjust the steering angle (Steering angle adjustment).

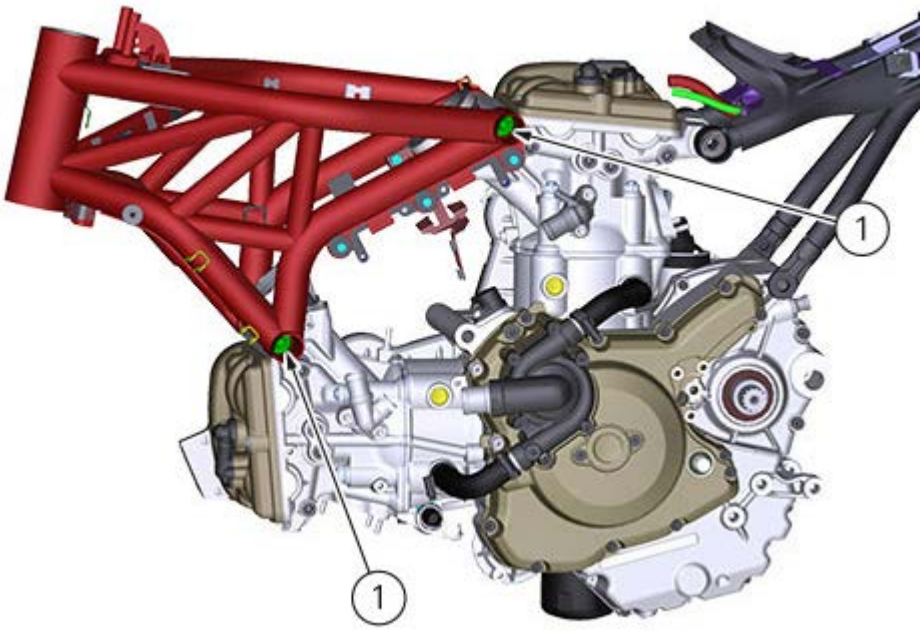
Removing the engine

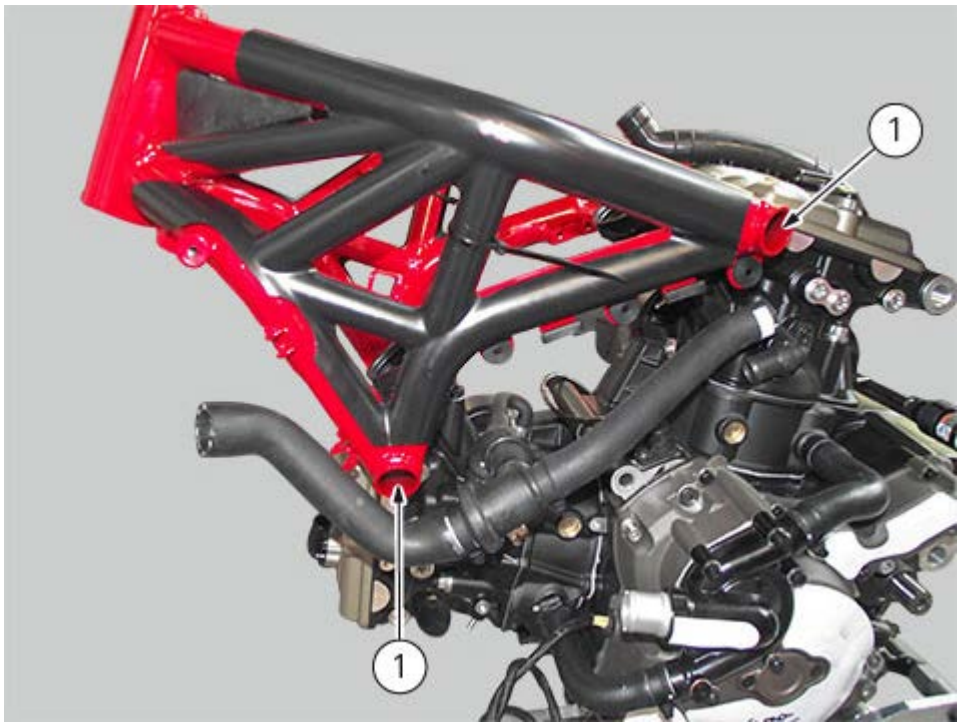
In order to remove engine you must first remove a series of other components from the motorcycle.
The removal procedures are described in the relative sections of this manual.
The list below indicates the components to be removed in a logical order.
This section describes only the operations to be carried out after having removed all the parts indicated in the list.

Vice front wheel and duly support vehicle front end.
Lock vehicle rear end.

Remove the seat (Removing the seat).
Remove the fuel tank (Removing the fuel tank).
Remove the airbox, the throttle body, the blow by and the oil breather pipe (Removing the airbox and throttle body).
Remove left wiring covers (Routing of wiring on frame).
Remove coil cover on frame left side (Routing of wiring on frame).
Remove the front sprocket cover (Removing the front sprocket).
Remove the coolant reservoir right side cover (Changing coolant).
Remove the exhaust heat guard, on the right side (Removing the exhaust system).
Remove the throttle control cable (Removing the throttle control).
Drain the coolant (Changing the coolant).
Remove the secondary air system pipes and valve (Removing the secondary air system).
Disconnect coil and spark plug cables (Routing of wiring on frame).
Refit the Canister filter pipes on the manifolds and restore the filter retainers on the horizontal head (USA and Canada versions only) (Removing the canister filter).
Remove the footrest holder plates, complete with rear brake assembly and gearchange lever assembly (Removing the footrest holder plate).
Remove the side stand (Removing the side stand).
Remove the complete exhaust system (Removing the exhaust system).
Disconnect electrical component connectors from engine and release the electrical components compartment (Removing the electrical components compartment).
Release engine from ABS pipes on vertical head (Routing wiring harnesses / hoses).
Remove clutch cable from clutch cover and release it from cableways on engine (Removing the clutch cover).
Disconnect the starter motor/solenoid starter cable (Removing the starter motor).
By releasing it from brake system hoses, remove swinging arm with rear wheel (Removing the swinging arm).
Disconnect the wiring connectors on the engine block (Routing of wiring on frame).
Slide out frame protection plugs (Removing structural components and frame).
Install support part no. **88713.3396** under engine to support it while removing the complete frame (Removing structural components and frame) and subframe (Removing the rear subframe).

Loosen nuts (1) on the frame LH side, on frame right side screws (2).

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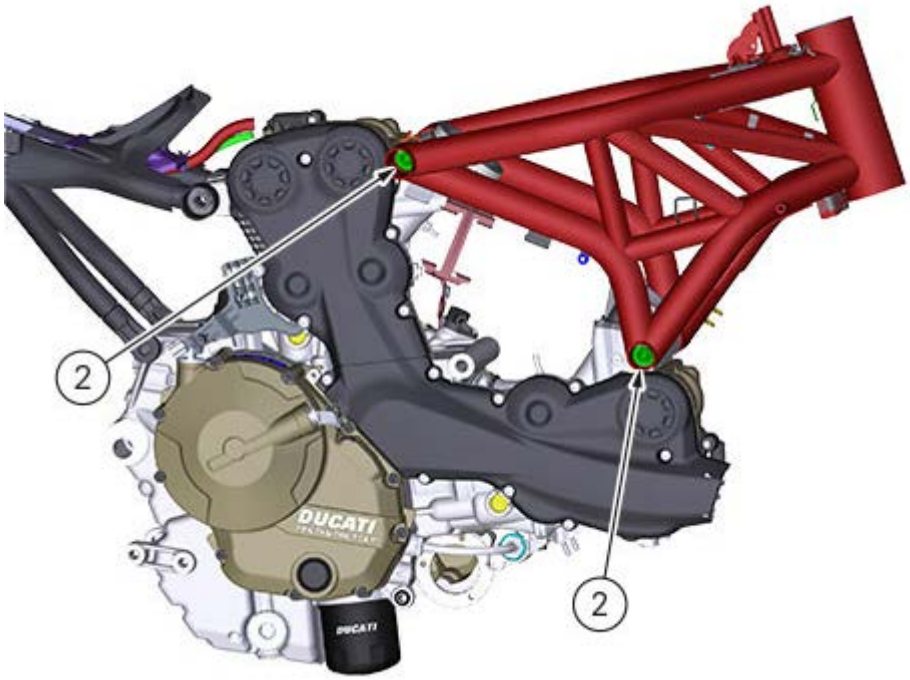
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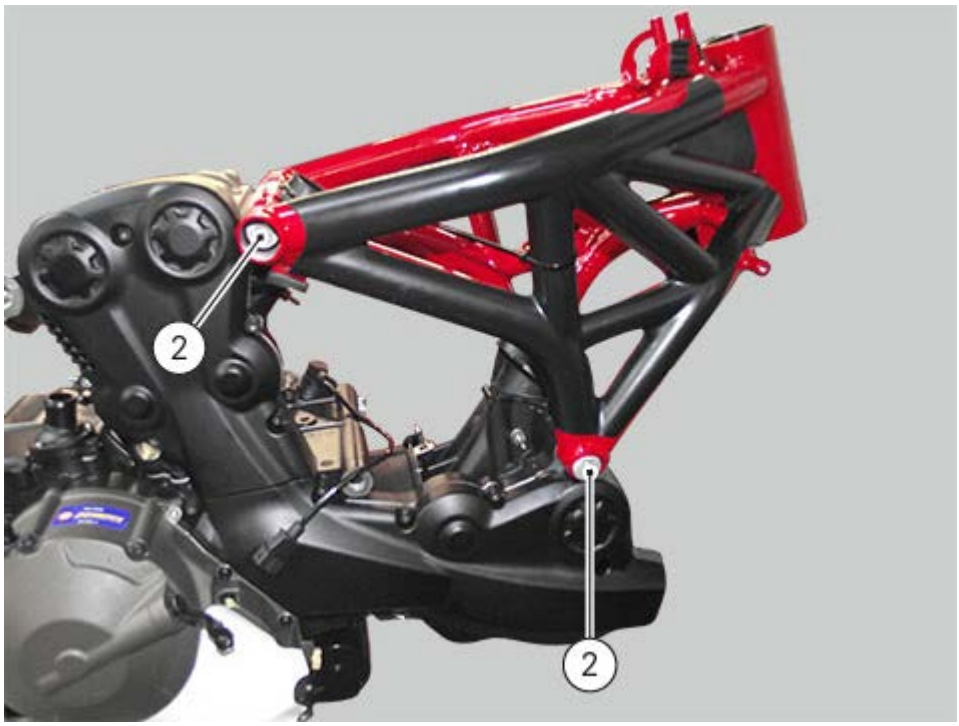
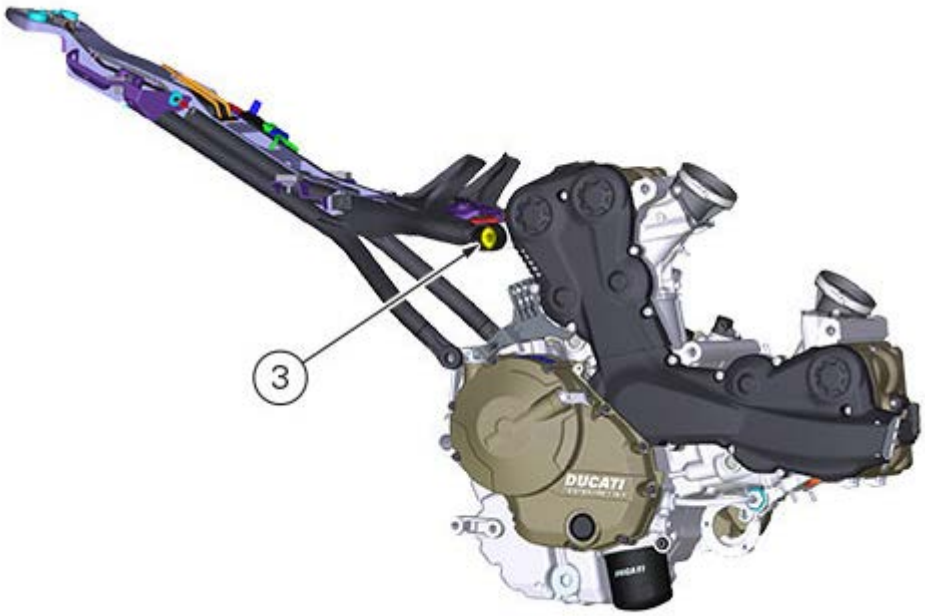
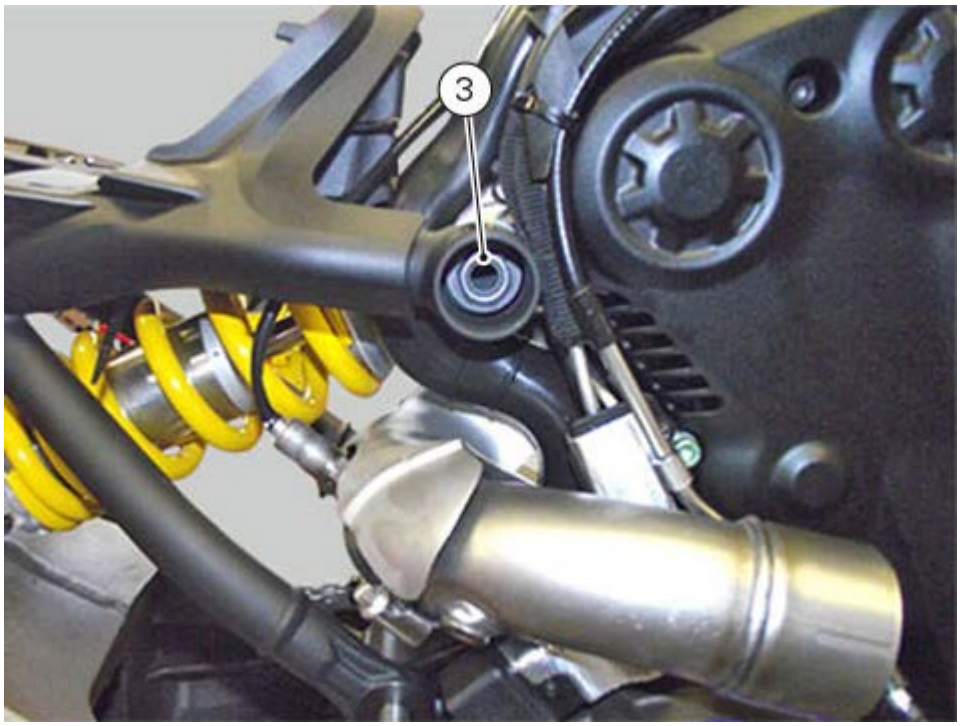
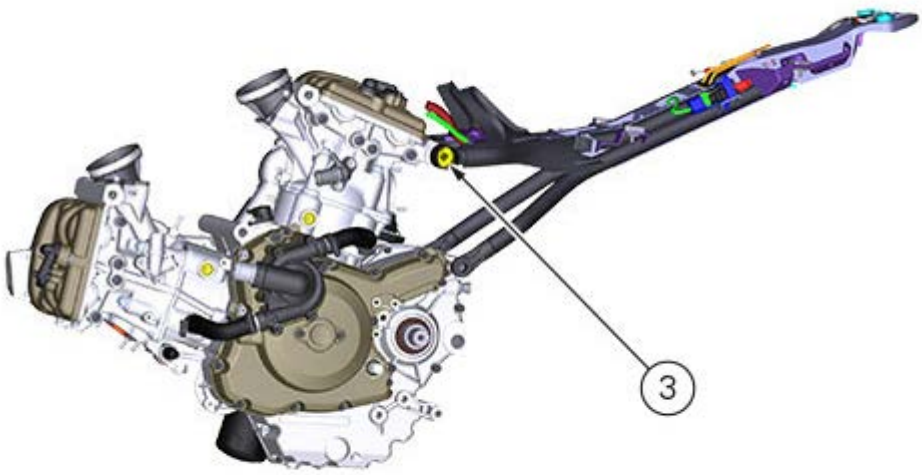


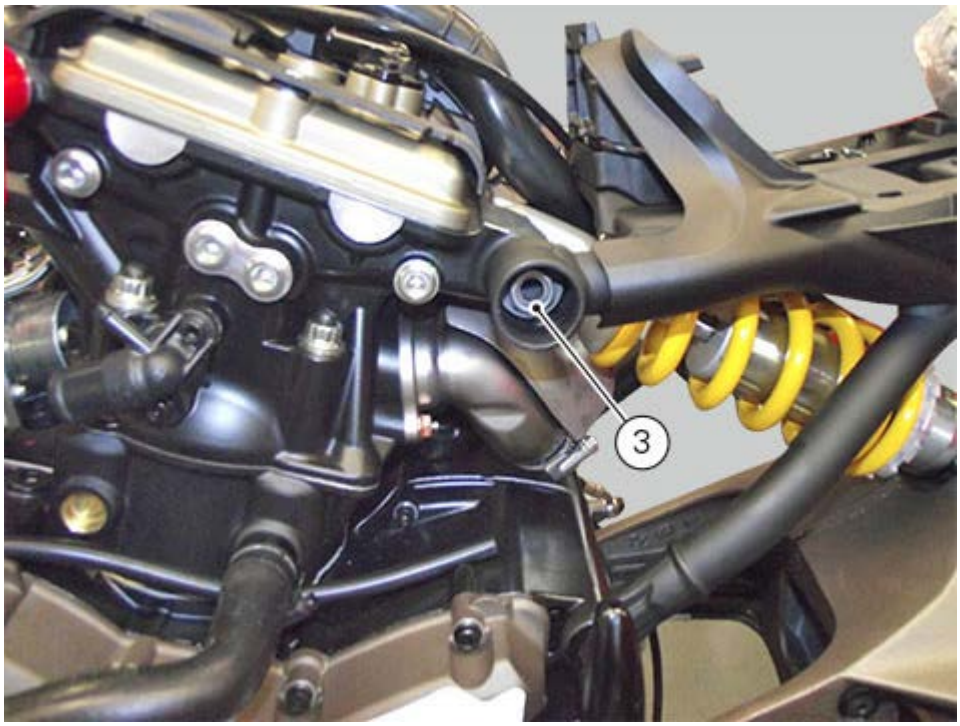
Loosen the two special screws (3) securing subframe upper side to engine, and slide out the complete rear subframe and the rear shock absorber.

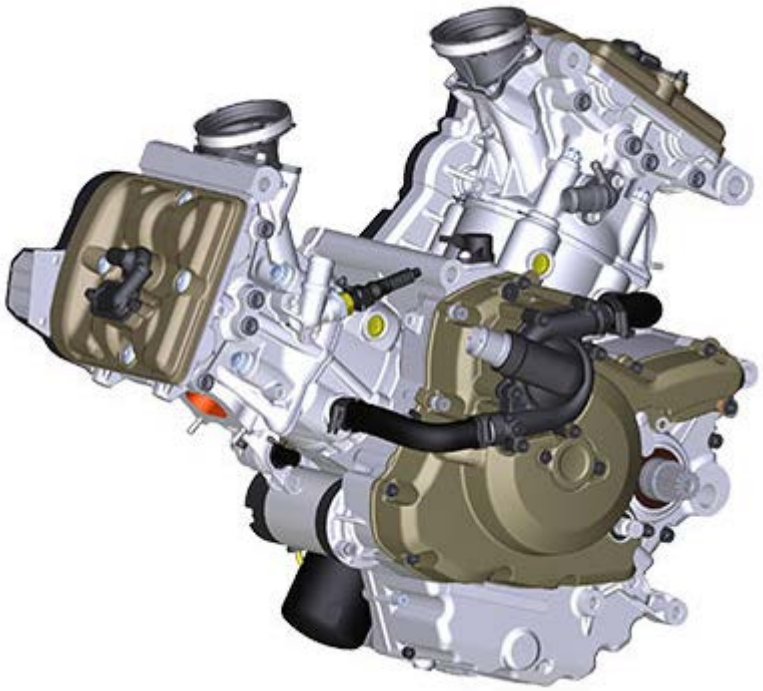




Release engine.

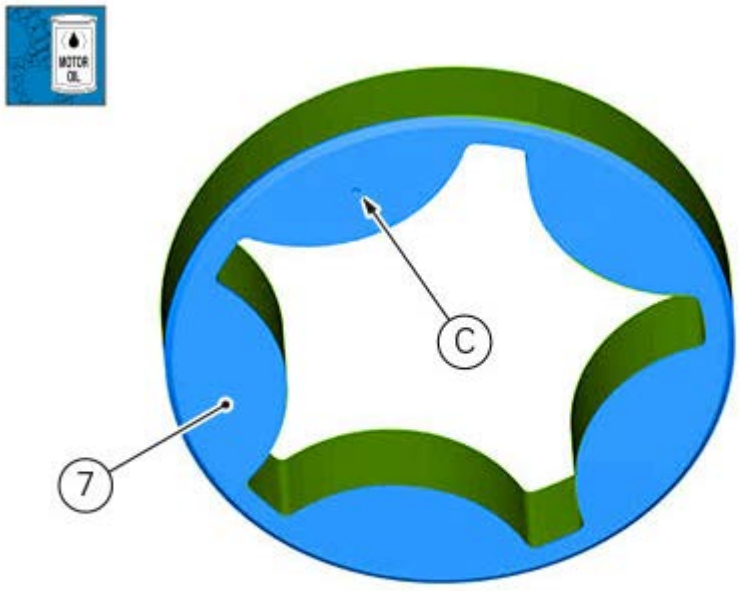


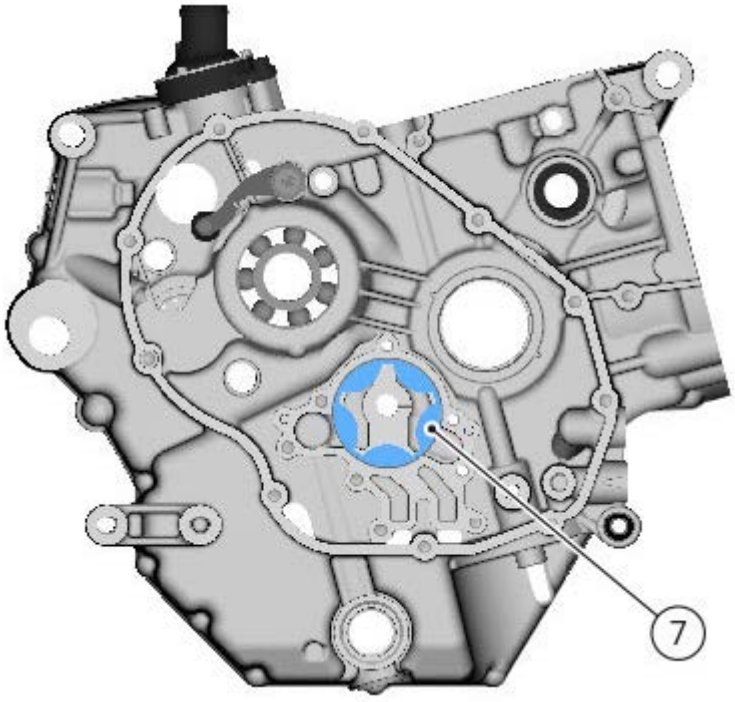




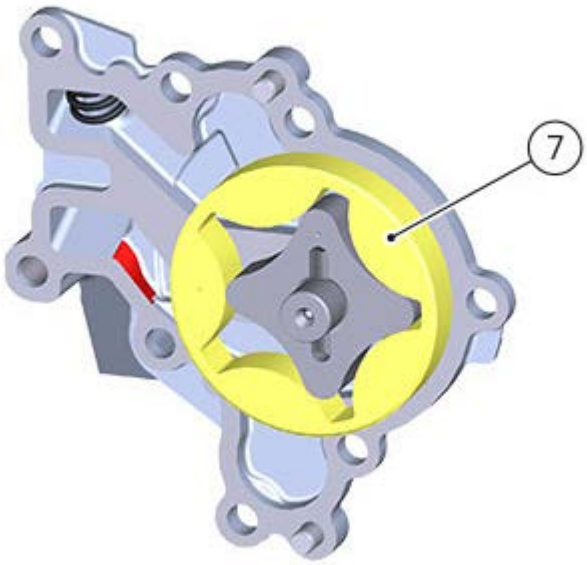
Refitting the oil pump

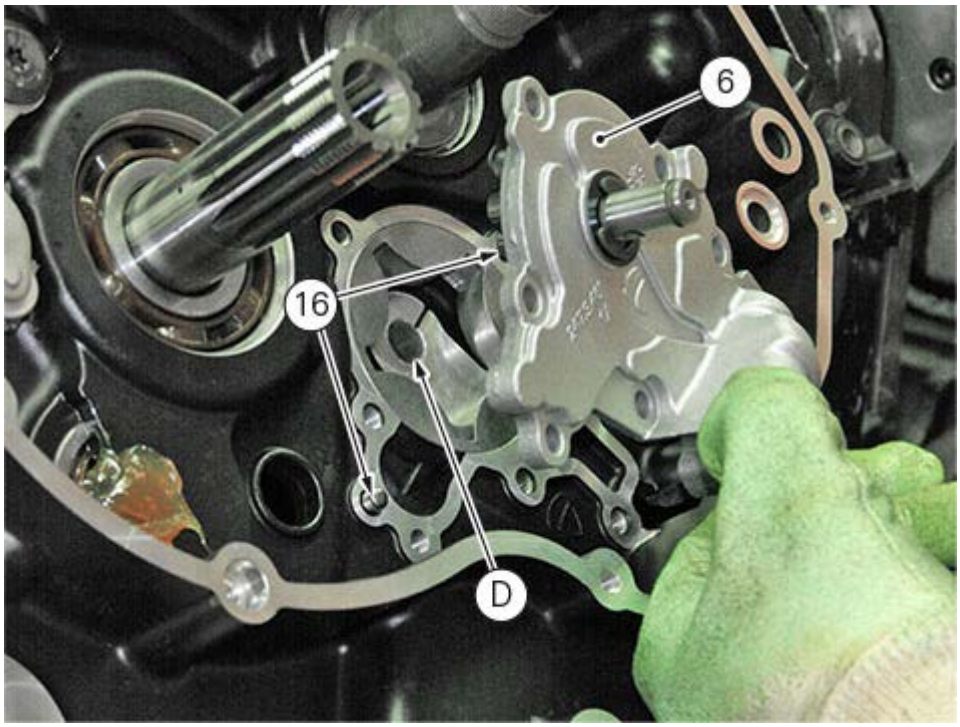
After having lubricated it with the indicated product on the mating surface between crankcase and inner rotor lobe, fit oil pump outer rotor lobe (7) on crankcase, hiding reference (C).



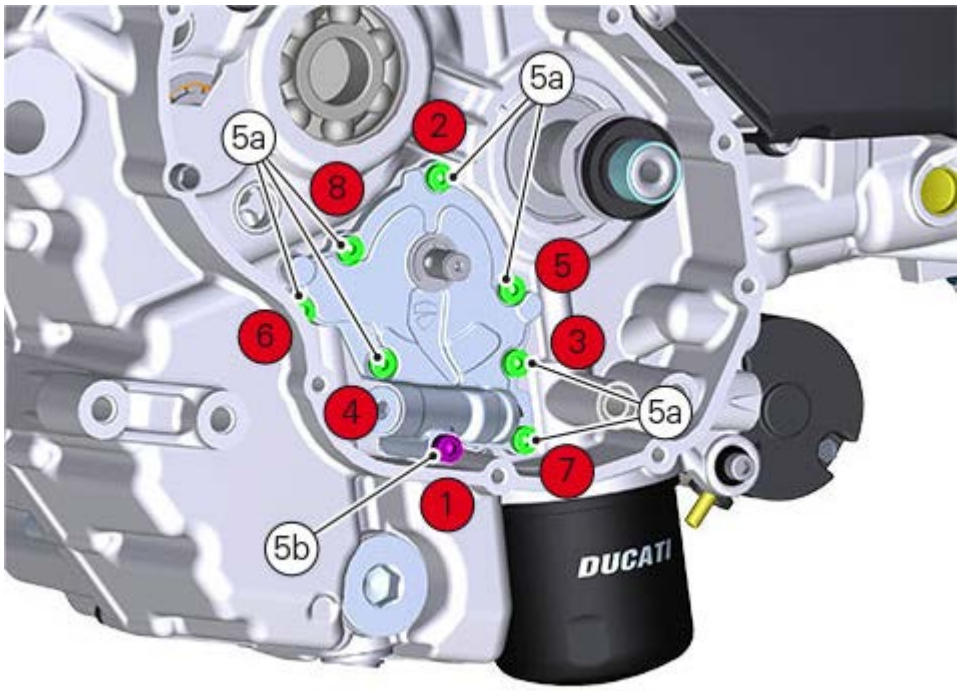


Check that the two reference pins (16) are present on crankcase.
Lubricate inner rotor lobe (14) with the indicated product.
Fit the assembled oil pump cover assembly (6) (Reassembling the oil pump) and centre it following the mandatory positions given by:
— crankshaft seat (D) on crankcase;
— inner rotor lobe with outer rotor lobe;
— reference pins (16).

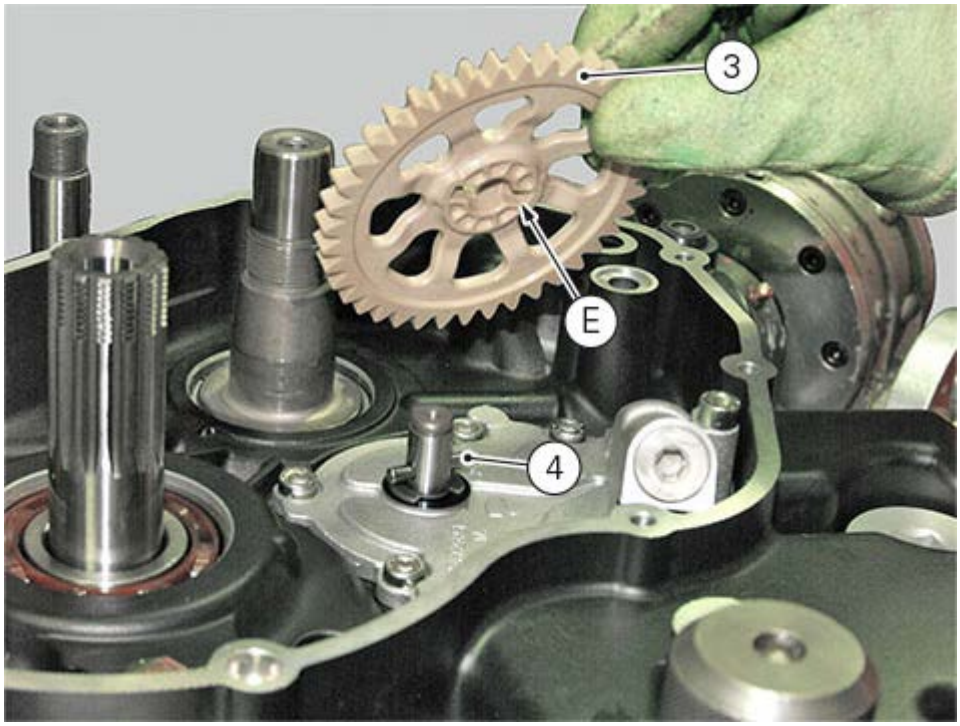




Start the screws (5a) and (5b) that retain the pump cover, and tighten them to a torque of 10 Nm (Min. 9 Nm - Max. 11 Nm).



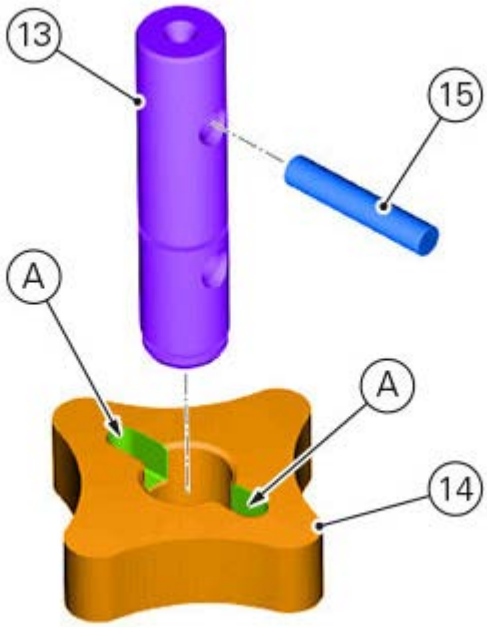
Insert rotation pin (4) inside pump shaft.
Fit gear (3) by inserting pin (4) inside its seat (E).
Fit shim (2) and snap ring (1) inside shaft.



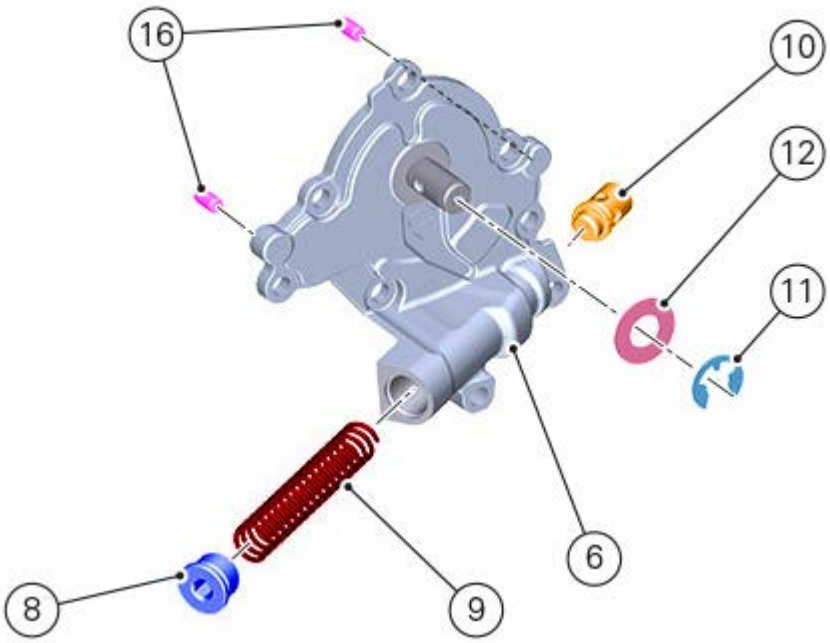
Refit the complete clutch unit (Refitting the clutch).
Refit the clutch cover (Refitting the clutch cover).
Restore lubrication system oil level (Changing the engine oil and filter cartridge).

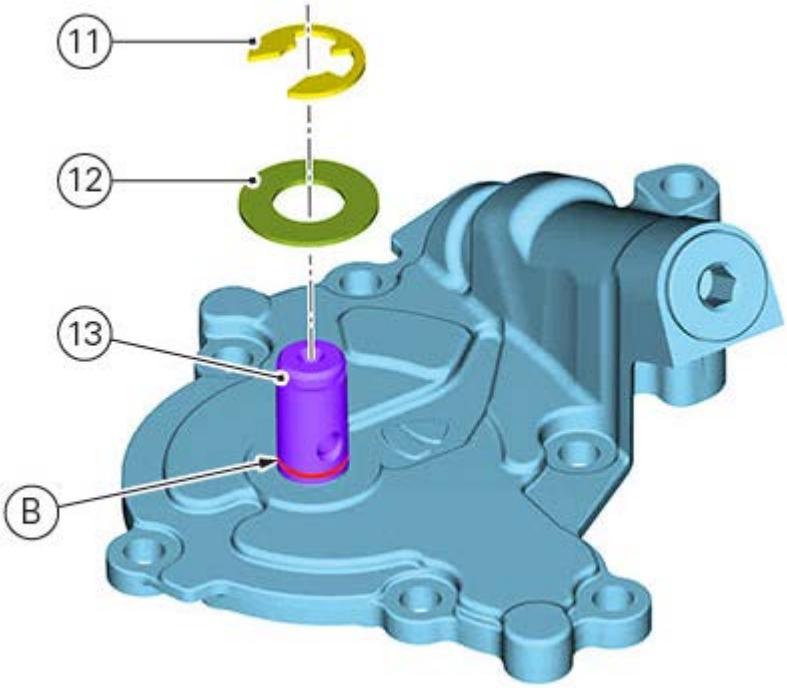
Reassembling the oil pump

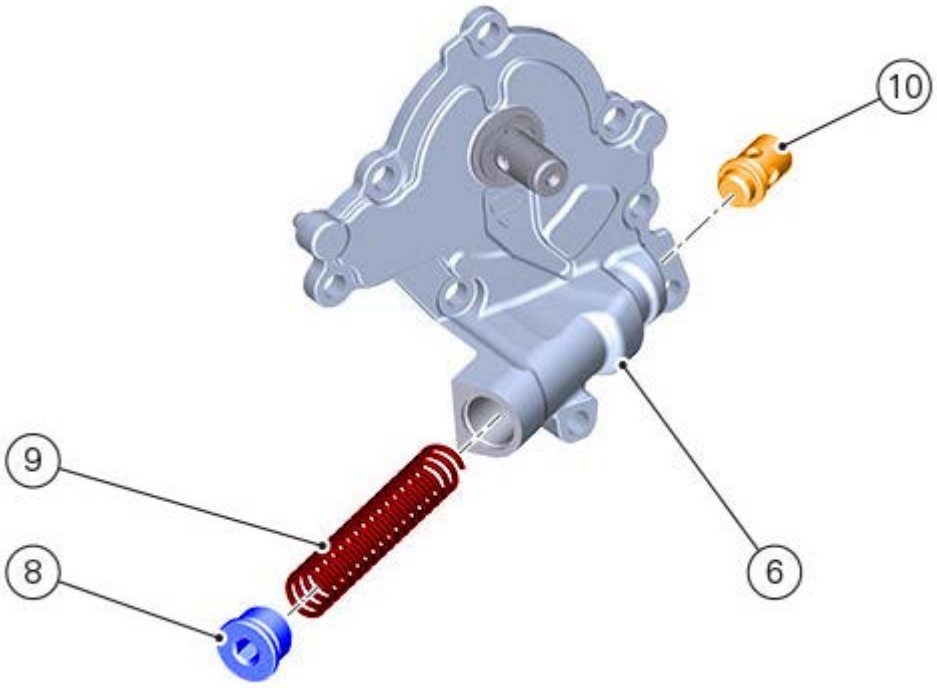
Insert pin (15) inside pump shaft (13).
Insert inner rotor lobe (14) fully home inside pin (15), then centre pin inside groove (A).



Fit pump shaft (13) working on oil pump cover (6) inner side.
Fit shim (12) and snap ring (11), inserting it inside groove (B).
If previously removed, fit by-pass valve (10), spring (9) and tighten plug (8) to a torque of 10 Nm (Min. 9 Nm – Max. 11 Nm) after having applied the specified threadlocker.





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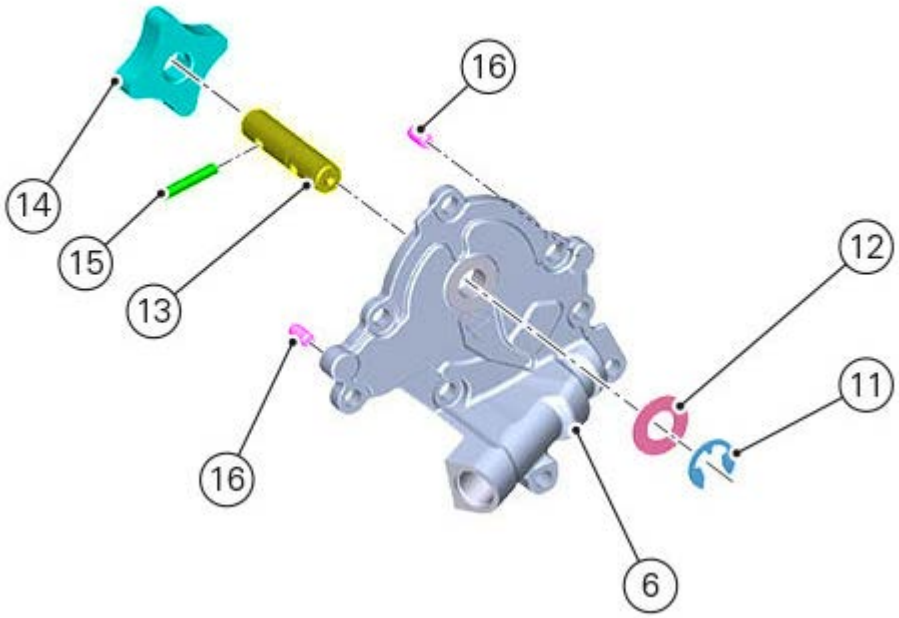
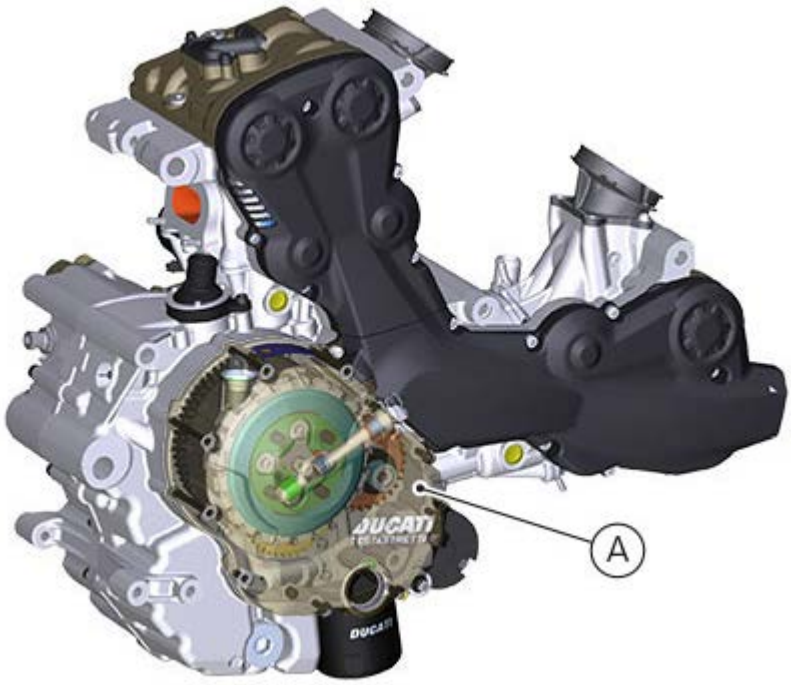
Disassembling the oil pump

Remove circlip (11) and collect shim (12).
Then, working on cover (6) inner side, slide out pump shaft (13) and, after having collected inner rotor lobe (14), slide out pin (15) as well.
Collect the two reference pins (16) present on oil pump cover (6).
Check the conditions of the removed components.



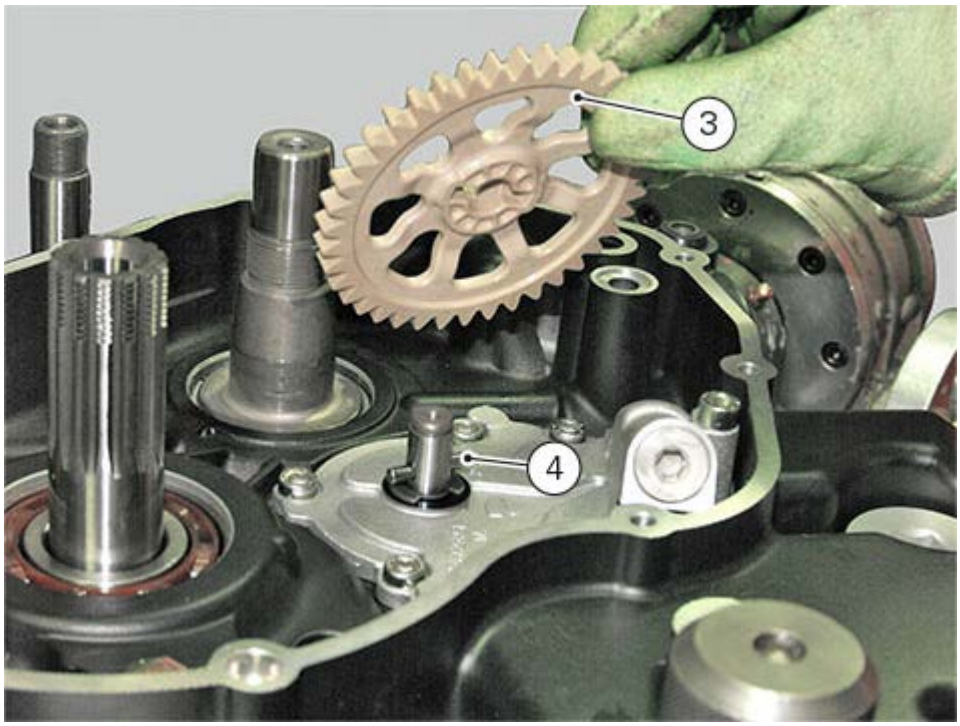
Removing the oil pump

Empty the lubrication system (Changing the engine oil and filter cartridge).
Remove the clutch cover (A) (Removing the clutch cover).
Remove the complete clutch unit (Removing the clutch)

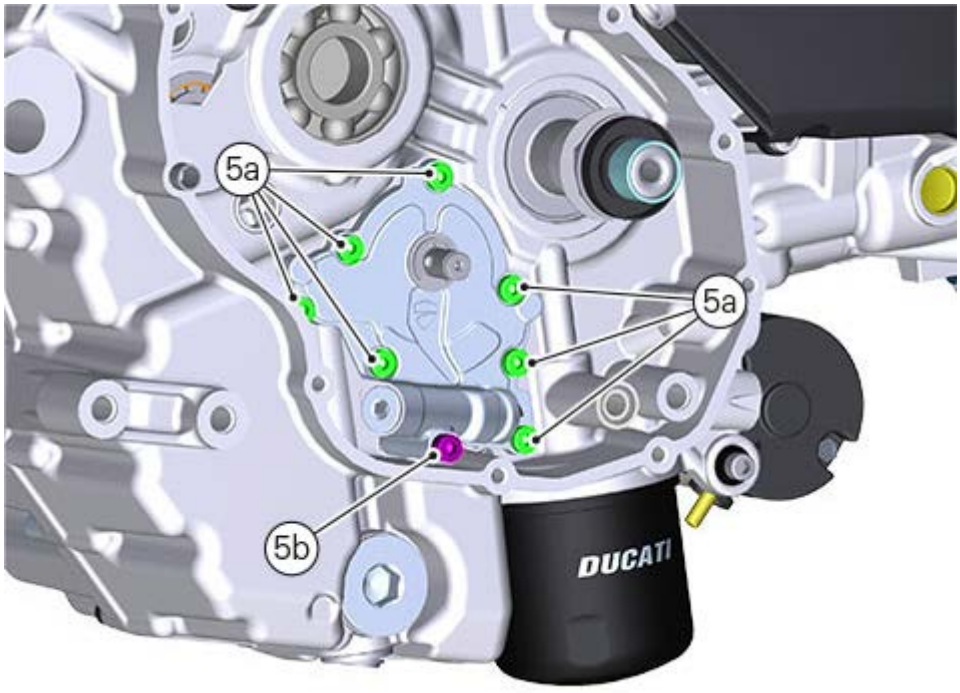


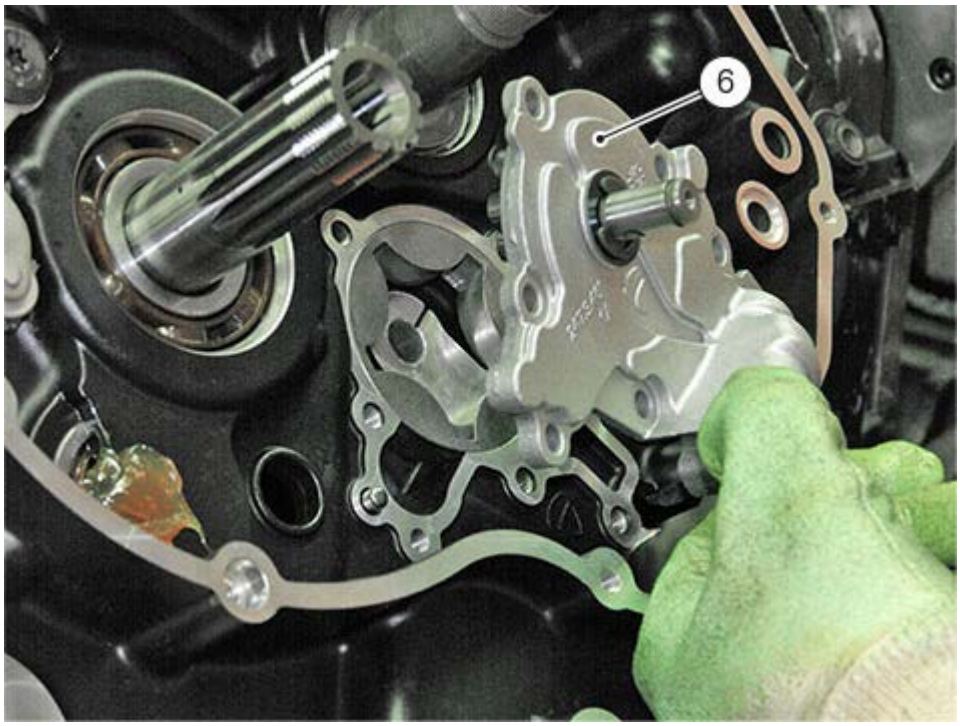
Remove the snap ring (1) and shim (2).

Slide out oil pump gear (3) and collect rotation pin (4).



Loosen the seven screws (5a) and screw (5b), then remove the complete oil pump cover (6).

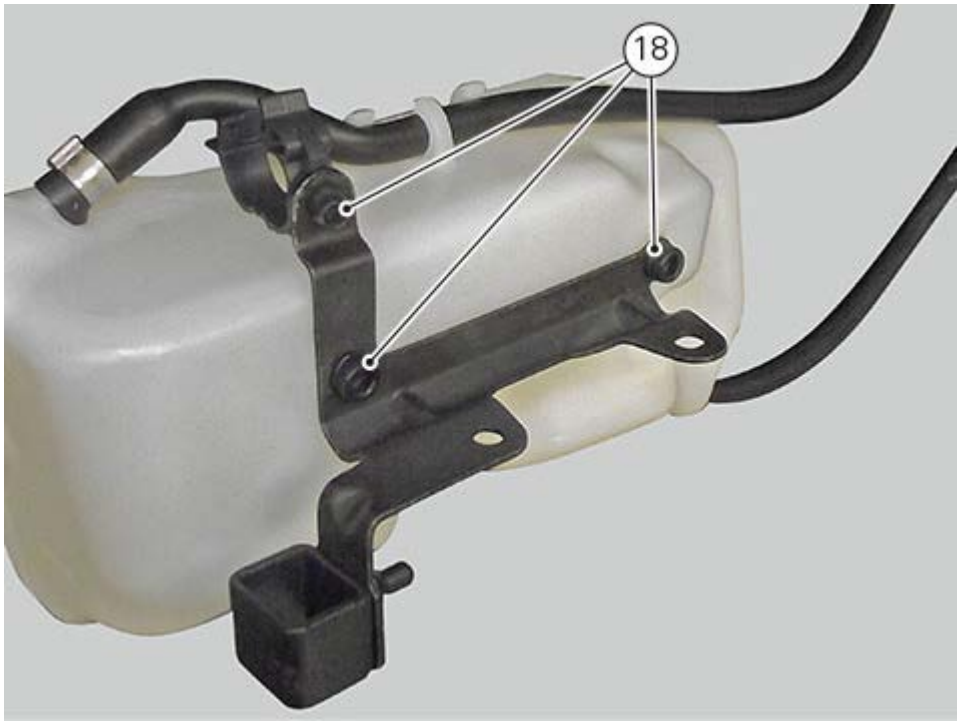




Remove oil pump outer rotor lobe (7) from crankcase.

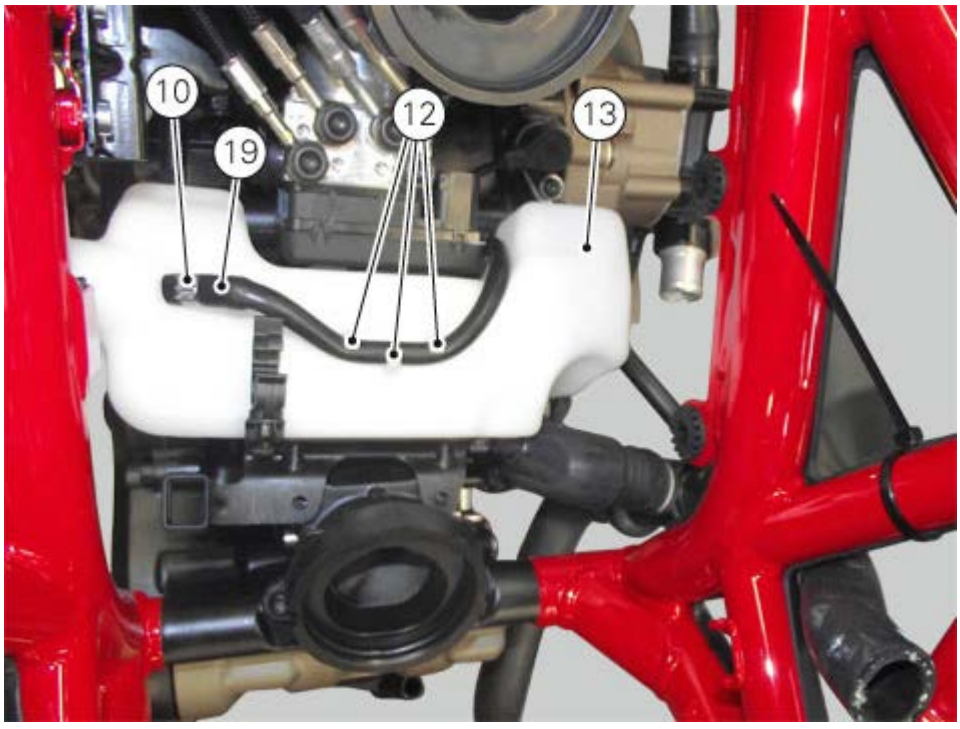
Refitting the water tank

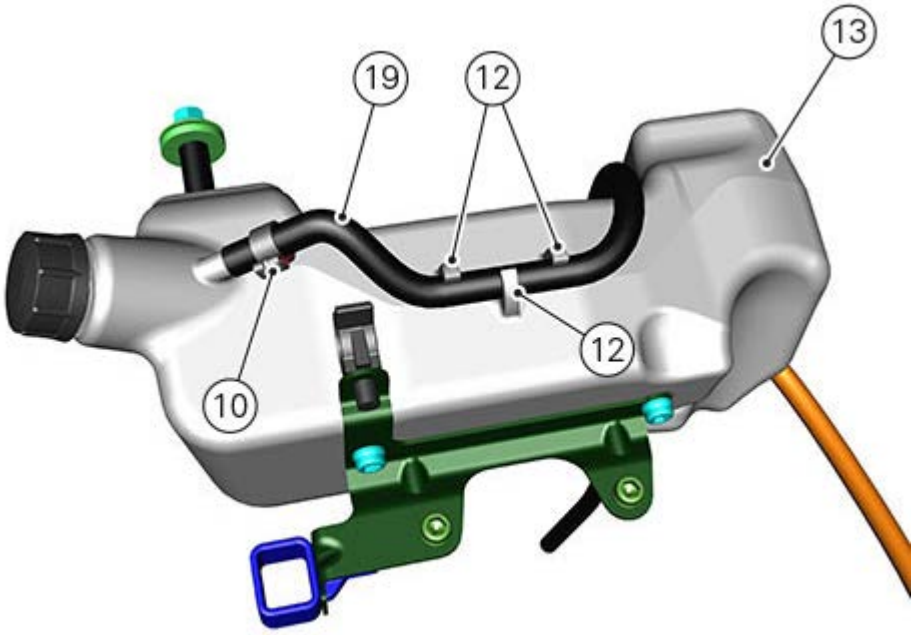
If previously removed, refit the water tank retaining plate and tighten the three screws (18) to a torque of 8 Nm ± 10%.



Position water tank (13).
Position the breather pipe (19) on tabs (12) and fix it to the water tank with clamps (10).

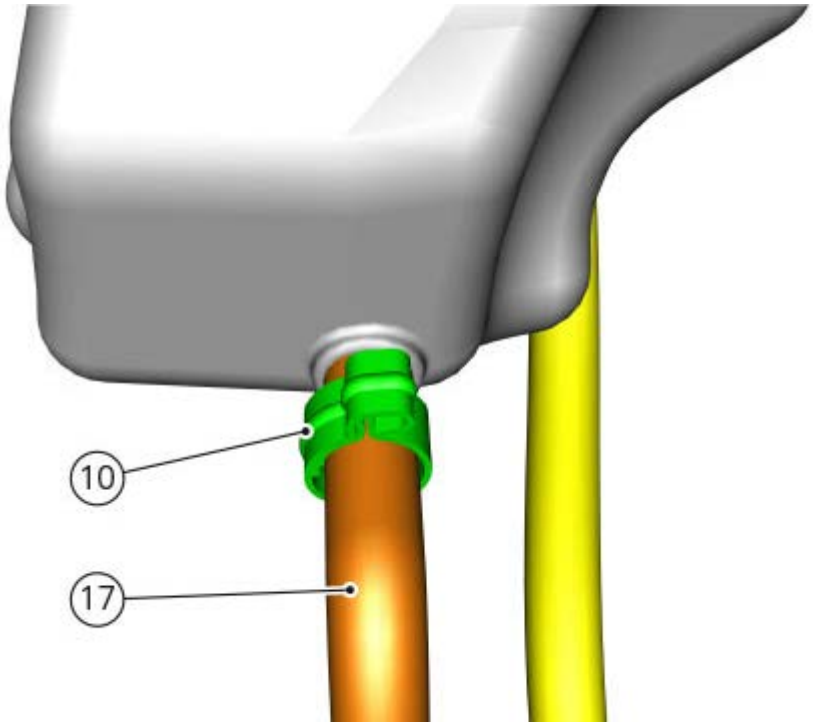
Note
If it proves hard to fit the tubes in the relevant unions, it is recommended to use RUBBER LUBRICANT, and apply some on the unions.

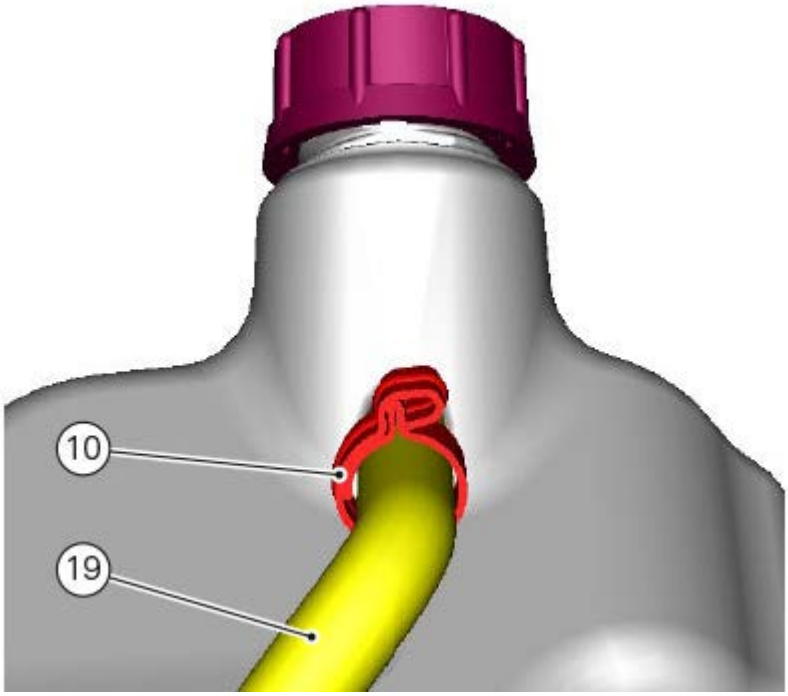




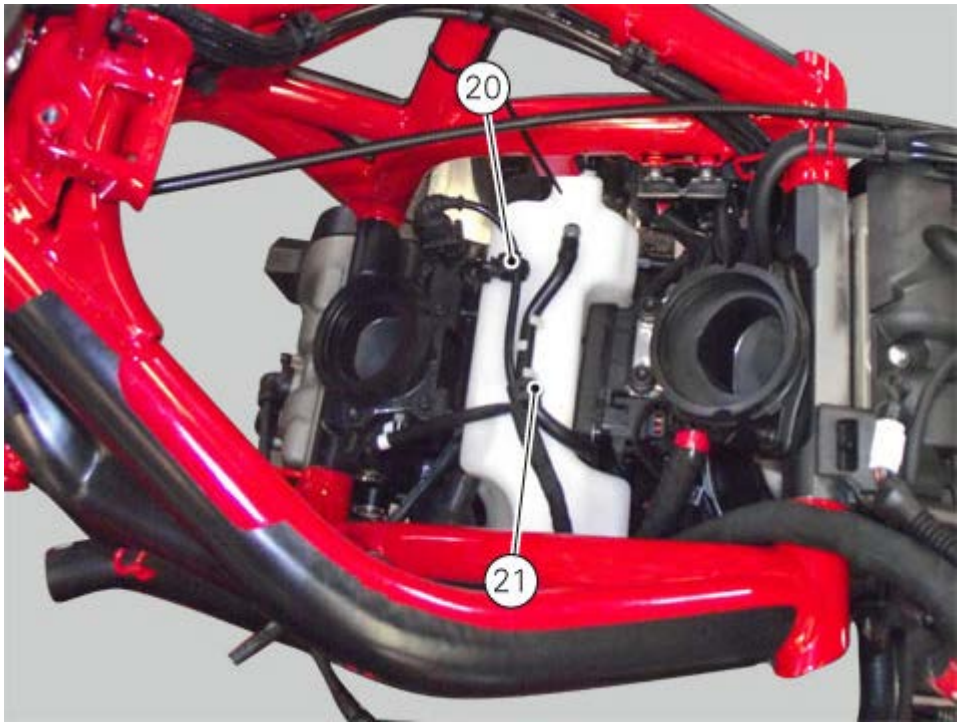
Warning

Check the correct position of the pipe clamps, as shown in the following figure.

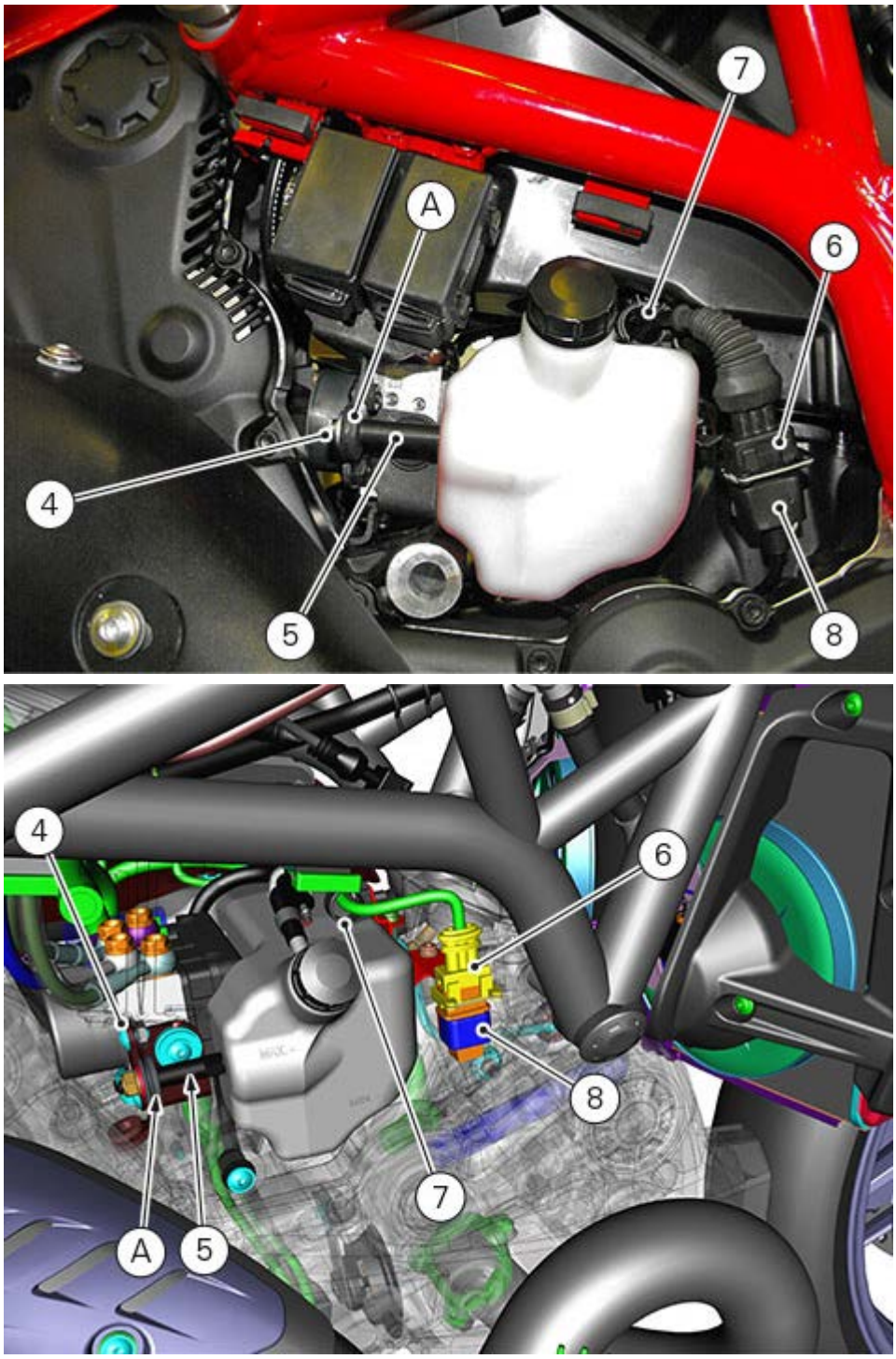




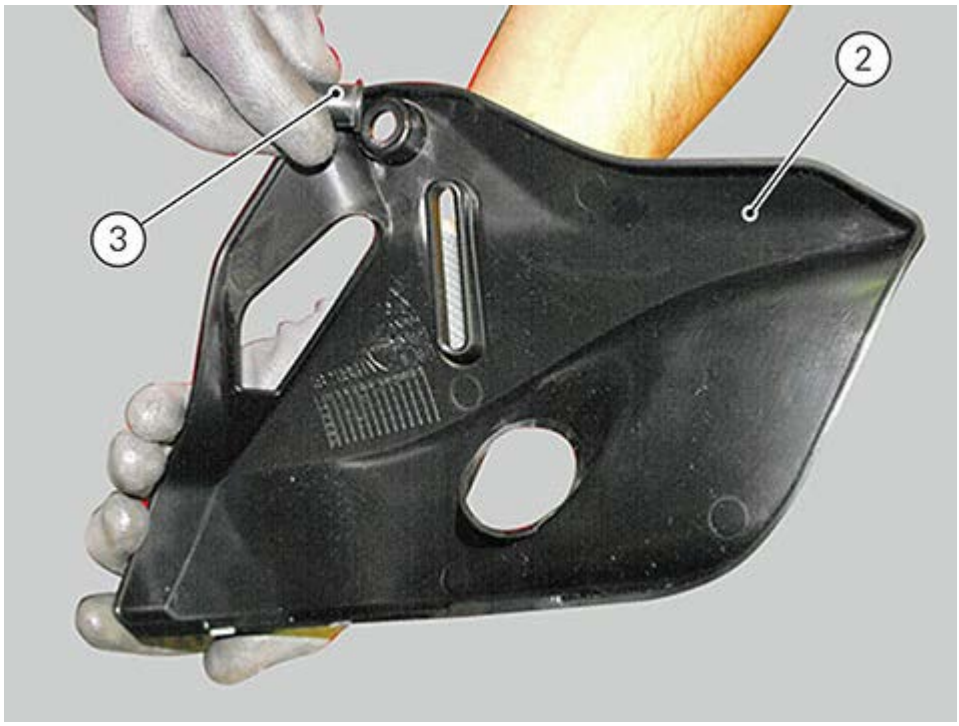
Restore wiring routing by securing pipes and cables on cable ring (20) with ties (21).



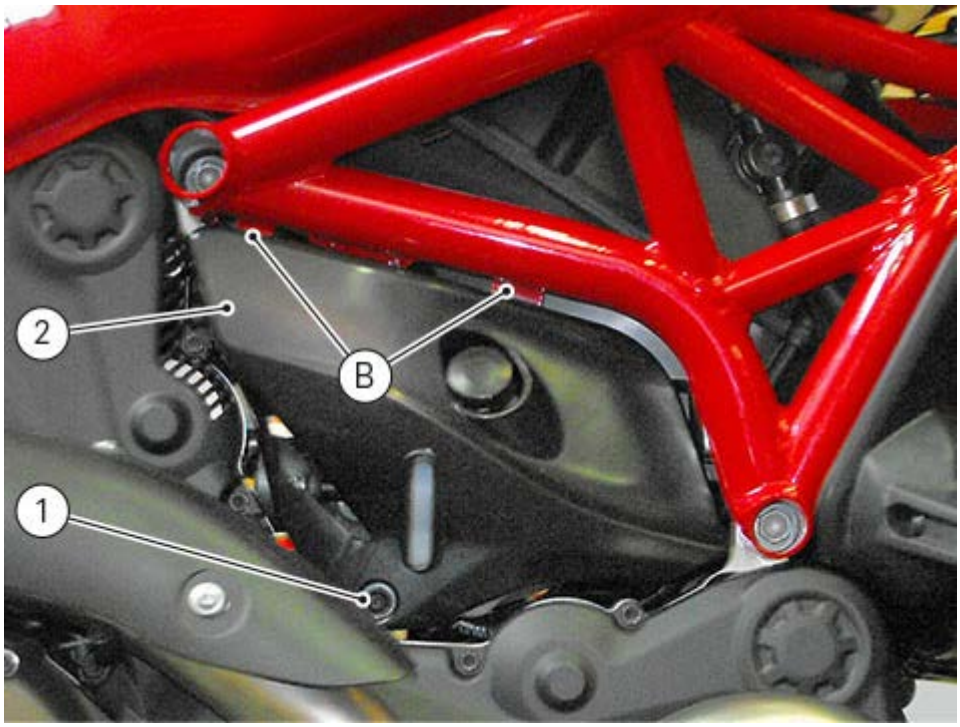
Connect the pick-up sensor (6), insert the wiring in cable rings (7) and position the connector in support (8).
Tighten spacer (5) to a torque of 8 Nm, check the presence of seal (A) and relevant spacer, then tighten screw (4) to 8 Nm ± 10%.



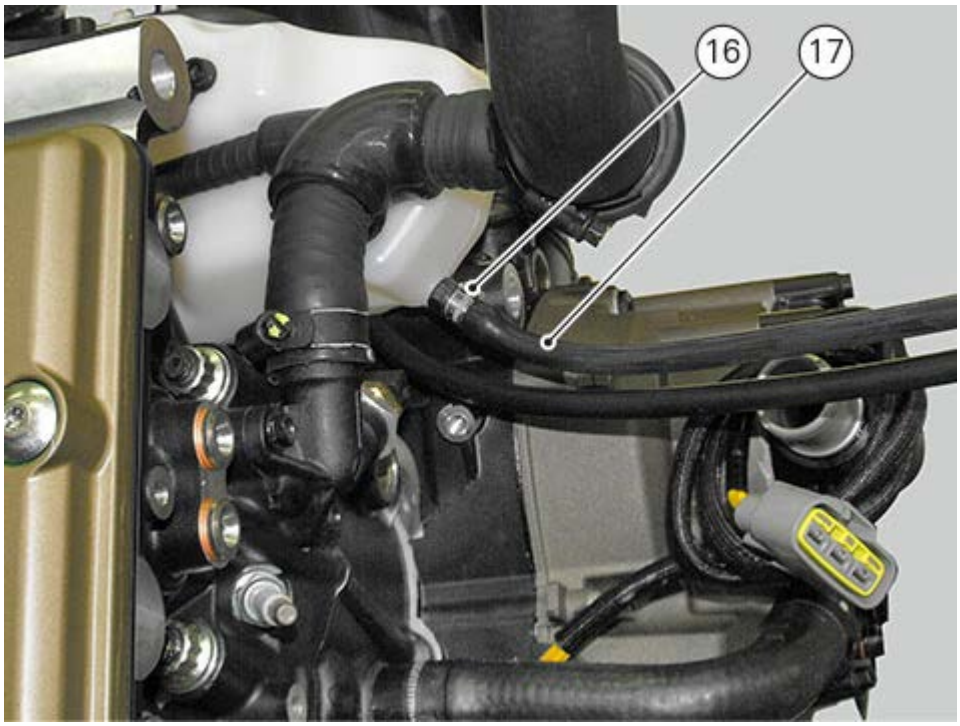
Position rubber spacer (3) on the side cover (2).



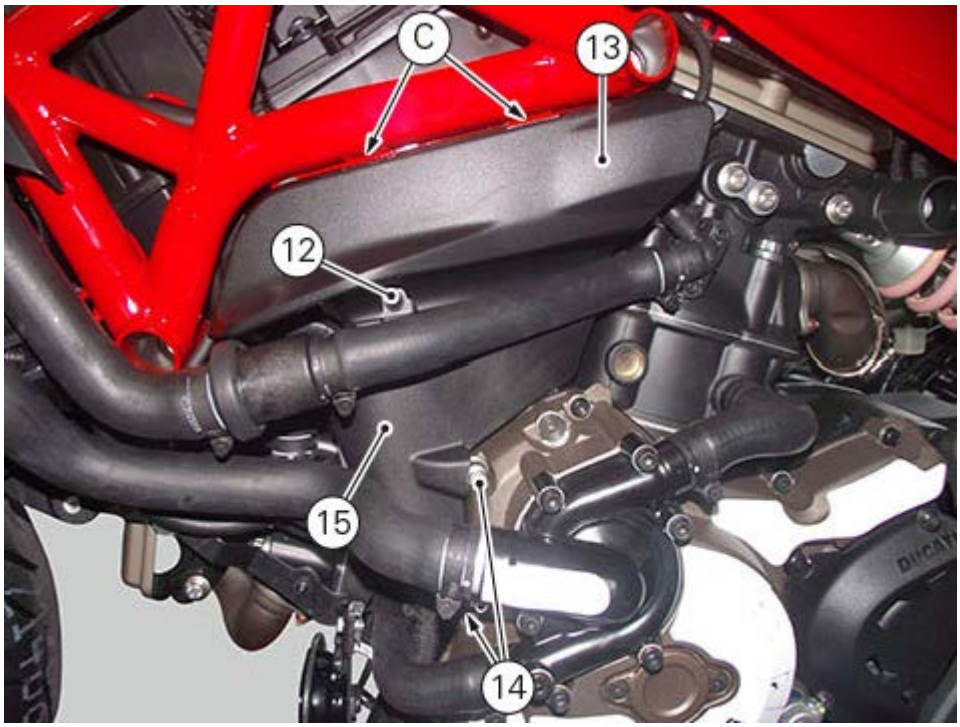
Fit the cover on the vehicle by pressing to engage it on tabs (B) on the frame.
Tighten the screw (1) to a torque of 1 Nm ± 10%.



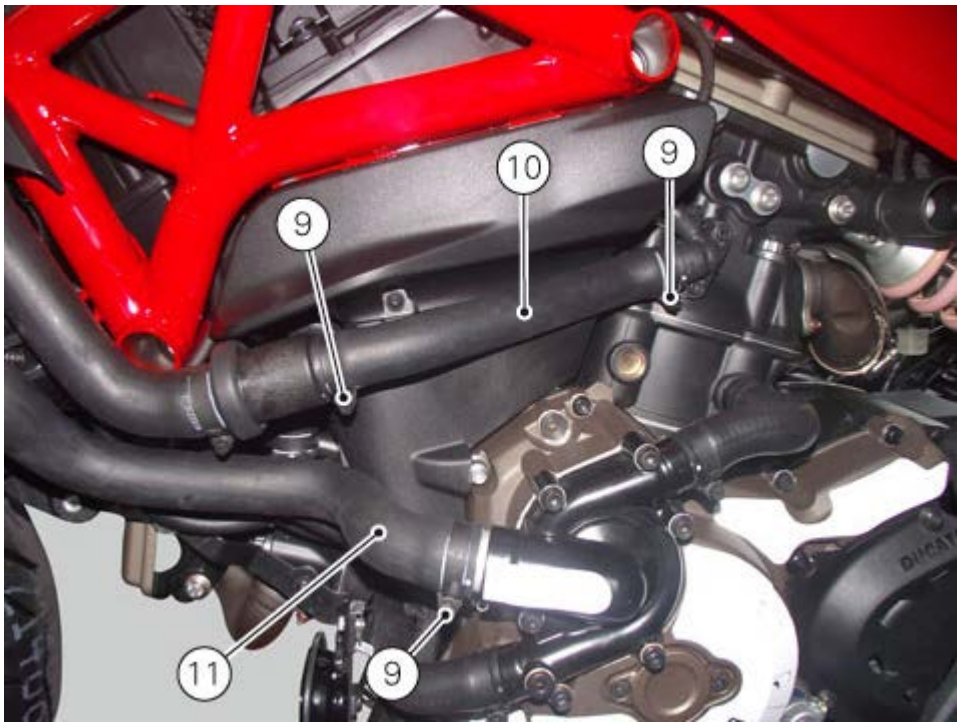
Insert the tank-radiator hose (17) and fit clamp (16).



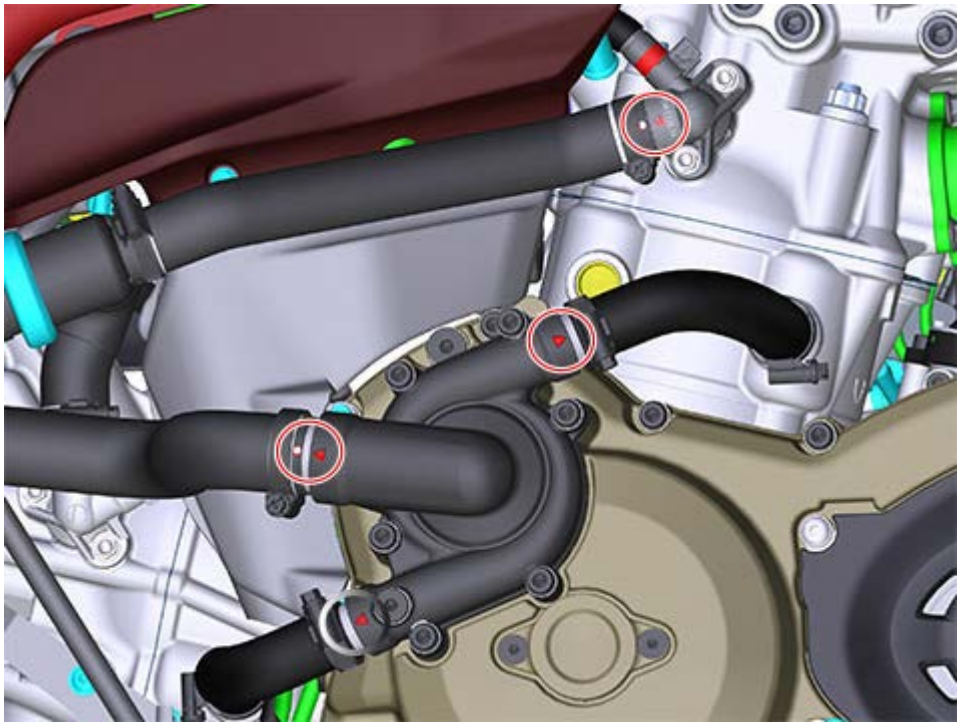
Tighten screws (14) of the lower side cover (15) to a torque of 5Nm ± 10%.
Engage the LH side cover (13) inside tabs (C), and tighten screw (12) to a torque of 3Nm ± 10%.



Position the vertical head-thermostat hose (10) and fix its ends by tightening clamps (9) to a torque of 2.5 Nm ± 10%.
Position the pump-radiator hose (11) and fix its end by tightening clamp (9) to a torque of 2.5 Nm ± 10%



Restore the hose correct position.



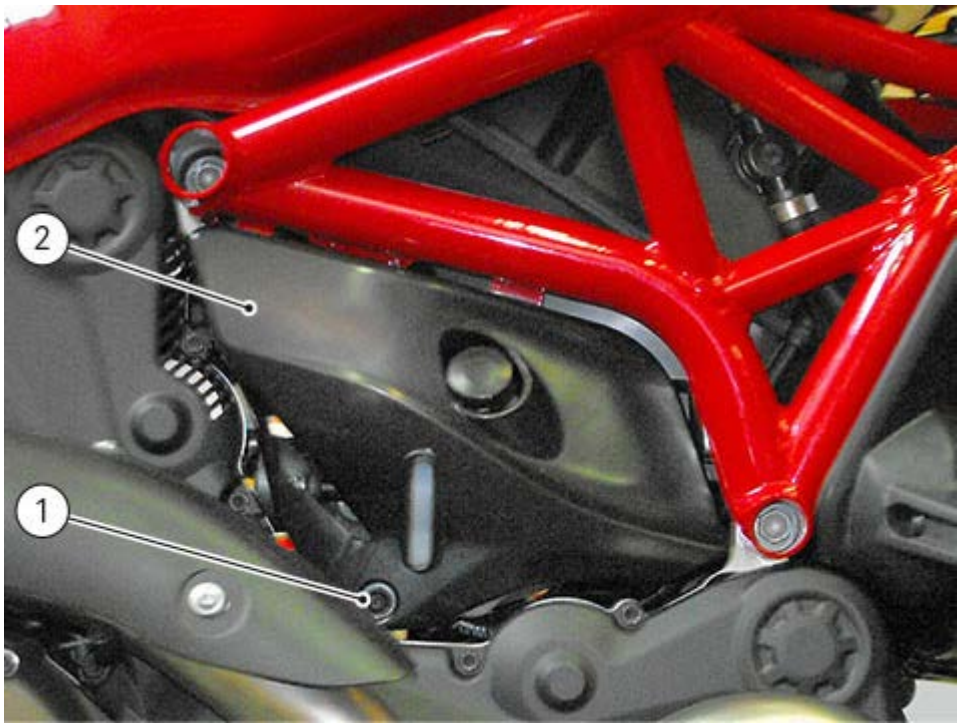
Refit the airbox and the throttle body (Refitting the airbox and throttle body).
Refit the fuel tank (Refitting the fuel tank).
Refit the seat (Refitting the seat).
Refill the coolant circuit (Changing the coolant).

Removing the water tank

Warning
This operation must be performed with cold engine. Failure to observe the above recommendation may lead to coolant or hot vapour leakage with possible consequent severe burns.

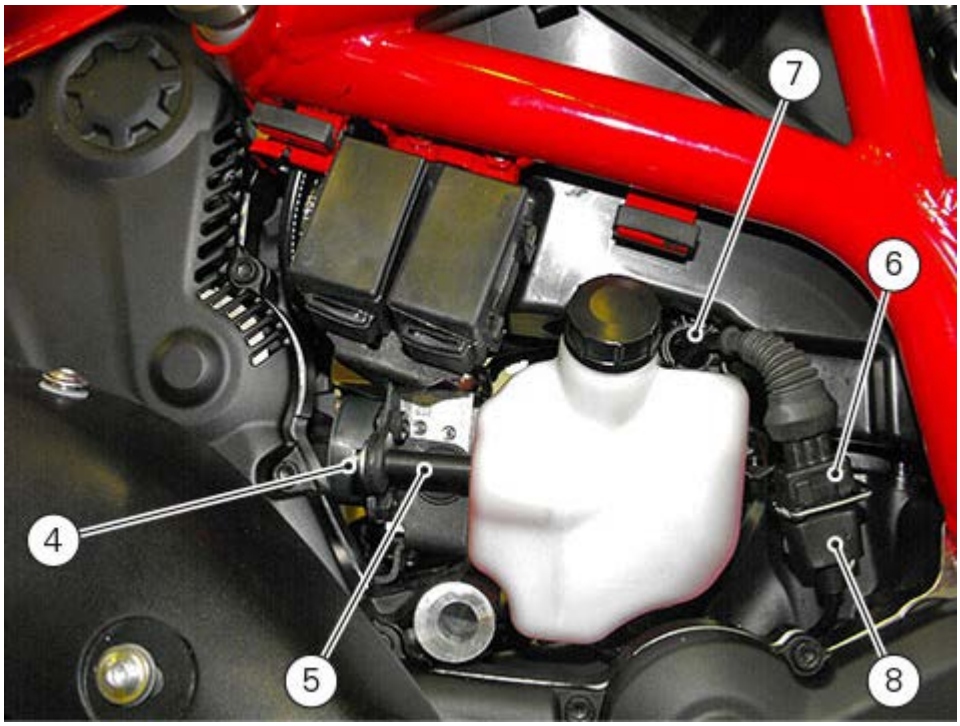
Drain the coolant (Changing the coolant).
Remove the seat (Removing the seat).
Remove the fuel tank (Removing the fuel tank).
Remove the airbox and the throttle body (Removing the airbox and throttle body).

Work on the right side to loosen screw (1) and remove the lateral cover (2).

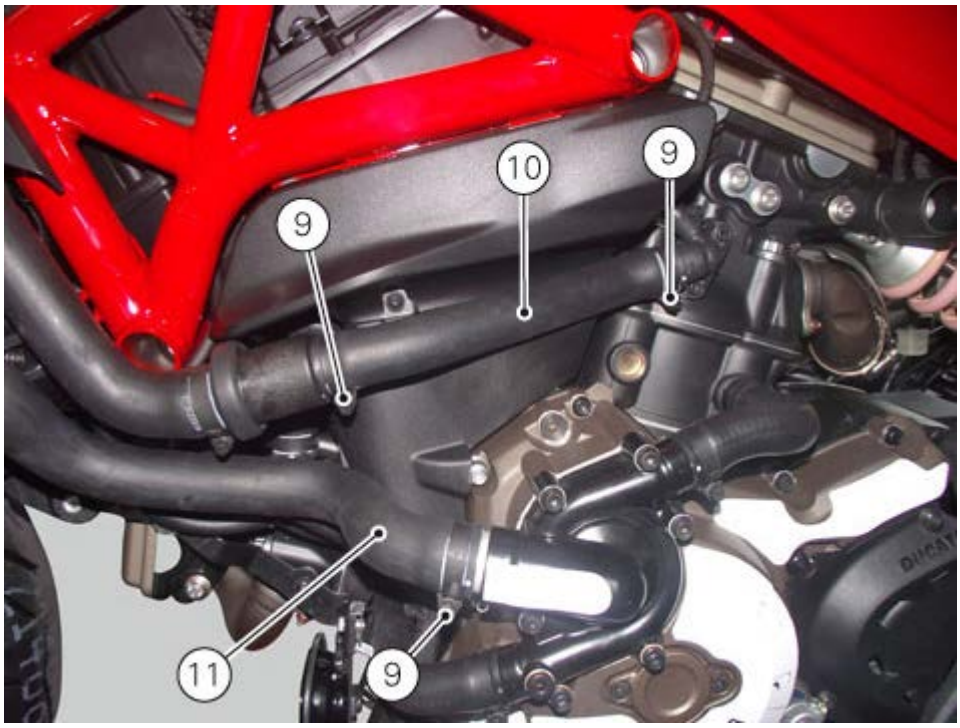


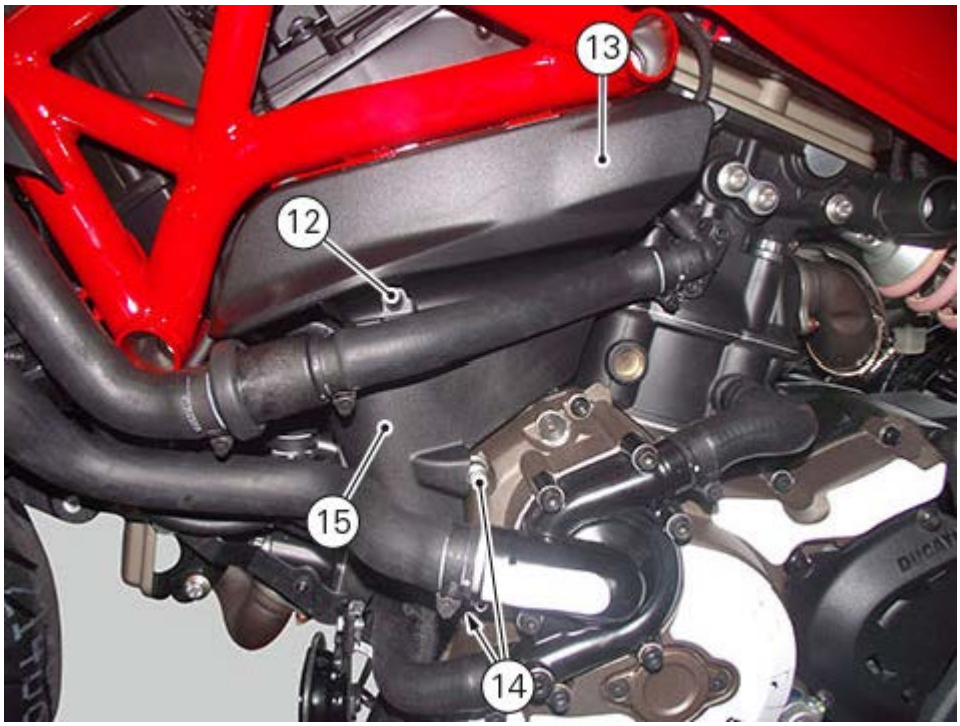
Collect spacer (3).

Loosen screw (4) and collect spacer (5) and washer positioned in-between.
Disconnect the pick-up sensor connector (6) by releasing it from cable ring (7) and seat (8).

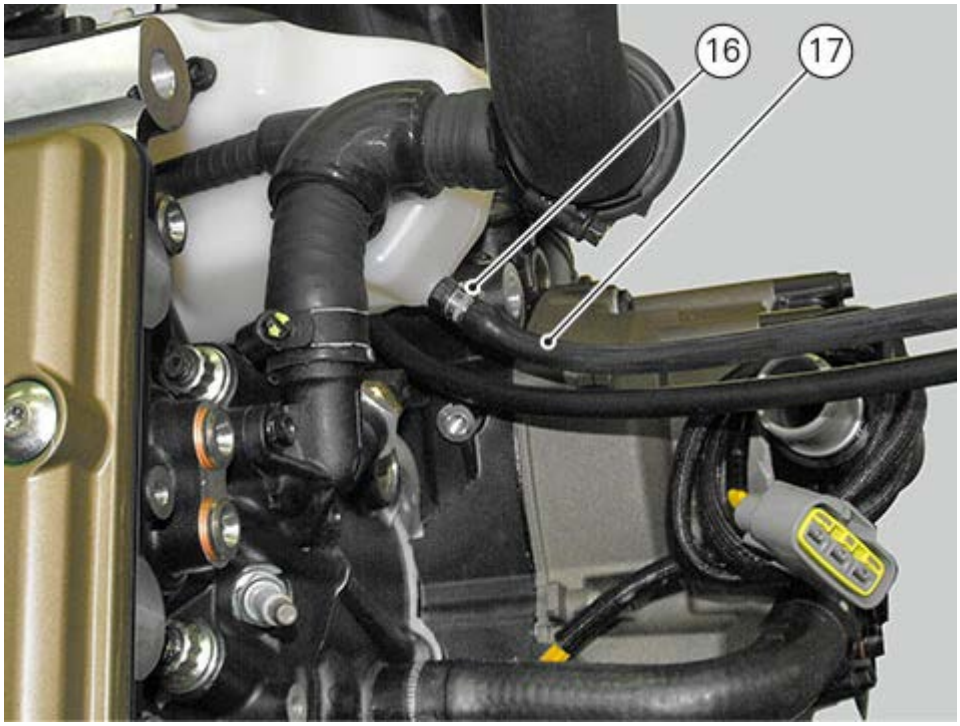


Work on the left side to loosen clamps (9).
Remove the vertical head-thermostat pipe (10).
Move the pump-radiator pipe (11) aside.
Undo screw (12) and remove the LH cover (13).
Undo screws (14) and remove the LH lower side cover (15).

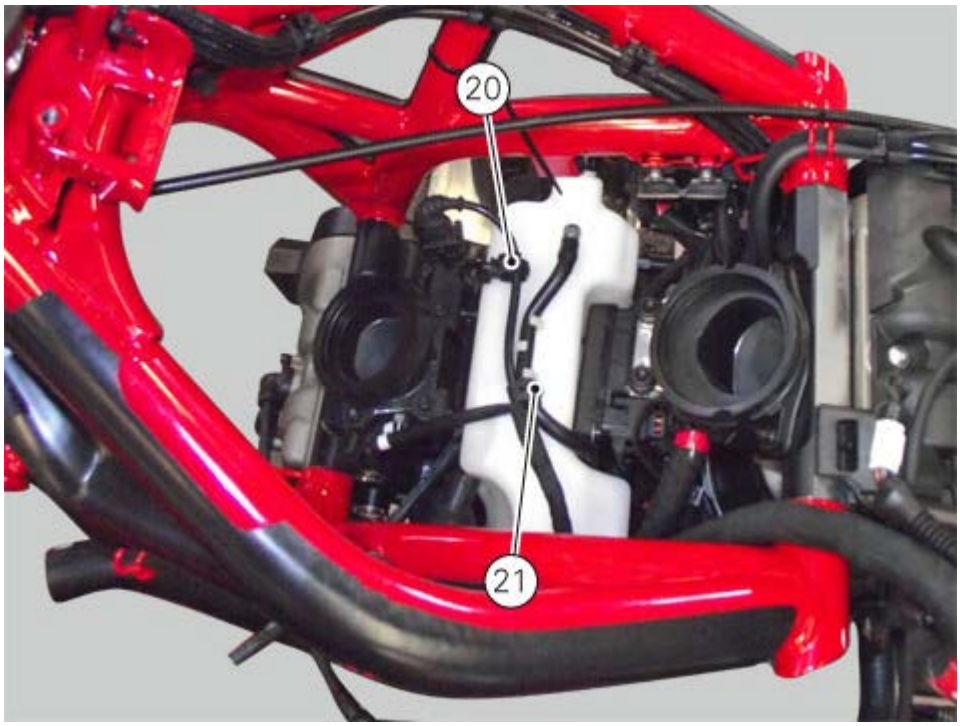




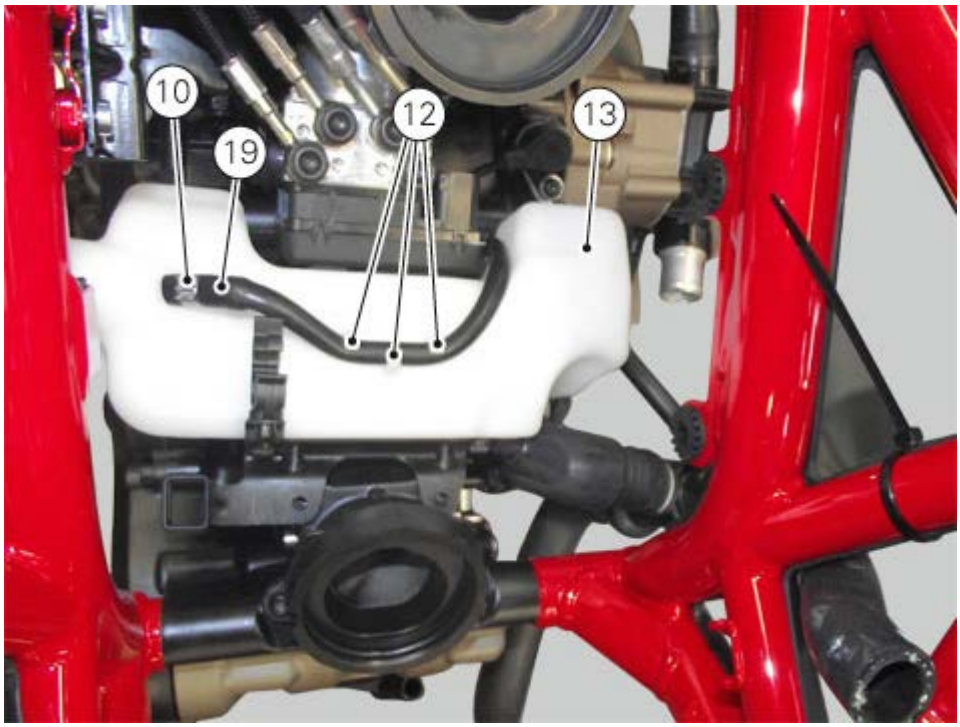
Remove clamp (16) and radiator-tank hose (17).



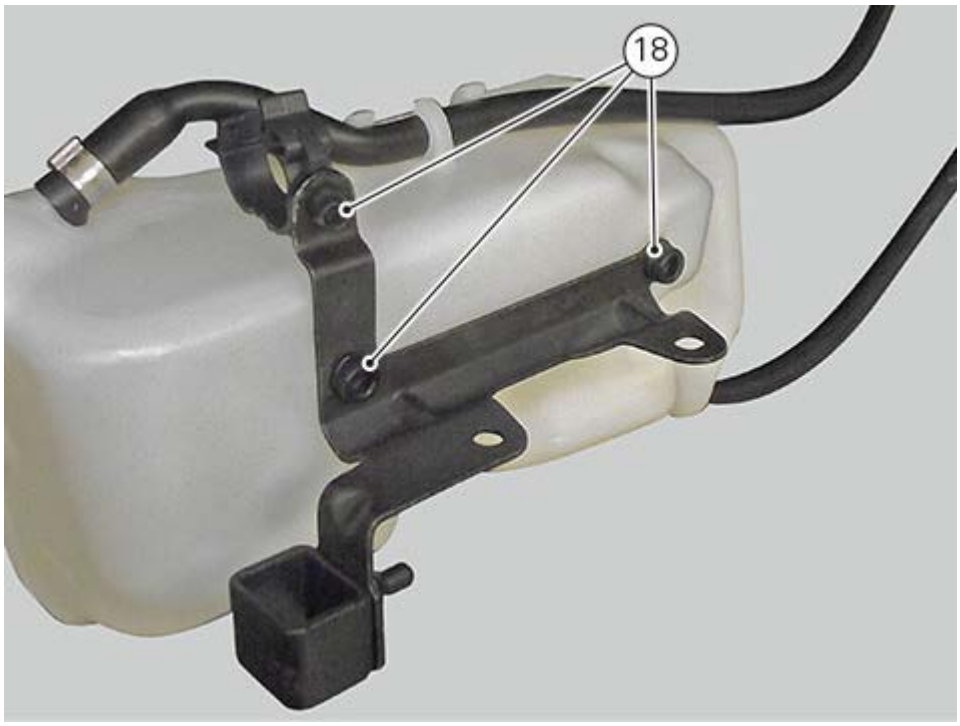
Release pipes and wirings from cable rings (20) and clamps (21).



Remove clamp (10) and breather pipe (19), by releasing it from tabs (12).
Remove water tank (13).

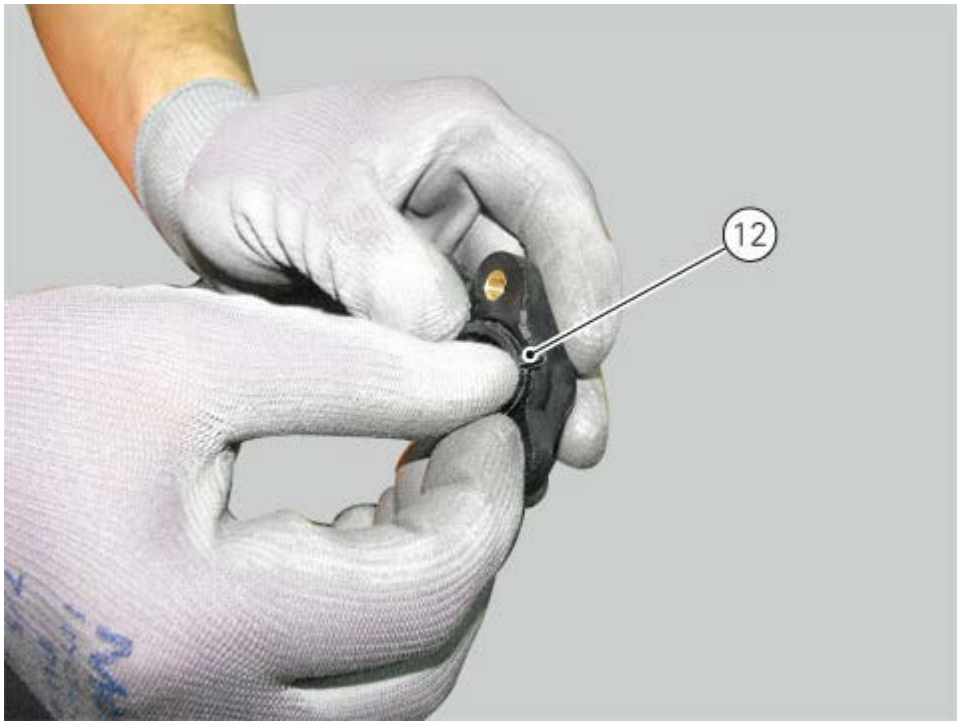


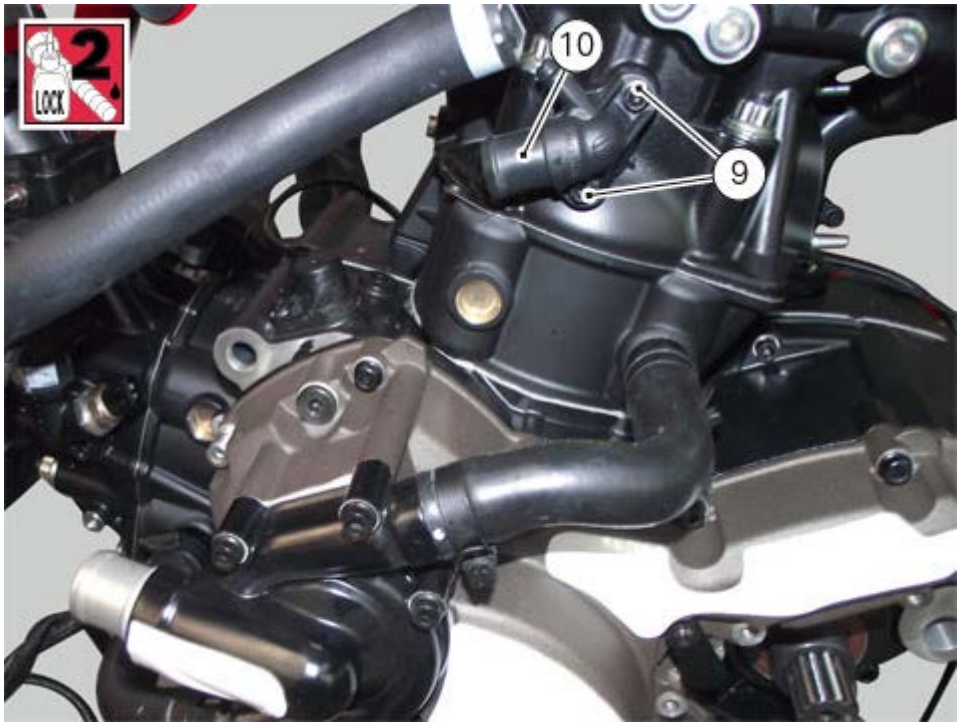
If necessary, loosen screws (18) and remove the water tank retaining plate.

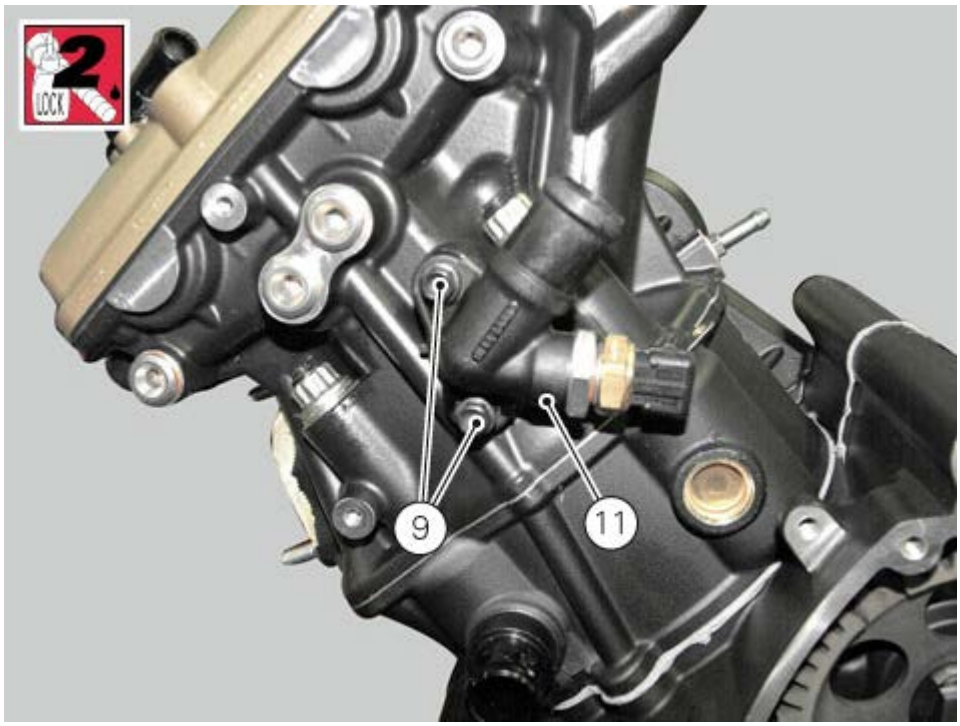


Refitting the cooling system hoses and unions

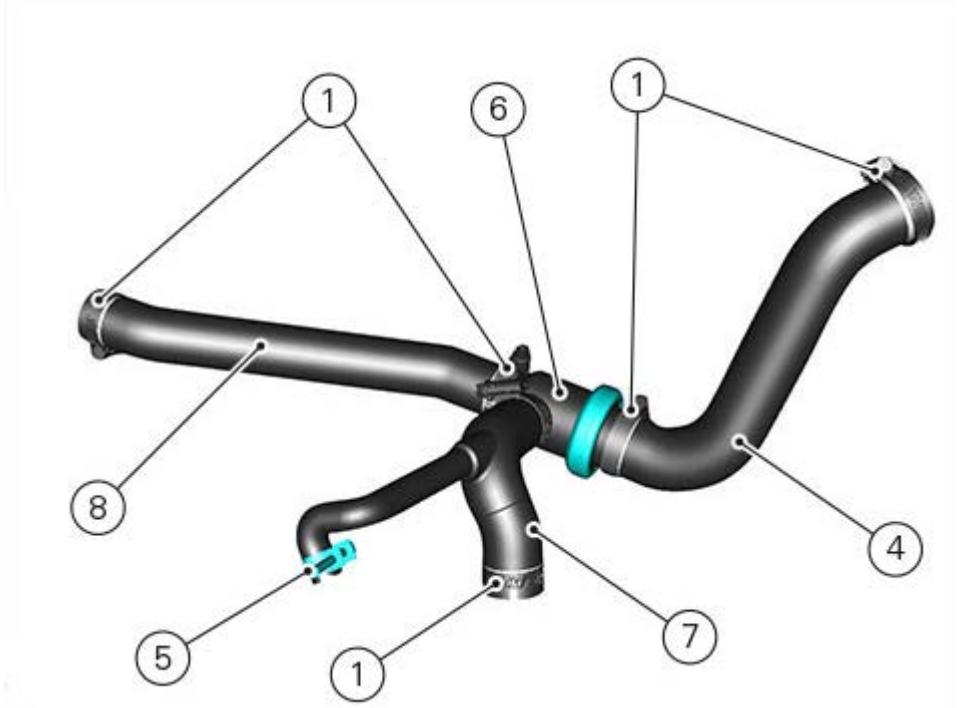
Install an O-ring (12) in the seat of the horizontal head union (11) and one in vertical head union seat (10).
Take special care to correctly insert the O-ring inside its seat.
Fix union (11) on the horizontal head with screws (9) with specified threadlocker and tighten screws (9) to a torque of 6 Nm (Min. 5 Nm - Max. 7 Nm).
Fix union (10) on the vertical head with screws (9) with specified threadlocker and tighten screws (9) to a torque of 6 Nm (Min. 5 Nm - Max. 7 Nm).



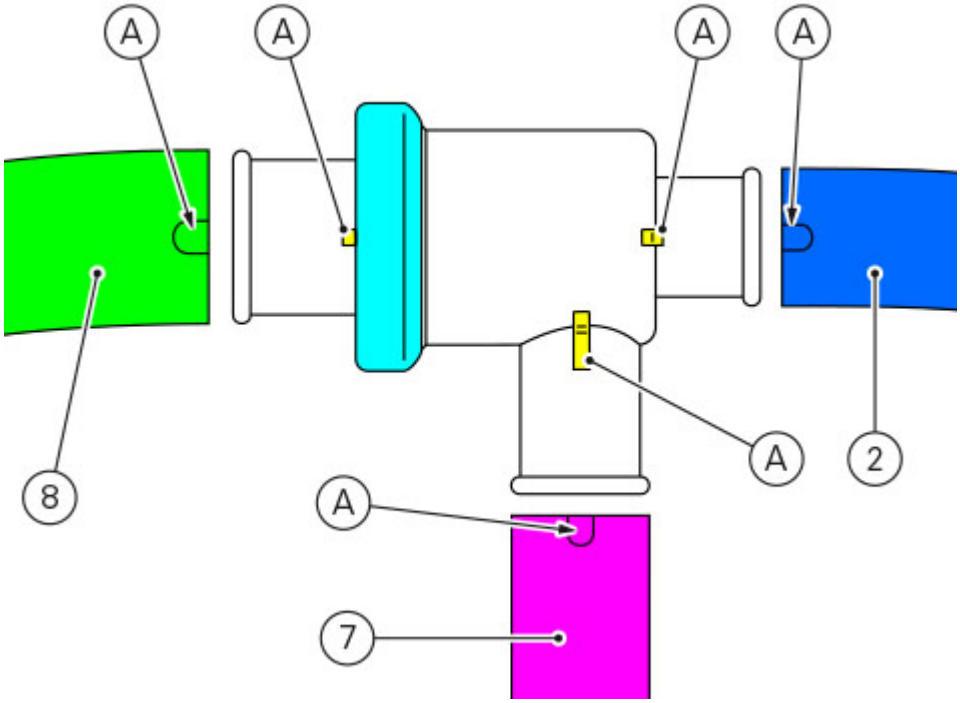




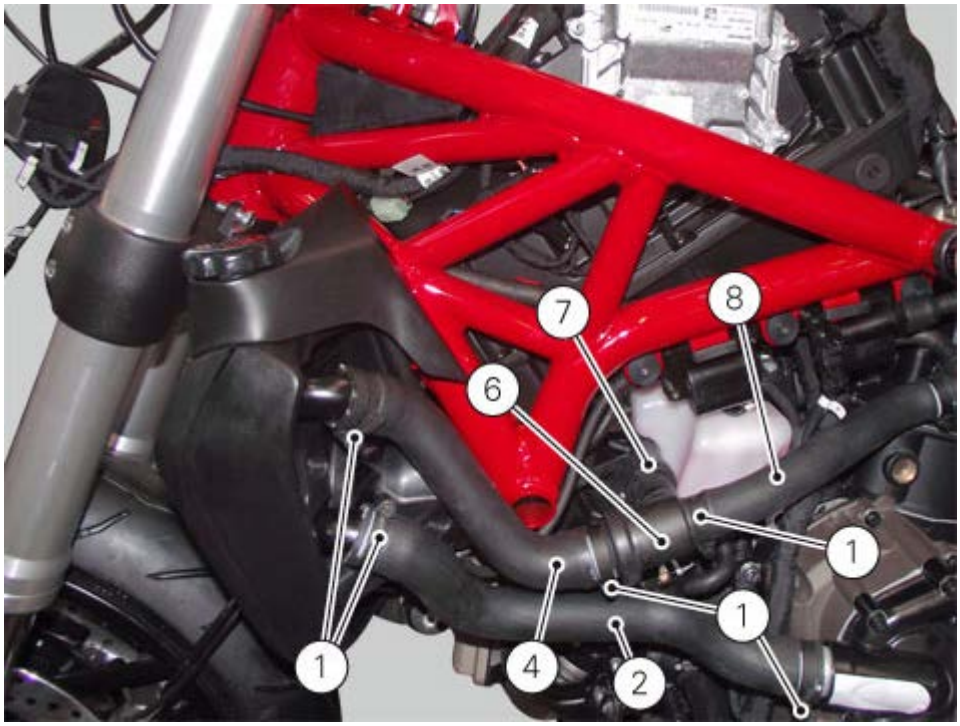
To assemble the thermostat unit (6) - thermostat/cylinder head hose (7) - thermostat/cylinder head hose (8) - radiator/thermostat hose (4), position clamps (1) and tighten them to a torque of 2.5 Nm ± 10%.

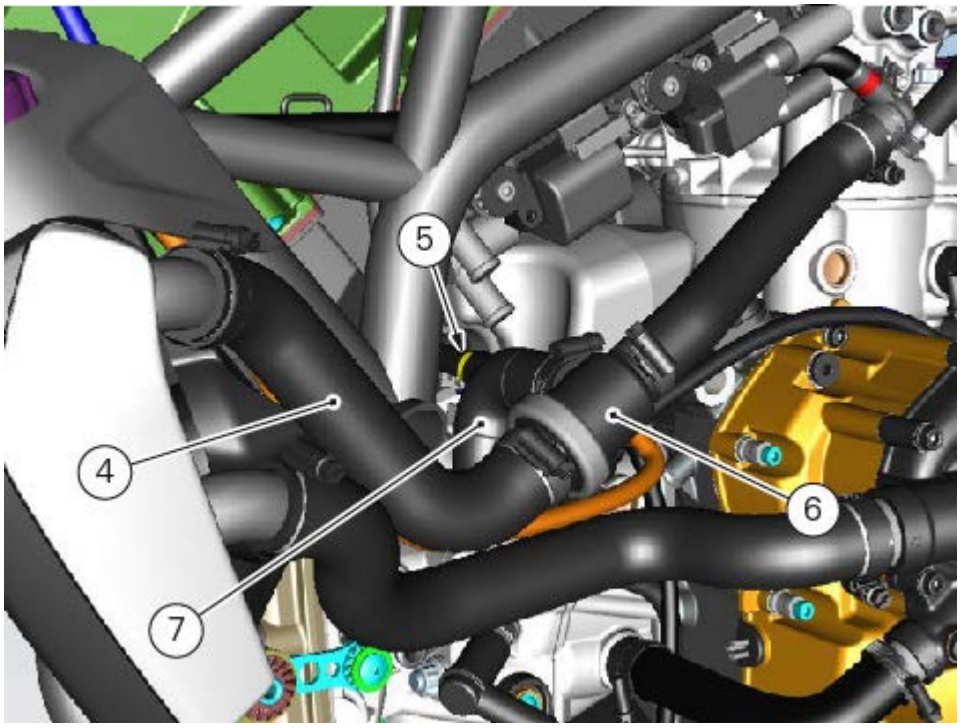


Pay special attention to the hose and thermostat routing, according to references (A).



Position the thermostat union (6) - thermostat/cylinder head hose (7) - thermostat/cylinder head hose (8) with clamps (1) and (5) and tighten clamps (1) to 2.5 Nm ± 10% and clamp (5) to 1 Nm ± 10%.
Position the pump/radiator hose (2) and the radiator/thermostat sleeve (4) with the clamps (1) and tighten the clamps to radiator (3) to the specified torque of 3 Nm ± 10%.



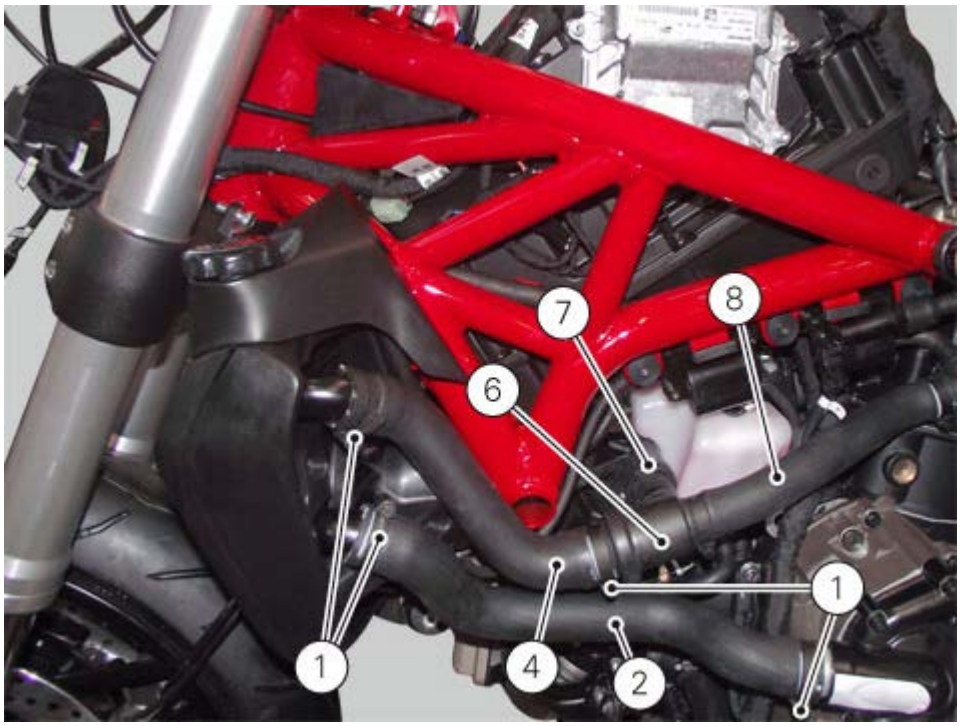


Refit the two LH side covers (Refitting the water tank).
Fill the cooling system (Changing the coolant).

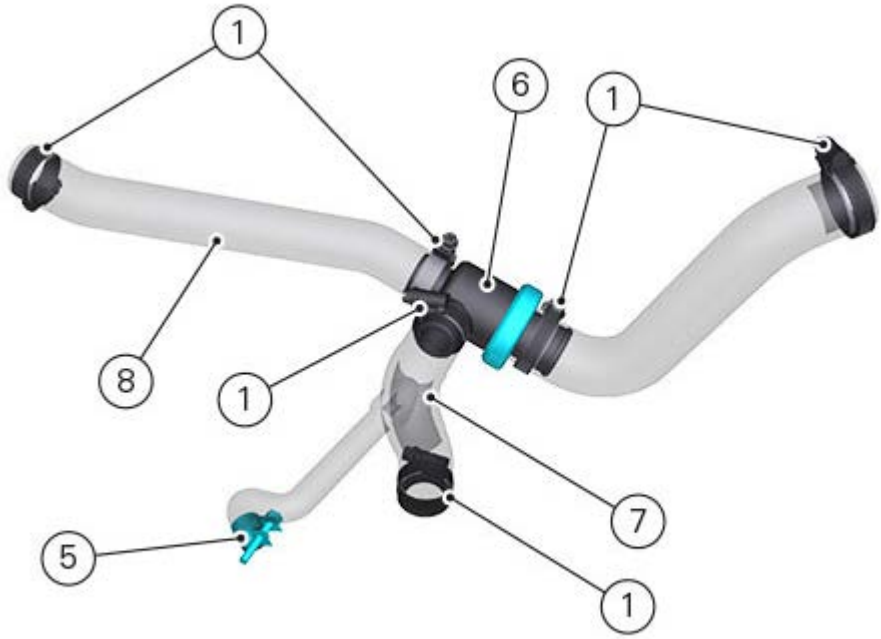
Removing the cooling system hoses and unions

Remove the two LH side covers (Removing the water tank)
Drain the coolant (Changing the coolant)

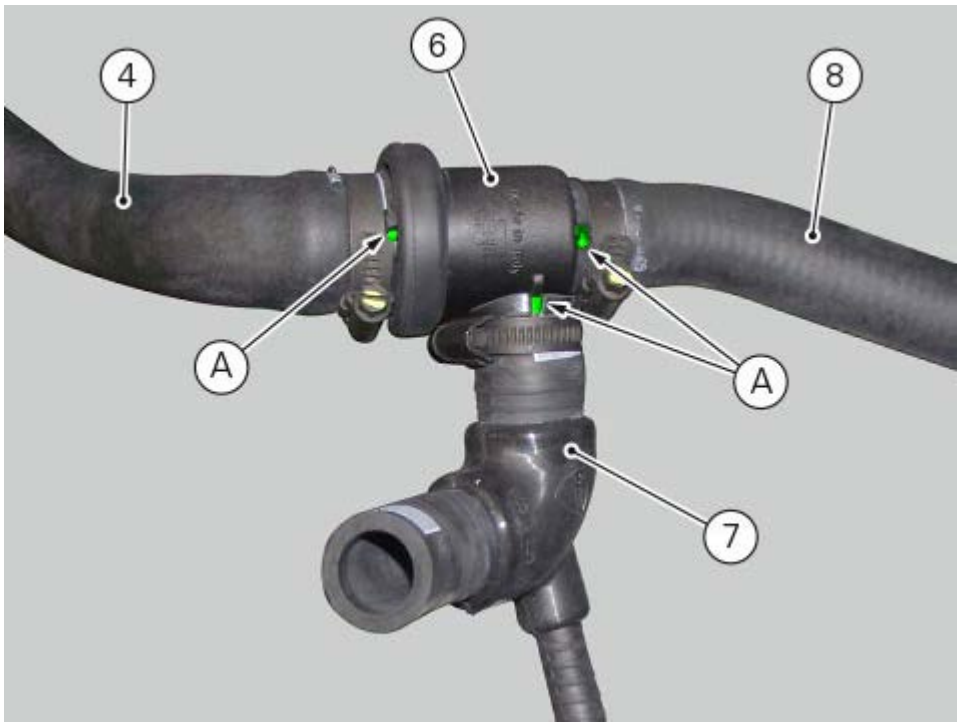
Loosen clamps (1) retaining the water radiator (3) hose (2) to the pump and the fixing clamps of the radiator/thermostat hose (4) to the thermostat.
Loosen the clamps (1) and (5) securing the thermostat unit (6) – thermostat-cylinder head hose (7) – thermostat-cylinder head hose (8).

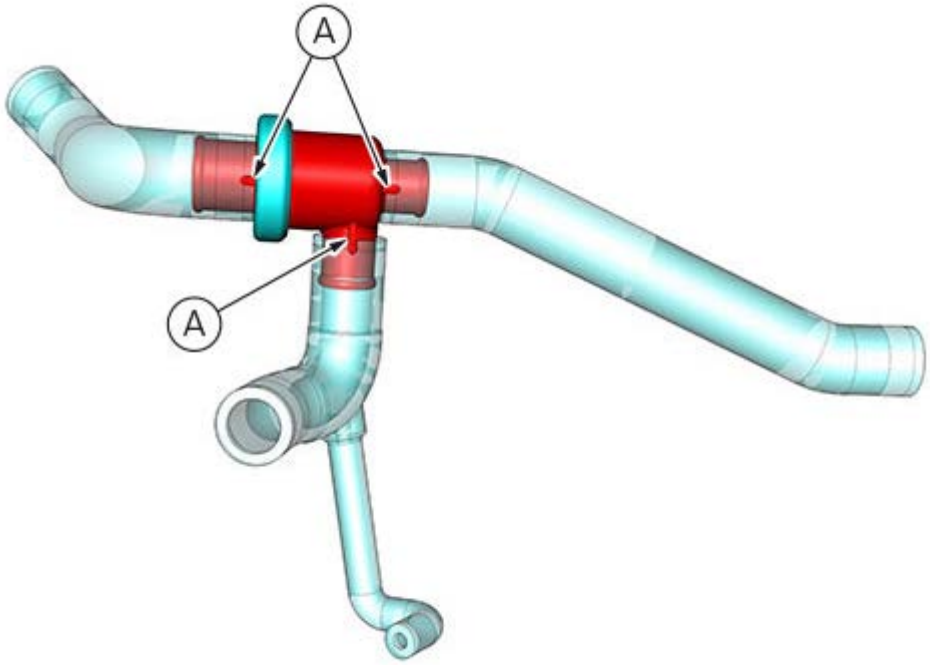


Loosen the clamps (1) and (5) to disassemble the thermostat unit (6) - thermostat/cylinder head hose (7) - thermostat/cylinder head hose (8) and radiator/thermostat hose (4).

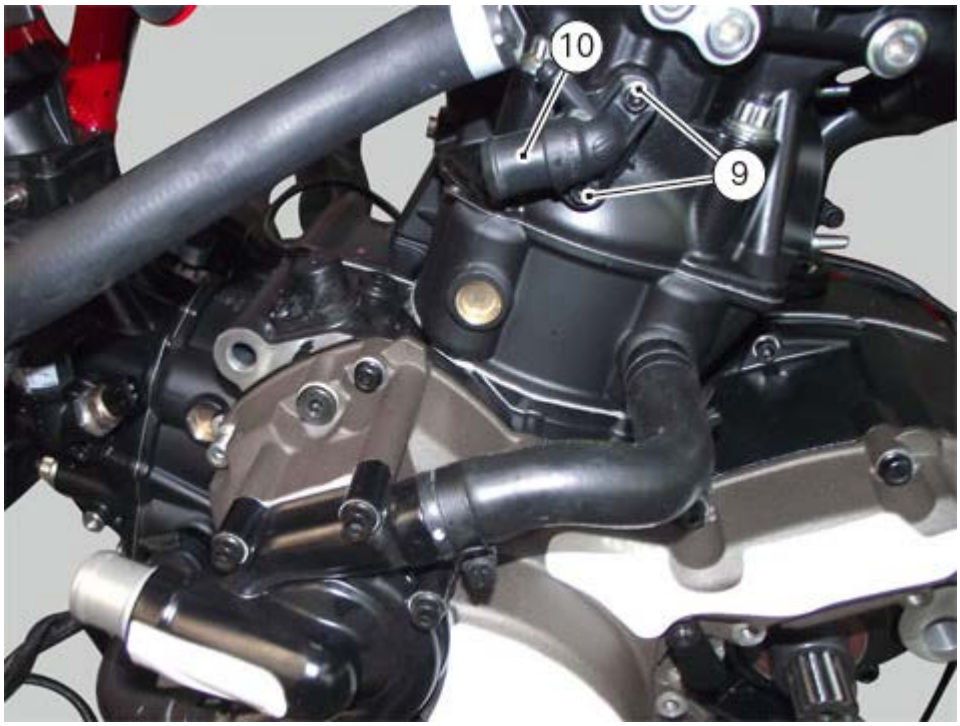


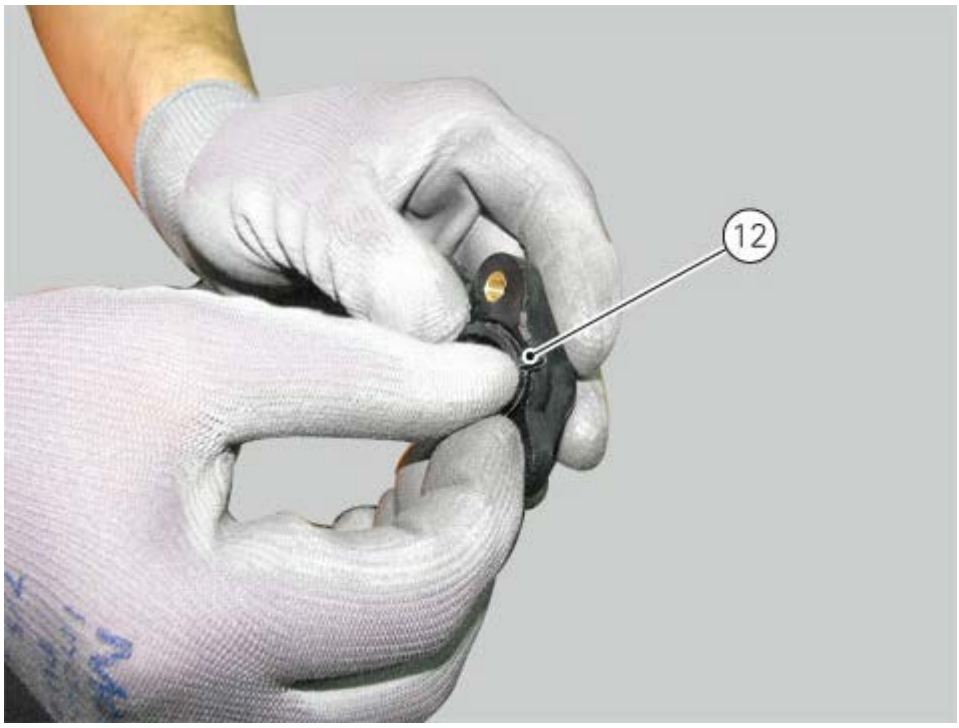
Check the correct position of hoses (4), (7), (8) and thermostat (6).
Position them as shown in the figure, respecting the indicated references (A).

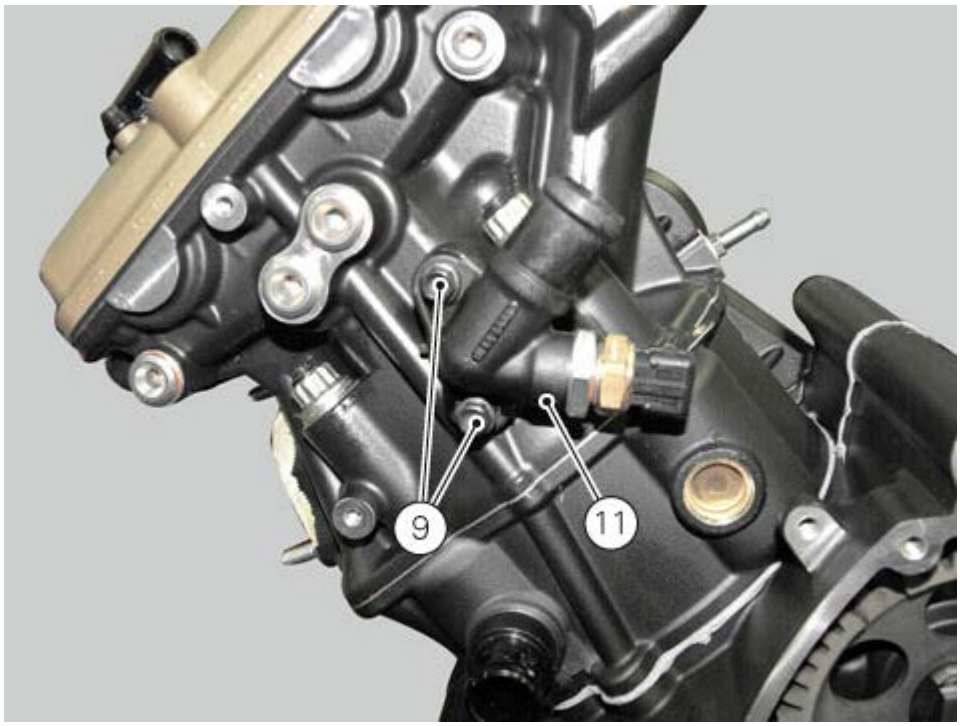




Loosen the screws (9) and remove union (10).
Recover the O-ring (12) located between the union and the vertical head.
Undo the screws (9) and remove the horizontal cylinder head union (11).
Collect the O-ring (12) located between the union and the horizontal head.







Important

Periodically check the connection unions for leaks. Hoses that are cracked, swollen, or hardened due to dry sleeves should be replaced.

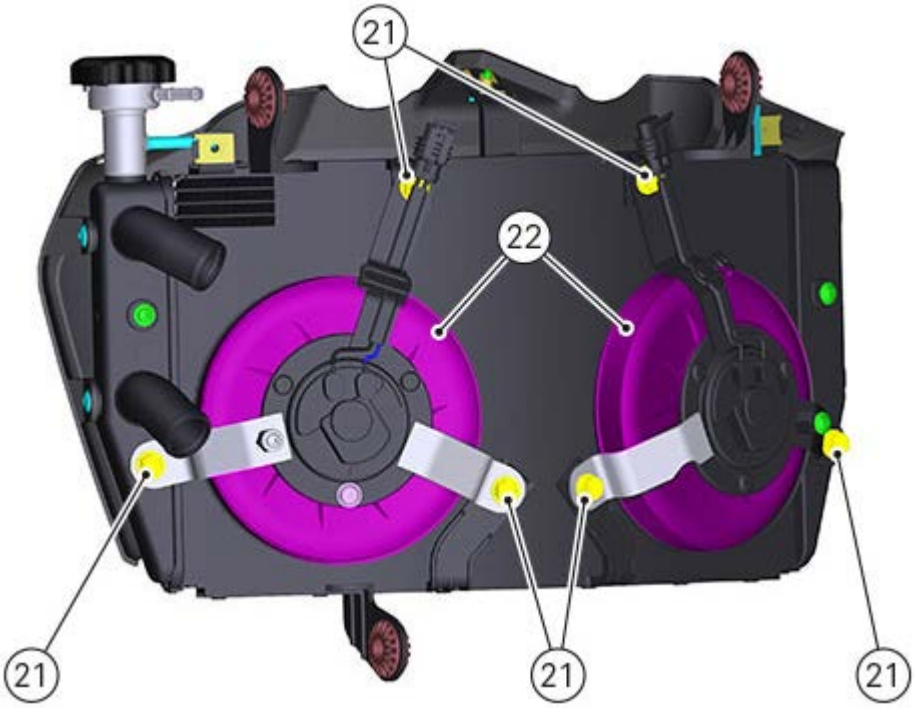
Fitting the radiator

Refit any previously removed component following the procedure described in paragraph "Removing the radiator" in reverse order.
Check that the components below have been refitted on radiator (7):

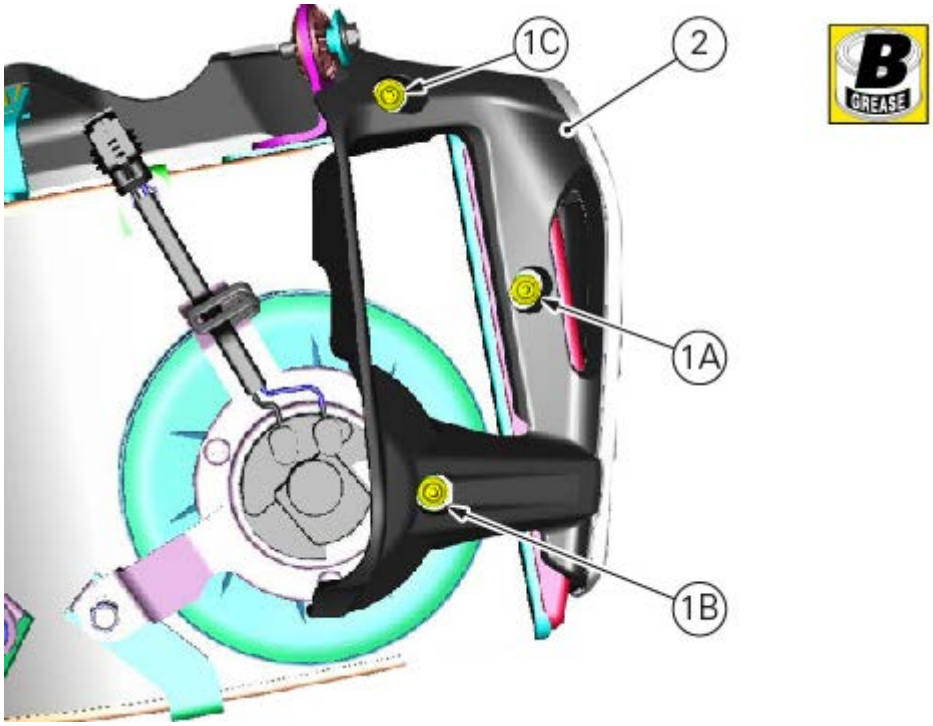
- front cover (6): tighten screws (8) and screw (4) to a torque of 3 Nm ± 10%;

- lateral left (2) and right (3) covers: tighten screws (1) to a torque of 3 Nm ± 10%

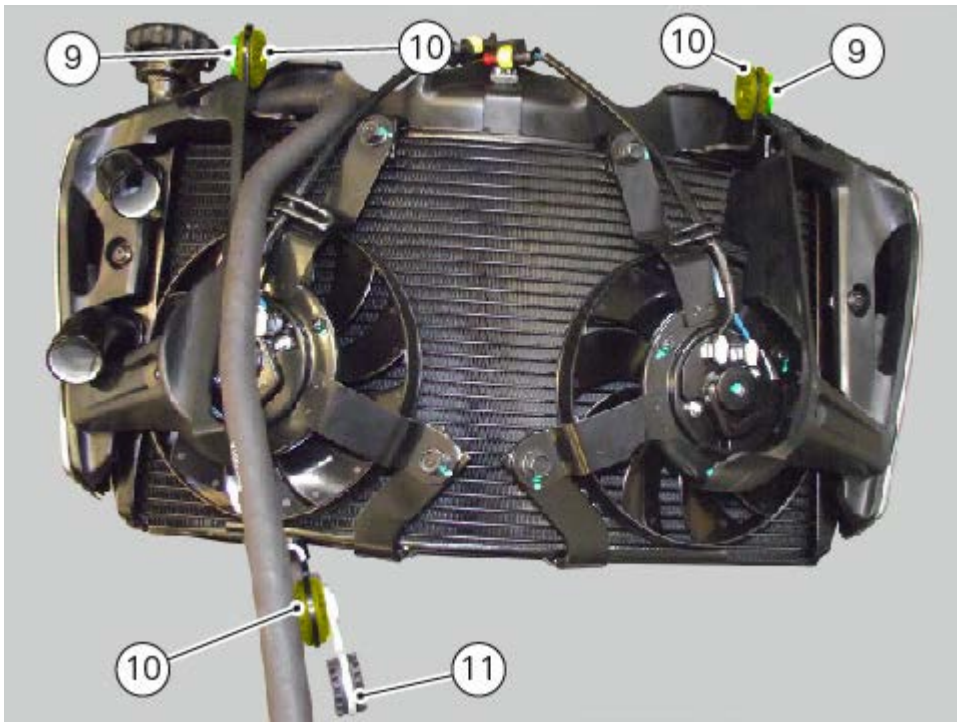
- the two electric fans (22) with screws (21);



Screws (1A) and (1B) have pre-applied threadlocker.

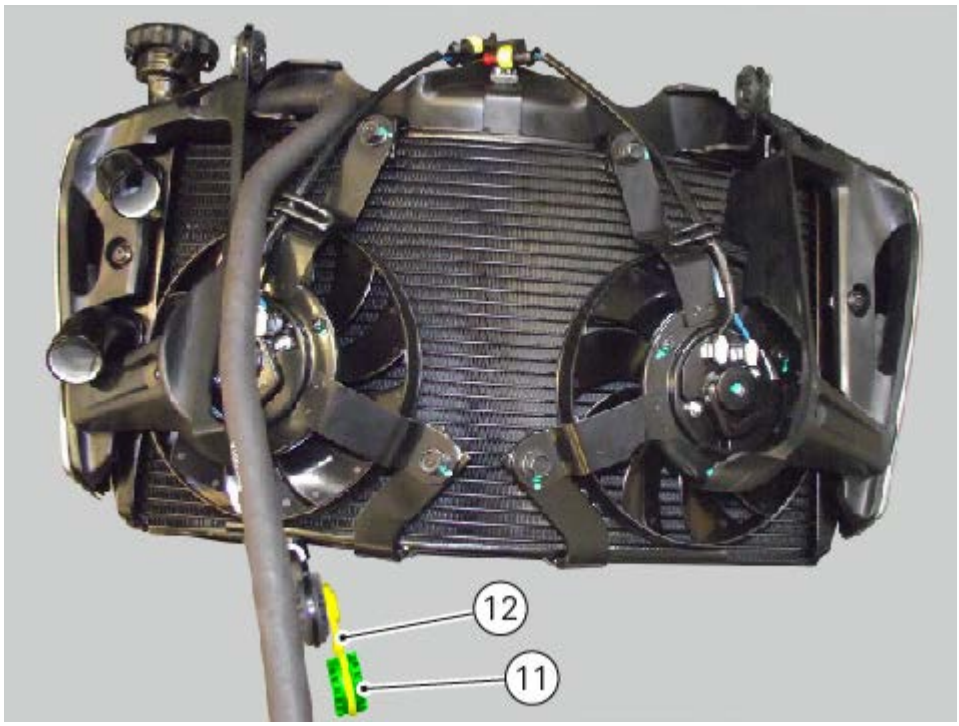


- spacers (9) and vibration damping rings (10) and (11);

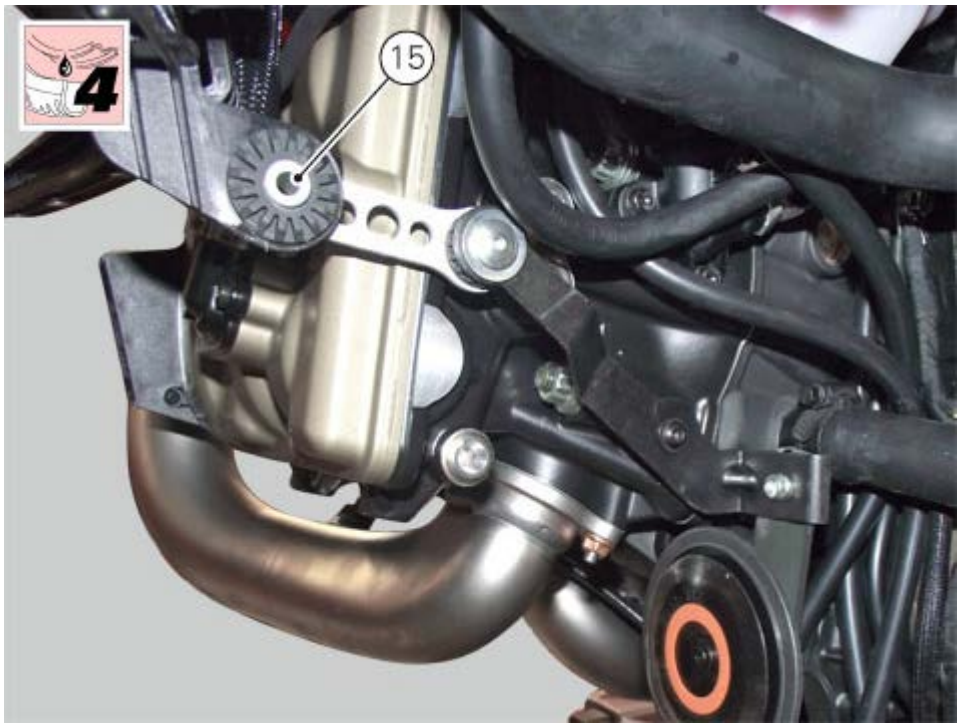


Check that the gap between front cover (6) and radiator (7) is the same along the whole upper arch.

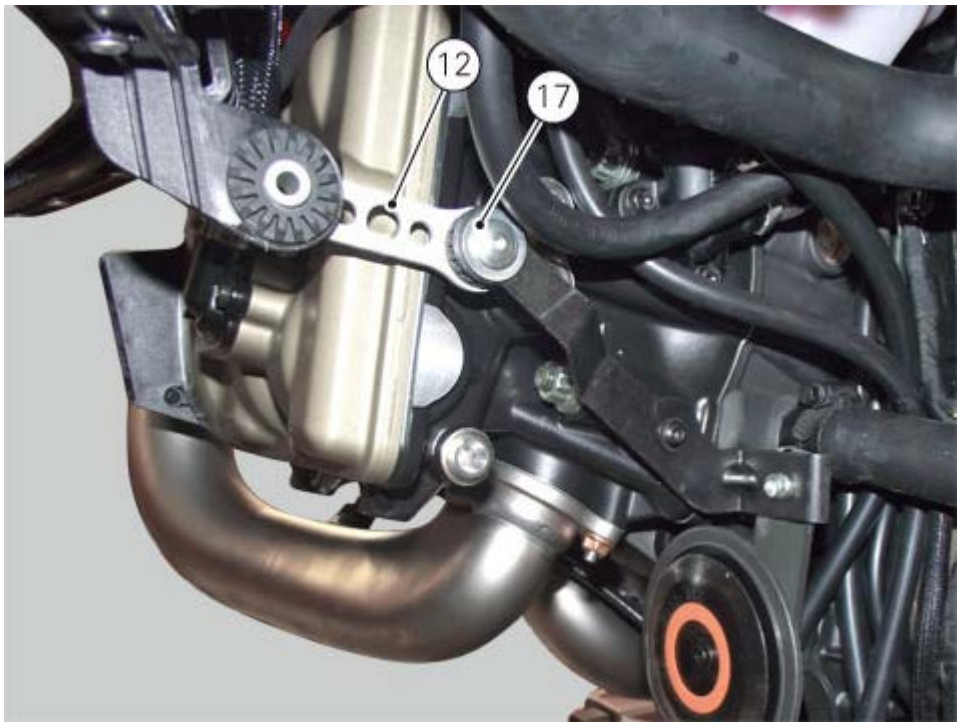
- vibration damper (11) on bracket (12).



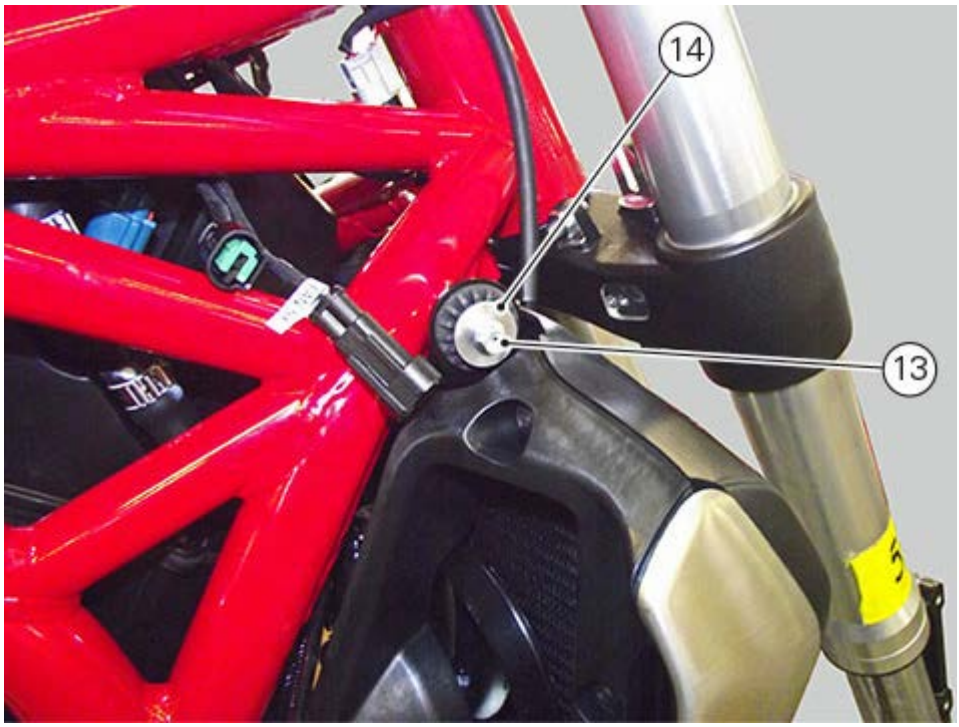
Insert the radiator support inside pin (15).
Lubricate pin (15) with specified product.

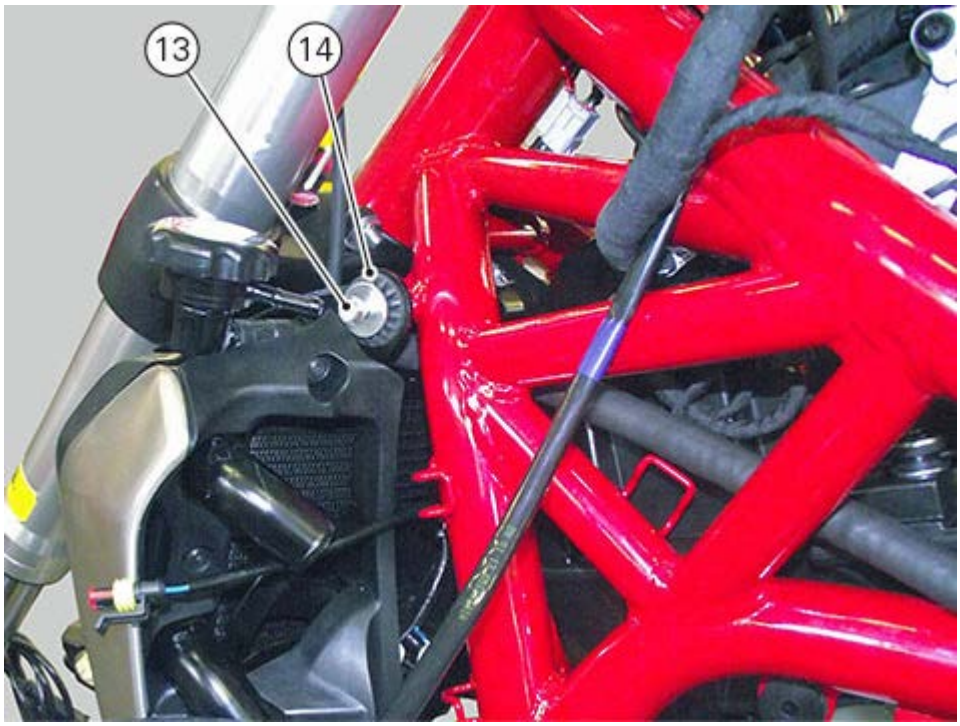


If, on the contrary, radiator is removed together with bracket (12), position it inside its seat and tighten screw (17) to a torque of 5 Nm ±10% inside threaded pin.

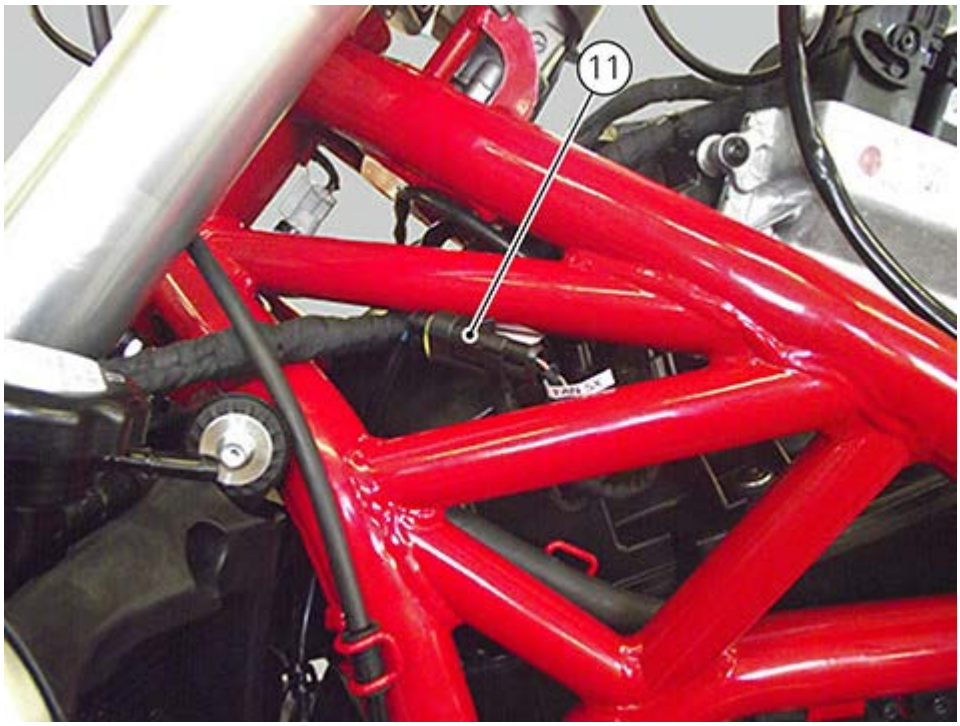


Start screws (13) with spacer (14) on the left and right sides.
Tighten the screws (13) to a torque of 10 Nm ± 10%.

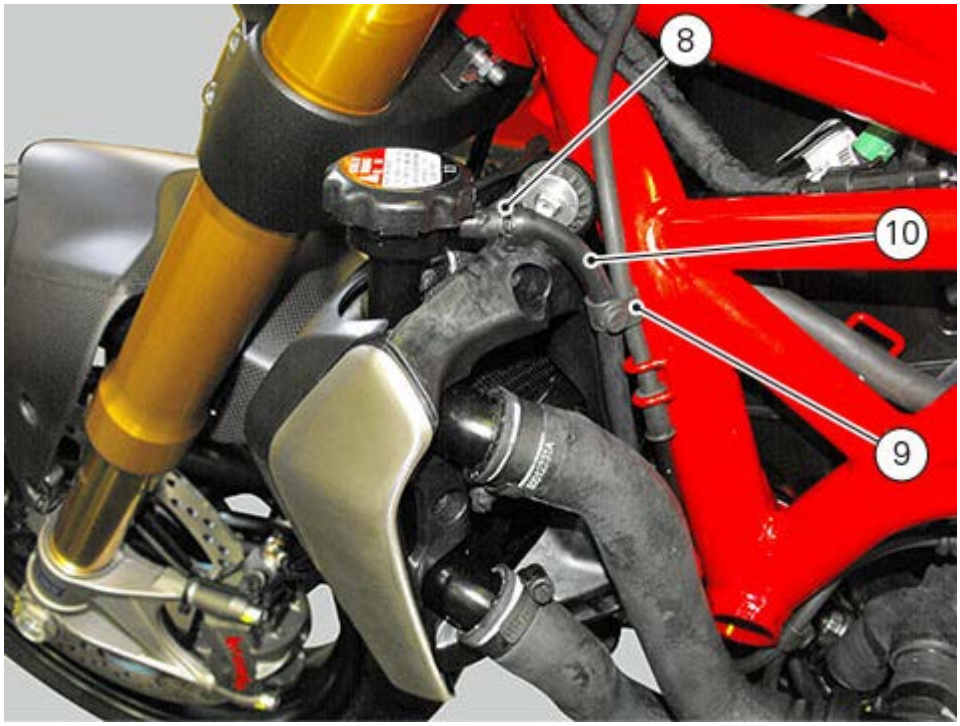




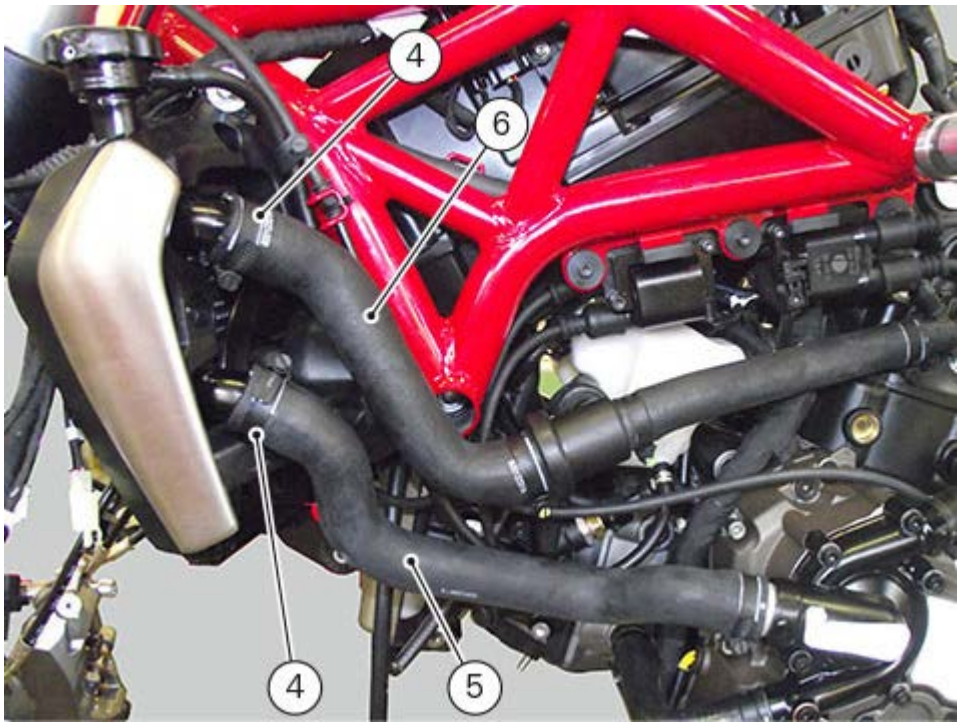
Connect the electric fan RH (12) and LH (11) connector to the main wiring.



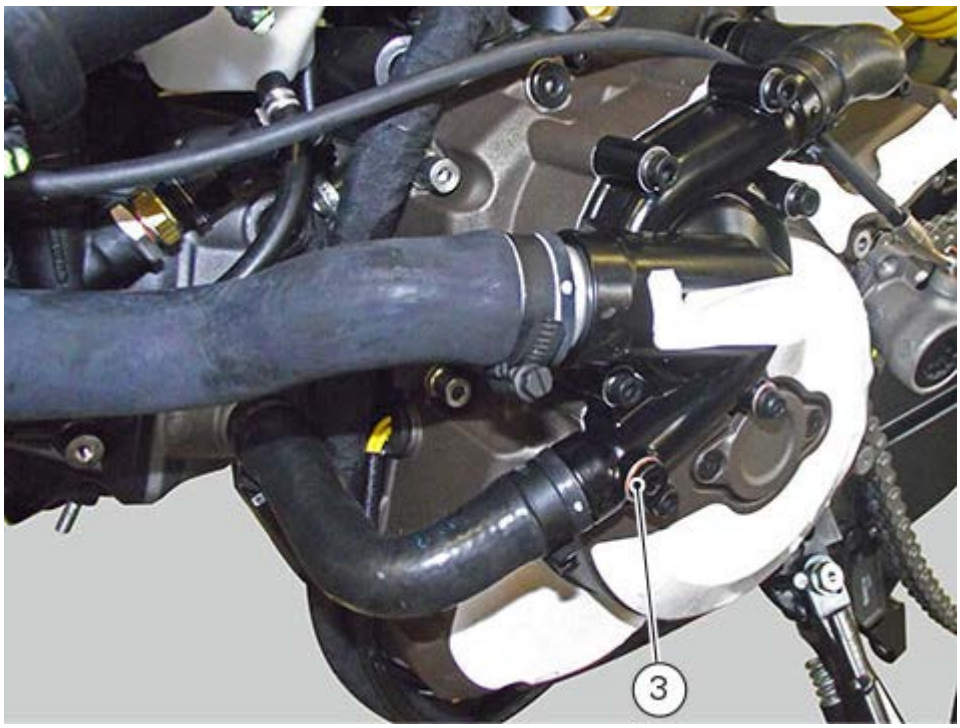
Connect the breather pipe (10) and fix it with ties (8) and (9).



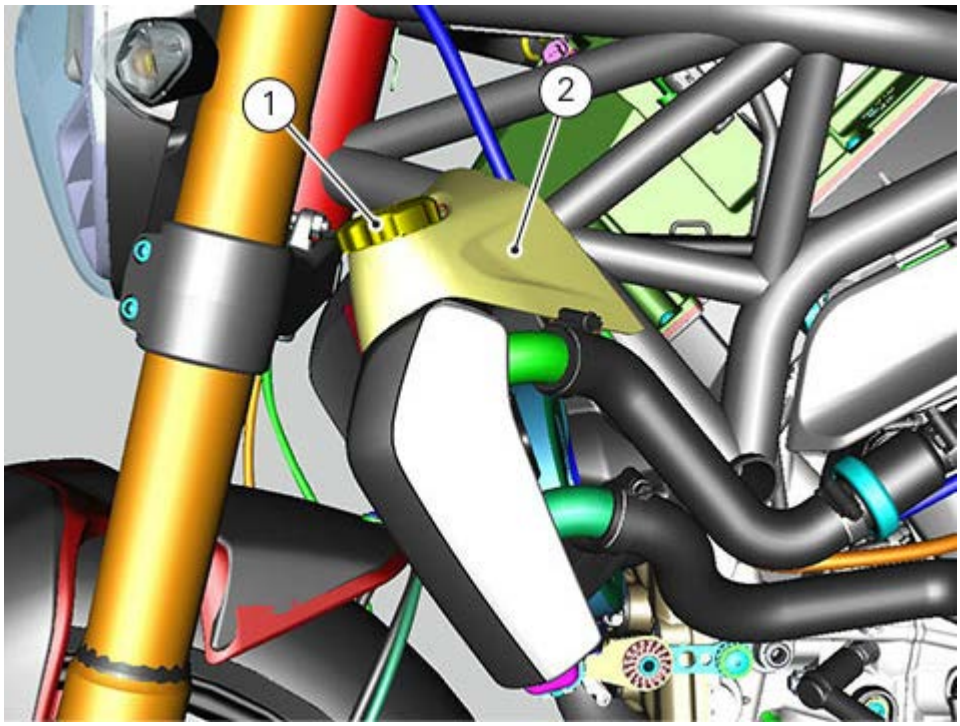
Insert the cooling system pipes (6) and (5) in the relevant unions on the radiator and tighten clamps (4) to a torque of 2.5 Nm ± 10%.



Tighten plug (3) to a torque of 15 Nm (Min. 13.5 Nm - Max. 16.5 Nm).

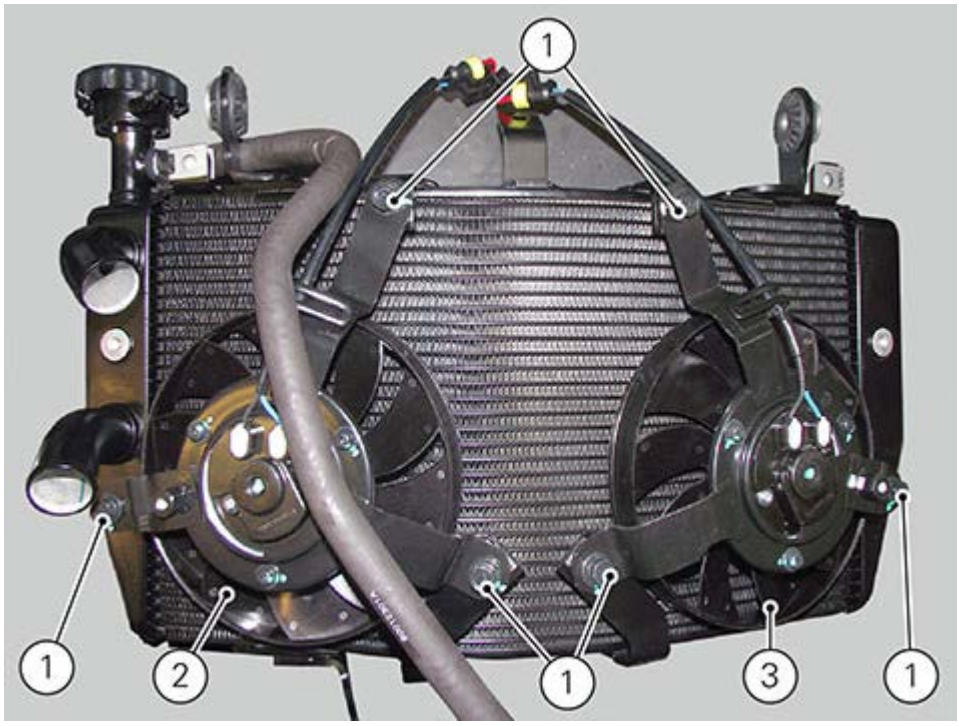


Position cover (2), fill and drain the cooling system and screw radiator plug (1) (Changing the coolant).



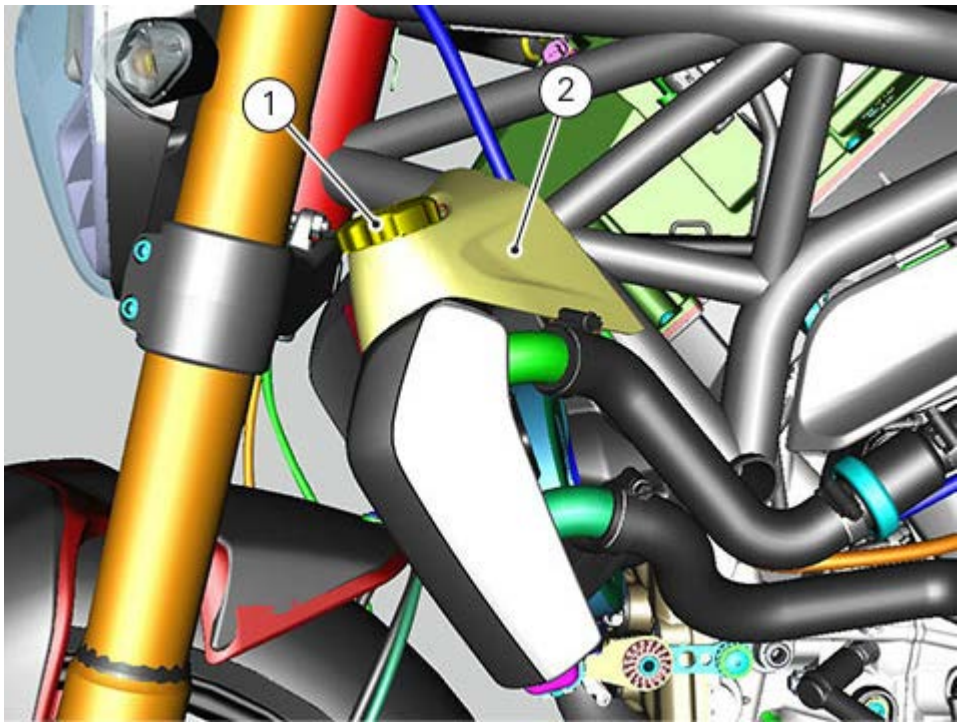
Replacing the electric fan

Remove the radiator cover (Removing the water radiator).
Loosen the three screws (1) retaining the electric fans (2) and (3) from the radiator and note the screw position.
Upon refitting, tighten the screws (1) (with pre-applied threadlocker) after inserting them in their original positions.
Refit the radiator covers (Refitting the water radiator)

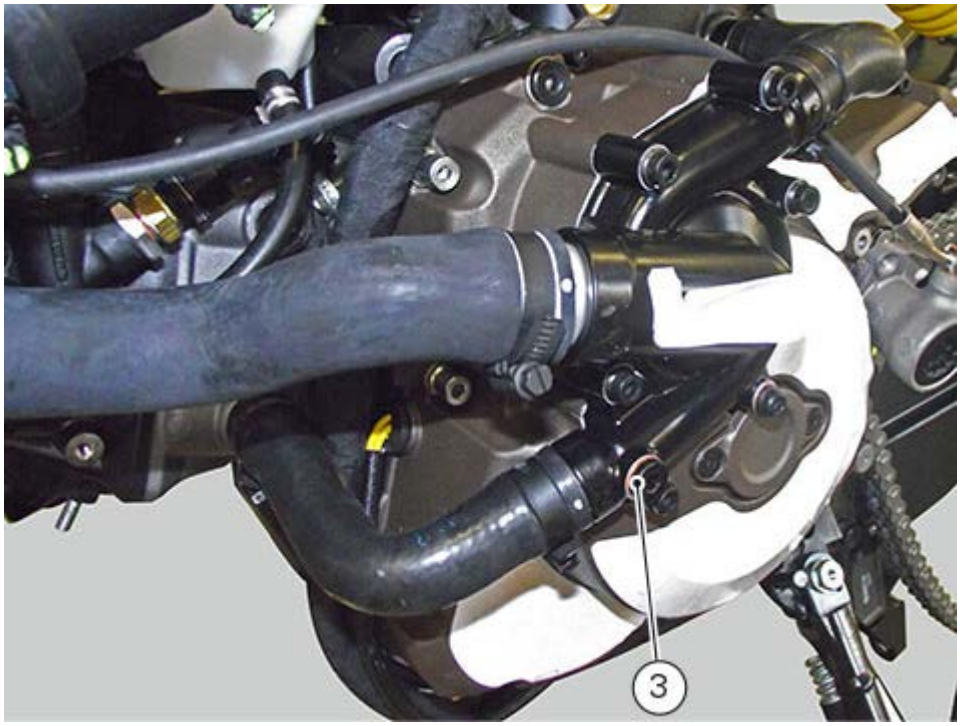


Removing the radiator

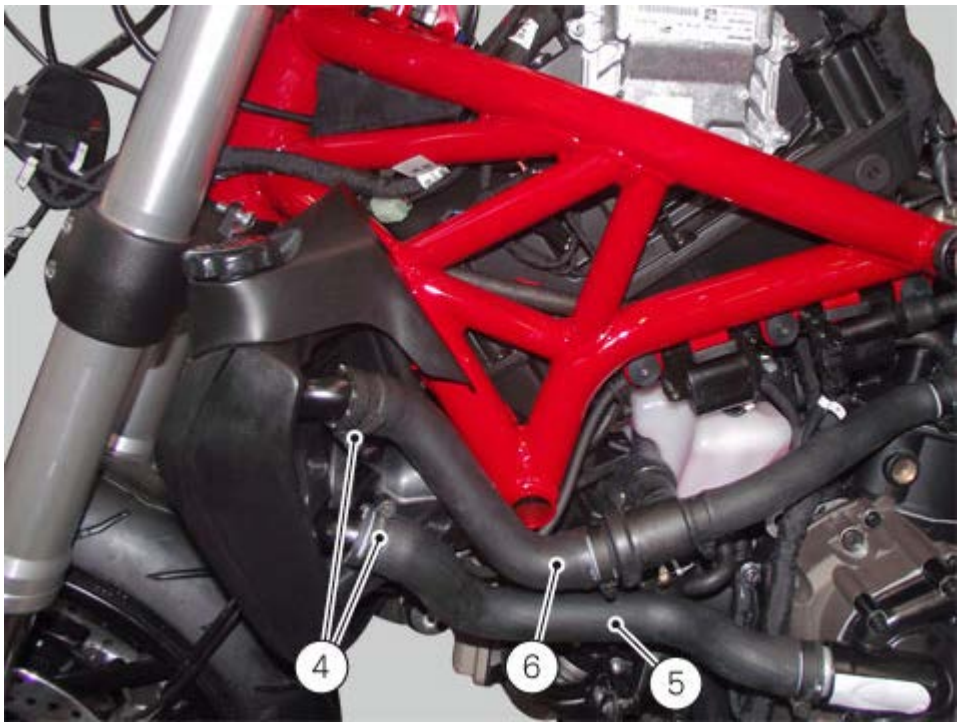
After removing plug (1), slide out cover (2).



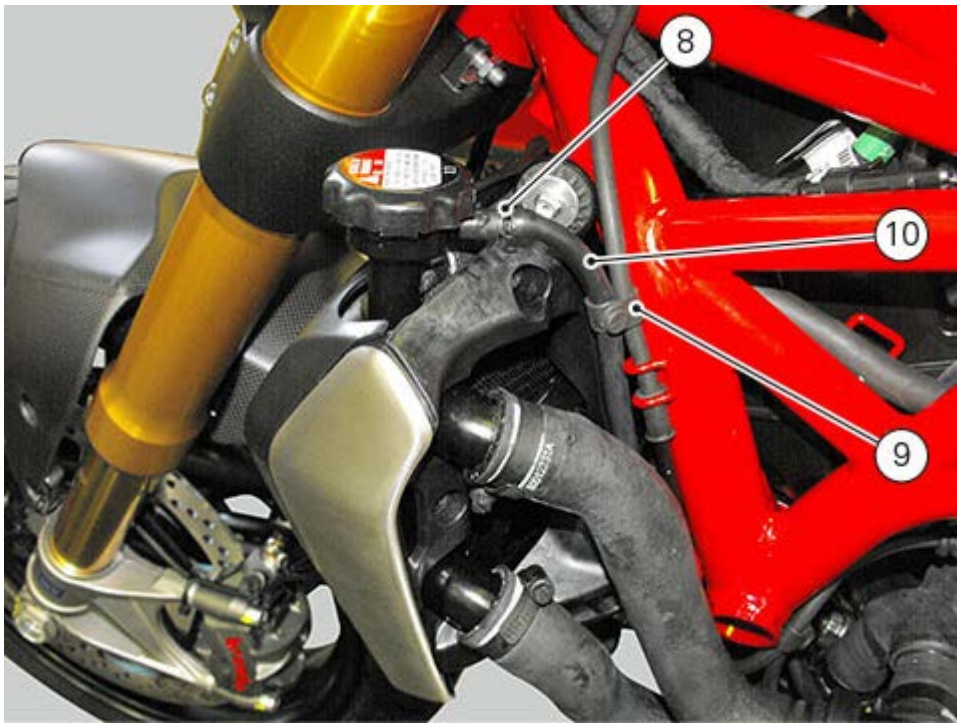
Loosen plug (3) and drain the coolant in a suitable container.



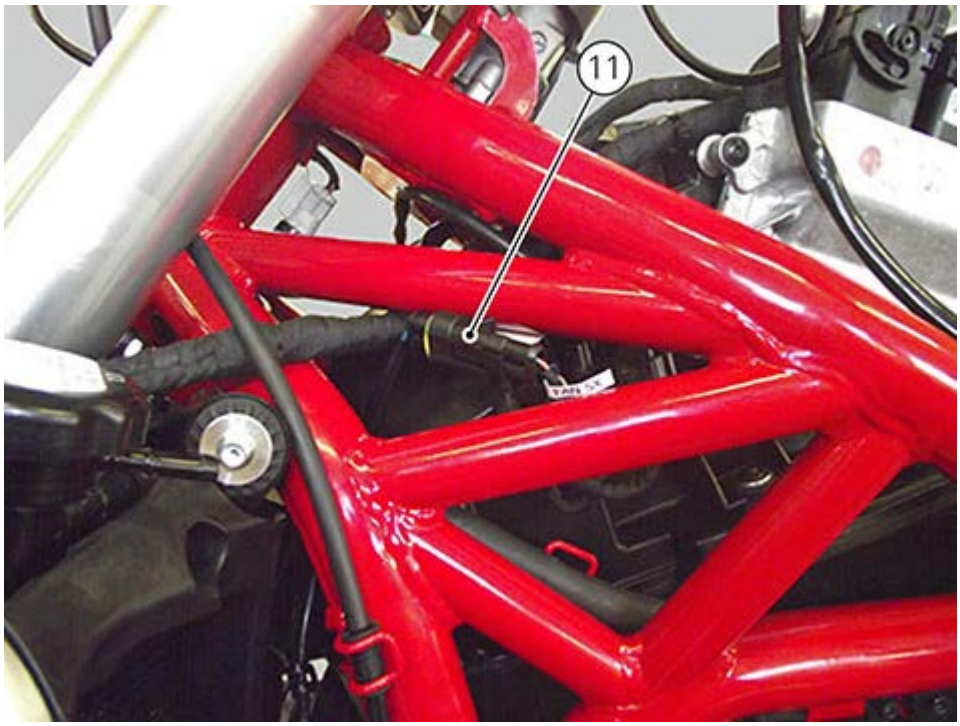
Loosen clamps (4) of water pipes (5) and (6) and slide them out of the radiator unions.

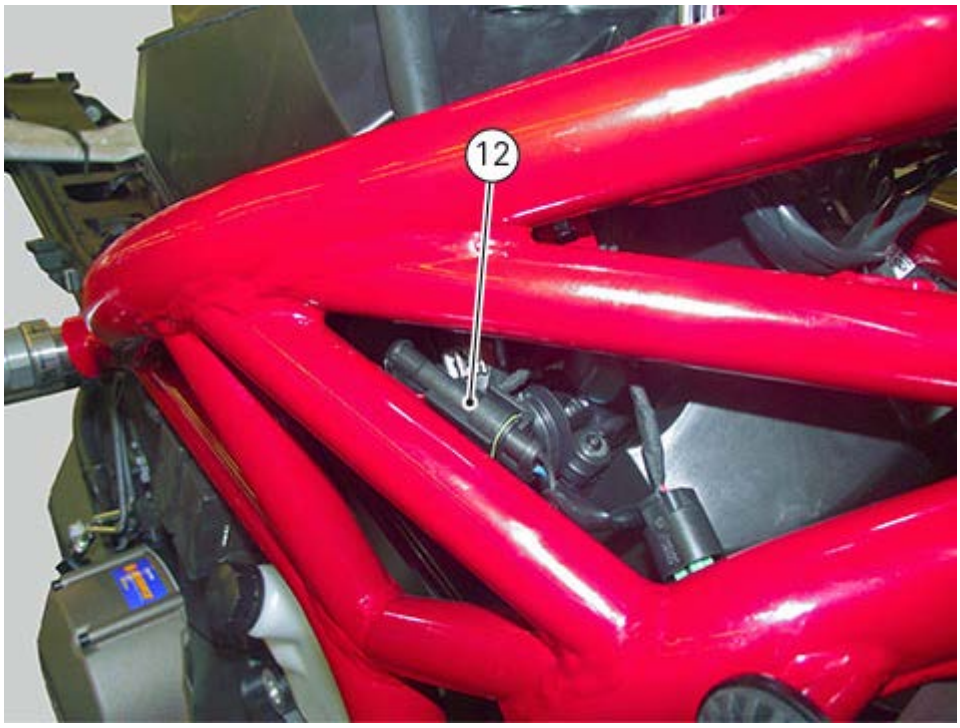


Slide clamp (8) out and remove tie (9).
Disconnect the breather hose (10).

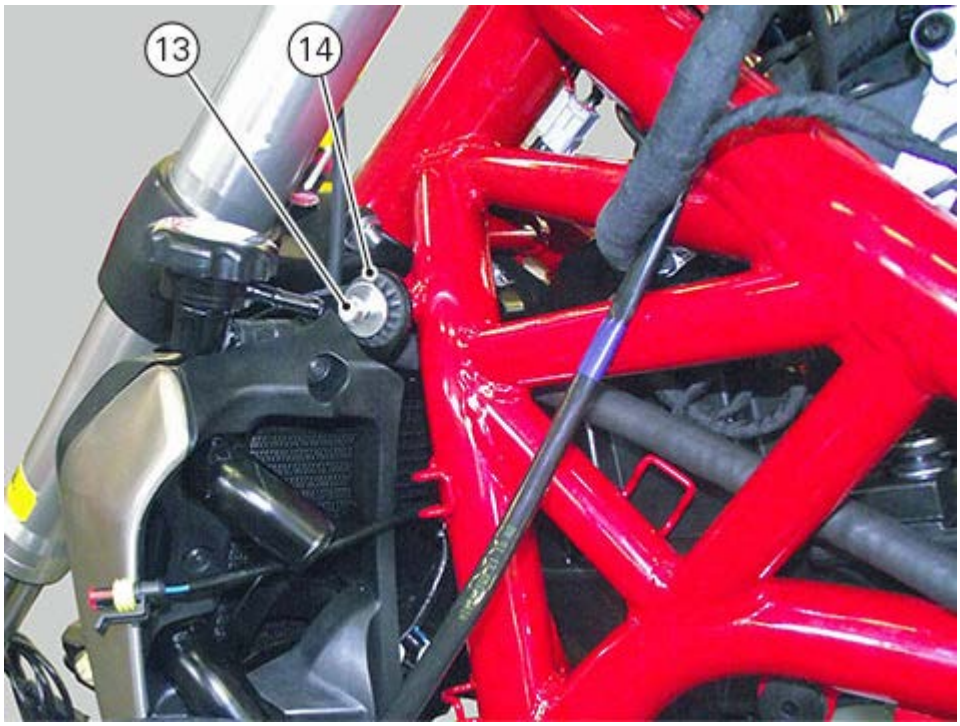


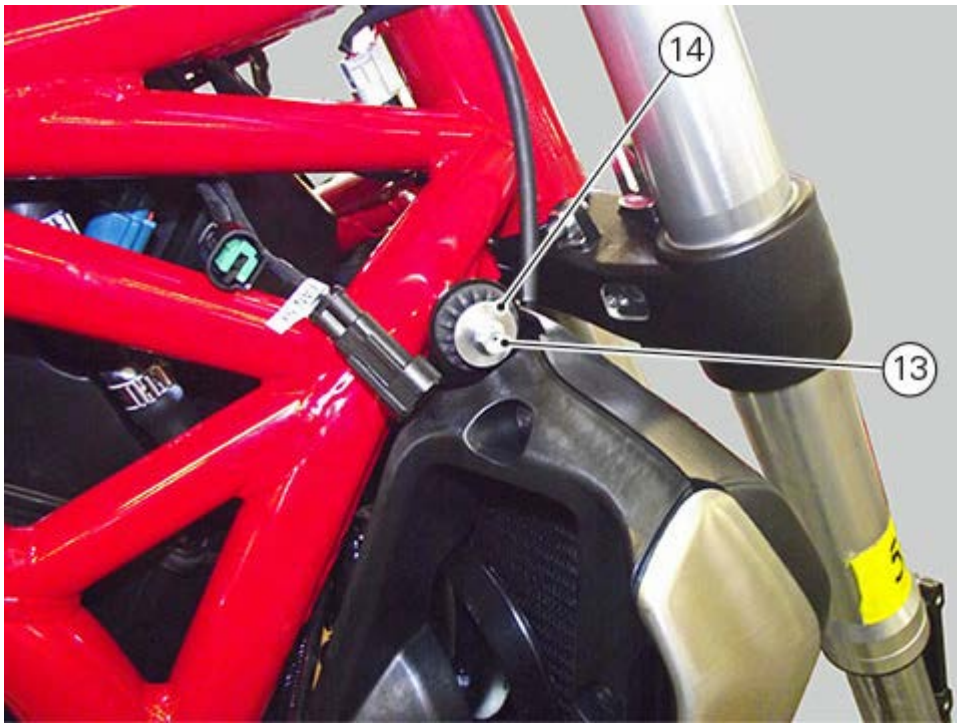
Disconnect the LH (11) and RH (12) connections of both electric fan main wiring.



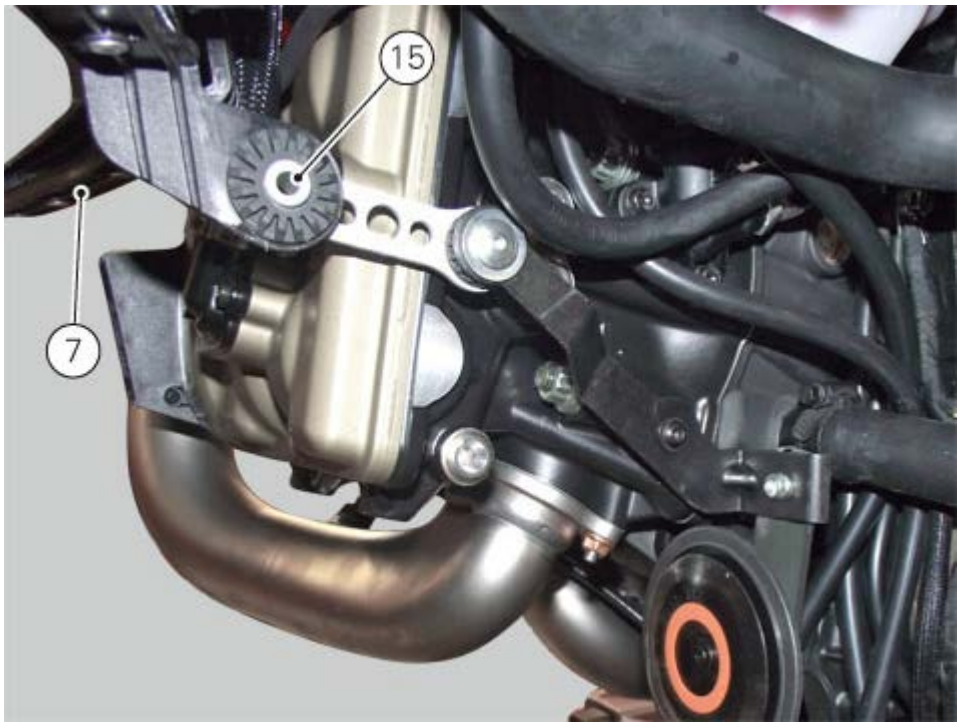


Working on both sides, loosen screws (13), and collect spacers (14).

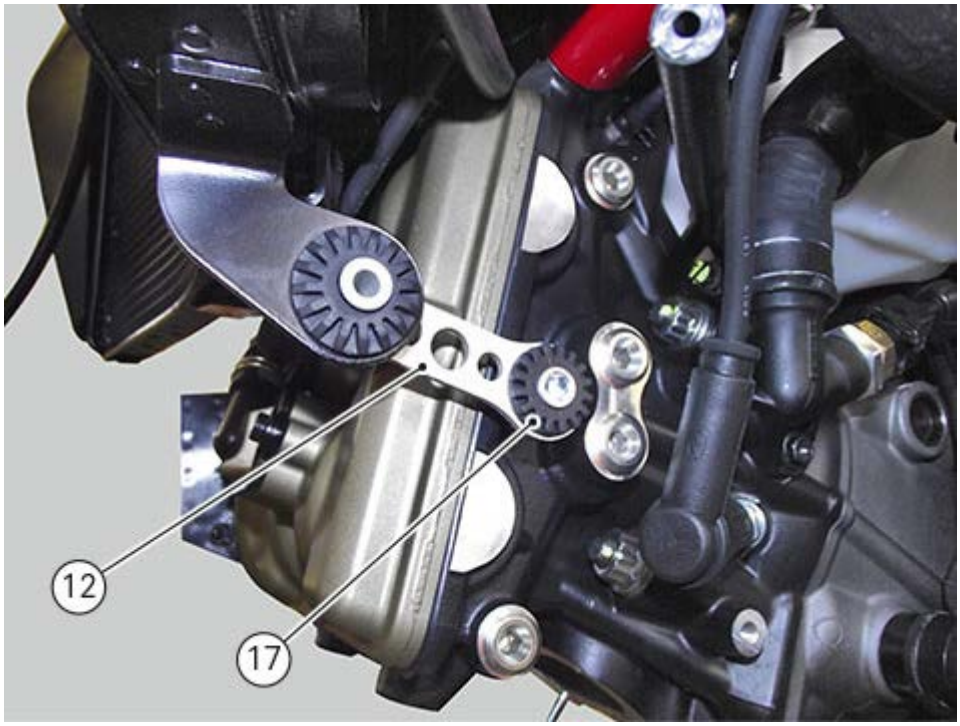




Remove water radiator (7) from the vehicle by disengaging it from pin (15).



As an alternative, you can remove radiator (7) by loosening bracket (12) retaining screw (17).



Inspecting the water radiator

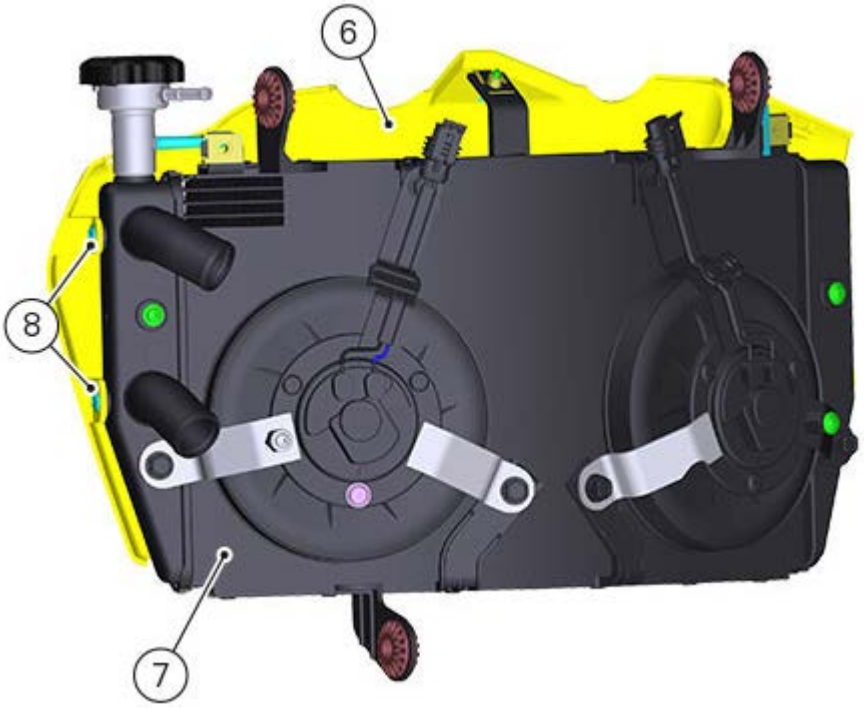
Visually inspect the cooler. Replace it at any sign of damage or leaks. Check also that the air flow through the radiator fins are not obstructed by leaves, insects, mud, etc.

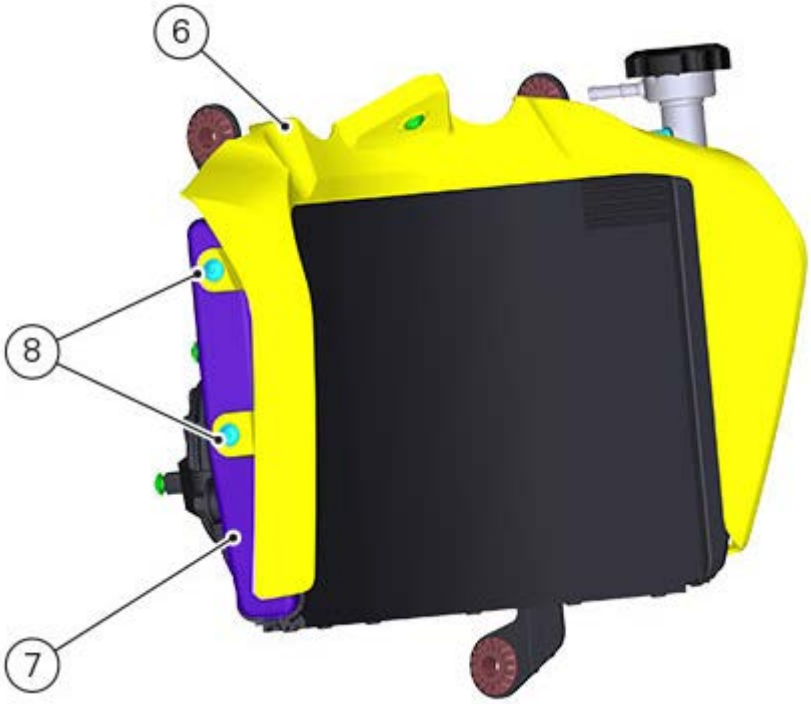
Important
Excessive coolant temperature can be caused by a partial obstruction of the radiator fins.

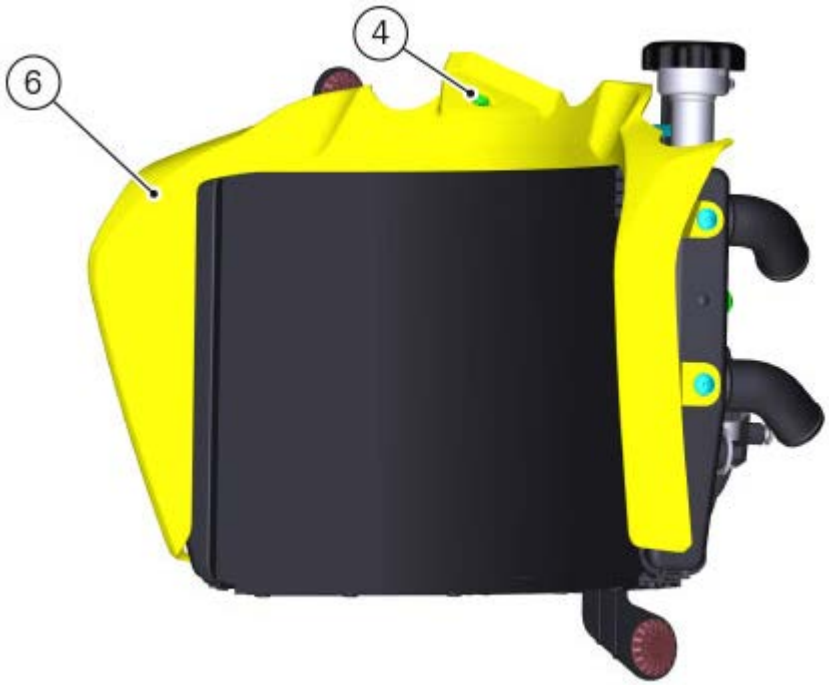
Carefully check the condition of the radiator fins.

If necessary, disassemble the radiator as described below.
Following the same procedure on both sides, loosen the three screws (1) and remove the left (2) and right (3) covers.

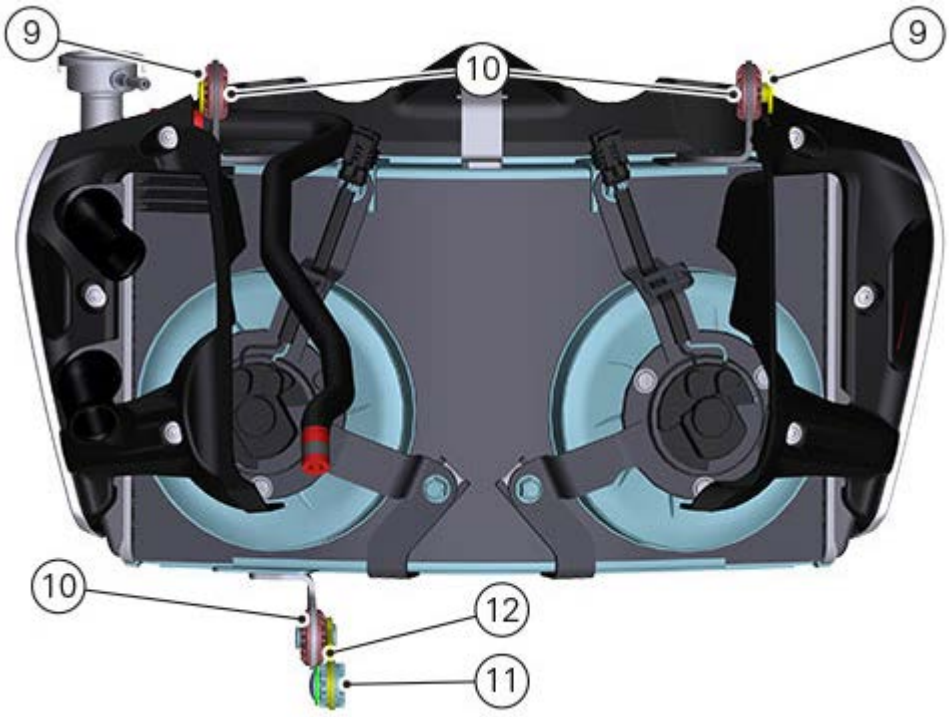
To remove the front cover (6), loosen screws (8) on both sides of radiator (7) and front screw (4).





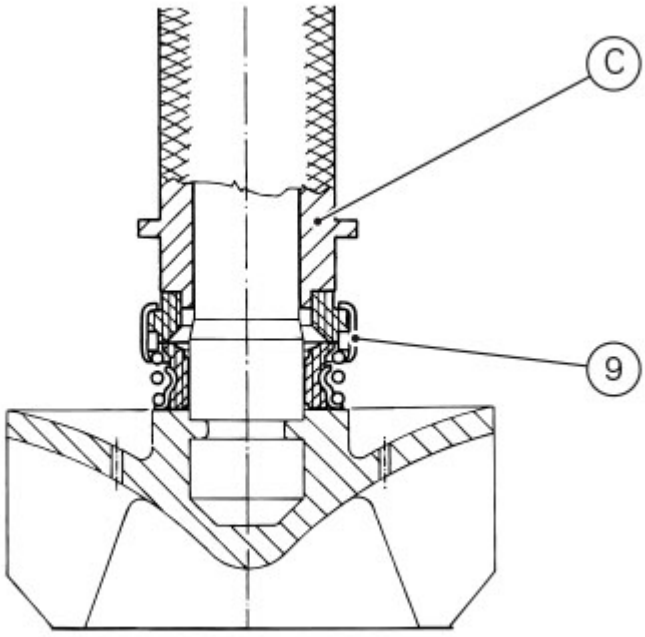


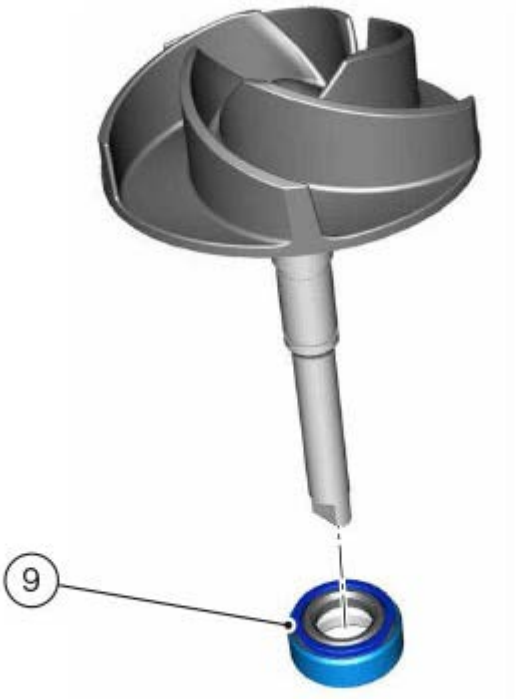
If necessary, remove spacers (9) and vibration damping pads (10) and (11).
Slide off bracket (12).



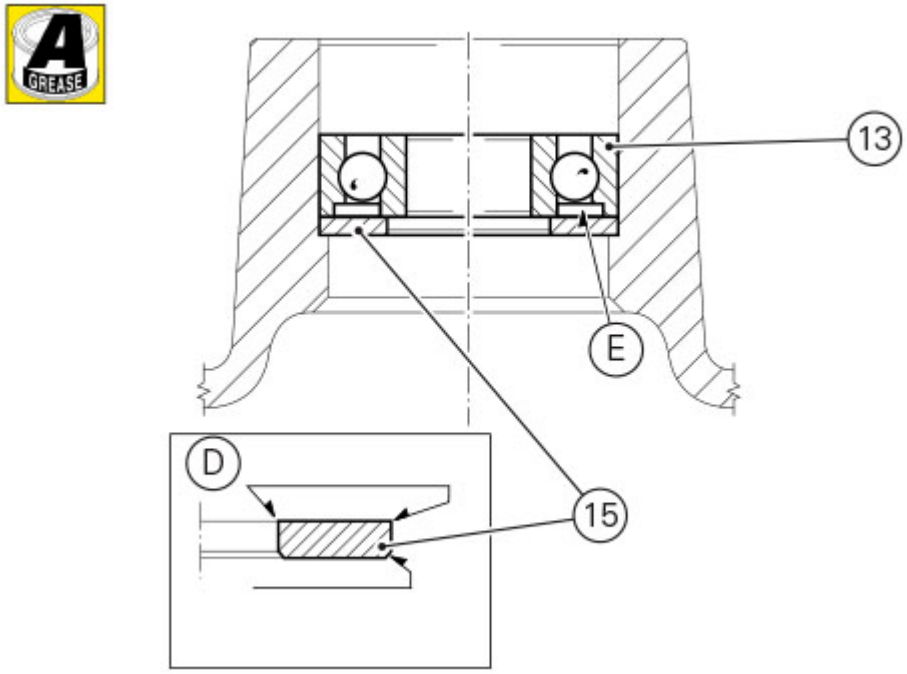
Refitting the water pump

Clean the seat in the cover, any parts you intend to reuse, and the impeller shaft. Lubricate with engine oil and refit as follows.
Lubricate the seal with the specified product.
Use drift (C) no. **88713.0869** to fit the new mechanic seal (9) on the impeller shaft.

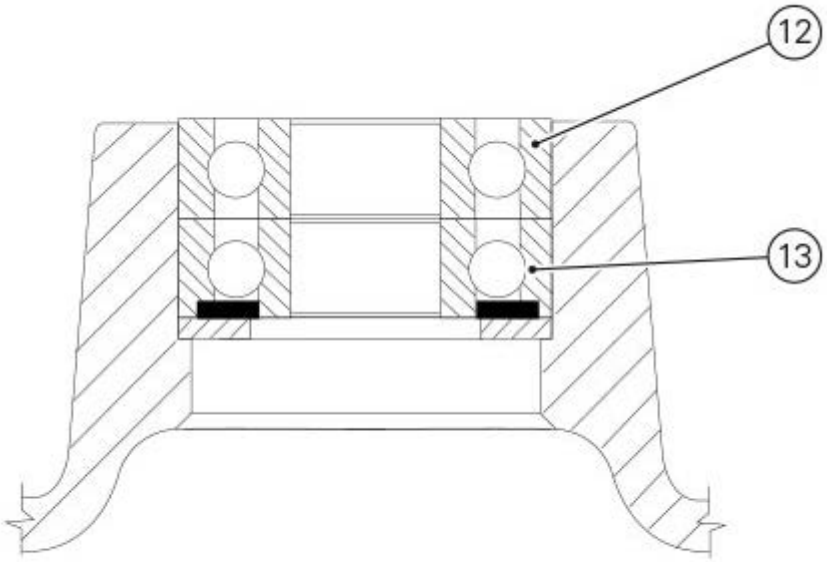




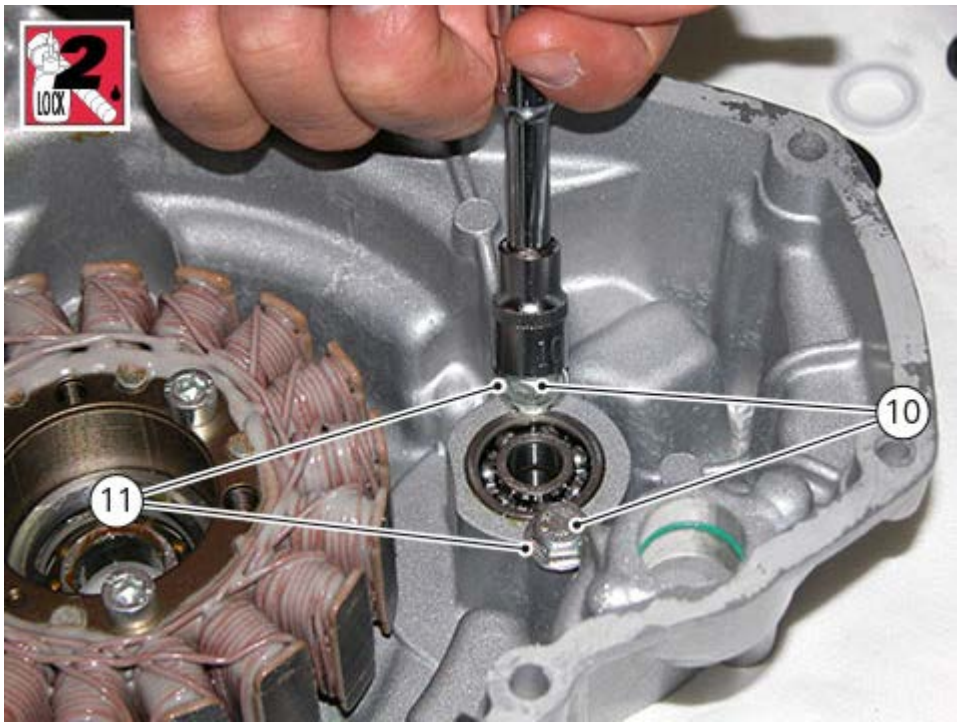
After having applied the indicated product on bearing seat sides, work on cover inner side and fit inner spacer (15) with the sharp edge side (D) facing outwards. Using a suitable drift working on the outer ring, drive bearing (13) - with the shielded side (E) facing the cover - fully home on the spacer (15).



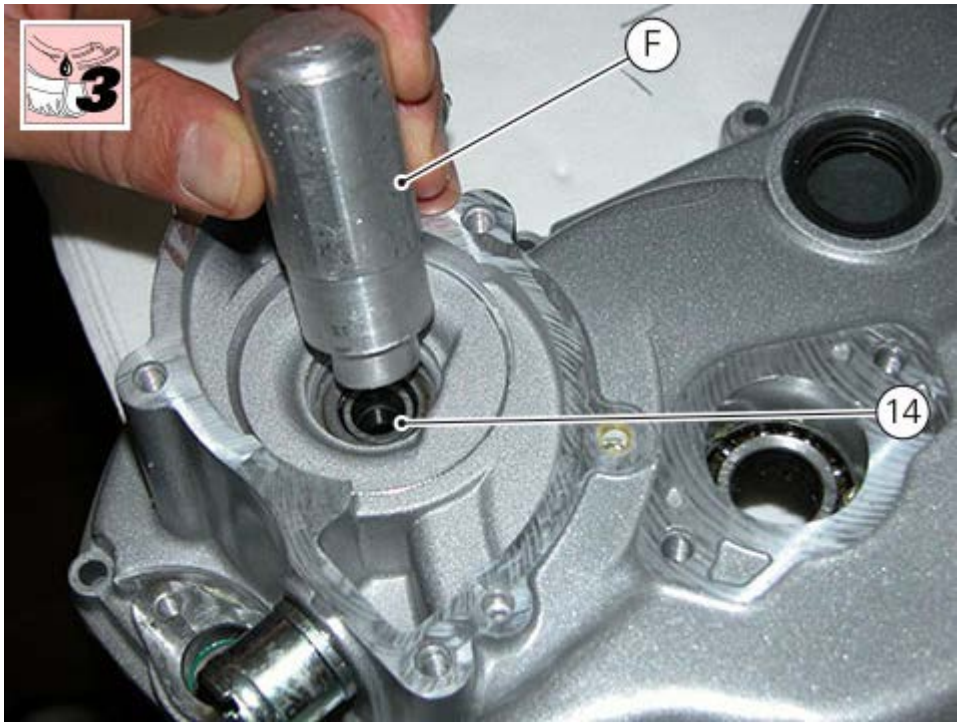
Fit the other bearing (12), driving it fully home on bearing (13).

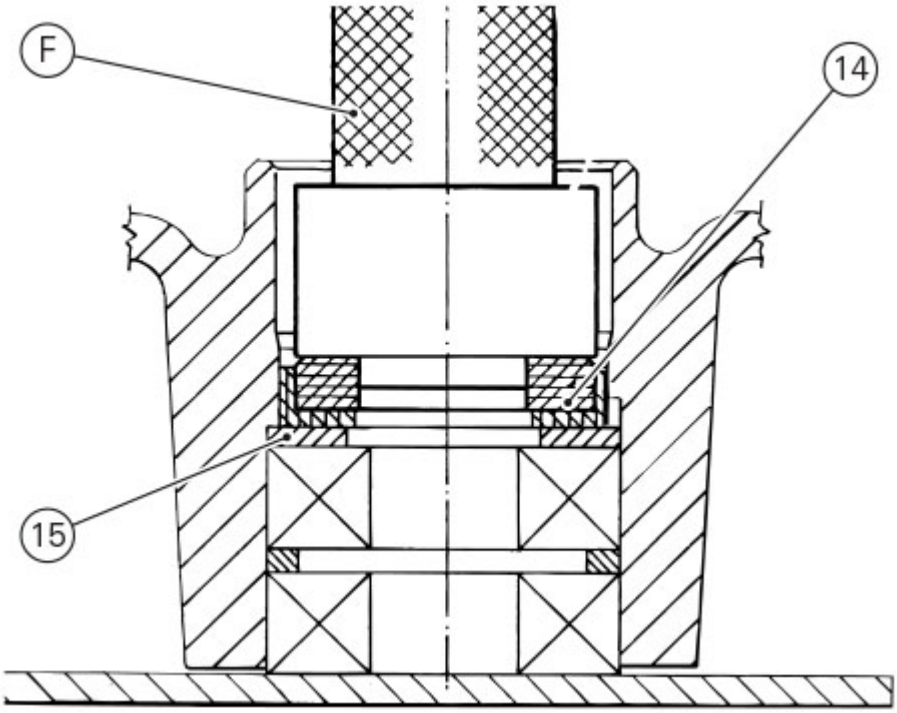


Apply the recommended threadlocker on the screws (10).
Fit the two screws (10) with the washers (11), and tighten to a torque of 10 Nm (Min. 9 Nm - Max. 11 Nm).



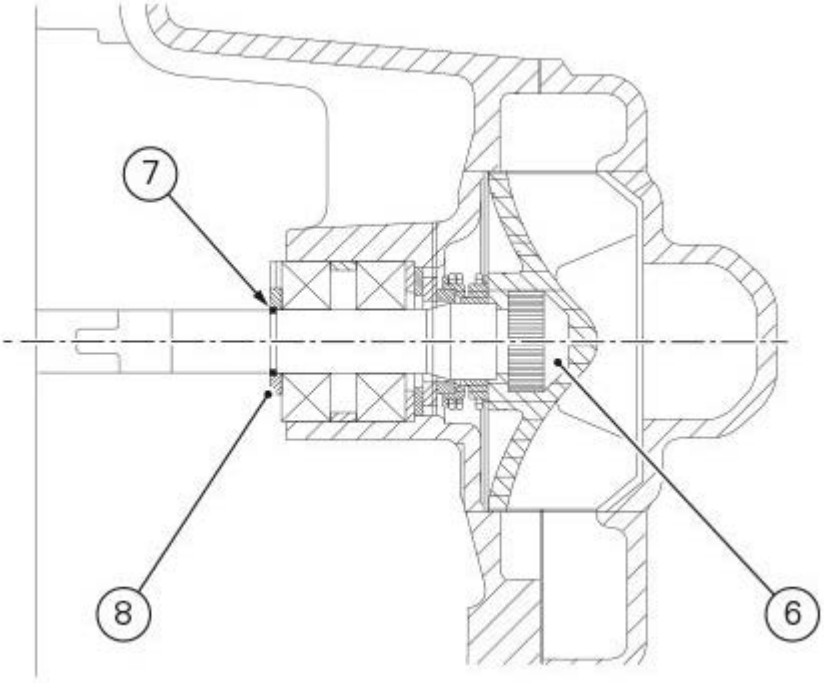
Turn the cover upside down and use drift (F) no. **88713.0870** to install counter-washer (14) fully home on spacer (15).
Counter-washer (14) must be positioned so that the white side is facing upwards.
Clean counter-washer (14) with the specified product.



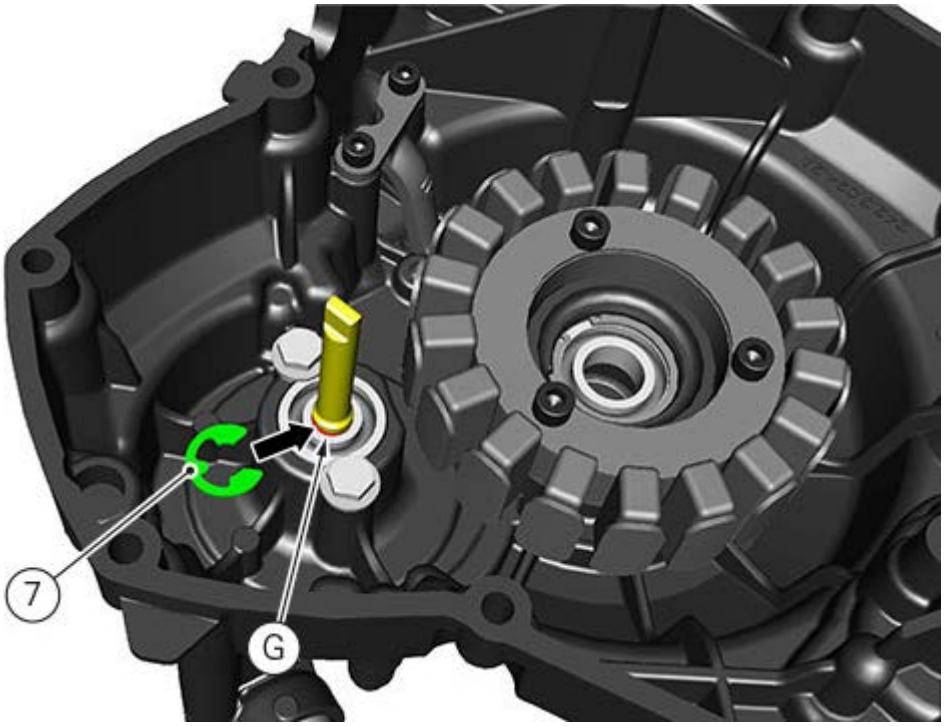


Fit the impeller shaft (6) with the previously installed mechanical seal (9).

Insert the spacer (8), aimed as shown in the figure, and lock in place with the snap ring (7) duly inserted inside seat (G).
Turn the impeller (6) and make sure that it can rotate freely, without excessive resistance.
Clean the mating surface thoroughly on the pump cover and on the generator cover.

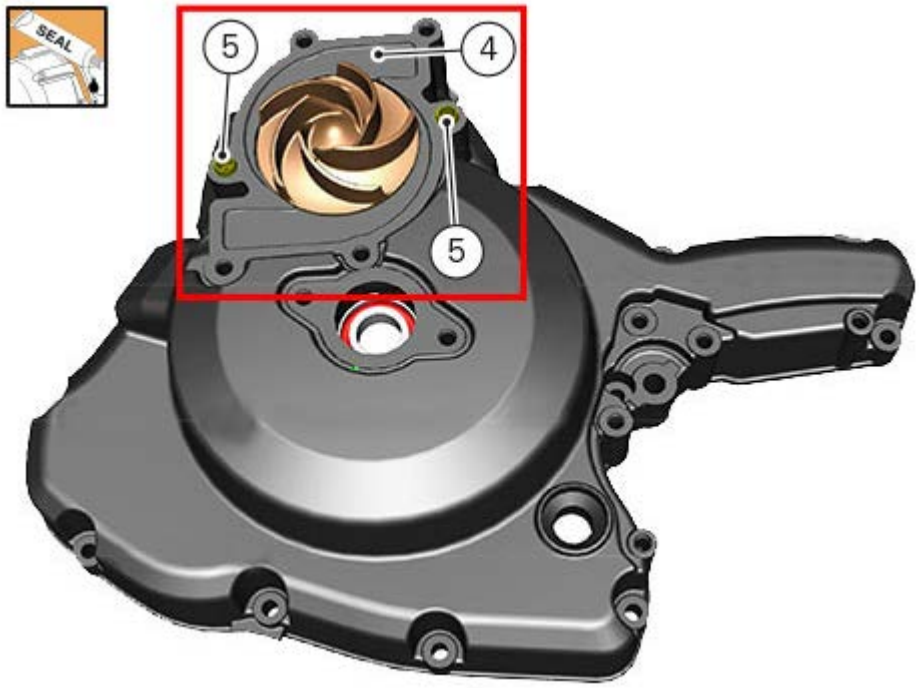


Snap ring (7) must be inserted in the suitable groove (G) on the impeller shaft.

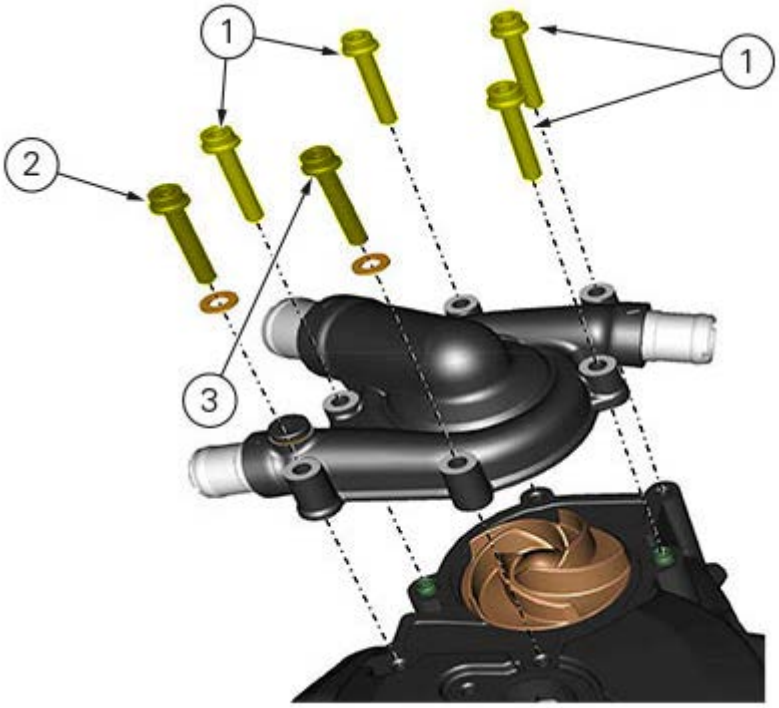


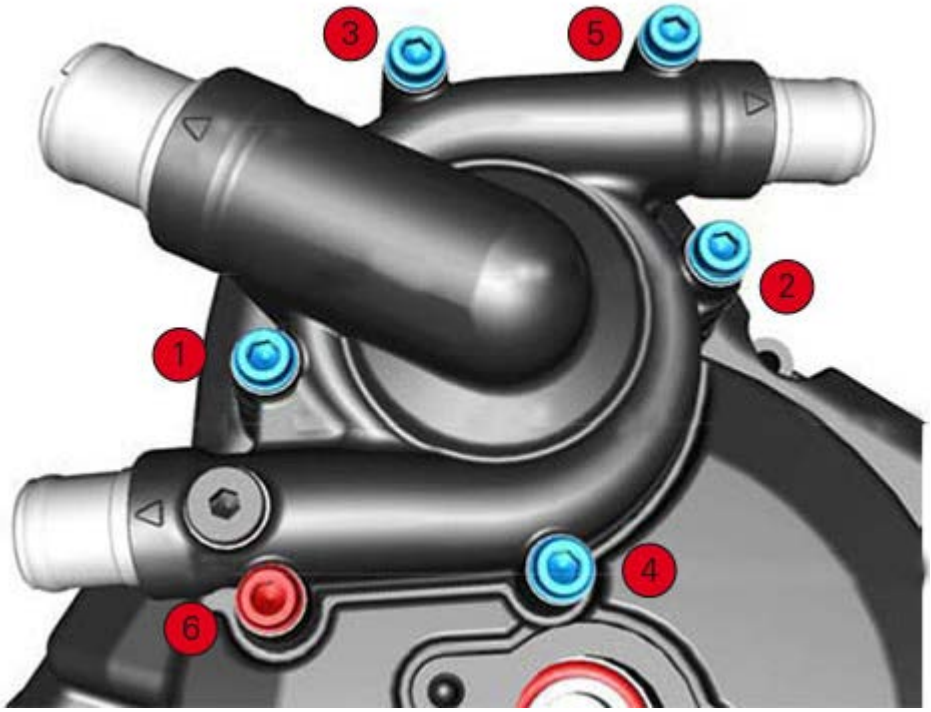
Duly clean with a suitable degreaser the mating profiles between pump cover (3) and generator cover.

Apply a bead of sealing compound on the perimeter of water pump cover on casing as shown in the figure. Fit bushes (5) and position the cover (3) on the generator cover.



Start screws (1).
Insert the screws (2) and (3) with their relevant washers.
Tighten the screws (1), (2) and (3) to a torque of 13.5 Nm (Min. 12.5Nm - Max. 14.5Nm).
Respect the sequence shown in the figure.
After tightening, remove any excess of threadlocker.





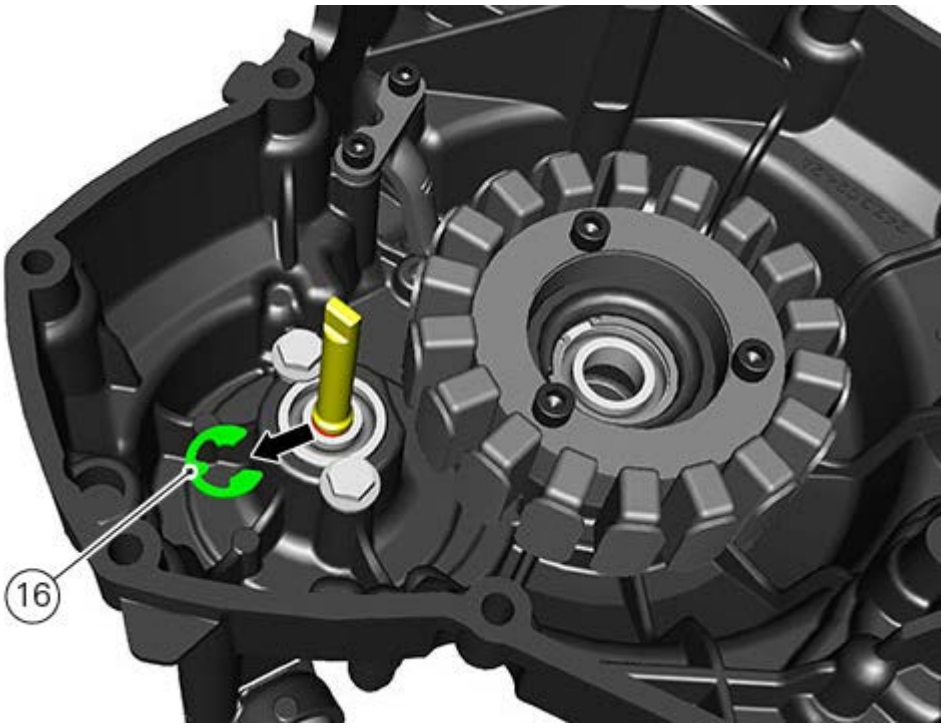
Fit the generator cover (Fitting the generator cover).
Refit the pump-cylinder hoses (Refitting the cylinder/piston assembly).
Fill the system with engine oil (Changing the engine oil and filter cartridge).
Refit the gear shift (Refitting the gear shift).
Refit the front sprocket cover (Refitting the front sprocket cover).
Fit the cooling system hoses on the water pump cover (Refitting cooling system hoses and unions).
Fill the cooling system (Changing the coolant).
Fit the lateral covers (Refitting the water tank).

Removing the water pump

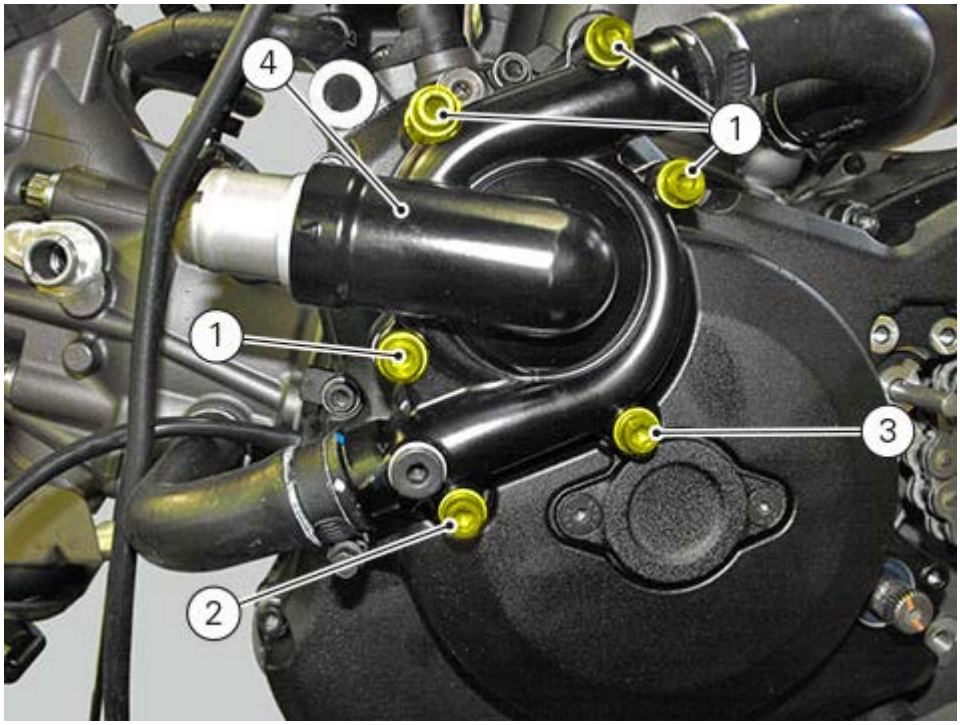
Drain the coolant (Changing the coolant).
Remove the cooling system hoses from the water pump cover (Removing cooling system hoses and unions).
Remove the front sprocket cover (Removing the front sprocket cover).
Remove the gear shift (Removing the gear shift).
Drain the engine oil (Changing the engine oil and filter cartridge).
Remove the pump-cylinder hoses (Removing the cylinder/piston assembly).
Remove the generator cover (Removing the generator cover).

Note
For clarity, the figures show the engine removed from the frame.

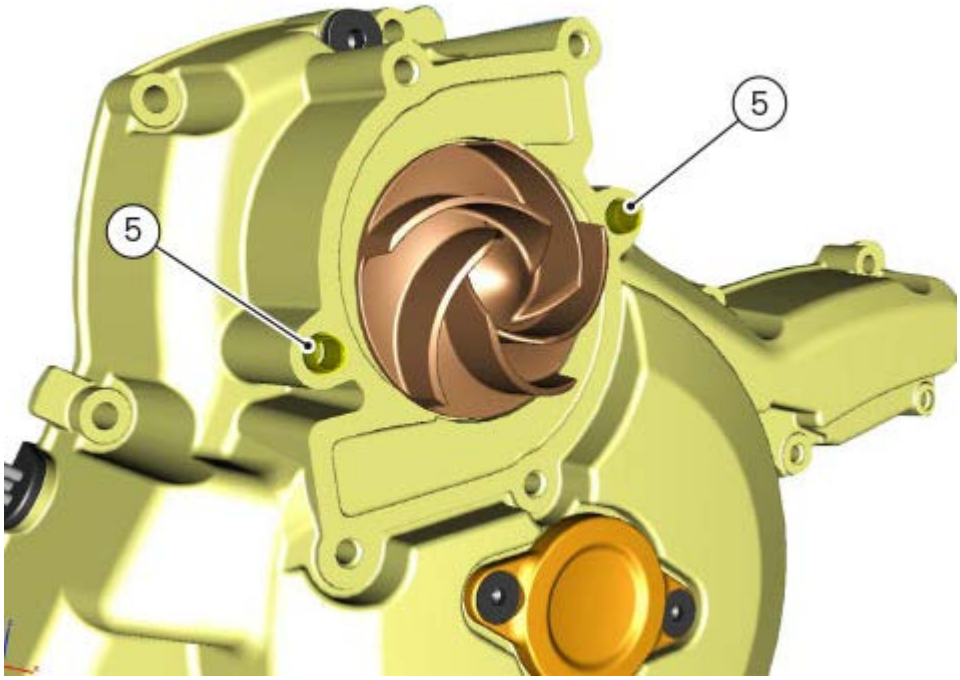
Remove the snap ring (16).



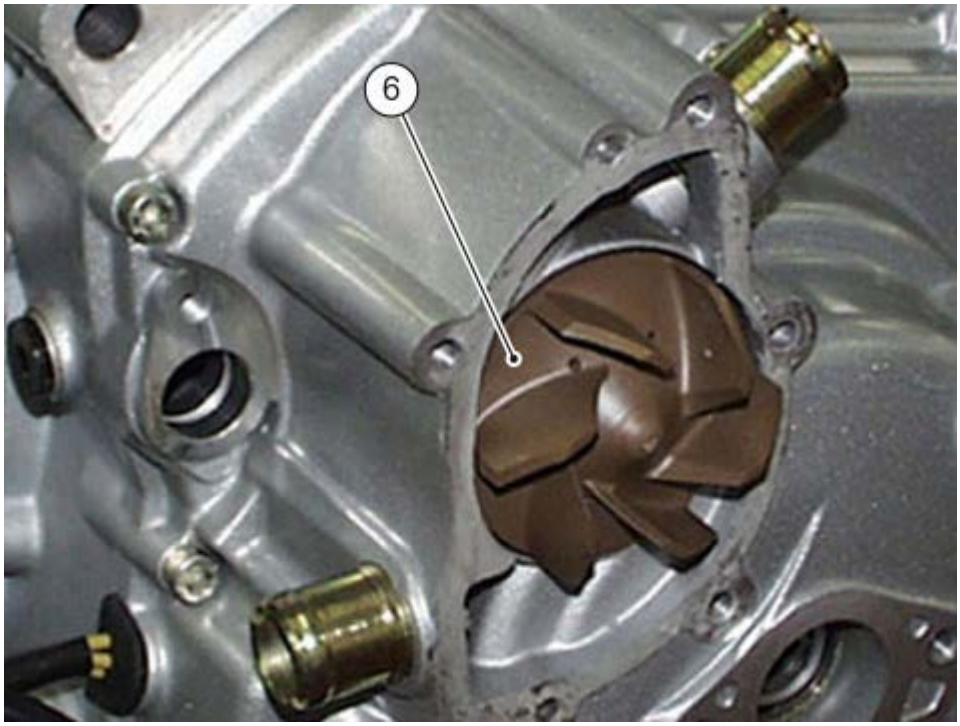
Loosen the upper screws (1) retaining the pump cover (4).
Loosen screws (2) and (3) and collect the relevant lower washers.



Slide out the water pump cover and collect the two bushes (5).

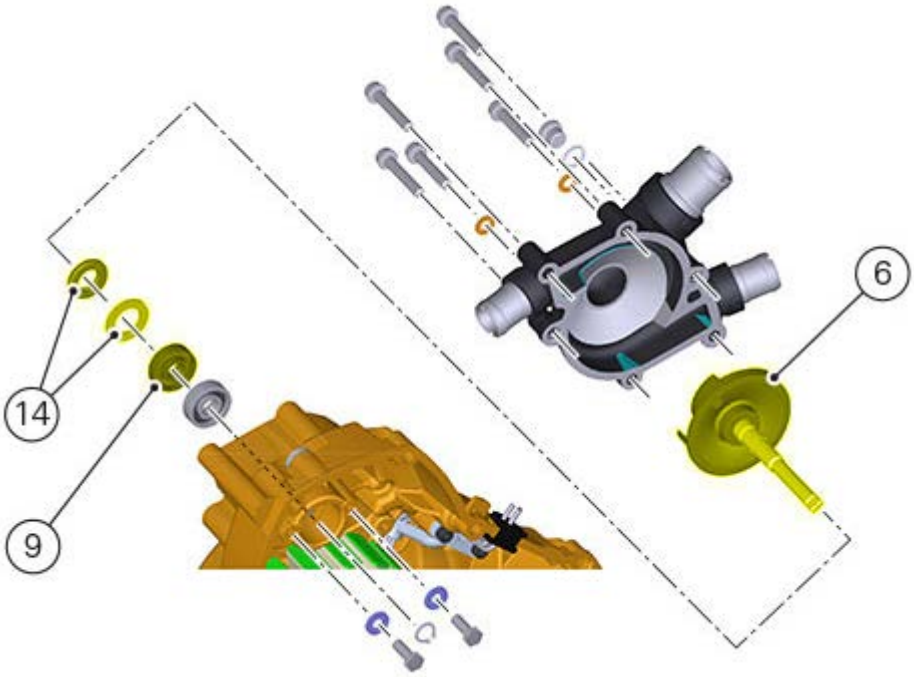


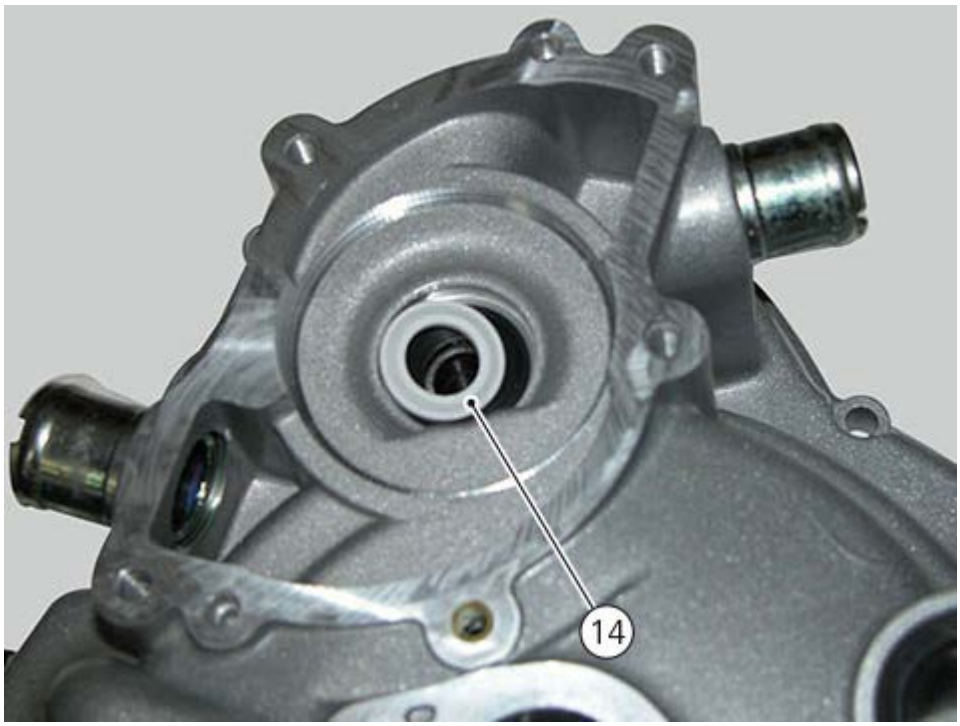
Clean the pump housing from any coolant scale. Check the bearing wear by turning the impeller shaft (6); in case of excessive clearance, it is necessary to replace them as follows.



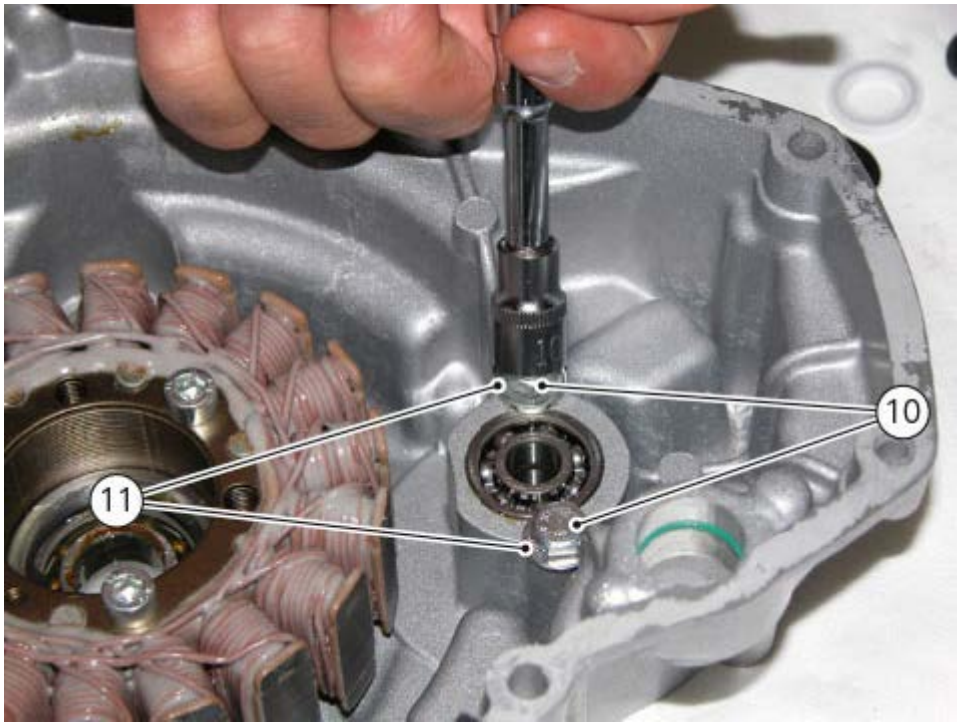
Remove the snap ring (7) from the impeller shaft, and the washer (8) underneath.
Slide off the impeller (6) with the sealing ring (9) from the outside.
Collect the ceramic washer and the seal ring unit (14).


7
8

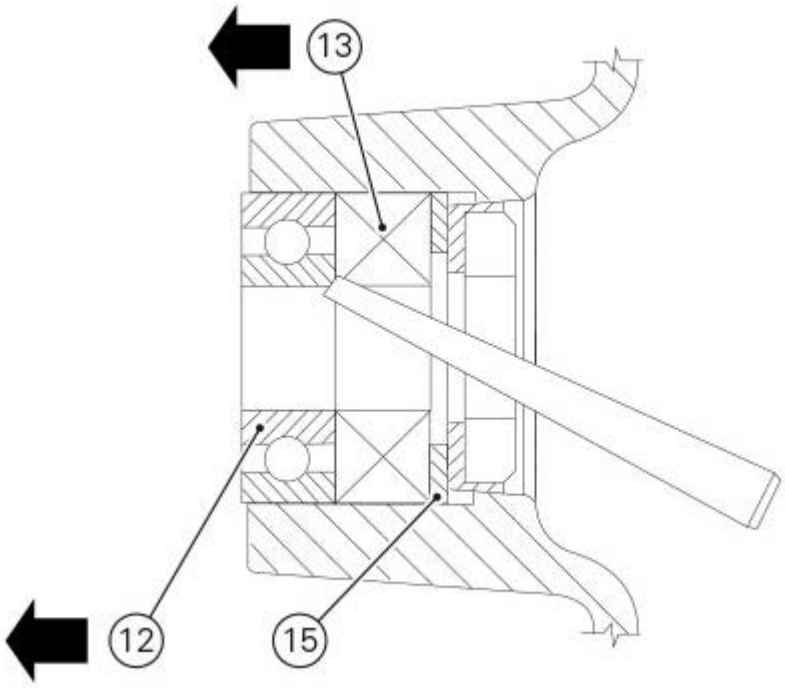

6
14
9



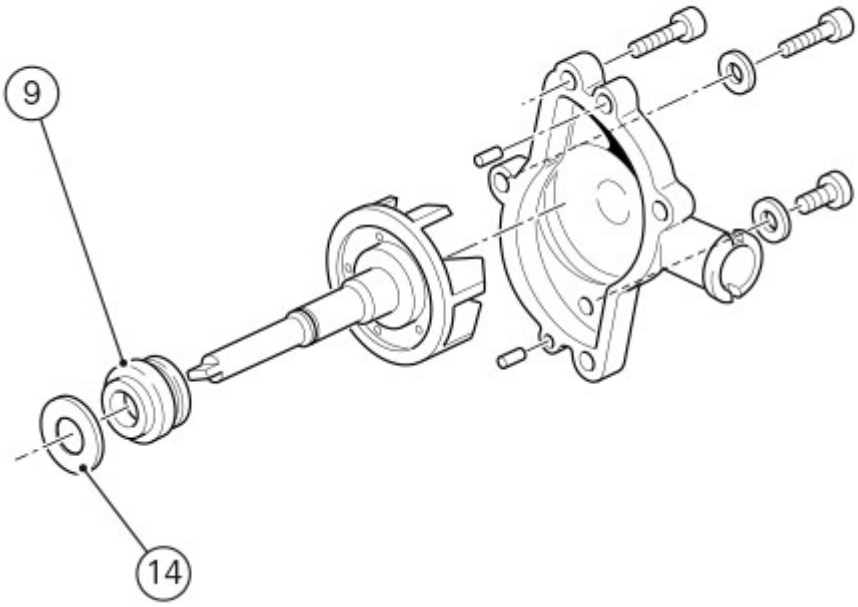
Undo and remove the screws (10) with the washer (11).



Working from the impeller side, use a suitable drift to press on the inner ring of end bearing (12) until it can be extracted from the cover.
Use the same technique to remove the other bearing (13).
Remove the inner spacer (15).



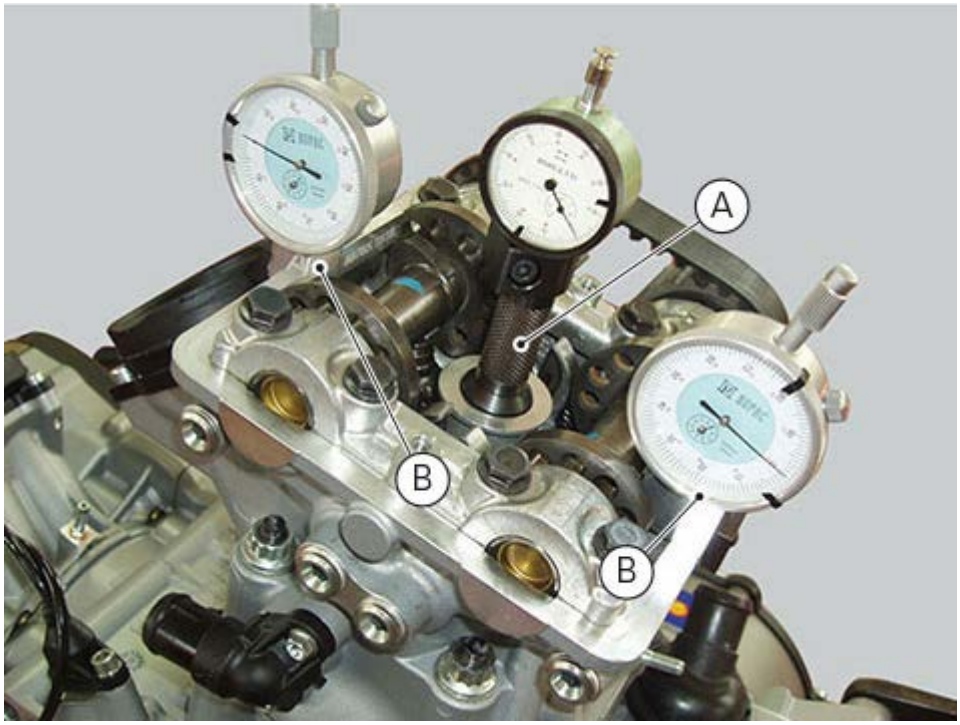
Check the condition of the mechanical seal components (9) and of the counter-washer (14): there should be no signs of deformation, cracking, or excessive wear.
In case of damage, both components must be replaced.

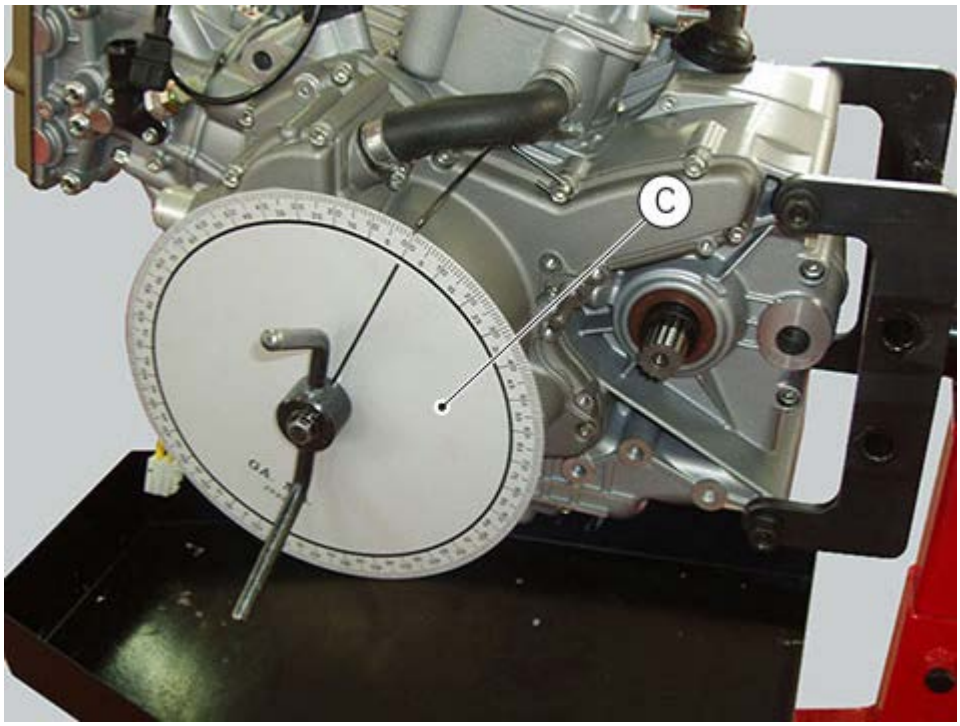


Checking the engine timing

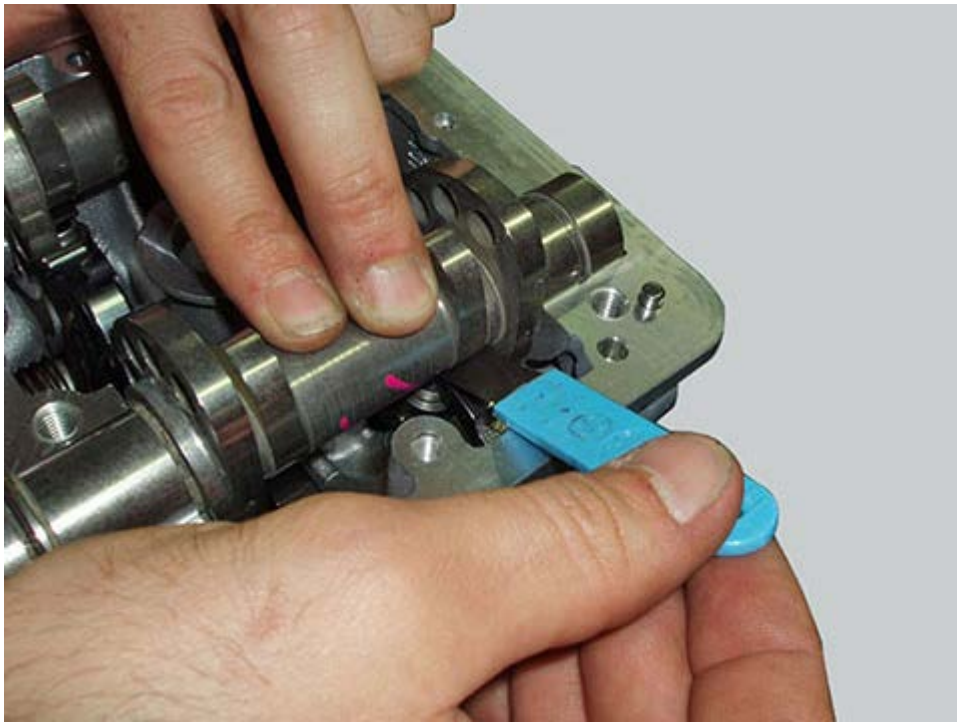
Remove the seat (Removing the seat).
Release the water radiator lower retainer and move it towards the front wheel (Removing the water radiator).
Remove the vertical head central exhaust pipe (Removing the exhaust system).
Remove the fuel tank (Removing the fuel tank).
Remove the airbox and throttle body, the blow-by, the oil breather pipe, the supply system and the injectors from intake manifolds (Removing the airbox and throttle body).
Remove the secondary air system pipes (Removing the secondary air system).
Release the ABS tubes and wiring from the wiring cover secured on vertical head (Routing wiring harnesses/hoses).
Remove the vertical head wiring cover (Checking the valve lift).
Disconnect the spark plug caps (Replacing the spark plugs).
Remove the cylinder head covers (Removing the camshafts).
Remove.
Remove the water radiator lower retainer from the engine (Removing the water radiator).

Set the engine to the condition described for the operation under "Checking and adjusting the valve clearance", indicated before. Install tool no. **88713.2087** (A) in the spark plug bore to determine the piston TDC, the gauges (B) on tool no. **88765.1690** and the timing check tool (degree wheel (C) no. **88765.1657** with graduated disk).

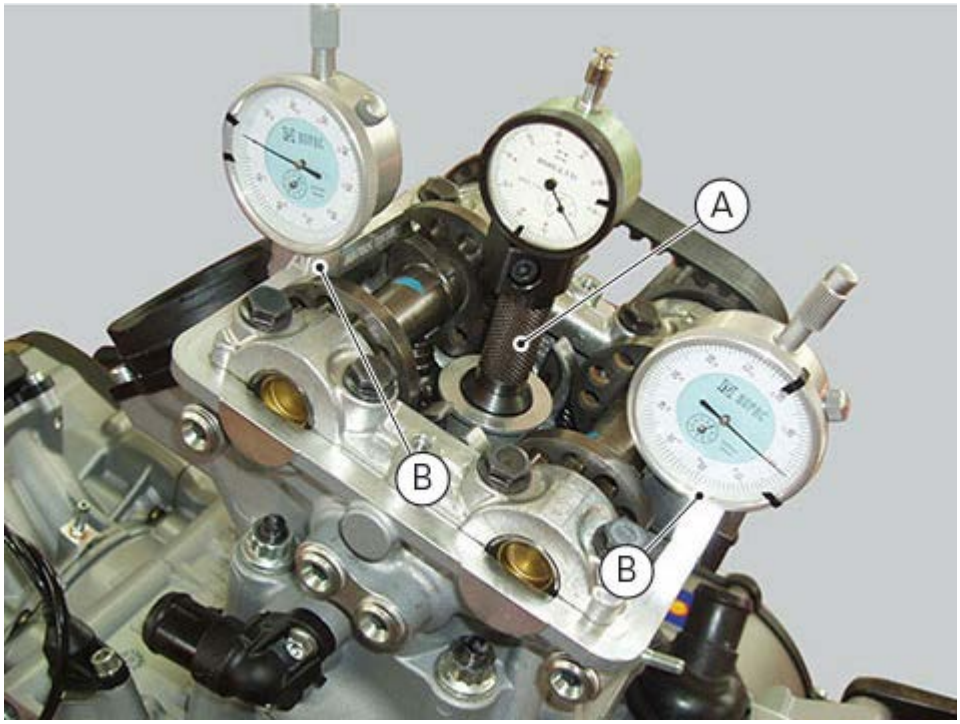


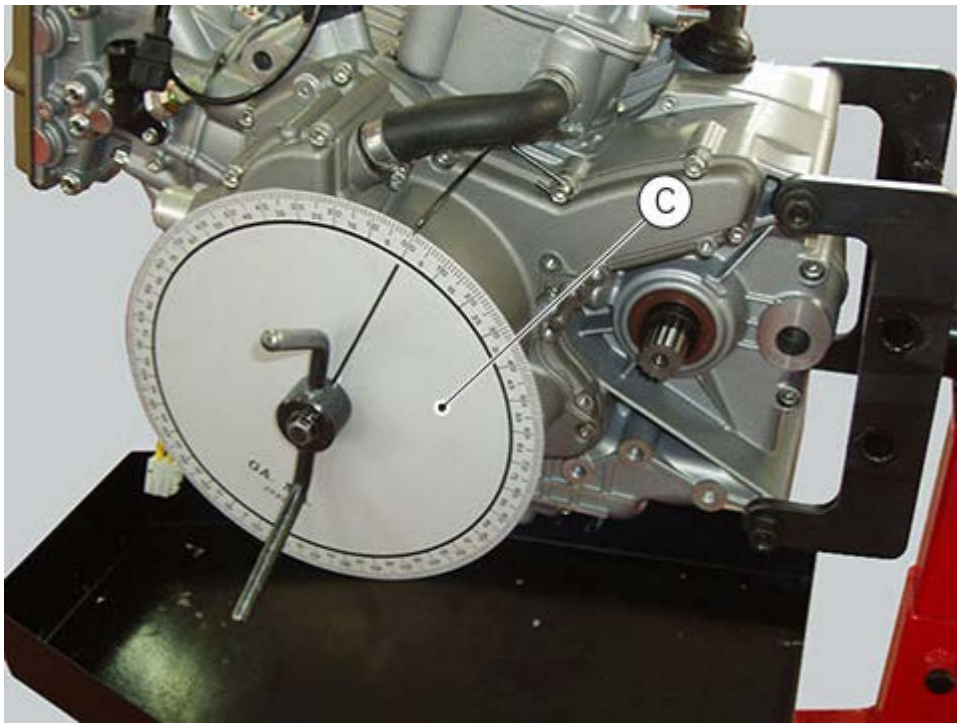


Set the opening valve clearance to zero when the camshafts are in rest position by fitting a feeler gauge, of suitable thickness, between the upper rocker arm and the opening shim.
Check that in this condition the camshaft can rotate. If it moves stiffly, use a thinner feeler gauge.

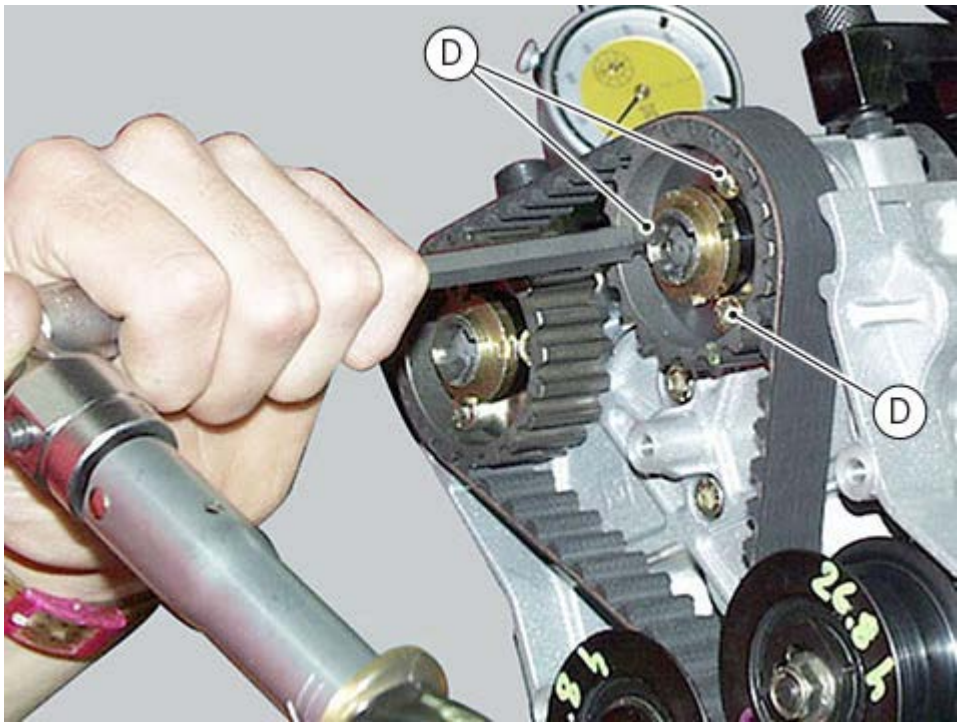


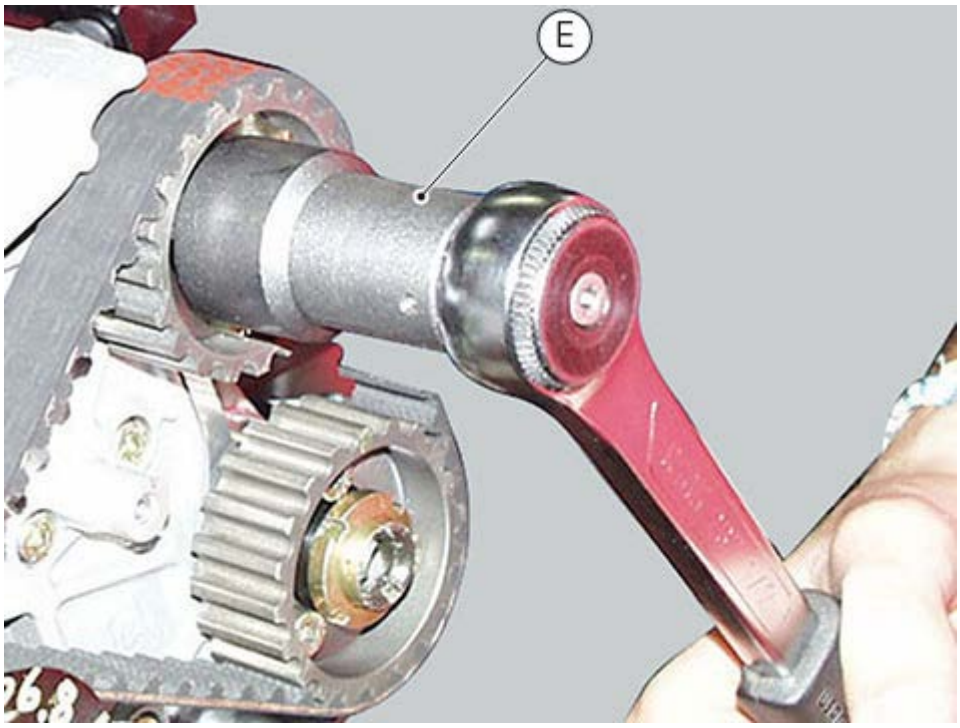
In this condition, with the piston of the horizontal cylinder at TDC with the valves fully closed as confirmed by the reading on gauge (A), set the gauges (B) to zero.
Tension the belts according to the value specified in paragraph "Checking and adjusting timing belt tension".
Turn the degree wheel (C) counter clockwise until the gauge dial (B), on the exhaust side, shows a lift of 1 mm. Check that the value of the angular displacement read on the degree wheel (C) is the specified one (Timing system/valves).
Continue to rotate in the same direction until you obtain a lift of 1 mm on the intake side. Check the angular value on the degree wheel. Continue to rotate until you obtain an intake valve lift of 1 mm on the gauge (B), during closure of the valve for the compression stroke. Check the angular value with the prescribed one (Timing system/valves). Continue to rotate the degree wheel (C) counter clockwise until you obtain a lift of 1 mm of the exhaust valve, when opening or closing the valve.
Check the angular displacement value against the specified value.
Repeat the procedure for the vertical cylinder.
A tolerance of ±3° is allowed in the values detected with the described procedure compared to the specified ones (Checking valve lift).





Remove the installed tools to check timing. Then tension the belts to the prescribed operation value.
In case of values different from the described ones (Timing system/valves), loosen the fixing screws (D) of the timing belt rollers and correct the value detected by turning the ring nut of the timing shaft with the supplied wrench (E) no. **88713.1806**.
Then block the three screws (D) retaining the timing belt roller to a torque of 10 Nm (Min. 9 Nm - Max. 11 Nm) and mark the new position on the components.





Specified values:

Adjusting the belt tension			
	Reference	Assembly value (new belt)	Recovery value (used belt)
Cold belt tension adjustment	DDS	110±5 Hz (horizontal)	80±5 Hz (horizontal)
		110±5 Hz (vertical)	80±5 Hz (vertical)
	Cold min. limit value		70 Hz

Timing diagram		
Timing diagram with valve clearance of 1 mm	Intake	Opening 4° B.T.D.C. Closing 52° A.B.D.C.

	Exhaust	Opening 58° B.B.D.C. Closing 7° A.T.D.C.
Intake valve diameter	35.5 mm	
Exhaust valve diameter	28.8 mm	

Refit the components removed in the procedure.

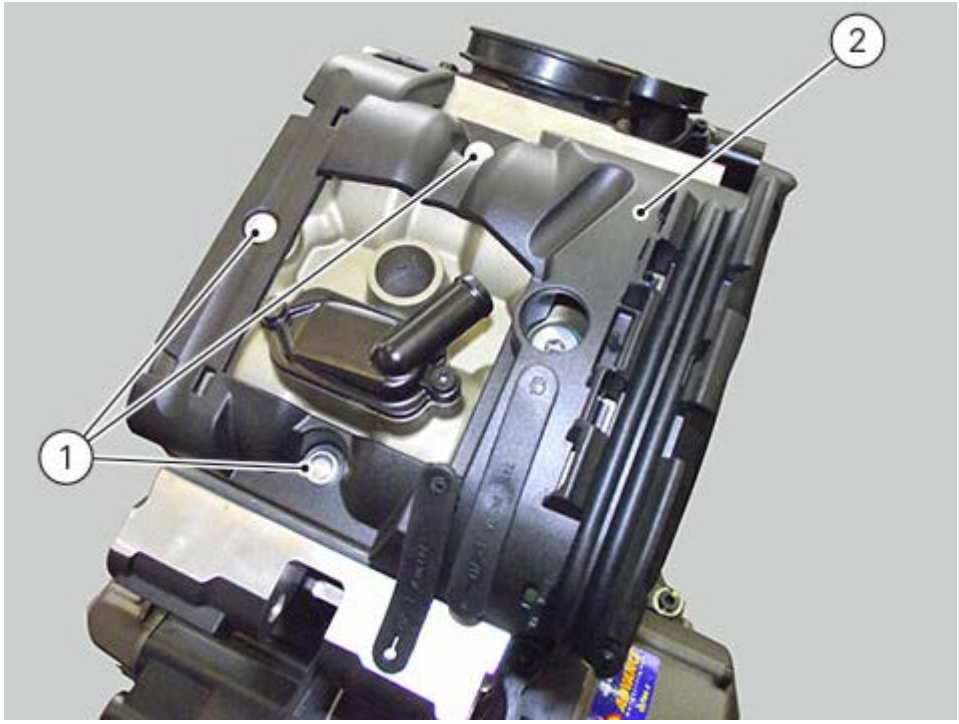
Refit the cylinder head covers (Refitting the camshafts).
Connect the caps to the spark plugs (Replacing the spark plugs).
Refit the cable rings on the vertical head (Checking the valve lift).
Position and tie the ABS system hoses and wiring on the vertical head (Positioning wiring/hoses).
Connect the secondary air system pipe on the cylinder head (Removing the secondary air system).
Fix the timing belt covers (Refitting the timing belt external covers).
Refit the airbox (Refitting the airbox and throttle body).
Refit the fuel tank (Refitting the fuel tank).
Refit the vertical head central exhaust pipe (Refitting the exhaust system).
Fix the water radiator to the frame (Refitting the water radiator).
Refit the seat (Refitting the seat).

Checking valve lift

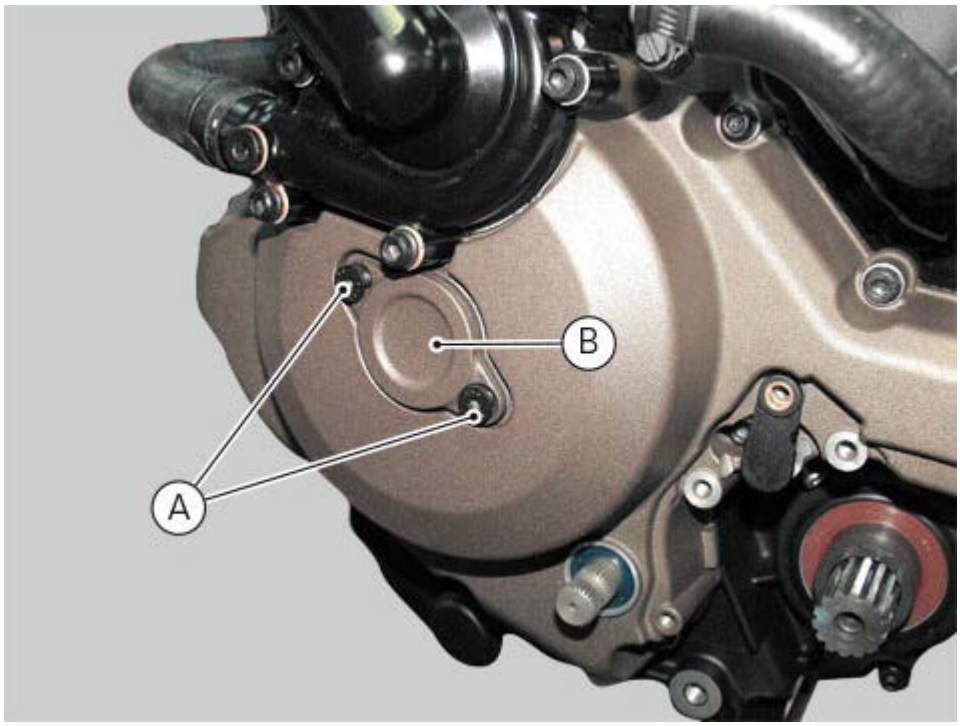
Remove the seat (Removing the seat).
Remove the fuel tank (Removing the fuel tank).
Release the water radiator lower retainer and move it towards the front wheel (Removing the water radiator).
Remove the airbox, the throttle body, the blow by and the oil breather pipe (Removing the airbox and throttle body).
Remove the water radiator lower retainer from the engine (Removing the water radiator).
Remove the secondary air system pipes (Removing the secondary air system).
Release the ABS tubes and wiring from the cable ring fixed on the vertical head (Routing wiring harnesses/hoses).
Disconnect the spark plug caps (Replacing the spark plugs).

Note
For clarity, the figures show the engine removed from the frame.

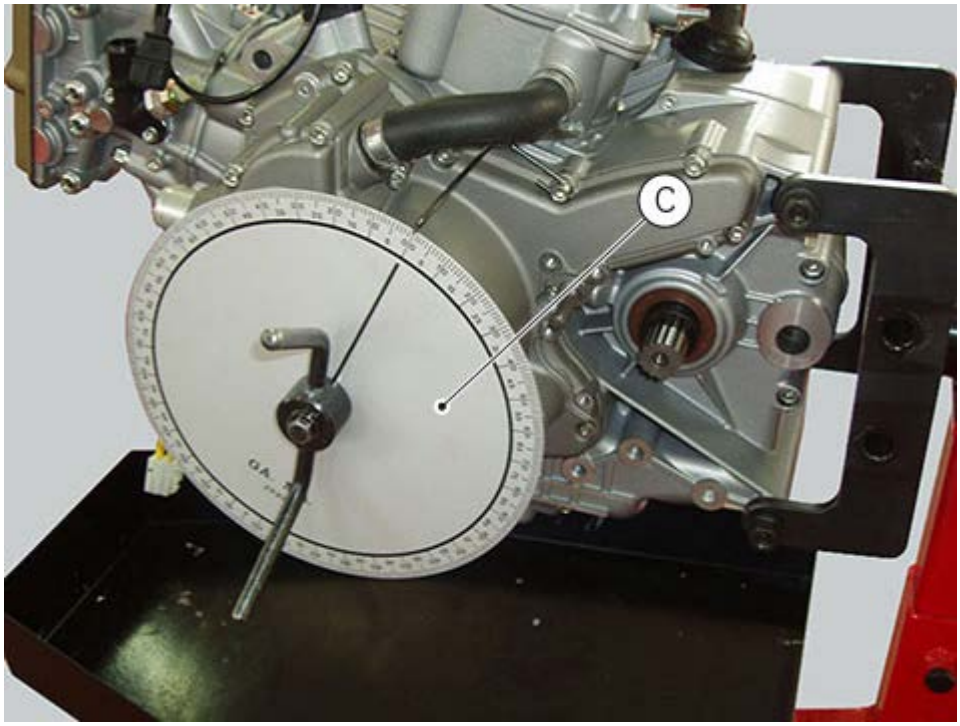
Working on the vertical head, loosen the three screws (1) and remove the wiring and tube cover (2).



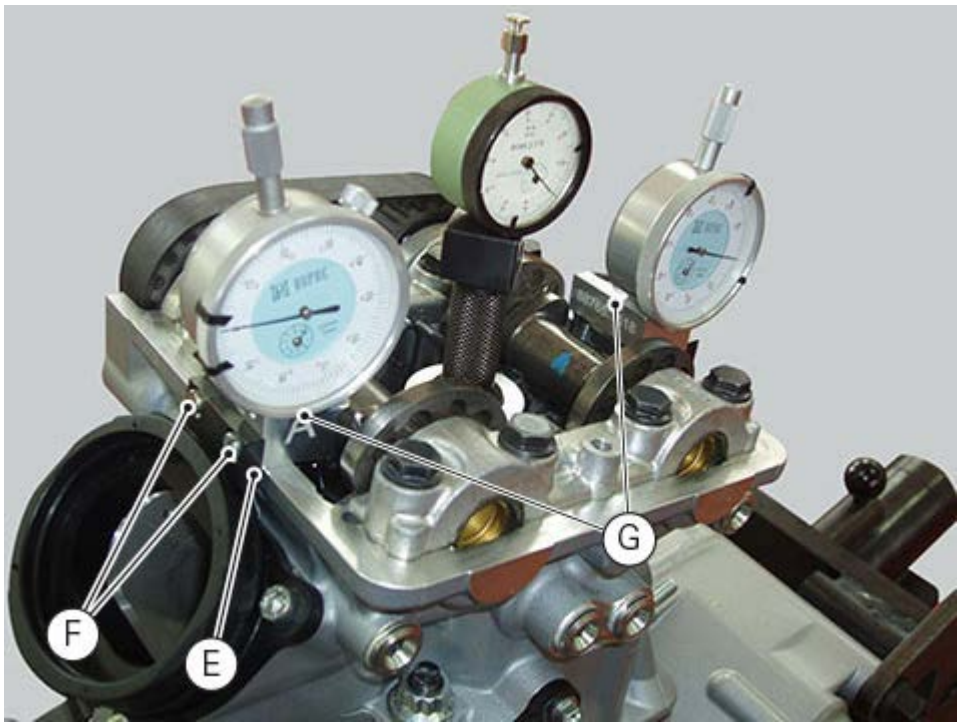
Remove the timing inspection cover (B) with seal from generator cover, loosening the two screws (A).

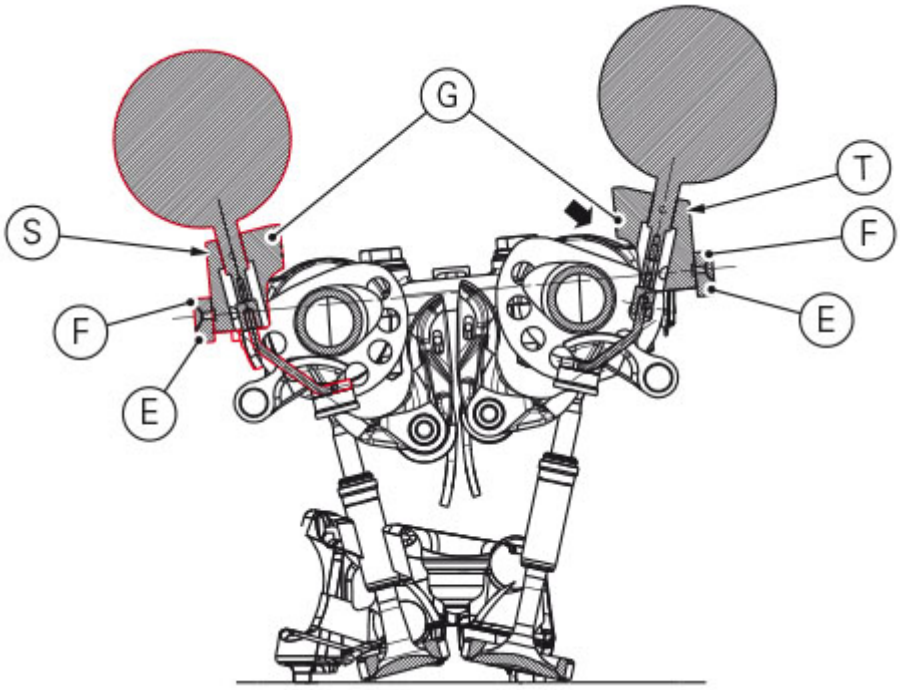


Fit tool (C) no. **88765.1523**.

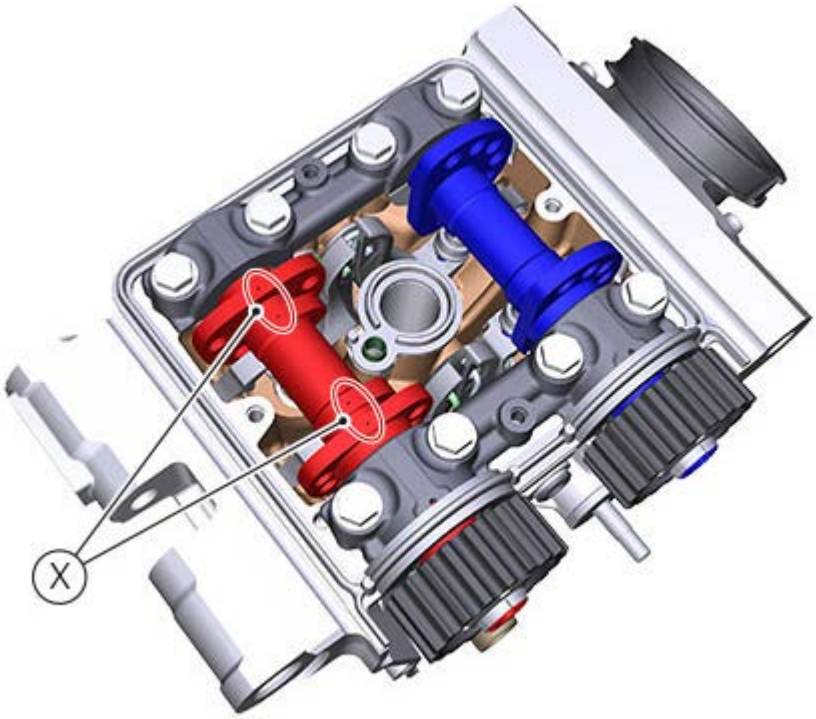


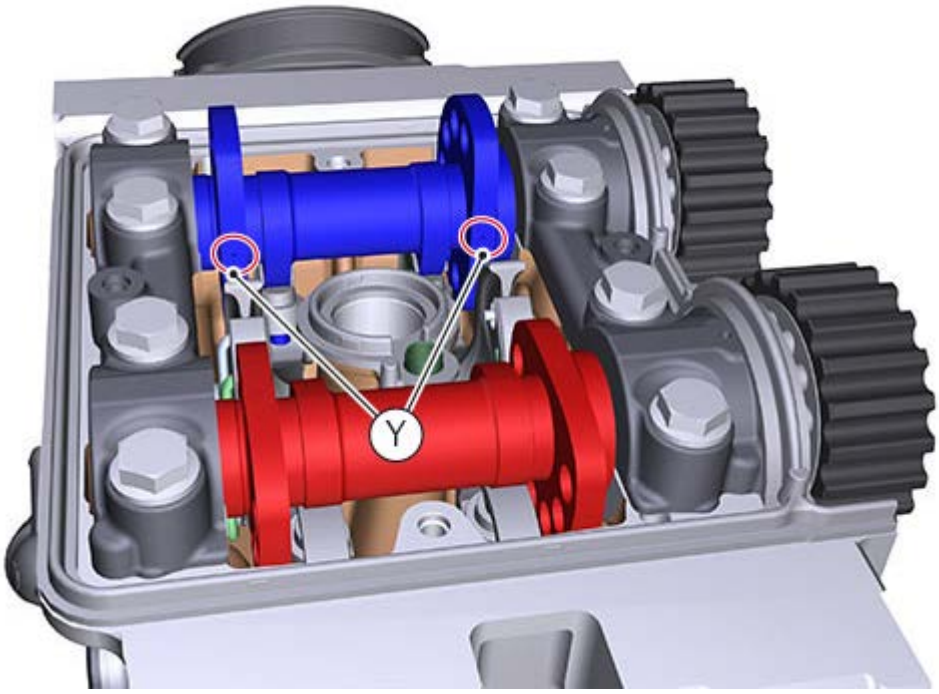
Fit tool (G) no. **88765.1690** on the head: support (S) of tool no. **88765.1690** with the intake indication must be positioned on the exhaust side whereas support (T) of tool no. **88765.1690** with the exhaust indication must be positioned on the intake side.
Seat the plate (E) and tighten the screws (F).



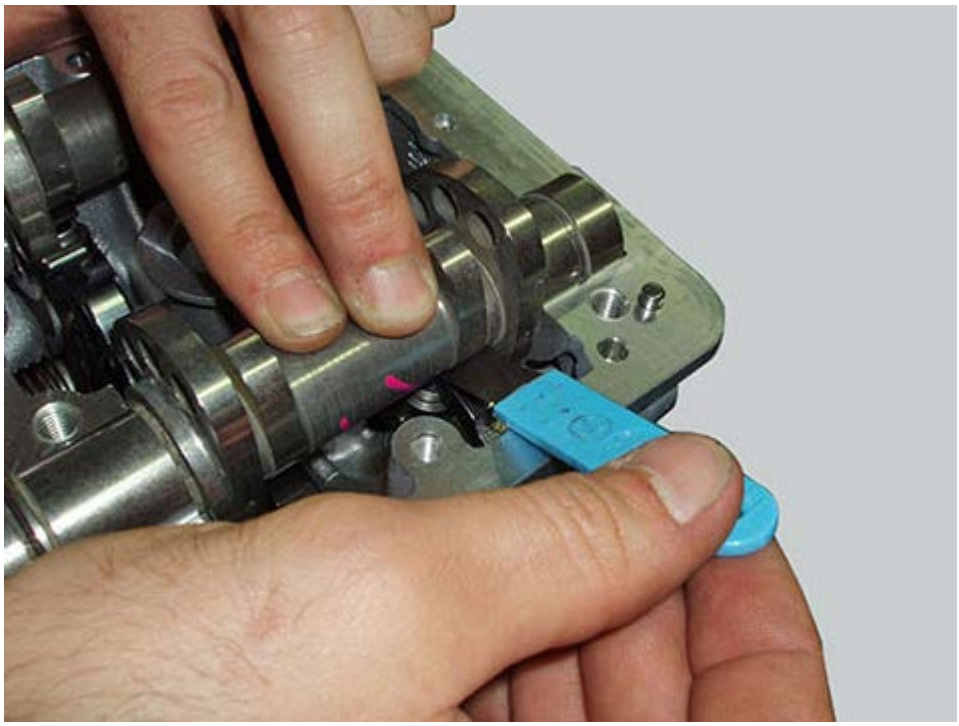


Turn the crankshaft in the engine direction of rotation until the vertical head valves are in rest position: (X) exhaust side, (Y) intake side, in this condition all valves are closed and the camshafts come in rest position and, therefore, free to rotate; check the valve lift.

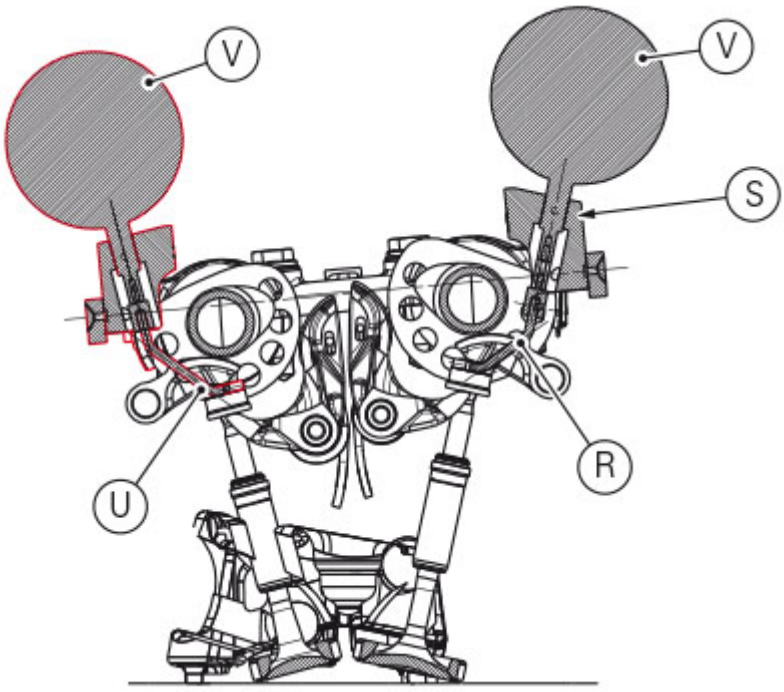




Set the opening valve clearance to zero when the camshafts are in rest position by fitting a feeler gauge, of suitable thickness, between the upper rocker arm and the opening shim.



Lock dial gauge (V) into the seat support (T) and position probe (R) against the face of the closing shim.
Set the dial gauge to zero when the valve is fully closed.
Rotate the intake camshaft so as to allow the intake valves to lift fully.
Check on the dial gauge that the measured value corresponds to the prescribed one.
Repeat the same operation for the exhaust valves, using dial gauge (V) in support seat (S) and probe (U).



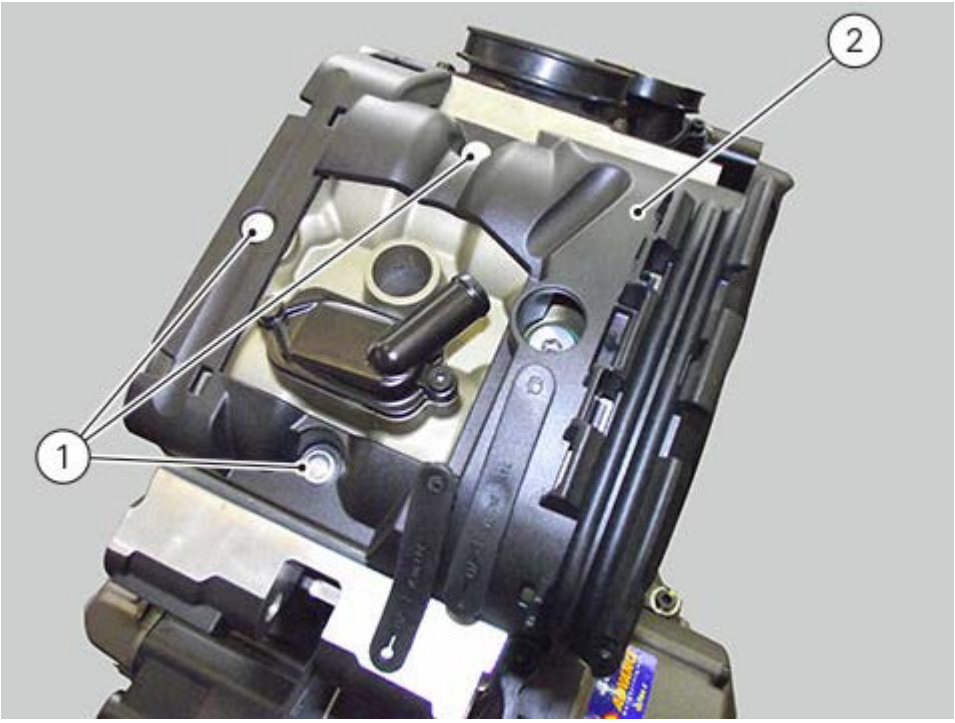
Specified values:

Valve lift	
Valve lift with valve clearance of 0 mm	Intake 11.30 mm Exhaust 9.60mm

Timing diagram		
Timing diagram with valve lift of 1 mm	Intake	Opening 4° B.T.D.C. Closing 52° A.B.D.C.

	Exhaust	Opening 58° B.B.D.C. Closing 7° A.T.D.C.
Intake valve diameter	35.5 mm	
Exhaust valve diameter	28.8 mm	

Working on the vertical head, position the wiring cover (2) and tighten the three screws (1).



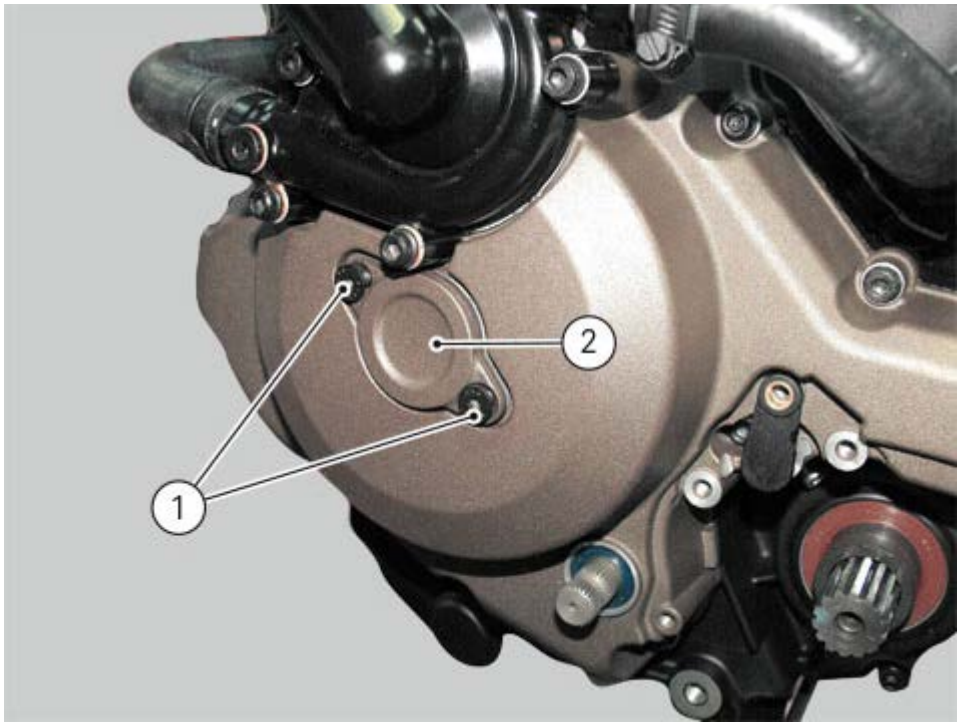
Connect the spark plug caps (Replacing the spark plugs).
Position the ABS tubes and wiring in the cable ring fixed on the vertical head (Routing wiring/hoses).
Position the secondary air system pipes (Refitting the secondary air system).
Refit the airbox, the throttle body, the blow by and the oil breather pipe (Refitting the airbox and throttle body).
Restore and tighten the water radiator lower retainer and move it towards the front wheel (Refitting the water radiator).
Refit the fuel tank (Refitting the fuel tank).
Refit the seat (Refitting the seat).

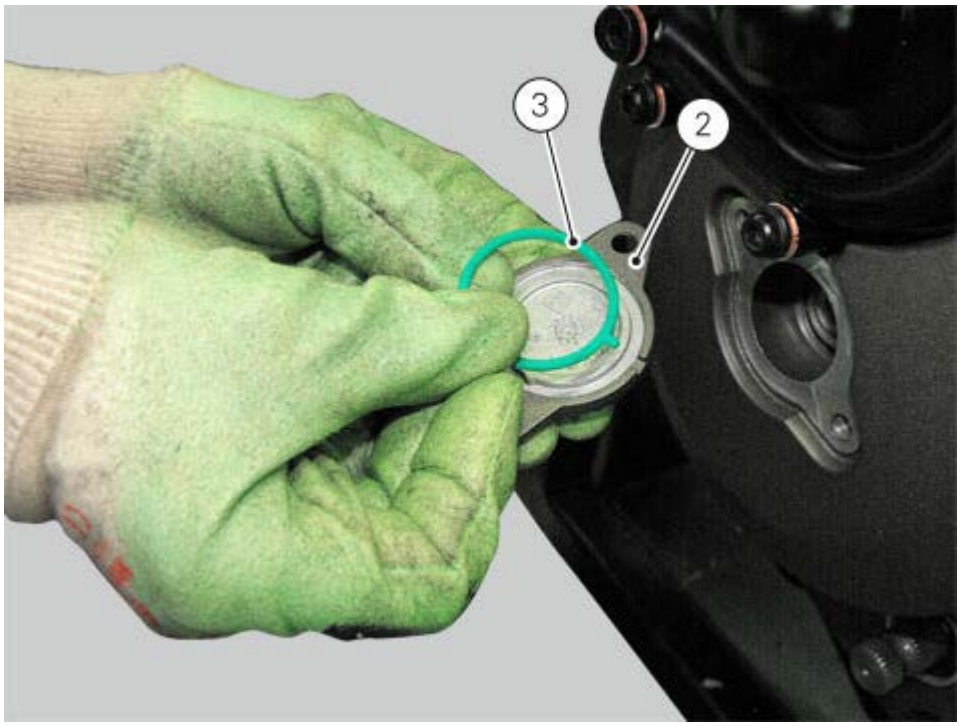
Checking and adjusting the valve clearance

Remove the seat (Removing the seat).
Remove the lateral covers (Changing the coolant, Removing the water tank).
Remove the fuel tank (Removing the fuel tank).
Remove the airbox (Removing the airbox and throttle body).
Loosen the timing belt covers (Removing the timing belt external covers).
Loosen the water radiator retaining screws by leaving the radiator connected to the cooling system (Removing the water radiator).
Disconnect the coil caps.
Disconnect the secondary air units of the head covers (Removing the secondary air system).
Remove the cylinder head cover (Removing the camshafts).

Note
For clarity, the figures show the engine removed from the frame.

Loosen the two screws (1) retaining cover (2) and remove them together with gasket (3).





Fit the tool handgrip no. **88765.1523** in the holes of the generator cover to be able to turn the crankshaft so that the valve on which the check is carried out is in rest position and the relevant piston at the top dead centre.

Check the valve clearance of the head you are working on.

Checking the opening clearance

Using a feeler gauge, check the clearance between the opening rocker arm (A) and the lowest point of the camshaft lobe (B), taking care not to compress the rocker arm return spring.

Important
Hold the feeler gauge at a distance of at least 4-5 cm from the point of measurement between cam and rocker arm.

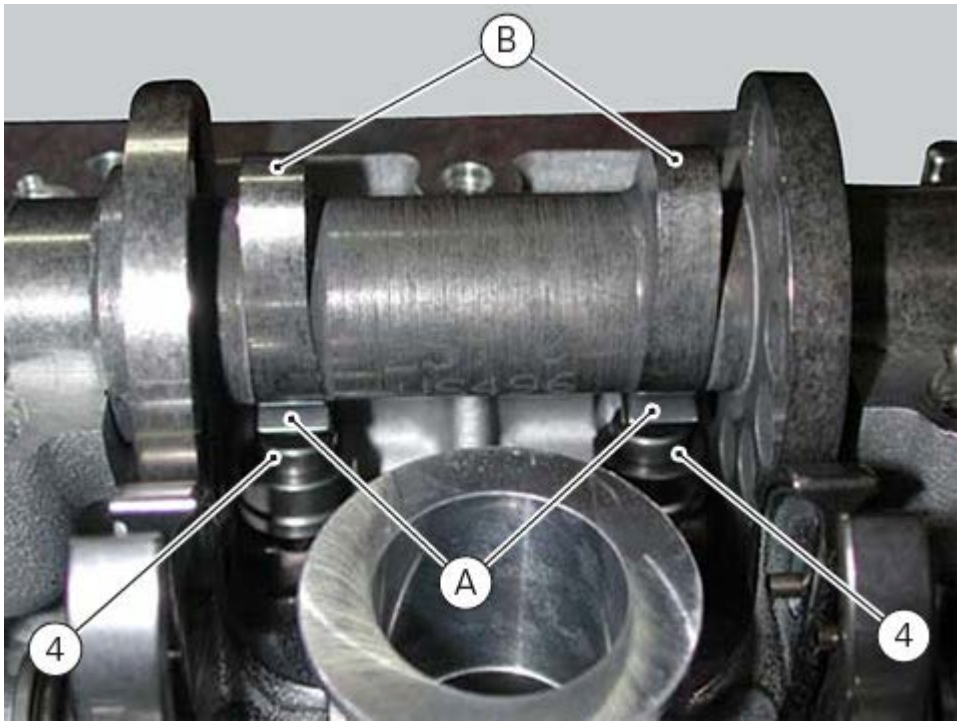
Important
During this operation, press on the camshaft perpendicularly to the head surface to keep it in seat.

The value must be within the prescribed ones (Timing system/valves).

	Reference	Assembly value	Check value every 24,000 km
Valve clearance	Opening rocker arm - intake	0.13÷0.18 mm	0.10÷0.25 mm
	Opening rocker arm - exhaust	0.13÷0.18 mm	0.10÷0.25 mm

If not so, remove the opening shim (4) (Removing the valves), and replace it with one of suitable height to obtain the prescribed clearance.

Note
Opening shims measuring 2.00 to 3.90 are available as spare parts: the size is punched on the shim



Checking the closing clearance

Using a feeler gauge, check the clearance between the closing rocker arm (C) sliding shoe and the highest point of the camshaft lobe (D).

Important
Hold the feeler gauge at a distance of at least 4-5 cm from the point of measurement between cam and rocker arm.

Important
During this operation, press on the camshaft perpendicularly to the head surface to keep it in seat.

The value must be within the prescribed ones (Timing system/valves).

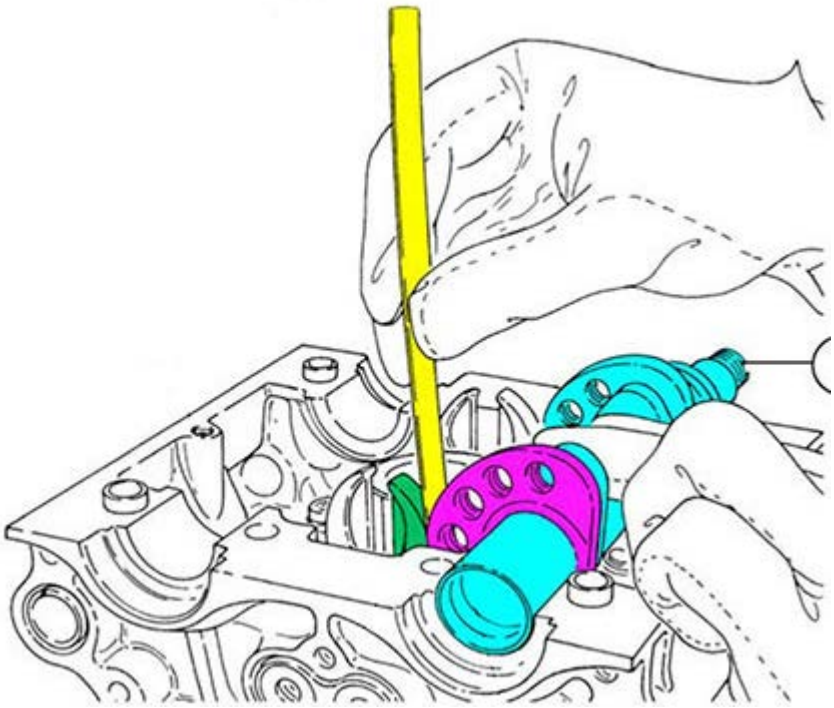
	Reference	Assembly value	Check value every 24,000 km
Valve clearance	Closing rocker arm - intake	0.05÷0.10 mm	0.05÷0.25 mm

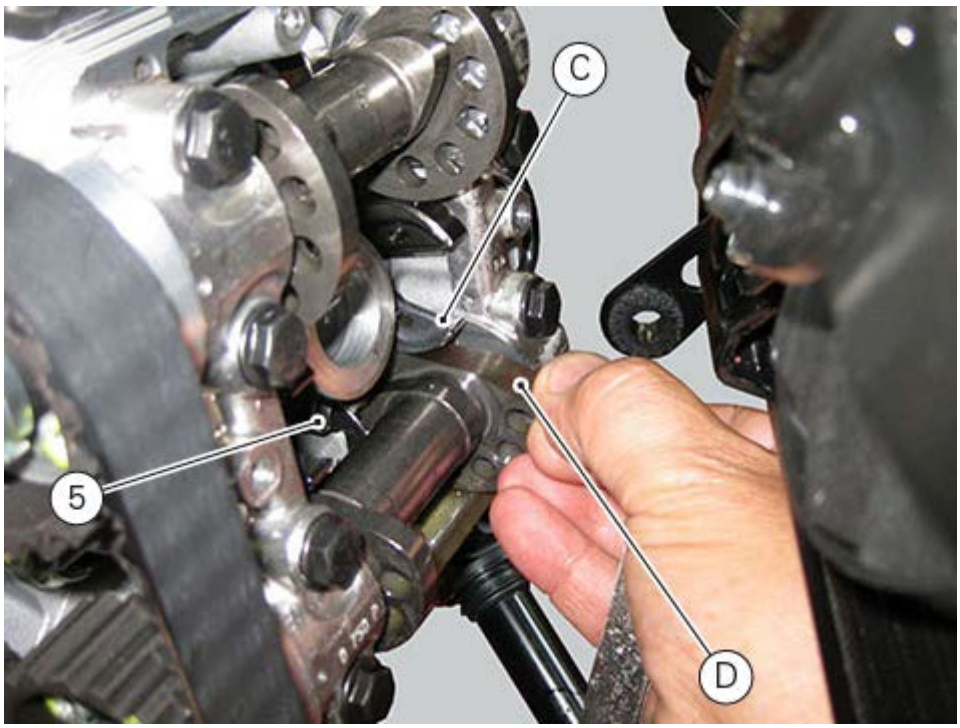
	Closing rocker arm - exhaust	0.05÷0.10 mm	0.05÷0.25 mm

If not, remove the closing shim (5), as described in paragraph (Removing the valves), and replace it with one of suitable height to obtain the prescribed clearance.

Note

Closing shims measuring 2.2 to 4.5 are available as spare parts: the size is punched on the shim.



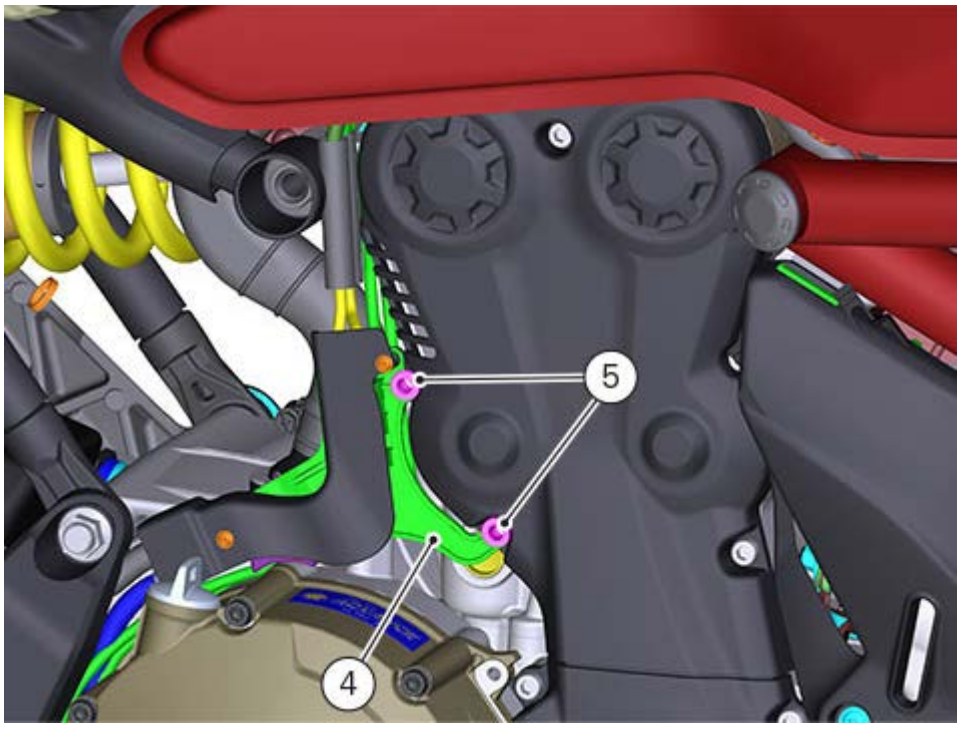


Restore the original conditions by refitting the previously removed components.

Refitting the timing outer covers

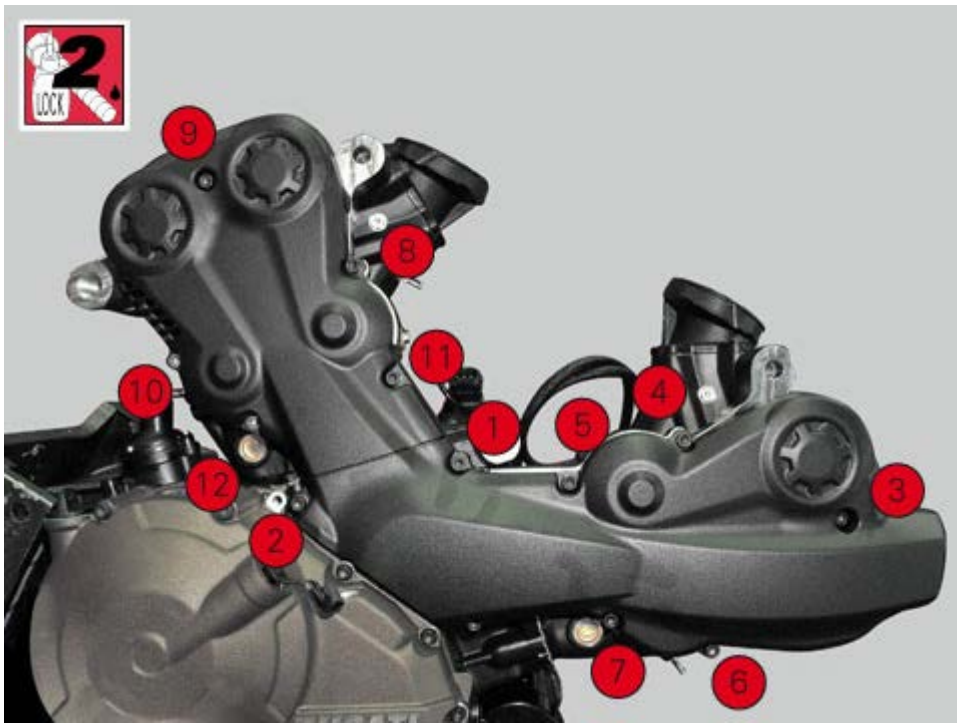
Position the horizontal cylinder external cover (3) and start screws (1) after applying the indicated product.

Position the vertical cylinder external cover (2).
Position cable ring support brackets (4) and insert the two spacers (5).



Apply the specified threadlocker to screws (1A) and start them.

Tighten screws (1) and (1A) of the plastic covers to a torque of 10 Nm (Min. 9 Nm - Max. 11 Nm), following the sequence indicated in the figure.



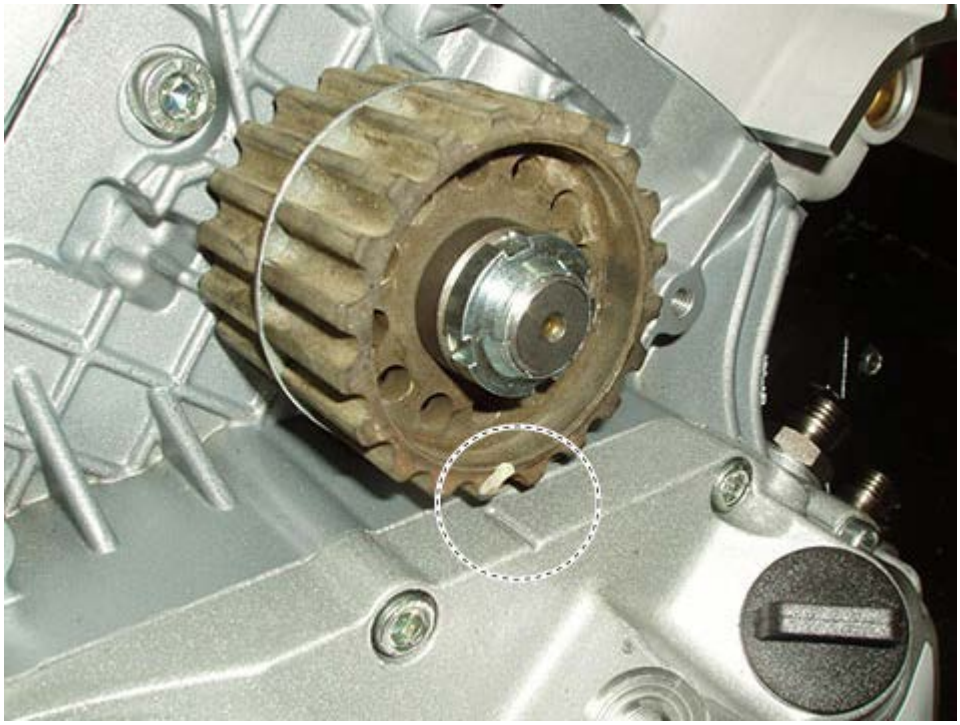
Note

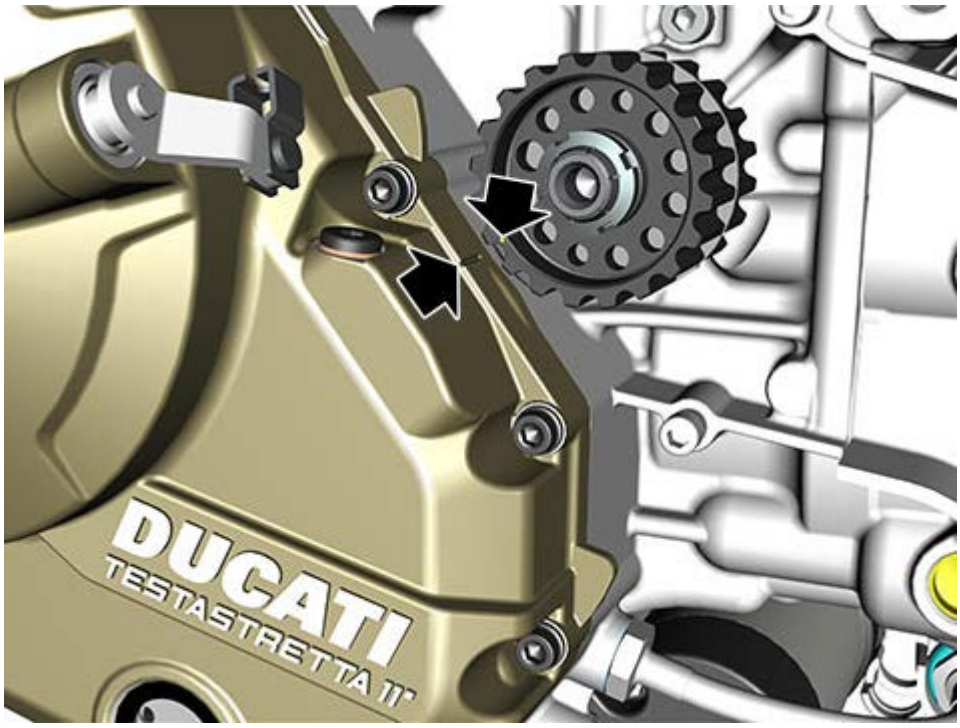
If the above operations have been carried out with the engine installed in the frame, refit the previously removed parts.

Refit the vertical cylinder exhaust heat guard cover on the right side (Refitting the exhaust system).
Connect the secondary air unit (Refitting the secondary air system).
Refit the fuel tank (Refitting the fuel tank).
Refit the seat (Refitting the seat).

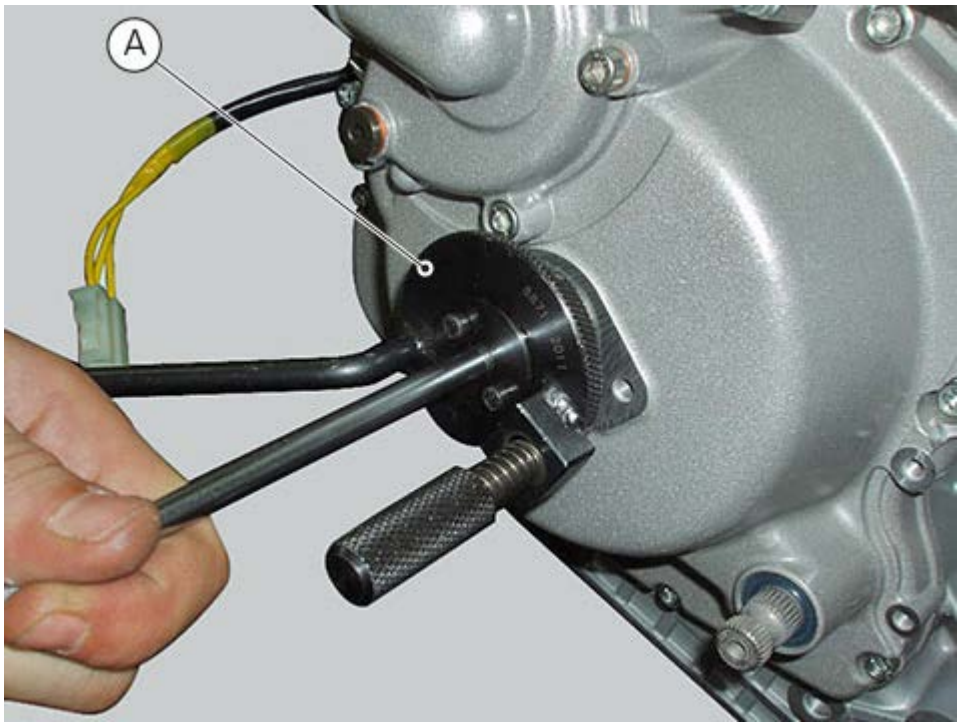
Refitting the timing belts

Rotate the pulleys on the timing layshaft until the timing mark on the outer pulley is aligned with the mark on the clutch cover.
In this condition, the horizontal cylinder piston will be at top dead centre.



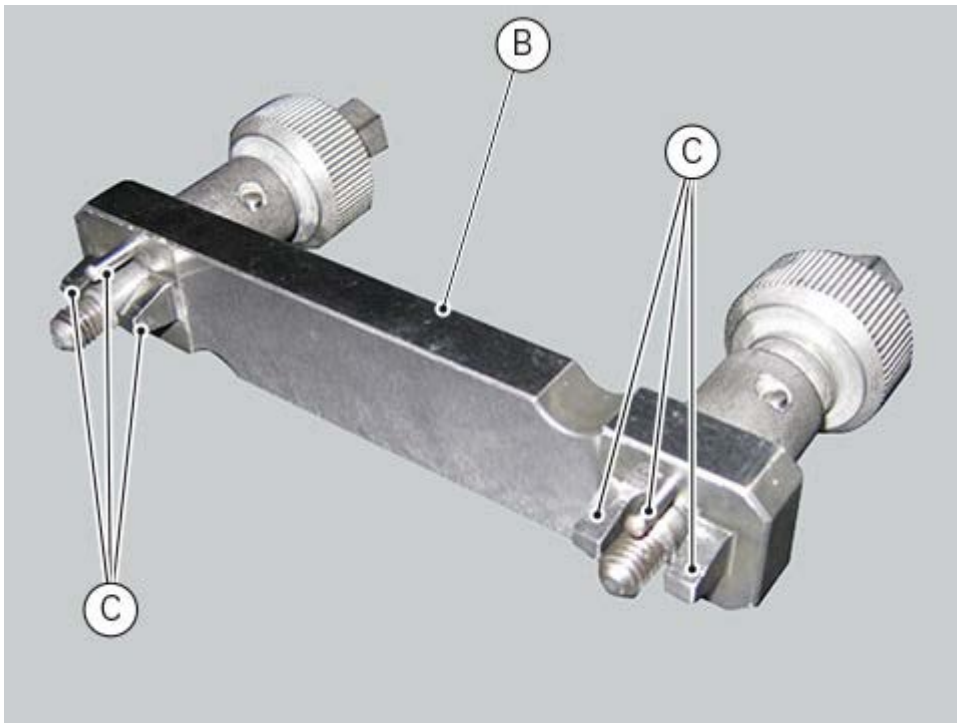


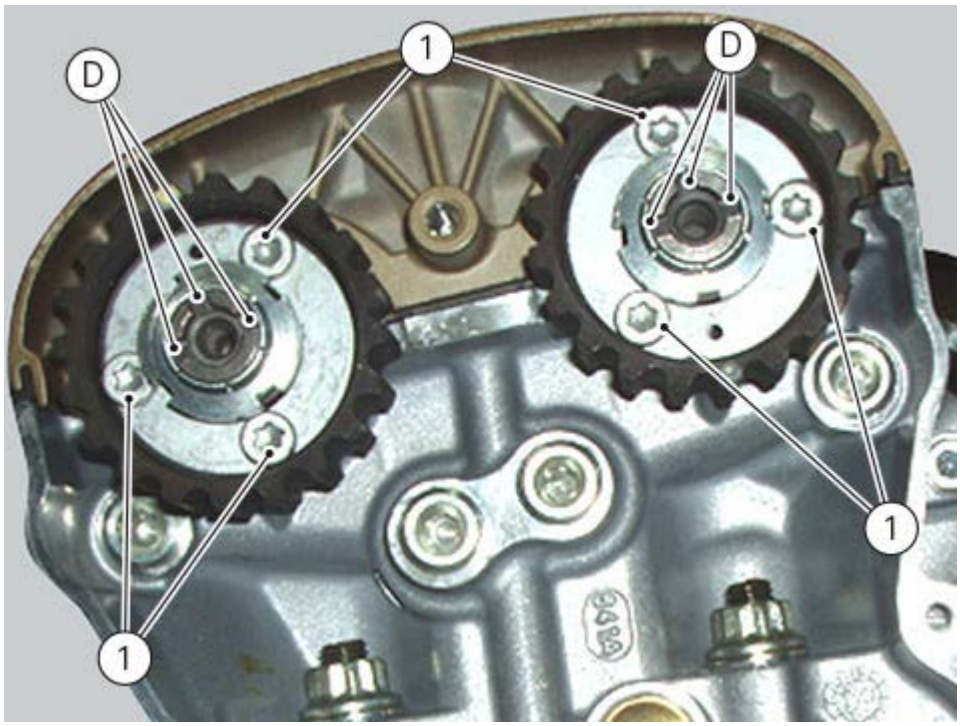
Install tool (A) no. **88713.2011** in the generator seat to prevent the rotation of the crankshaft and block it with the suitable pin. Then tighten screw M8 of the tool to 20 Nm.



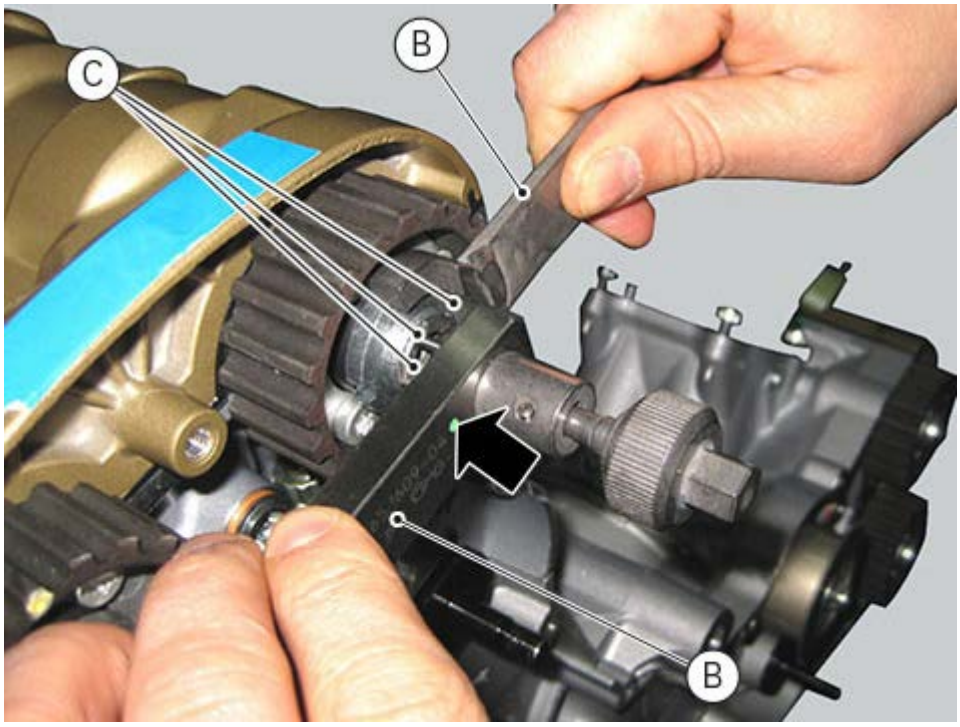
To achieve correct timing, the screws (1) securing the pulleys to the hubs must be loose and positioned in the centre of their slots.

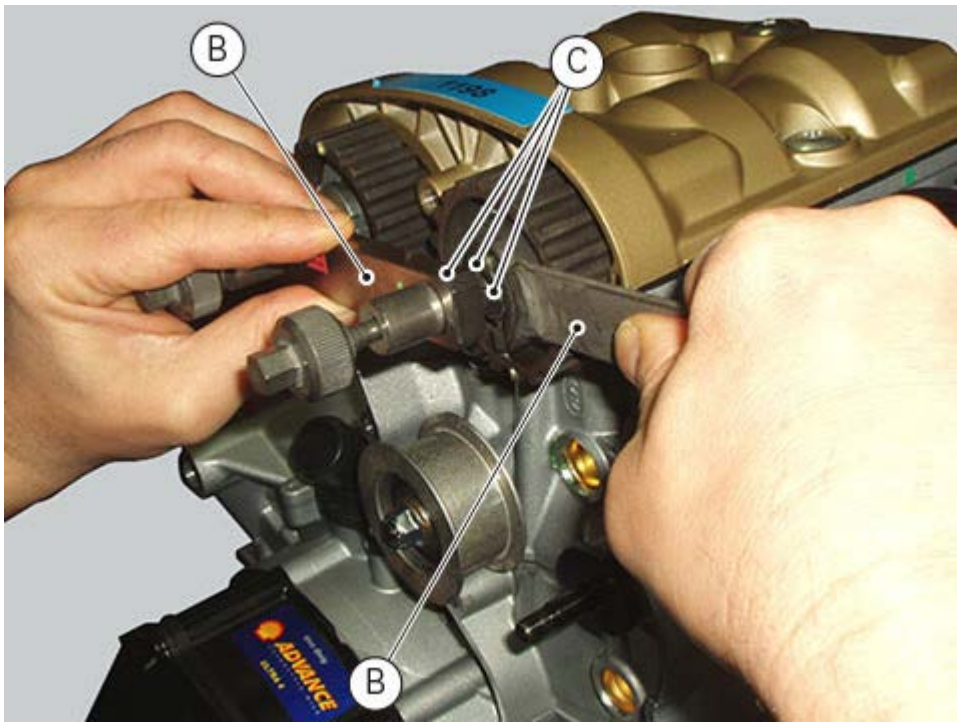
First time the vertical head.
Use tool (B) no. **88765.1623** to insert pins (C) in seats (D) of the camshafts.



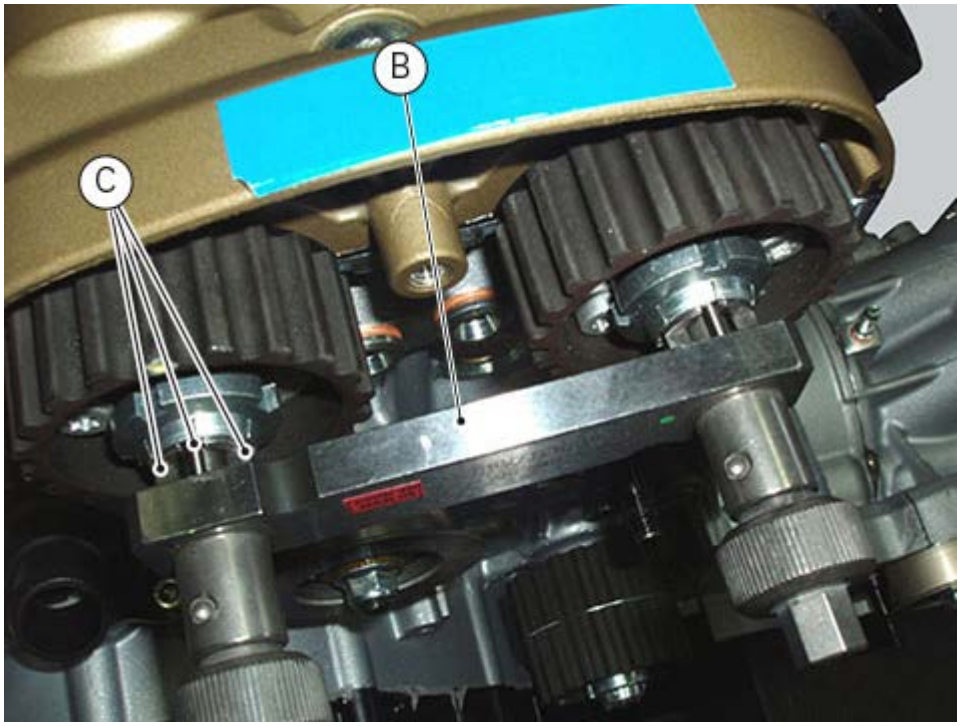


Use tool (B) no. **88765.1623** with writing "UP" and the arrow pointing to the head cover.
First position pins (C) of tool (B) no. **88765.1623** in the intake side belt roller using tool (B) wrench no. **88765.1623**.

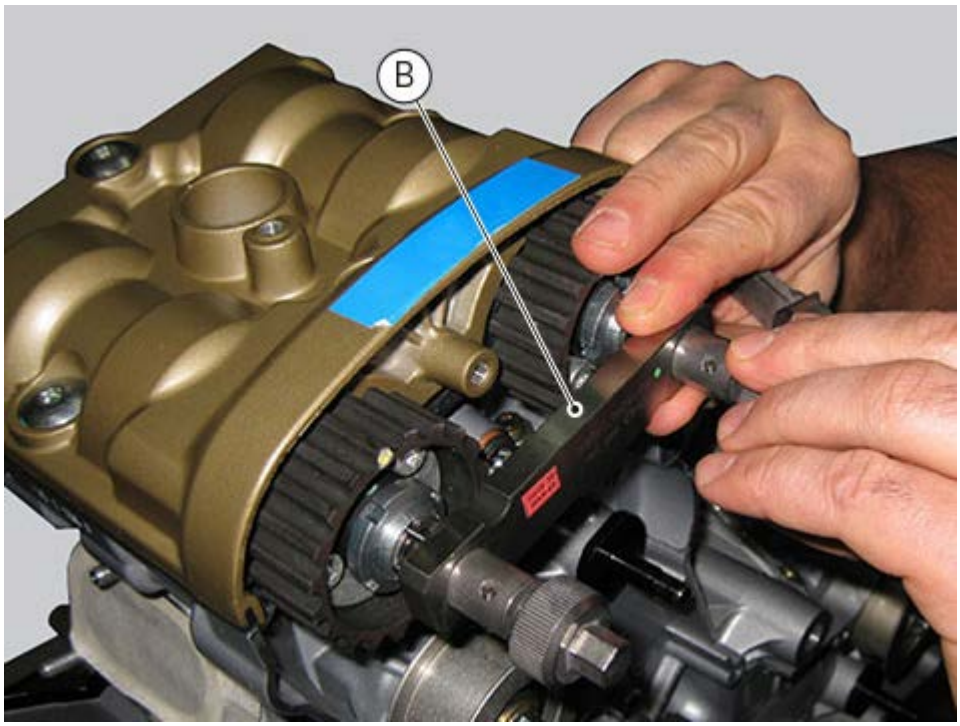




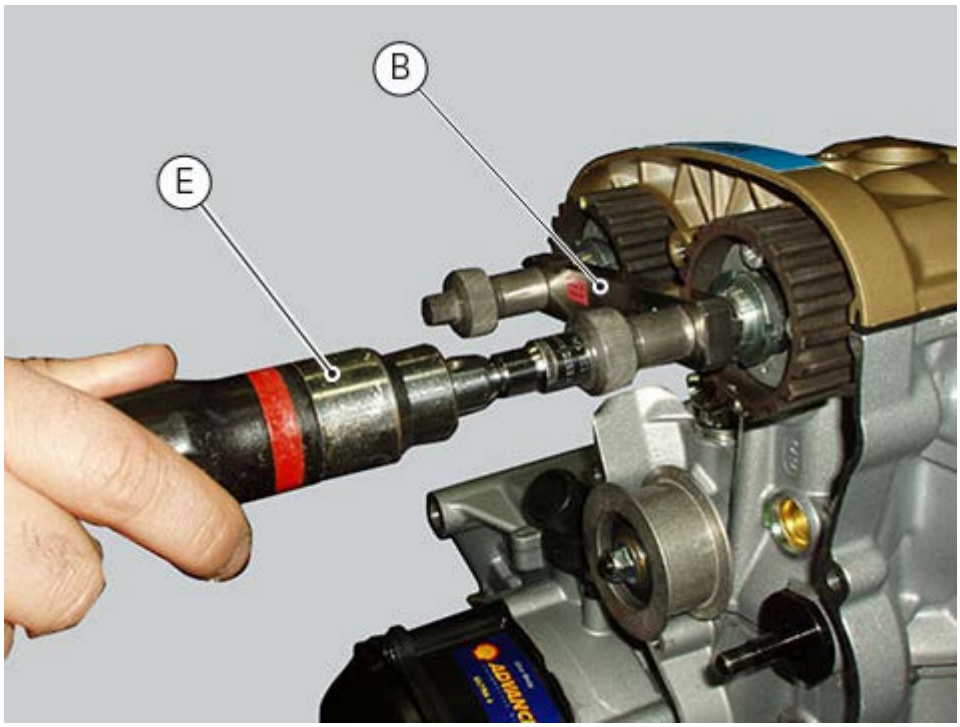
Position pins (C) of tool (B) no. **88765.1623** in the exhaust side belt roller.



Manually screw all the way in the knobs of tool (B) no. **88765.1623**.



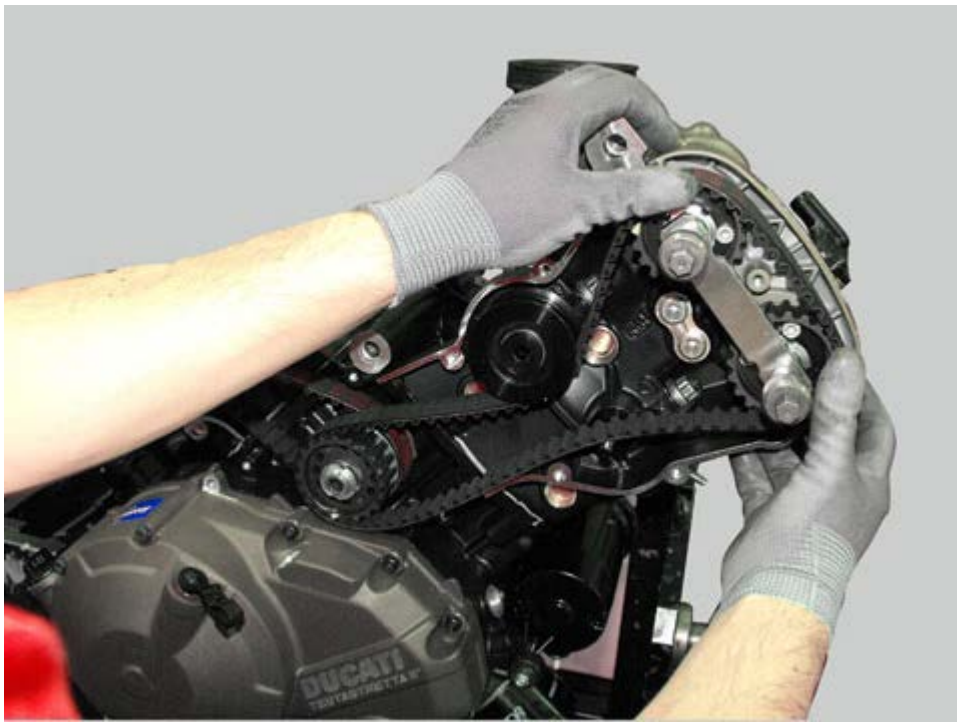
Use a torque screwdriver (E) to tighten the knob nuts of tool (B) no. **88765.1623** to a torque of 2 Nm ± 10%.

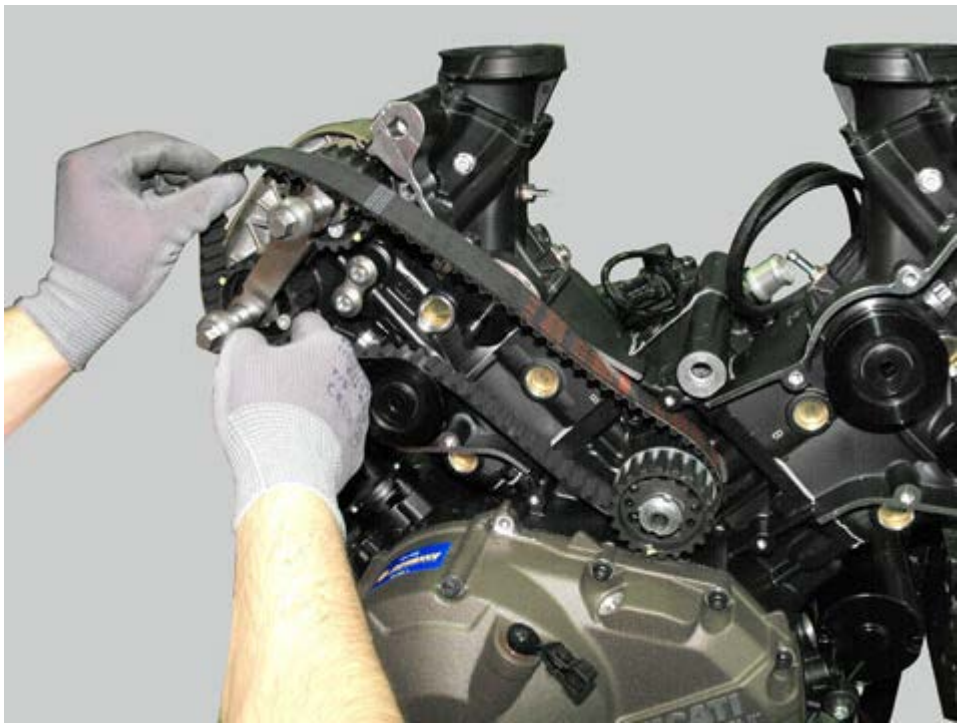


Fit the vertical piston-cylinder assy timing belt around the cylinder head belt rollers and pass it behind the idler pulley.

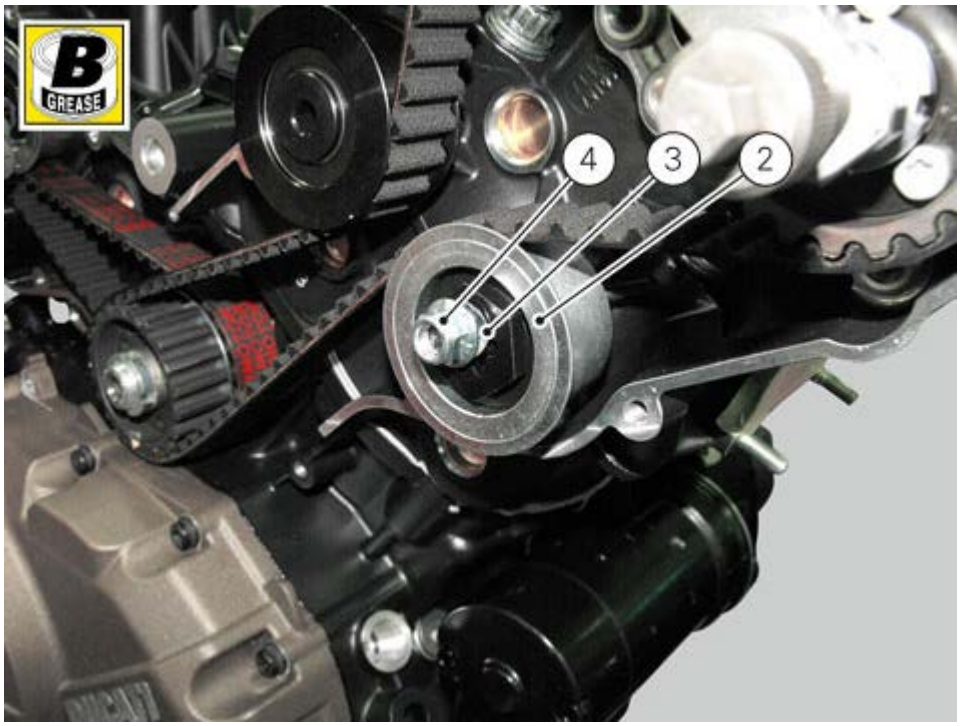
Note

If the used belts are to be refitted, position them in their original direction of rotation and on their original cylinder.



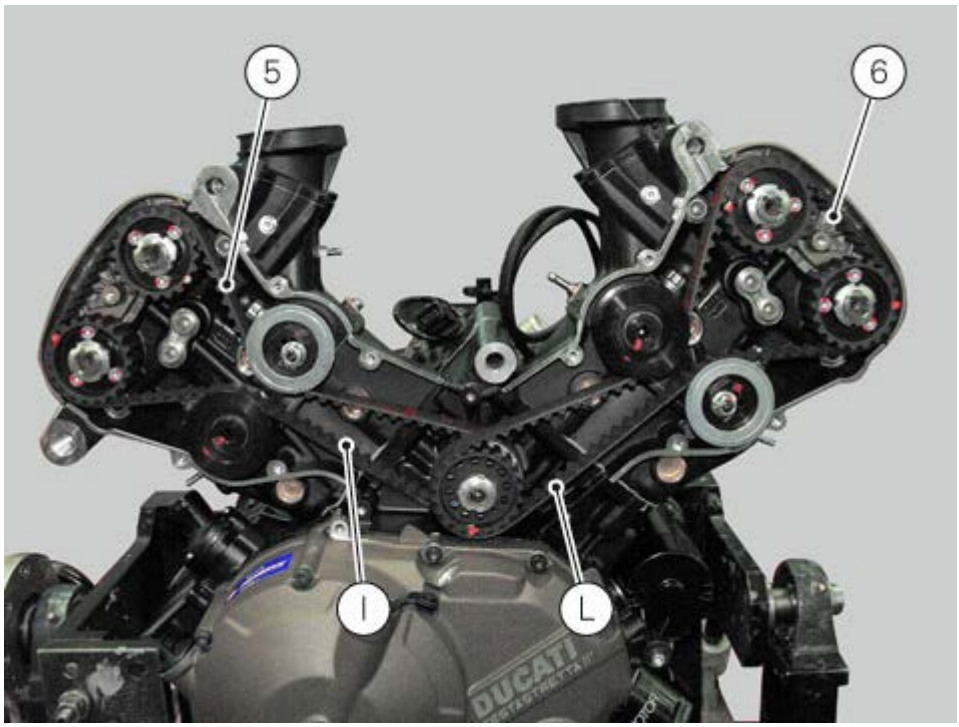


Fit the mobile tensioner (2) and the washer (3) on the cylinder head pin.
Apply the indicated grease on mobile tensioner pin threads, and on nut (4) mating surface.
Start the nut (4).

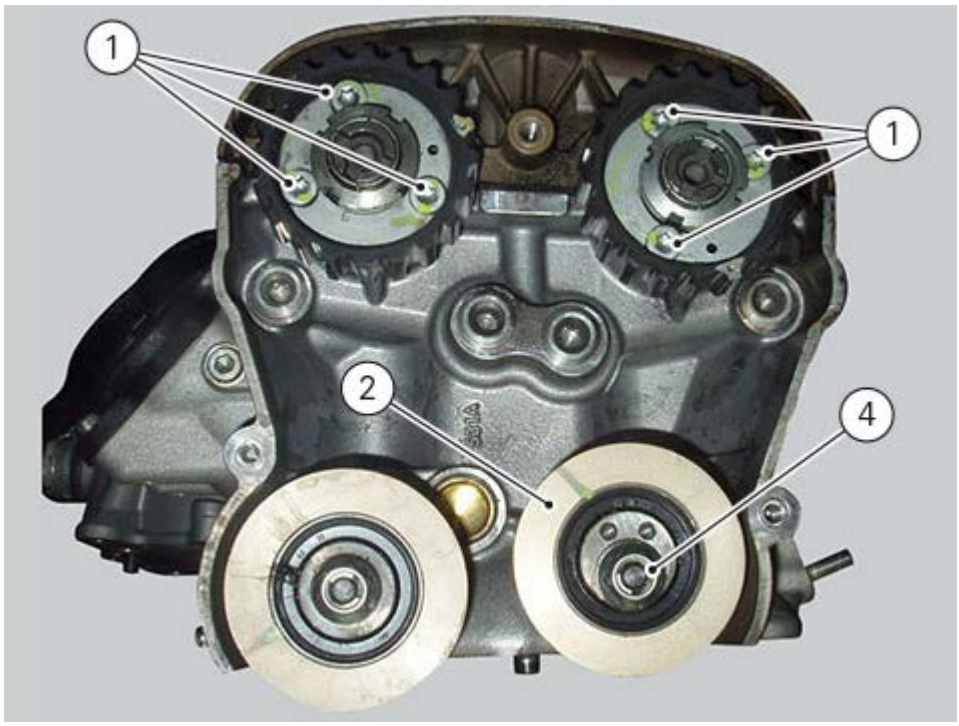


Check the tensioning value and adjust the vertical head belt (5) and horizontal head belt (6), if necessary.

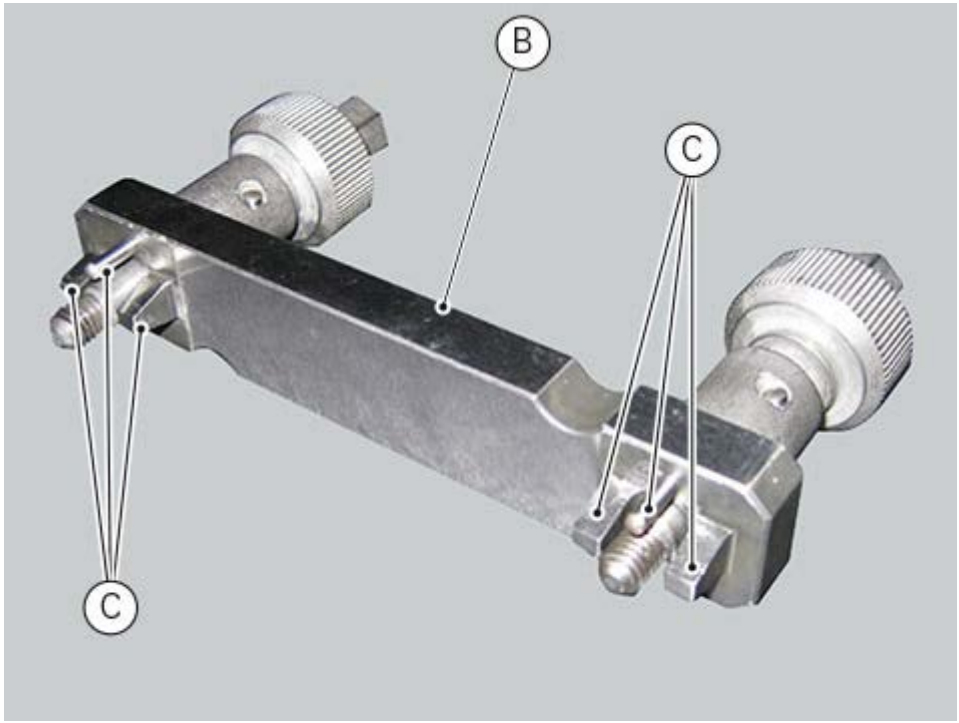
Check the tensioning values on belt (5) section (I) and belt (6) section (L).

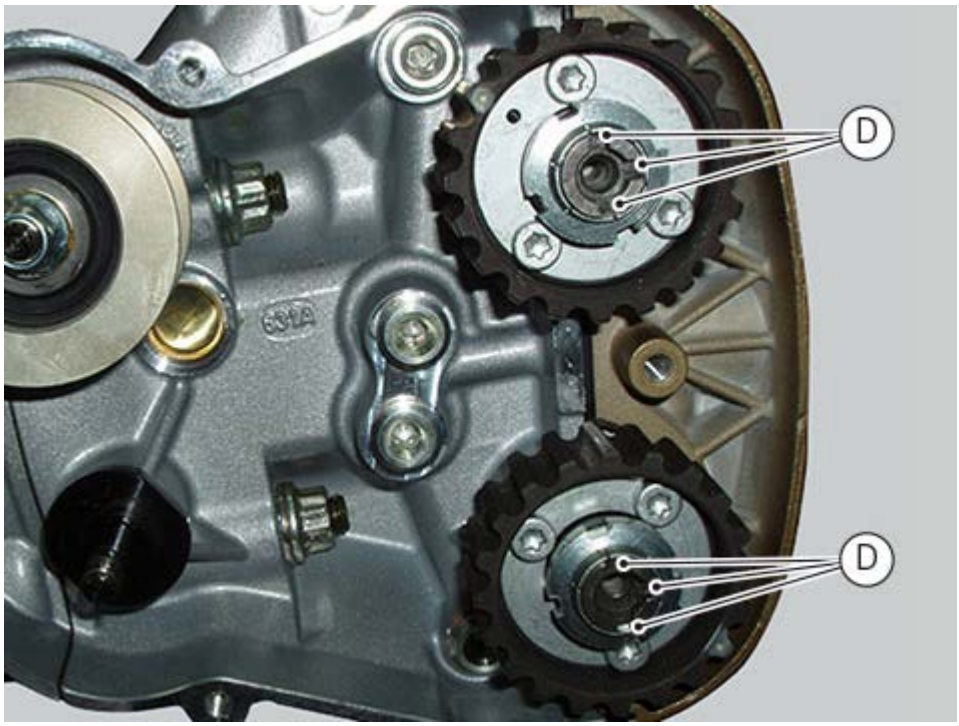


After reaching the required tension, make sure that nut (4) retaining the mobile tensioner (2) is tightened to 25 Nm (Min. 22 Nm - Max. 28 Nm) and vertical head screws (1) to 10 Nm (Min. 9 Nm - Max. 11 Nm).

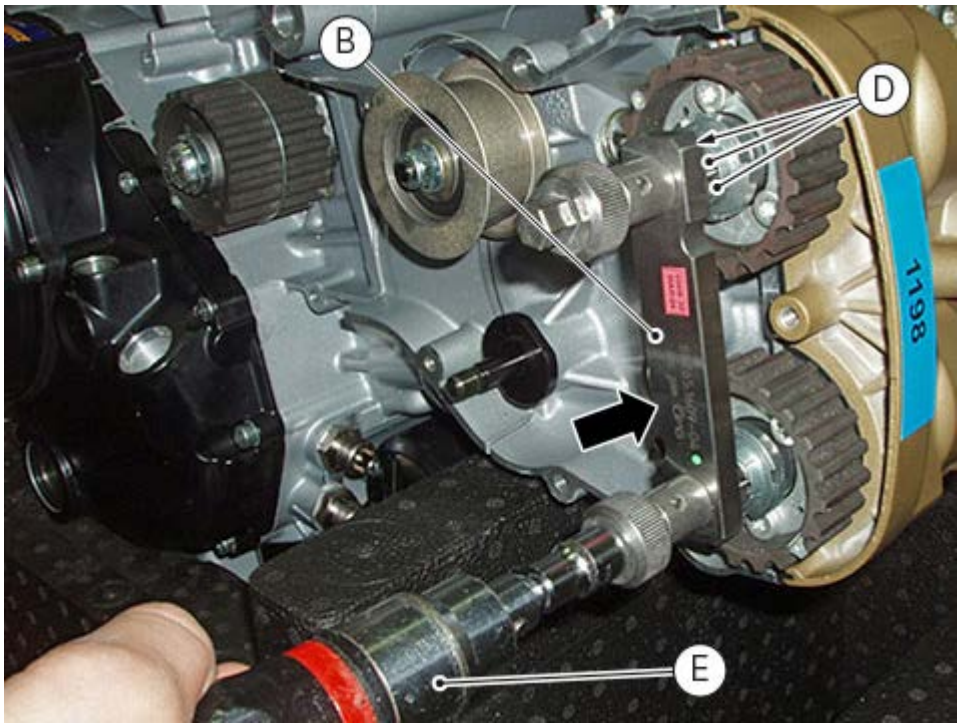


Remove tool (B) no. **88765.1623** that blocks the vertical head camshafts.
Time the horizontal head.
Use tool (B) no. **88765.1623** to insert pins (C) in seats (D) of the camshafts.





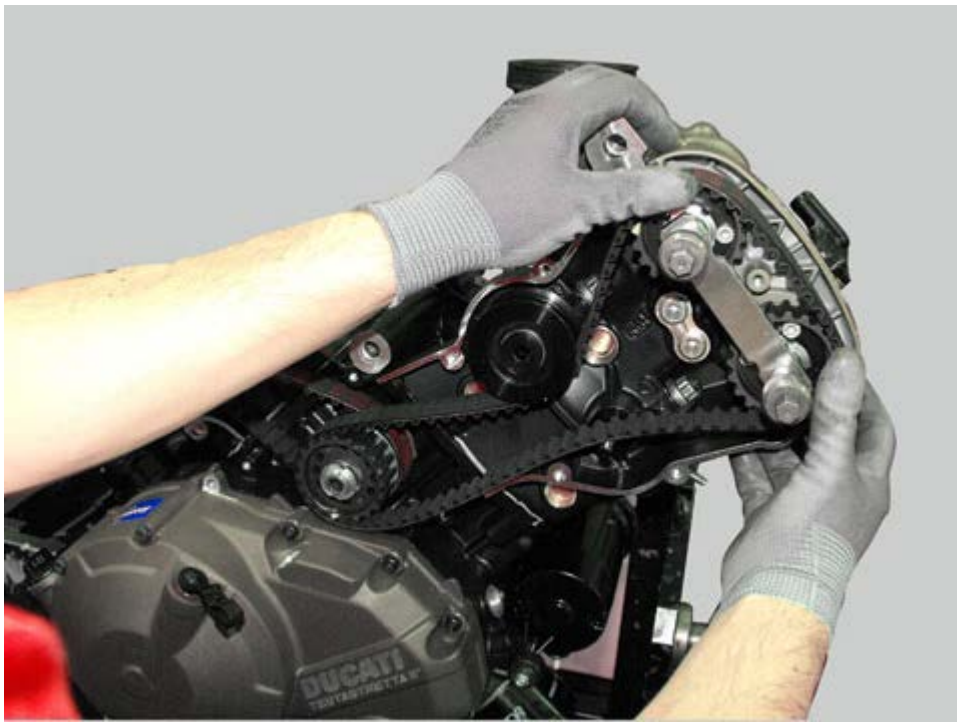
Position tool (B) no. **88765.1623** with writing "UP" and the arrow pointing to the head cover.
Manually position the pins of tool (B) no. **88765.1623** in seats (G) of the exhaust side belt roller by hand.
Manually screw all the way in the knobs of tool (B) no. **88765.1623**.
Use a torque screwdriver (E) to tighten the knob nuts of tool (B) no. **88765.1623** to a torque of 2 Nm ±10%.



Fit the horizontal piston-cylinder assy timing belt around the cylinder head belt rollers and pass it behind the idler pulley.

Note
If the used belts are to be refitted, position them in their original direction of rotation and on their original cylinder.

Repeat the same procedure when reassembling and checking the horizontal head components.



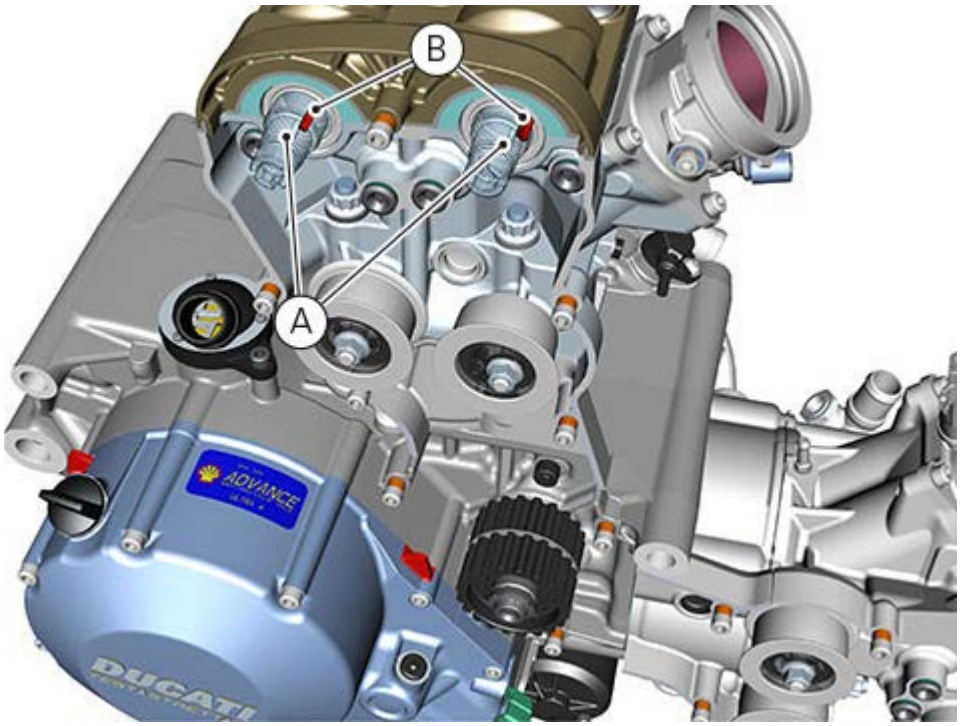
	Reference	Assembly value (new belt)	Recovery value (used belt)
Cold belt tension adjustment	DDS	110±5 Hz (horizontal)	80±5 Hz (horizontal)
		110±5 Hz (vertical)	80±5 Hz (vertical)
	Cold min. limit value		70 Hz

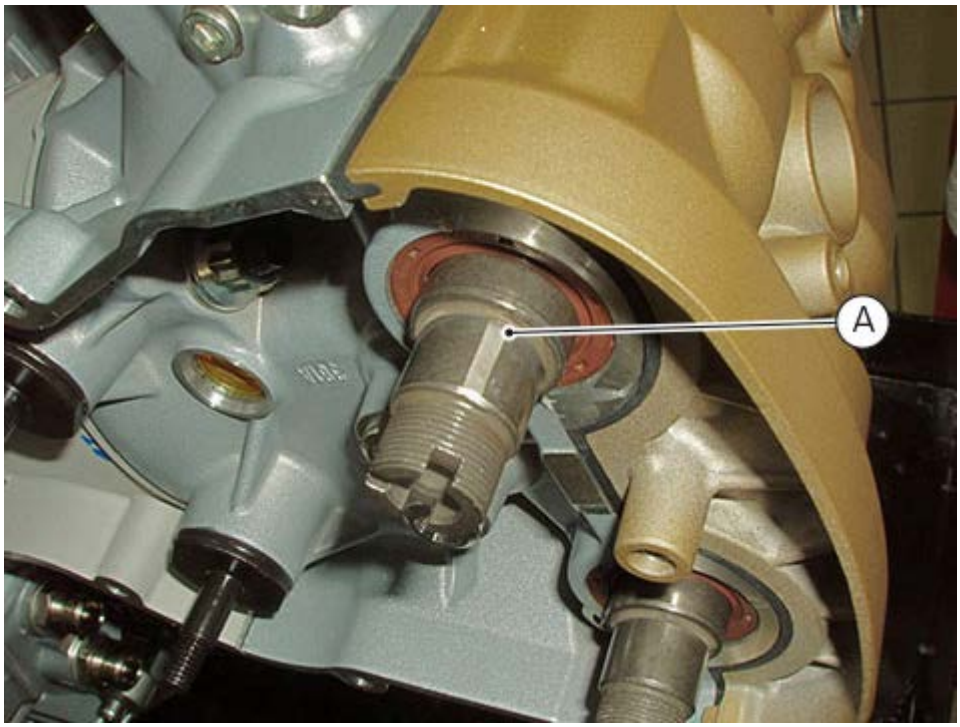
Remove the horizontal head camshaft blocking tool (B) no. **88765.1623** .

Refit the external timing belt covers (Refitting the timing belt external covers).
Refit the vertical head central exhaust pipe (Refitting the exhaust system).
Connect the secondary air unit (Refitting the secondary air system).
Refit the fuel tank (Refitting the fuel tank).
Refit the seat (Refitting the seat).

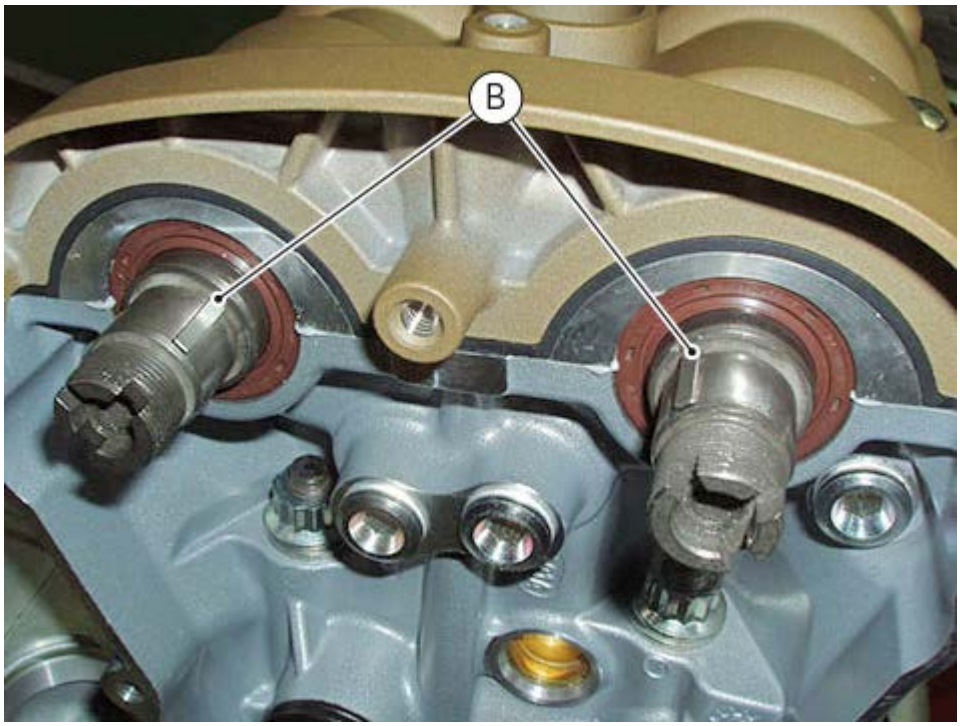
Refitting the cylinder heads pulleys/idler pulleys

Check that the seat (A) on the end of the camshafts is in good condition and without burrs.

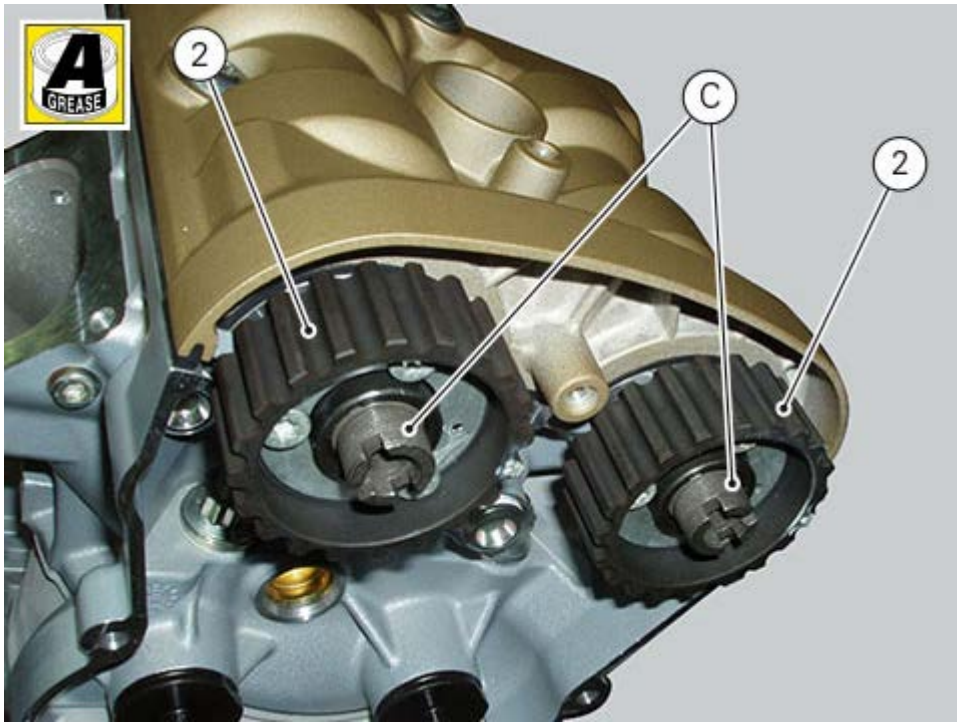




Fit a key (B) in the keyway of each camshaft.

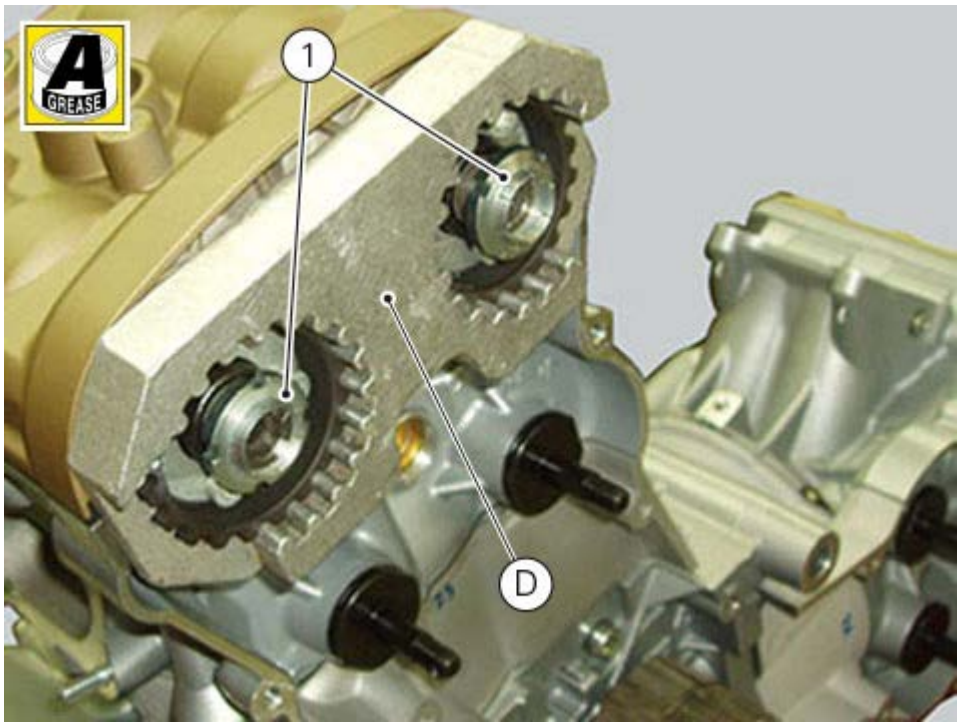


Fit the pulley (2) on the camshaft, inserting the key in the in the pulley slot (C).
Apply the indicated grease to the threads of the camshaft.
Repeat the procedure on the other camshaft.

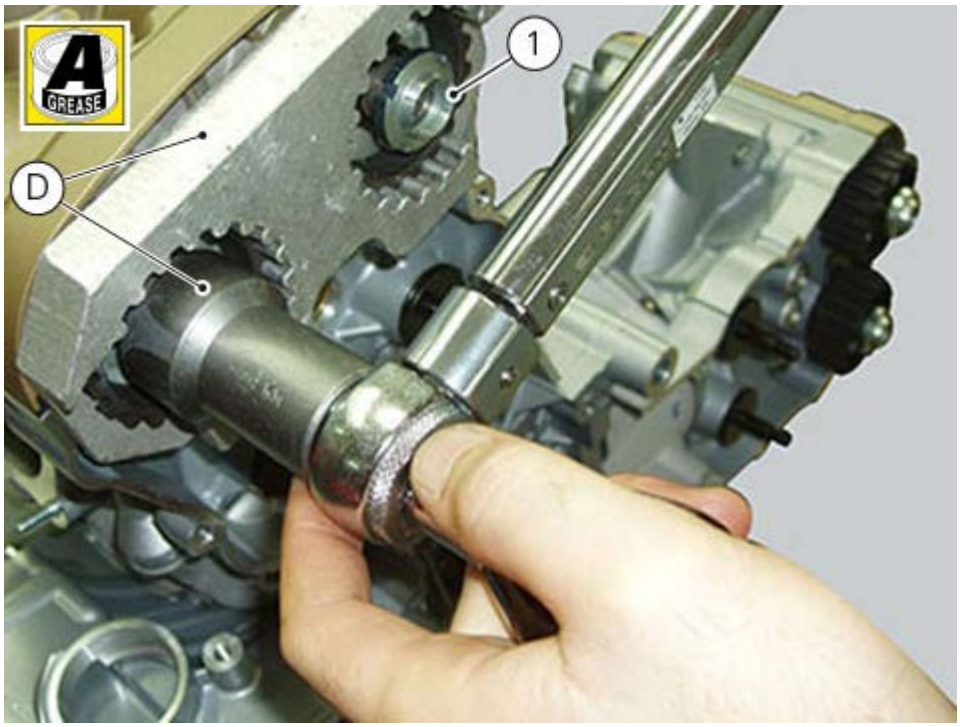


Insert tool (D) no. **88713.1806** in the belt rollers to prevent them from rotating.
Apply the indicated grease to the mating face of the ring nut (1).
Fit the ring nut (1).
Carry out the same operations on the other camshaft.

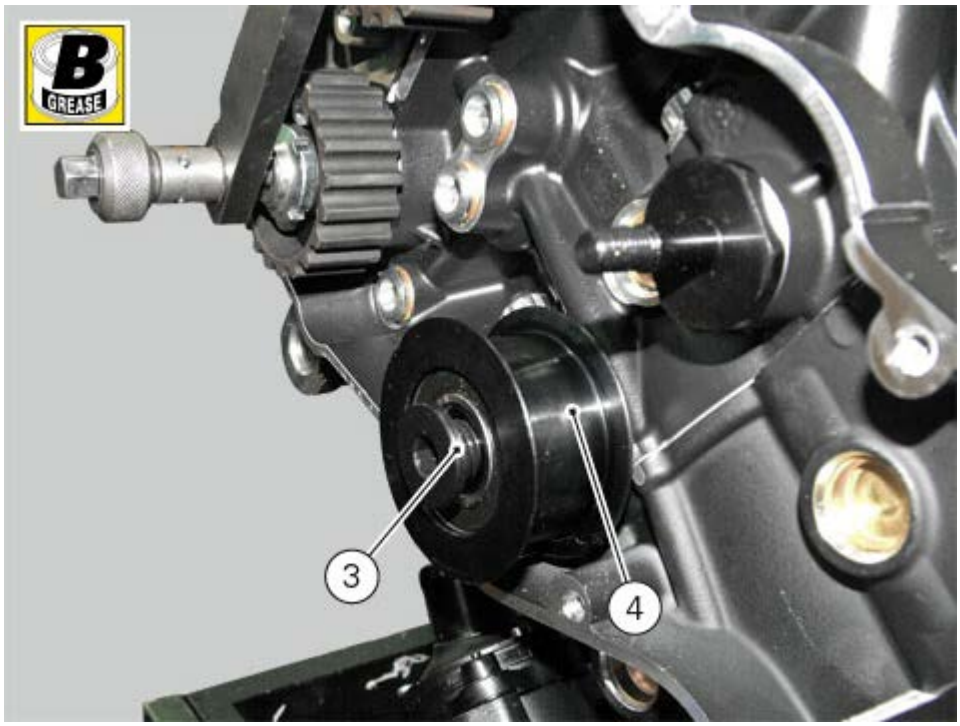
Important
Always fit new nuts on reassembly.



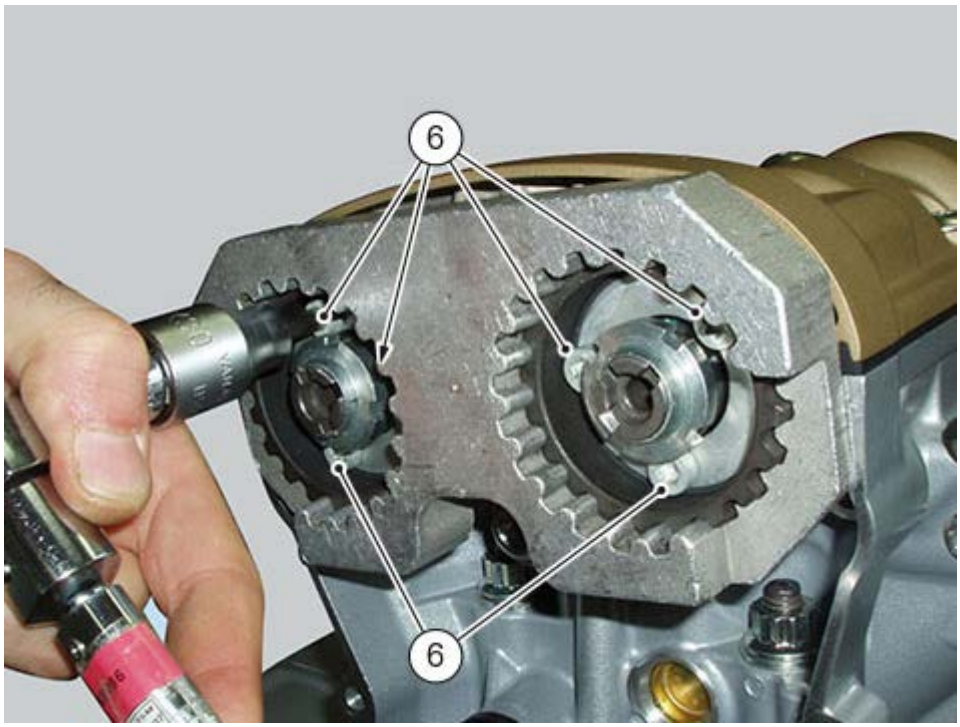
Use the bush supplied with tool no. **88713.1806**, and a torque wrench to tighten ring nuts (1) to 71 Nm (Min. 64 Nm - Max. 78 Nm).



Insert the fixed tensioners (4) with relevant bearing in the head pins and tighten screws (3) to a torque of 50 Nm (Min. 45 Nm - Max. 55Nm).



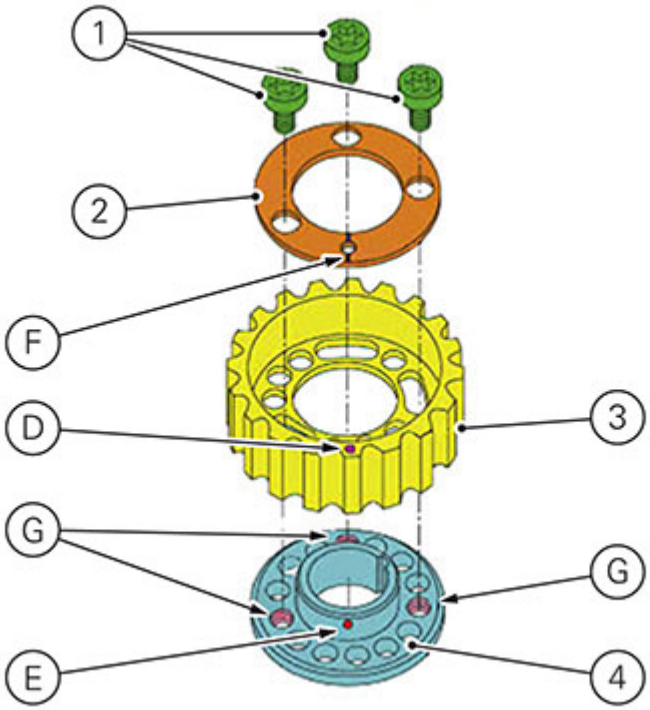
Undo the locking screws (6) of the pulleys, by turning them counter clockwise by 90° ± 5°.
Check that the pulleys have no end float and can rotate freely at all points along the full length of the slots.

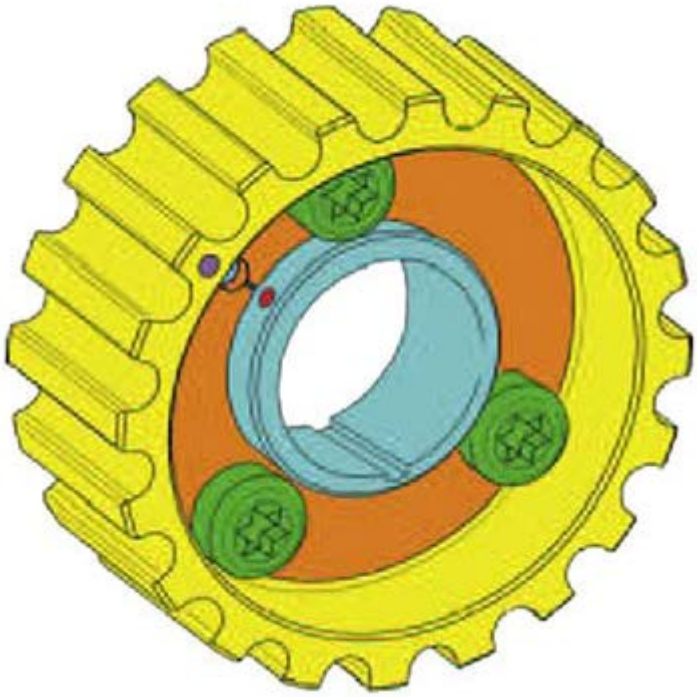


Refit the mobile tensioners and the timing belts (Refitting the timing belts).
Refit the external timing belt covers (Refitting the timing belt external covers).
Refit the vertical head central exhaust pipe (Refitting the exhaust system).
Connect the secondary air unit (Refitting the secondary air system).
Refit the fuel tank (Refitting the fuel tank).
Refit the seat (Refitting the seat).

Reassembling the timing pulleys

Fit the pulley (3) on the flange (4), aligning the timing pulley mark (D) with the flange timing mark (E).
Install the washer (2) up against the pulley, aligning the timing notch (F) with the pulley (D) and flange (E) timing marks.
Insert the three screws (1) in the threaded holes (G) of the flange.
Tighten the screws (1) to a torque of (Min. 6 Nm - Max. 7 Nm).

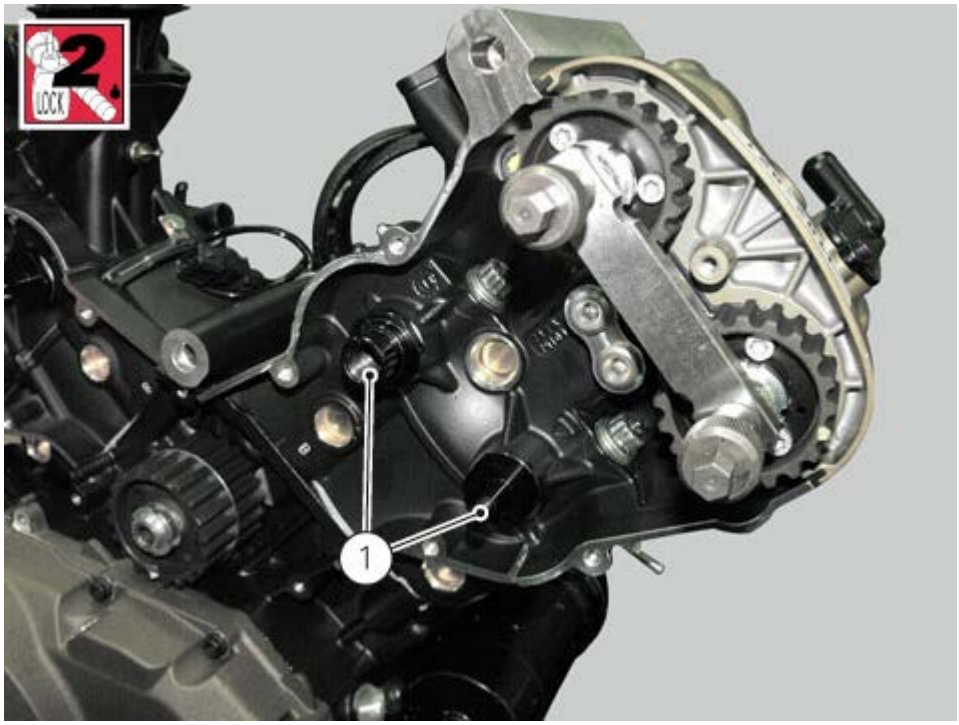


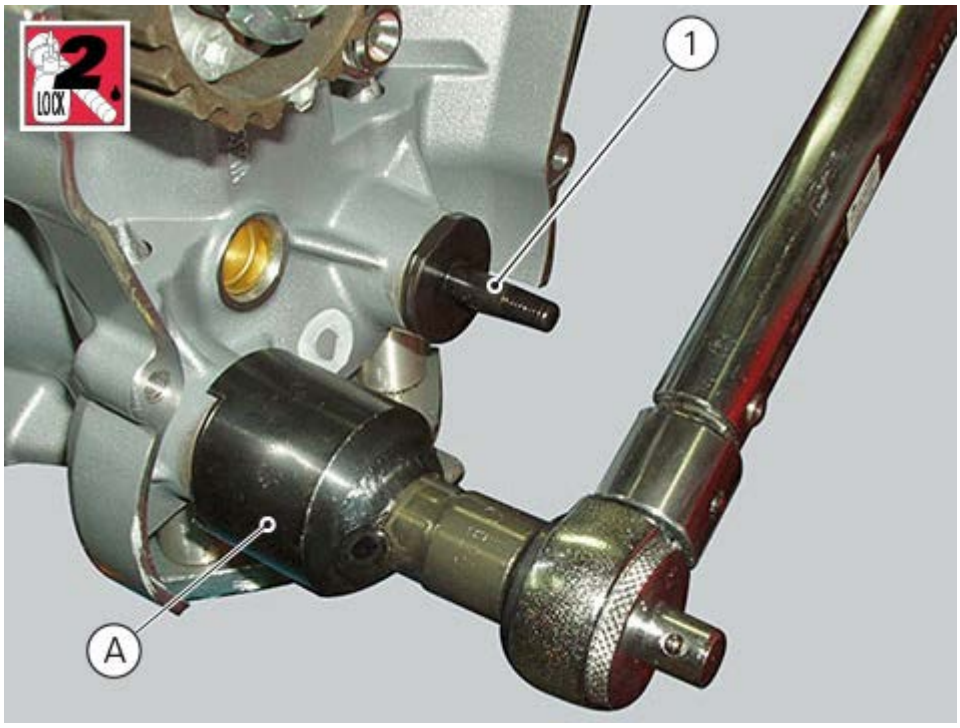


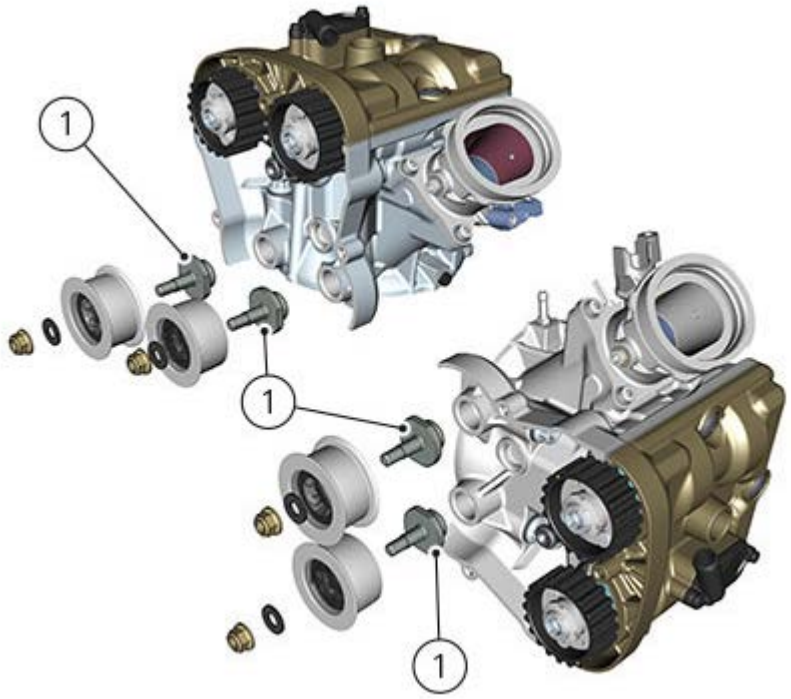
Refit the timing belts (Refitting the timing belts).
Refit the timing belt covers (Refitting the timing belt external covers).
Refit the vertical head exhaust heat guard cover (Refitting the exhaust system).
Refit the secondary air unit (Refitting the secondary air system).
Refit the fuel tank (Refitting the fuel tank).
Refit the seat (Refitting the seat).

Refitting the tensioner pins

Apply the recommended threadlocker to the pin thread.
Insert the tensioner pins (1) on the heads and tighten them with tool (A) no. **88713.1821**.
Tighten the tensioner pins to a torque of 50 Nm (Min. 45 Nm - Max. 55 Nm).



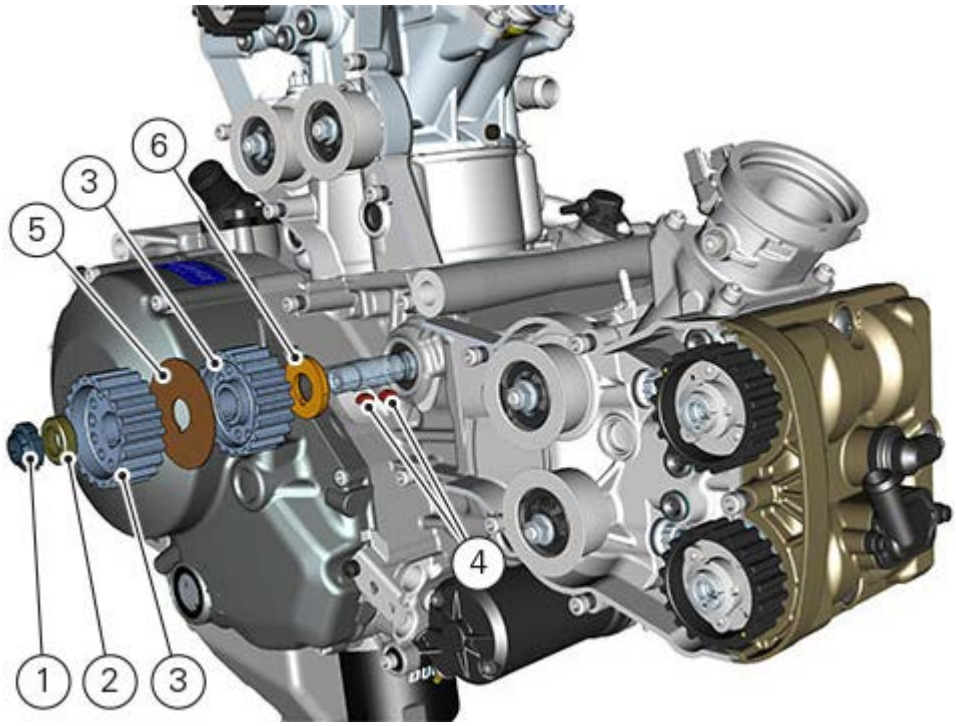




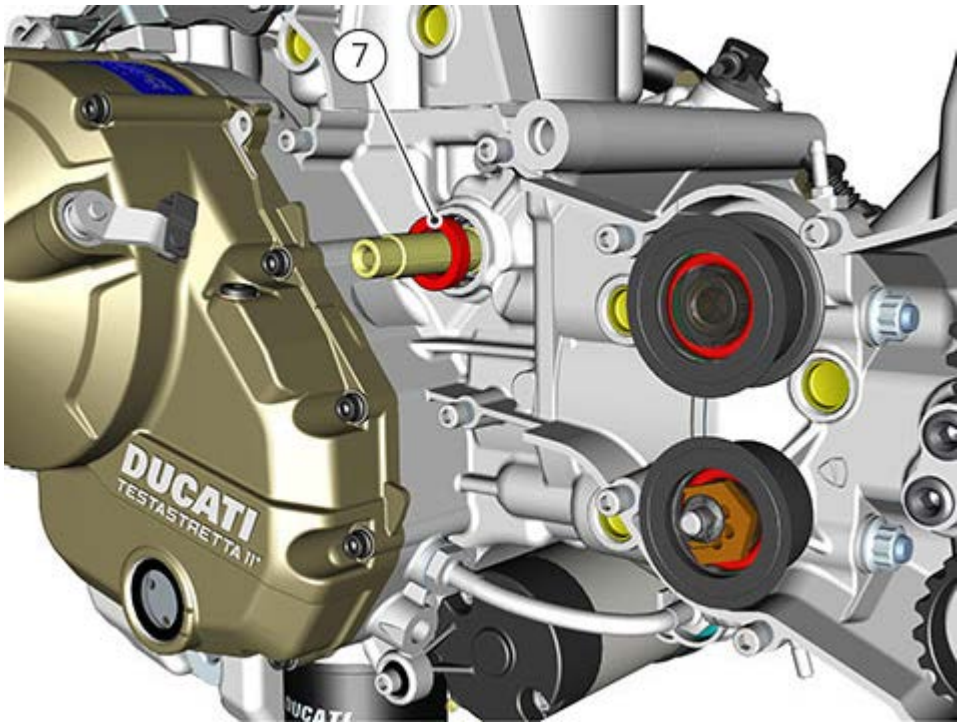
Refit the timing belts (Refitting the timing belts).
Refit the timing belt covers (Refitting the timing belt external covers).
Refit the vertical head exhaust heat guard cover (Refitting the exhaust system).
Refit the secondary air unit (Refitting the secondary air system).
Refit the fuel tank (Refitting the fuel tank).
Refit the seat (Refitting the seat).

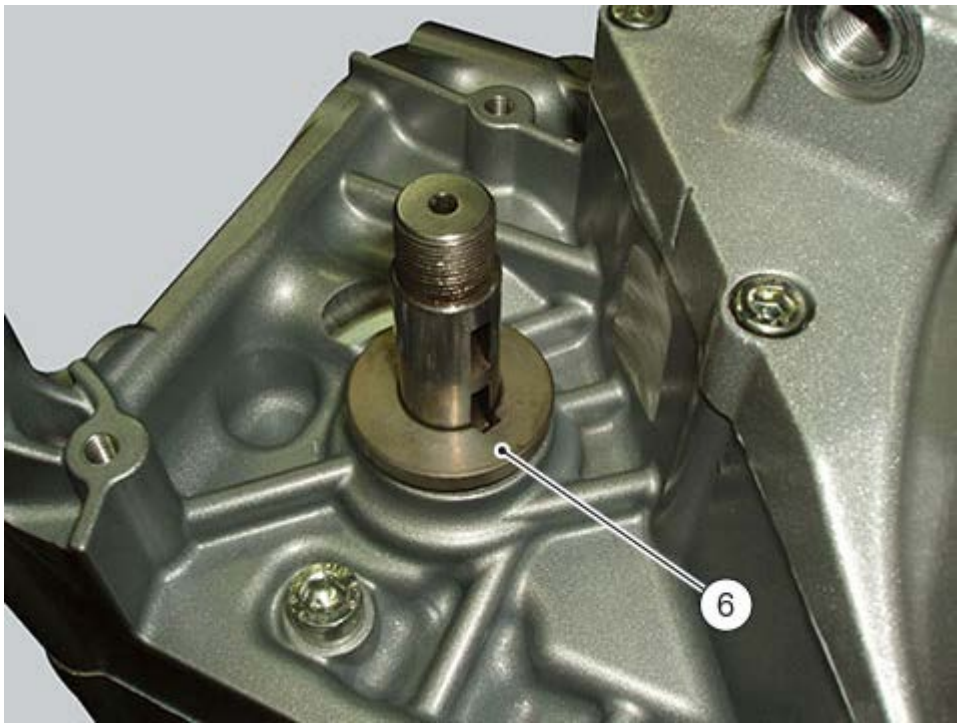
Refitting the timing layshaft pulley

To fit the snap ring (7) in the timing layshaft seat, use the tool no. **88713.2834**.

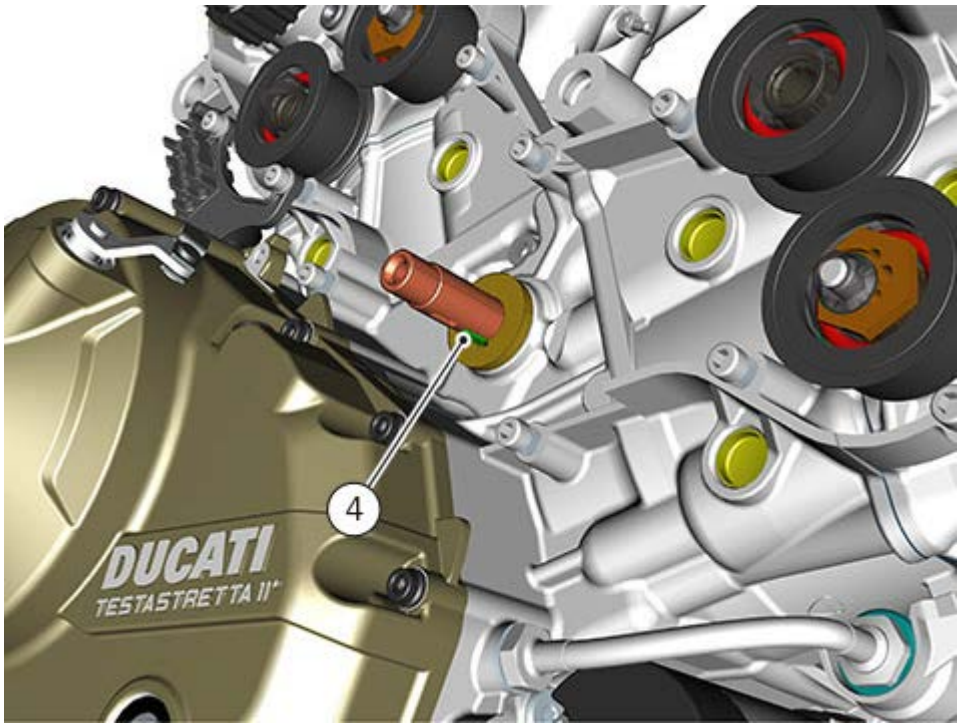


Install the inner spacer (6) on the timing layshaft, taking care to match the key notch.



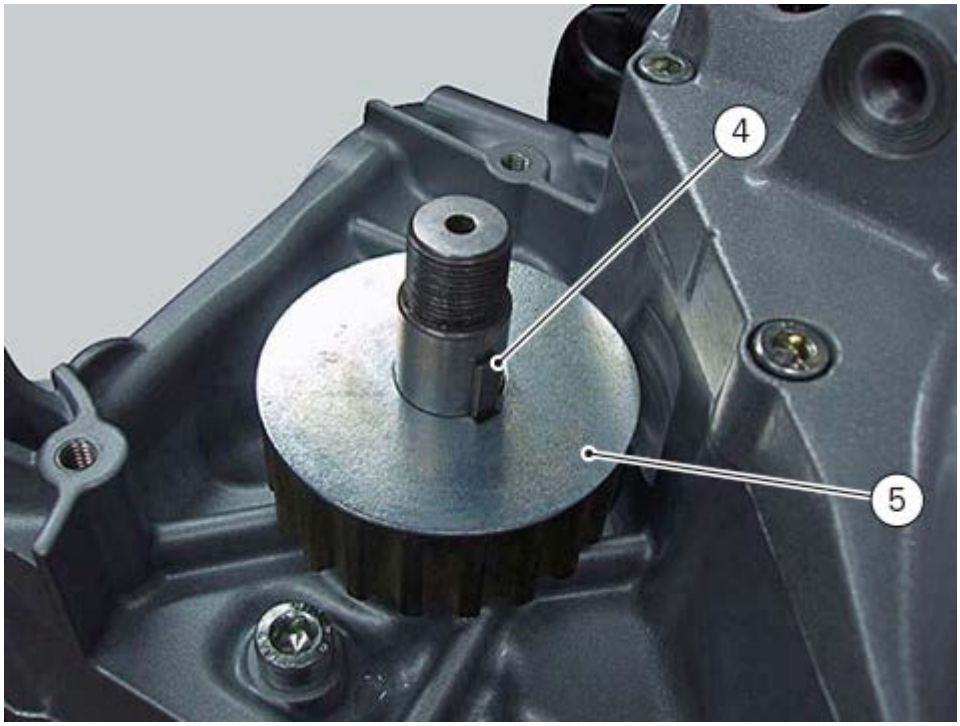


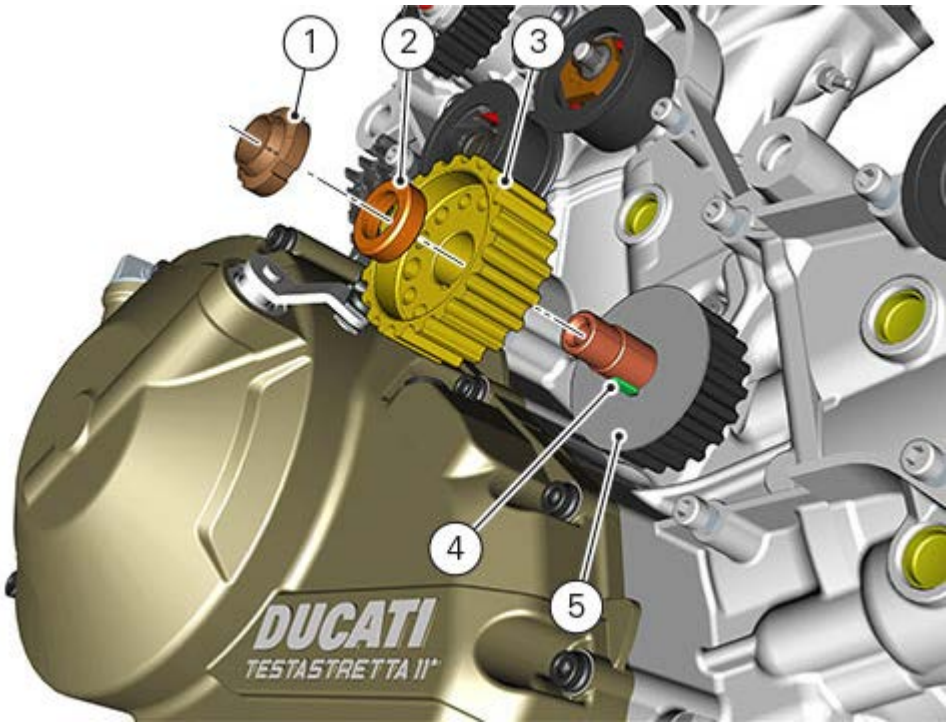
Fit the first key (4) on the timing layshaft.



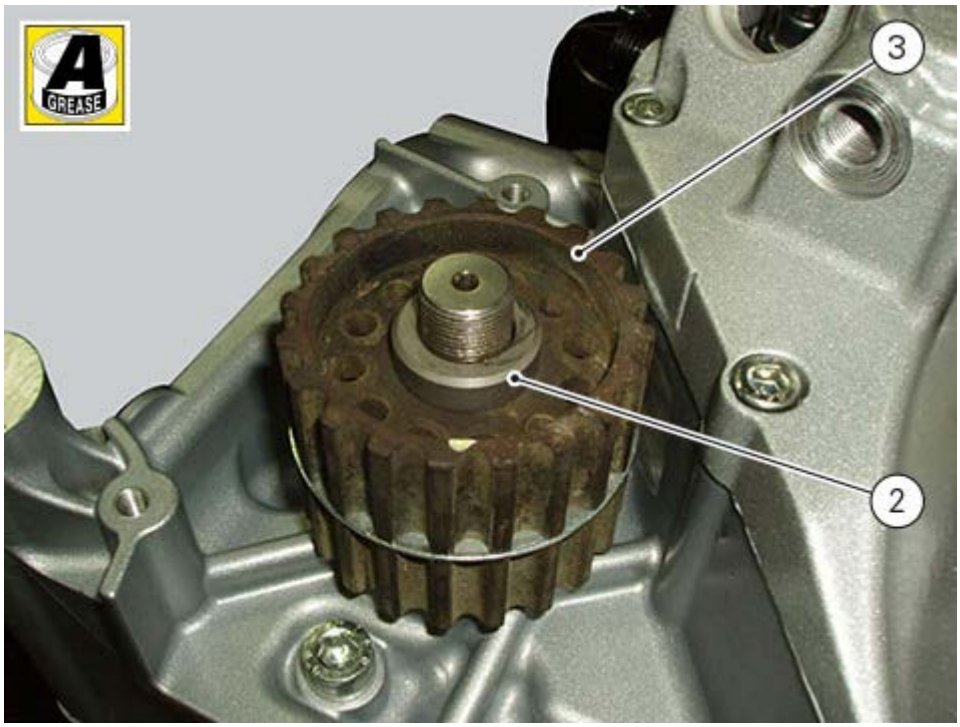
Locate the inner pulley (3).

Refit the second key (4) and the washer (5).





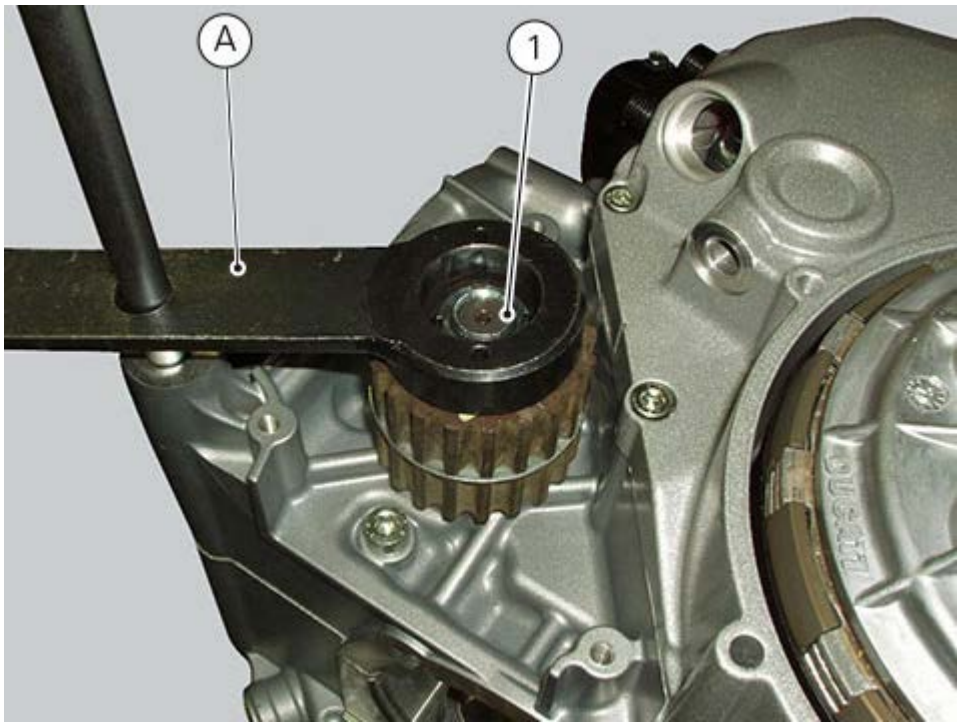
Locate the outer pulley (3) and the spacer (2).
Apply the indicated grease to the threads of the shaft.



Fit the ring nut (1).

Important
To prevent the ring nuts from loosening and consequent serious engine damage, always use new self-locking ring nuts on all the timing belt rollers.

Block with tool (A) no. **88713.1805** the rotation of the belt rollers and tighten to 71 Nm (Min. 64 Nm - Max. 78 Nm) the self-locking ring nut using the insert supplied with the wrench and a torque wrench.



Undo the six locking screws (1) of the pulleys, by turning them counter clockwise by 90° ± 5°.
Check that the pulley has no end float and can rotate freely at all points along the full length of the slots.
After checking, tighten the six screws (1) to a torque of (Min. 6 Nm - Max. 7 Nm).

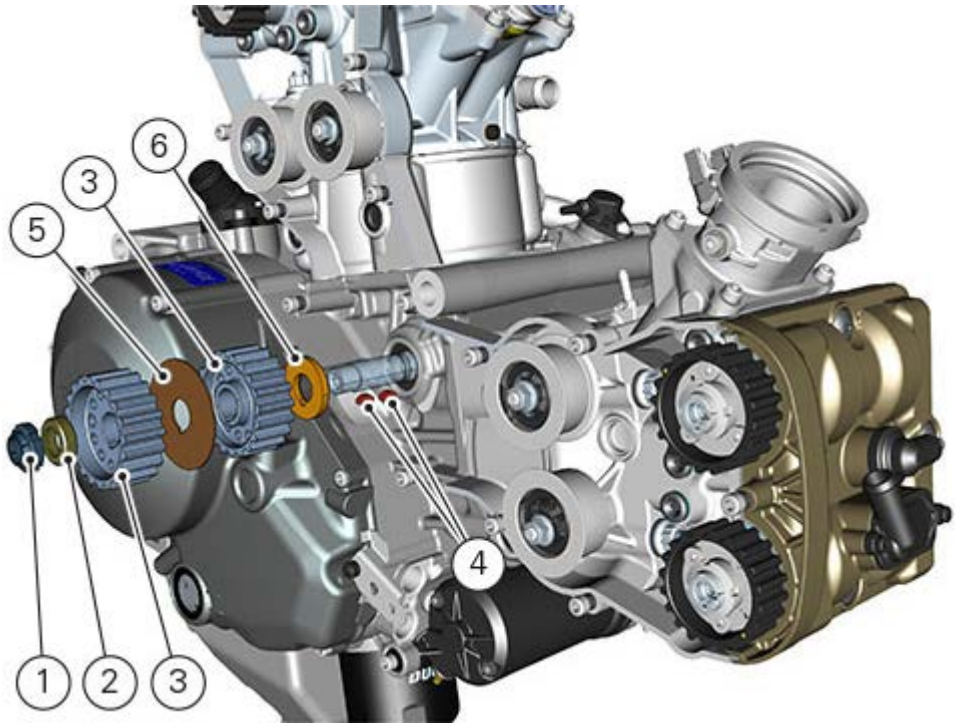
Refit the timing belts (Refitting the timing belts).
Refit the timing belt covers (Refitting the timing belt external covers).
Refit the vertical head exhaust heat guard cover (Refitting the exhaust system).
Refit the secondary air unit (Refitting the secondary air system).
Refit the fuel tank (Refitting the fuel tank).
Refit the seat (Refitting the seat).

Removing the timing layshaft pulleys

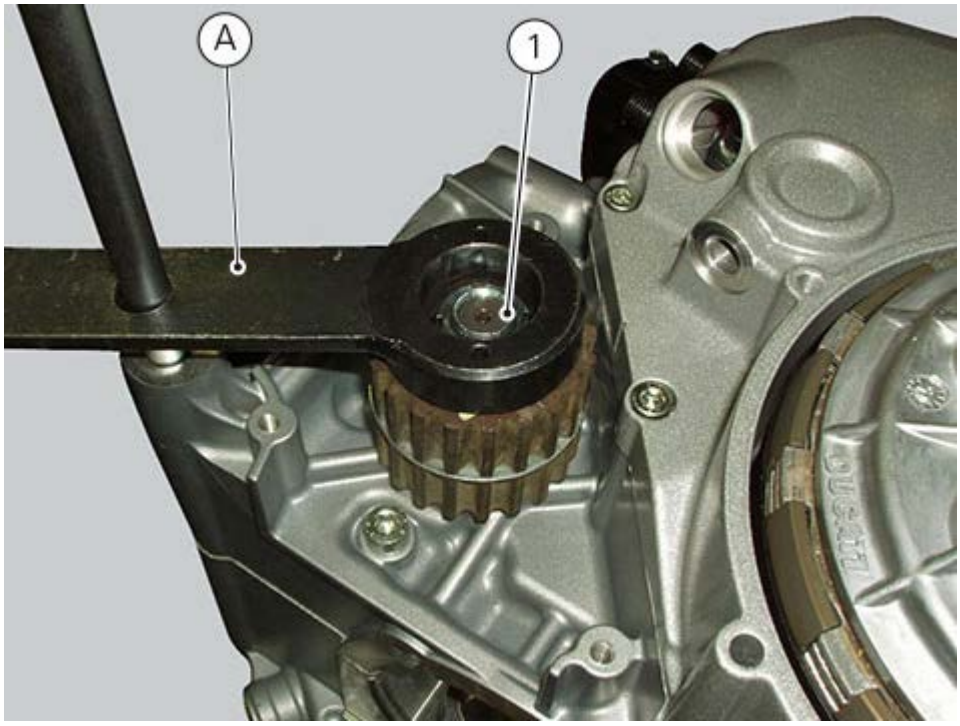
Remove the seat (Removing the seat).
Remove the fuel tank (Removing the fuel tank).
Disconnect the secondary air unit (Removing the secondary air system).
Remove the vertical head central exhaust pipe (Removing the exhaust system).
Remove the external timing belt covers (Removing the timing belt external covers).
Remove the mobile tensioner/timing belt (Removing the mobile tensioner/timing belt).
Remove the cylinder head pulley/fixed tensioner (Removing the cylinder head pulley/fixed tensioner).

Block with tool no. **88713.1805** the rotation of the driving belt rollers on the crankcase.

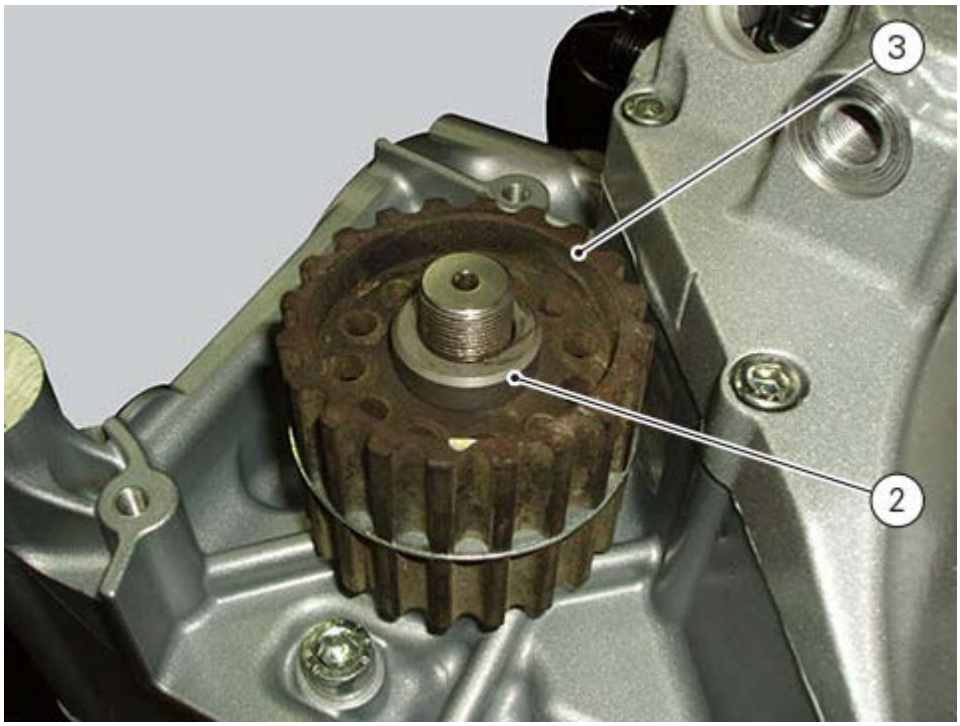
If this operation is carried out with the engine installed in the frame, hold the driving pulleys against rotation using tool (A) no. **88713.2011** mounted on the generator cover.



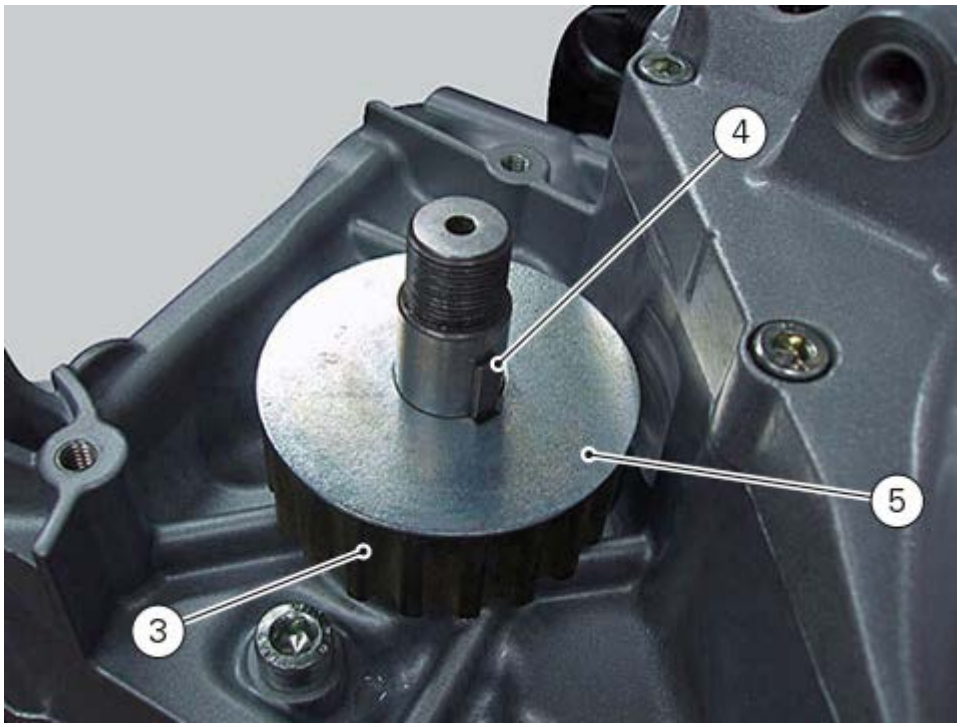
Loosen the ring nut (1) using the socket supplied with the tool.



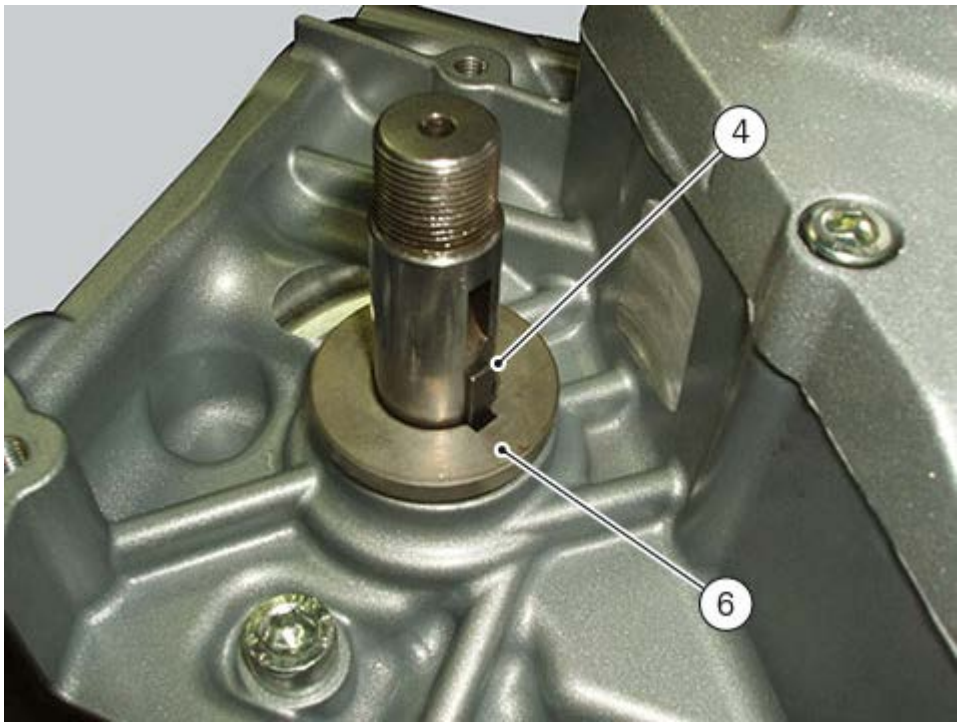
Remove the ring nut (1), the spacer (2) and the outer pulley (3).



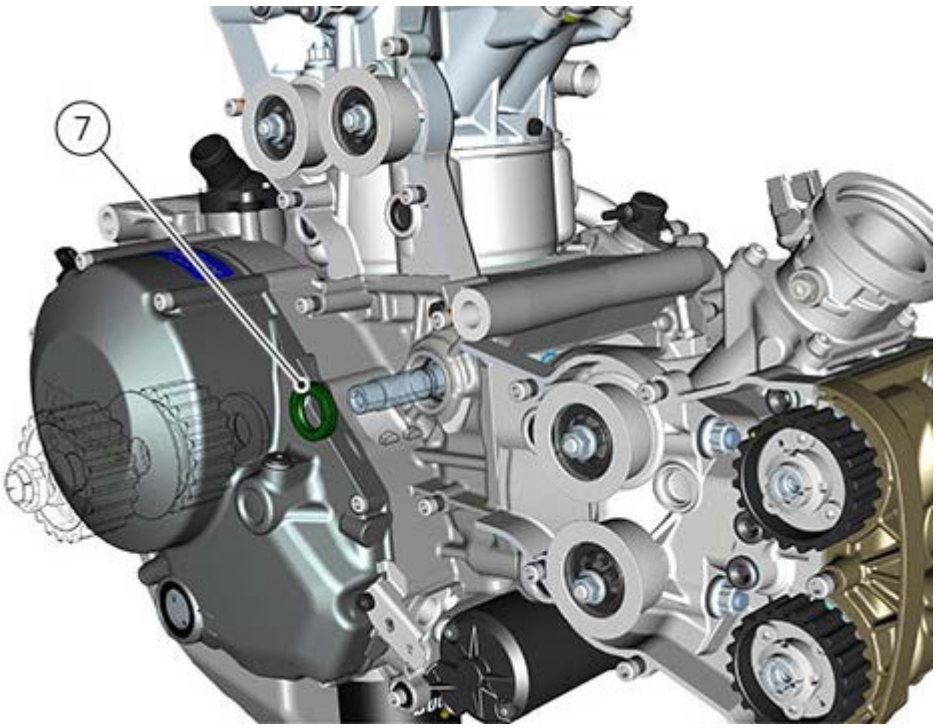
Remove the first key (4) from the timing layshaft.
Remove the spacer (5) and the inner pulley (3).



Remove the inner spacer (6) and second key (4) on the timing layshaft.



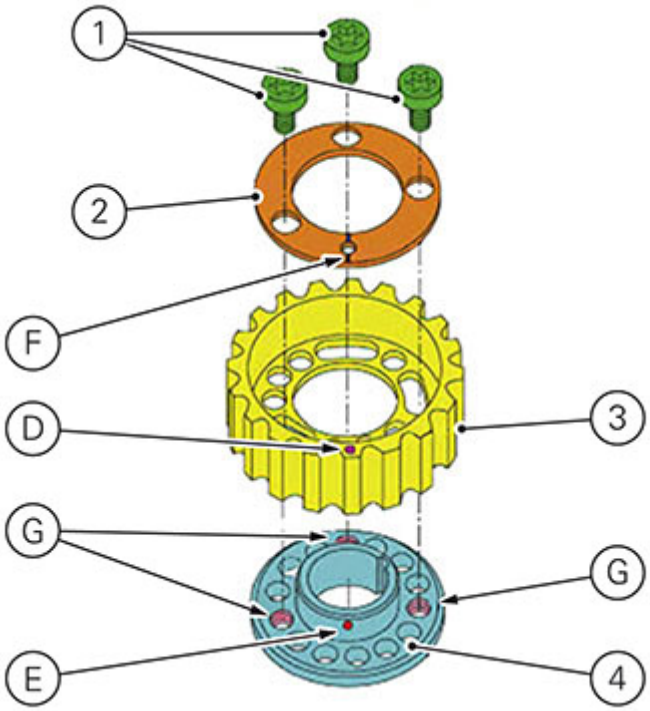
It is now possible to remove the snap ring (7) on the timing layshaft.

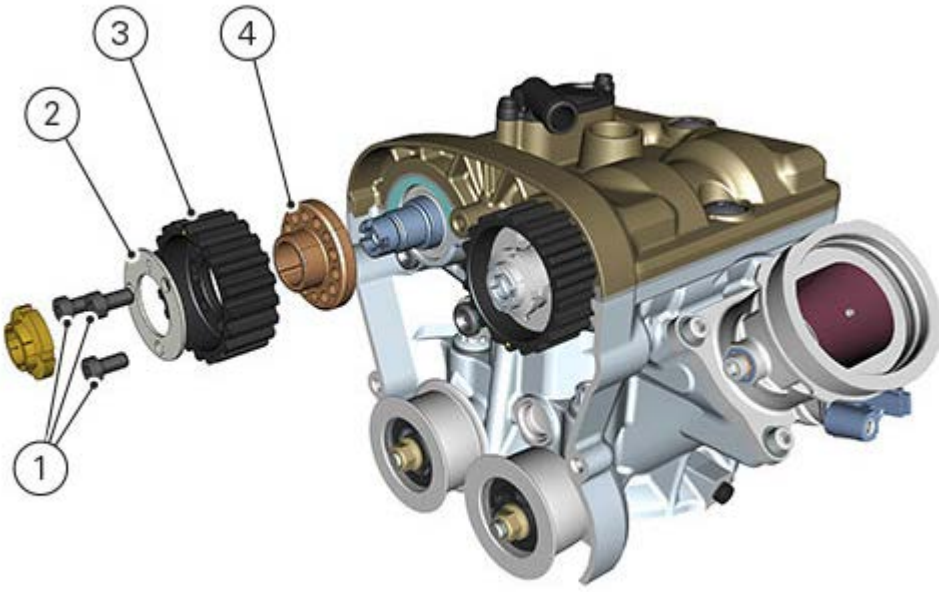


Disassembling the camshaft pulleys

Remove the seat (Removing the seat).
Remove the fuel tank (Removing the fuel tank).
Disconnect the secondary air unit (Removing the secondary air system).
Remove the vertical head central exhaust pipe (Removing the exhaust system).
Remove the external timing belt covers (Removing the timing belt external covers).
Remove the mobile tensioner/timing belt (Removing the mobile tensioner/timing belt).
Remove the cylinder head pulley/fixed tensioner (Removing the cylinder head pulley/fixed tensioner).

Undo and remove the screws (1).
Slide off the washer (2).
Withdraw the camshaft pulley (3) from the spacer flange (4).

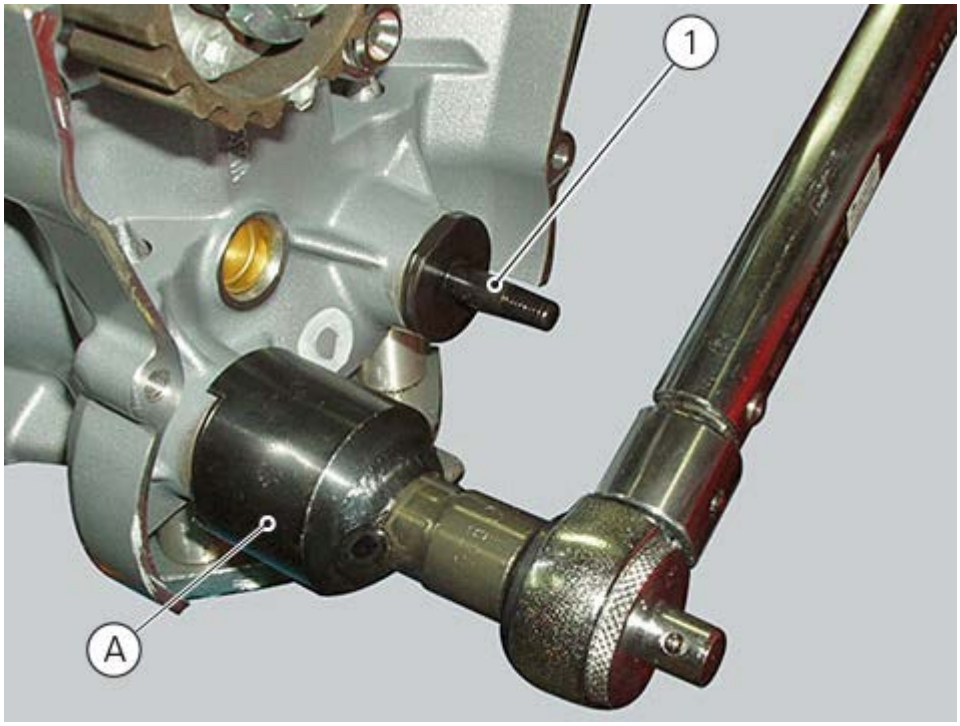


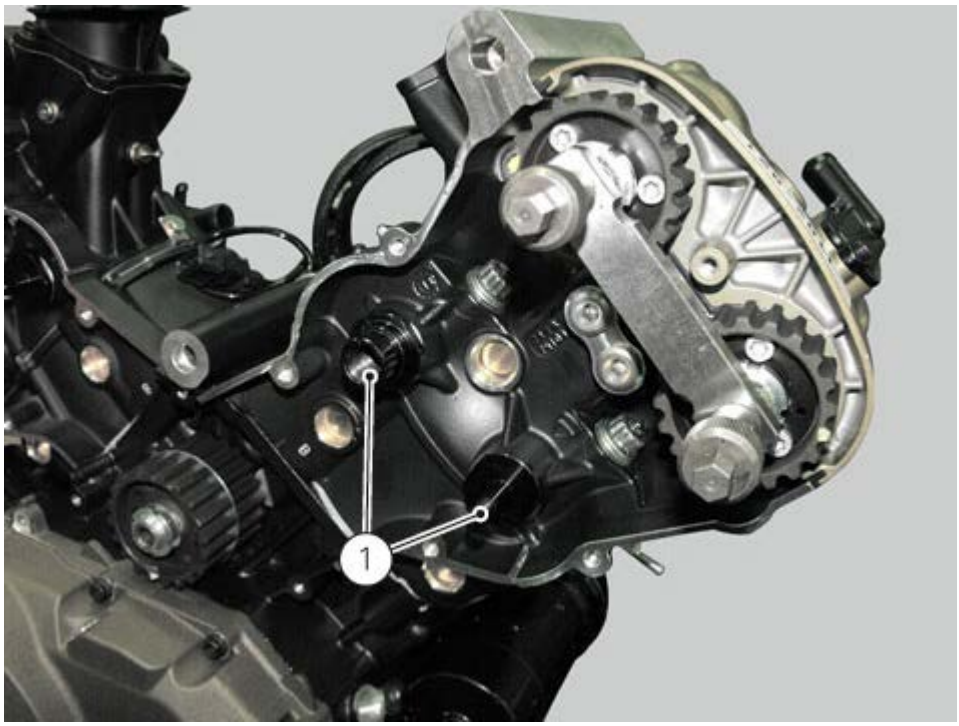


Removing the tensioner pins

Remove the seat (Removing the seat).
Disconnect the secondary air unit (Removing the secondary air system).
Remove the vertical head central exhaust pipe (Removing the exhaust system).
Remove the external timing belt covers (Removing the timing belt external covers).
Remove the mobile tensioner/timing belt (Removing the mobile tensioner/timing belt).
Remove the cylinder head pulley/fixed tensioner (Removing the cylinder head pulley/fixed tensioner).

Use tool (A) no. **88713.1821** to remove tensioner pins (1) from both heads.





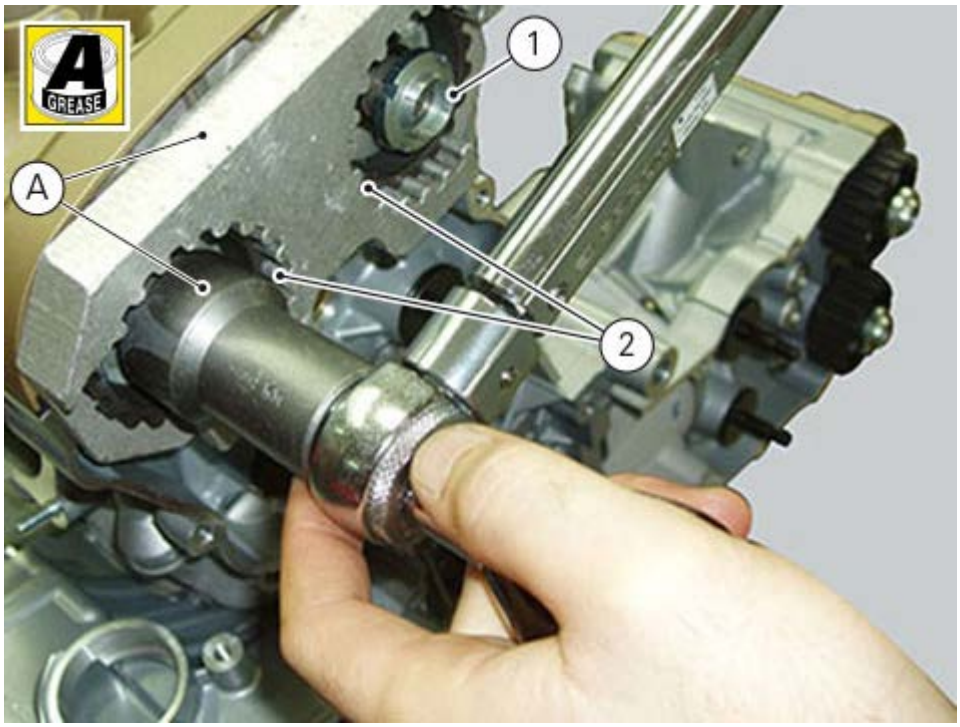
Removing the cylinder head pulley/fixed tensioner

Remove the seat (Removing the seat).
Remove the fuel tank (Removing the fuel tank).
Disconnect the secondary air unit (Removing the secondary air system).
Remove the vertical head central exhaust pipe (Removing the exhaust system).
Remove the external timing belt covers (Removing the timing belt external covers).
Remove the mobile tensioner/timing belt (Removing the mobile tensioner/timing belt).

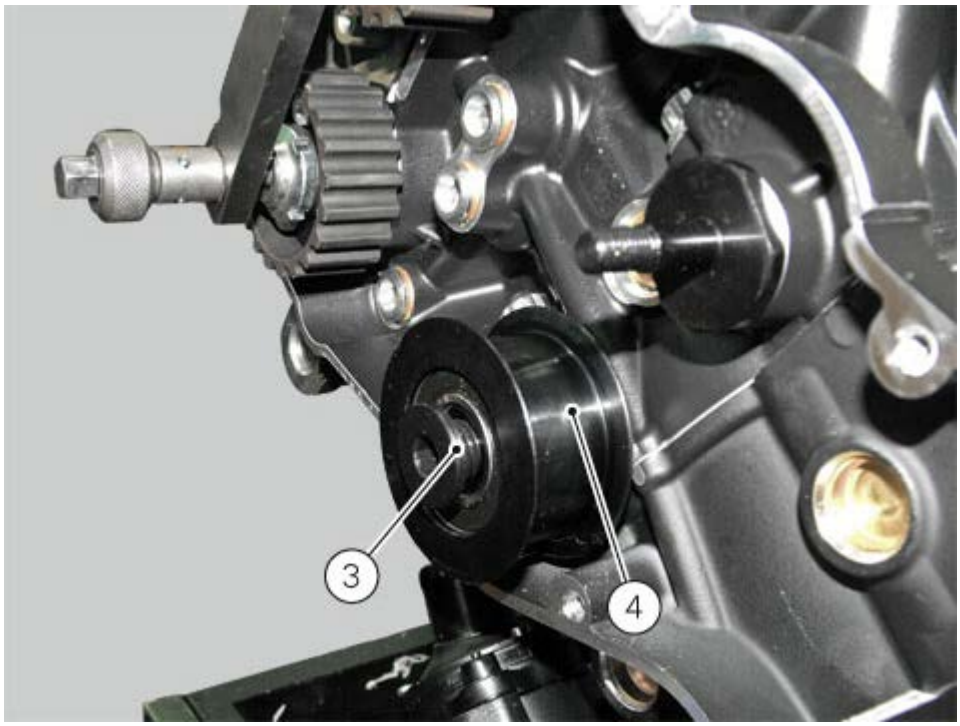
Fit tool (A) part no. **88713.1806** in the pulleys to lock their rotation and use the supplied bush to loosen the fixing ring nuts (1) of the pulleys.

Important
Upon reassembly, always use new ring nuts.

Remove the ring nuts (1) and the pulleys (2) from the camshafts.



Loosen screw (3) and remove the fixed tensioner pulley (4).
Repeat the same procedure to remove the other tensioner.



Removing the mobile tensioner/timing belt

Remove the seat (Removing the seat).
Remove the fuel tank (Removing the fuel tank).
Disconnect the secondary air unit (Removing the secondary air system).
Remove the vertical cylinder exhaust heat guard cover (Removing the exhaust system).
Remove the timing belt covers (Removing the timing belt external covers).

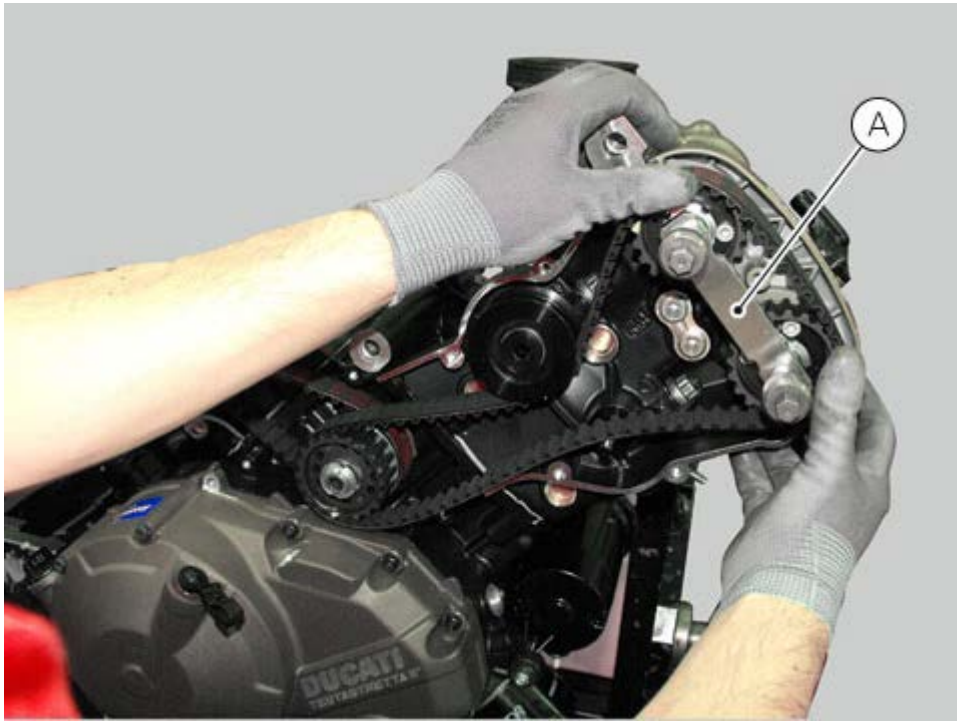
Fit tool (A) part no. **88765.1623** in the belt rollers to prevent them from rotating.

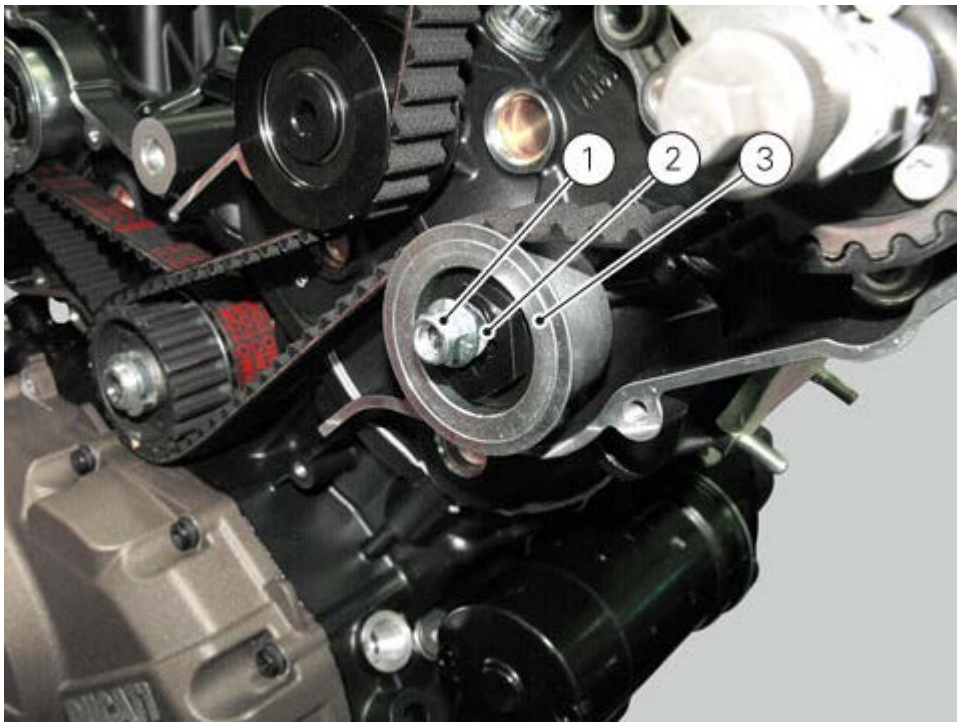
Loosen the nut (1) and remove the washer (2) and the mobile tensioner (3) from the pin (4) on the cylinder head.
Remove the timing belt (5) from the piston-cylinder assy.

Important

If the belts are to be re-used, mark the direction of rotation with an arrow and also mark the piston-cylinder assy they belong to.

Repeat the procedure for the other piston-cylinder assy.





Removing the timing belt covers

Note
For clarity, the figures show the engine removed from the frame.

To work with the engine installed on the frame, first proceed as follows:

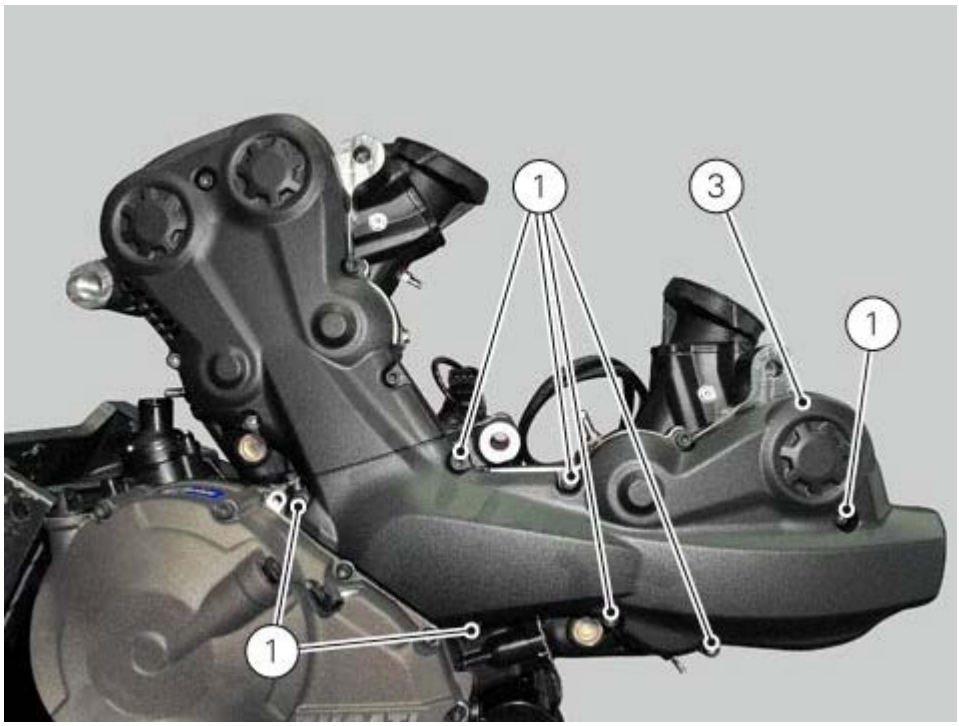
Warning
When working with installed engine, wait for the components to cool down

Remove the seat (Removing the seat).
Remove the fuel tank (Removing the fuel tank).
Disconnect the secondary air unit (Removing the secondary air system).
Remove the vertical cylinder exhaust heat guard cover (Removing the exhaust system), on the right side.

Note
Remove also any parts which may impede the procedure.

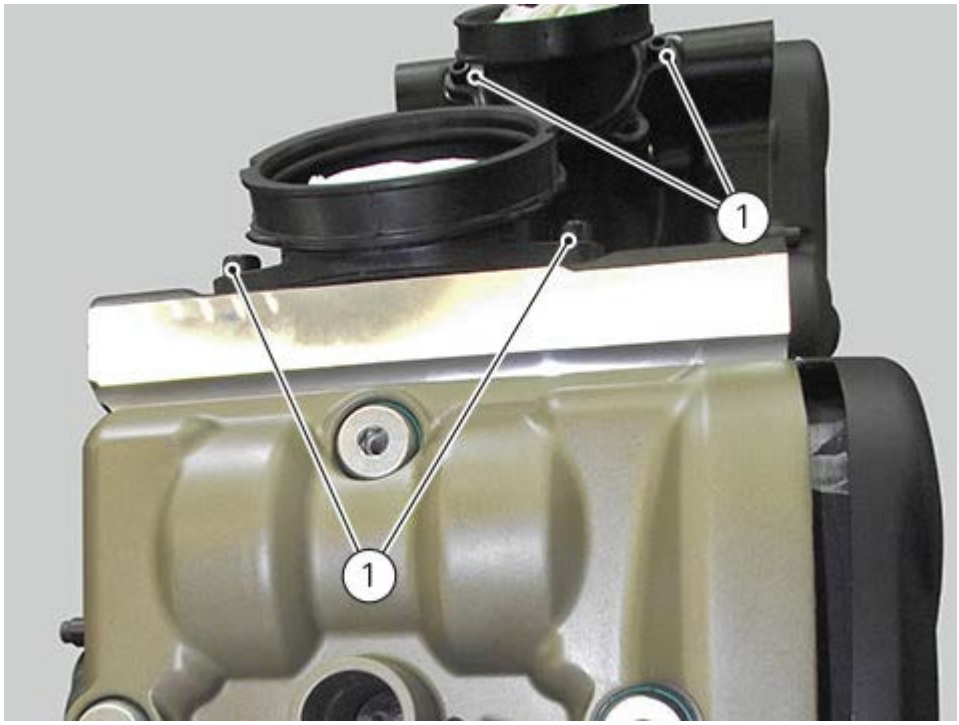
Undo the fixing screws (1) of the external cover (2) and remove it from the vertical piston-cylinder assy.

Undo the fixing screws (1) of the external cover (3) and remove it from the horizontal piston-cylinder assy.

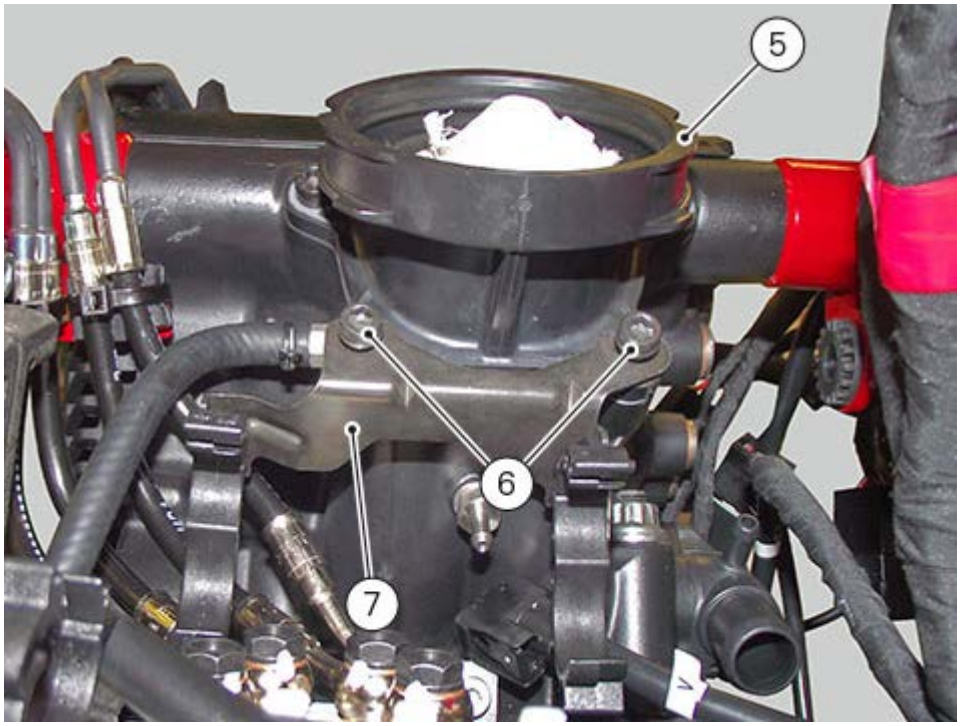


Refitting the intake manifold and water union

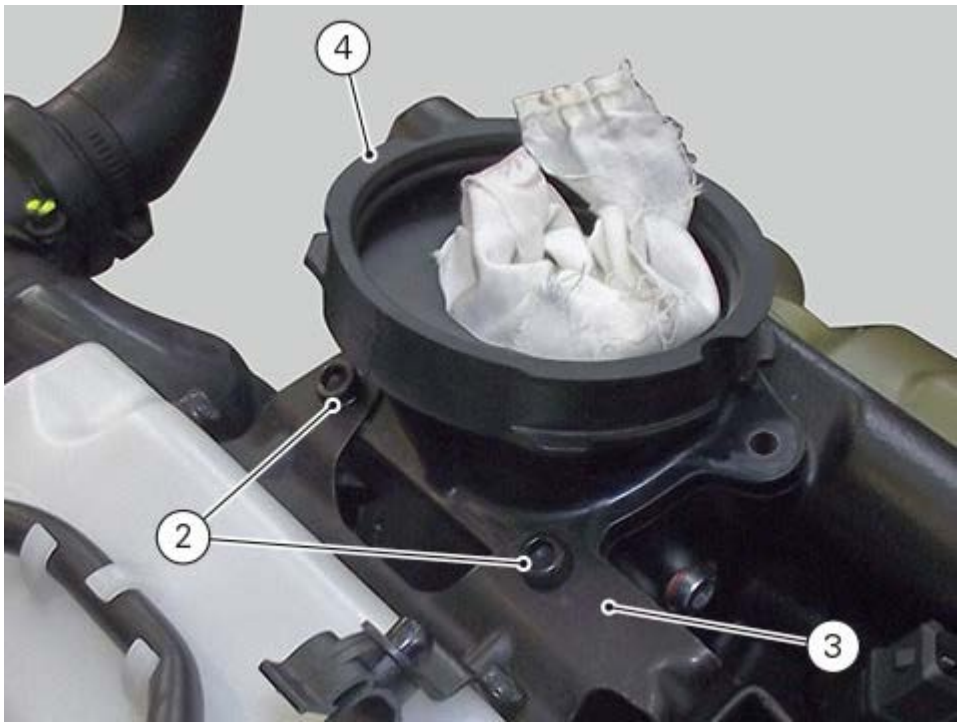
After ensuring that the matching surfaces of horizontal and vertical manifolds and heads are perfectly flat and clean, install the intake manifolds and fix them with screws (1).



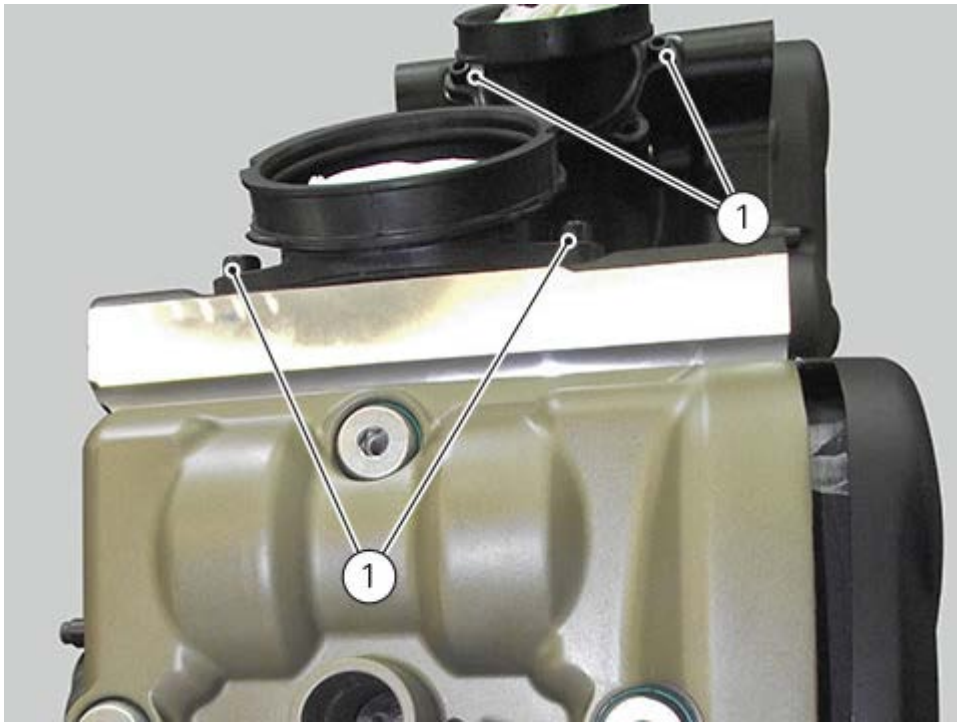
Work on the vertical head to position cable guide plate (7) and tighten screws (6) to a torque of 10 Nm ± 10%.



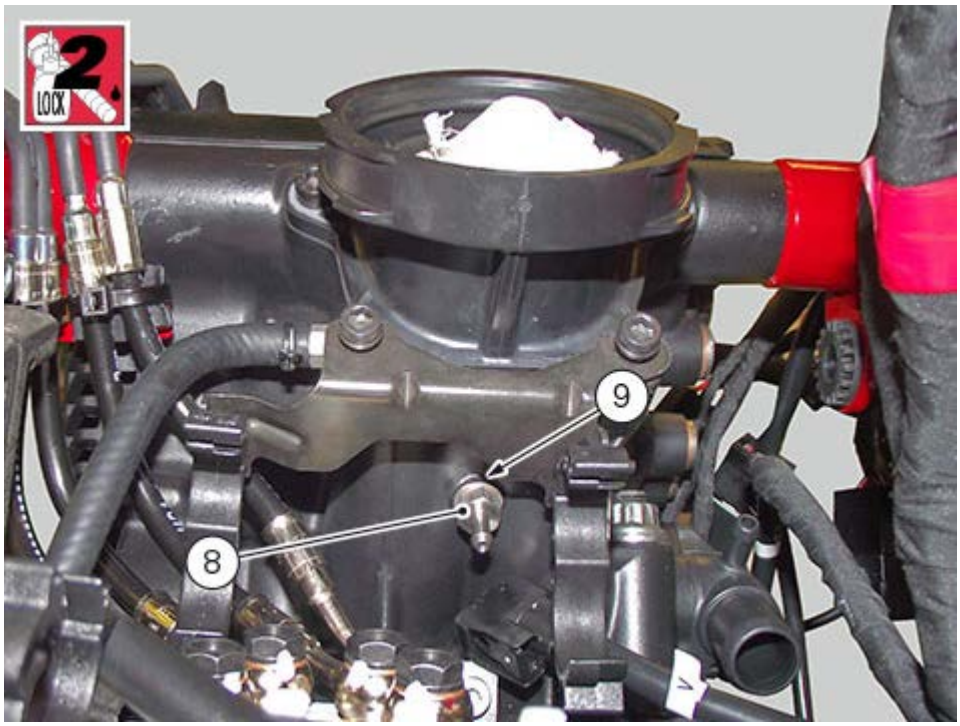
Work on the horizontal head to position expansion reservoir retaining bracket (3) and tighten screws (2) to a torque of 8 Nm ± 10%.



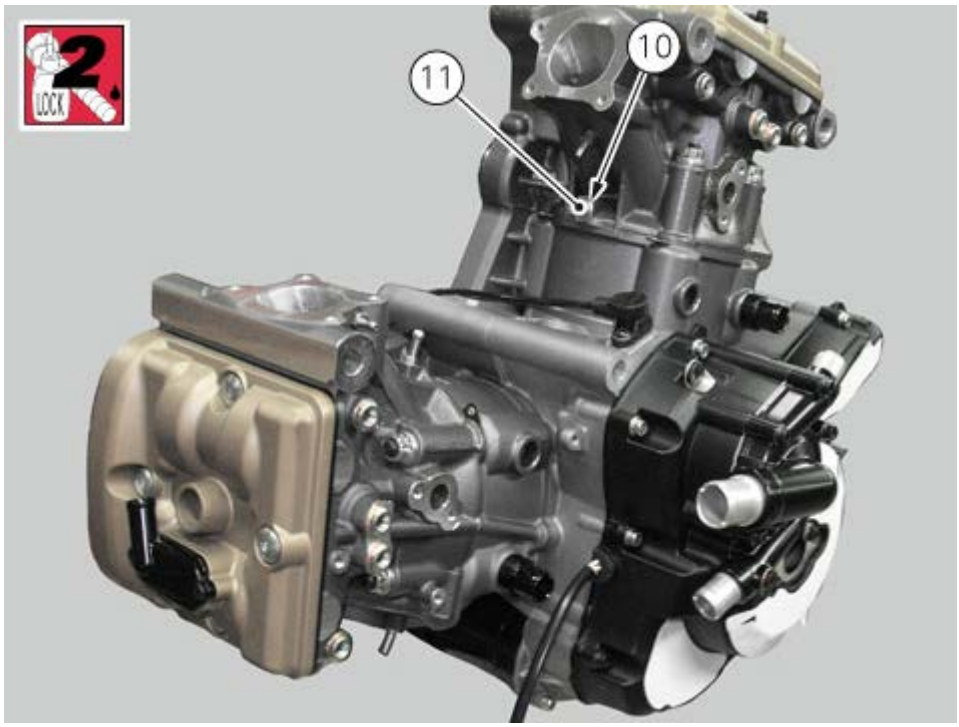
Work on both intake manifolds and tighten screws (1) to a torque of 10 Nm (Min. 9 Nm - Max. 11 Nm).



Apply specified threadlocker on the vertical head union (8).
Fit seal (9) and tighten union (8) to a torque of 2 Nm (Min. 2 Nm - Max. 3 Nm).



Working on the vertical head, fit seal (10) and tighten screw (11) with pre-applied specified threadlocker to a torque of 10 Nm (Min. 9 Nm - Max. 11 Nm).

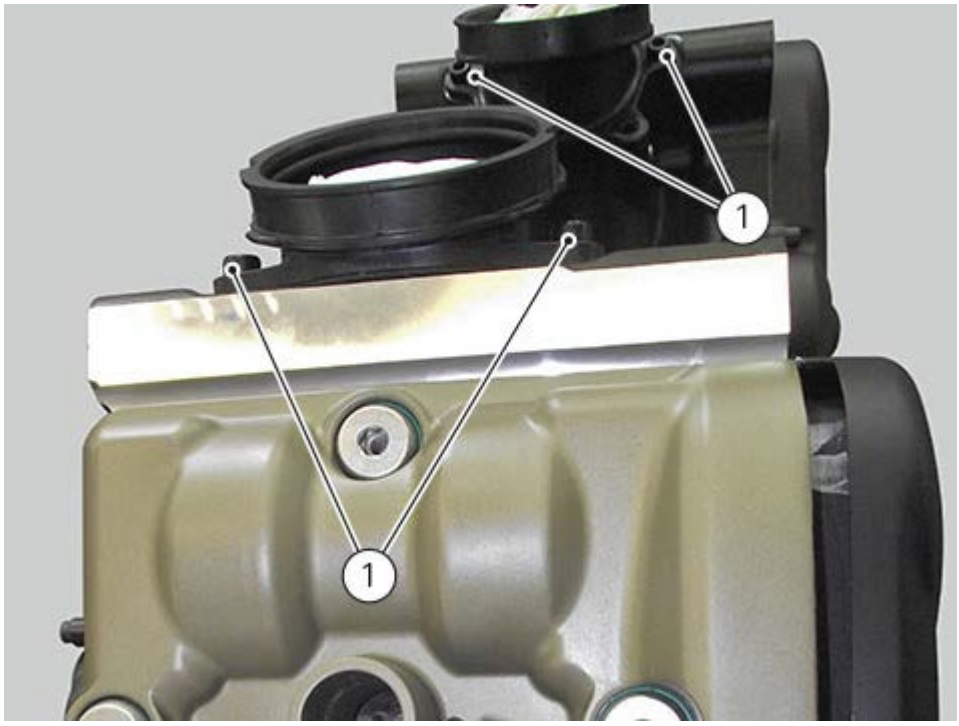


Refit the airbox and the throttle body (Refitting the airbox and throttle body).
Refit the tank (Refitting the fuel tank).
Refit the seat (Refitting the seat).

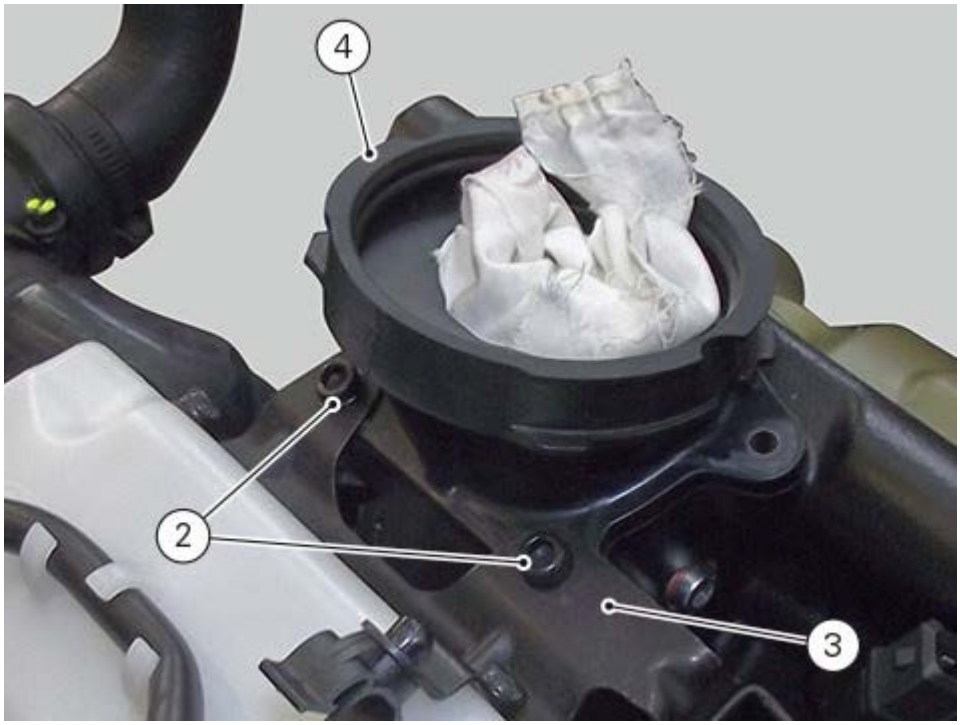
Removing the intake manifold and water union

Remove the seat (Removing the seat).
Remove the fuel tank (Removing the fuel tank).
Remove the airbox and injector unit (Removing the airbox and throttle body).

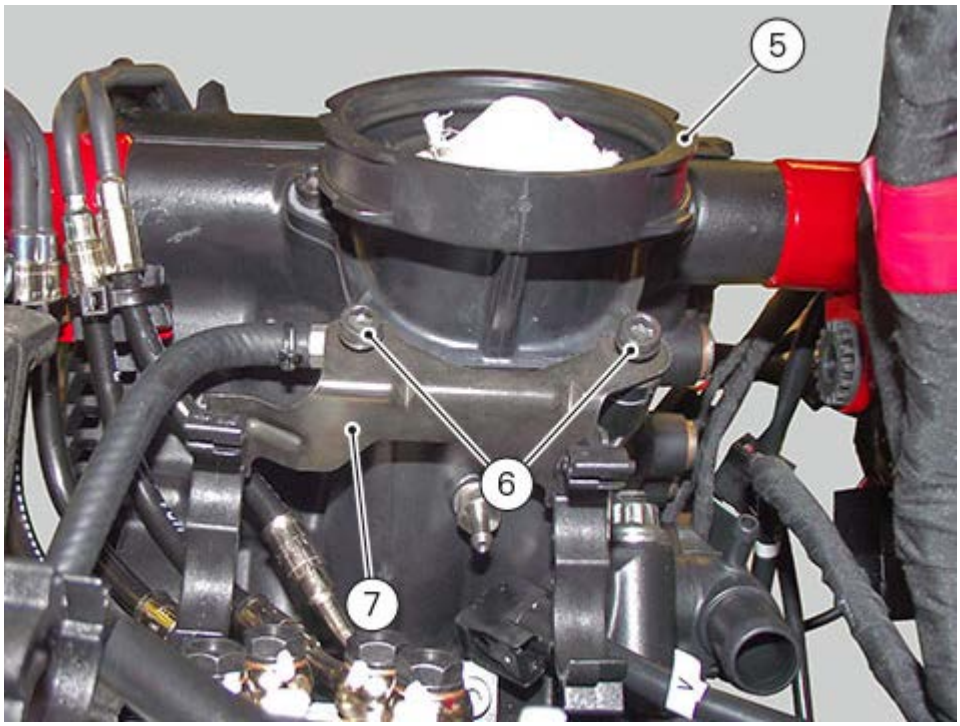
Working on both manifolds, loosen the screws (1).



Working on the horizontal head manifold, loosen screws (2) and remove the expansion reservoir (3) support bracket.
Remove the horizontal head intake manifold (4).

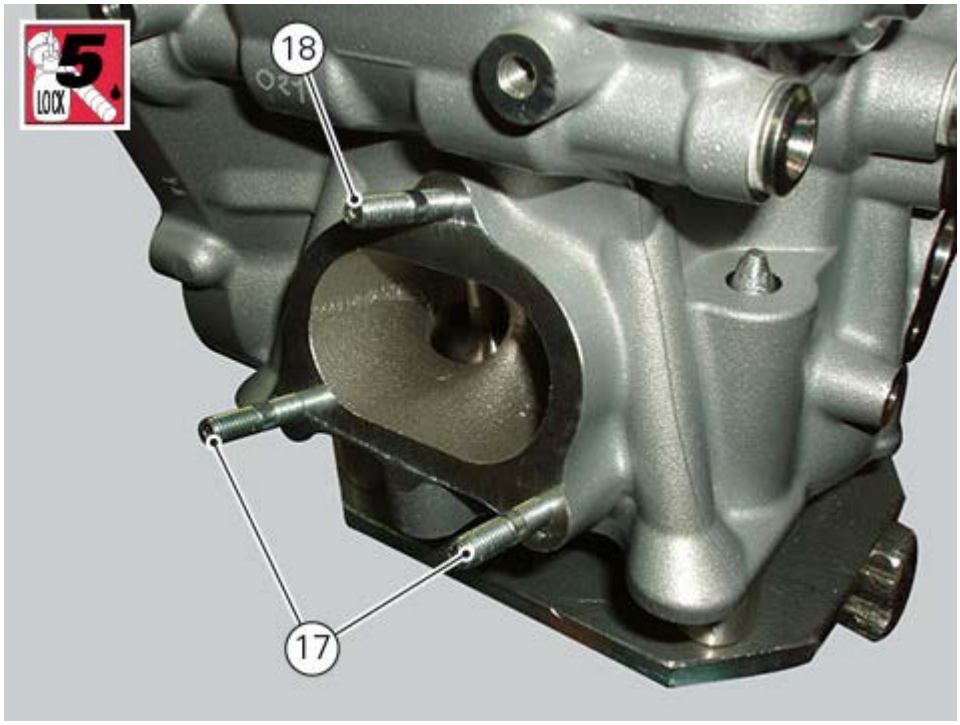


Working on the vertical head manifold (5), loosen screws (6) and remove the wiring cover (7).

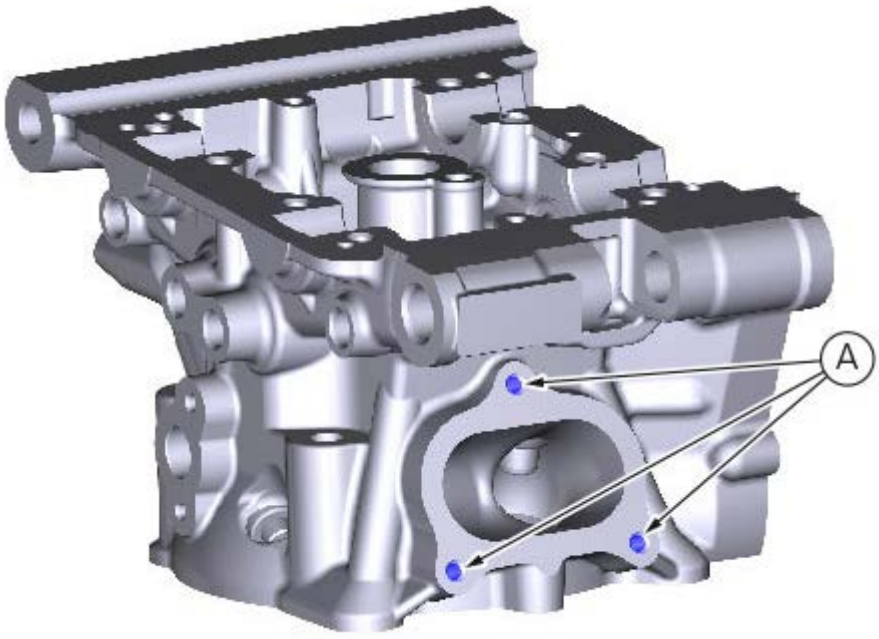


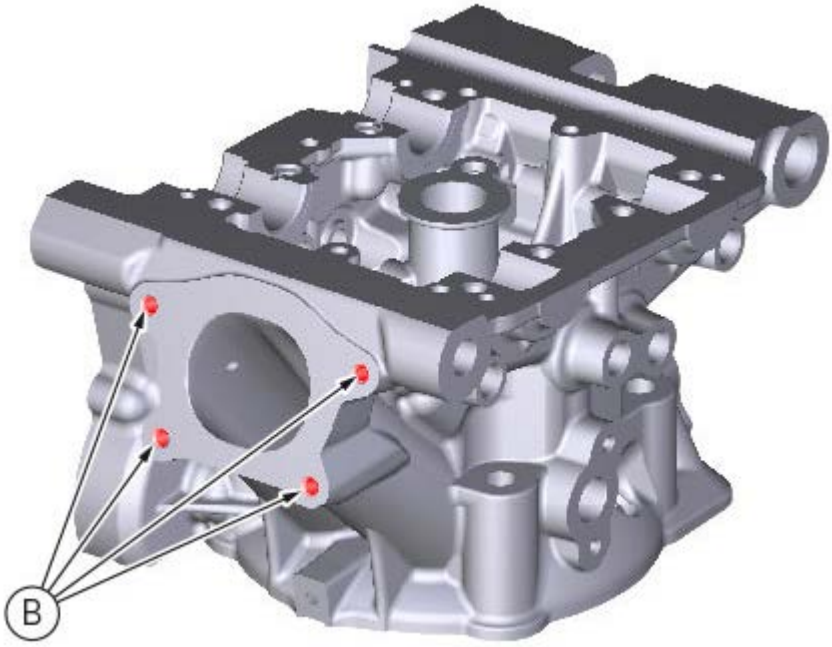
Refitting the camshafts

If the stud bolts (17) and (18) were removed, apply the recommended threadlocker to the short end of the stud bolts (17) and (18), i.e. the side that is to be screwed into the cylinder head.
Tighten the stud bolts (17) and (18) to a torque of 10 Nm (Min. 9 Nm - Max. 11 Nm).

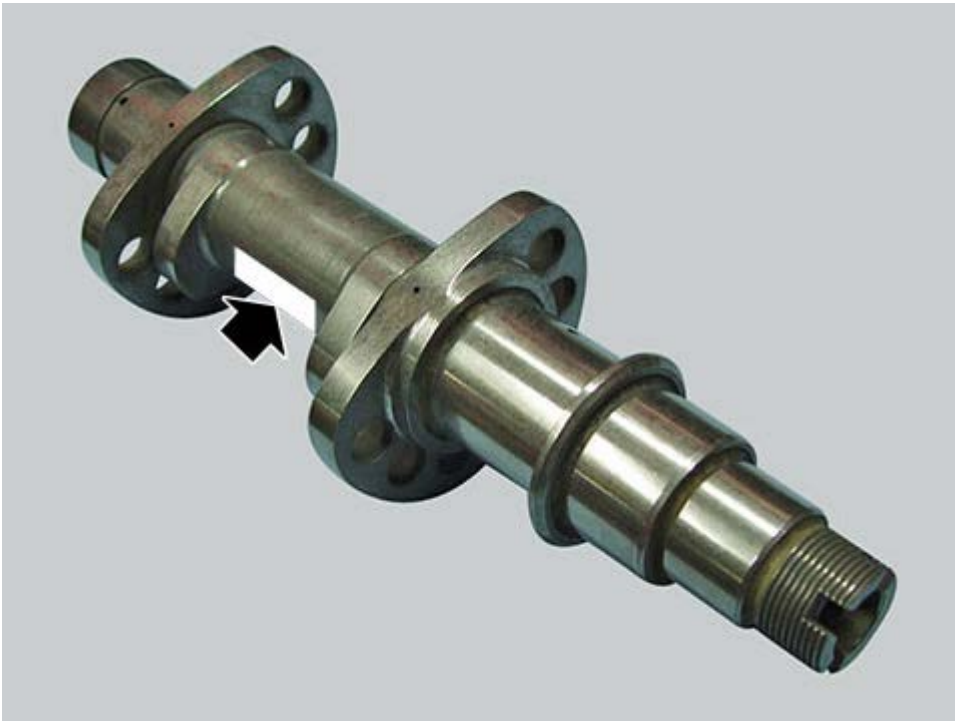


Pay attention to the exhaust side flange featuring three threaded holes (A) for stud bolts; on the intake side there are four threaded holes (B) for the relevant stud bolts.

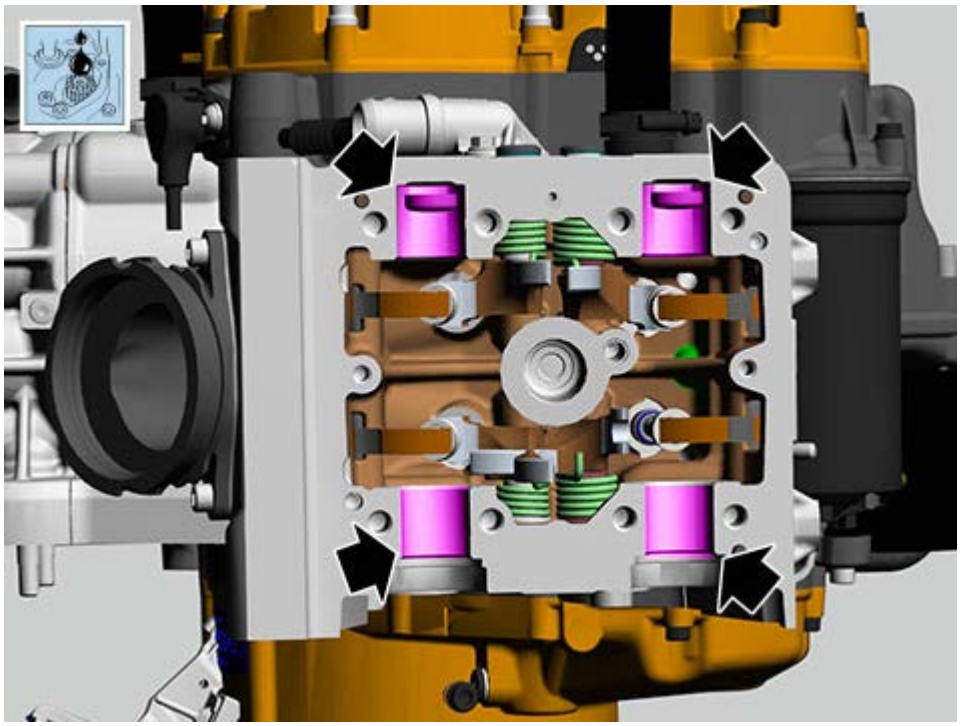




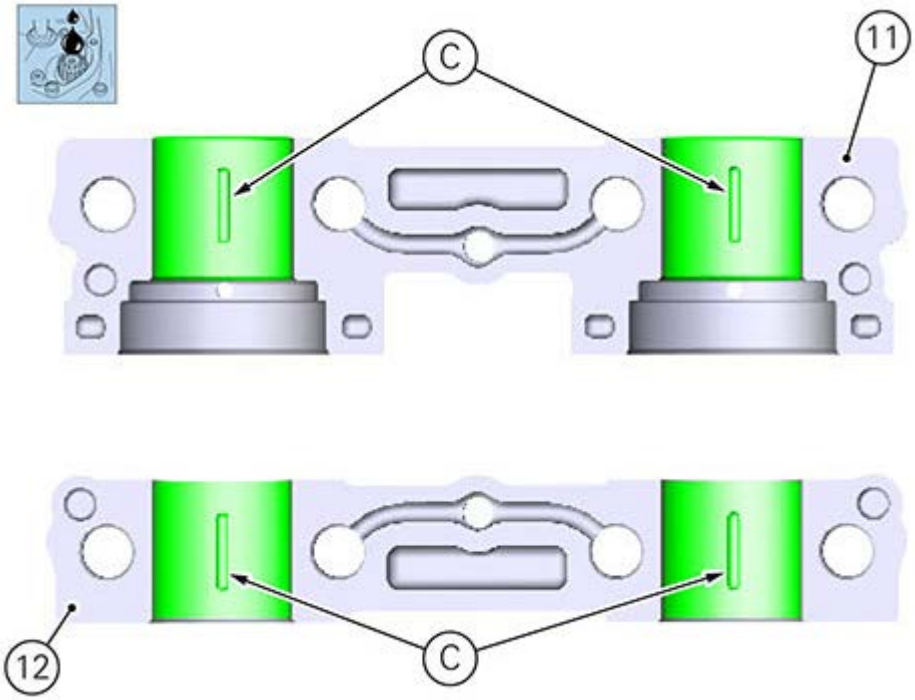
Check that the camshafts (marked "VA" and "VS" for the vertical head and "OS" and "OA" for the horizontal head) are clean and in good condition. If the camshafts are not new, use emery cloth to remove signs of wear on the cam and support surfaces, working on a flat surface.
VA: vertical head, intake side
VS: vertical head, exhaust side
OA: horizontal head, intake side
OS: horizontal head, exhaust side



Use the specified product to lubricate the head, the supports (11) and (12) and the camshaft seats.

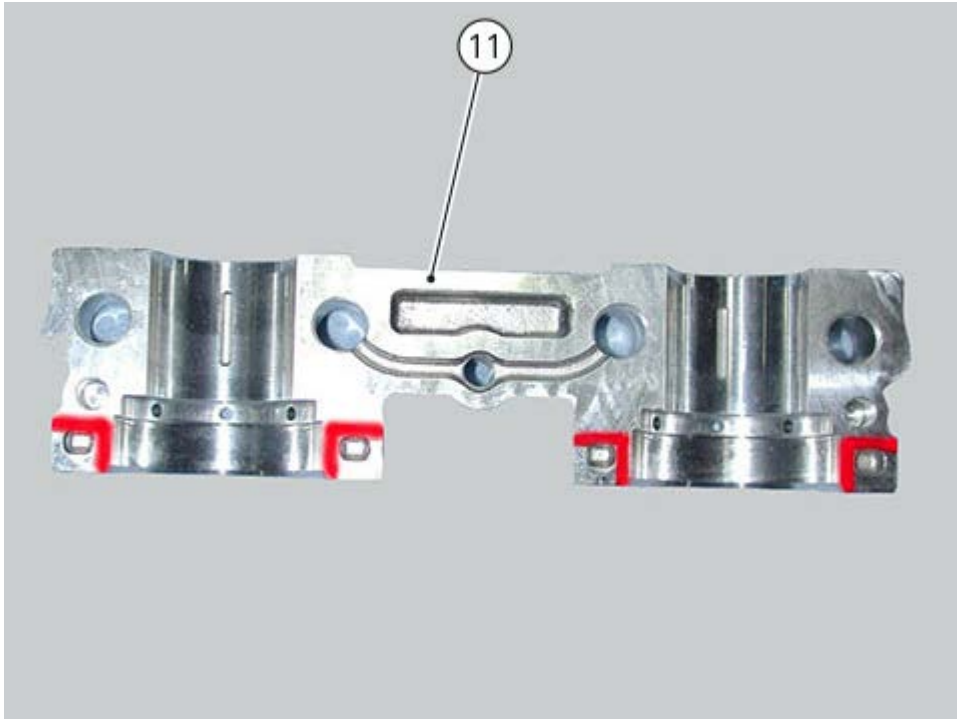


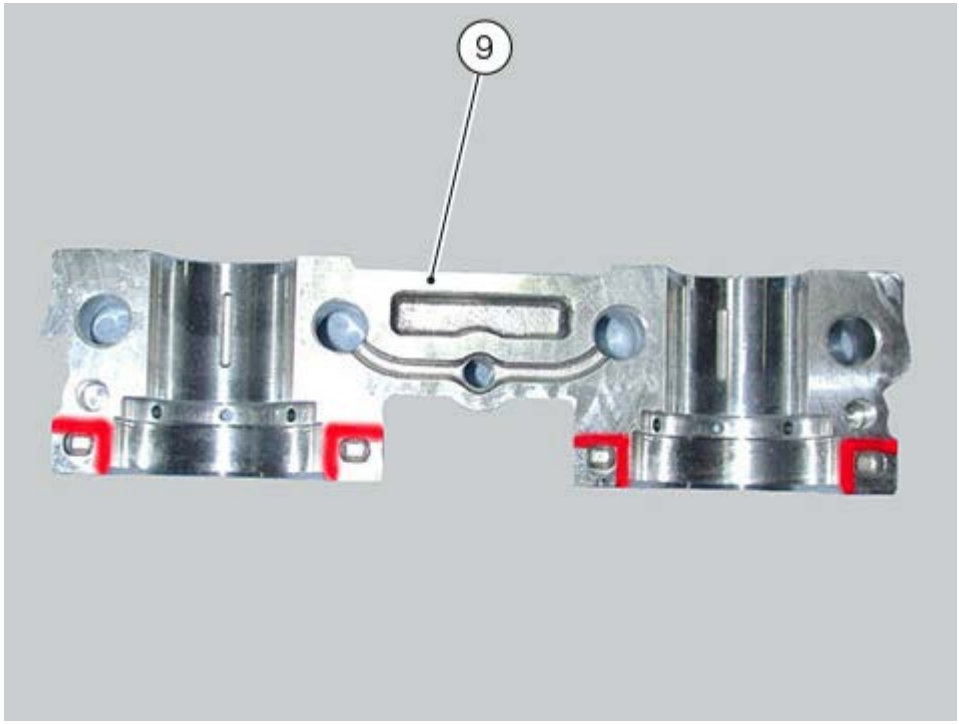
It is necessary to fill with specified lubricant the four seats (C) on caps (11) and (12).



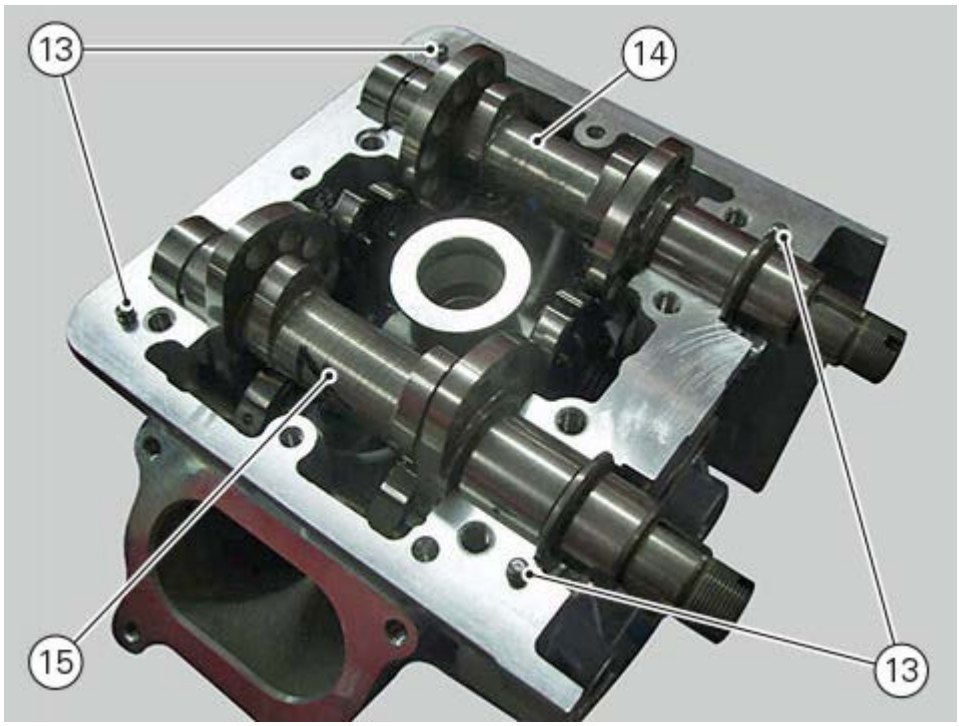
Apply the specified sealant at the four points of the support (11) shown in red in the figure. Clean off any excess of sealant.

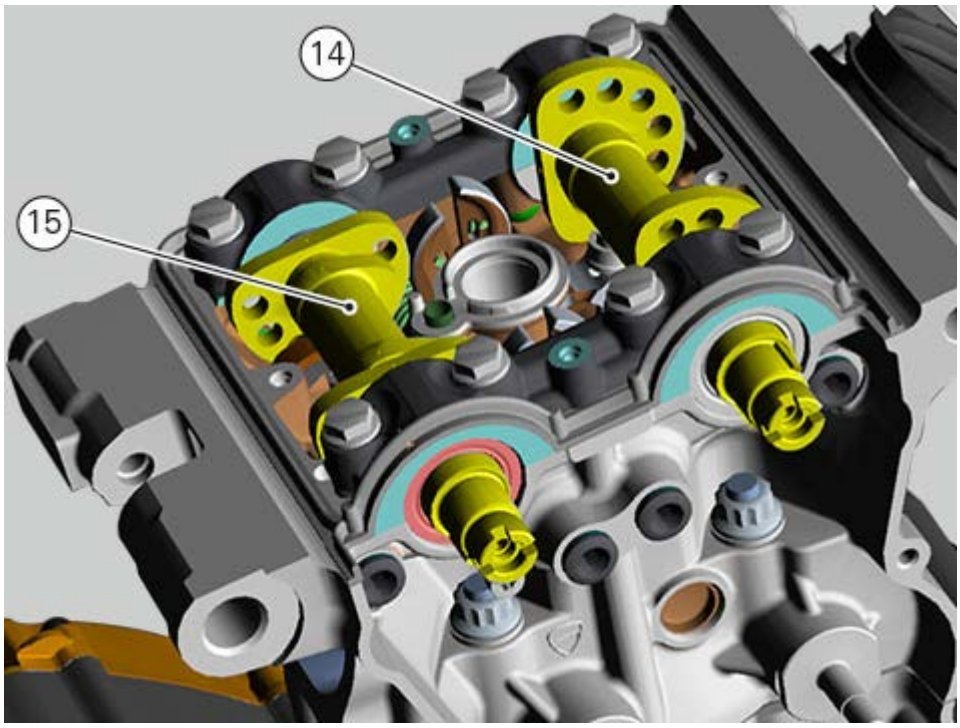
Apply sealant only on the timing side support (11) and not on support (12).





Install the camshafts (14) and (15) in the cylinder head, and rotate them to distribute the lubricant evenly. Check that the centring dowels (13) are present.

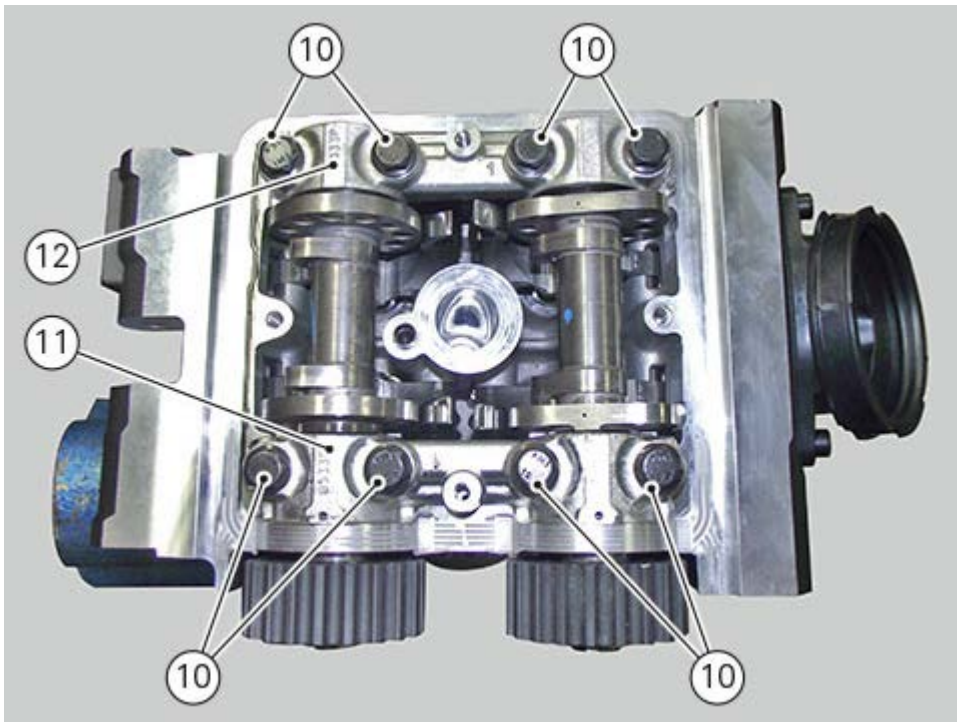


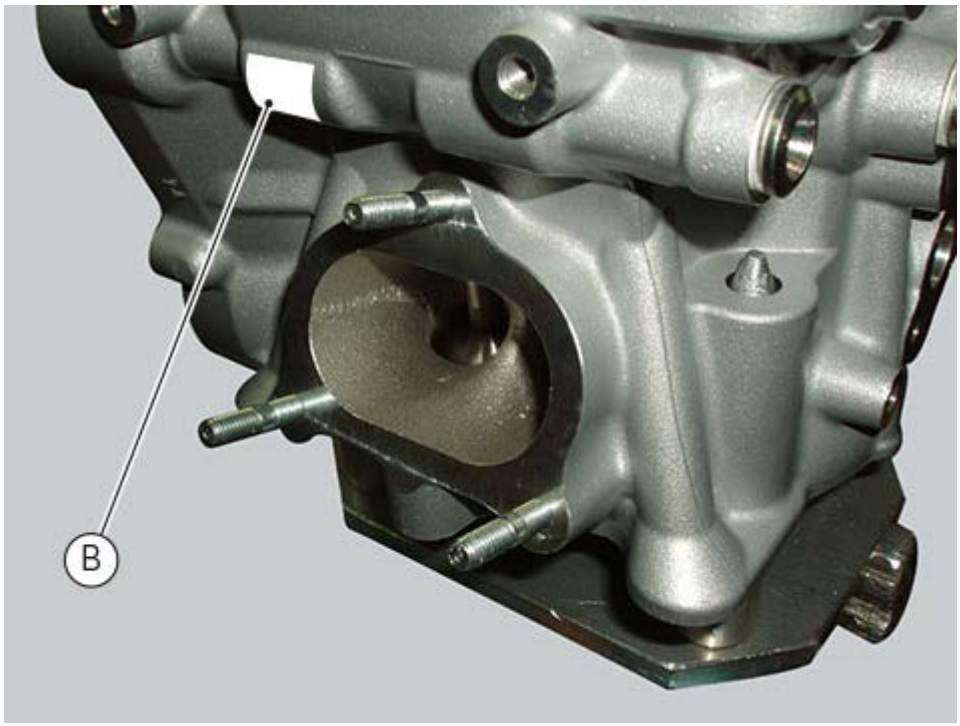


Fit the supports (11) and (12) so that they are perfectly seated on the cylinder head, checking that the number stamped in zone (B) of the cylinder head is the same as the number stamped in the support zone (C).

Important
The support must be installed on the timing side.

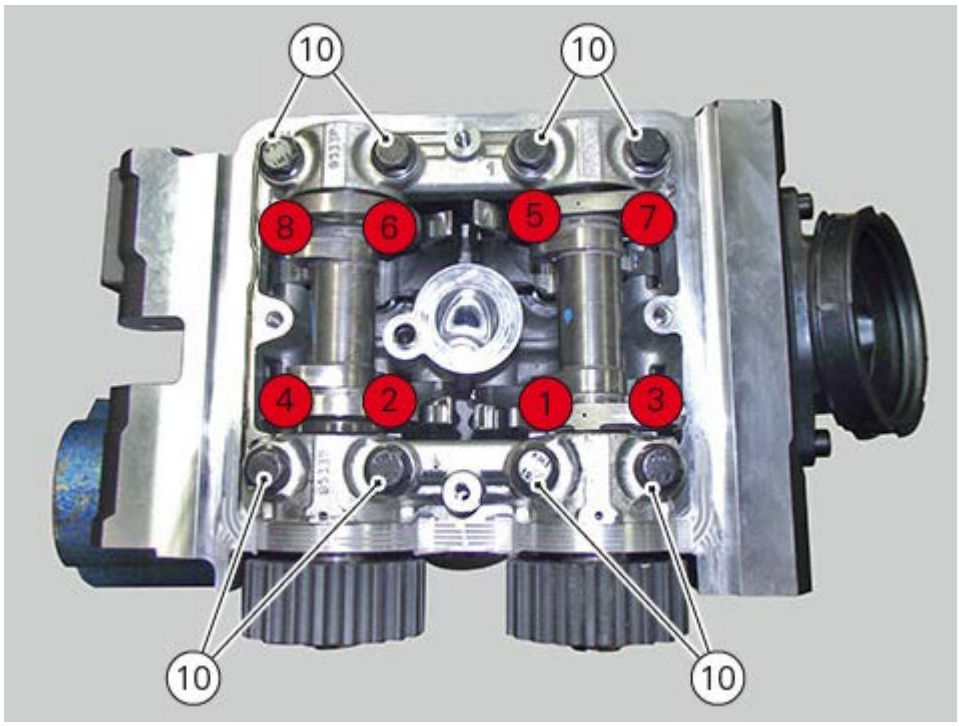
Bed down the supports.
Apply engine oil to the thread and underhead of screws (10).
Start screws (10).





Pre-tighten screws (10) to a torque of 10 Nm (Min. 9 Nm - Max. 11 Nm).
Pre-tighten one support at a time, working in the sequence 1-2-3-4-5-6-7-8.
Then tighten screws to a torque of 22.5 Nm (Min. 21 Nm - Max. 25 Nm).
Tighten one support at a time, working in the sequence 1-2-3-4-5-6-7-8.
Remove any excess of sealant from between the cylinder head and the cap.
Turn the camshafts by hand to check that they rotate freely.

Note
The first screw to work on, in position 1, must always be positioned on the intake and timing side.



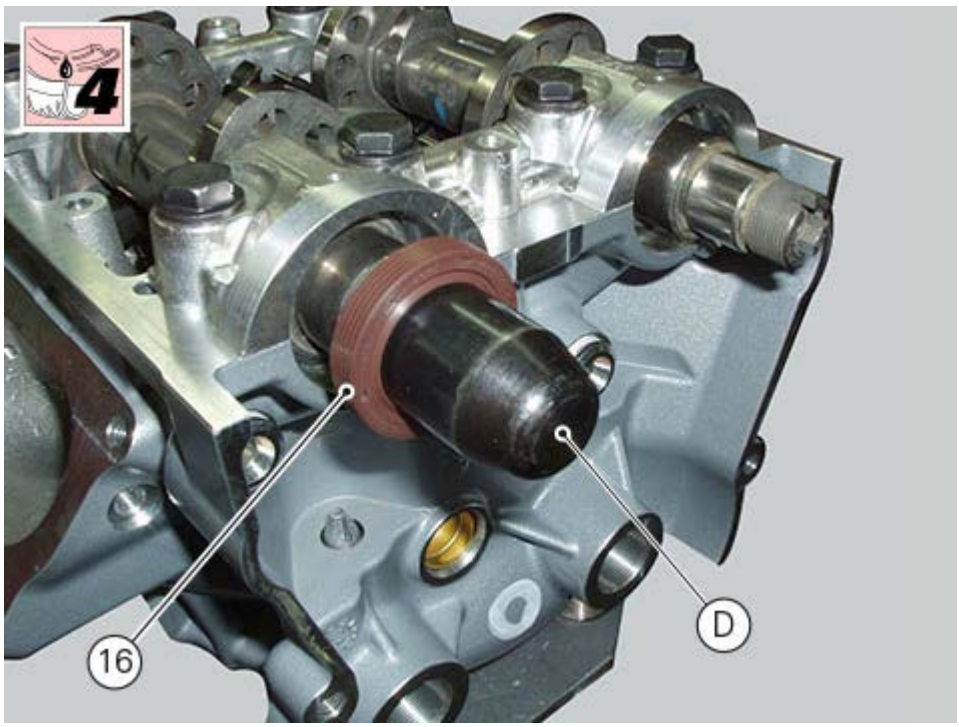
Check valve lift as explained (Checking valve lift).

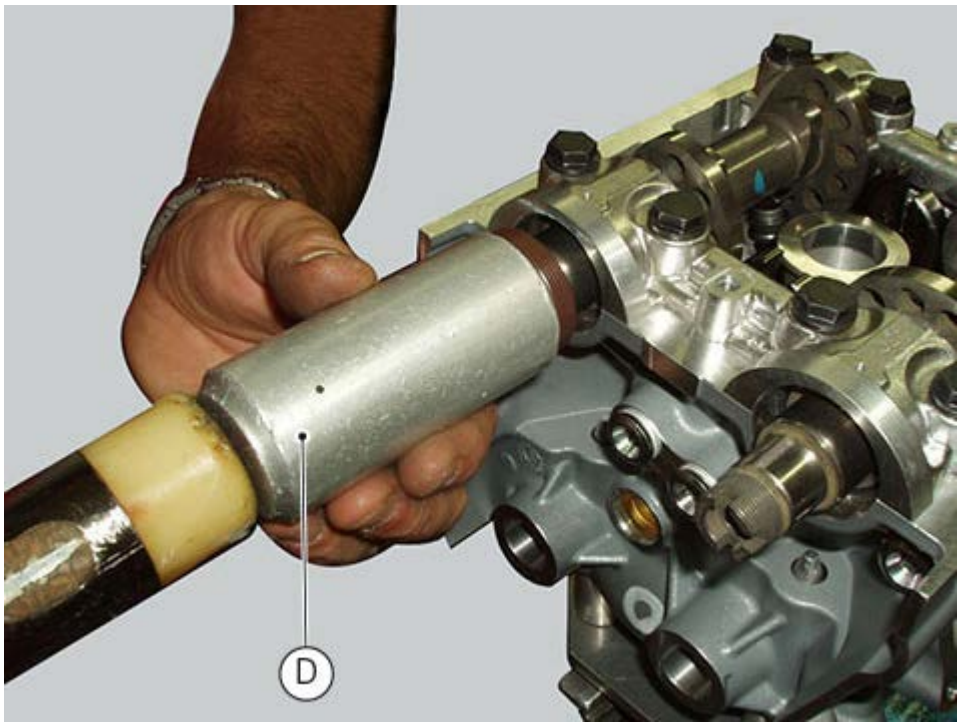
Sealing rings

Lubricate the sealing rings (16) with denatured alcohol.
Install driving tool (D) no. **88713.2861** on the camshaft and start the seal ring on the cylinder head with the side featuring a spring.

Important
Always fit new sealing rings upon reassembly.

Use the drift provided with the tool and a mallet to seat the sealing rings.



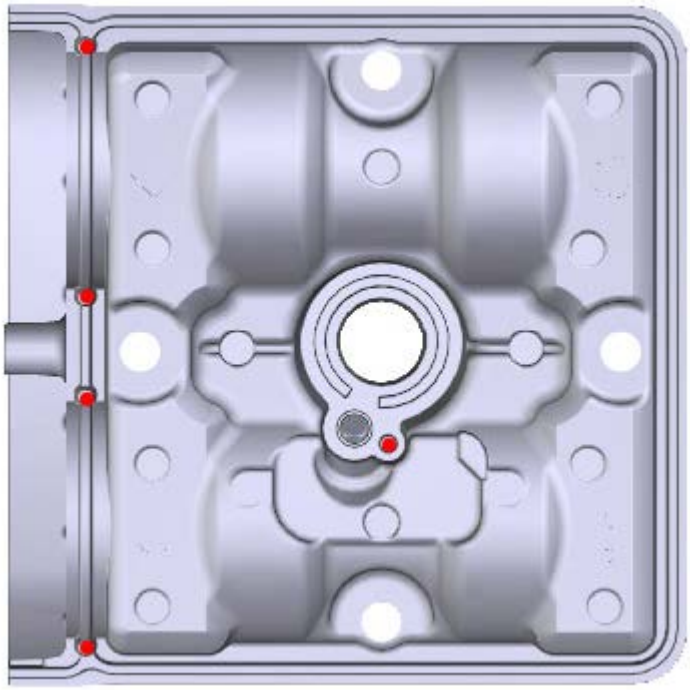


When correctly installed, the sealing ring should be flush with the bevel of the cylinder head.

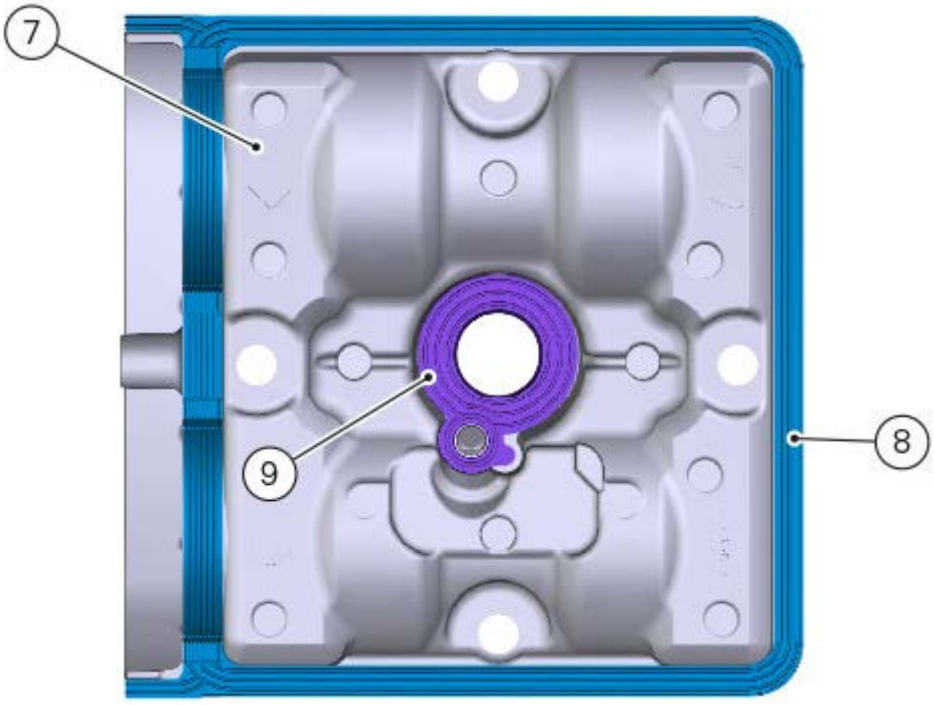
Check valve clearance and restore it in compliance with the correct values, as specified in section "Checking and adjusting the valve clearance".

Cylinder head cover

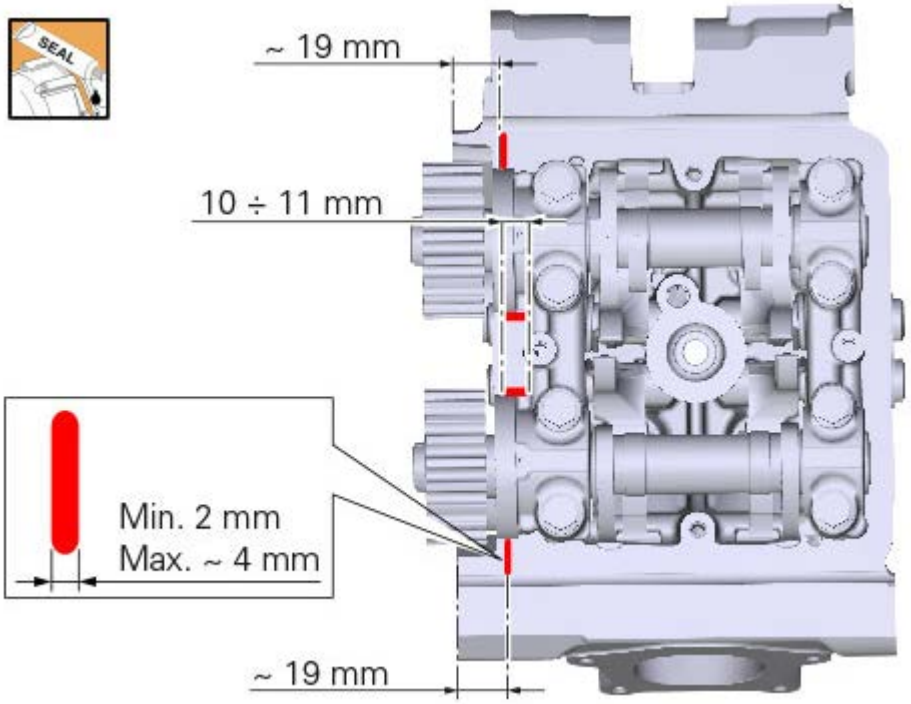
Apply the specified sealant at the five points, highlighted in red, of the head cover (7).



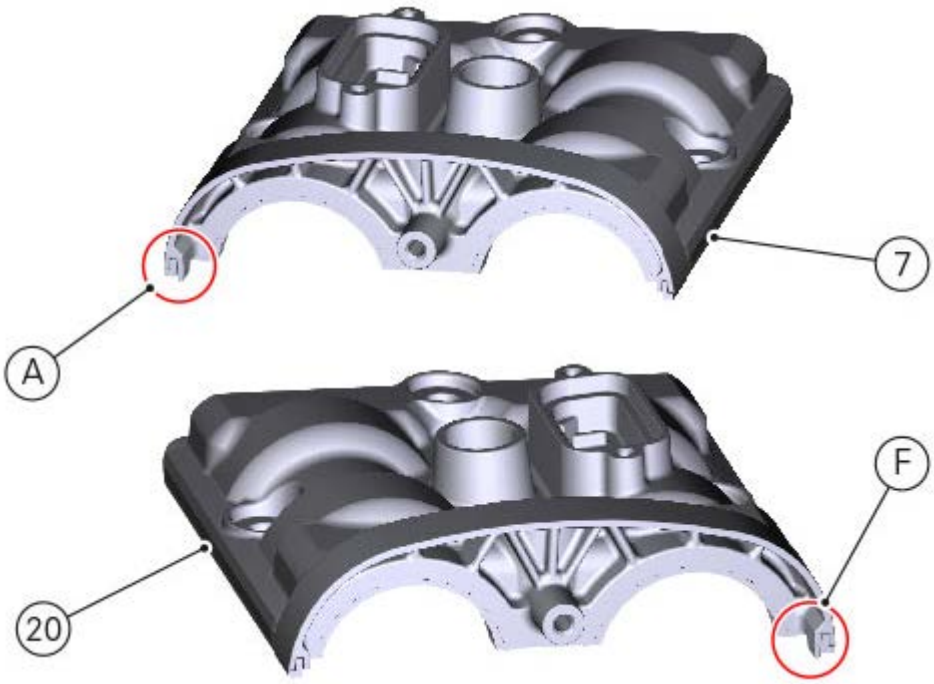
Fit the gaskets (8) and (9) on the cylinder head cover (7), as shown in the figure.



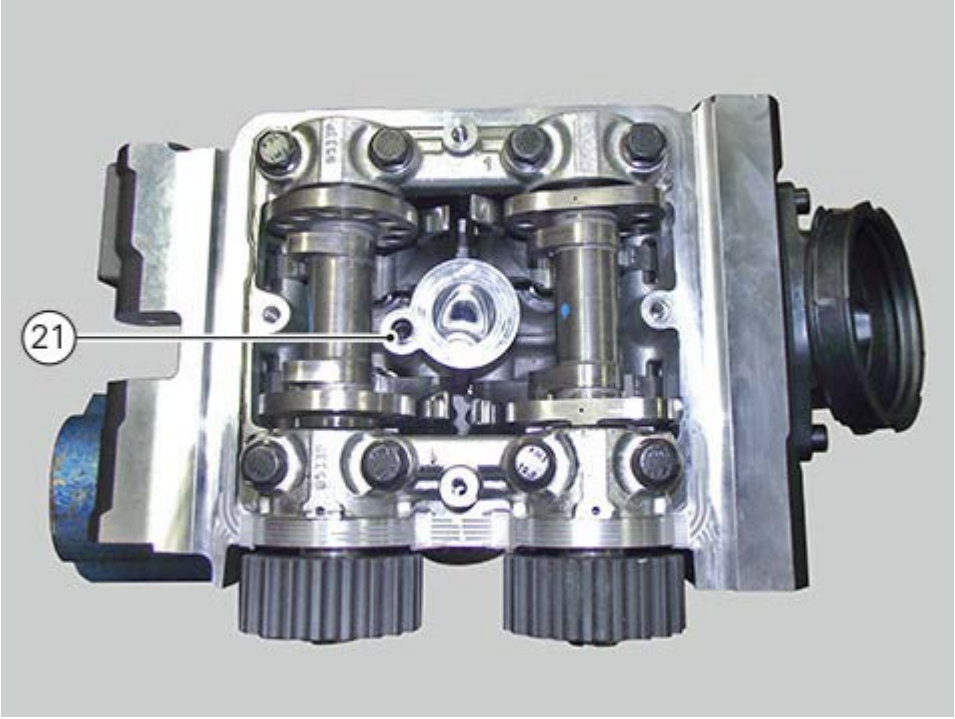
Apply in the two areas of the cylinder head surface a strip of about 2 mm (MAX. about 4 mm) of specified sealant, observing the heights and position indicated in figure.



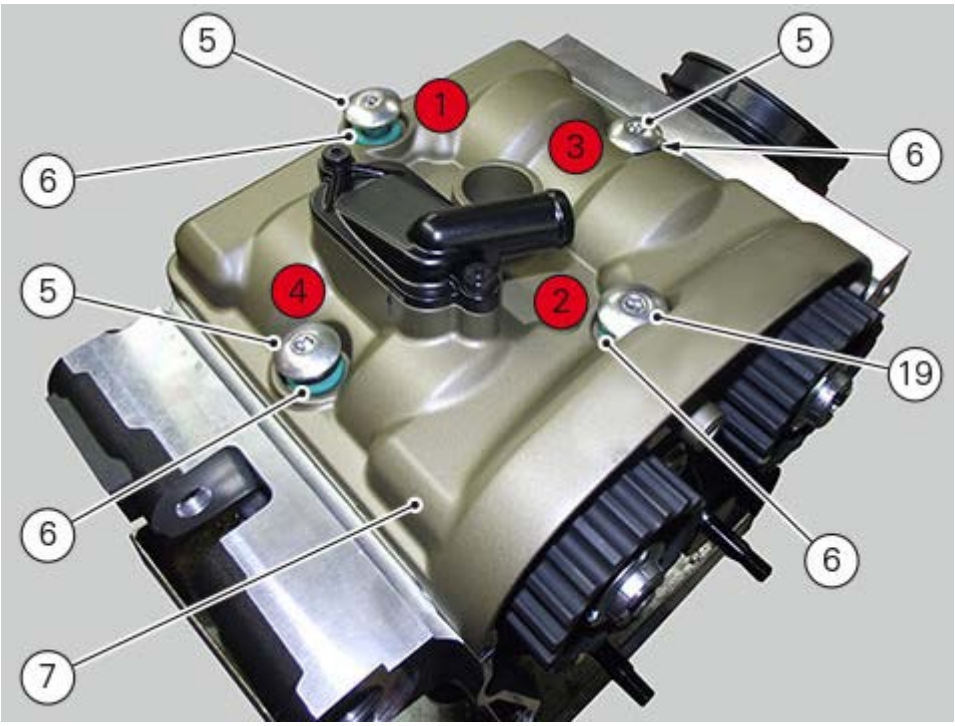
Cylinder head cover identification: the vertical head cover (7) has a tooth (E) on the left-hand side (exhaust side), whereas cover (20) has a tooth (F) on the right-hand side (exhaust side).



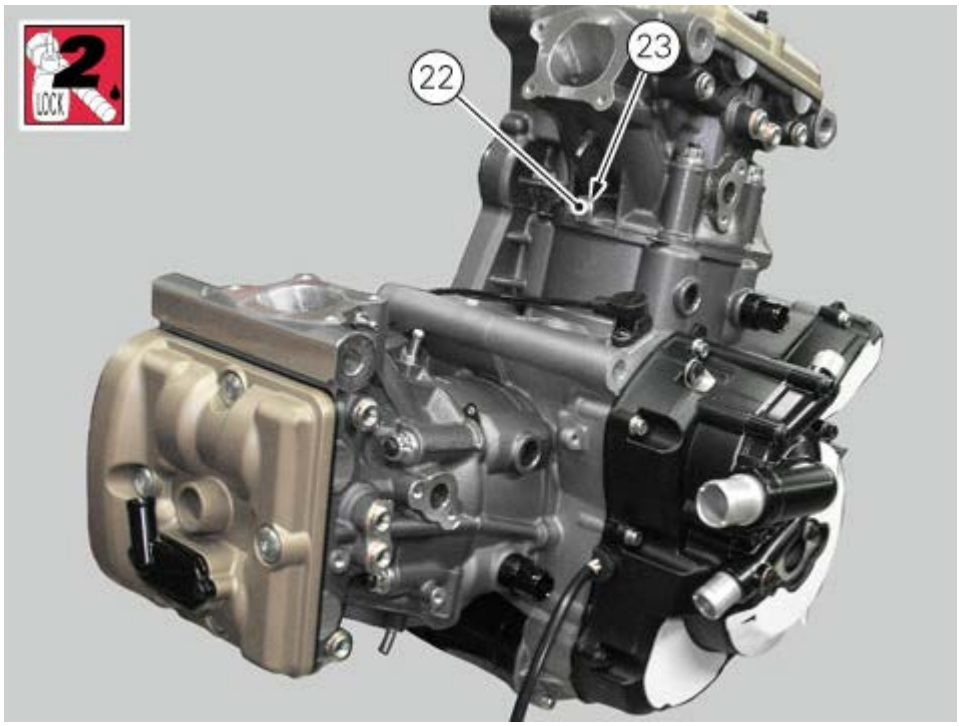
If previously removed, insert the centring pin (21).



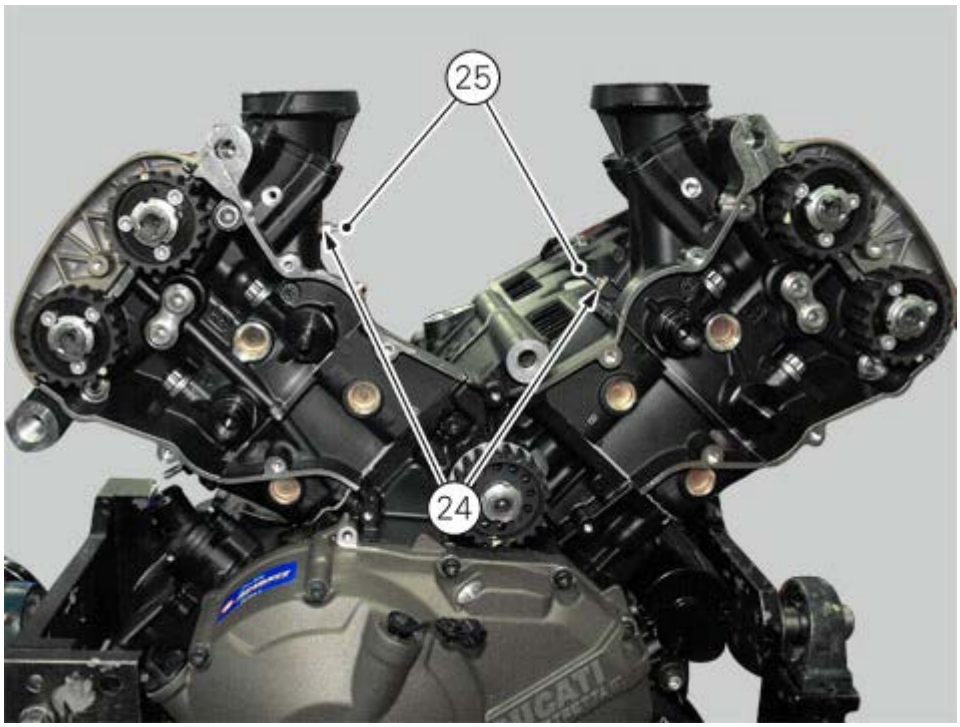
Locate the cover (7) (or (20)) on the cylinder head, aligning it with the four fixing holes.
Start the special screws (5) and screw (19), after positioning the relevant O-Rings (6).
Working on vertical head cover, tighten screws (5) and special screw (19) to a torque of 10 Nm (Min. 9 Nm - Max. 11 Nm), respecting the indicated sequence.
Working on horizontal head cover, the four cover screws are all alike and of type (5); tighten them to a torque of 10 Nm (Min. 9 Nm - Max. 11 Nm), respecting the indicated sequence.



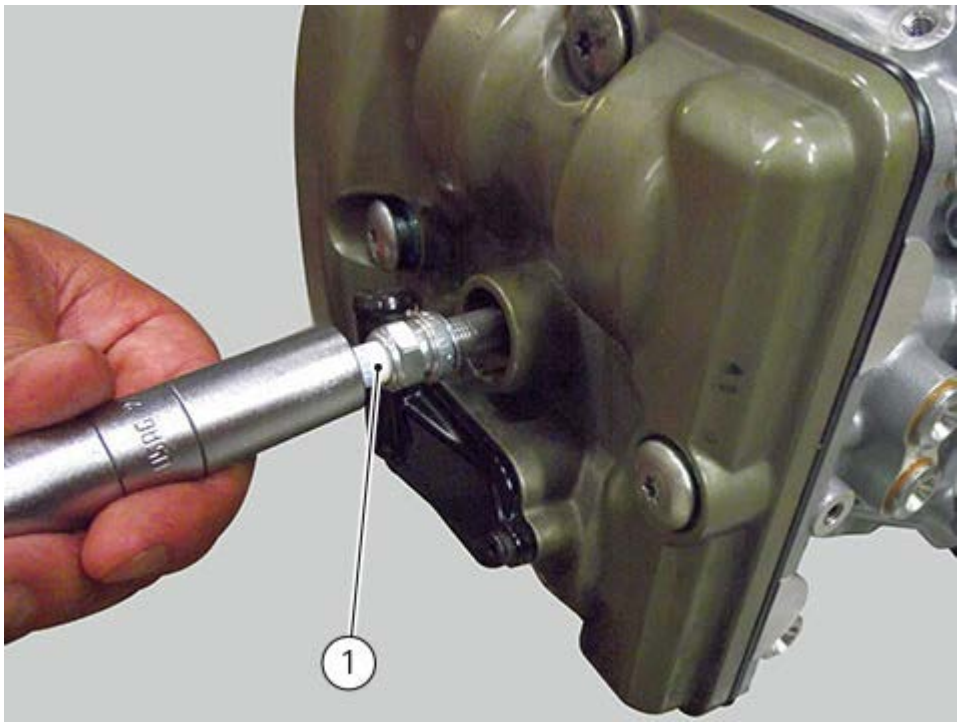
Remove excessive sealant from the area of application.
Repeat the same procedure for the other cylinder head.
If screw (22) has been removed, upon refitting, position washer (23) and apply the indicated threadlocker on the screw, then tighten it to 8 Nm (Min. 7 Nm - Max. 9 Nm).

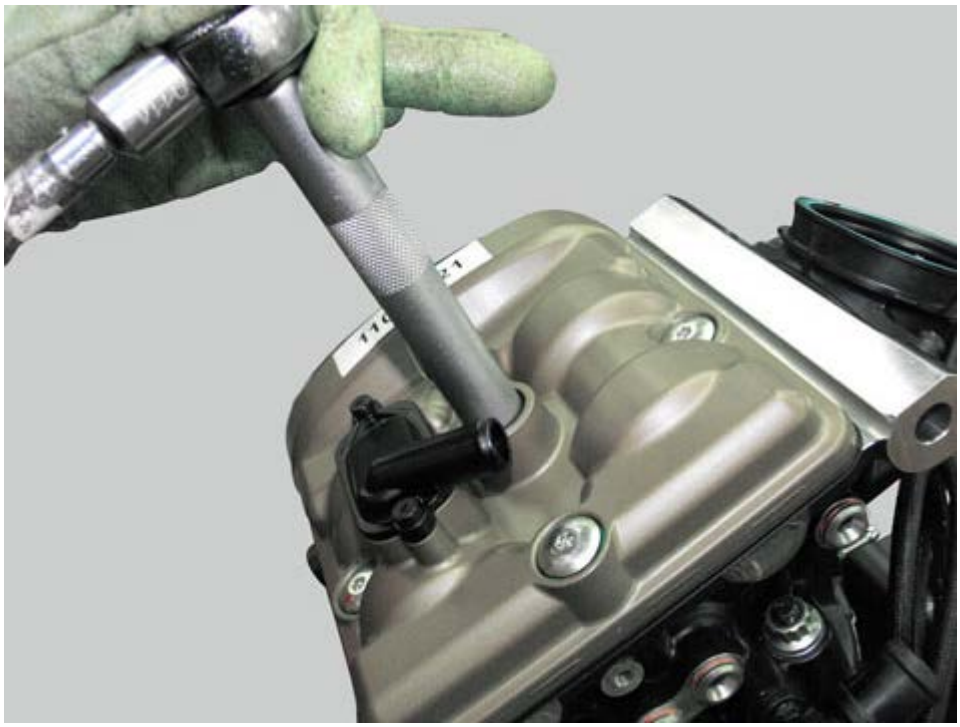


Working in the same way on both heads, if previously removed, fit washer (24) and MAP sensor union (25), tightening it to a torque of 5 Nm (Min. 4 Nm - Max. 6 Nm).

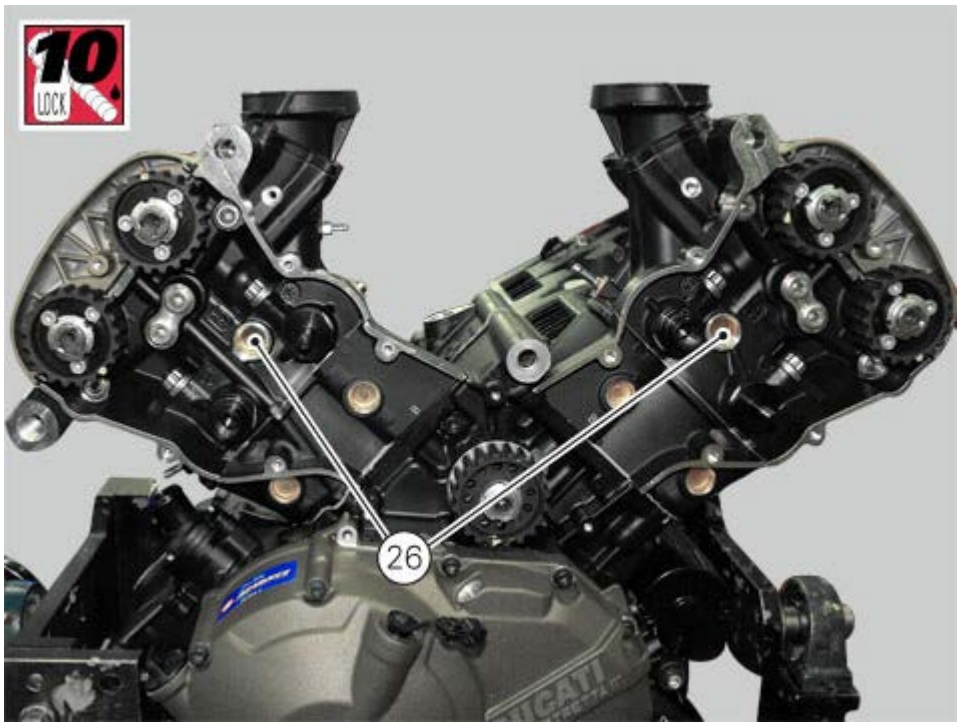


Install and tighten spark plug (1) with a suitable wrench.

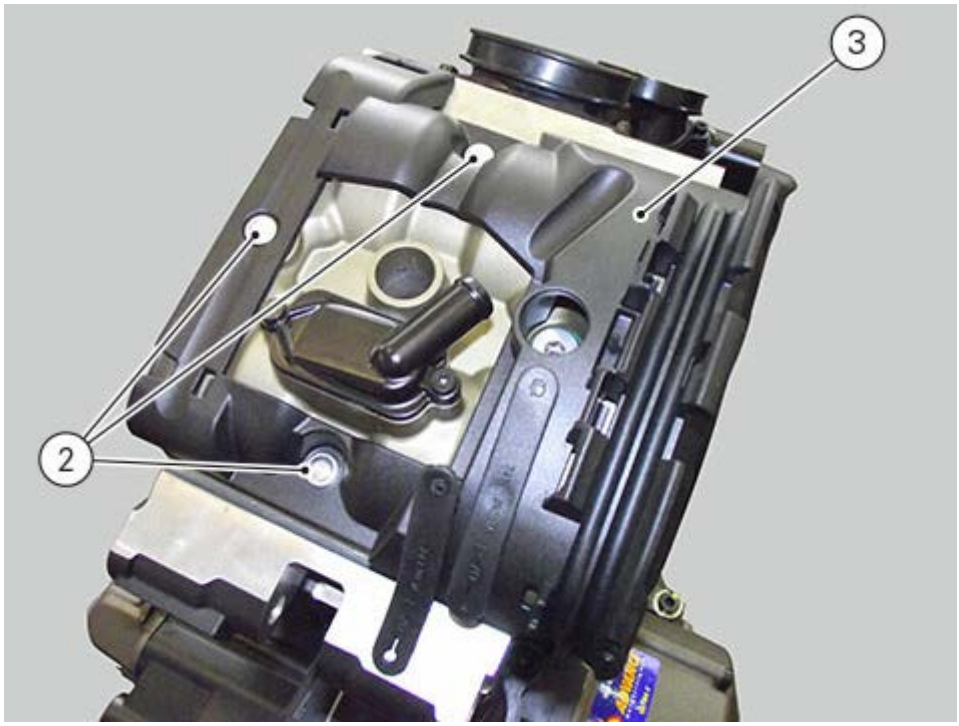




Working in the same way on both heads, apply a bead of the indicated sealant on cap (26), then insert it inside its seat on the relevant head.

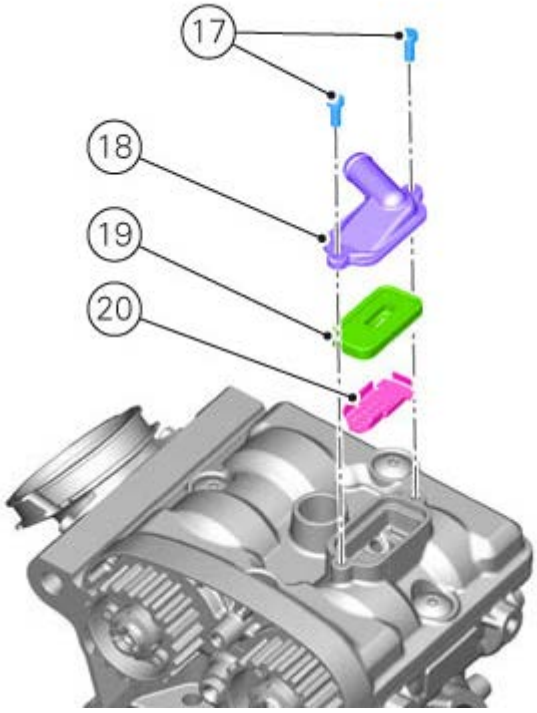


Position the wiring/hose cover on vertical head (3) and tighten the three screws (2).
Restore the ABS tubes and wiring position on cover (3) (Positioning wiring/hoses).



If previously removed, refit secondary air system valve as follows:

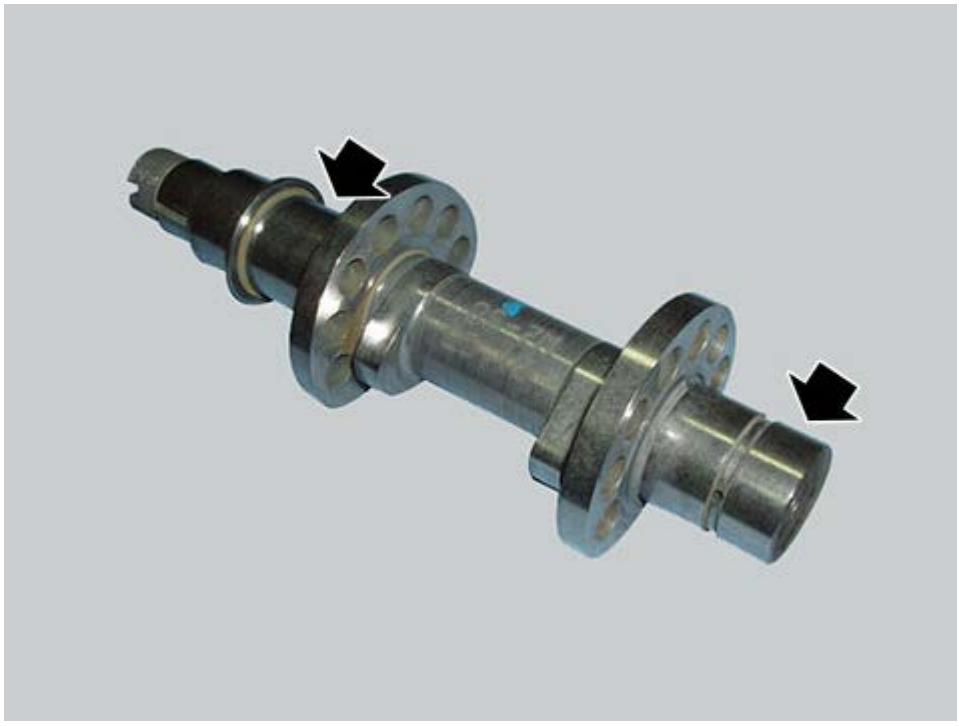
- fit the spark arrestor (20) by respecting the mandatory positioning given by its seat;
- fit reed valve (19) and secondary air system valve cover (18), taking care to match head cover notch (C) with valve cover (18) notch (D);
- tighten the two screws (17) to a torque of 6 Nm (Min. 5 Nm - Max. 7 Nm).



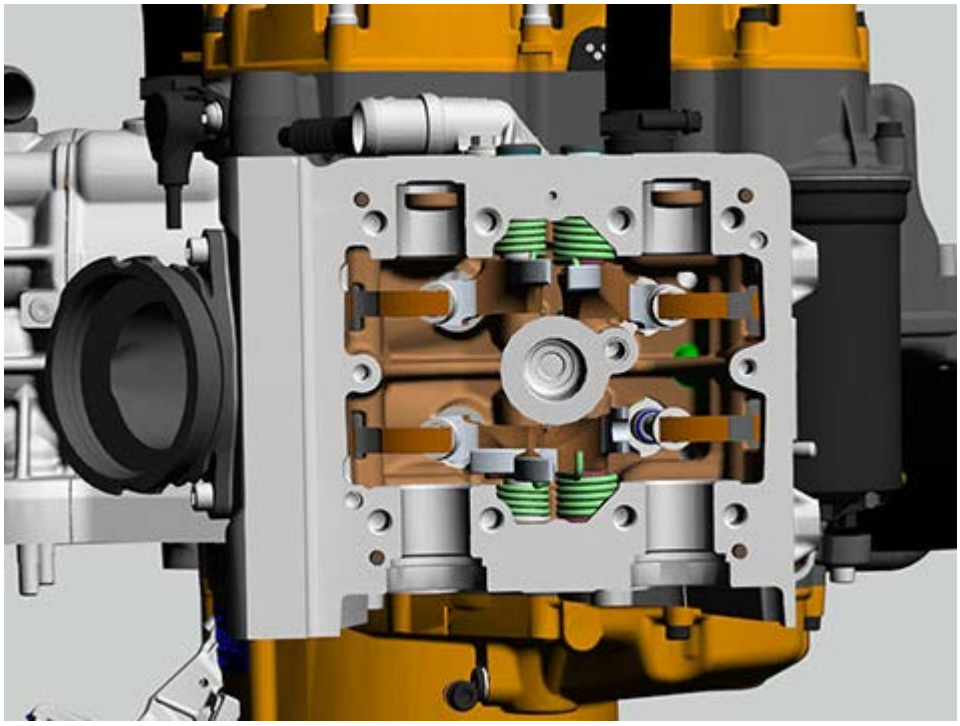
Refit the water radiator (Refitting the water radiator).
Refit the seat (Refitting the seat).

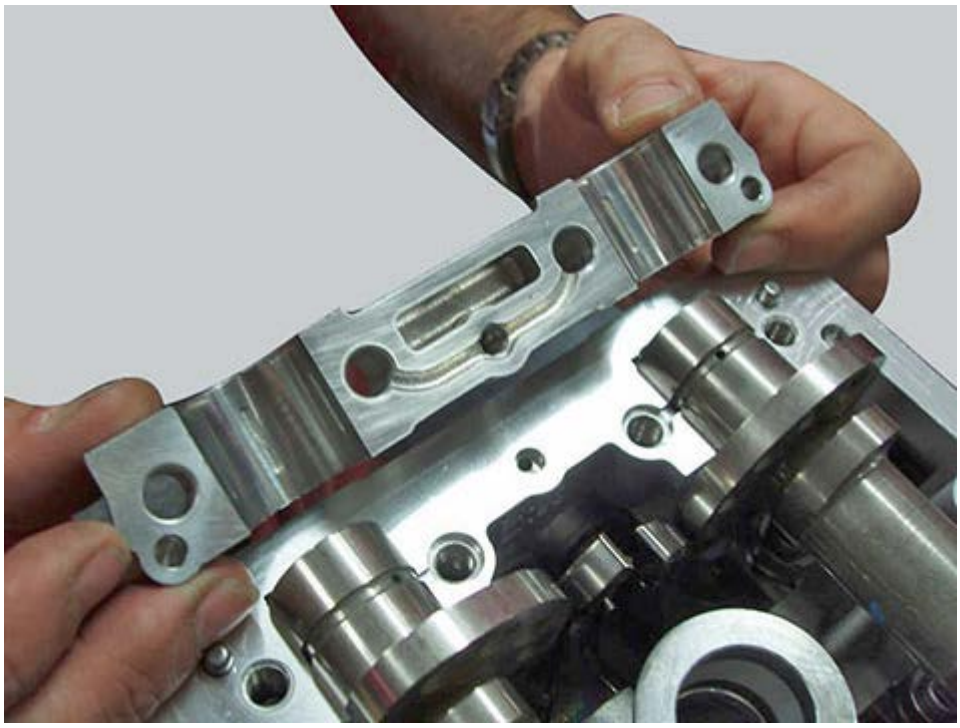
Check of the camshafts and supports

Check the cam contact surfaces for scratches, grooves, steps and waving.
Worn cams are frequently the cause of poor timing, which leads to loss of engine power.
Place the camshaft between two opposite centres and check the run-out on the areas indicated using two dial gauges.
Service limit: 0.1 mm.



Visually inspect the camshaft tracks for scoring and abnormal wear. If any of the above defects are found, the camshaft should be replaced.
If you find scoring or excessive wear, check the operation of the engine lubrication circuit.

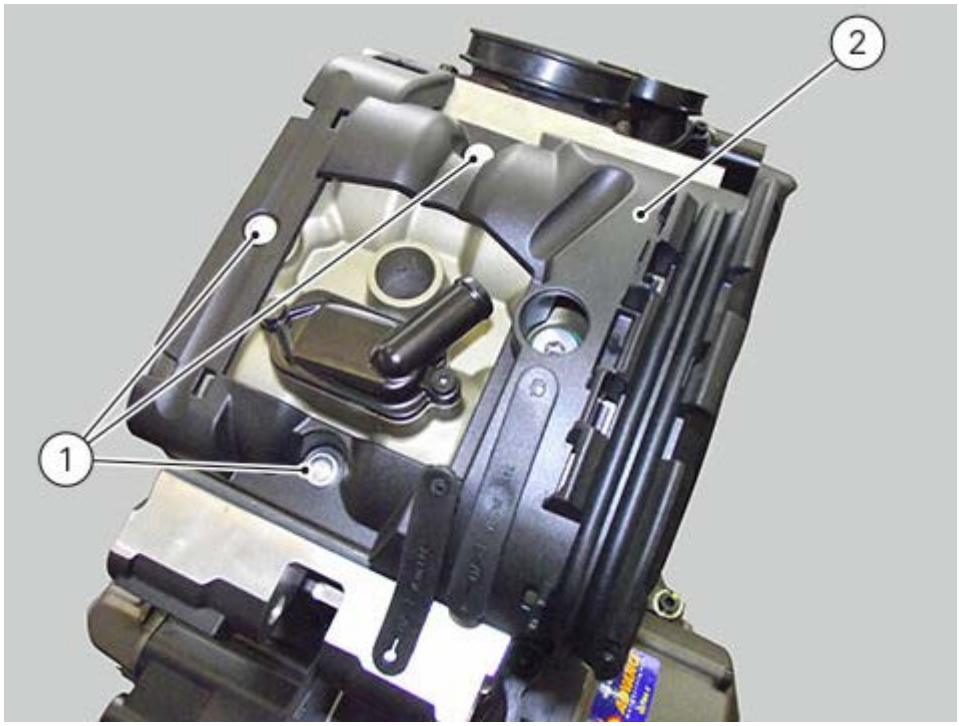




Removing the camshafts

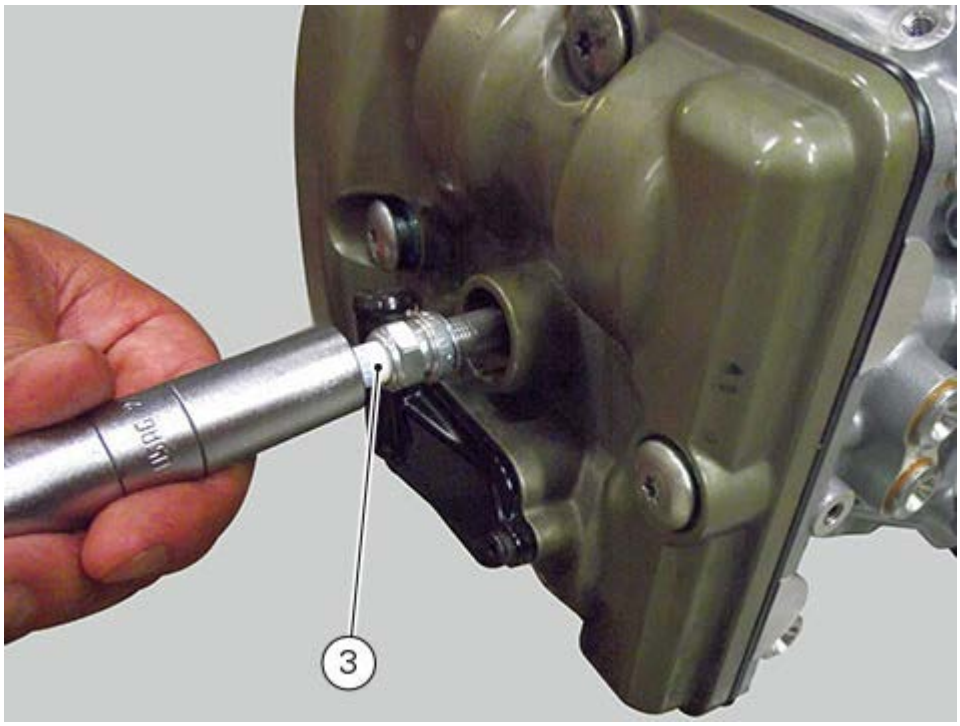
Remove the seat (Removing the seat).
Release the water radiator lower retainer and move it towards the front wheel (Removing the water radiator).
Release the ABS hose and wiring from the vertical head cover (Routing wiring harnesses/hoses).
Loosen the timing belt covers (Removing the timing belt external covers).

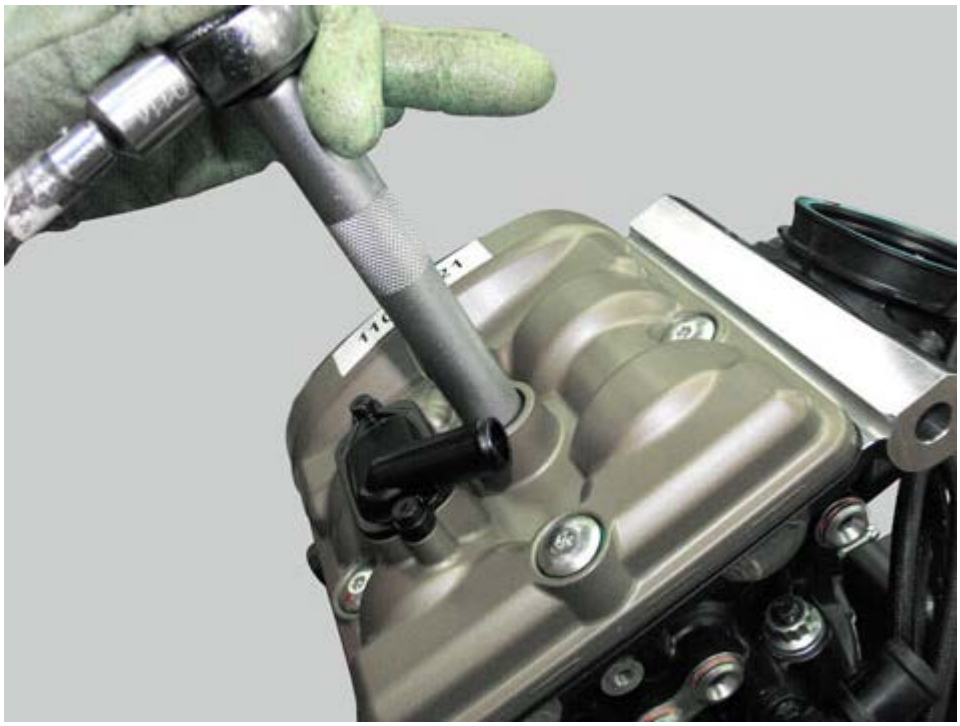
Removing the head covers.
Working on the vertical head, loosen the three screws (1) and remove the wiring cover (2).



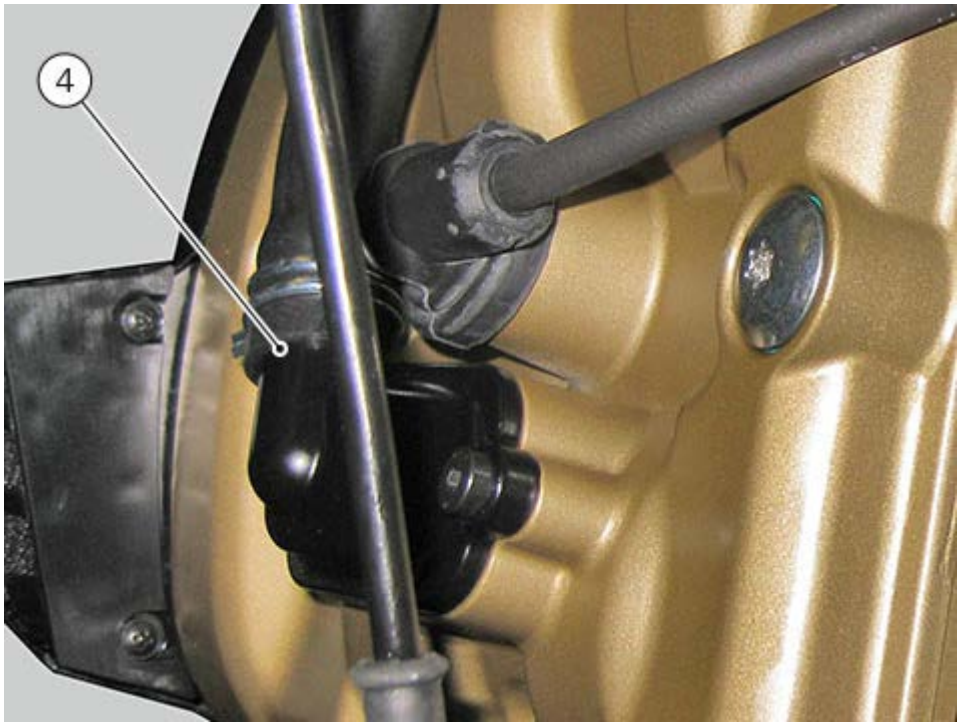
The described operations apply to both head covers.

Remove spark plug (3) with a suitable wrench.

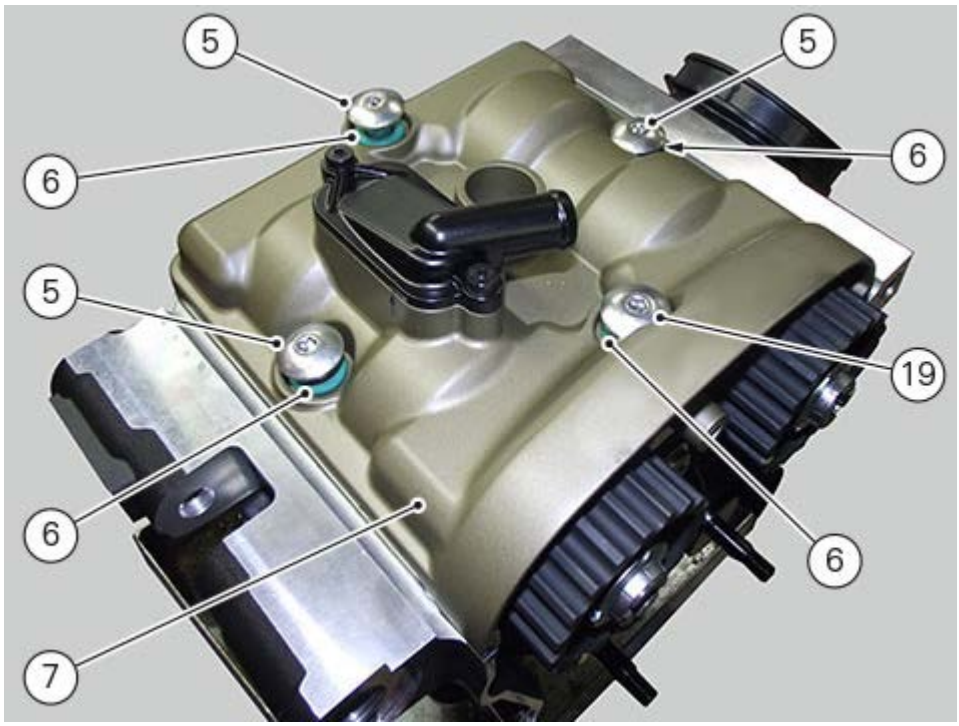




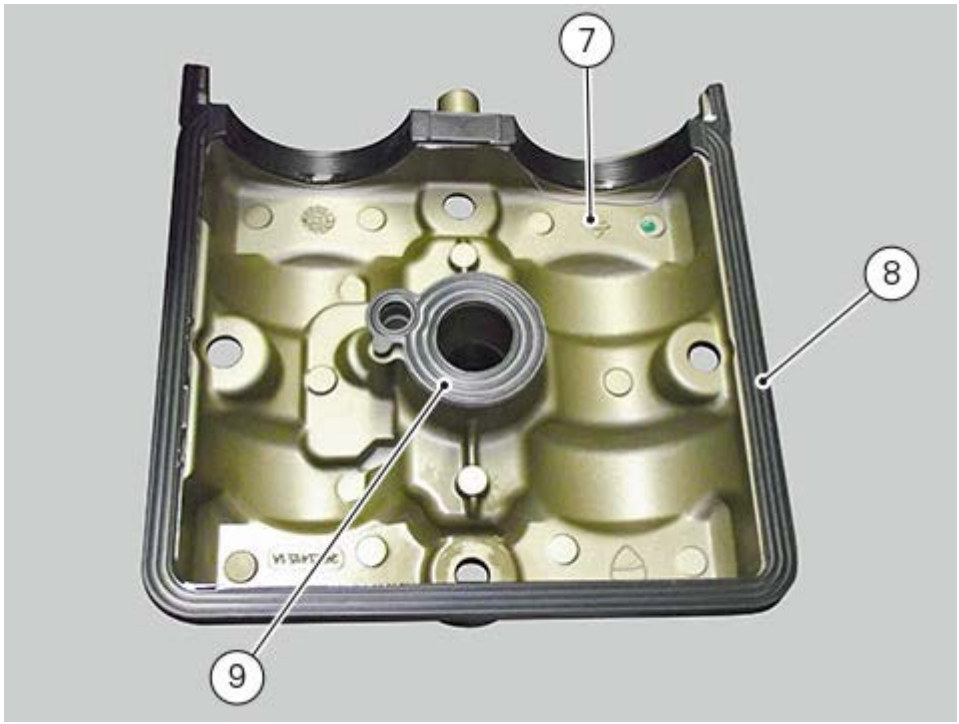
Slide clamp out and disconnect the secondary air system pipe (4).



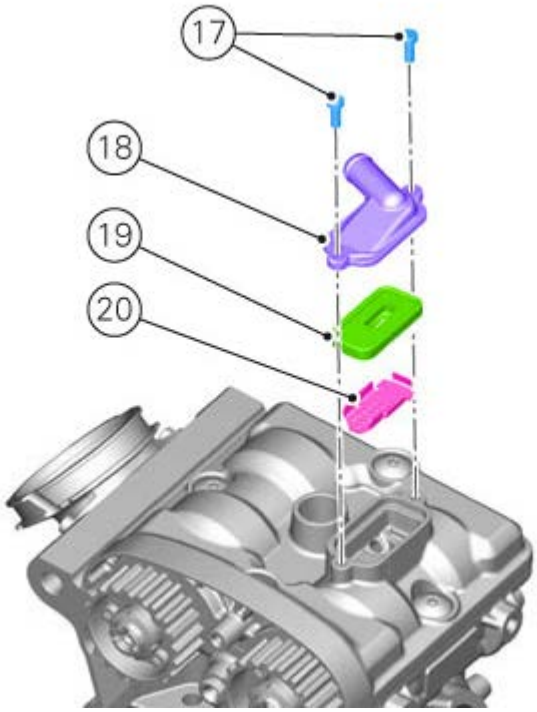
Undo and remove the screws (5) and (19) and the O-rings (6) from the cylinder head covers. Remove the cylinder head cover (7).



Remove the gaskets (8) and (9).

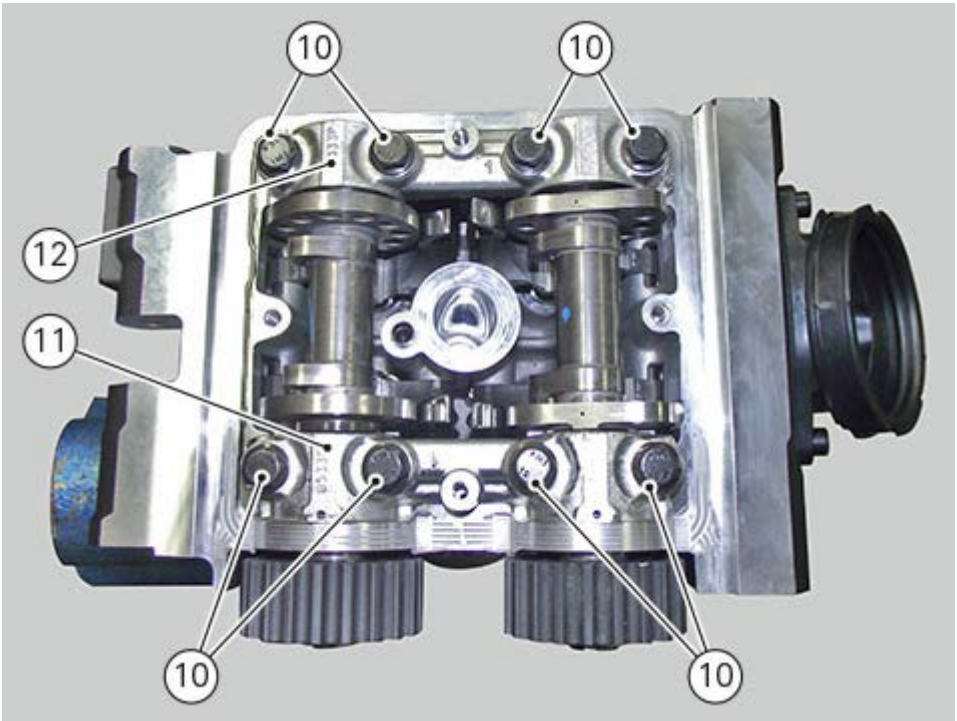


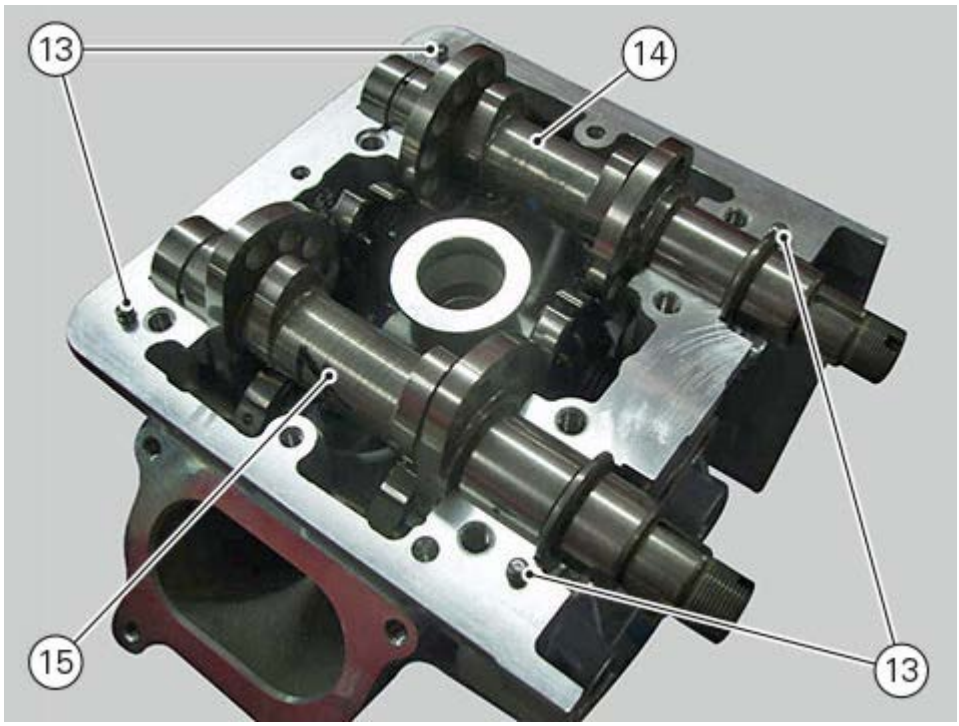
If necessary, remove the secondary air system valve, and proceed as follows (this procedure applies to both covers):
loosen the two screws (17) and collect the secondary air system valve cover (18), the reed valve (19) and the spark arrestor (20).

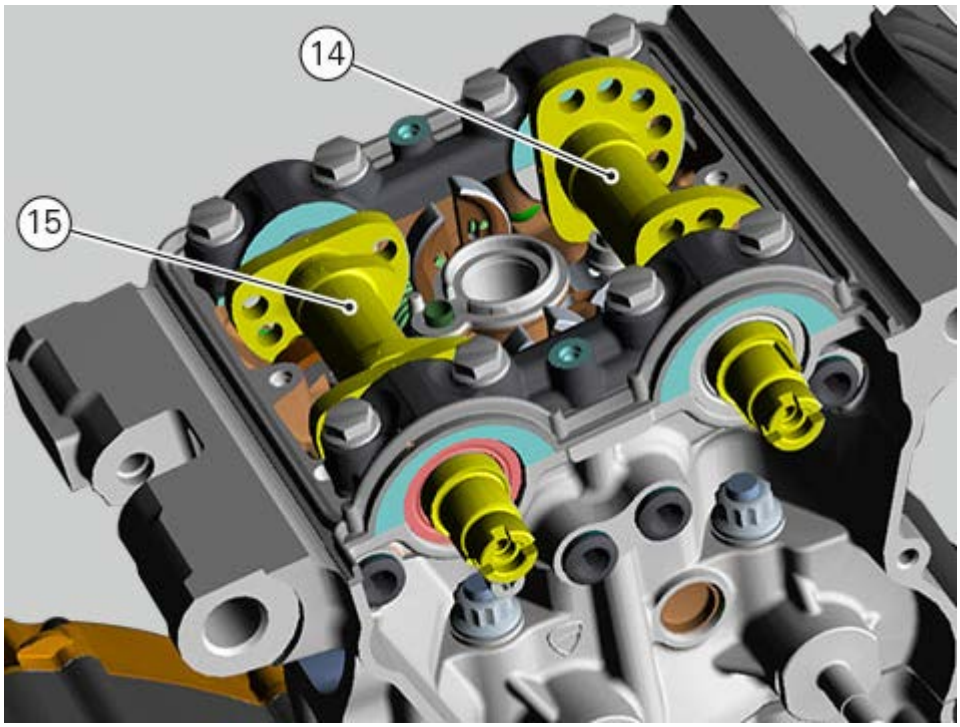


Removing the camshafts.

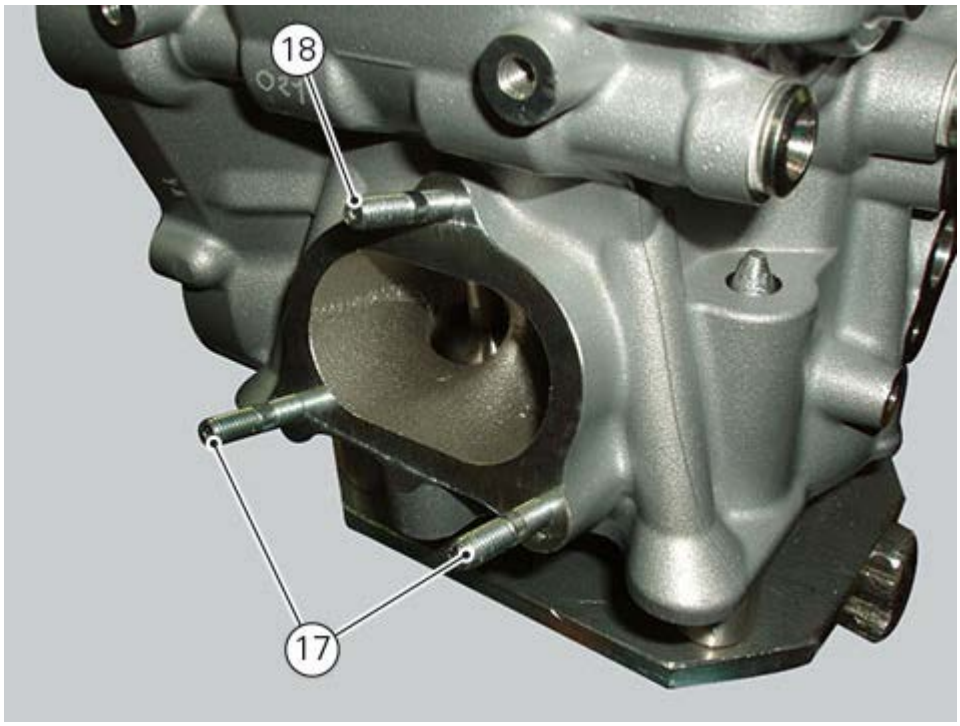
Undo the screws (10) securing the camshaft supports.
Withdraw the camshaft supports (11) and (12) straight out from the cylinder head, taking care not to damage the machined faces and centring dowels (13).
Remove the exhaust side camshaft (14) and intake side camshaft (15).
Slide out seal rings at their ends.
Repeat the same procedure for the other cylinder head.







If necessary, unscrew the stud bolts (17) and (18) from the cylinder heads.

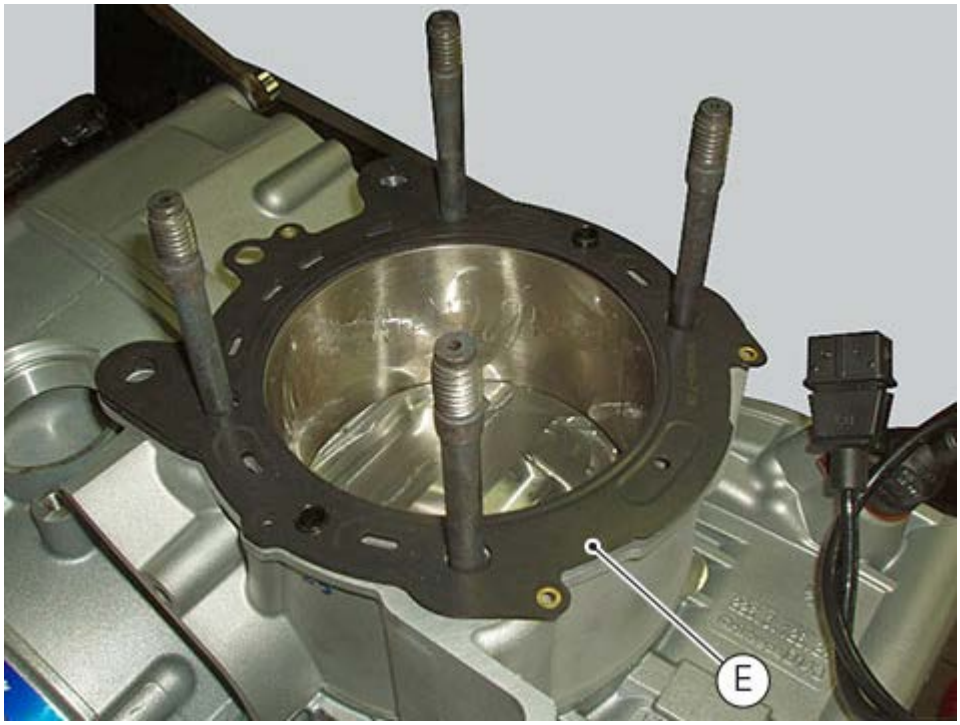


Refitting the cylinder head assemblies

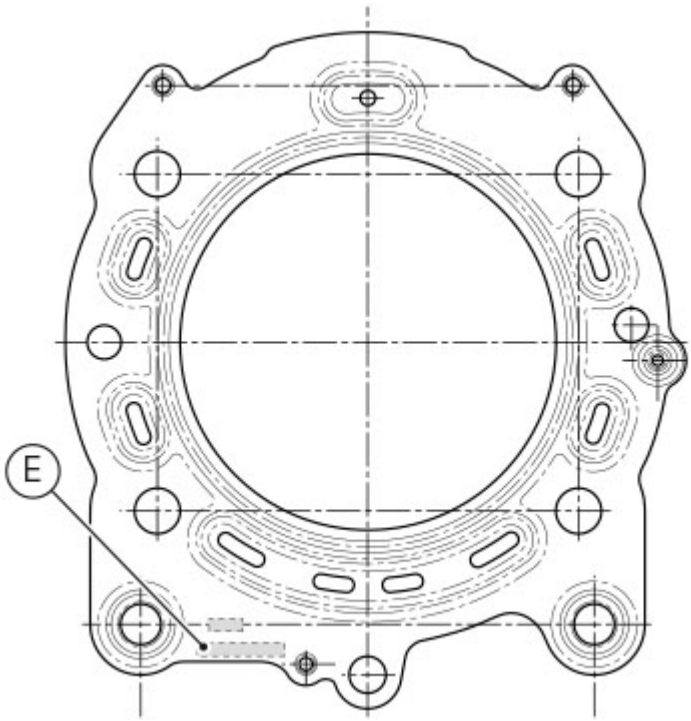
Warning

To prevent oil leaks in the contact area between cylinders and crankcase, each time the head is removed, cylinder and piston must be removed as well to clean the mating faces of crankcase and cylinder and restore the worn gaskets and O-rings and apply again sealing compound.

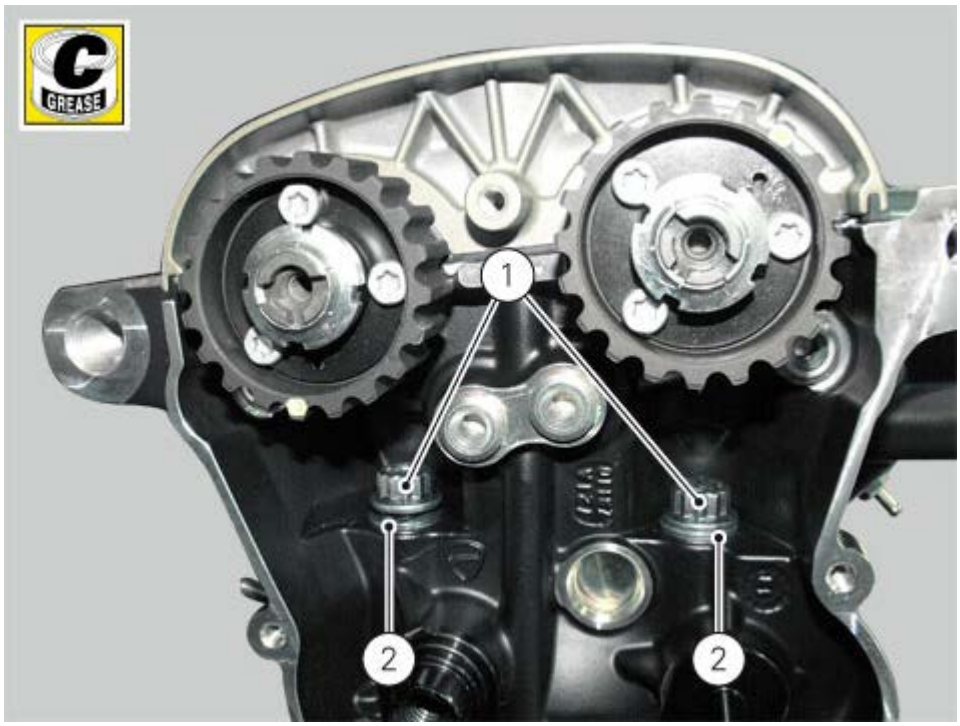
Before fitting the head, check that the gasket (E) is fitted on the mating surface between head and cylinder.



When fitting the gasket, side (E) with the stamped part no. must be in contact with the cylinder head.



Lower the cylinder head carefully over the stud bolts. Take care not to damage the threads.
Apply the specified product to the threads of stud bolts.
Fit the special washers (2) and nuts (1) onto the stud bolts.
Screw nuts (1) on the stud bolts following a cross pattern using tool no. **88713.2676** together with a torque wrench.
Apply a snug torque of 20 Nm to nuts (1), a pre-tightening to a torque of 40 Nm (Min. 38 Nm - Max. 42 Nm) and a tightening to a torque of 60 Nm (Min. 57 Nm - Max. 63 Nm).

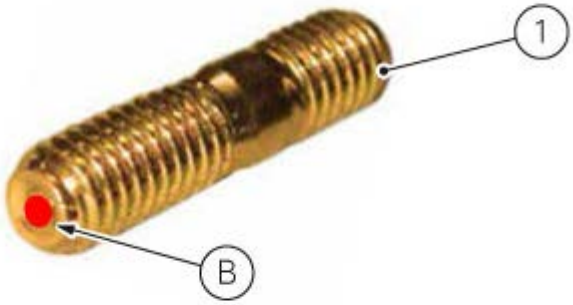


Apply the same procedure to the horizontal head.
Refit the cooling system hoses (Refitting cooling system hoses and unions).
Refit the intake manifolds (Refitting the intake manifold and water union).
Refit the timing belts and covers (Refitting the cylinder head pulleys/fixed tensioners).
Refit the engine to frame (Refitting the cylinder head pulleys/fixed tensioners).

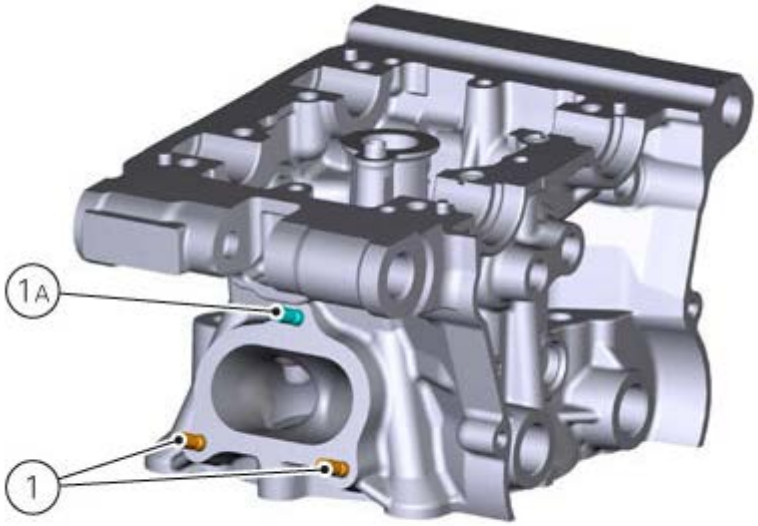
Reassembling the cylinder head

The exhaust side can be identified by the three threaded holes on the flange.

Working in the same way on both heads, apply the indicated product on stud bolts (1) and (1A) short thread.

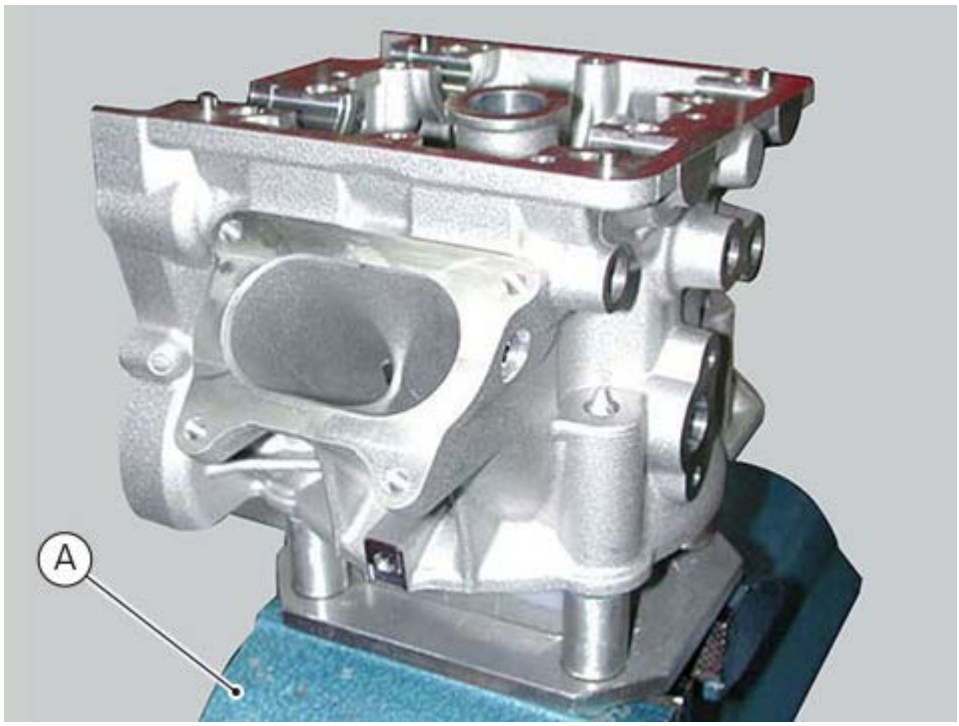


For vertical head only: tighten stud bolt (1A) with the special tool.



Tighten the three stud bolts (1) and (1A) to a torque of 10 Nm (Min. 9 Nm - Max. 11 Nm) so that reference point (B) is clearly visible.

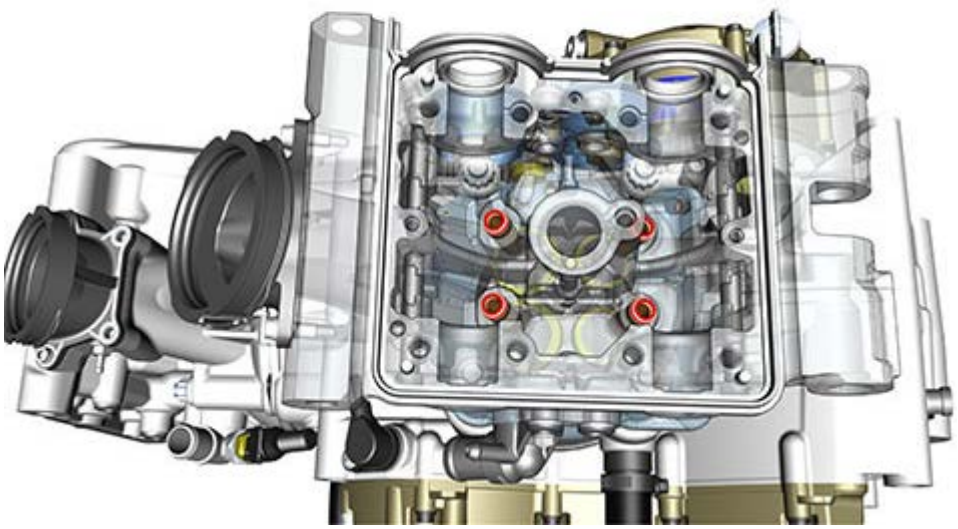
The intake side can be identified by the presence of four threaded holes on the flange.

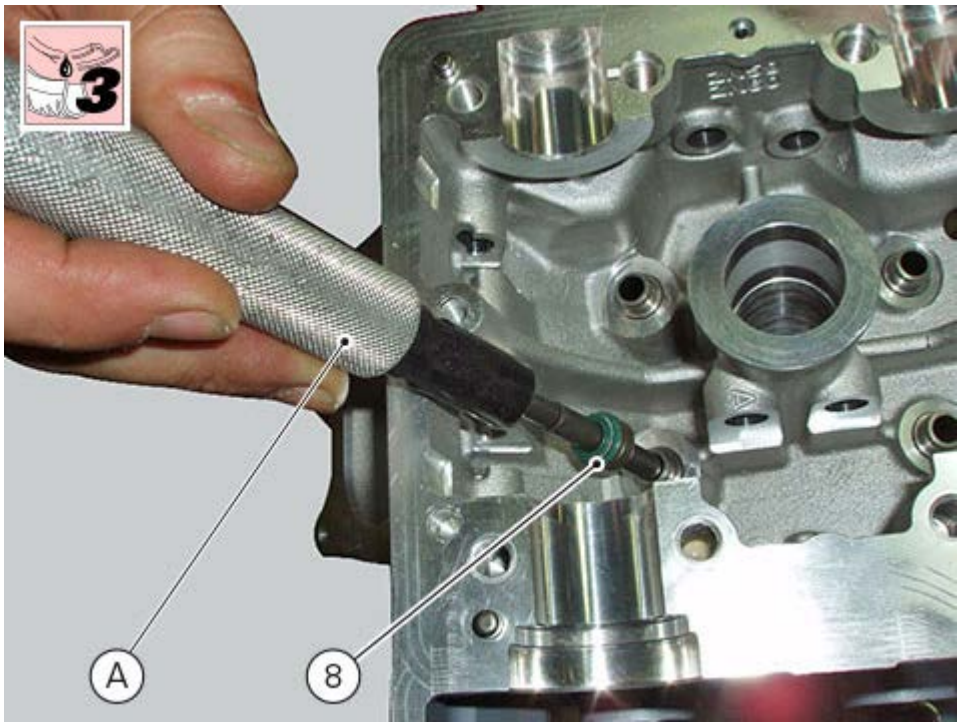


All the figures in this chapter refer to a vertical cylinder head.

Valve guide sealing rings

Position the cylinder head on the appropriate support (A) no. **88713.2103**.
Use the indicated product to lubricate the valve guide sealing rings (1) and insert them from the spring side onto tool (A) no. **88713.2442**.
Fit the end of the tool into the valve guide and use a hammer to tap the sealing rings (1) home into the valve guides.

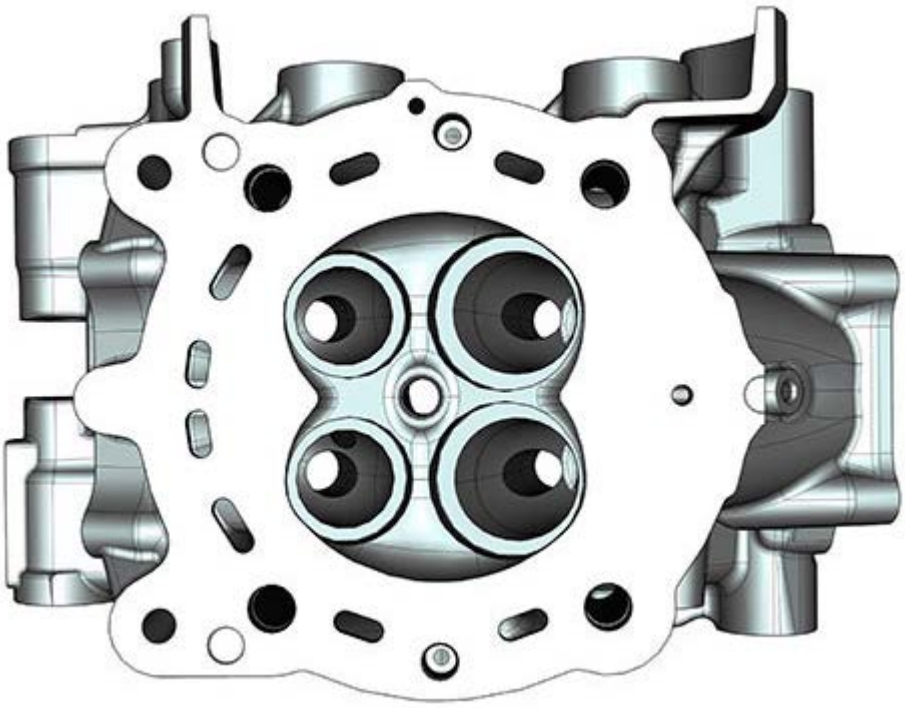


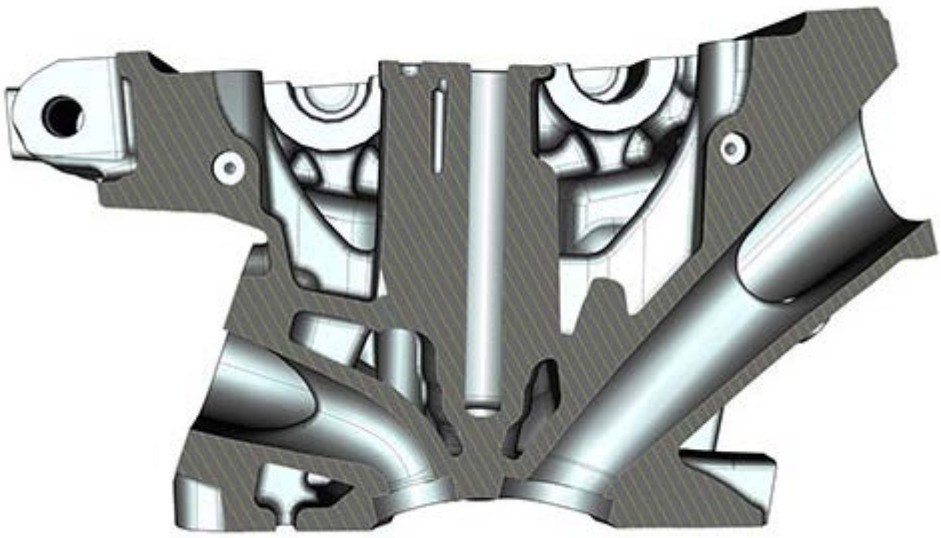


Overhauling the cylinder head components

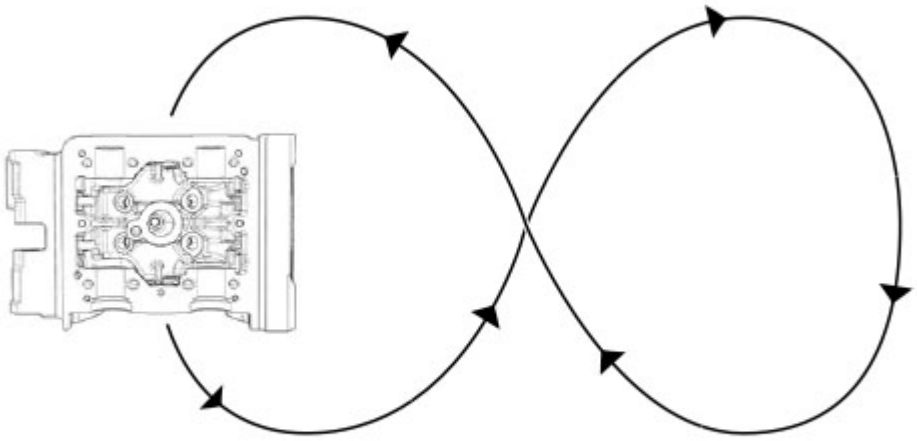
Cylinder heads

Remove any carbon deposits from the combustion chamber and its ducts.
Remove any scale from the coolant ducts.
Check for cracking and inspect the sealing surfaces for scoring, steps or other damage.



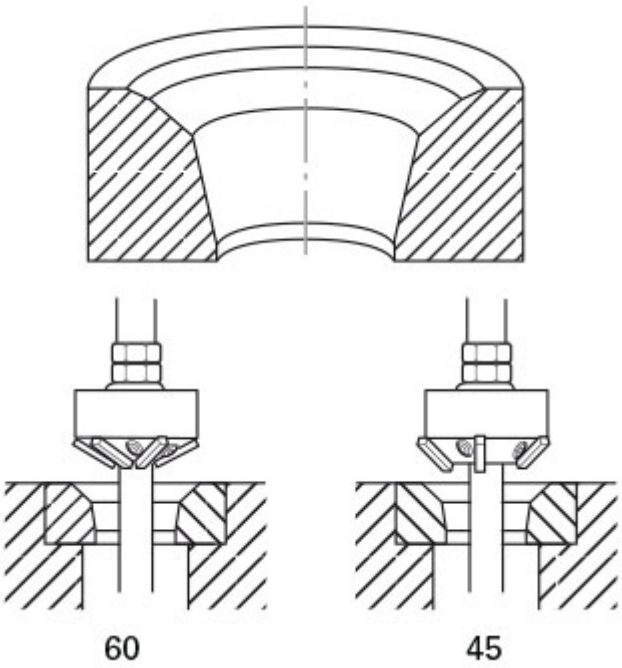


Check that the cylinder mating surfaces of the cylinder head are free of carbon deposits and scale. If this is not the case, spread diamond lapping paste (6 to 12 micron thickness) on a reference surface and slide the cylinder head on the surface as shown in the figure until a flat surface is obtained.



Valve seats

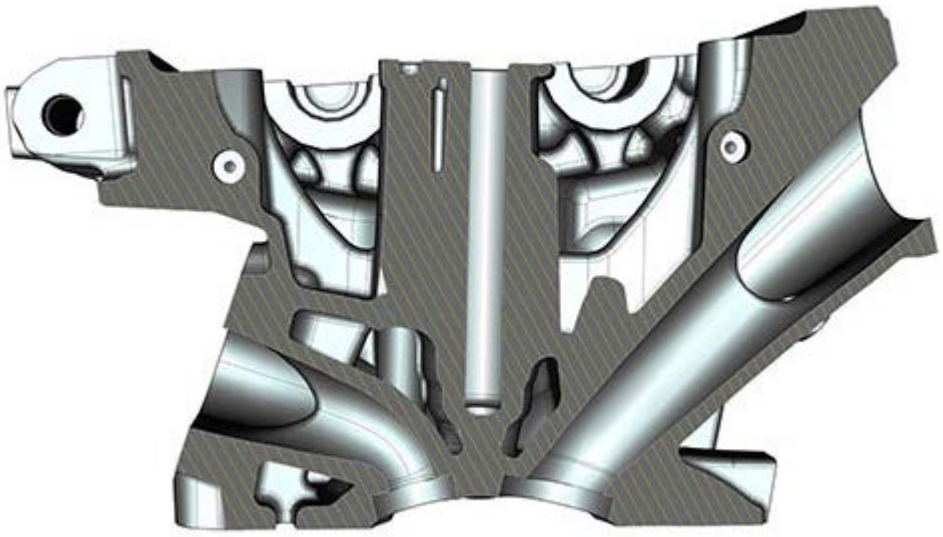
Visually inspect the valve seats: there must be no pitting or cracks.
Minor damage can be repaired by grinding with special 45° and 60° single-blade grinders. Grind the valves and check the seal.



If the valve seats are excessively damaged, fit oversize seats. Replacement seats are available with 0.03 and 0.06 mm oversized outside diameters.

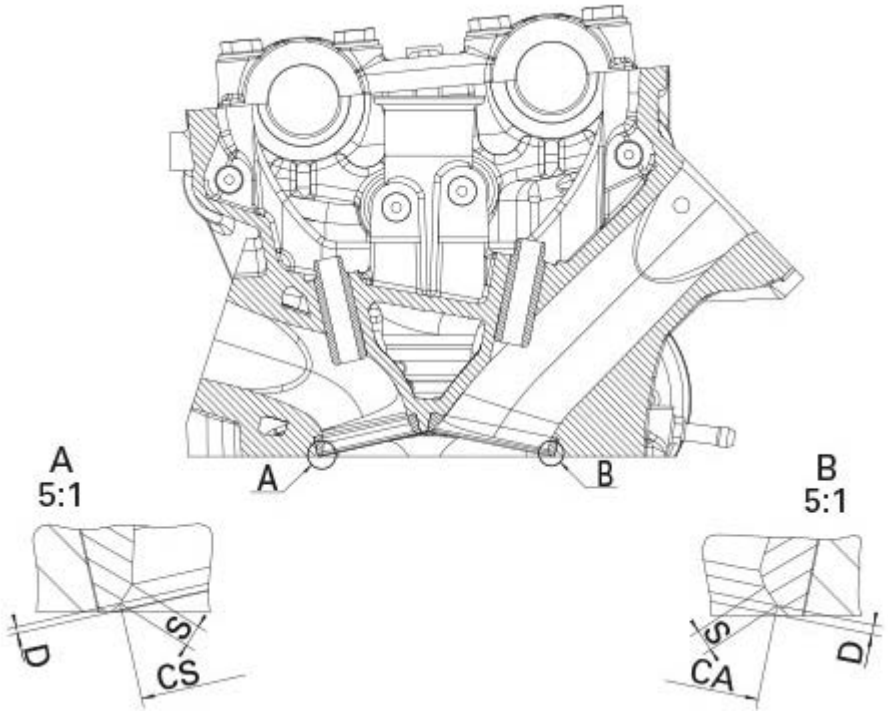
Important
When you change the valve seats, change the valve guides as well.

Proceed as follows.
Remove the worn seats, grinding carefully to avoid any damage to cylinder head housings.
Check the diameter of head housings and choose the oversized valve seat that will give an interference fit of 0.04 to 0.10 mm.

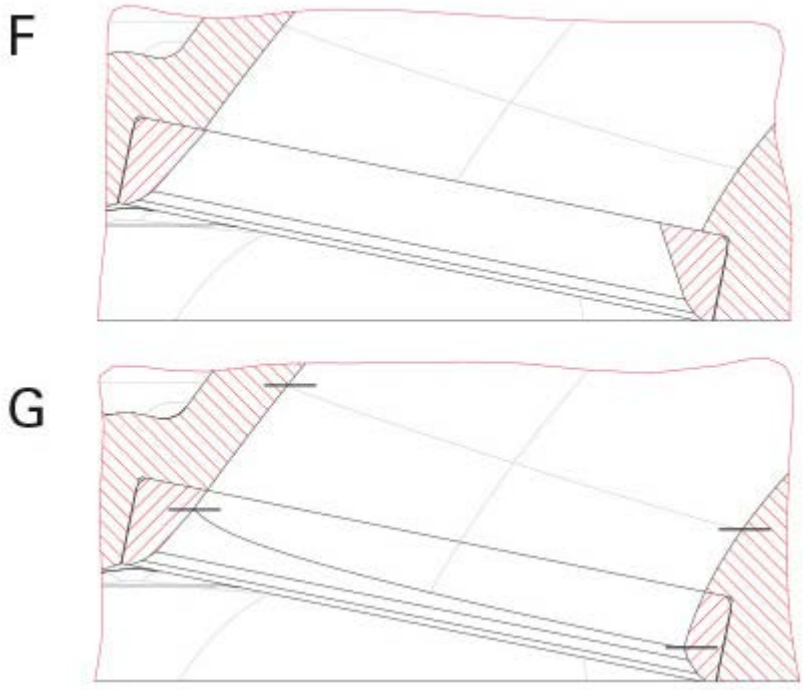


Heat the cylinder head gradually and evenly up to 150 °C and chill the new valve seats in dry ice.
Drive the seats perfectly square into the head housings using the appropriate valve guide seat installers **88713.2846** and **88713.2847**.
Allow the cylinder head to cool down and grind the seats to the following dimensions: CA = Ø 41.6 ± 0.025 mm. CS = Ø 33.6 ± 0.025 mm. S = 1.2 mm. D = 0.2 to 0.4 mm.

Important
Do not use any lapping compound after final grinding.



It is advisable to lap the radius between the intake valve seats and the intake ducts (F = before; G = after).

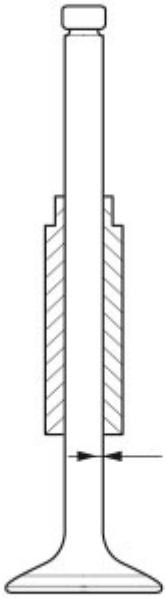


Lubricate valve seats with the indicated product.

Valve guides

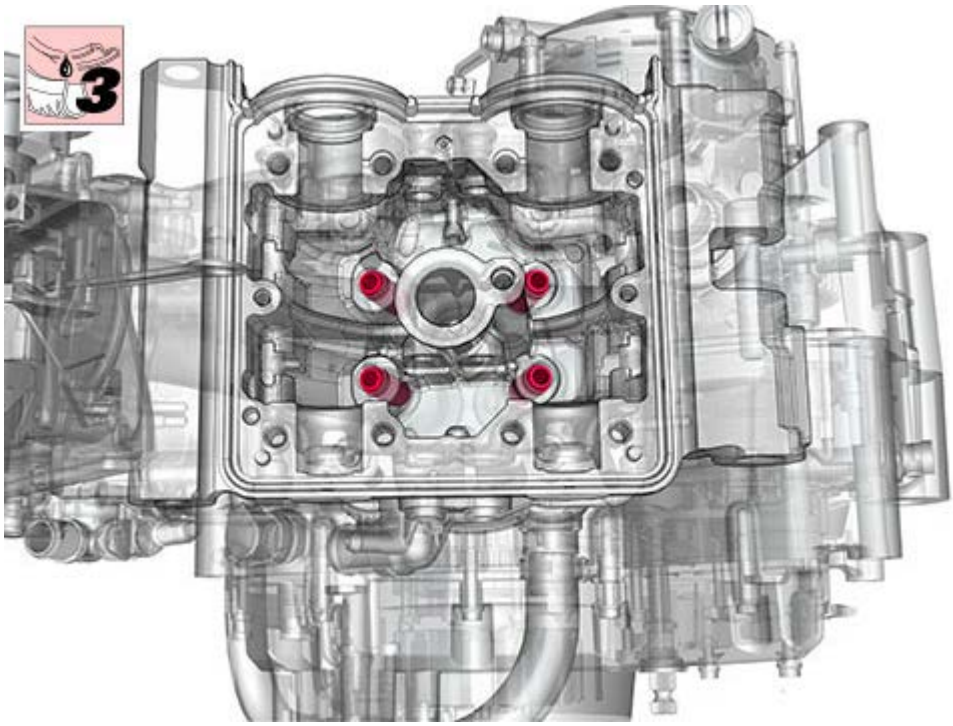
Check the internal surface of the valve guides: there should be no signs of deformation or cracking.

Thoroughly check the dimensions of the valve guide.
Measure the inside diameter with a suitable gauge.
Measure the diameter at different positions of the valve guide.



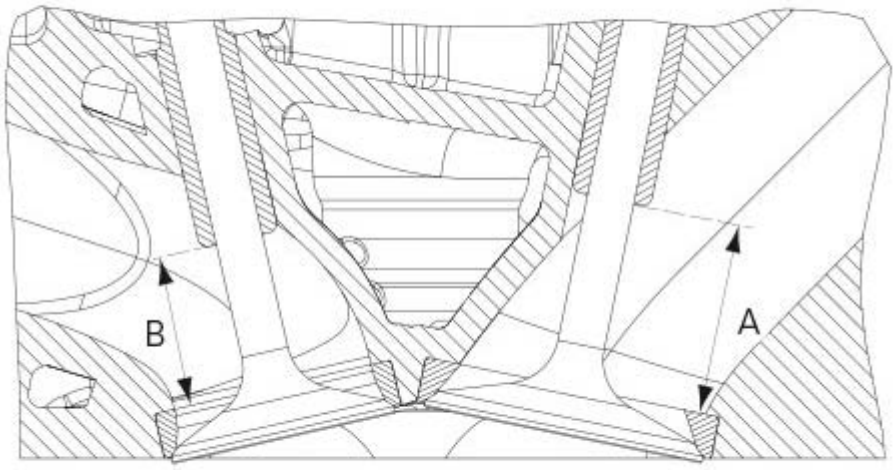
The clearance upon fitting must be: maximum detected value - minimum detected value = 0.03÷0.045 mm.
The maximum permissible wear limit is 0.08 mm.
Change the valve guides when the ovality exceeds permissible limit or the valve stem clearance is outside the tolerance range.
When you change the valve guide, you must also change the valve.
Valve guides as spare parts are available with outside diameter oversized by 0.03, 0.06 and 0.09 mm.
Change the valve guides as follows:

- heat up the cylinder head gradually and evenly up to 150 °C;
- remove the original valve guides using tool no. **88713.2842**;
- allow the cylinder head to cool down and check the condition of the seats;
- choose suitable valve guides to obtain an interference fit in the cylinder head of 0.022 to 0.051 mm;
- heat up the cylinder head again and chill the new valve guides in dry ice;
- lubricate the seats in the cylinder head and install the valve guides using the appropriate service tools and with reference to the dimensions given in the figure;



A= 22.4±0.15 mm
B= 28.45±0.15 mm

Hone the mating surface with a reamer.

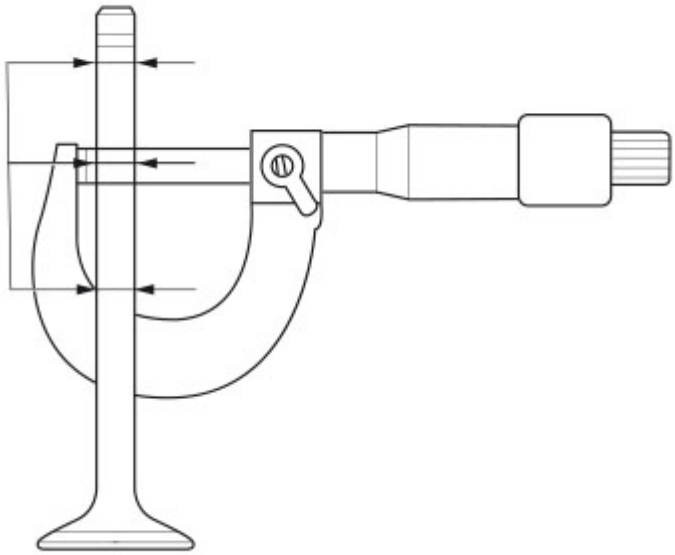


Checking the valve

Check that the stem and the valve seat contact surface are in good condition.
There must be no pitting, cracks, deformations or signs of wear.

Warning
The valves cannot be ground.

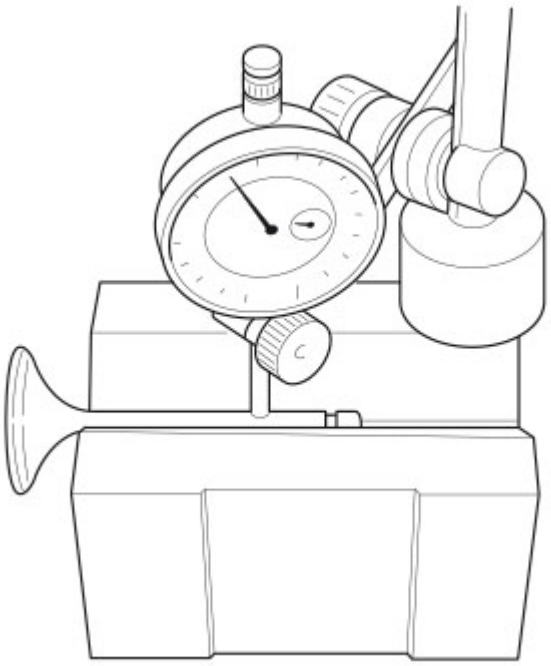
Perform the following checks.
Measure the diameter of the valve stem at various points along the section that runs in the valve guide.



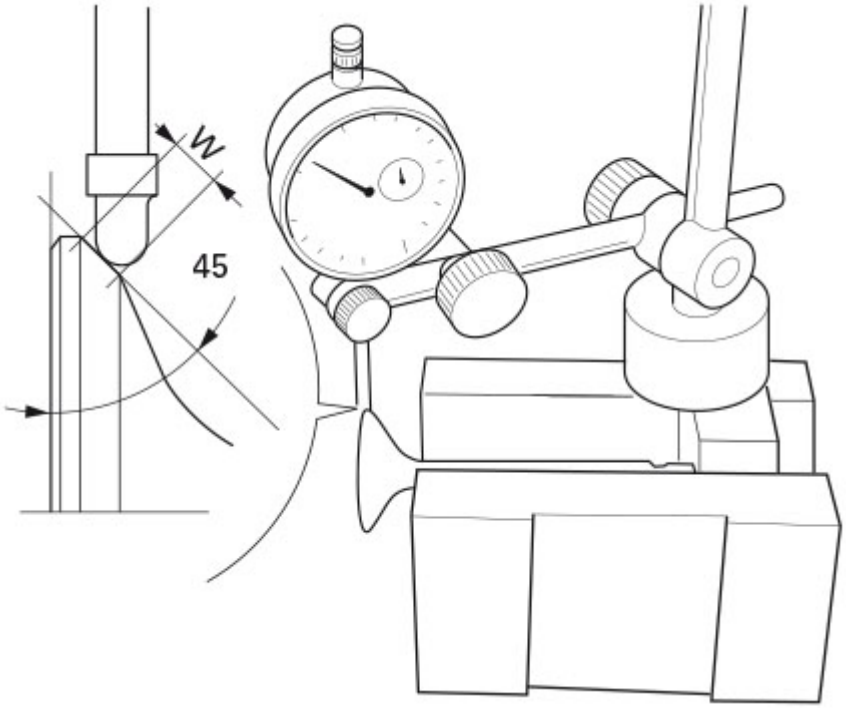
Check the valve stem for buckling. Place it on a "V" reference and measure deformation with a dial gauge. Service limit: 0.053 mm.

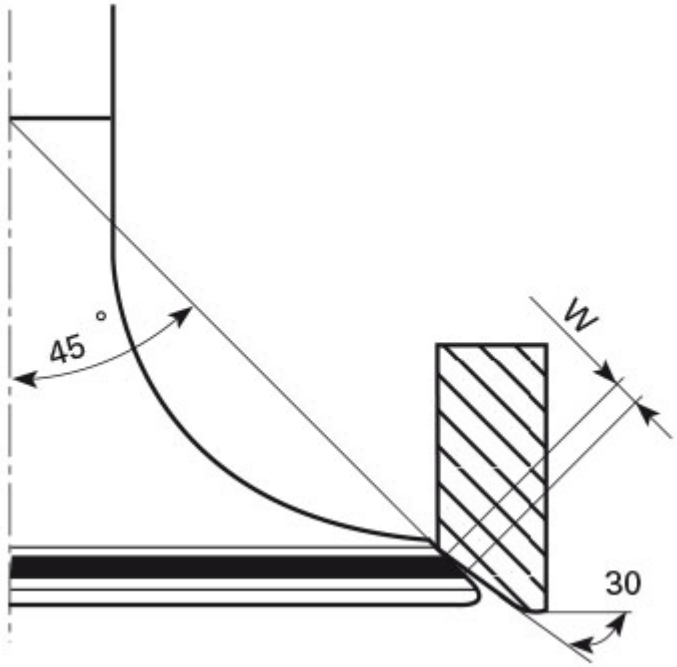
Check the valve stem for buckling. Place the valve on a "V" reference block, set a dial gauge perpendicular to head and measure concentricity of valve face at 45°:

- nominal concentricity: 0.01 mm;
- service limit: 0.03 mm.



Use Prussian blue or a mixture of minium and oil to check that the contact surface (W) between valve and seat is 1.4 to 1.6 mm (1.05 to 1.35 mm when new). Grind the seat if the dimension measured is greater than the above limit.

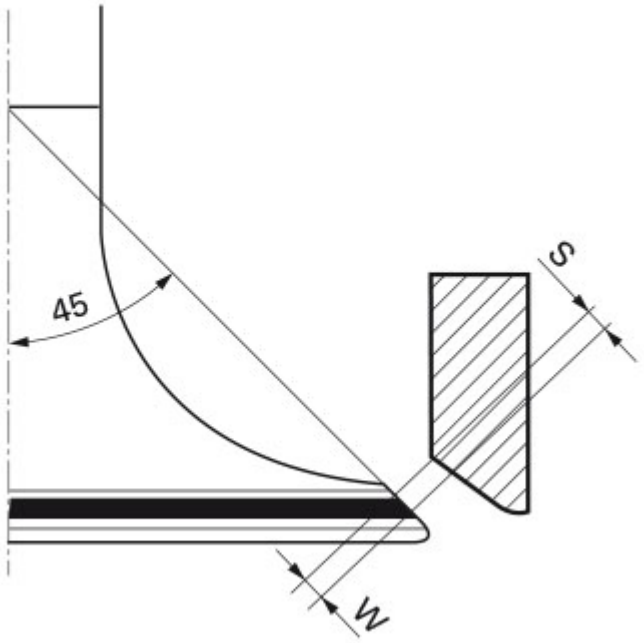




Checking the valve seal

Note
Lubricate valve stems in the indicated area, only.

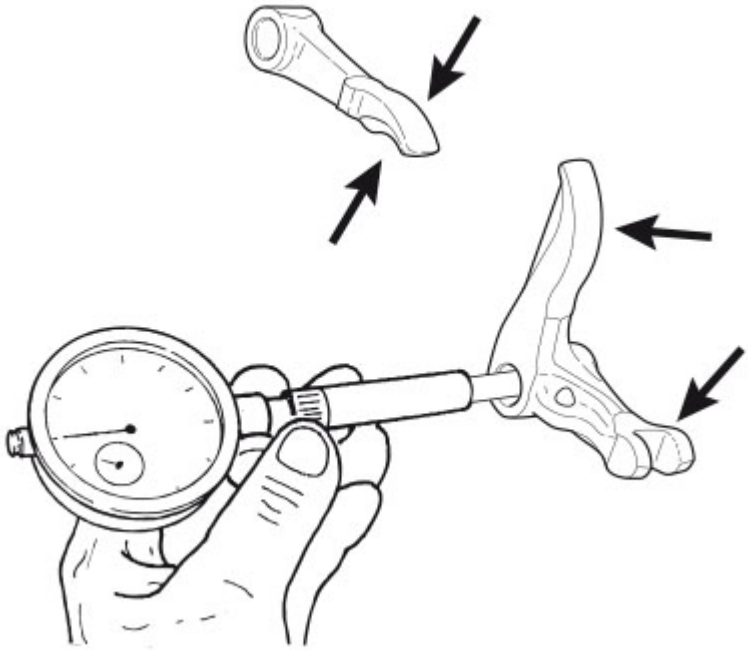
After grinding the seats it is important to check the seal between valve face and seat: if the seat contact area (S) on the valve is wider than the 45° band (W) this could lead to poor sealing.

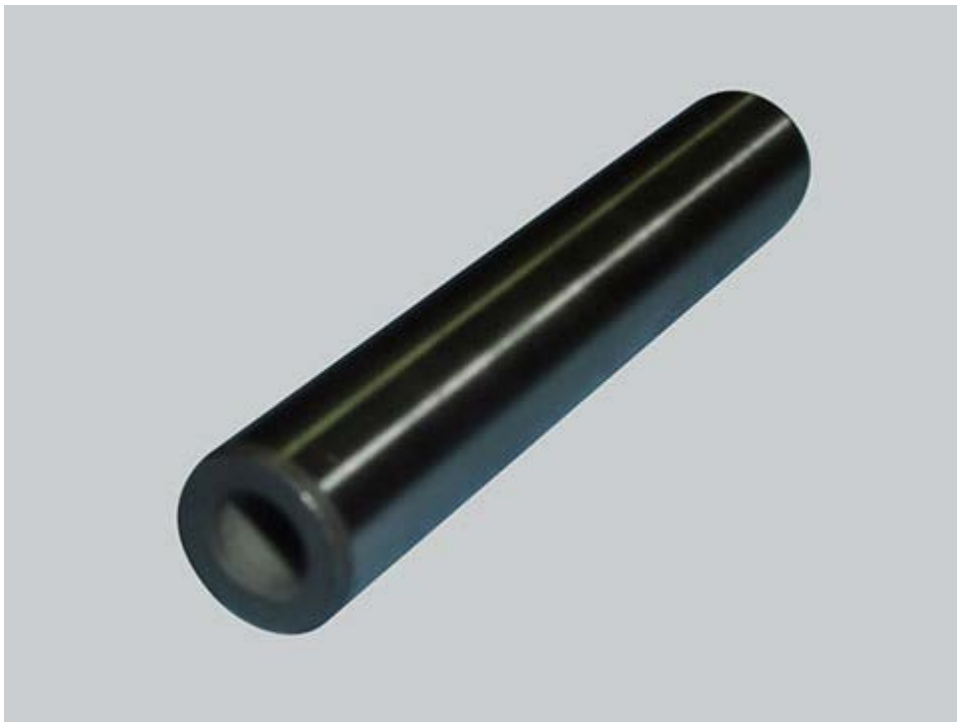


If valve sealing test outcome is negative, remove valve, clean it and refit it making sure that it is properly seated.
Then repeat sealing test; should test outcome be still negative, repeat the whole process.
Once sealing test has been repeated and outcome is still negative, identify the leaking duct and replace valve.
Repeat the sealing test until outcome is positive.

Checking the rocker arms

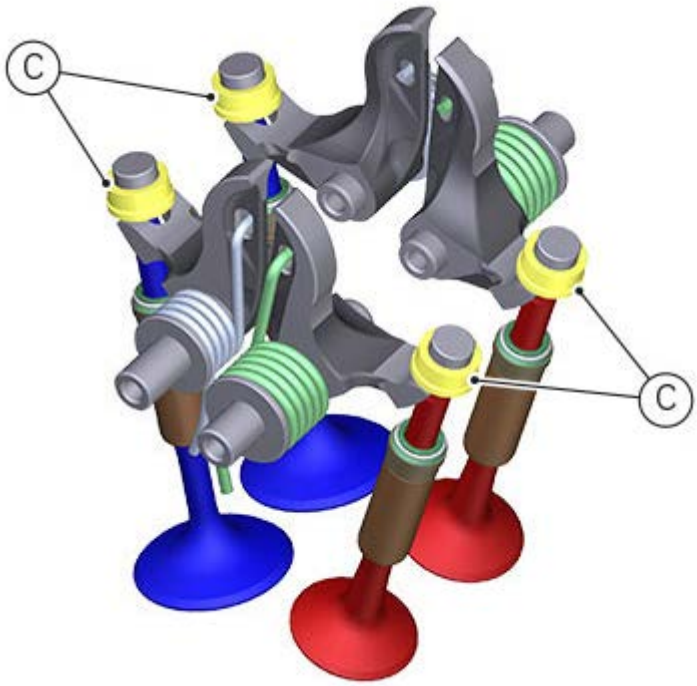
Check for signs of wear, grooves or chrome flaking off.
Check the condition of rocker arm bore and shaft.
Clearance upon fitting: 0.025÷0.049 mm.
Wear limit: 0.08 mm.

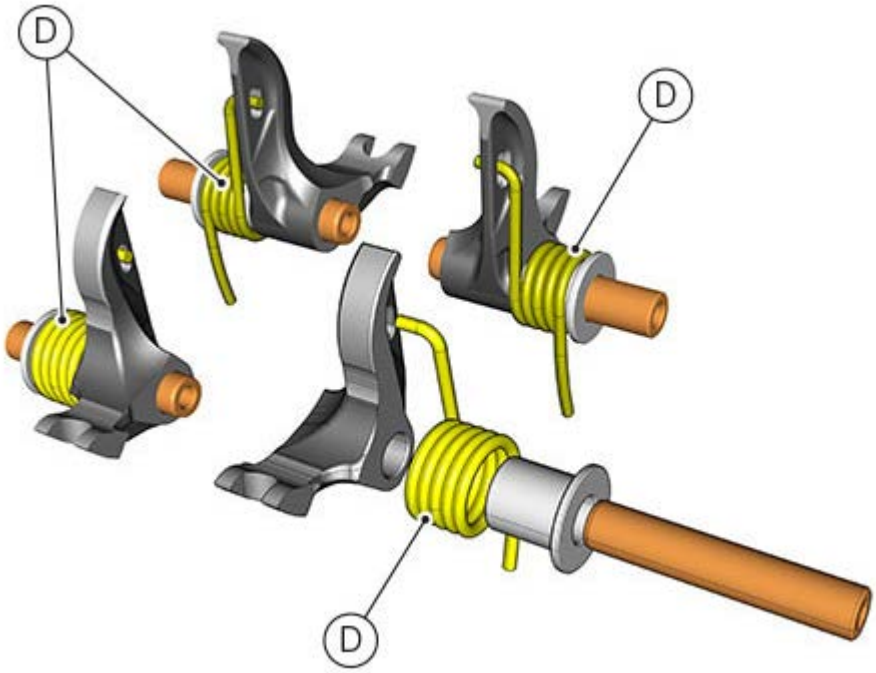




Opening and closing shims - Springs

Check the condition of the contact surfaces of the valve opening and closing shims (C): there must be no signs of wear.
Check the conditions of the return springs (D) of the closing rocker arms: no cracks, deformations or failure must be present.

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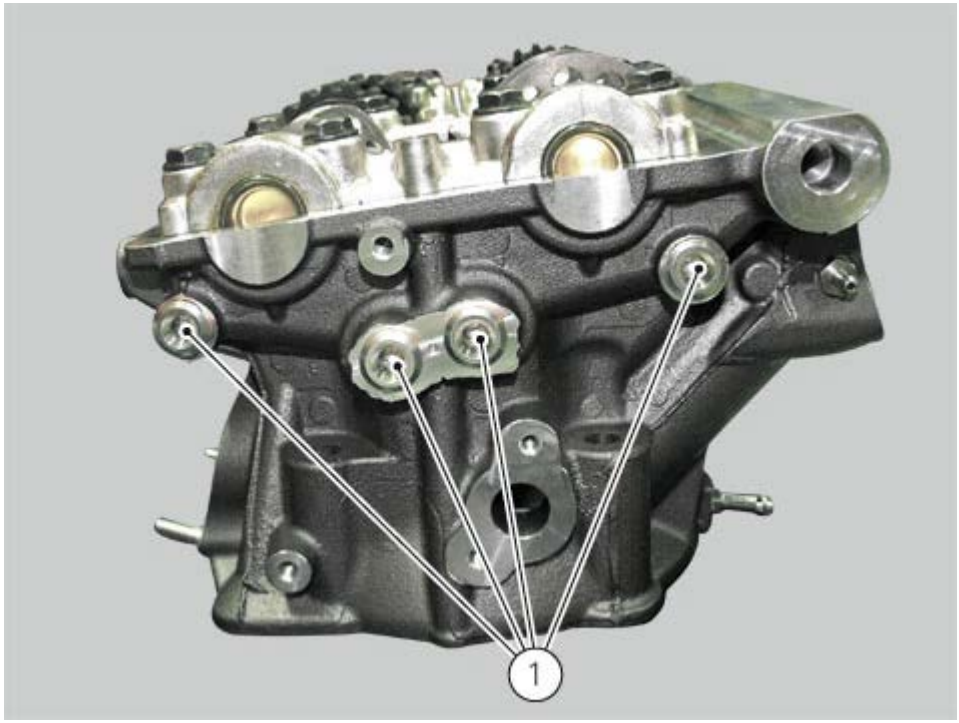
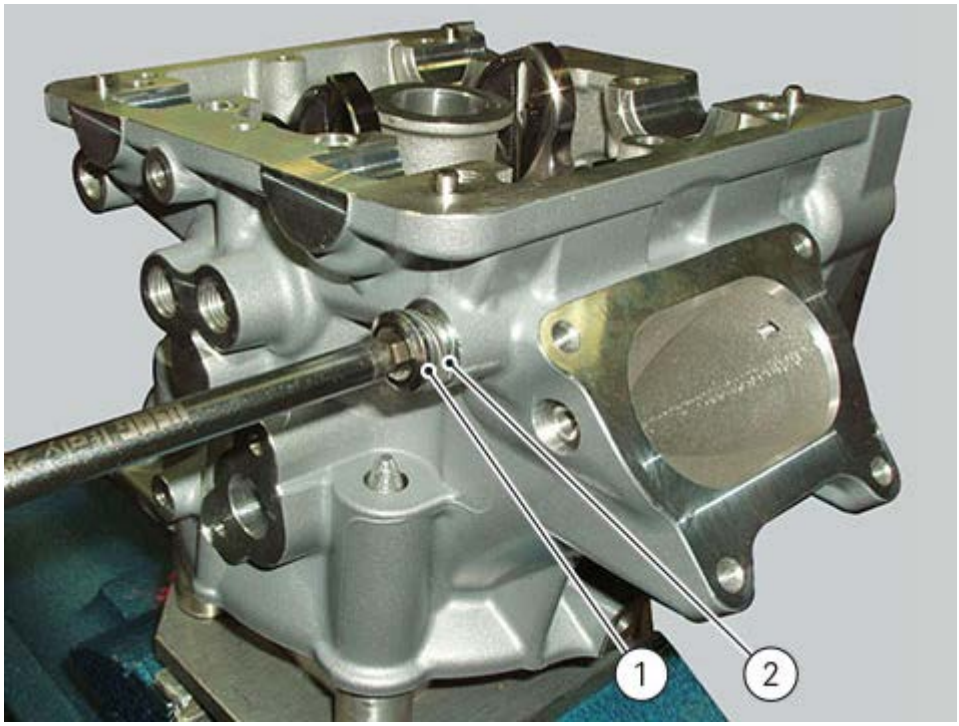
D
D

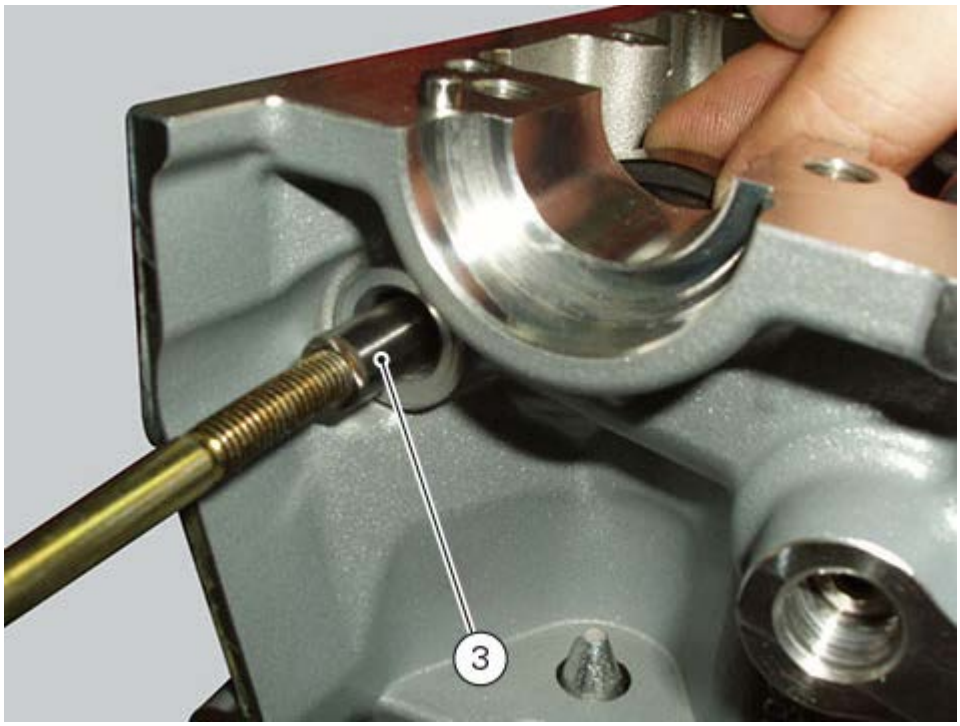
Removing the valve rocker arms

With the cylinder head in the condition described in the previous paragraph, remove the rocker arms. Working on both sides, loosen plugs (1) and collect seals (2).





Using an M6 screw, withdraw the shafts (3) of the opening rocker arms (4) on the exhaust and intake sides. Remove the opening rocker arms (4).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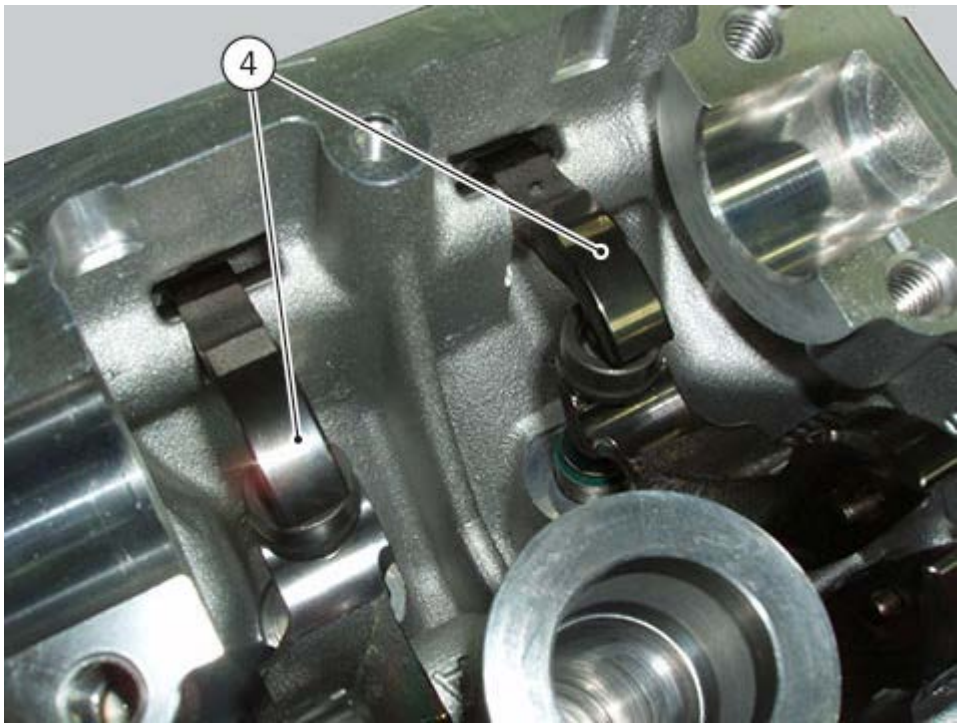
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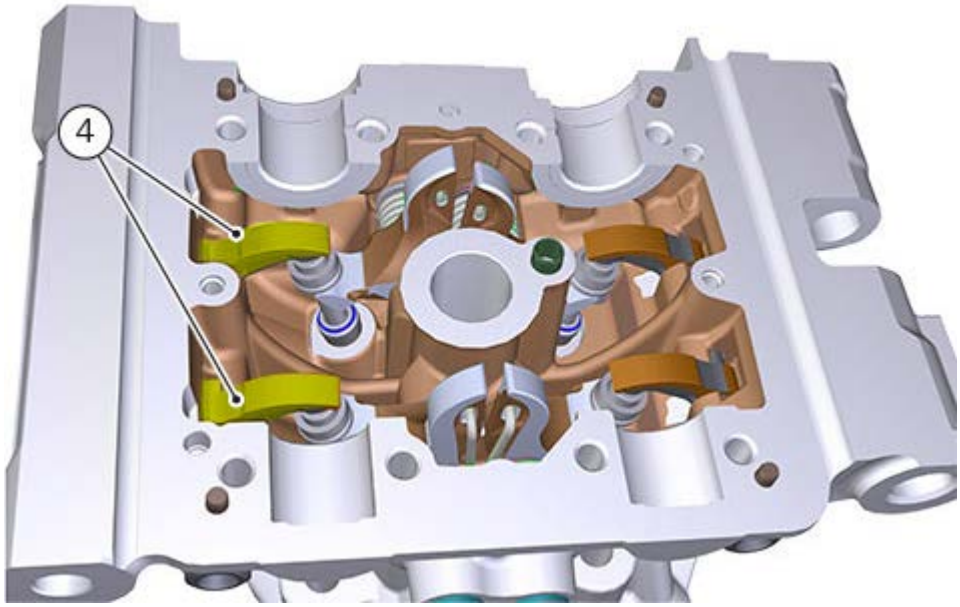
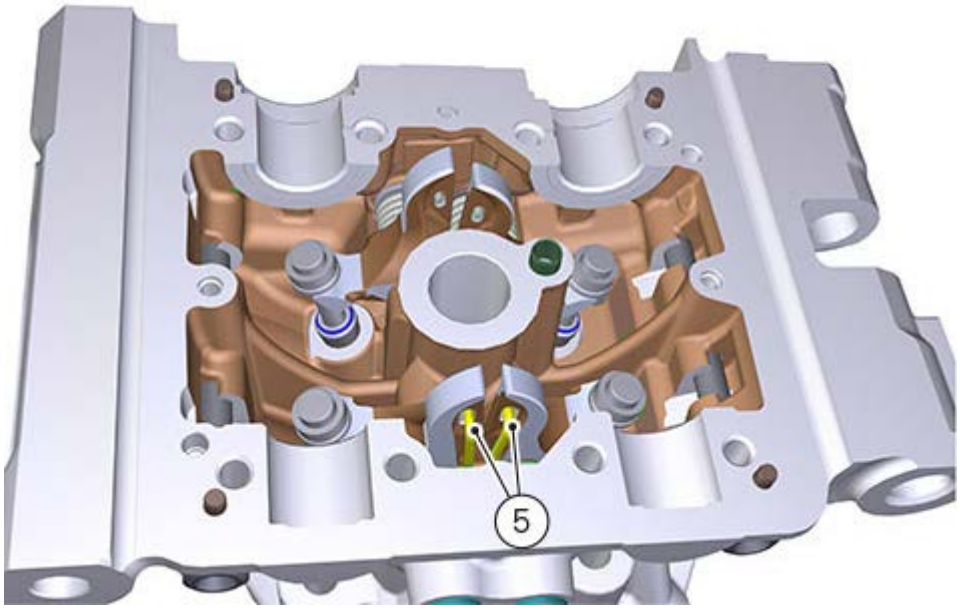
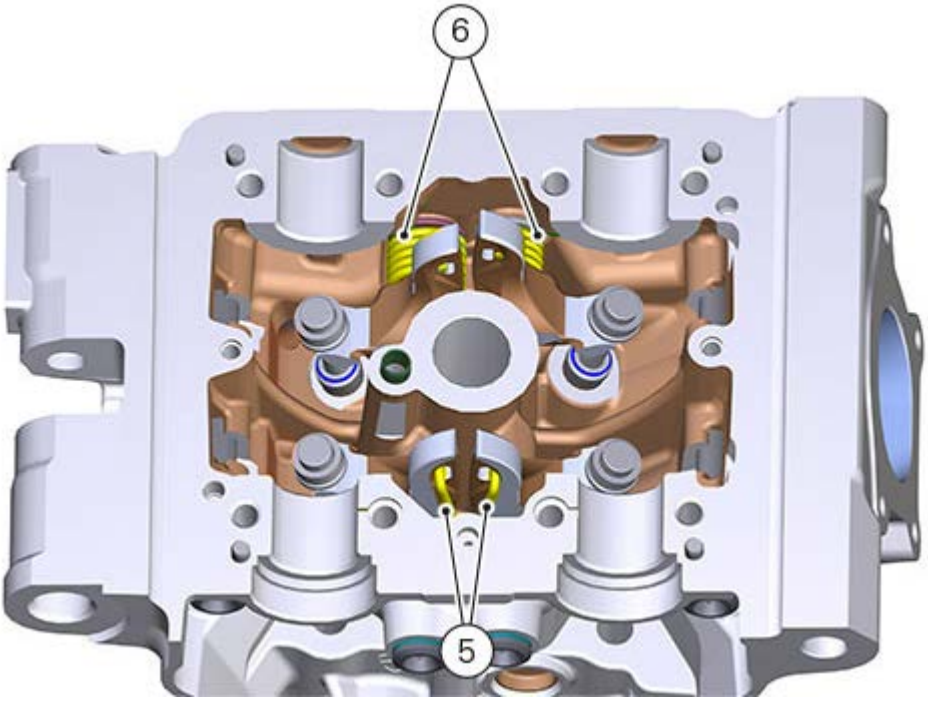
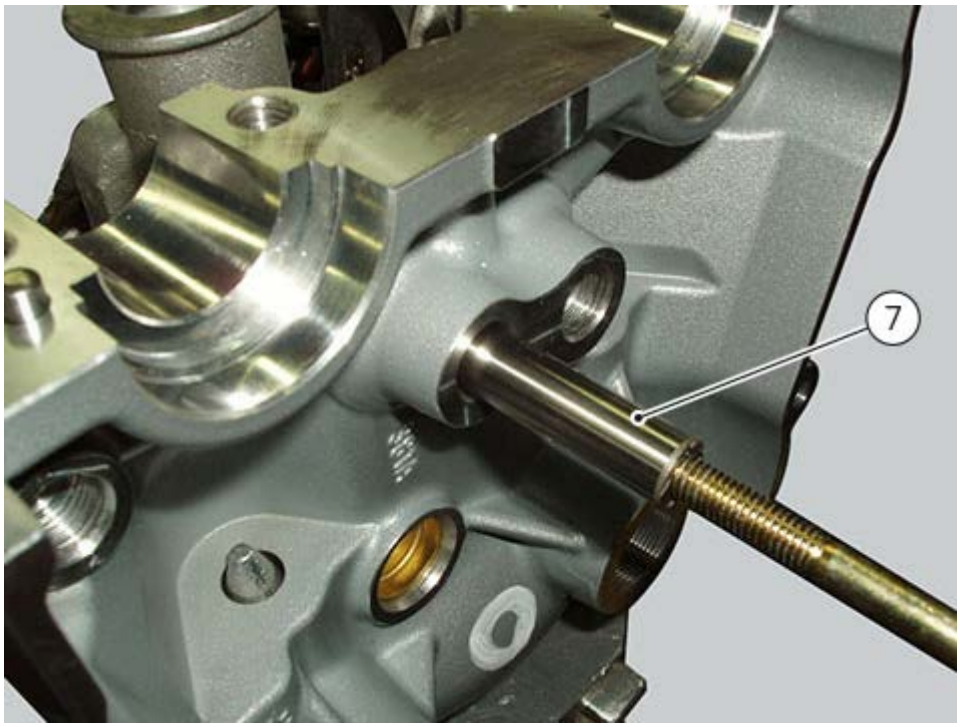


Using the pawl of the rocker arm spring tensioning kit no. **88713.2068** installed between the spring and the inner wall of the cylinder head, move the straight end of the rocker arm return springs (5) and (6) and insert it in the kit drilled rod.

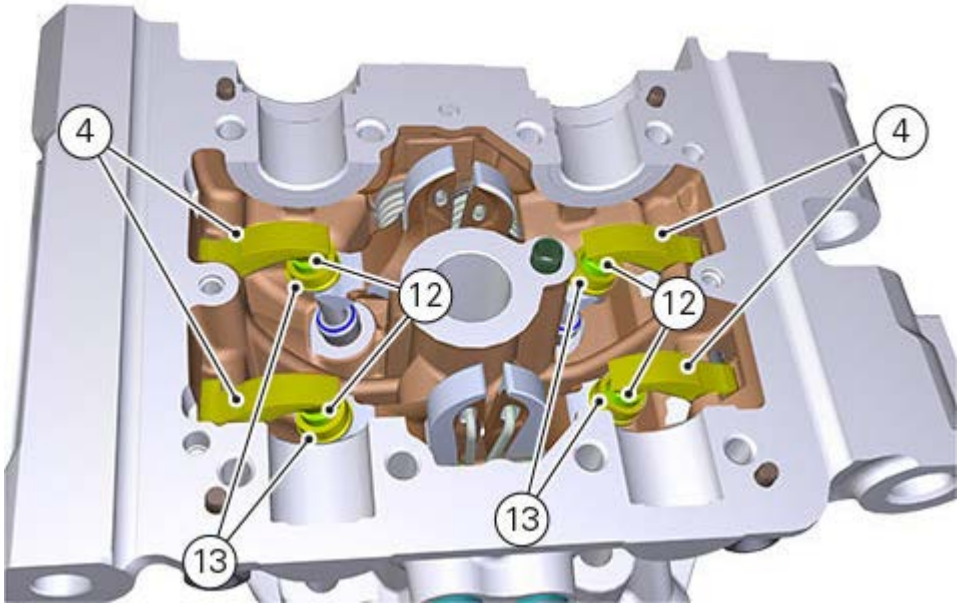




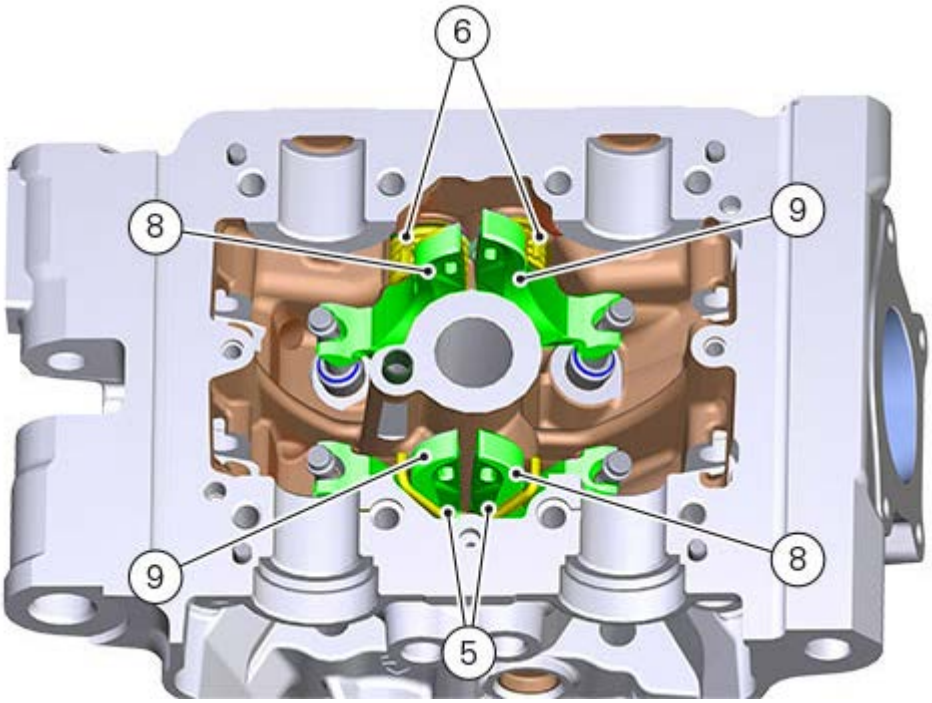
Use the kit shaft to slide the end of the spring into its rest position.
Using an M6 screw, withdraw the shafts (7) of the closing rocker arms on the exhaust and intake sides.

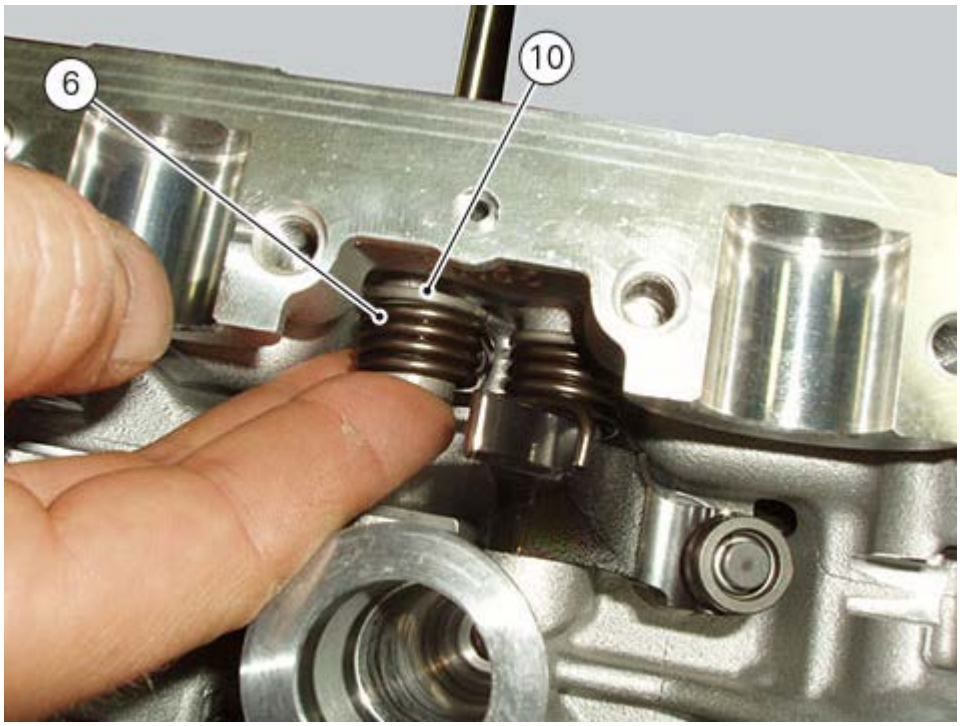


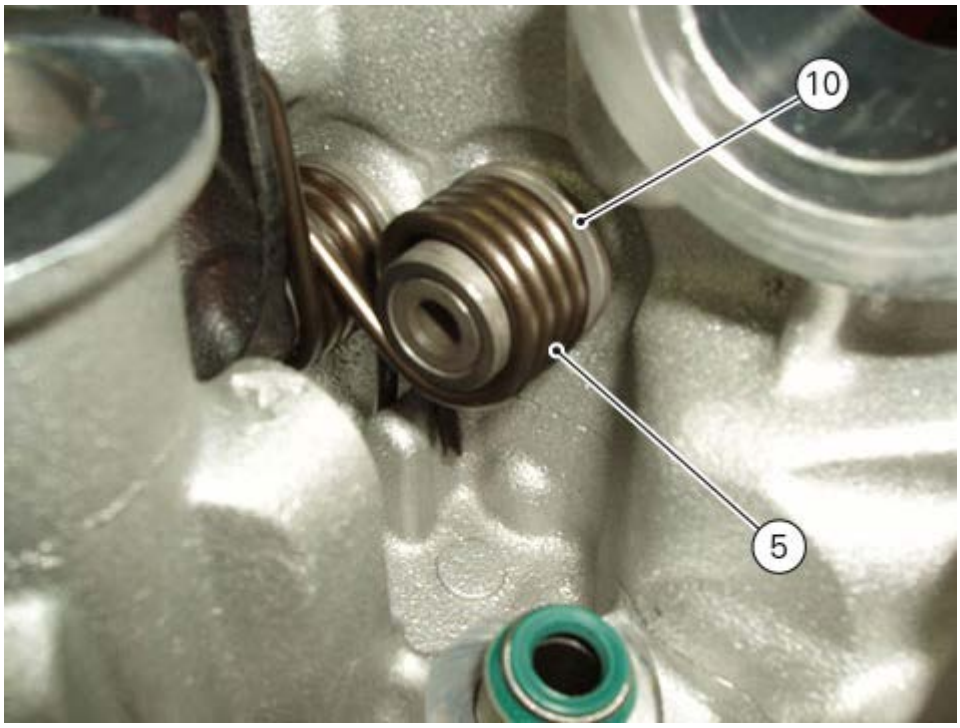
Remove the opening (12) and closing (13) shims.



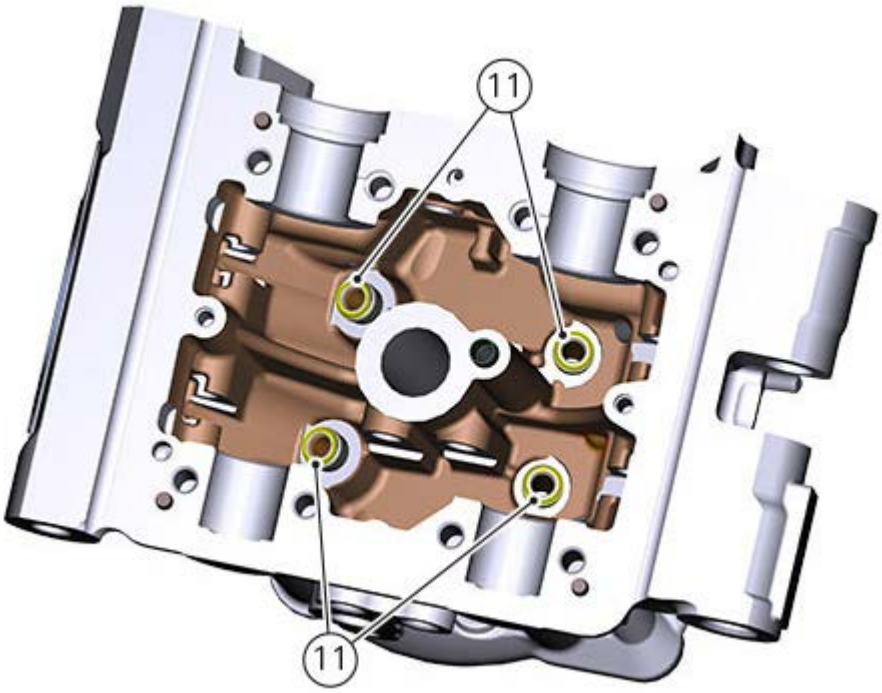
Remove the closing rocker arms (8) and (9), the springs (6) and (5) with the spacers (10).







Remove the sealing rings (11) from the ends of the valve guides.

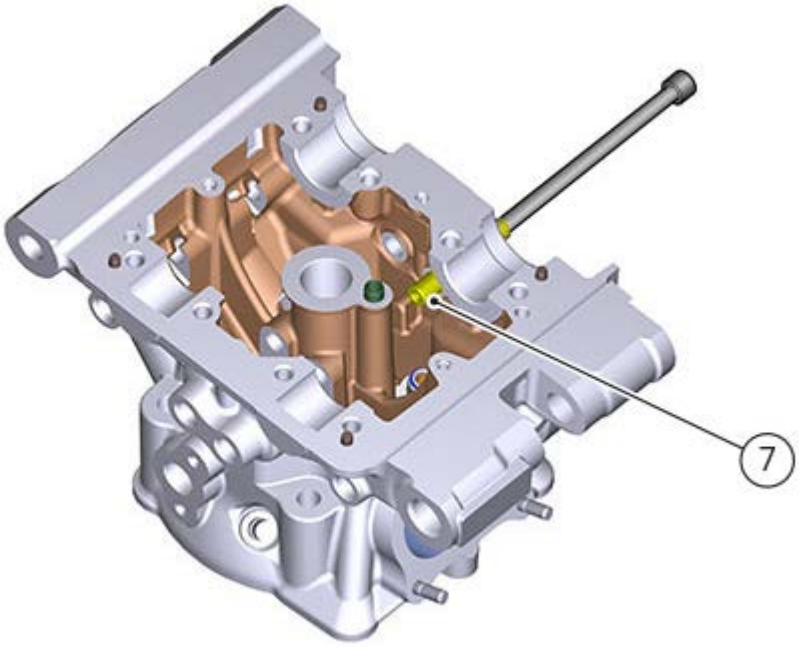


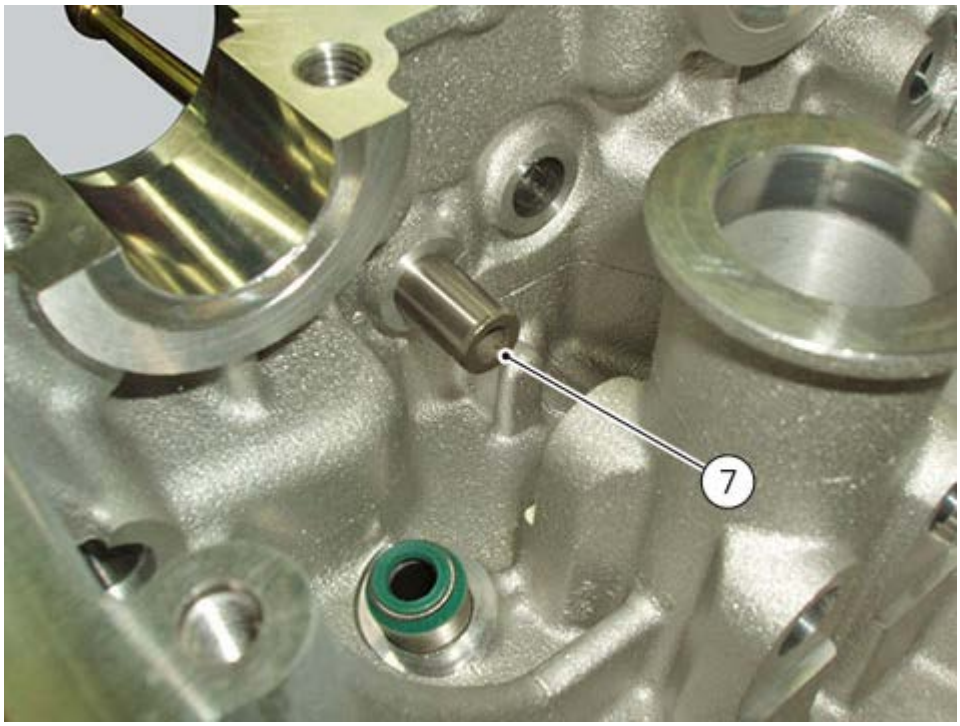
Repeat the same procedure for the other cylinder head.

Reassembling the closing rocker arms

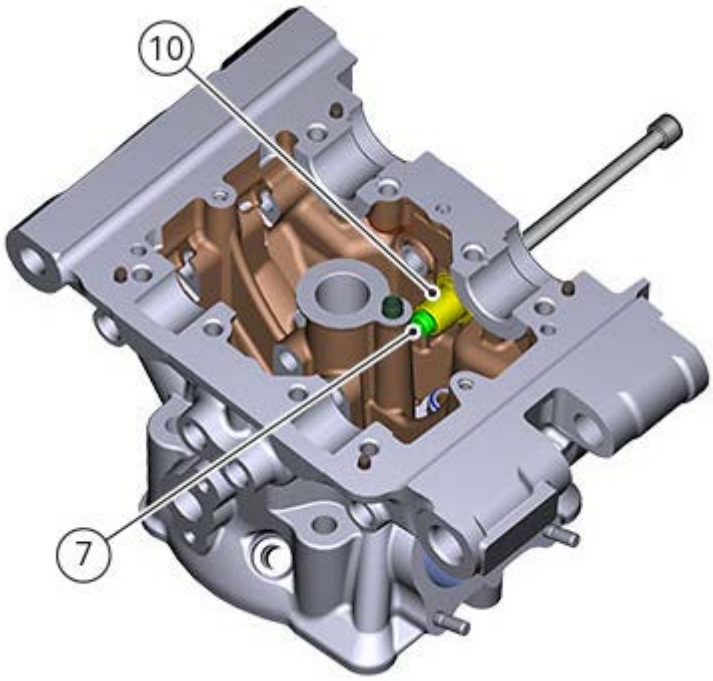
Note
The closing rocker arm shafts feature a 10 mm diameter, whereas the opening rocker arm shafts feature a 9 mm diameter.

Check that the rocker arms are not scored or show signs of breakage in the area of contact with the camshaft and shim.
Using an M6 screw, position the closing rocker shaft (7) towards the exhaust side of the cylinder head.

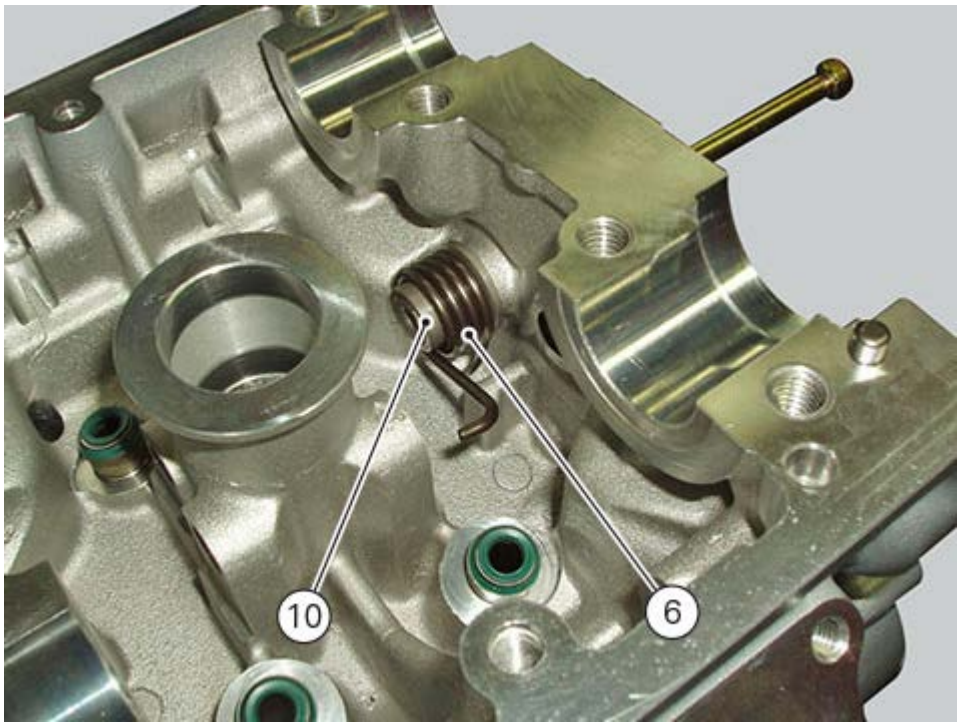




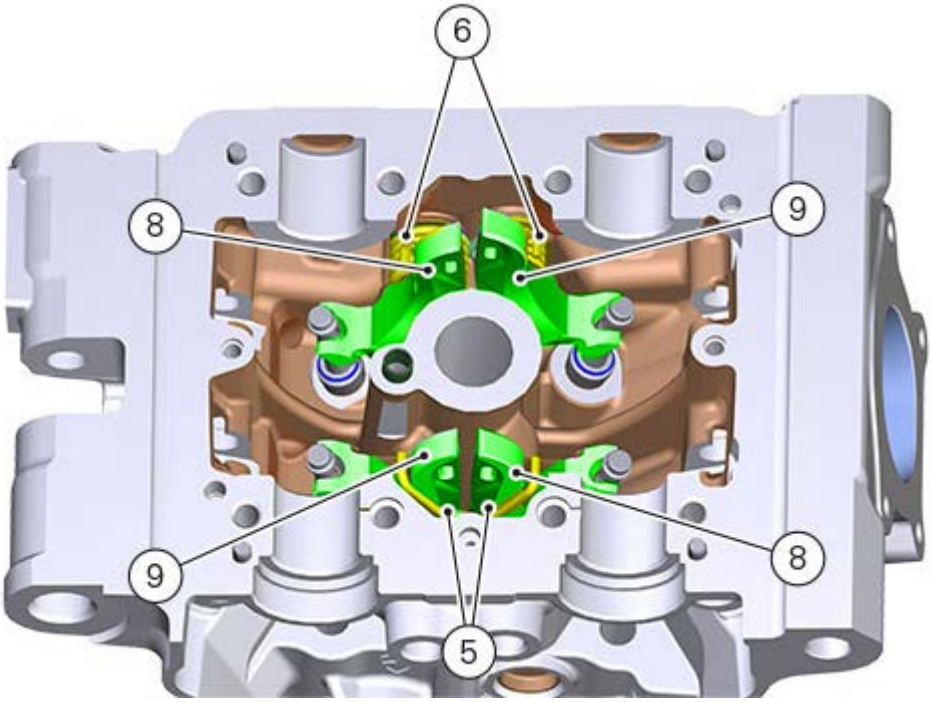
Locate the spacer (10) on the shaft.

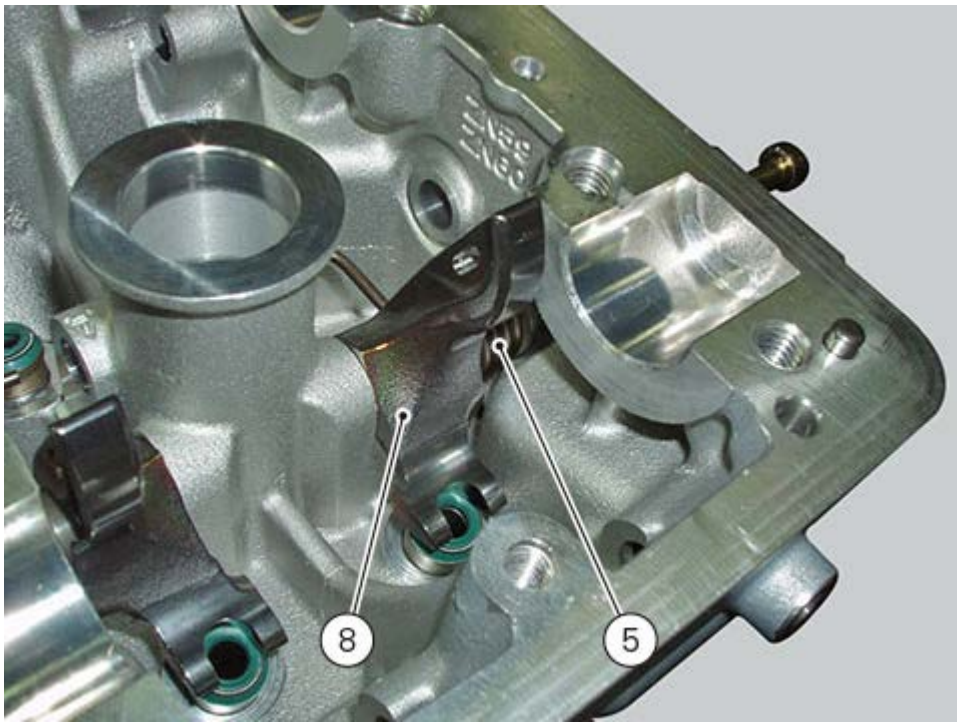


Locate the spring (6) on the spacer (10).

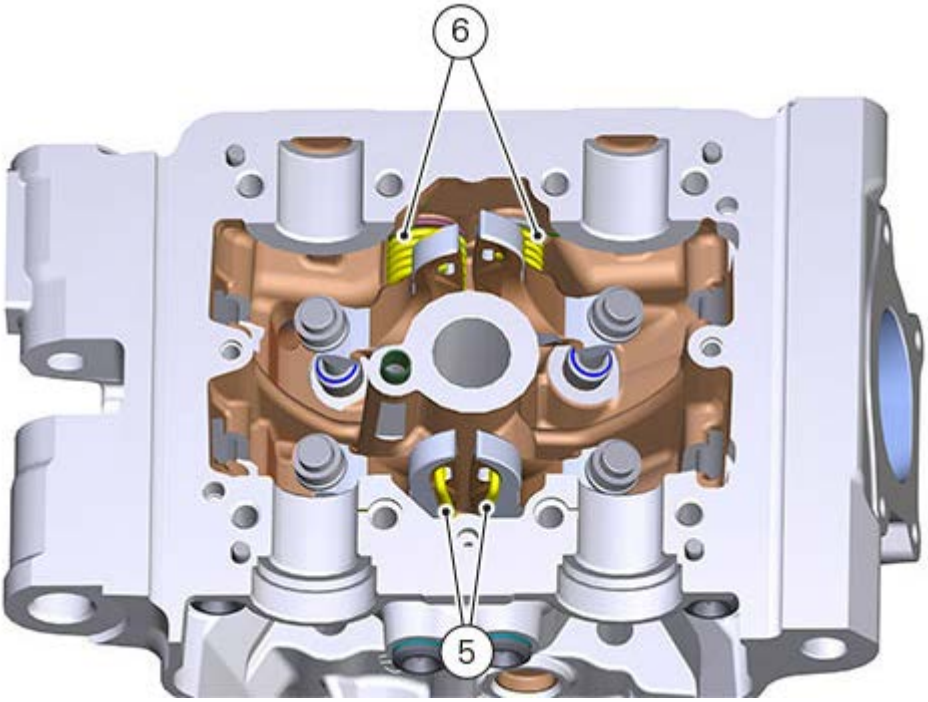


Locate the closing rocker arm (9) and drive the shaft home.
Proceed in a similar manner to install the closing rocker arm (8) with the spring (5).





Load the springs (6) and (5) on the closing rocker arms (9) and (8) respectively using the tool no. **88713.2068**.

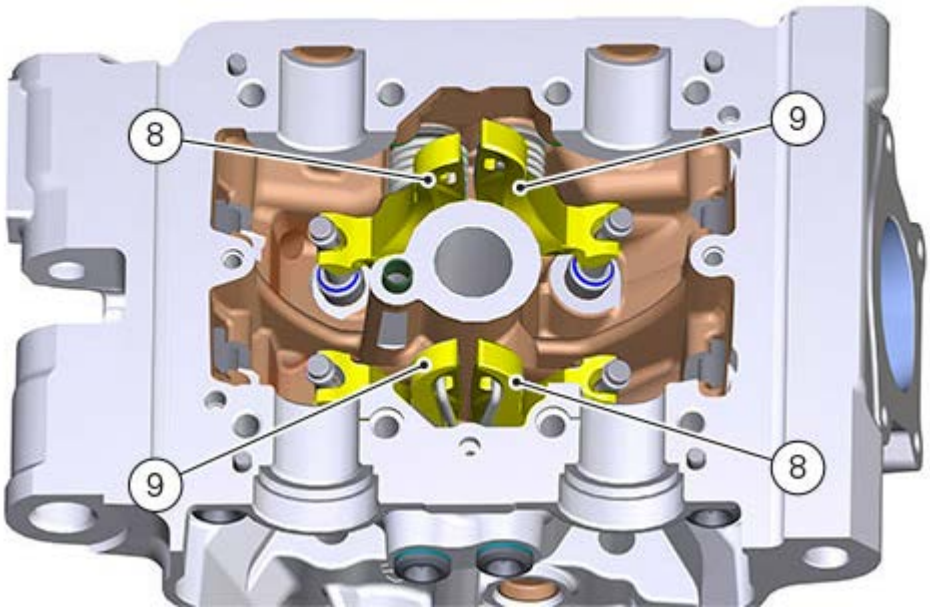


Note

Always install the closing rocker arms on the exhaust side before those on the intake side.

Warning

Take care not to damage the shoe of the closing rocker arm with the intake spring during assembly.

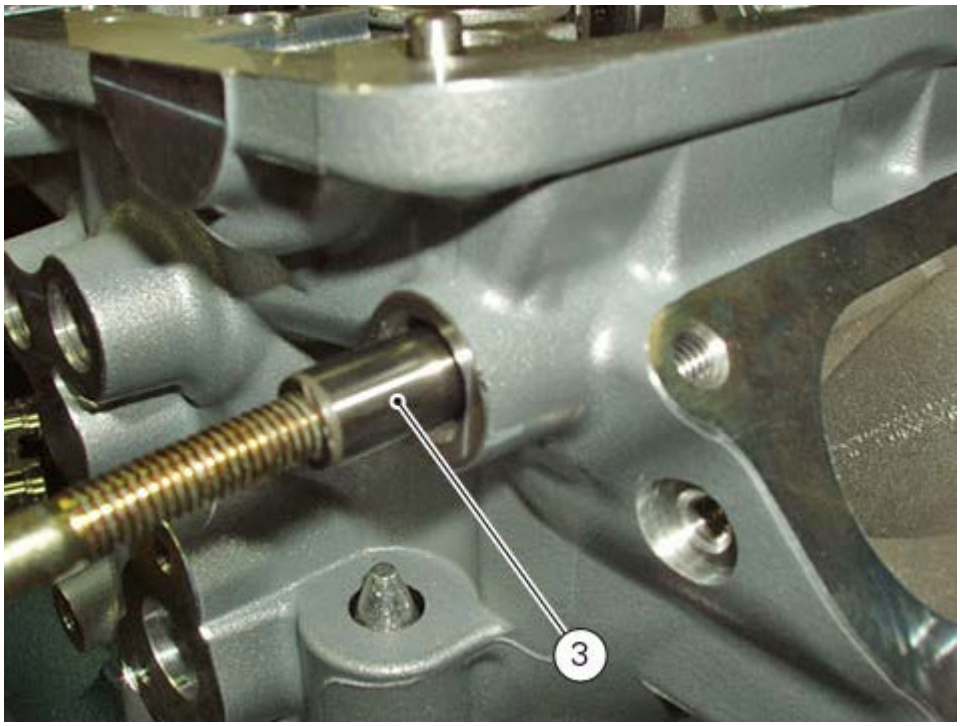


Refitting the opening shims and opening rocker arms

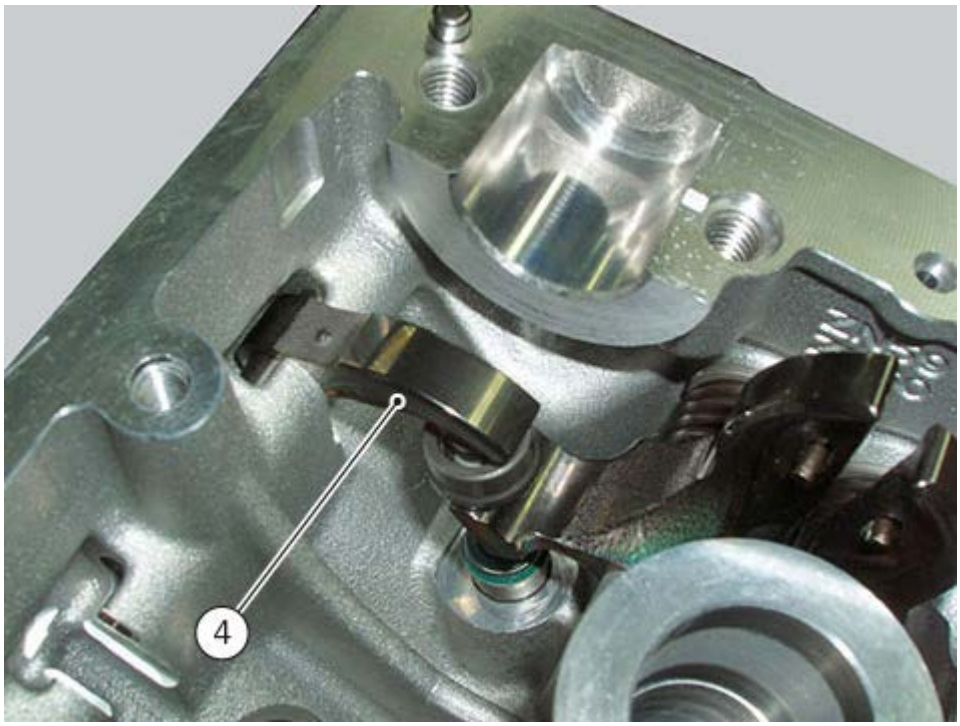
Using an M6 screw, position the opening rocker arm shaft (3) (diameter 9 mm).

Note
Always install the closing rocker arms on the exhaust side before those on the intake side.

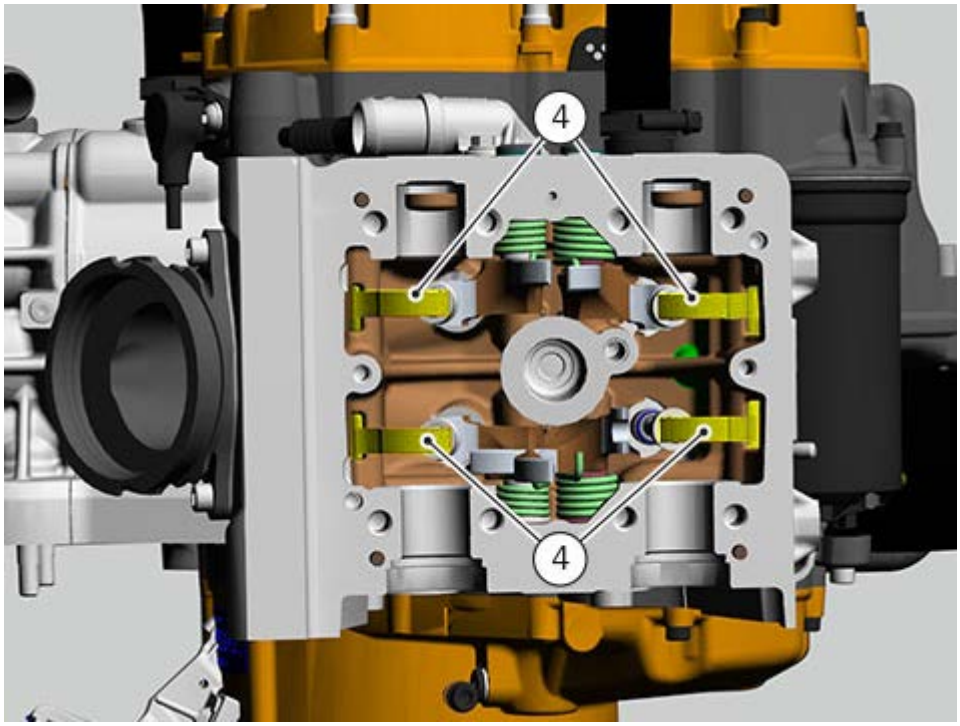
Attention
Take care not to damage the shoe of the closing rocker arm with the intake spring during assembly.



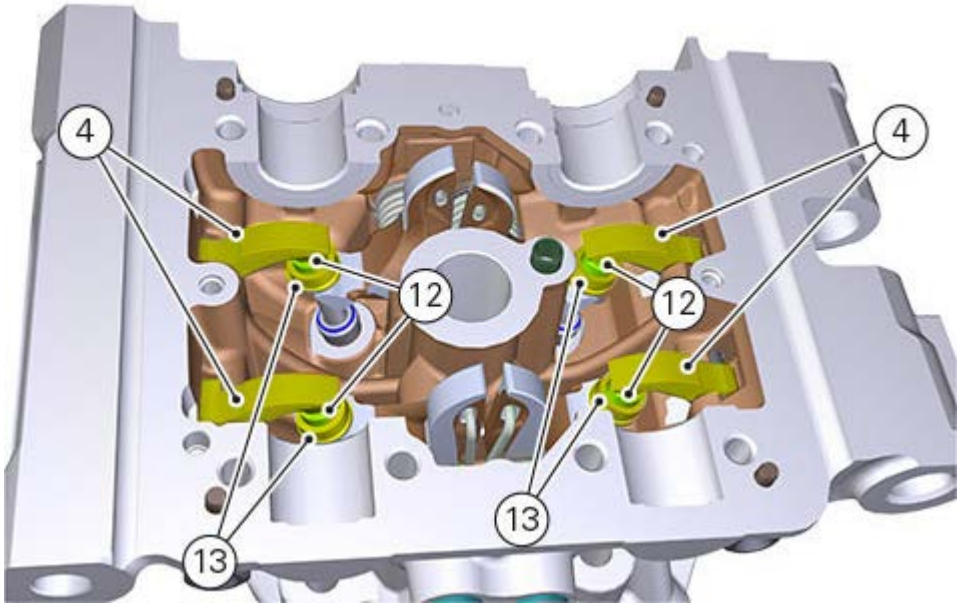
Locate the opening rocker arm (4) and drive the shaft home.



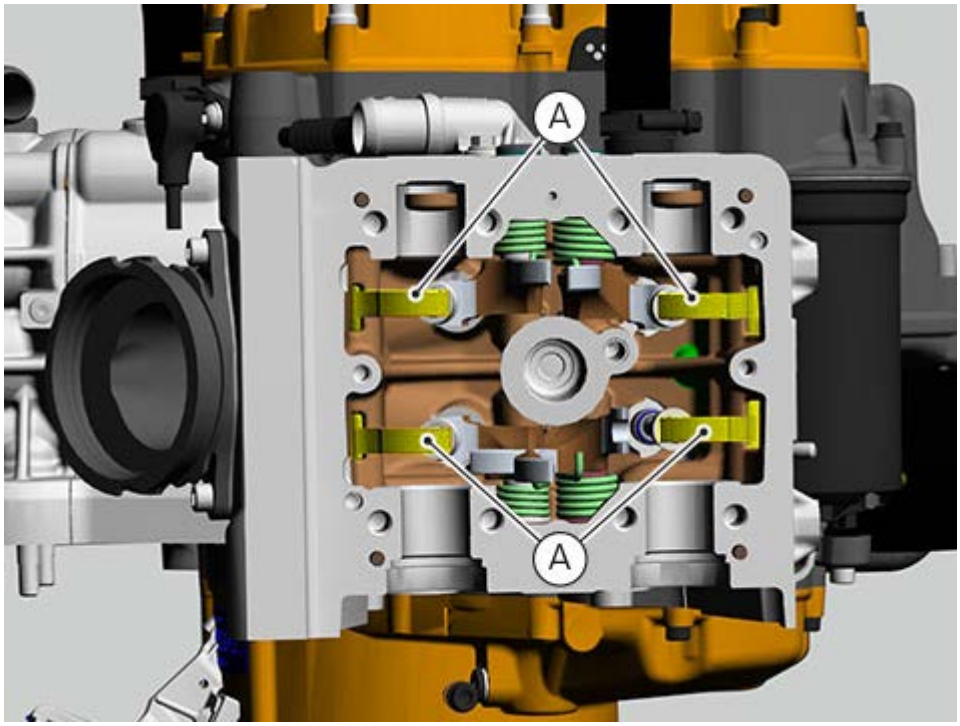
Install the four rocker arms (4) as described above.



Lift the opening rocker arm (4) and install closing shims (13).
Install the opening shim (12) fully against the valve stem.

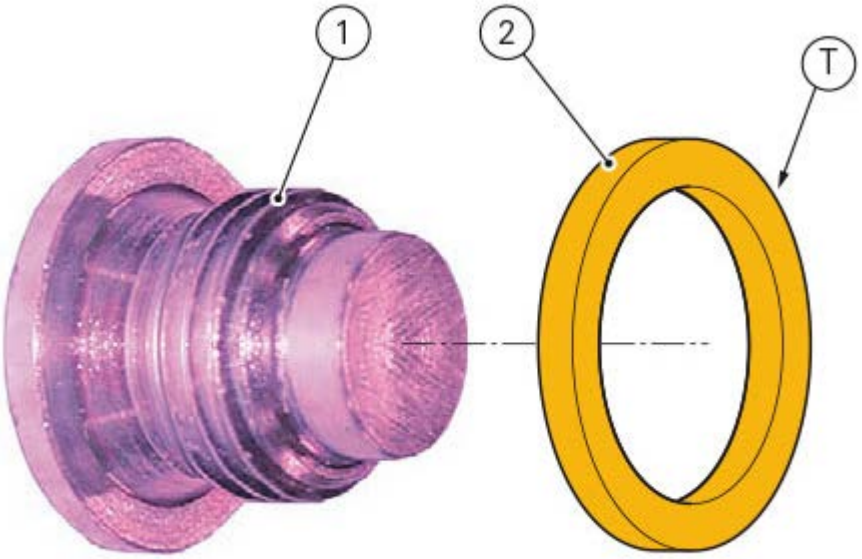


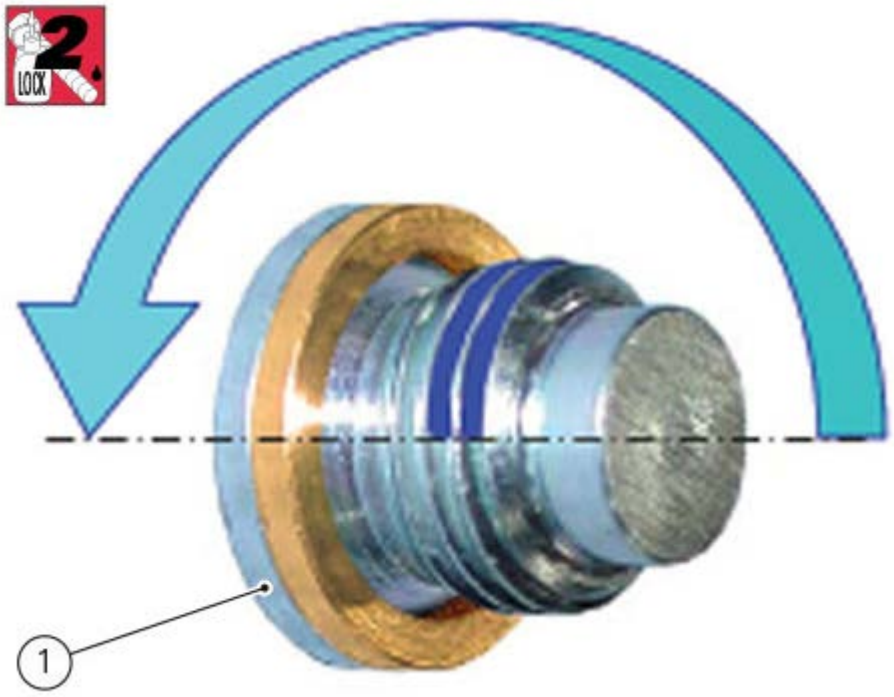
Release the rocker arm so that it rests against the shim.
Ensure the shim is correctly seated by lightly tapping the rocker arm shoe (A) with plastic mallet.
Refit the camshafts (Refitting the camshafts) and check the valve opening clearance (Checking and adjusting the valve clearance).

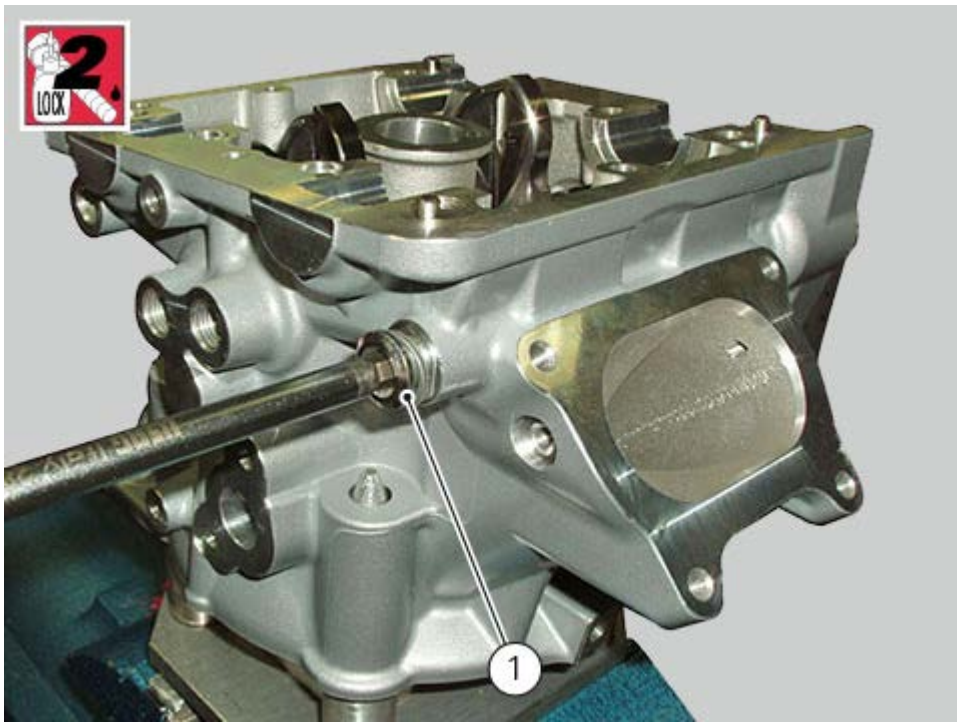


Insert the gaskets (2) on the plugs (1), orienting them (preferably) with the square edge side (T) facing the cylinder head.
Apply the recommended threadlocker on the plug (1) threads: apply the product on the first two plug threads, spreading it for the half circumference (about 180°).
Tighten the plugs to a torque of 15 Nm (Min. 14 Nm - Max. 16 Nm).

Note
After tightening, remove any excess of product.





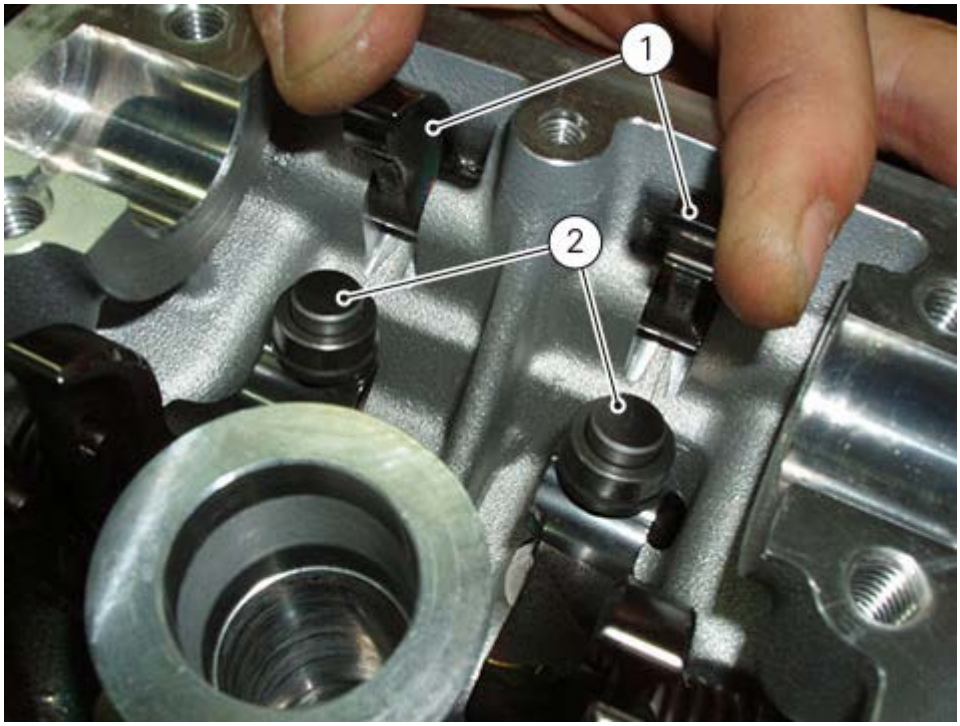


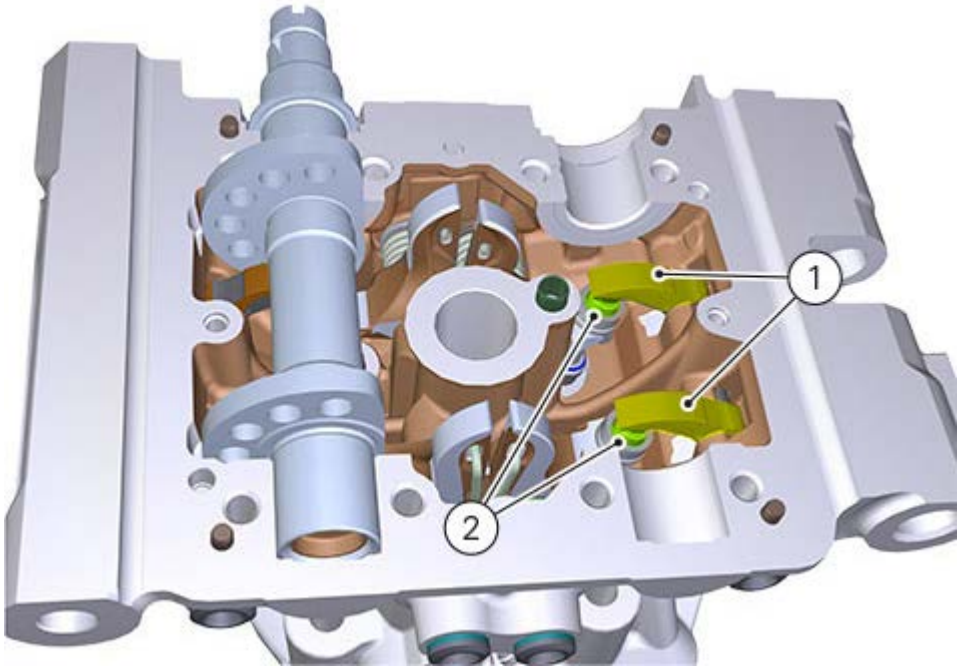
Refit the camshaft supports (Refitting the camshafts).
Refit the timing pulleys (Refitting the cylinder head pulleys/fixed tensioners).
Refit the cylinder head covers (Refitting the camshafts).
Connect the caps to the coils.
Refit the complete head (Fitting the complete heads).

Removing the valves

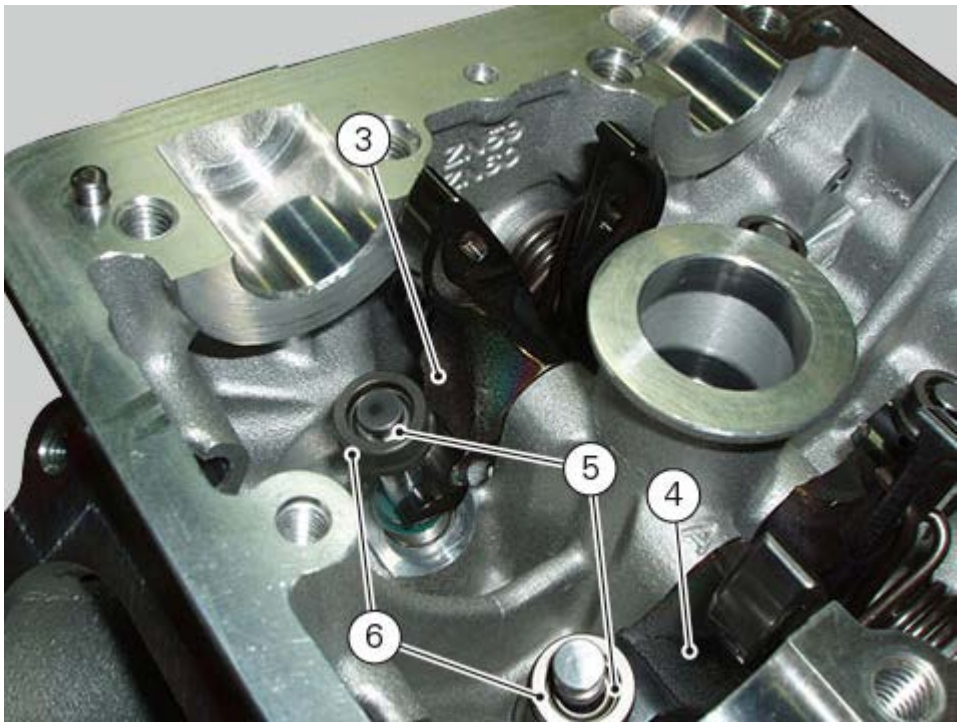
Remove the complete head from the engine (Removing the engine heads).
Remove the timing pulleys (Removing the cylinder head pulley/fixed tensioner).
Disconnect the spark plug caps.
Slide out the secondary air pipe (Removing the secondary air system).
Remove the cylinder head covers, the camshaft supports and the camshafts (Removing the camshafts).

Raise the opening rocker arm (1) and remove the opening shim (2) from the valves with a pair of pliers.

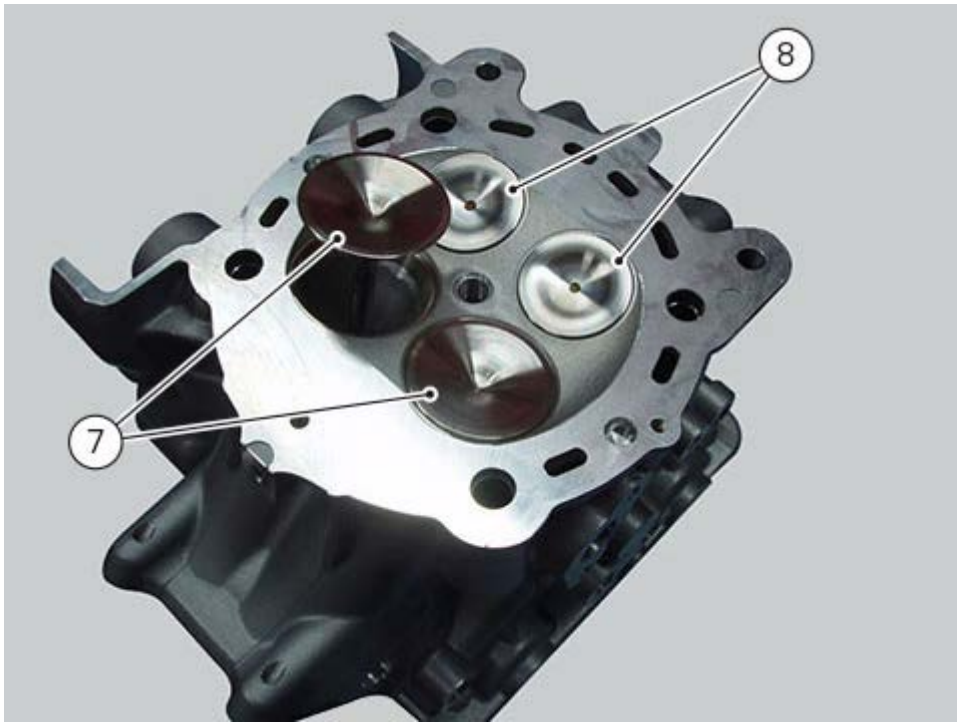




Push down the closing rocker arms (3) and (4) and the closing shim (6).
Remove the split rings (5) from the valves with a magnetic screwdriver. Extract the closing shims (6) from the valve using a pair of pliers.



Withdraw the valves (7) and (8) from underhead of the cylinder head.

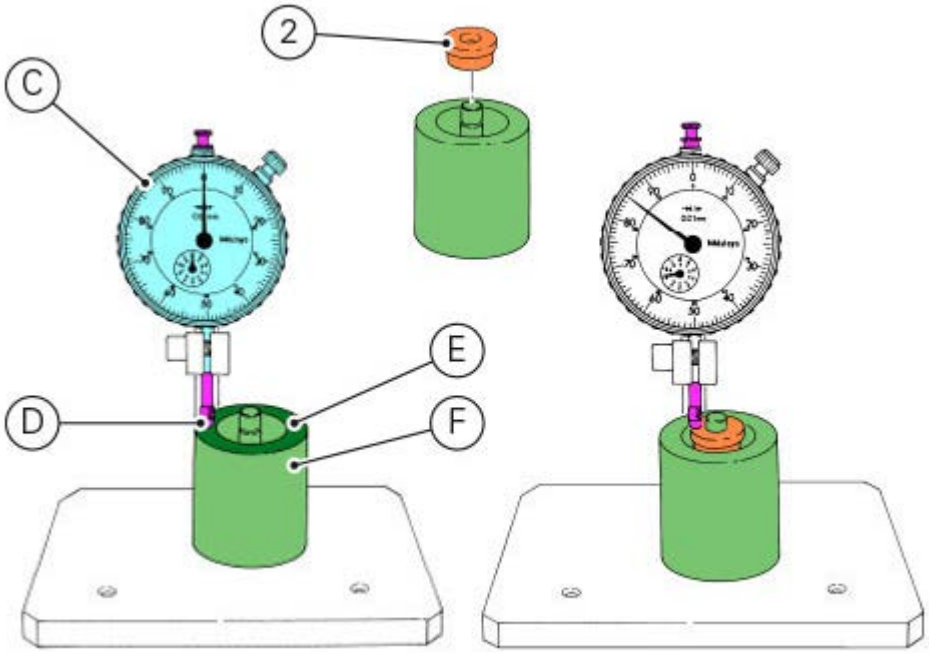


Repeat the same procedure for the other cylinder head.

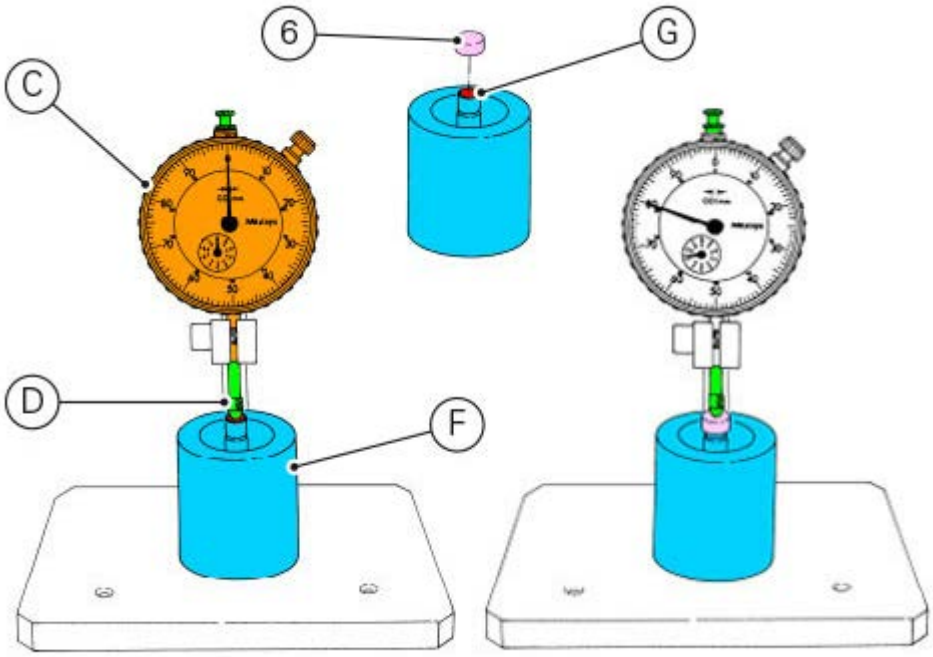
Refitting valves, closing shims and split rings

Note
Before fitting the previously removed components, check the conditions of the shims as described.

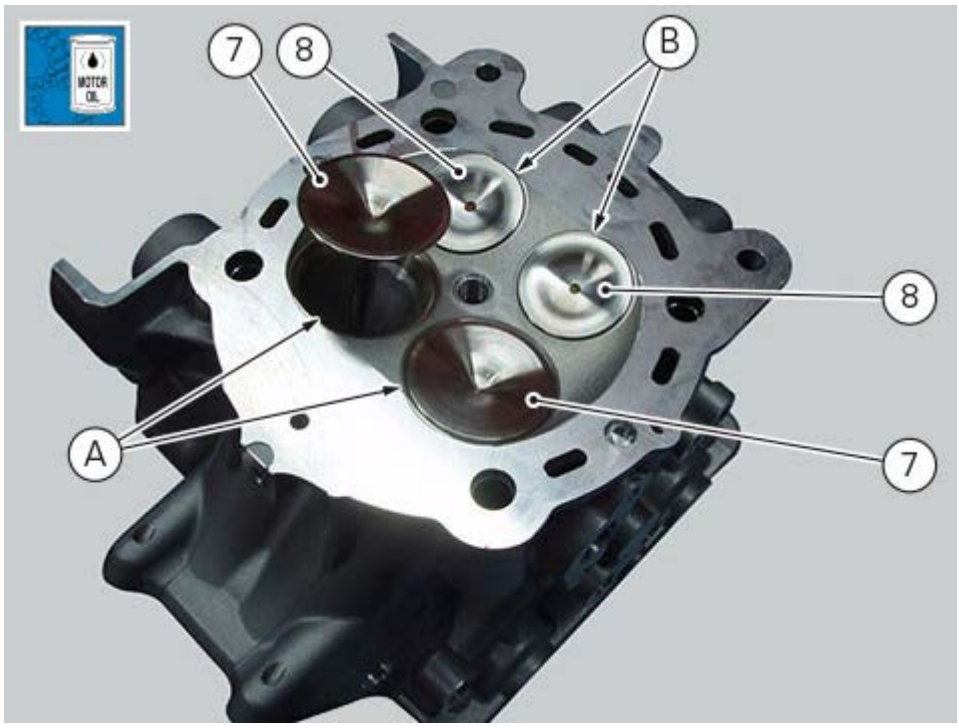
Closing shims
Reset the dial gauge (C) and position stylus (D) on surface (E) of inspection gauge (F).
Insert the closing shim (2) fully against the inspection gauge, as shown in the figure.
Measure the shim thickness by placing dial gauge stylus on the shim surface.
Rotate the shim to take the measurement on different points. The difference between the thicker and the thinner part must not exceed 0.02 mm.



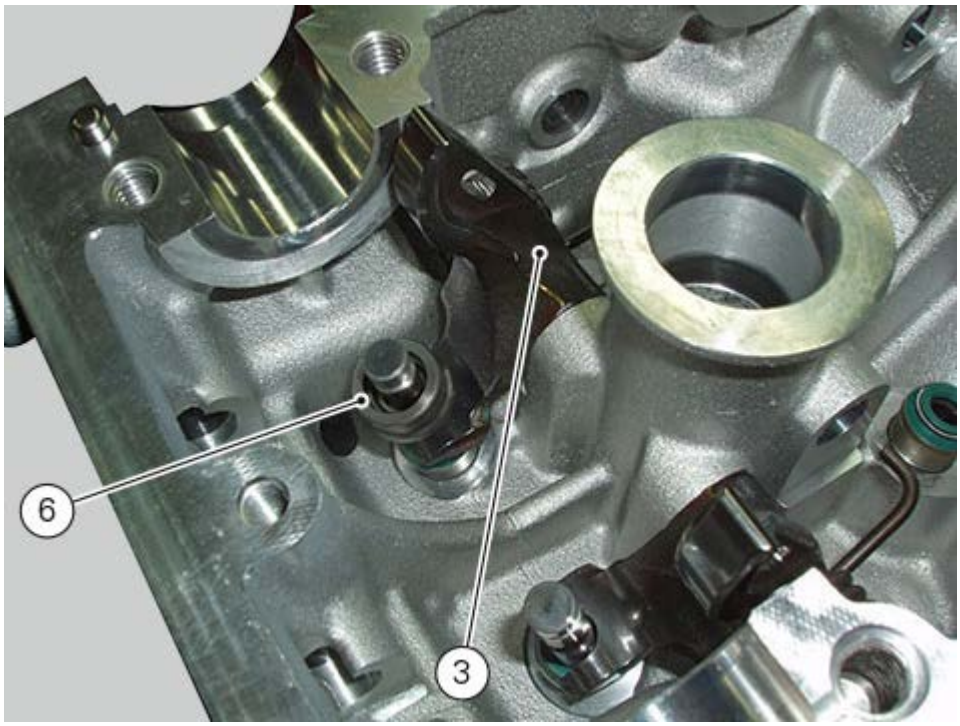
Opening shims
Reset the dial gauge (C) and position stylus (D) on surface (G) of inspection gauge (F).
Insert the opening shim (6) fully against the inspection gauge, as shown in the figure.
Measure the shim thickness by placing dial gauge stylus on the shim surface.
Rotate the shim to take the measurement on different points. The difference between the thicker and the thinner part must not exceed 0.02 mm.



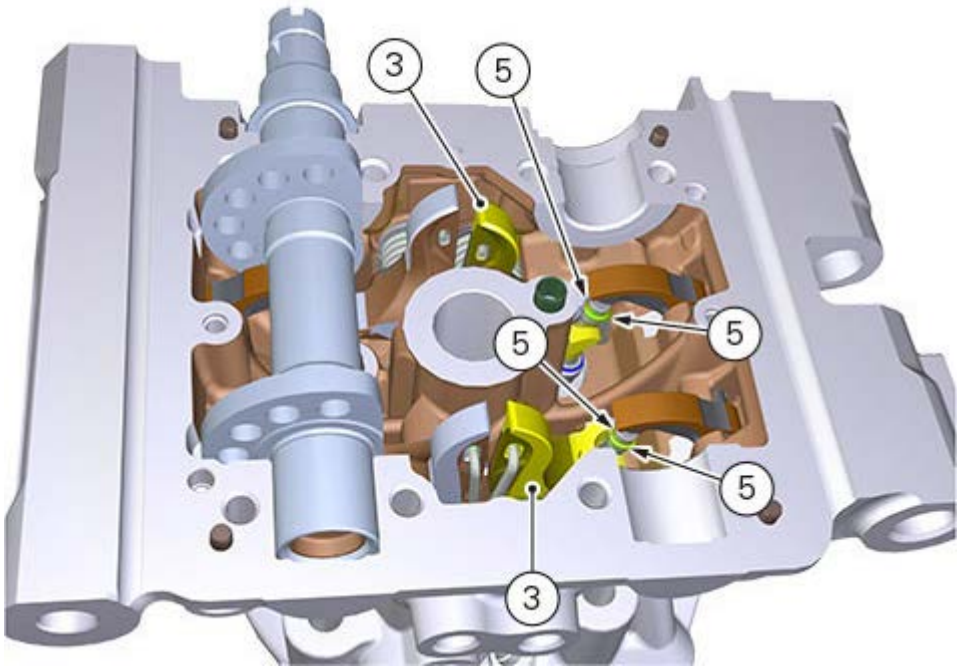
Carefully clean the two intake valve seats (A) and the two exhaust valve seats (B).
Lubricate the stems of the two intake valves (7) and the two exhaust valve stems (8) with engine oil.
Fit the valves in their seats on cylinder head, fully home.

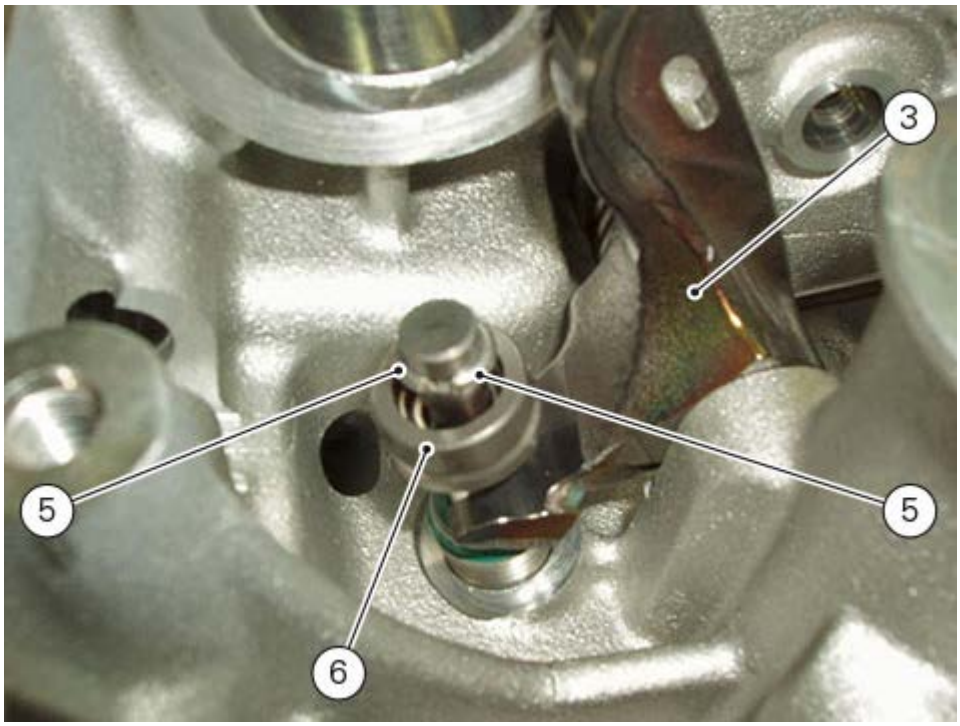


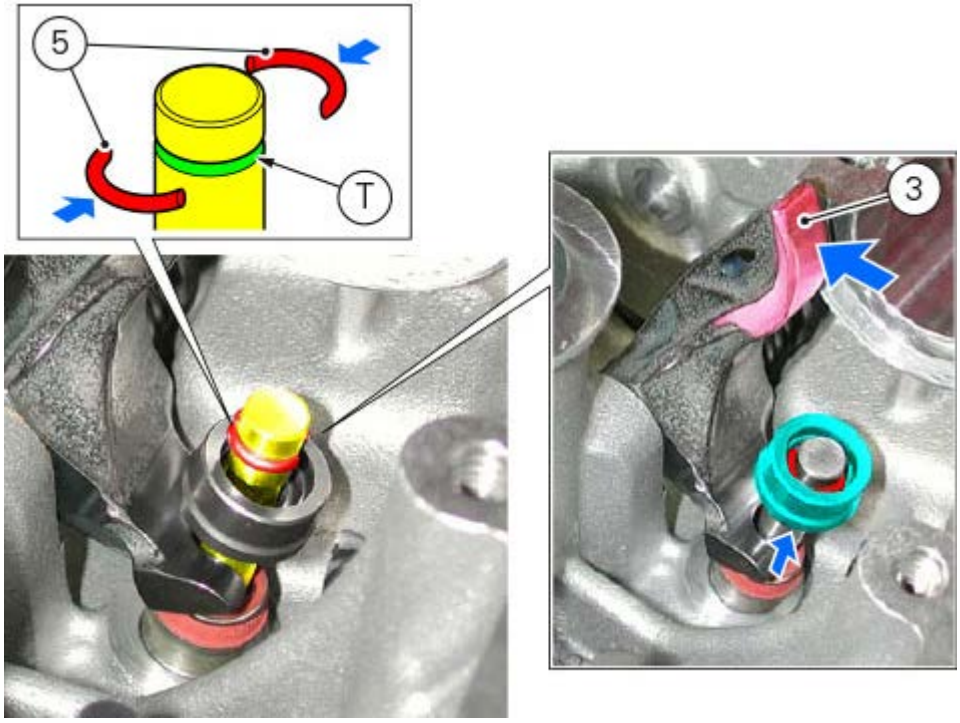
Hold the closing rocker arm (3) pushed downwards and fit the closing shim (6) on the valve stem up to reach the rocker arm. If using the old cylinder head, start by refitting the original shim.



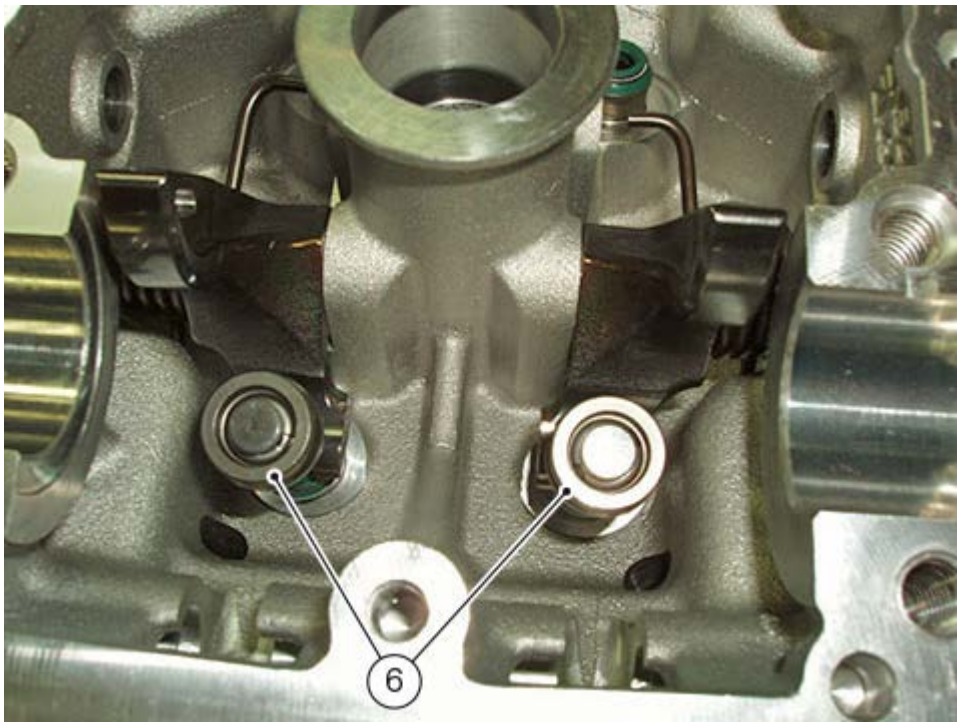
Insert the new split rings (5) in the valve groove (T) and release the rocker arm to correctly position shim (6). Turn the closing rocker arm (3), and compress the spring as much as possible while holding valve, shim and split rings in the valve closed position. Release the rocker arm with a quick movement, so that the split rings seat in the shim.







Repeat the procedure with the opposite valve and check that the top of the valve stem is aligned with the surface of the shim (6); if it is not the case, repeat the split ring installation procedure.

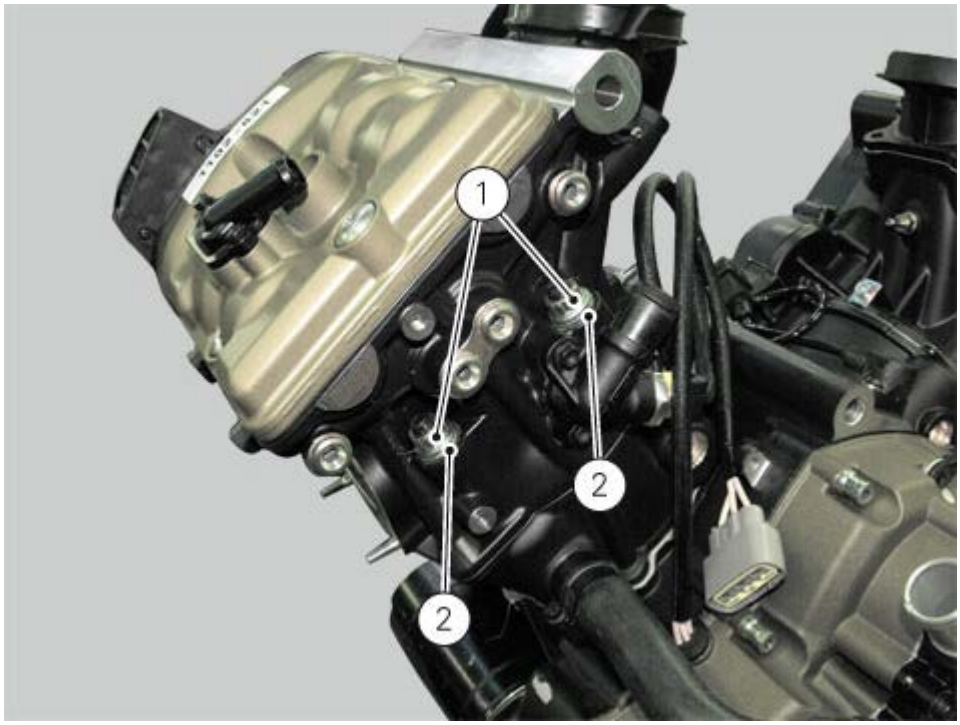


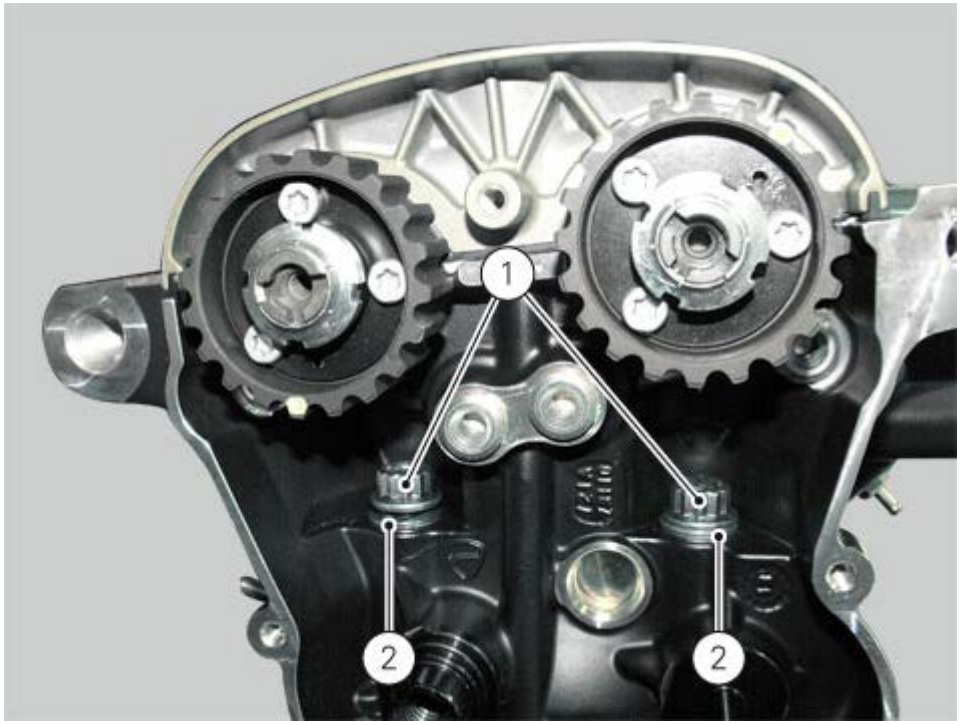
Install the closing shims on the intake valves (7) using the method described above for the exhaust valves. Refit the camshafts (Refitting the camshafts) to check the valve closing clearance (Checking and adjusting the valve clearance).

Removing the cylinder heads

Remove the engine from the frame (Removing the engine).
Remove the cooling system hoses (Removing cooling system hoses and unions).
Remove the belts and their external covers (Removing the timing belt external covers).

Use tool part no. **88713.2676**, undo the nuts (1) on the cylinder head stud bolts.
Remove the polygonal nuts (1) and special washers (2).





Remove the cylinder head assembly by lifting it off the engine stud bolts.
Repeat the same procedure for the other cylinder head.

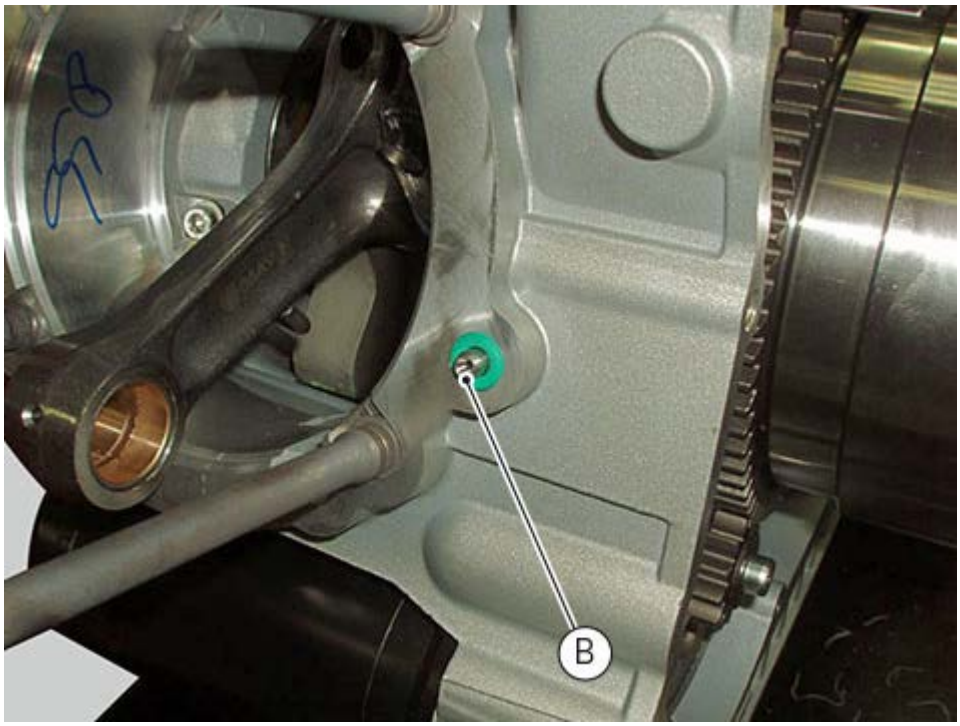
Refitting the cylinder/piston assembly

If new parts are used, it is necessary to match cylinders and pistons of the same selection (see chapter "Overhauling the cylinder/piston components").

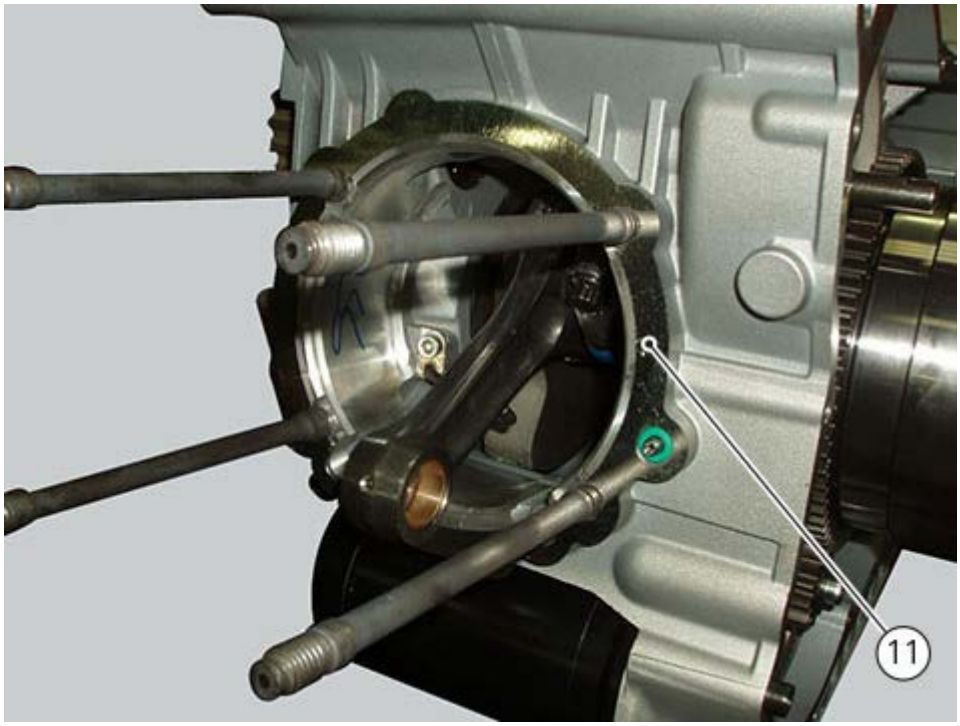
Note
If the pistons have been separated from their cylinders, before reassembling these components, position the piston ring gaps at 120° from one another (the markings must always face the piston crown).

Use a universal tool to carefully insert the piston into the cylinder (first lubricate the inside of the cylinder with engine oil). Position the cylinder with the smallest valve recess is on the side of the exhaust.

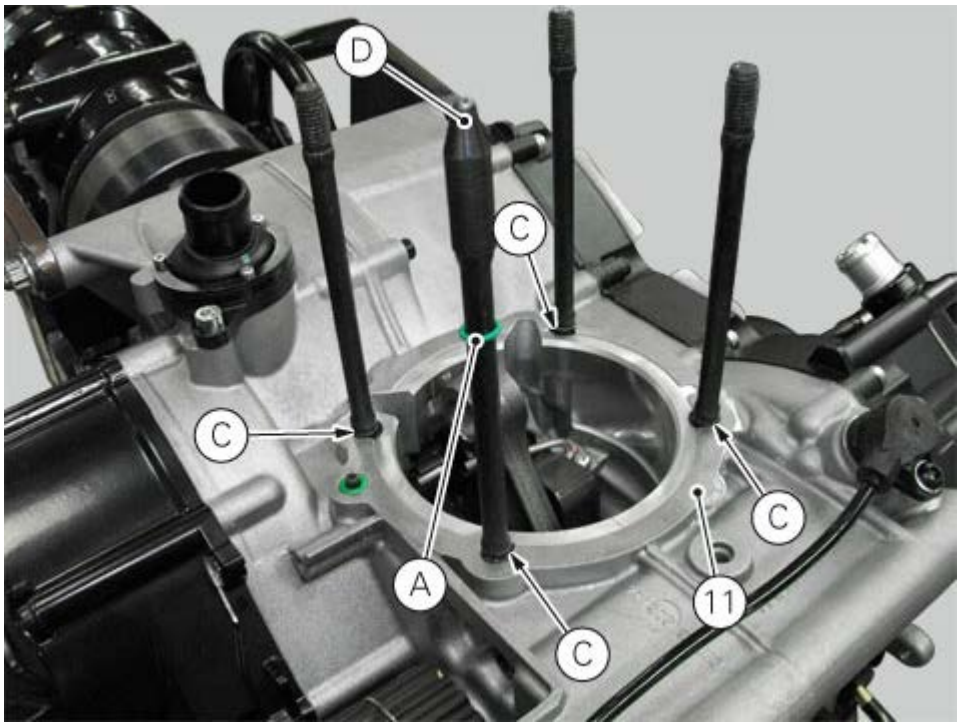
Remove any deposits and degrease the contact surfaces of the crankcase half and the cylinders.
Check that the cylinder centring dowels (B) are fitted on the crankcase.



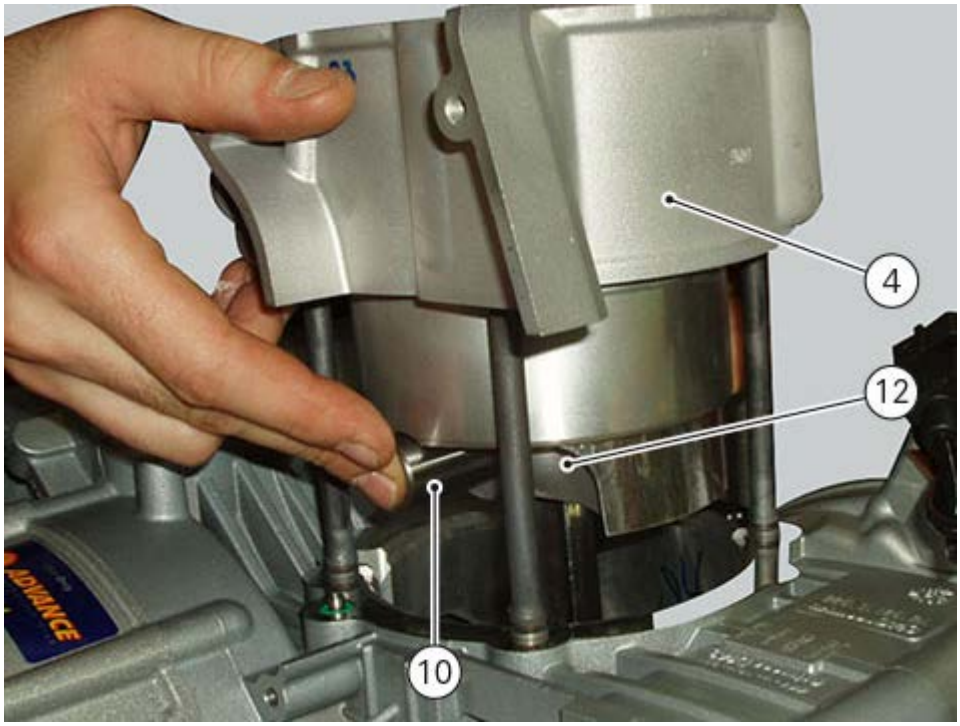
Apply sealant to the gasket (11) then locate the gasket on the crankcase.



If not previously replaced, use the cap (D) no. **88713.1920** to fit the O-rings (A) on each stud bolt and guide them into their seats (C) in the crankcase.

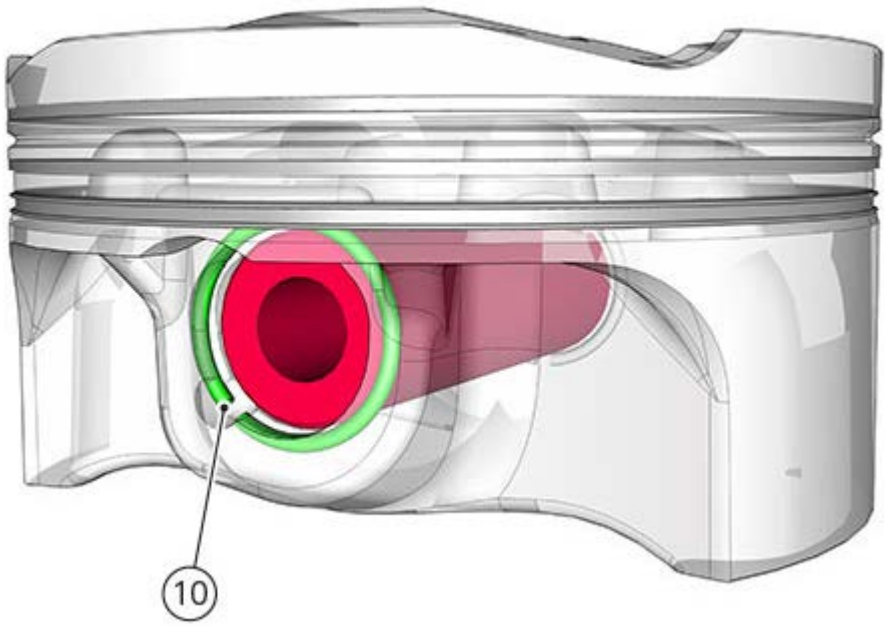


Bring the connecting rod small end close to TDC and slide the cylinder-piston assembly (12-4) onto the crankcase stud bolts.
Push the connecting rod small end into the piston close to the gudgeon pin (10) hole. Lubricate and insert the gudgeon pin.

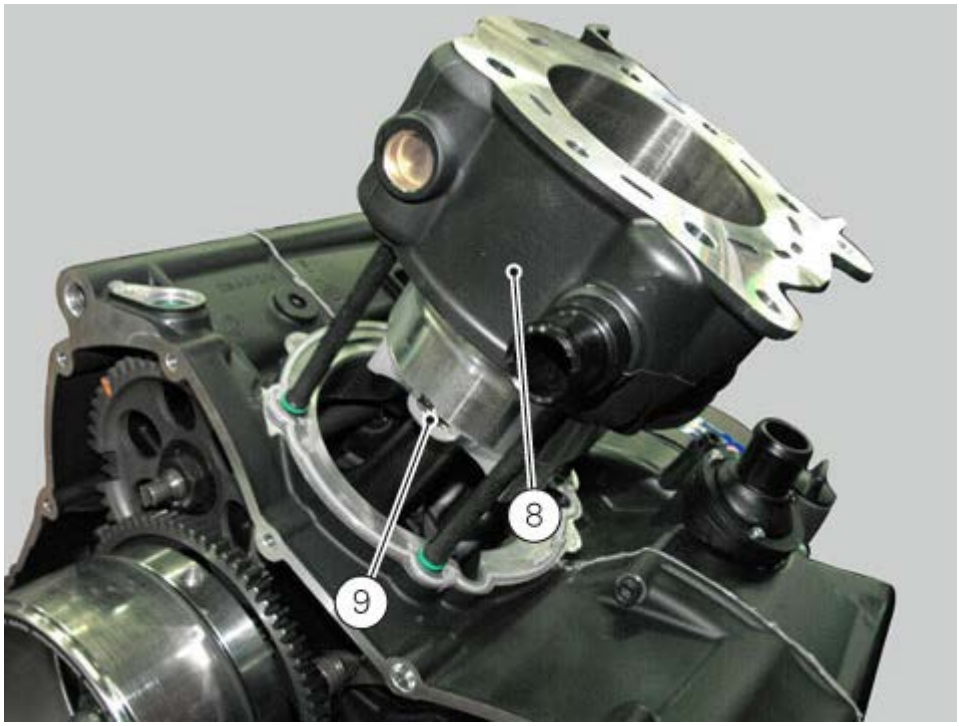


The gudgeon pin (9) must slide smoothly in the connecting rod small end bush and in the piston (12).
Close the crankcase opening with a cloth to prevent foreign objects from falling inside and then fit the snap ring (10) as shown in the figure.

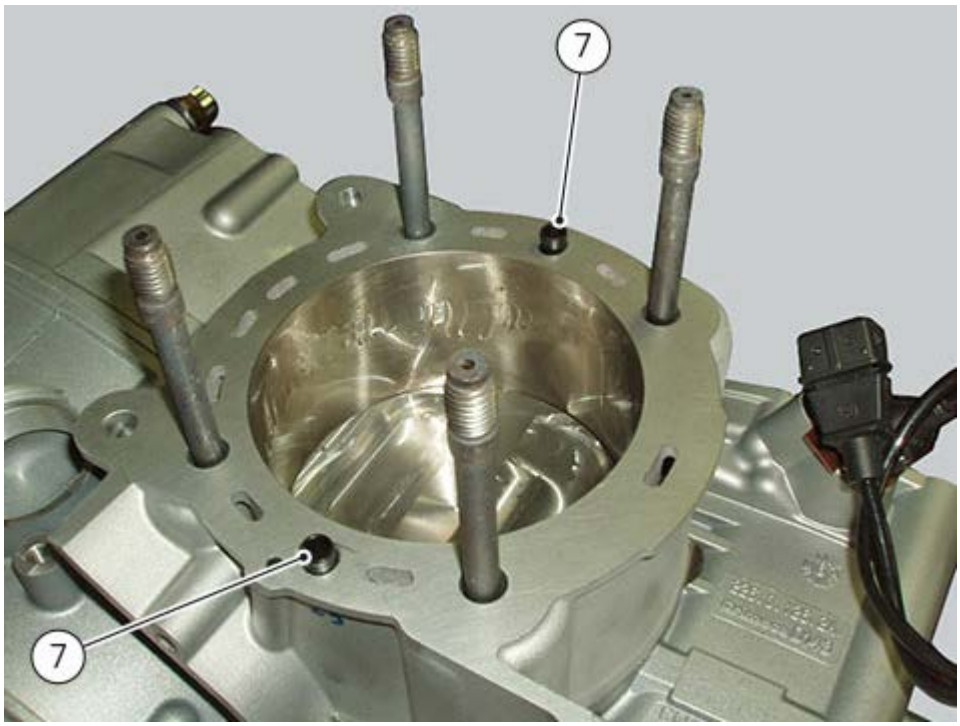
Important
Always fit new circlips upon reassembly.



Push the cylinder (8) down until it seats against the crankcase.



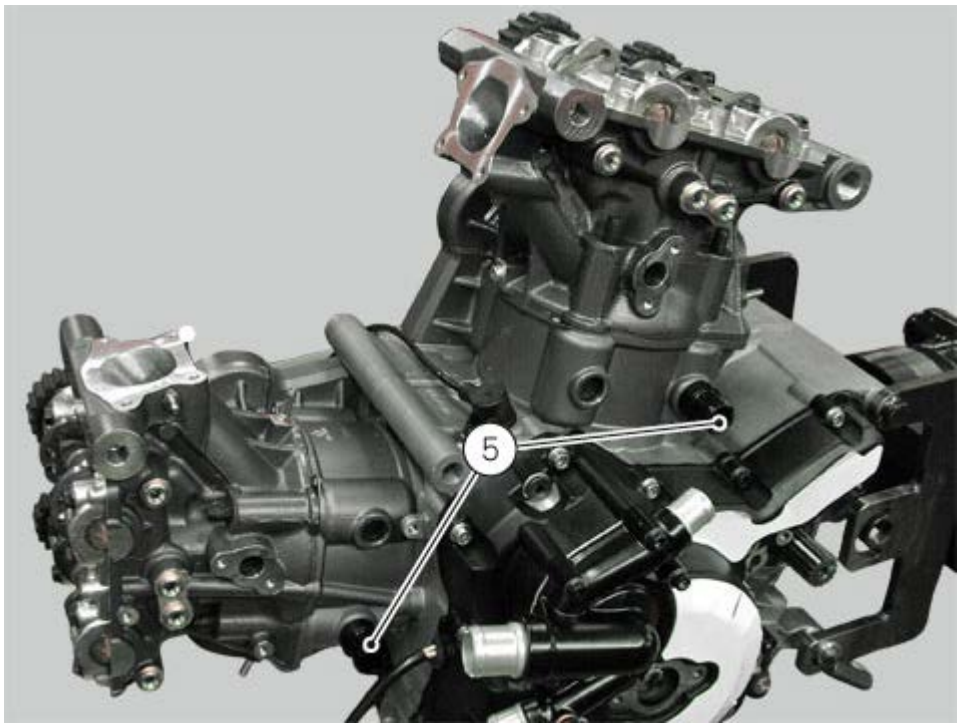
Refit bushings (7) on both piston-cylinder assemblies.

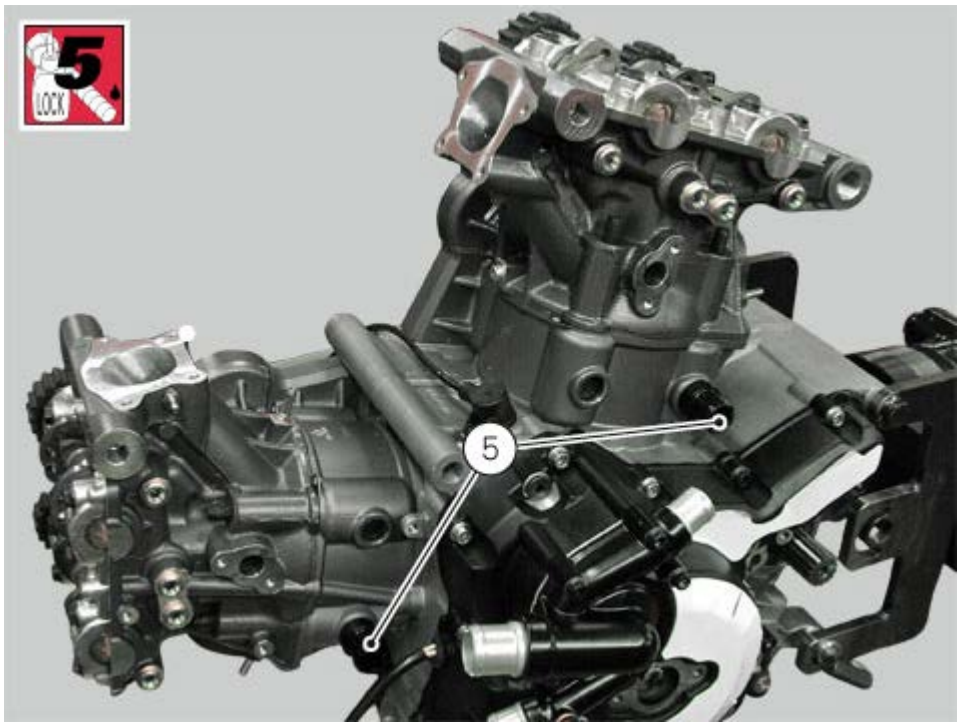


Insert cylinder head gaskets (6a) and (6b) on stud bolts.
The side marked with the part number must be facing the cylinder head.

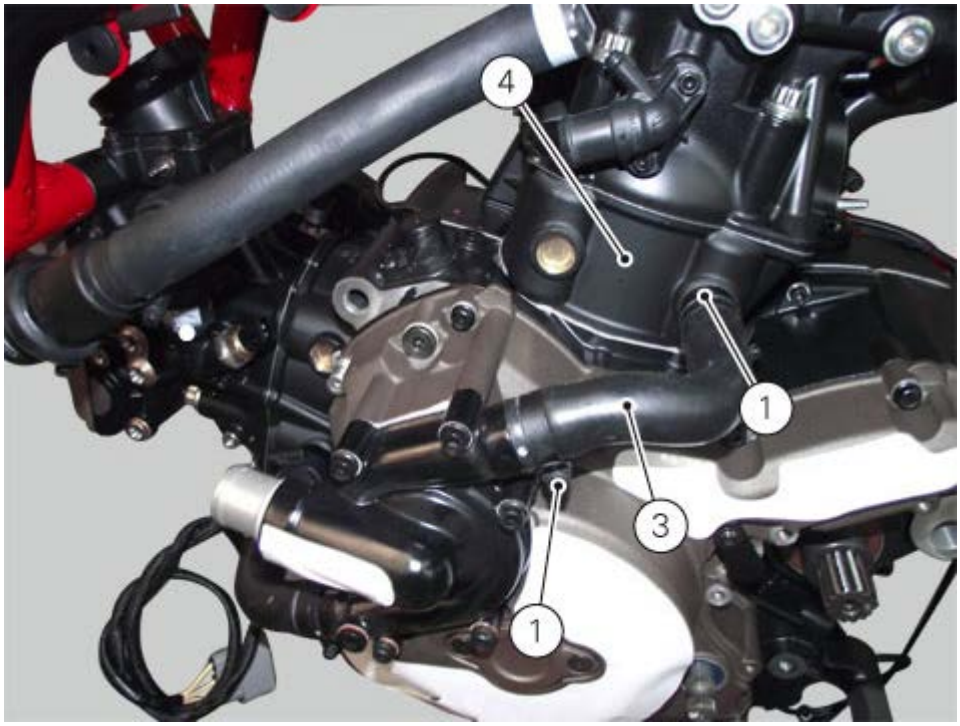
Note
The shape of the gasket prevents incorrect fitting, provided that the fluid flow holes are aligned with those on the cylinder.

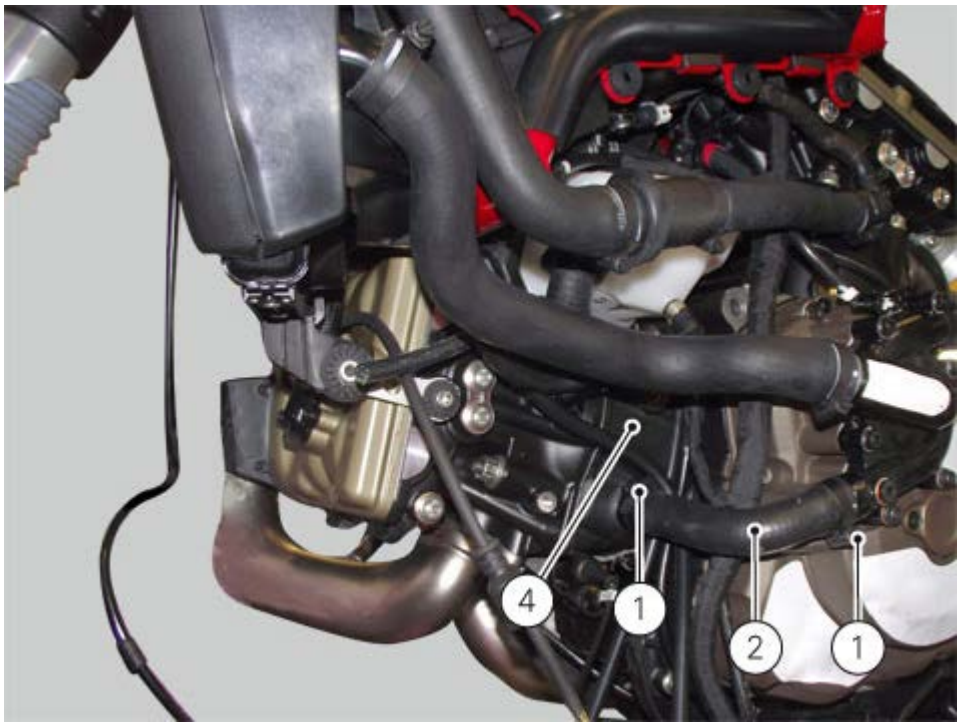
Repeat the procedure for the other cylinder and refit the cylinder heads (Refitting the cylinder head assemblies). In case they have been removed, apply the indicated threadlocker to unions (5) and tighten them to a torque of 25 Nm (Min. 23 Nm - Max. 27 Nm).





Fit hoses (2) and (3), and tighten the clips (1) to a torque of 2.5 Nm (Min. 2 Nm - Max. 3 Nm).



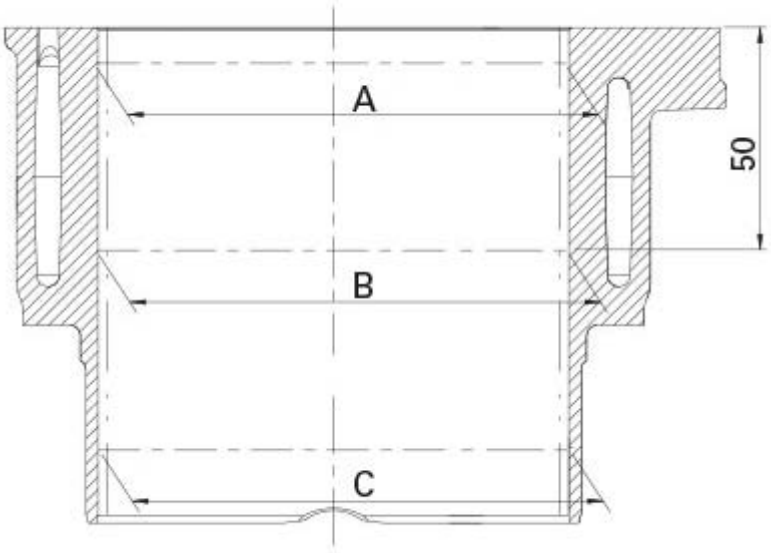


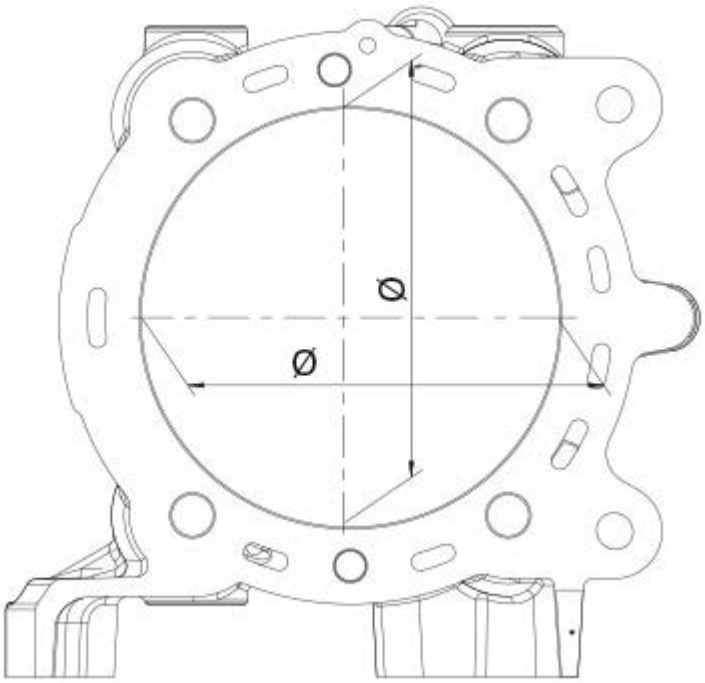
Remove the heads (Removing the engine heads)
Refit the belts and their external covers (Refitting the timing belt external covers).
Refit the cooling system hoses (Refitting cooling system hoses and unions).
Refit the engine in the frame (Refitting the engine).

Overhauling the cylinder/piston components

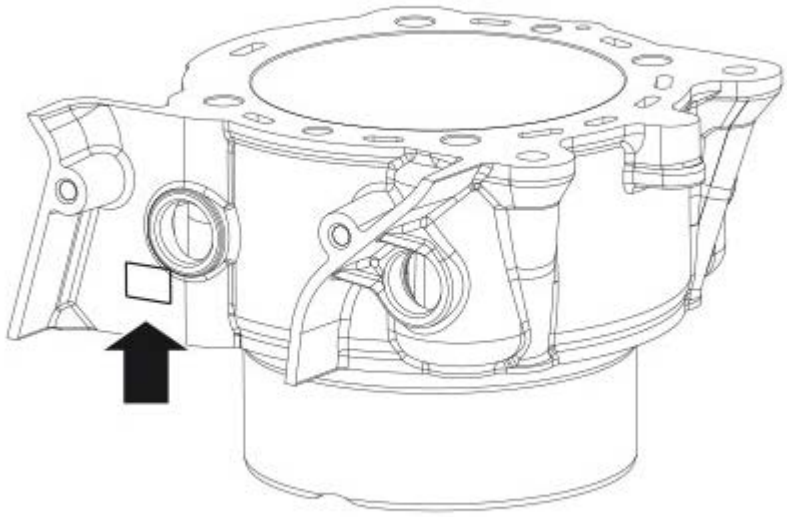
Overhauling the cylinder

Check that the walls of the cylinder are perfectly smooth.
Measure the cylinder diameter at 50 mm from the top face and determine the size class to which it belongs in accordance with the values specified in Sect. Cylinder/piston.
Repeat measurement of the diameter at three heights A (10 mm from the upper surface), B (50 mm from the upper surface) and C (100 mm from the upper surface) and in two directions at 90° between them; check that the measurements of taper and ovality fall within the range specified in section "Overhauling the cylinder/piston components".
In the event of damage or excessive wear the cylinder must be replaced as it has a silicon carbide coating (which provides the cylinder walls with excellent anti-friction and anti-wear properties) and therefore cannot be ground.



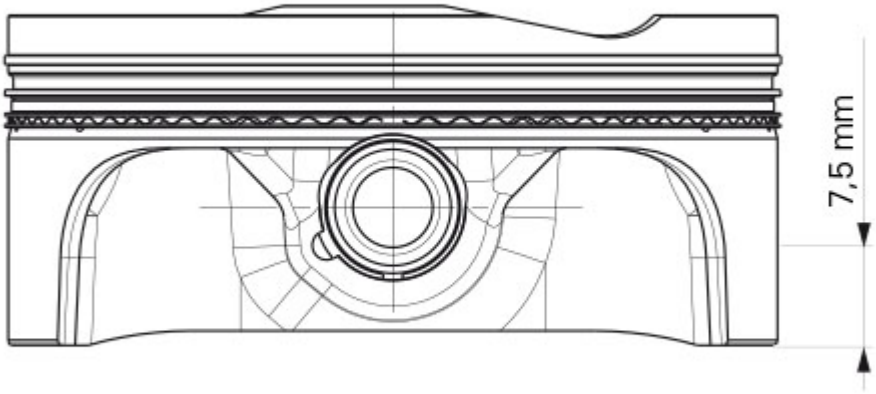


The cylinders are marked with letters (stamped between the two oil return ways) indicating their size class. Always match cylinders with pistons from the same size class.



Overhauling the piston

Clean the piston crown and piston ring grooves, removing any carbon deposits.
Visually inspect the piston and check its dimensions carefully: there must be no signs of scuffing, scoring, cracks, or other damage.
The piston diameter must be measured at 7.5 mm up from the bottom of the skirt and in perpendicular direction to the gudgeon pin axis.
The pistons must always be replaced as a pair.

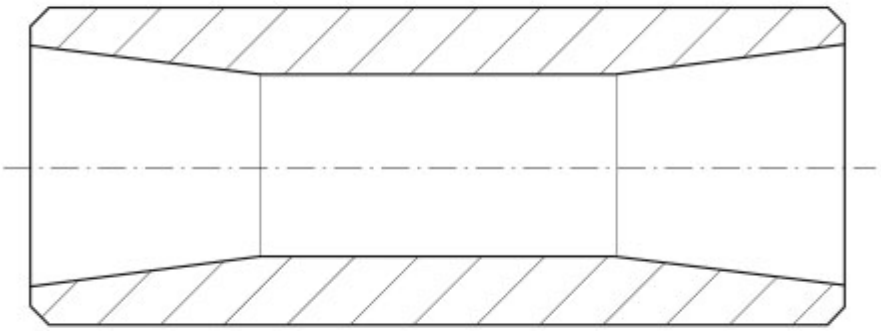


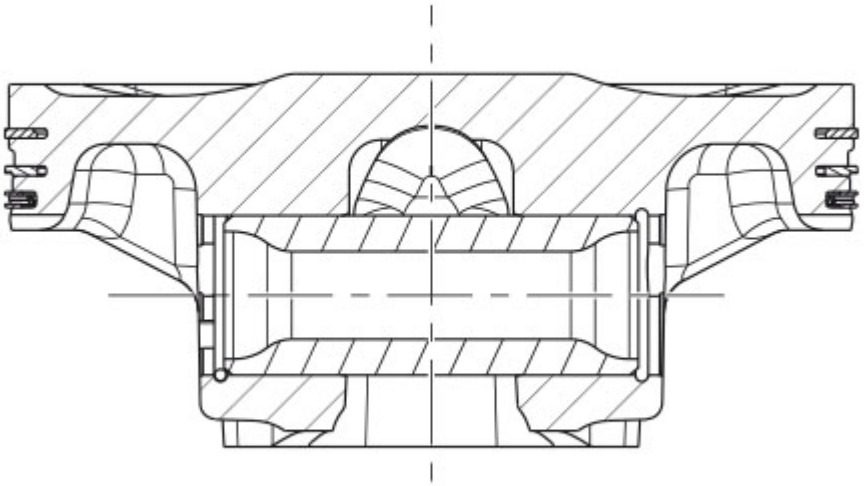
Checking the piston-cylinder clearance

The pistons are marked with a letter (1) (punched into the piston crown) that indicates the size class to which they belong.
Always match piston with cylinder from the same size class.
For the correct values refer to chapter "Cylinder/piston".
The arrow (2) punched into the piston crown, on the contrary, indicated the exhaust side.

Overhauling the gudgeon pins

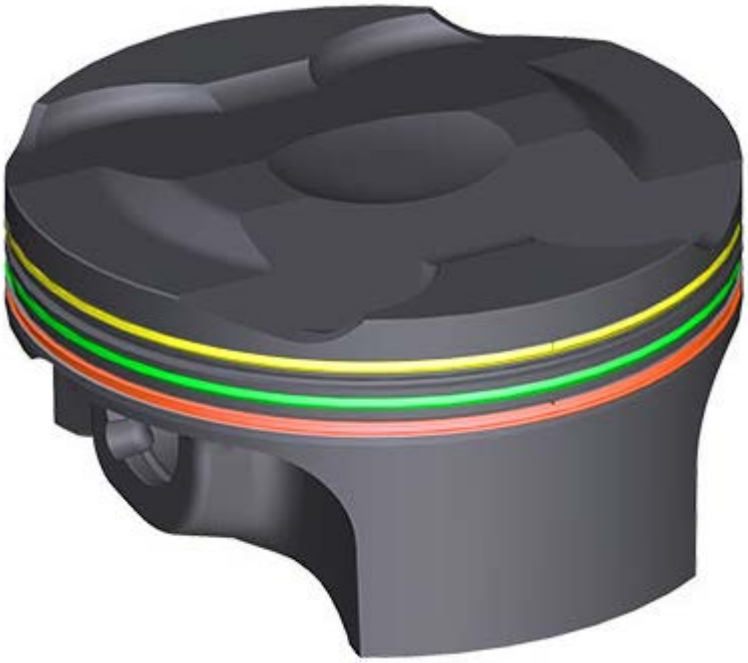
Gudgeon pins must be perfectly smooth without signs of scoring, steps, or blueing due to overheating. The well-lubricated gudgeon pin must slide smoothly inside the piston without stiffness.
For the coupling clearance values with the piston and the connecting rod, see chapter "Cylinder/Piston".
If a new gudgeon pin is fitted, you must also change the connecting rod small end bush.





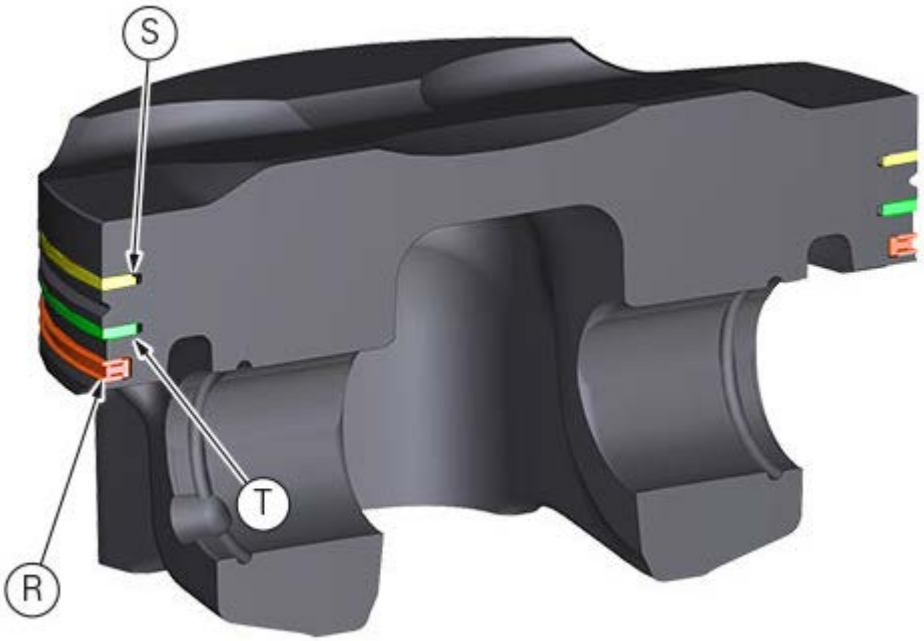
Overhauling the piston rings

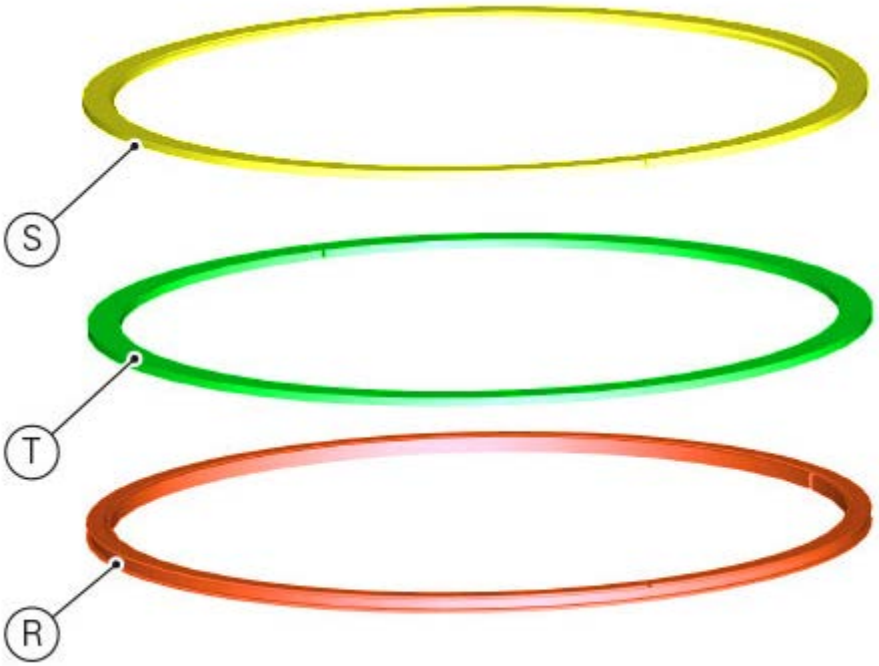
The piston rings must not show any signs of scuffing or scoring. Spare pistons are supplied complete with piston rings and gudgeon pin.



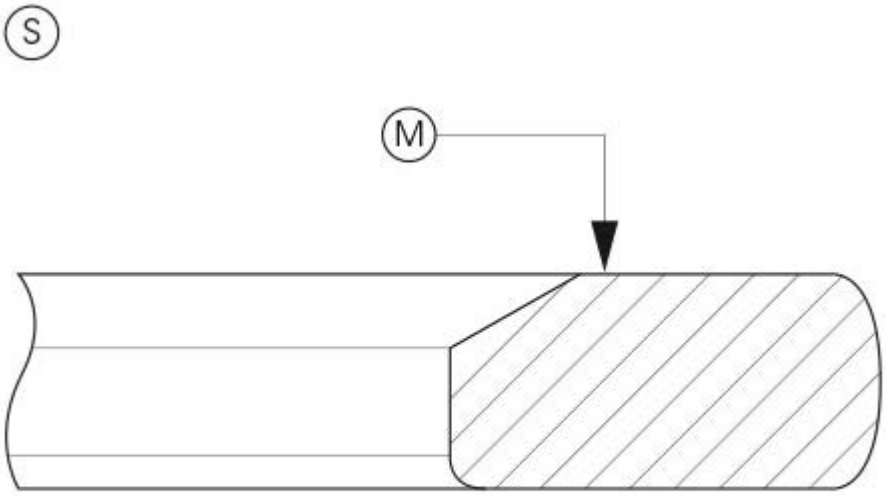
Checking the piston ring-grooves clearance

The maximum permissible wear limit is 0.15 mm for the top ring (1st ring "S") and 0.10 mm for the others (2nd ring "T" and oil scraper ring "R").
The piston rings must always be fitted with markings (M) facing upwards.

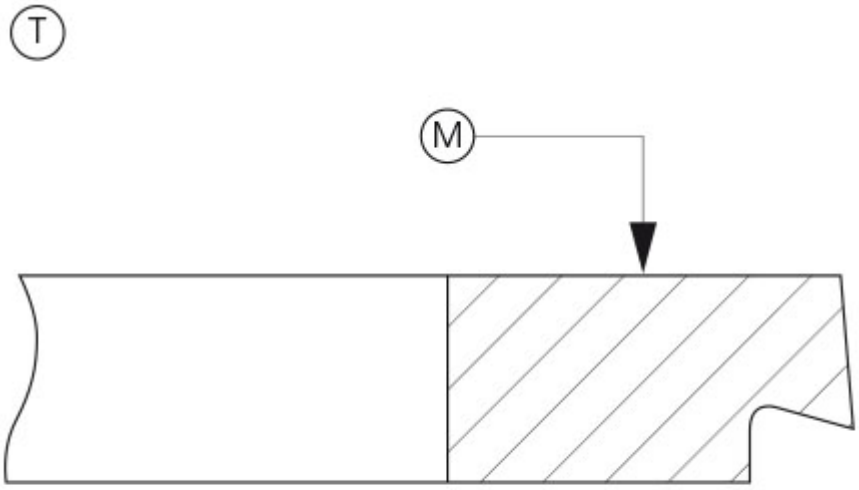




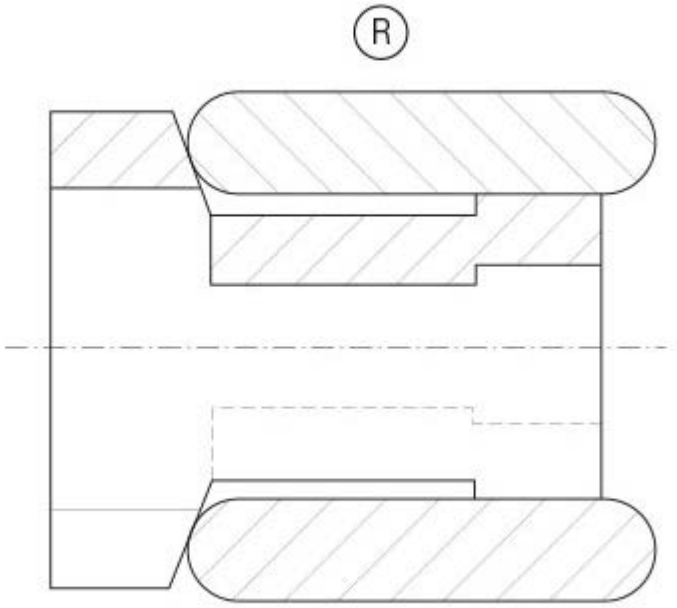
First ring (S).



Second ring (T).



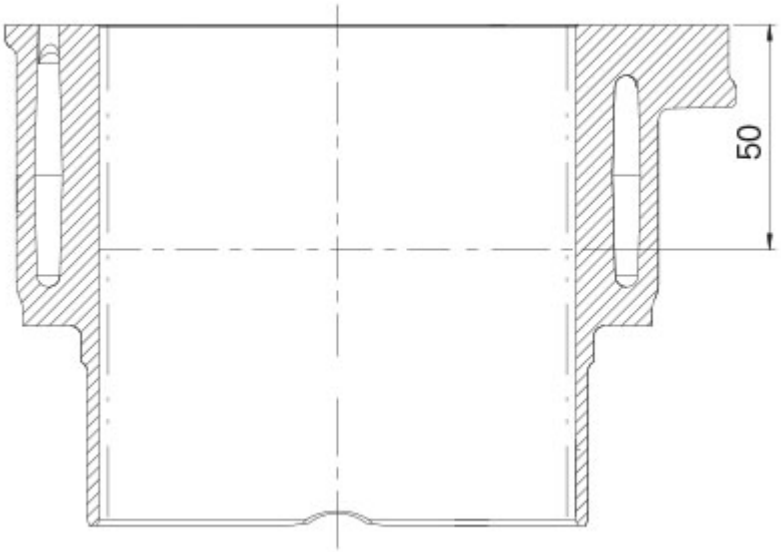
Oil scraper ring (R).

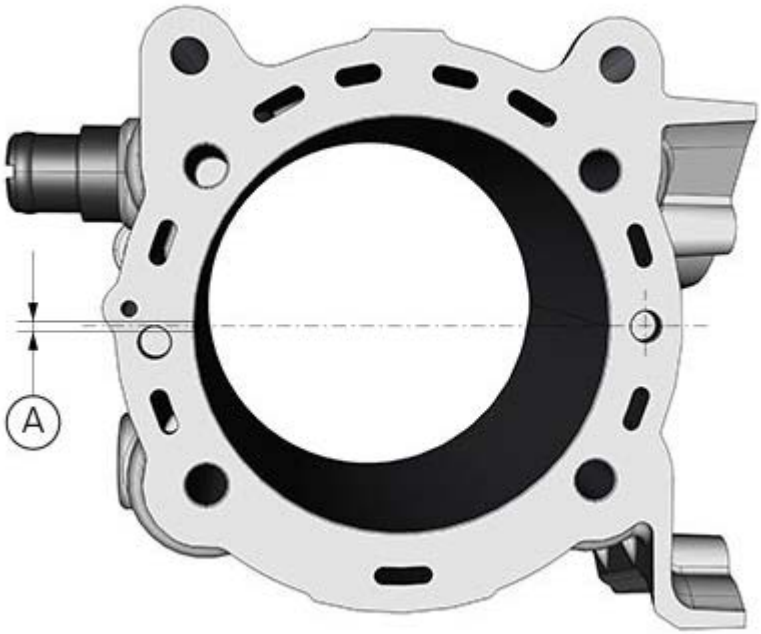


Checking the piston ring/cylinder clearance

Insert the piston ring 50 mm from the top face of the cylinder; make sure that the ring is positioned perfectly square to the cylinder axis by checking with a gauge at several points around the ring that the top surface of the ring is 50 mm from the cylinder top face.
Measure the piston ring gap (A):

	Distance (A) mm	Wear limit
Upper piston ring	0.2 to 0.4	0.8
Intermediate piston ring	0.3 to 0.5	0.8
Oil scraper ring	0.2 to 0.7	1.0

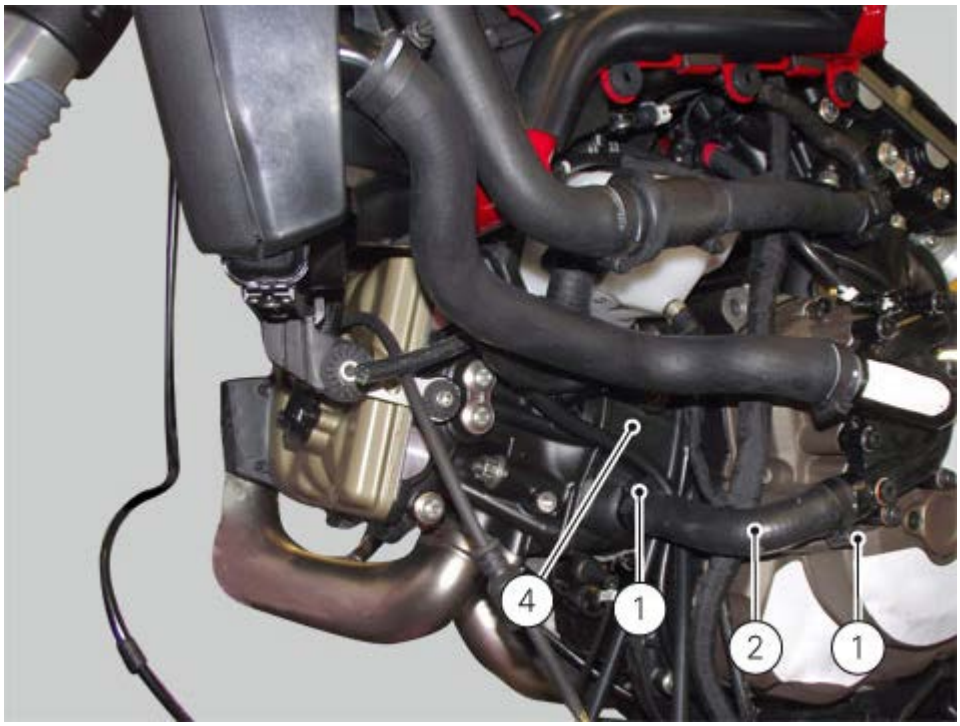


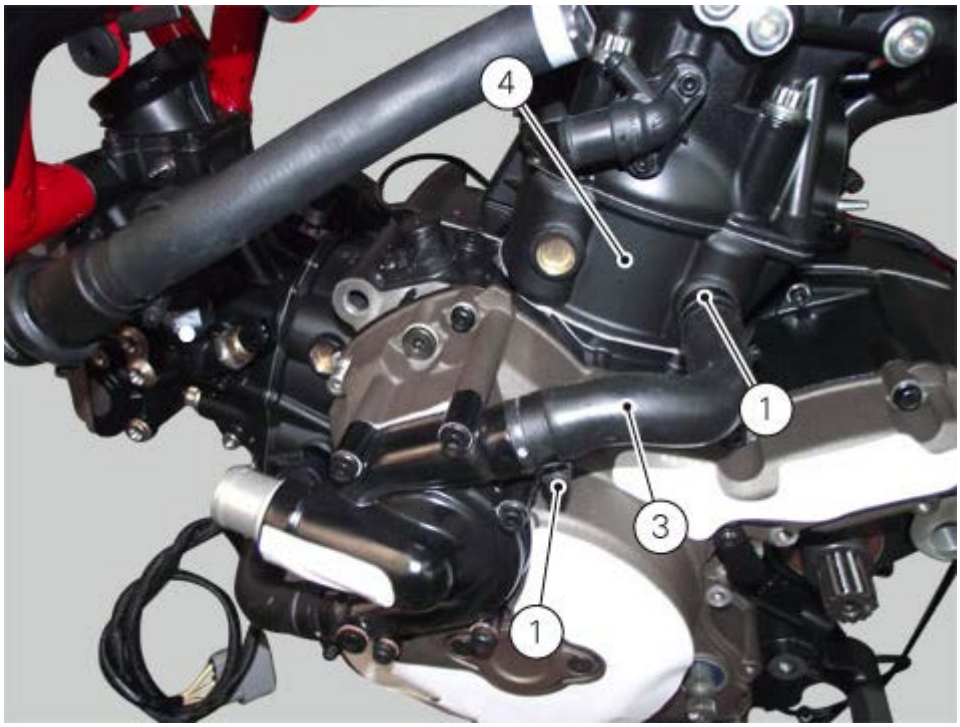

A

Removing the cylinder/piston assembly

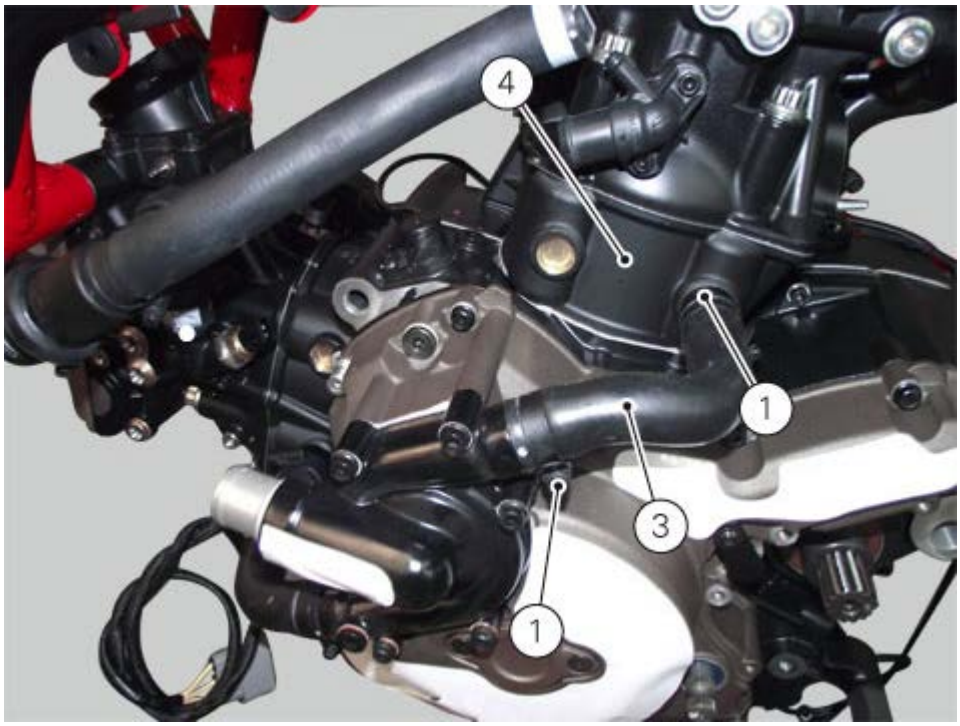
Remove the engine from the frame (Removing the engine).
Remove the cooling system hoses (Removing cooling system hoses and unions).
Remove the belts and their external covers (Removing the timing belt external covers).
Remove the heads from the engine block (Removing the engine heads).

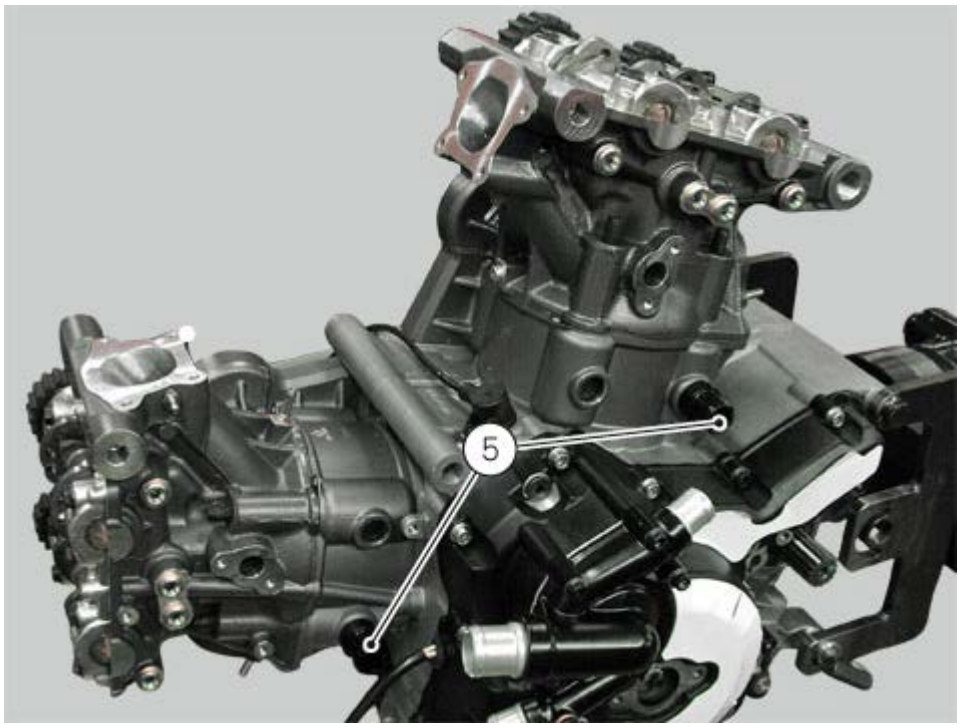
Loosen the clips (1) and remove the hoses (2) and (3) from the cylinders (4) and from the generator cover.





If damaged, unscrew the unions (5).



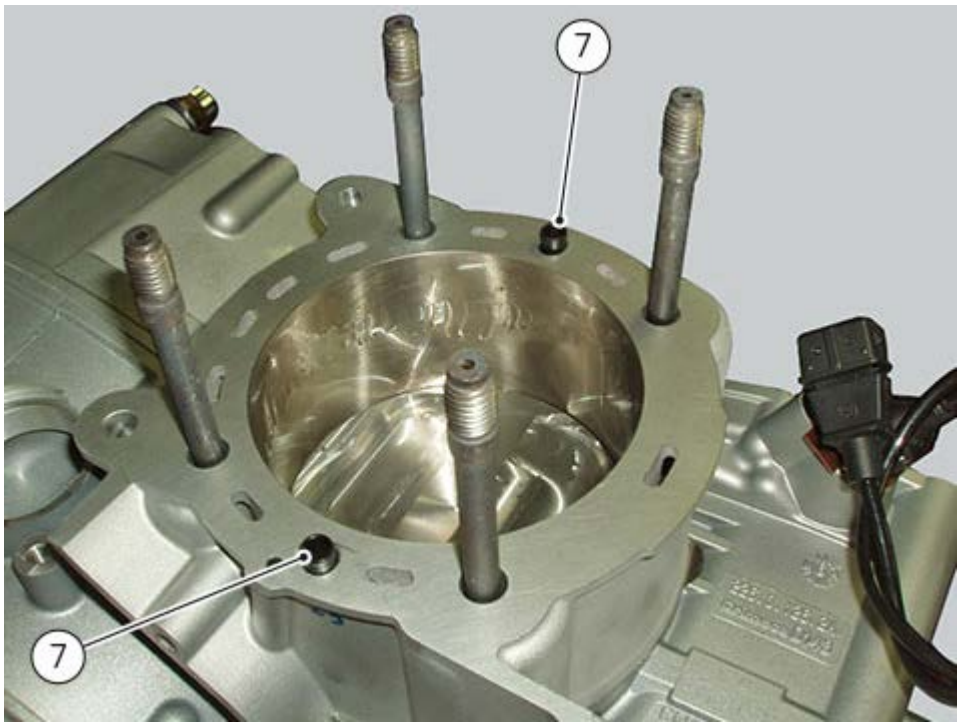


Note

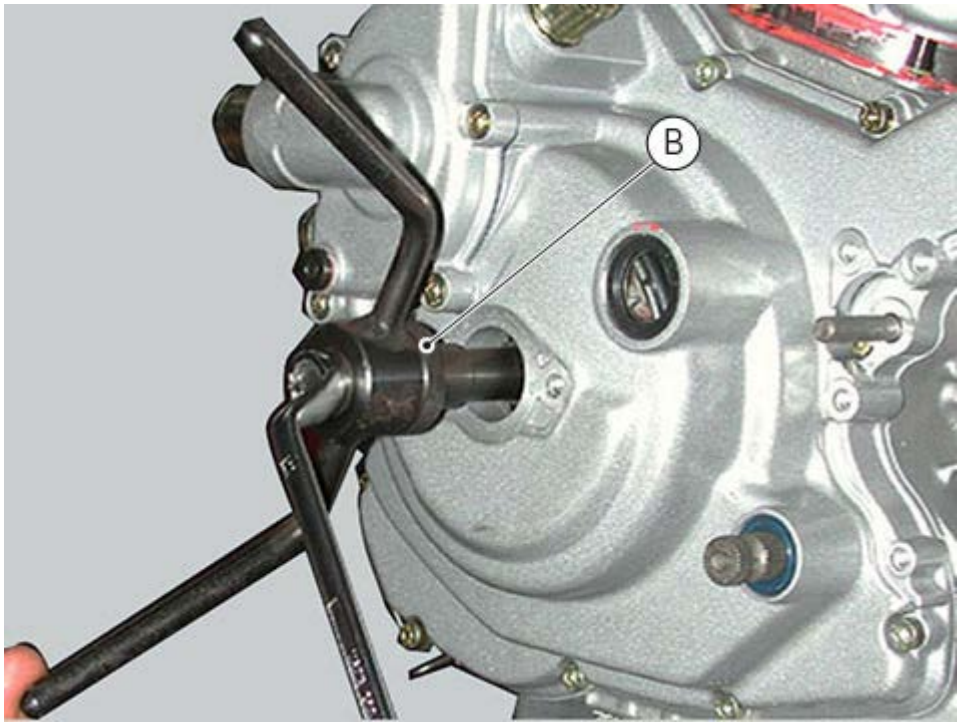
The following procedure is described with the engine removed from the frame and the cylinder head removed from the engine.

Remove gaskets (6a) from the horizontal piston-cylinder assy and (6b) from the vertical piston-cylinder assy.

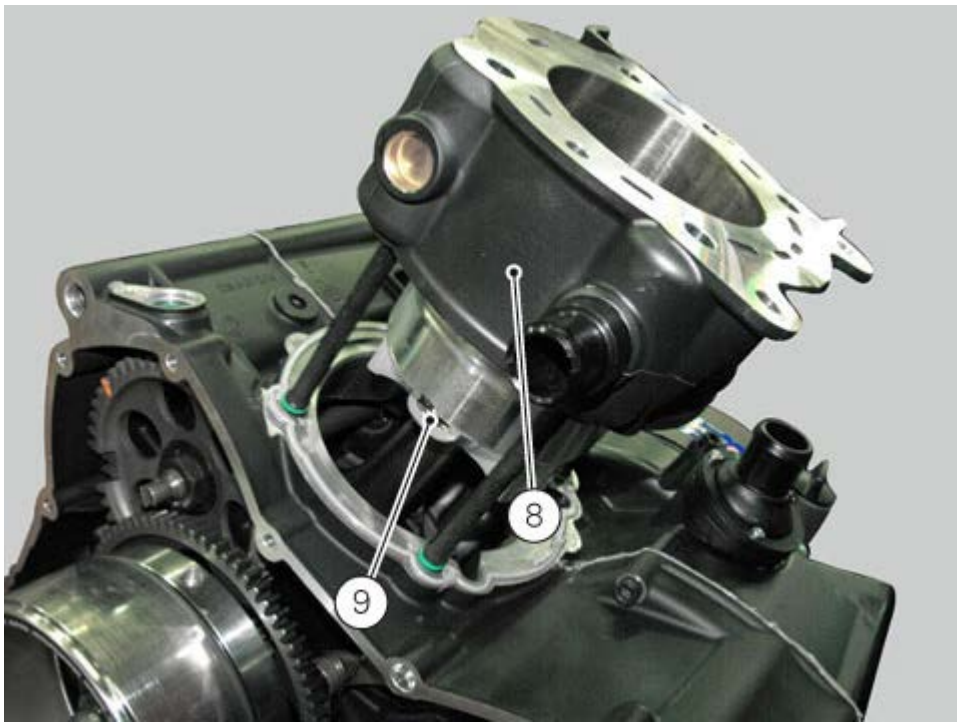
Remove bushings (7) from both piston-cylinder assemblies.



Use tool (B) part no. **88765.1657** to bring the piston of the horizontal cylinder near the TDC.

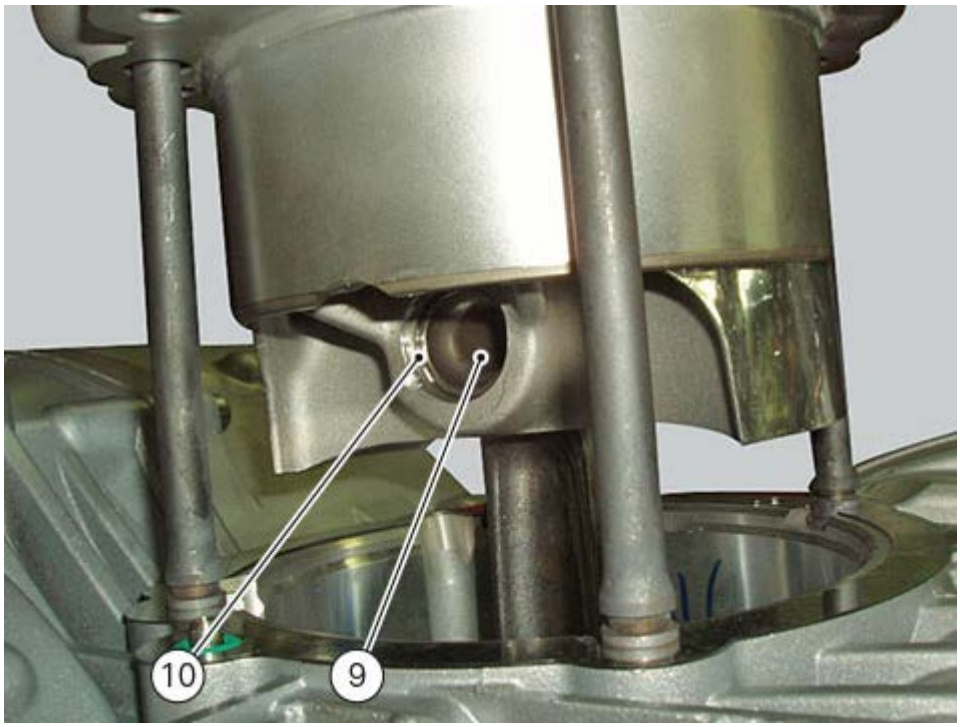


Carefully lift the vertical cylinder (8) off the crankcase, keeping it vertical.
If necessary, rock the cylinder slightly using both hands or tap its base gently with a rubber mallet.
Continue to lift the vertical cylinder until you can access the gudgeon pin (9).

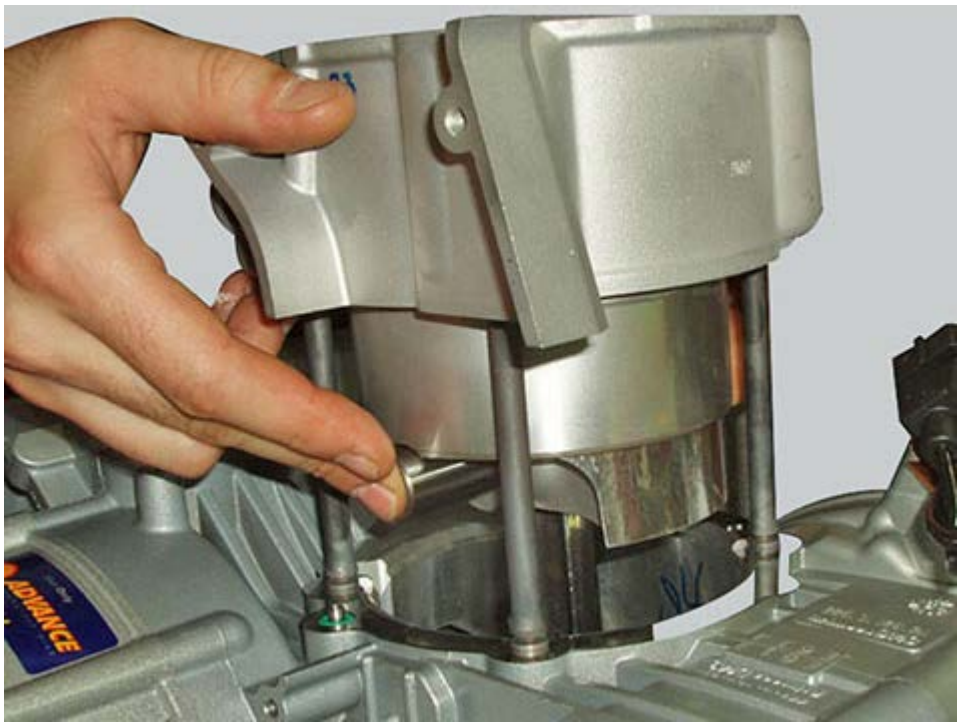


Since insertion of piston in the cylinder is a difficult operation to perform at the time of reassembly, remove the piston together with the barrel as described below:
block the crankcase opening with a rag or soft paper to prevent foreign material from falling inside.

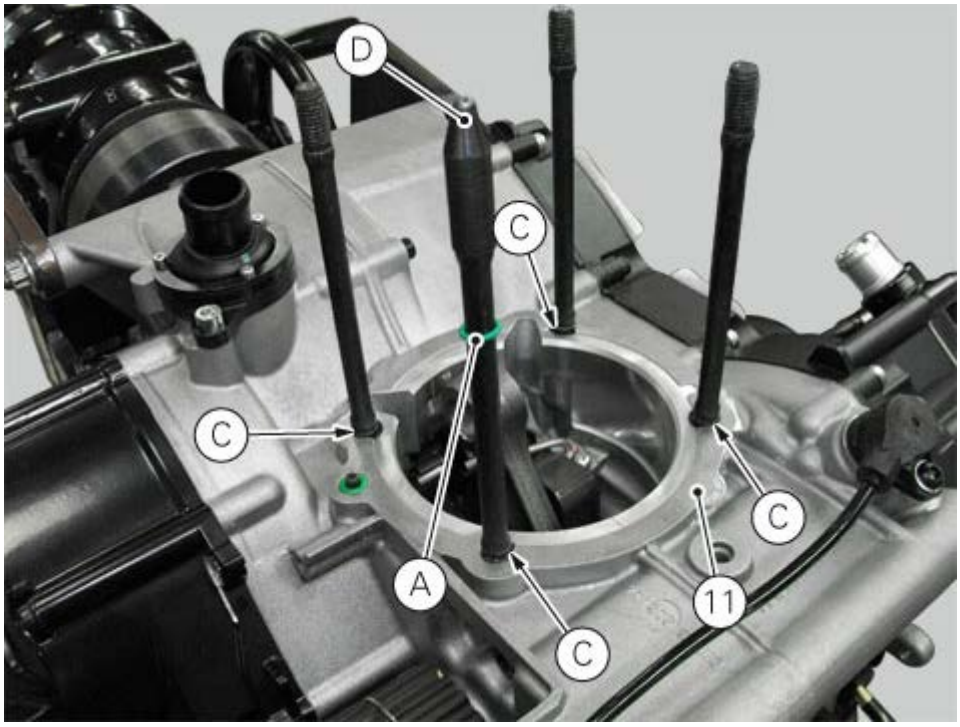
Remove the snap ring (10) from the gudgeon pin (9) on the clutch side.



Working from the opposite side, drive out the gudgeon pin to release the connecting rod.
Lift the cylinder-piston assembly clear of the crankcase stud bolts.
If work is to be carried out on the piston, carefully withdraw it from the cylinder.



Remove from the cylinder head stud bolts the four O-rings (A) (one per stud bolt) located on the crankcase between cylinder and gasket (11) and replace them with four new O-rings (A) by inserting them inside their seats (C) using tool (D).



To remove the horizontal cylinder-piston assembly, bring the vertical piston to TDC and proceed as for removal of the vertical cylinder.

Important

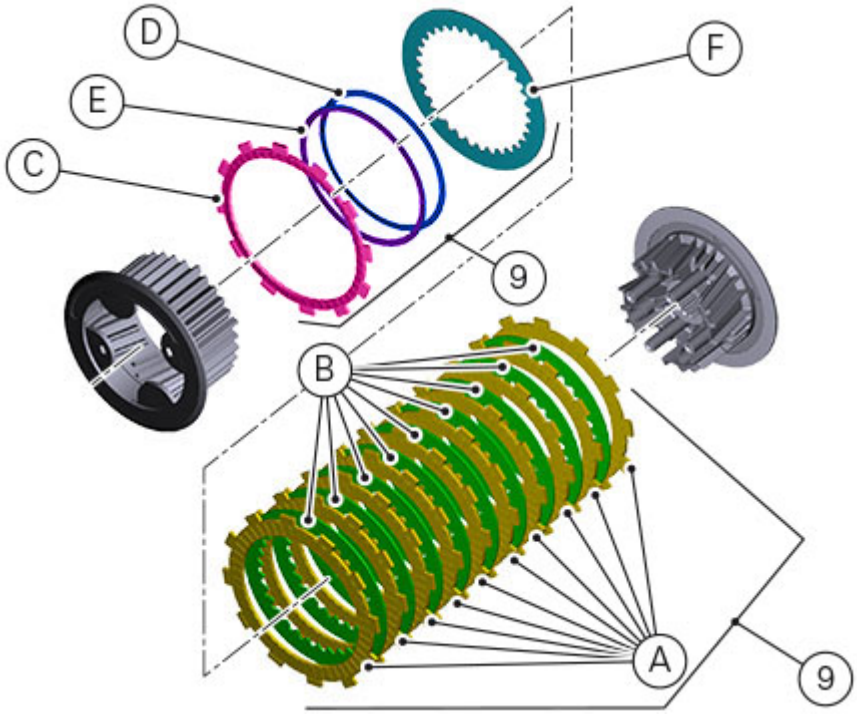
Mark the pistons to show from which cylinder they were removed:
V= Vertical - O= Horizontal.

Refitting the clutch

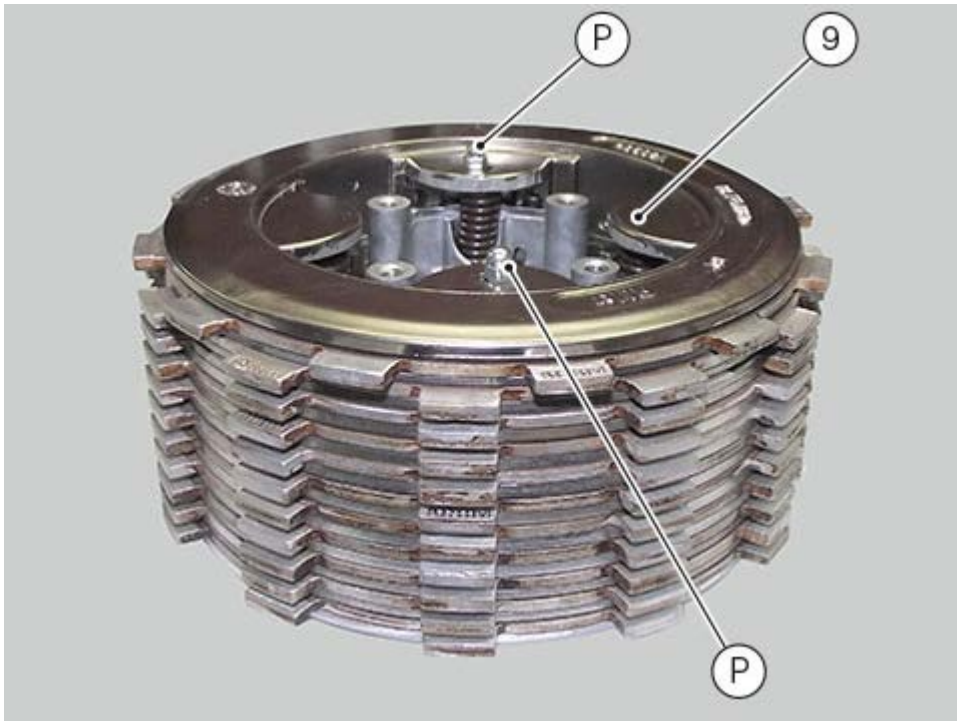
If the hub - plates - drum assy (9) was disassembled, take special care to clutch plate positioning upon reassembling.
Insert the clutch plate pack on hub:
The plate pack (9) consists of:

- 10 driving plates (A): 3.5 mm thickness;
- 9 driven plates (B): 1.5 mm thickness;
- 1 driving plate (C): 3.5 mm thickness;
- 1 anti juddering spacer (D): 1.6 mm thickness;
- 1 Belleville washer (E): 1.5 mm thickness;
- 1 driven plate (F): 1.5 mm thickness.

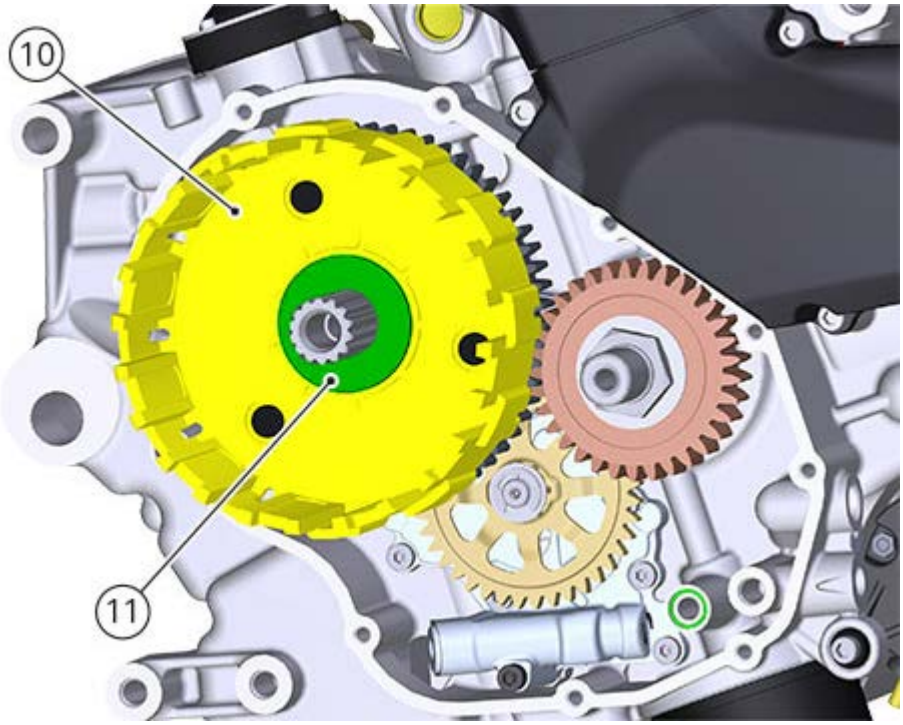
Plate pack thickness: 53.5 ± 1.2 mm.



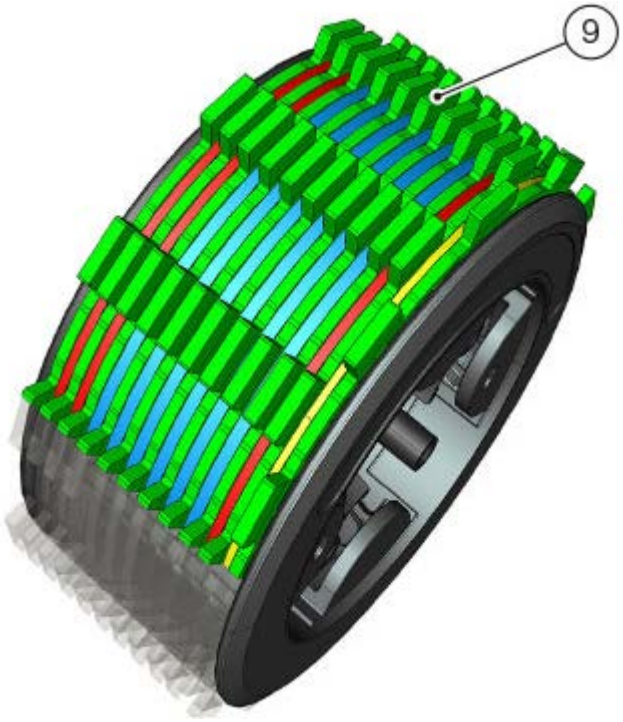
Fit the clutch plate pack with hub inside drum.
Fit the two service pins (P).

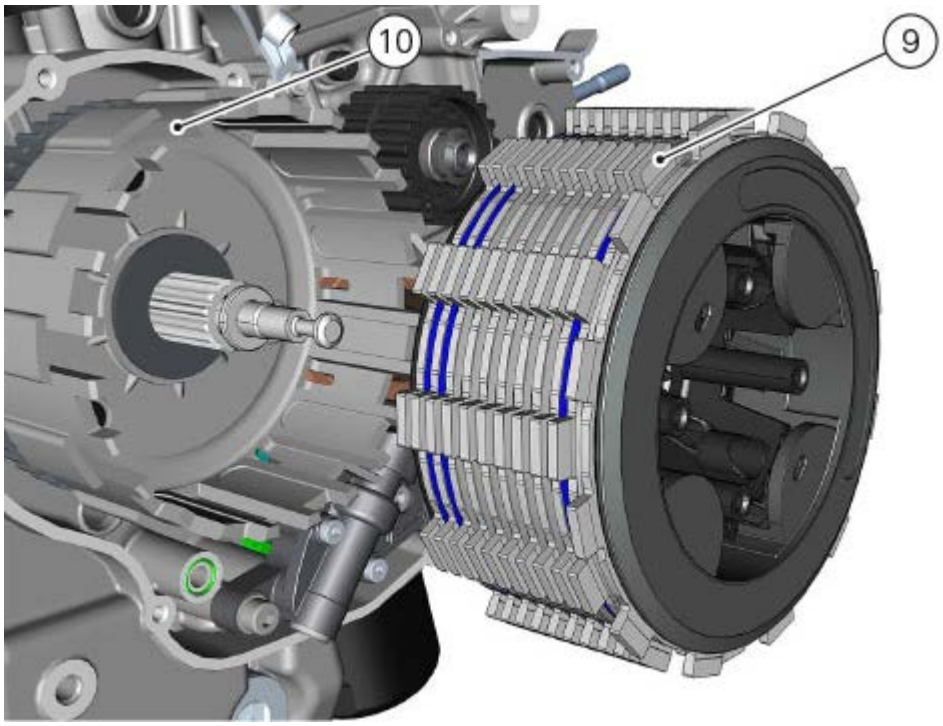


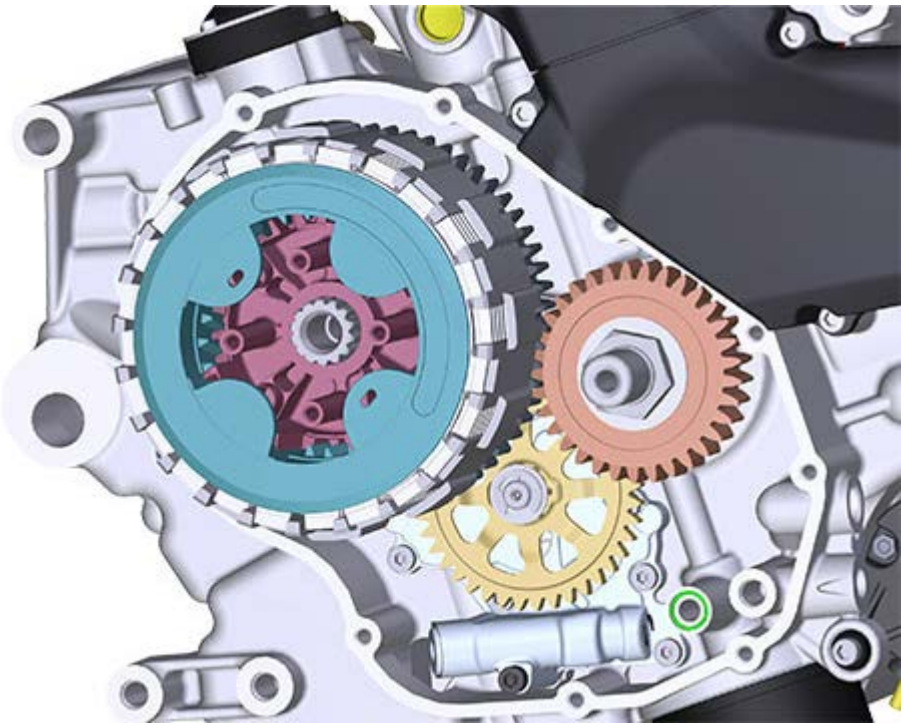
Fit the spacer (11) to the clutch housing (10).



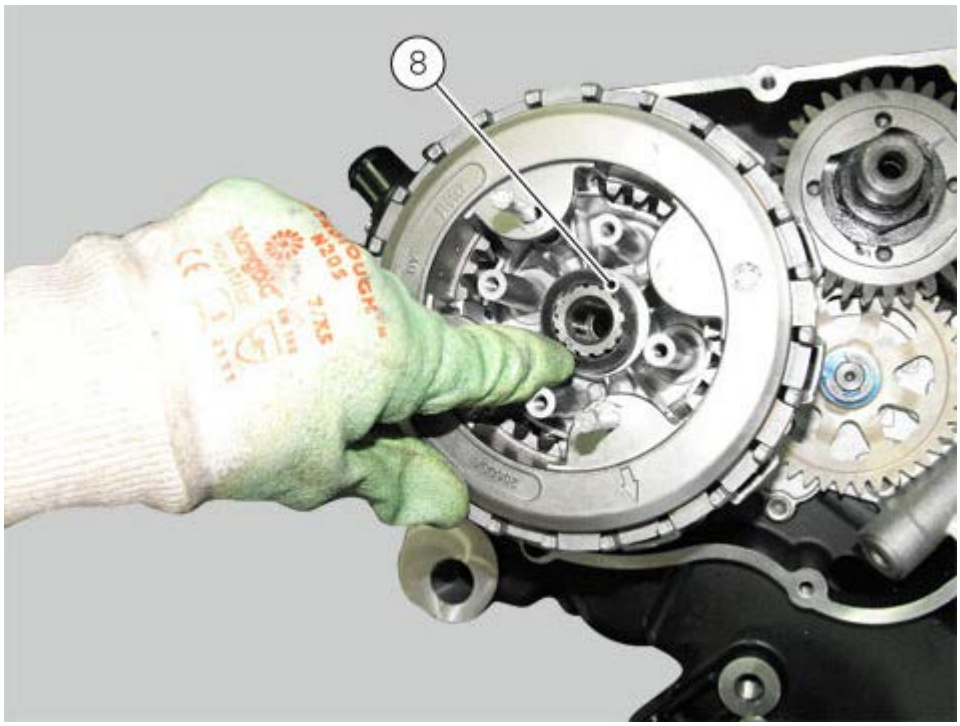
Fit the hub-plates-drum assy (9) to the clutch housing (10).

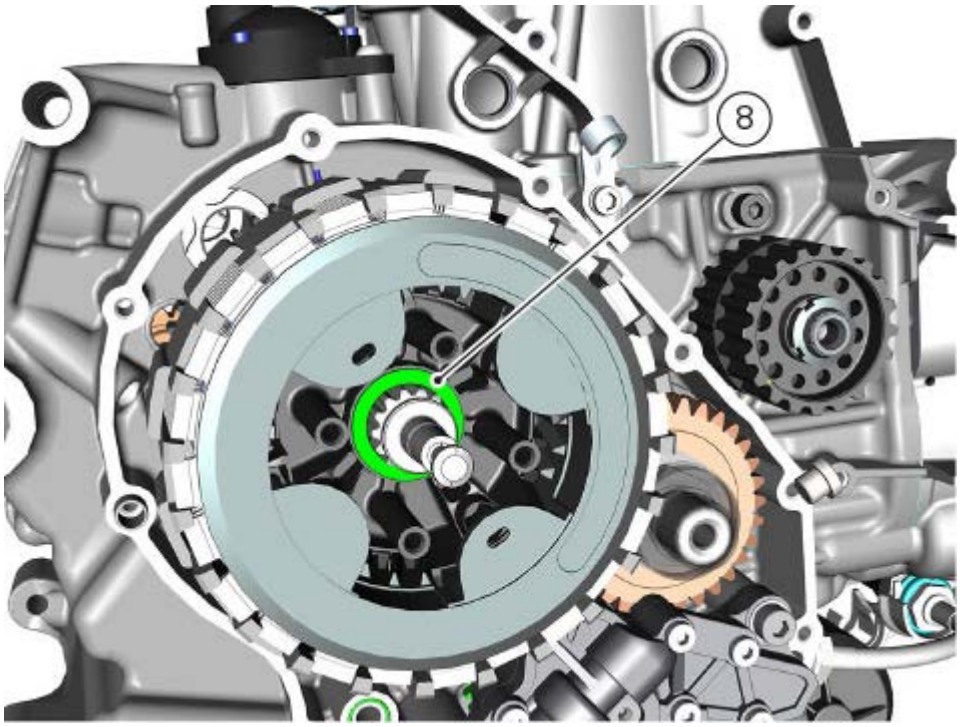






Fit lock washer (8) on primary shaft, driving it fully home inside clutch unit.

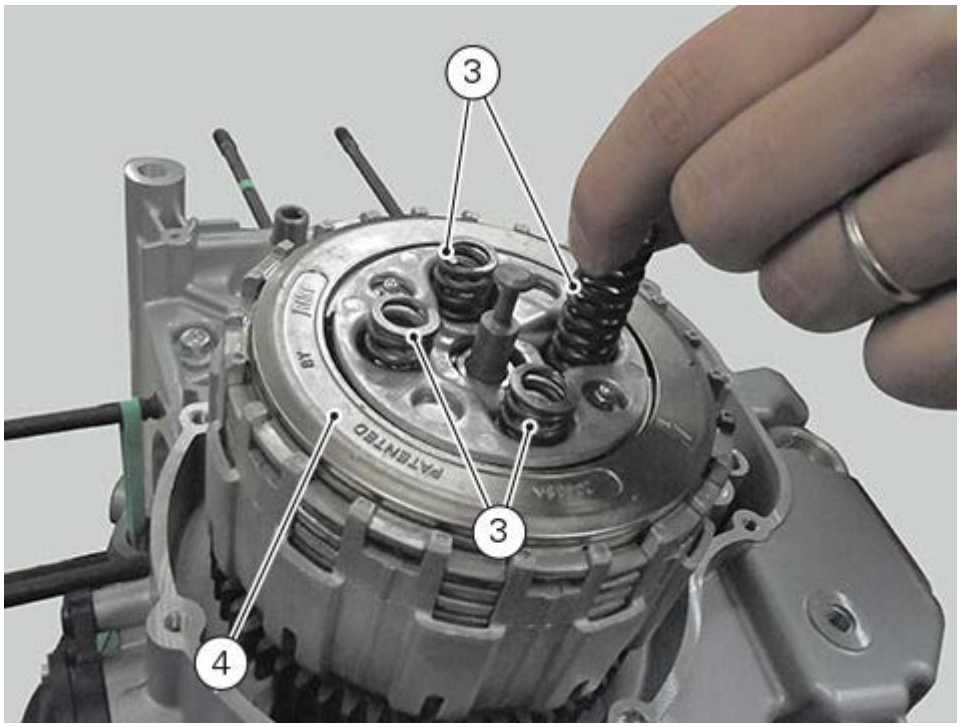


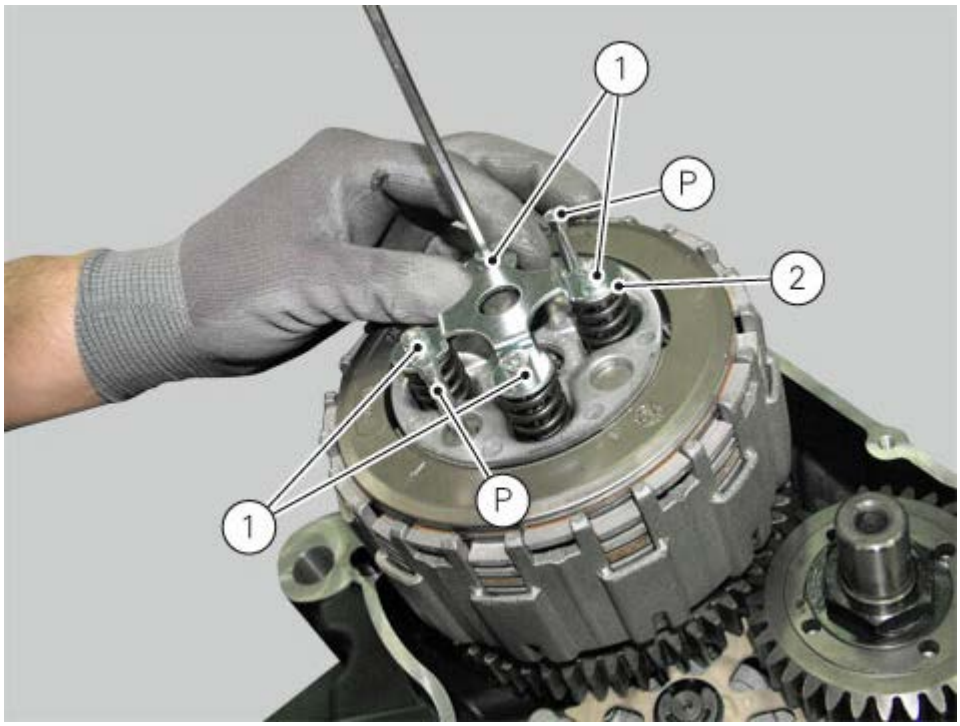


Apply the indicated grease on nut (7) mating surface and on primary shaft thread, then insert nut driving it fully home by hand inside primary shaft.
Lock clutch housing with tool (T) no. **88713.2556**, so as to hold it when tightening nut (7).
Tighten nut (7) to a torque of 190 Nm (Min. 180 Nm - Max. 200 Nm).
Remove tool (T) no. **88713.2556**.

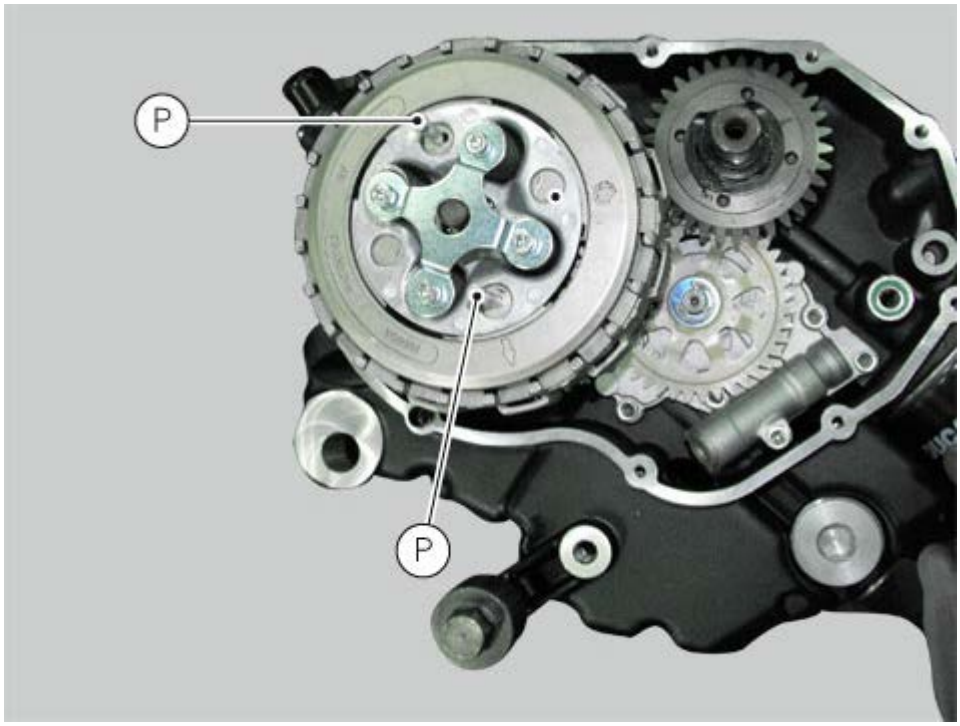
Fit the pusher plate (4) with the clutch control pin (5) with bearing (6).

Fit springs (3) and ring (2) on pusher plate (4). Start screws (1) and tighten them to a torque of 5 Nm (Min. 4.5 Nm - Max. 5.5 Nm).





Remove the two service pins (P).

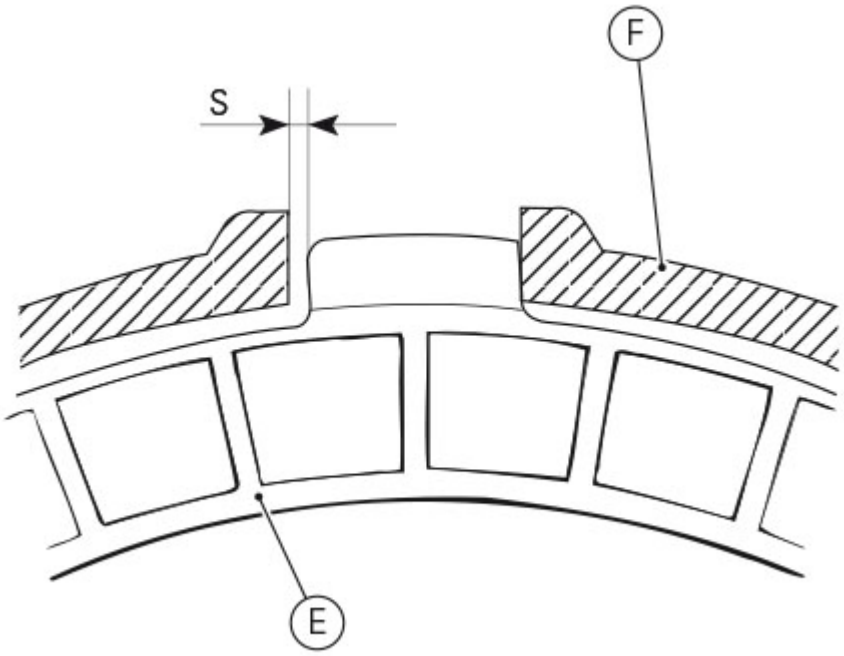


Refit the clutch cover (Refitting the clutch cover).
Fill the engine with oil (Changing the engine oil and filter cartridge).

Checking and overhauling the components

Clearance between the clutch housing and friction plate

Insert a friction plate (E) in the clutch housing (F) and measure the clearance (S) with a feeler gauge.
Clearance "S" must not exceed 0.6 mm.
If it does, replace the plates and, if necessary, the clutch housing.

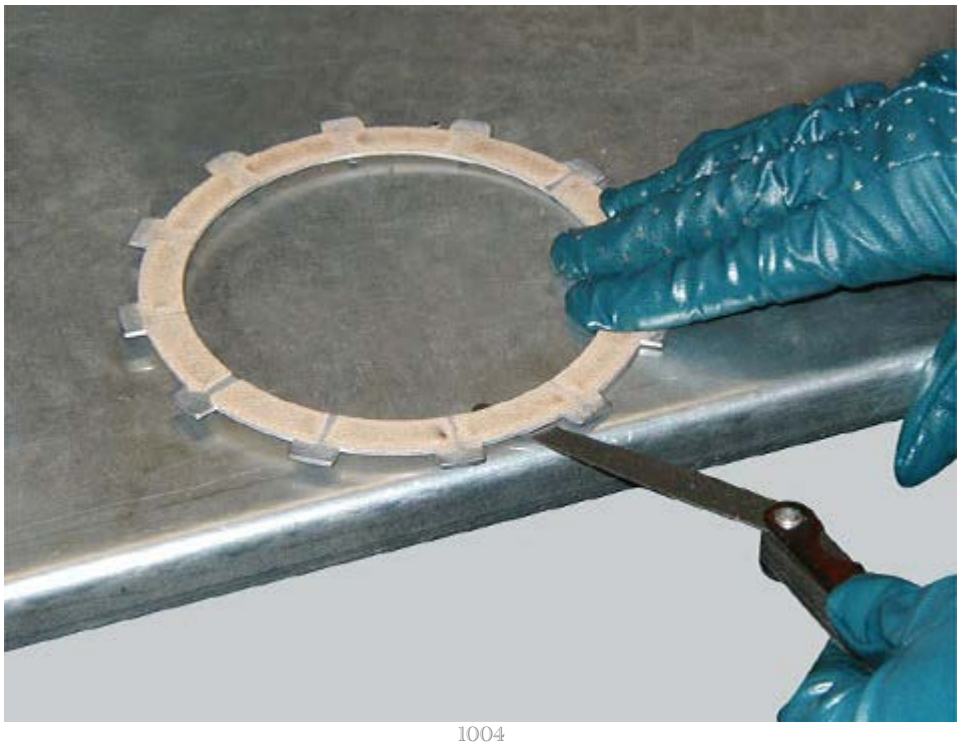


Overhauling the clutch plates

The clutch plates must not show any signs of blackening, grooves or deformation.
Measure the thickness of the friction plates; it should not be less than 2.6 mm.

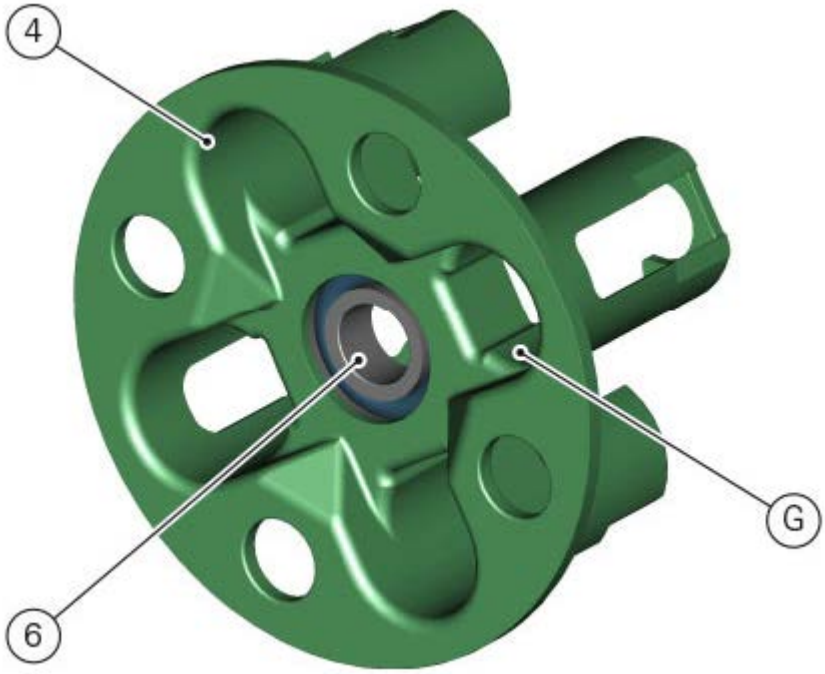
Important
The total thickness of the plates pack must not be less than 46.1 mm.

Place the plate on a flat surface and check the amount of deformation with a feeler gauge.
Max. flatness error: 0.2 mm.



Overhauling the pressure plate

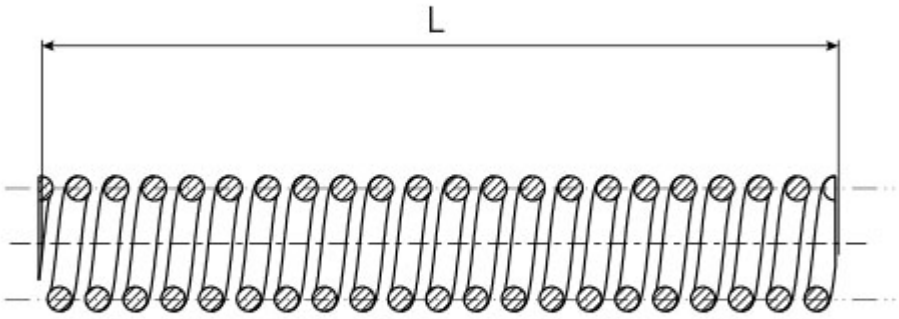
Check bearing (6) conditions: replace the bearing if the play is excessive.
Check the contact surface of the last friction plate; if extremely scored, polish it in the same manner as described previously for the cylinder head surface (Overhauling the cylinder head components).
Check the condition of the spring guide seats (G) of pusher plate (4).



Pusher plate springs

(L) can indicate two lengths:

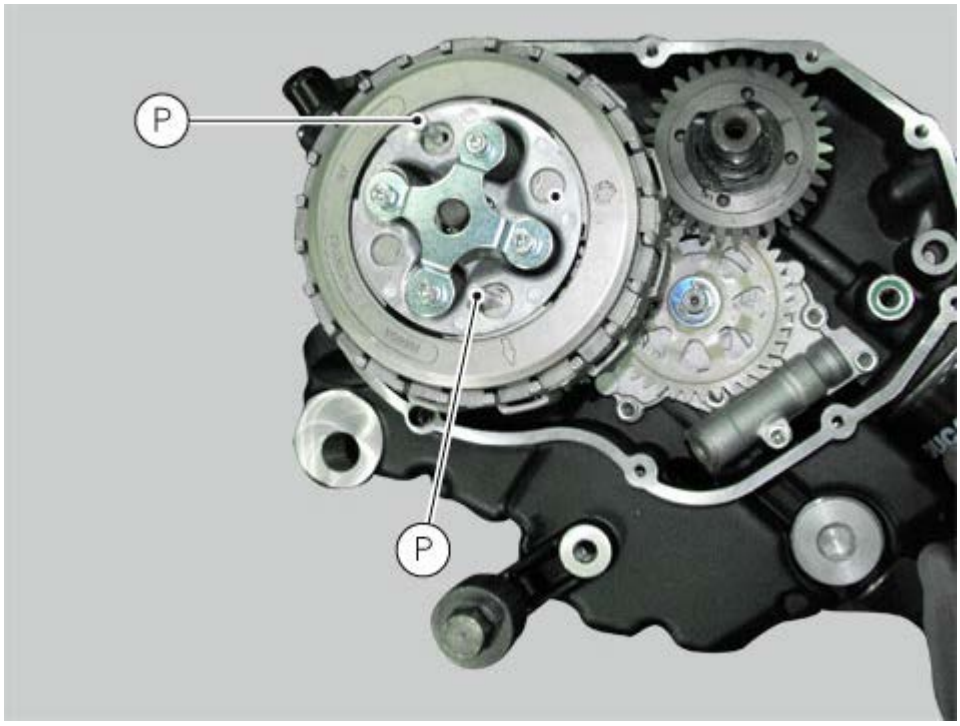
- uncompressed length = 57.81;
- working length = 36.10.



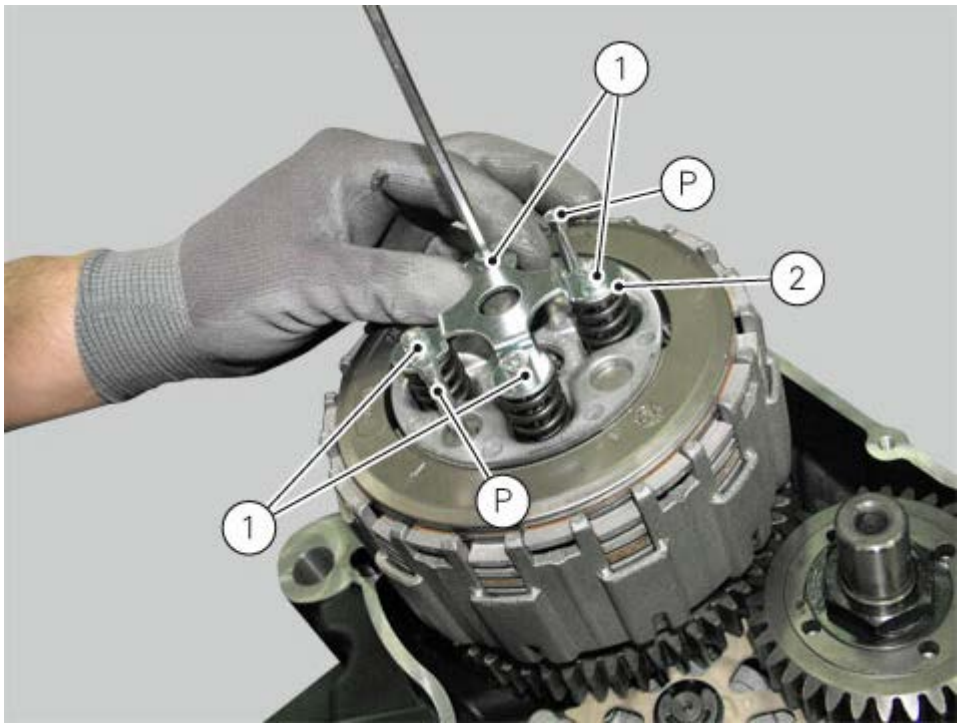
Removing the clutch

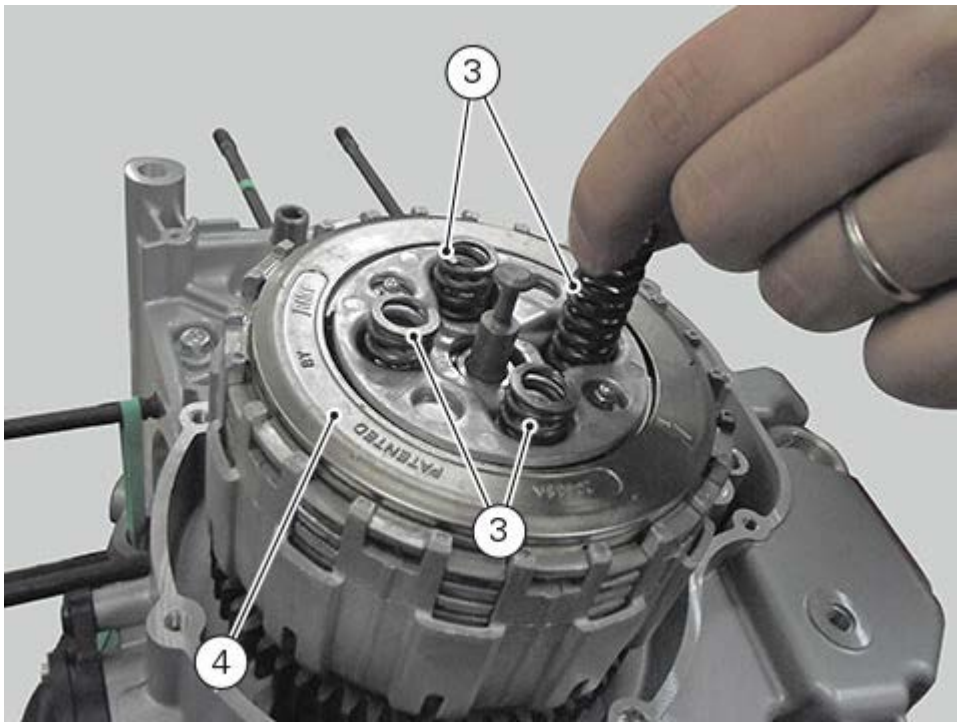
Drain the engine oil (Changing the engine oil and filter cartridge).
Remove the clutch cover (Removing the clutch cover).

Fit the two service pins (P) inside their seats on hub.



Undo the fixing screws (1) and remove the ring (2) and the springs (3) from the pusher plate (4).

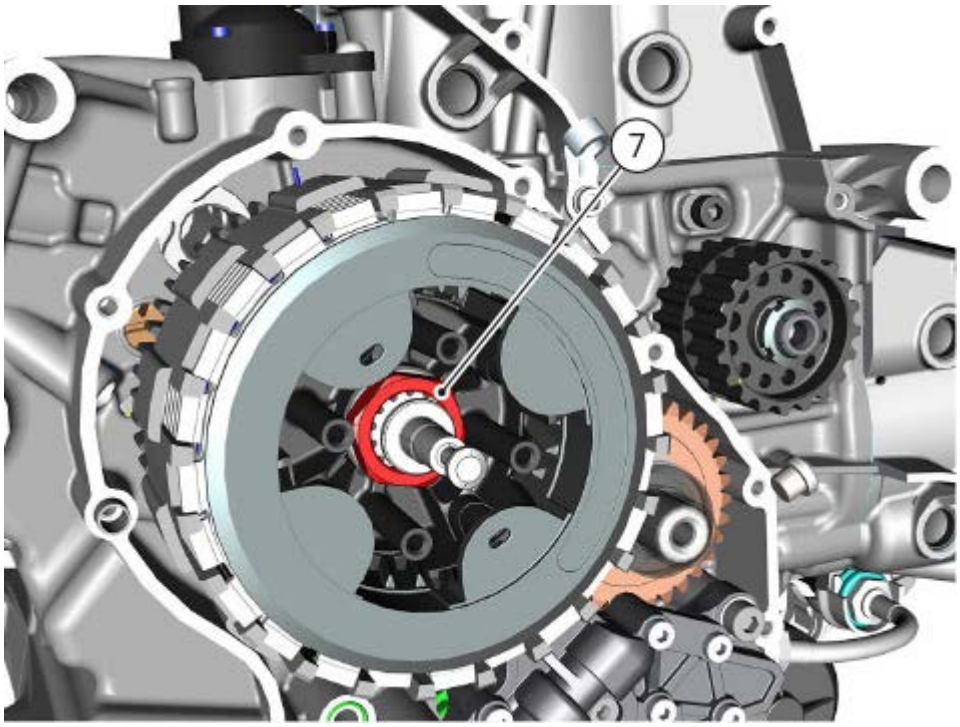




Slide out the pusher plate (4) with the clutch control pin (5).
If necessary, using a suitable diameter drift, remove the bearing (6) fitted on pusher plate inner side (4).

Lock clutch housing with tool (T) no. **88713.2556** and loosen retaining nut (7).


T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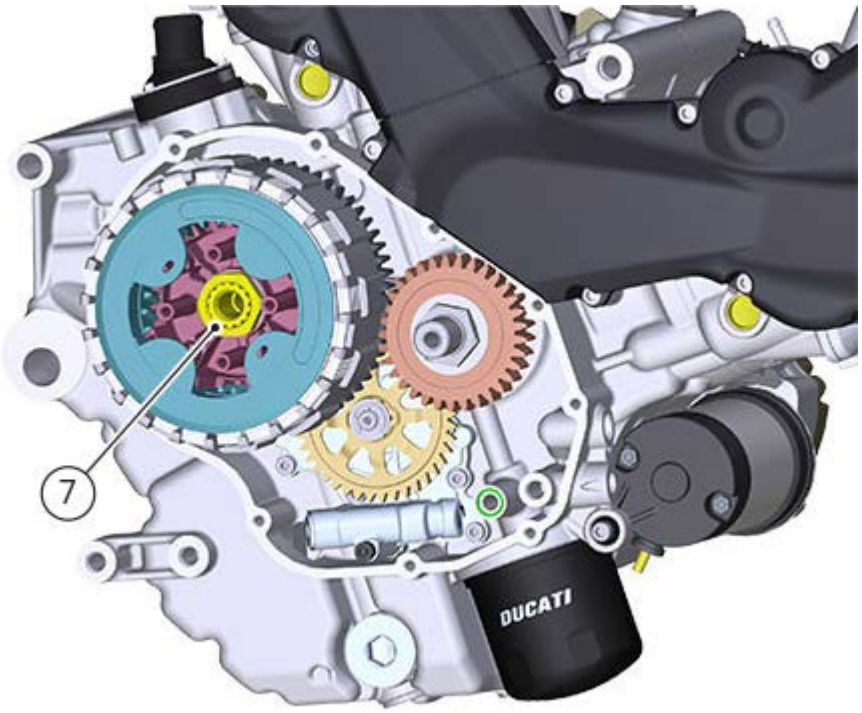
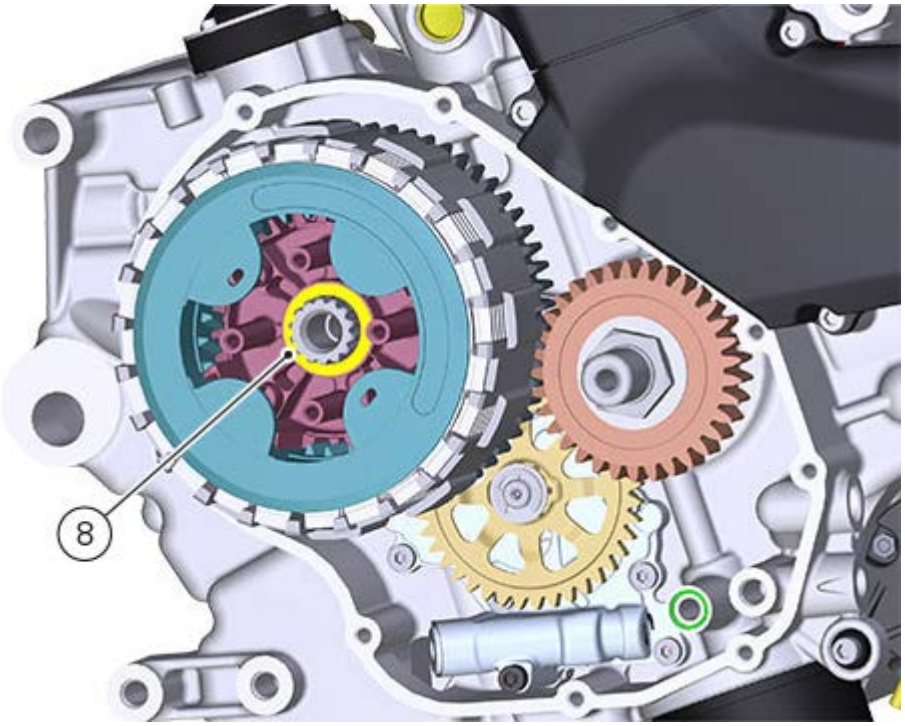
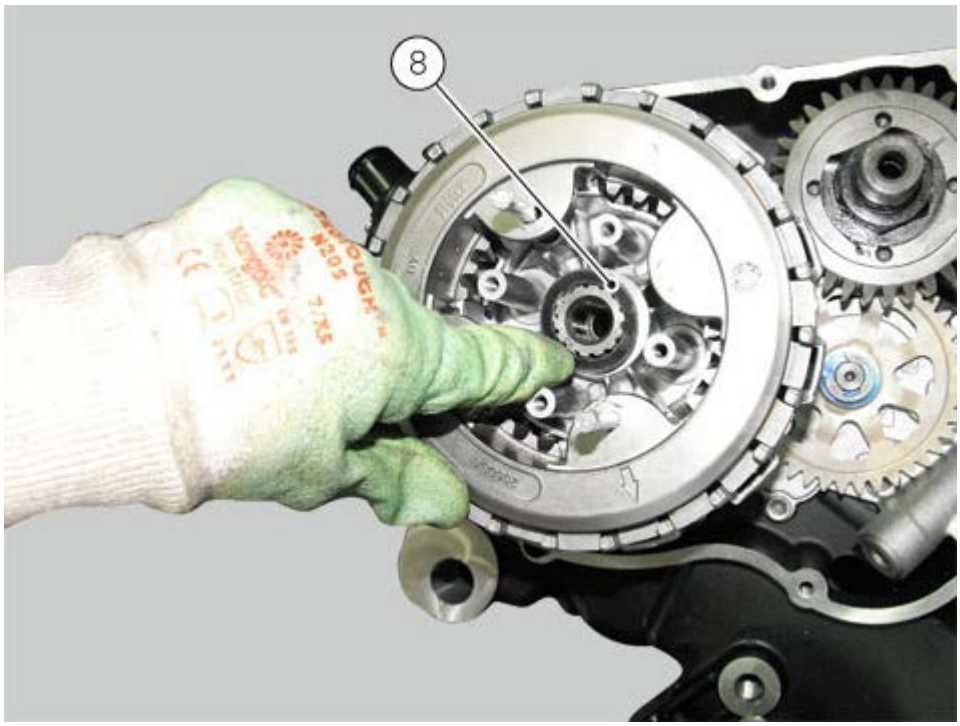
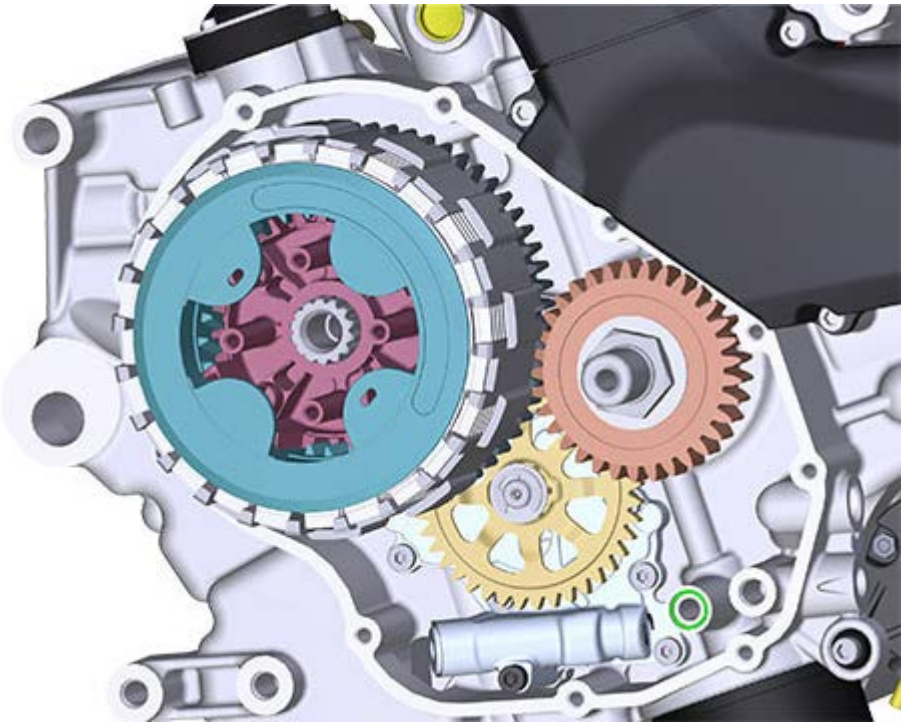


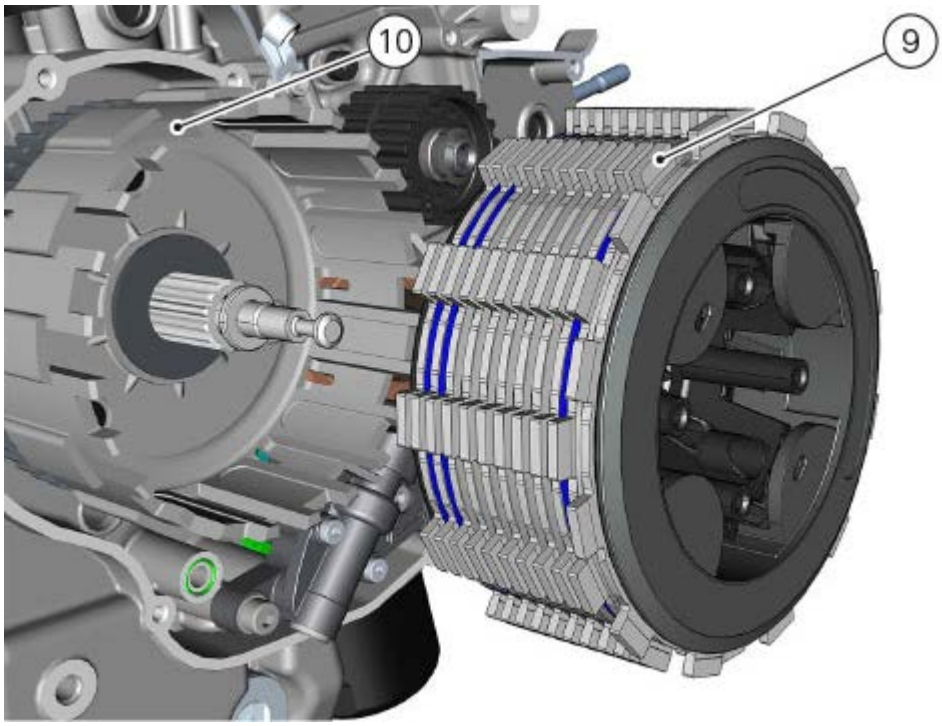
Remove the lock washer (8).





Slide the hub-plates-drum assy (9) out of clutch housing (10), marking them so as to refit them in the same position in which they were removed.
Remove the spacer (11) from the clutch housing (10).

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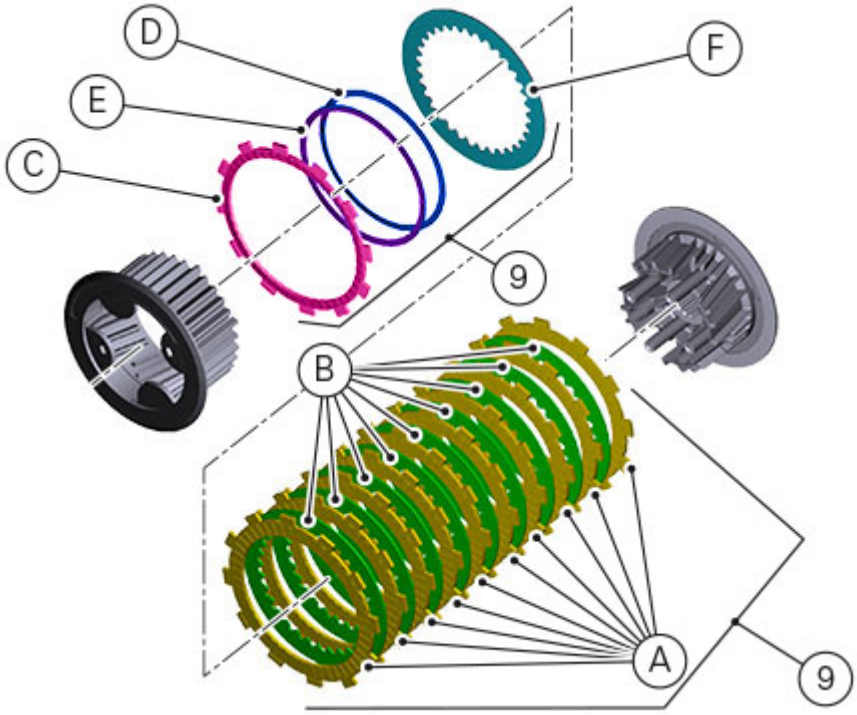
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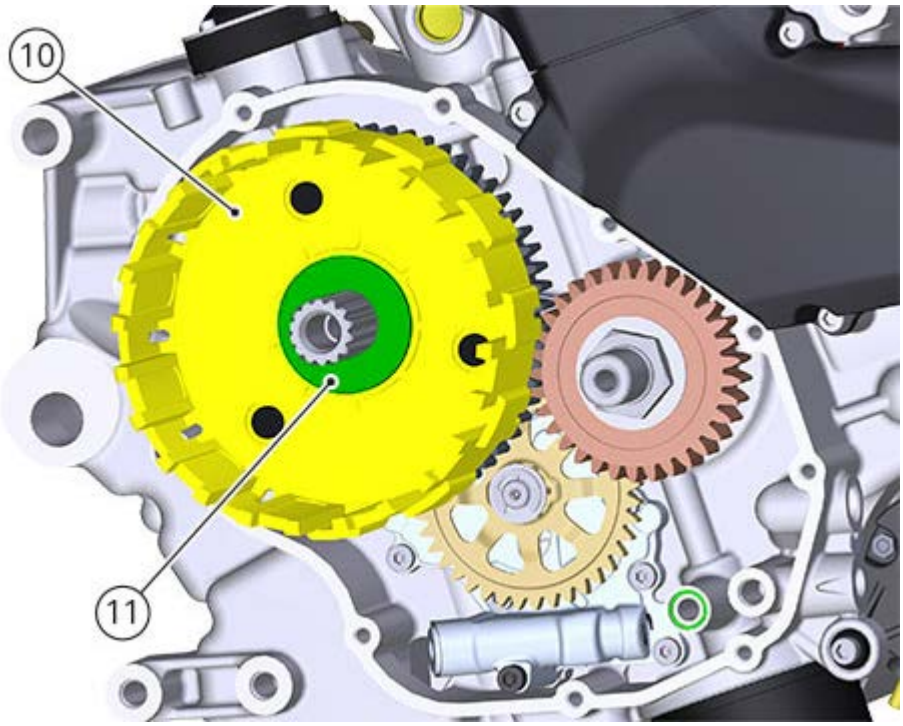
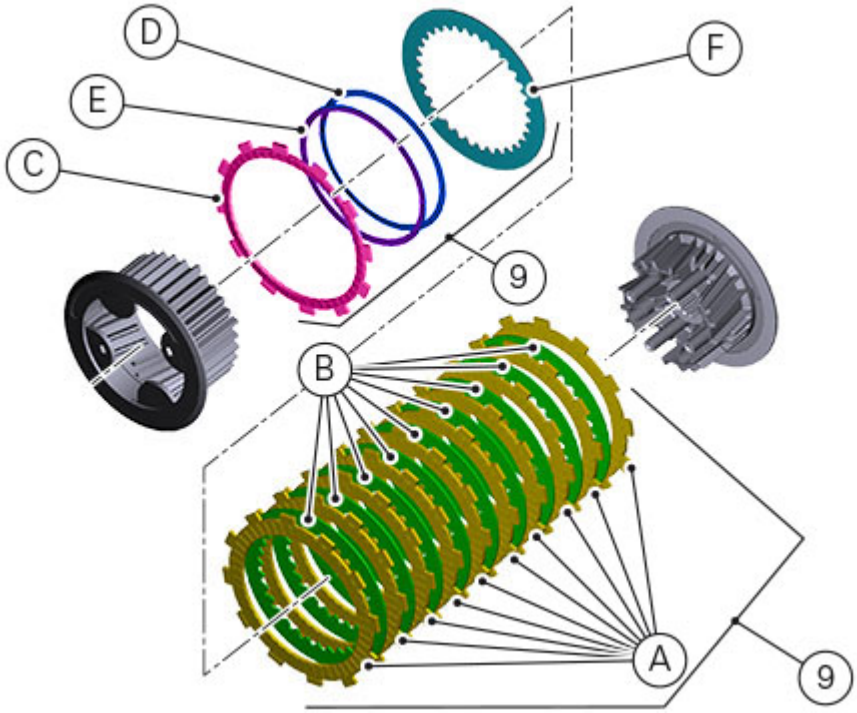
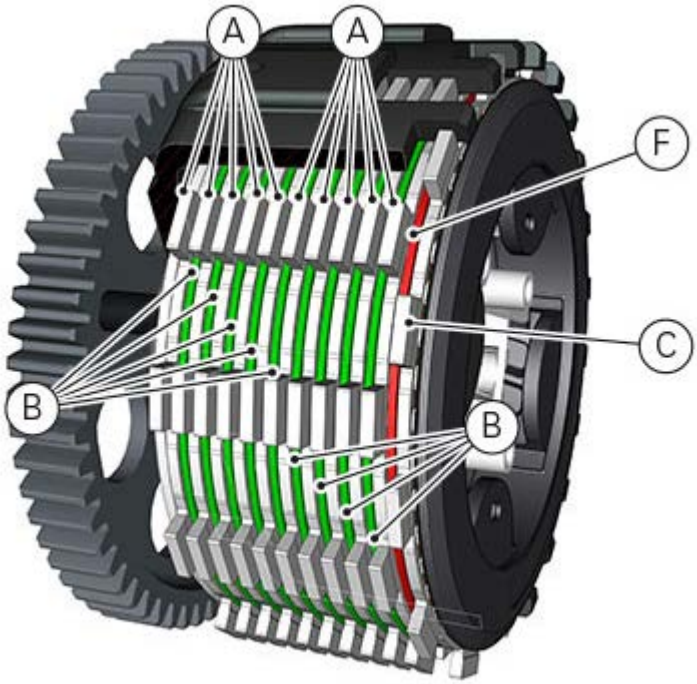


The plate pack (9) consists of:

- 10 driving plates (A): 3.5 mm thickness;
- 9 driven plates (B): 1.5 mm thickness;
- 1 driving plate (C): 3.5 mm thickness;
- 1 anti juddering spacer (D): 1.6 mm thickness;
- 1 Belleville washer (E): 1.5 mm thickness;
- 1 driven plate (F): 1.5 mm thickness.

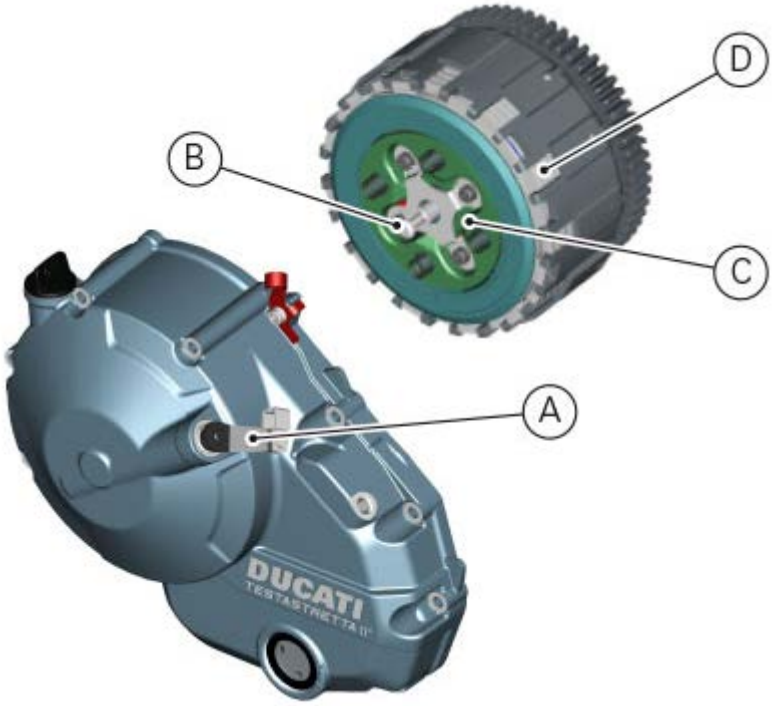
Plate pack thickness: 53.5 ± 1.2 mm.

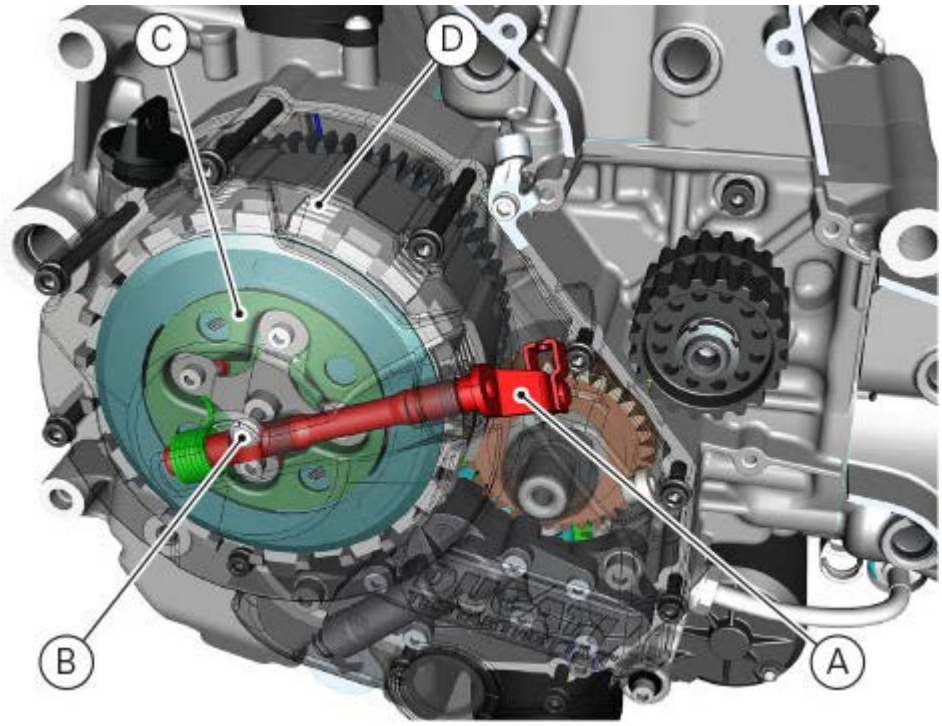




Description of the clutch assembly

The clutch is disengaged by a drive unit (lever (A) and spring) positioned on clutch cover. The drive unit directly operates on clutch control pin (B) that, in its turn, operates the pressure plate (C) positioned at the top of plate pack (D).
Drive is transmitted from the crankshaft to the gearbox primary shaft by a gear integrated with the clutch housing/primary drive gear pair.
Accommodated in the clutch housing is a pack (D) of driving and driven plates that push away a drum (B) which is splined onto the gearbox primary shaft.
Before working on the internal clutch parts, check that the clutch operates correctly. Then deal with the problem in a systematic manner.





The following is a list of possible causes of clutch malfunction.

A clutch which does not disengage may be caused by:

- excessive play of the control lever;
- distorted clutch plates;
- incorrect spring tension;
- faulty clutch release mechanism;

- excessive wear of the hub or clutch housing.

A clutch which slips may be caused by:

- no backlash of the control lever;
- worn clutch plates;
- weakened springs;
- faulty clutch release mechanism;
- excessive wear of the hub or clutch housing.

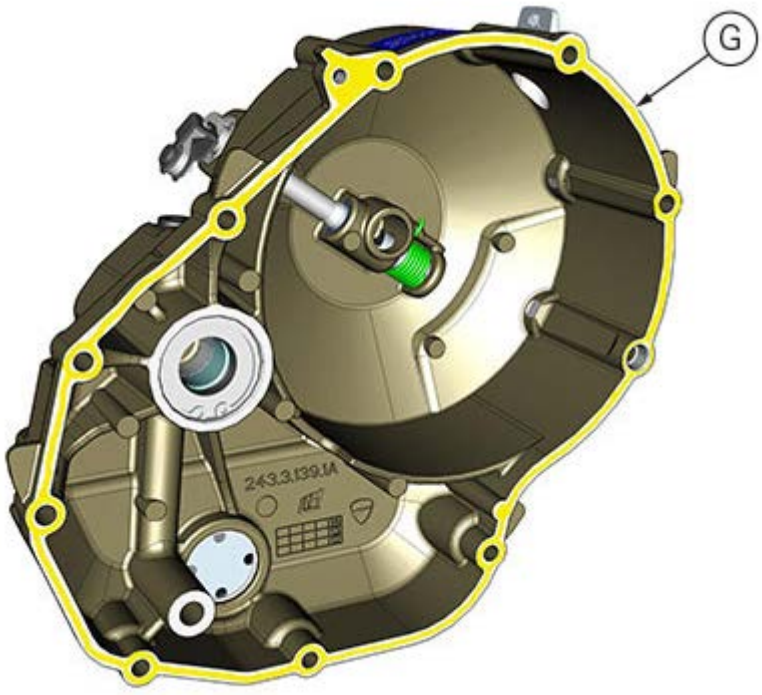
A noisy clutch may be caused by:

- excessive backlash between the primary drive gears;
- damaged primary drive gear teeth;
- excessive housing between driving plate tabs and the clutch housing;
- worn gear/clutch housing bearings;
- the presence of metal particles (filings) on the gear teeth.

Refitting the clutch cover

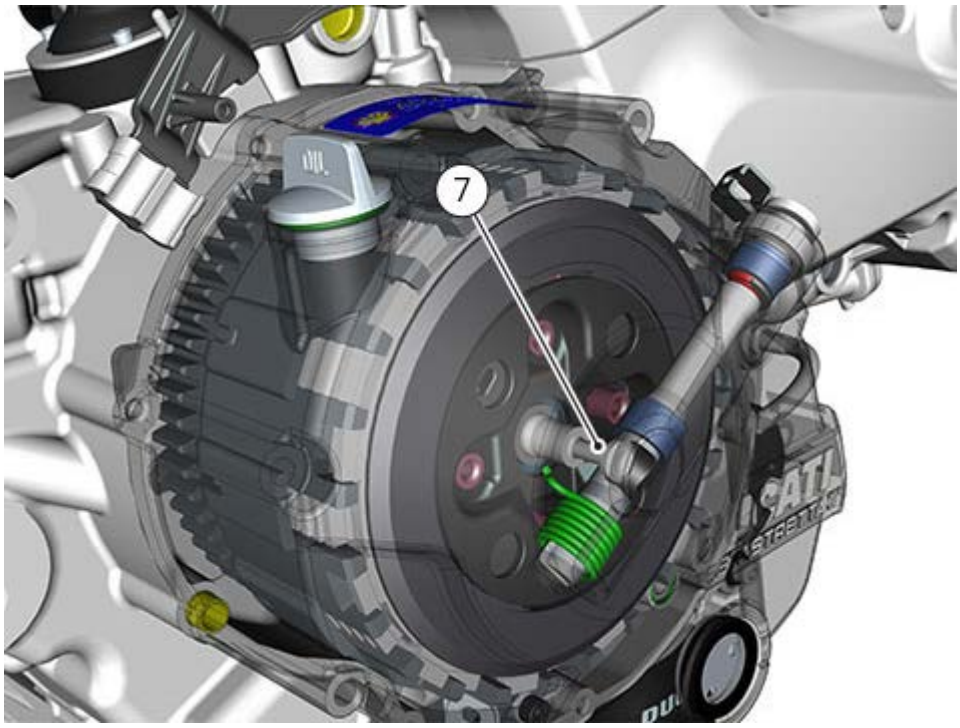
Clean and degrease mating surfaces on cover and crankcase half, and ensure that centring bushing (8) is fitted in the crankcase.

Apply an even, regular bead of DUCATI sealing compound (G) on the mating surface of the crankcase half and around all holes.



Bring cover near the crankcase half and, operating on clutch cover lever (6), make sure that clutch control pin (7) is duly inserted inside its seat on cover (3).


7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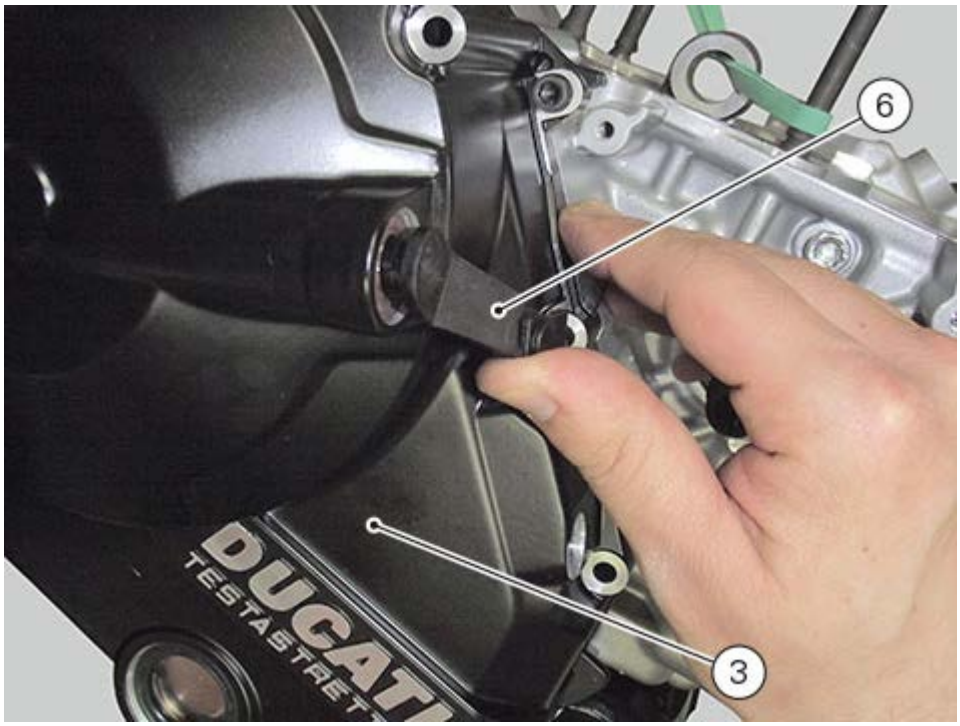
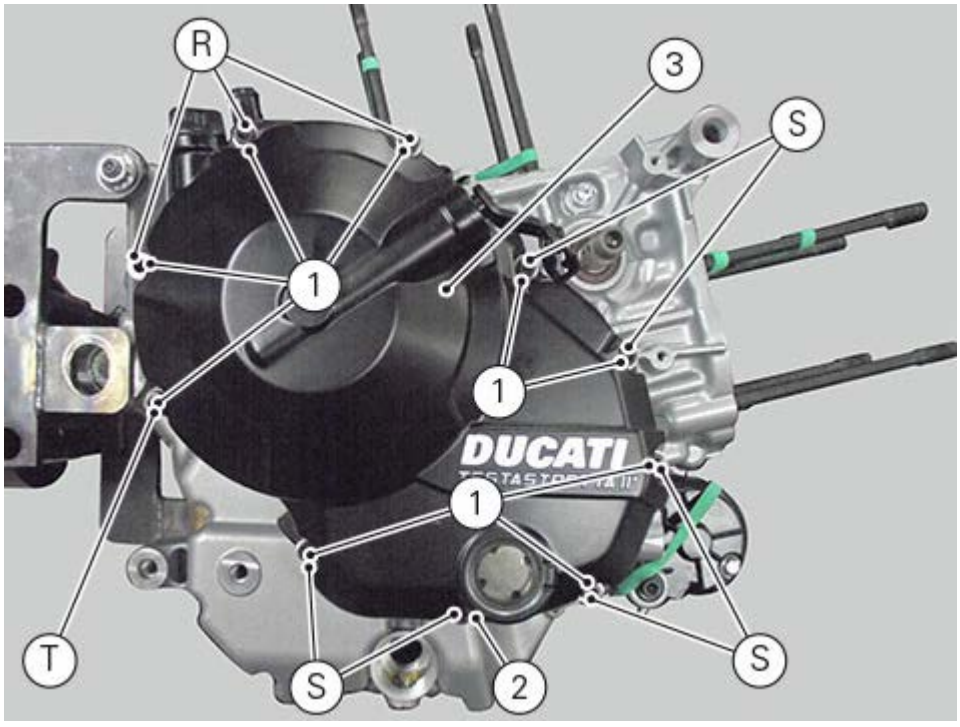


Start the fastening screws (1) and (2) inside the clutch cover (3).

Ref.	Quantity	Description
1-R	3	M 6 x 80
1-S	5	M 6 x 30
2-S	1	M 6 x 30
1-T	1	M 6 x 90

Tighten the screws to a torque of 13.5 Nm (Min. 12.5 - Max. 14.5).



Refit the clutch cable (4) on the clutch cover.

Turn adjuster (5) to tension clutch cable (4) on handlebar.
Screw adjuster (5).

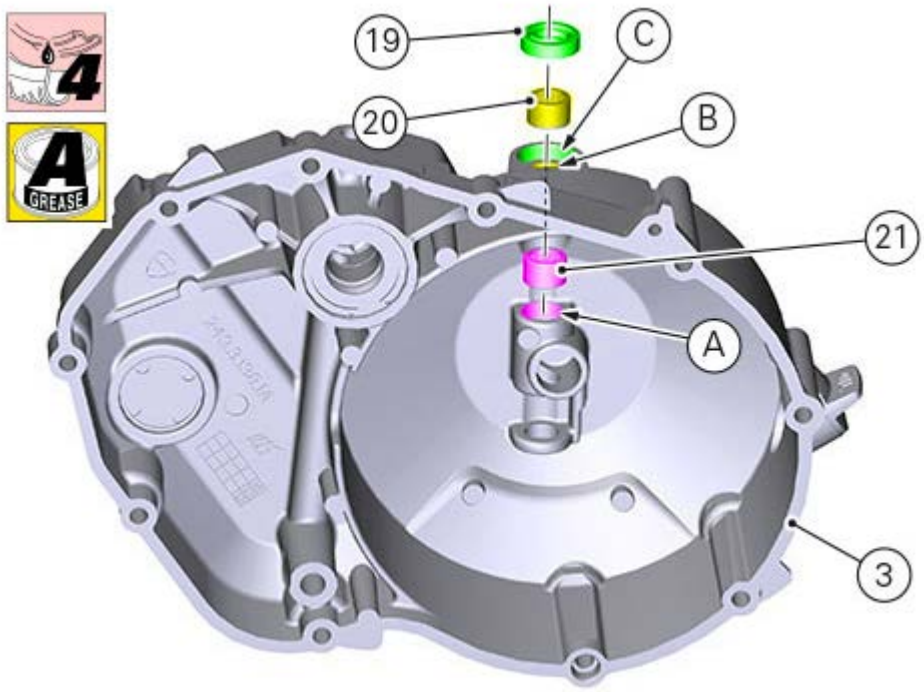
Warning
Never loosen adjuster. Adjuster must be screwed, only.

Adjuster (5) standard adjustment (A) is higher than or equal to 5 mm from the fully home position.
Pull brake lever two or three times to settle cable, then check distance (A).
If, with (A) = 5mm, clutch does not correctly disengage, adjust cable as follows:
- loosen lock nut (22);
- screw nut (23) until clutch disengages correctly.
If the procedure cannot be repeated again and distance (A) is not respected, restore clutch.

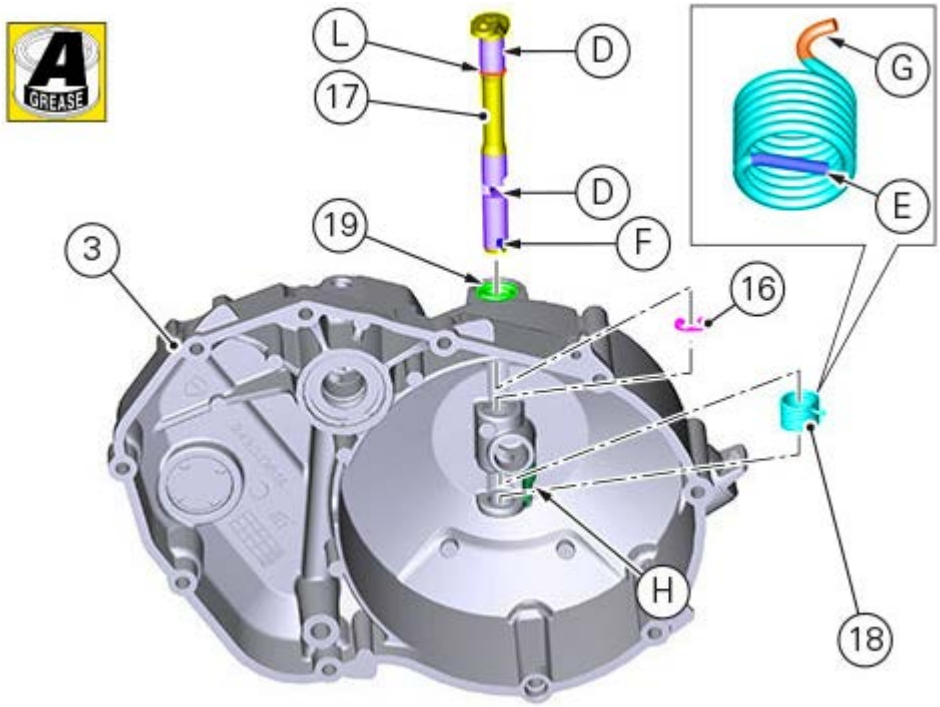
Fill the engine with oil (Changing the engine oil and filter cartridge).

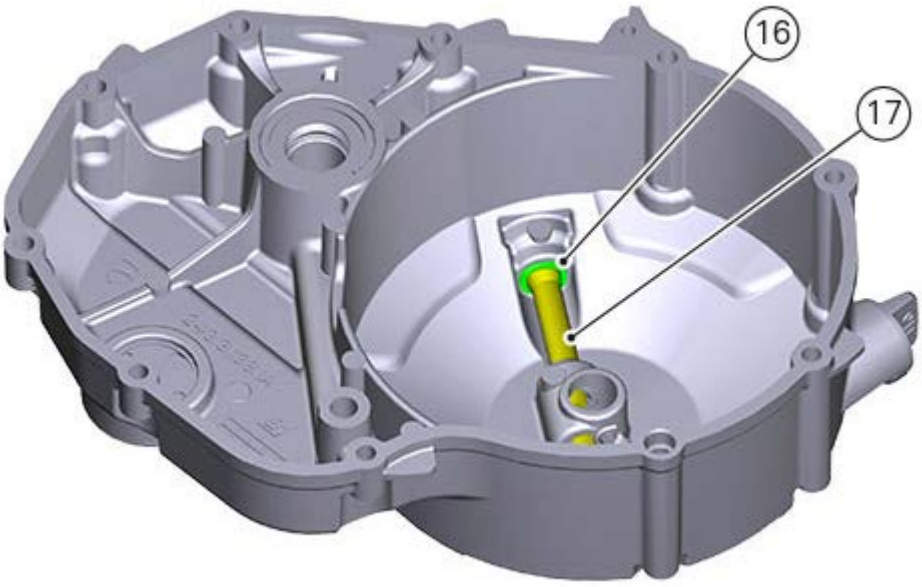
Reassembling the clutch cover

Apply specified grease on roller bearing (21) and position it fully home in seat (A) of cover (3).
Apply specified grease on roller bearing (20) and position it fully home in seat (B) of cover (3) on roller bearing (20).
Apply specified lubricant on seal ring (19) and position it fully home in seat (C) of cover (3).

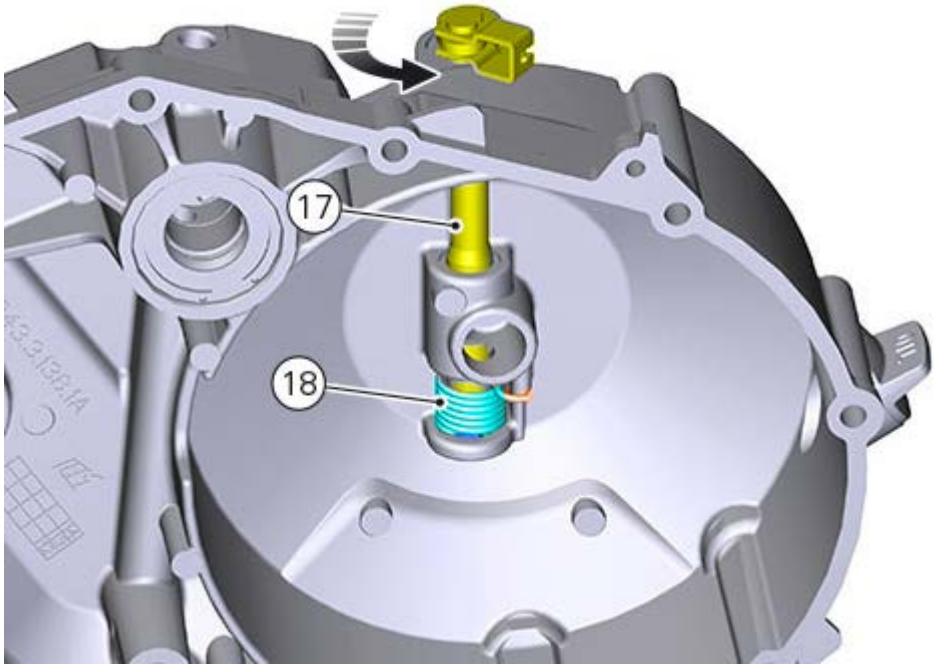


Lubricate sliding pins (D) of clutch drive shaft (17) with specified grease.
Insert clutch drive shaft (17) in seat ring (19) having care not to damage it.
To insert the clutch drive shaft (17) inside clutch cover (3), position spring (18) considering that part (E) has to be engaged in recess (F): bring the clutch drive shaft (17) fully home on clutch cover (3).
Rotate clutch drive shaft (17) counter clockwise until part (G) touches bearing surface (H).
Insert snap ring (16) of clutch drive shaft (17) fully inside groove (L).

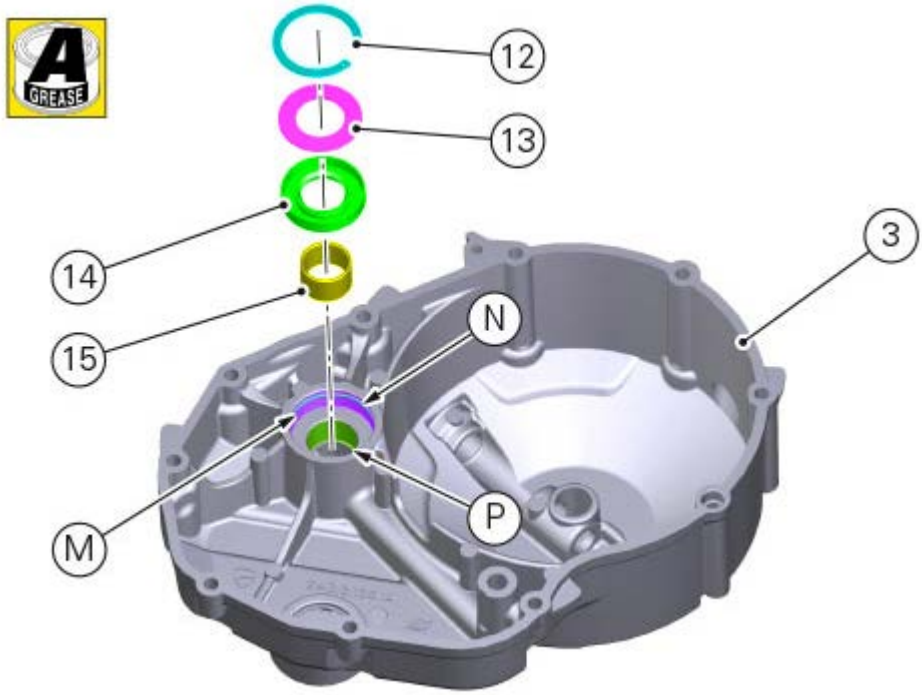


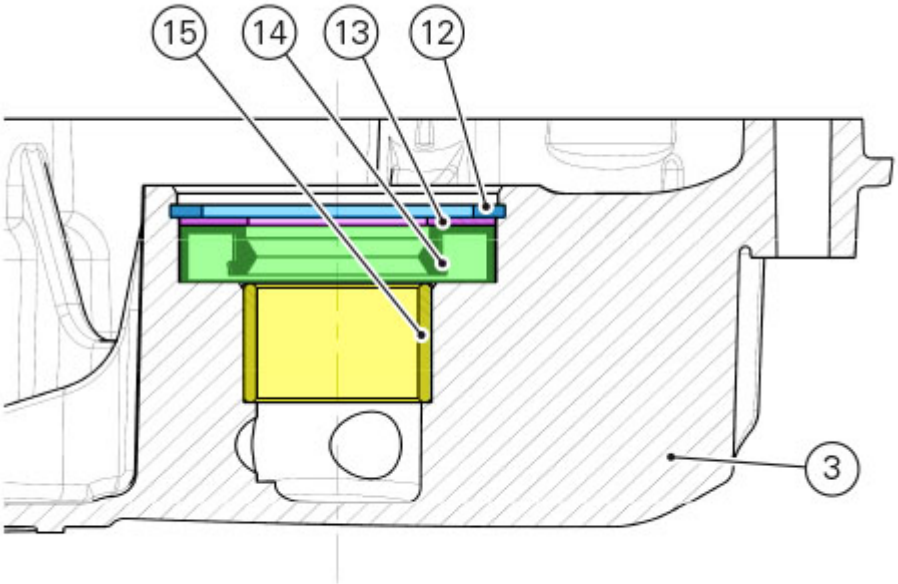


Check spring (18) operation by acting on, it in the direction of the arrow on clutch drive shaft (17), and ensuring that the shaft goes back to its initial position once released.

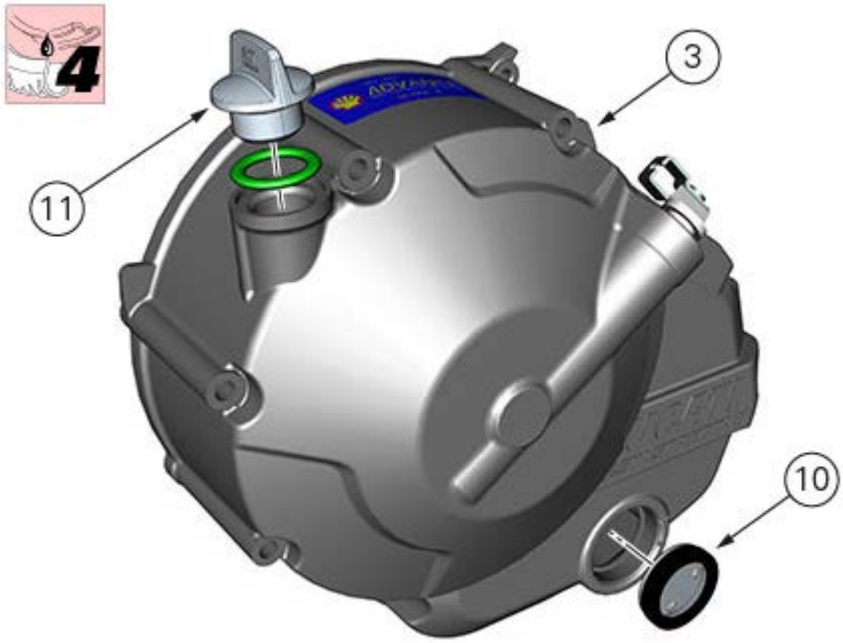


Apply indicated product to the bushing seat (22).
Drive crankshaft bushing (15) in bushing (22) seat.
Apply the indicated lubricant to the seal ring (14).
Install seal ring (14) in seat (M) of clutch cover (3), positioning the side with the spring as shown.
Fit spacer (13) and snap ring (12).
Make sure that the snap ring is completely inside seat (N) of clutch cover (3).



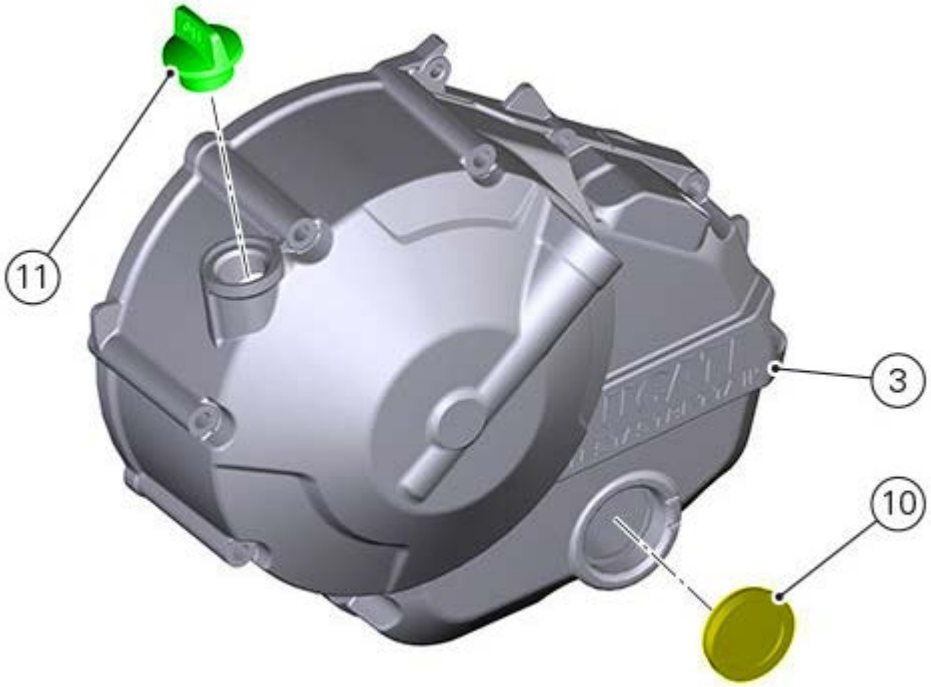


Apply the indicated lubricant to the oil sight glass (10).
Position it on clutch cover (3).
Tighten filler plug (11) to a torque of 5 Nm (min 4.5 Nm — max 5.5 Nm).

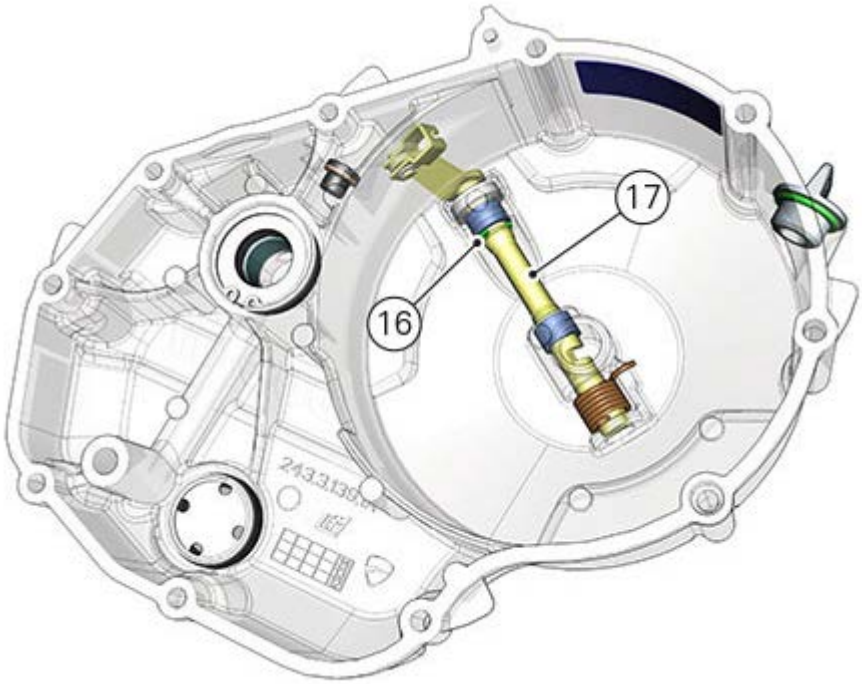


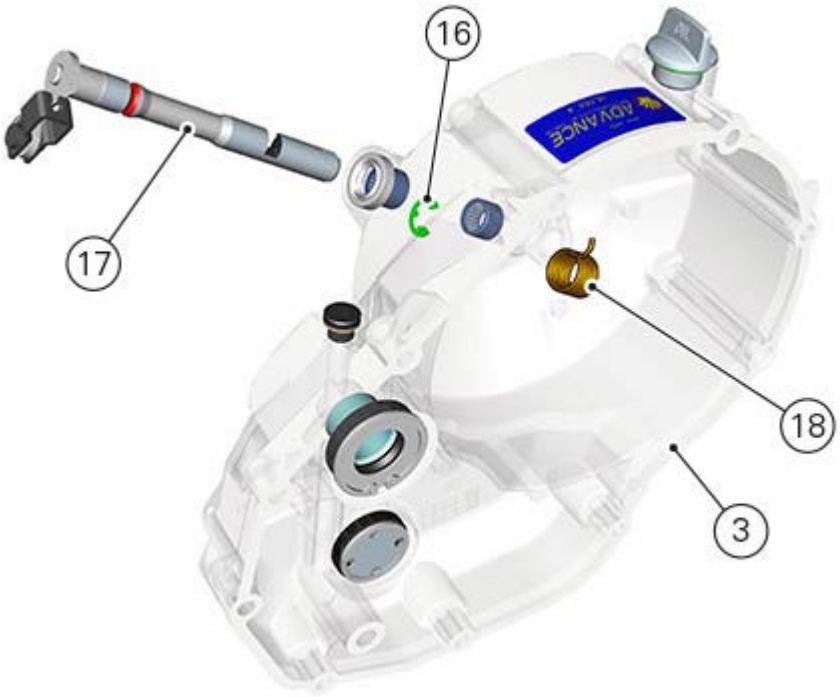
Disassembling the clutch cover

Remove oil sight glass (10) and plug (11) from cover (3).

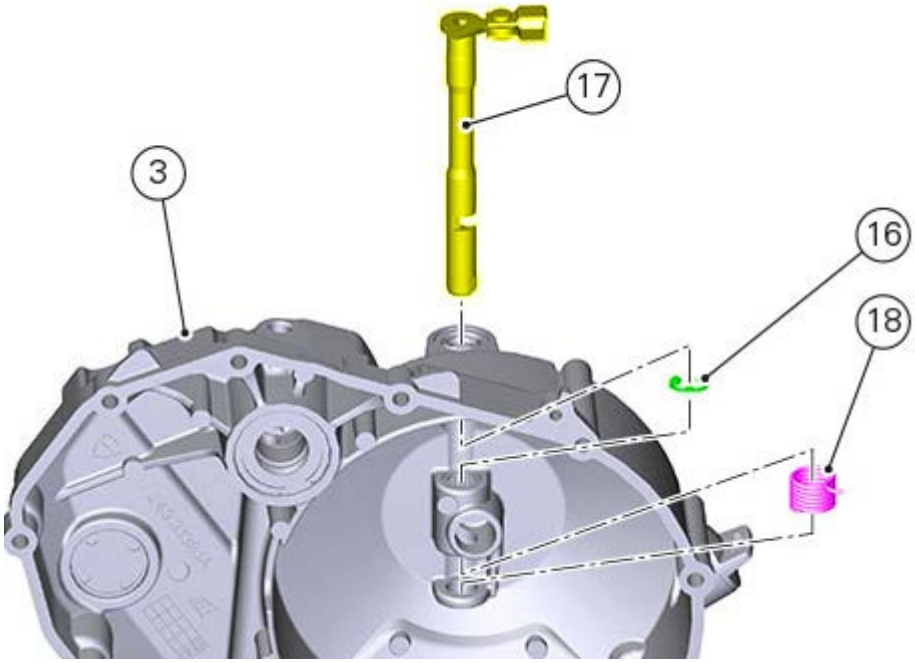


Remove snap ring (12), shim (13), seal ring (14) and crankshaft bushing (15) from cover (3).

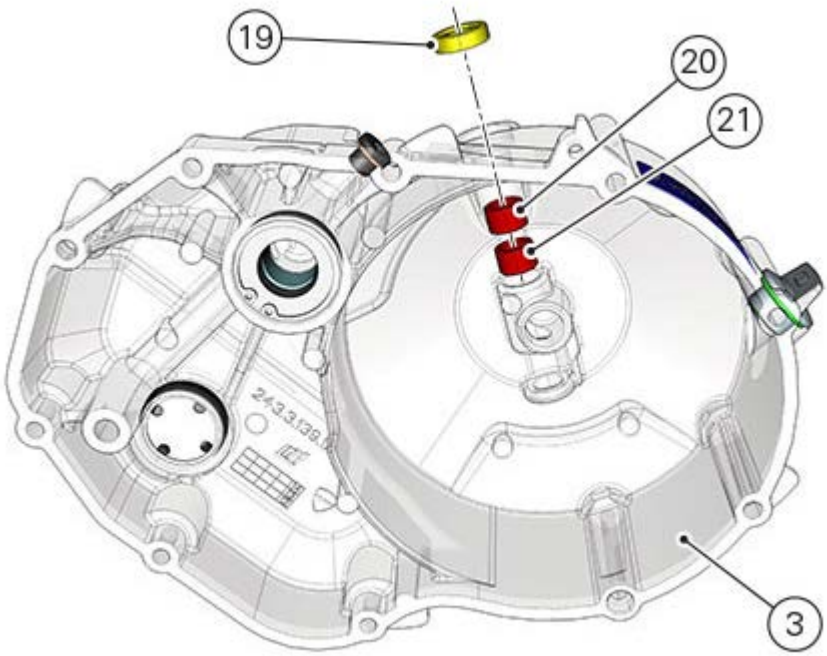




Remove snap ring (16) from cover (3). Slide out clutch drive shaft (17) and spring (18).



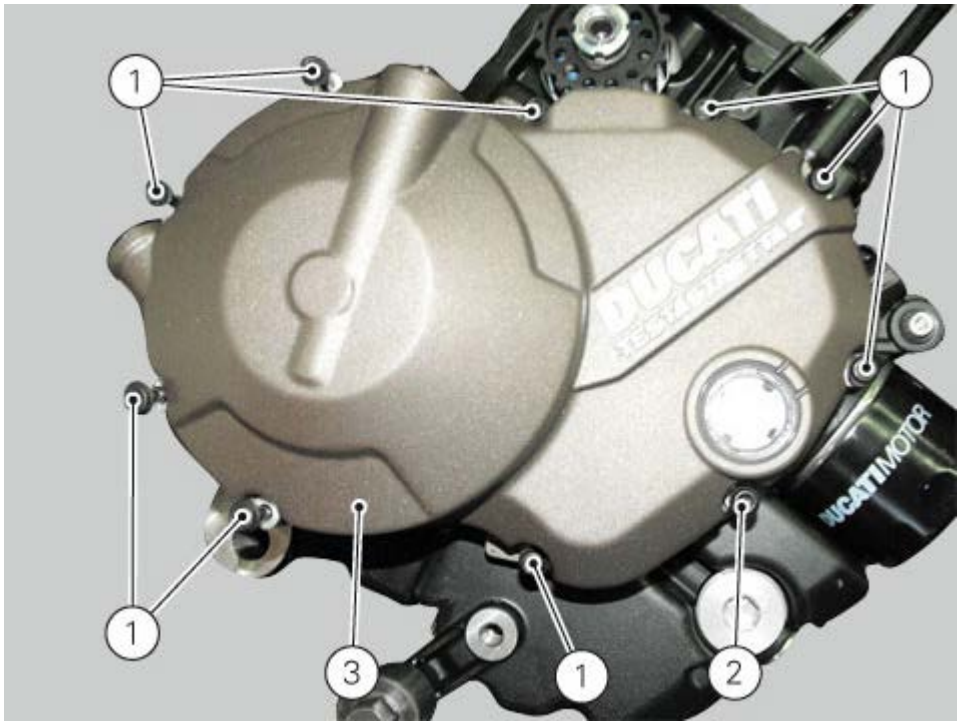
Remove seal ring (19), roller bearings (20) and (21) from cover (3).



Removing the clutch cover

Drain the engine oil (Changing the engine oil and filter cartridge).

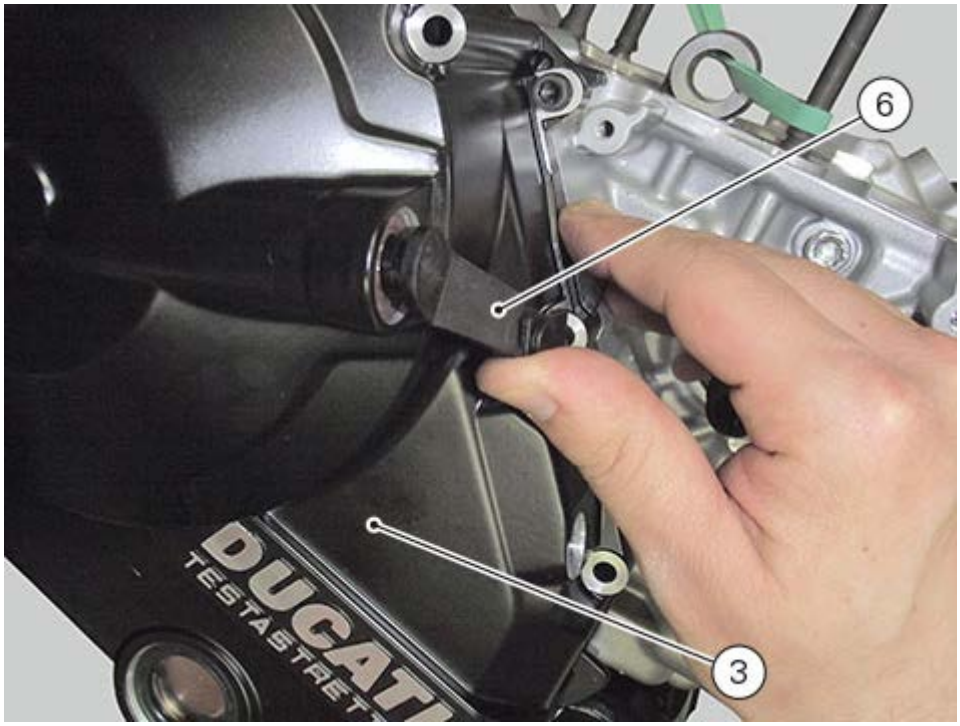
Loosen the fastening screws (1) and (2) on the clutch cover (3).

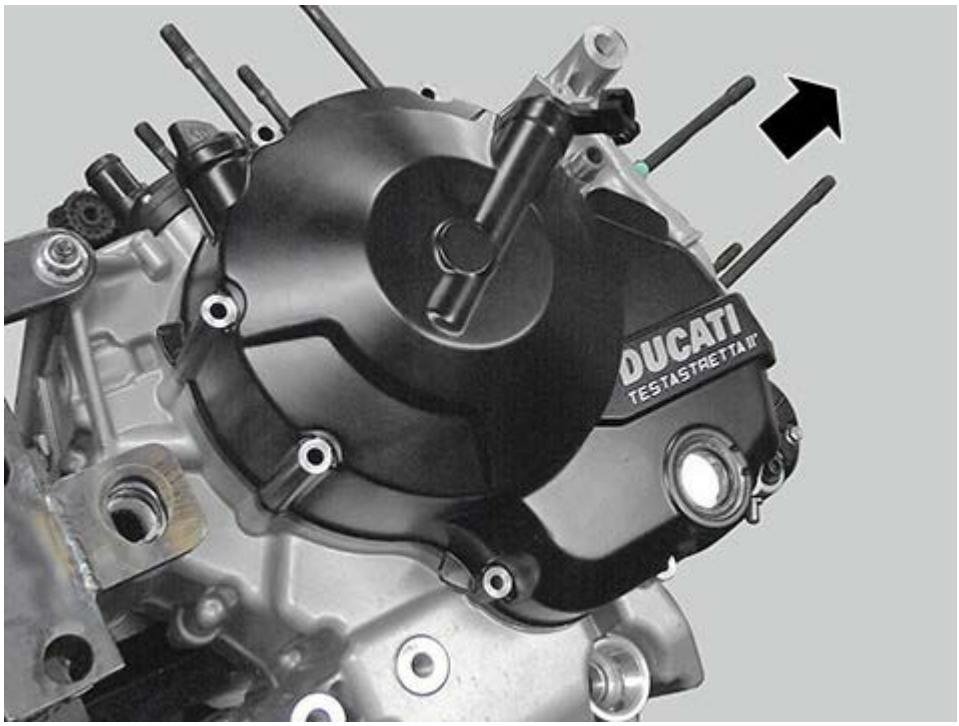


Screw clutch cable (4) fully home on clutch lever on handlebar, working adjuster (5).
Loosen adjuster (22).

Remove the clutch cable (4) from the clutch cover.

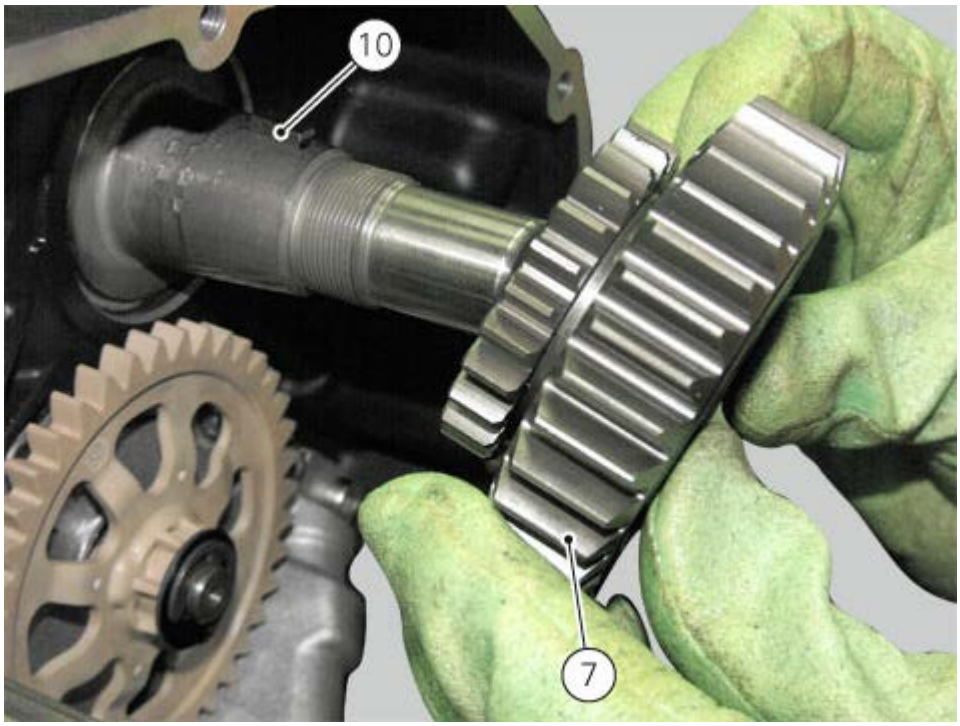
Working on clutch cover lever (6), slowly remove cover (3) to release it from clutch control pin (7).

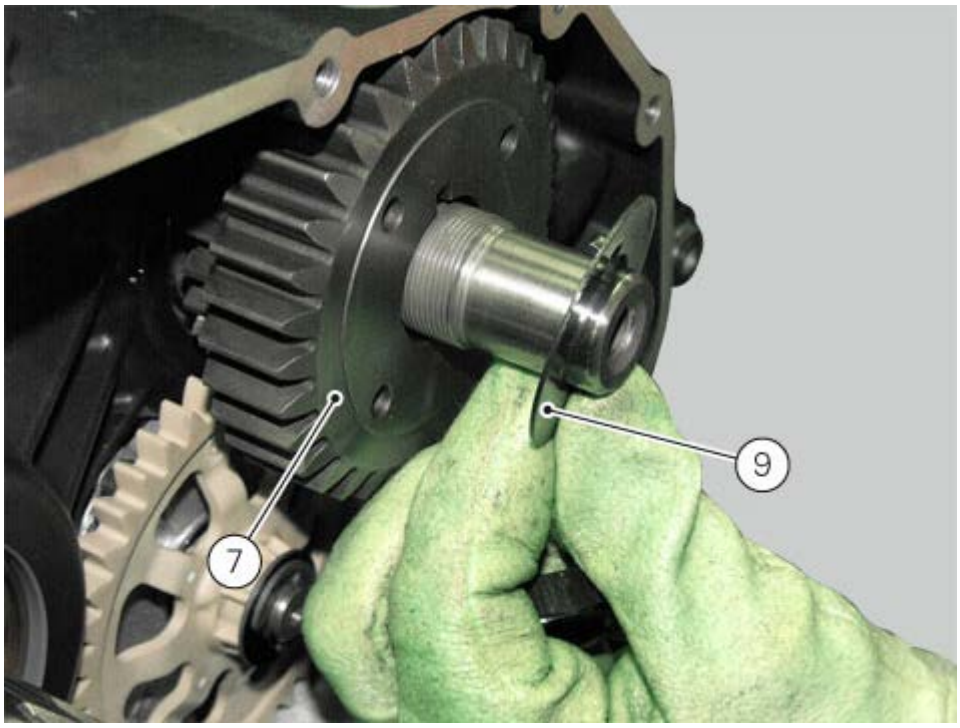




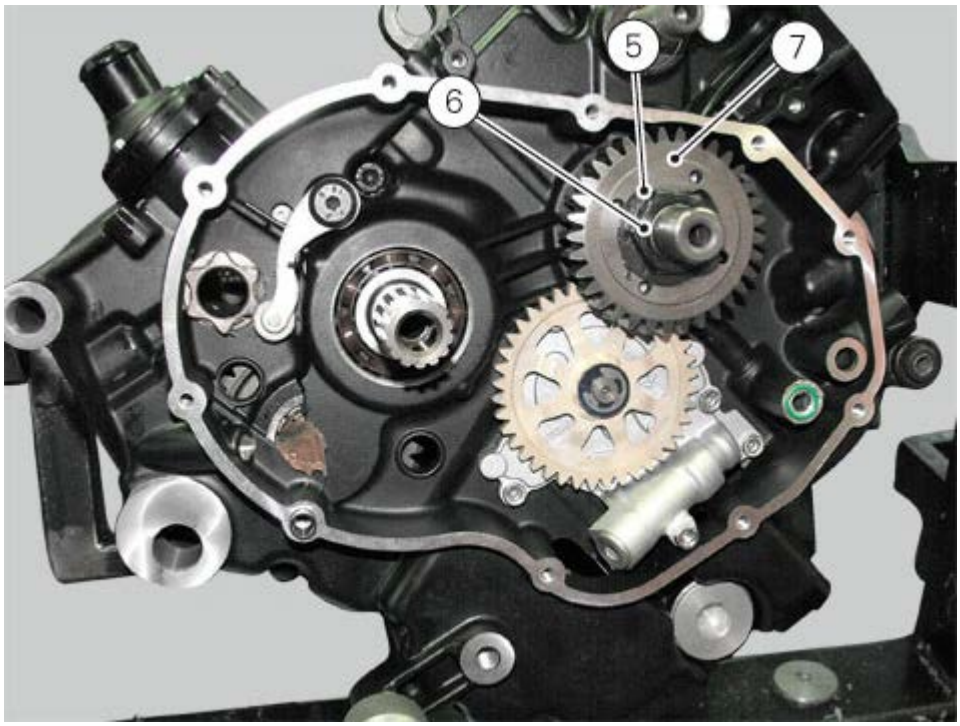
Refitting the primary drive gears

If previously removed, refit the complete oil pump and the oil pump gear (Refitting the water pump).
Fully degrease the crankshaft splined end and the corresponding spline on the primary drive gear.
Make sure that key (10) is positioned on crankshaft.
Insert washer (9) on crankshaft, respecting key (10) positioning.



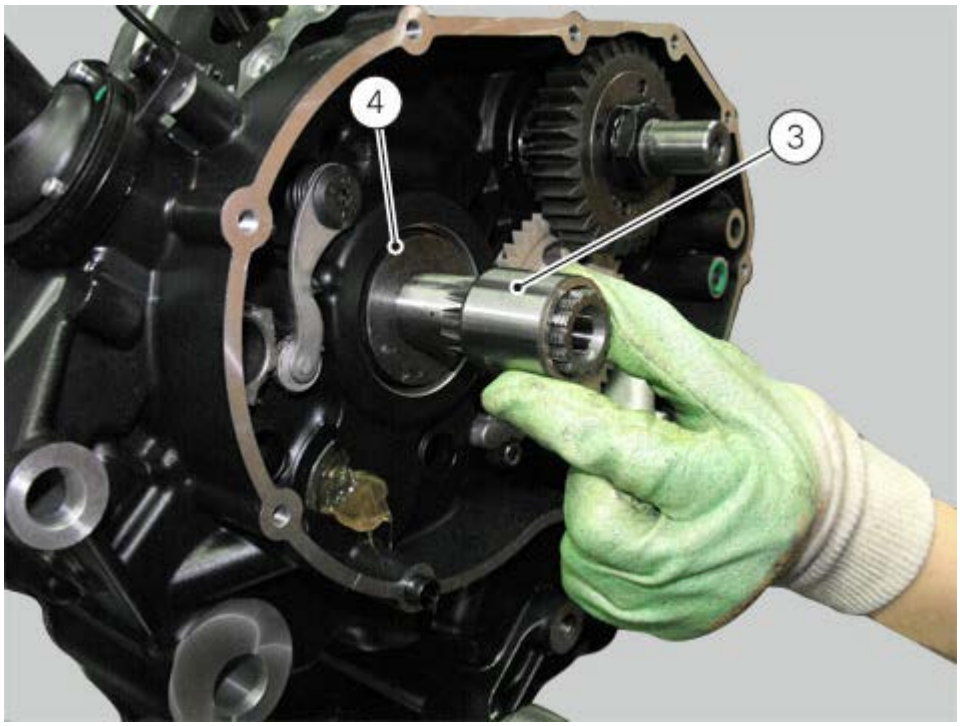


Fit the driving gear (7) onto the crankshaft with the oil pump drive sprocket facing the crankcase.
Temporarily secure the gear with the washer (5) and nut (6).

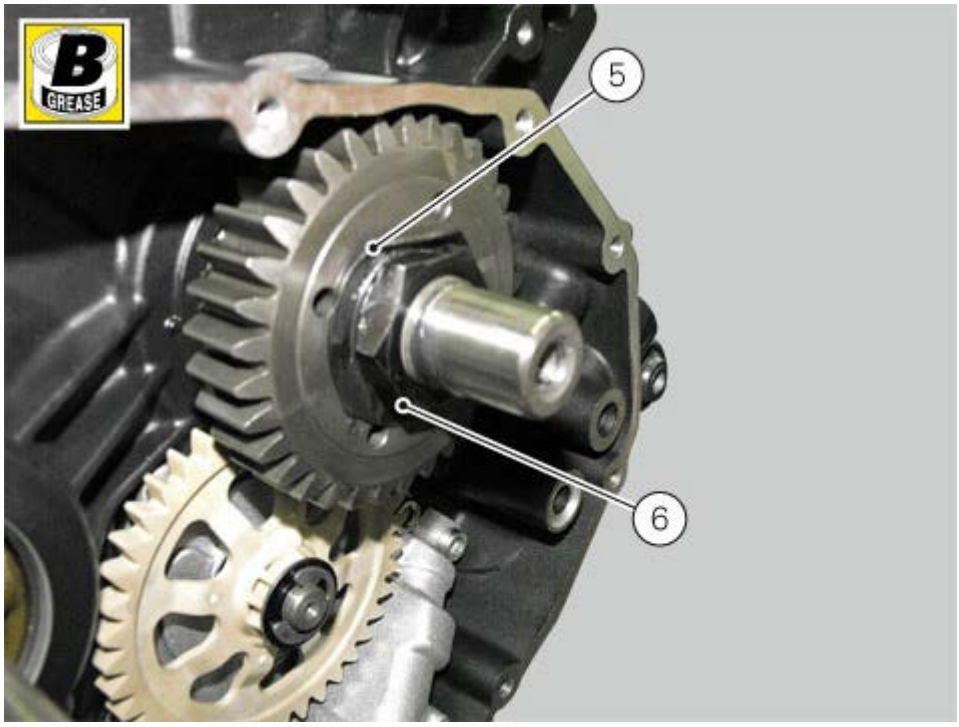


Warning
If fitting a new primary driving gear, check the backlash.

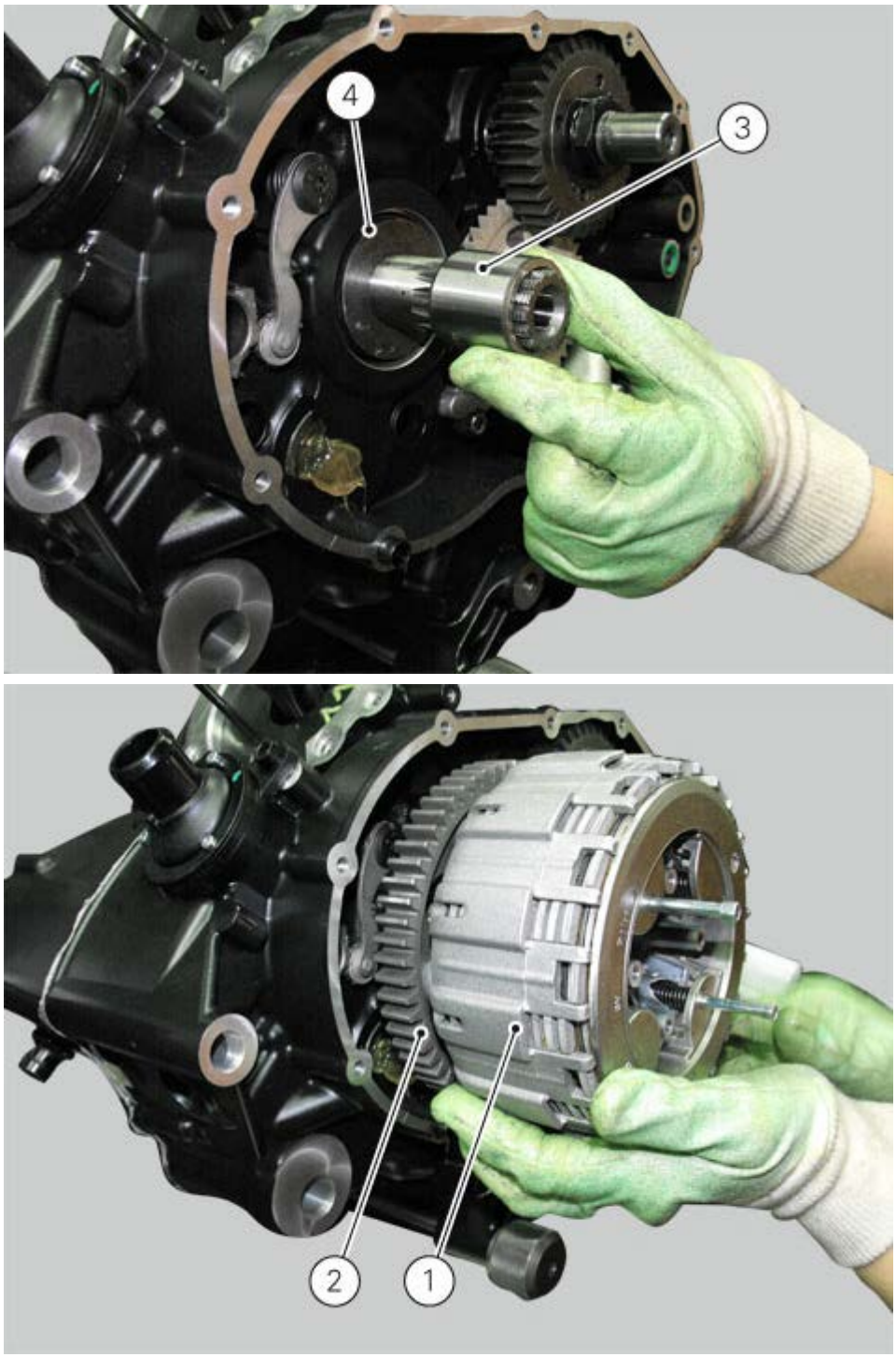
To check the backlash, temporarily fit the clutch housing (1) complete with inner spacer (3), the driven gear (2) and the inner race on the gearbox primary shaft.
Fix a dial gauge to the crankcase, positioning the stylus against a gear tooth.
Turn the driven gear (2) to mesh the teeth and check that backlash ranges between 0.05 and 0.07 mm.
Repeat the check at 16 different points of the driven gear.
If the measured values are outside the tolerance limits, try changing the position of driven gear (2) on the primary shaft, leaving the driving gear (7) on the crankshaft in the same position.
If the backlash is still outside the tolerance limits, replace the complete primary drive gears: gear (2) and gear (7).



After having checked the backlash, lock gear (7) using tool no. **88713.0137**, apply the indicated grease on nut (6), and tighten it to a torque of 190 Nm (Min. 171 Nm - Max. 209 Nm).
Bend the washer (5) over the nut (6).



Thoroughly degrease clutch housing (1), inner ring (3) and inner spacer (4) contact surfaces.
Insert inner spacer (4) inside primary shaft, with the flat side facing outside.
Fit the inner ring (3), the clutch housing (1) along with the driven gear (2).

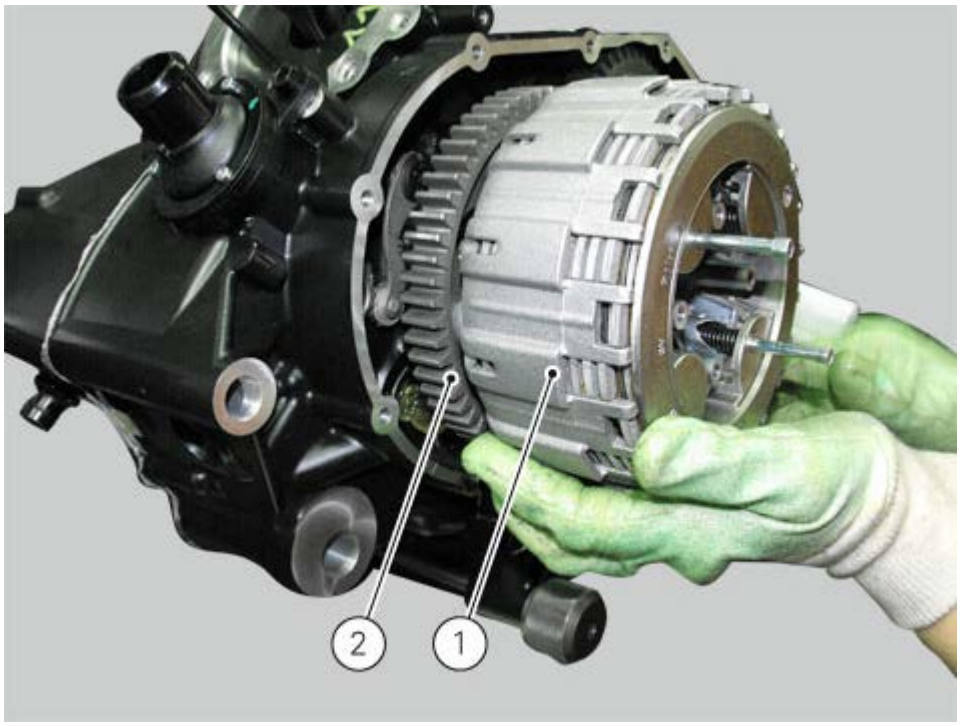


Refit the clutch unit (Refitting the clutch).
Refit the clutch cover (Refitting the clutch cover).
Fill the engine with oil (Changing the engine oil and filter cartridge).

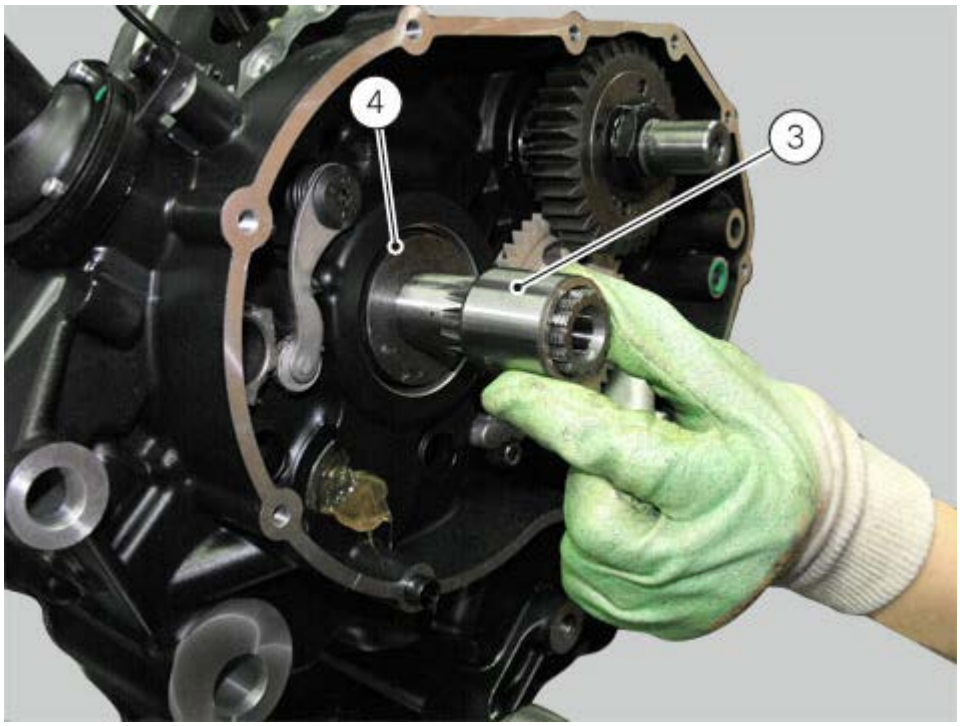
Removing the primary drive gears

Drain the engine oil (Changing the engine oil and filter cartridge).
Remove the clutch cover (Removing the clutch cover).
Remove the clutch unit (Removing the clutch).
Remove the oil pump (Removing the oil pump).

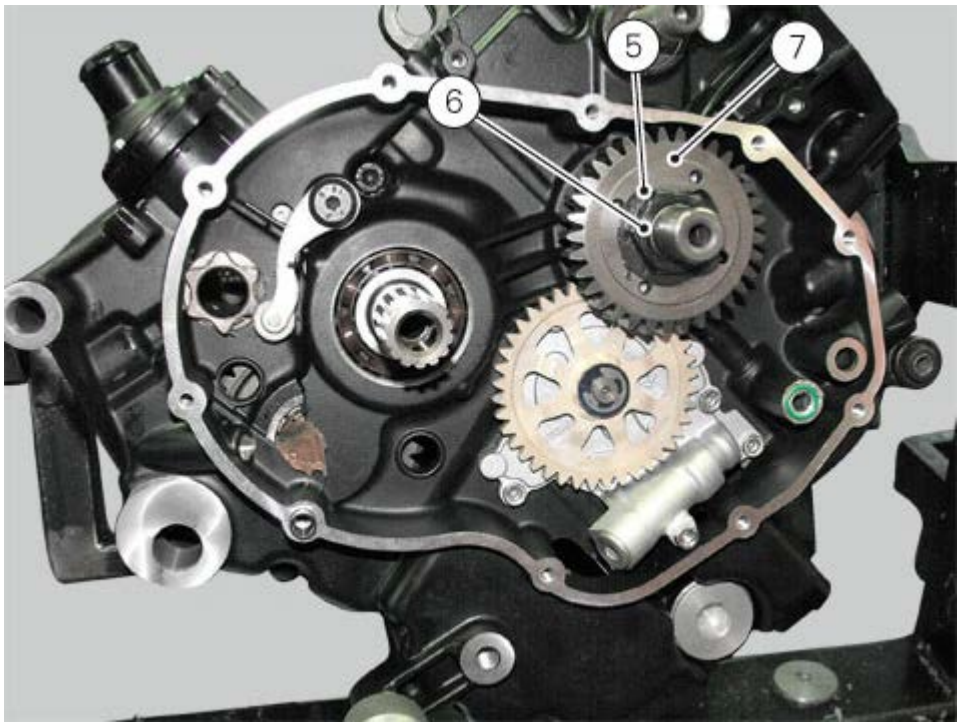
Remove the clutch housing (1) complete with primary driven gear (2).

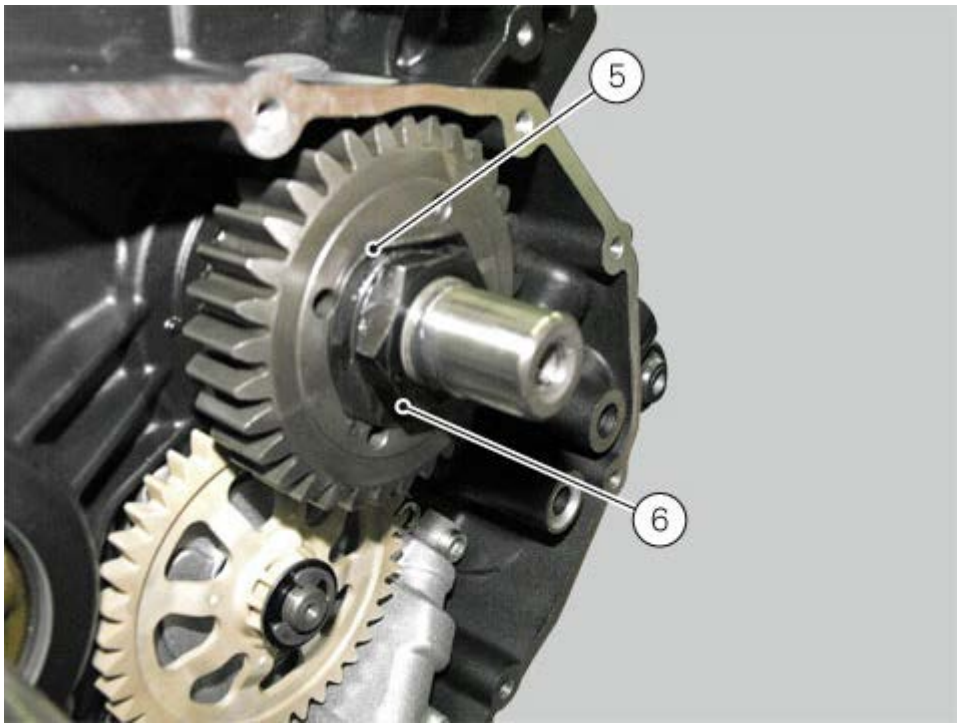


Remove inner ring (3) and inner spacer (4).



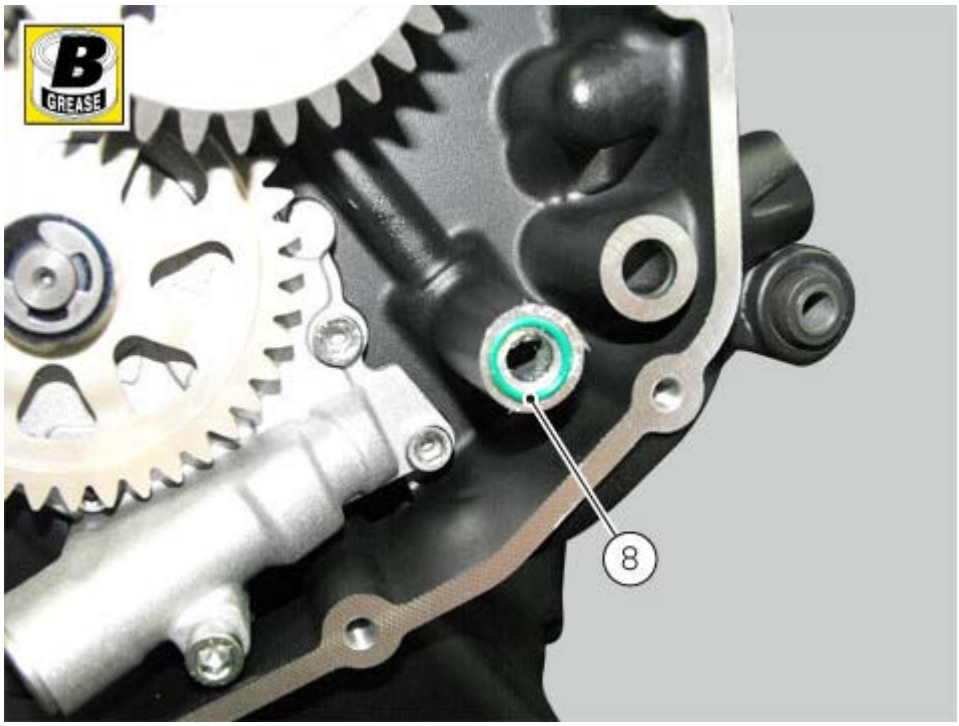
Straighten out lock washer (5) on primary drive driving gear (7) fastening nut (6).

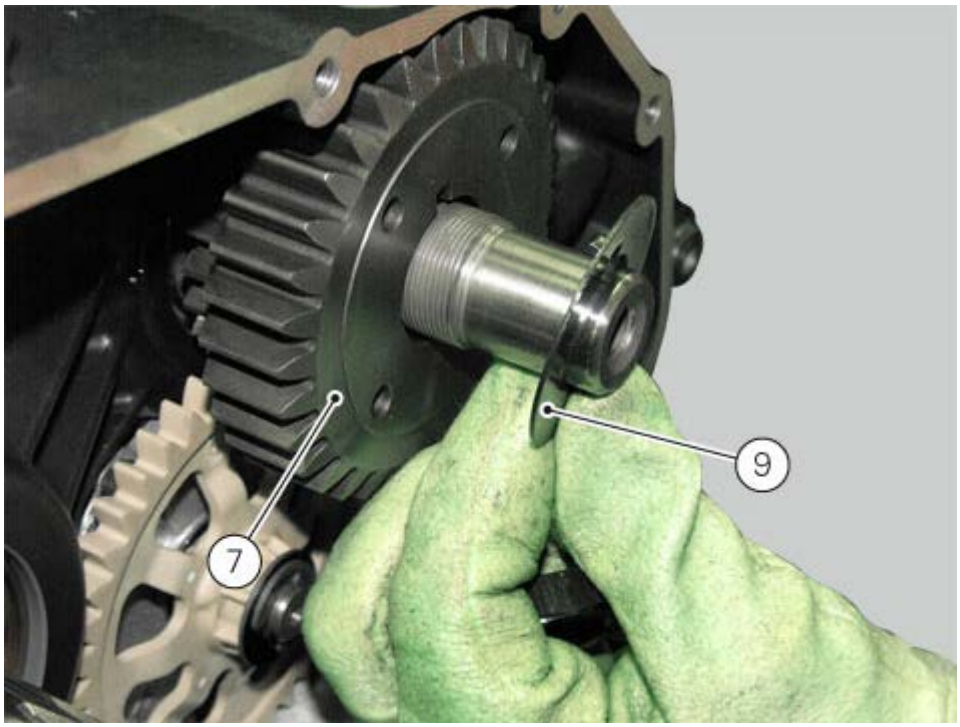




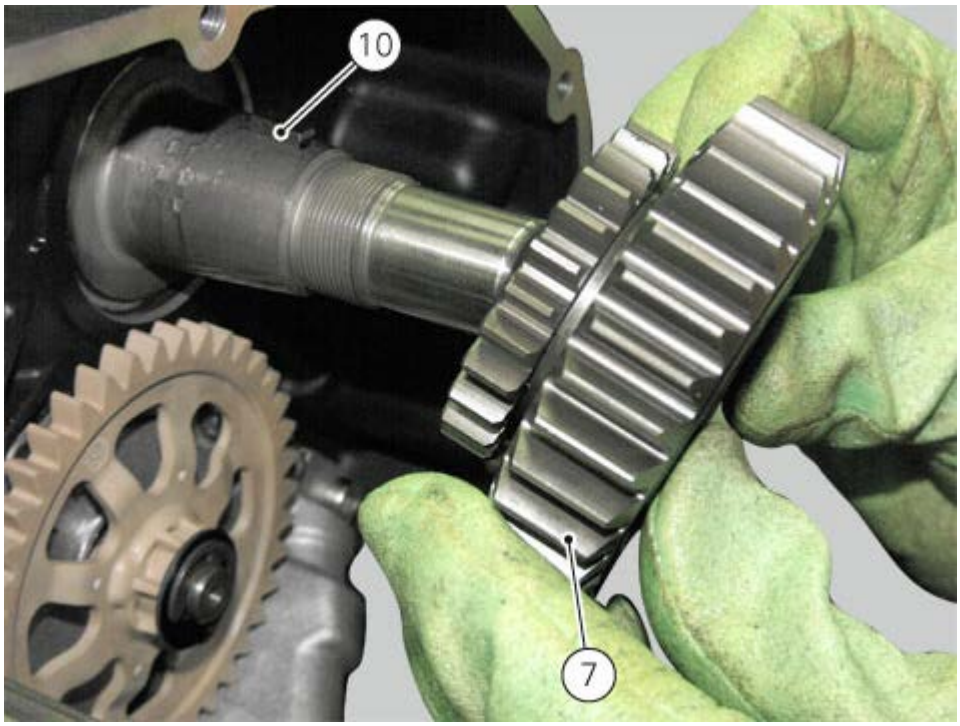
Replace the O-ring (8) after having lubricated it with the indicated product.

Lock the primary drive gear (7) with holding tool no. **88713.0137** and loosen sprocket nut (6). Remove nut (6), washer (9) and lock washer (5).





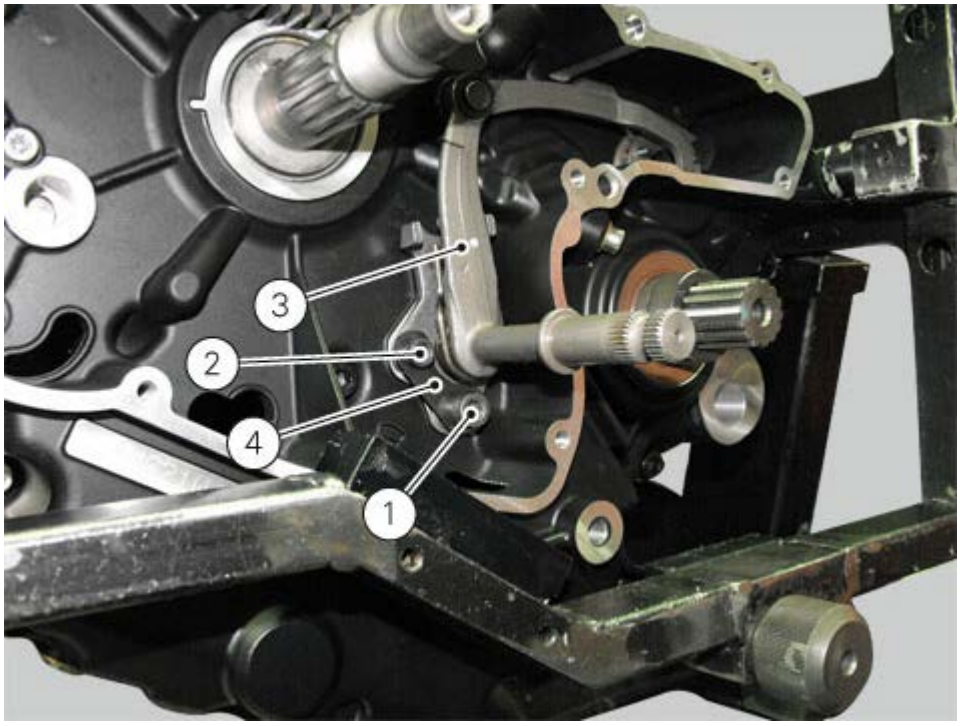
Remove the primary drive driving gear (7) using puller **88713.2092** and placing a brass or aluminium pad between crankshaft and puller screw.
Collect crankshaft key (10).



If necessary, remove the oil pump gear and the complete oil pump (Removing the oil pump).

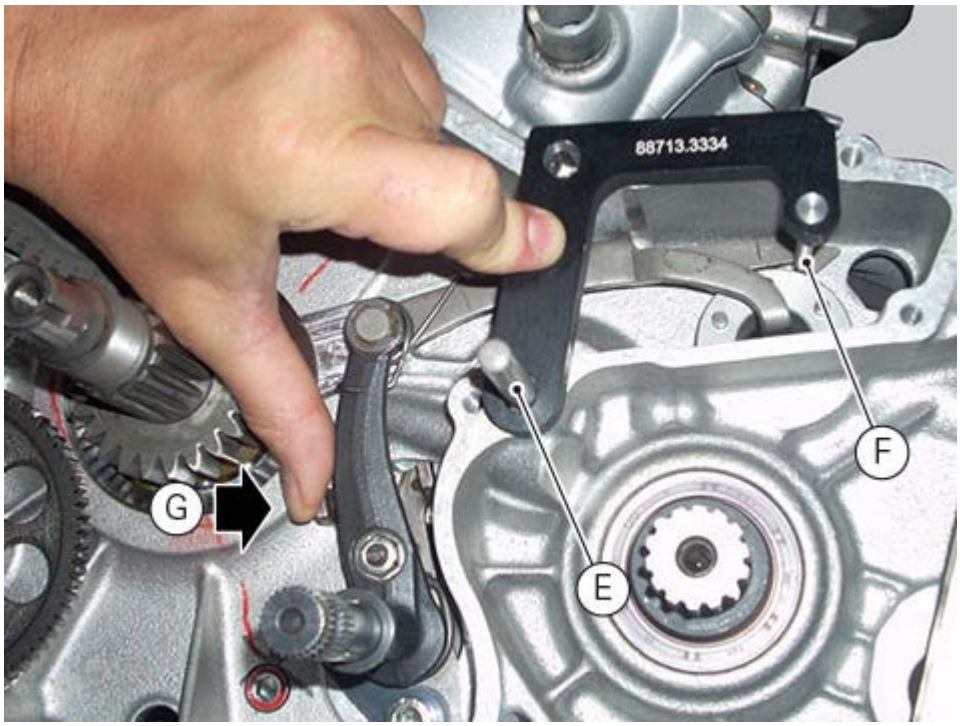
Refitting the gearchange mechanism

Position the gearbox drum selector fork in the centre of the gear rollers.
Position the gearchange mechanism (3) together with control shaft, spring and plate into the chain-side crankcase half.
Insert the screws (1) and (2) with the spacer (4).
Temporarily fit gearchange lever (or a service lever) and engine sprocket and shift to neutral gear.



Set tool (A) part no. **88713.3334** on the gearbox pawl.

Place tool (A) part no. **88713.3334** inserting a service pin (E) into the tool hole, block the pin (F) of the tool in the gear pawl pressing with the hand in the point (G) (pawl stroke stop plate) towards the right, as shown in photo.

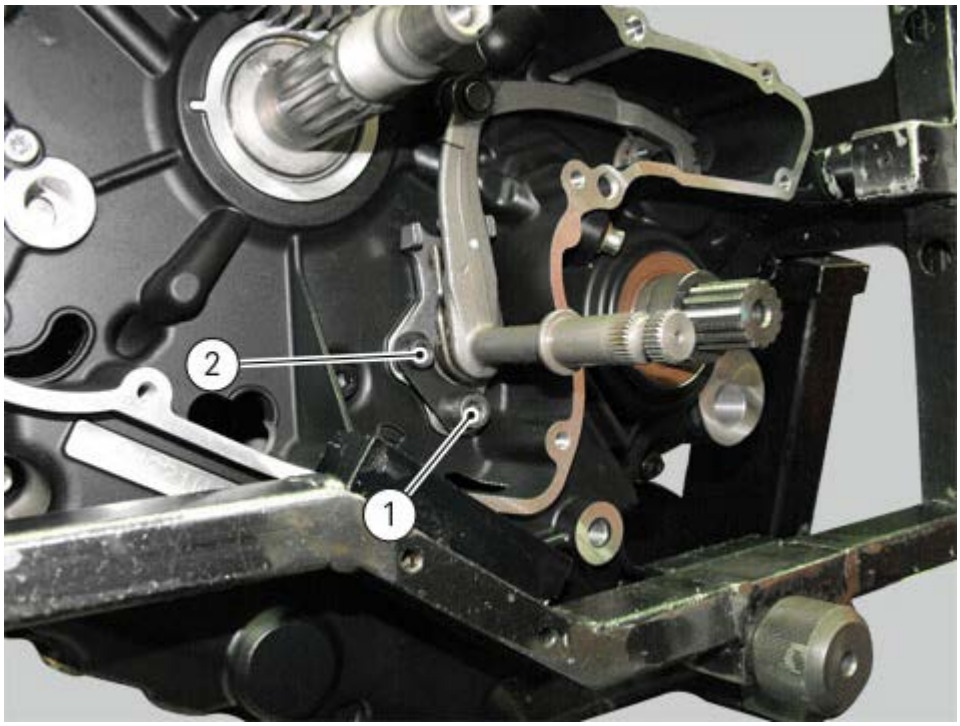


In this position tighten the screw (1) to a torque of 36 Nm (Min. 34 Nm - Max. 38 Nm) and the screw (2) to a torque of 16 Nm (Min. 15 Nm - Max. 17 Nm).

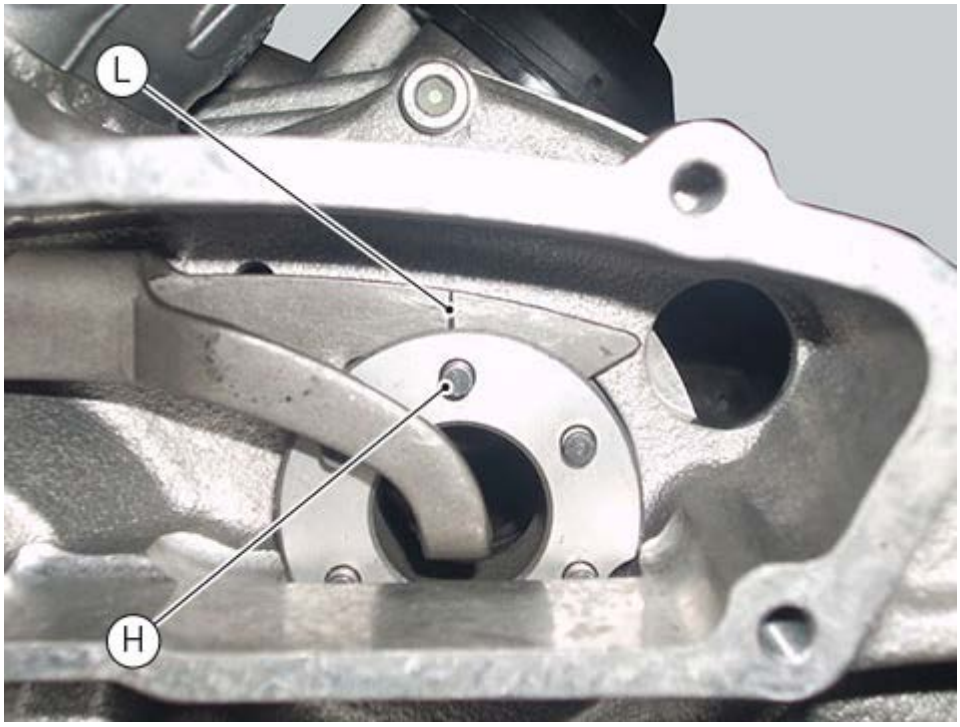
Warning
Make sure that the gearchange mechanism fixing screws are those indicated in our spare part catalogues. They must be screws of class 12.9 in order to respect the tightening torque indicated above.

Warning
Screws have pre-applied threadlocker. After having removed them for the second time, replace screws applying the indicated product.

Start tightening the first screw (1), and continue with screw (2).



Remove service tool.
Check that the pin (H) placed on the gearbox selector drum is aligned with the notch (L) on the gear pawl (with gear in neutral).

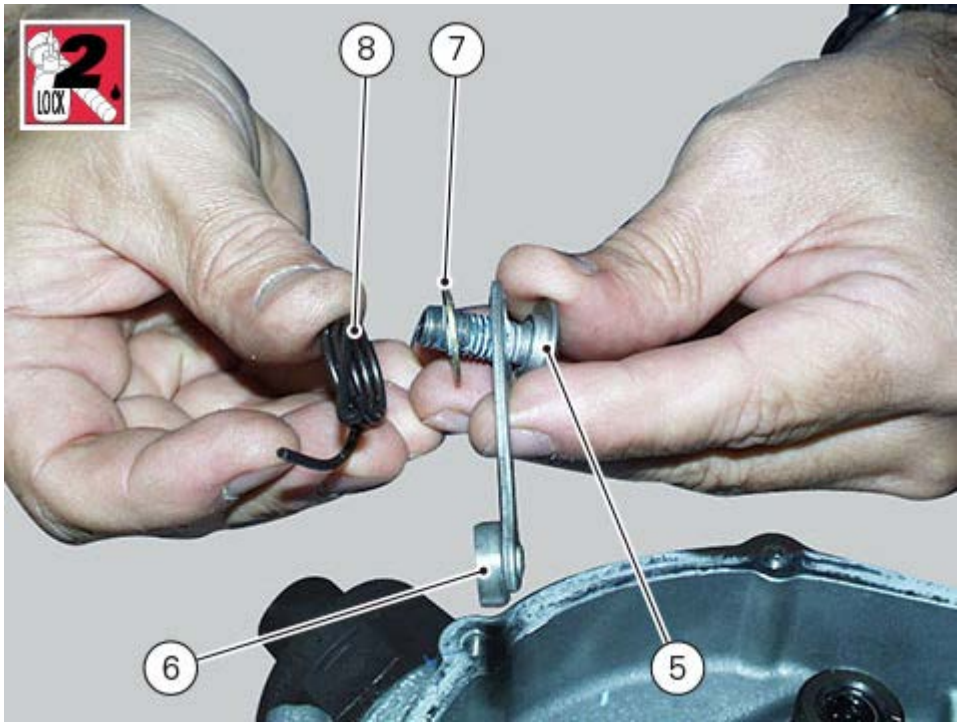


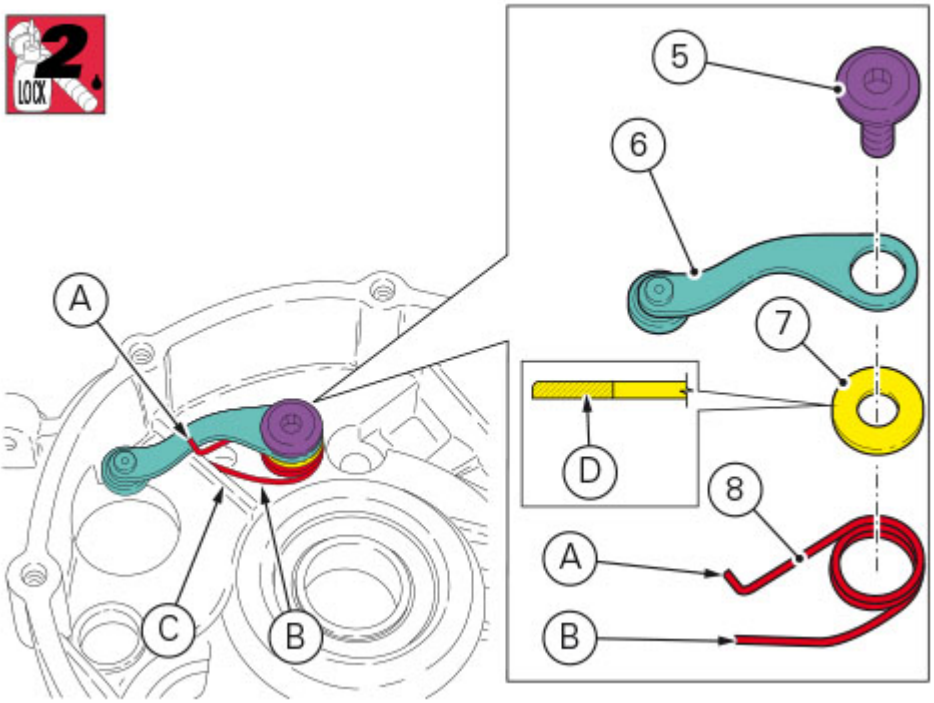
With the gearbox in neutral, check that the lever travel is the same when shifting up and down. The same should apply when a gear is engaged.
Operate the gearchange lever and turn the front sprocket at the same time to check that all the gears engage when shifting up and down.
Remove the previously installed lever and sprocket.

Refit the flywheel/generator assembly and the generator cover (Refitting the flywheel/generator assembly).
Refit the pump-water radiator hose (Refitting cooling system hoses and unions).
Refit the pump-cylinder hoses (Refitting the cylinder/piston assembly).
Refill the cooling system (Changing the coolant).
Refit the gear shift (Refitting the gearbox unit).
Fill the system with engine oil (Changing the engine oil and filter cartridge).

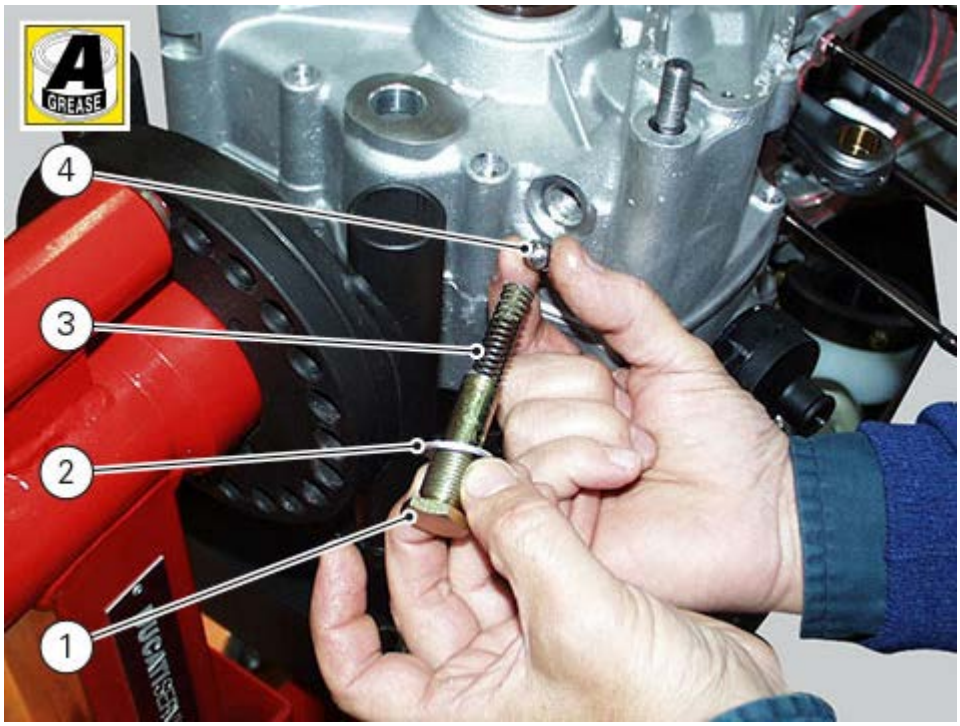
Refitting the gear interlock plunger and ratchet

On the special screw (5), fit the gear ratchet (6), orienting it as shown in the figure, the washer (7) with the square edge side (D) facing the clutch-side crankcase half, and the spring (8), positioning it so that the hook end (A) is facing the gear ratchet.
Locate the hook (A) of the spring on the gear ratchet as shown in the figure.
Apply threadlocker to the screw thread.
Start the screw in the crankcase half.
Position end (B) of the spring so that it rests against rib (C) of the crankcase half, as shown in the figure.
Tighten screw (5) to a torque of 18 Nm (Min. 16 Nm - Max. 20 Nm).
Manually move the gear ratchet to check for proper spring operation.





Grease and then fit the ball (4), spring (3), and seal (2) to the gear interlock plunger (1).
Tighten the gear interlock plunger to a torque of 30 Nm (Min. 27 Nm - Max. 33 Nm).

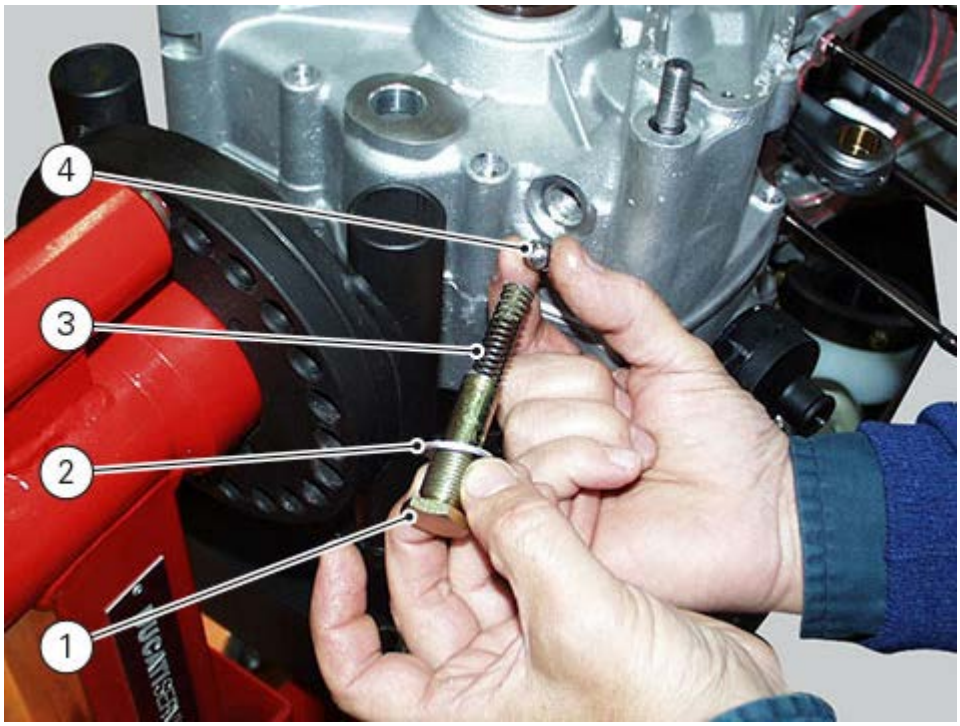


Refit the primary drive gear (Refitting the primary drive gear and checking backlash).
Refit the clutch unit (Refitting the clutch).
Refit the clutch cover (Refitting the clutch cover).
Fill the system with engine oil (Changing the engine oil and filter cartridge).

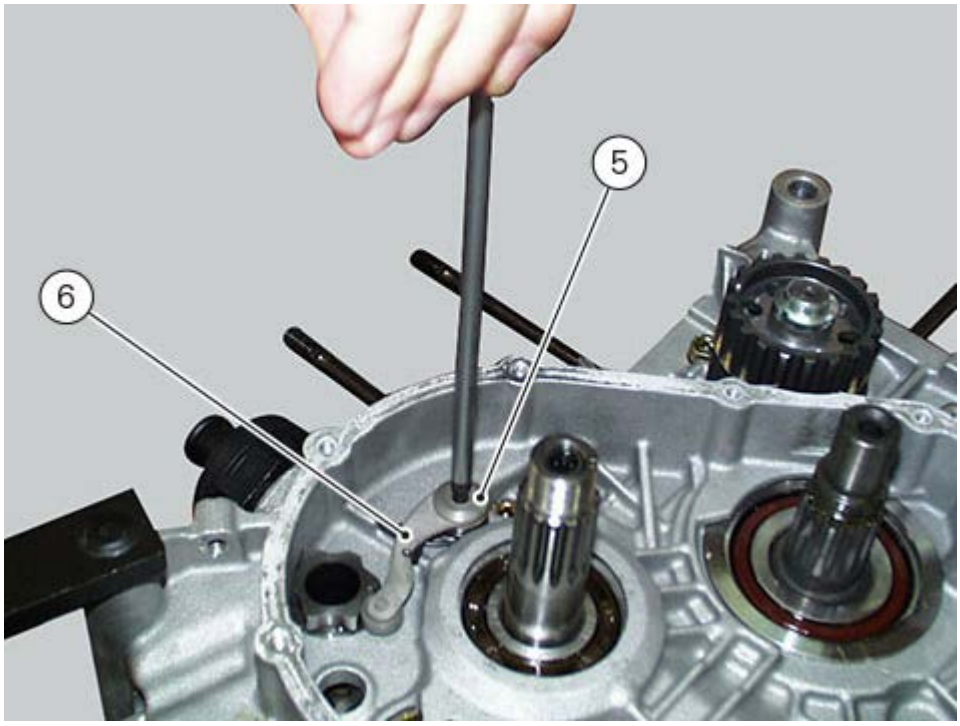
Disassembling gear interlock plunger and ratchet

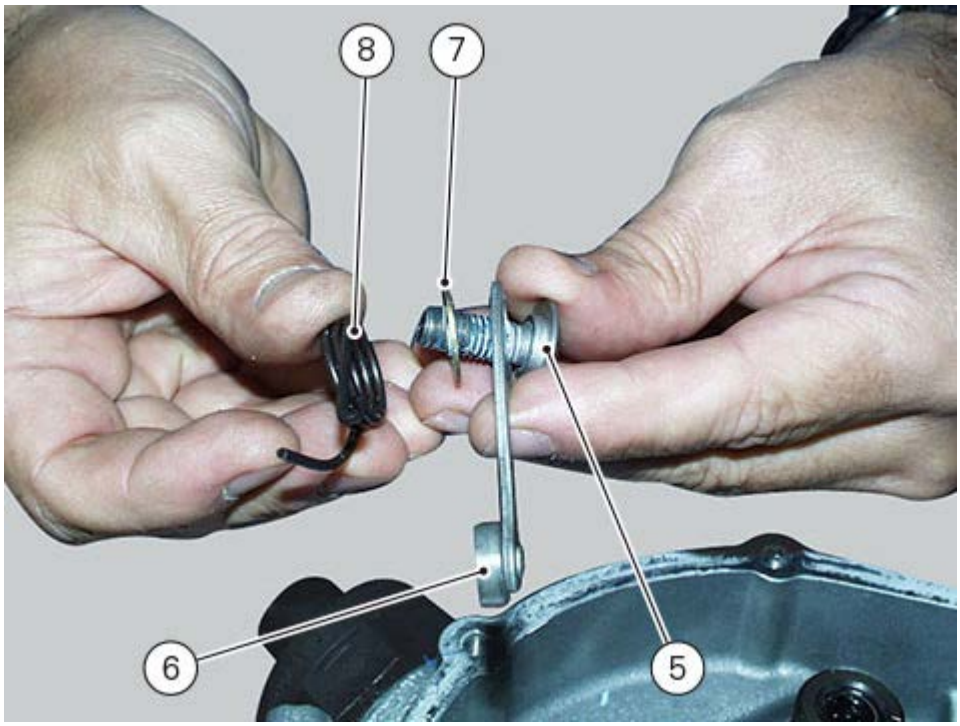
Drain the engine oil (Changing the engine oil and filter cartridge).
Remove the clutch cover (Removing the clutch cover).
Remove the clutch unit (Removing the clutch).
Remove the primary drive gear (Removing the primary drive gear).

Undo the interlock plunger screw (1) and remove the seal (2), the spring (3) and the ball (4).



Undo the clutch-side crankcase half screw (5) and remove the ratchet (6), the washer (7) and the spring (8).

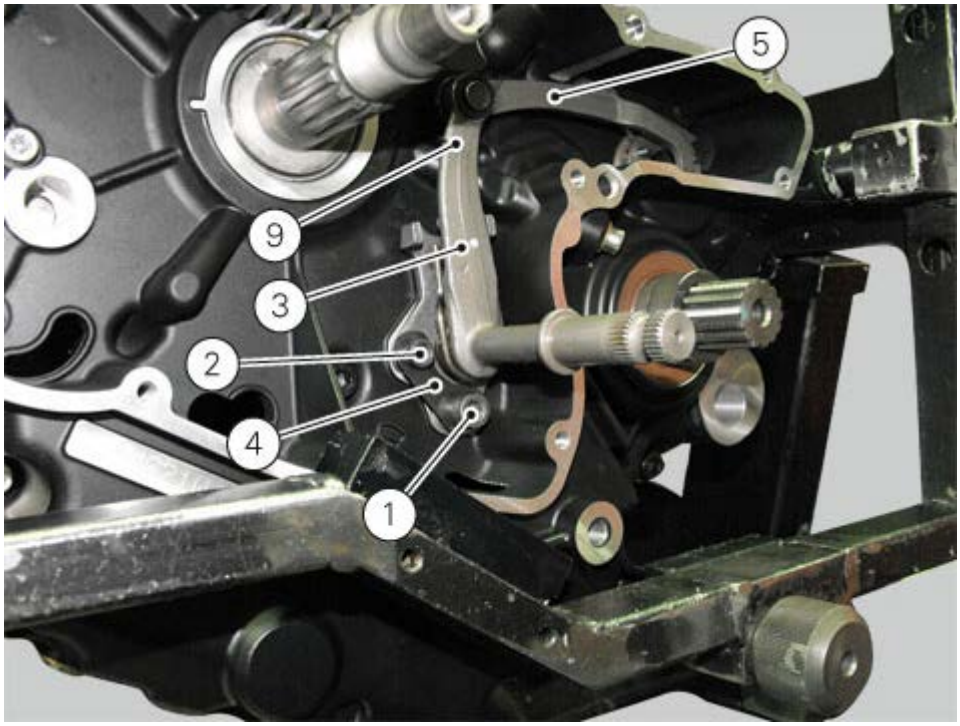



8
7
6
5

Removing the gearchange mechanism

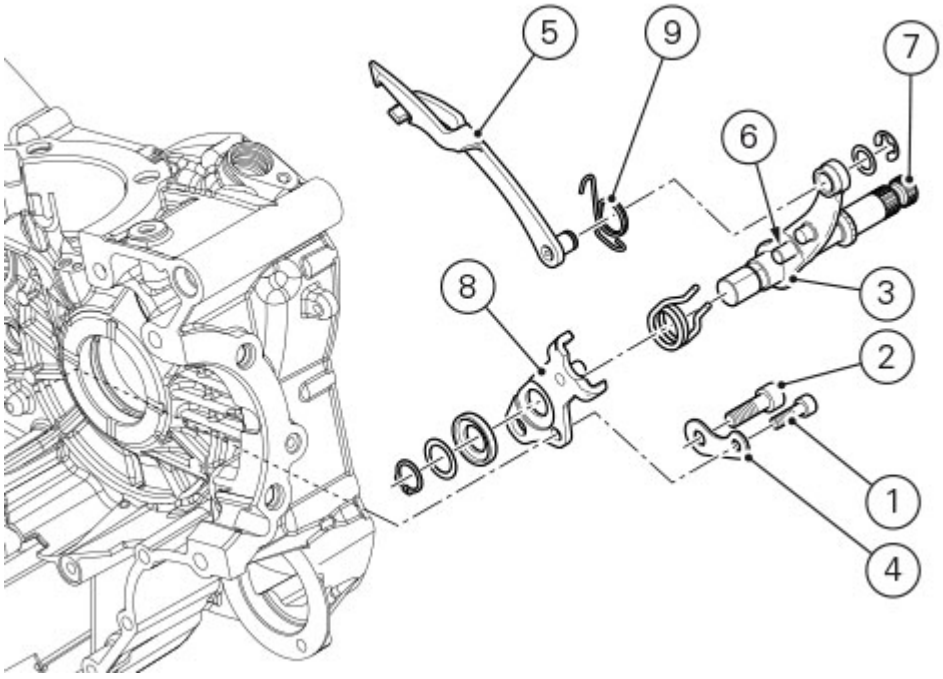
Drain the engine oil (Changing the engine oil and filter cartridge).
Remove the gear shift (Removing the gearbox unit).
Drain the coolant (Changing the coolant).
Remove the pump-cylinder hoses (Removing the cylinder/piston assembly).
Remove the pump-water radiator hose (Removing cooling system hoses and unions).
Remove the generator cover (Removing the generator cover) and the flywheel-generator assembly (Removing the flywheel/generator assembly).

Undo and remove the fixing screws (1) and (2) of the complete gearchange mechanism (3) and collect the spacer (4).
Remove the gearchange mechanism complete with the shaft, spring, and plate.

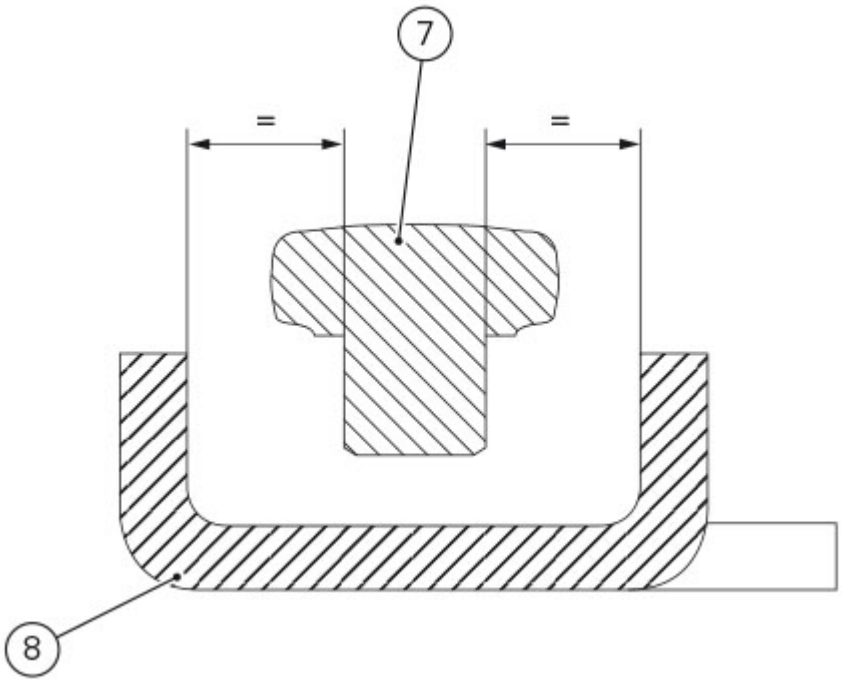


Visually inspect the gear selector fork (5) for wear, particularly around the area where it contacts the selector drum.

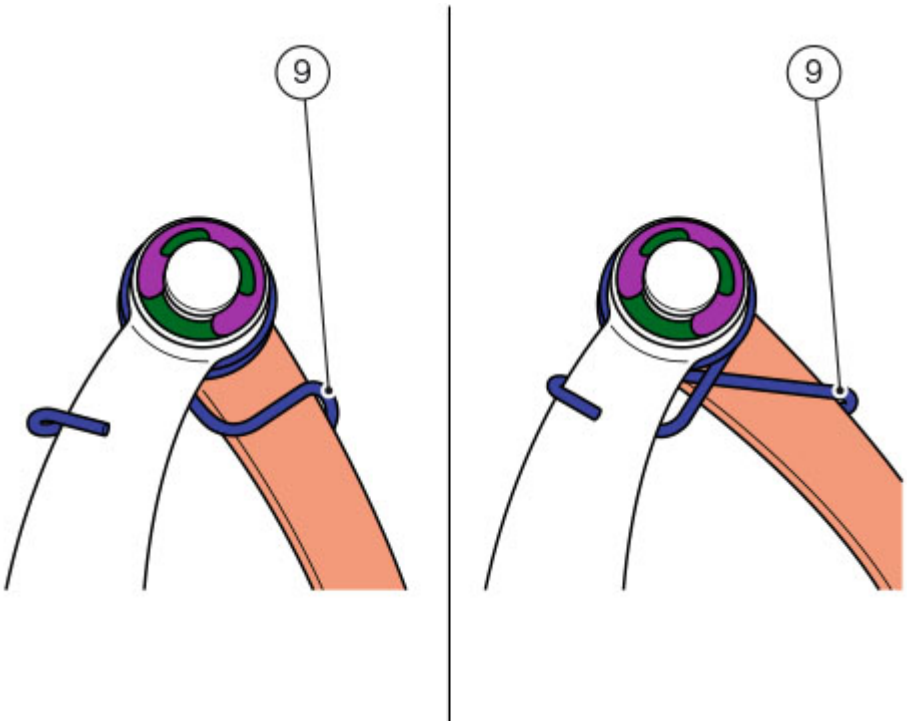
If it proves necessary to change components, disassemble the gearchange mechanism as shown in the exploded view.



Reassemble the gearchange mechanism orienting the eccentric pin (6), suitably lubricated, in such a way that the lever (7) is positioned centrally with respect to the shoulders of the stop plate (8).

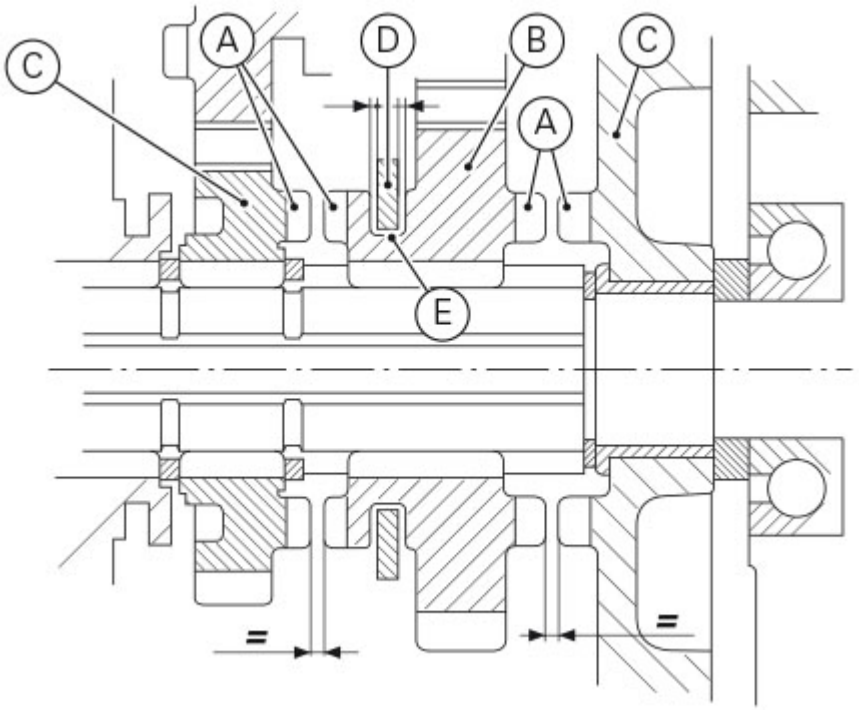


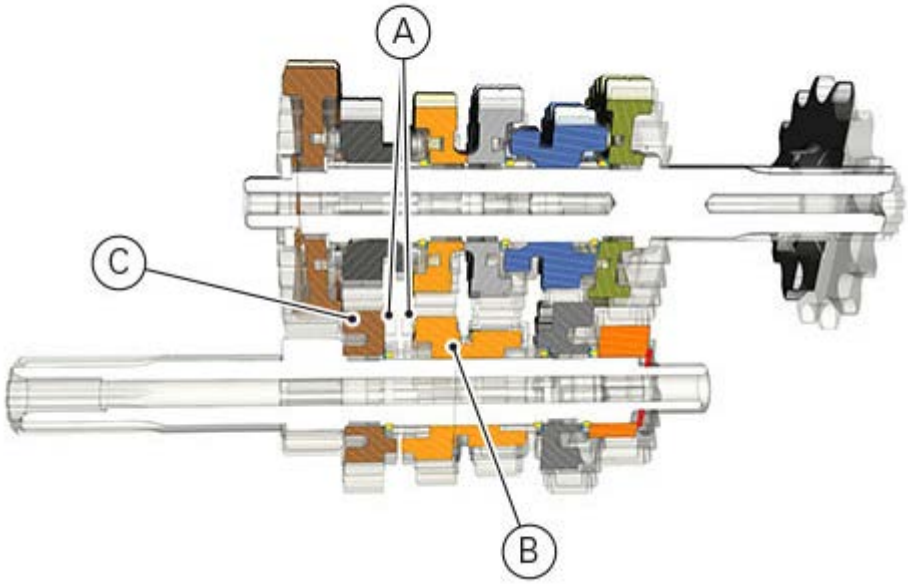
Check that the spring (9) is installed correctly as shown in the figure.



Reassembling the gearbox assembly

To refit the gearbox components follow the procedure under chapter "Closing the crankcase" relating to the reassembly of the crankcase.
As a final practical test, ensure that with the gearbox in neutral the front coupling dogs (A) of sliding gears (B) are equidistant on both sides with respect to the corresponding coupling dogs on the fixed gears (C). Check also that there is always a small amount of clearance between fork (D) and relative groove (E) on sliding gear (B) when engaging the gears.



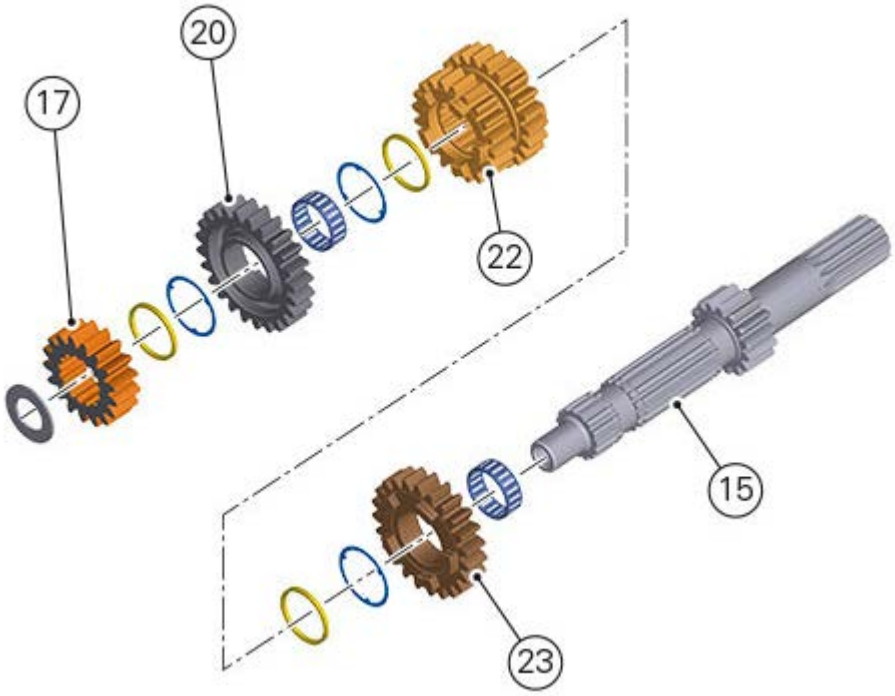


Close the crankcase halves (Closing the crankcase).
Refit the primary drive gear (Refitting the primary drive gear and checking backlash).
Refit the clutch unit (Refitting the clutch).
Refit the clutch cover (Refitting the clutch cover).
Refit the starter motor (Refitting the starter motor).
Refit the complete generator (Fitting the flywheel/generator assembly) and the generator side cover (Fitting the generator cover).
Refit the oil pump (Refitting the oil pump).
Refit the complete cylinder/piston assembly (Refitting the cylinder/piston assembly).
Refit the complete cylinder head assembly (Refitting the cylinder heads).

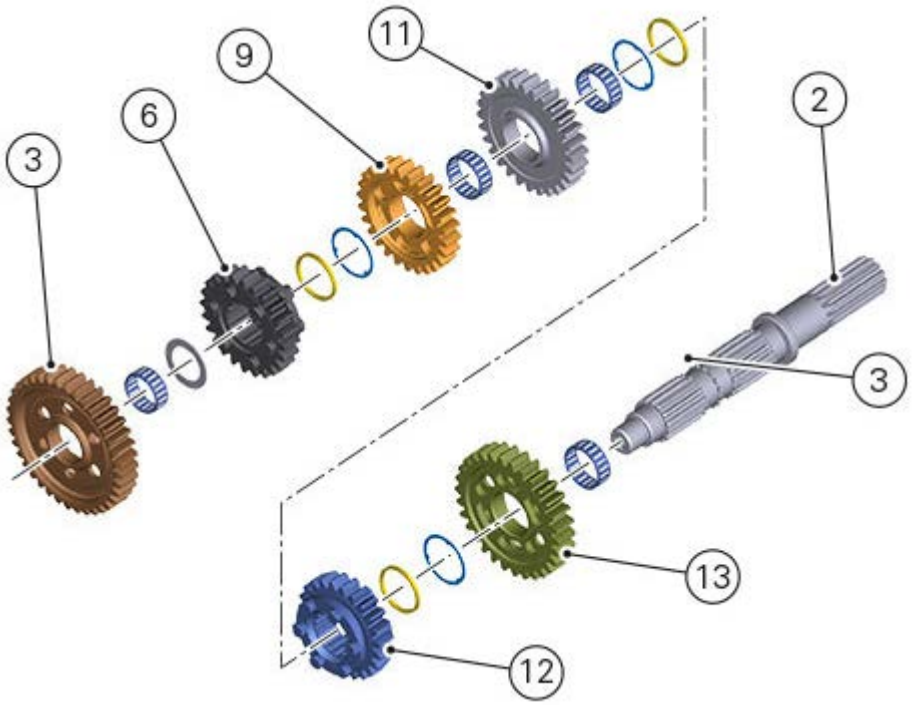
Refit the timing pulleys (Refitting the timing layshaft pulley).
Refit the timing belts (Refitting the timing belts).
Refit the external timing belt covers (Refitting the timing belt external covers).
Refit the engine in the frame (Refitting the engine).

Reassembling the gearbox shafts

The figure shows all components that must be fitted on the primary shaft (15).



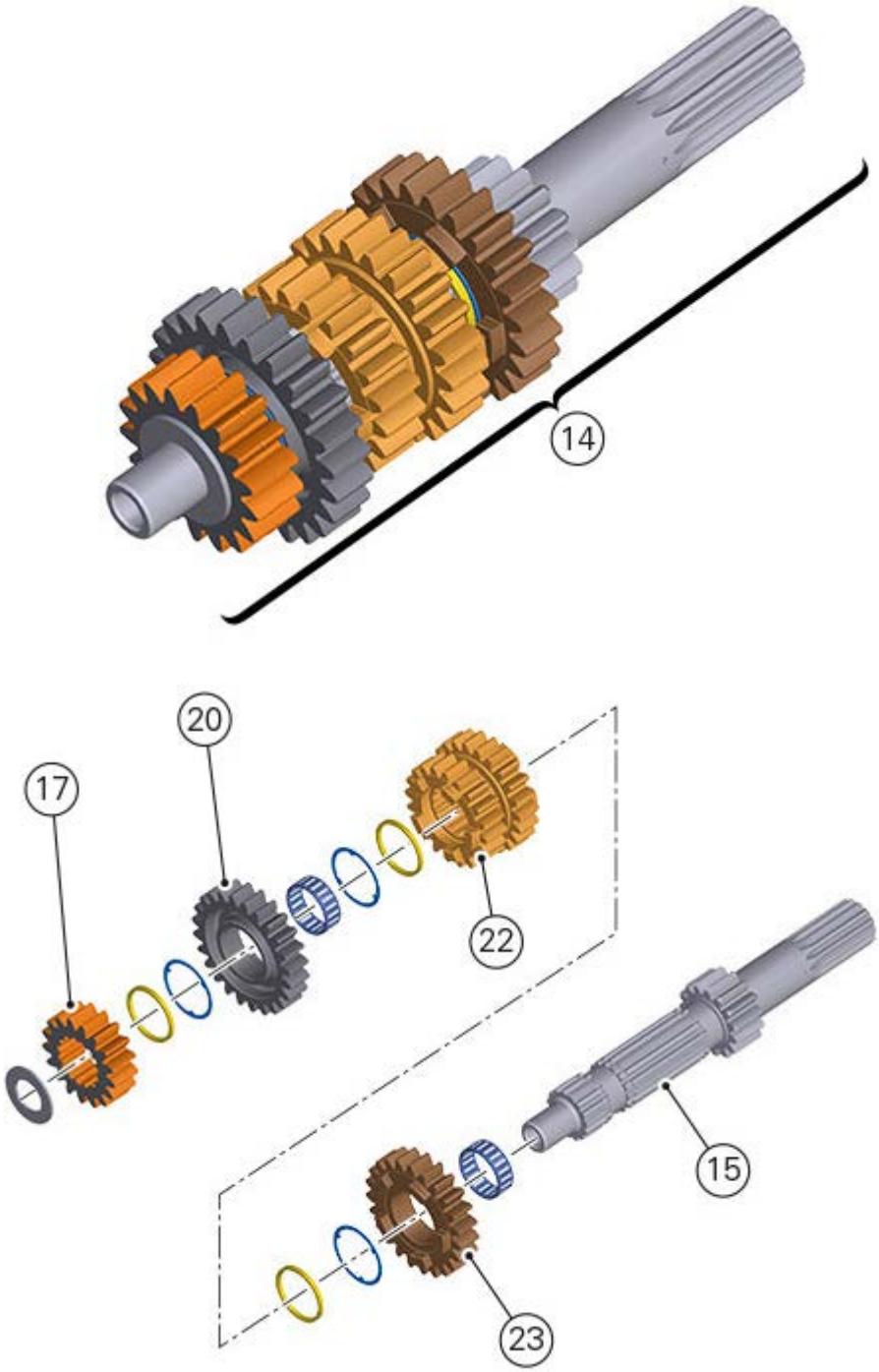
The figure shows all components that must be fitted on the secondary shaft (2).



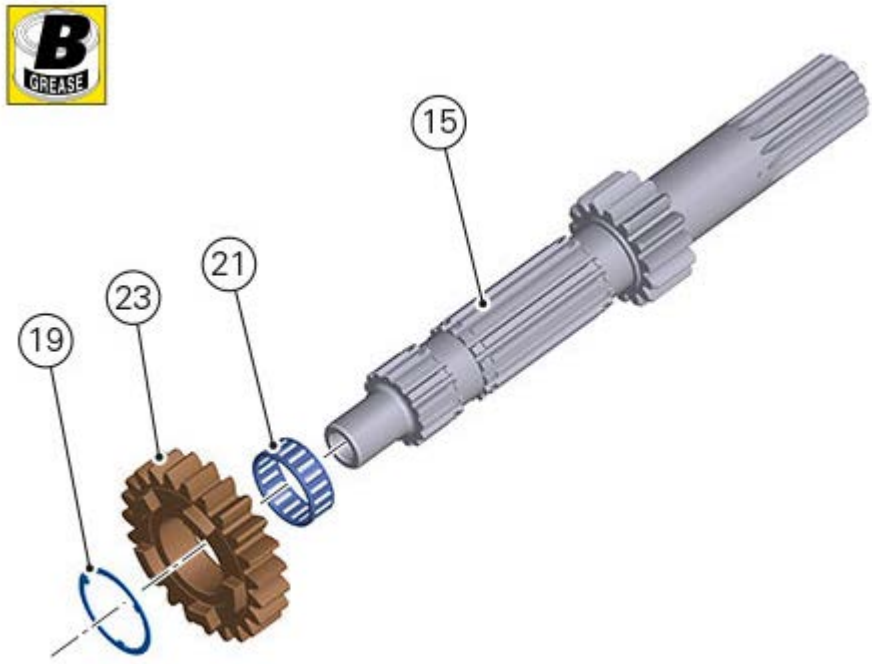
Refit gears and components on gearbox shafts, reversing the disassembly procedure.
Respect gear assembly direction, driving them fully home.

REASSEMBLING THE PRIMARY SHAFT

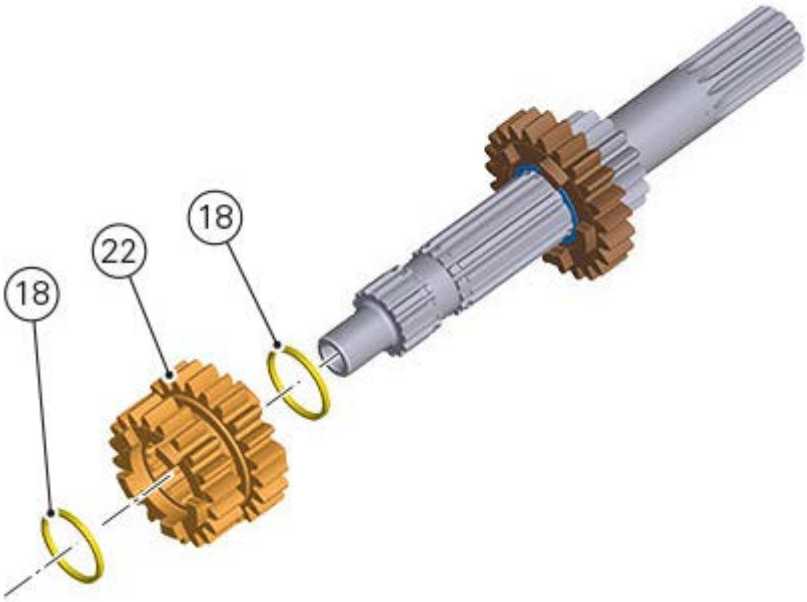
Reassemble the complete primary shaft (14), inserting the components listed below on chain side.



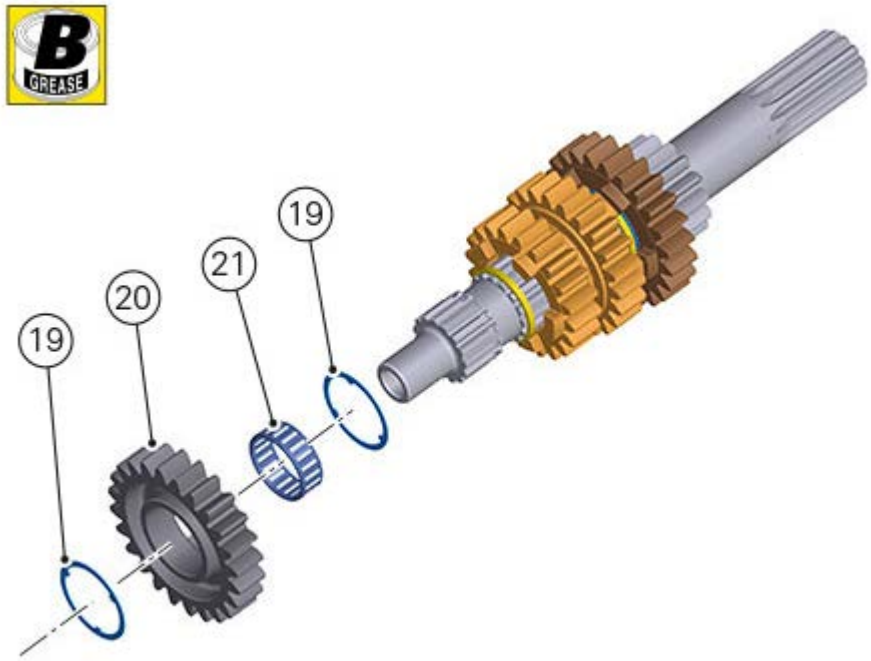
Fit the roller bearing cage (21), duly lubricated, the splined washer (19) and the fifth speed gear (23) on the primary shaft (15).



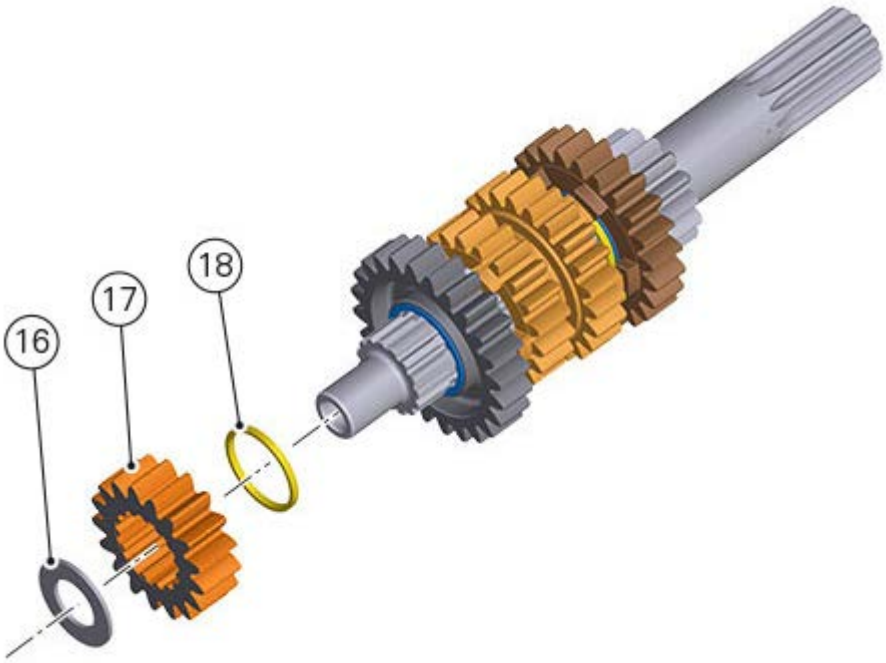
Fit the washer (18), the third and fourth speed gear (22) and the washer (18).



Fit the roller bearing cage (21), duly lubricated, the splined washer (19), the sixth speed gear (20) and the washer (19).

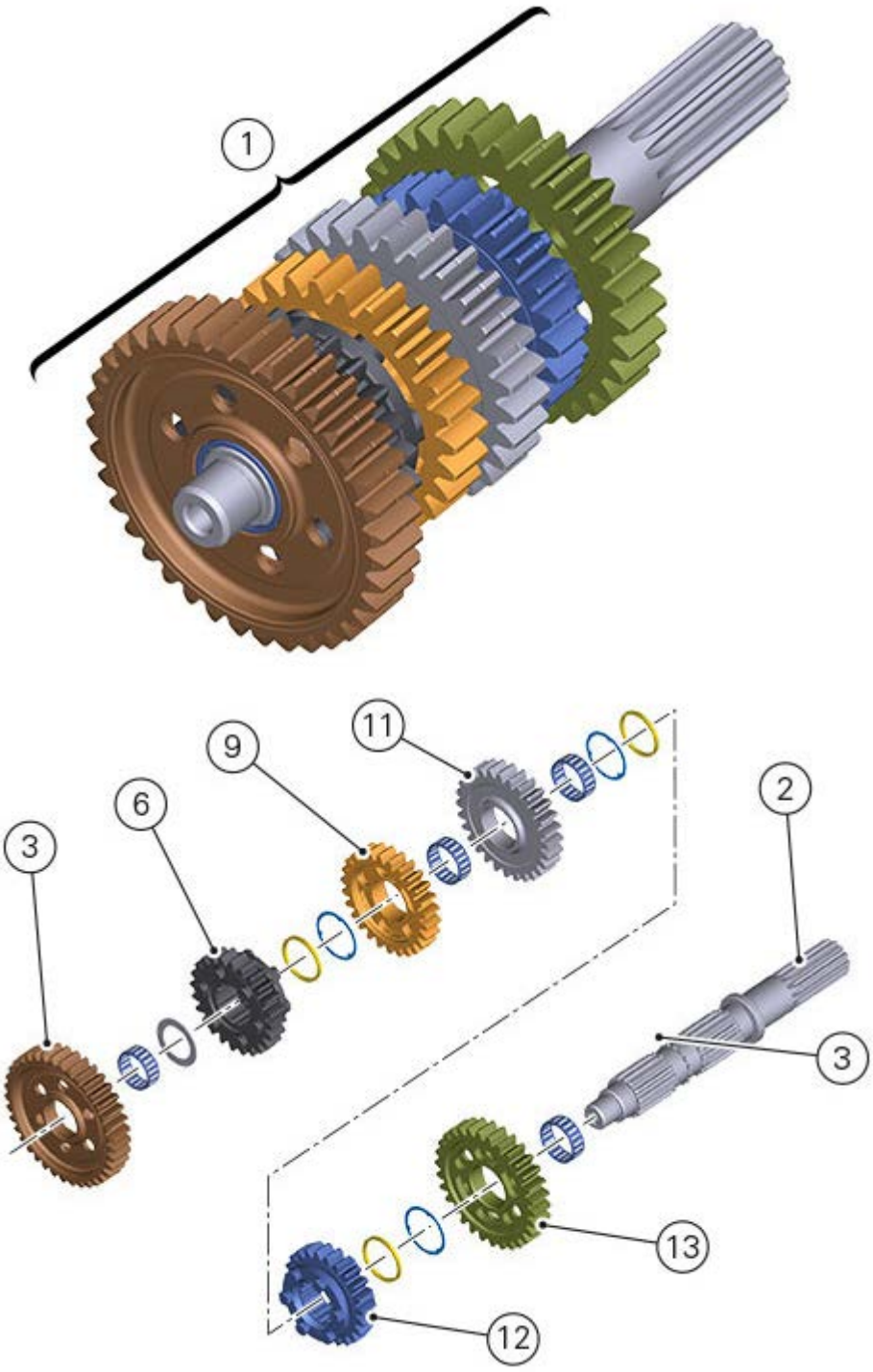


Fit the splined washer (18), the second speed gear (17) and the washer (16).

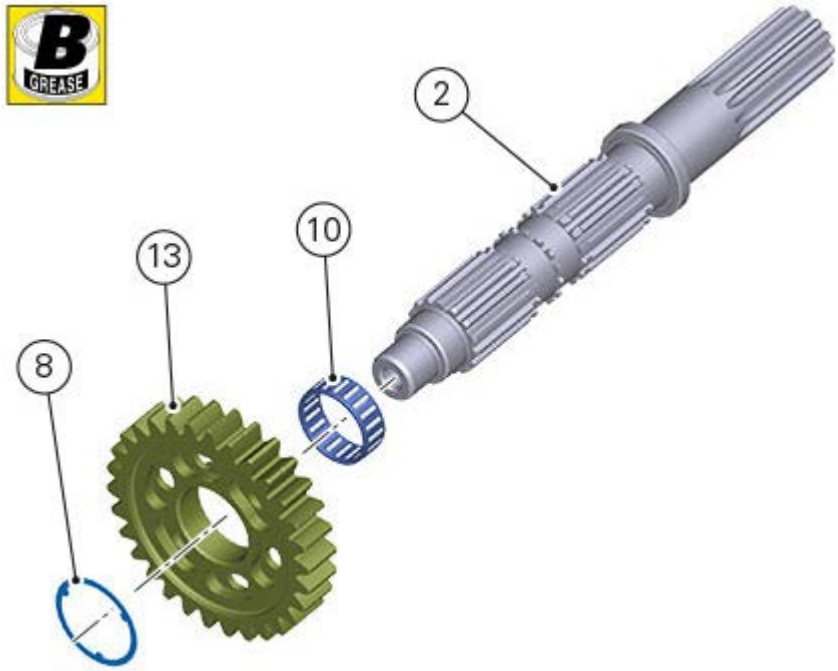


REASSEMBLING THE GEARBOX SECONDARY SHAFT

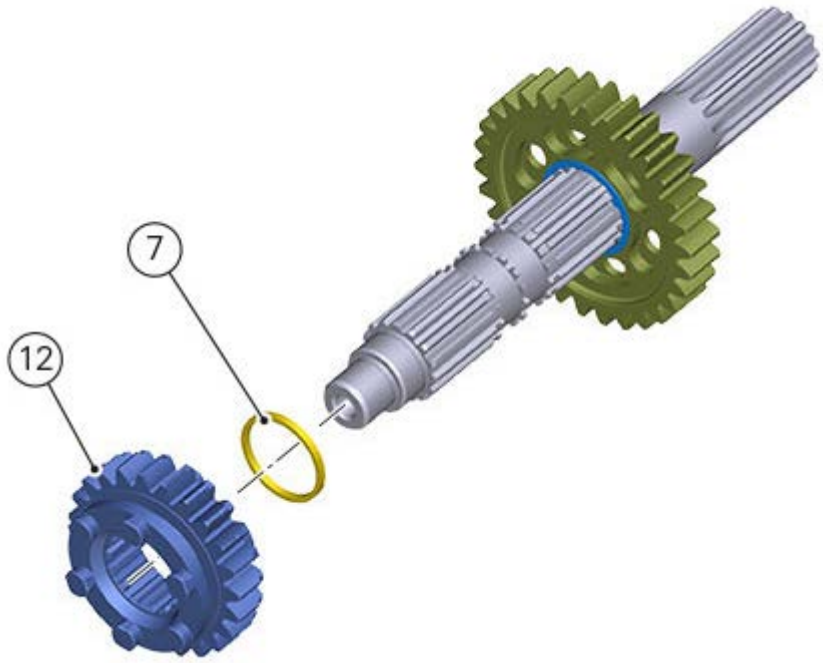
Disassemble the complete secondary shaft (1), removing the components listed below in the indicated order, starting from the clutch side.



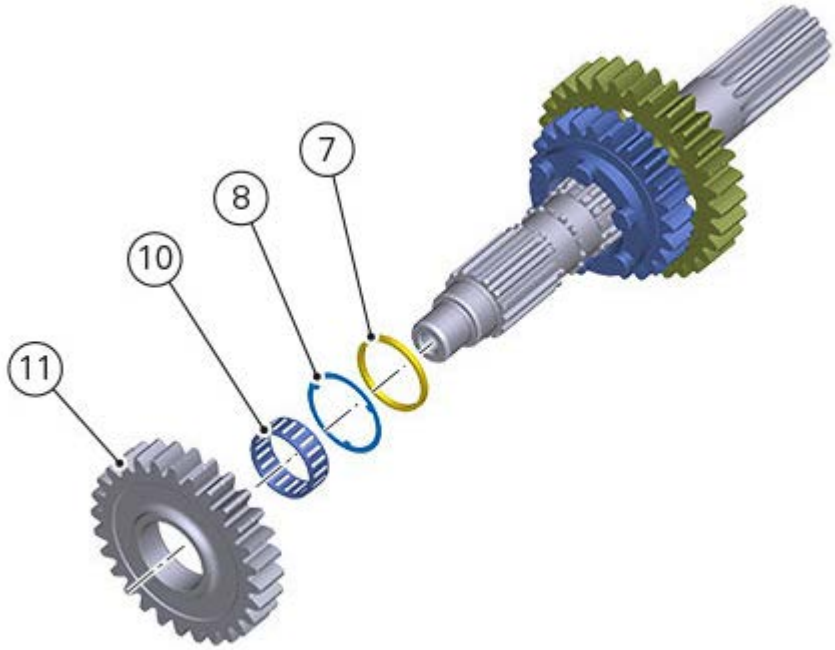
Fit the roller bearing cage (10), duly lubricated, on the secondary shaft (15); fit the second speed gear (13) and the washer (8).



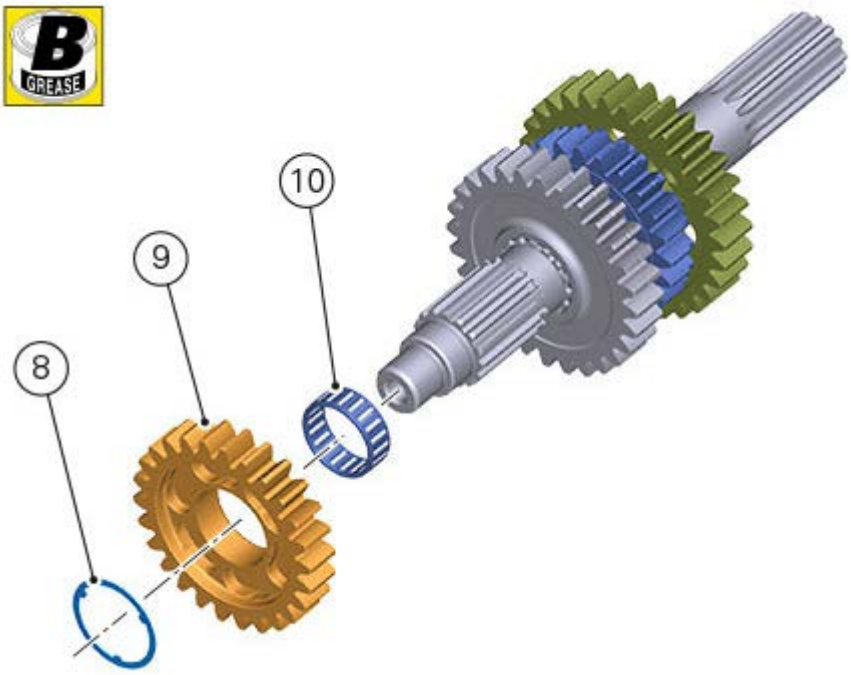
Fit the splined washer (7) and the sixth speed gear (12).



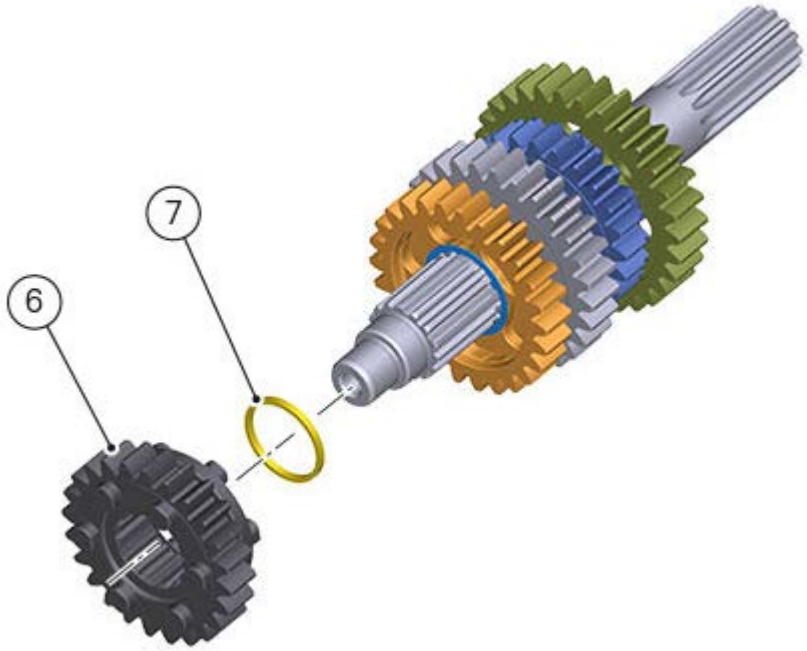
Fit the splined washer (7), the washer (8), the roller bearing cage (10), duly lubricated, and the third speed gear (11).



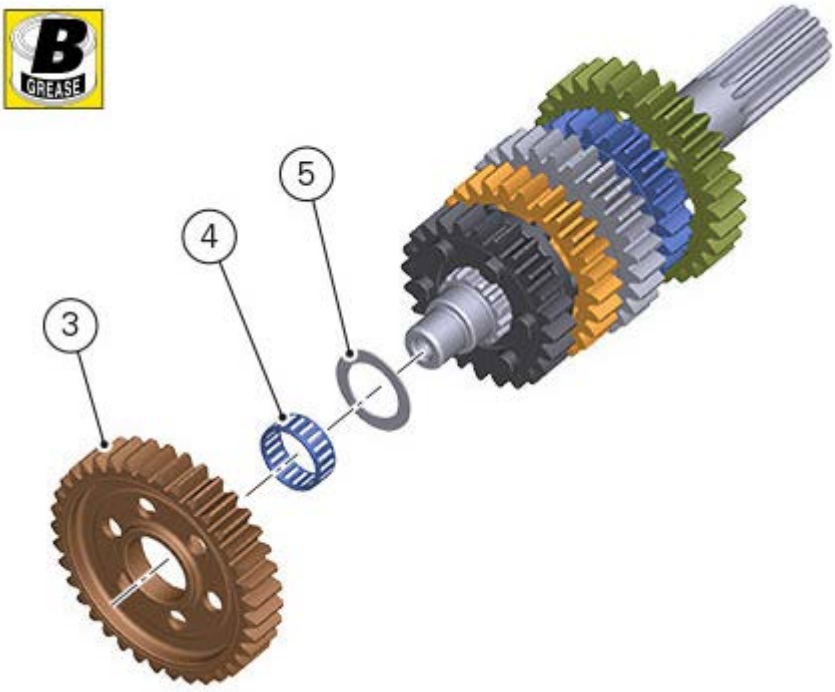
Fit the roller bearing cage (10), duly lubricated, and the fourth speed gear (9).



Fit the splined washer (7) and the fifth speed gear (6).

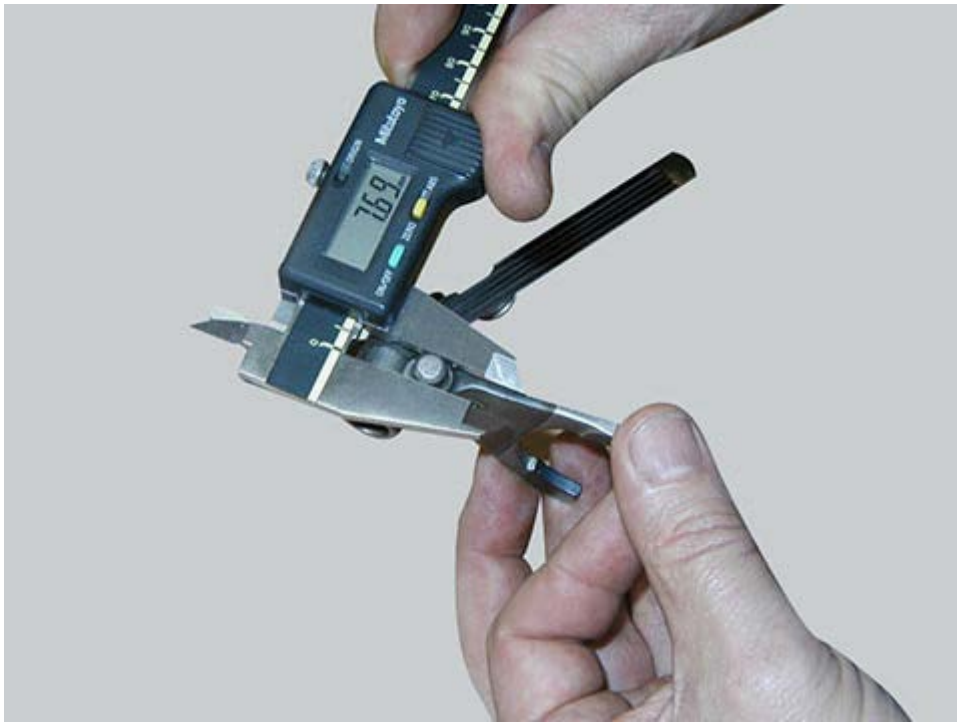


After having duly lubricated and positioned the roller bearing cage (4), slide out shim (5) and fit the first speed gear (3).



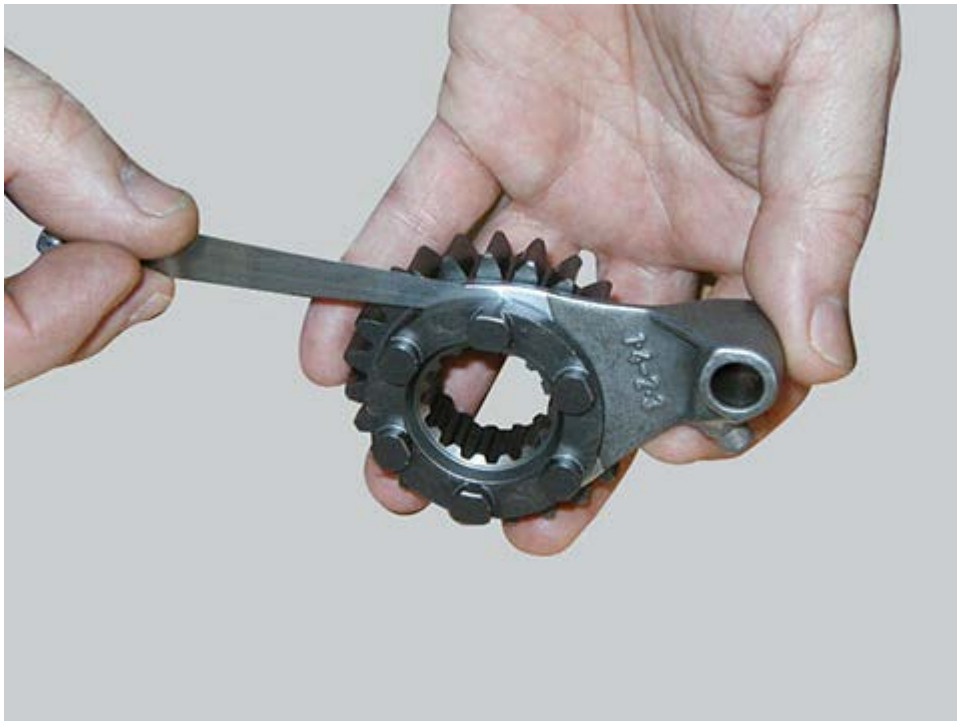
Inspecting the fork selector drum

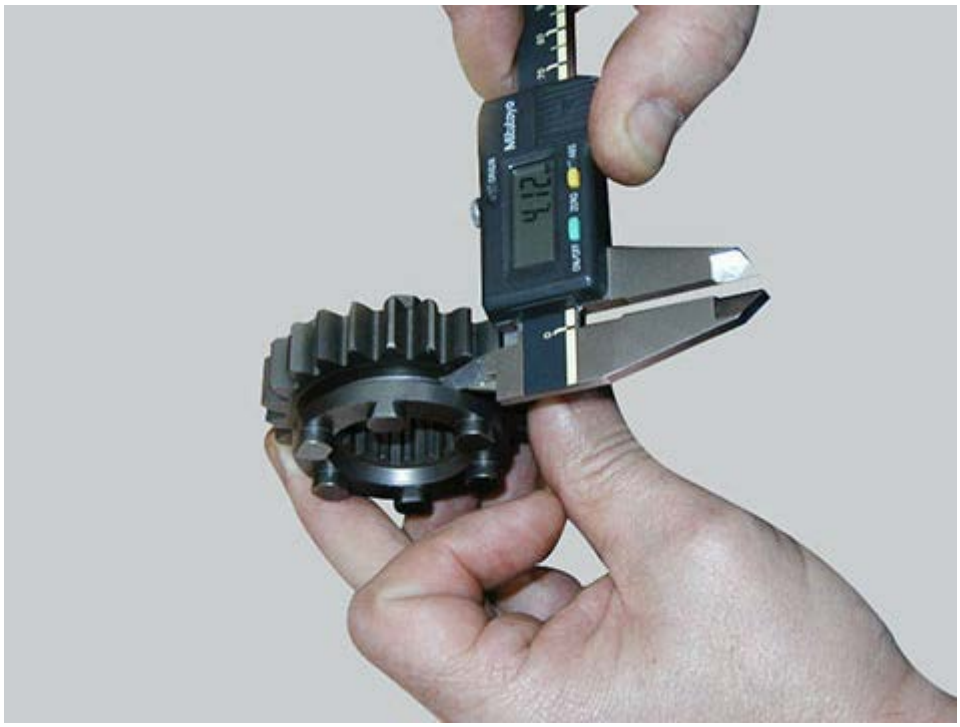
Use a gauge to measure the clearance between fork pin and the groove on the selector drum.
If the service limit has been exceeded, determine which part must be replaced by comparing these dimensions with those of new components.
Also check the wear on the drum support pins; these must not show any signs of scoring, burrs, or deformation.
Turn the drum in the crankcase to establish the extent of radial play.
If play is excessive, change whichever part is most worn.



Inspecting the gear selector forks

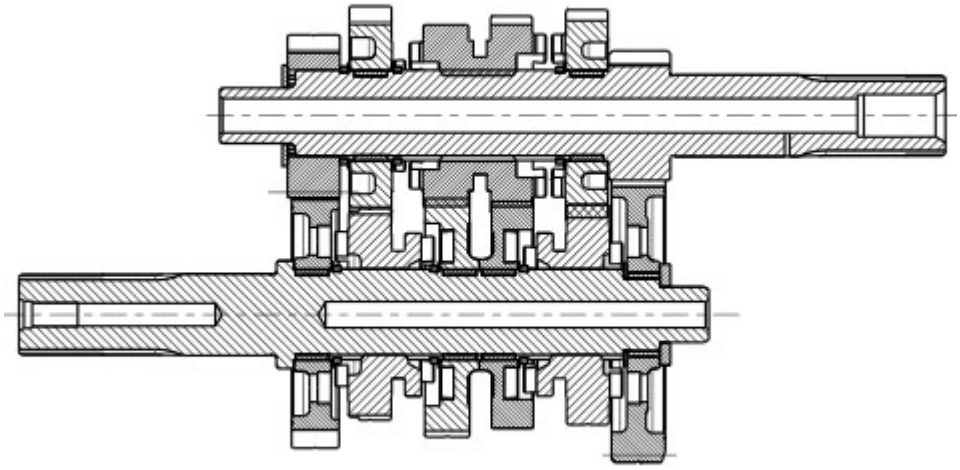
Visually inspect the gear selector forks. Bent forks must be replaced as they may lead to difficulties in gear changing or may suddenly disengage when under load.
Use a feeler gauge to check the clearance of each fork in its gear groove.
If the service limit has been exceeded, check whether or not it is necessary to replace the gear or the fork by referring to the limits specified for each part.






Mitutoyo

Check the condition of the front coupling dogs of the gears. They must be in perfect condition and with no sign of wear on the edges of the teeth.
The idler gears must rotate freely on their shafts.
When refitting, make sure the circlips are correctly positioned.
Check the needle roller bearings for wear.
The threads and splines of the shafts must be in perfect condition.
Also check that the component parts of the gear selector mechanism are in good condition.



Engage the gears and check that the gearchange mechanism does not stick (selector fork-gear groove, and fork pin-desmodromic drum groove) due to incorrect end float.
Restore the correct end float by shimming the gearbox shafts and the selector drum with suitable shims.

Disassembling the gearbox shafts

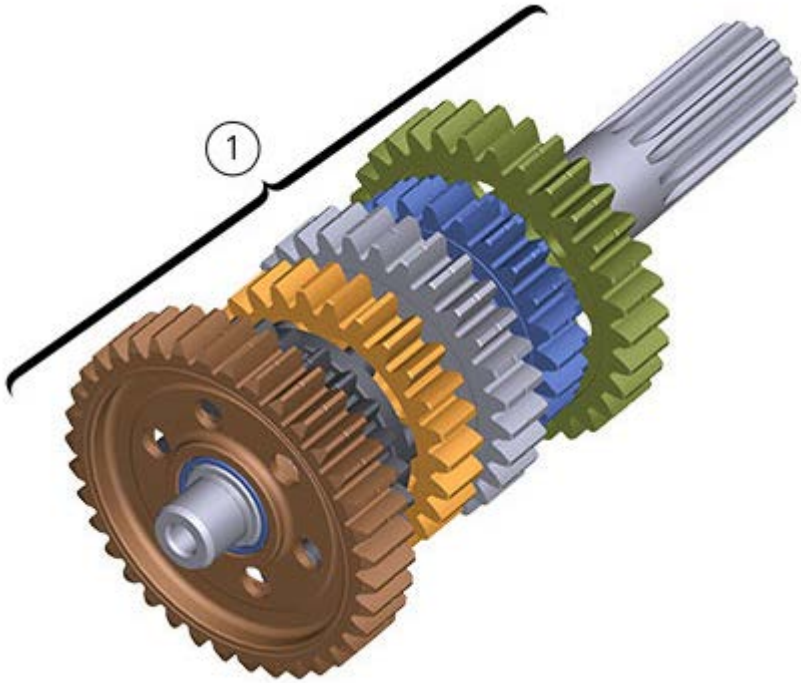
Place the shaft in a vice in such a way to facilitate the disassembly operations.

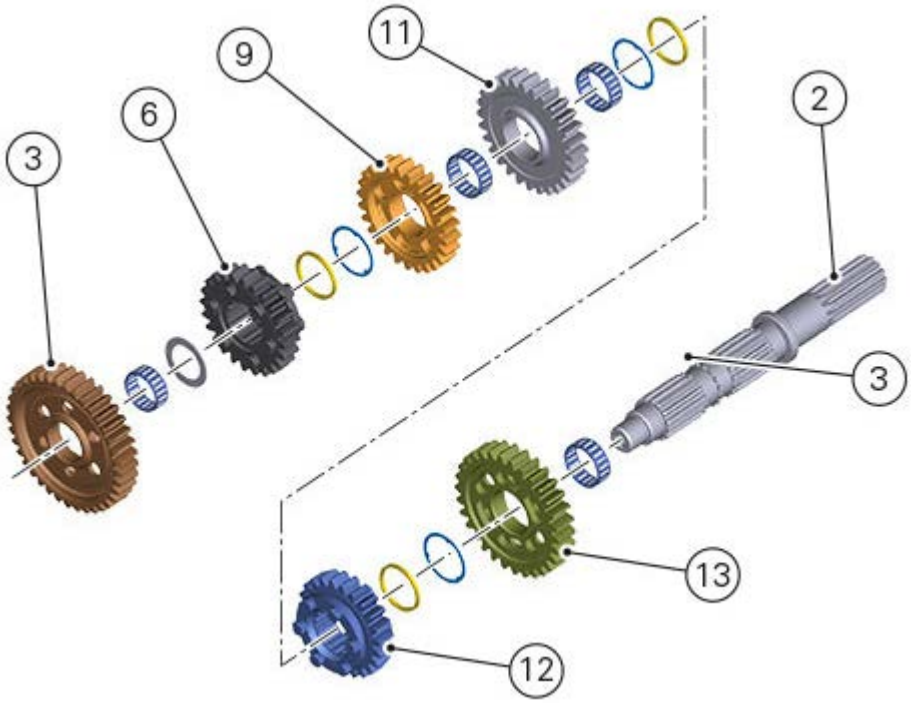
Important

Take care not to invert the shim position upon reassembly: this would potentially lead to jamming when using the gear selector control, making it necessary to reopen the crankcase.

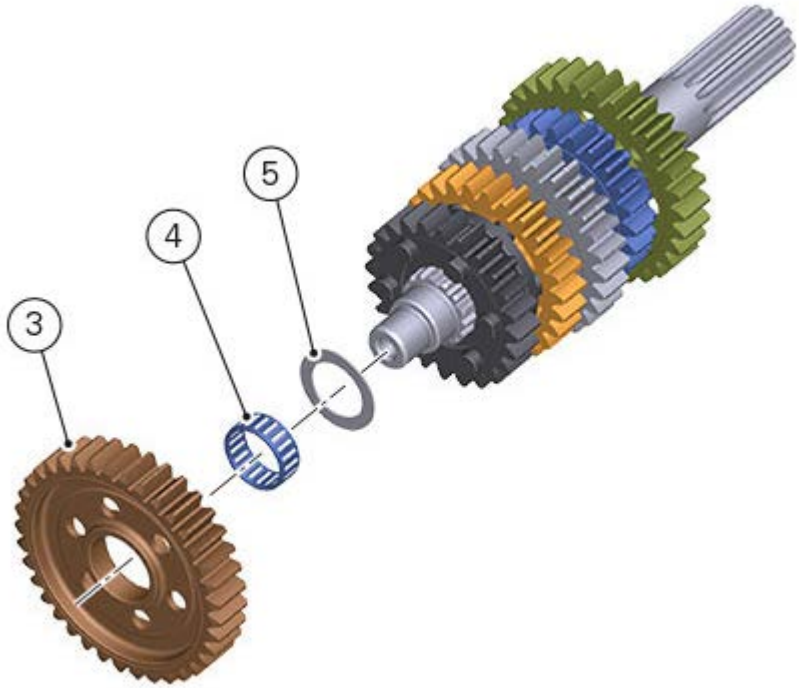
Disassembling the gearbox secondary shaft

Disassemble the complete secondary shaft (1), removing the components listed below in the indicated order, starting from the clutch side.

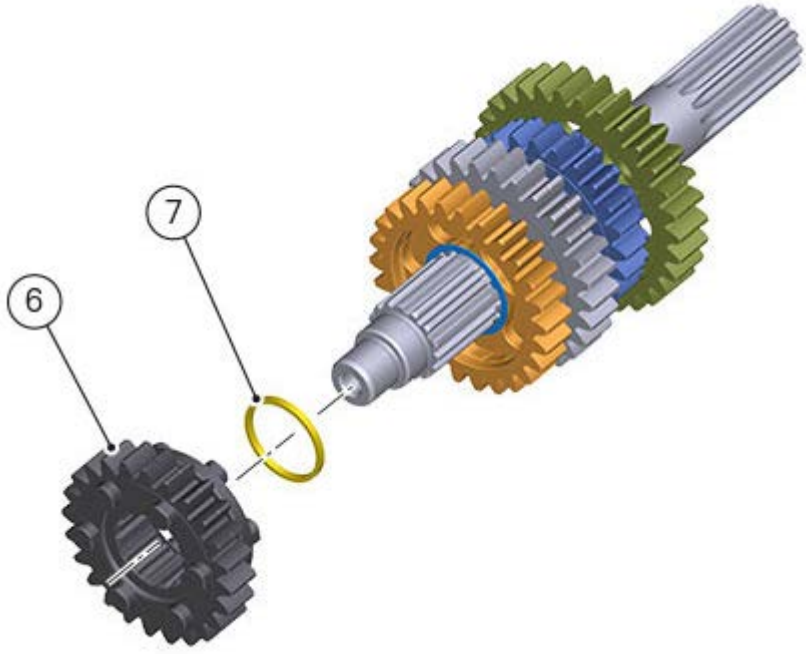




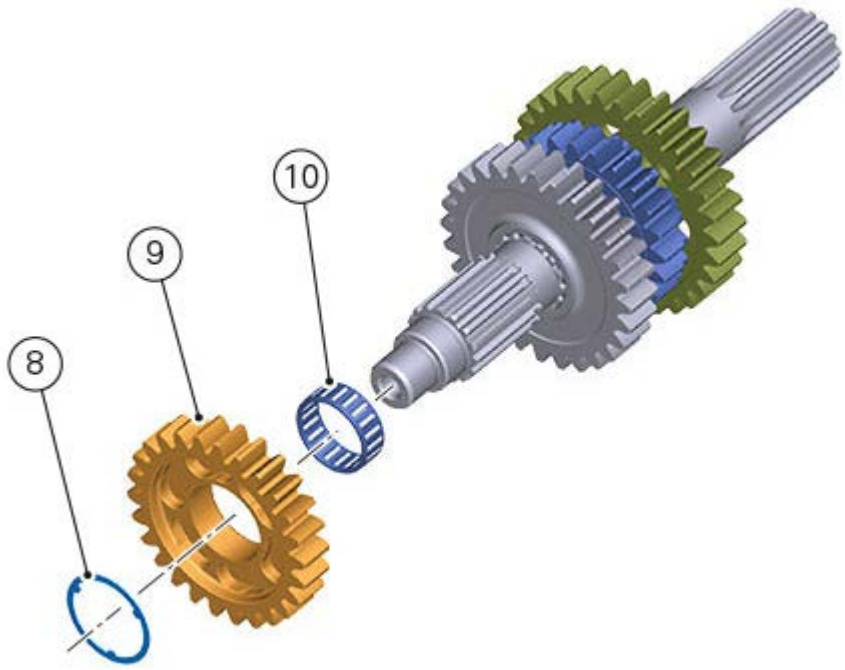
Remove the first speed gear (3), remove the roller bearing cage (4) and the shim (5).



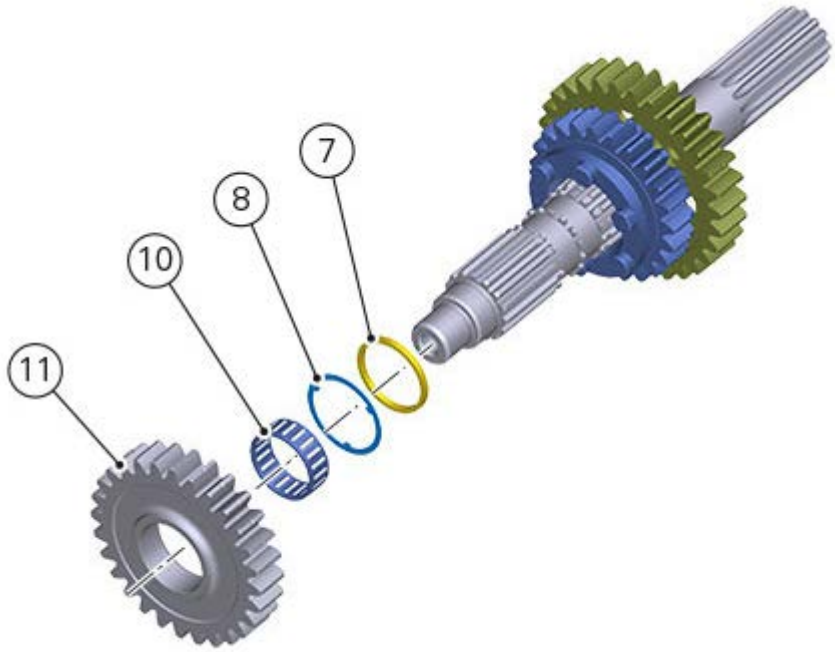
Remove the fifth speed gear (6) and the splined washer (7).



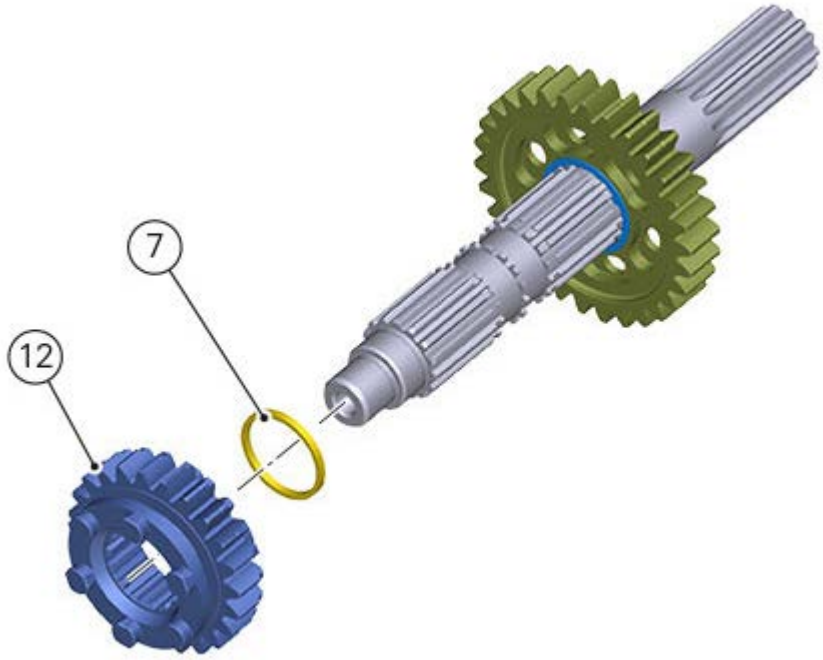
Remove the washer (8), the fourth speed gear (9) and the roller bearing cage (10).



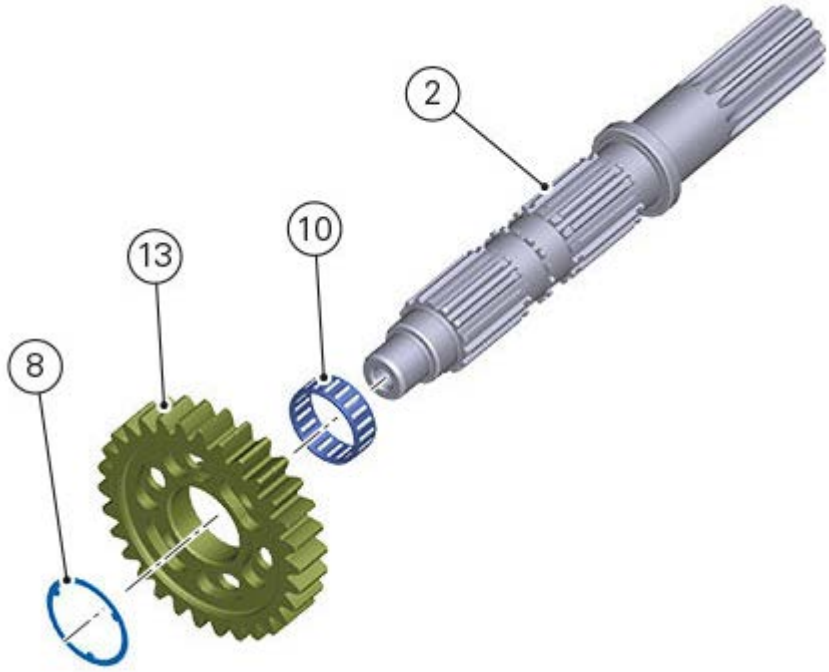
Remove the third speed gear (11), the roller bearing cage (10), the washer (8), and the splined washer (7).



Remove the sixth speed gear (12) and the splined washer (7).

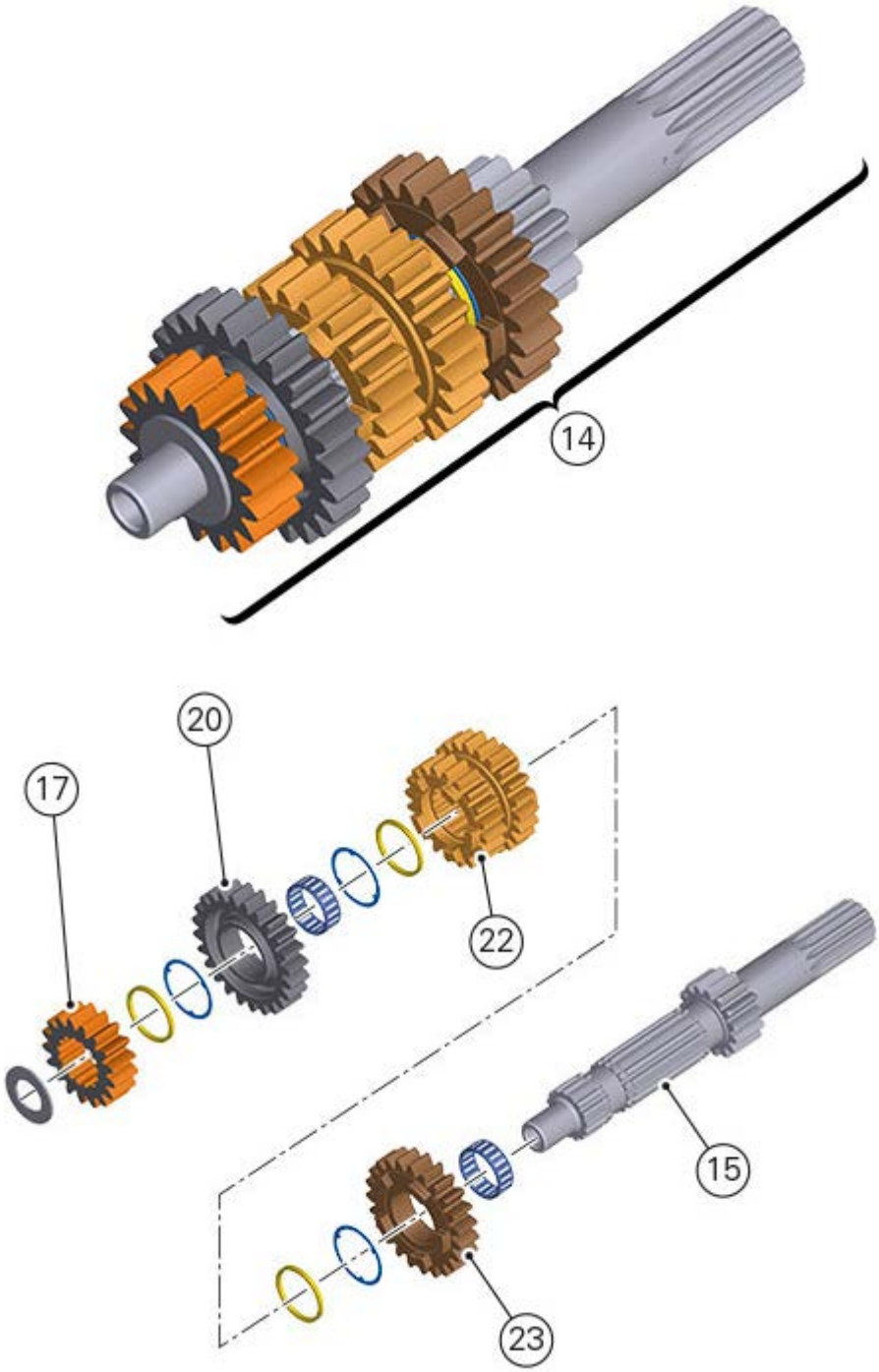


Remove the washer (8), the second speed gear (13), the roller bearing cage (10), and release the secondary shaft (2).

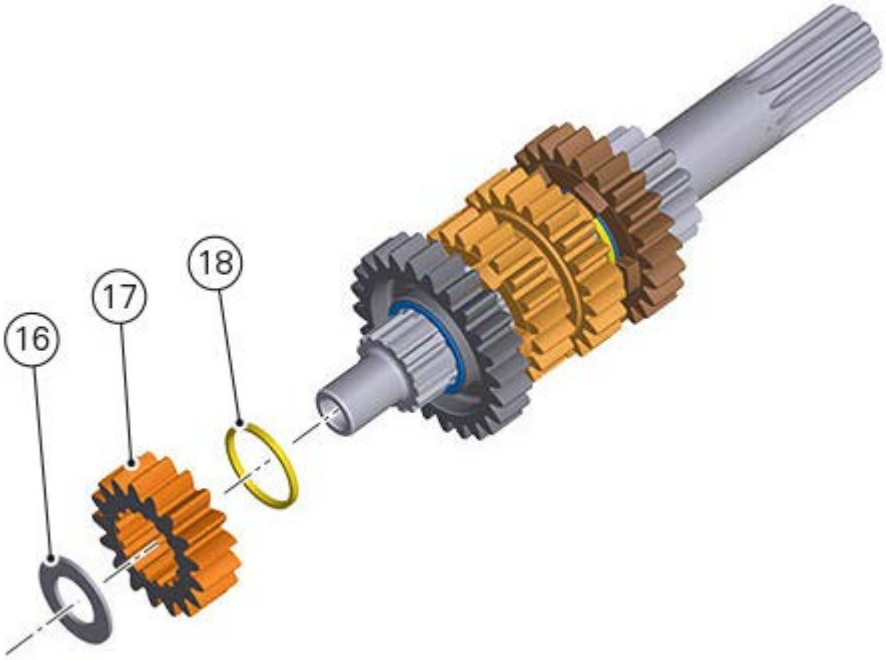


Disassembling the gearbox primary shaft

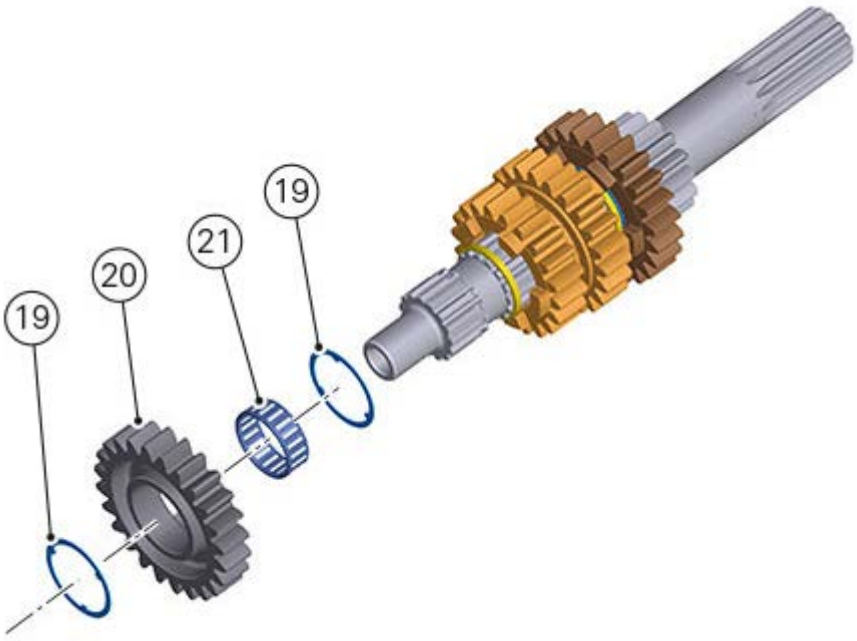
Disassemble the complete primary shaft (14), removing the components listed below in the indicated order, starting from the chain side.



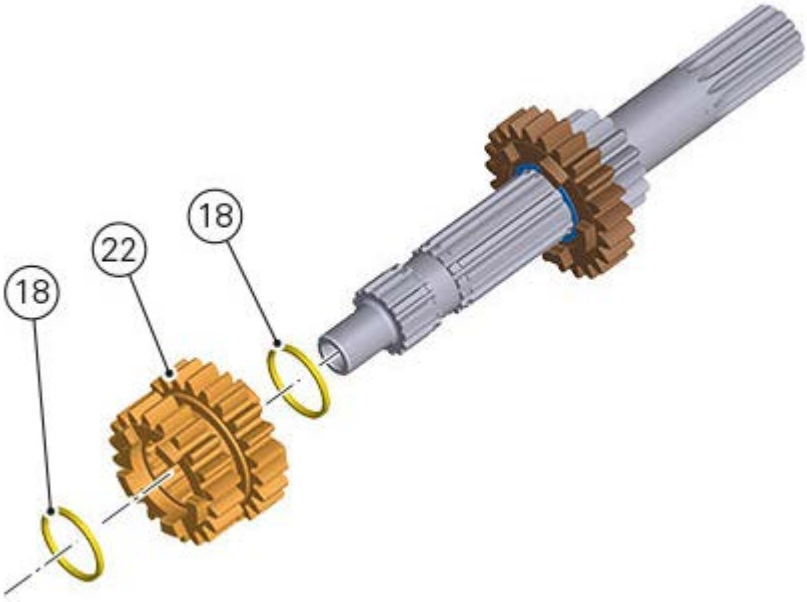
Remove the washer (16), the second speed gear (17) and the splined washer (18).



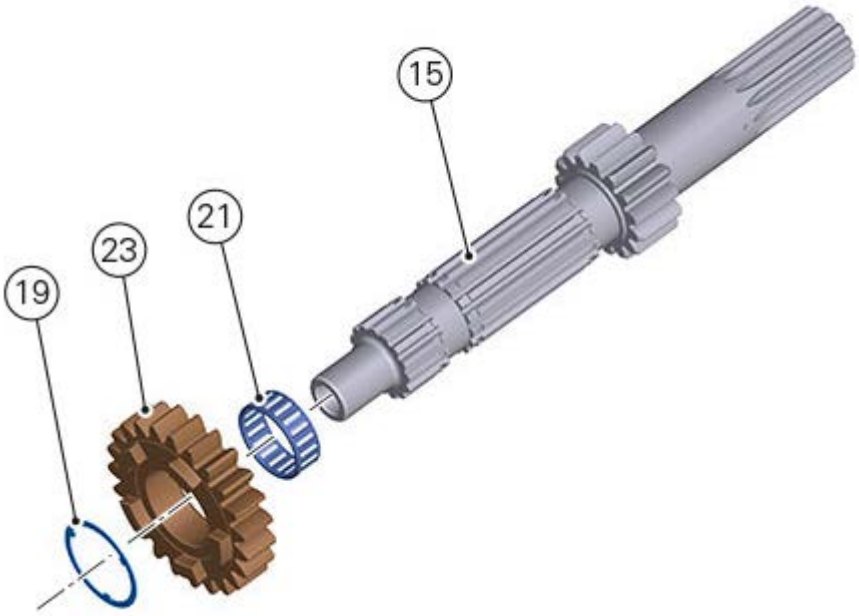
Remove the washer (19), the sixth speed gear (20), the roller bearing cage (21), and the splined washer (19).



Remove the washer (18), the third and fourth speed gear (22) and the washer (18).

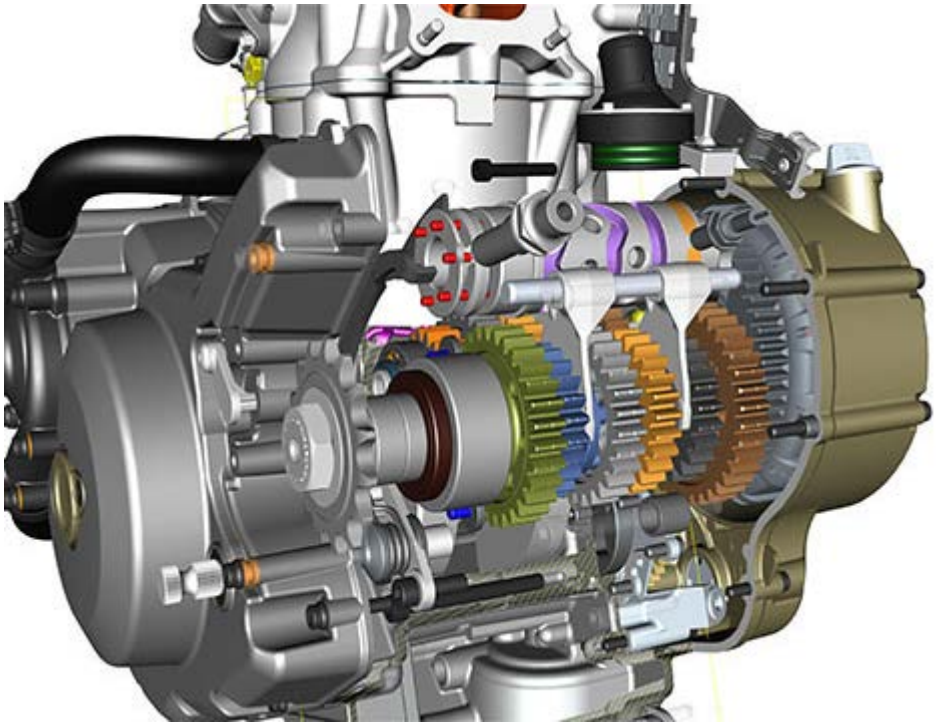


Remove the fifth speed gear (23), the splined washer (19), the roller bearing cage (21), and release the primary shaft (15).

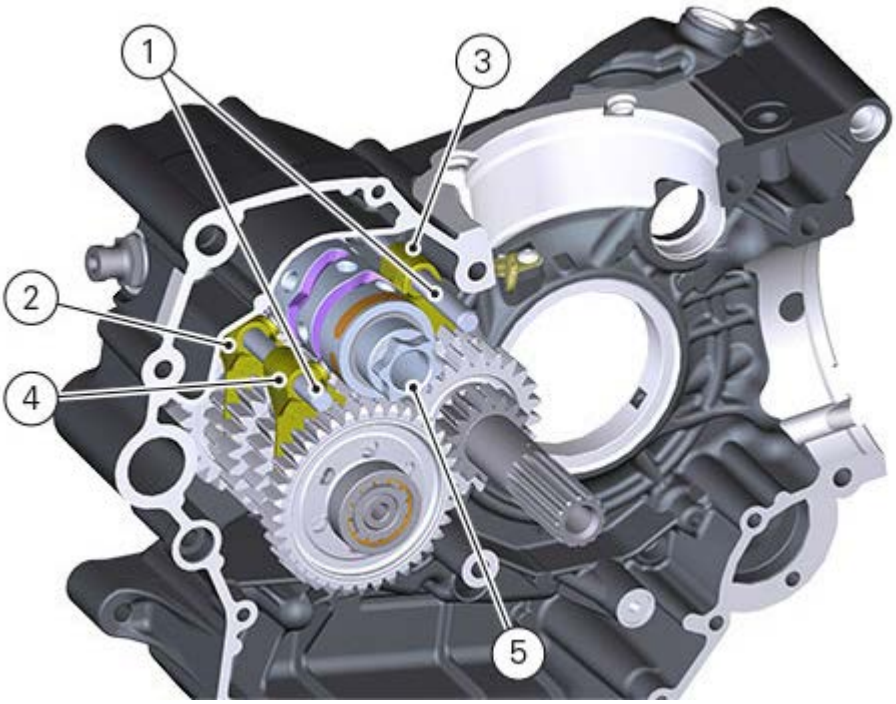


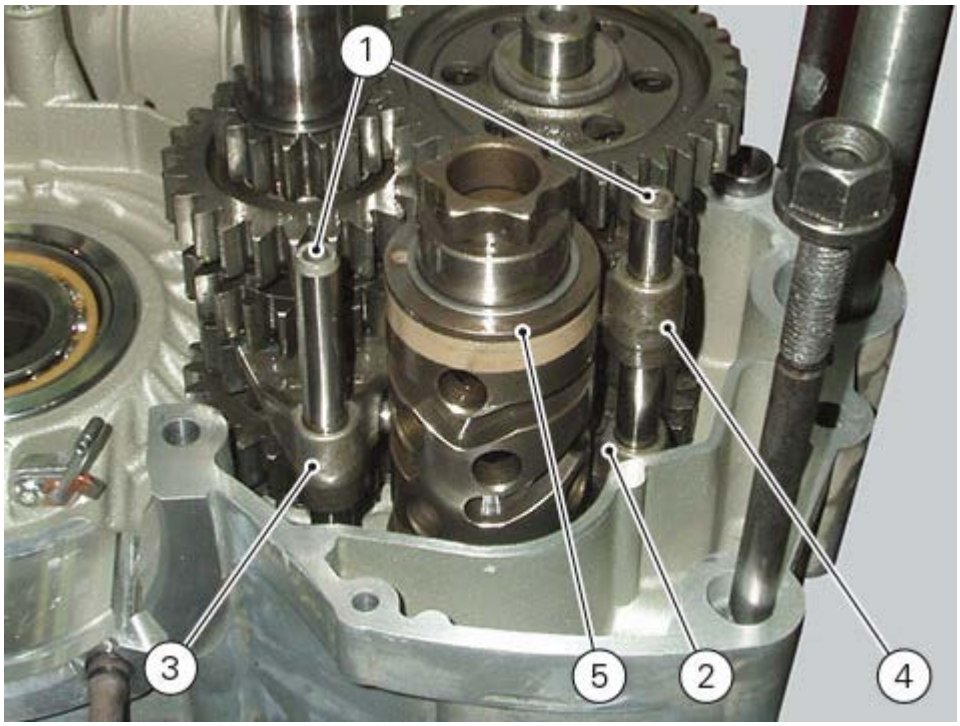
Removing the gearbox assembly

Remove the engine from the frame (Removing the engine).
Remove the external belt covers (Removing the timing belt external covers).
Remove the camshaft assembly (Removing the camshafts).
Remove the complete cylinder head assembly (Removing the cylinder heads).
Remove the complete cylinder/piston assembly (Removing the cylinder/piston assembly).
Remove the generator side cover (Removing the generator cover) and the complete generator (Removing the flywheel/generator assembly).
Remove the oil pump (Removing the oil pump).
Remove the starter motor (Removing the starter motor).
Remove the clutch cover (Removing the clutch cover).
Remove the clutch unit (Removing the clutch).
Remove the primary drive gear (Removing the primary drive gear).
Separate the crankcase halves (Separating the crankcase halves).

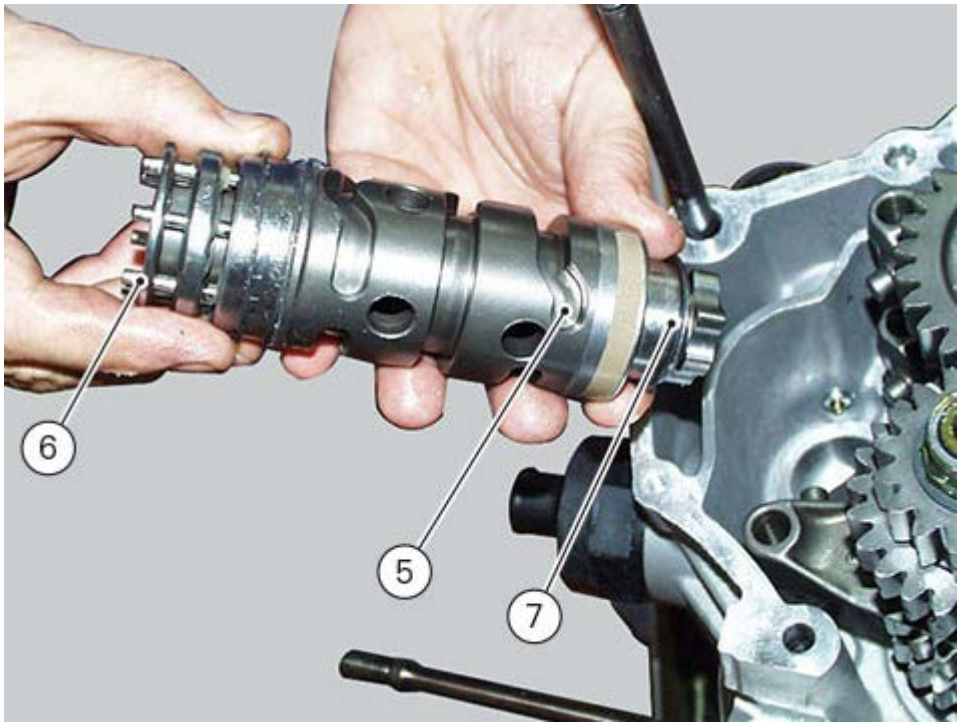


Withdraw the selector fork shafts (1).
Move the forks (2) and (3) to disengage them from the slots in the gear selector drum (5).

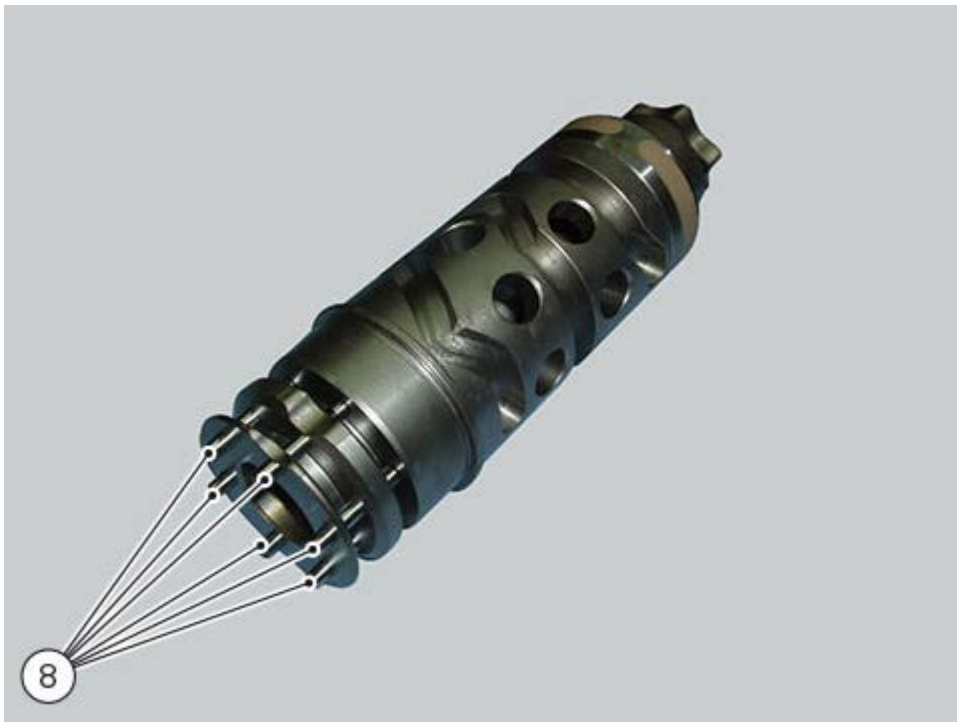




Remove the gear selector drum (5) taking care not to invert the fitted shims (6) and (7).

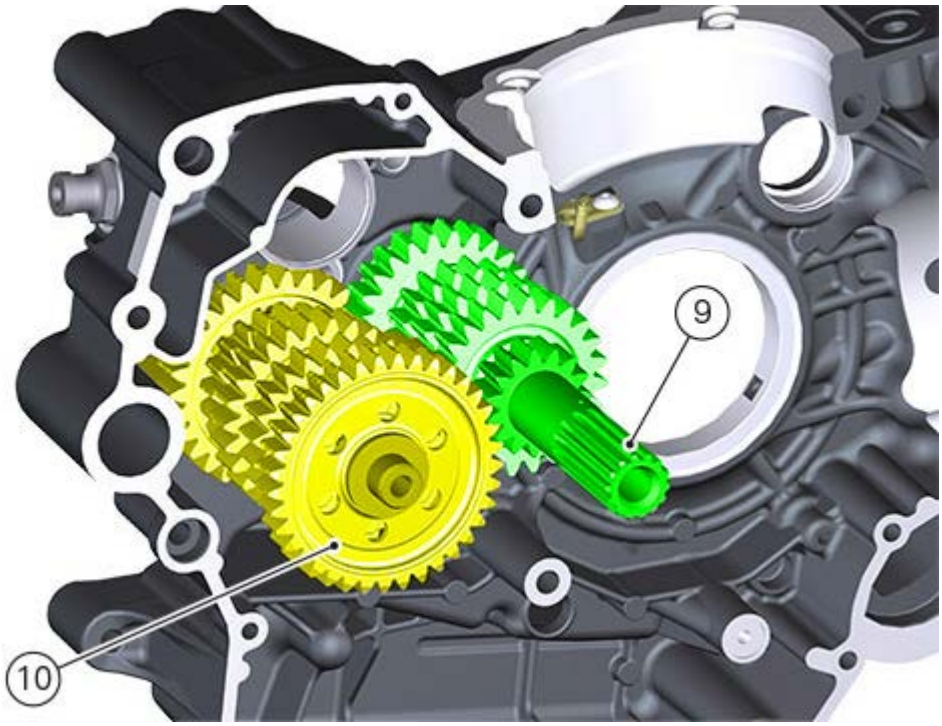


Once removed, it is possible to replace the special rollers (8).



Remove gear selector forks (2), (3) and (4).

Remove the gearbox primary (9) and secondary (10) shafts complete with gears, taking care to recover the shim washers on the ends of the shafts.
If the bearing inner rings (A) are left on the shafts, slide them off the ends of the gearbox primary (9) and secondary (10) shafts (Separating the crankcase halves).


9
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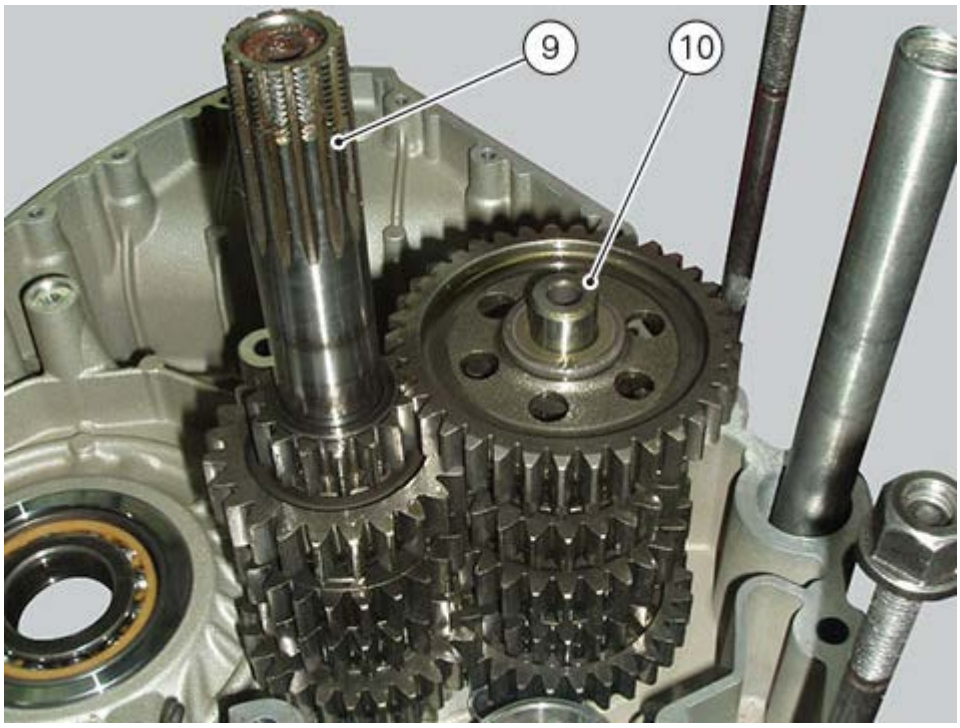
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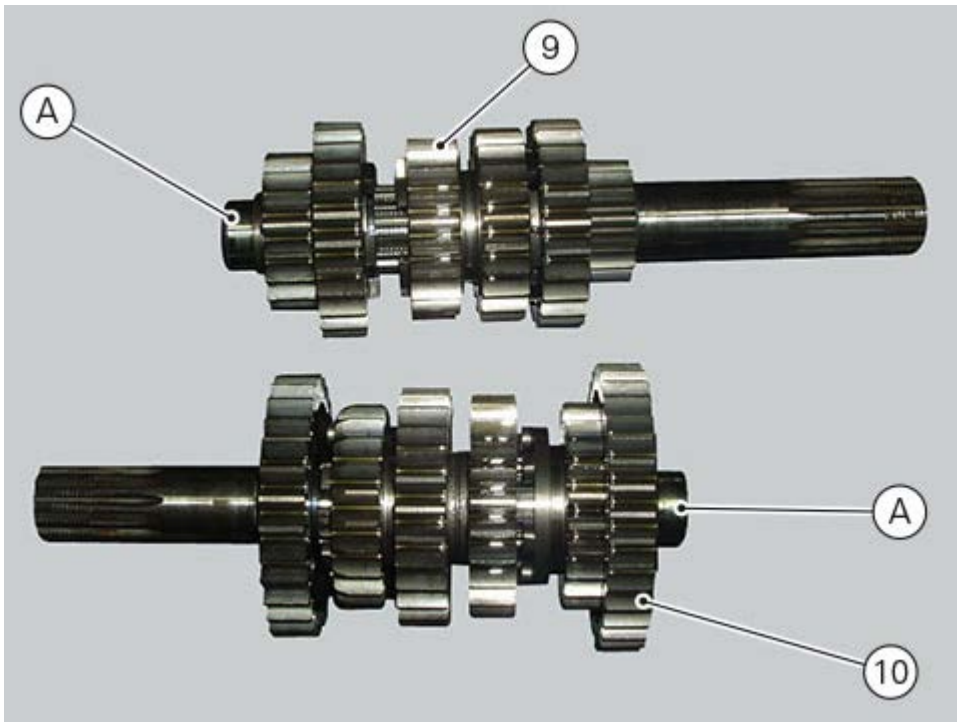
10



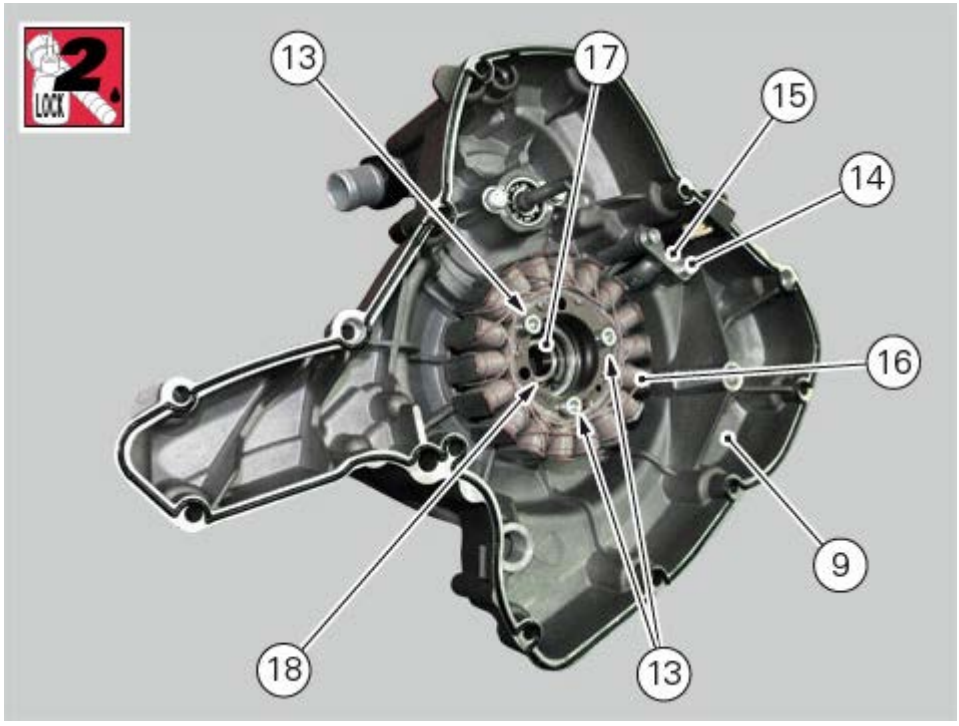
Fitting the generator cover

Before the assembly, make sure that the following parts are fitted on the generator cover (9):

- the crankshaft bearing (17) with the circlip (18);
- the generator stator (16) with cable locking bracket (15).

Tighten the three stator screws (13) to a torque of 10 Nm (Min. 9 Nm - Max. 11 Nm) after having applied the indicated product.
Tighten the two screws (14) on bracket (15) to a torque of 5 Nm (Min. 4.5 Nm - Max. 5.5 Nm) after having applied the indicated product.

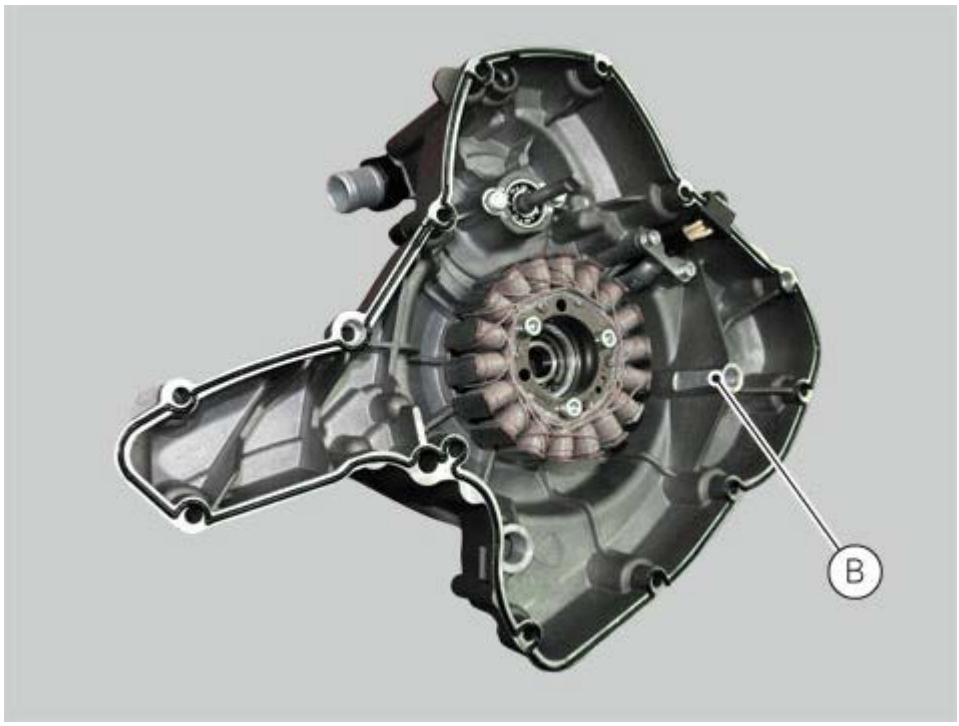
Fit the water pump assembly (Refitting the water pump).



Remove any scale and grease from the mating surfaces of the left-hand crankcase half and the generator cover.
Fit the two centring bushes (20).
Spread a continuous uniform bead of DUCATI sealing compound on the cover mating surface, and around the holes for the screws and bushes.

Grease the crankshaft and the gearchange lever shaft ends to facilitate installation of the cover and to prevent the sealing ring (10) from being damaged, if already installed in the cover.
While positioning the cover (9) on the crankcase half, slightly turn the timing layshaft belt rollers to facilitate insertion of the pump control shaft.

Starter motor gear pin (C) must be fitted to generator cover hole (B).



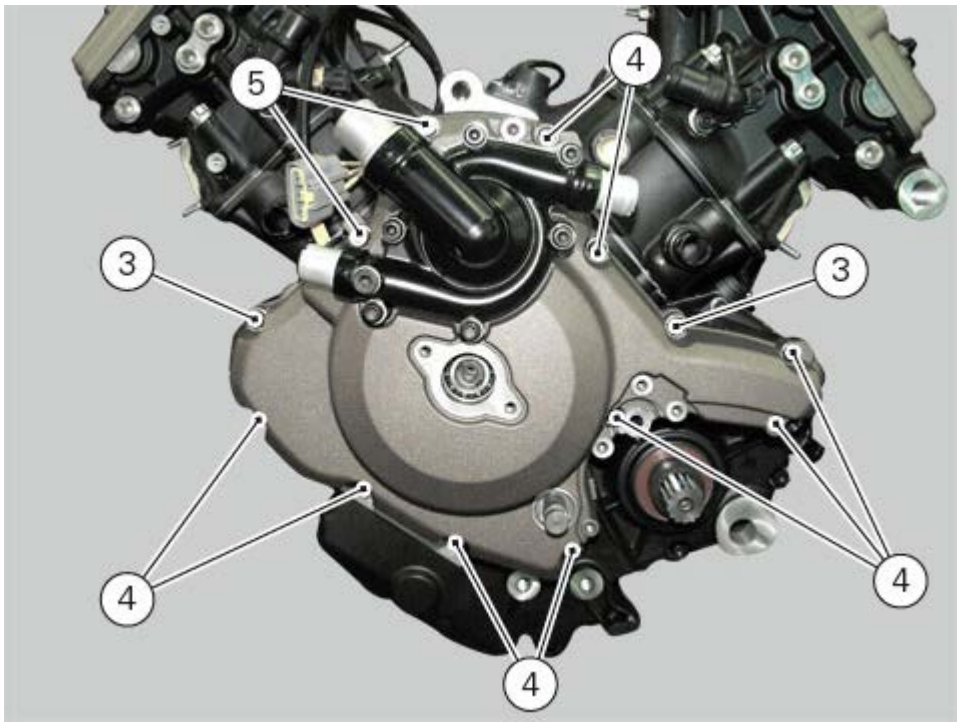
Tap the cover at different positions with a rubber mallet to facilitate its location on the shafts and centring bushes.

Note
Should it be necessary to remove the cover again, fit the puller no. 88713.1749 in the threaded holes, at the crankshaft.

Insert the fixing screws in their holes following the indications given in the table.

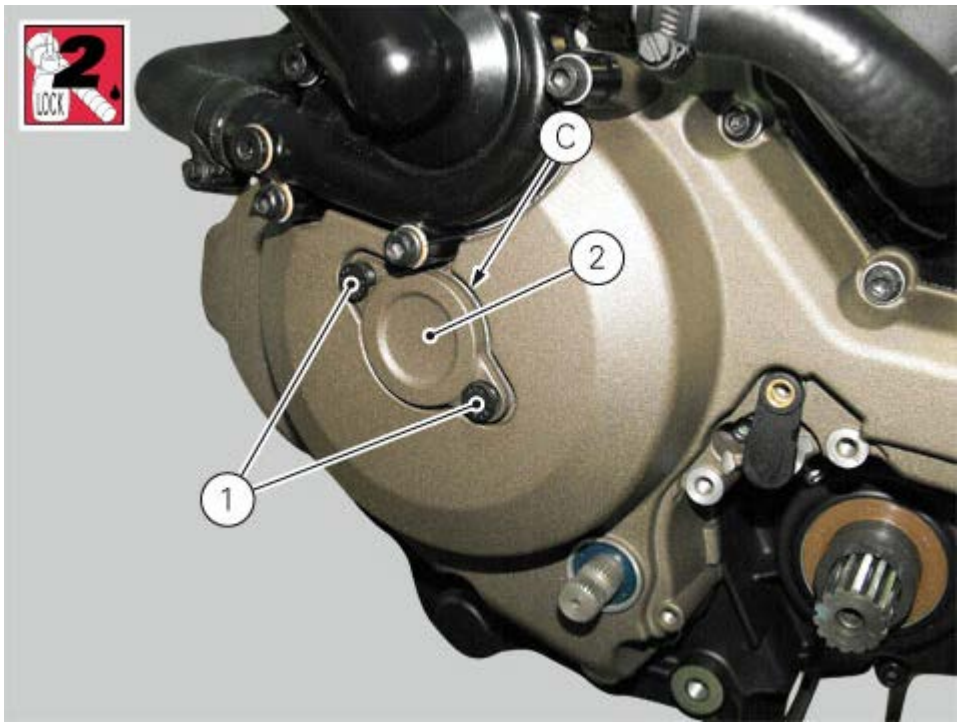
Ref.	Q.ty	Description
3	2	M6x25 mm screws
4	9	M6x20 mm screws
5	2	M6x30 mm screws

Tighten the retaining screws to a torque of 13.5 Nm (Min. 12.5 Nm - Max. 14.5 Nm).

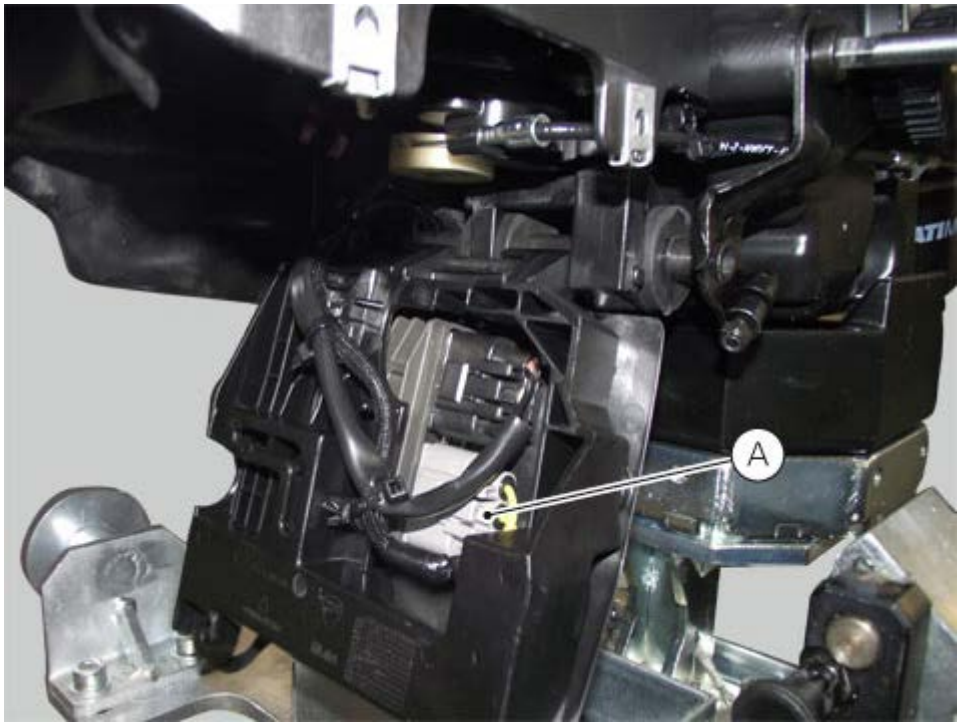


Damp the sealing ring (10) with alcohol and install it on the generator cover (9), at the gearchange lever shaft.

Make sure that the O-ring (C) is installed on the cover (2).
Apply grease to the screws (1).
Tighten the two fixing screws (1) of the cover (2) matching the crankshaft to a torque of 5 Nm (Min. 4.5 Nm - Max. 5.5 Nm).



Connect the generator cable connector to the main wiring (A).

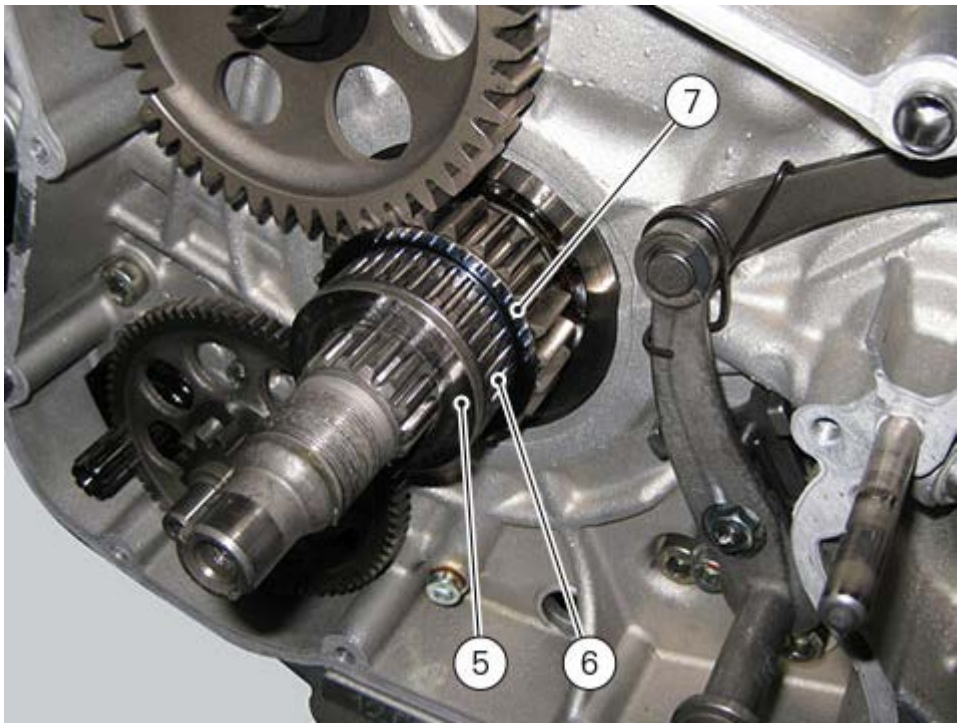


Refit the gearchange mechanism (Refitting the gearchange mechanism).
Refit the front sprocket cover (Refitting the front sprocket).
Change the engine oil (Changing the engine oil and filter cartridge).
Refit the left lower cover and release wirings (Separating the crankcase halves).
Refit the cooling system hoses (Refitting cooling system hoses and unions).

Fitting the flywheel/generator assembly

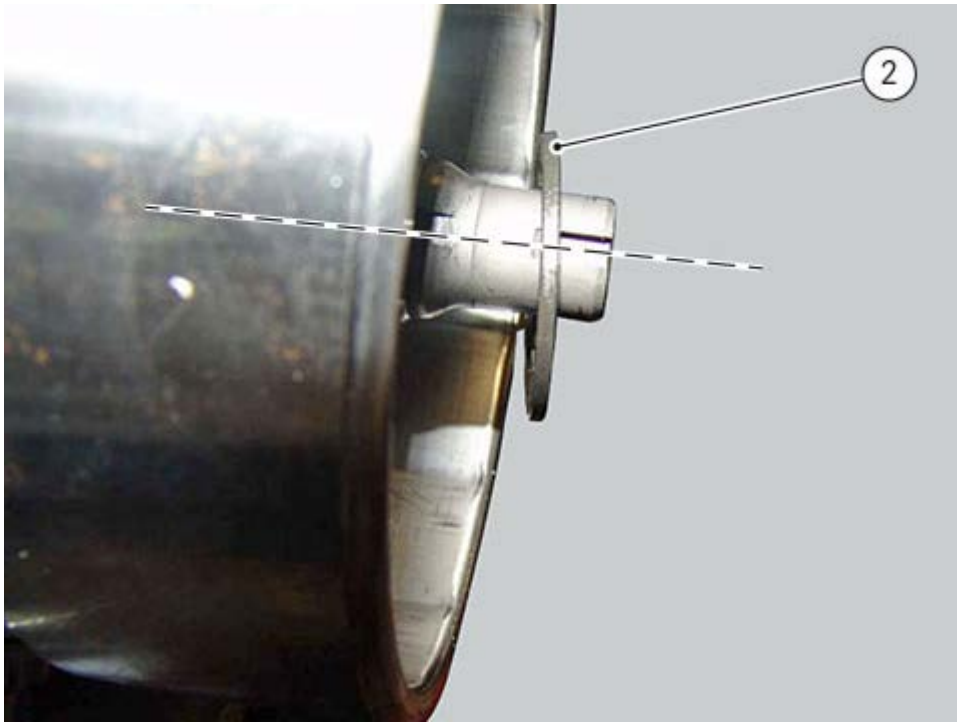
Fit the roller cage unit (6) with washer (7) and internal race (5), applying prescribed grease on the washer (7).

Install the roller bearing cage (6), washer (7) and inner race (5) assembly on the crankshaft.

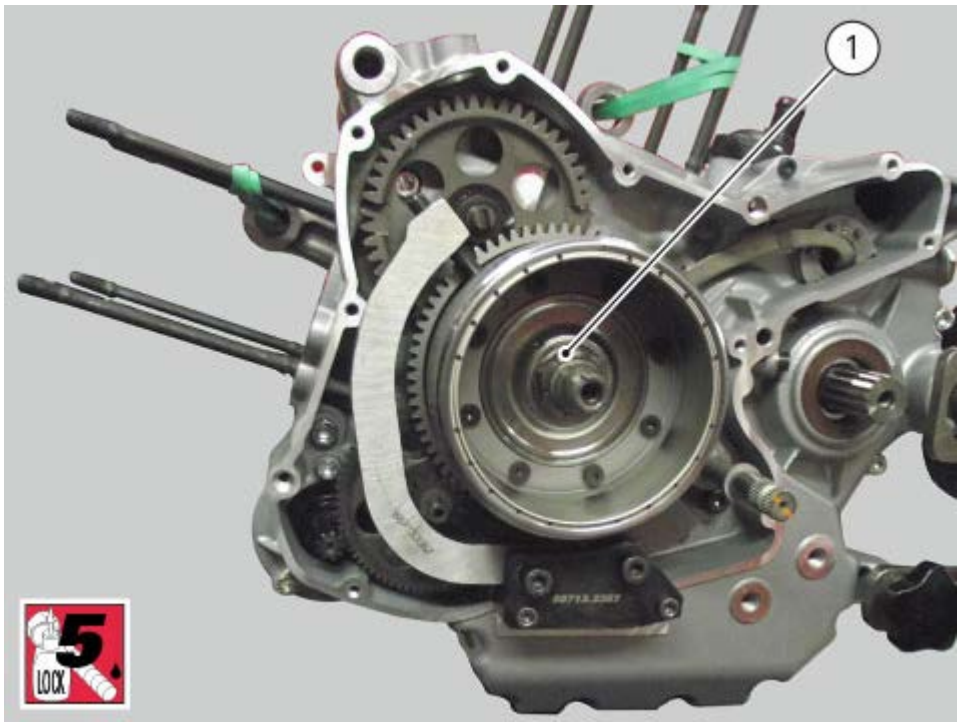


Install the flywheel assembly (3) with the gear (4), aligning the notches as shown in the photo.

Fit the washer (2) on the end of the crankshaft.



Apply the recommended threadlocker to the thread of the crankshaft and the nut (1).
Start the nut (1).
Lock the flywheel rotation with the special tool no. **88713.3367** and tighten the nut (1) to a torque of 330 Nm (Min. 313 Nm - Max. 346 Nm).



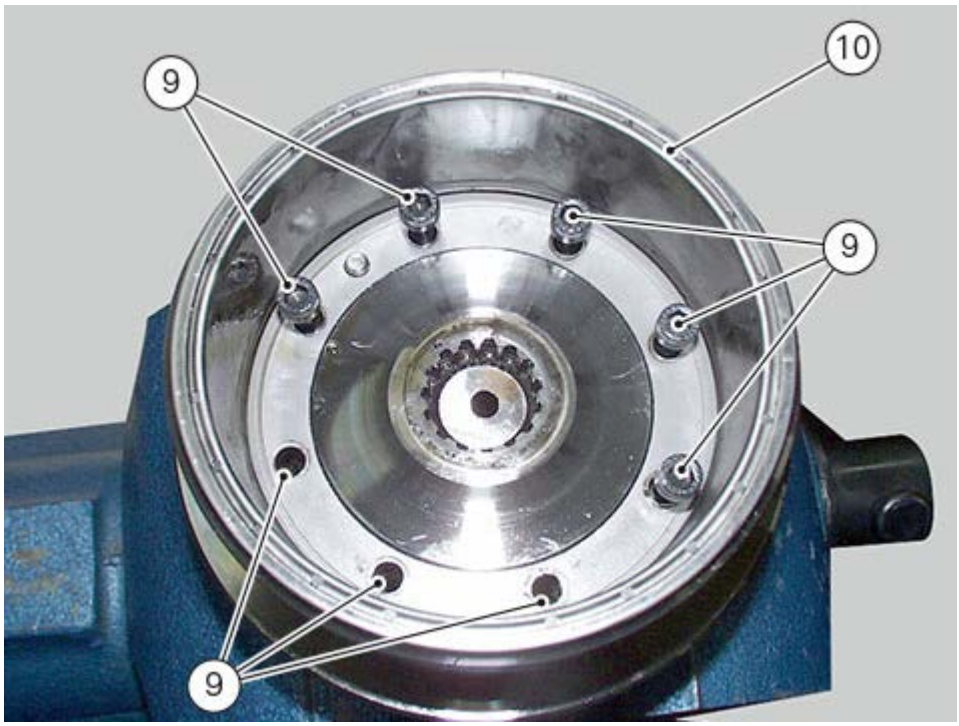
Refit the generator cover (Fitting the generator cover).
Refit the cooling system hose (Refitting cooling system hoses and unions).
Refit the pump-cylinder hoses (Refitting the cylinder/piston assembly).
Fill with engine oil (Changing the engine oil and filter cartridge).
Refill the cooling system (Changing the coolant).

Overhauling the flywheel/generator assembly

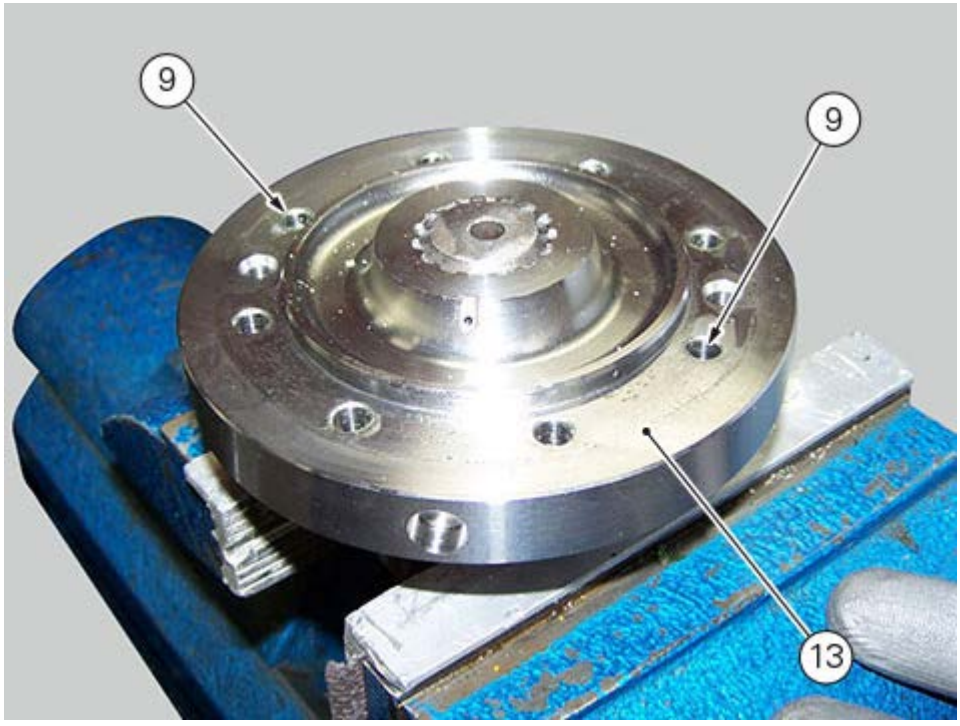
Inspect the inner part of generator rotor (8) for signs of damage.
Check that the starter clutch is working properly and that the roller races do not show signs of wear or damage of any kind.
Disassemble the unit if you find faulty operation.

Disassembling the flywheel/generator assembly

Unscrew the eight screws (9) and remove the generator rotor (10) from the flywheel.



Start two of the screws (9) just removed from the flywheel rotor side in order to remove the flange (11) and the starter clutch (12) from the flywheel (13).
The starter clutch is a slight interference fit on the flange.
Use a suitable drift to remove it.

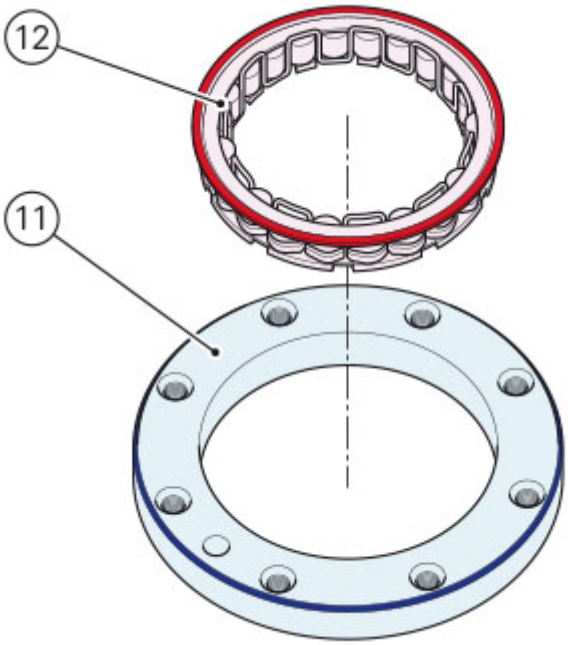


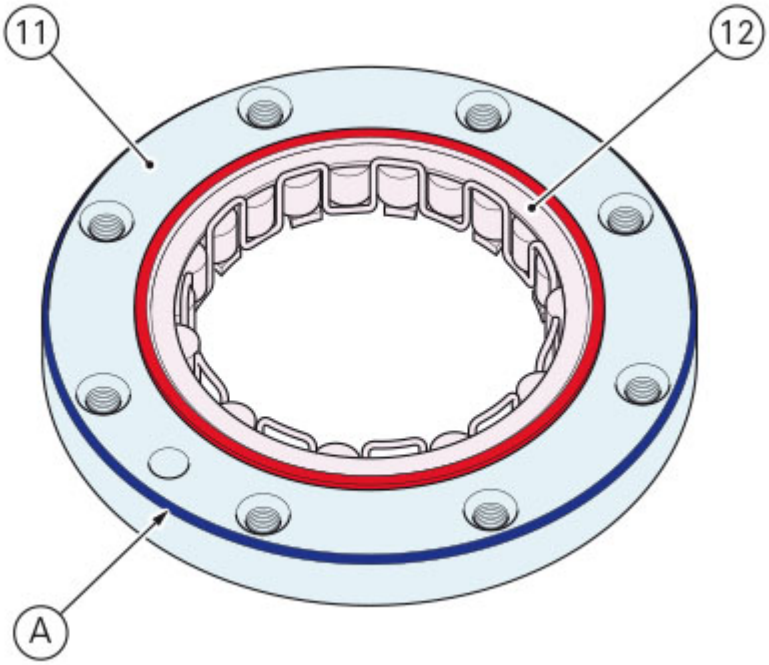
Reassembling the flywheel/generator assembly

Fit starter clutch (12) driving it fully home inside flange (11).

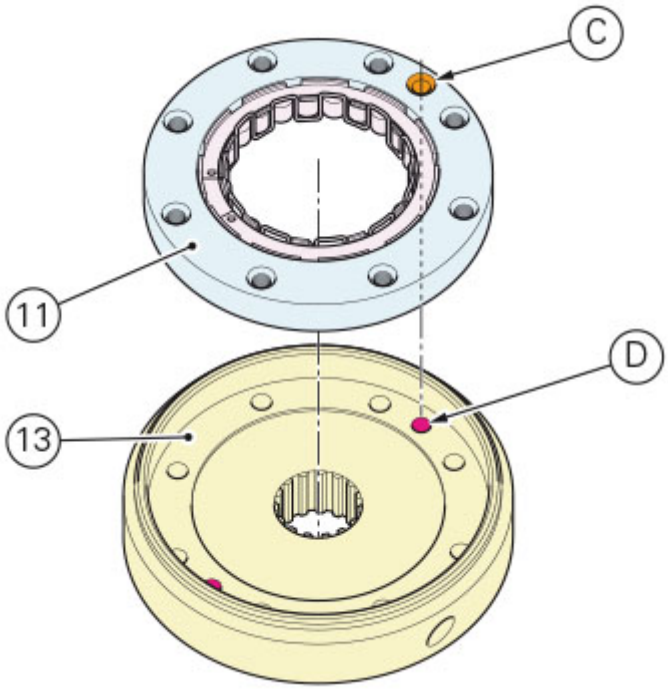
Important

Aim flange so that the side with the chamfered edge is facing the starter clutch.

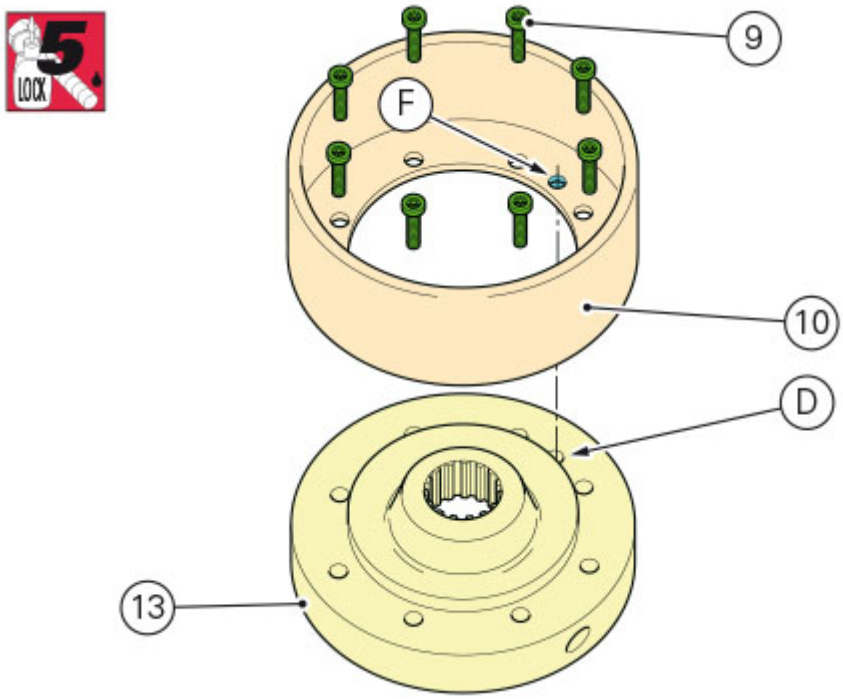




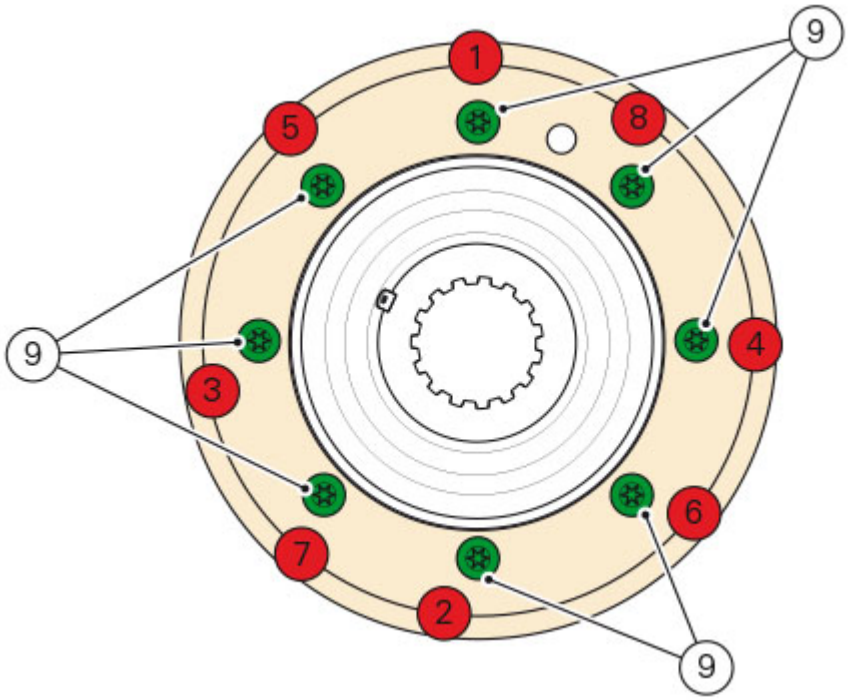
Fit the flange (11) with starter clutch fully home into the flywheel (13), ensuring the centring hole (C) on flange matches the flywheel centring hole (D).
Insert a pin or a wrench inside rotor flywheel hole (E) so as to align flywheel holes with flange threads.
This precaution can prove useful as flange is mounted by a forced interference fit and holes cannot thus be aligned after flange is fitted inside flywheel.
Aim flange so that the side with the chamfered edge is facing the flywheel.



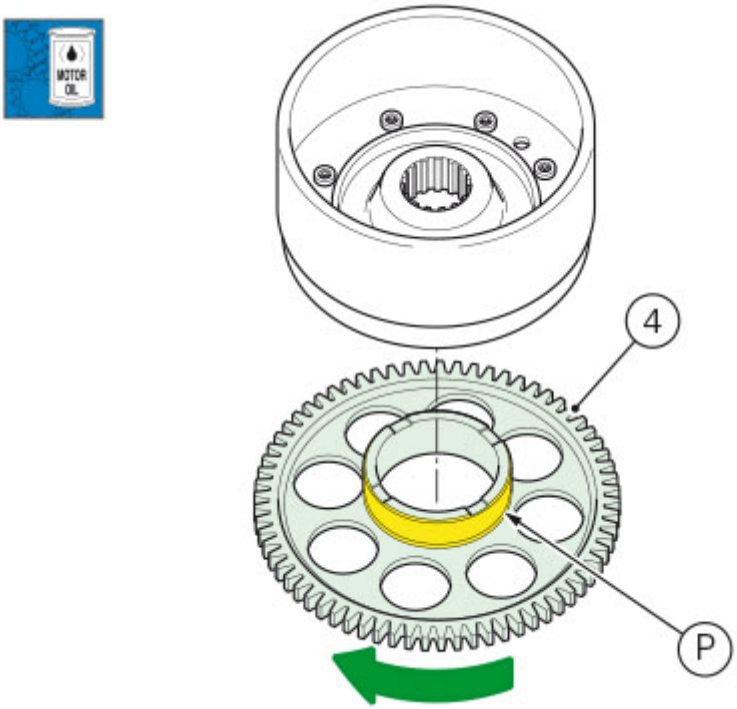
Fit rotor (10) on flywheel (13) centring flywheel hole (D) with rotor centring hole (F).
If screws are not new, apply threadlocker on the rotor/flywheel fastening screws (9) and start them.



Tighten the screws (9) to a torque of 13 Nm (Min. 11 Nm - Max. 15 Nm), following the sequence indicated in the figure.



Lubricate the race (P) of the driven gear (4) with engine oil.

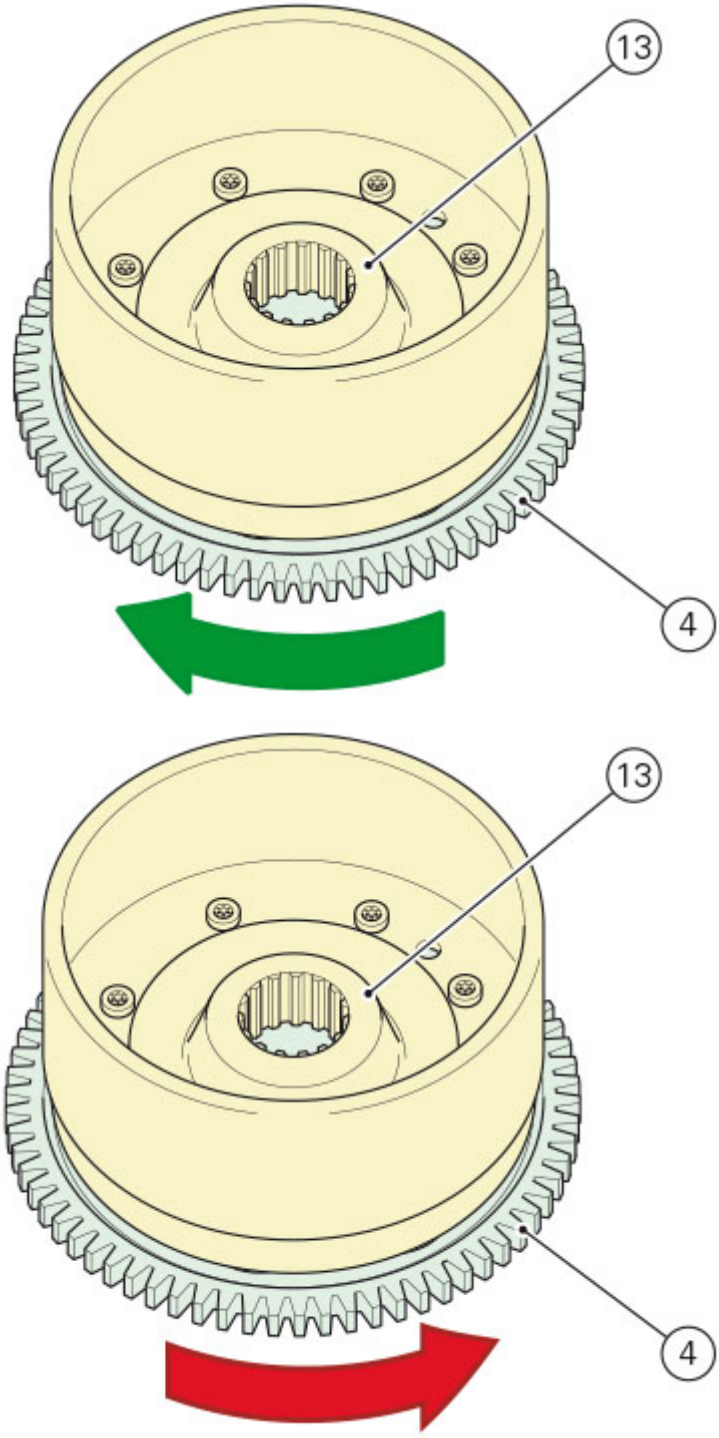


Fit the driven gear (4) on the starter clutch (13), ensuring it is properly seated.

Note

To help insertion, turn the driven gear in the direction indicated by the "green" arrow.

Check that the driven gear can rotate freely in the direction of the green arrow but not in the direction of the red arrow.
If either of these two conditions is not met, this means that the starter clutch has not been fitted correctly.

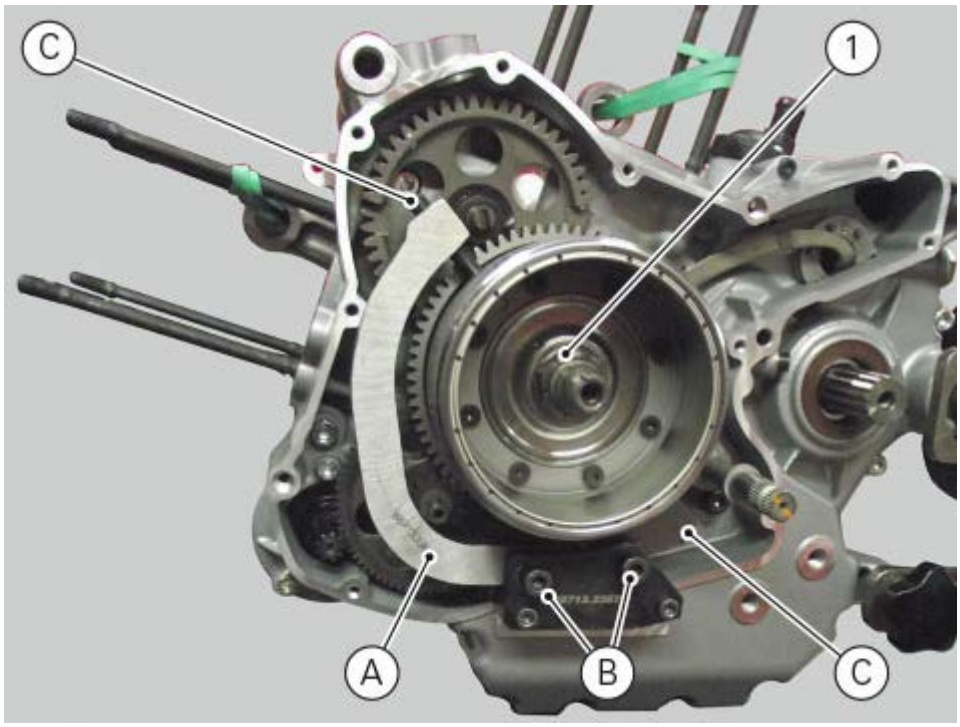


Removing the flywheel/generator assembly

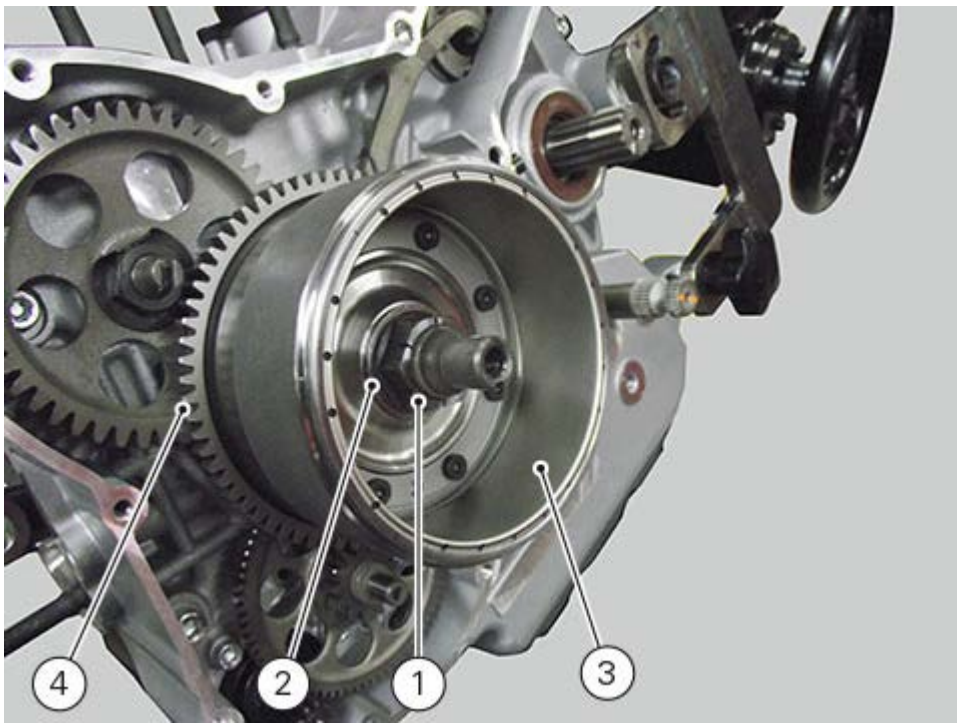
Drain the coolant (Changing the coolant).
Drain the engine oil (Changing the engine oil and filter cartridge).
Remove the cooling system hoses (Removing cooling system hoses and unions).
Remove the generator cover (Removing the generator cover).

Fix tool (A) part no. **88713.3367** to the mounting holes M10 (B) of side stand.
Secure the tool to the flywheel with the screws (C).
Unscrew the generator-flywheel retaining nut (1).

Warning
While unscrewing the nut, apply axial pressure to the socket to avoid damage or injury in the event of the wrench suddenly slipping off the nut.

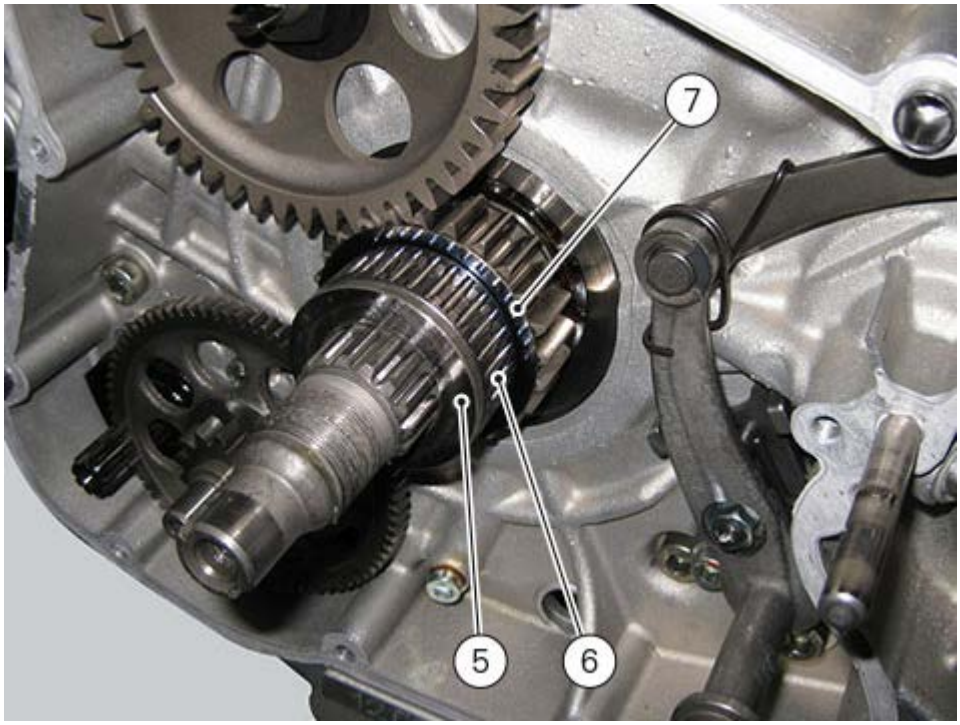


Remove the nut (1), the washer (2) and the flywheel assembly (3) with the driven gear (4) from the crankshaft.



Remove the inner ring (5), the needle roller bearing cage (6) and the washer (7).

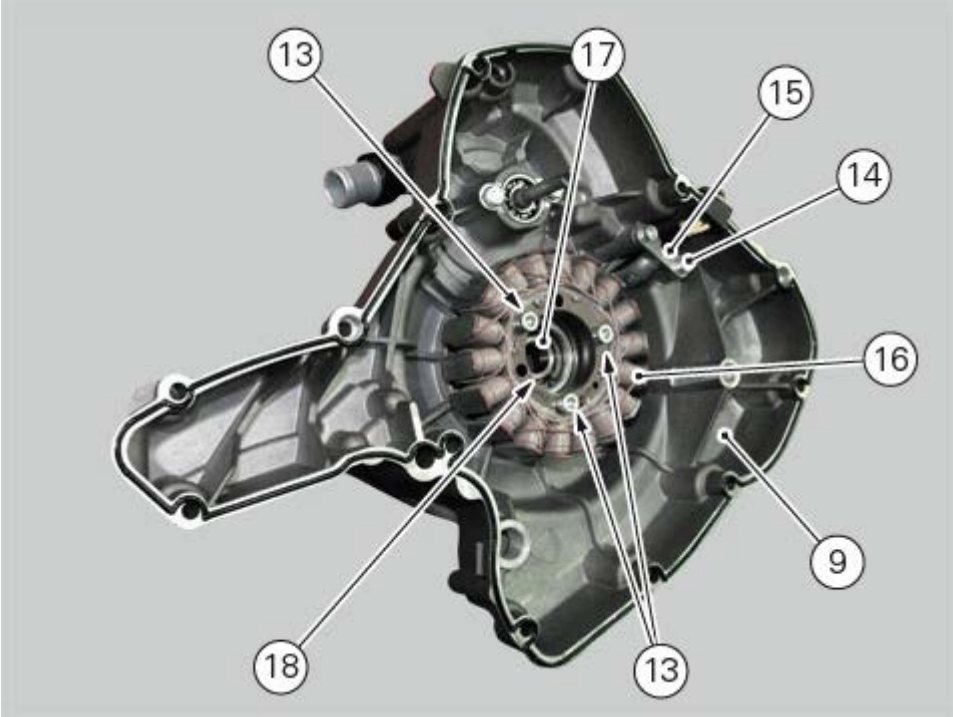
Check the inner ring (5), the needle roller bearing cage (6) and the washer (7) for wear. Replace if worn.



Disassembling the generator cover

Undo the three stator retaining screws (13) and the retaining screws (14) of the cable guide bracket (15) from inside the generator cover.
Remove the stator (16) and the cable guide bracket (15).

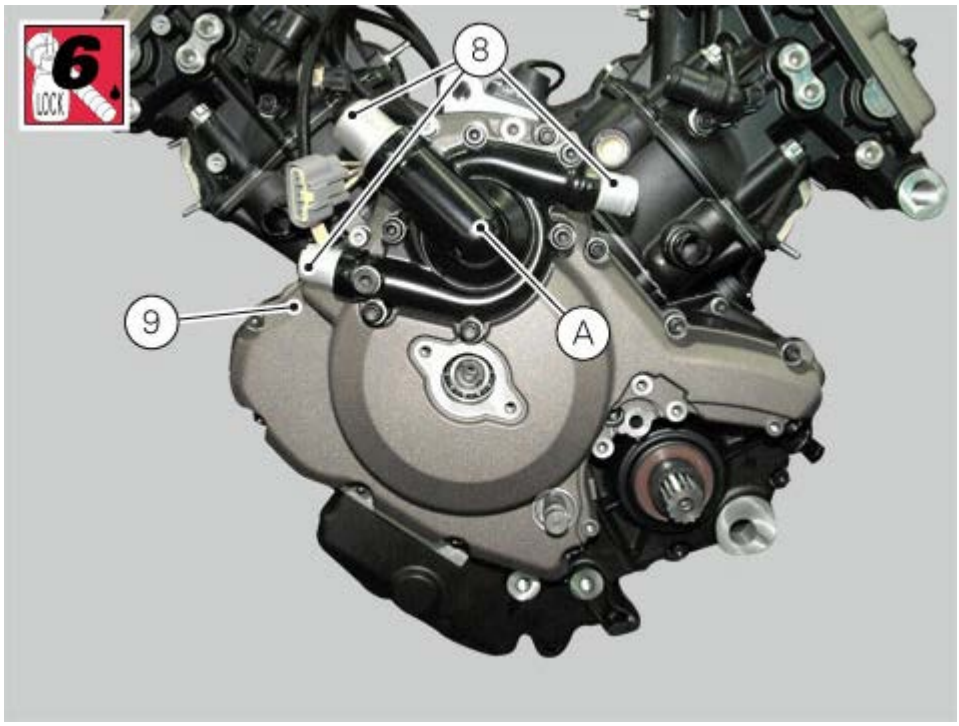
The generator cover is fitted with a bearing (17), held in place by the circlip (18), which is located on the end of the crankshaft.
Remove the circlip (18) with suitable pliers.
Remove the bearing (17) using a universal puller.
Be careful when fitting the new bearing (17) to ensure it is positioned with the shielded side facing away from the cover.
Secure the bearing with the circlip (18), ensuring that it is correctly fitted in its seat in the generator cover (9).
When refitting stator, tighten the three screws (13) to a torque of 10 Nm (Min. 9 - Max. 11) and the screws (14) to a torque of 5 Nm (Min. 4.5 Nm - Max. 5.5 Nm) after having applied the indicated product.



Loosen the unions (8) delivering water to the horizontal and vertical cylinder assemblies.
When fitting the new components, apply the recommended sealant and tighten to a torque of 25 Nm (Min. 23 Nm - Max. 27 Nm).

The unions (8) may also be removed without removing the generator cover (9) from the engine.

Remove the water pump components (A) (Removing the water pump).

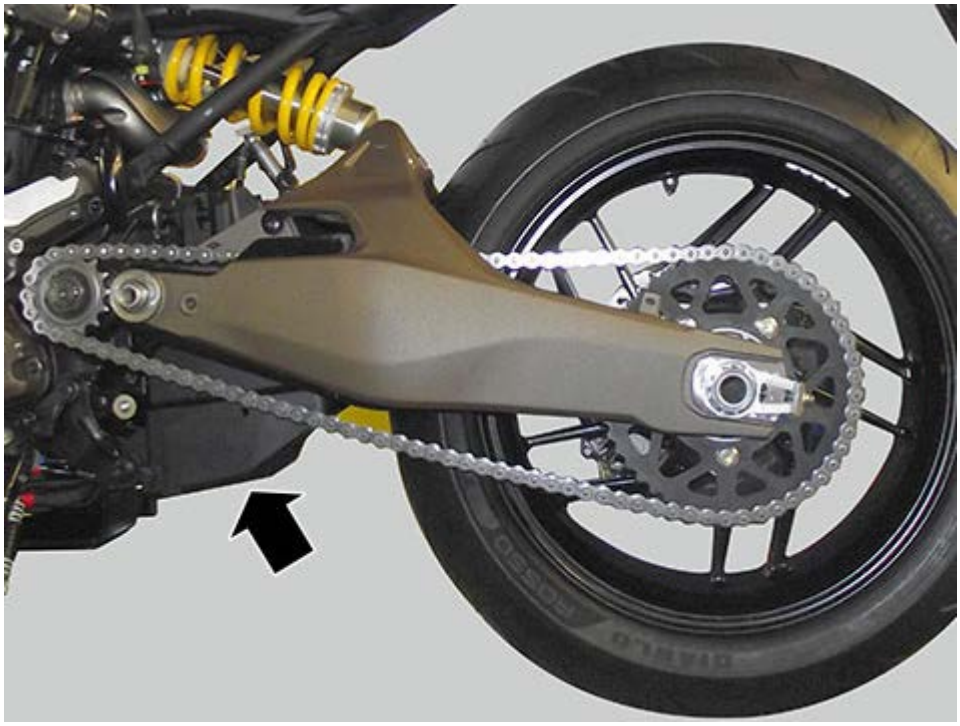


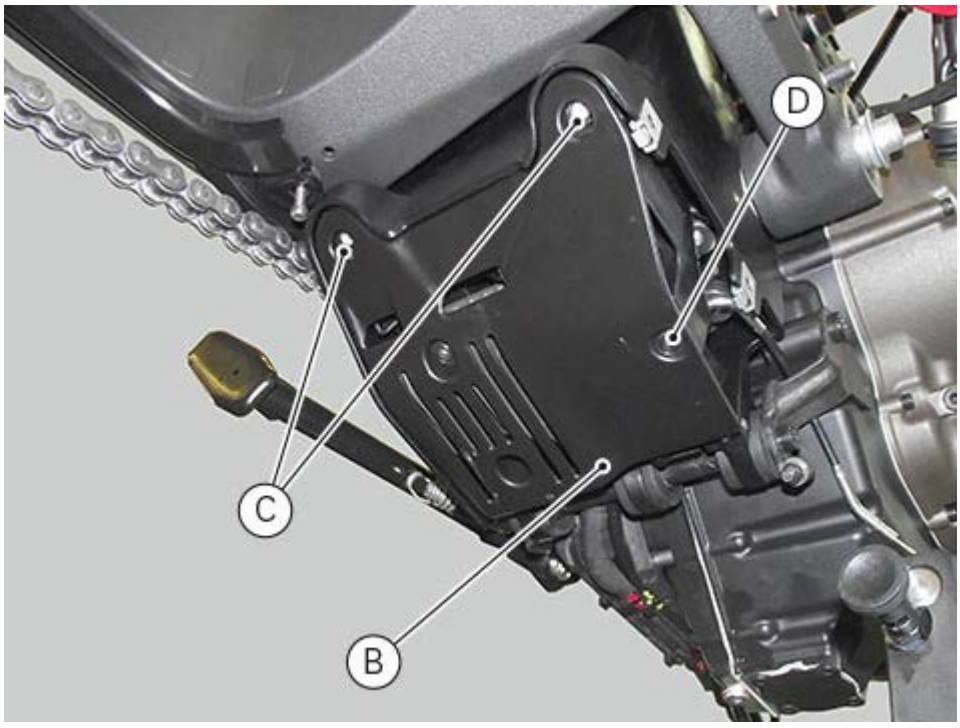
Removing the generator cover

Remove the cooling system hoses (Removing cooling system hoses and unions).
Drain the engine oil (Changing the engine oil and filter cartridge).
Remove the front sprocket cover (Removing the front sprocket).
Remove the gearchange mechanism (Removing the gear shift).

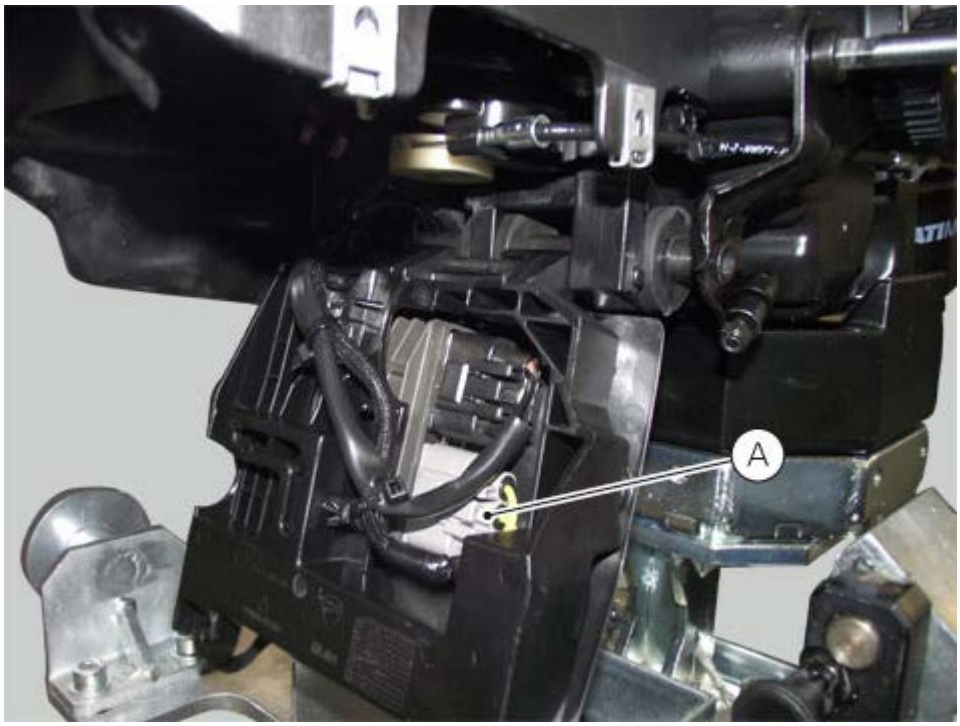
Note
This operation is described for an engine removed from the frame since all reassembly procedures are easier with the engine on the bench.

The voltage regulator is located inside battery mount (B).
To gain access to generator cable connector, open battery mount (B) by loosening screws (C) and (D).

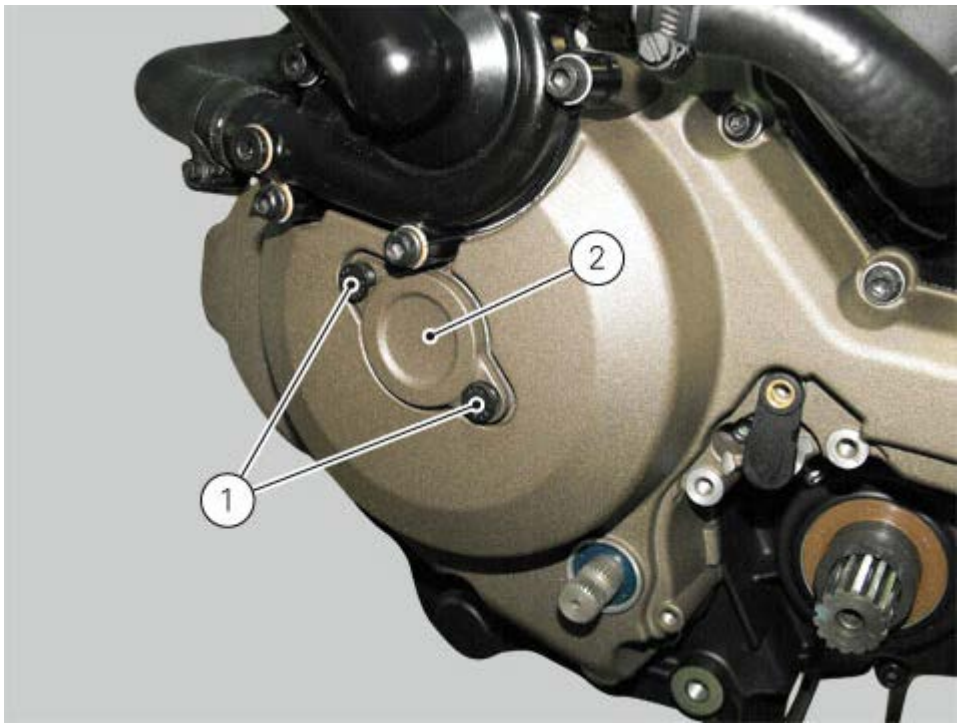




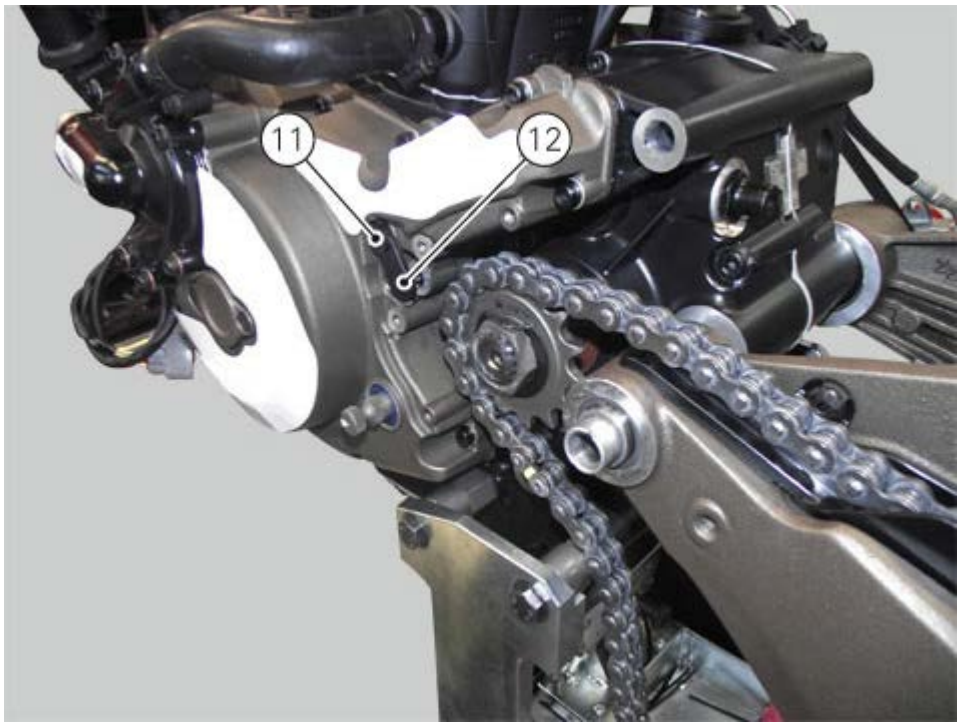
Disconnect generator cable connector (A) from voltage regulator, releasing it from ties.



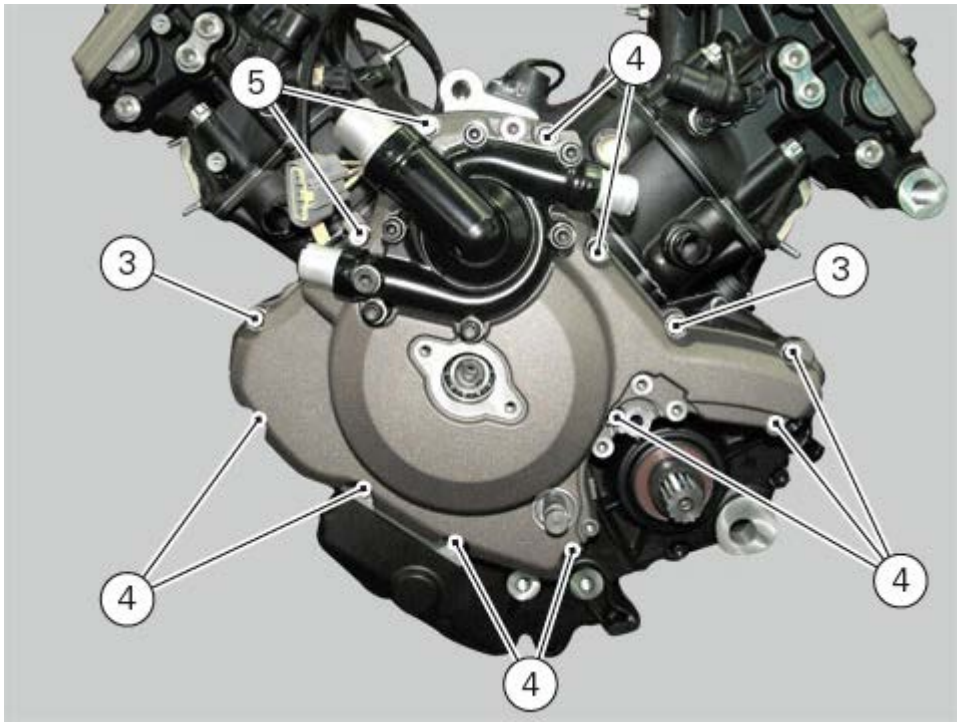
Undo the two retaining screws (1) of cover (2) over the end of the crankshaft and collect the relevant gasket.



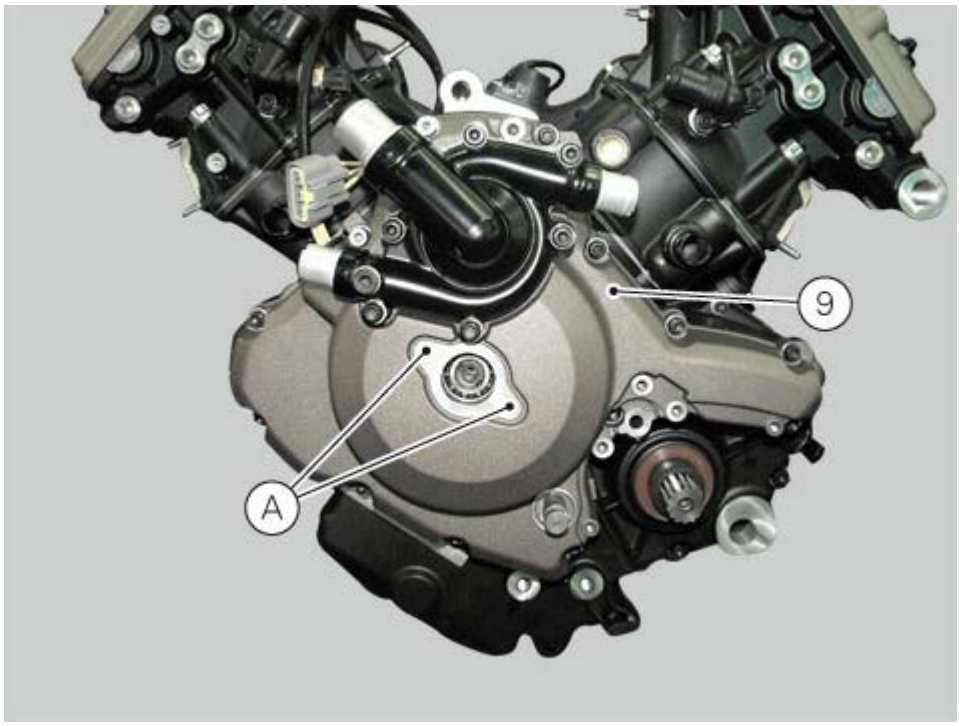
Loosen screw (11) and slide out clutch rod cap (12).



Loosen the two screws (3), the nine screws (4) and the two screws (5) on generator cover.



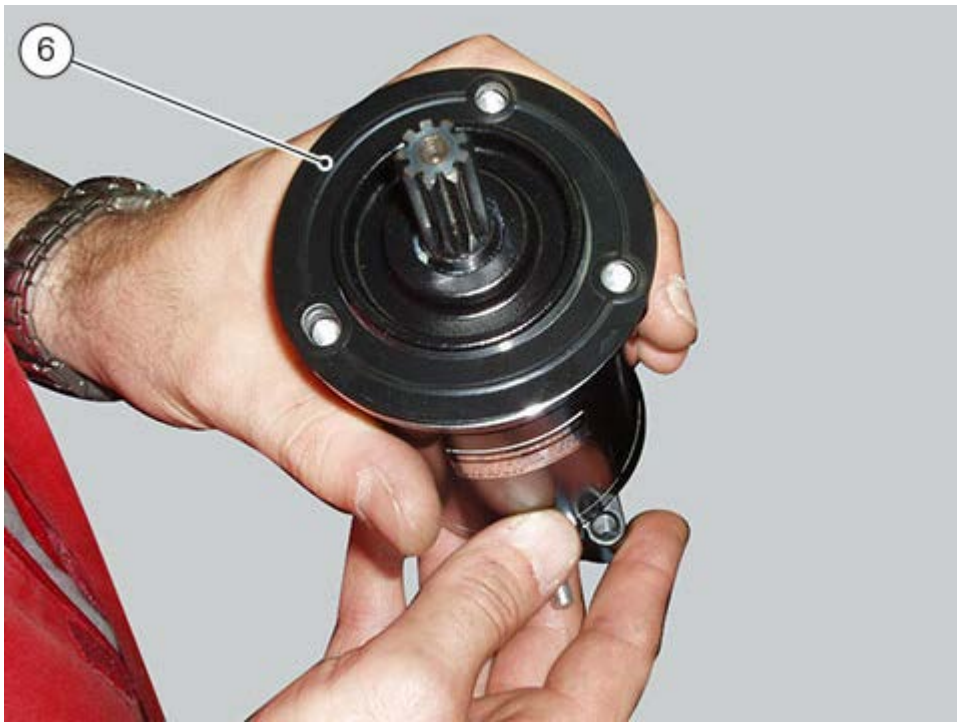
Fix service tool no. **88713.1749** to the holes (A) left vacant by the screws (1) you have just removed. Turn the tool shaft slowly to separate the cover (9) from the LH crankcase half.



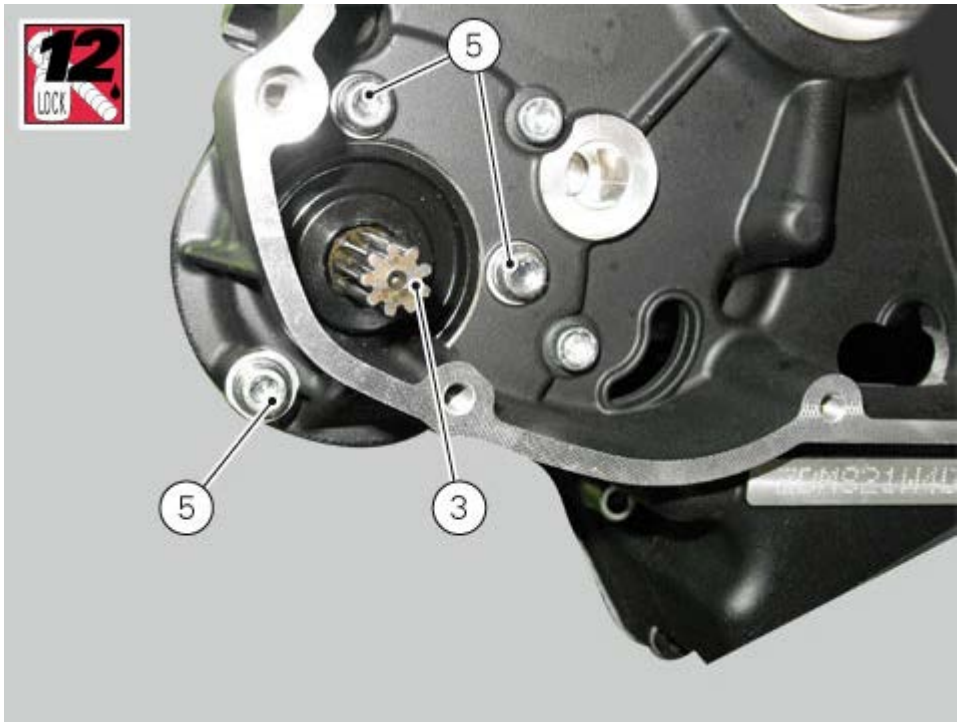
There is a sealing ring (10) on the cover (9) at the gearchange lever shaft that may be damaged when removing the generator cover.
Always check the condition of this sealing ring and replace it if damaged.

Refitting the starter motor

Visually check the gasket (6) for wear and replace it if necessary.



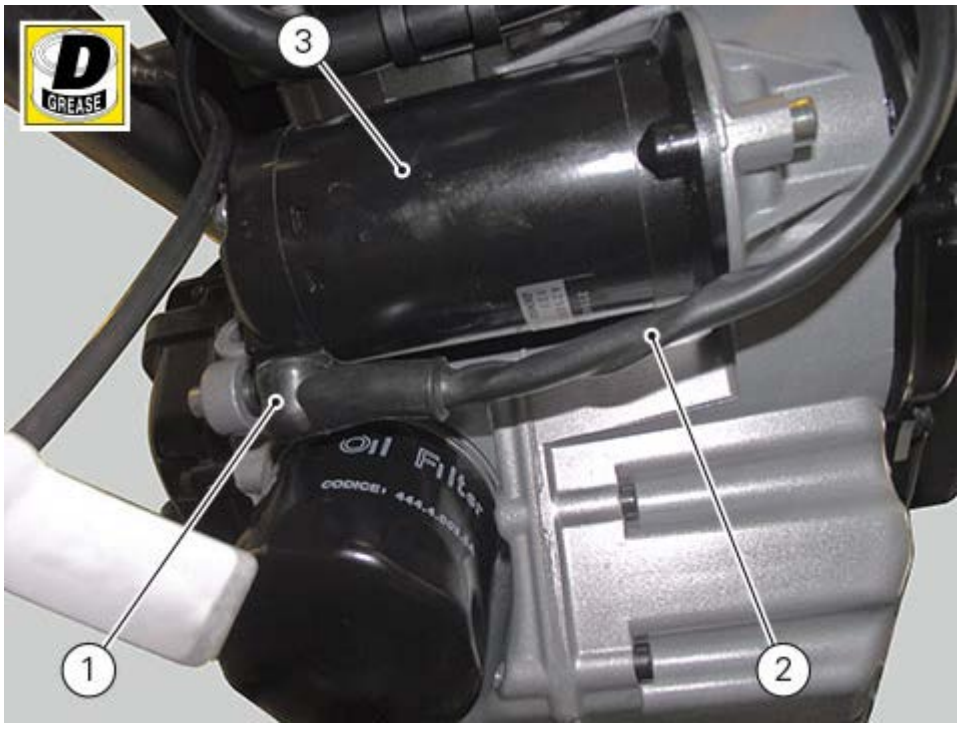
Position the gasket (6) and starter motor on the crankcase.
If screws (5) are not new, apply specified threadlocker and start them.
Tighten screws (5) to a torque of 10 Nm (min. 9 Nm. - Max. 11 Nm).



Place starter motor/solenoid starter cable (2) and tighten starter motor fastening nut (3) to a torque of 5 Nm ± 10%.

Important
Fill the protection cap with protective grease before fitting it on the starter motor.

Position protection cap (1).

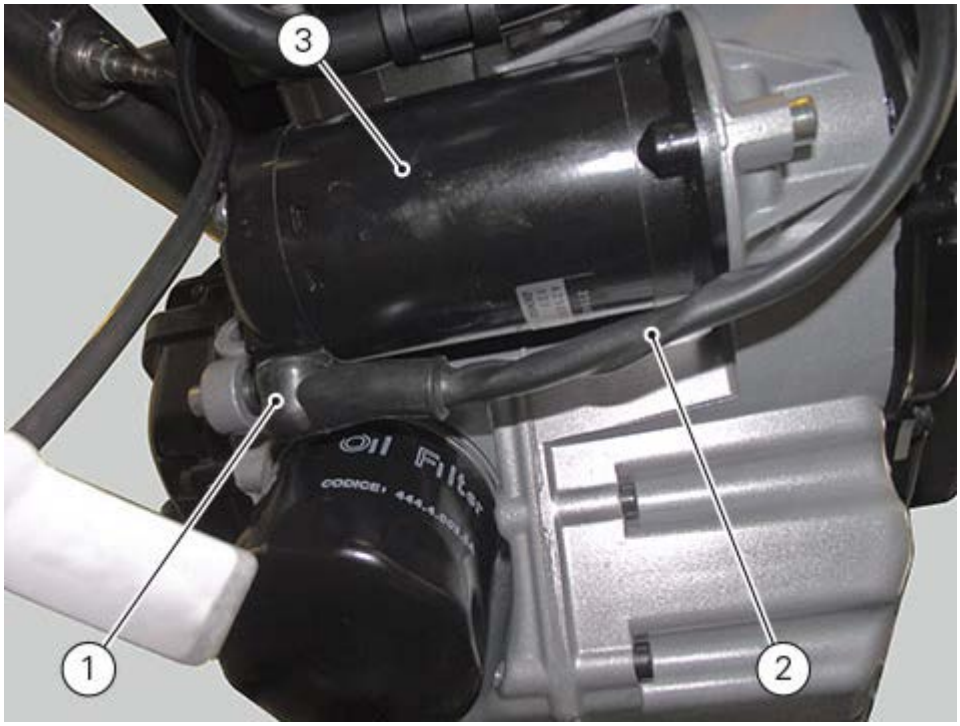


Refit the complete generator (Fitting the flywheel/generator assembly) and the generator side cover (Fitting the generator cover).
Refit the cooling system hose (Refitting cooling system hoses and unions).
Refill the cooling system (Checking the coolant level).
Fill the engine with oil (Changing the engine oil and filter cartridge).
Refit the lower wiring covers (Closing the crankcase).
Refit the exhaust system (Refitting the exhaust system).

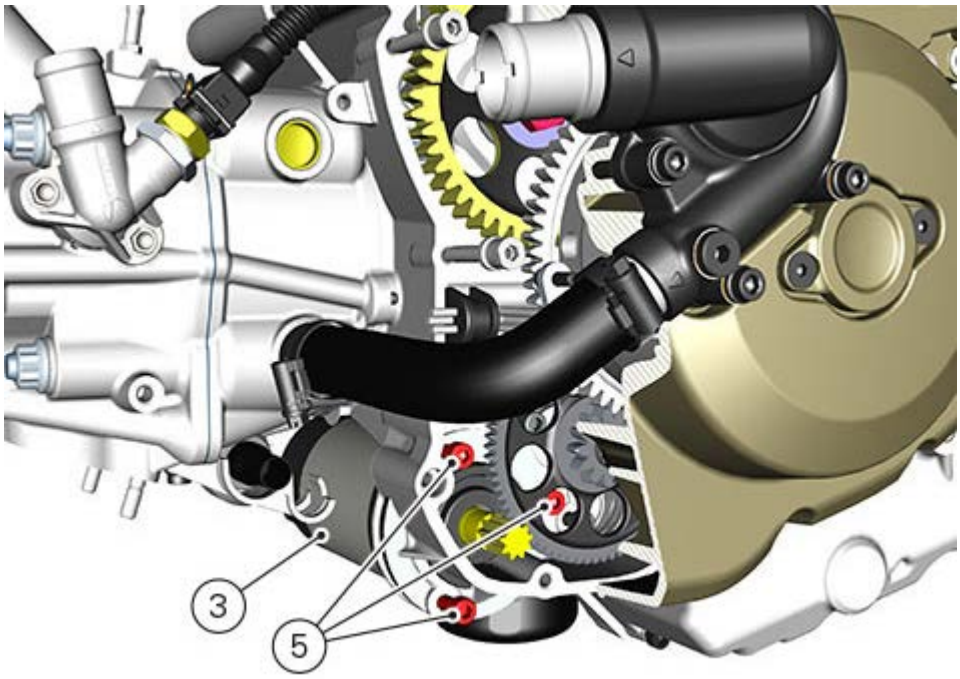
Removing the starter motor

Remove the left lower wiring cover (Separating the crankcase halves)
Remove the exhaust system (Removing the exhaust system).
Drain the engine oil (Changing the engine oil and filter cartridge).
Drain the coolant (Checking the coolant).
Remove the cooling system hoses (Removing cooling system hoses and unions).
Remove the generator cover (Removing the generator cover).
Remove the flywheel/generator assembly (Removing the flywheel/generator assembly).
Remove the starter motor idler gear (Removing the starter motor idler gear).

Remove protection cap (1) of starter motor /solenoid starter cable.
Loosen the screw located under cap and remove starter motor cable (2) from starter motor (3).



Loosen the screws (4) and (5) securing starter motor to crankcase, and remove both gasket (6) and starter motor.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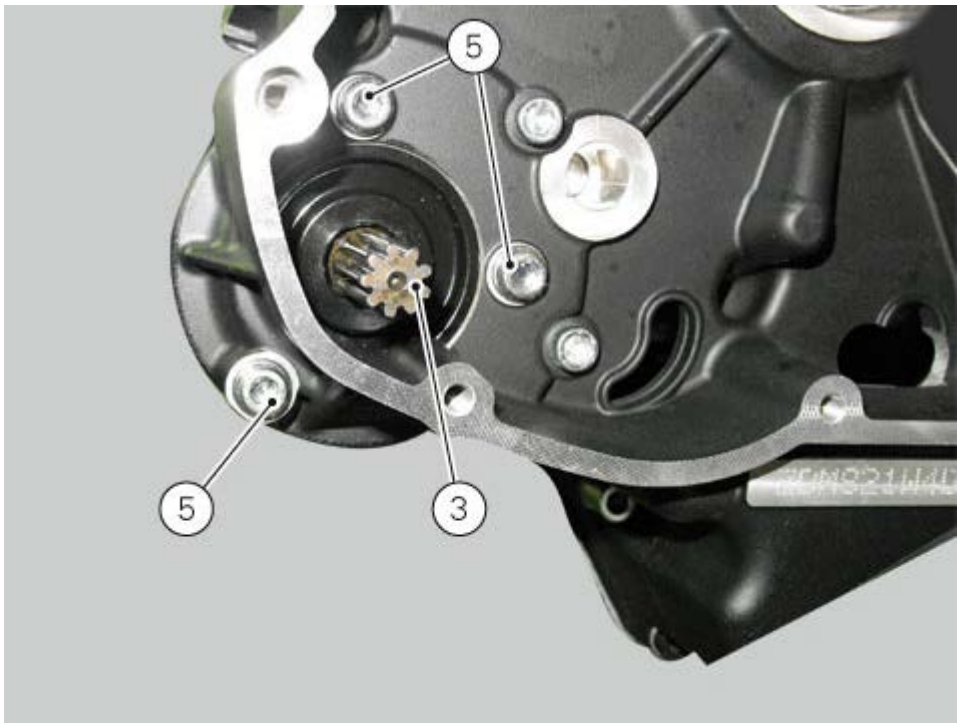
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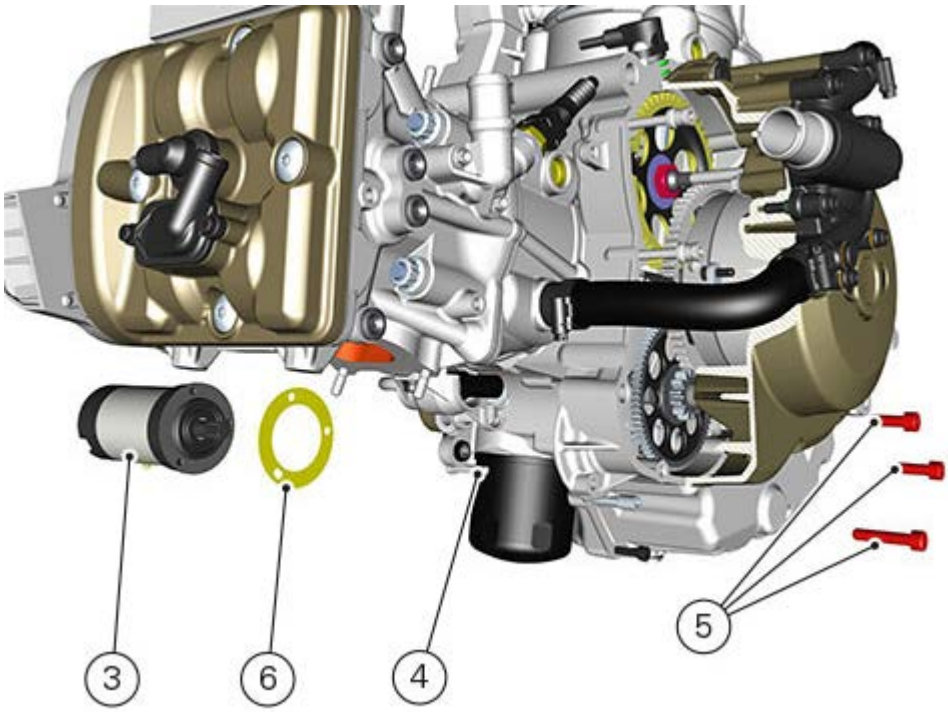
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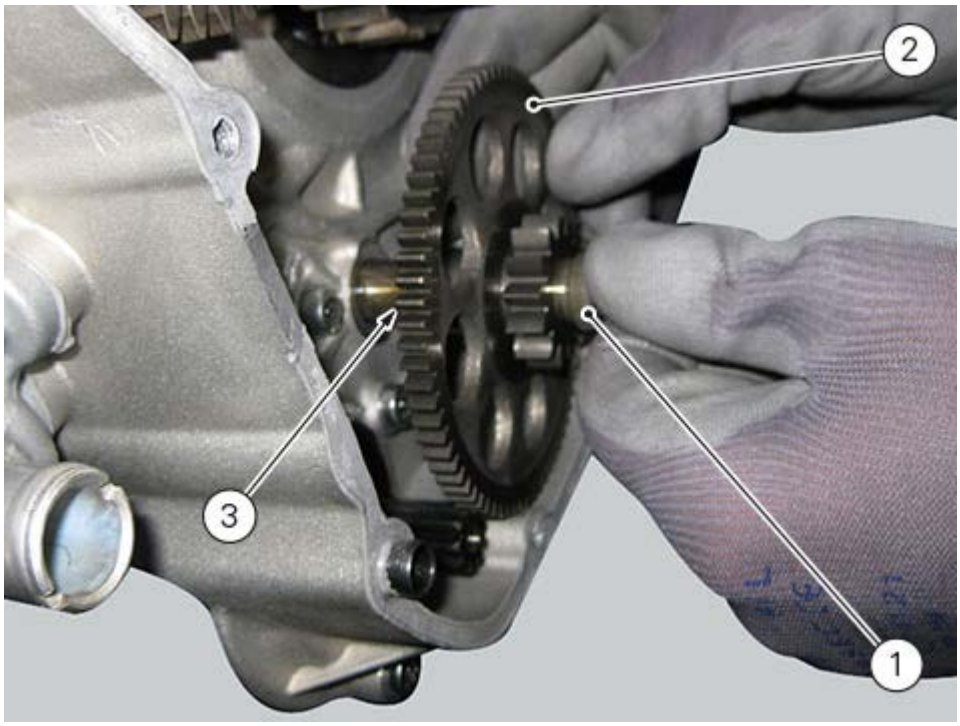
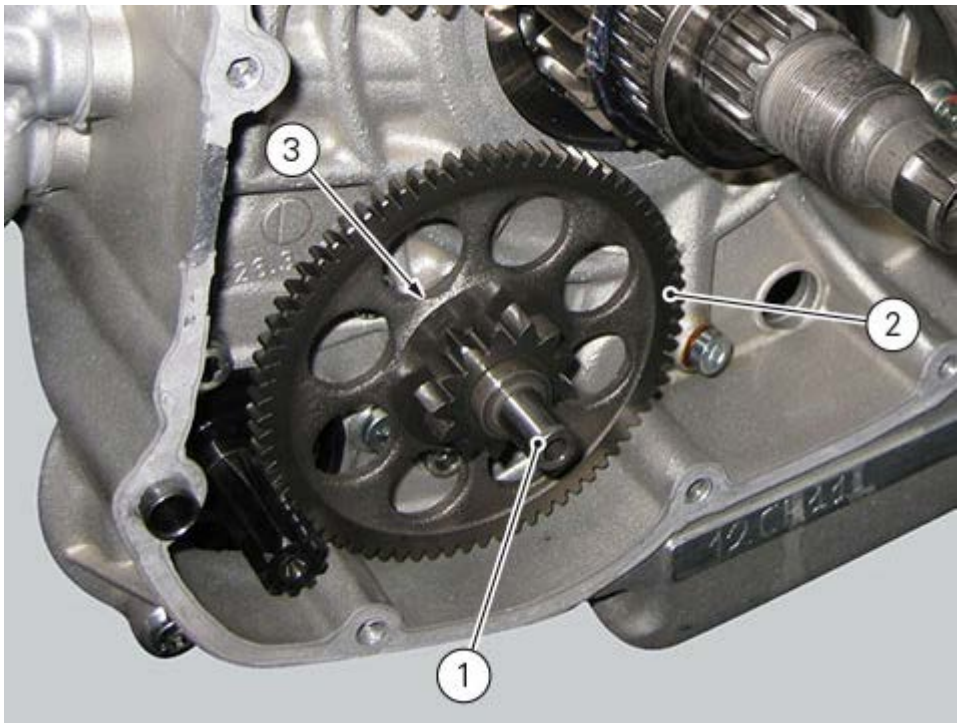
Refitting the starter motor gear

Position the washer (3) and the gear (2) on the pin (1) and drive it fully home on the crankcase half.





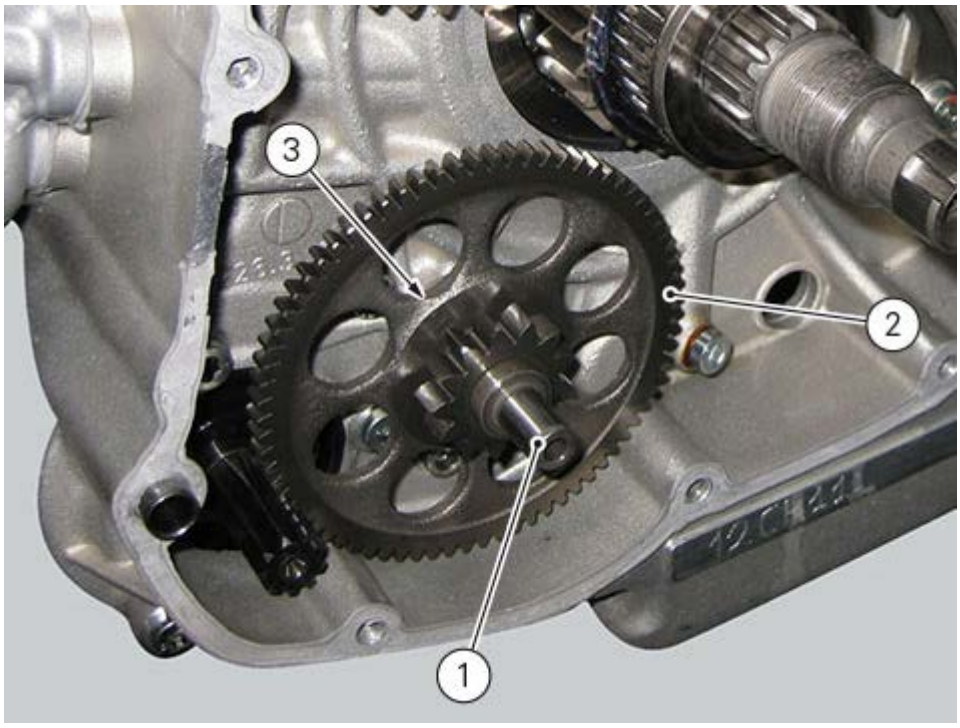
Refit the complete generator (Fitting the flywheel/generator assembly) and the generator side cover (Fitting the generator cover).
Refit the cooling system hose (Refitting cooling system hoses and unions).
Refill the cooling system (Changing the coolant).
Fill the engine with oil (Changing the engine oil and filter cartridge).

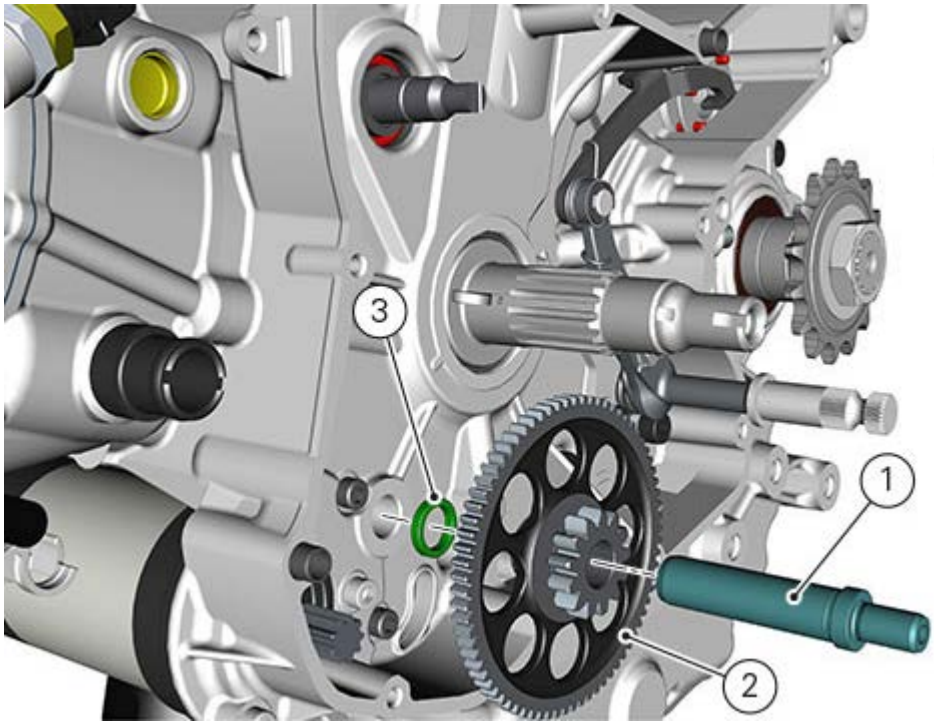
Removing the starter motor idler gear

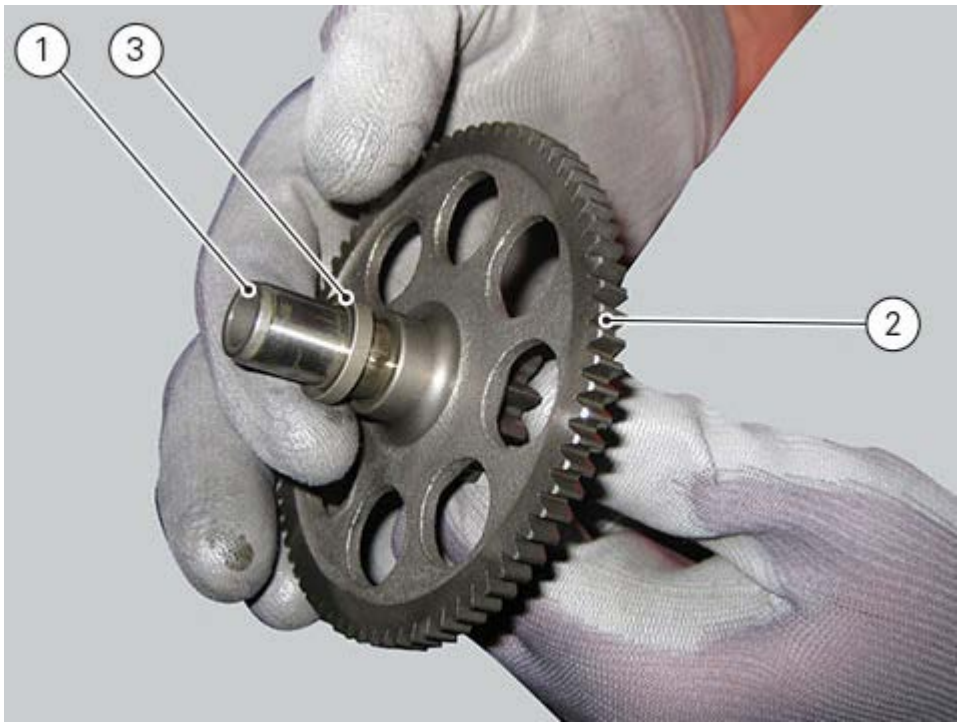
Remove the lower wiring covers (Separating the crankcase halves)
Drain the engine oil (Changing the engine oil and filter cartridge).
Drain the coolant (Changing the coolant).
Remove the cooling system hoses (Removing cooling system hoses and unions).
Remove the generator cover (Removing the generator cover).
Remove the flywheel/generator assembly (Removing the flywheel/generator assembly).

Slide out the transmission pin (1) with gear (2) and washer (3).

Warning
Be careful when positioning the washer as it could fall inside the crankcase half







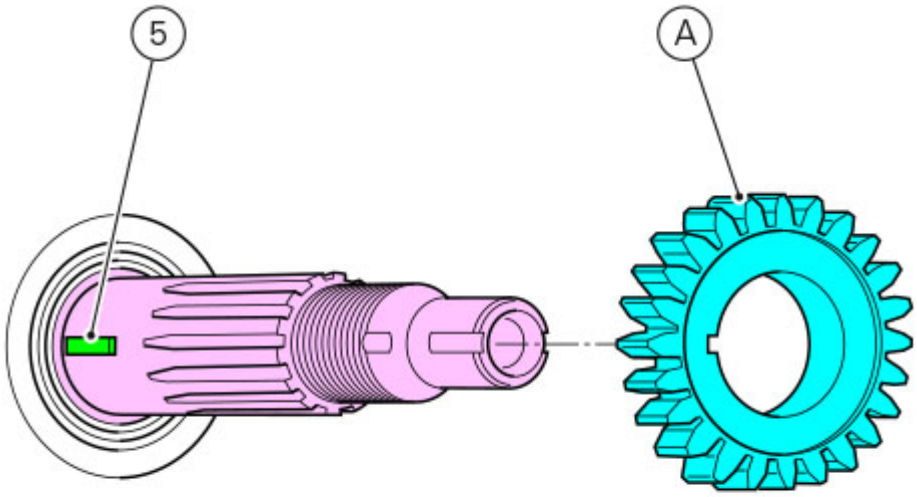
At this point, it is possible to remove the starter motor (Removing the starter motor).

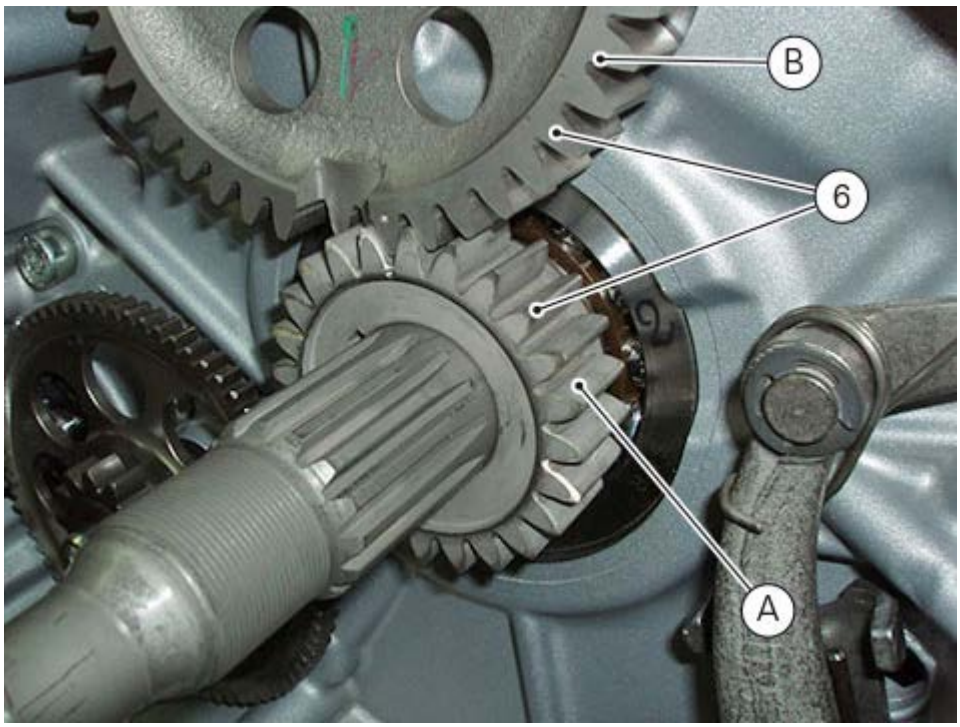
Refitting the timing gears

Before reassembling the removed parts, check timing gears (6) for wear. Change, if necessary.

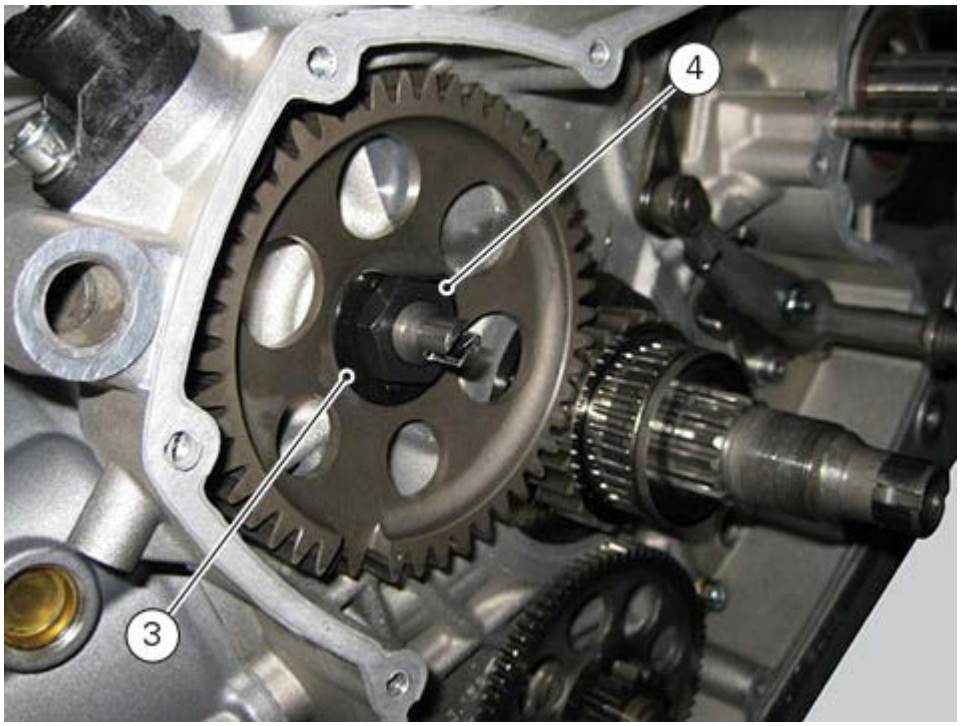
Important
The timing gears must always be replaced as a pair.

Refitting is the reverse of removal.
When introducing the driven gear (B) check that the key (5) is correctly fitted on the timing layshaft, align the gear slot with the key matching the driving gear timing mark (A) with the gear (B).





On completion of the refitting operations, check that washer (3) is staked against nut (4) in such a way to prevent the nut from working loose.

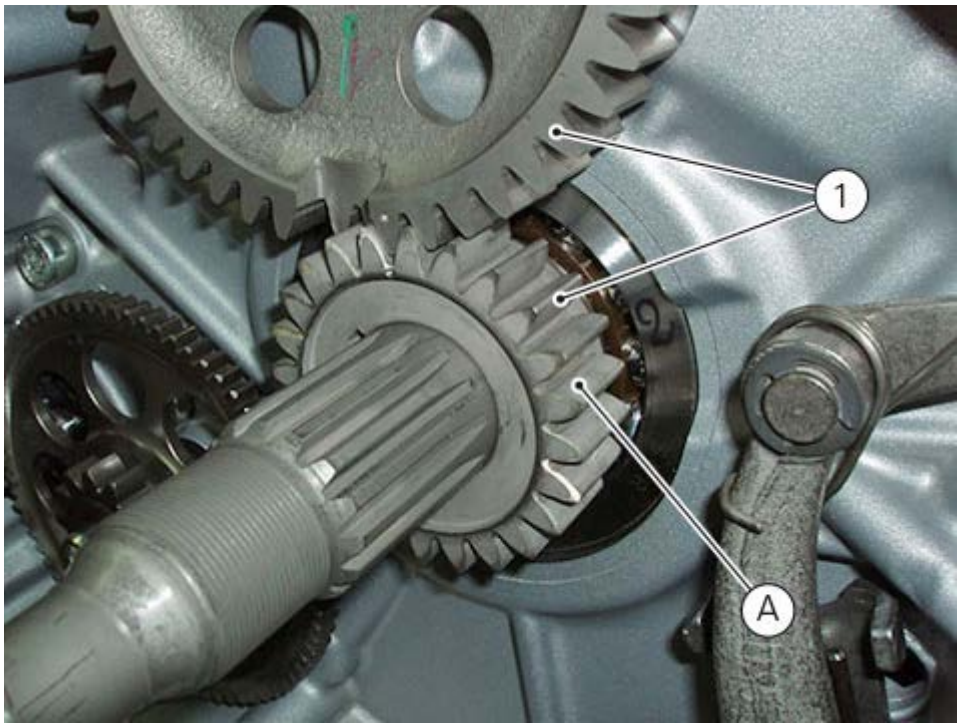


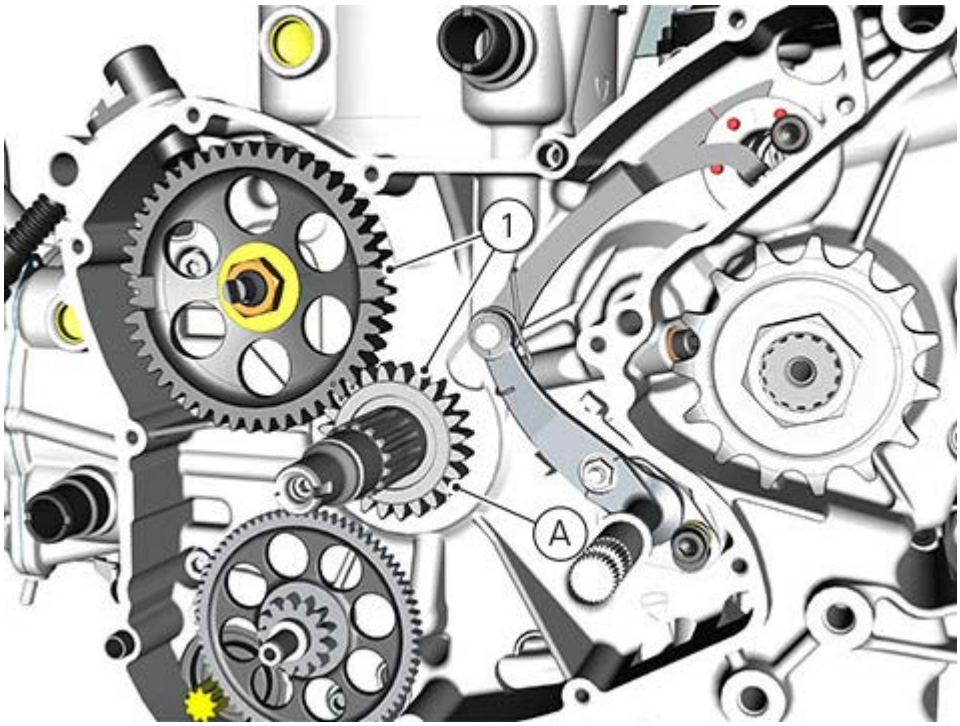
Refit the starter motor (Refitting the starter motor).
Refit the complete generator (Fitting the flywheel/generator assembly) and the generator side cover (Fitting the generator cover).
Refit the cooling system hose (Refitting cooling system hoses and unions).
Refill the cooling system (Changing the coolant).
Fill the engine with oil (Changing the engine oil and filter cartridge).

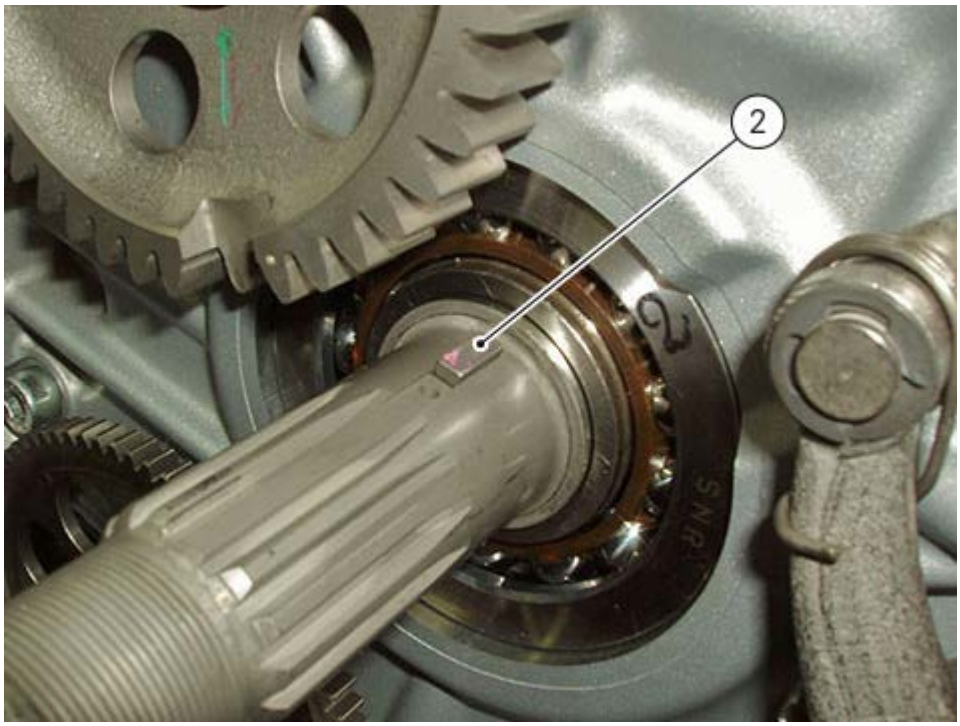
Removing the timing gears

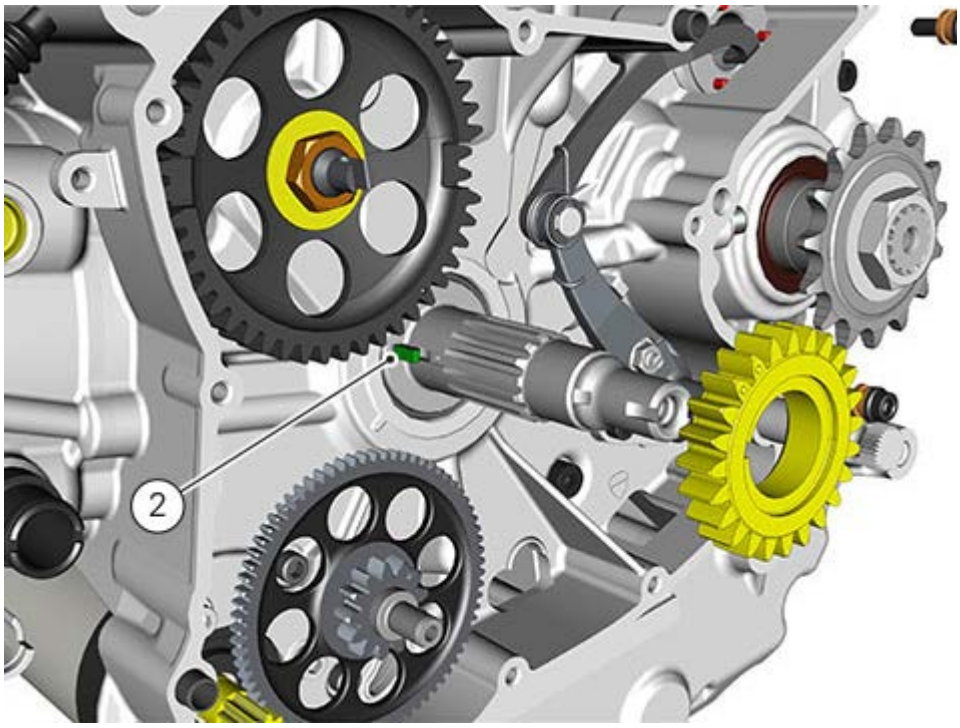
Drain the engine oil (Changing the engine oil and filter cartridge).
Drain the coolant (Changing the coolant).
Remove the cooling system hoses (Removing cooling system hoses and unions).
Remove the generator cover (Removing the generator cover).
Remove the flywheel/generator assembly (Removing the flywheel/generator assembly).

Slide out the driving gear (A) of the timing gear pair (1) and remove the key (2).

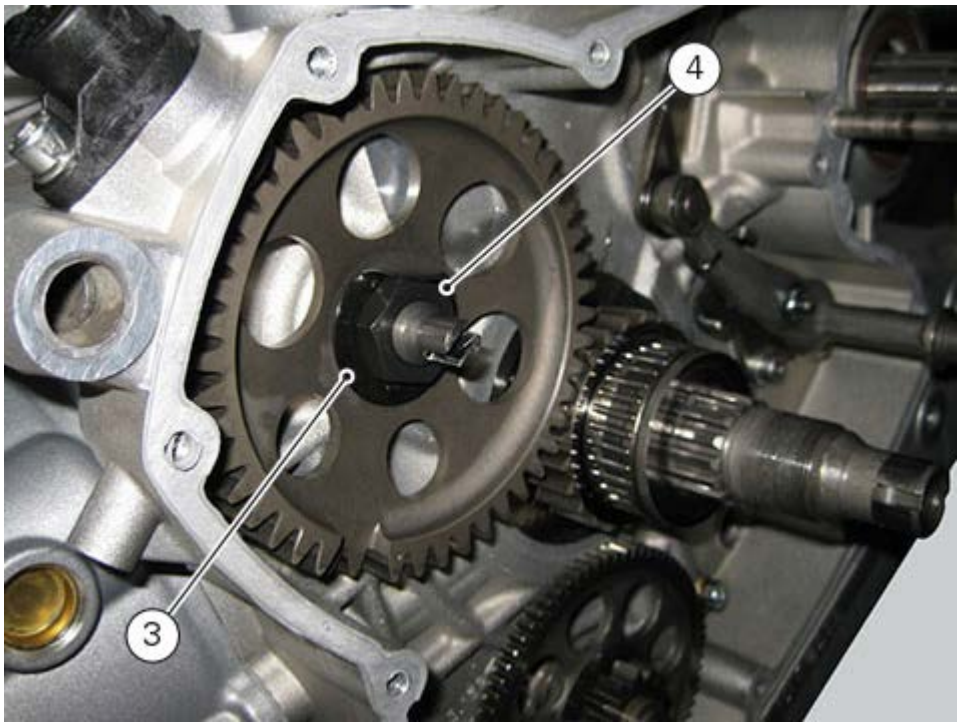


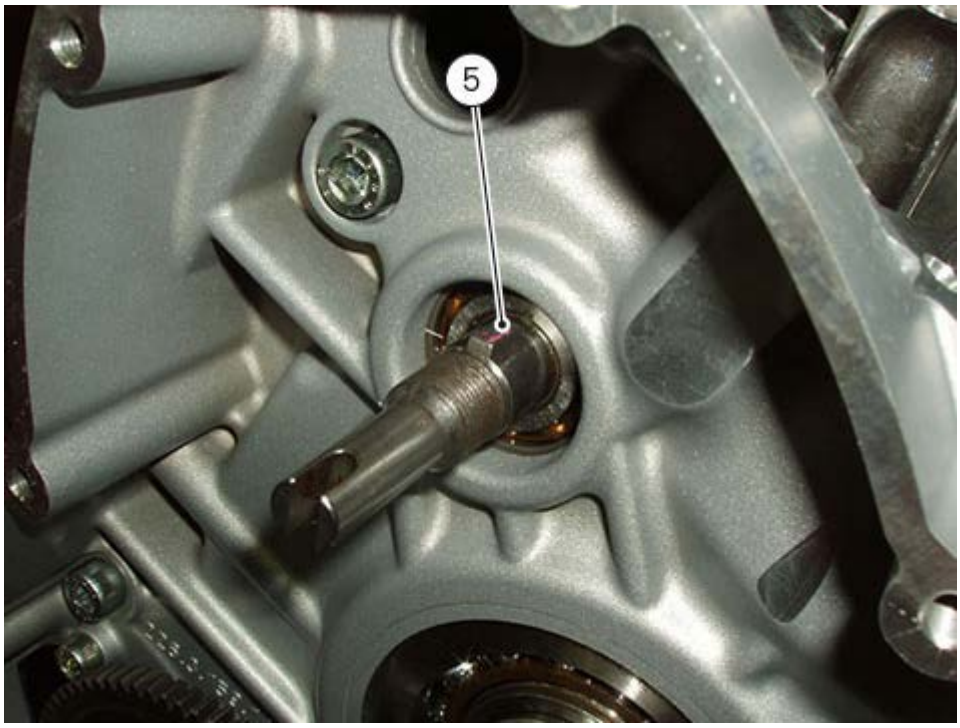


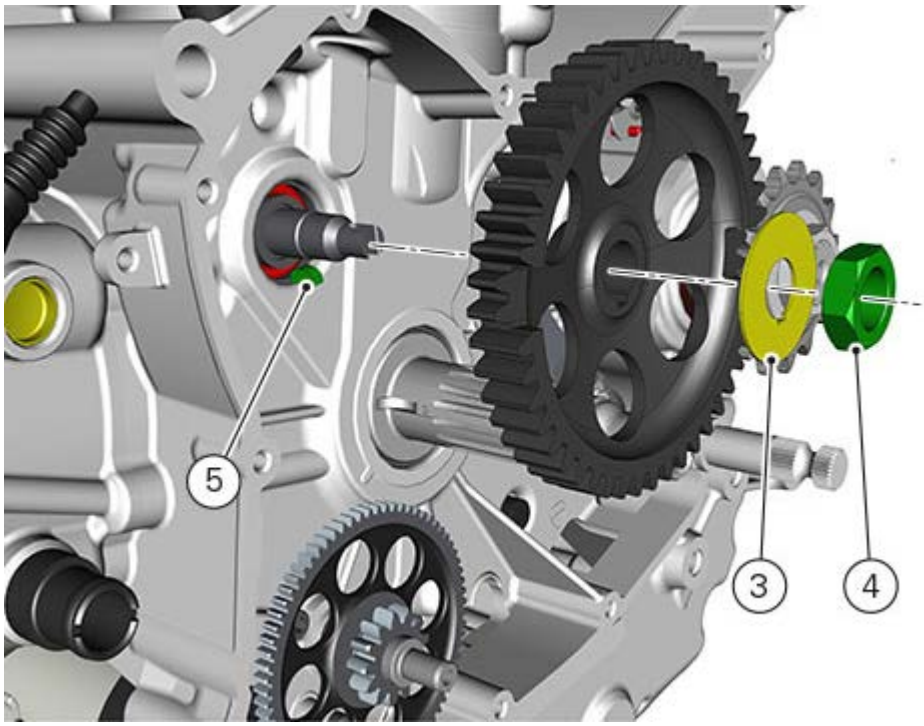




Straighten out the lock washer (3) of nut (4).
Restrain the timing gear by inserting a pin in one of the holes, and unscrew the locking nut (4).
Remove the nut (4), washer (3), timing driven gear and key (5) from the timing layshaft.



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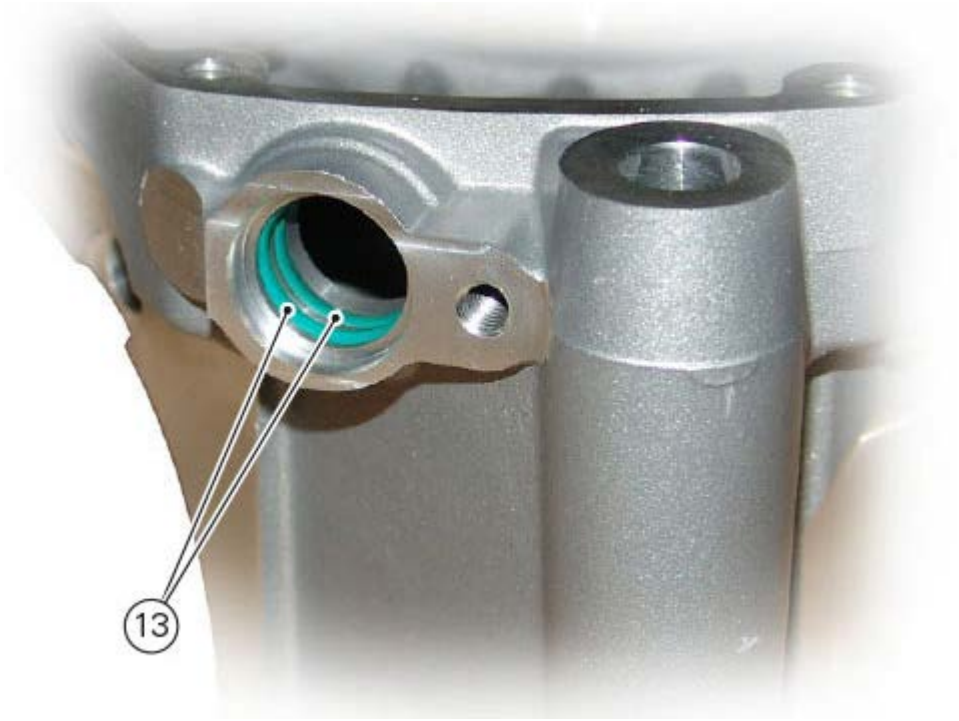
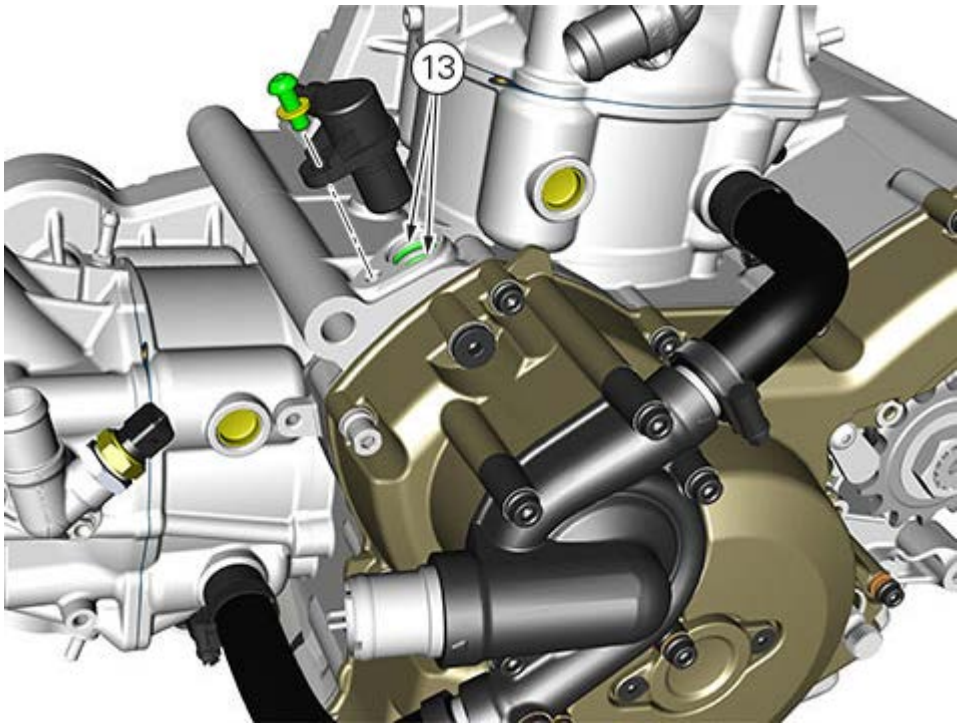
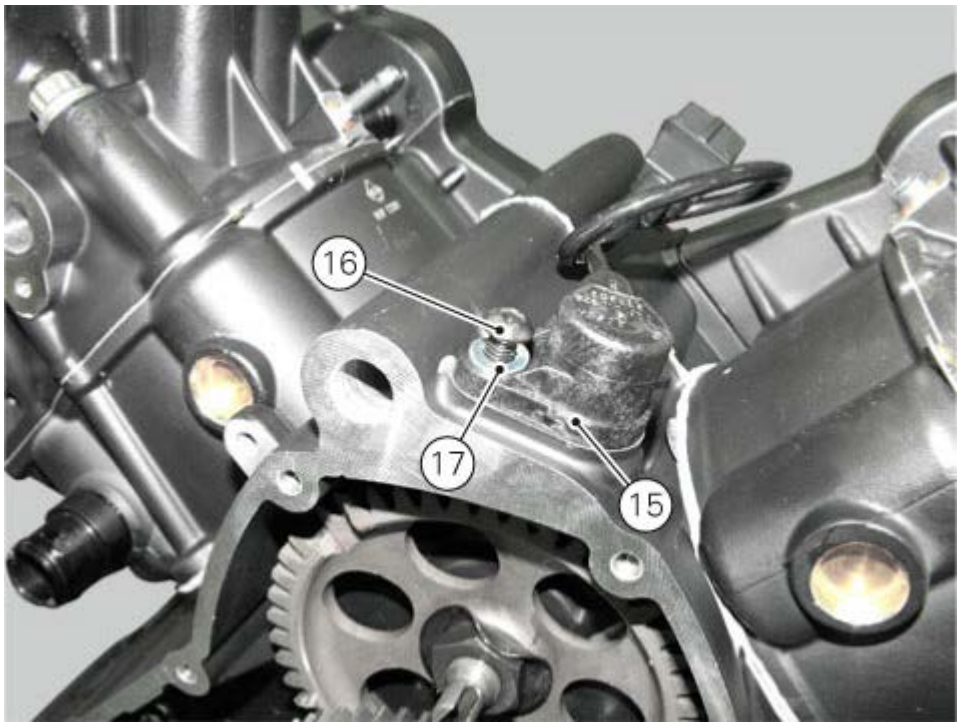
Refitting the external components

Make sure that the O-rings (13) are fitted on the crankcase.

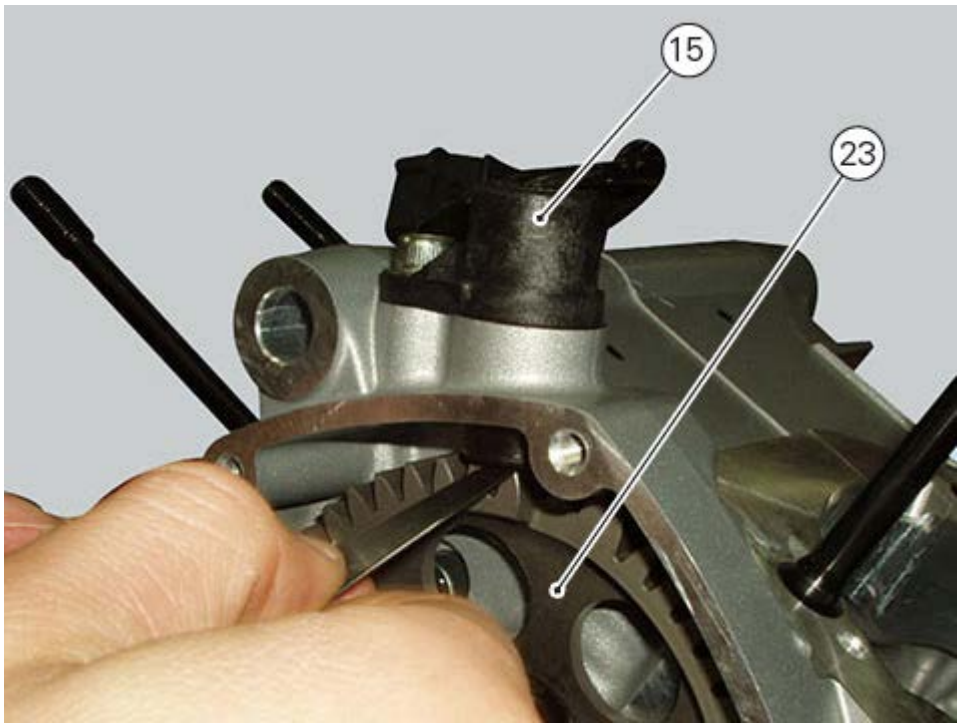




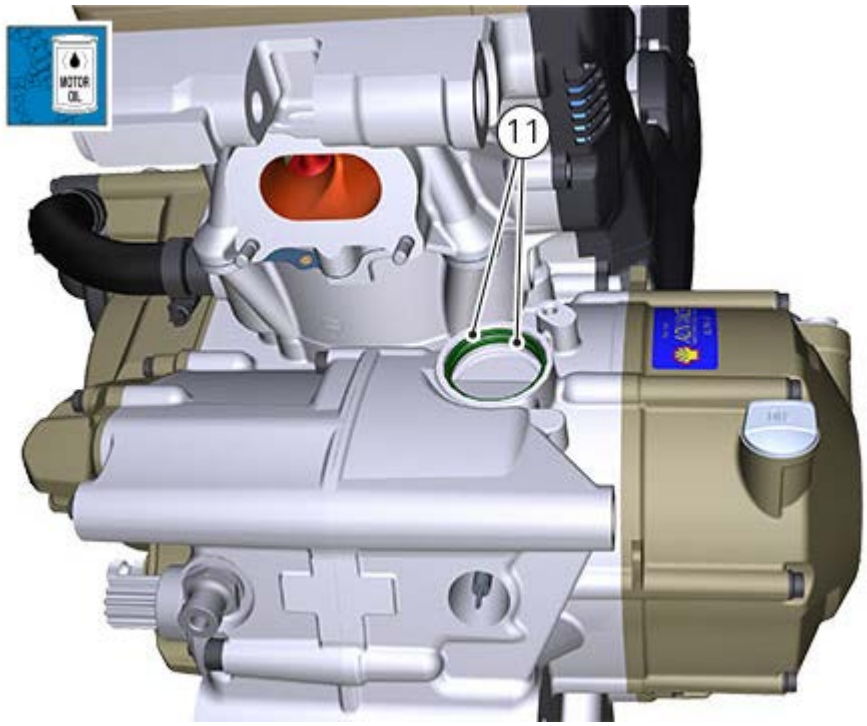
Fit the timing sensor (15) in its seat in the crankcase half.
Start the screw (16) with the washer (17) and tighten to a torque of 10 Nm (Min. 9 Nm - Max. 11 Nm).



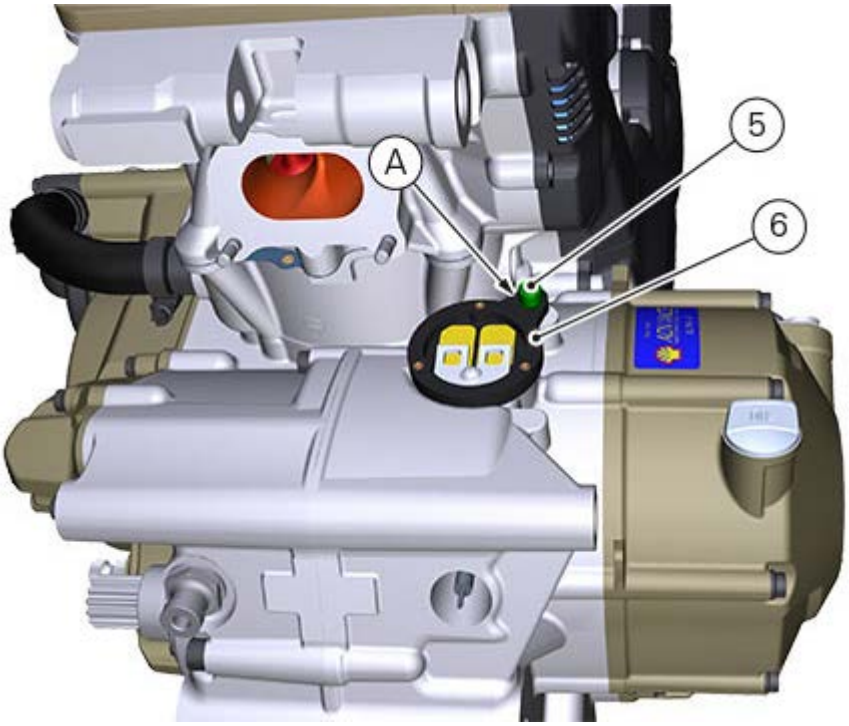
Use a feeler gauge to check the clearance between the timing sensor (15) and the timing gear (23): the value must be between 0.6 and 0.8 mm.



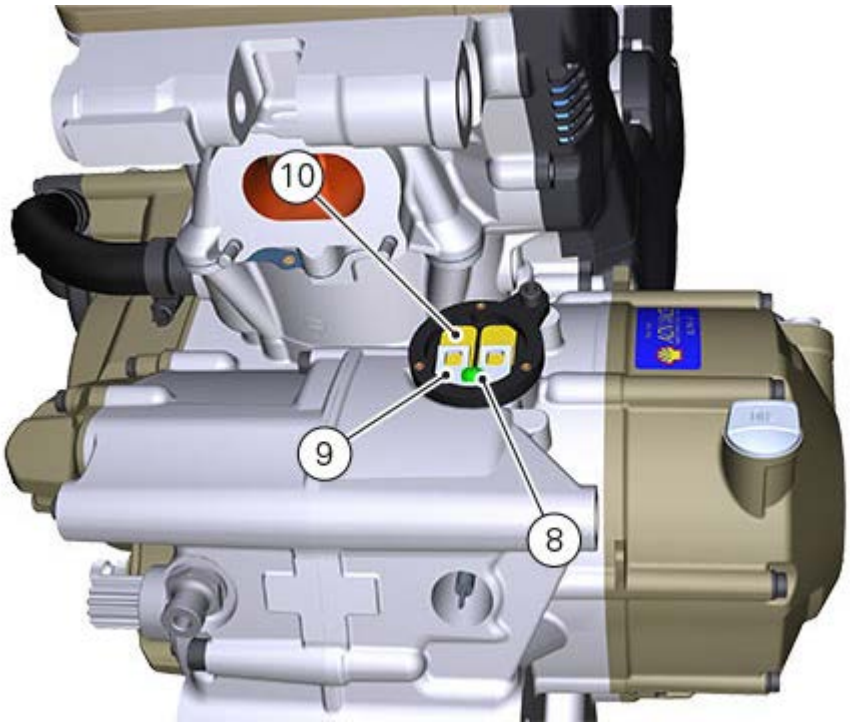
If previously disassembled, reassemble the oil vapour breather valve as follows:
Fit two new O-rings (11) after having lubricated them with the indicated product.



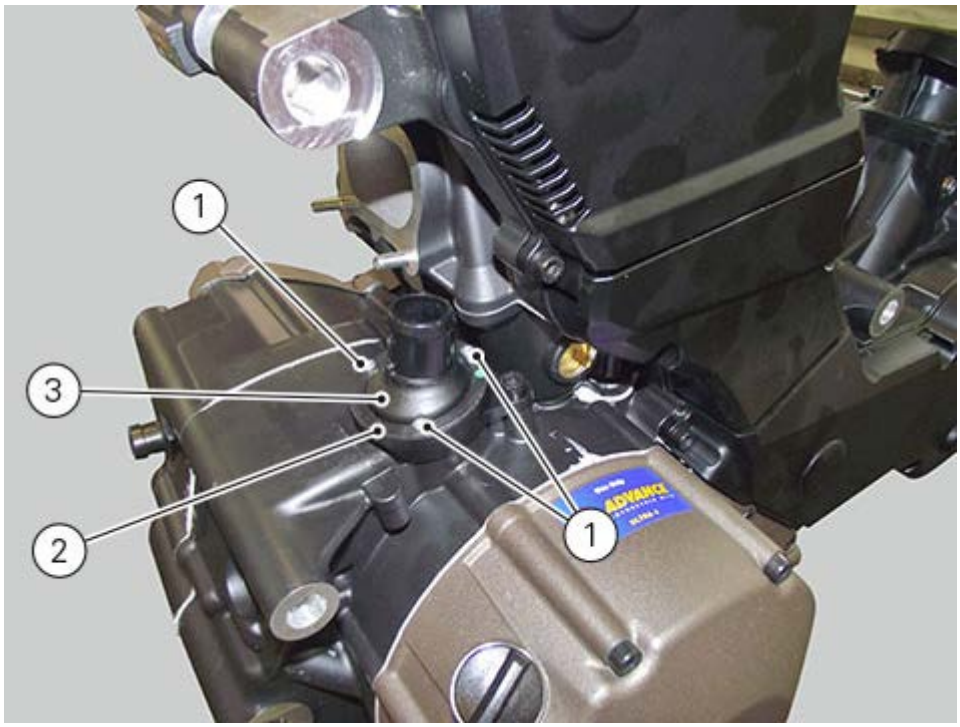
Fit lower flange (6) on crankcase and tighten screw (5) to a torque of 10 Nm (Min. 9 Nm - Max. 11 Nm).



Fit reed valve (10), spacer (9), and tighten screw (8).



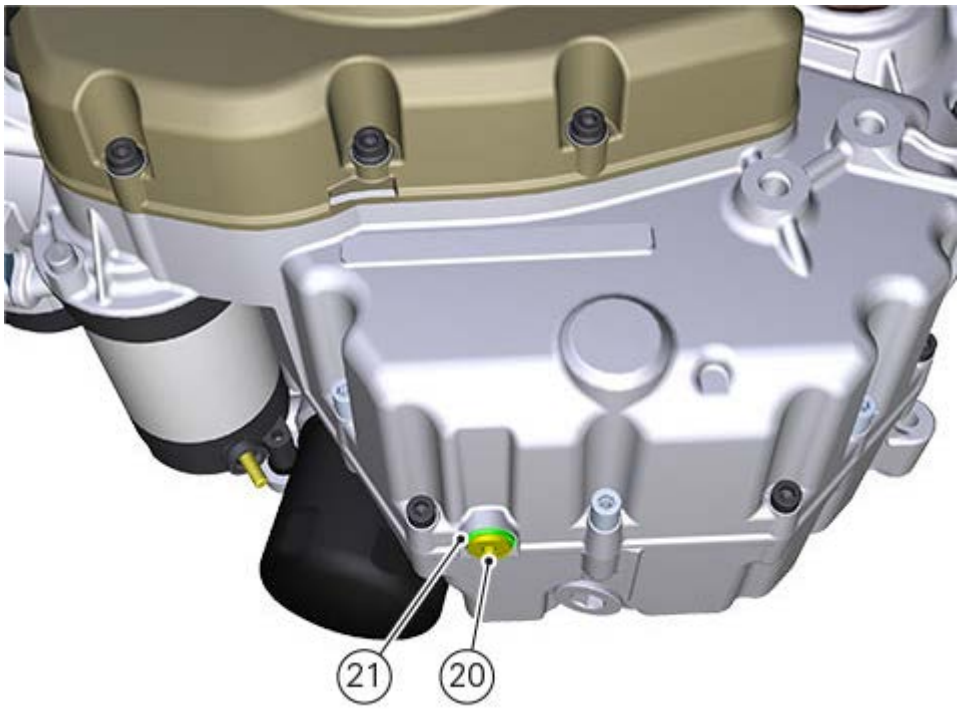
Fit seal (4), breather valve union (3), flange (2), and tighten the three screws (1) to a torque of 1 Nm ± 10%.



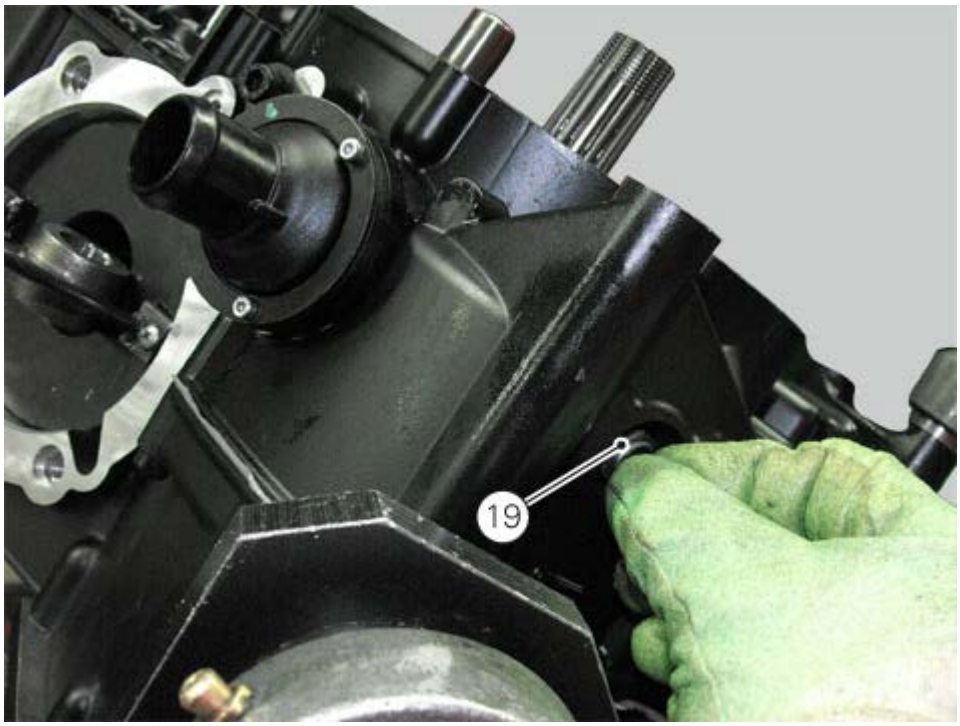
Apply the indicated threadlocker on the thread of nipple (12) to be screwed inside crankcase half.
Start and then drive fully home oil filter cartridge supporting nipple (12) inside crankcase half.
Tighten the nipple to a torque of 42 Nm (Min. 38 Nm - Max. 46 Nm).

Fit the seal (7) on the oil drain plug (6).
Position the seal so that the side with the square edge is facing the chain side crankcase half.
Clean the plug thread, apply a bead of THREE BOND TB1215 along the plug thread spreading it by the entire circumference (360°).
Screw the drain plug (6) with seal (7) to a torque of 20 Nm (Min. 18 Nm - Max. 22 Nm).

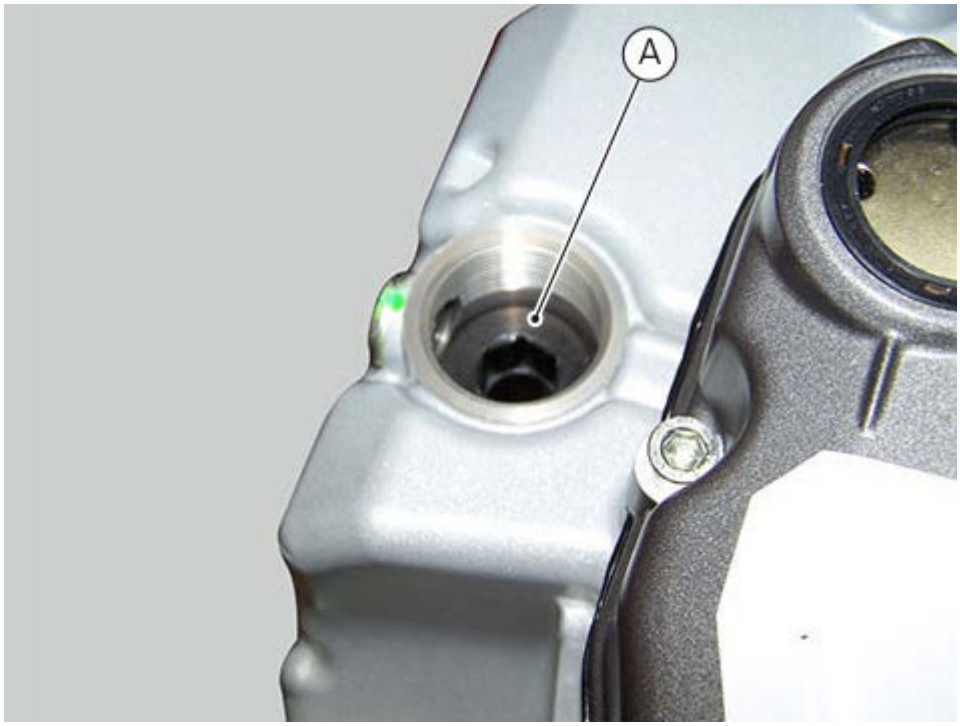
Note
After tightening, remove any excessive sealant.



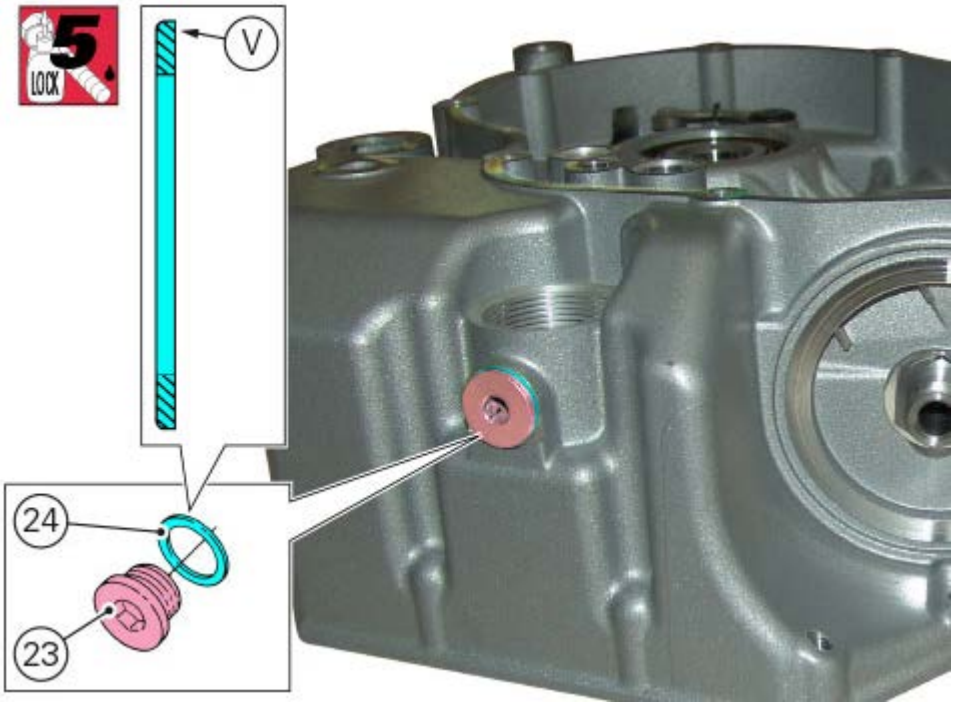
Refit the neutral sensor (8) and the relevant seal (5).



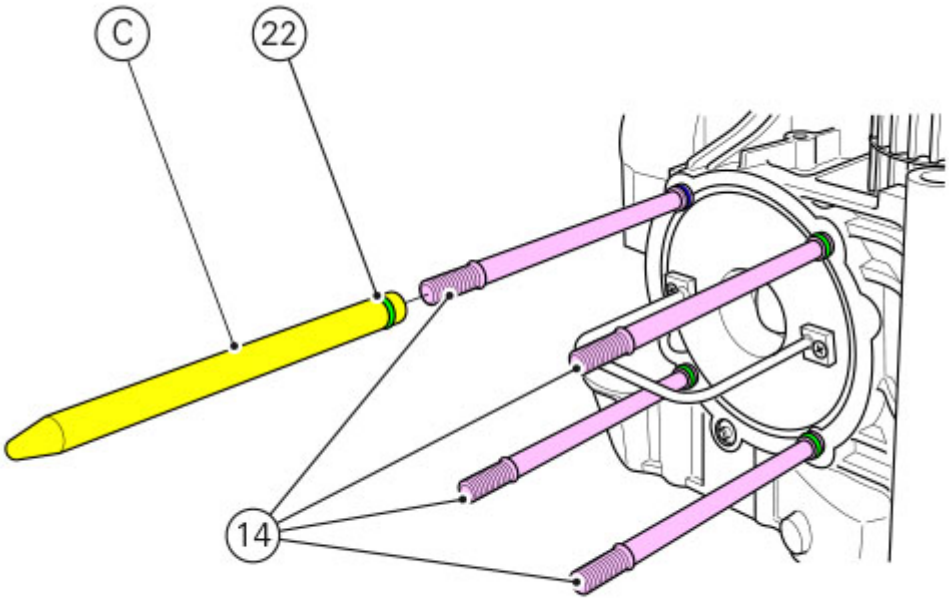
Refit the mesh filter (A) (Changing the engine oil and filter cartridge).



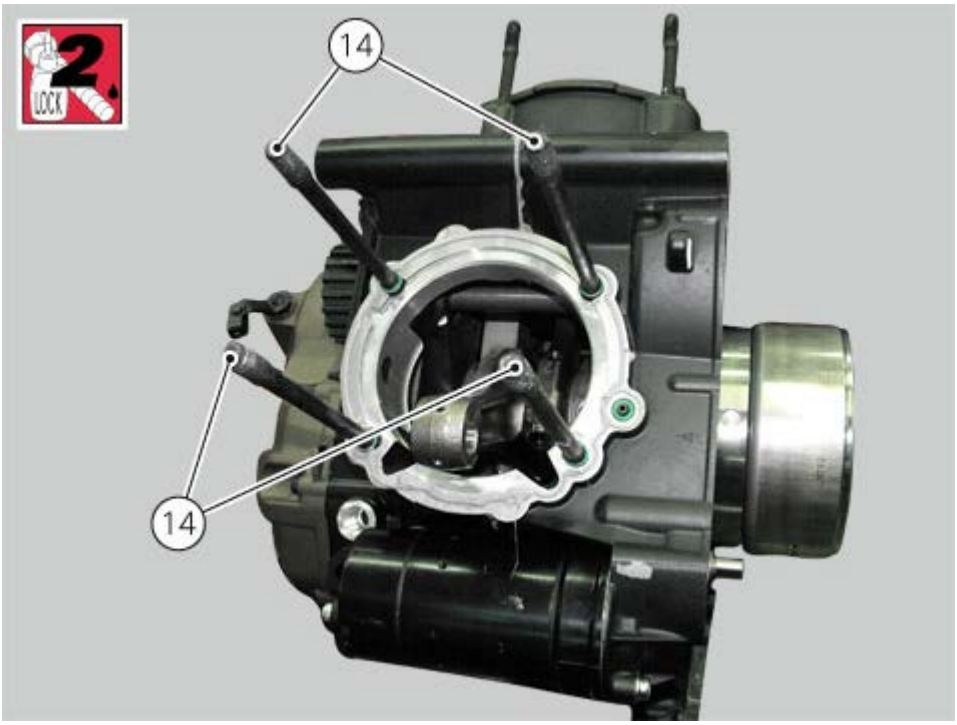
Fit the seal (24) on the mesh filter plug (23).
Seal must be positioned so that the cutting edge (V) faces the crankcase half.
Apply the recommended threadlocker to the plug.
Start plug inside crankcase half, and then tighten it to a torque of 25 Nm (Min. 22 Nm - Max. 28 Nm).
After tightening, remove any excess of threadlocker.



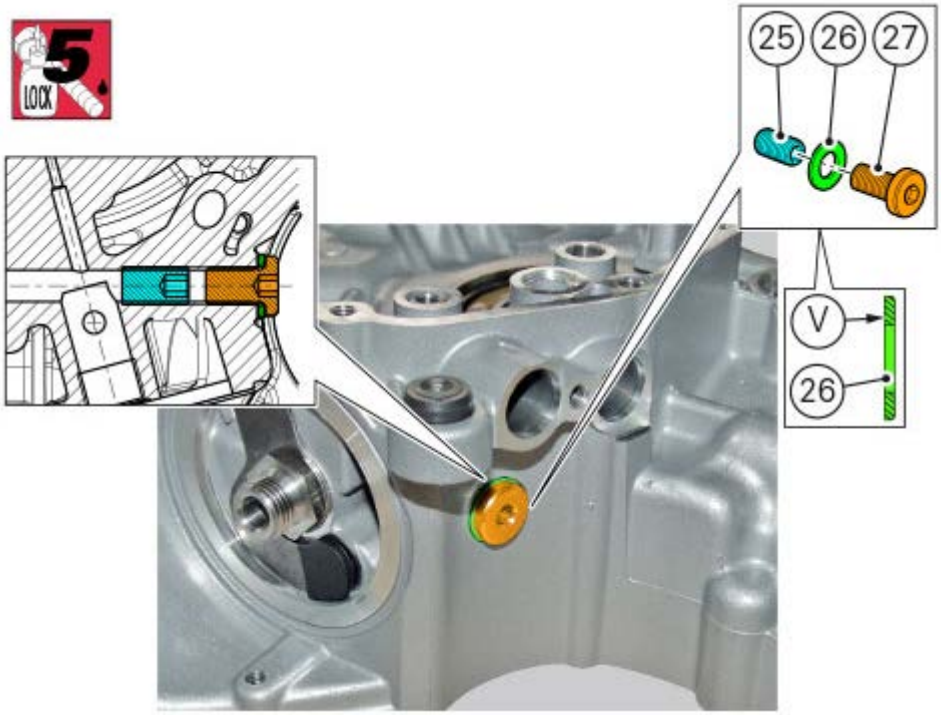
Check the condition of the O-rings (22) of the stud bolts (14) and replace them if necessary.
Use tool (C) part no. **88713.1920**, to fit the O-rings (22) in the suitable seats of stud bolts (14).



Now fit the stud bolts (14) on the crankcase halves, applying the indicated threadlocker on the thread and tightening to a torque of 30 Nm (Min. 28 Nm - Max. 32 Nm).
Use the appropriate commercial tool for this operation.



If previously removed, apply recommended threadlocker on dowel (25), tighten to a torque of 15 Nm (Min. 13.5 Nm - Max. 16.5 Nm), fit the seal (26) on the service plug (27): the seal must be positioned so that the cutting edge (V) faces the clutch-side crankcase half.
Apply the specified threadlocker on the plug thread (27), insert it in the crankcase half and tighten to a torque of 15 Nm (Min. 13 Nm - Max. 17 Nm).



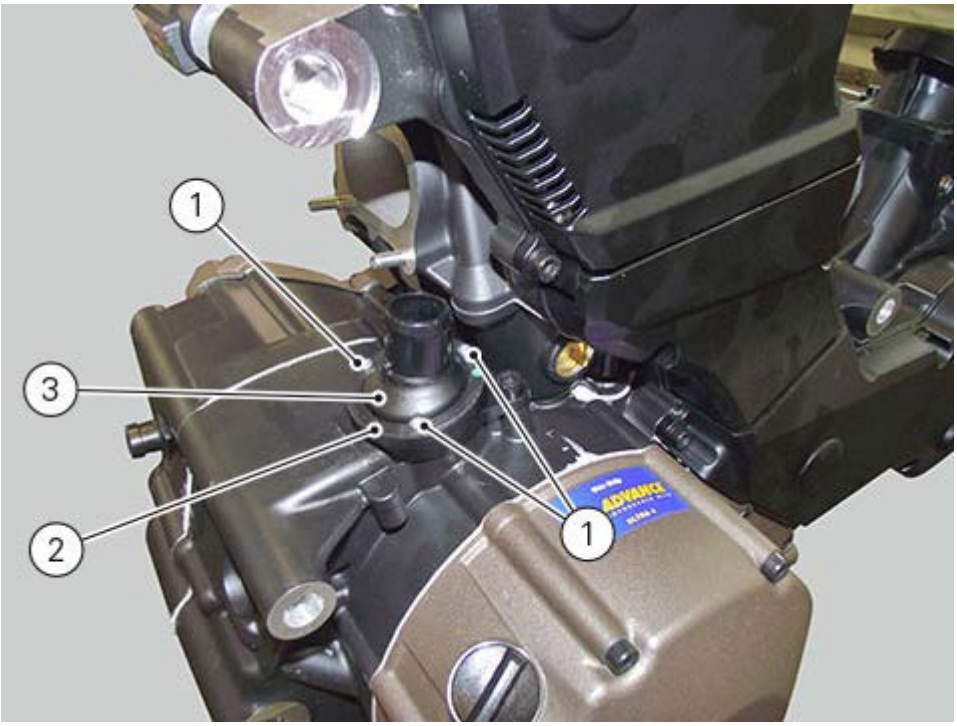
Refit the oil filter (Changing the engine oil and filter cartridge).
Refit the primary drive gear (Refitting the primary drive gear and checking backlash).
Refit the oil pump (Refitting the oil pump).
Refit the clutch unit (Refitting the clutch).
Refit the clutch cover (Refitting the clutch cover).
Refit the starter motor (Refitting the starter motor).
Refit the complete generator (Fitting the flywheel/generator assembly) and the generator side cover (Fitting the generator cover).
Refit the complete cylinder/piston assembly (Refitting the cylinder/piston assembly).
Refit the complete cylinder head assembly (Refitting the cylinder heads).
Refit the timing pulleys (Refitting the cylinder head pulleys/fixed tensioners).
Refit the timing belts (Refitting the timing belts).
Refit the external timing belt covers (Refitting the timing belt external covers).

Refit the engine in the frame (Refitting the engine).

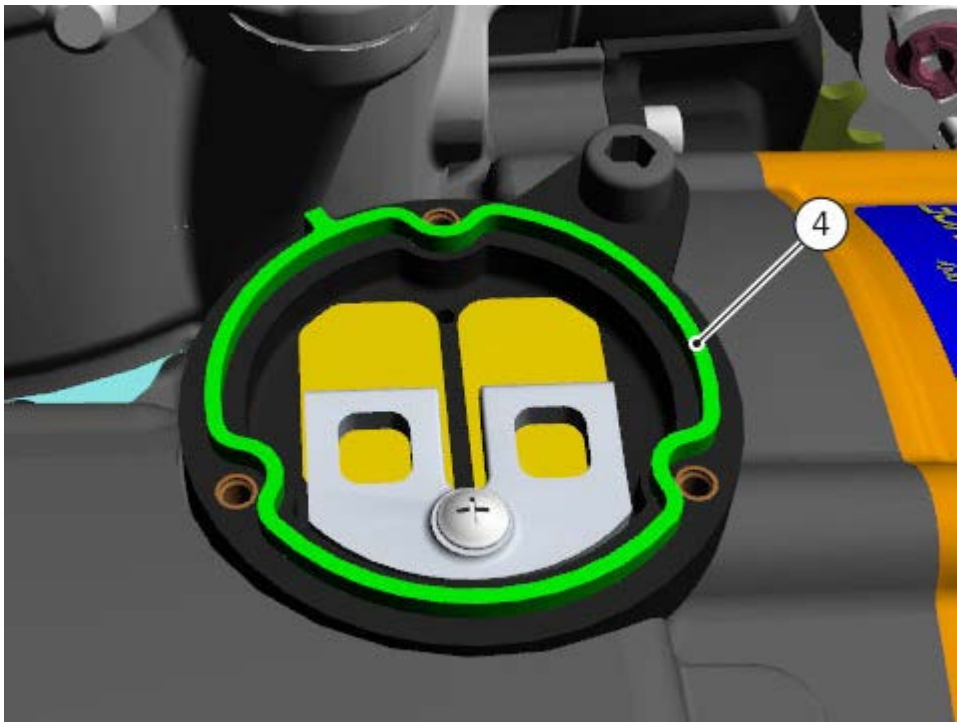
Removing outer components

Remove the engine from the frame (Removing the engine).
Remove the external belt covers (Removing the timing belt external covers).
Remove the camshaft assembly (Removing the camshafts).
Remove the complete cylinder head assembly (Removing the cylinder heads).
Remove the complete cylinder/piston assembly (Removing the cylinder/piston assembly).
Remove the generator side cover (Removing the generator cover) and the complete generator (Removing the flywheel/generator assembly).
Remove the starter motor (Removing the starter motor).
Remove the clutch cover (Removing the clutch cover).
Remove the clutch unit (Removing the clutch).
Remove the oil pump (Removing the oil pump).
Remove the primary drive gear (Removing the primary drive gear).

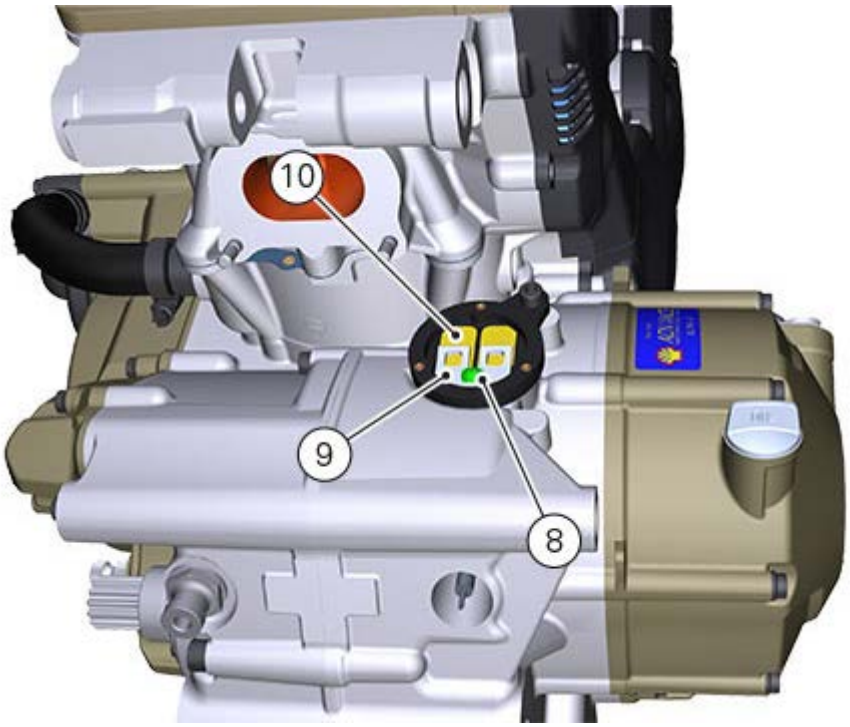
Loosen the screws (1) and remove flange (2).
Remove the oil breather valve (3) union from the engine.



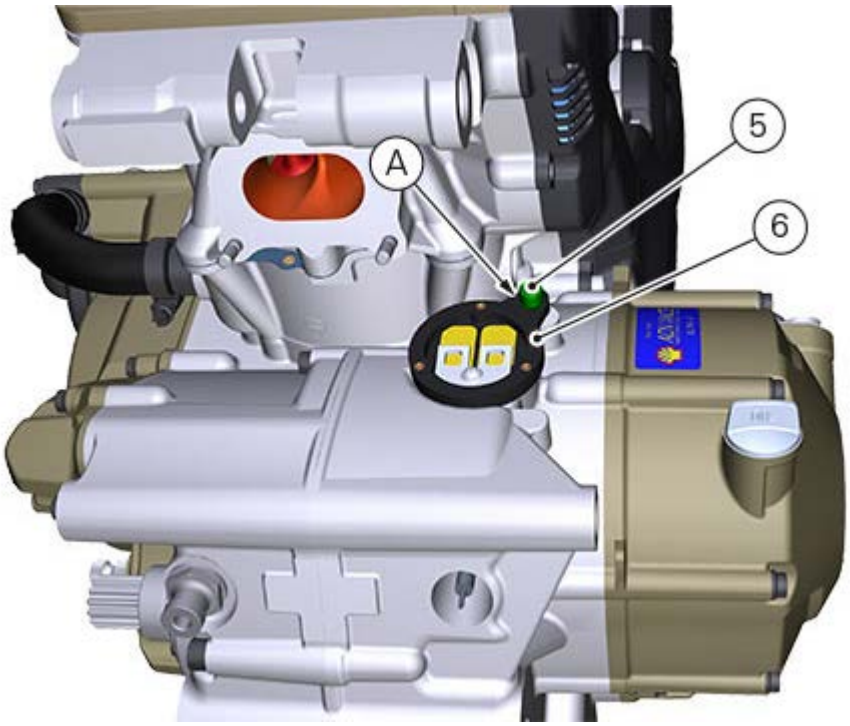
Remove gasket (4).



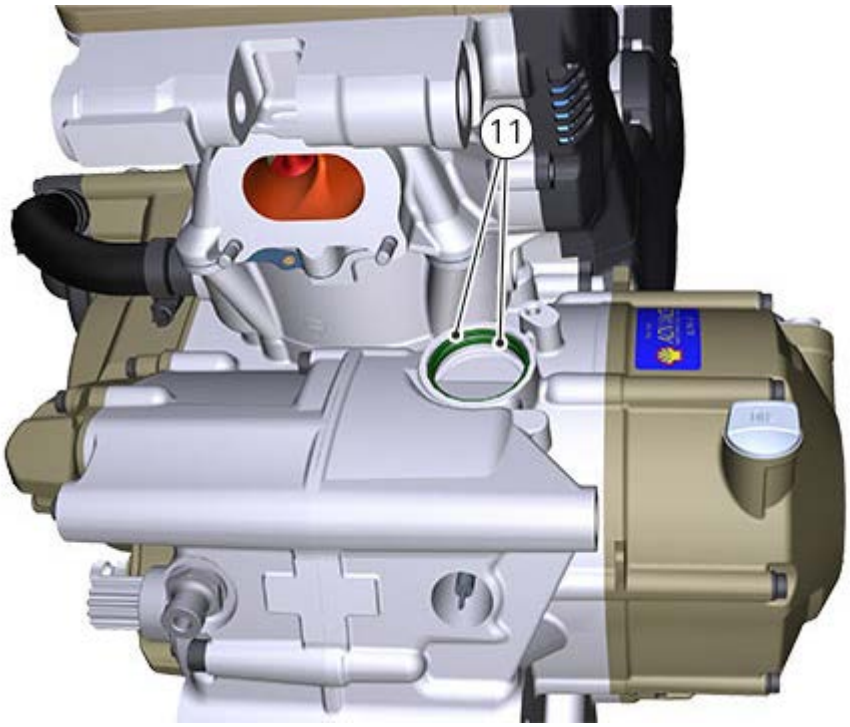
Undo screw (8) and remove spacer (9).
Remove reed valve (10).



Loosen screw (5) and remove lower flange (6).



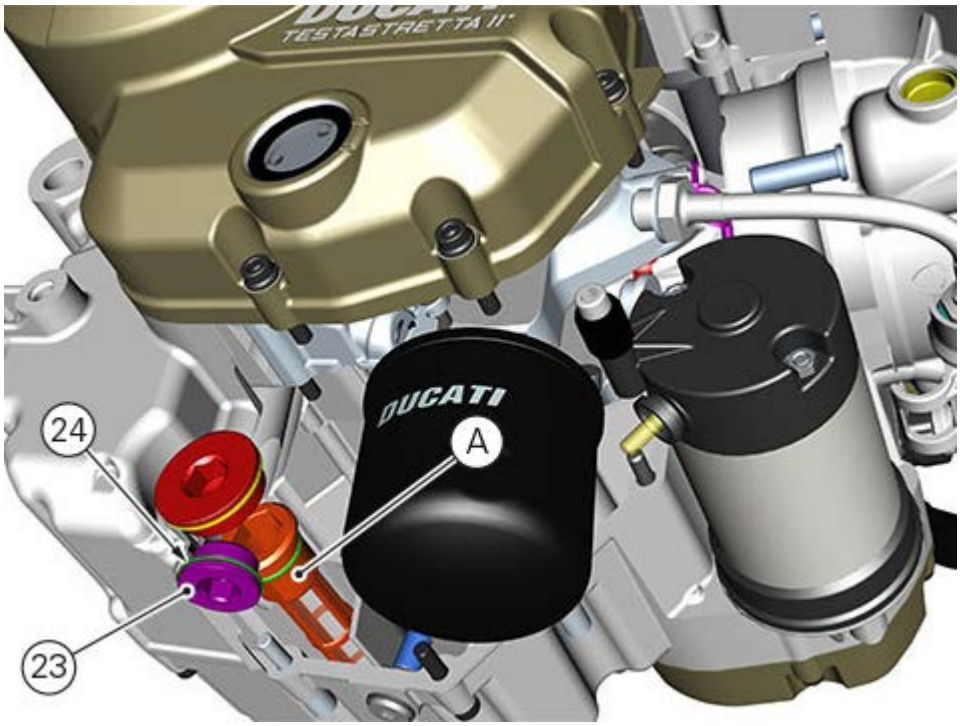
Collect the two O-rings (11).
Check the condition of the two O-rings (11) and replace them if necessary.

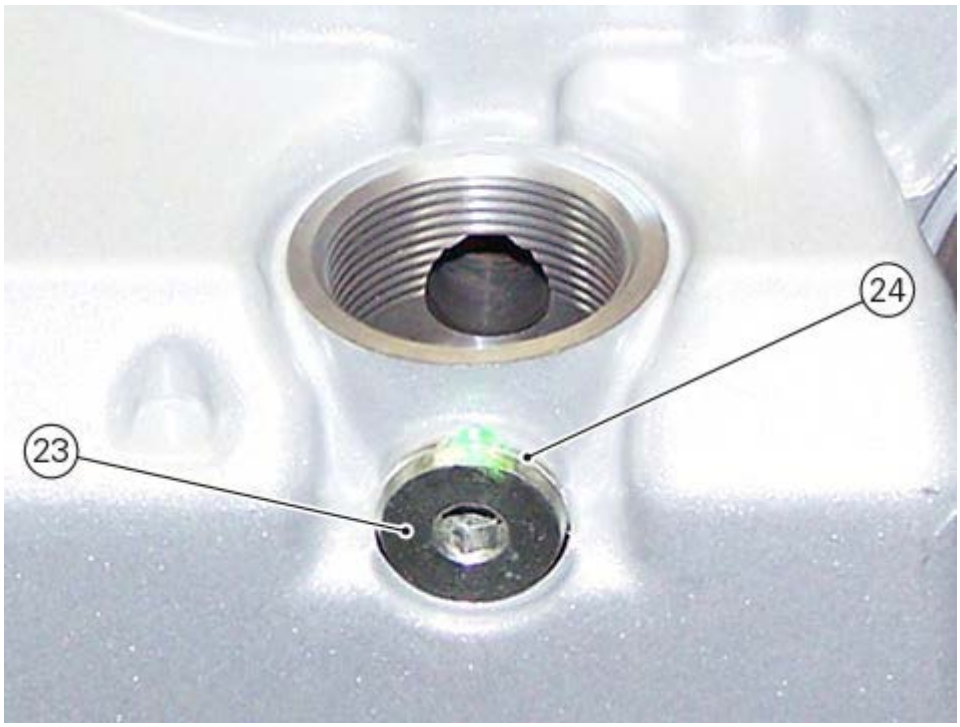


Loosen and remove oil filter supporting nipple (12).

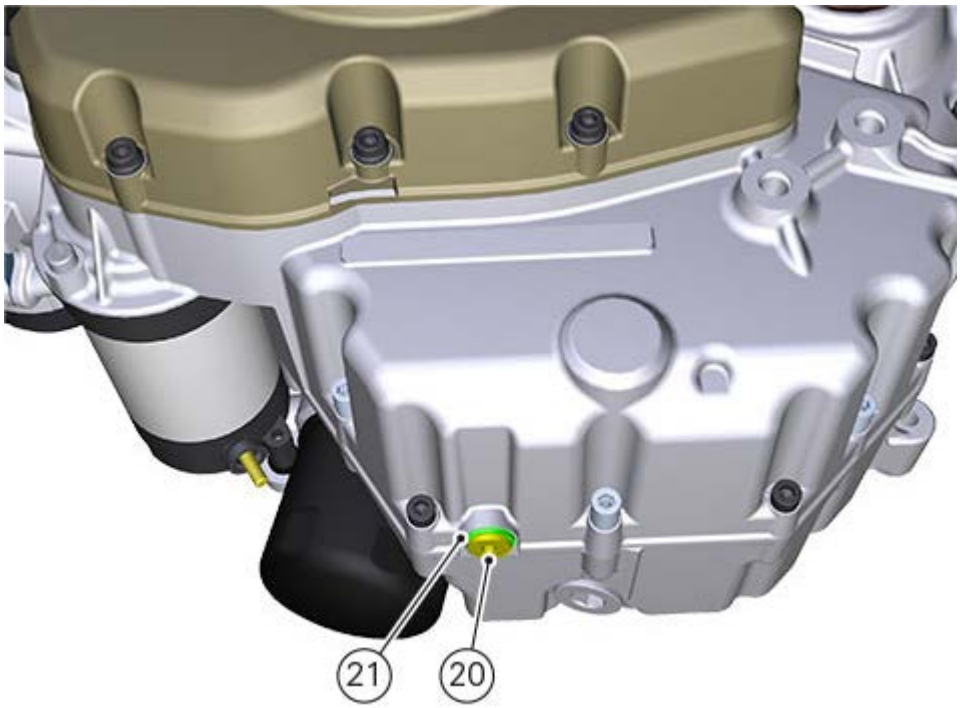
Remove the mesh filter (A) from the clutch crankcase half (Changing the engine oil and filter cartridge).

Loosen lower plug (23), taking care not to damage seal (24).





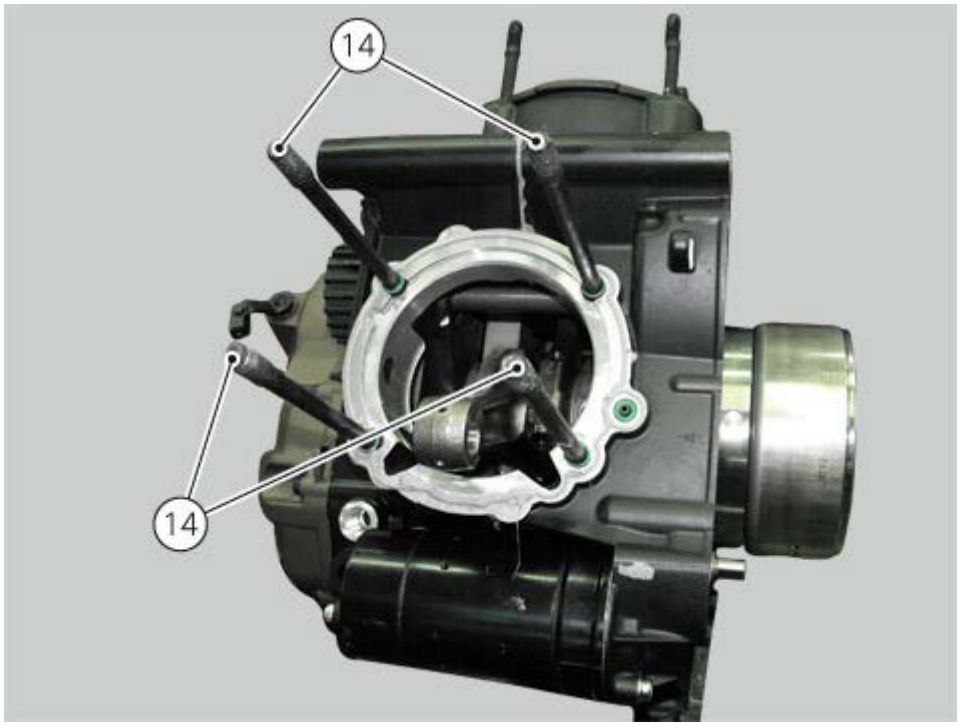
Remove the drain plug (20) with its seal (21).



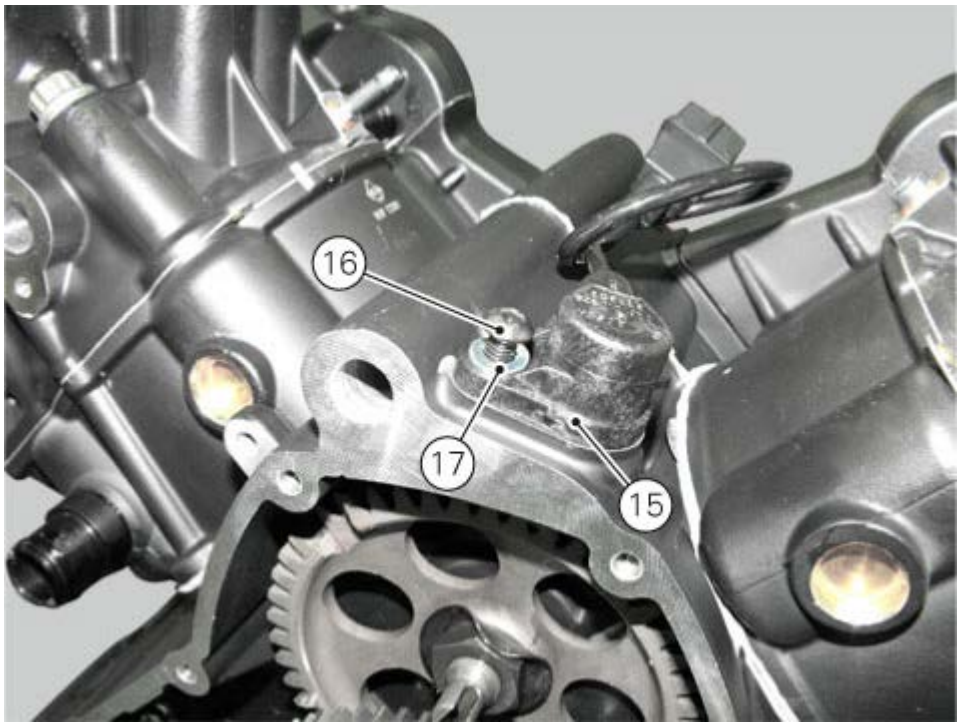
Remove the cylinder head stud bolts (14) with the aid of an appropriate tool.

Important

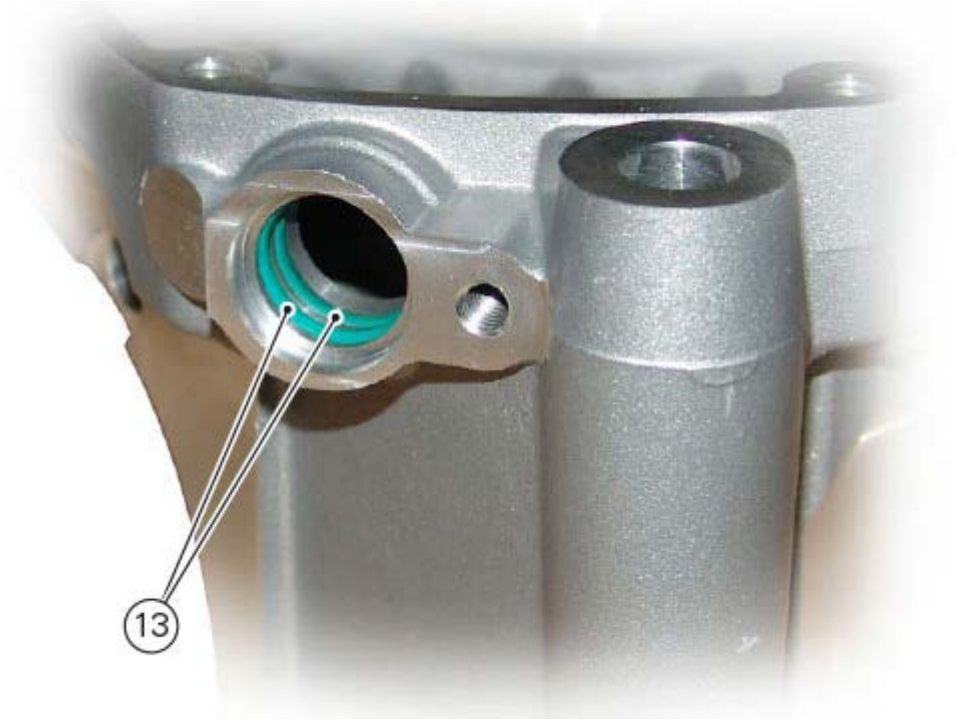
Check stud bolt O-rings and, if damaged, replace them with new O-rings of the same type.

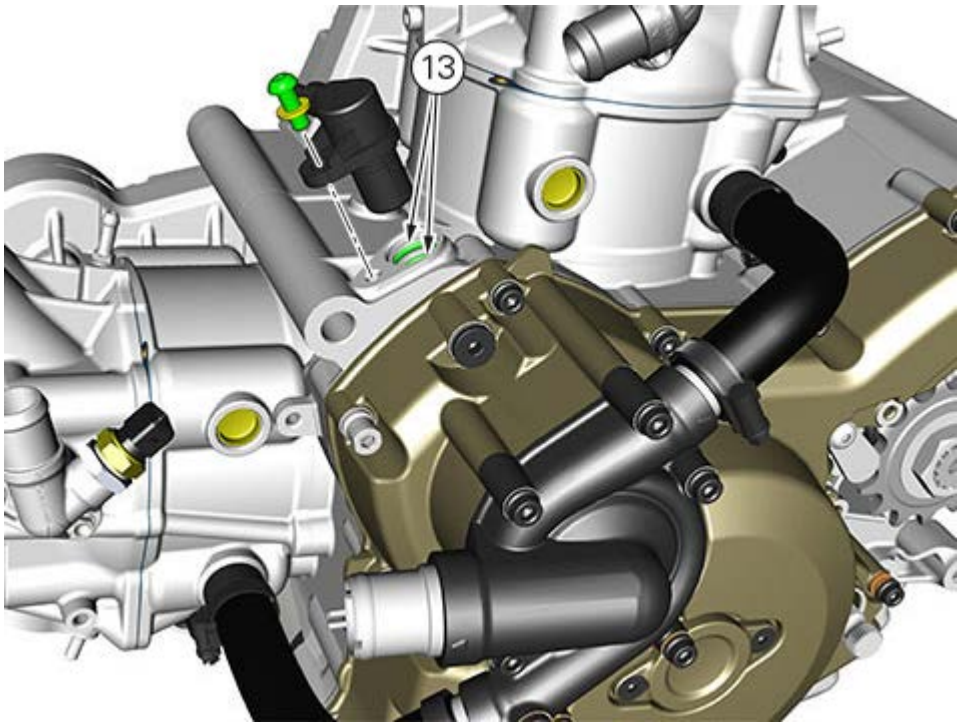


To remove the timing sensor (15), undo the screw (16) and collect the washer (17).

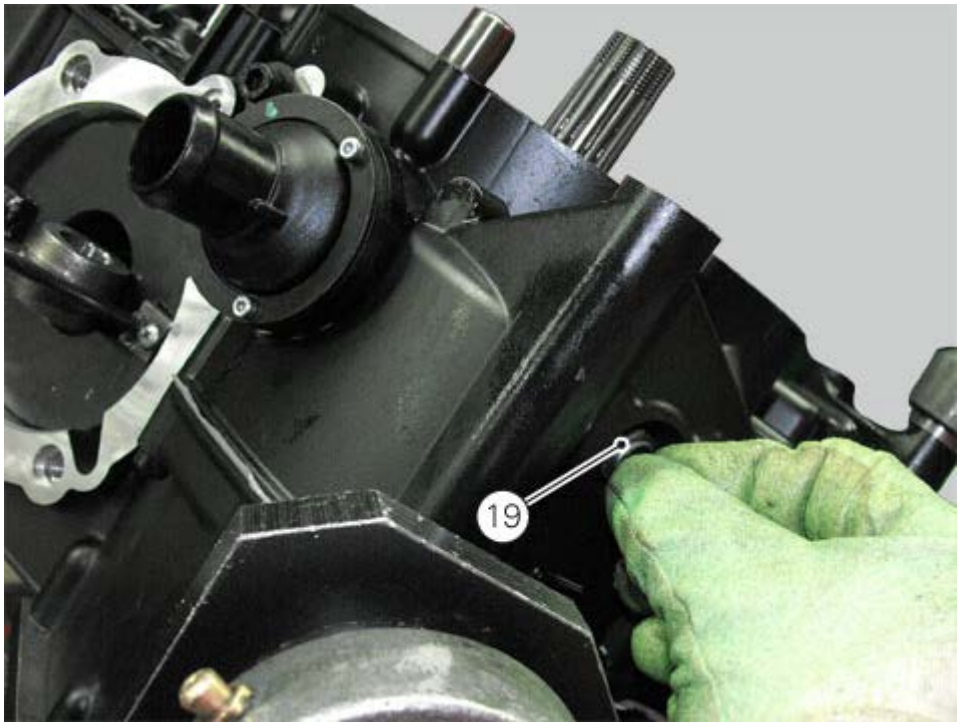


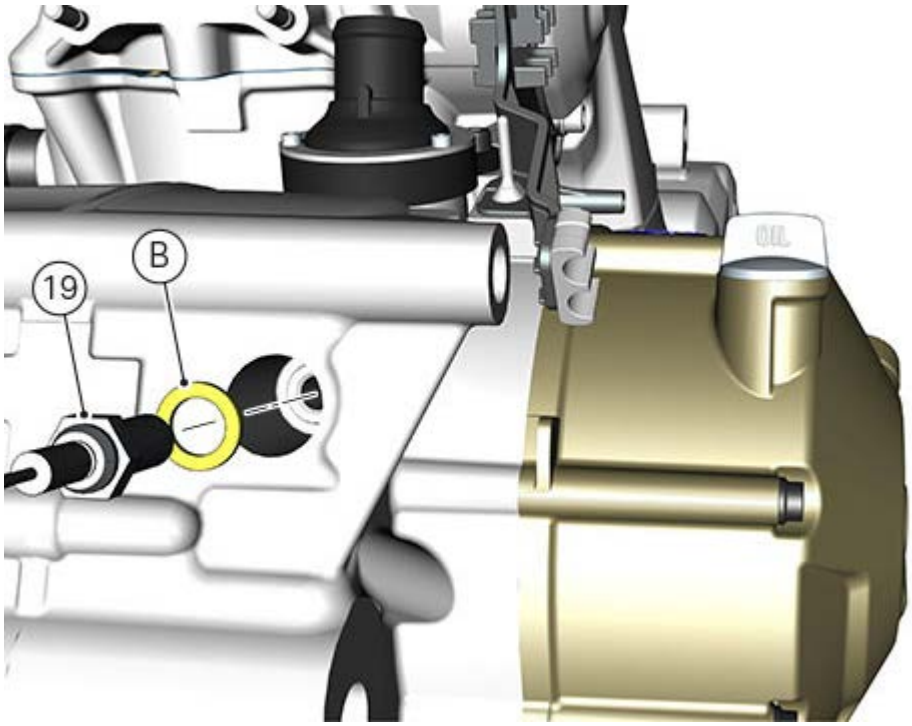
Check the condition of O-rings (13) on the crankcase and replace them if necessary.





Remove the neutral sensor (19) and the relevant seal (B).





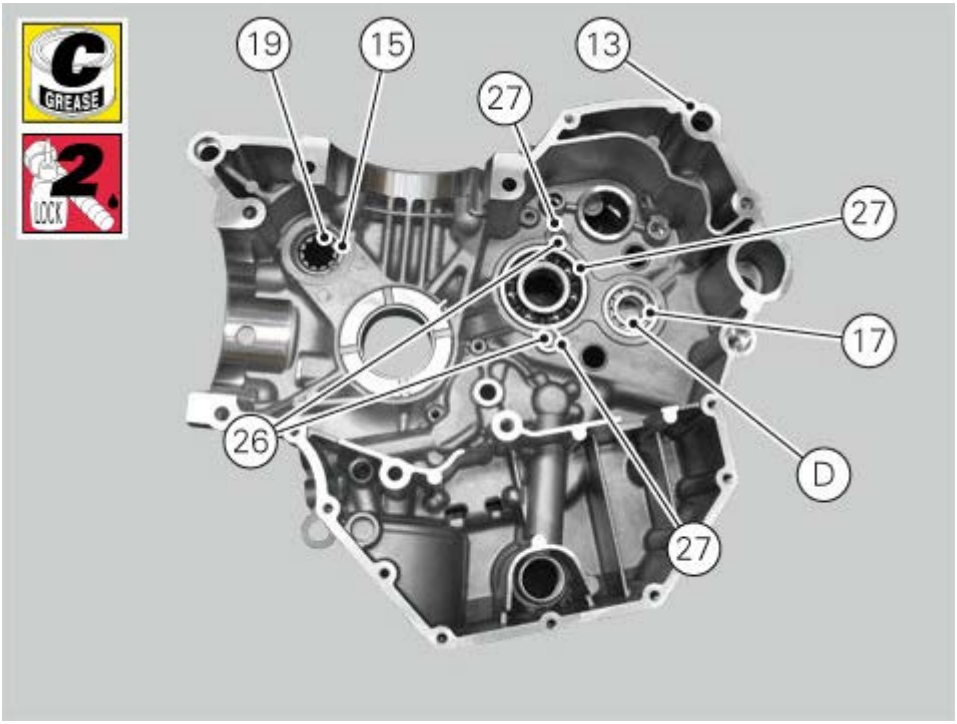
Reassembling the crankcase halves

The crankcase halves must be in good condition and perfectly clean.
The mating surfaces must be perfectly flat and free from burrs.

Reassembling the clutch side crankcase half (13)

The following parts must be present on the internal side of the crankcase half:

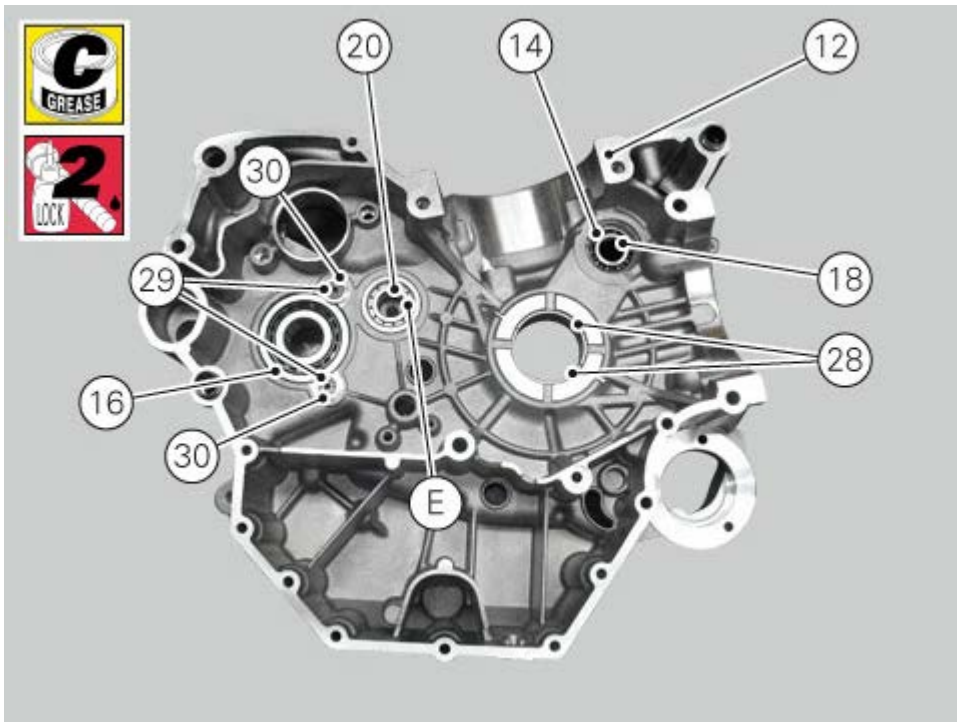
- the secondary shaft bearing (17); apply grease on the bearing rollers. Drive the inner race (D), removed previously, fully home in the bearing. Apply grease to the inner race;
- the primary shaft bearing (21), secured with the screws (26) and the retaining spacers (27): apply recommended threadlocker to the screws (26), and tighten to a torque of 10 Nm (Min. 9 Nm - Max. 11 Nm);
- the roller bearing (19) with circlip (15) installed at the timing layshaft.
- the main bearing shells (28)



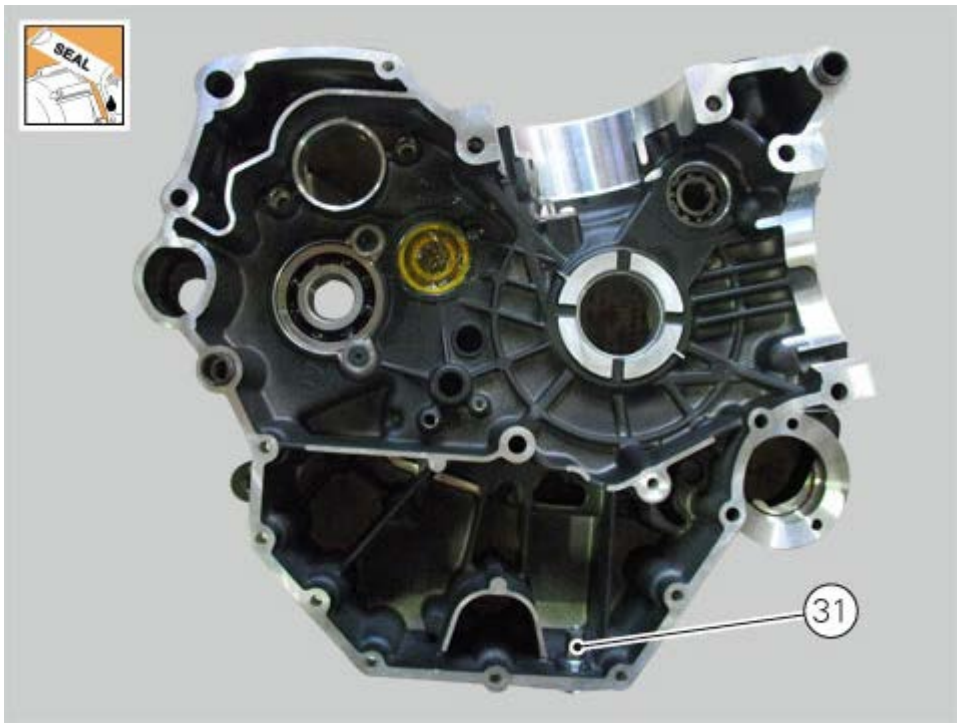
Reassembling the generator side crankcase half (12)

The following parts must be present on the internal side of the crankcase half:

- the double-race ball bearing (16) supporting the selector fork shaft.
  If removed, apply threadlocker to the screws (29). Start screws (29) with retaining spacers (30). Tighten the screws (29) to a torque of 10 Nm (Min. 9 Nm - Max. 11 Nm).
- the gearbox primary shaft end bearing (20) with inner race (E): apply grease on the bearing needle rollers.
  Drive the inner race (E), removed previously, fully home in the bearing. Apply grease to the inner race.
- the main bearing shells (28).
- the ball bearing (18) with circlip (12) at the timing layshaft, aiming it so that the plastic cage closed side is facing the crankcase half.

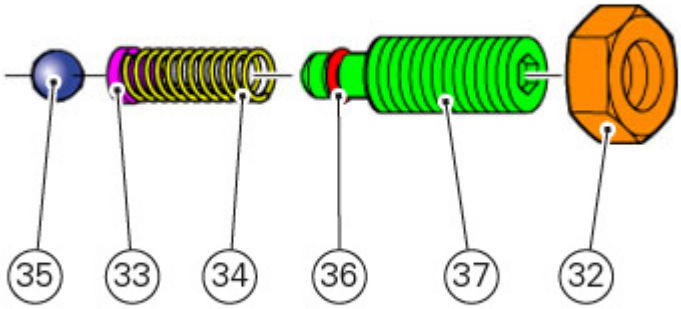


If previously removed, apply the indicated product to the thread of oil drain plug (31) and tighten to a torque of 20 Nm (Min. 18 Nm - Max. 22 Nm).



If previously removed and disassembled, refit the clutch fluid flow adjuster valve, as follows:
- insert plate (33) on spring (34) until it locks in place;
- fit O-ring (36) in its seat on special dowel (37);
- fit the ball (35), the spring (34) with plate (33) and the special dowel (37) with O-ring (36) on chain-side crankcase half.

Drive nut (32) fully home.

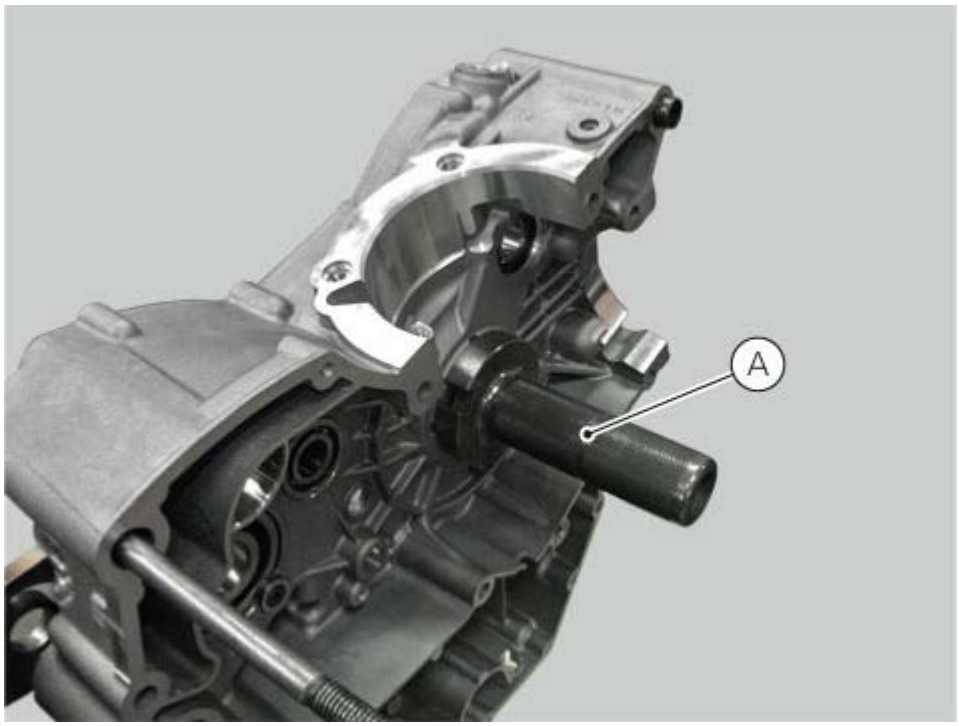


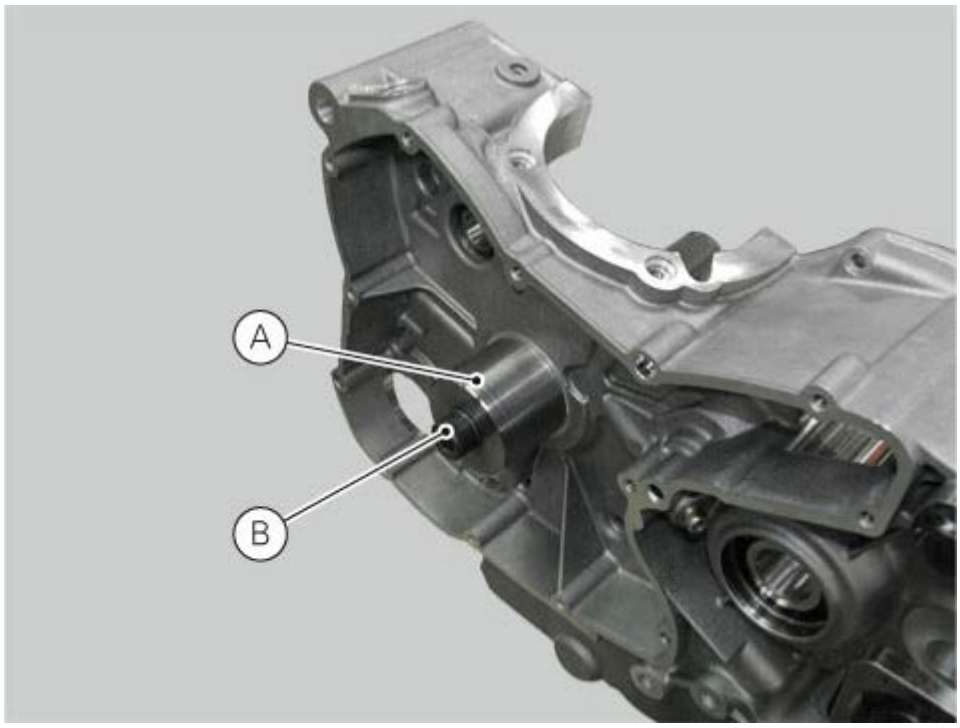
Main bearing shells

Remove the engine from the frame (Removing the engine).
Remove the external belt covers (Removing the timing belt external covers).
Remove the timing belts (Removing the mobile tensioner/timing belt).
Remove the timing pulleys (Disassembling the timing shaft pulleys).
Remove the timing gears (Removing the timing gears).
Remove the complete cylinder head assembly (Removing the cylinder heads).
Remove the complete cylinder/piston assembly (Removing the cylinder/piston assembly).
Remove the water pump (Removing the water pump).
Remove the generator side cover (Removing the generator cover) and the complete generator (Removing the flywheel/generator assembly).
Remove the starter motor idler gear (Removing the starter motor idler gear).
Remove the starter motor (Removing the starter motor).
Remove the clutch cover (Removing the clutch cover).
Remove the clutch unit (Removing the clutch).
Remove the oil pump (Removing the oil pump).
Remove the primary drive gear (Removing the primary drive gear).
Remove the oil filter (Changing the engine oil and filter cartridge).
Remove the gearchange mechanism (Removing the gearchange mechanism).
Separate the crankcase halves (Separating the crankcase halves)

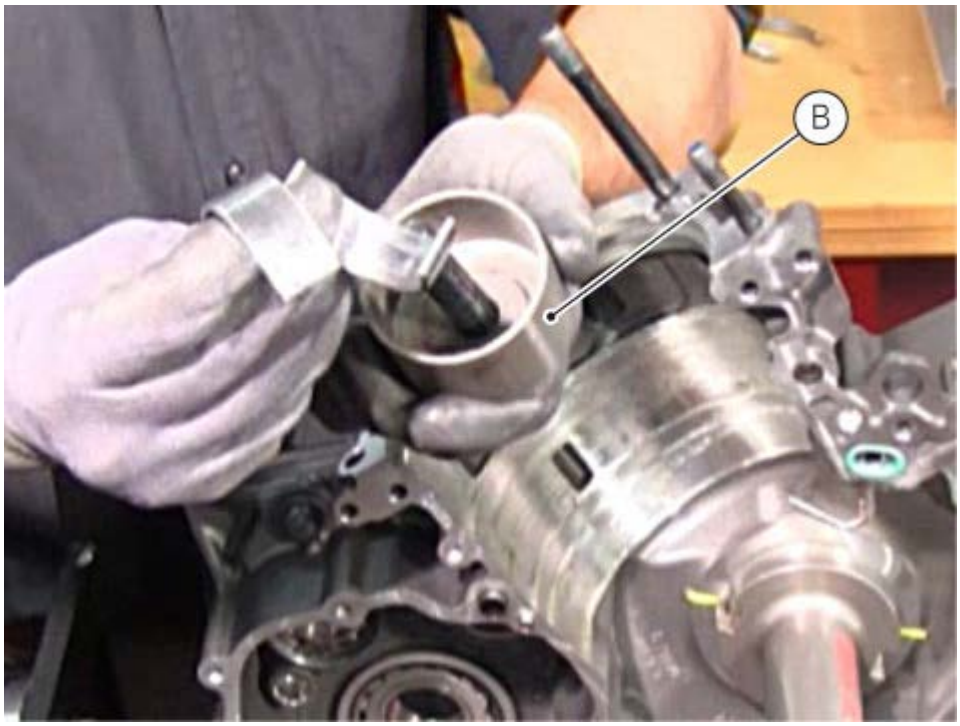
Changing the crankshaft bearing shells.

To remove crankshaft bearing shells (28), use tool (A) no. **88713.4145** by setting drift inside the crankcase half and cap on the outside.
Tighten screw (B) fully home.





Loosen screw (B) and remove main bearing shells (28) from tool.

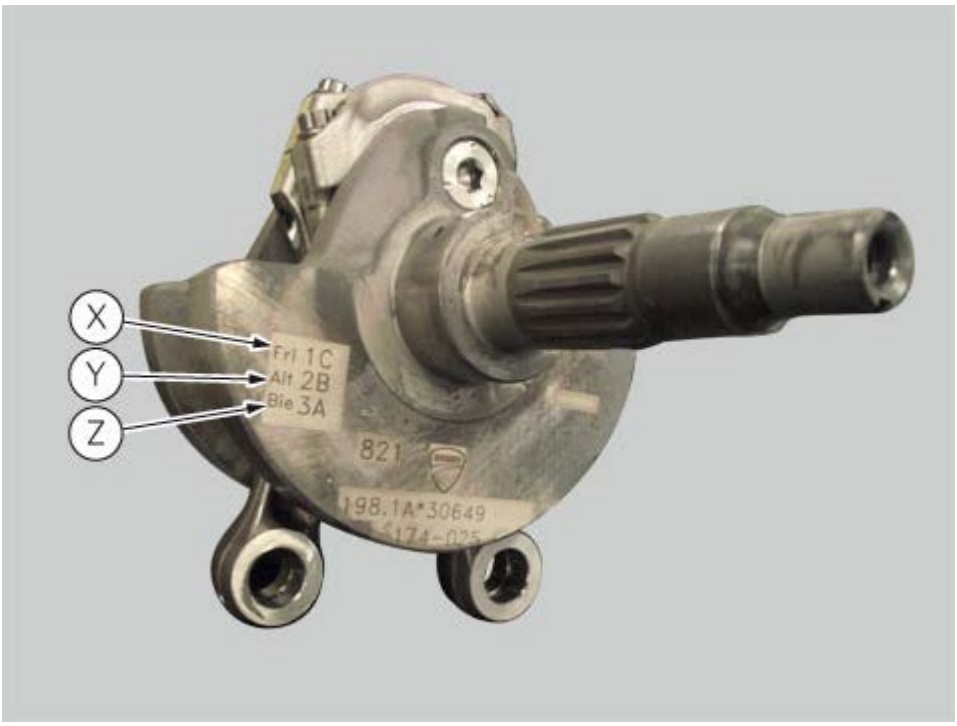


Crankshaft is supplied in classes ranging from "A" to "D"

Select the bearing shells according to crankshaft and crankcase punching, as follows:
X - **Fri**: shimming on clutch side
Y - **Alt**: Shimming on generator side
Z - **Bie**: type of selected connecting rod

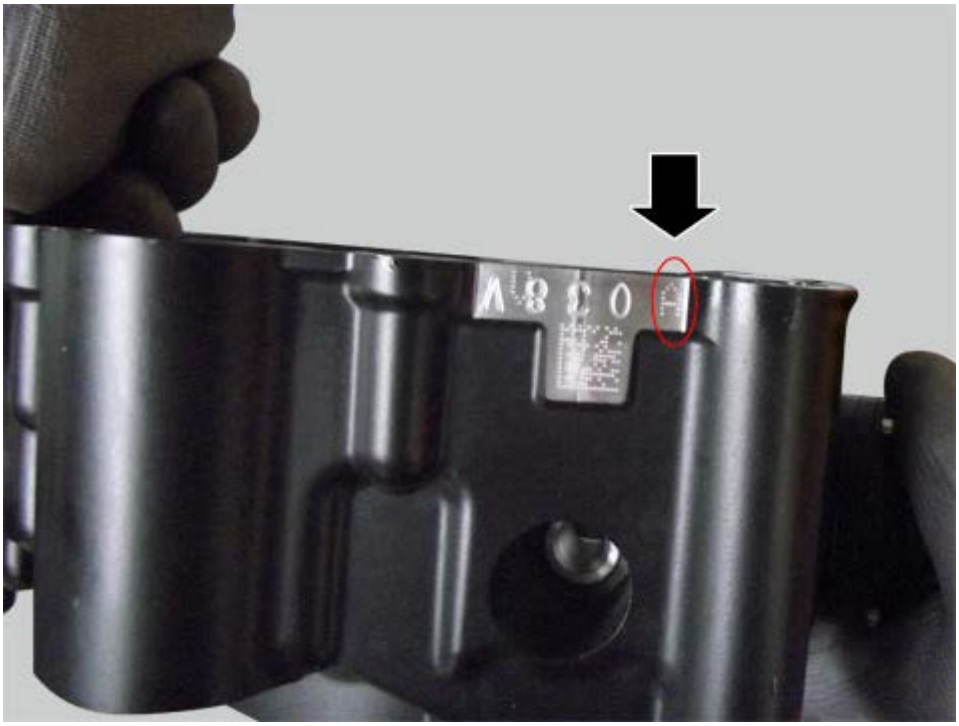
MAIN BEARING SHELLS CLASS					
Crankshaft class	Crank pin size (mm)	Crankcase class	Crankcase hole size (mm)	Shell colour	Bearing shell thickness (mm)
A	49.992 to 45.000	A	49.000 to 49.008	RED	1.994 to 1.999
A	49.992 to 45.000	B	49.008 to 49.016	BLUE	1.998 to 2.003
B	49.984 to 49.992	A	49.000 to 49.008	BLUE	1.998 to 2.003
B	49.984 to 49.992	B	49.008 to 49.016	YELLOW	2.002 to 2.007
C	44.976 to 44.984	A	49.000 to 49.008	YELLOW	2.002 to 2.007
C	44.976 to 44.984	B	49.008 to 49.016	BLACK	2.006 to 2.011
D	44.968 to 44.976	A	49.000 to 49.008	BLACK	2.006 to 2.011
D	44.968 to 44.976	B	49.008 to 49.016	GREEN	2.010 to 2.015
COUPLING CLEARANCE **0.037 to 0.063**					

Important
As shown in the figure, the size class of the two main journals is punched on the crank web and CLUTCH side and CHAIN side are clearly indicated.

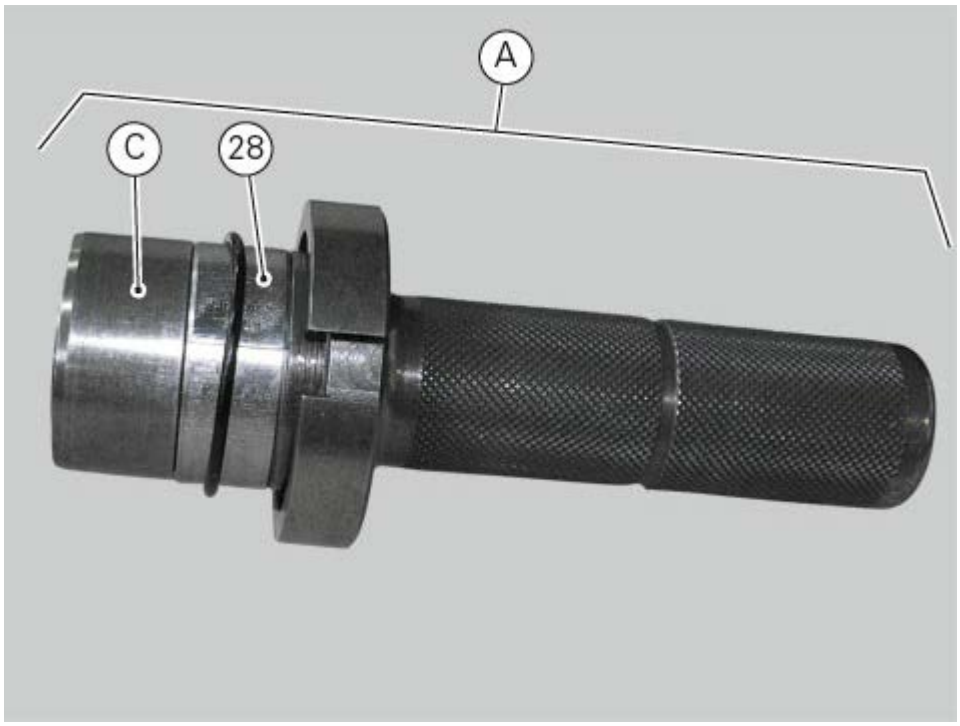


Important

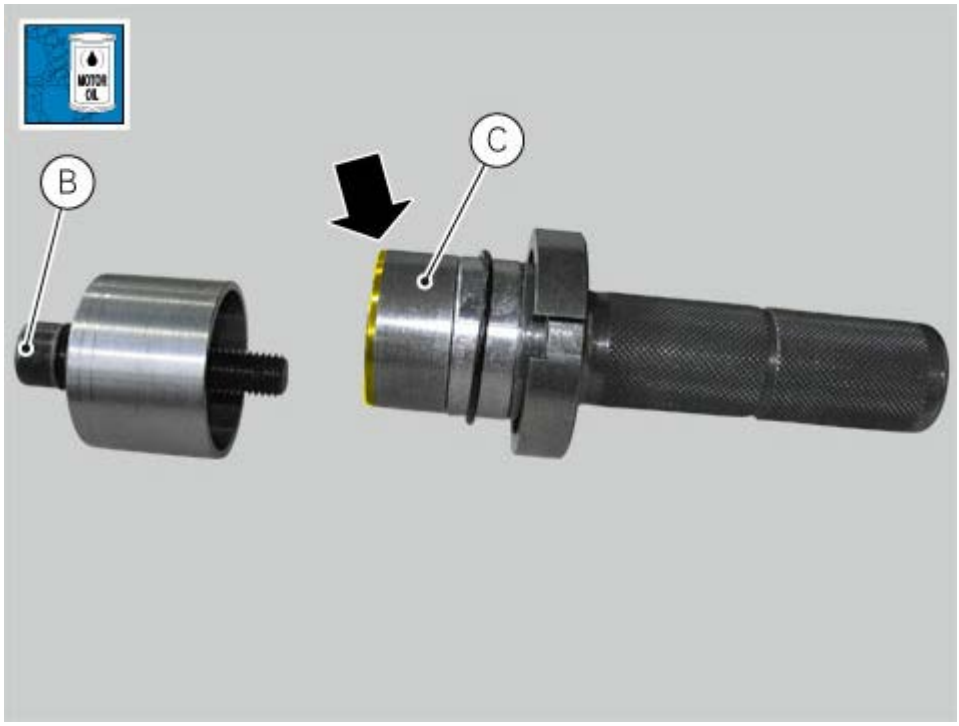
As shown in the figure, both casings are clearly marked with main journal size class.

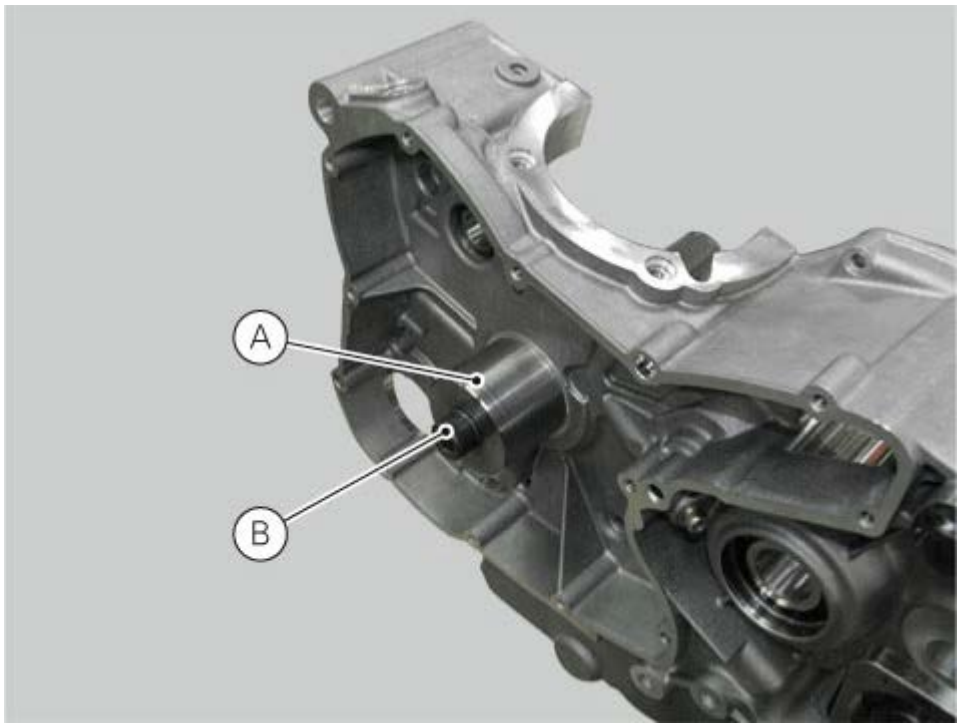


Fit the new main bearing shells (28) inside drift of tool (A) no. **88713.4145** and drive bushing (C) fully home.



Smear with engine oil tool (A) no. **88713.4145**.
Fit main bearing shells using the drift of tool (A) no. **88713.4145**and positioning the shell parting line at a right angle to the cylinder angle bisector, as shown in the figure.
Drive screw (B) fully home.





Remove tool (A) no. **88713.4145** and check that the main bearing shells (28) have been correctly fitted.

Refit the components in the reverse order of removal.

Overhauling the crankcase halves

Remove the engine from the frame (Removing the engine).
Remove the external belt covers (Removing the timing belt external covers).
Remove the timing belts (Removing the mobile tensioner/timing belt).
Remove the timing pulleys (Disassembling the timing shaft pulleys).
Remove the timing gears (Removing the timing gears).
Remove the complete cylinder head assembly (Removing the cylinder heads).
Remove the complete cylinder/piston assembly (Removing the cylinder/piston assembly).
Remove the water pump (Removing the water pump).
Remove the generator side cover (Removing the generator cover) and the complete generator (Removing the flywheel/generator assembly).
Remove the starter motor idler gear (Removing the starter motor idler gear).
Remove the starter motor (Removing the starter motor).
Remove the clutch cover (Removing the clutch cover).
Remove the clutch unit (Removing the clutch).
Remove the oil pump (Removing the oil pump).
Remove the primary drive gear (Removing the primary drive gear).
Remove the oil filter (Changing the engine oil and filter cartridge).
Remove the gearchange mechanism (Removing the starter motor idler gear).
Separate the crankcase halves (Separating the crankcase halves).

Visually inspect the crankcase halves (12) and (13).

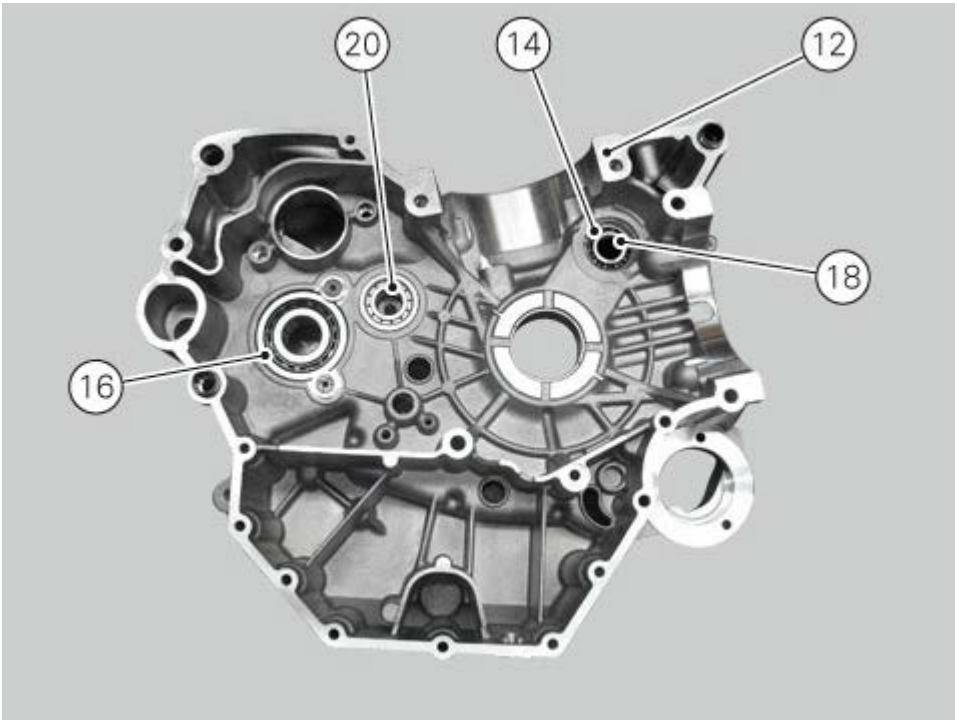
Important
If crankcase halves have to be replaced, they are supplied as a new spare part set.

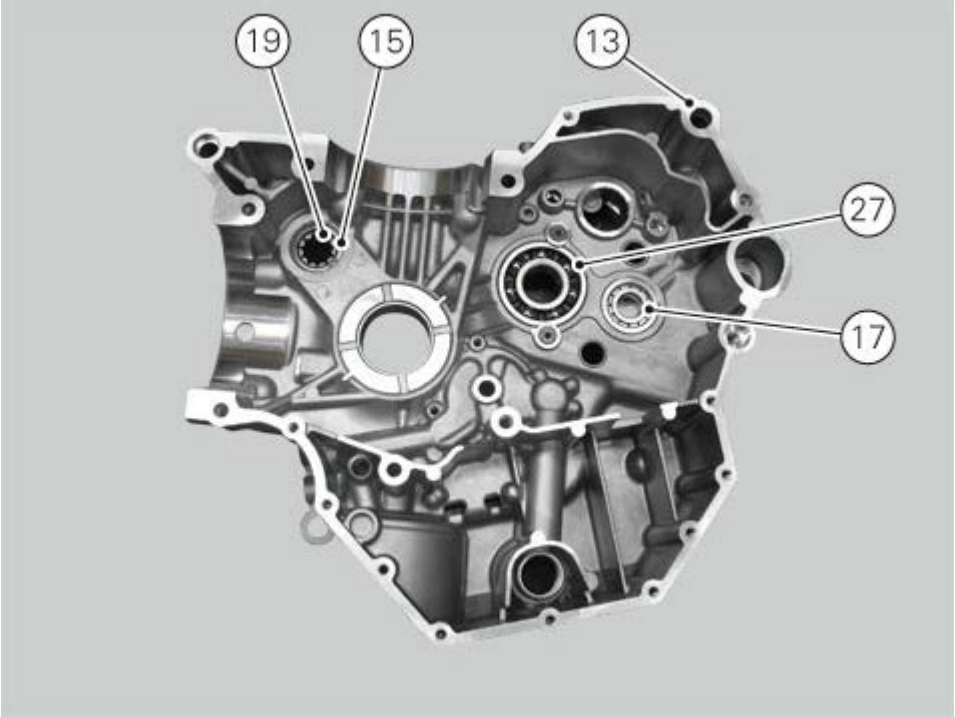
Check that the surfaces of the crankcase halves are perfectly flat using a reference surface.

Warning
When overhauling an engine it is good practice to replace all the crankcase bearings.

Replace secondary shaft end bearings (16) and (17)
Replace timing layshaft bearings (18) and (19) after having removed the O-rings (14) and (15).
Replace primary shaft bearings (20) and (21).

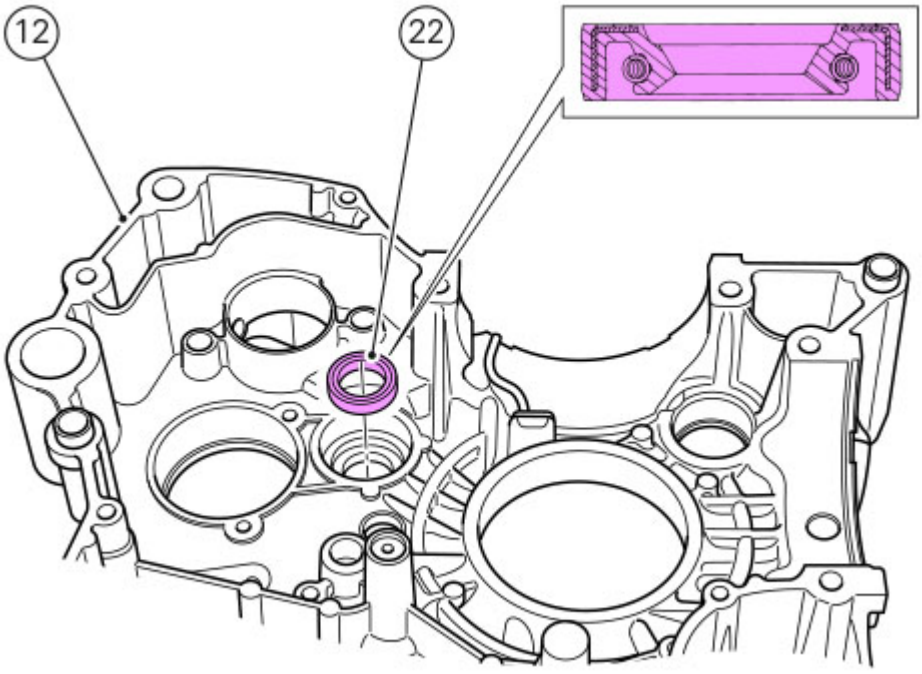
When refitting bearing (16), make sure that the side with the writings is facing upwards (visible).
When refitting bearing (18), aim cage closed side towards the crankcase.

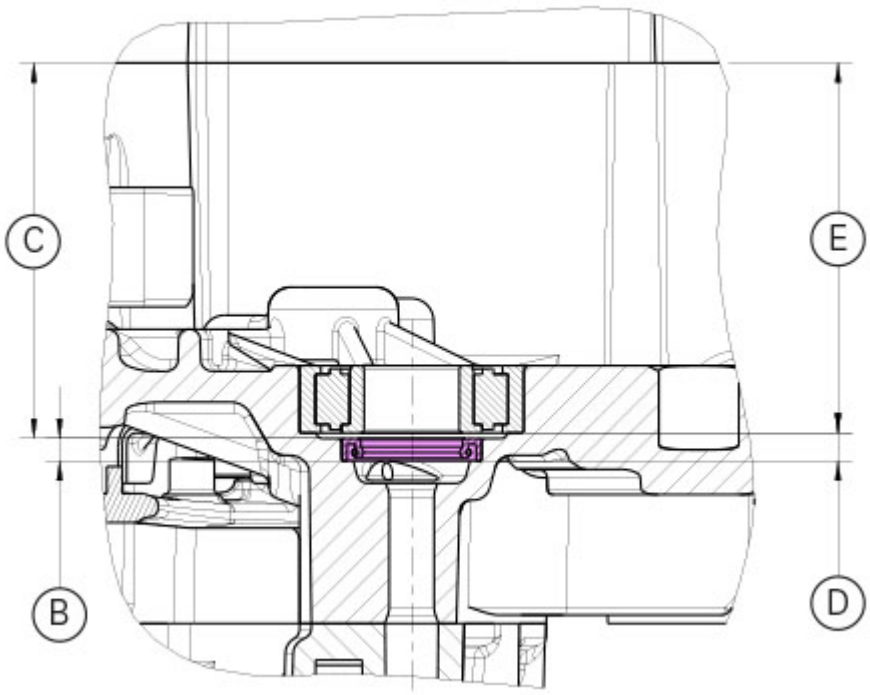




At each overhaul it is recommended to also replace the sealing ring (22) positioned between gearbox primary shaft support bearing (20) and chain-side crankcase half (12).
Upon assembling, lubricate ring (22) with KLÜBERPLUS S 06/100 (or denatured alcohol), then drive it fully home inside crankcase half and aim it as shown.
Check ring positioning value. It must be:

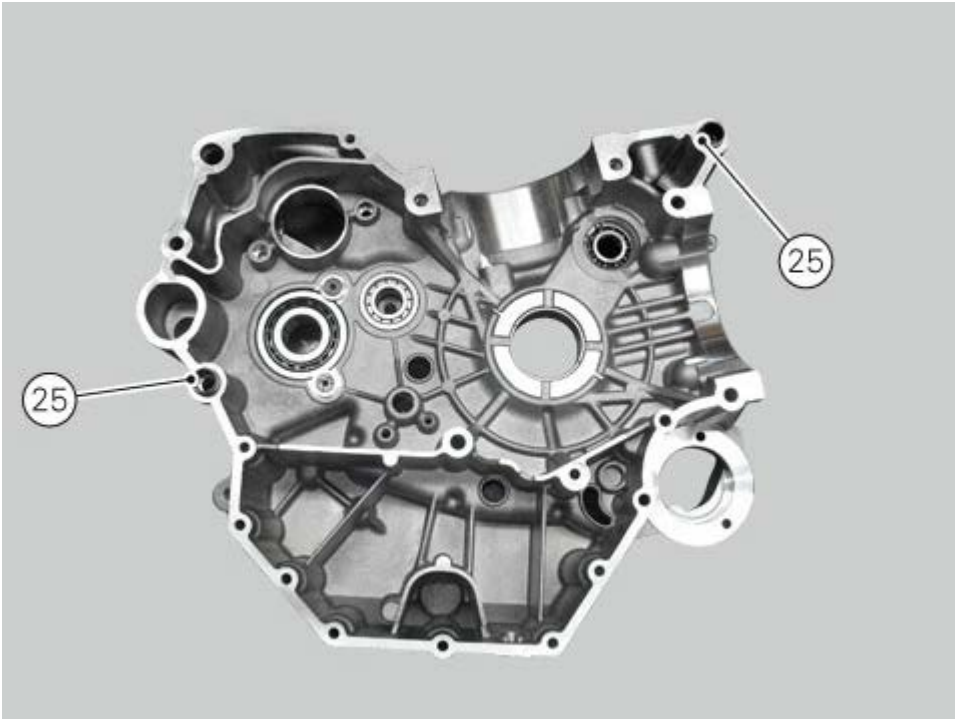
- oil seal height (B) 4 ± 0.2 mm;
- oil seal positioning (C) 67 ± 0.2 mm;
- (D) 5.0 ÷ 5.02 mm;
- (E) 66.0 ÷ 66.05 mm.





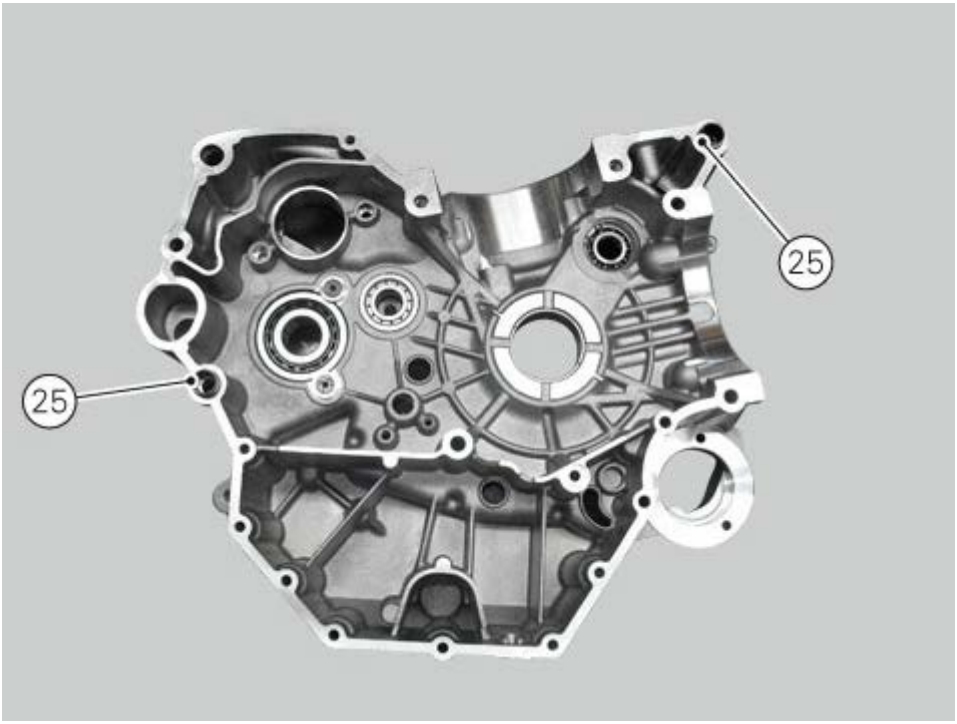
At each overhaul it is recommended to replace also the sealing ring (23) positioned outside gearbox secondary shaft bearing (16) on crankcase outer side (12), on chain side.
Upon assembling, lubricate ring (23) with KLÜBERPLUS S 06/100 (or denatured alcohol), then fit it as shown.

At each overhaul it is recommended to replace also the sealing ring (24) positioned outside timing layshaft bearing (19) on crankcase outer side (13), on clutch side.



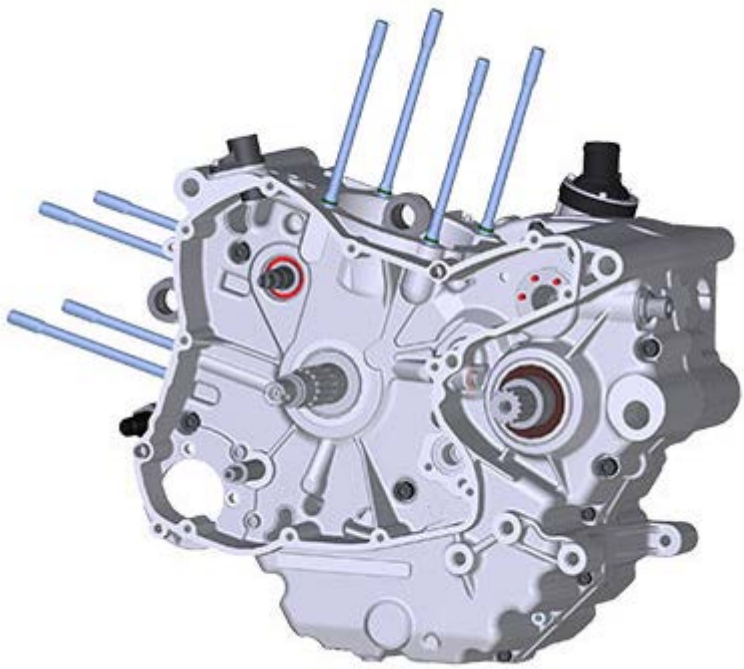
Check the condition of centring bushes (25). If apparently distorted or loose in their seats, change them using suitable tools.
When the centring bushes (25) are hard to remove from casing, use a left-hand tap to force bushes out.

Important
The bushes must always be replaced when they have been removed using the above procedure.

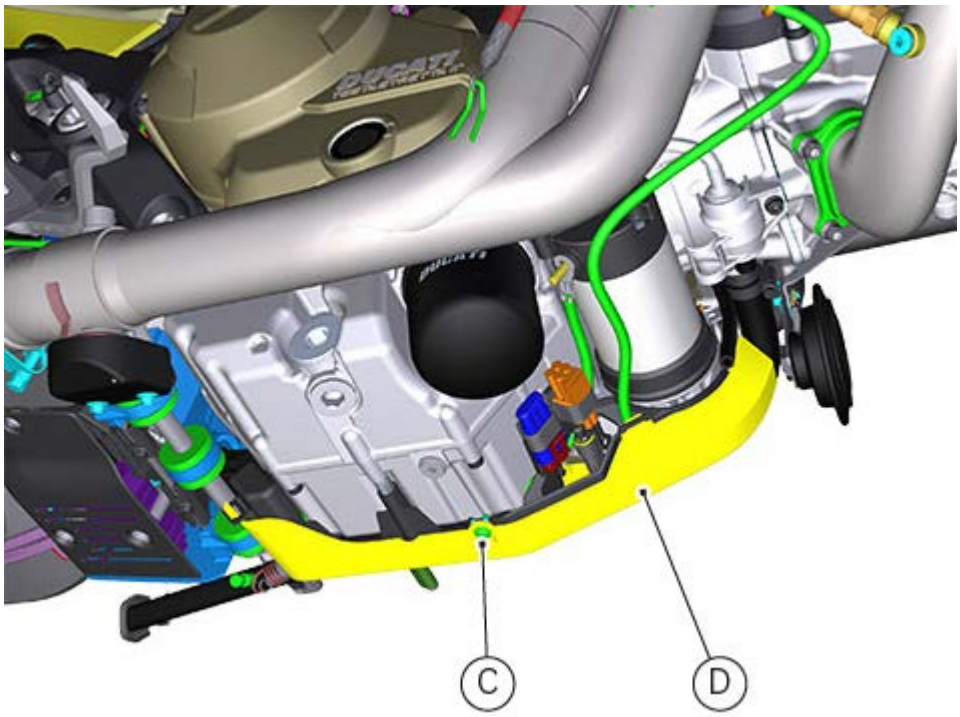


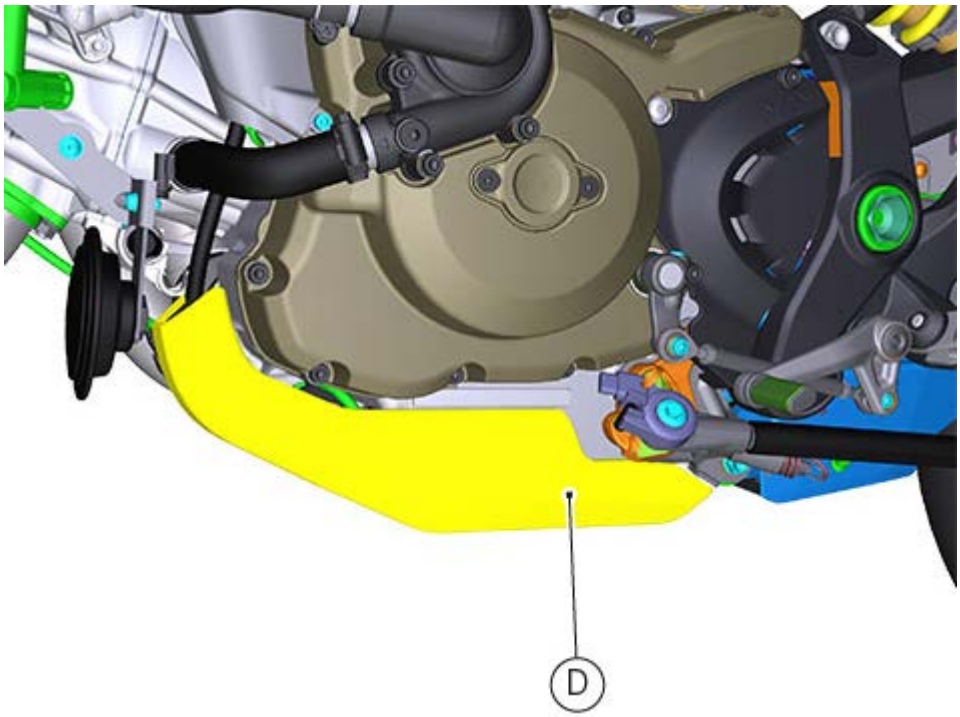
Separating the crankcase halves

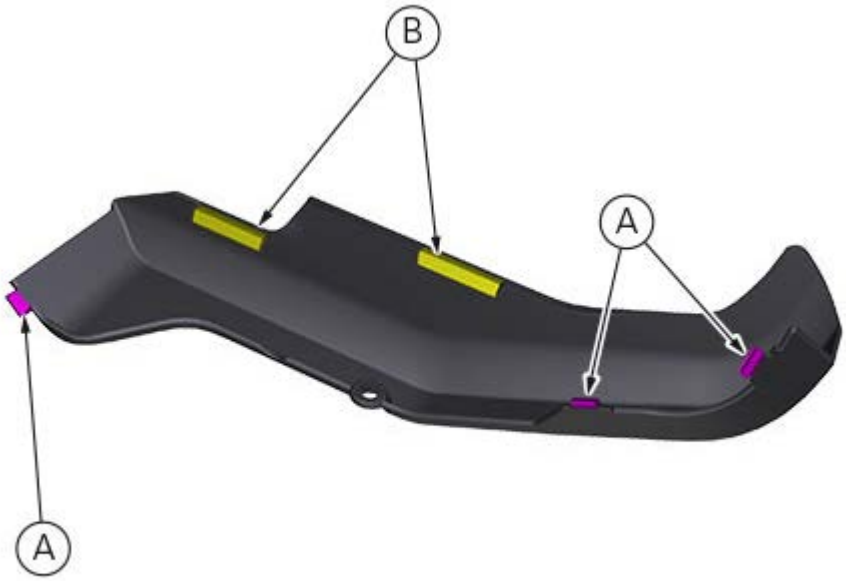
Remove the engine from the frame (Removing the engine).
Remove the external belt covers (Removing the timing belt external covers).
Remove the timing belts (Removing the mobile tensioner/timing belt).
Remove the timing pulleys (Disassembling the timing shaft pulleys).
Remove the timing gears (Removing the timing gears).
Remove the complete cylinder head assembly (Removing the cylinder heads).
Remove the complete cylinder/piston assembly (Removing the cylinder/piston assembly).
Remove the water pump (Removing the water pump).
Remove the generator side cover (Removing the generator cover) and the complete generator (Removing the flywheel/generator assembly).
Remove the starter motor idler gear (Removing the starter motor idler gear).
Remove the starter motor (Removing the starter motor).
Remove the clutch cover (Removing the clutch cover).
Remove the clutch unit (Removing the clutch).
Remove the oil pump (Removing the oil pump).
Remove the primary drive gear (Removing the primary drive gear).
Remove the oil filter (Changing the engine oil and filter cartridge).
Remove the gearchange mechanism (Removing the starter motor idler gear).



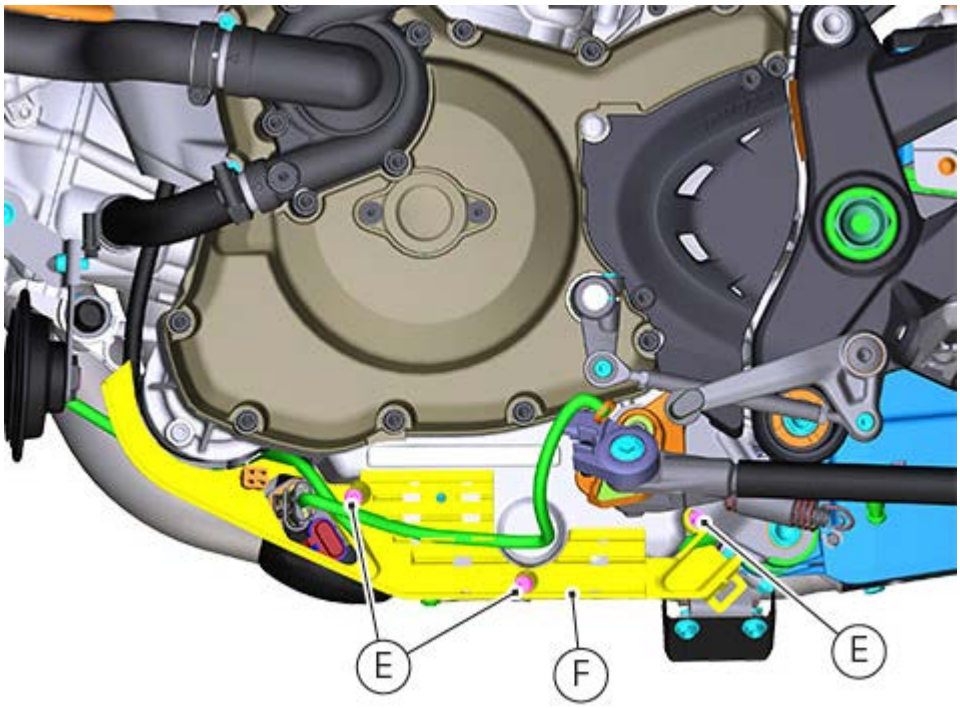
Remove the left cover and wiring support, as described below:
- loosen lower screw (C) and remove cover (D) from the crankcase half, releasing it from retainers (A) and (B).

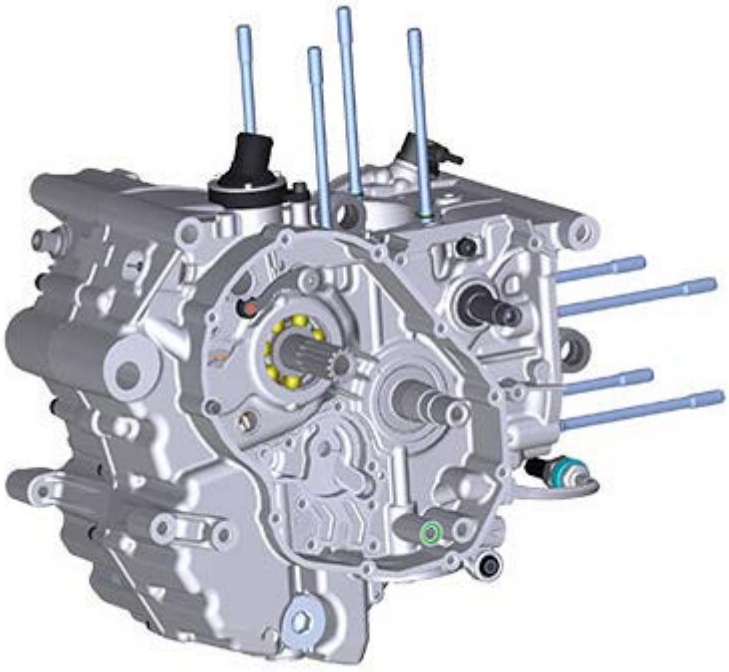

C
D


D

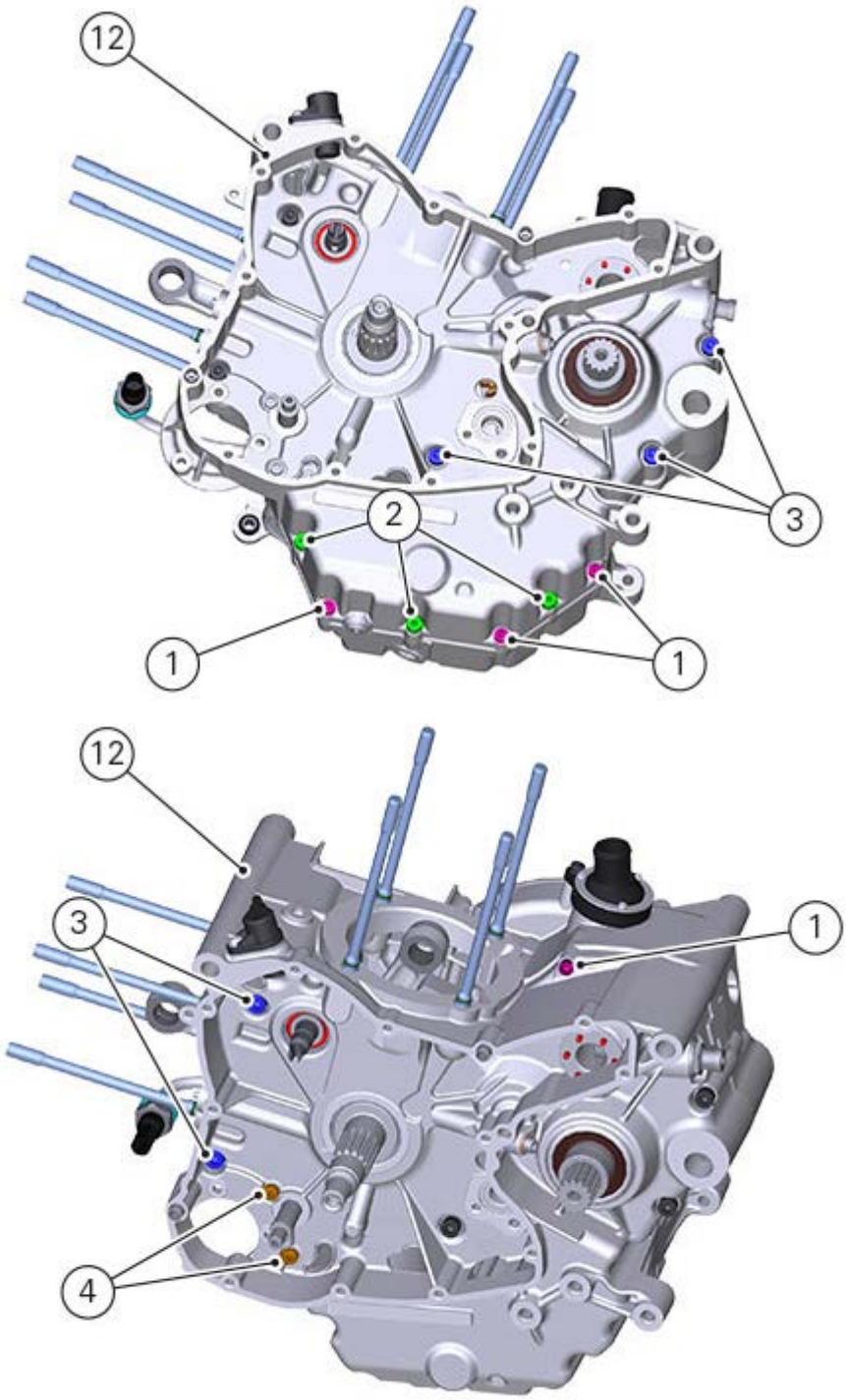


- release wirings and pipes from ties and clamps, and loosen the three screws (E);
- remove the wiring support (F).

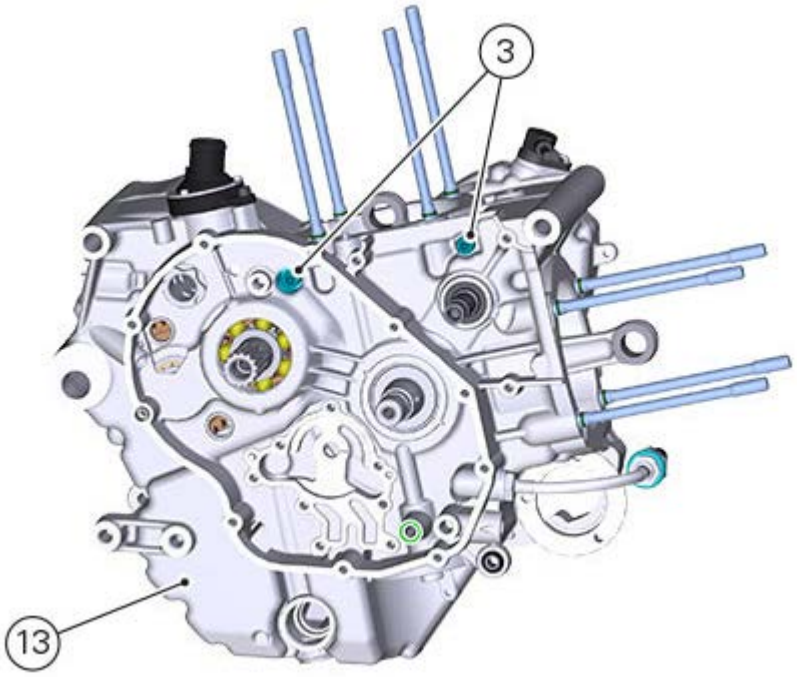




Loosen crankcase half jointing screws (1), (2), (3) and (4) on generator side (12).

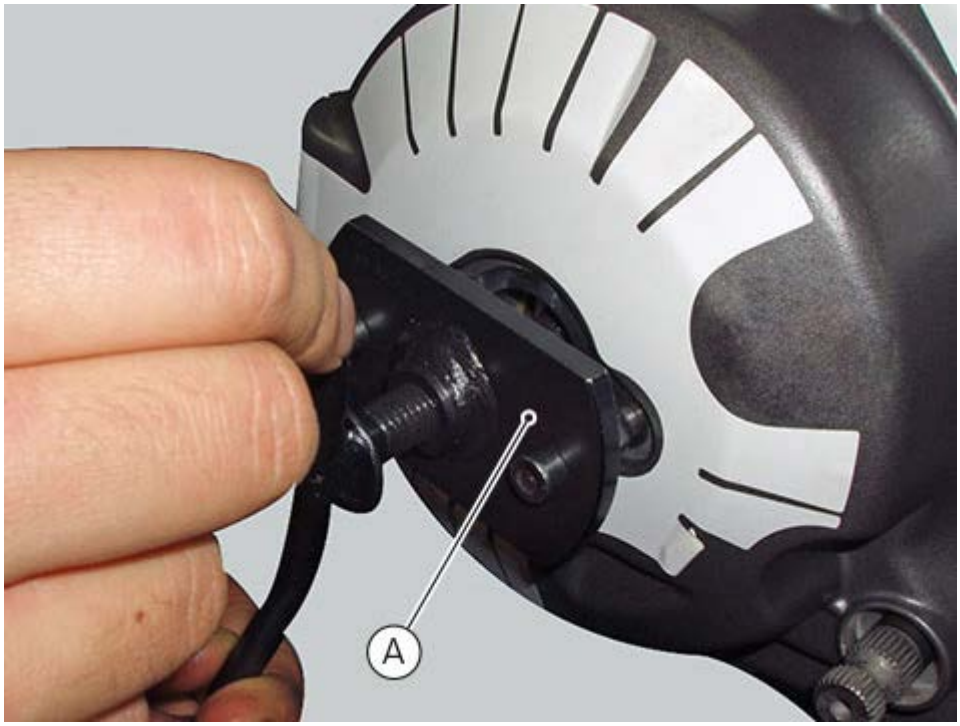


Loosen the two jointing screws (1) on clutch side crankcase half (13), at the vertical cylinder seat

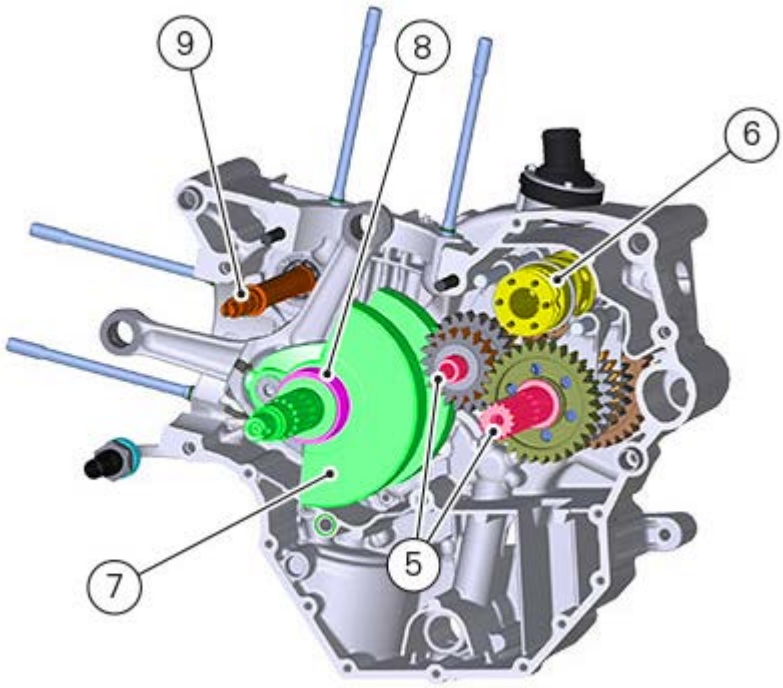


Reuse the generator cover or a service cover with puller (A) no. **88713.1749** duly fitted.
Secure cover to crankcase half with some of the original screws and begin separation by turning the central pin of the tool.
Tap the end of the gearbox secondary shaft with a plastic mallet to separate the crankcase halves.

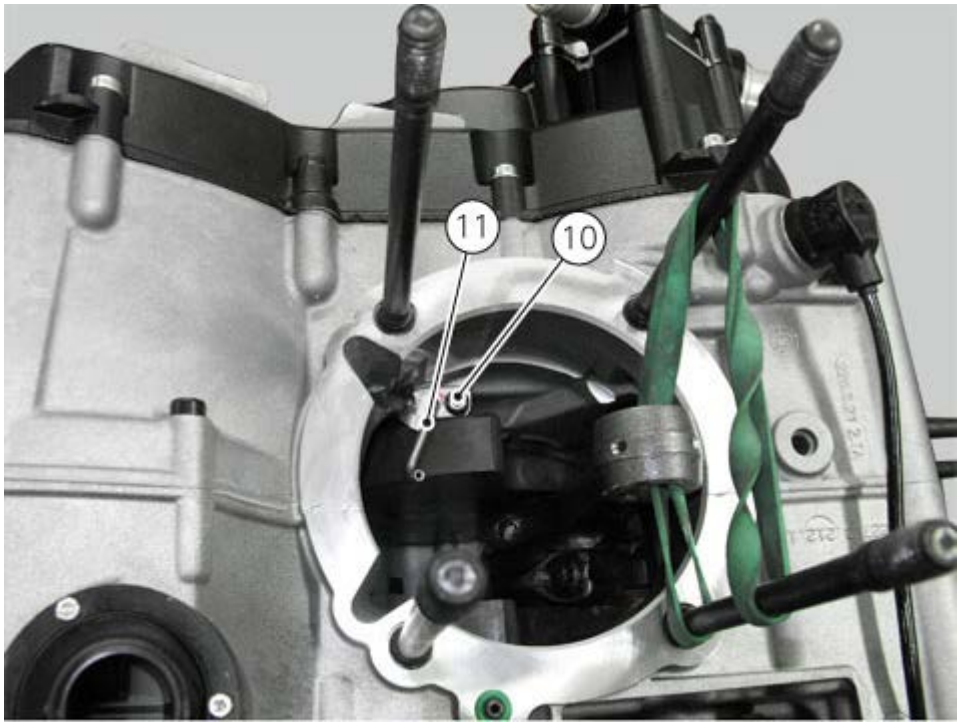
Note
Take care not to lose the shim washers on the shafts and on the selector drum.



Remove the gearbox shafts (5) and the gearbox selector drum (6) from the crankcase halves.
Slide out crankshaft (7) using a plastic mallet and taking special care to the single shim (8) positioned on the clutch side only.
Remove the timing layshaft (9).
Collect the O-rings present on the crankcase half.

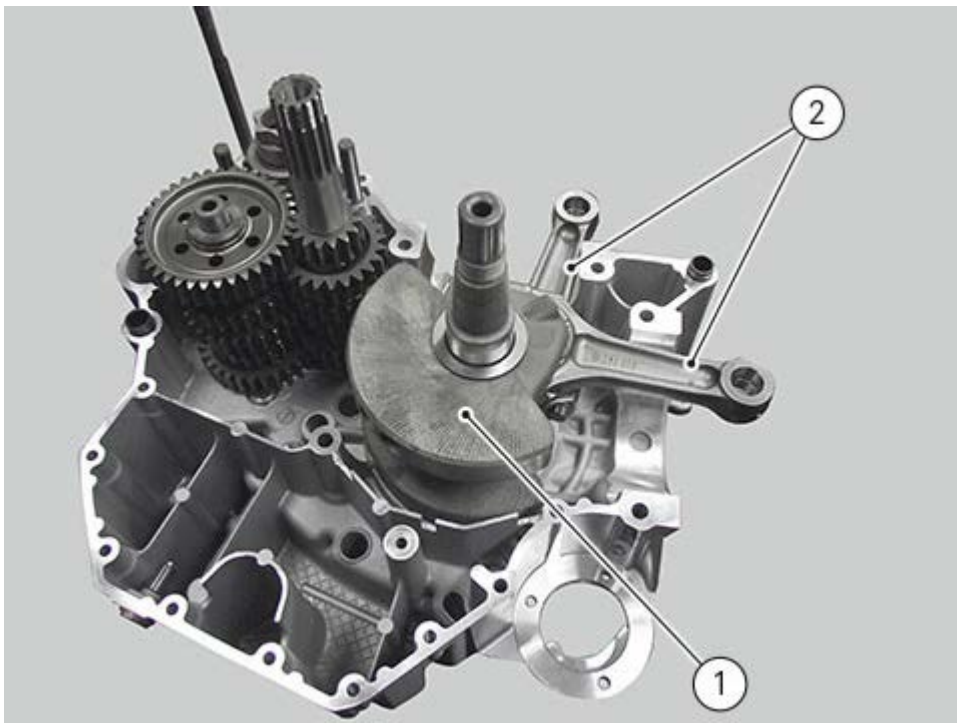


If necessary, on both cylinders, loosen screws (10), remove squirters (11) and collect the O-rings.



Refitting the connecting rod assembly

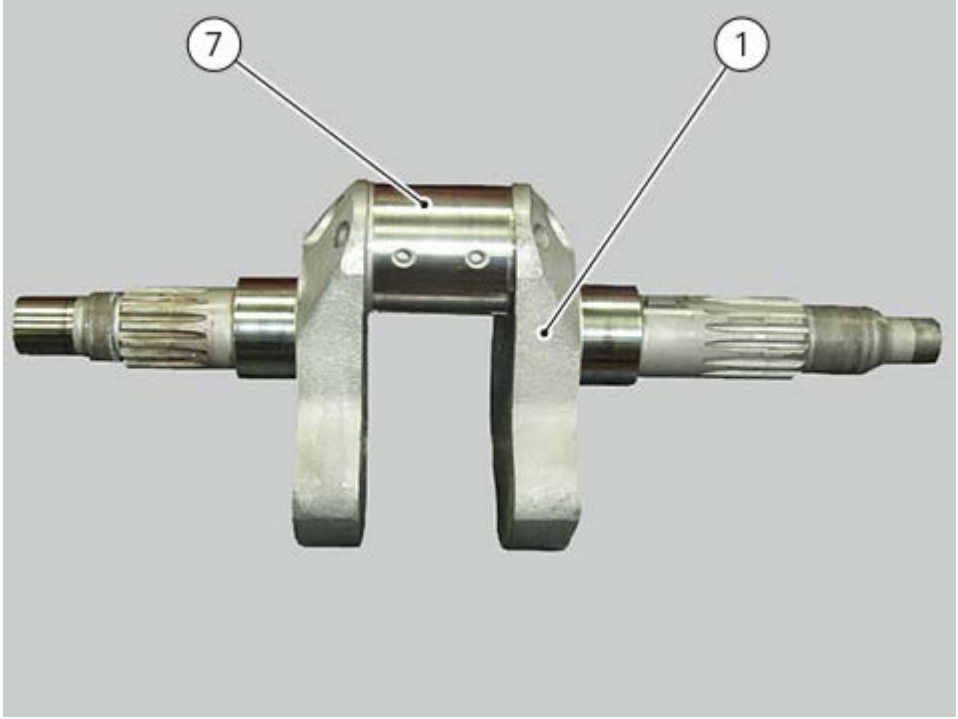
Install the complete connecting rod assembly inside crankcase half and proceed to shimming.
Make sure that the connecting rods (2) are correctly positioned in the relevant cylinder seats.
Incorrect positioning of the connecting rods at this stage will inevitably lead to the need to re-open the crankcase halves.



Close the crankcase halves (Closing the crankcase).
Refit the gearchange mechanism (Refitting the starter motor idler gear).
Refit the oil filter (Changing the engine oil and filter cartridge).
Refit the primary drive gear (Refitting the primary drive gear and checking backlash).
Refit the clutch unit (Refitting the clutch).
Refit the clutch cover (Refitting the clutch cover).
Refit the starter motor (Refitting the starter motor).
Refit the starter motor idler gear (Refitting the starter motor gear).
Refit the complete generator (Fitting the flywheel/generator assembly) and the generator side cover (Fitting the generator cover).
Refit the water pump (Refitting the water pump).
Refit the complete cylinder/piston assembly (Refitting the cylinder/piston assembly).
Refit the complete cylinder head assembly (Refitting the cylinder heads).
Refit the timing gear (Refitting the timing gears).
Refit the timing pulleys (Refitting the timing layshaft pulley).
Refit the timing belts (Refitting the timing belts).
Refit the external timing belt covers (Refitting the timing belt external covers).
Refit the engine in the frame (Refitting the engine).

Reassembling the connecting rod assembly

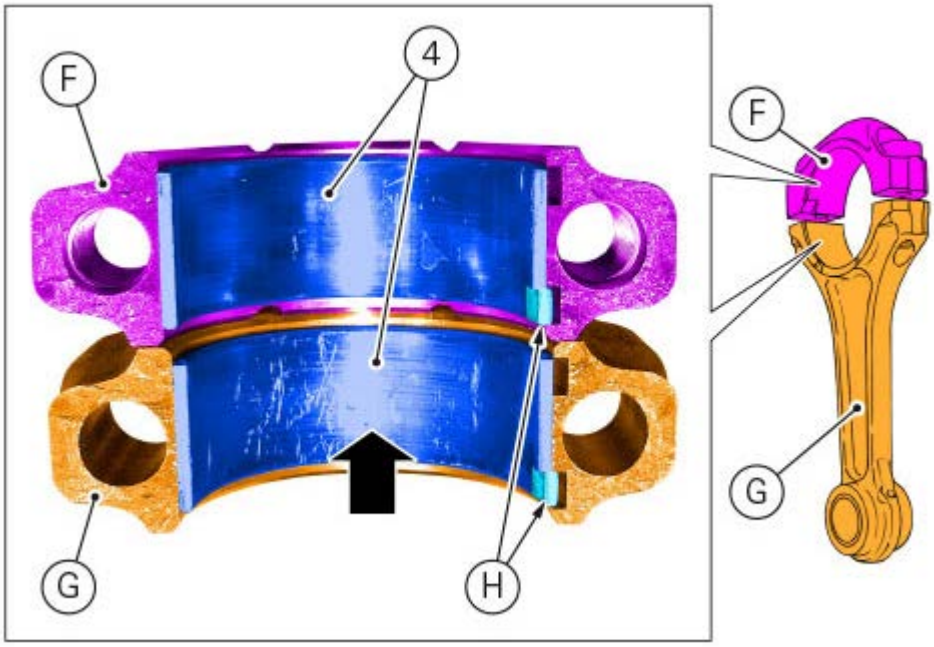
Before starting, check that the crankshaft main bearing and big-end journals are free of burrs or evident signs of machining: if necessary, clean the surfaces with very fine emery cloth and oil.
Check that the grooves are in perfect condition with no signs of forcing.
Thoroughly clean and lubricate the crank pin (7) on the crankshaft (1) and lubricate it with ROTHEN EXTRA additive.



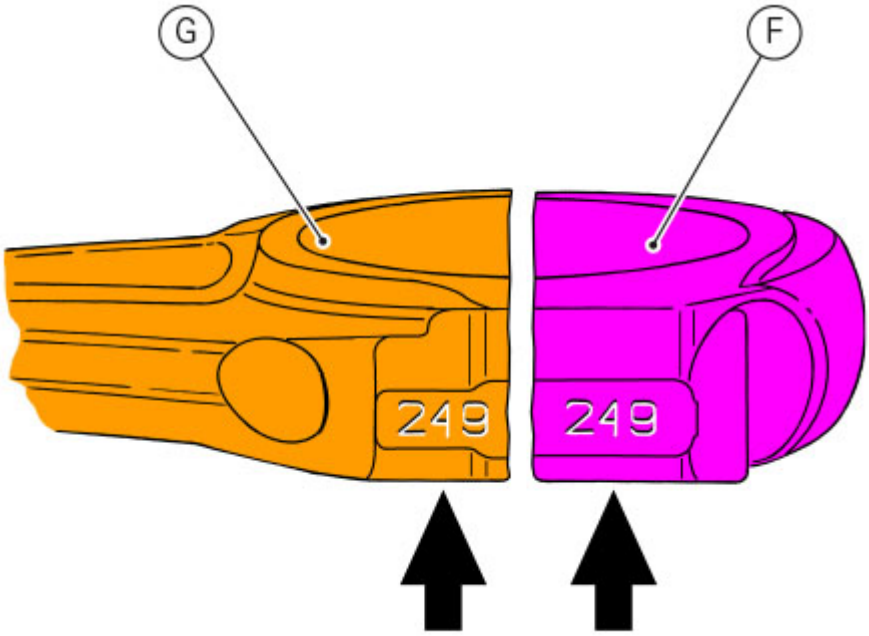
Take the bearings (4) necessary to shaft/connecting rod coupling, following the indications.

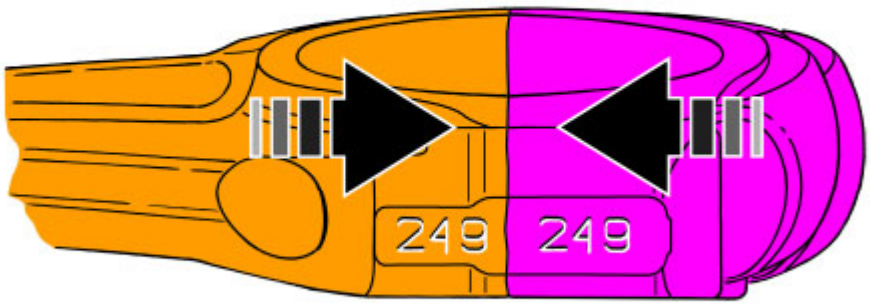
Crankshaft class	Connecting rod class	Bearings colour
A	A	RED - RED
B	A	BLUE - BLUE

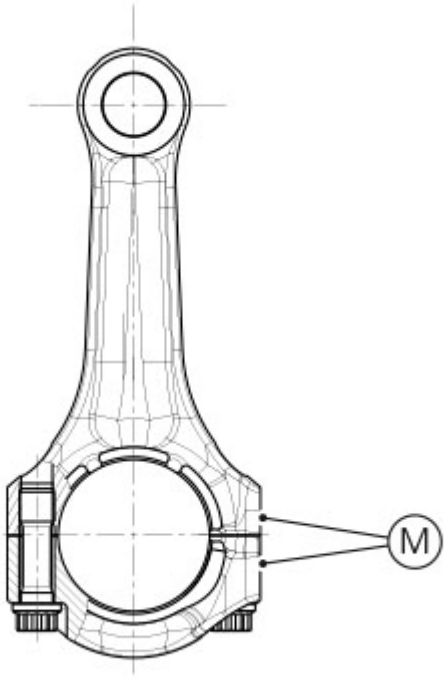
Insert the bearing shells in the connecting rod seats matching the tooth (H) of the bearings with the corresponding marks on the connecting rod cap (F) and on the connecting rod small end (G). It is essential that the tooth (M) adheres perfectly to its own seat.
Lubricate shank bearing (4) with lubricant ROTHEN EXTRA additive.



Fit connecting rods inside crankshaft.
Join the connecting rod cap (F) with the corresponding connecting rod small end (G), ensuring that the laser marking (M) of the progressive number stamped on the two pieces is the same, as shown in the figure.



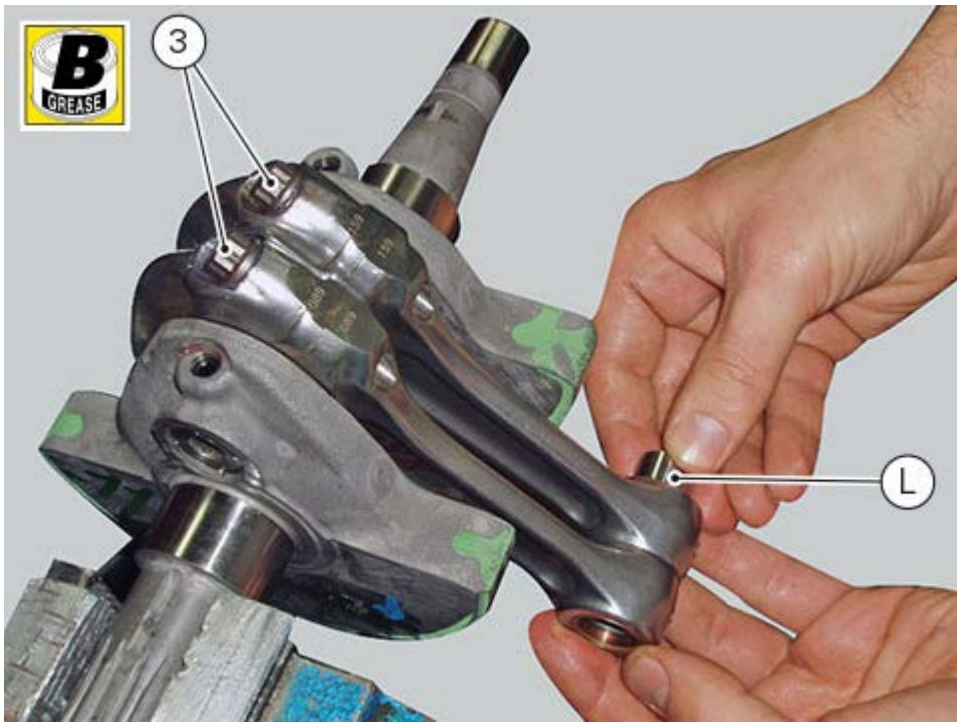




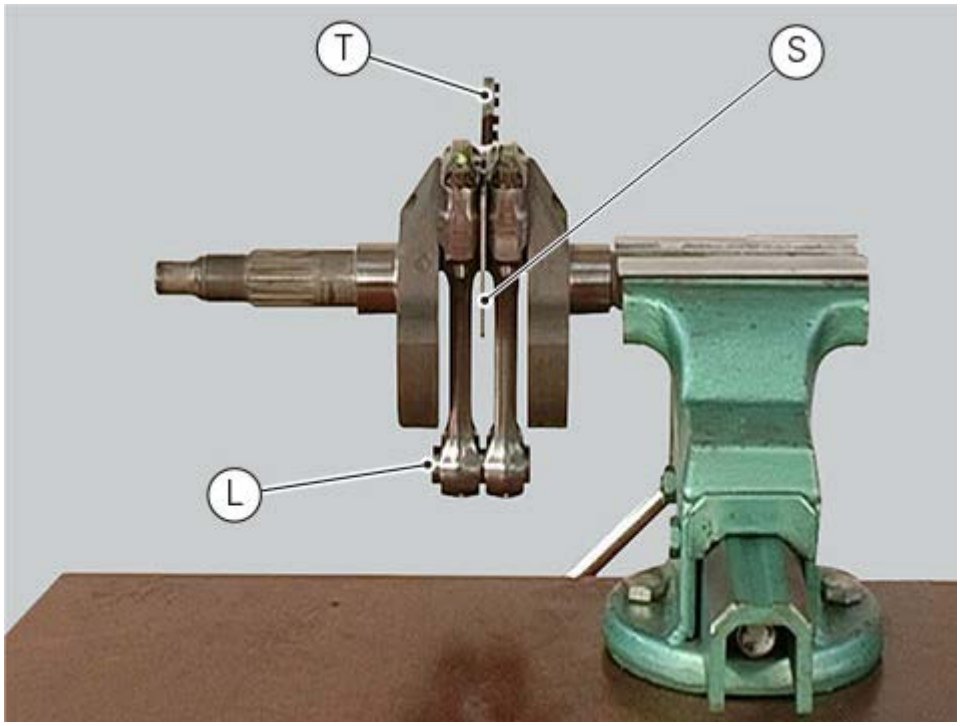
Warning
The grease utilised is irritant in contact with the skin; wear protective gloves.

Important
Lubrication of con-rod bolts is essential to obtain the correct coupling and to prevent breakage of the parts.

The con-rod screws may only be used for one tightening.
Tighten the screws (3) fully home by hand.
If this proves difficult or if the screws jam, undo them and lubricate them again.
Remove any excess grease. Tighten the screw by hand until the head seats against the connecting rod.
Temporarily fit the gudgeon pin (L) to align the connecting rods.



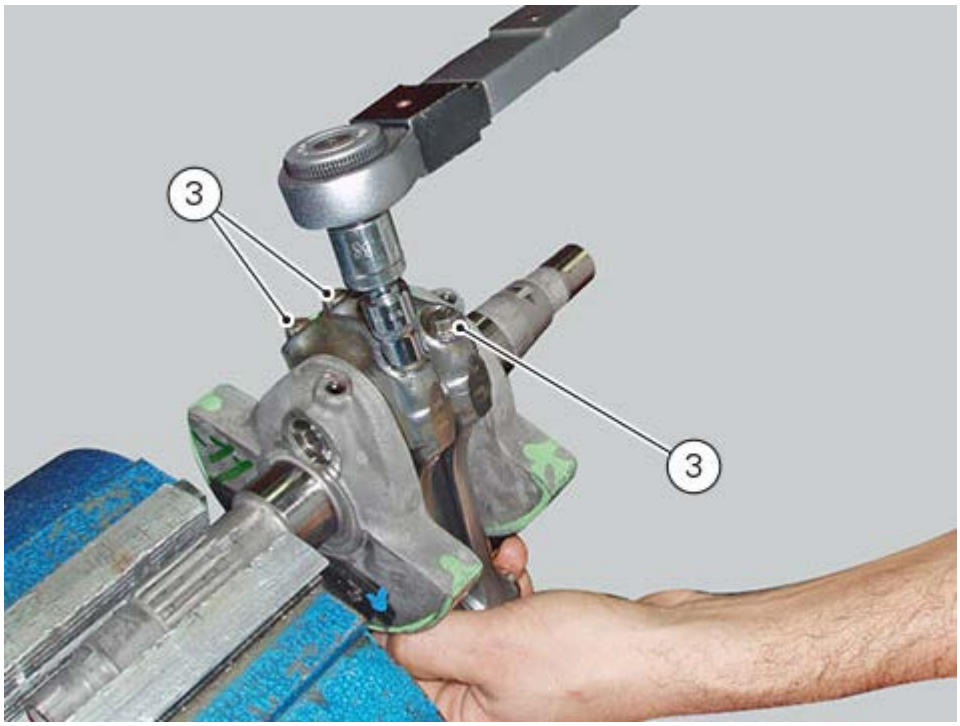
Fit the spacer (S) of the tool no. **88713.2878** between the connecting rods and take up residual axial clearance with the fork feeler gauge (T) of the tool no. **88713.2878** which is available in the following thickness values:
- 0.1 mm - 0.2 mm - 0.3 mm.



Using a torque wrench as shown in the figure, tighten screws (3) to the values specified here below:

- tighten to 35 Nm;
- pause of 2 seconds and 360° loosening;
- snug to 20 Nm;
- snug to 35 Nm;
- tighten with a rotation of 65°±1°;
- torque check 70÷103 Nm.

Remove the feeler gauge and check that connecting rods/crankshaft end float is: 0.15÷0.35 mm.



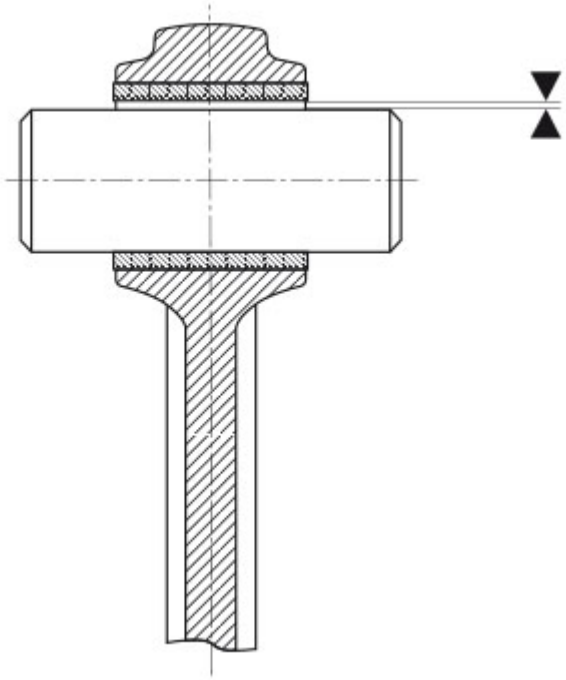
Overhauling the connecting rod assembly

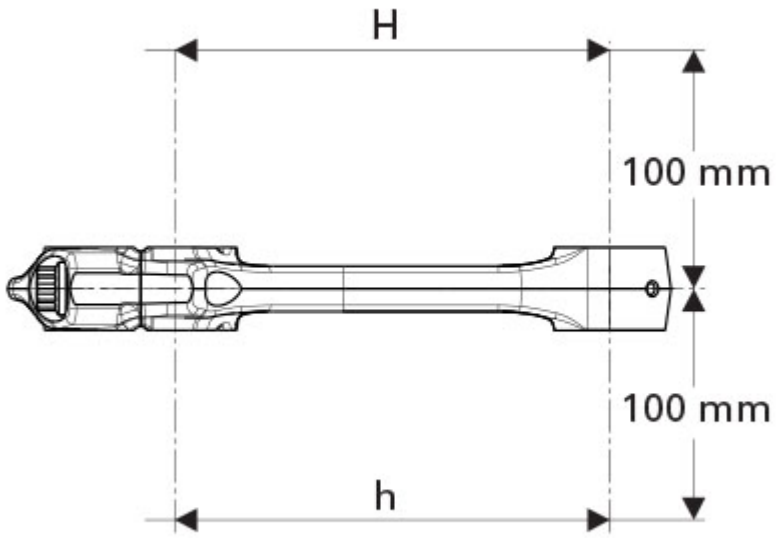
Remove the engine from the frame (Removing the engine).
Remove the external belt covers (Removing the timing belt external covers).
Remove the timing belts (Removing the mobile tensioner/timing belt).
Remove the timing pulleys (Disassembling the timing shaft pulleys).
Remove the timing gears (Removing the timing gears).
Remove the complete cylinder head assembly (Removing the cylinder heads).
Remove the complete cylinder/piston assembly (Removing the cylinder/piston assembly).
Remove the water pump (Removing the water pump).
Remove the generator side cover (Removing the generator cover) and the complete generator (Removing the flywheel/generator assembly).
Remove the starter motor idler gear (Removing the starter motor idler gear).
Remove the starter motor (Removing the starter motor).
Remove the clutch cover (Removing the clutch cover).
Remove the clutch unit (Removing the clutch).
Remove the oil pump (Removing the oil pump).
Remove the primary drive gear (Removing the primary drive gear).
Remove the oil filter (Changing the engine oil and filter cartridge).
Remove the gearchange mechanism (Removing the starter motor idler gear).
Separate the crankcase halves (Separating the crankcase halves)
Remove the connecting rod assembly from the crankcase halves (Removing the connecting rod assembly).
Disassemble the connecting rod assembly (Disassembling the connecting rod assembly)

Make the following dimensional checks on the connecting rods:

- clearance with gudgeon pin upon fitting.

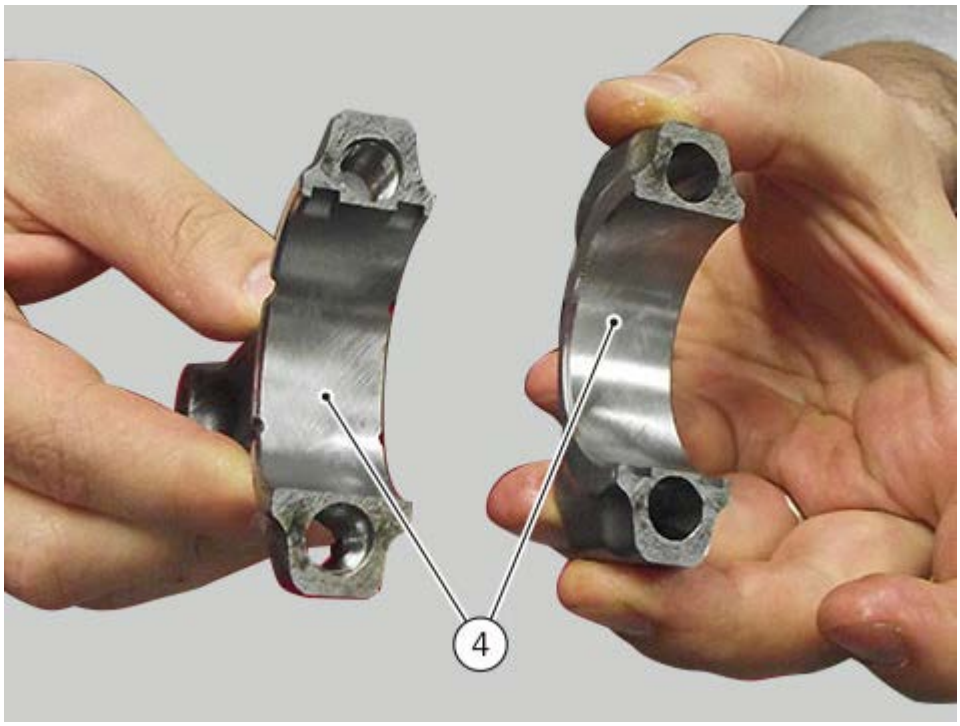
In case of excessive wear, replace the connecting rod. The small end bush must be in good condition and firmly driven into its seat. Check the parallelism error measured at 100 mm from the connecting rod longitudinal axis:
it must be H-h lower than 0.02 mm (H standard height when new is 124 mm); change the con-rod if it is not so.
Connecting rod big-end diameter must be within the specified limits.
It is preferable to use crankshafts and connecting rods of the same size class.



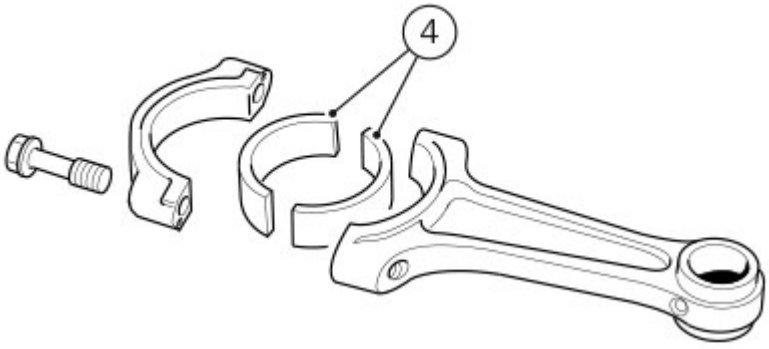


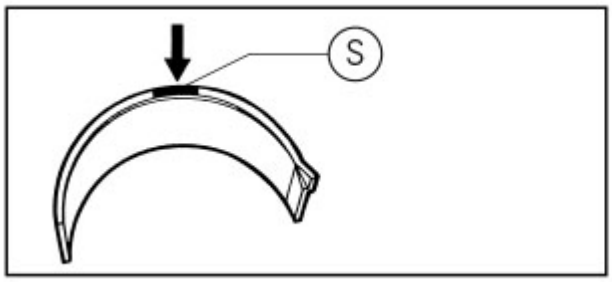
Replacing connecting rod big end bearings

It is good practice to replace the bearings (4) each time the engine is overhauled.
Spare bearings are supplied ready for fitting and they must not be reworked with scrapers or emery cloth.



The bearings may belong to two different size classes, each identified by a specific colour (S) (RED and BLUE).





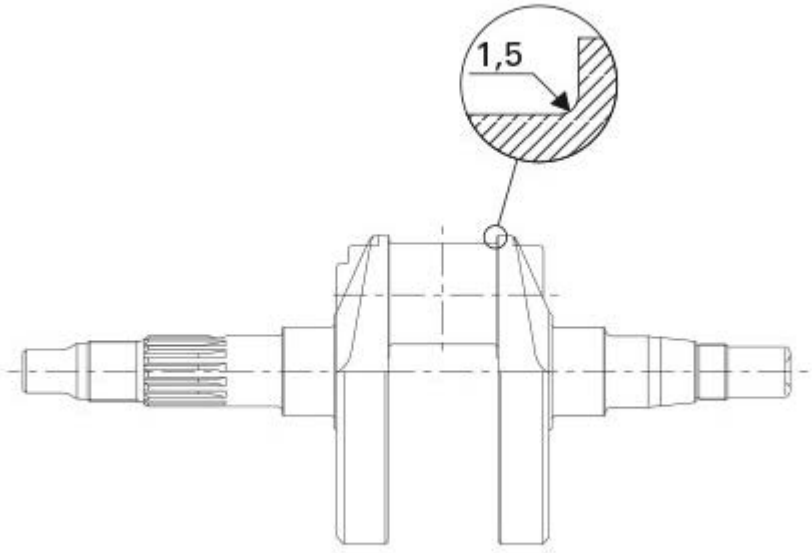
The bearings are comprised of an external steel ring, the inner face of which is electroplated with a lead-based compound.
The table shows the appropriate bearings to be fitted according to the size class of the crankshaft.

Crankshaft class	Connecting rod class	Bearings colour
A	A	RED - RED
B	A	BLUE - BLUE

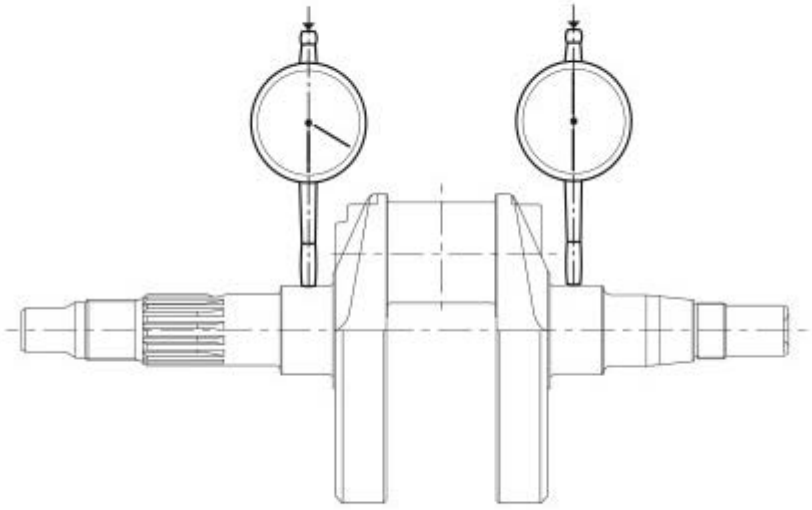
Overhauling the crankshaft

The journals for main bearings and crank pin should not be scored or grooved.
The threads, keyways, and slots must be in good condition.
Check for fretting or burrs in the fillet between journal and shoulder.
Fillet radius: 1.5 mm.
Use a micrometer to measure oval and taper of the crank pin. Measure oval and taper in several different

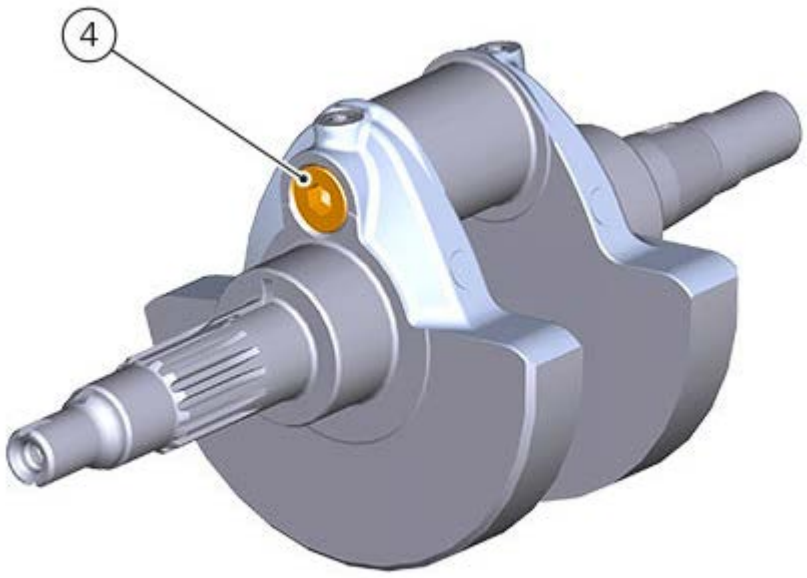
directions.



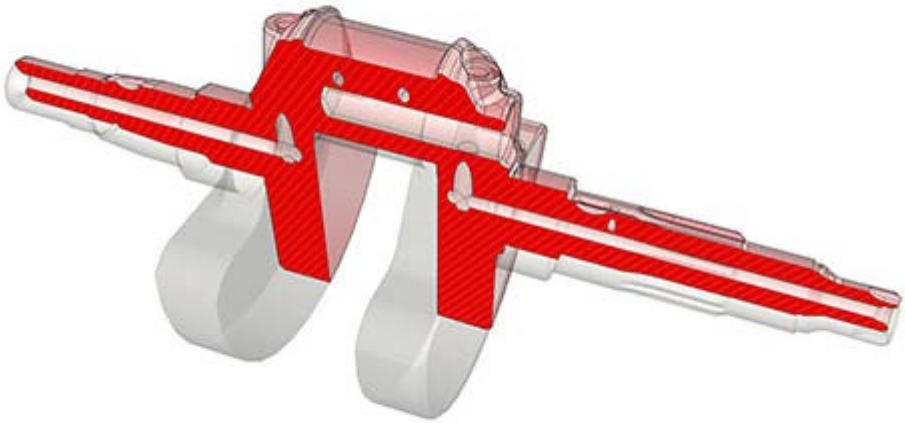
Use a dial gauge to measure the alignment of the main journals by positioning the crankshaft between two centres.

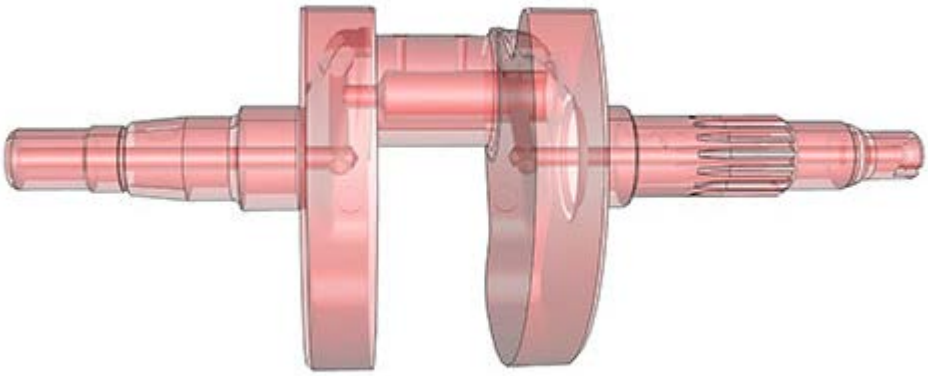


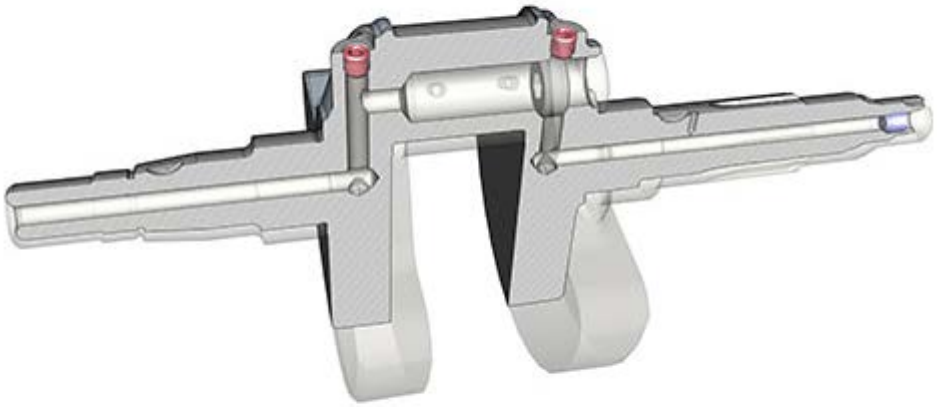
To carry out this operation, use a heat gun able to reach 150 °C.
Loosen the plug (5) of the crankshaft, heating the latter, if necessary, to remove the sealant applied upon assembly.

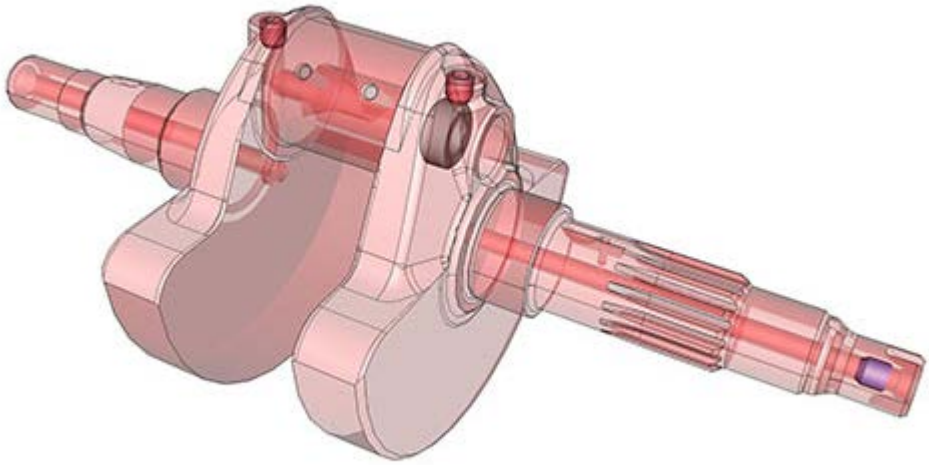


Clean all the oilways using suitable diameter metal brushes and then blow with compressed air to remove any residues that may have accumulated and may be restricting the oil flow.

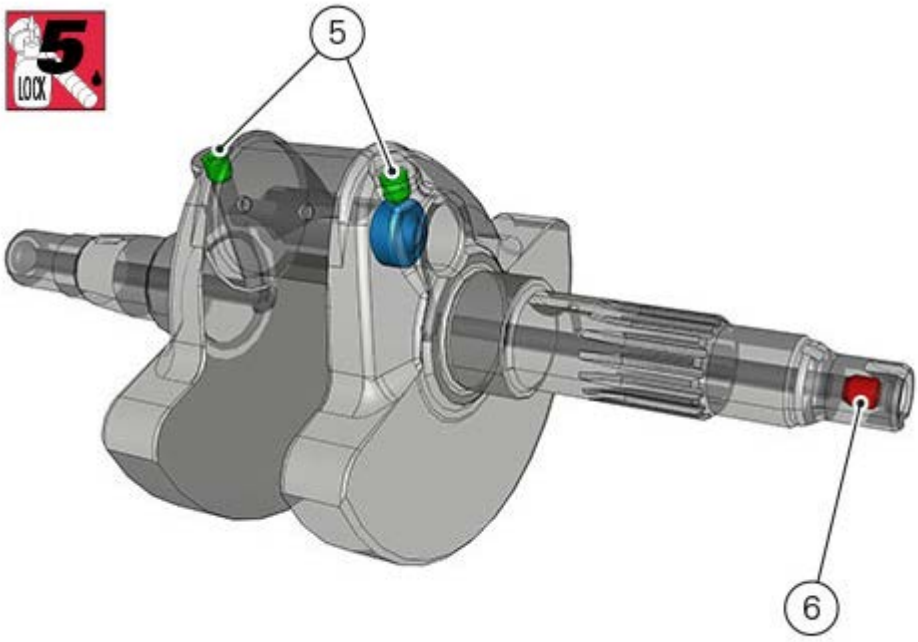


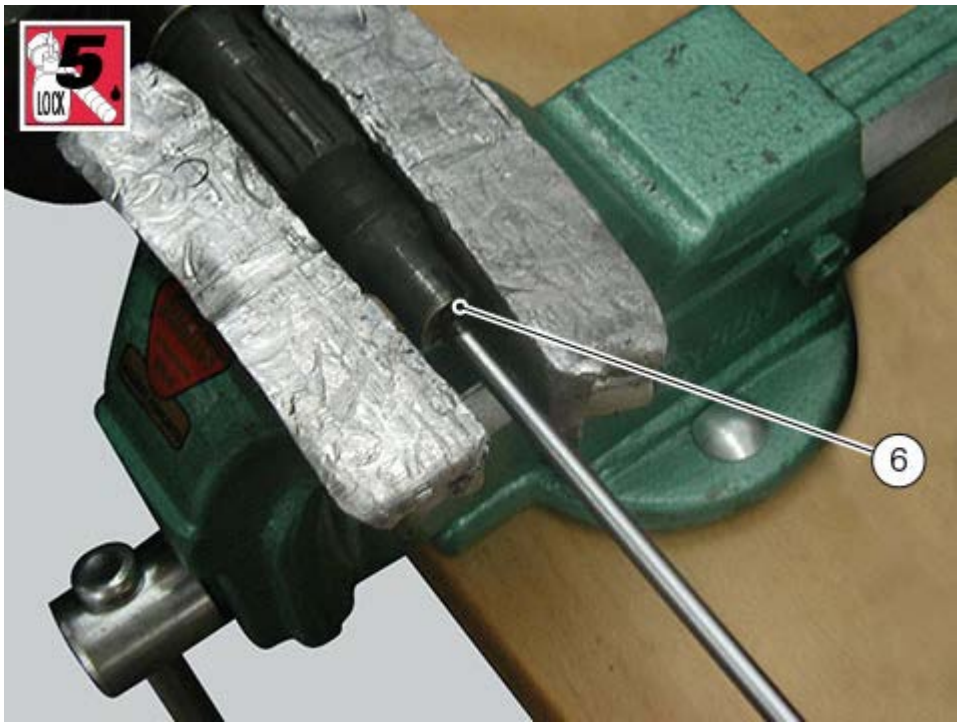






Apply specified threadlocker to the threads of dowels (5) and (6), then refit them.
Tighten dowels to a torque of 13 Nm (Min. 11 Nm - Max. 15 Nm).





Big-end bearing-crank pin clearance

In order to correctly couple big-end bearings and crank pin, proceed as follows:

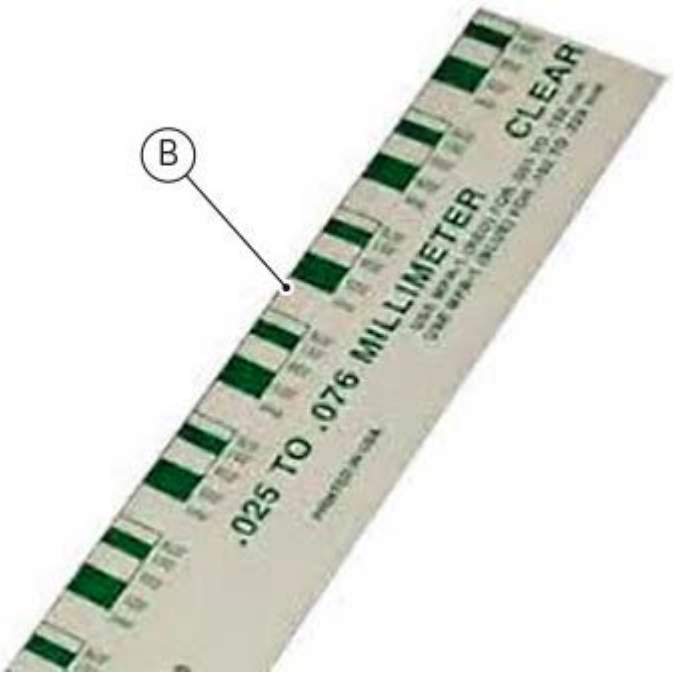
- apply a strip (A) of GREEN "Plastigauge PG-1" to the crank pin;
- fit the connecting rod and the original big-end bearings.

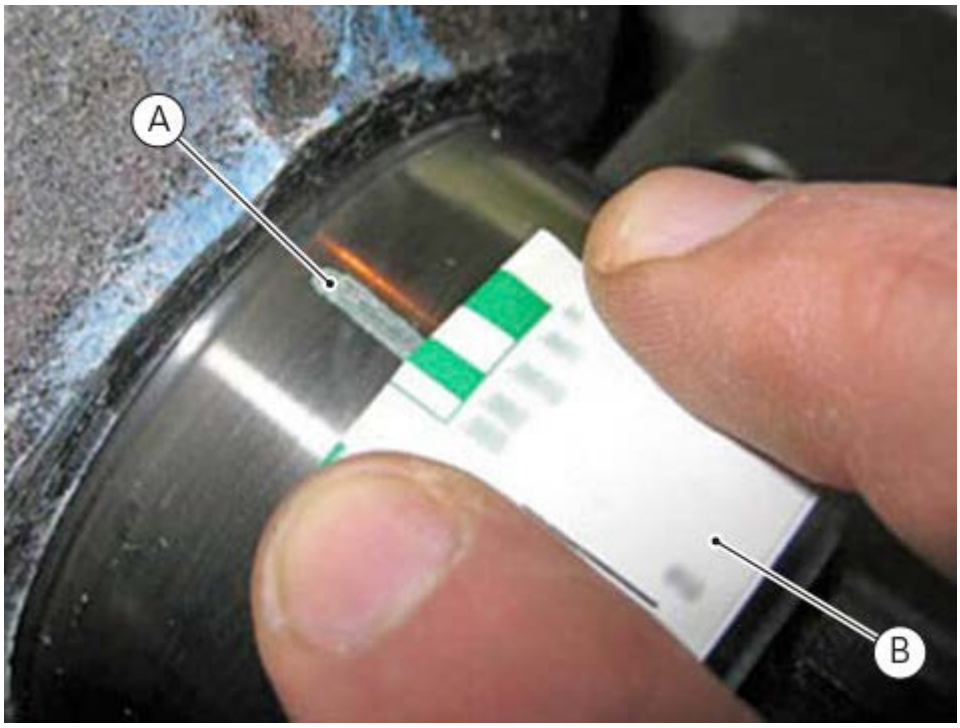
Tightening procedure
Tighten the connecting rod bolts (Class 14.9) as described below:

- apply the recommended threadlocker to the thread;
- tighten the screw to a torque of 35 Nm ± 10% at 50 rpm;
- wait for 2 seconds then loosen by 360° at 30 rpm;
- tighten to a snug torque of 20 Nm ± 10% at 30 rpm;
- tighten to a snug torque of 35 Nm ± 10% at 10 rpm;
- tighten with a rotation of 65° ± 1° at 14 rpm;
- Check the applied tightening torque (Min. 70 Nm - Max. 113 Nm).

Continue the coupling procedure as described below:

- loosen the screws and remove the connecting rod;
- check the thickness of the strip of "GREEN Plastigauge PG-1" (A), using the suitable reference scale (B);
- the thickness measured with scale (B) represents the actual clearance: if it is not within the specified limits (Crankshaft), it is necessary to replace the bearings or the crankshaft and repeat the procedure;
- If the clearance value complies with the established limits, carefully remove the strip of "GREEN Plastigauge PG-1" (A) from the crankshaft and repeat the tightening procedure as described.


B
.025 TO .076 MILLIMETER
CLEAR


A
B

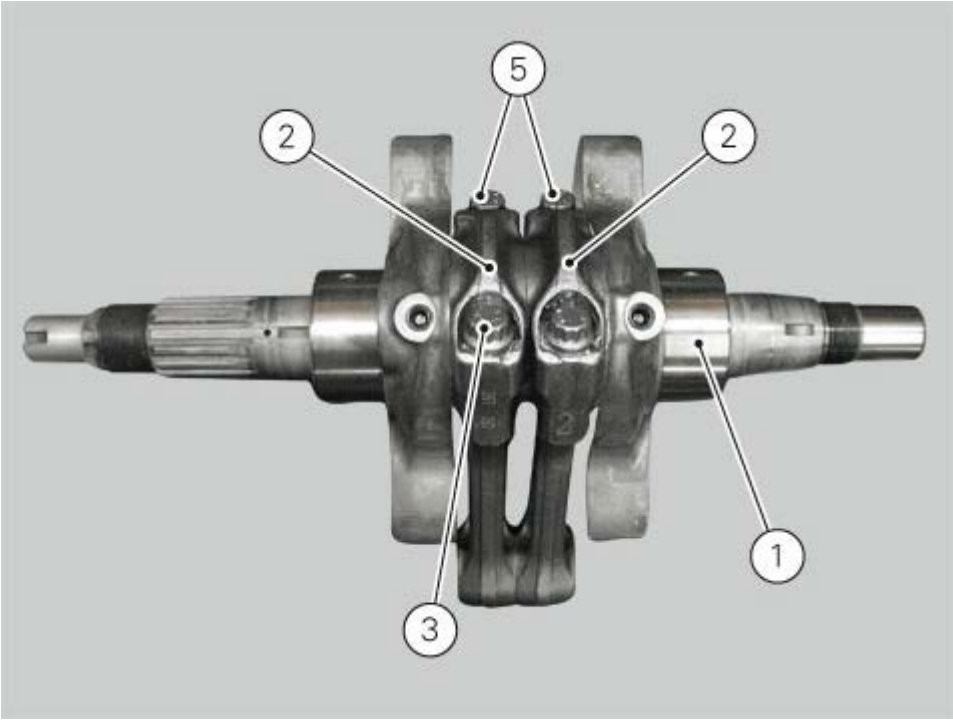
Disassembling the connecting rod assembly

Remove the engine from the frame (Removing the engine).
Remove the external belt covers (Removing the timing belt external covers).
Remove the timing belts (Removing the mobile tensioner/timing belt).
Remove the timing pulleys (Disassembling the timing shaft pulleys).
Remove the timing gears (Removing the timing gears).
Remove the complete cylinder head assembly (Removing the cylinder heads).
Remove the complete cylinder/piston assembly (Removing the cylinder/piston assembly).
Remove the water pump (Removing the water pump).
Remove the generator side cover (Removing the generator cover) and the complete generator (Removing the flywheel/generator assembly).
Remove the starter motor idler gear (Removing the starter motor idler gear).
Remove the starter motor (Removing the starter motor).
Remove the clutch cover (Removing the clutch cover).
Remove the clutch unit (Removing the clutch).
Remove the oil pump (Removing the oil pump).
Remove the primary drive gear (Removing the primary drive gear).
Remove the oil filter (Changing the engine oil and filter cartridge).
Remove the gearchange mechanism (Removing the starter motor idler gear).
Separate the crankcase halves (Separating the crankcase halves)
Remove the connecting rod assembly from the crankcase halves (Removing the connecting rod assembly).

To disassemble the connecting rod assembly, loosen screws (3) and separate connecting rods (2) from crankshaft (1).

Important

Take care not to mix up components of different connecting rods and maintain the original orientation.



Removing the connecting rod assembly

Remove the engine from the frame (Removing the engine).
Remove the external belt covers (Removing the timing belt external covers).
Remove the timing belts (Removing the mobile tensioner/timing belt).
Remove the timing pulleys (Disassembling the timing shaft pulleys).
Remove the timing gears (Removing the timing gears).
Remove the complete cylinder head assembly (Removing the cylinder heads).
Remove the complete cylinder/piston assembly (Removing the cylinder/piston assembly).
Remove the water pump (Removing the water pump).
Remove the generator side cover (Removing the generator cover) and the complete generator (Removing the flywheel/generator assembly).
Remove the starter motor idler gear (Removing the starter motor idler gear).
Remove the starter motor (Removing the starter motor).
Remove the clutch cover (Removing the clutch cover).
Remove the clutch unit (Removing the clutch).
Remove the oil pump (Removing the oil pump).
Remove the primary drive gear (Removing the primary drive gear).
Remove the oil filter (Changing the engine oil and filter cartridge).
Remove the gearchange mechanism (Removing the starter motor idler gear).
Separate the crankcase halves (Separating the crankcase halves)

After separating the crankcase halves, remove the crankshaft (1) complete with connecting rods (2).