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1 - Technical specifications

Engine

Type	2-cylinder 4-stroke with Desmodromic system
Bore	98 mm
Stroke	71.5 mm
Displacement	1079 cm ³
Compression ratio	10.5 ± 0.5:1
Maximum power at crankshaft (95/1/EC)	63 kW (86 CV) at 7750 rpm
Maximum crankshaft power measured on test bench	67 kW (92 CV) at 8000 rpm
Max torque at crankshaft (95/1/EC)	94 Nm - 9.6 kgm at 4750 rpm
Maximum crankshaft torque measured on test bench	92 Nm - 9.4 kgm at 5000 rpm
Maximum engine speed	8500 rpm
Timing system	Desmodromic with two valves per cylinder, operated by four rocker arms (two opening rockers and two closing rockers) and one overhead camshaft. The camshaft is driven by the crankshaft through spur gears, belt rollers toothed belts.
Lubrication system	Pump-forced
Oil pump type	Gear pump
Cooling system	Air-cooled
Air filter	One filtering element
Crankshaft type	One-piece
Cylinder arrangement	"L" at 90°

Cylinder/Piston

	Reference	Standard value	Service limit
Cylinder barrel	Max. bore ovality	0.03 mm	
	Max. bore taper	0.03 mm	
	Nominal diameter	Ø98 mm	
	Size group A	9.000 mm/0 to 0.01 mm	
Piston	Size group B	98.010 mm/0 to 0.01 mm	
	Size group C	98.020 mm/0 to 0.01 mm	
	Nominal diameter	Ø98 mm	
	Size group A	97.965 mm/0 to 0.01 mm	
Connecting rod	Size group B	97.975 mm/0 to 0.01 mm	
	Size group C	97.985 mm/0 to 0.01 mm	
	Piston outside diameter measured at 6.0 mm from piston base		
	Connecting rod big-end bore diameter	Ø45 mm	
Big-end bearing pairings	Crankshaft class	Connecting rod class	Bearings colour
	A	A	Blue + Yellow
	B	A	Yellow + Yellow
	A	B	Blue + Blue
Gudgeon pin-to-piston clearance	B	B	Blue + Yellow
		0.015÷0.024 mm	
	Nominal diameters	Ø19 mm	
	Gudgeon pin	Ø19 mm/0 to 0.004	
Piston-to-cylinder bore clearance	Piston	Ø19 mm/0.020 to 0.015	
		0.025÷0.045 mm	
	Gudgeon pin-to-connecting rod clearance	0.035÷0.049 mm	
	Big-end bearing-to-crankpin clearance	Ø42.014 mm/0 to 0.016 mm	
Engine cylinders and compression measured with DDS tester		11÷12 bar	10 bar (min), difference between the two cylinders: 2 bar (max.)

Gearbox

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

Transmission

	Reference	Technical specifications
	Clutch	Wet multiplate
	Clutch control	Hydraulic
	Gearbox	6 speed
	Primary drive	32/59
	Transmission ratio	1.84
	Final drive	15/42
	Gearbox type	With constant mesh spur gears, operated by a lever on the left side of the motorcycle
Transmission	Gear ratios	
	1 st	15/37
	2 nd	17/30
	3 rd	20/27
	4 th	22/24
	5 th	24/23
	6 th	28/24

Timing system/valves

	Reference	Adjusting clearance	Checking clearance
Timing diagram	With 1 mm valve clearance		
	Intake	Opening 15° B.T.D.C. Closing 65° A.B.D.C	
	Exhaust	Opening 62° B.B.D.C. Closing 19° A.T.D.C.	
	Intake valve diameter Exhaust valve diameter	45 mm 40 mm	
Valve lift	With 0 mm valve clearance	Intake 11.2 mm Exhaust 10.78 mm	
	Opening rocker arm - intake	0.10÷0.15 mm	0.05÷0.15 mm
	Opening rocker arm - exhaust	0.10÷0.15 mm	0.05÷0.15 mm
	Closing rocker arm - intake	0÷0.05 mm	0÷0.20 mm
	Closing rocker arm - exhaust	0÷0.05 mm	0÷0.20 mm
Timing belt tensioning		140 Hz (horizontal) +/- 5 Hz 140 Hz (vertical) +/- 5 Hz	140 Hz (horizontal) +/- 5 Hz 140 Hz (vertical) +/- 5 Hz
	Minimum limit value	70 Hz	70 Hz

1.1 - Engine torque settings

Part	Thread (mm)	Nm	Min.	Max.	Notes
Blow-by valve	M40x1.5	40	36	44	
Pick-up filter cap	M32x1.5	42	38	46	
Oil temperature sensor holder nut	M30x1.5	38	34	42	LOCK 4
Crankshaft gear nut	M25x1.5	190	171	209	GREASE B
Alternator rotor nut	M24x1	270	256	284	ENGINE OIL
Primary drive gear nut	M22x1	190	171	209	GREASE B
Oil drain plug	M22x1.5	42	38	46	
Oil pick-up filter	M22x1.5	42	38	46	
Oil filler plug	M22x1.5	5	5	6	
Idler/tensioner pulley mounting stud	M20x1	50	45	55	LOCK 2 or THREE BOND 1
Steel/aluminium crankshaft blanking cap	M20x1	15	13.5	16.5	
Timing belt camshaft pulley nut	M10x1	71	64	78	GREASE A
Selector drum locating screw	M16x1.5	30	27	33	
Oil filter nipple	M16x1.5	42	38	46	LOCK 2 or THREE BOND 1
Oil filter cartridge	M16x1.5	11	10	12	Engine oil on gasket
Pick-up filter housing plug	M15x1	20	18	22	LOCK 5 or THREE BOND 1375B
By-pass pump cap	M15x1	25	22	28	LOCK 5 or THREE BOND 1375B
Timing belt driveshaft pulley nut	M15x1	71	64	78	GREASE A
Timing belt camshaft pulley nuts	M15x1	71	64	78	GREASE A
Alternator cover inspection plug	M15x1	20	18	22	THREE BOND 1
Idler pulley bearing screw	M14x2	50	45	55	GREASE C
Timing belt driveshaft gear nut	M14x1	55	50	60	GREASE A
Radiator connection blanking plug	M14x1.5	27	24	30	LOCK 5 or THREE BOND 1375B
Oil cooler nipple	M14x1.5	27	24	30	LOCK 5 or THREE BOND 1375B
Pick-up sensor inspection screw	M12x1	15	13	17	LOCK 2 or THREE BOND 1
Earth connection bolt	M12x1	15	30	17	LOCK 2 or THREE BOND 1
Oil temperature sensor	M12x1.5	18	16	19	LOCK 4
Spark plugs	M12x1.25	20	18	22	
Cylinder head nuts: Stage 1	M10x1.5	15			GREASE C on face under cylinder head and on stud threads
Stage 2		25	23	27	
Stage 3		40	38	42	
Connecting rod bolts:					GREASE B Apply grease to thread
Stage 1	M10x1	35			
pause for 2 sec. then back off by 360°					
Stage 2		20			
Stage 3		35	66	73	

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Stage 4
angle check:>30°

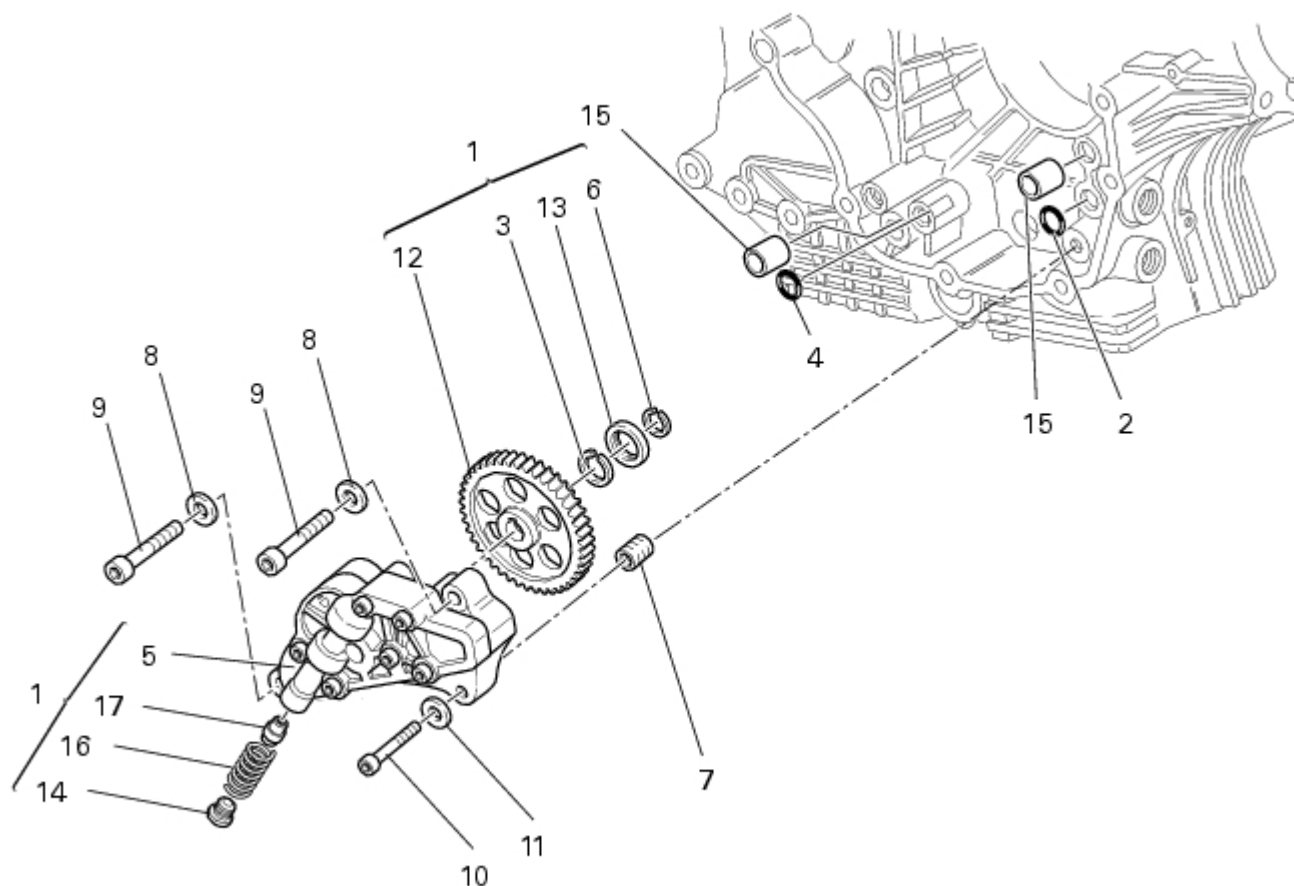
70.5

Oil pump duct plug	M10x1.5	fully seated with tool 15 13 17			LOCK 5 or THREE BOND 1375B
Cylinder head studs	M10x1.5	25	23	26	LOCK 2 or THREE BOND 1
Pressure switch	M10x1	19	17	21	
Threaded insert	M10x1				LOCK 5 or THREE BOND 1375B
Spark plug	M10x1	15	13	17	
Neutral warning light switch	M10x1.25	10	9	11	
Clutch-side crankcase service plug	M10x1.5	15	13	17	LOCK 5 or THREE BOND 1375B
Oil circuit plug - exhaust side	M10x1	15	13	17	LOCK 2 or THREE BOND 1
Crankshaft grub screws	M8x1.25	13	11	15	THREE BOND 1375B
Selector claw bolt	M8x1.25	25	22	28	
Gear stop lever bolt	M8x1.25	18	16	20	LOCK 2 or THREE BOND 1
Intake and exhaust manifold studs	M8x1.25	15	13	17	LOCK 2 or THREE BOND 1
Intake manifold nuts	M8x1.25	23	20	26	
Oil pump bolts	M8x1.25	26	23	29	
Crankcase bolt: Stage 1 tightening	M8x1.25	19 25	17 22	21 28	
Crankcase drilled bolt	M8x1.25	20	18	22	
Timing belt idler pulley	M8x1	20	18	22	LOCK 2 or THREE BOND 1
Timing belt tensioner pulley	M8x1.25	26	23	29	
Earth bolt	M8x1.5	13	11	15	
Clutch spring screws	M6x2	6	5	7	
Stator wiring clamp bracket bolt	M6x1	10	9	11	LOCK 2 or THREE BOND 1
Starter motor bolts	M6x1	10	9	11	LOCK 2 or THREE BOND 1
Starter idler gear shaft screw	M6x1	10	9	11	LOCK 2 or THREE BOND 1
Alternator stator bolts	M6x1	10	9	11	LOCK 2 or THREE BOND 1
Rotor/flywheel bolts	M6x1	13	11	15	LOCK 2 or THREE BOND 1
Gearbox bearing retaining plate bolts	M6x1	10	9	11	LOCK 2 or THREE BOND 1
Cylinder head service screws (aluminium)	M6x1	3	2	3	LOCK 2 or THREE BOND 1
Fuel pump/intake manifold union	M6x1	2.5	2	3	LOCK 2 or THREE BOND 1
Bosch pick-up bolts	M6x1	10	9	11	
Battery support lower stud	M6x1	10	9	11	LOCK 2 or THREE BOND 1

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Selector claw bolt	M6x1	9	8.5	9.5	LOCK 2 or THREE BOND 1
Inspection cover bolts	M6x1	4.5	4.5	6	
Valve cover bolts	M6x1	10	9	11	
Intake/exhaust valve cover screws	M6x1	10	9	11	
Crankcase screws	M6x1	9	8.5	9.5	
Clutch cover bolts	M6x1	10	8.5	9.5	
Alternator cover bolts	M6x1	10	9	11	
Clutch spring bolts	M5x0.8	5	5	7	
Driven pulley flange bolts	M5x0.8	5	5	7	
Manifold nipple	M5x0.8	3	2	3	LOCK 2 or THREE BOND 1
End cap plug	M5x0.8	2.5	2.5	3	
Cylinder head oil hose screws	M5x0.8	5	5	7	LOCK 2 or THREE BOND 1
Unspecified fasteners	M10x1.5	45	40	50	
Unspecified fasteners	M8x1.25	25	22	28	
Unspecified fasteners	M6x1	10	9	11	
Unspecified fasteners	M5x0.8	5	5	7	

2 - Lubrication system: Oil pump

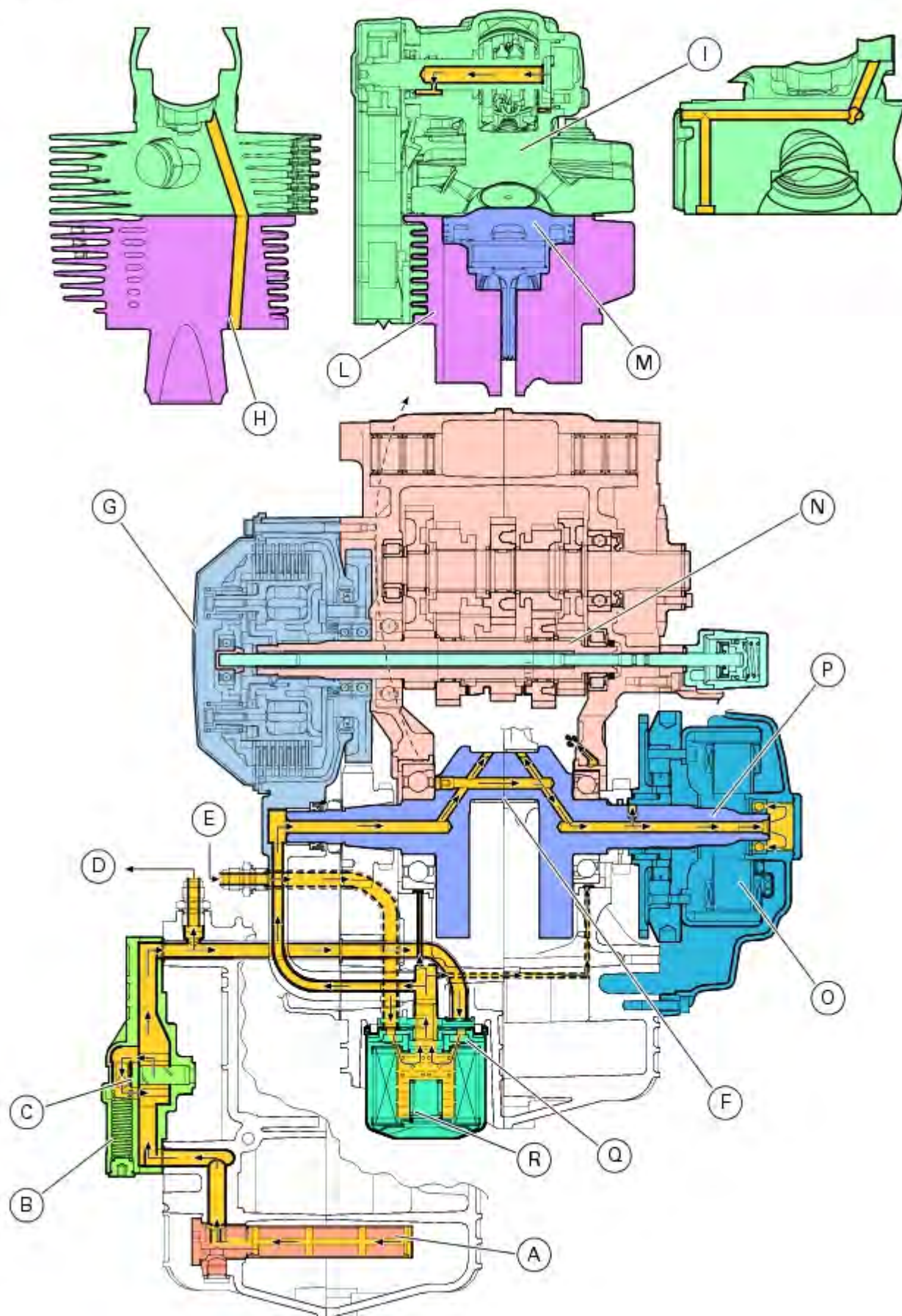


- 1 Complete oil pump assembly
- 2 O-ring
- 3 Circlip
- 4 O-ring
- 5 Pump body
- 6 Circli
- 7 Reducer bush
- 8 Spring washer
- 9 Bolt
- 10 Bolt
- 11 Spring washer
- 12 Pump drive gear
- 13 Bush
- 14 By-pass plug
- 15 Locating dowel
- 16 By-pass spring
- 17 By-pass valve □□

Lubrication system

SIDE VIEW

FRONT VIEW



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Description of the lubrication system

Forced lubrication with gear pump. Built-in pressure relief by-pass valve. Gauze oil pick-up filter. Disposable filter cartridge on delivery side with relief valve to protect against possible filter clogging. Low oil pressure indicator on instrument panel.

Lubrication system components:

- 1 Gauze pickup filter
- 2 By-pass spring
- 3 Oil pump
- 4 Outlet to oil cooler
- 5 Inlet to engine
- 6 Connecting rod shell bearings
- 7 Clutch cover
- 8 Oil supply to cylinder heads
- 9 Cylinder head
- 10 Cylinder barrel
- 11 Piston
- 12 Gearbox
- 13 Flywheel/starter assembly
- 14 Crankshaft
- 15 By-pass spring/reed
- 16 Cartridge filter

Operation of the lubrication system

The oil gear pump (C) is driven by the crankshaft through a gear pair. The pump flow rate therefore varies with the engine speed. Internally the pump is equipped with pressure limiting valve (B) that sends excess oil to the intake side in the event of excessive pressure. Oil is drawn from the sump through a gauze filter(A), which intercepts any large size particles that could otherwise damage the pump. From the pump outlet the oil is delivered to the oil cooler before reaching cartridge filter (R). The oil circulation inside the oil cooler is controlled by a reed valve (Q) located between engine block and cartridge filter (R).

NOTES

In the event of clogging or freezing of the oil cooler, the oil pressure rises causing the reed valve (Q) on the filter cartridge (R) to open. In this case the oil reaches the cartridge filter (R) without flowing through the oil cooler. This results in an increase in oil temperature although circulation is unaffected.

The oil flows from the oil cooler to cartridge filter (R), which, like the oil cooler, is internally protected by an anti-clogging valve that ensures correct circulation in all cases (although if it opens the oil will no longer be filtered).

After the filter the oil circuit is divided into three: two circuits lead to the pistons and serve also to lubricate the main bearings. The third circuit passes through an oilway in the clutch cover (G) and feeds oil to crankshaft (P). The oil flows through the inside of the crankshaft from where it lubricates the big end bearings (F); a portion of this oil flow reaches the nozzles responsible for cooling the piston crowns (M). As it flows on through the crankshaft internal oilway, the oil passes through radial holes in the crankshaft to lubricate the internal ring of the starter gear and the starter clutch (O). Finally, as it flows out of the opposite side to the inlet, the oil lubricates the crankshaft bearing in the alternator cover. Oil is carried to the cylinder heads (I) through the oil ways (H), where it lubricates the camshafts.

Once the oil has been pumped out of the circuit under pressure and lubricated all the parts described above, it returns to the block where it lubricates the primary drive gears, the gearbox, and the gearbox shaft support bearings. The breather circuit for fumes created inside the engine block includes a breather reed valve located on the top of the right-hand crankcase half, a reservoir, and a connection hose to the airbox.

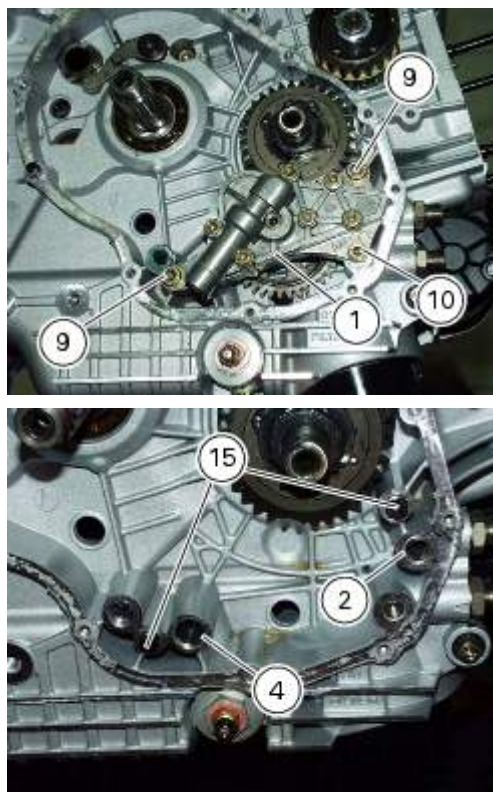
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Removal of the oil pump

Remove the right-hand side crankcase cover

Undo and remove the bolts (9) and (10) securing the pump assembly.

Remove the oil pump assembly (1) and extract O-rings (2) and (4) from the crankcase half together with two centring bushes (15).



Disassembly of the oil pump

Hold the oil pump (1) in a vice taking care not to damage the drive gear (12).

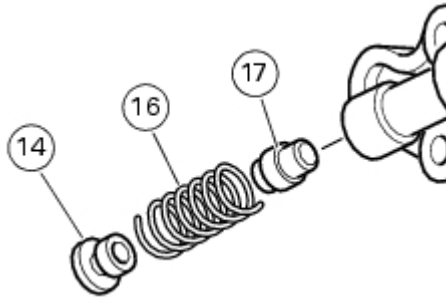


WARNING

Make sure that vice jaws are faced with soft material.

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Remove the plug (14) and extract the spring (16) and by-pass valve (17).



Check the condition of the above components.
Remove the circlip (6), slide out the bush (13) and the circlip (3).
Slide out the pump drive gear (12).

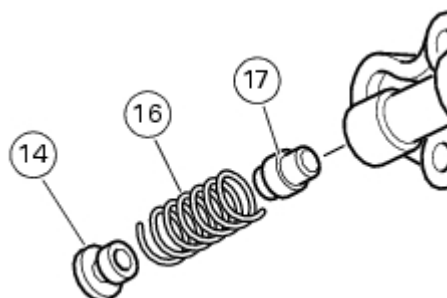


Reassembly of the oil pump

On the oil pump, fit the pump drive gear (12), snap ring (3) and bush (13).
Secure the components installed by inserting the circlip (6) in its groove.



Install in the pump the by-pass valve (17) and the spring (16); screw in the plug (14) and tighten to the specified torque (Sect. 1.1) after applying a medium strength threadlocker.



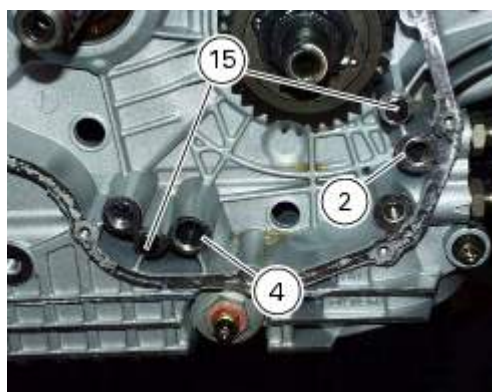
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Fit the cover (2) to the pump body (5) complete with the gears.

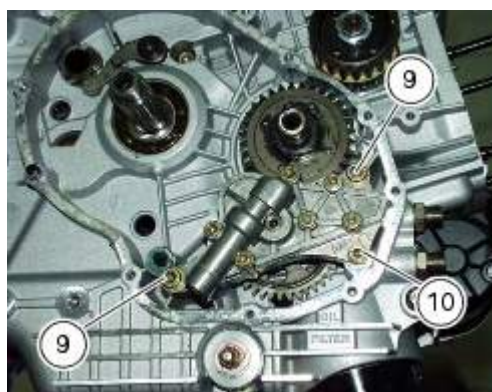


Refitting the oil pump

Position the locating dowels (15) and the O-rings (2) and (4) in correspondence with the crankcase lubrication oilways.



Position the oil pump on the crankcase and tighten the bolts (9) and (10) to the specified torque (Sect. 1.1).



Check the gear backlash with the driving pinion by fixing dial gauge part no. 88765.1181, equipped with the relevant stylus, to the crankcase.

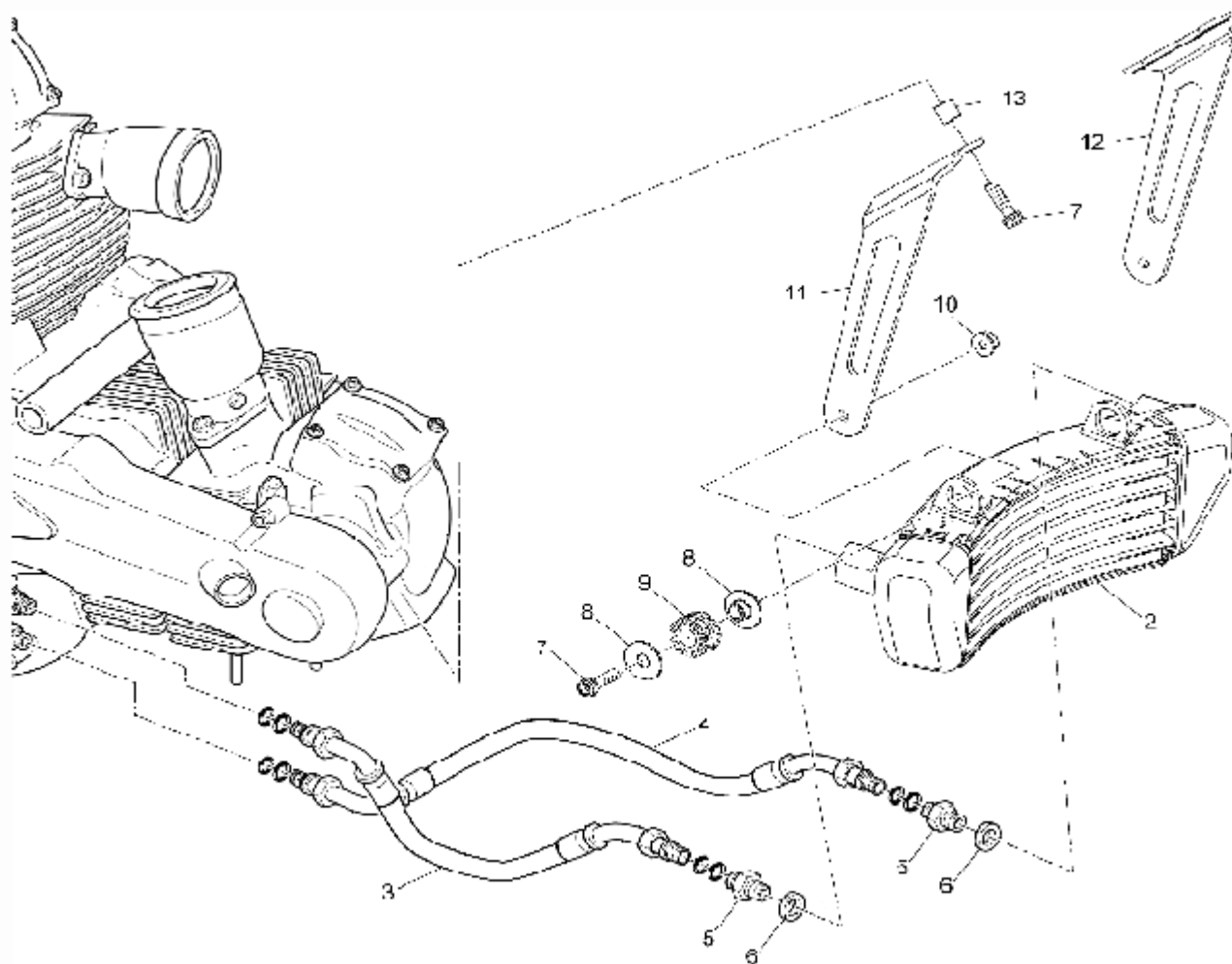
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Set dial gauge stylus on one tooth of oil pump gear and zero set instrument in this position.
Move gear slightly to measure play; take four readings in diametrically opposed positions of the gear.
The backlash should be 0.10 mm.

Refit the right-hand crankcase cover

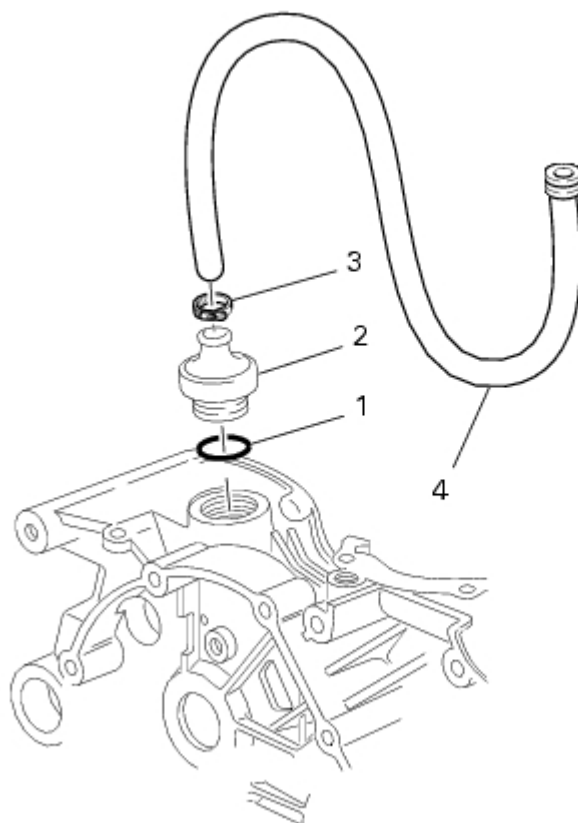
2.1 - Lubrication system: Oil cooler



- 1 Engine
- 2 Oil cooler
- 3 Oil return hose
- 4 Oil delivery hose
- 5 Nipplo Twin Seal
- 6 Aluminium sealing washer
- 7 Bolt M6x25
- 8 Special bush
- 9 Rubber mounting
- 10 Nut
- 11 Mounting oil cooler right
- 12 Mounting oil cooler left
- 13 Bush

To remove the Oil cooler, refer to sect. 5.1 of Tesi3D Workshop manual.

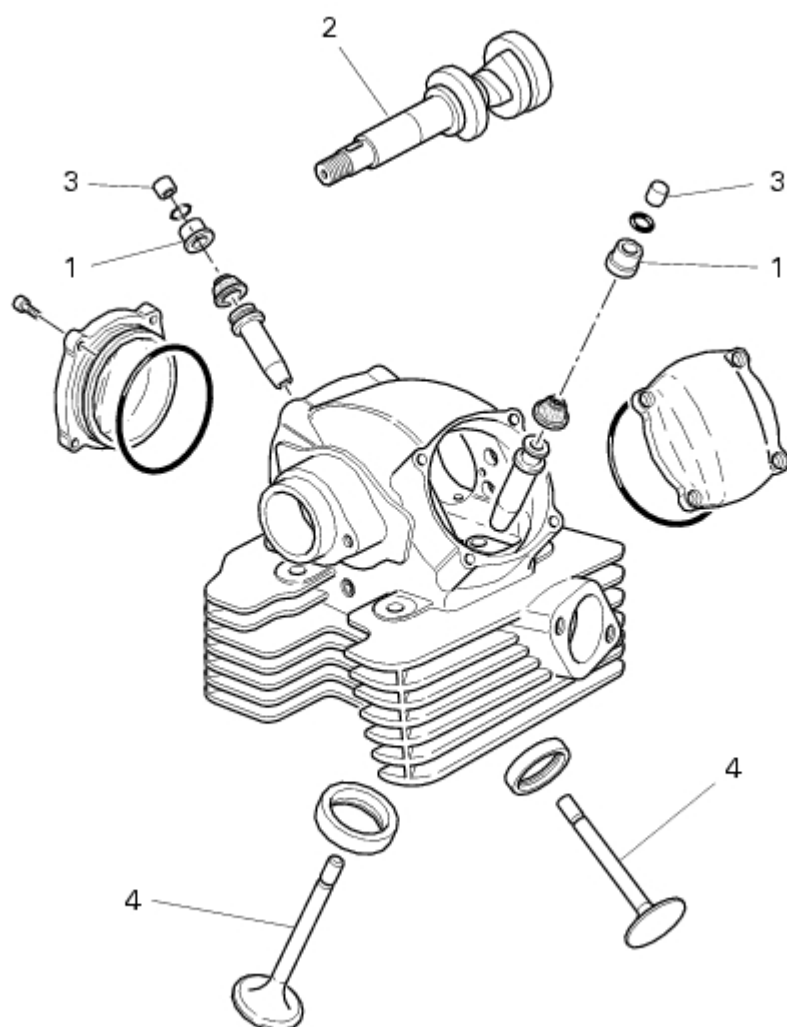
2.2 - Lubrication system: oil breather



- 1 O-ringAnello
- 2 Oil breather valve
- 3 Clamp
- 4 Hose

To remove the oil breather, refer to sect. 4.4 of Tesi 3D Workshop manual.

3 - Cylinder head assemblies: Checks and adjustments



- 1 Closing shim
- 2 Camshaft
- 3 Opening shim
- 4 Valve

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Checking and adjusting valve clearances

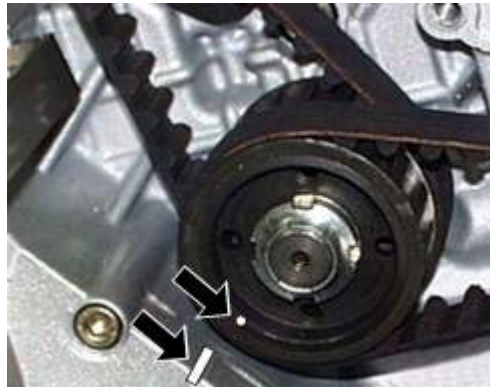
Remove the fuel tank/seat assembly.

Remove the valve covers and the timing belt covers.

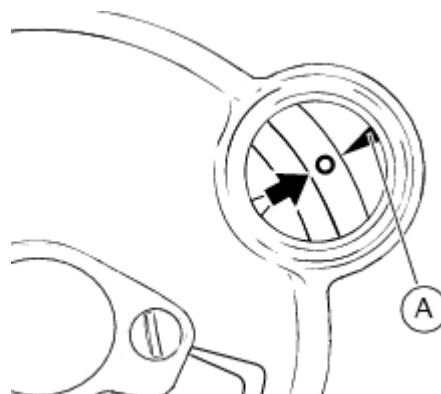
Take off the inspection cover on the alternator side and install service tool no. 88713.0123.



Turn the crankshaft until the mark on the timing belt driveshaft pulley is aligned with the mark on the crankcase cover.



Looking through the sight glass in the left-hand crankcase cover, you can see that the mark on the flywheel and fixed pointer (A) are now aligned for both cylinders.



Set the degree wheel of service tool no. 88713.0123 to zero the horizontal cylinder is at top dead centre of the expansion stroke, and therefore we can proceed to check the valve clearances on this cylinder. To measure valve clearances in the vertical cylinder, rotate the crankshaft counterclockwise through 270° from this position. This will bring the vertical cylinder to top dead centre of the expansion stroke, and therefore we can proceed to check the valve clearances on this cylinder.

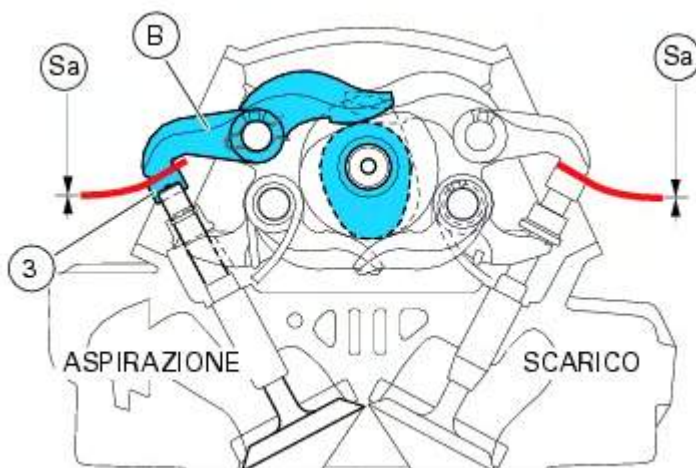
Checking the opening clearance (Sa) of the intake / exhaust valves

To check the valve opening clearance (Sa), insert the blade of a feeler gauge between the opening rocker (B) and the shim (3). The clearance values must be within the specified limits (Sect. 1). If they are not, remove the opening shim (3), as described in the paragraph "Removal of the valves" (Sect. N 3.3), and replace it with a shim of appropriate thickness to obtain the specified clearance.

NOTES

While inserting the blade of the feeler gauge to check the clearance, apply gentle leverage to overcome the force of the closing rocker spring and thus eliminate any play in the rocker mechanism: then check that the shim can rotate freely.

Opening rocker arm shims measuring 1.8 to 3.8 are available as replacement parts: each shim is marked with its size.



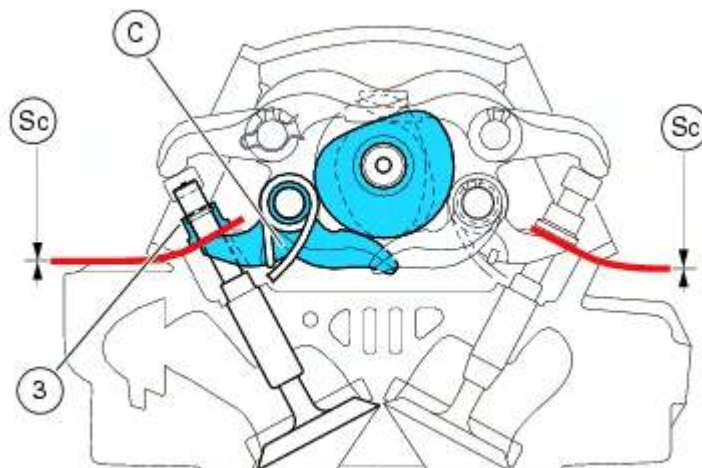
Checking the closing clearance (Sc) of the intake/exhaust valves

When checking the valve closing clearance, using a screwdriver, apply leverage to overcome the force of the closing rocker spring and thus eliminate the play between the camshaft and the rocker arm. Insert a feeler gauge between the closing rocker arm (C) and the shim (3): the closing clearance (Sc) corresponds to the thickness of the feeler gauge and should allow the free rotation of the shim without any significant play. The clearance must be within the specified limits (Sect. 1).

If it is not, remove the closing shim (1), as described in the paragraph "Removal of the valves" (Sect. N 3.3) and replace it with a shim of suitable thickness to obtain the specified clearance.

NOTES

Closing rocker arm shims measuring 2.5 to 4.4 are available as replacement parts: each shim is marked with its size.

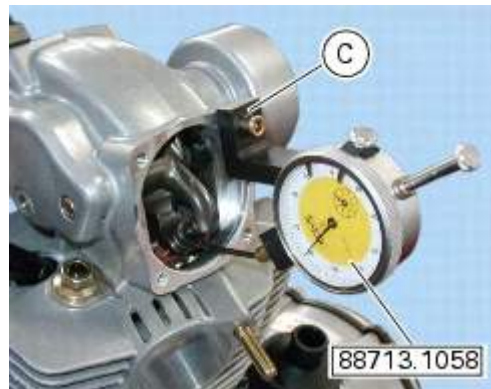
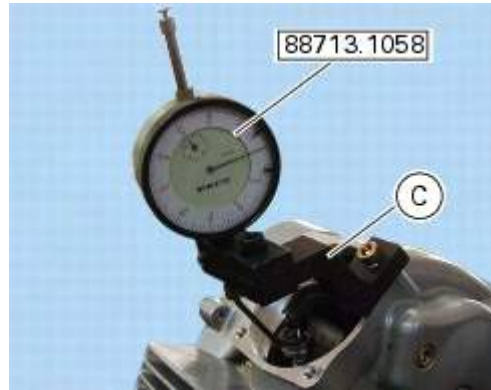


Refit the opening and closing shims as described in the paragraph "Refitting the valves", Sect. N 3.3.

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Checking valve lift

Fit the gauge (D) 88765.1058 in correspondence with the fixing hole of the previously removed cylinder head valve cover, as shown in the photo. Reset the valve opening clearance when the camshaft is in its rest position by fitting a feeler gauge between the upper rocker arm and opening shim.



NOTES

This operation is best done using one dial gauge for the exhaust valve and another one for the intake valve.

Make sure the dial gauge fork is centred relative to the valve axis and located against 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 that the reading on the dial gauge corresponds to the specified value (Sect. 1).

Perform the same procedure for the exhaust valve, fixing the support to the opposite side of the cylinder head. Refit following the procedure indicated in the previous paragraph "Checking and adjusting valve clearances".

Remove the tools 88765.1058.

Refit the timing belt covers.

Refit the valve covers.

Refit the fuel tank/seat assembly.

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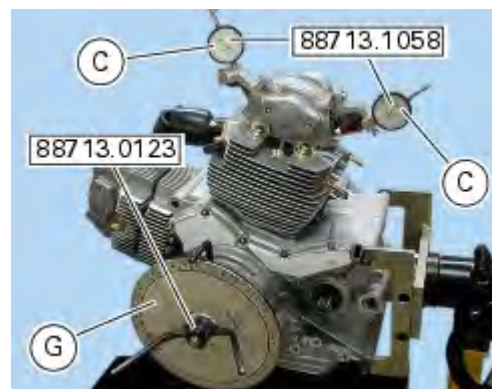
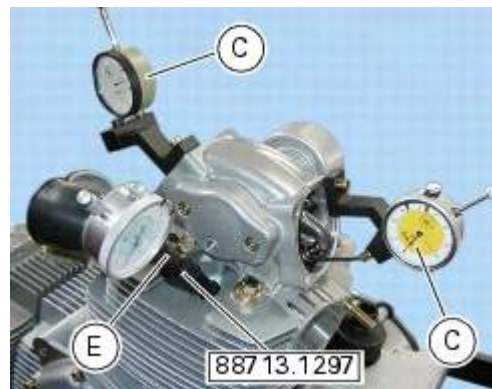
Checking the engine timing

Remove the timing belt covers and the valve covers.

NOTES

Engine timing should be checked after changing parts such as camshafts, valves or timing belt rollers or when overhauling badly worn engines.

Remove the spark plugs and install the tool (E) 88765.1297 in the spark plug bore to determine the piston's TDC, along with gauges (C) 88713.1058 and the timing check tool (hub 88713.0123 with timing degree wheel (G) 98112.0002).



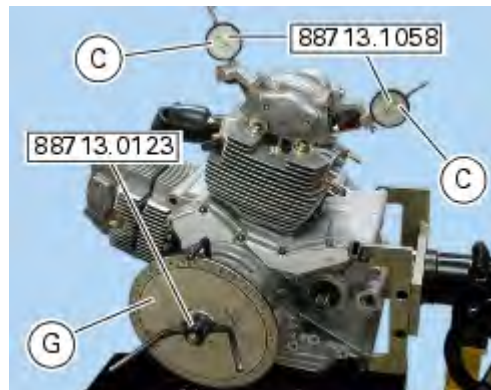
Reset the opening valve clearance when the camshaft is in rest position by inserting a feeler gauge between the opening rocker arm and the opening shim. Check that, in this condition, the camshaft can rotate. If it moves stiffly, use a thinner feeler gauge. In this condition, with the piston of the horizontal cylinder is at TDC and the valves fully closed as confirmed by the reading on gauge (E), set gauges (C) to zero.

Set the tension value to:

- Horizontal belt 140 Hz
- Vertical belt 140 Hz.

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Turn degree wheel (G) counterclockwise until the dial gauge (C) on the exhaust side reads 1 mm lift. Check that the angular displacement reading on the degree wheel (G) is as specified (Sect. 1).



Continue to rotate in the same direction until you obtain a 1 mm lift on the intake side.

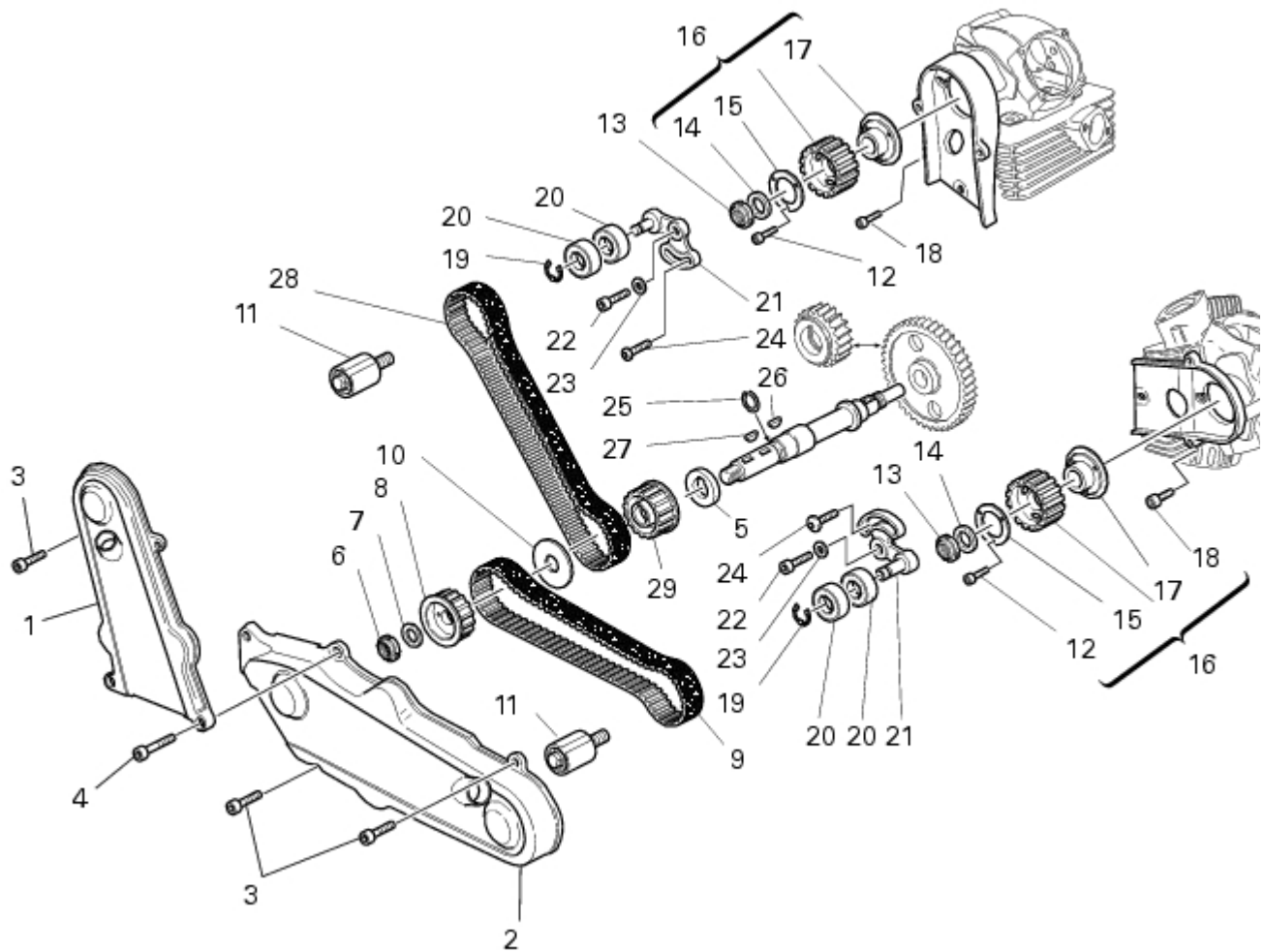
Check the angular value on the degree wheel. Continue turning the shaft until you reach total closure of the valve on the expansion stroke. Reverse rotation (i.e. turn clockwise) of degree wheel (G) until gauge (C) shows 1 mm lift of intake valve. Check that the angular value is as specified. Rotate clockwise again until obtaining 1 mm lift of the exhaust valve. Check the angular value against the specified value.

Repeat the procedure for the vertical cylinder. Permissible tolerance for measured values is $\pm 3^\circ$ with respect to specified values. Remove the tools used to check engine timing.

Refit the valve covers.

Refit the timing belt covers.

3.1 - Cylinder head assemblies: Timing belt covers / timing system



- 1 Vertical cylinder timing belt cover
- 2 Horizontal cylinder timing belt cover
- 3 Bolt
- 4 Bolt
- 5 Spacer
- 6 Elastic-stop ring
- 7 Washer
- 8 Outer timing belt driveshaft pulley
- 9 Horizontal cylinder timing belt
- 10 Intermediate spacer
- 11 Idler pulley assembly
- 12 Bolt
- 13 Elastic-stop ring
- 14 Washer
- 15 Special washer□□

- 16 Camshaft pulley
- 17 Flange
- 18 Bolt
- 19 Circlip
- 20 Bearing
- 21 Tensioner pulley assembly
- 22 Bolt
- 23 Washer
- 24 Bolt
- 25 Circlip
- 26 Key
- 27 Key
- 28 Vertical cylinder timing belt
- 29 Inner timing belt driveshaft pulley □□

Bimota

Removal of the timing belt covers

Remove the fuel tank/seat assembly.

Disconnect the HT leads.

Undo the bolt (3) and bolts (4) and remove the horizontal timing belt cover (2).

Undo the bolts (3) securing the timing belt cover (1) and remove it from the vertical cylinder assembly.



Removal of the timing system assembly

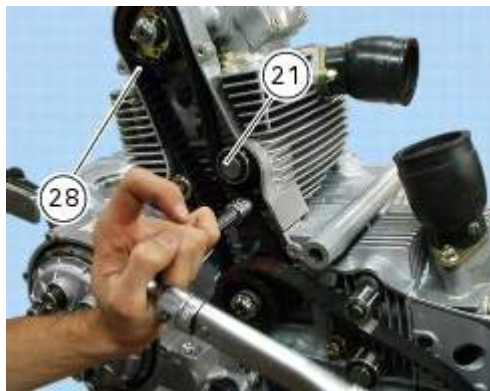
Loosen the positioning bolt (24) of the tensioner pulley (21) of the horizontal cylinder timing belt.

Loosen the tensioner pulley fixing bolt (22), recover the washers (23) and move the tensioner pulley (21) to its rest position. Remove the horizontal cylinder timing belt (9).



Bimota

Repeat the above operations to remove the vertical cylinder timing belt (28).



To remove the camshaft pulleys, install the tool 88713.2355 on the pulley to be removed to prevent its rotation, and using the bush part no. 88700.5644 inserted in a torque wrench or ratchet arm, loosen the pulley retaining nut (13).

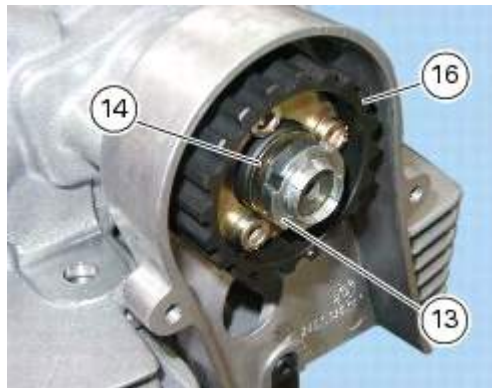


Bimota

Remove the nut (13), washer (14) and pulley (16).

IMPORTANT

On reassembly, always fit new nuts.



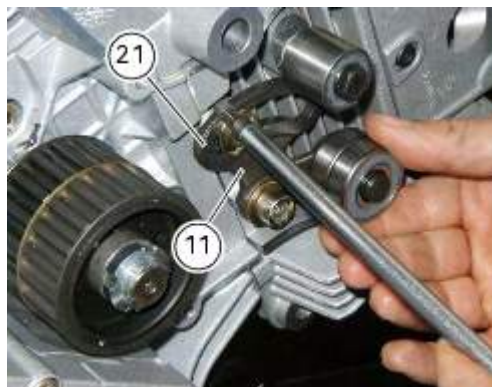
Remove the positioning bolts (24) and fixing bolts (22) of the timing belt tensioner pulleys (21) and the washer (23). Remove the two timing belt tensioner pulleys (21).



NOTES

The belt tensioner pulleys can be also be removed from the engine without removing the timing belts.

Unscrew and remove the idler pulleys (11).



Bimota

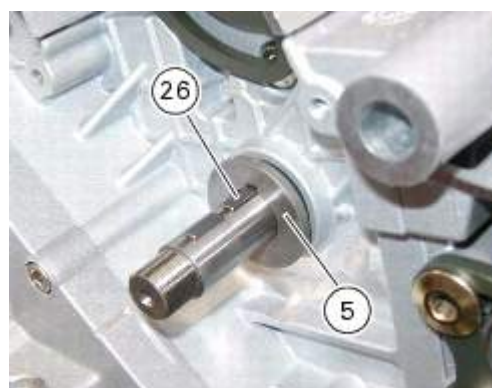
Use the wrench of tool part no. 88700.5644 to lock rotation of the drive roller on the crankcase and, using the bush combined with the tool, loosen ring nut (6). Remove the nut (6), the washer (7) and the outer pulley (8).



Remove the first Woodruff key (27) located on the timing belt driveshaft. Remove the intermediate spacer (10) and the inner pulley (29).

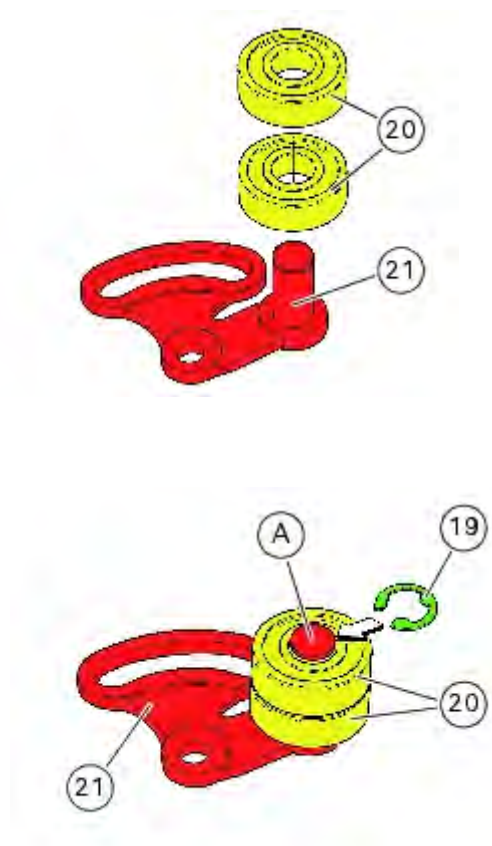


After removing the inner pulley (29), remove the second Woodruff key (26) on the timing belt driveshaft. Remove the spacer (5) and the circlip (25).



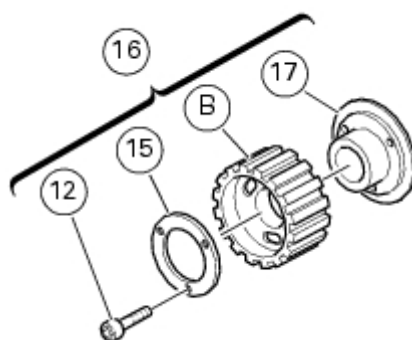
Disassembly of the tensioner pulley

Remove the circlip (19) to release the bearings (20). Check that the tensioner pulley bearings rotate freely without excessive play. Install the bearings (20) in the plate (21), so they are firmly seated. Install the circlip (19) in its groove (A) in the pin (21).



Disassembly of the pulleys

Loosen and remove the three bolts (12).
Slide off the washer (15)
Withdraw the pulley (B) from the flange (17).



Bimota

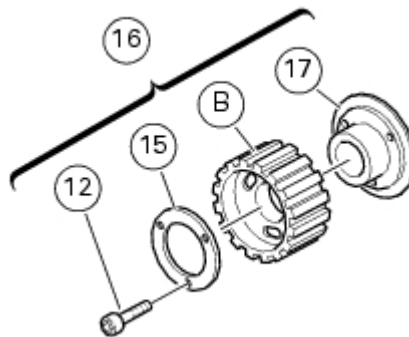
Refitting the timing system assembly

Refitting the camshaft timing pulleys

Check that the keyway on the end of camshaft is in good condition and without burrs.
If removed, install the Woodruff key (C) in the keyway on the camshaft.

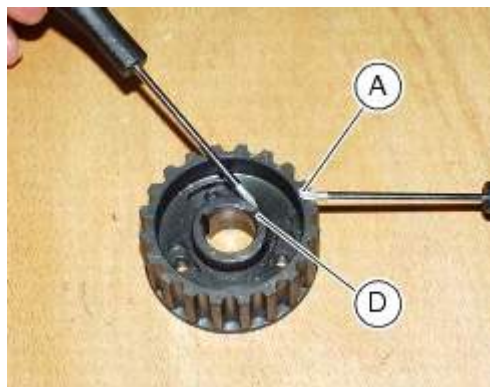


To assemble these parts, install the pulley (B) and washer (15) in the flange (17), as shown in the figure.



IMPORTANT

During reassembly, take care that the timing mark "B" on the spacer flange is aligned with the mark "A" on the pulley and washer.



Bimota

Screw the three bolts (12) into the flange.

Fit the assembled pulley (16) onto the camshaft, so that is firmly seated.

WARNING

Make sure that the Woodruff key remains in its seat.

Insert tool no. 88713.2355 in the belt rollers to prevent rotation. Apply a smear of grease to the thread and underside of the ringnut (13), and fit the washer (14) and the nut.



IMPORTANT

Always fit new nuts on reassembly.

Using the bush of service tool no. 88700.5644 in combination with a torque wrench, tighten the nuts (13) to their specified torque (Sect. 1.1).



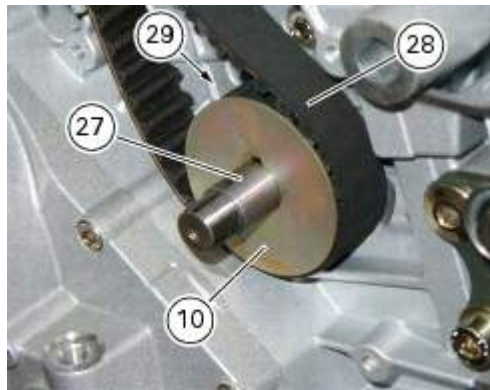
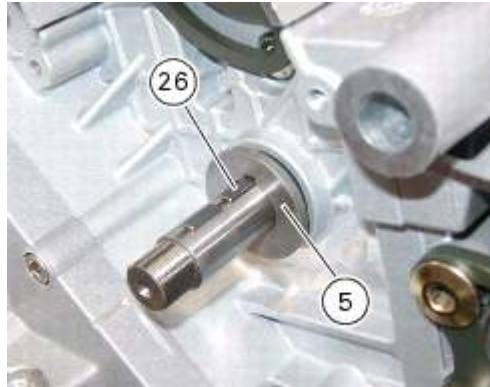
Refitting the timing belt driveshaft pulleys

Install the circlip (25) on the pulley side of the timing belt driveshaft. Drive it into its seat using the protective cap 88700.5749.



Bimota

Fit the spacer (5) with the slot facing the crankcase. The timing belt pulleys on the 1100S engine have 20 teeth, while those on other 2 V engines have 18 teeth. This serves to reduce the space between sprockets and crankcase. To facilitate assembly, it is good practice to fit the timing pulleys complete with the belts. Locate the first Woodruff key (26), the inner pulley (29) complete with belt (28) with the protruding hub facing outwards and the guide washer (10) on the timing belt driveshaft.



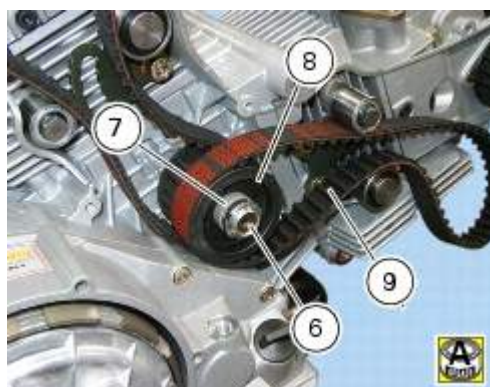
Then fit second Woodruff key (27), outer pulley (8) complete with belt (9) with the protruding hub facing inwards, outer spacer (7) and locking ringnut (6).

IMPORTANT

To prevent the nuts working loose and consequent serious engine damage, always use new self-locking nuts on all timing belt pulleys on reassembly.

NOTES

Apply a thin coating of grease to the thread and underside of the nut (6). □ □



Bimota

Use the wrench of tool 88700.5644 to restrain the pulleys against rotation and, using the bush of the tool in a torque wrench, tighten the self-locking nut to the specified torque (Sect. 1.1).



Refitting the timing belt tensioner pulleys

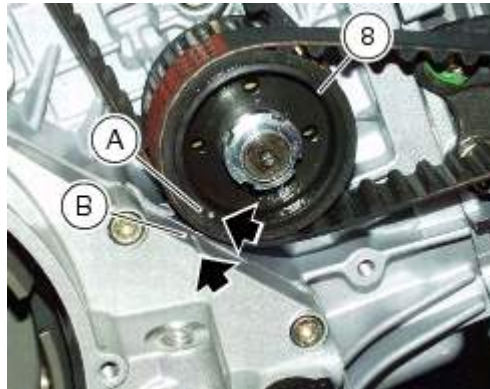
If removed, apply the recommended threadlocker to the idler pulley (11) and tighten to the specified torque (Sect. 1.1). Position the tensioners (21) on the vertical and horizontal cylinders.

Screw in, but do not tighten at this point, the bolt (22) with the washer (23) and the bolt (24), so that the tensioners can still rotate.



Bimota

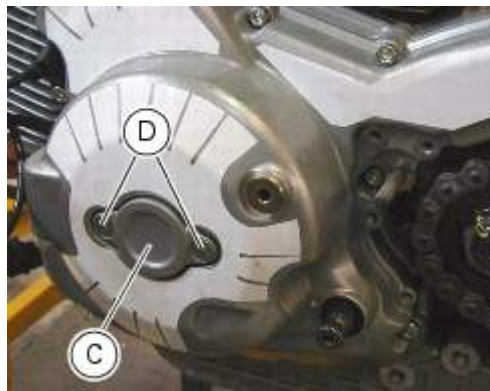
Position the crankshaft so that the piston of the horizontal cylinder is at TDC on its power stroke. This is achieved by aligning the timing mark (A) on the timing belt driveshaft pulley (8) with the reference notch (B) on the crankcase cover.



IMPORTANT

Turn the timing belt driveshaft roller with the spark plugs removed from the engine.

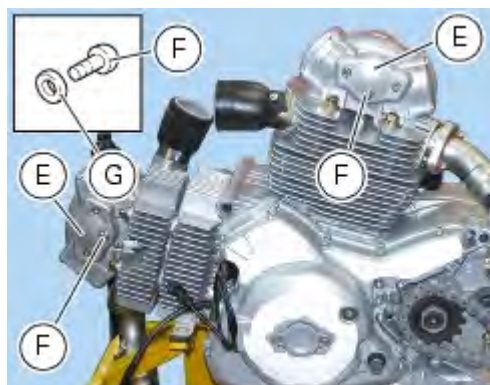
Remove the inspection cover (C) from left-hand crankshaft cover by unscrewing the two bolts (D).



Install the service tool 88713.2011 in the left-hand crankcase cover to hold the crankshaft against rotation and secure it with the relative pin.



Remove the bolt (F) from the side cover (E) and recover the washer (G).



Bimota

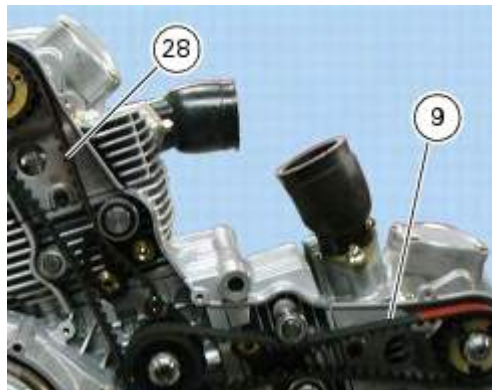
Restrain the camshafts (H) of both cylinder heads by screwing tool no. 88713.2282 into side covers (E).



Turn the pulleys by hand as shown in the figure until the end of the tool engages the slot (L) on the camshaft.



Fit the horizontal (9) and vertical (28) timing belts using your hands only and without altering the alignment of the sprockets.

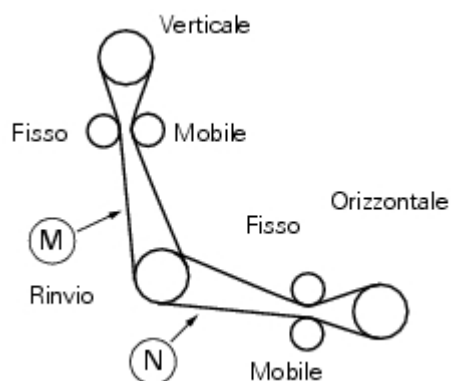


Check the timing belt tension and adjust if necessary.

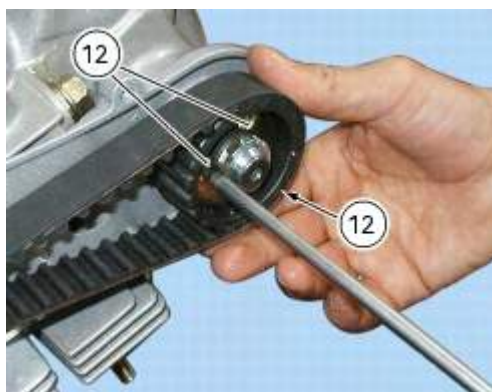
Bimota

WARNING

Check the tension values on sections of belts (M) and (N) shown in the figure.



When the correct belt tensioning value is reached, ensure that bolts (22), (24) and (12) are tightened to the specified torque (Sect. 1.1).

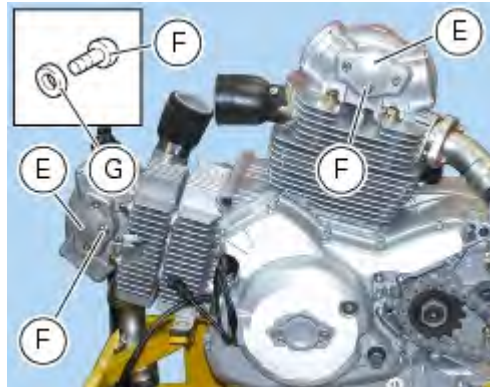


WARNING

Whenever you renew any components of the timing system, it is good practice to also check the timing (Sect. N 3, Cylinder head assemblies: checks and adjustments).

Bimota

Remove the service tools no. 88713.2282 from the cylinder head side covers (E) and and refit the bolts (F) with washers (G), tightening them to the specified torque (Sect. 1).



WARNING

Whenever you tension the belts, it is good practice to also check the timing (Sect. N 3, Cylinder head assemblies: checks and adjustments).

Remove the optical reader and the tester.

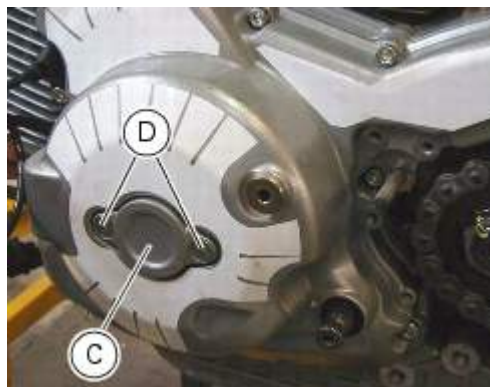
Remove the crankshaft locking tool 88713.2011 unscrewing first the pin and then the bolt from the tool.



Refit the inspection cover (C) in the left-hand crankcase cover, inserting the two bolts (D). Tighten the bolts to the specified torque (Sect. 1.1).

NOTES

Before refitting the cover (C), check the condition of the O-ring and renew it if necessary.



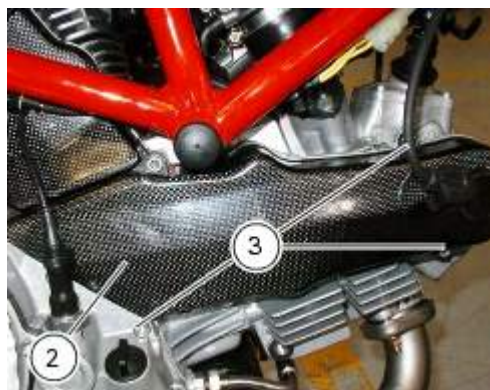
Bimota

Refitting the timing belt covers

Position the vertical timing belt cover (1) on the engine. Fit the cover retaining bolts (3) and tighten to the specified torque (Sect. 1.1).

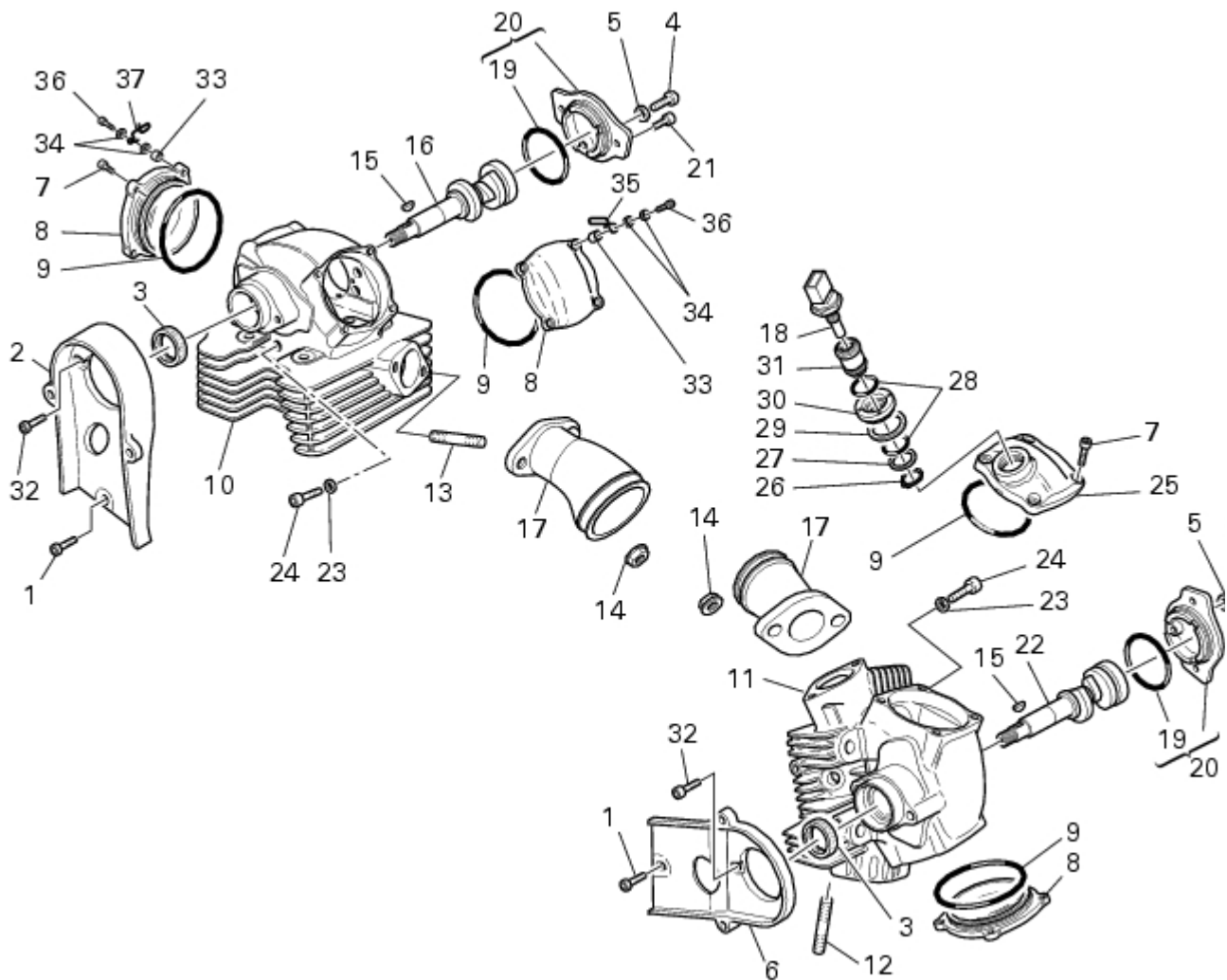


Position the horizontal timing belt cover (2) on the engine.
Tighten the bolts (3) and (4) to the specified torque (Sect. 1.1).



Reconnect the HT leads.
Refit the fuel tank/seat assembly.

3.2 - Cylinder head assemblies: Camshafts

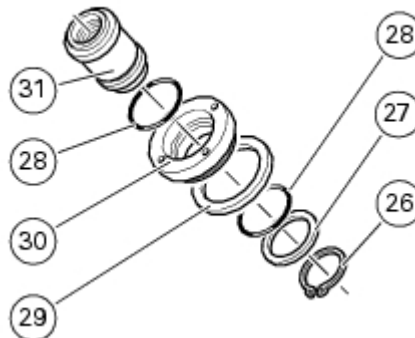
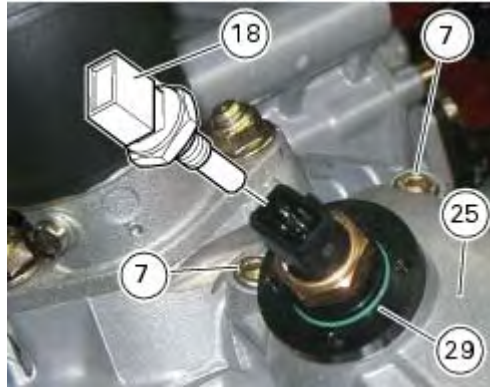


- | | |
|--|--------------------------------------|
| 1 Special screw | 20 End cap |
| 2 Vertical cylinder head inner timing belt cover | 21 Bolt |
| 3 Oil seal | 22 Horizontal cylinder head camshaft |
| 4 Bolt | 23 Copper gasket |
| 5 Washer | 24 Bolt |
| 6 Horizontal cylinder head inner timing belt cover | 25 Intake valve cover |
| 7 Bolt | 26 Circlip |
| 8 Valve cover | 27 Spacer |
| 9 O-ring | 28 O-ring |
| 10 Vertical cylinder head | 29 Aluminium gasket |
| 11 Horizontal cylinder head | 30 Nut |
| 12 Stud bolt | 31 Sensor support |
| 13 Stud bolt | 32 Bolt |
| 14 Nut | 33 Spacer |
| 15 Key | 34 Washer |
| 16 Camshaft-vertical cylinder head | 35 Guide |
| 17 Intake manifold | 36 Bolt |
| 18 Sensor | 37 Guide □□ |
| 19 O-ring | |

Removal of the engine oil temperature sensor

Disconnect the engine oil temperature sensor.

The engine oil temperature sensor (18) is installed on the intake valve cover (25) of the horizontal cylinder head (11). Remove the sensor (18) from the support (31). Unscrew the nut (29) from the valve cover (25). Remove the circlip (26) from the nut and extract the support (31).



Refitting the engine oil temperature sensor

Check the condition of the gasket (29) and spacer (27): renew if necessary.

NOTES

Before refitting the sensor, it is advisable to renew the O-rings (28).

Refitting is the reverse of removal.

Reconnect the engine oil temperature sensor.

Bimota

Removal of the intake manifolds

Remove the throttle body.

Unscrew and remove the nuts (14) securing the intake manifolds of the vertical and horizontal cylinder heads from the studs (13). Remove the manifolds (17).



If necessary, remove the studs (12) and (13) from the cylinder heads.



Refit the throttle body

Refitting the intake manifolds

Apply the recommended threadlocker to the studs (12) and (13), install them in the cylinder heads (10) and (11) and tighten them to the specified torque (Sect. 1.1).

Locate the intake manifolds (17) and secure with the nuts (14).

Remove the camshaft timing pulleys

Remove the retaining bolts (32) and (1) and remove the inner timing belt cover (2) from the vertical cylinder head (10).

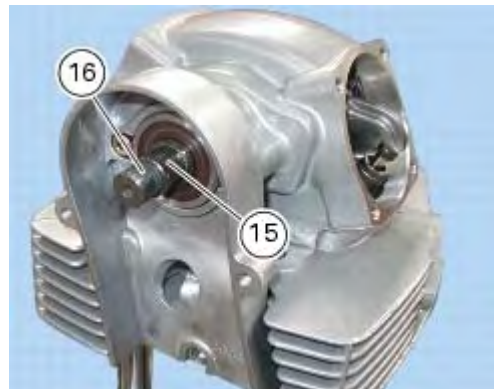


Bimota

Repeat the operation for the horizontal cylinder head (11).

NOTES

When removing the covers, take care not lose the keys (15) located on camshafts (16) and (22).



Unscrew the bolts (21) of the end cap (20) of the camshaft (16).



Remove the camshaft end cap (20) from the cylinder head and recover the O-ring (19).

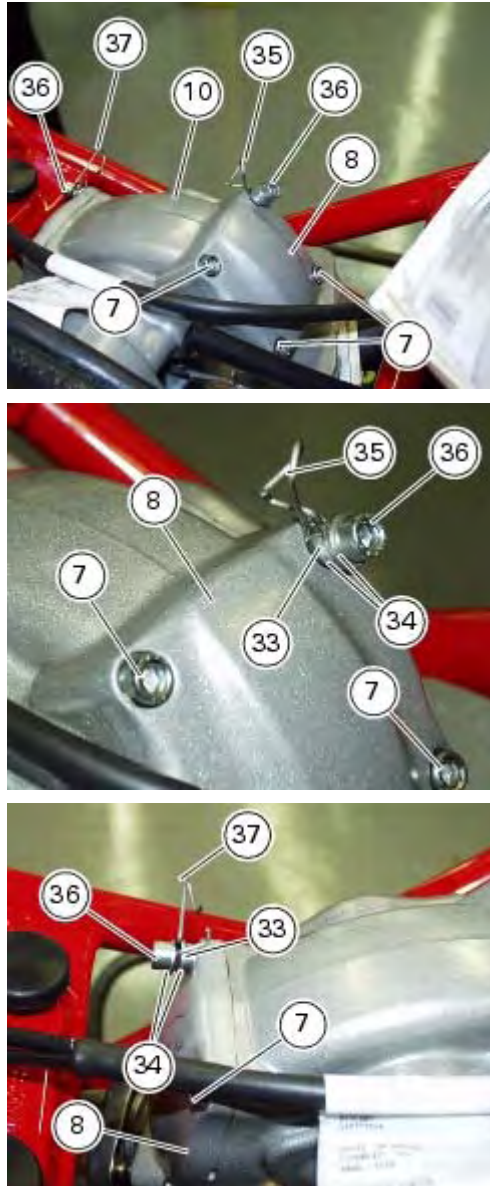


The camshafts are not mounted on ball bearings but on hydrodynamic bearings, since this solution serves to reduce the number of moving parts and aids heat dispersal

Bimota

Removal of the valve covers

Unscrew the retaining bolts (7) of the valve covers (8) and (25). On the vertical cylinder head (10), unscrew the bolts (36) and recover the cable guides (35) and (37), the washers (34) and the spacers (33). Refit the valve covers with their O-rings (9).



Refitting the valve covers

Always fit new O-rings (9) when refitting the valve covers. Fix the valve covers (8) and (25) with the relative O-rings (9) to the cylinder head. On the vertical cylinder head (10), reposition the spacers (33), the washers (34) and the cable guides (35) and (37). Tighten the bolts (7) to the specified torque (Sect. 1.1).

Bimota

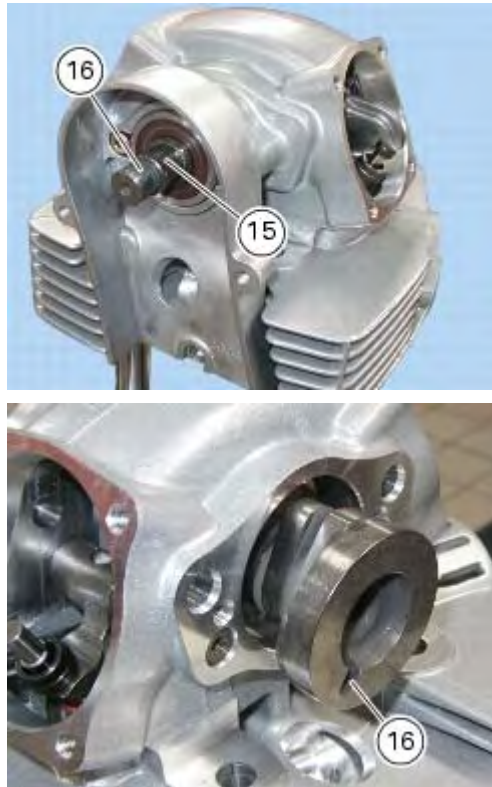
Removal of the camshafts

Remove the inner timing belt covers as described above, and remove the key (15) from the camshaft.

IMPORTANT

To prevent possible damage to components, turn the camshaft (16) through a series of rotations so that the cams do not foul the rockers.

Withdraw the vertical cylinder head camshaft (16) from its housing.



Remove the oil seal (3) from the cylinder head.



Inspecting the camshafts

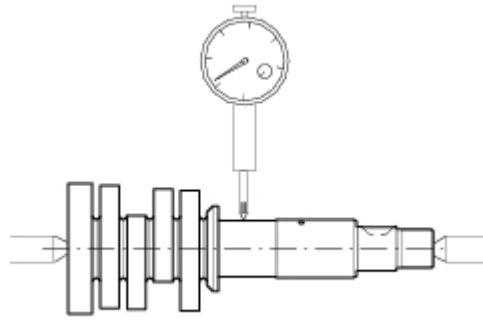
Check the cam contact surfaces for scratches, grooves, steps and waving. Worn cams are frequently the cause of poor timing, which leads to loss of engine power. Install the camshaft between two centres and check for distortion using a dial gauge:

- service limit: 0.1 mm

NOTES

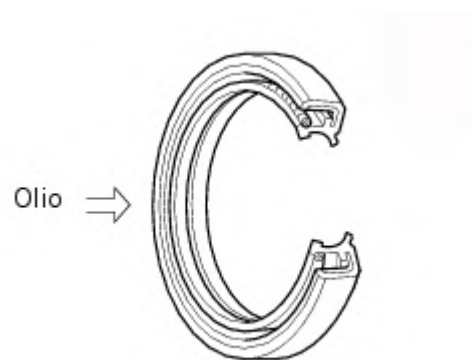
The effective distortion will be half the total reading obtained on the dial gauge.

Each camshaft is stamped with an identification letter: O: horizontal - V: vertical



Checking the oil seals

Fit new oil seals at each engine overhaul. Insert the new oil seals squarely in their bores. Use suitable drifts. Lubricate the lip of oil seals after assembly. This operation must be performed very carefully.



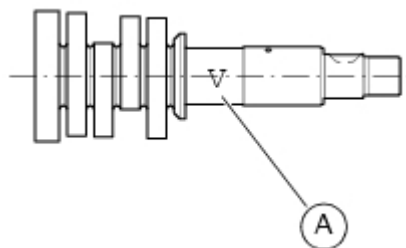
Refitting the camshafts

On reassembly, install a new oil seal (3) in the bore on the right-hand side of the cylinder head (10) with the side without the spring oriented as shown in the figure.

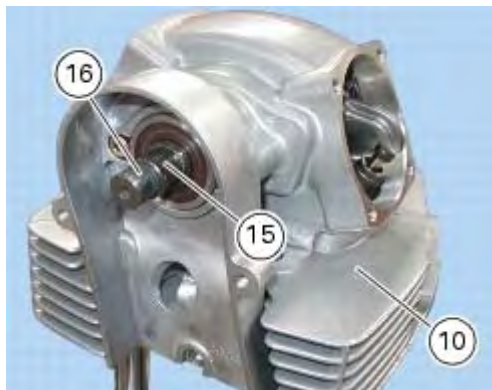


IMPORTANT

If the rockers arms are already installed in the cylinder head (Sect. N 3.3, Refitting the cylinder head assembly), insert the camshaft (16) carefully, rotating it as you go, so that the camshaft lobes do not foul the rocker arms. Before fitting the camshaft, check the mark (A): "V" means vertical, "O" means horizontal.sembly).



Apply graphite oil to the seats of the camshaft so that it is lubricated also during the initial revs of the engine.
Insert the camshaft (16) from the left-hand side of the cylinder head (10).
Fit the key (15) on the right-hand end of the camshaft.



Refitting the camshaft end caps

Lubricate the new O-rings (19) with the recommended grease and fit on end cap (20).
Fit the end cap (20) on the left-hand side of the cylinder head.



Secure the end cap (20) with the bolts (21).
Tighten the bolts (21) to the specified torque (Sect. 1.1). □ □



NOTES

Pay attention to key (15) located on camshaft (16).

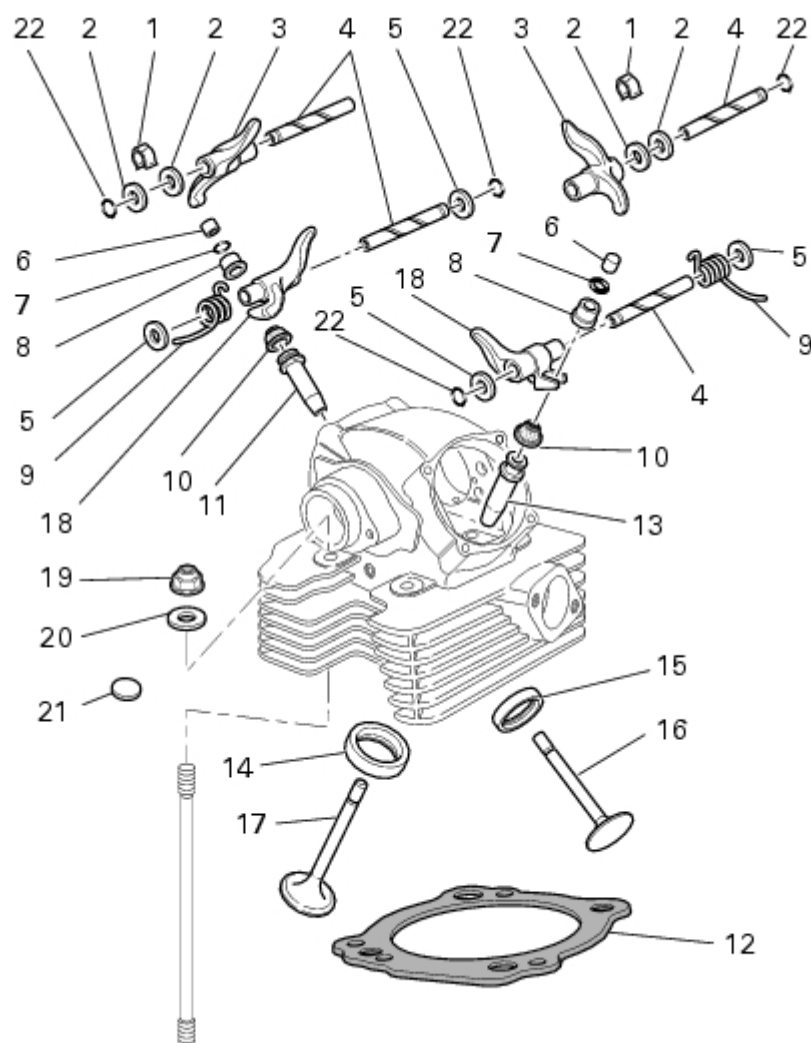


Locate the inner timing belt cover (2) of the horizontal cylinder head on the right-hand side of the cylinder head and insert the retaining bolts (1). Take care to position special screw (1) correctly. Tighten the bolts (32) and (1) to the specified torque (Sect. 1.1).



Repeat the above operations for the other cylinder head.
Refit the camshaft timing pulleys to the cylinder heads.

3.3 - Cylinder head assemblies: Valves - rocker arms



- 1 Clip
- 2 Shim
- 3 Opening rocker arm
- 4 Rocker arm shaft
- 5 Shim
- 6 Valve opening shim
- 7 Half rings
- 8 Valve closing shim
- 9 Spring
- 10 Valve rubber
- 11 Exhaust valve guide

- 12 Cylinder head gasket
- 13 Intake valve guide
- 14 Intake valve seat
- 15 Exhaust valve seat
- 16 Exhaust valve
- 17 Intake valve
- 18 Closing rocker arm
- 19 Nut
- 20 Washer
- 21 Rubber
- 22 O-ring

Bimota

Removal of the cylinder head assembly

The 1100 engine is designed with a reduced angle between the intake and exhaust valves.

This allows for improved design of the combustion chamber with a reduced volume for more complete combustion, higher compression, and more power. The new configuration sets the camshafts in a more direct relationship with the valves, thereby reducing friction and stress on valve components and, consequently, enhancing reliability.

The engine temperatures have been further reduced and reliability improved thanks to the new geometry and layout and greater number of cooling fins.

Disconnect the exhaust pipes from the cylinder heads

Remove the intake manifolds

Disconnect the oil temperature sensor from the horizontal cylinder head

Remove the timing belt covers and the timing belts.

Removal of the cylinder heads

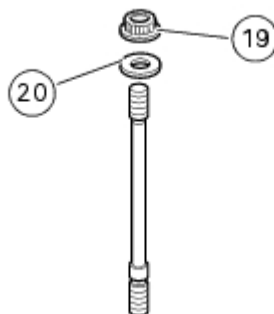
NOTES

On disassembly of the components mounted on the cylinder head it is essential that they are laid out or marked in such a way that they can be refitted in exactly the same position they occupied before being removed.

Using tool 88713.2096, unscrew the nuts (19) on the cylinder head studs.

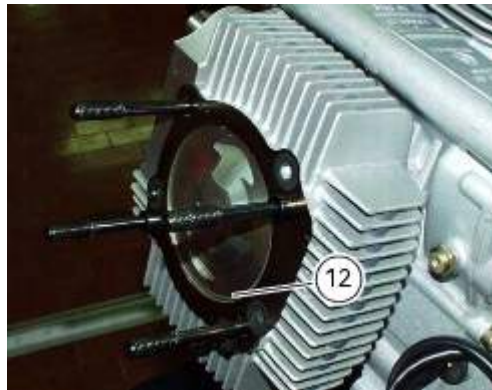


Remove the nuts (19) and recover the special washers (20) positioned between the nuts and the cylinder head.



Bimota

Remove the head assembly from the engine by lifting it off the engine stud bolts.
Remove the cylinder head gaskets (12).



Removal of the valves

Remove the valve covers
Remove the clip (1) securing the opening rocker (3).



Fit the bush of service tool no. 88700.5644 into the camshaft nut then rotate the camshaft to release the opening rocker arm (3). Move the rocker arm (3) to free the valve opening shim (6).



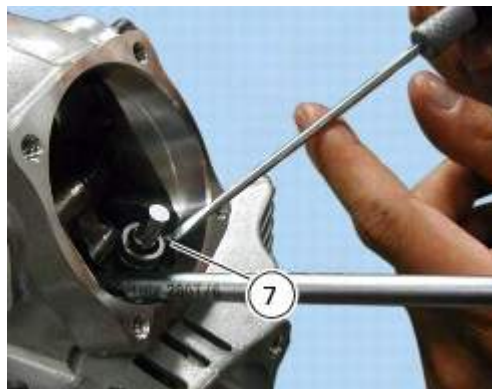
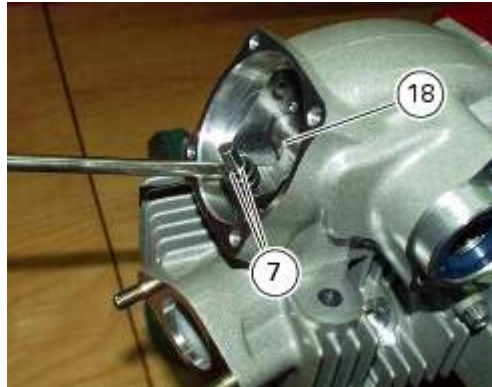
Bimota

NOTES

The diagrams show the cylinder head without the opening rocker arm, although the operation can be performed with the rocker arm still installed.

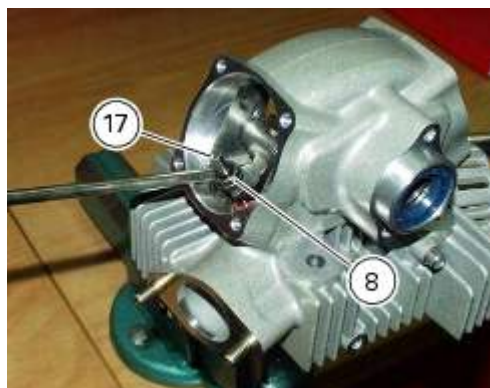
Using two screwdrivers, hold the closing rocker arm (18) in the “valve open” position: position one screwdriver under the closing rocker arm, while positioning the other screwdriver on the closing rocker along the axis of the valve. Slide the valve closing shim (8) along the intake valve stem (17) in such a way as to make it possible to remove the two half rings (7) securing the valve.

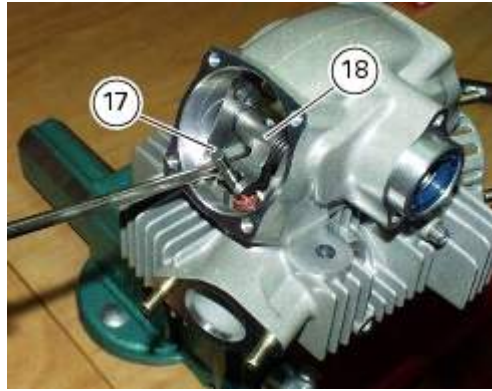
Use long nosed pliers or a magnetic screwdriver to remove the half rings (7) from the valve stem.



Slide the valve closing shim (8) off the valve (17).

Withdraw the valve (17) from the underside of the cylinder head.





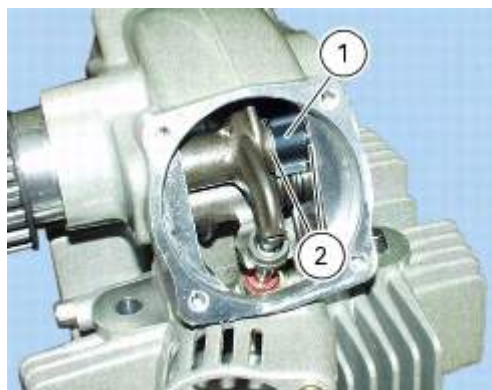
Repeat the above operations to remove the exhaust valve (16).



Removing the valve rocker arms

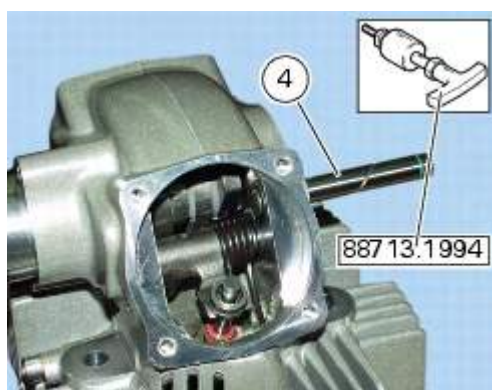
Remove the inner timing belt covers

Remove the clip (1) from the rocker shaft (4).

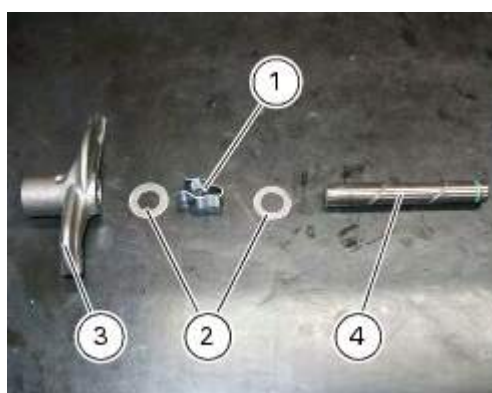


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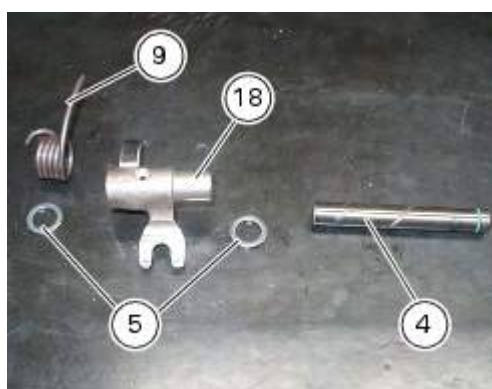
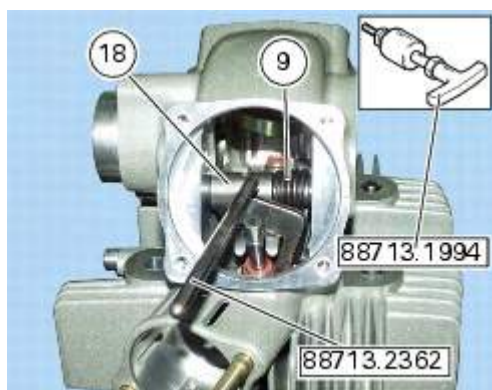
Screw the service tool no. 88713.1994 with pin M5 onto the threaded end of the opening rocker shaft (4).
Remove the rocker arm shaft (4).



Remove the opening rocker arm (3) along with the two shims (2).



Attach the end of the spring (9) of the closing rocker arm (18) to the tool 88713.2362.
Removing the closing rocker shaft (4) using the tool 88713.1994, taking care to recover the two shims (5).
Remove the rocker arm (18), the spring (9) and service tool no. 88713.236.



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Overhaul of cylinder head components

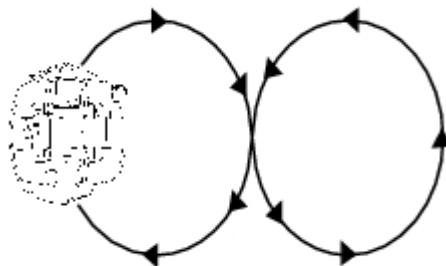
Remove any carbon deposits from the combustion chamber and its ducts.

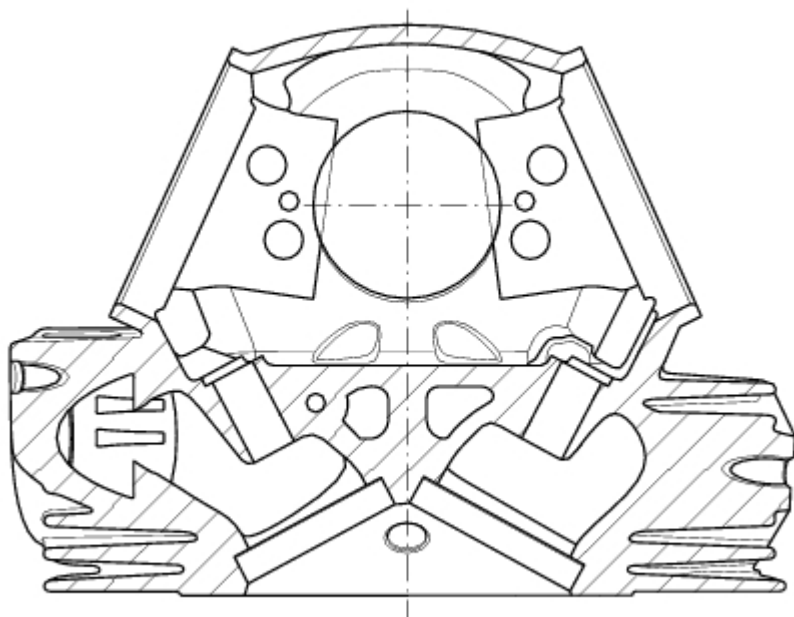


Check for cracking and inspect the sealing surfaces for scoring, ridges or other damage.



The cylinder barrel mating surface must be perfectly flat. If this is not the case, spread diamond dressing compound (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 finish is obtained





Checking the valves

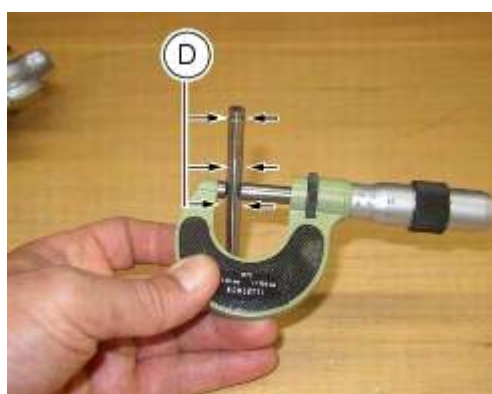
Check that the stem and the surface that contacts the valve seat are in good condition. There must be no pitting, cracks, deformations or signs of wear.

WARNING

The valves cannot be ground.

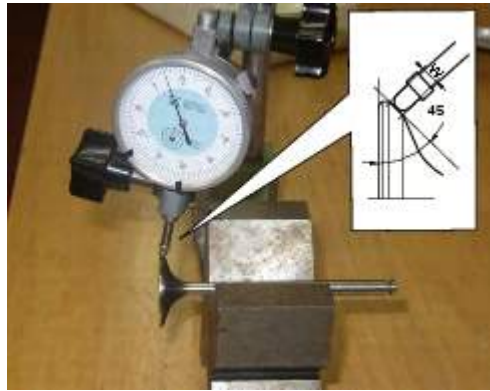
Perform the following checks:

measure the diameter of the valve stem (B) at various points along the section that runs in the valve guide.



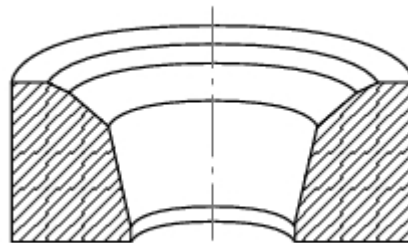
Check that valve head band (at 45° to valve head top face) is concentric to the valve stem as follows: place the valve on a V block, set a dial gauge at right angles to the head and rotate the valve.

- Service limit: 0.03 mm.

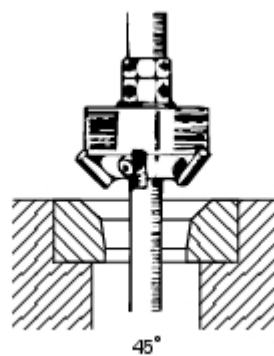


Checking the valve seats

Visually inspect the valve seats: there must be no excessive hollowing and there must be no pitting or cracks.



If a valve seat is only slightly damaged, it may be lapped using the special 45° lapping tools, with subsequent grinding of the valve into its seats. If the valve seats are excessively damaged, fit oversize seats. Replacement seats are available with 0.03 and 0.06 mm oversized outside diameters.

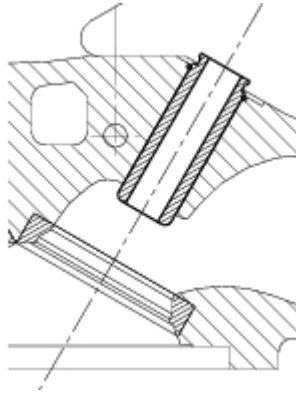


IMPORTANT

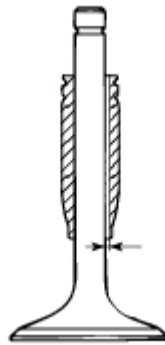
When you change the valve seats, change the valve guides as well.

Renewal of the valve seat

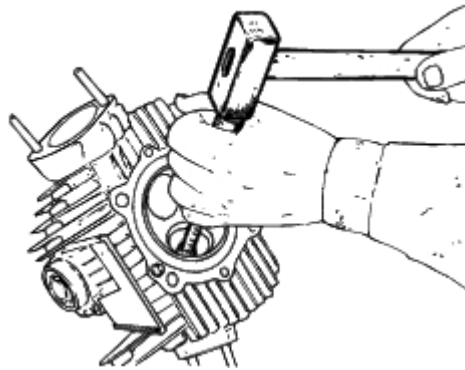
Remove the worn seats by grinding out the rings. Take great care not to damage the valve seat housing in the cylinder head.



Check the diameter of cylinder head bores and choose the oversized valve seat that will give an interference fit of 0.11 to 0.16 mm. Replacement valve seats are supplied in outside diameter oversizes of 0.03 and 0.06 mm.



Allow to cool and then lap the valve seats, smooth the connections between the ducts and the new seats and grind the valves

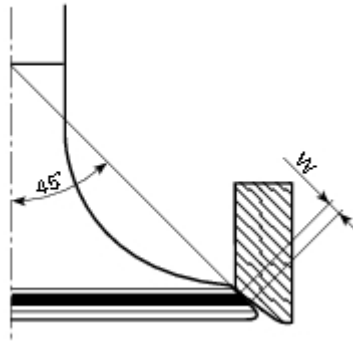


Valve-seat contact surfaces

Use Prussian blue or a mixture of minium and oil to check that the contact surface (W) between valve and seat is 1.0 to 1.5 mm.

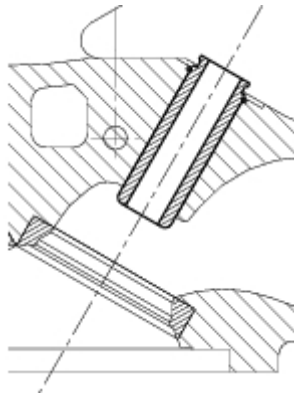
Maximum permissible limit: 2.0 mm.

Grind the seat if the dimension measured is greater than above limit. Fill the intake and exhaust ducts with fuel to check for leaks; if leaking occurs, check the sealing surfaces for burrs.



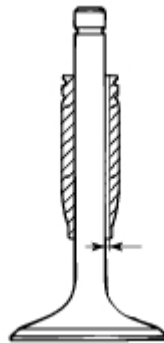
Overhaul of the valve guides

Carefully examine the internal surface of the valve guide: for cracking or distortion. If the guide is excessively out-of-round, use a reaming tool to make the mating faces more uniform.



NOTES

When you change the valve guide, you must also change the valve. The intake valve guides are made from cast iron, whereas the exhaust valve guides are bronze.



Valve-valve guide clearance

Assembly clearance: 0.03 to 0.06 mm.

Maximum permissible wear limit: 0.08 mm.

Renewal of the valve guides

To renew the valve guide, proceed as follows.

Heat up the cylinder head gradually and evenly up to 200 °C.

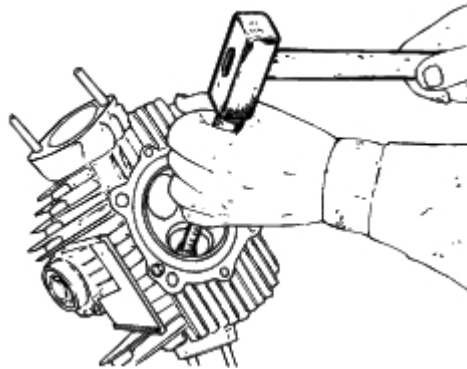
Drive out the valve guide using a suitable drift (see drawing).

Allow the cylinder head to cool down and check the condition of the seat.

Select the most suitable replacement valve guide to obtain an interference fit in the cylinder head bore of 0.022 to 0.051 mm; replacement valve guides are supplied in O.D. oversizes of 0.03, 0.06 and 0.09 mm complete with lock rings.

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Heat up the cylinder head again and chill the new valve guide in dry ice. Lubricate the seat and install the valve guide so that the stop ring is located against the head, using the same drift previously used to remove the old guide. Allow the cylinder head to cool, then ream out the inside of the new valve guide.



Overhauling the rocker arms

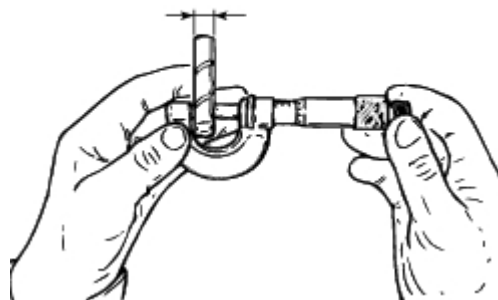
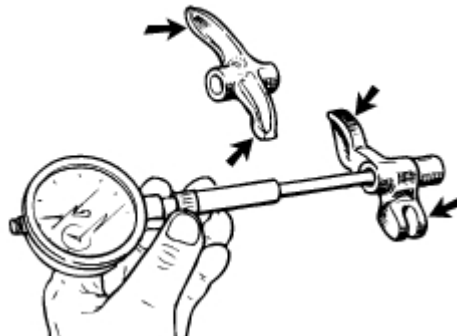
Check for signs of wear, grooves or chrome flaking off.

Check the condition of the rocker arm bore and shaft.

nominal diameter of rocker arm bore: 10.040 to 10.062 mm.

nominal diameter of rocker arm shaft: 10.001 to 10.010 mm.

Check the contact surfaces of the shims and the valve return collets are perfectly flat with no signs of wear.



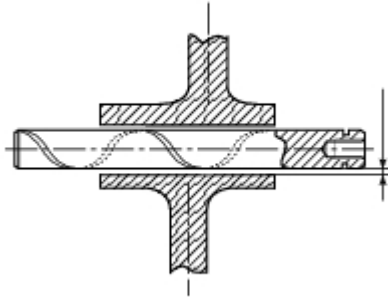
Rocker shaft-rocker bore clearance

The assembly clearance must be: 0.03 to 0.06 mm.

Maximum permissible wear limit: 0.08 mm.

The rocker arm shafts should be a light force fit in the cylinder head.

In the event of excessive clearance, fit 0.02 mm oversize shafts (available from Parts Service).



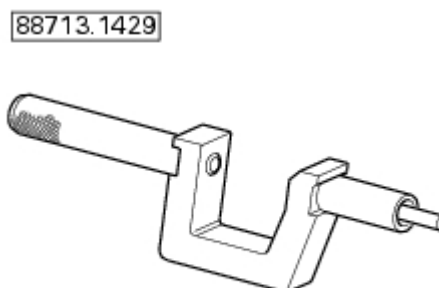
Checking the rocker arm springs

Carefully examine the springs of the closing rockers.
There must be no signs of cracking, distortion, or loss of elasticity.

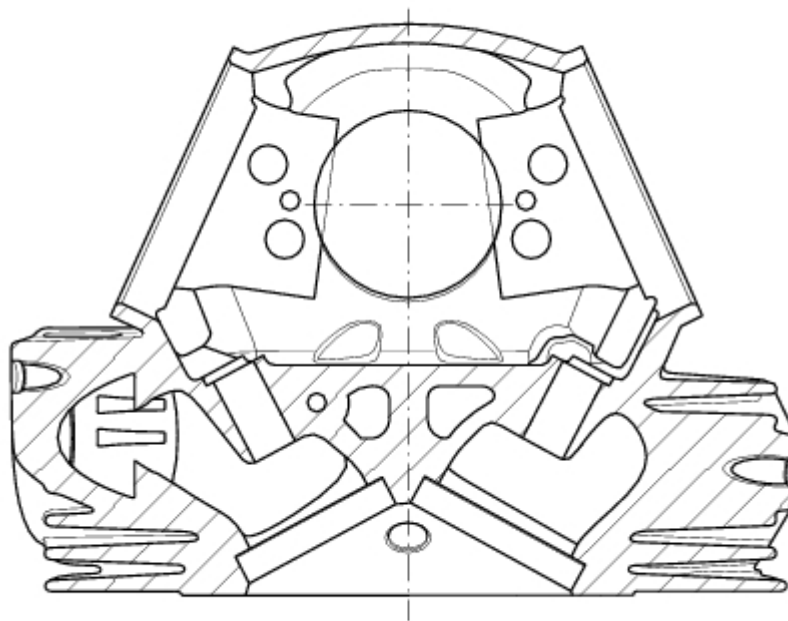


Refitting the cylinder head assembly

To refit the cylinder head reverse the steps of the removal procedure; pay particular attention to those operations mentioned specifically. It is very important that all the components are carefully cleaned. If removed, fit new valve guide seal rings (10), lubricate with engine oil and insert from the spring side with tool part no. 88713.1429.

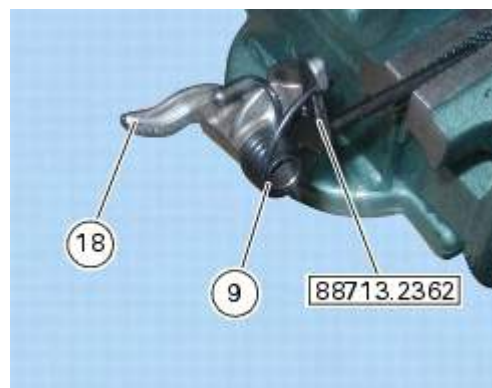


Fit the end of the tool into the valve guide and use a mallet to tap the seal rings (10) home into the valve guides.



Reassembly of the rocker arms

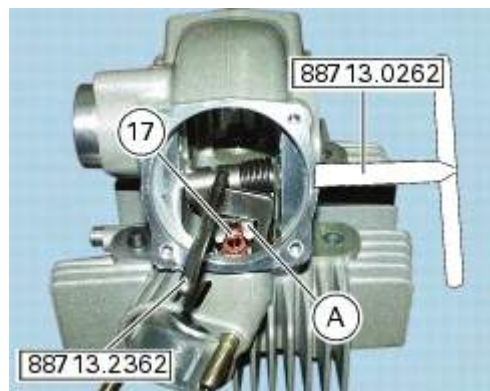
Fit the closing rocker arm (18) and relative spring (9) on service tool no. 88713.2362.
Insert the tool-rocker arm–spring assembly into the cylinder head and fit pin 88713.0262 to keep the parts in position.



Temporarily fit the valve (17) and lubricate with engine oil.



Shim the sides with the specific shims (5), positioning the rocker arm fork (A) as centrally as possible with respect to the valve stem.



Minimum clearance between stem and rocker arm: 0.15 mm.

Closing rocker arm end float: 0.05 to 0.20 mm.

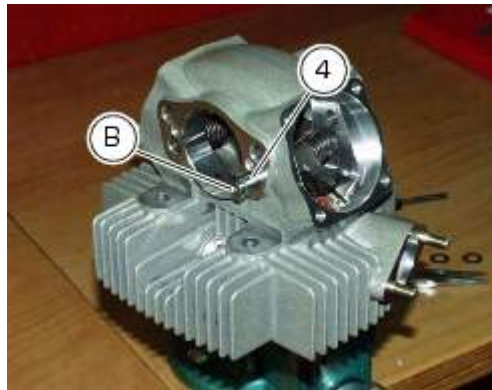
Remove the tool no. 88713.0262 and fit the rocker arm shaft (4) with a new O-ring (22) (previously greased).



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IMPORTANT

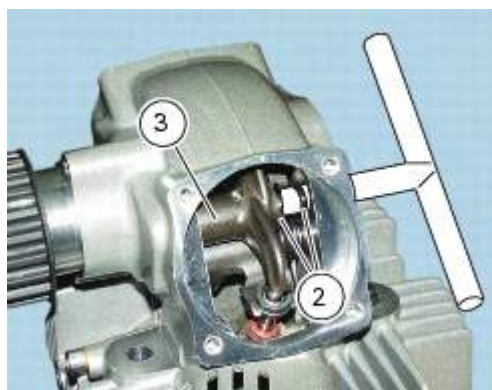
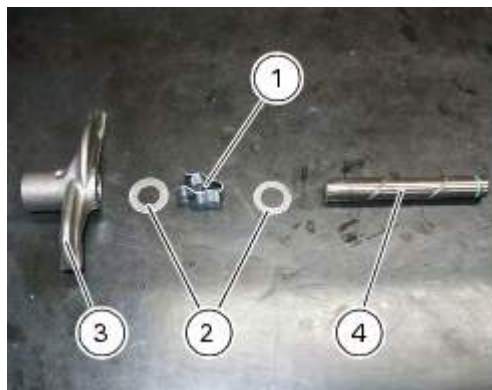
When assembling the rocker arm shafts (4) make sure that threaded hole (B) is on the external side of the cylinder head.



Detach the spring (9) and remove the tool no. 88713.2362.



Again using tool 88713.0262, position the opening rocker arm (3) and install the lateral shims (2). position the rocker arm and the shims on the exhaust side of the horizontal cylinder head, on the intake side of the vertical cylinder head, on the intake side of the horizontal cylinder head and on the exhaust side of the vertical cylinder head. The shims (2) must be positioned either side of the clip (1). Opening rocker arm end float: 0.05 to 0.20 mm.



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After shimming the sides, remove the tool no. 88713.0262 and position the shaft (4) with threaded bore (B) on the external side of the cylinder head.

Always fit new O-rings (22) on reassembly and lubricate them with recommended grease.



Fit the side clip (1) on the shaft (4) of the opening rocker arm (3) between the two spacers (2).



Refit the camshaft end caps

Refitting the valves

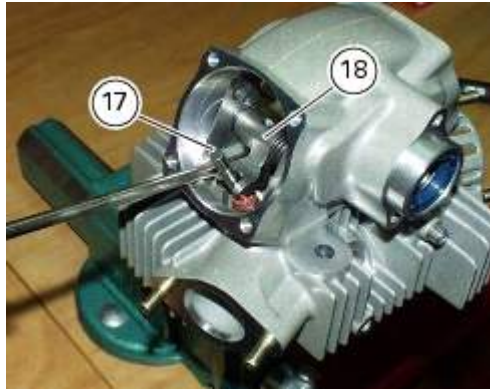
NOTES

The diagrams show the cylinder head without the opening rocker arm, although the operation can be performed with this rocker arm still installed.

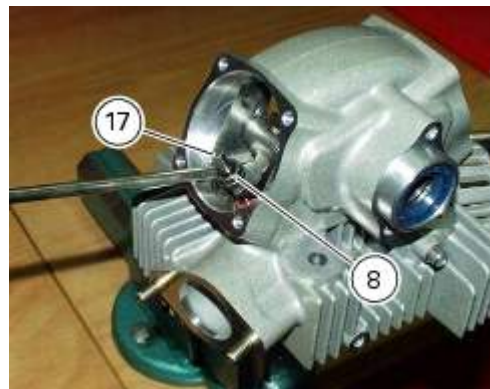
Position the valves (16) and (17) on the cylinder head.

Using two screwdrivers, hold the closing rocker (18) in the "valve open" position position one screwdriver under the closing rocker arm, while positioning the other screwdriver on the closing rocker along the axis of the valve.

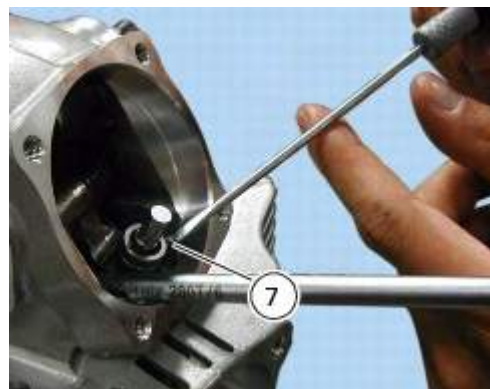




Fit the closing shim (8) on the valve stem (17) with the larger diameter side facing the rocker arm.



Position the two half rings (7) on the valve stem.



Remove the two screwdrivers and position the closing rocker arm (18) in rest position. With the valve in rest position and while pushing on the rocker arm to oppose the force of the return spring, check that the clearance between the rocker and the closing shim is within the specified tolerance limits (Sect. N 3, Checking the closing clearance (Sc) of the intake/exhaust valves). If not, adjust the valve clearance (Sect. N 3, Checking and adjusting valve clearances).



Locate the valve opening shim (6) on the valve stem. □□

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Locate the opening rocker arm (3) and secure it with the clip (1).



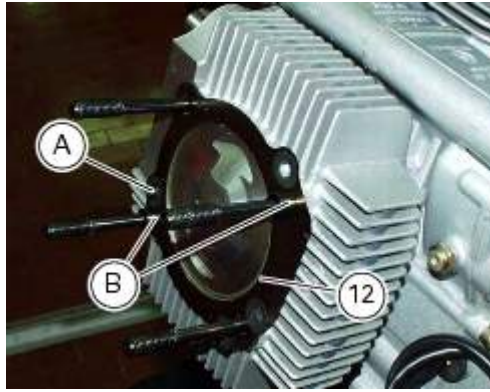
With the valve in rest position, check that clearance between the rocker arm (3) and the shim (6) is within the specified tolerance limits (Sect. N 3, Checking the opening clearance (Sa) of the intake/exhaust valves). If not, adjust the valve clearance (Sect. N 3, Checking and adjusting valve clearances). Follow the same procedure to fit the intake valve (16).



Refit the valve covers

Refitting the cylinder heads

Before refitting the cylinder head assemblies, fit new head gaskets (12) and check that the locating dowels (A) and bushings (B) are installed (Sect. N 4, Cylinder/piston assemblies).

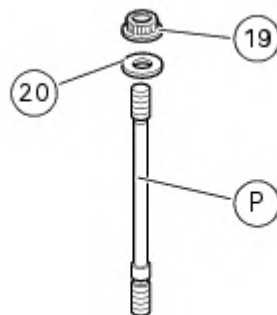


Fit the cylinder head onto the studs and lower it down onto the cylinder block.



Fit the special washers (20) over the stud bolts (P) with the square edged face towards the cylinder head and the flat face towards the inside.

Grease the threads and undersides of the nuts (19) and the threads of the studs with the recommended grease.



Using tool no. 88713.2096 in conjunction with a torque wrench, gradually tighten the cylinder head nuts to the specified torque in a crosswise sequence (Sect. 1.1).



IMPORTANT

Incorrect tightening could cause abnormal elongation of the studs and serious damage to the engine.

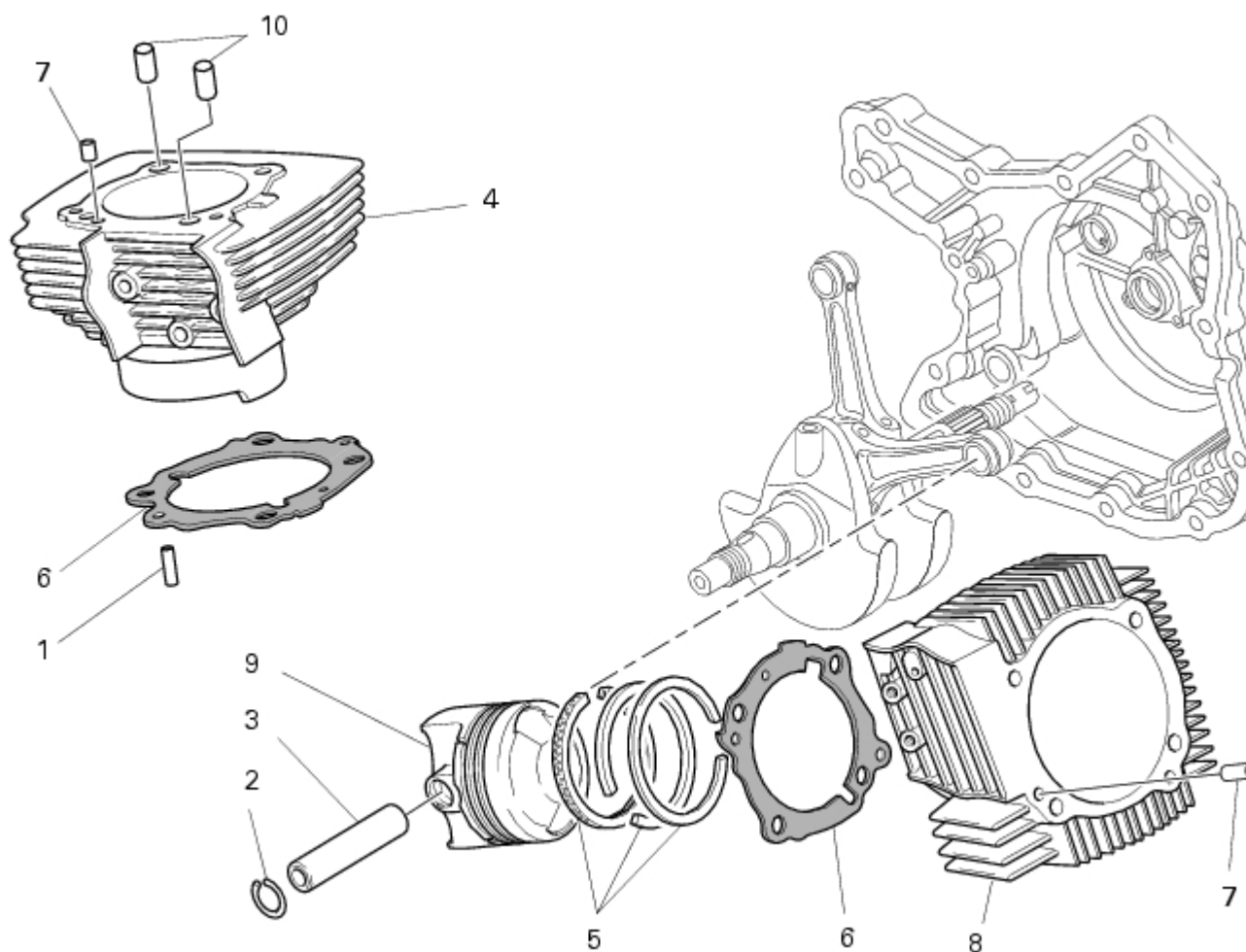
Refit the timing belt covers and the timing belts

Reconnect the oil temperature sensor to the horizontal cylinder head

Refit the intake manifolds

Reconnect the exhaust pipes to the cylinder heads

4 - Cylinder / piston assemblies



- 1 Locating dowel
- 2 Circlip
- 3 Gudgeon pin
- 4 Vertical cylinder
- 5 Piston rings
- 6 Cylinder-crankcase gasket
- 7 Locating dowel
- 8 Horizontal cylinder
- 9 Piston
- 10 Centring bush □□

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Removal of the cylinder / piston assembly

Remove the cylinder heads from the engine.

Remove the dowel (7), bushes (10) and head gasket (A) from their seats on the cylinder barrel (Sect. N 3.3, Cylinder head assemblies: valves - rocker arms).



Use the the tool no. 88700.5644 to bring the horizontal cylinder piston (8) close to TDC. Carefully lift the cylinder barrel (4) 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 cylinder until you can access the gudgeon pin (3).



Since insertion of piston in the barrel is a difficult operation to perform at the time of reassembly, remove the piston together with the barrel as an assembly as described below.

Close the opening in the engine crankcase with a rag or soft paper to prevent foreign material or solid combustion residue from falling in. Remove the circlip (2) of the gudgeon pin (3) from the clutch side.



Working from the opposite side, drive out the gudgeon pin (3) sufficiently to release the connecting rod.



Lift the cylinder/piston assembly clear of the engine crankcase studs.
If work is to be carried out on the piston, carefully withdraw it from the cylinder.
Remove cylinder-crankcase gaskets (6) from the cylinder barrel.

IMPORTANT

Mark the pistons to show from which cylinder they were removed: V= Vertical - H= Horizontal.



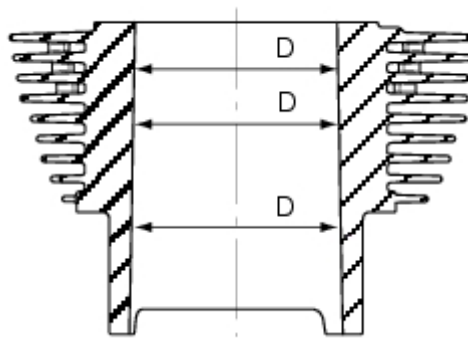
Use the tool no. 88700.5644 to bring the horizontal cylinder piston (8) close to TDC. To remove the vertical cylinder-piston assembly, proceed as described above for the horizontal cylinder.



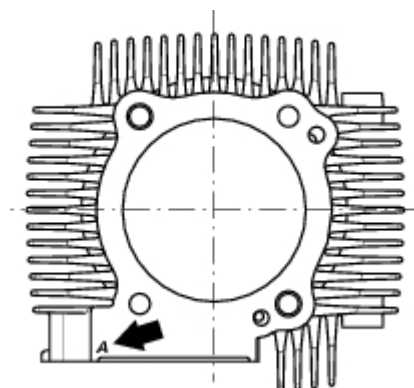
Overhaul of the cylinder barrel / piston components

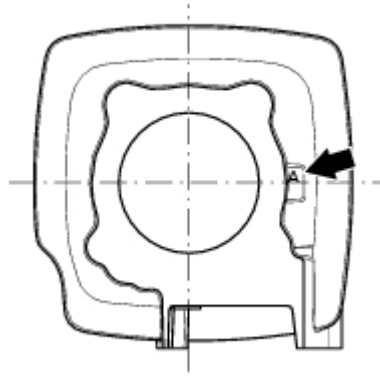
Overhauling the cylinder

Check that the walls are perfectly smooth. Measure the cylinder bore diameter (D) at three different heights and in two directions offset by 90°, thereby determining the assembly clearance, taper, and ovality (see specified values in Sect. 1 Cylinder/Piston)

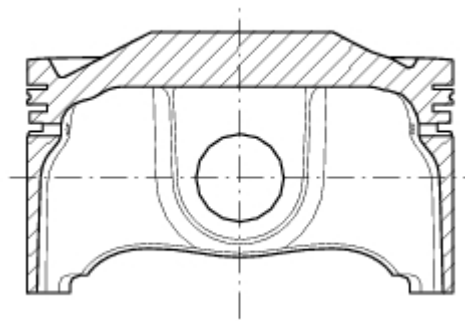


In the event of damage or excessive wear the barrel must be renewed as it has a silicon carbide coating (which provides the cylinder walls with excellent anti-friction and anti-wear properties) and therefore cannot be rebored. The cylinders are marked by a letter (punched into the specific surface on the cylinder side) showing the class to which they belong. Always match cylinders with pistons from the same size class.

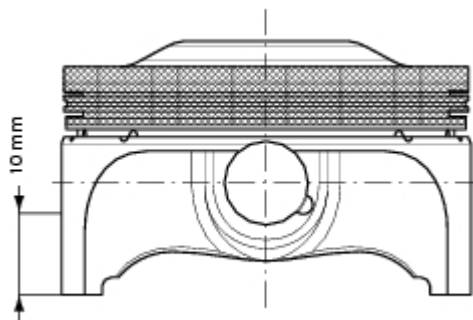




Overhauling the piston



Clean the piston crown and piston ring grooves of any carbon deposits. Inspect the piston and check its dimensions carefully: there must be no signs of scuffing, scoring, cracks, or other damage. The piston diameter (P) must be measured at 10 mm from the skirt base at right angles to the axis of the gudgeon pin. The pistons must always be renewed as a pair.



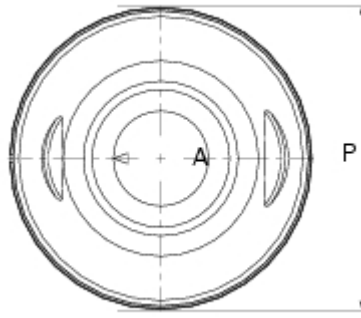
Piston-cylinder clearance

The pistons are marked by a letter (punched into the piston crown) that indicates the size class to which they belong.

Always match cylinders with pistons from the same size class.

For the values, refer to Sect. 1 Cylinder/Piston.

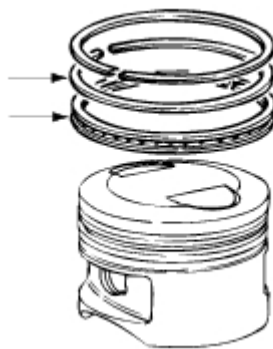
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Overhauling the gudgeon pins

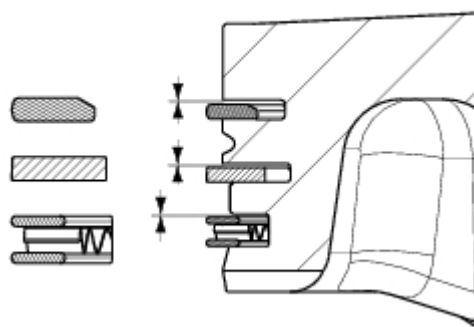


Gudgeon pins must be perfectly smooth without signs of scoring, steps, or blueing due to overheating. The well-lubricated gudgeon pin must slide smoothly inside the piston without stiffness. The assembly clearance with the piston at the time of installation must be 0.002-0.008 mm. The maximum permissible wear limit is 0.035 mm. 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. Replacement pistons are supplied complete with piston rings and gudgeon pin.



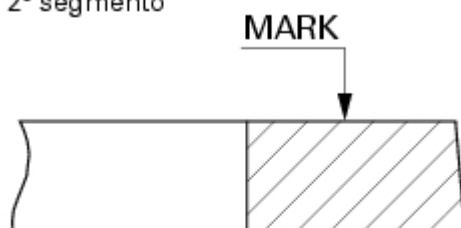
Piston ring-to-groove clearance

The maximum permissible wear limit is 0.15 mm for the top compression ring (1st) and 0.10 mm for the others (2nd and oil control ring).

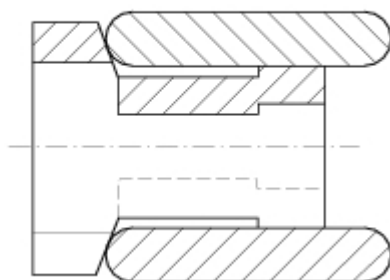
1° segmento



2° segmento



raschiaolio



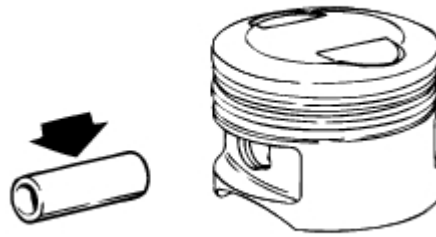
NOTES

The markings punched on the piston rings must always be facing upwards.

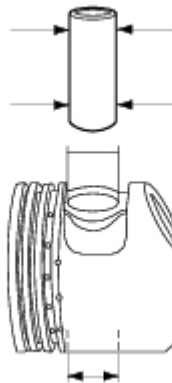
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Gudgeon pin-piston clearance

Measure the diameter of the gudgeon pin bore in the piston.



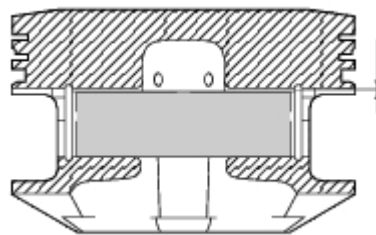
Measure the diameter of the gudgeon pin.



Maximum wear limit: 0.025 mm.

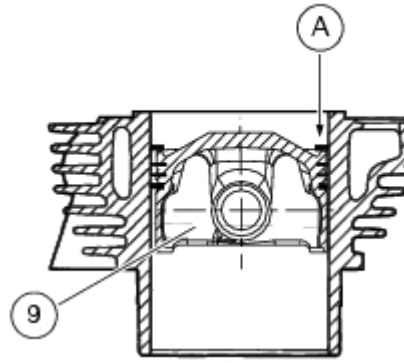
NOTES

If you fit a new gudgeon pin, you must also change the connecting rod small end bush.



Piston ring-to-bore clearance

It is essential that the measurement be performed with the piston ring (A) positioned perfectly square in the cylinder. For this reason, the piston (9) should be inserted in the cylinder without piston rings fitted and then place the piston ring to be checked on top of the piston.



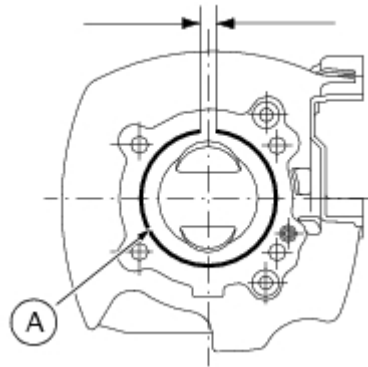
Measure the piston ring gap:

Top and second piston ring (nominal): 0.04 to 0.06 mm.

Wear limit: 0.80 mm.

Oil control ring (nominal): 0.030 to 0.060 mm.

Wear limit: 1.0 mm.



Refitting the cylinder/piston assembly

If a new cylinder/piston assembly is to be fitted, make sure that the piston and cylinder are of the same size class: The letter indicating the cylinder size class is stamped on the cylinder-head mating face; the piston size class letter is stamped on the crown in between the two recesses.

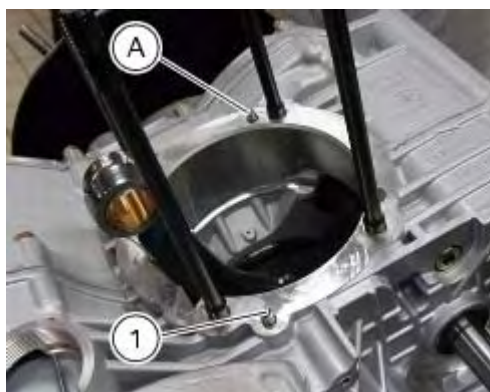


If the pistons have been separated from their cylinders, before reassembling these components, position the piston ring gaps at 120° from one another (the marks must always face the piston crown).

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 pockets facing the exhaust port.

Remove any deposits and degrease the contact surfaces of the crankcase and the cylinders.

Check that connection (1) for transfer of oil to the cylinder heads and cylinder locating dowel (A) are installed on the crankcase.



Apply a bead of liquid gasket to the mating surface (6) as shown in the figure. Position the gasket (6) on the crankcase with the word "TOP" facing upwards.



Using the tool no. 88700.5644, bring the small end of the connecting rod up to near TDC. Fit the piston-cylinder assembly on the crankcase studs.



Push the connecting rod small end into the piston close to the gudgeon pin (3) bore. Lubricate and insert the gudgeon pin. The gudgeon pin must slide smoothly in the connecting rod small end bush and in the piston (9).



Stuff the crankcase opening with a cloth to prevent foreign objects from falling inside and then fit circlip (2).

IMPORTANT

Always use new circlips (2) on reassembly.

Push the cylinder barrel (4) down until it seats against the crankcase.



Apply liquid gasket to the gasket (6).

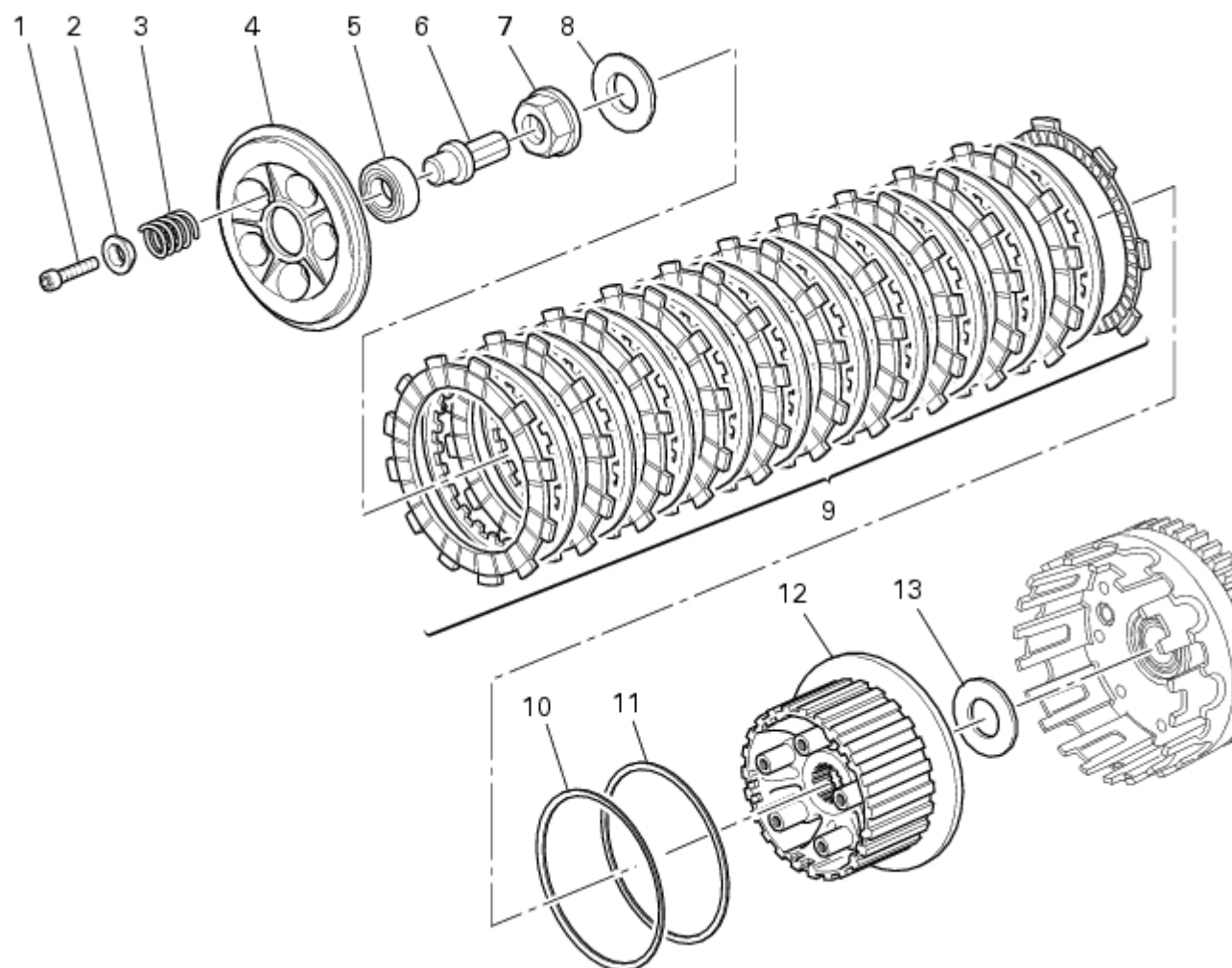


IMPORTANT

Position the locating dowel (7), head gasket (A) (Sect. N 3.3, Cylinder head assemblies: valves - rocker arms) and centring bush (10).

Repeat the procedure for the other cylinder.
Refit the cylinder heads.

5 - Clutch assembly: Clutch



- 1 Bolt
- 2 Collar
- 3 Clutch spring
- 4 Pressure plate
- 5 Bearing
- 6 Clutch lifter
- 7 Nut
- 8 Belleville washer
- 9 Clutch plates
- 10 "FCC" Belleville washer
- 11 Flat ring
- 12 Clutch centre
- 13 Spacer □□

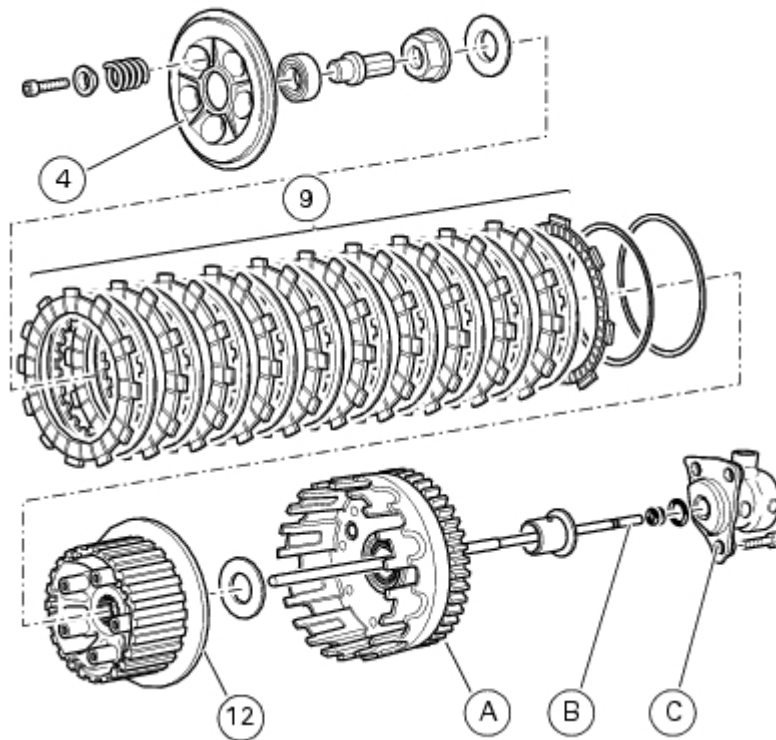
Description

The clutch is disengaged by a slave cylinder consisting of a piston (C) housed inside a cylinder mounted to the left-hand side crankcase cover. This piston (C) pushes a pushrod (B), which runs through gearbox primary shaft and operates the pressure plate (4) located on top of the clutch plate pack (9).

Drive is transmitted from the crankshaft to the gearbox primary shaft by a gear integrated with the clutch housing/primary drive gear pair (A). The latter contains the clutch plate pack (9) made up of driving and driven discs; the latter move a drum (12) keyed 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 malfunctions.

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 drum.

A clutch which slips may be caused by:

- insufficient play of the control lever
- worn clutch plates
- weakened springs
- faulty clutch release mechanism
- excessive wear of the hub or clutch drum.

A noisy clutch may be caused by:

- excessive backlash between the primary drive gears
- damaged primary drive gear teeth
- excessive play between driving plate tabs and clutch drum
- worn gear/clutch drum bearings
- the presence of metal particles (filings) on the gear teeth.

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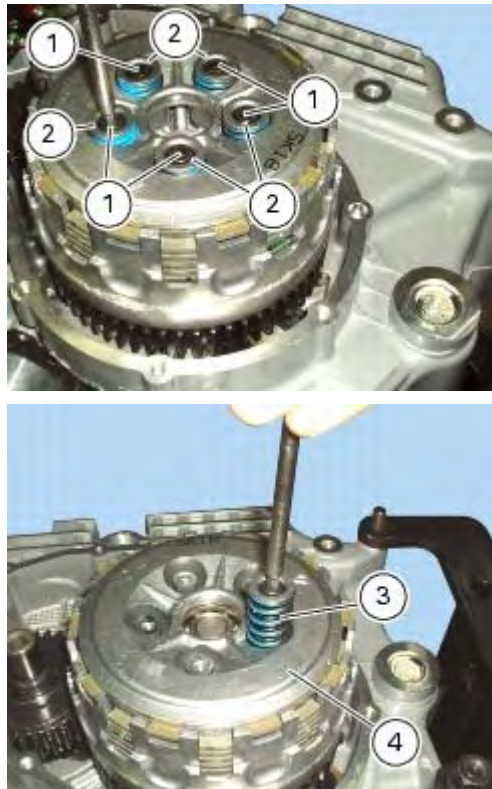
Removal of the clutch

Remove the side fairings

Drain the engine oil

Remove the clutch cover

Unscrew the retaining bolts (1) and remove the collars (2) and the clutch springs (3) of the pressure plate (4).
Svitare le viti (1) di fissaggio ed estrarre le rosette (2), le molle (3) dello spingidisco (4).



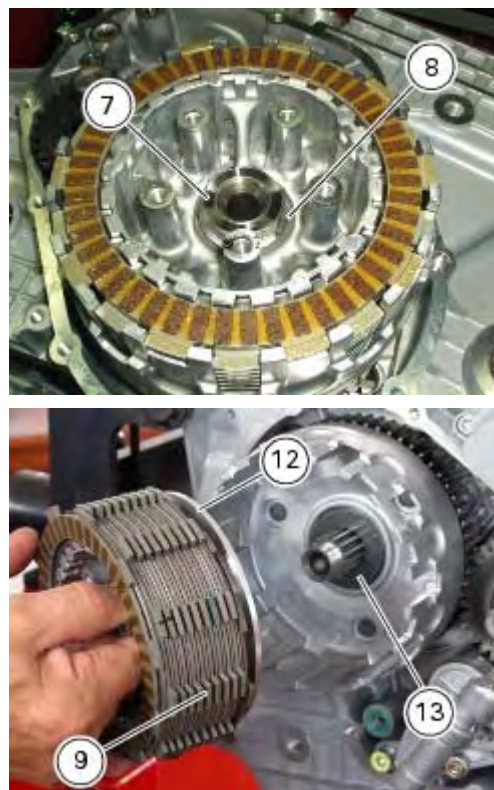
Remove the clutch lifter (6). If necessary, remove the bearing (5) using tool of suitable diameter.



Restrain the clutch centre (12) using service tool no. 88713.2651, insert the bush (D) inside the tool and unscrew the locking nut (7).

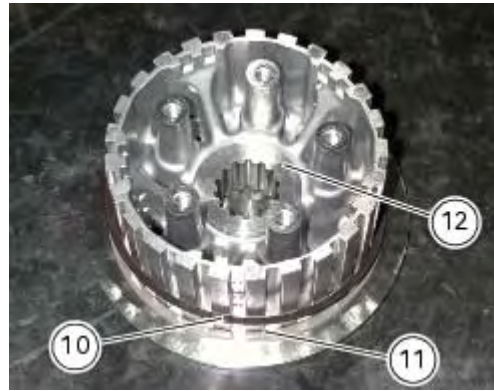


Remove the nut (7) and the Belleville spring (8), withdraw the clutch centre (12) and the plates (9) from the clutch drum. Slide the clutch plates (9) off the clutch centre (12). When removing the plates, keep them paired in the assembly order and set them aside tied together, if necessary. Remove the spacer (13) from the primary shaft.



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Withdraw the Belleville washer (10) and flat ring (11) from the clutch centre (12).



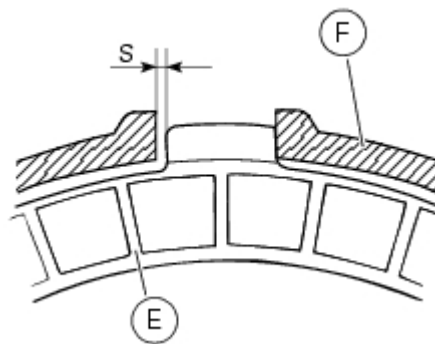
Checking and overhauling the components

Clearance between the clutch drum and friction plates

Insert a friction plate (E) in the clutch drum (F) and measure the clearance (S) with a feeler gauge.

The clearance "S" must not exceed 0.6 mm.

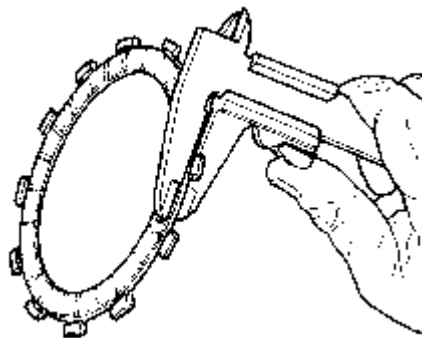
If it does, renew the plates and, if necessary, the clutch drum.



Overhaul of the friction plates

The friction 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.

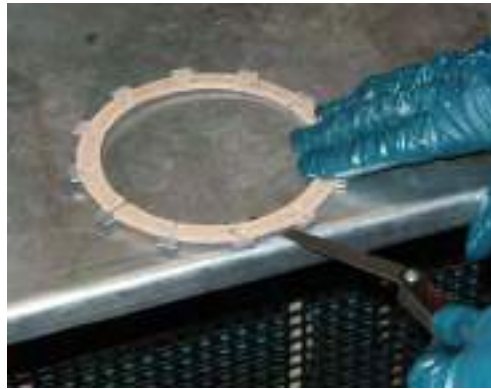


IMPORTANT

The total thickness of the plate 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.

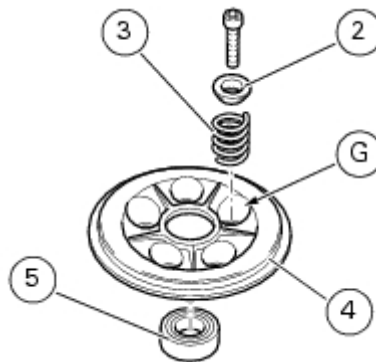


Overhaul of the pressure plate

Check the condition of bearing (5): renew the bearing if the play is excessive.

Check the contact surface of last plain steel plate. If extremely scored, polish it in the same manner as described previously for the cylinder head surface (Sect. N 3.3, Overhaul of cylinder head components).

Check the condition of spring guide cups (G) of pressure plate (4) and at each overhaul always renew spring retainer collars (2).

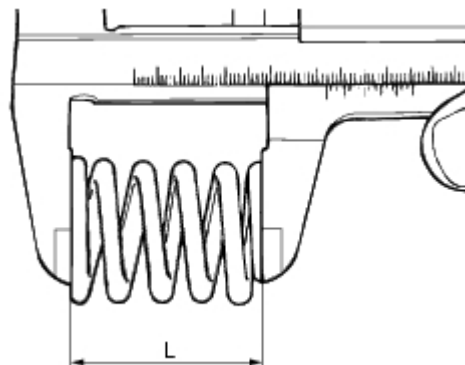


Overhauling the pressure plate springs

Measure the length "L" of each spring (3):

Minimum length: 41 mm.

Renew any springs that are shorter than the above limit value.



Reassembly of the clutch

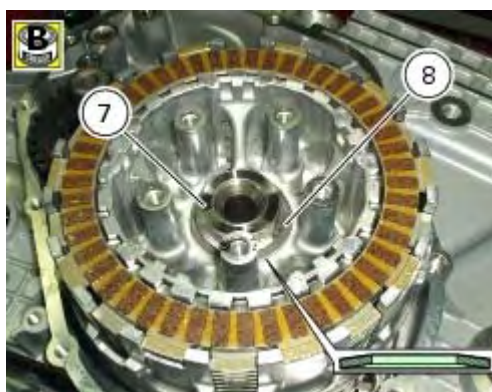
Fit the spacer (13) onto the primary shaft: the spacer (13) must be centred relative to the axis of the gearbox primary shaft.



Fit the clutch centre (12) and onto the latter fit the flat ring (11) and the Belleville washer (10).



Locate the Belleville spring (8), orienting it so that the convex side faces the clutch centre. Apply the prescribed grease to the thread of the gearbox primary shaft and the mating surface of nut (7), and fit it over Belleville washer (8).



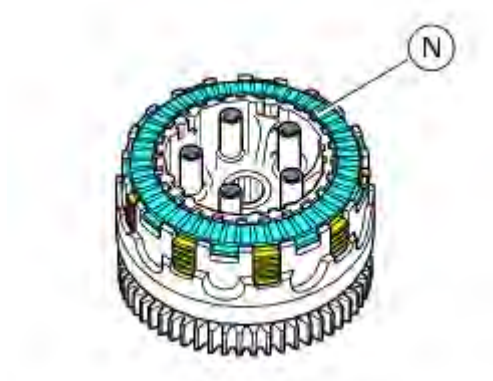
Restrain the clutch centre using service tool no. 88713.2651, insert the bush (D) inside the tool and tighten the locking nut (7) to the specified torque (Sect. 1.1).





Install the clutch plates (9) in the following order:

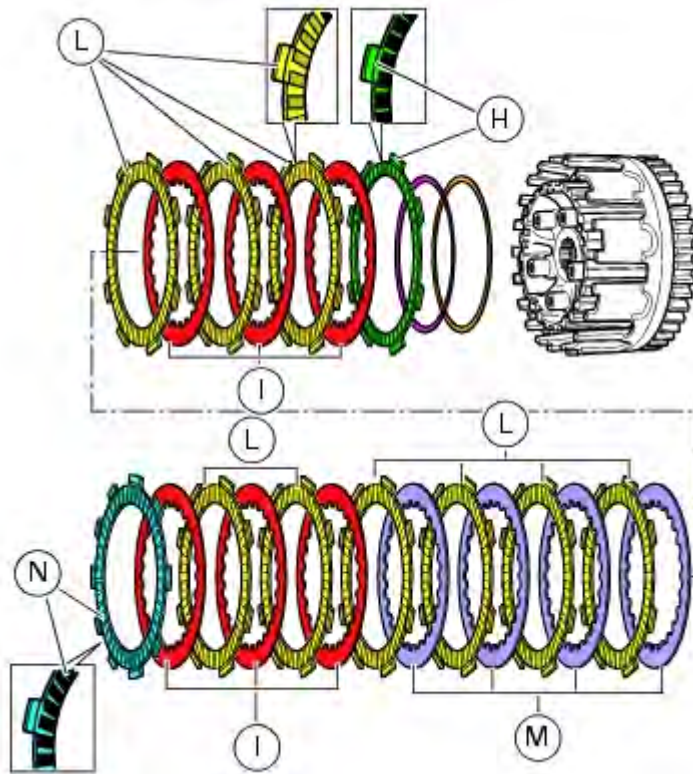
- one friction plate (H) with 48 square tangs
- a series of three plain plates (I) thickness 1.6 mm, alternated with three friction plates (L) with 40 rectangular tangs
- a series of four plain plates (M) thickness 2 mm, alternated with four friction plates (L) with 40 rectangular tangs
- a series of two plain plates (I) thickness 1.6 mm, alternated with two friction plates (L) with 40 rectangular tangs
- one plain plate (I), 1.6 mm thick
- one friction plate (N) with 48 rectangular tangs.



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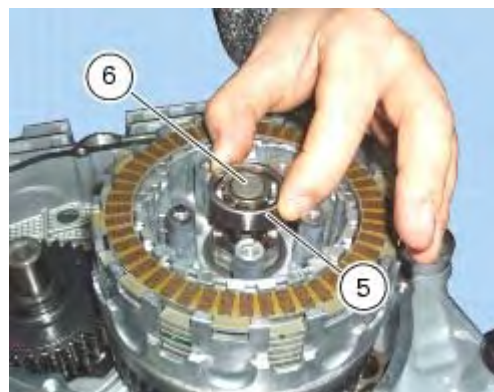
NOTES

The last plate must be fitted the opposite way round to the previous plates, as shown in the figure.



Lubricate the hole in the primary shaft with engine oil.

Fit the clutch lifter (6) in the bearing (5) in the primary shaft.



Fit the pressure plate (4).

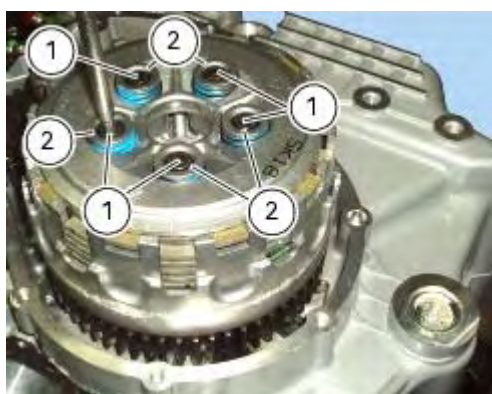
In each recess, fit a spring (3) and a collar (2).



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Lubricate the thread of the bolts (1) with oil.

Tighten the bolts (1) to the specified torque (Sect. 1.1), working in a crosswise pattern.

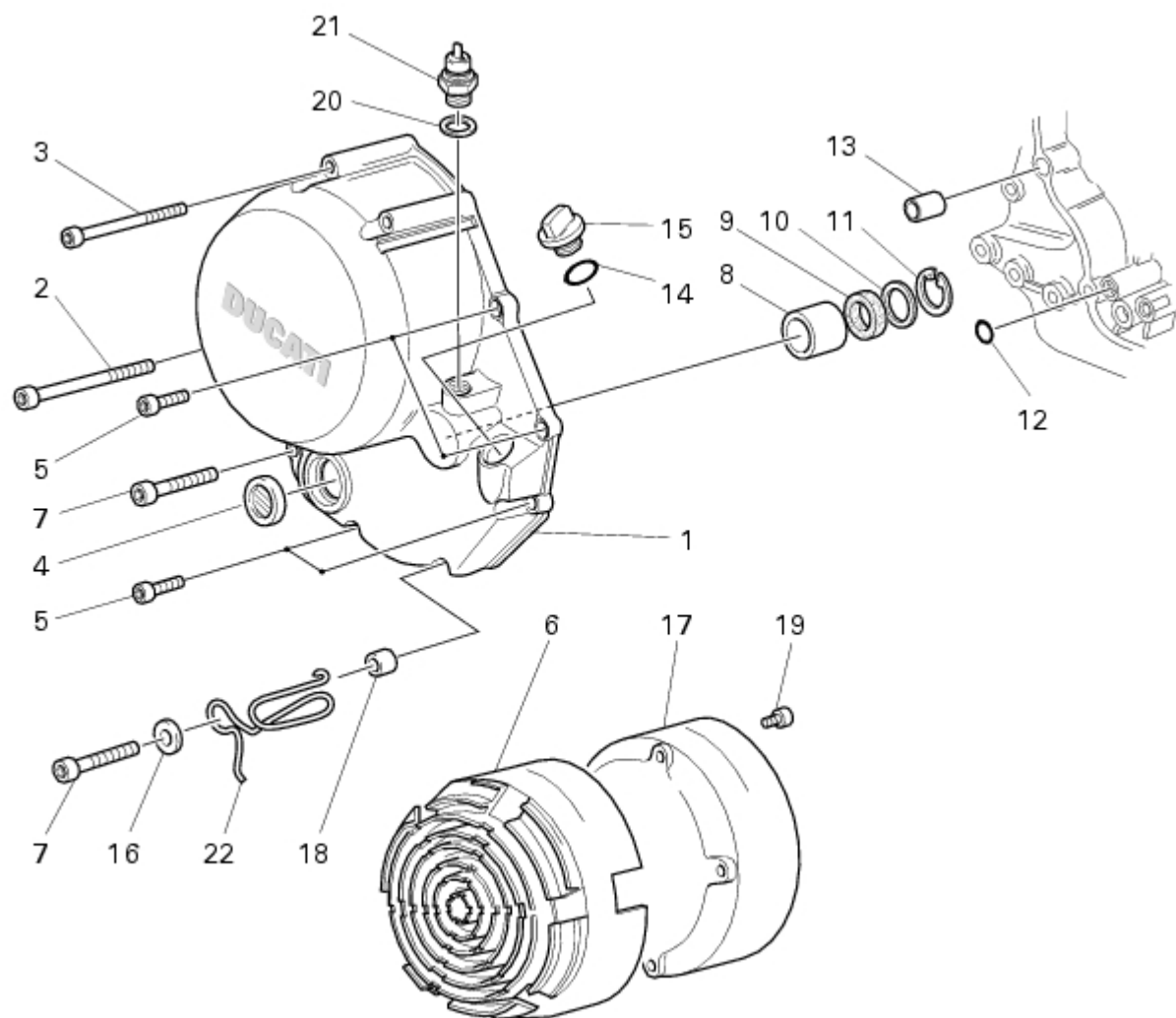


Refit the clutch cover.

Top up the engine oil.

Refit the side fairings.

5.1 - Clutch assembly: Clutch cover



- | | |
|-------------------------------|--------------------------------|
| 1 Clutch cover | 12 O-ring |
| 2 Bolt | 13 Locating dowel |
| 3 Bolt | 14 O-ring |
| 4 Oil level inspection window | 15 Plug |
| 5 Bolt | 16 Washer |
| 6 Panel (BLACK) | 17 Cover |
| 7 Bolt | 18 Spacer |
| 8 Bush | 19 Bolt |
| 9 Oil seal | 20 Sealing washer, thickness 2 |
| 10 Shim | 21 Pressure switch |
| 11 Circlip | 22 Cable guide □□ |

Removal of the clutch cover

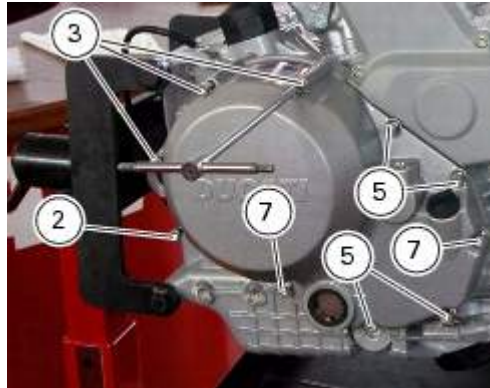
Drain the engine oil

Disconnect the oil pressure sensor

Unscrew the bolt (7) from the bottom of the clutch cover.

Remove the bolt (7), washer (16), cable guide (22) and spacer (18).

Unscrew the bolts (2), (3) and (5) securing the clutch cover (1).



Tap around the edge of the cover with a plastic mallet to detach it from the crankcase.



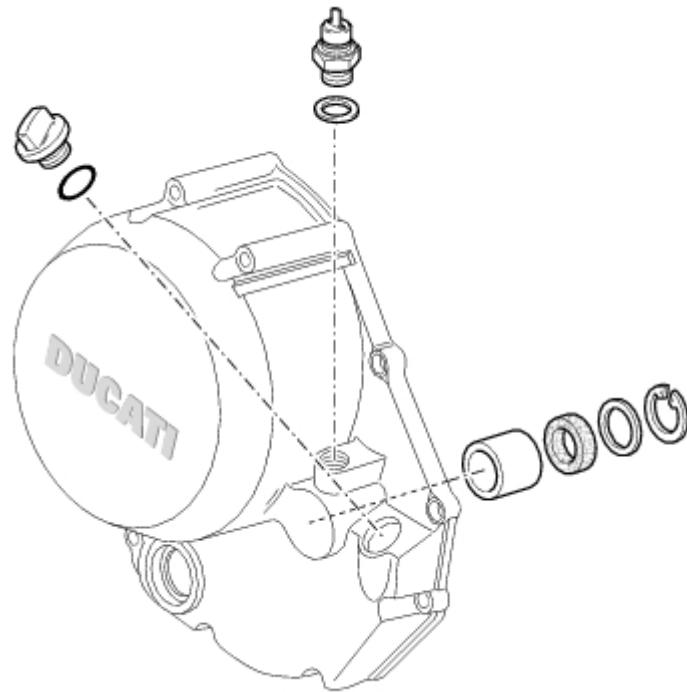
Remove clutch cover (1) taking care not to damage centring bush (13).

Check the condition of centring bush (13) and replace if deformed.

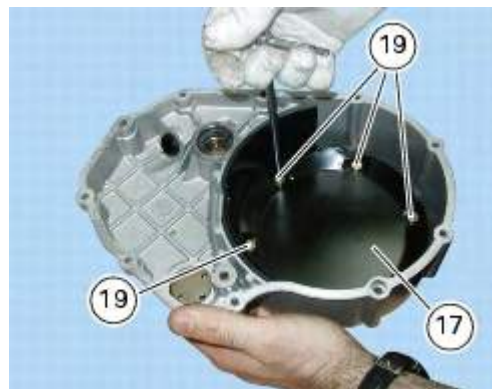


Bimota

Disassembly of the clutch cover

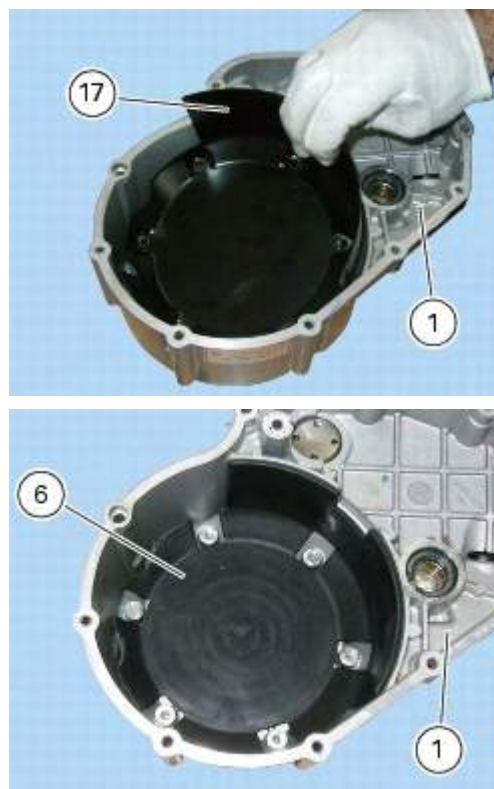


Undo the six bolts (19) securing the inner cover (17).

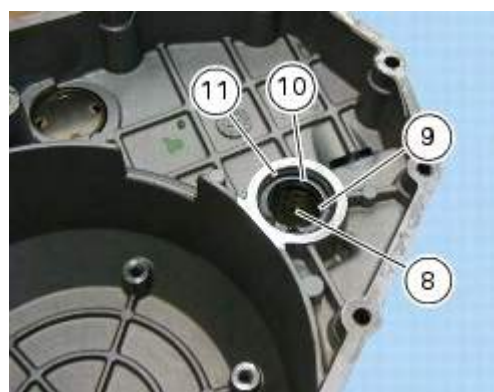


Bimota

Remove the inner cover (17) and sound-proofing panel (6).



Remove the circlip (11) and remove the shim (10) and the oil seal (9).
The drilled bush (8) is mounted to the cover by a forced interference fit.
Remove it using a suitable puller.



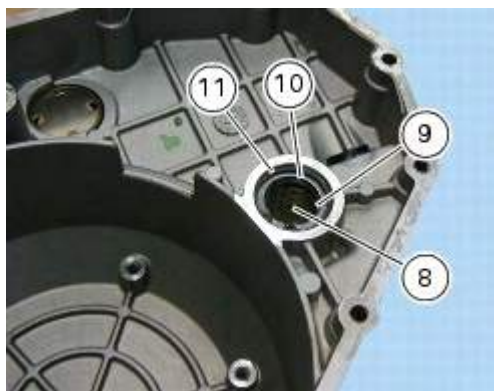
Inspect the oil seal (9) and renew it if necessary.
Remove the plug (15) from the cover and the relative O-ring (14), the engine oil pressure switch (21)
and its seal (20).

Bimota

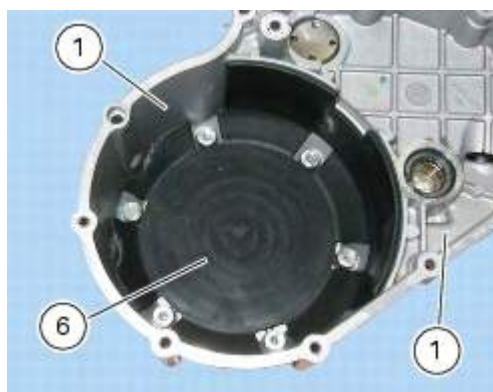
Reassembly of the clutch cover

Fit the plug (15) and the seal (14). Install the pressure switch (21) with its seal (20).

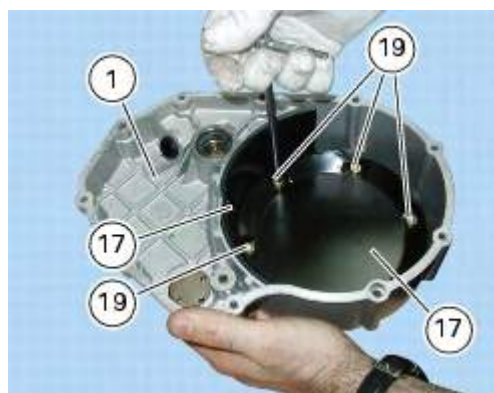
If the bush has been replaced, fully seat the new bush (8) in the slot in the clutch cover with a suitable drift and press.



Position the sound-proofing panel (6) inside the clutch cover (1) as shown in the figure.



Locate the inner cover (17) on the sound-proofing panel (6).
Tighten the six bolts (19) to the specified torque (Sect. 1.1).



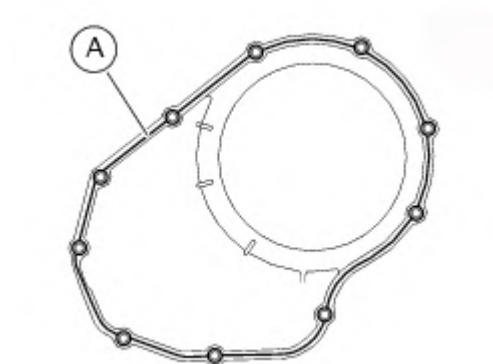
Bimota

Refitting the clutch cover

Clean and degrease mating surfaces on the clutch cover and crankcase and ensure that locating bush (13) and the O-ring (12), located in correspondence with the oil way, are installed in the crankcase.

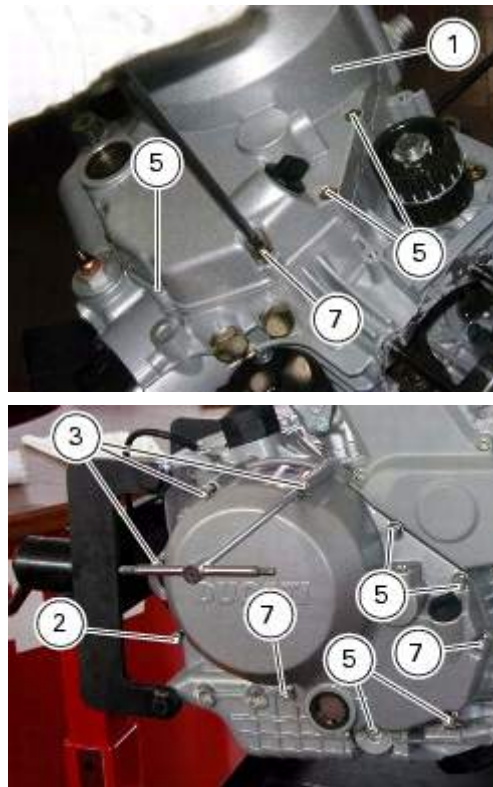


Apply a uniform continuous bead of DUCATI liquid gasket (A) onto crankcase mating surfaces, working around all the holes.



Bimota

Fit the cover assembly (1) to the crankcase half and insert the retaining screws. Tighten the bolts (2), (3), (5) and (7) to the specified torque (Sect. 1.1) in a crosswise pattern.

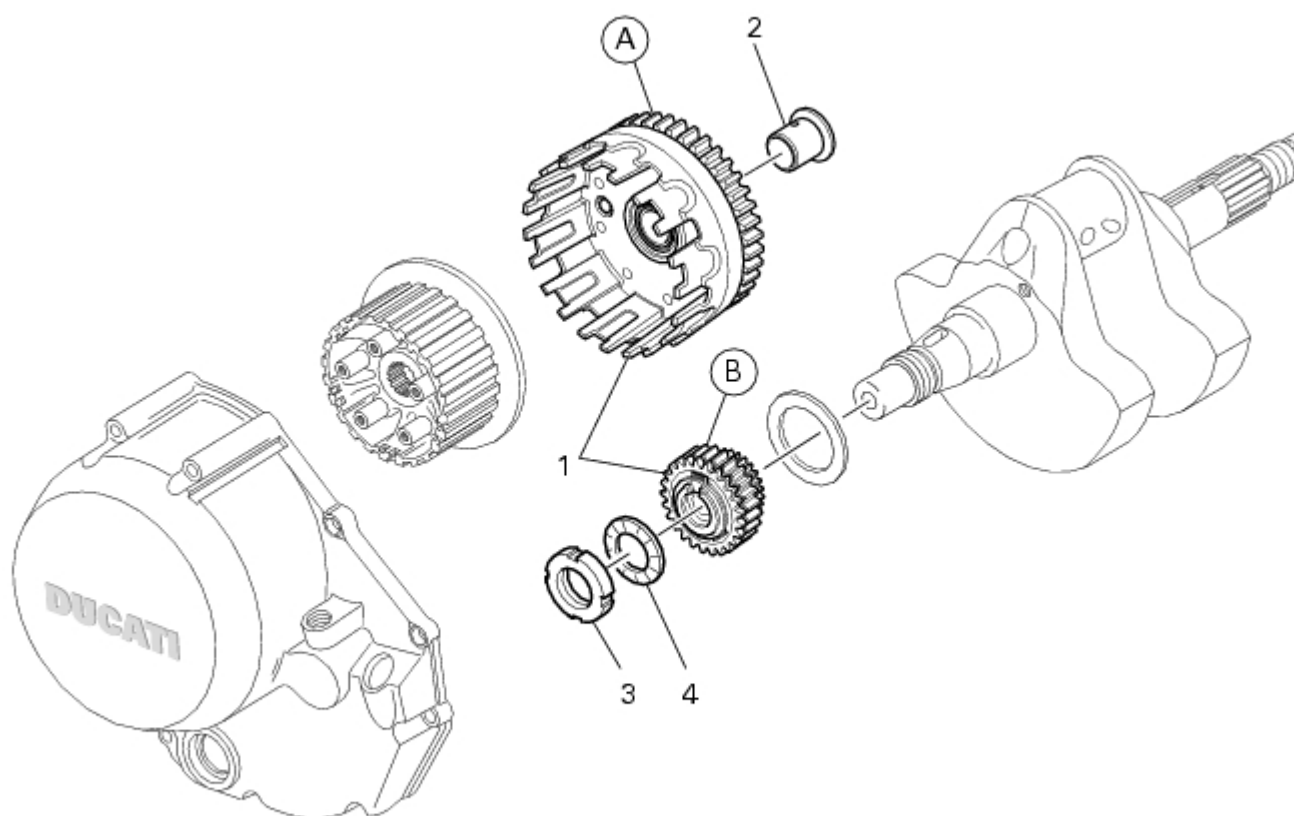


NOTES

Refit the cable guide (22), the bush (18) and the washer (16).

Connect the oil pressure sensor.
Top up the engine oil.

5.2 - Clutch assembly: Primary drive gears



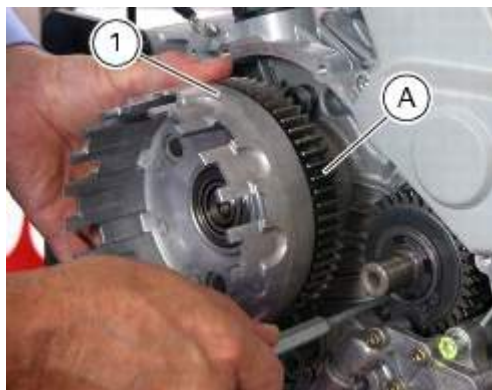
- 1 Clutch drum / Primary drive gears
- 2 Spacer
- 3 Threaded ringnut
- 4 Lock washer

Bimota

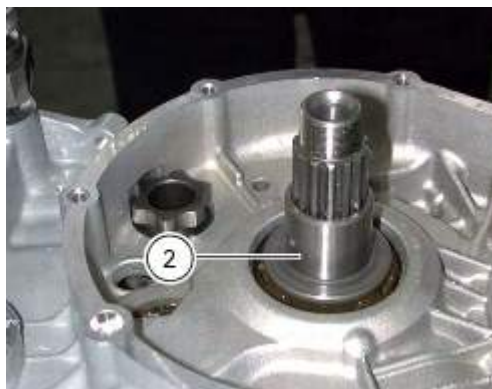
Removal of the primary drive gears

Drain the engine oil and remove the clutch cover.
Remove the clutch assembly.

Withdraw the clutch drum (1) complete with driven gear of the primary pair (A).



Remove the inner spacer (2).



Remove the oil pump (C).

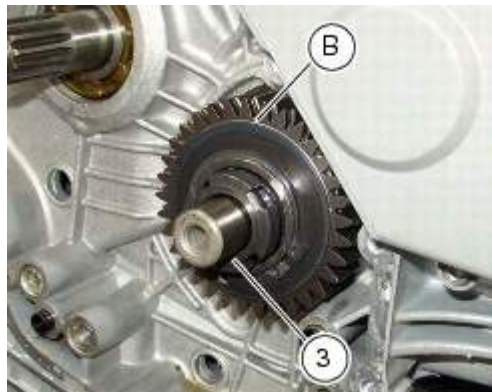


Restrain the primary drive gear (B) with the holding tool no. 88713.2423 and unscrew the nut (3) using socket wrench part no. 88713.2422.





Remove the nut (3) and lockwasher (4).

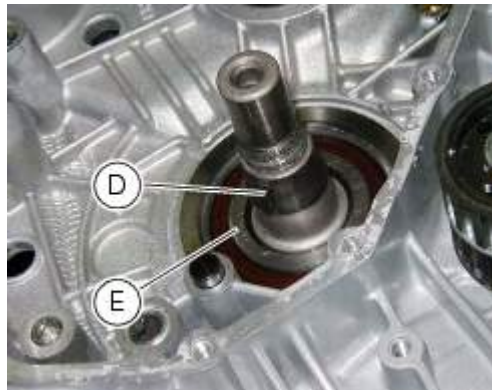


Remove the complete primary drive gear (B) using a commercial puller and placing a brass or aluminium pad between the end of the crankshaft and the puller screw.



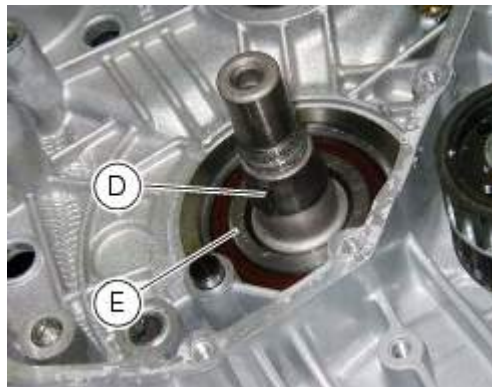


Take care not to lose the Woodruff key (D) on the crankshaft and the shim (E).



Refitting the primary drive gears and checking backlash

Fully degrease the crankshaft splined end and the corresponding spline on the primary drive gear. Check that the Woodruff key (D) is located in its slot on the crankshaft and the shim (E) is located on the crankcase half.



Fit the gear (B) onto the crankshaft with oil pump drive sprocket facing the crankcase.



Bimota

Temporarily secure the gear with the washer (4) and nut (3).

IMPORTANT

If fitting a new primary driving gear (B), check the backlash.

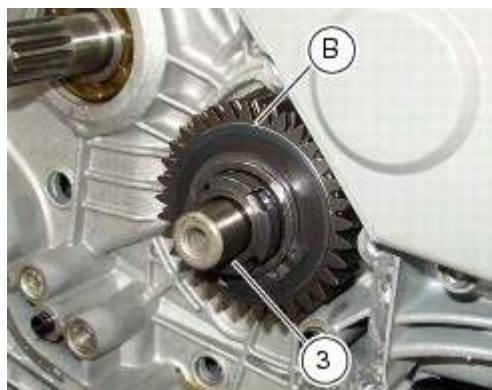


To check the backlash, temporarily fit the clutch drum (1) complete with the primary driven gear (A) on the gearbox input shaft. Fix a dial gauge to the engine crankcase, positioning the stylus against a gear tooth.

Turn the driven gear (A) to mesh the teeth and check with the dial gauge 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 permissible tolerance limits, try changing the position of driven gear (A) on the input shaft, leaving the drive gear (B) on the crankshaft. If the backlash is still outside the tolerance limits, renew the primary drive gear pair (1). After checking backlash, fit the socket part no. 88713.2422 to a torque wrench, retrain the pinion (B) with the holding wrench part no. 88713.2423 and tighten the nut (3) to the specified torque (Sect. 1.1).

Stake the washer (4) onto the drive gear (B) in a milled location and onto nut (3) at a diametrically opposed position.



Bimota

Refit the oil pump and check the backlash between the oil pump gear and primary drive gear on the crankshaft.

Thoroughly degrease the mating surfaces of the clutch drum (1).

Fit the spacer (2) onto the input shaft. Fit the clutch drum (1) along with the driven gear (A).

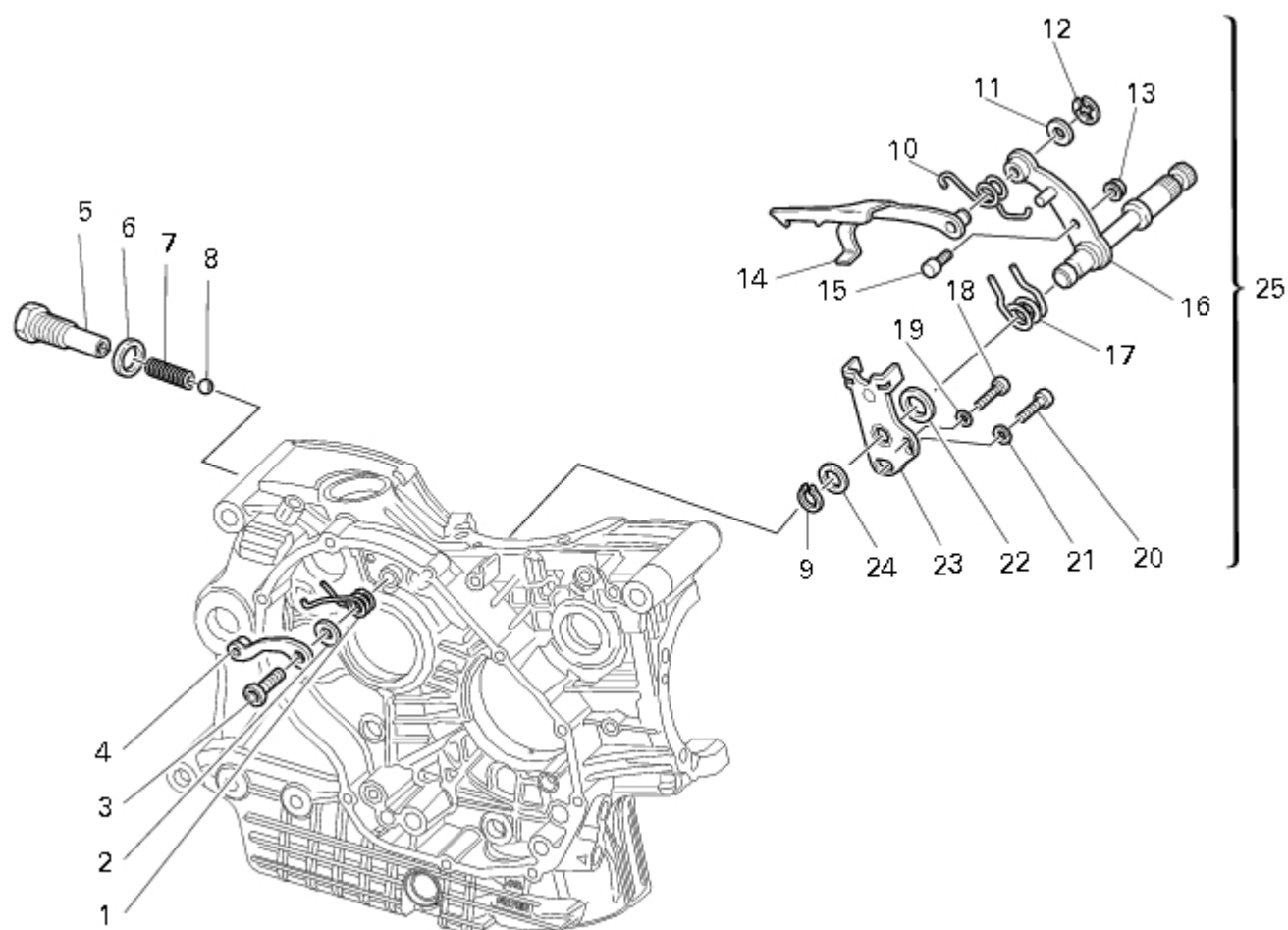


Refit the complete clutch assembly

Refit the clutch cover

Refill the engine with oil

6 - Gearbox assembly: Gearchange mechanism



- 1 Return spring
- 2 Washer
- 3 Special screw
- 4 Gear pawl assembly
- 5 Interlock plunger holder
- 6 Seal
- 7 Detent ball spring
- 8 Ball
- 9 Circlip
- 10 Selector claw return spring
- 11 Shim, thickness 0.5
- 12 Shim, thickness 0.2
- 13 Ring
- 14 Nut □□

- 15 Selector drum control fork
- 16 Gearchange lever pin
- 17 Shaft with gearchange lever arm
- 18 Gearchange lever arm return spring
- 19 Bolt
- 20 Washer
- 21 Bolt
- 22 Washer
- 23 Locating ring
- 24 Stop plate
- 25 Shim, thickness 0.2
- 26 Shim, thickness 0.5
- 27 Gearchange mechanism □□

Bimota

Removal of the gearchange mechanism

Remove the alternator cover and flywheel/alternator assembly

Remove the clutch cover complete with the clutch drum and primary drive gear

Undo and remove the bolts (18) and (20) securing the gearchange mechanism (25).

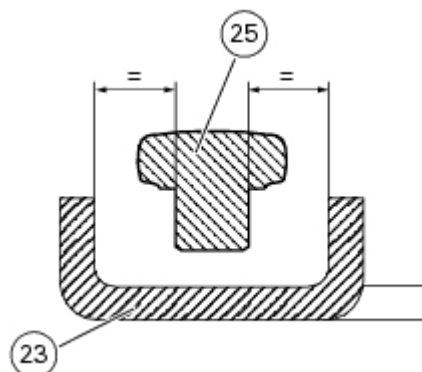


Remove the gearchange mechanism complete with the shaft, spring, and stop plate.

IMPORTANT

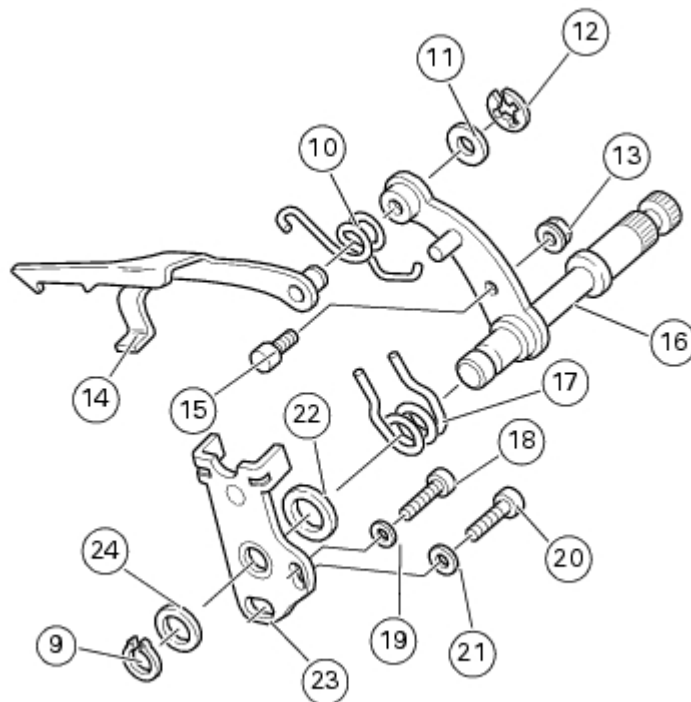
Visually inspect the gear selector claw (14) for wear, particularly around the area where it contacts the selector drum.

If it proves necessary to change components, disassemble the gear selector lever as shown in the exploded view. Reassemble the gearchange mechanism, orienting the eccentric pin (15) in such a way that the lever arm (16) is positioned centrally with respect to the shoulders of the stop plate (23).



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Now tighten the nut (13) to the specified torque (Sect. 1.1).



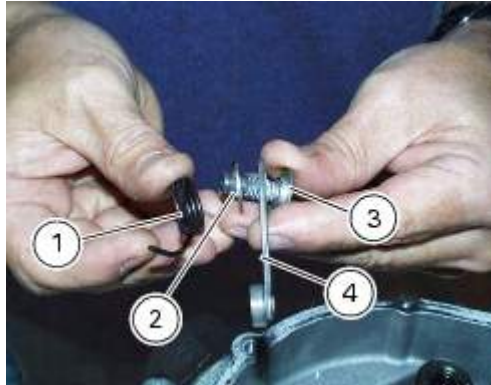
Disassembly of gear interlock plunger and pawl assembly

Unscrew the interlock plunger screw (5) and remove the seal (6), spring (7) and the detent ball (8).



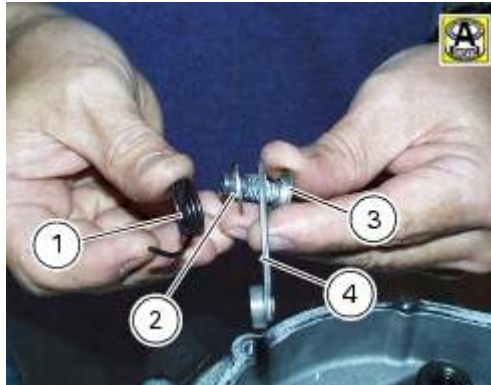


Unscrew the rh crankcase half bolt (3) and remove the pawl (4), washer (2) and spring (1).



Refitting the gear interlock plunger and pawl assembly

Fit the pawl (4), washer (2) and spring (1) on the retaining bolt (3).



Fit the assembled unit on the clutch side crankcase half, locating the end of spring (1) behind the crankcase rib.

Tighten the bolt (3) to the specified torque (Sect. 1.1).

Grease and then fit the ball (8), spring (7), and seal (6) to the gear interlock plunger (5).

Tighten the gear interlock plunger to the specified torque (Sect. 1.1).



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Refitting the gearchange mechanism

Locate the gearchange mechanism (25) with the shaft, spring, and stop plate, on the chain-side crankcase half.



Locate the gearbox drum selector claw in the centre of the drum rollers
Temporarily fit the gearchange lever (or a service lever) and the engine sprocket, and shift to second gear.
Fit the plate 88713.1091 in the claw shaft pins (see figure).



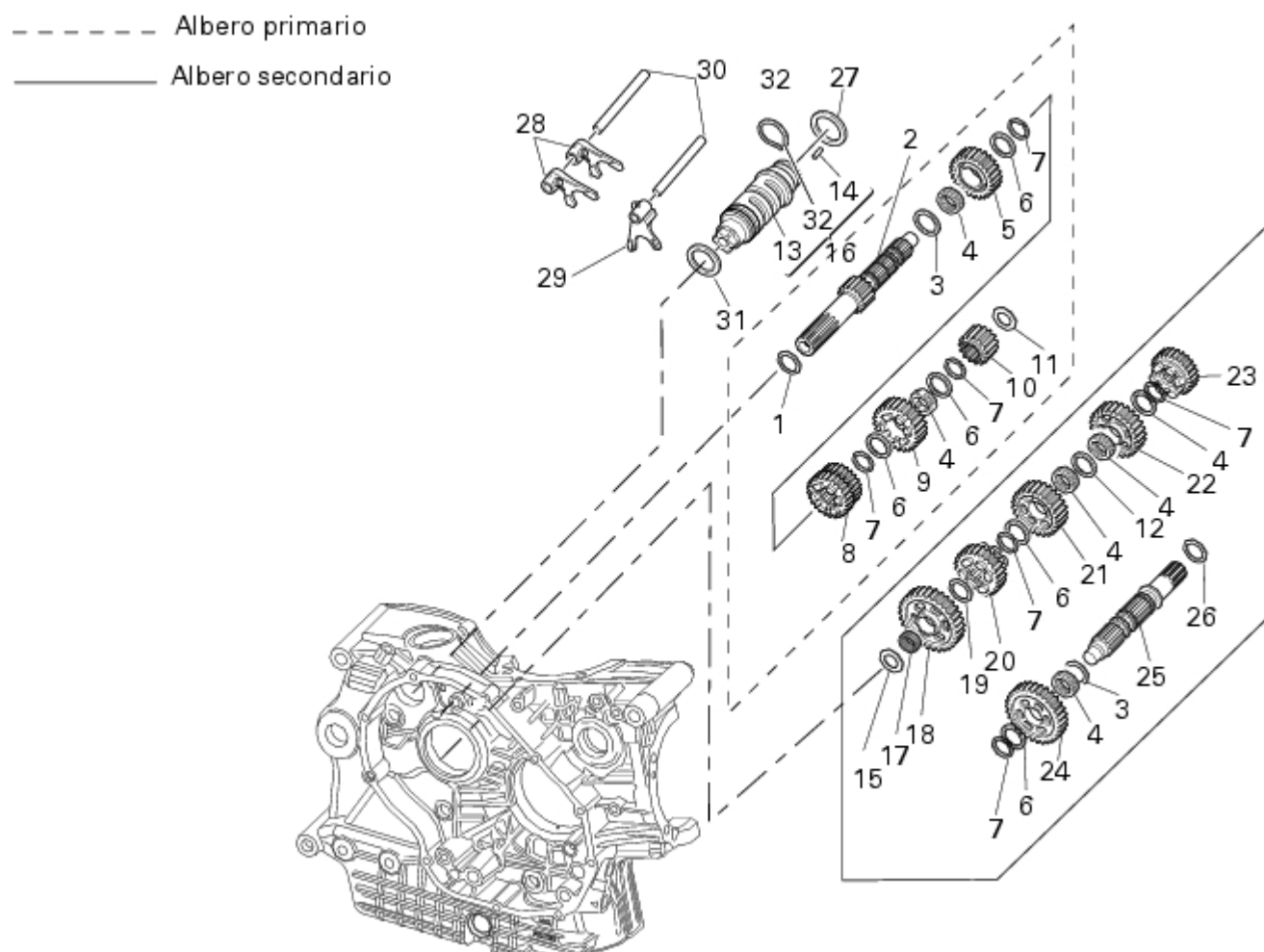
Align the notch that marks the centreline of the selector claw, with the end of the plate.
Then tighten the gearchange mechanism retaining bolts (18) and (20) to the specified torque (Sect. 1.1).



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 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 clutch cover complete with the clutch drum and primary drive gear.
Refit the flywheel/alternator assembly and alternator cover.

6.1 - Gearbox assembly: Gearbox shafts



- | | |
|---|---|
| 1 Shim, thickness 1 | 17 Needle roller bearing |
| 2 Gearbox input shaft | 18 1' speed driven gear |
| 3 Shim, thickness 0.5 | 19 Shim, thickness 1 |
| 4 Needle roller bearing | 20 5' speed driven gear |
| 5 5' speed driving gear | 21 4' speed driven gear |
| 6 Splined washer, thickness 0.5 | 22 3' speed driven gear |
| 7 Circlip | 23 6' speed driven gear |
| 8 3' - 4' speed driving gear | 24 2' speed driven gear |
| 9 6' speed driving gear | 25 Gearbox output shaft |
| 10 2' speed driving gear | 26 Shim |
| 11 Shim, thickness 1.8 | 27 Shim, thickness 1 |
| 12 Splined washer, thickness 0.5 | 28 1', 4' - 2', 3' speed selector fork |
| 13 Selector drum | 29 5', 6' speed selector fork |
| 14 Special needle roller (square cross-section) | 30 speed selector fork shaft |
| 15 Shim | 31 Shim, thickness 1 |
| 16 Selector drum assembly | 32 Needle roller retaining circlip (square cross-section) |

Bimota

Removal of the gearbox assembly

Separate the crankcase halves

Withdraw the selector fork shafts (30).

Move the forks (28) and (29) to disengage them from the slots in the selector drum (13).



Withdraw the selector drum (13) taking care not to lose shims (31) and (27) mounted on the shaft. Note that the positions of the shims must not be inverted.



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Now you can renew the needle roller retaining ring (32) and the special needle rollers (14).
Remove gear selector forks (29) and (28).



Remove the gearbox input (2) and output (25) shafts complete with gears, taking care to recover the spacers on the ends of the shafts. If the bearing inner races (A) are left on the shafts, slide them off the ends of the gearbox input (2) and output (25) shafts (Sect. N 8.1, Main bearings).



Disassembly of the gearbox shafts

Place the shaft in a vice in such a way as to facilitate the disassembly operations.

IMPORTANT

Take care not to invert the positions of the shims on reassembly:
this would potentially lead to jamming when using the gear selector control, making it necessary to reopen the engine crankcase.

Disassembly of the gearbox output shaft

Remove the chain-side clearance washer (15) and clutch-side clearance washer (26) from the output shaft.

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Withdraw the first speed driven gear (18) with the roller cage (17) and the shim (19).



Remove the fifth speed driven gear (20).



Use two flat screwdrivers to remove the circlip (7) taking care not to damage the shaft surface.



Remove the circlip (7) and the splined washer (6).



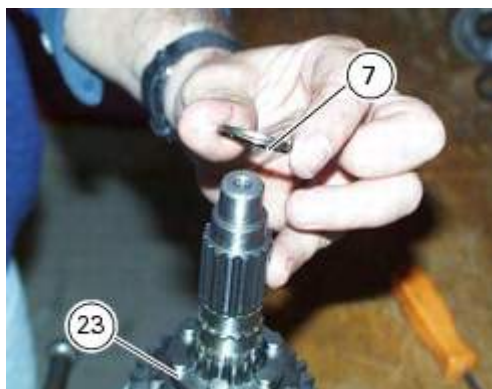
Withdraw the fourth speed driven gear (21) with the roller cage (4) and splined washer (12).



Remove the third speed driven gear (22) with the roller cage (4) and the splined washer (6).

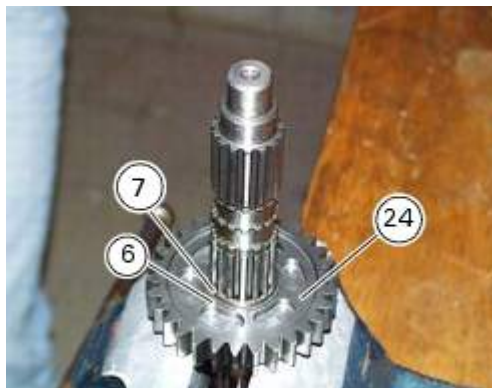


Remove the circlip (7) and remove the sixth speed driven gear (23).



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Remove the circlip (7) and withdraw the splined washer (6) and the second speed driven gear (24).



Withdraw the roller cage (4) and the shim (3). All the components have thus been removed from gearbox output shaft (25).

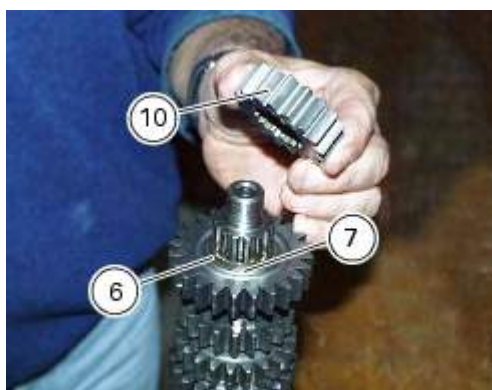


Disassembly of the gearbox input shaft

Remove the chain-side shim (11) and the clutch-side shim (1) from the input shaft.



Remove the second speed driving gear (10). Use two screwdrivers to prise out the circlip (7) and the splined washer (6).



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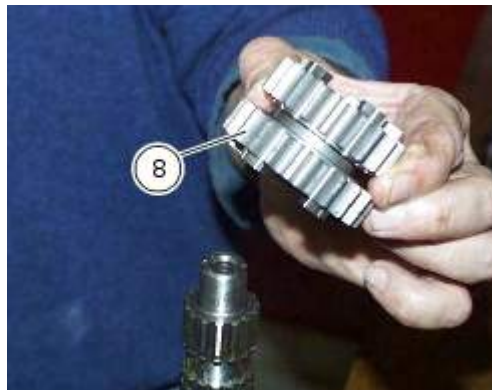
IMPORTANT

Take care to avoid damaging the surface of the shaft while removing circlip (7).

Remove the sixth speed driving gear (9) with its roller cage (4). Withdraw the splined washer (6) and the circlip (7).



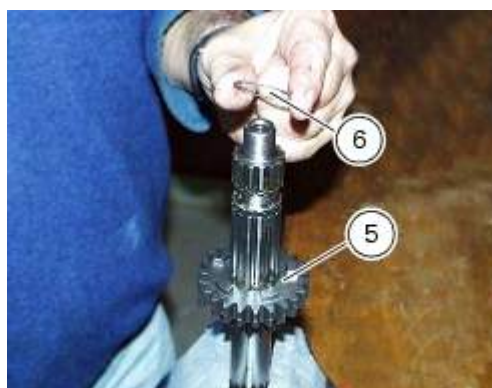
Withdraw the third and fourth speed driving gear (8).



Remove the circlip (7) and the splined washer (6).



Remove the fifth speed driving gear (5) with the roller cage (4).





Remove the shim (3) from the primary shaft.



Overhaul of the gearbox

Check the condition of the front coupling dogs of the gears.

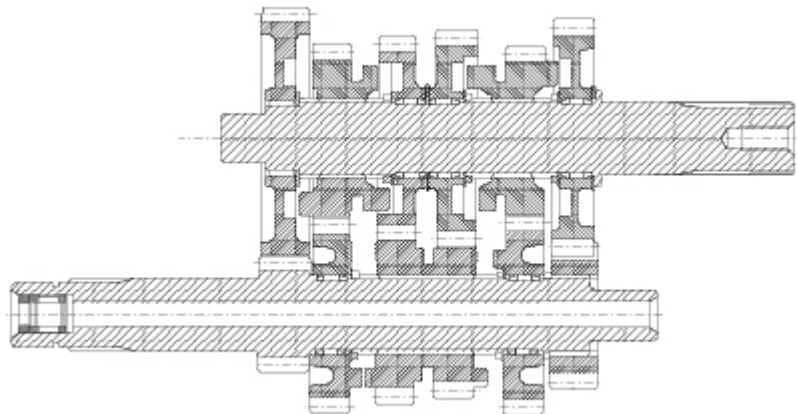
They must be in perfect condition and with no sign of wear on the edges of the teeth.

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.



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Also check that the component parts of the gear selector mechanism are in good condition (see exploded view). 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 endfloat by shimming the gearbox shafts and the selector drum with suitable shims.

Inspection of the gear selector forks

Visually inspect the gear selector forks. Bent forks must be renewed 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 renew the gear or the fork by referring to the limits specified for each part (Sect. 1, Gearbox)



Inspection of the gear selector drum

Use a gauge to measure the clearance between fork pin and the slot on the selector drum.



If the service limit is exceeded, determine which part must be renewed by comparing these dimensions with those of new components (Sect. 1 Gearbox). 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.

Reassembly of the gearbox shafts

Figure 1 shows all the parts to be reassembled on the gearbox input shaft (2), with the calculated end shims (1) and (11) (Sect. N 8.1, Shimming the shafts).

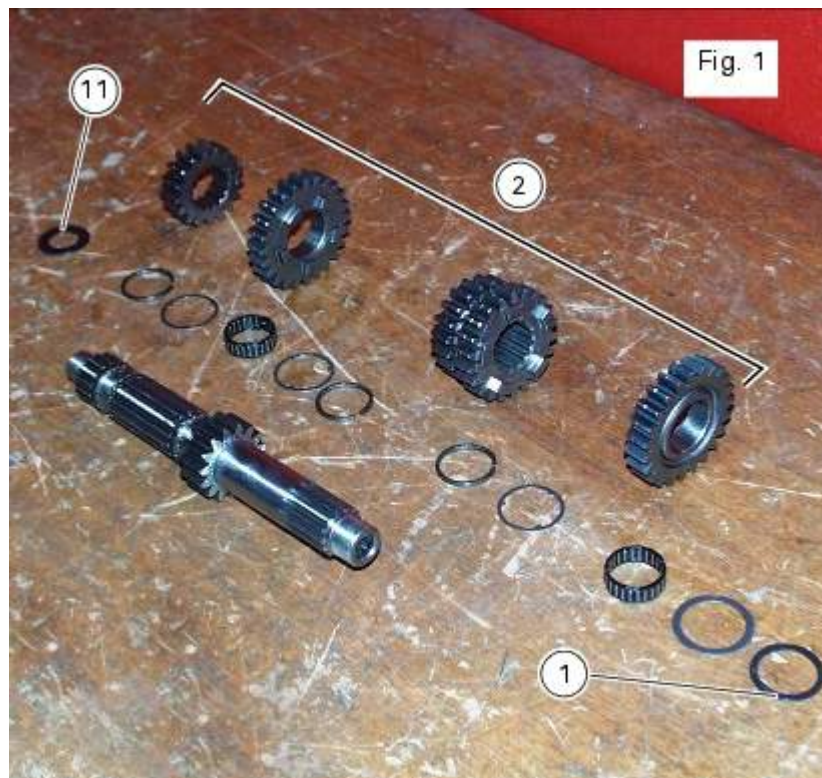


Figure 2 shows all the parts to be reassembled on the gearbox output shaft (25), with calculated end shims (15) and (26) (Sect. N 8.1, Shimming the shafts).



Reassemble the gears on the gearbox shafts by reversing the disassembly procedure.

Take particular care when installing the idler gears. The assembly of the 3rd and 4th speed gears and the relative fixing components on the output shaft is given as an example.

Fit the circlip (7), checking that it is fully inserted into its groove on the shaft.

Push the circlip into position with a suitable size tubular drift.



Slide the washer with three internal points (6) over the shaft until it locates against the circlip you have just fitted.



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To fit the needle roller cage (4) onto the shaft, first lubricate it with plenty of grease (of recommended type) and then open it slightly to make it easier to slide on to the shaft.



Fit the 3rd speed gear (22).



Fit the three-pointed washer (12), which can be distinguished from its counterpart (6) by its bigger outside diameter.



Fit another needle roller cage (4) using the method already described.



Fit the 4th speed gear (21).

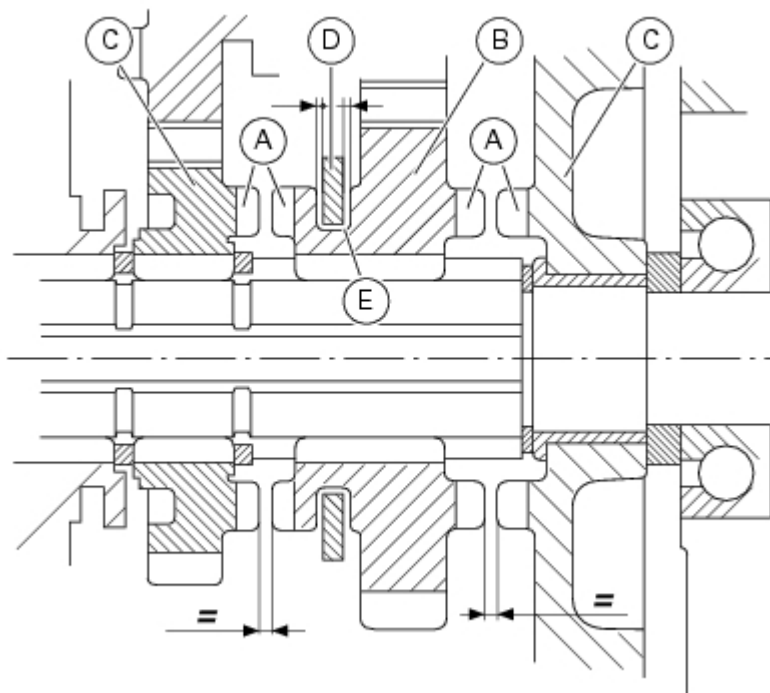


Fit another 3-pointed washer (6) and another circlip (7) onto the shaft. Seat the circlip using the drift used previously.



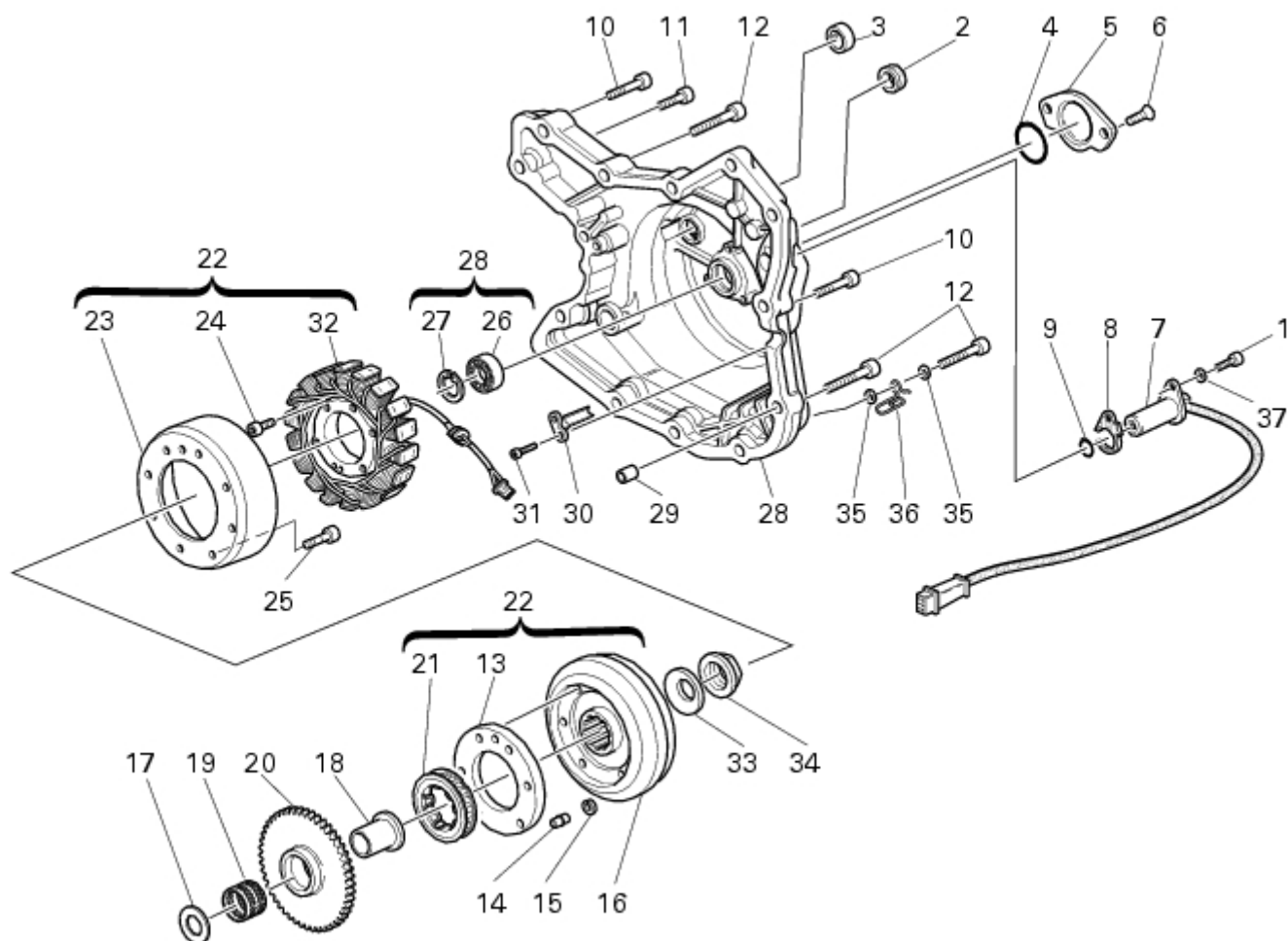
Reassembly of the gearbox

To reassemble gearbox components follow the procedure under Sect. N 8.1, Reassembly of the crankcase halves relating to reassembly of the crankcase halves. 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.



Reassemble the engine crankcase halves.

7 - Flywheel - alternator



- | | |
|----------------------------|-------------------------------------|
| 1 Bolt | 20 Electric starter driven gear |
| 2 Ignition inspection plug | 21 Starter clutch |
| 3 Oil seal | 22 Flywheel-starter clutch assembly |
| 4 O-ring | 23 Alternator rotor |
| 5 Cover | 24 Bolt |
| 6 Bolt | 25 Bolt |
| 7 Engine sensor | 26 Bearing |
| 8 Seal | 27 Circlip |
| 9 O-ring | 28 Alternator cover |
| 10 Bolt | 29 Locating dowel |
| 11 Bolt | 30 Bracket |
| 12 Bolt | 31 Bolt |
| 13 Flange | 32 Alternator stator |
| 14 Locating dowel | 33 Belleville washer |
| 15 Retaining ring | 34 Flanged nut |
| 16 Flywheel | 35 Washers |
| 17 Washer | 36 Hose clip |
| 18 Inner ring | 37 Spring washer |
| 19 Needle roller bearing | |

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Removal of the alternator cover

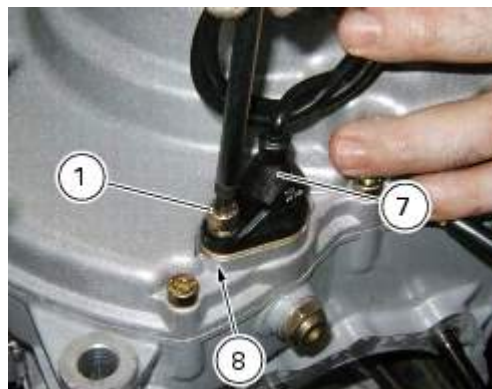
Drain the engine oil

Remove the gearchange control

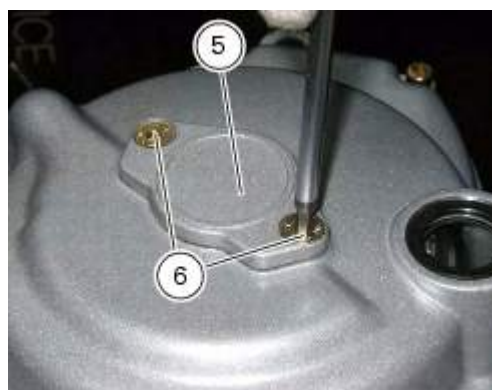
Remove the clutch slave cylinder

Remove the front sprocket cover

Undo the screw (1), recover the washer (37) and remove the engine sensor (7) on the alternator cover, taking care not to lose the shim (8) and O-ring (9).



Undo the two retaining bolts (6) of the centre cover (5) over the crankshaft.

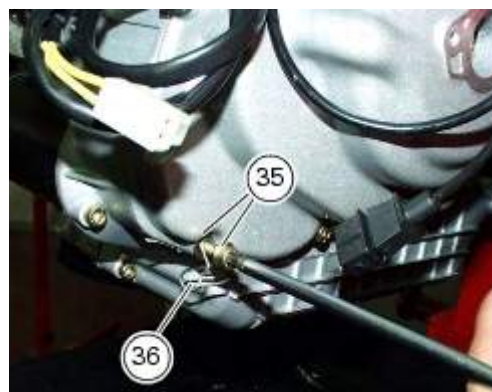


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Undo the alternator cover bolts (10), (11) and (12) shown in figure by the arrows.



Recover the two washers (35) and hose guide (36).



Fix service tool 88713.1749 to the holes of the two bolts (6) you have just removed.
Turn the tool shaft slowly to remove the cover (28) from the LH crankcase half



Disassembly of the alternator cover

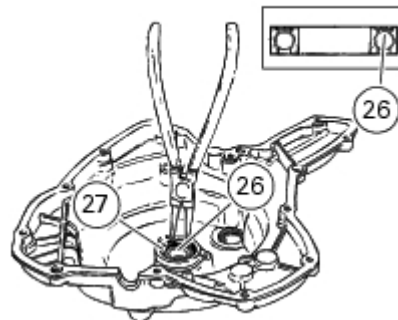
Undo the three stator retaining screws (24) and two screws (31) securing the cable guide bracket (30) from inside the alternator cover. Remove the stator (32) and the cable guide (30).



There is a bearing (26) inside the alternator cover in correspondence with the crankshaft, held in place by circlip (27).

Remove the circlip (27) with circlip pliers.

Remove the bearing (26) using a universal puller.



Removal of the flywheel / alternator assembly

Use tool part no. 88713.2036 fixed to the M10 sidestand fixing holes (D).

Lock tool to the flywheel with screw (E).



Unscrew the alternator / flywheel nut (34), heating it with a hot air gun; do not use a naked flame as this could damage the starting system components.

WARNING

While unscrewing the nut, apply axial pressure to the wrench socket to avoid damage or injury in the event of the wrench suddenly slipping off the nut.



Remove the nut (34), the Belleville washer (33) and the flywheel assembly (22).



Remove the driven gear (20) from the crankshaft.



Remove inner bush (18), the needle roller bearing (19) and the washer (17).



IMPORTANT

Check the inner bush (18), needle roller bearing (19) and inner washer (17) for wear.

NOTES

The hole on inner bush (18) allows the passage of oil for lubrication of needle roller bearing (19).

Checking the flywheel / alternator assembly

Check that the inner part of alternator rotor (23) shows no signs of damage.

Check that the starter clutch is working properly and that the needle races do not show signs of wear or damage of any kind. If there is any malfunction, remove the whole assembly.

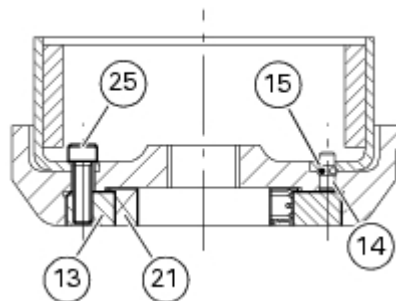
Disassembly of the flywheel-alternator assembly

Undo the eight bolts (25) and remove the alternator rotor (23) from the flywheel.



Slide out reference pin (14) and retaining ring (15).

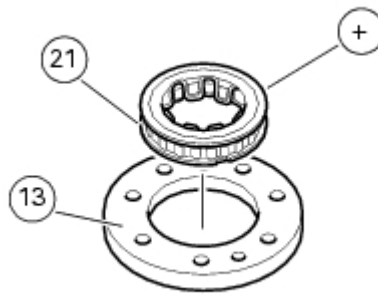
Insert two of the bolts (25) just removed from flywheel rotor-side in their holes in order to remove the flange (13) and the starter clutch (21).



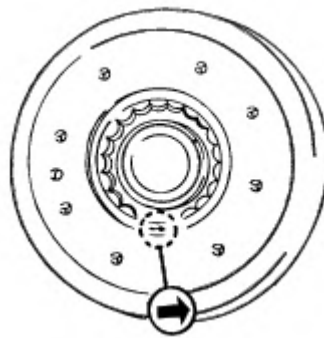
The starter clutch is a slight interference fit on the flange. To remove it, use a suitable drift.

Reassembly of the flywheel-alternator assembly

When refitting the starter clutch (21) on the flange (13), position it with the side with the largest diameter (+) seated against the flange. The chamfered side of the flange should be facing the starter clutch.



When refitting the starter clutch, note the arrow etched on outer ring indicating the direction of rotation of the engine.



To check that the starter clutch is in the correct position, proceed as follows, taking into account that flywheel rotates together with crankshaft as it is splined on the shaft. If you turn the crankshaft (and thus also the flywheel) counterclockwise, the starter motor and the idle gear will not move (as when the engine is running), while if you turn the crankshaft clockwise, the flywheel, the starter motor, and the idle gear will also turn.

IMPORTANT

When refitting the parts of the starter clutch, use engine oil only. Do not use grease as this could affect starter clutch operation.

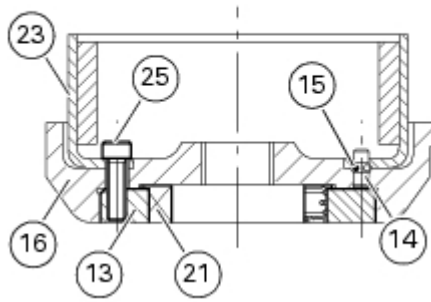
When refitting the flange (13) to the flywheel (16), position it with the tapered side facing the flywheel.



When refitting the flange to flywheel, insert a pin or a wrench inside the hole for the rotor flywheel locating dowel (14) in order to line up flywheel holes with flange. This operation proves useful since the hole cannot be aligned after having fitted the flange to the flywheel due to the interference fit of this part.

Position the locating dowel (14) with the circlip (15) on the flywheel.

Apply threadlocker to the screws (25) and fix the rotor (23), the flange (13) and the starter clutch (21) to the flywheel (16).



Tighten the bolts to the specified torque (Sect. 1.1).

Refitting the flywheel / alternator assembly

Fit the washer (17), needle roller bearing (19), and inner bush (18) to the crankshaft. Make sure the inner bush is centred on the washer. Fit the starter clutch driven gear (20) on the flywheel s tarter clutch. Fit the previously assembled flywheel (22) on the starter clutch (21), taking care not to alter the position of inner bush (18) with respect to the washer (17).



The flywheel reference mark must be aligned with the groove on the crankshaft, in correspondence with the keyway.

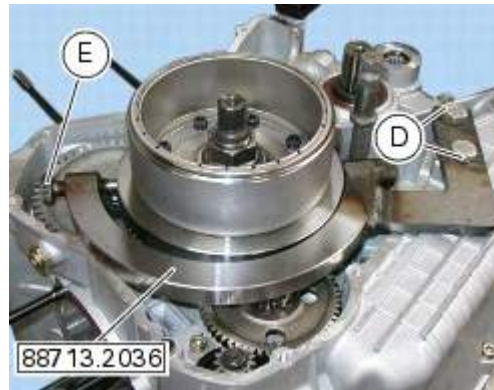


Lubricate the contact surfaces of Belleville washer (33) with engine oil. Fit the Belleville washer (33) on the end of the crankshaft.

IMPORTANT

The widest part of the Belleville washer (33) should be installed facing the flywheel.

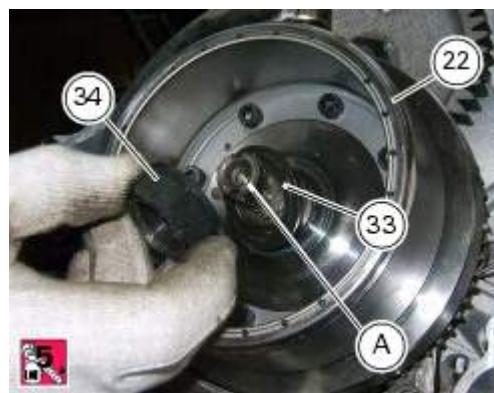
Restrain the rotation of the flywheel with the appropriate holding tool 88713.2036.



Remove all traces of Loctite from the threads of the nut (34) and the crankshaft (A).

To ensure that the threadlocker fills all the contact surfaces, apply as follow: 3 beads of threadlocker in an axial direction on the three generatrices along the thread of the crankshaft (A) and a bead inside the nut (34).

Fit the nut (34) on the end of the crankshaft (A): the widest part of the Belleville washer (34) should be installed facing the flywheel.



IMPORTANT

After applying the recommended threadlocker, immediately tighten the nut (34) to the specified torque (Sect. 1.1).

WARNING

It is advisable to wait at least three hours after tightening before starting the engine to ensure that the threadlocking compound is fully cured.

Refitting the alternator cover

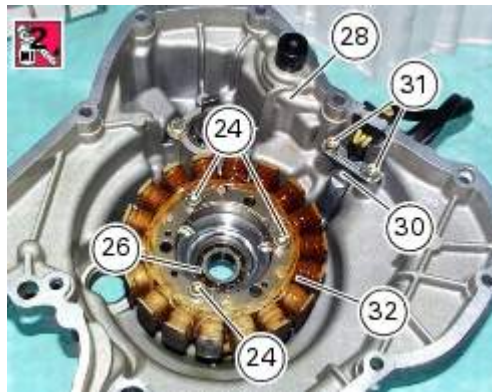
Install the stator (32) on the alternator cover, positioning it so that the cable is routed towards the notch in the cover.

Apply threadlocker to the stator fixing bolts (24) and tighten to the specified torque (Sect. 1.1).

Fit the cable clamp (30) and fix it to the cover with the two screws (31).

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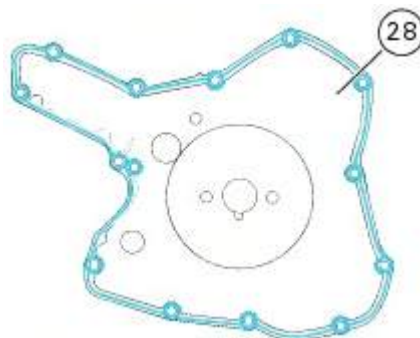
Before refitting, make sure that the crankshaft end bearing (26) and relative retaining ring are installed on the alternator cover (28).



Remove any scale and grease from the mating surfaces of the left-hand crankcase half and the cover. Fit the two locating dowels (29).

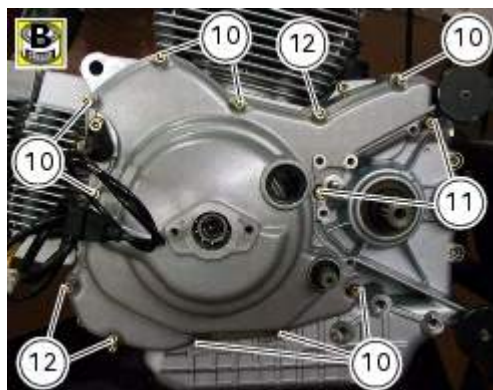


Spread a continuous uniform bead of DUCATI liquid gasket on the mating surface of the cover (28), ensuring continuity around the holes for the retaining screws and locating bushes.

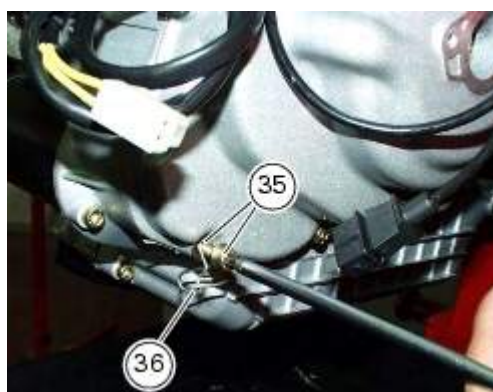


Grease the end of the crankshaft and the gearchange shaft to facilitate installation of the cover and to prevent the oil seal (3) from being damaged, if already installed in the cover. Tap the cover at different positions with a rubber mallet to facilitate its location on the shafts and locating dowels.

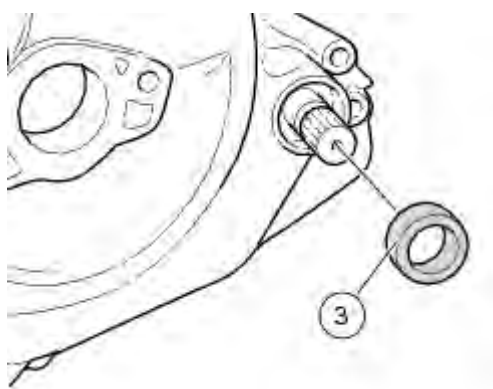
Rif	Q.tà	Descrizione
10	8	viti M6x25mm
11	2	viti M6x20mm
12	3	viti M6x30mm



Tighten the retaining bolts to the specified torque (Sect. 1.1).
 Fit the washer (35) and hose guide (36) under the bolt (12) in correspondence with the starter motor.
 Tighten the retaining bolts to the specified torque (Sect. 1.1).



Dampen the oil seal (3) with alcohol and install it in the alternator cover, in correspondence with the gear change shaft (Sect. N 6, Gearbox assembly: gearchange mechanism).



Install the O-ring (9) and the gasket (8) on the alternator cover. Locate the engine sensor (7) in its seat and secure it with the bolt (1) and the relative washer (37), tightening the bolt (1) to the specified torque (Sect. 1.1).



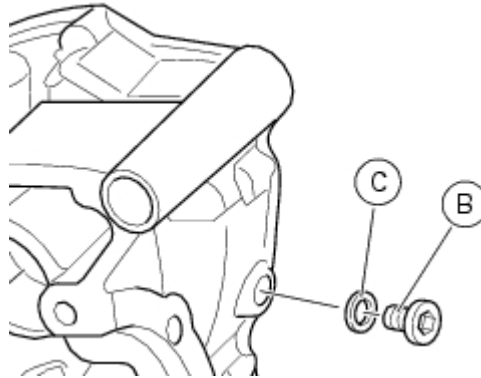
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Check also the air gap between sensor and timing layshaft gear as described below.

Checking the engine sensor air gap

The engine rpm sensor is designed to read the teeth of the timing layshaft gear and is able to determine engine speed by detecting the gap caused by the two missing teeth on the gear.

Remove the screw plug (B) from the inspection hole in the LH crankcase half.



Do not check the air gap at the point where the gear has two missing teeth.

Insert a feeler gauge (A) through the hole, positioning it between the end of the sensor and the teeth of the timing belt driveshaft gear.



SPESSORE 0,6 mm
(Color Rame)



SPESSORE 0,8 mm
(Color Inox)



SPESSORE 1,0 mm
(Color Ottone)



Check that the air gap is 0.75 to 0.95 mm. If it is not, loosen the bolt (1) securing the sensor (7) so as to extract the shim (8) and replace it with one of suitable thickness. Refit the plug (B) with the seal (C) and tighten to the specified torque (Sect. 1.1).

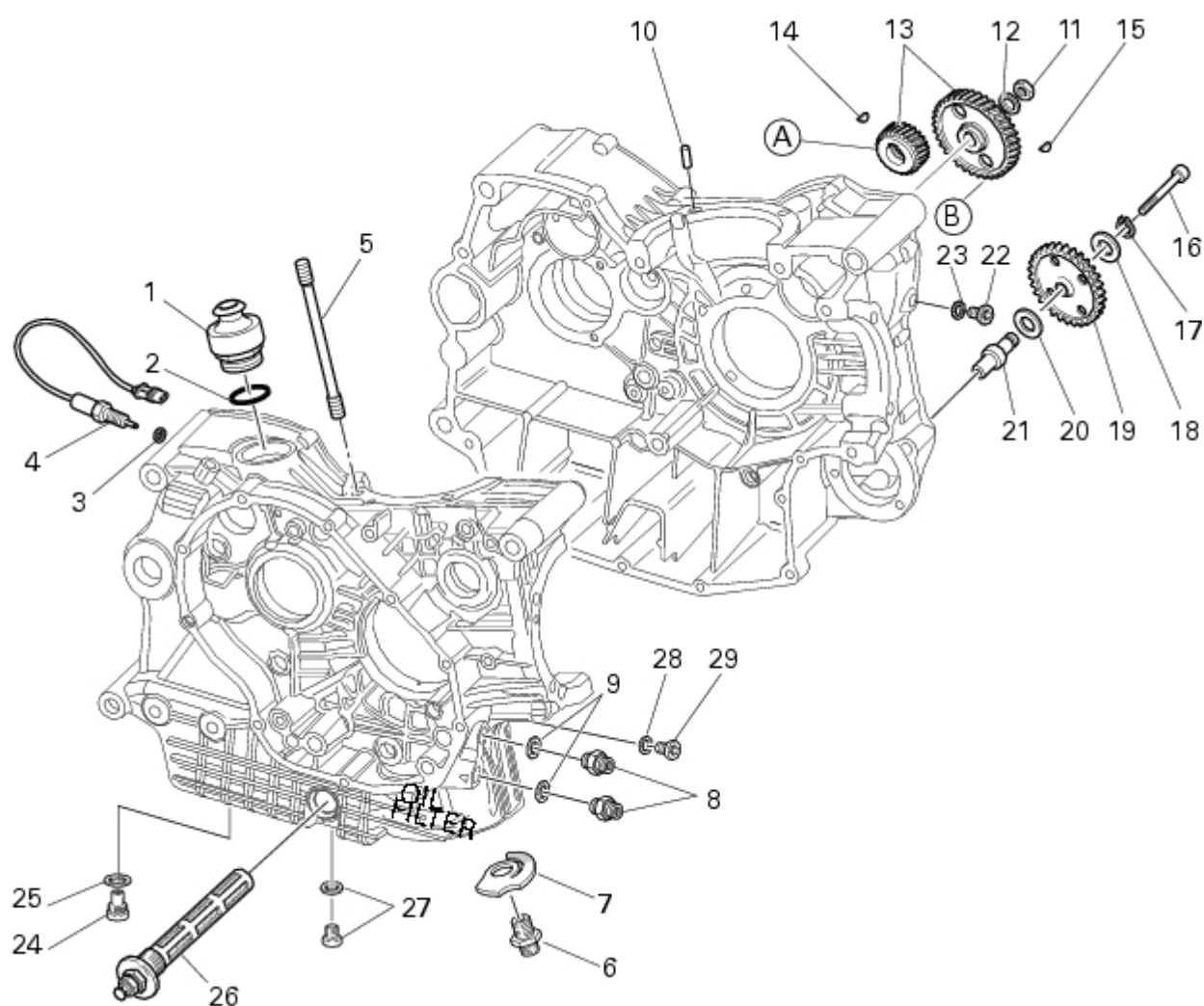
Refit the front sprocket cover

Refit the clutch slave cylinder

Refit the gearchange mechanism

Top up the engine oil

8 - Crankcase assembly: External components



- 1 Oil breather valve
- 2 O-ring
- 3 Seal
- 4 Neutral switch
- 5 Cylinder barrel / head stud
- 6 Nipple
- 7 By-pass spring
- 8 Nipple
- 9 Washers
- 10 Locating dowel
- 11 Nut
- 12 Lock washer
- 13 Timing gear pair
- 14 Timing drive gear
- 15 Timing driven gear
- 16 Key □□

- 17 Key
- 18 Bolt
- 19 Circlip
- 20 Washer
- 21 Starter idler gear
- 22 Washer
- 23 Gear shaft
- 24 Plug
- 25 Aluminium gasket
- 26 Plug
- 27 Aluminium gasket
- 28 Gauze pickup filter
- 29 Plug
- 30 Washer
- 31 Bolt □□

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Removal of external components

Remove the engine from the frame

Remove the lubrication system

Remove the cylinder head assemblies and the timing parts

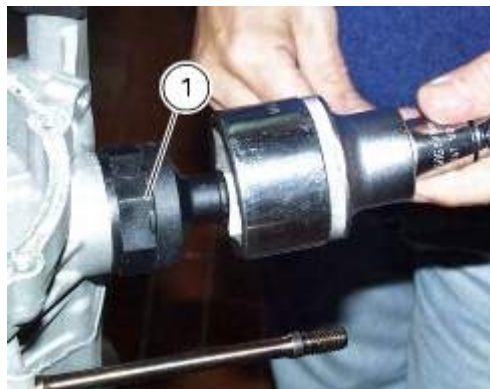
Remove the cylinder barrel/piston assemblies

NOTES

The following removal operations are required in order to renew and/or clean the crankcase halves.

If the original crankcase halves are to be reused, then the removal of these components is not essential.

Remove the oil vapour breather valve (1) from the crankcase along with its O-ring (2).

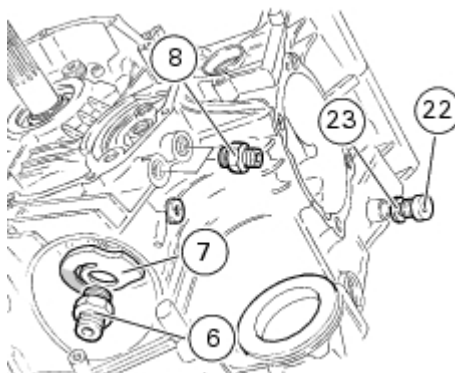


Unscrew and remove the oil inlet and outlet nipples (8) from the clutch-side crankcase half and recover the seals (9).

Unscrew and remove the oil filter cartridge.

Unscrew and remove the oil filter support nipple (6) and remove also by-pass spring (7).

Undo and remove the bolt (22) with the seal (23) for checking the air gap of the timing sensor.

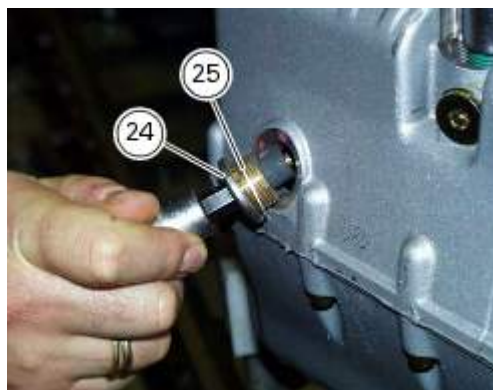


Bimota

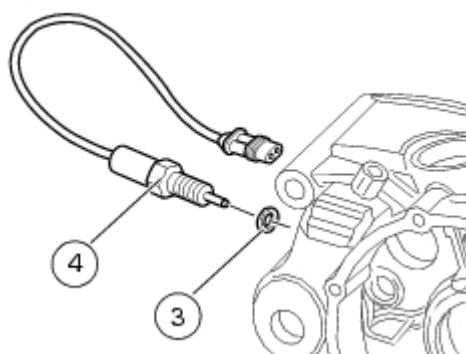
Remove the gauze pickup filter (26) with its seal from the clutch-side crankcase half as described in Sect. 2.2 of Tesi 3D Workshop manual.



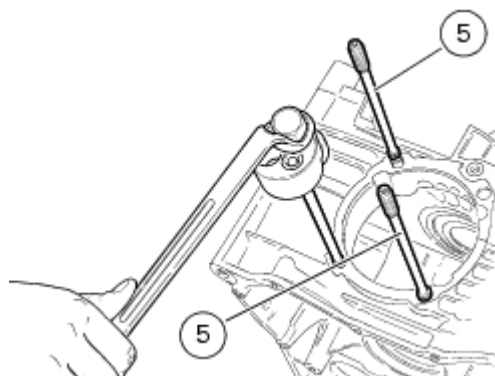
Remove the drain plug (24) with its seal (25).



Remove the neutral switch (4) with seal (3).



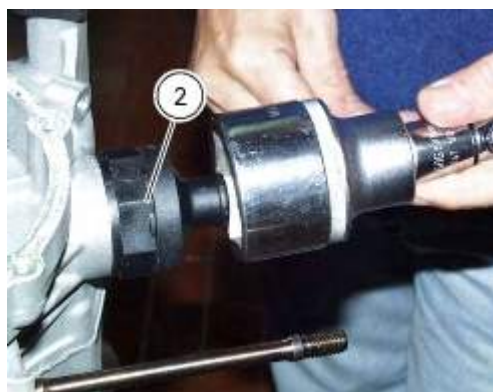
Remove the cylinder head studs (5) with the aid of the appropriate tool.



Refitting the external components

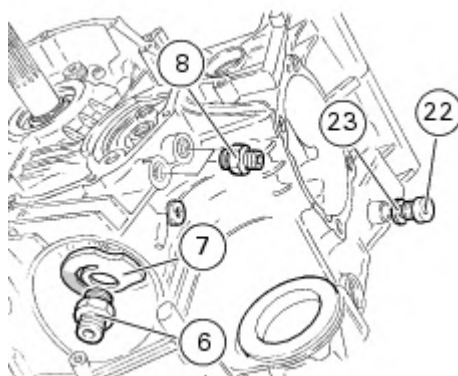
Check the condition of O-ring (2) and renew if necessary.

Install the oil vapour breather valve (1) in the crankcase with the O-ring (2) and tighten to the specified torque (Sect. 1.1).

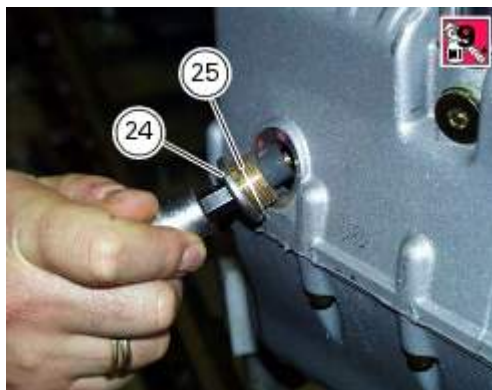


Tighten the two oil line nipples (8) with the seals (9) to the specified torque (Sect. 1.1).

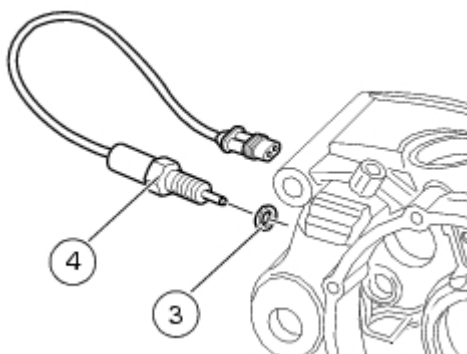
Locate the by-pass spring (7) and screw on the nipple (6) that supports the oil filter cartridge, tightening to the specified torque (Sect. 1.1).



Fit the drain plug (24) with its seal (25) and tighten to the specified torque (Sect. 1.1), applying the specified threadlocker. □



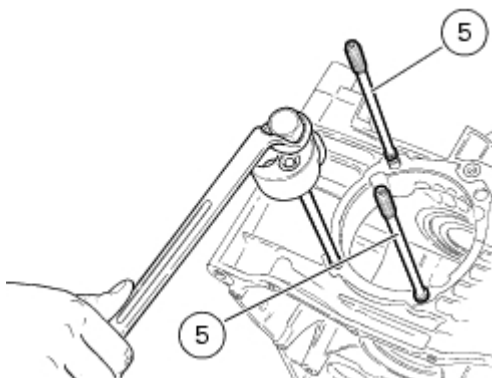
Refit the neutral switch (4) with its seal (3) and tighten to the specified torque (Sect. 1.1).



Refit the gauze pickup filter (26) with its seal.



Now fit the studs (5) on the crankcase halves, applying threadlocker and tightening to the specified torque value (Sect. 1.1). Use the special service tool for this procedure.



Refit the cylinder barrel/piston assemblies.
Refit the cylinder head assemblies and the timing parts.
Refit the lubrication system.
Refit the engine to the frame.

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Removal of the timing gears

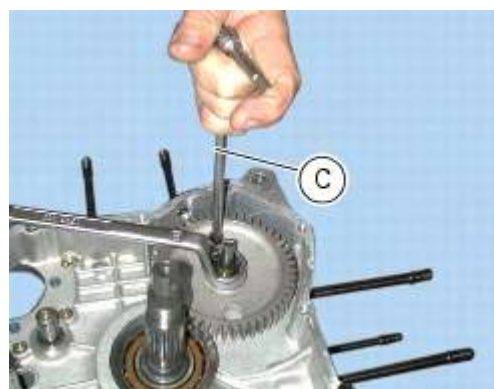
Remove the flywheel/alternator assembly.

Slide the drive gear (A) of timing gear pair (13) off the crankshaft along with the Woodruff key (14).

Relieve the staking on the lock washer (12) of the nut (11).



Restrain the driven gear (B) by inserting a rod (C) in one of the holes, and unscrew the retaining nut (11). Remove the nut (11), the washer (12), the driven gear (B) and the Woodruff key (15) from the timing belt driveshaft.





Refitting the timing gears

Before refitting, check the wear on the timing gear pair (13) and renew if necessary.

IMPORTANT

The timing gears (13) must always be renewed as a pair.

Refitting is the reverse of removal.

IMPORTANT

On completion of the refitting operations, check that tab washer (12) is staked against nut (11) in such a way as to prevent the nut from working loose.



Refit the flywheel/alternator assembly

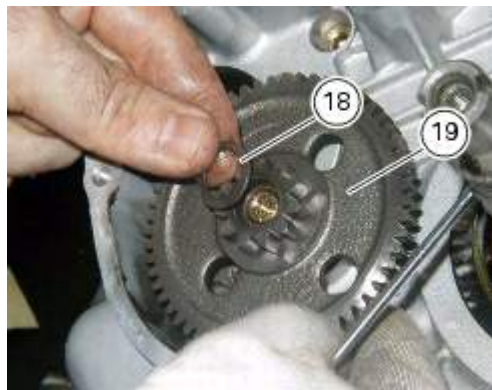
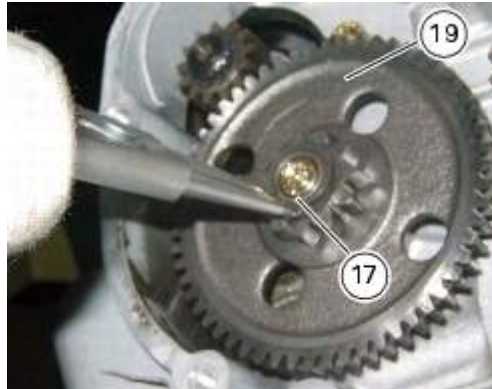
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Removal of the starter motor idler gear

Remove the flywheel/alternator assembly

Remove the circlip (17) and the washer (18).

Remove the starter motor idler gear (19) and the underlying shim (20).



Undo the screw (16) securing the idler gear shaft (21) and remove the shaft.



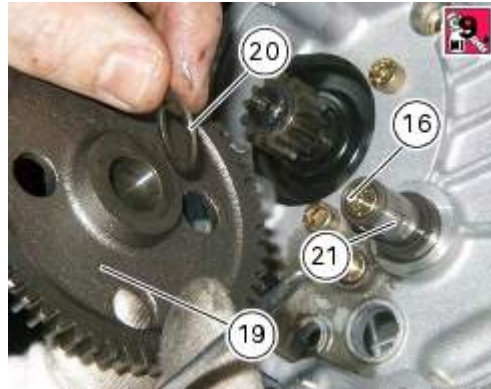
It is now possible to remove the starter motor.

Bimota

Refitting the starter motor idler gear

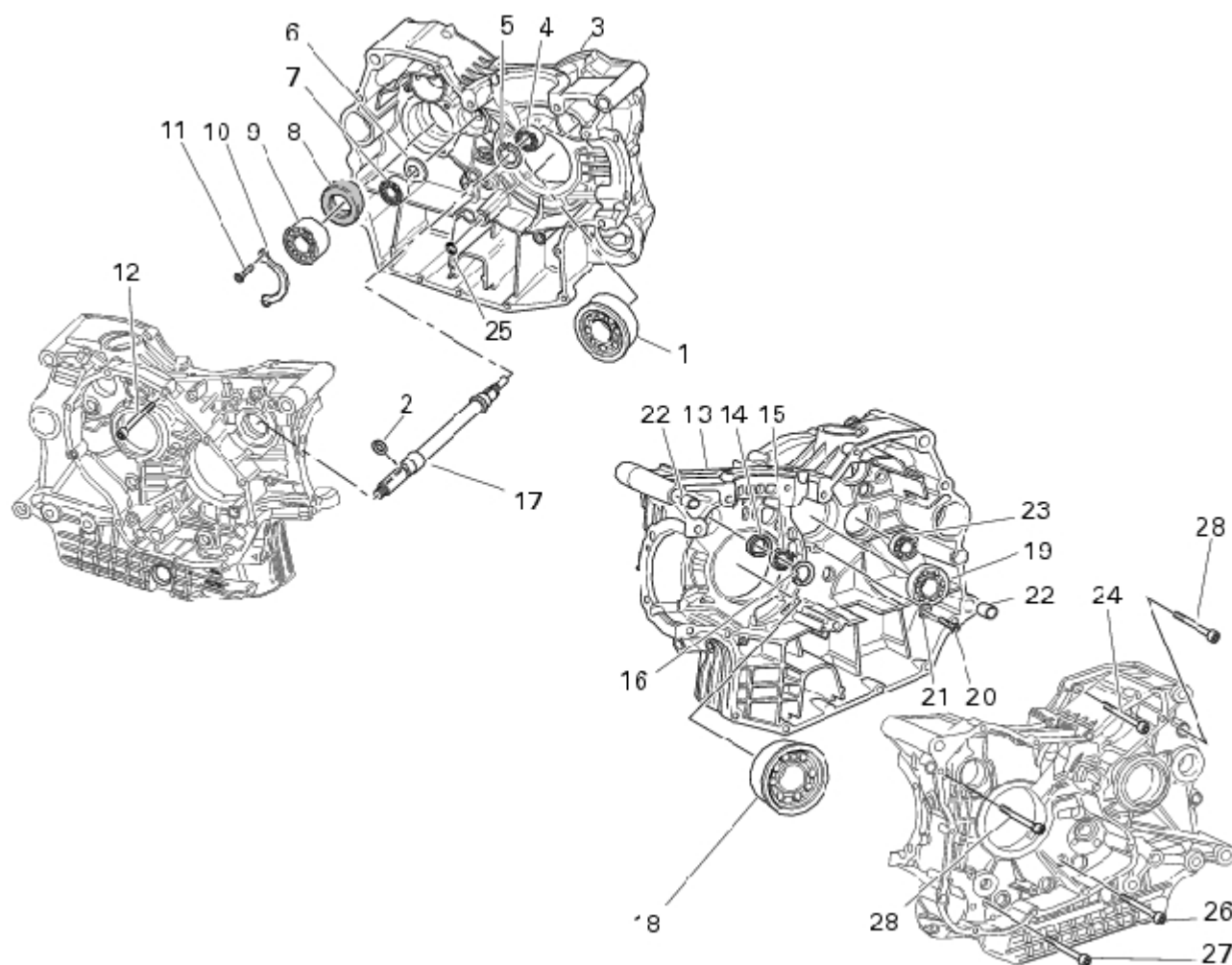
Refitting is the reverse of removal.

Apply the prescribed threadlocker to the screw (16) and tighten to the specified torque (Sect. 1.1).



Refit the flywheel/alternator assembly

8.1 - Crankcase assembly: Crankcase halves



- 1 Bearing
- 2 Circlip
- 3 Alternator - side crankcase half
- 4 Bearing
- 5 Circlip
- 6 Washer
- 7 Bearing
- 8 Oil seal
- 9 Bearing
- 10 Retaining plate
- 11 Bolt
- 12 Bolt (M8x75)
- 13 Clutch-side crankcase half
- 14 Oil seal □□

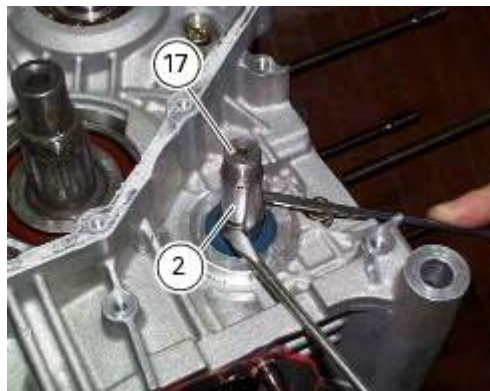
- 15 Bearing
- 16 Circlip
- 17 Timing belt driveshaft
- 18 Bearing
- 19 Bearing
- 20 Bolt
- 21 Spacer
- 22 Bush
- 23 Bearing
- 24 Bolt (M6x35)
- 25 O-ring
- 26 Bolt (M8x75, drilled)
- 27 Bolt (M6x75)
- 28 Bolt (M8x75) □□

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Separation of the crankcase halves

Remove the engine from the frame
Remove the lubrication system
Remove the cylinder head assemblies and the timing parts
Remove the cylinder barrel/piston assemblies
Remove the alternator cover and alternator assembly
Remove the engine starting system
Remove the clutch assembly
Remove the clutch cover
Remove the gauze pickup filter

Use two screwdrivers to prise the circlip (2) from the timing belt driveshaft on the clutch-side crankcase half.



NOTES

Take care to avoid scoring the surface of the shaft while removing the circlip.

Unscrew the alternator - side crankcase bolts.



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Unscrew the two bolts (12) on the clutch side near the vertical cylinder.



Re-use the alternator cover or a service cover with puller 88713.1749. Secure it to the crankcase half using some of the original bolts and begin separating the crankcase halves by turning the central pin of the tool. Tap the end of the gearbox output shaft with a plastic mallet to separate the crankcase halves.

NOTES

Take care not to lose the shims on the shafts and on the selector drum.



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Remove the gearbox shafts and gear selector drum from the crankcase halves as described in Sect. N 6.1, Gearbox assembly: gearbox shafts.

Drive out the crankshaft (L) using a plastic mallet, taking care not to lose the shims.

Remove the timing belt driveshaft (17) and recover the O-ring (25) in the oil way connecting the crankcase halves.



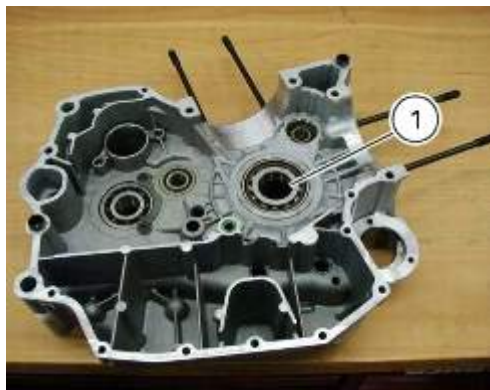
Overhaul of the crankcase halves

Carefully examine the engine crankcase halves.

Check that the surfaces of the crankcases are perfectly flat using a reference surface.

Check that the bearings (1) and (18) are in good condition

Note that the main bearings must always be changed in pairs (refer to the procedure below in "Main bearings").



NOTE

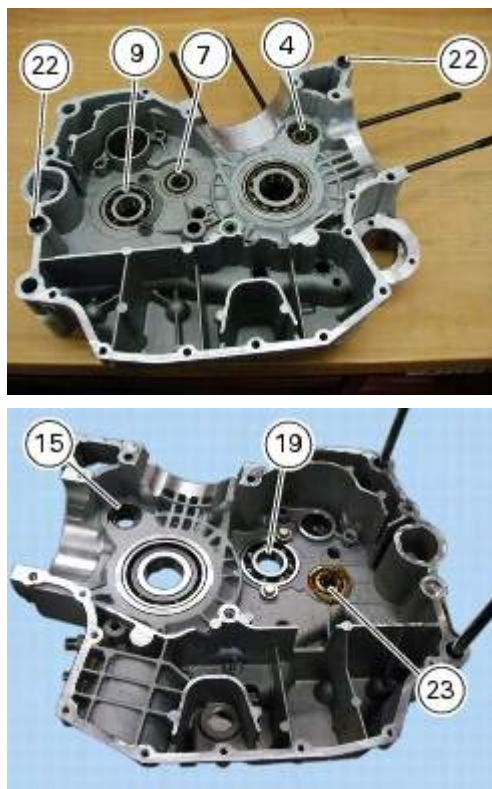
When overhauling an engine it is good practice to renew all the crankcase bearings.

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After having renewed the gearbox shaft bearings (19) and (9), secure them in the crankcase with the spacers (2) and the retaining plate (10).

At each overhaul it is recommended to renew also the oil seal (8) on the outside of bearing (9).

Renew the bearings (7) and (23) on the ends of the gearbox shafts and timing belt driveshaft bearings (4) and (15). Take care not to lose the shim (6) interposed between the bearing (7) on the end of the gearbox input shaft and the chain-side crankcase half. The oil seal (14) on the external side of the roller bearing (15) must be renewed at each engine overhaul.



Check that the oilways are free of restrictions or clogging.

Check the condition of locating dowels (22).

In the event of signs of distortion or excessive assembly clearance with the corresponding seats, remove the locating dowels using appropriate tools. If it proves difficult to remove the dowels (22) from the crankcase, use a tap with a left-hand thread to force them out.

IMPORTANT

The bushes (22) must always be renewed when they have been removed using the above procedure.

Main bearings

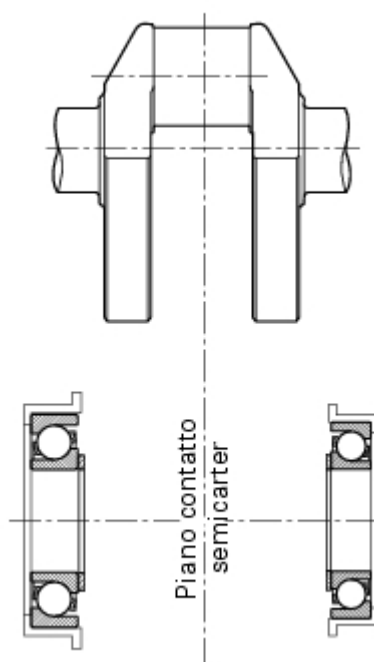
The main bearings have are of the angular contact type with offset inner races so that the balls transmit loads from one groove to the other along straight lines at an angle to the axis of the bearing.

Angular contact thrust bearings are designed to withstand combined loads (radial and axial loads).

Bearings of this type can bear thrust loads in one direction only. In fact, under the action of a radial load inside the bearing, an axial force is created that must be counterbalanced by an axial force acting in the opposite direction; that is why these bearings are generally fitted back to back in pairs.

To renew the bearings proceed as follows:

- heat the crankcase half in an oven to 100 °C.
- remove the bearing using a drift and hammer.
- install the new bearing (while the crankcase is still hot) keeping it perfectly square in its seat using a tubular drift that only bears on the outer ring of the bearing.
- allow the parts to cool and check that the bearing is securely seated in the crankcase.



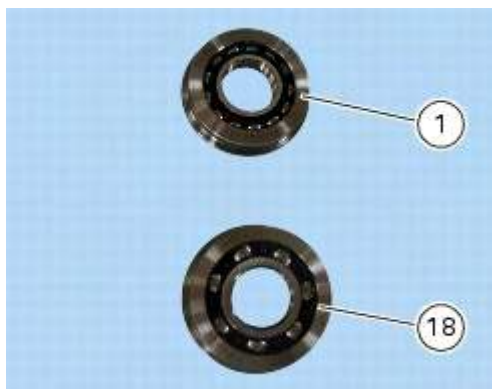
IMPORTANT

On worn engines, the bearing holder may no longer be a tight fit in the crankcase half.

Check that the interference fit between the crankcase and the bushes, with bearings (1) and (18) installed, is not less than 0.03 mm, otherwise the crankcase halves must be renewed.

NOTES

For shimming the main bearings, see the chapter at the end of this section.



Bimota

Reassembly of 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.

Refitting the clutch-side crankcase half

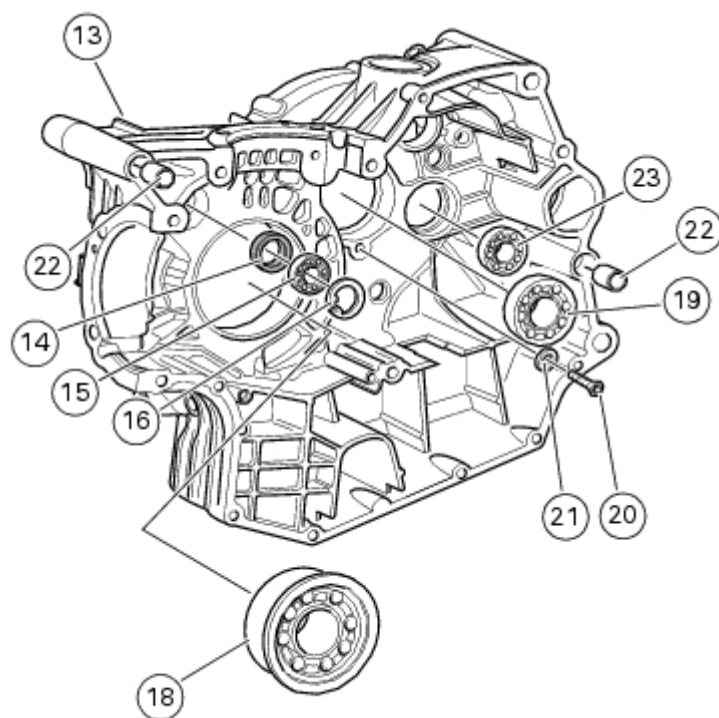
The following parts must be present on the internal side of the crankcase half:
the output shaft end bearing (23)

The input shaft bearing (19), secured with screws (20) and retaining spacers (21) the main bearing (18) complete with bush (17).



the roller bearing (15) with retaining circlip (16) installed in correspondence with the end of the timing belt driveshaft.

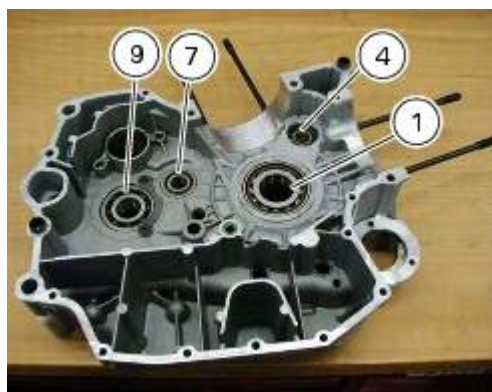




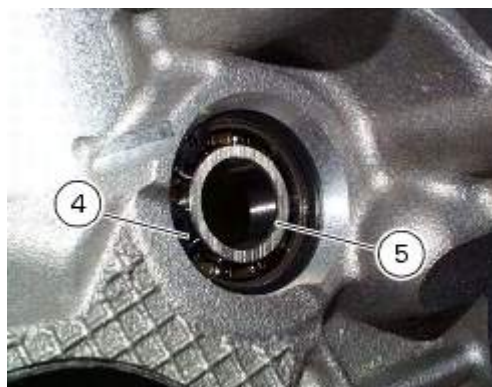
Refitting the alternator - side crankcase half

The following parts must be present on the internal side of the crankcase half:

- the double cage ball bearing (9) supporting the fork control shaft with stop plate (10) and retaining bolts (11)
- the gearbox input shaft end bearing (7) with the inner spacer (6)
- the main bearing (1)

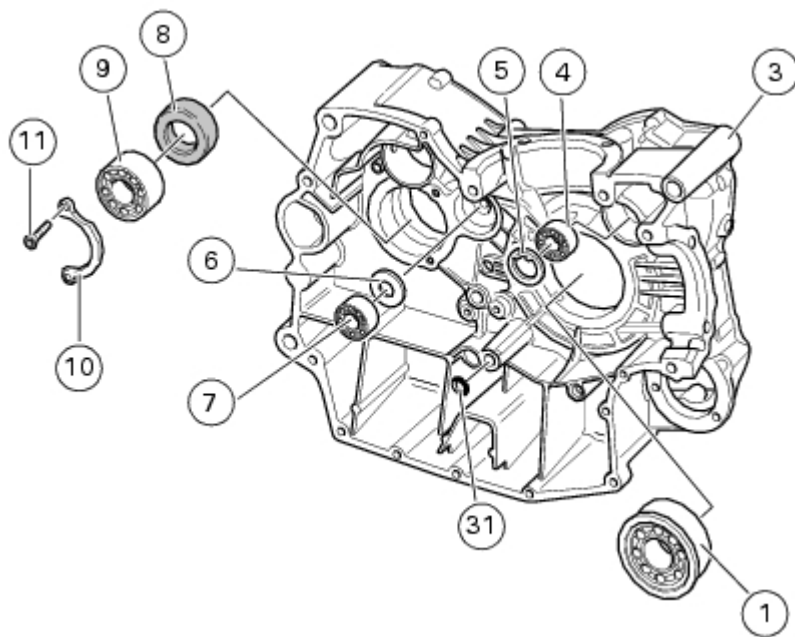


the bearing (4) with the retaining circlip (5) installed in correspondence with the timing belt driveshaft.



NOTES

None of the bearings except the main bearings have an obligatory assembly direction.



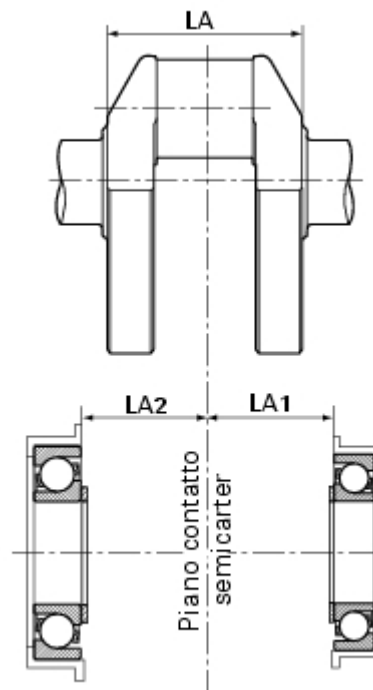
Shimming the shafts

Before assembling the crankcase halves, calculate the shims required to obtain the correct end float of the crankshaft and gearbox shafts.

To determine the correct shim thicknesses proceed as follows.

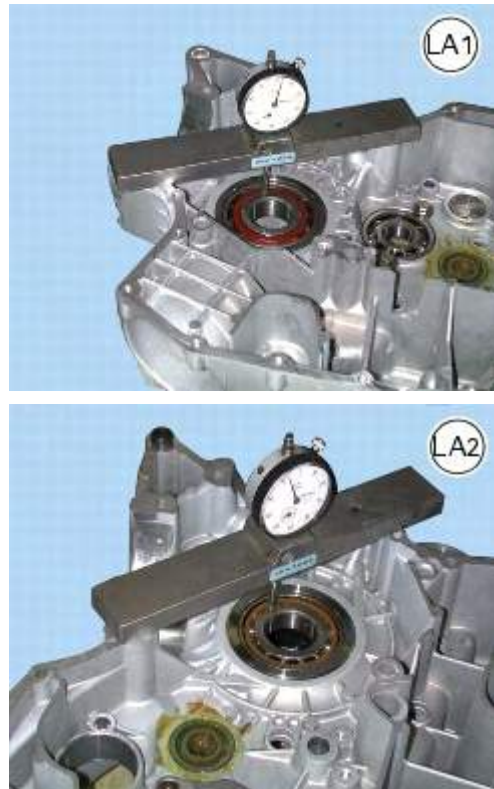
Shimming the crankshaft

After fitting the new main bearings, proceed as follows to determine the total shim thickness "SA": measure the distance "LA" between the bearing contact surfaces on the crankshaft.



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Measure the depths “LA1” and “LA2” corresponding to the distance between contact surface of the crankcase half and the contact surface of the inner race of the bearings.



Add a pre-load of 0.30 mm to prevent excessive crankshaft end float when the crankcase halves are at their normal operating temperature. This gives: $SA = LA1 + LA2 + 0.30 - LA$.

To calculate the each single shim thickness note that: $SA = SA1 + SA2$

where “SA1” and “SA2” represent the shims for the right-hand crankcase half 1 and the left-hand crankcase half 2.

Considering the alignment of the shaft, this gives: $SA1 = LA1 + 0.15 - LA/2$;

and finally, the second shim thickness: $SA2 = SA - SA1$.

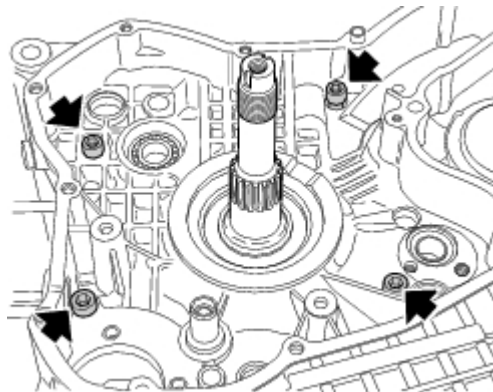
Practical method for determining crankshaft shims

In addition to the above description, the following text illustrates a practical shimming procedure, providing a guide on how to calculate the crankshaft shim thicknesses accurately.

Install a shim of minimum thickness (1.90 mm) on each side of the crankshaft, to prevent contact between the crankshaft web and the engine block.

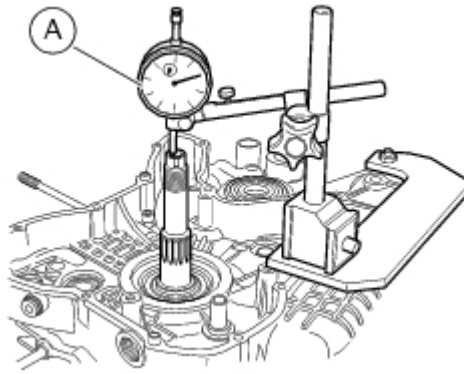
Install the crankshaft and assemble the two crankcase halves.

Fit four M8 screws into the holes shown in the figure and tighten to the specified torque (Sect. 1.1).

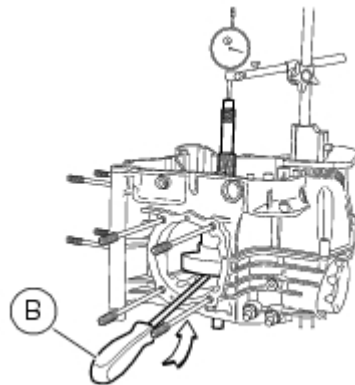


Place a dial gauge (A) with a magnetic base on a support plate fixed to the crankcase.

Bring the stylus into contact with the end of the crankshaft and set the dial gauge to zero in this position.



Insert a lever (B) between the crankcase and the crank web and force the crankshaft towards the dial gauge.



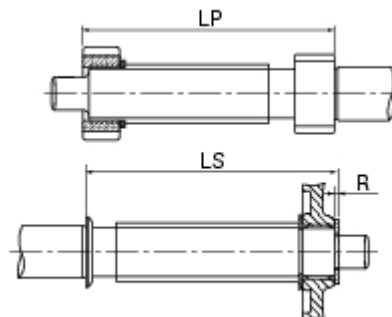
Note the dial gauge reading. This is the crankshaft endfloat. Add a preload of (0.30 mm) plus the thickness of the shims used ($1.90 \times 2 = 3.8$ mm). Divide the resulting value by two to obtain the thickness of the shim packs to be installed at either end of the crankshaft.

NOTES

After assembling the crankcase, the crankshaft should turn with some interference in the new bearings.

Shimming the gearbox shafts

To establish the total shim thicknesses to be installed on the input shaft "SP" and the output shaft "SS", proceed as follows: measure the dimensions "LP" and "LS" on the input and output shafts (for the output shaft add shim thickness "R" of 2.3 mm;



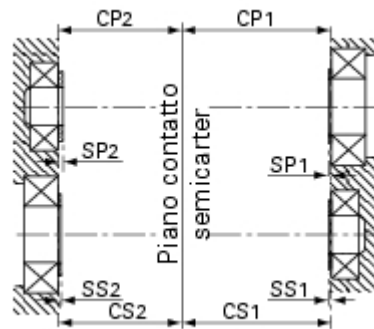
measure the depth corresponding to the distance between the contact surface of the crankcase half and the contact surface of the inner race of the bearing for the input shaft ("CP1" and "CP2") and for the output shaft ("CS1" and "CS2"); given that the end float should be in the range 0.05 to 0.20 mm, we will take the optimal value of 0.15 mm, this gives: $SP = CP1 + CP2 - LP - 0.15$ and $SS = CS1 + CS2 - LS - 0.15$.

To determine the thickness of each single shim pack, note that: $SP = SP1 + SP2$ and $SS = SS1 + SS2$

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Where “SP1” and “SP2” are the clutch- and chain-side input shaft shimming values respectively and “SS1” and “SS2” the corresponding values for the output shaft.

This gives: $SP1 = CP1 - 64 - 0.075$ and $SS1 = CS1 - 64 - 0.075$, so that $SP2 = SP - SP1$ and $SS2 = SS - SS1$.



Shimming the gearbox selector drum

A similar procedure is used to establish the total shim thickness “ST” for the gearbox selector drum given that:

LT1 = clutch-side crankcase half depth

LT2 = chain-side crankcase half depth

LT = gearbox selector drum shoulder

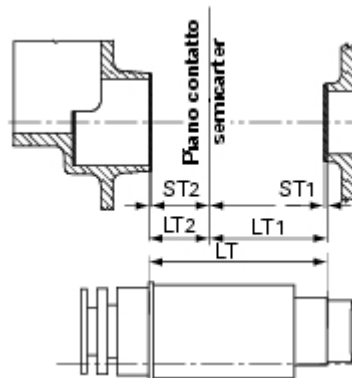
Given that the end float should be 0.10 to 0.40 mm.

and taking the mean optimal value of 0.25 mm.

This gives: $ST = LT1 + LT2 - LT - 0.25$.

Given that $ST = ST1 + ST2$

we obtain $ST1 = LT1 - 59 - 0.125$, so that $ST2 = ST - ST1$.

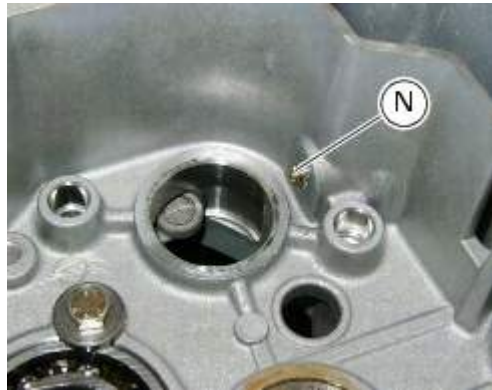


Practical method for determining the thickness of shims for the gearbox selector drum and gearbox shafts

In addition to the methods described provided above, the following is another practical procedure that can be used to determine the shim thicknesses to be installed on the gearbox selector drum (E) and the gearbox input and output shafts. □



First determine the selector drum end float without shims.
Open the crankcase, remove the crankshaft with the previously calculated shims.
Remove neutral switch (N) before inserting the drum in the crankcase to avoid the risk of damage.



Install the selector drum without shims and fix the crankcase half by tightening a number of the bolts in the area of the drum. Position a dial gauge (T) with magnetic stand on a support plate fixed to the crankcase. Bring the stylus into contact with the end of the selector drum and set the dial gauge to zero in this position. Apply leverage to the drum and measure the total end float, considering that final end float should be between 0.10 and 0.40 mm. Determine the shim thickness to be added.



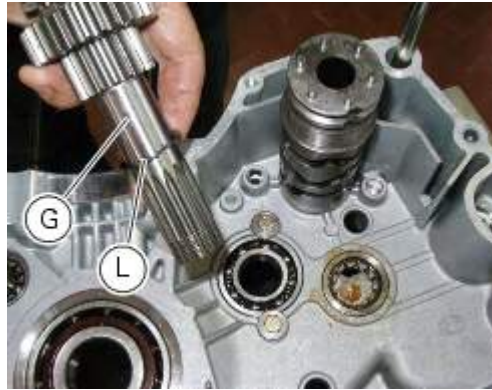
The total end float must be divided by two to obtain the shim thickness to be installed on each side of the gearbox selector drum.

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NOTES

It is preferable that the end float value obtained is nearer to 0.40 rather than 0.10 mm.

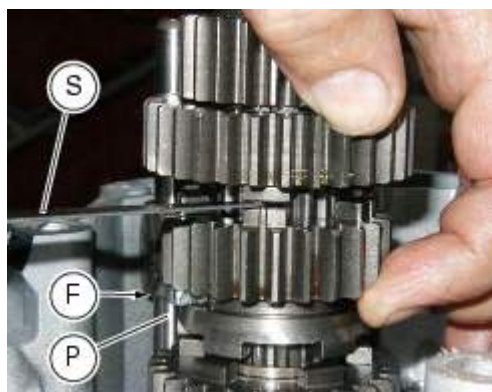
Open the crankcase again and fit the calculated shims either side of the selector drum.
As regards the gearbox input shaft (G), as a starting point use a shim (L) of the same thickness as that determined for the selector drum.



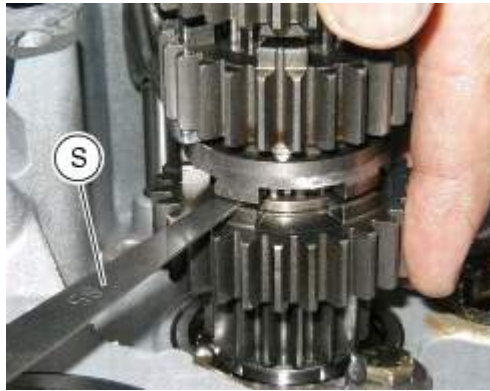
Position the input shaft in the right-hand crankcase half (clutch-side) with the above shim.



Fit the fork (F) and relative pin (P).



Check that the selector drum is in the NEUTRAL position when observing the end from the clutch side.
At this point, hold the input shaft in position, and check that the front coupling dogs of the sliding gear are equidistant from the couplings on the fixed gears.
Perform this check by inserting a feeler gauge (S) between the dogs.



NOTES

During this operation, push the sliding gear in one direction and then in the other in such a way as to eliminate play.

If the frontal coupling dogs are found not to be equidistant, substitute the input shaft shim spacer (L) for a more appropriate shim. Fit the output shaft with a shim (H) size 2.5 mm as a starting point.



Install the output shaft in the right-hand (clutch-side) crankcase half and the two selector forks with relative pin.



Now select the most suitable shim, working as described for the input shaft.



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Calculate the shim thickness for the left-hand (alternator-side) end of the shaft in such a way as to obtain end float close to 0.

Place a thin shim (1.5 mm) on the gearbox input shaft and no shim on the output shaft.

Remove the gear selector drum, the forks, and the relative pins.

Close the crankcase again, securing the two halves with several bolts in the area of the gearbox shafts.

Use the dial gauge to measure end float of the input and output shafts.



The final end float for both shafts must be between 0.05 and 0.20 mm.

NOTES

Preferably the value obtained should be closer to 0.05 than to 0.20 mm.

Gearbox positioning check

After shimming the gearbox shafts, reopen the crankcase.

Insert the forks (F) into the sliding grooves of the gears.



Fit the drum with the calculated shims. Position the forks on the drum and insert the relative pins.

Close the crankcase without the crankshaft in order to check the position on the gearbox.

Fit the gearchange mechanism (M) and adjust as necessary.



Observing from the opening of the horizontal cylinder, check that, with the gearbox in NEUTRAL, the frontal coupling dogs of the sliding gears are perfectly equidistant (Fig. 1 - Fig. 2) on both sides from the corresponding coupling dogs of the fixed gears.



With gear engaged, check that the fork is free in the groove of the sliding gear (Fig. 3).



Insert the 1st - 4th and 2nd - 3rd speed selector forks (D) in their respective channels in the driven gears of the output shaft.



NOTES

The two selector forks are identical.

Insert the 5th - 6th speed selector fork (E) in the driven gear of the input shaft.



Install the selector drum (F) in the crankcase with calculated shim thickness.



Fit the pins (G) in the previously installed selector forks.

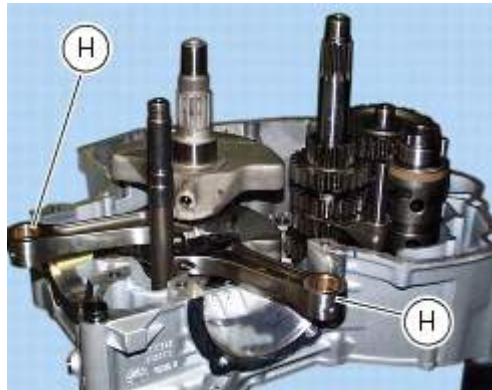


Fit the shimmed crankshaft into the clutch-side crankcase half, positioning the connecting rods (H) in correspondence with the relative cylinder barrel seats.

IMPORTANT

Make sure that the connecting rods (H) are correctly positioned in the respective cylinder seats.

Incorrect positioning of the connecting rods at this stage will inevitably lead to the need to re-open the crankcase.



Check that the two locating bushes (22) are correctly fitted.

Grease the O-ring (31) to hold it in position and install it on the oil way connecting the two crankcase halves.

Reassembly of the crankcase halves

Install the timing belt driveshaft (17) in the roller bearing (4) in the clutch-side crankcase half.

To avoid damaging the oil seal (14) on the timing belt driveshaft, protect the threaded end of the shaft with the special protective cap 88713.5749. Dampen the oil seal (14) with alcohol and fit it on the timing belt driveshaft, seating it against the roller bearing (4).

Fit the circlip (2) in the groove on the shaft and remove the protective cap.



NOTES

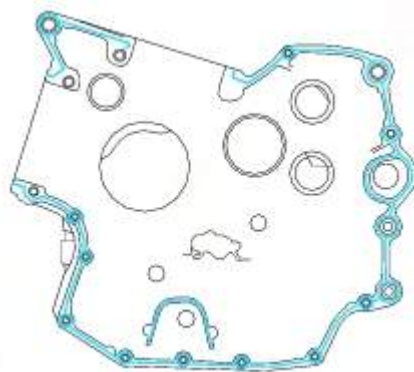
When refitting used components, make sure that the inner races (C) of the gearbox shaft bearings are fitted into the correct bearings and have not been left on the shafts.



Mesh the gearbox shafts and install them on the clutch-side crankcase half with the calculated shims.



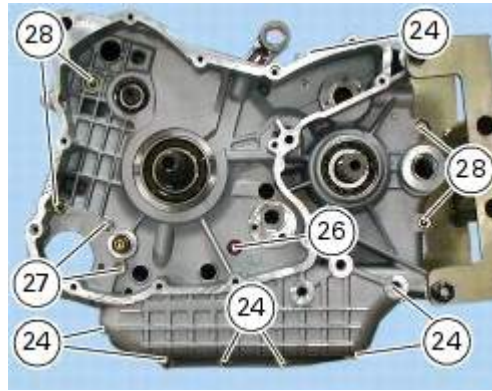
Apply a uniform and continuous bead of DUCATI liquid gasket to the mating surfaces of the crankcase halves, going around all the holes as shown in the figure.



Bring the crkcase halves (3) and (13) together, tapping with a rubber mallet in the area of the shafts if necessary.

Lubricate the crankcase bolts and insert them in the alternator-side crankcase half; note that the bolts are of different lengths.

Rif.	Q.tà	Descrizione
12-28	6	viti M8x75 mm
26	1	vite forata M8x75 mm
24	7	viti M6x35 mm
27	2	viti M6x75 mm



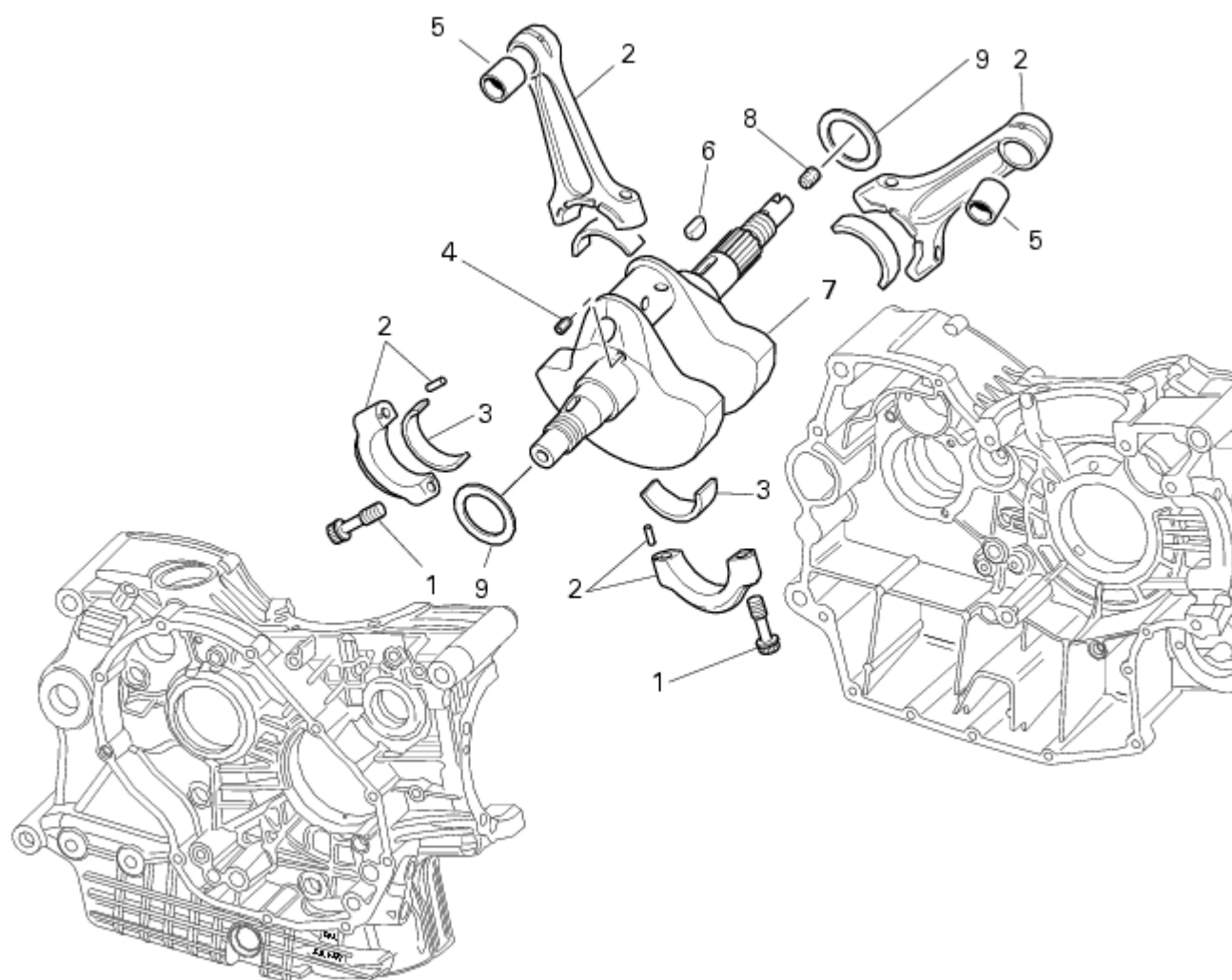
Progressively tighten the crankcase bolts until fully seated, starting with the bolts of the largest diameter (M8). Insert two M8 bolts (12) in the clutch-side crankcase half.



Starting with those of larger diameter, tighten all the bolts to the specified torque (Sect. 1.1). Check that the crankshaft can be turned with a certain amount of interference with the main bearings (the crankshaft should have a pre-load of 0.2 to 0.30 mm); check also that all the parts you have fitted are free to rotate or move correctly. Fit the filter cartridge as described in Section. 2.2 of Tesi 3D Workshop manual "Changing the engine oil and filter cartridge". Now install the oil seal (8) and the spacer with the O-ring on the gearbox output shaft. Renewal of the oil seal on the gearbox output shaft.

- Refit the clutch cover
- Refit the clutch assembly
- Refit the engine starter system
- Refit the alternator cover and alternator assembly
- Refit the cylinder barrel/piston assemblies
- Refit the cylinder head assemblies and the timing parts
- Refit the lubrication system
- Install the engine in the frame

8.2 - Crankcase assembly: Connecting rod assemblies



- 1 Vite speciale
- 2 Biella completa
- 3 Semicuscinetto
- 4 Grano filettato
- 5 Boccole
- 6 Linguetta
- 7 Albero motore
- 8 Grano filettato
- 9 Rosetta rasamento

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Removal of the connecting rods assembly

Remove the engine from the frame
Remove the lubrication system
Remove the cylinder head assemblies and the timing parts
Remove the cylinder barrel/piston assemblies
Remove the alternator cover and alternator assembly
Remove the engine starting system
Remove the clutch assembly
Remove the clutch cover
Separate the crankcase halves

The geometry of the shaft has been modified, with more centralised weights and a different arrangement of the oilway holes to obtain a more rigid crankshaft with reduced vibration and better reliability.

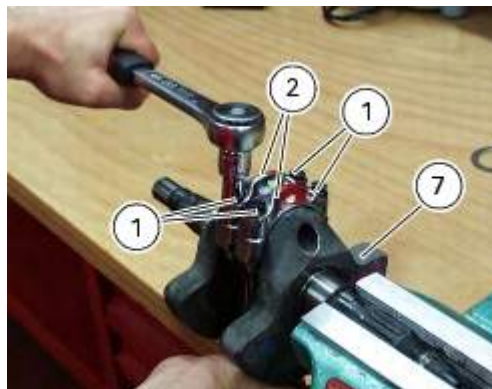
After separating the crankcase halves, withdraw the crankshaft (7) complete with connecting rods (2).

Disassembly of the connecting rods

To disassemble the connecting rod, undo the bolts (1) and separate the connecting rod from the crankshaft.

IMPORTANT

Take care not to mix up components of different connecting rods and maintain the original orientation.



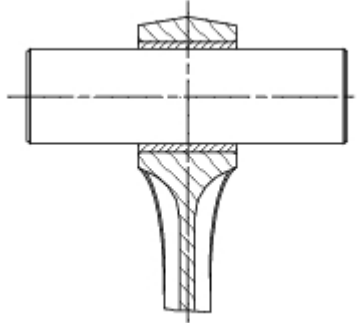
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Overhaul of the connecting rods

Make the following dimensional checks on the connecting rods:

- clearance with gudgeon pin on assembly.

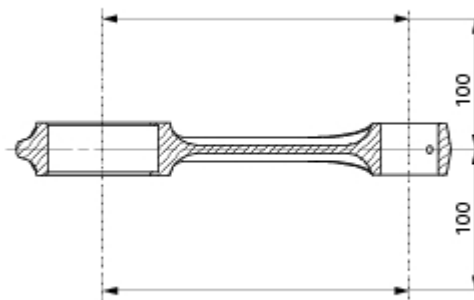
In the event of excessive wear (Sect. 1, Cylinder/Piston), renew the connecting rod.



The small end bushing must be in good condition and firmly driven into its seat.

Check for parallelism error measured at 100 mm from the connecting rod longitudinal axis:

the value must be $H - h$ less than 0.02 mm; otherwise, renew the connecting rod.



The connecting rod is supplied in two size classes A and B relative to the big end diameter (Sect. 1, Cylinder/Piston) as punch marked on the side of the cap.

It is preferable to use crankshaft and connecting rods of the same size class.

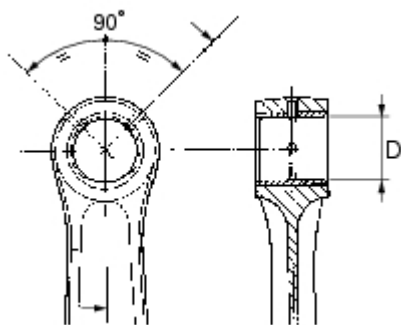
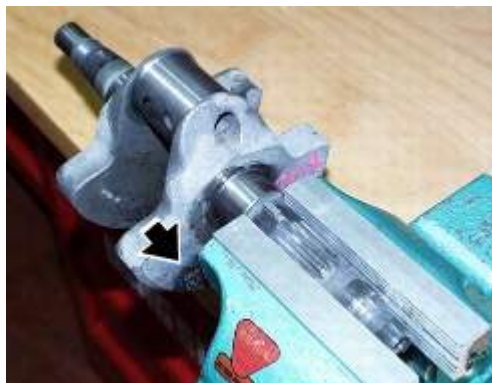
Renewal of the small end bushing

To remove the worn bushing, use a suitable drift and a press.

Drill lubrication holes into the new bushing in correspondence with the existing lubrication holes on the connecting rod small end.

Now ream out the bushing until the inside diameter (D) is 20.035 to 20.045 mm.



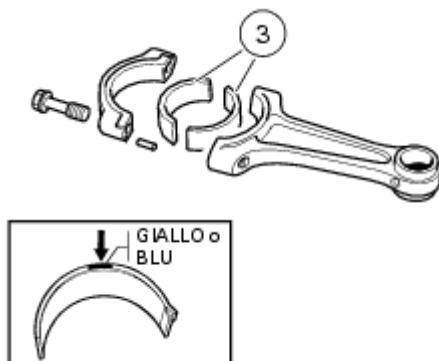


Renewal of the connecting rod bearings

It is good practice to renew the bearings (3) each time the engine is overhauled.



Replacement bearings are supplied ready for assembly 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 (YELLOW and BLUE).



The bearings are composed of an external steel ring, the inner face of which is electro-plated with a lead-based compound.

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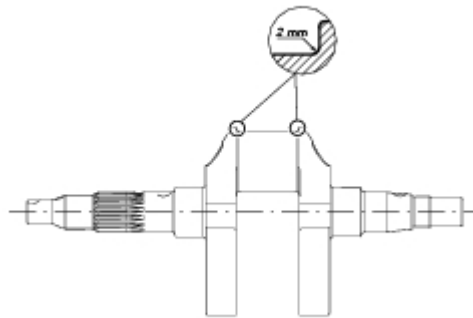
The table shows the appropriate bearings to be fitted according to the size class of the crankshaft and connecting rod.

Crankshaft overhaul

The main bearing and big-end journals 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: 2 mm.

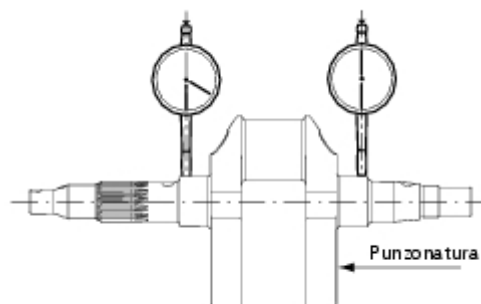


With the aid of a micrometer, measure the ovality and taper of the big-end journals, taking the measurements in various different directions.

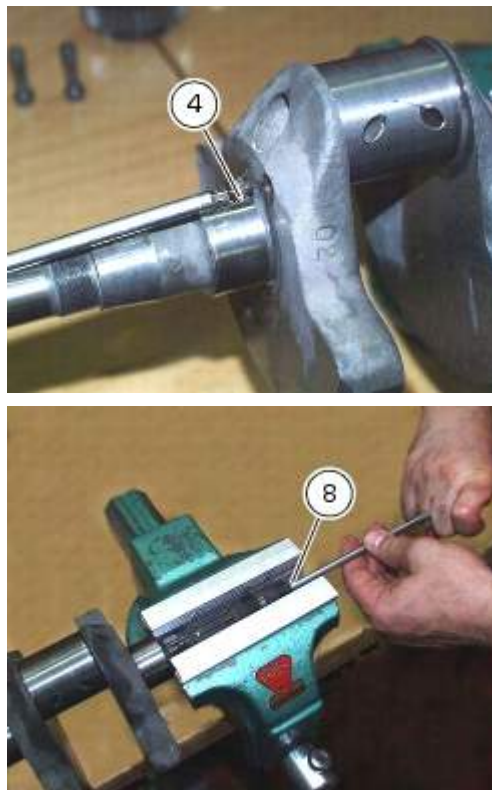
Use a dial gauge to measure the alignment of the main journals by setting the crankshaft between two opposing centres. At each overhaul it is strongly recommended to clean the crankshaft's internal oilways.

The prescribed values are given in Sect. 1.

The crankshaft is supplied in two size classes (journals) A and B, as punch marked on the side of the crank web on the pinion side.



Unscrew all the plugs (4) and (8) from the crankshaft, heating the crankshaft, if necessary, to remove the threadlocker applied at the time of assembly.



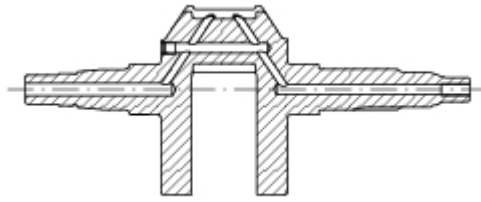
Clean all the oilways using suitable diameter metal brushes and then blow with compressed air to remove any residues that have accumulated and are restricting the oil flow.
Apply DUCATI liquid gasket to the threads of plugs (4) and (8) and refit them.



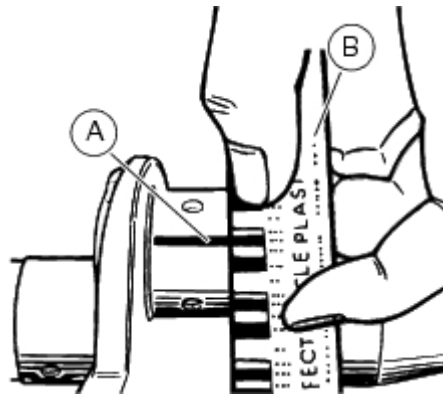
Tighten all the plugs to the specified torque (Sect. 1.1).

Bimota

Big-end bearing shell-journal clearance



To check the assembly clearance between the bearing shells and crankshaft journals you need to lay a strip (A) of GREEN “Plastigauge PG-1” on the journal. Fit the connecting rod with the original bearings and tighten the bolts to a torque of 50 Nm. Remove the connecting rod and compare the width of the Plastigauge strip to the scale (B).



If the width measured corresponding to the existing clearance is not within the prescribed limit (Sect. 1), either the bearings or the crankshaft must be renewed

Reassembly of the connecting rods

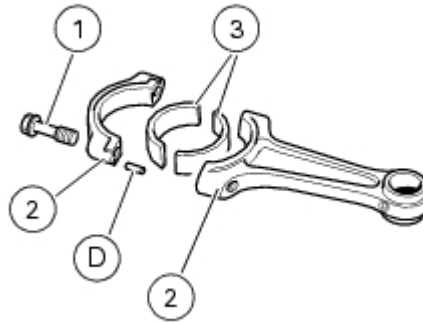
Before starting the work, check that the crankshaft main bearing journals and big-end journals are free of burrs or evident signs of machining: if necessary, clean the surfaces with very fine emery cloth and oil. Check that the grooves are in perfect condition with no signs of forcing.



Bimota

Check that each connecting rod (2) and cap are fitted with their locating pins (D).

Wash the pins and dry them with compressed air. Clean and lubricate the journals and con-rod bearing shells (3) with engine oil and fit the connecting rods in their original mounting positions.



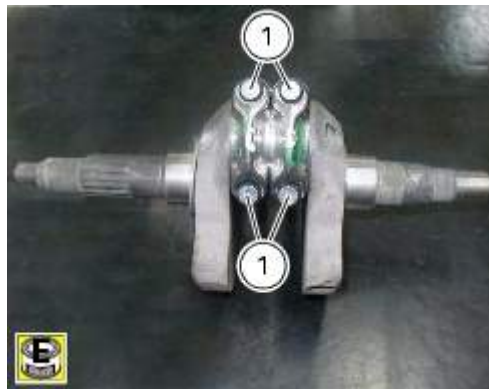
Use the recommended grease to lubricate the threads and underside of the heads of the new bolts (1) and the threaded hole in the connecting rod, packing in grease from both sides of the hole.

WARNING

The grease utilised is an irritant in contact with the skin. Wear protective gloves.

IMPORTANT

Lubrication of connecting rod cap bolts is essential to obtain the correct coupling and to prevent breakage of the parts.



Fit the spacer 88713.1309 between the connecting rods and eliminate residual end float by fitting the fork-shaped shim 88765.1000, which is available in the thicknesses 0.1 - 0.2 and 0.3 mm.

Tighten bolts (1) as specified: lubricate with the recommended grease;

stage 1 tightening to a torque of 20 ± 1 Nm

stage 2 tightening to 32 ± 1 Nm

stage 3 tightening to 67 Nm.



Bimota

Refitting the connecting rods

Install the connecting rod assembly (7) and (2) in the crankcase, carry out the shimming and crankcase reassembly procedure as described in Sect. N 8.1, Crankcase assembly: crankcase halves.

IMPORTANT

Make sure that the connecting rods (2) are correctly positioned in the respective cylinder seats.

Incorrect positioning of the connecting rods at this stage will inevitably lead to the need to re-open the crankcase.



- Refit the clutch cover
- Refit the clutch assembly
- Refit the engine starter system
- Refit the alternator cover and alternator assembly
- Refit the cylinder barrel/piston assemblies
- Refit the cylinder head assemblies and the timing parts
- Refit the lubrication system
- Install the engine in the frame