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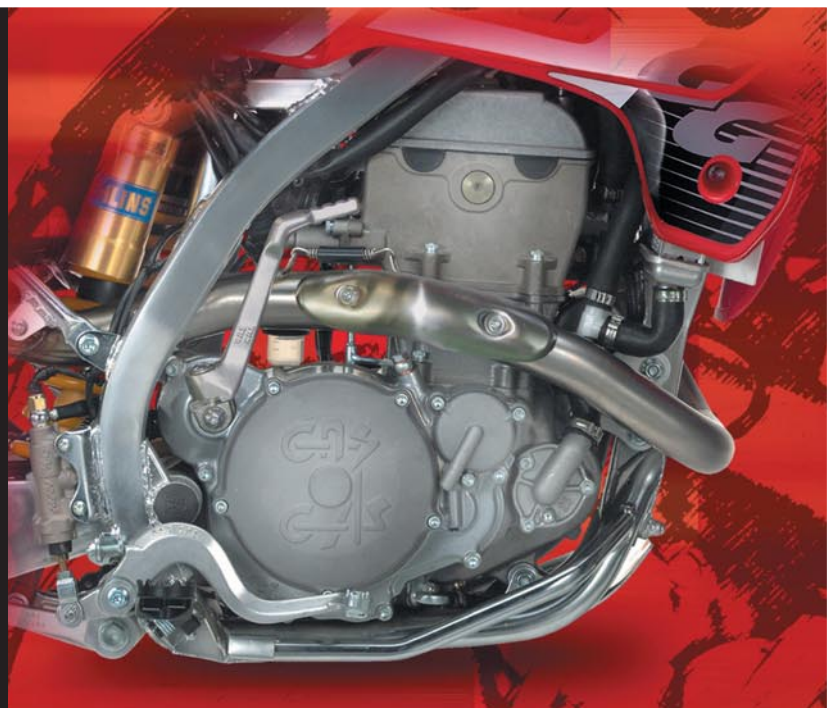

SERVICE MANUAL

MOTOR FSE400 / 450

2002 / 2003

GASGAS

Contents

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Technical Specifications

MODEL *Ec 400 / 450 FSE*

ENGINE

Cubic Capacity
399 cc. / 449 cc.
Type
4-stroke with 4-valve cylinder head
Number of Cylinders
One
Cooling System
Water-cooled
Bore and Stroke
90 x 62.6 mm. / 95 x 62.6 mm.
Injection
E.F.I. Magneti Marelli Electronic Fuel Injection System
Ignition
E.F.I. integrated
Clutch
Hydraulic-drive disc clutch
Gearbox
6 Gears

FRAME

Type of Frame
Deltabox, made from Cromoly rectangular tubes
Aluminium Rocker
Front Suspension
Inverted WP
43-mm Diameter
295-mm Stroke
Inverted Marzocchi
45-mm Diameter
295-mm Stroke
Inverted Öhlins
46-mm Diameter
295-mm Stroke
Rear Suspension
Progressive System fitted with Ohlins Shock-Absorber
320-mm Stroke
Front Brake
260-mm Disc
Nissin Pump and Nissin single plunger clip
Rear Brake
220-mm Disc
Nissin Pump and Nissin single plunger clip
Wheels
Type U D.I.D. Rims fitted with Michelin Comp3 Tyres

DIMENSIONS

Wheelbase
1475 mm
Seat Height
940 mm
Minimum Ground Distance
340 mm
Fuel Tank Capacity
9.5 Litres

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Engine Removal and Installation

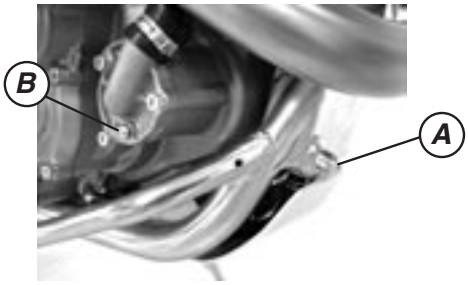
Engine Removal

Before removing the engine from the frame, wash it with a steam machine.
The following steps cover the disassembly sequence.

Remove the saddle and the frame covers.

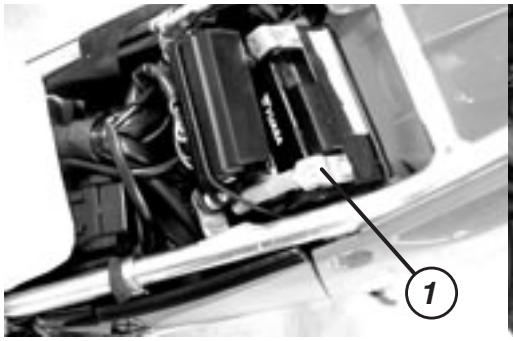
Drain the oil in the engine. .

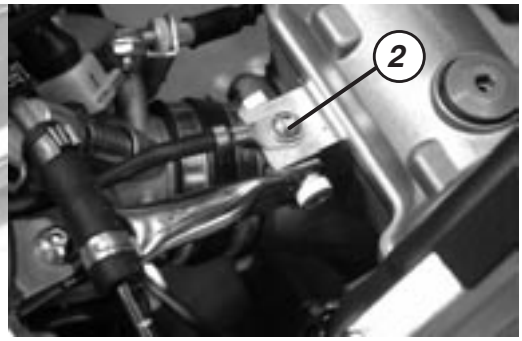
Remove the engine plate.

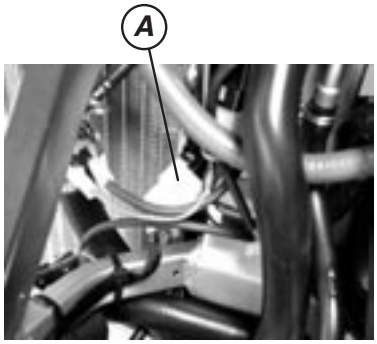


Drain the frame oil reservoir (A).
Drain the engine coolant (B).

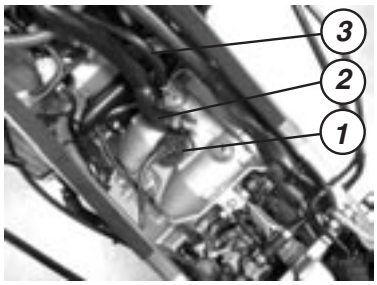
Detach the cable (-) from the battery (1) and the ground coupler from the engine (2).



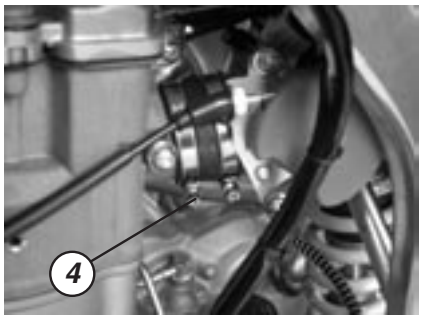




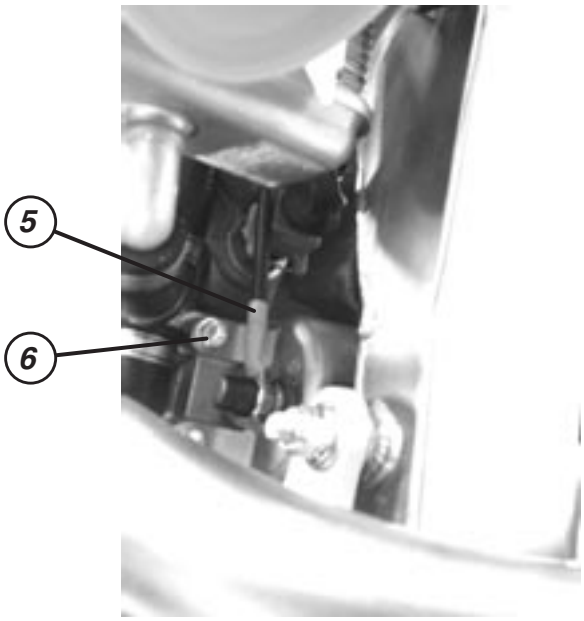
Detach the wire clamp from the alternator (A) and the sensor cable from the tonewheel.



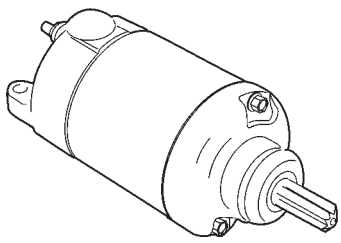
Detach the spark-plug arm (1), the engine-oil devaporizing tube (2), the engine-oil reservoir breather pipe (3).



Loosen the clamp holding the cylinder head injector conduit (4).

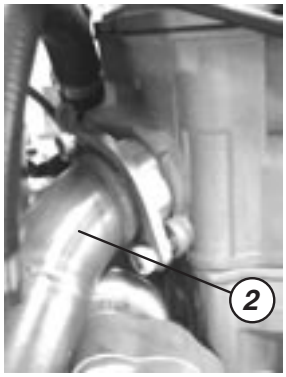


Detach the wire clamp from the water-temperature sensor (5).
Detach the connecting cable from the starter (6) and remove the starter.



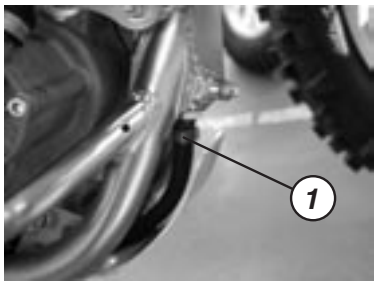
Remove the water tubes (1).

Remove the lever from the pedal-operated starter.



Remove the exhaust manifold (2).

Detach the radiator tubes.

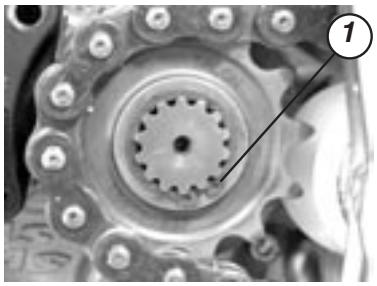


Detach the engine-oil tube (1) in the frame reservoir.

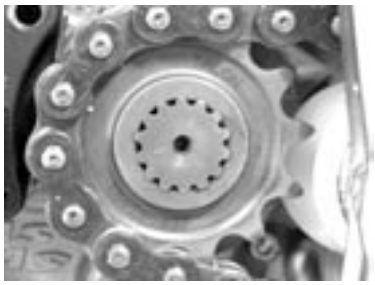
Remove the gearbox lever.

Remove the engine-pinion cover.

Remove the clutch pump.
Loosen the chain.



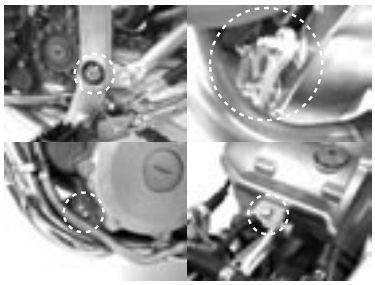
Remove the outlet pinion Seeger (1).



Remove the engine pinion.

Remove the split pin and the brake pedal.

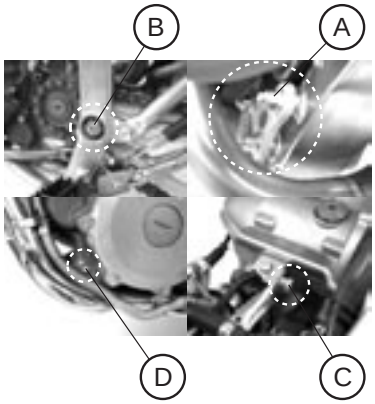
CAUTION!
Replace the split pins with new ones.



Remove the engine from the frame.

Engine Installation

Reverse the above operations to install the engine.



Fit the screws and nuts securing the engine.

NOTE:
At this stage, nuts must only be tightened provisionally.
The nuts securing the engine are self-locking. Upon removal, they cease to be self-locking and become useless.

CAUTION!
Replace the nuts securing the engine with new ones.

Secure the screwheads with a spanner and tighten the nuts securing the engine at the specified torque.

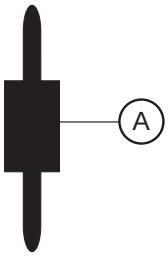
Item	*Nm*	*Kgf-m*
A	*66*	*6,6*
B	*66*	*6,6*
C	*14*	*1,4*
D	*66*	*6,6*

Screw length

(A): 108 mm.
(B): 110 mm.
(D): 103 mm.

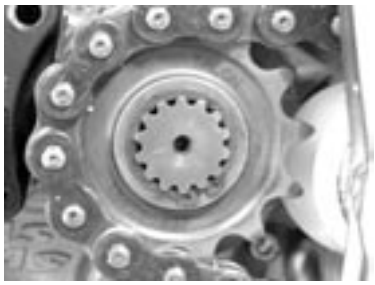
Tighten the brake-pedal screw at the specified torque.

Brake-pedal screw: 29 Nm (2,9 Kgf-m)



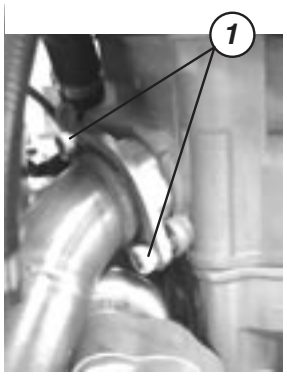
Attach the engine pinion.

NOTE:
The previous CW/ACW direction of this pinion must be duly noted, so that the same wear CW/ACW direction may be preserved.



Attach the engine pinion Seeger.

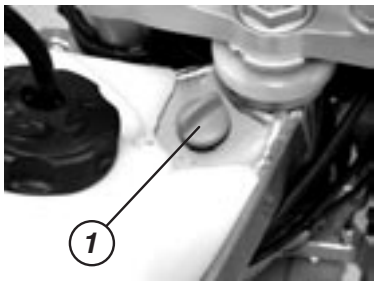
Attach the tube to the frame reservoir.



Tighten the exhaust manifold screw (1) at the specified torque.

Apply NURAL 29 component to the exhaust-system joints.

Apply LOCTITE 243 to the screw on the pedal-operated starter lever, then tighten.

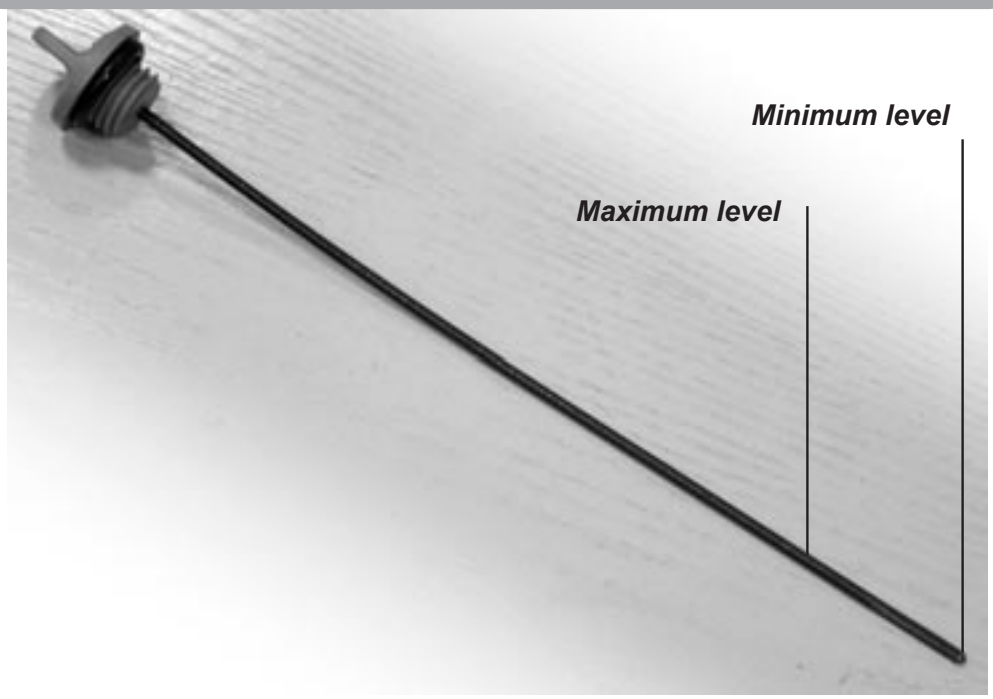


For 1.9 litre of API-compliant SF- or SG-grade motor oil and SAE 10W-40-viscosity oil into the oil inlet located in the frame (1) and check the level.

DETAILS
Engine oil capacity
Oil replacement: 1.7 l
Oil and filter replacement: 1.9 l
Overall engine check: 1.9 l

3 min.

Start the engine and leave it ticking over for about 3 minutes.
Stop the engine, wait for 3 minutes, then check the oil level with the dipstick.



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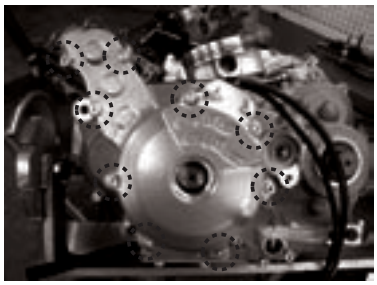
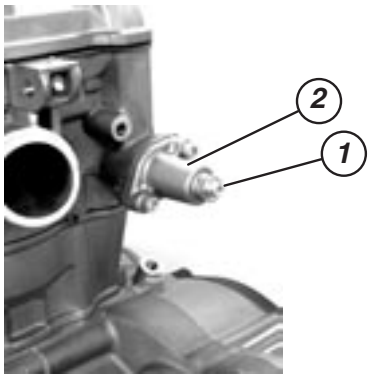
Engine Disassembly



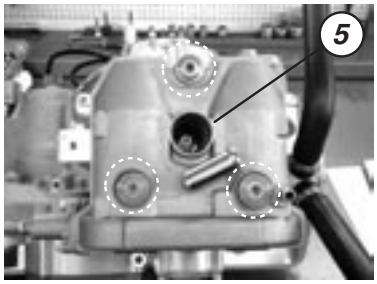
Detach the alternator cover.

Turn the alternator rotor until the 7th tonewheel tooth becomes aligned with the position-sensor hole centre.

NOTE:
The cylinder-head lid must be removed with the piston in the compression stroke PMS.

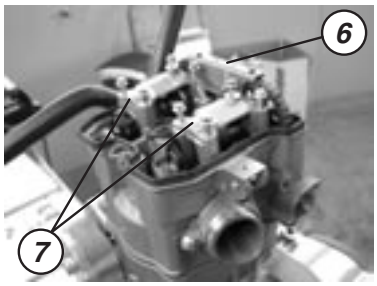


Remove the cap bolt (1) and the timing-chain idler (2).

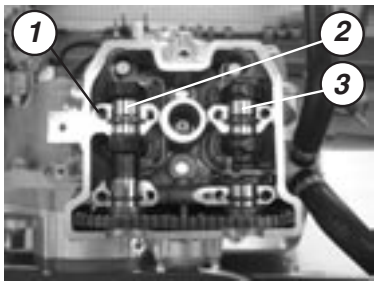


Remove the spark plug (5).

Then, remove the cylinder-head lid screws in a diagonal sequence and detach the cylinder-head cover.

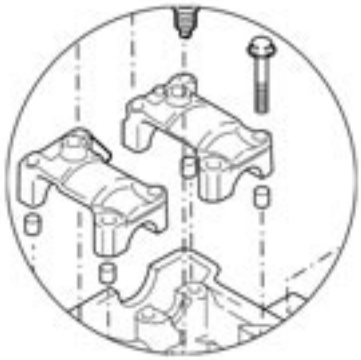


Remove the chain guide (6) and the brackets of the camshaft journals (7).

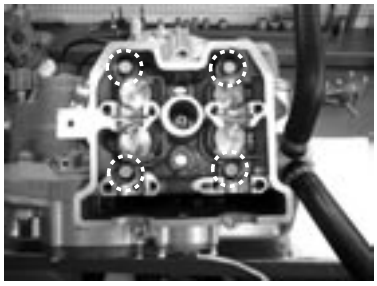


Remove the centering devices (1),
the input camshaft (2)
and the output camshaft (3).

NOTE:
Prevent the centering devices from falling into the crankcase.



Remove the cylinder-head side screw.

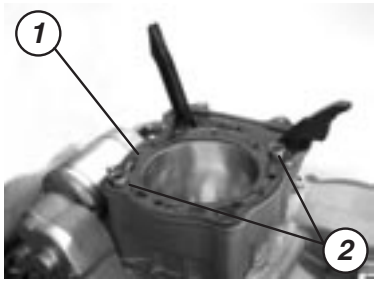


Remove all four cylinder-head screws in a diagonal sequence.

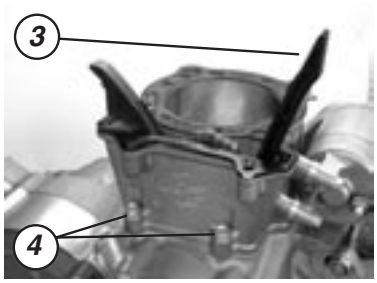
NOTE:
Prior to loosening the cylinder-head screws, loosen the cylinder-head screws (6 mm) and the cylinder-base screws.

Remove the cylinder-head screws and then the cylinder head.

NOTE:
In case of difficulty removing the cylinder-head, tap it with a plastic mallet.



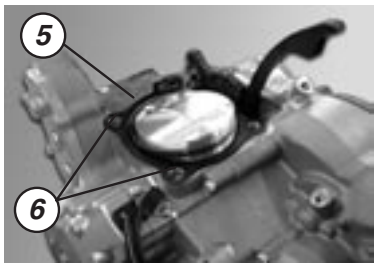
Remove the cylinder-head gasket (1) and the centering devices (2).



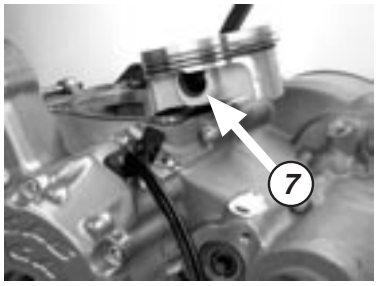
Remove the timing-chain guide (3).

Remove the cylinder-base screws (4) and then the cylinder.

NOTE:
In case of difficulty removing the cylinder, tap it with a plastic mallet.



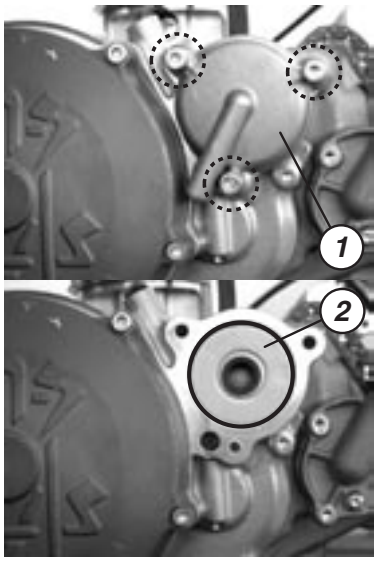
Remove the cylinder gasket (5) and the centering devices (6).



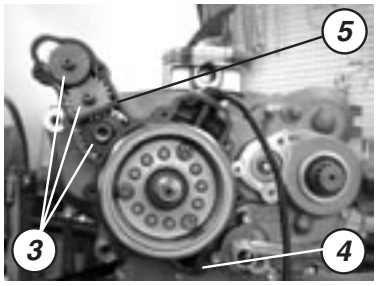
Cover the cylinder base with a clean cloth to prevent the piston-bolt spring ring from falling into the crankcase.

Remove the piston-bolt spring ring. (7)

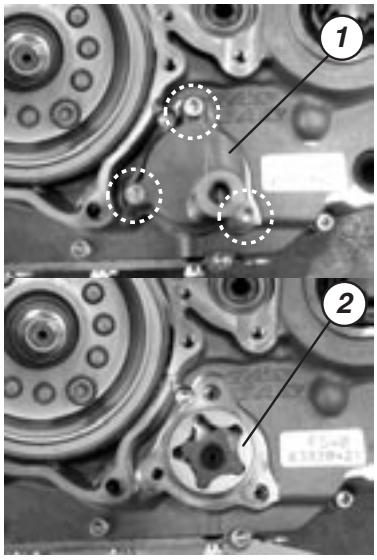
Remove the piston-bolt and the piston.



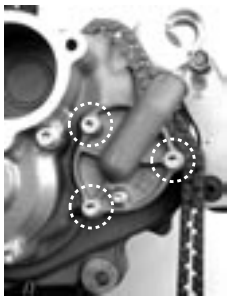
Detach the oil-filter lid (1)
and the oil filter (2).



Remove the starter followers (3), the centering devices (4) and the gasket (5).



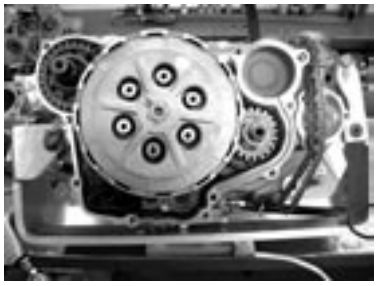
Remove the pressure-pump lid (1)
and the rotor (2).



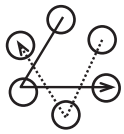
Remove the coolant-pump cover.

Remove the clutch lid.

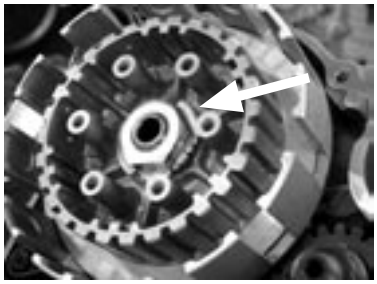
Remove the centering devices (3) and the gasket (4).



Loosen the clutch-spring screws in a diagonal sequence (as illustrated) and remove them when they become totally loose.



Detach the clutch press and the disc assembly.

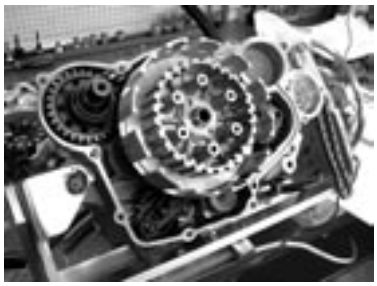


Remove the clutch rod.

Flatten the clutch-hub washer.

Holding the clutch hub with the special tool supplied, remove the clutch-hub nut.

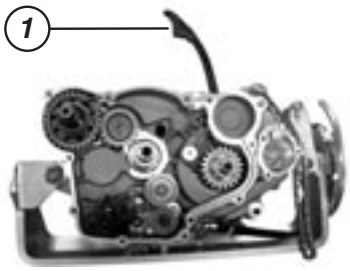
Tool Part No.:
Clutch-hub fastener



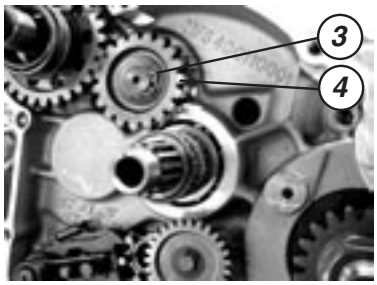
Remove the clutch hub and the washer.

CAUTION!
The clutch hub has a specific fitting position in respect of the input shaft. Mark the position with an indelible marker on the lubrication groove. This mark must be taken into account during the installation process.

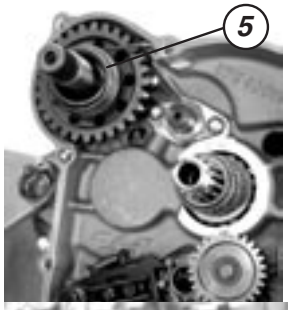
Remove the clutch-drum assembly.



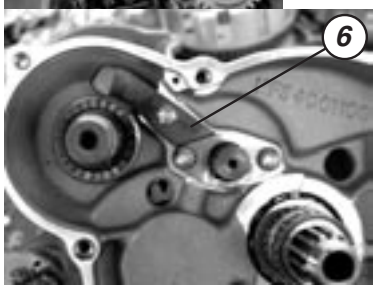
Detach the timing-chain guide idler (1).



Remove the Seeger ring (3) and the pedal-operated starter intermediate gear (4).

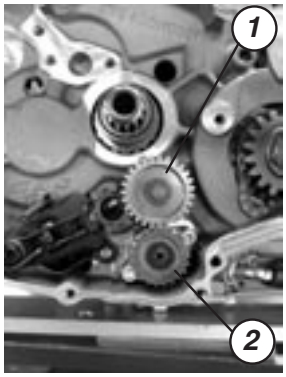


Detach the foot-operated starter assembly.



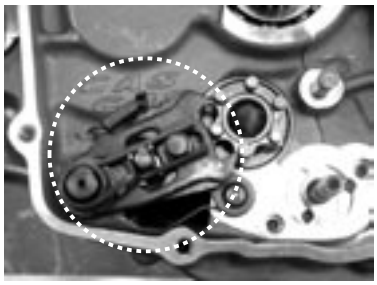
Detach the pedal-operated starting pawl plate (6).

Detach the pedal-operated starter intermediate pinion shaft.

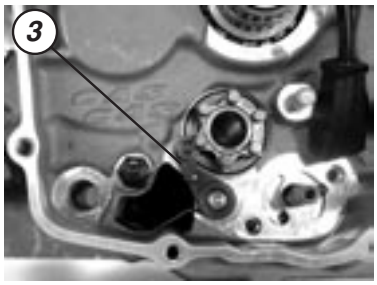


Detach the oil-pump intermediate gear (1) and the oil-pump follower (2).

Remove the oil-pump assembly.



Remove the selector-shaft assembly.



Detach the gear-centering device plate (3)

Remove the crankshaft pinion bolt, the washer, the gear, the timing chain and the timing-chain gear.

CAUTION!
The crankshaft pinion bolt has a left-hand thread.

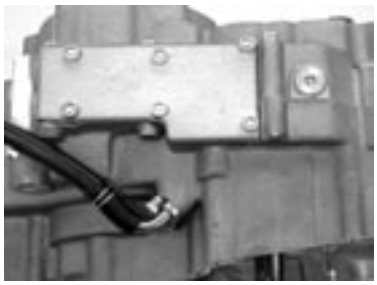
Remove the alternator-rotor bolt and washer.

Holding the puller with a spanner, loosen the rotor.

Tool Part No.:
MFS400134045, FSE400 flywheel puller

Use the special tool supplied to detach the alternator rotor.

CAUTION!
Tapping the alternator rotor with a hammer might damage it.



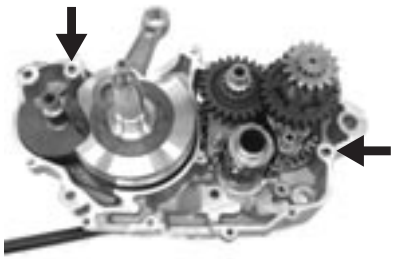
Remove the lower oil-reservoir lid.

Remove the crankcase left-hand set screws.

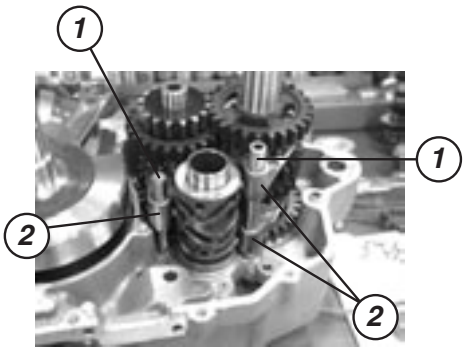
Detach the crankcase using the special tool supplied.

Tool Part No.:
ME2595000: crankcase-detachment tool

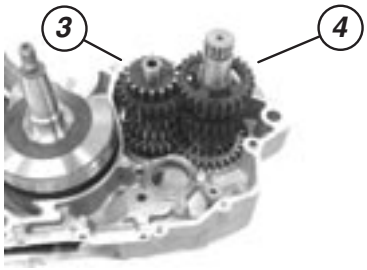
NOTE:
Fit the crankcase-detachment tool on the left-hand side, so that its plate becomes parallel with the surface of the crankcase end.



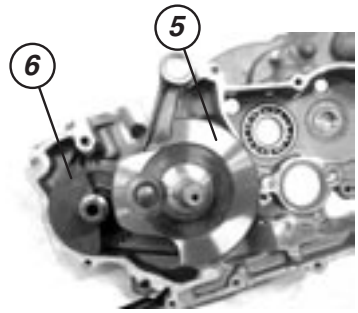
Remove the centering devices.



Remove the shafts of the shifter forks (1) and the forks (2).



Detach the gearbox input-shaft assembly (3) and the gearbox output-shaft assembly (4).



Detach the crankshaft (5) and the rocker shaft (6).

NOTE:
Should this detachment operation prove difficult, tap both shafts with a plastic mallet in an alternating pattern.

Remove the oil-intake filter and clean it.

GASGAS

Inspection and Maintenance of Engine Components

CAUTION!

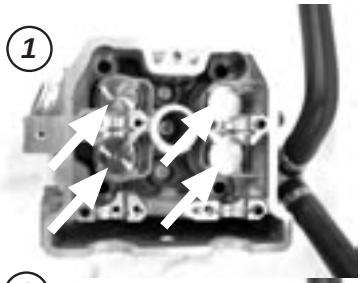
Identify the position of each part.
Set them in groups (exhaust, admission) so that they may be assembled in their original positions.

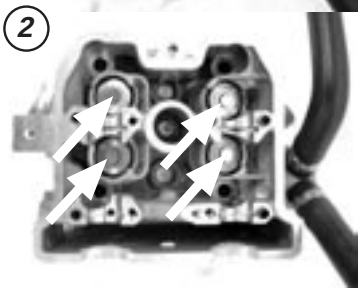
CYLINDER HEAD

Disassembly

Detach the intake pipe.

Detach the engine-coolant pipe bracket.





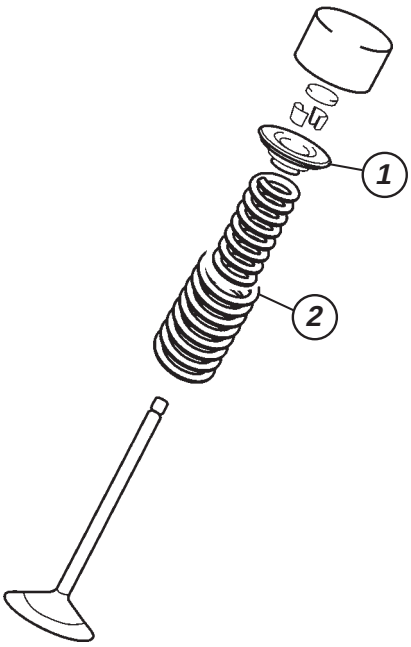
Remove the tappets (1) and the adjustment washers (2), by hand or with a magnet.

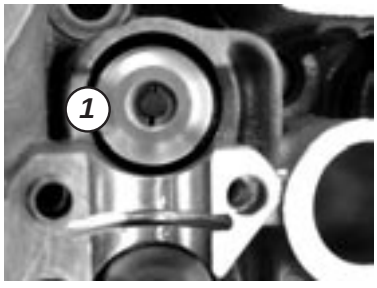
Compress the valve springs and then use the special tools provided to remove the valve-rod semicones.

Tool Part Description.:
valve-spring compressor

Tool Part Description:
Adapter

Tool Part Description:
Pliers





Remove the valve-spring plate (1) and the valve springs (2).

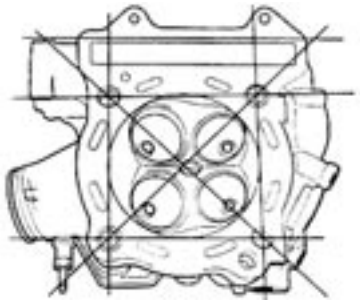
Remove the valves from the opposite side.

Use long-nosed pliers to remove the valve seals.

Detach the valve-spring washer.

NOTE:
The valve detachment completes the standard disassembly operation. If you had not detached the valve guides for replacement after inspecting their associated parts, follow the instructions given in the valve-guide maintenance section.

Cylinder-head deformation

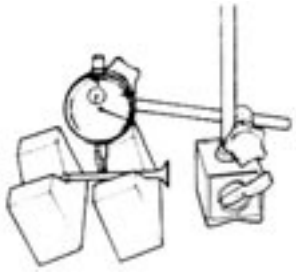


Decarbonize the combustión chamber.
Using a ruler and a feeler gauge, check the surface of the cylinder-head gasket for signs of deformation. Measure the clearance in several places. If any of the clearance measurements is found to exceed the service limit, replace the cylinder head with a new one.

Tool Part Description:
Feeler gauge

DETAILS
Cylinder-head deformation
Service limit: 0.05 mm (0.002 in)

Valve-rod offsetting



Using tapered blocks to hold the valve, measure the valve-rod offsetting with a dial gauge, as illustrated. If the offsetting is found to exceed the service limit, replace the valve with a new one.

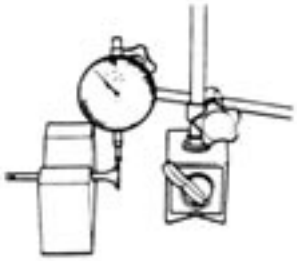
Tool Part Description:
Dial gauge (1/100 mm)

Tool Part Description:
Magnetic support

Tool Part Description:
Set of tapered blocks (100 mm)

DETAILS
Valve-rod offsetting
Service limit: 0.05 mm (0.002 in)

Valve-head radial offsetting

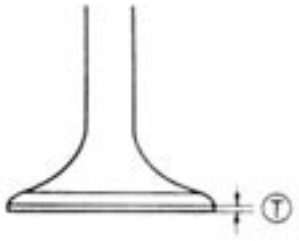


Using one tapered block to hold the valve, measure the valve-head radial offsetting with the dial gauge, as illustrated. If the offsetting is found to exceed the service limit, replace the valve with a new one.

Tool Part Description:
Dial gauge (1/100 mm)
Tool Part Description:
Magnetic support
Tool Part Description:
Set of tapered blocks (100 mm)

DETAILS
Valve-head radial offsetting
Service limit: 0.03 mm (0.001 in)

Valve working-surface wear

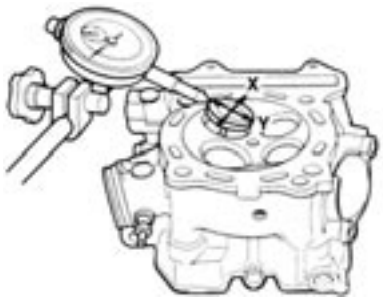


Check the working surface of each valve for signs of wear or damage. If any unusual signs of wear are found, replace the valve involved with a new one. Measure the thickness (T) of the valve working surface. If the thickness is found to exceed the specified value, replace the valve with a new one.

Tool Part Description:
Vernier calipers

DETAILS
Thickness (T) of the valve working surface
Service limit: 0.5 mm (0.02 in)

Valve rod deflection



Lift the valve about 10 mm from its seat.
Measure the rod deflection in two directions, “X” and “Y”, at right angles to each other. Position the dial gauge as illustrated.
If the deflection is found to exceed the service limit, decide whether it is the valve or the guide that must be replaced with a new one.

Tool Part Description:
Dial gauge (1/100 mm)
Tool Part Description:
Magnetic support

DETAILS
Valve rod deflection
Service limit: 0.35 mm (0.014 in)

Valve rod wear

Use a micrometer to measure the rod outside diameter.
If the outside diameter is found to exceed the specified value, replace the valve with a new one.
If the rod outside diameter is found to be within the specified value, but the deflection is not within the specified value, replace the valve guide with a new one. After replacing the valve or guide, check the deflection.

Tool Part Description:
Micrometer (0-25 mm)

DETAILS
Valve-rod outside diameter
Normal:
Inlet: 4.975-4.990 mm (0.1959 – 0.1965 in)
Exhaust: 4.955-4.970 mm (0.1951 – 0.1957 in)

Valve-guide maintenance

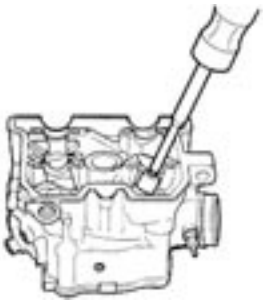
Use the valve-guide puller to remove the valve guide towards the camshaft side.

Tool Part Description:
Valve-guide puller/fitter

NOTE:
Discard the valve guide.
Only oversize valve guides are available as spares.

Use the valve-guide reamer and shank to smooth the valve-guide holes in the cylinder head.

Tool Part Description:
Valve-guide reamer (10.8 mm)
Tool Part Description:
Reamer shank



Oil the rod hole of each valve guide and use the valve-guide puller/fitter and adaptor to drive the guide into the hole.

Tool Part Description:
Valve-guide puller/fitter
Tool Part Description:
Valve-guide fitter adaptor

CAUTION!
Unless the valve-guide hole is oiled as instructed prior to the fitting of the new guide, the guide or the cylinder head may be damaged.

Use the valve-guide reamer to smooth the guide inner walls after the valve guides have been fitted. Clean and oil the guides after smoothing them.

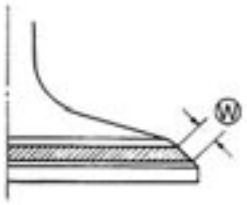
Tool Part Description:
Valve-guide reamer (5 mm)
Tool Part Description:
Reamer shank

Valve-seat width

Use Prussian blue to spray the valve seat evenly. Fit the valve and attach a valve burnisher to it. Tap the sprayed seat several times in a circular direction to get a clear imprint of the surface contact.

Tool Part Description:
Valve-burnisher set

The ring-shaped sprayed imprint left on the valve working surface must be a continuous, unbroken one. Also, the width of the sprayed ring, which is equivalent to the width of the valve seat, must not exceed the following specified value.

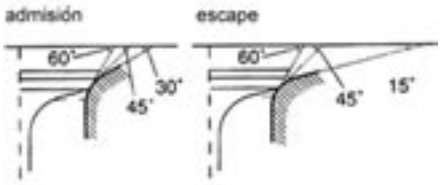


DETAILS
Valve-seat width (W)
Normal: 0.9-1.1 mm (0.035 – 0.043 in)

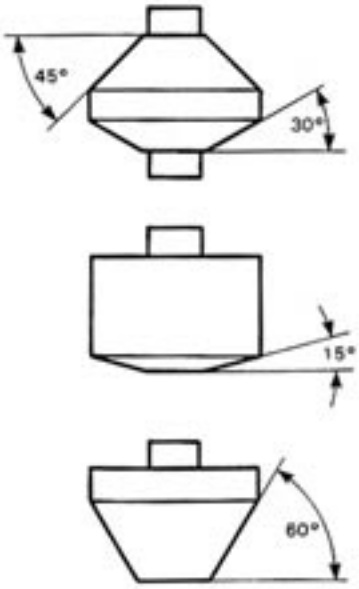
Grind the valve seat as required, if it is found to exceed the specified value.

Valve-seat maintenance

Inlet- and exhaust-valve seats are machined at three different angles.
The seat contact surface is cut at a 45º angle.



	Inlet	***Exhaust***
45º	N-128	***N-128***
15º	-	***N-121***
30º	N-128	**-**
60º	N-114	***N114***



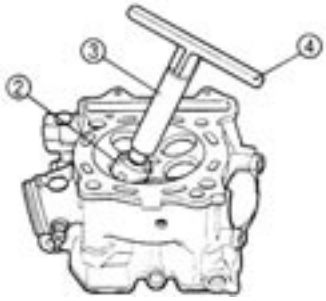
Tool (United States)
Valve-seat knife:
N-114, N-121 and N-128

Tools (Other countries)
Description:
Valve-seat grinding set
Description:.....N-128 Knife
Description:.....N-114 Knife
Description:.....N-121 Knife

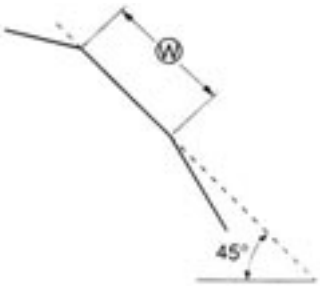
NOTE:
Use the solid centering device together with the N-114, N-121 and N-128 valve-seat knives.

CAUTION!
The valve-seat contact surface should be checked after each cutting operation.

When fitting the solid centering device (1), turn it slightly.



Settle the centering device properly. Fit the 45º knife (2), the adaptor (3) and the T-shaped shank (4).



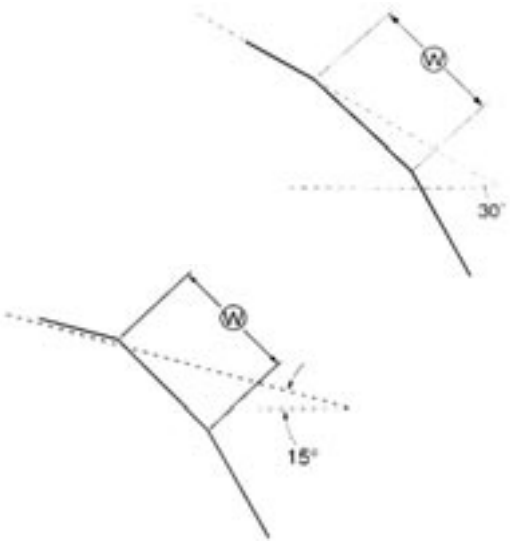
Initial seat-cutting operation

Use the 45° knife to descale and clean the seat. Turn the knife around once or twice.

Measure the valve-seat width (W) after each cutting operation.

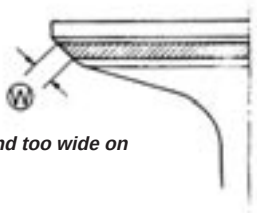
If the valve seat appears to be pitted or burnt, use the 45º knife to complete the seat-conditioning operation.

NOTE:
Cut only as little as possible off the seat, to avoid the risk of having to replace the tappet shim.



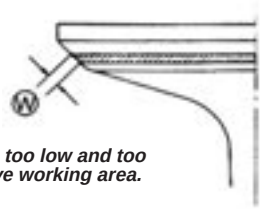
Upper narrowing cutting operation

If the contact surface is too high up the valve, or if it is too wide, use the 30º knife (inlet side) and the 15º knife (exhaust side) to lower and narrow it.



Contact surface is too high and too wide on the valve working area.

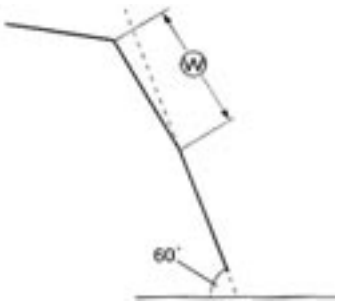
Final seat-cutting operation



Contact surface is too low and too narrow on the valve working area.

If the contact surface is too low down the valve, or if it is too narrow, use the 60º knife to lift and widen it. If the contact surface is too high up the valve, or if it is too wide, use the 15º knife to lower and narrow it to the correct width.

Upon achievement of the correct seat position and width, use the 60º knife very slightly to remove any burrs resulting from the previous cutting operations.



CAUTION!
Do not use any burnishing compounds after completing the final cutting operation. A completed valve seat must show a velvety finishing, but this should not be exceedingly polished or bright. This should provide a smooth surface for the final settling of the valve, which will have place during the first few seconds of the running of the engine.

NOTE:
After completing the maintenance of the valve seats, fit the cylinder head and checl the clearance of the tappets. (2-5 to 2-8)

Valve-seat tightness check

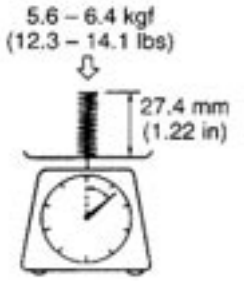
With the valve and spring properly fitted, pour a small amount of petrol through the intake- or exhaust port.
Check to see that no petrol is leaking through the valve seat. If a leak is found, tighten the sealing surface.

WARNING
Petrol is highly inflammable and explosive. Keep the petrol away from heat sources, sparks or flames.

Valve-spring

The strength of the helical spring keeps the valve-seat pressed. A weak spring will result in loss of engine power and valve-mechanism clattering.

Check the strength of the valve springs by measuring their unsupported length and the amount of strength required to compress them. If the unsupported length of a spring is found to be below the service limit, or if the strength required to compress it is not within the specified value, replace the inner and outer springs altogether.



DETAILS
Spring unsupported length (intake and exhaust)
Service limit:
Inner: 32.6 mm
Outer: 36.3 mm

DETAILS
Valve-spring tension (intake and exhaust)
Normal:
Inner: 5.6-6.4 kgf/27.4 mm
Outer: 12.6-14.5 kgf/30.9 mm

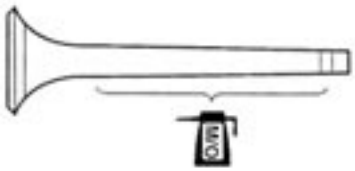
CYLINDER HEAD

Fitting

Fit the valve-spring seats.

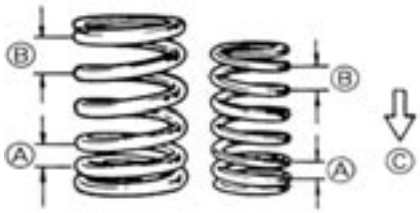
Apply a molybdenum-oil solution to each valve seal and press the valves into position.

CAUTION!
Do not re-use valve seals.



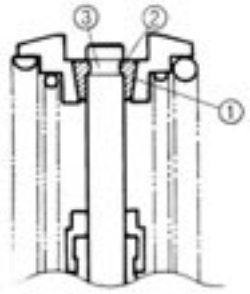
Apply a molybdenum-oil solution to the valves, as illustrated, and then fit them into the guides.

CAUTION!
Care must be taken not to damage the valve-seal lips when fitting the valves into their guides.



Fit the valve spring with the **lesser-pitch** end facing the cylinder head.

(A) Lesser pitch
(B) Greater pitch
(C) Down

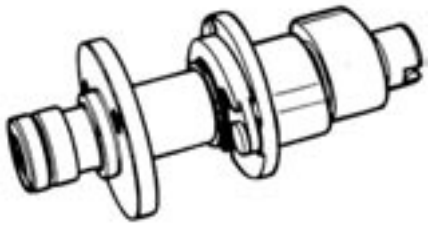


Fit the spring clip by pressing it with the tappet. Fit the semicones on the rod end and release the tappet so that the semicones (1) become jammed between the clip and the rod. Check to see that the valve rounded lip (2) fits properly into the groove (3) in the semicone end.

Tool Description:
valve-spring compressor
Tool Description:
adaptor
Tool Description:
pliers

CAUTION!
Make sure to fit all the parts into their original positions.

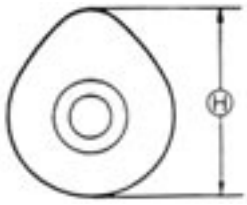
CAMSHAFT - AUTOMATIC DECOMPRESSOR ASSEMBLY



CAUTION!
Do not try to disassemble the camshaft / automatic decompressor assembly. It cannot be repaired.

Automatic decompressor

Move the automatic-decompressor counterweight by hand to make sure that it works smoothly. If the automatic-decompressor counterweight does not work smoothly, replace it with a new one.



Cam wear

Cam wear usually results in the loss of the valve settings and in a subsequent loss of power.
Use the micrometer to measure the cam height (H). If the wear is found to exceed the service limit, replace the camshaft with a new one.

Tool Description:
Micrometer (25-50 mm)

DETAILS
Cam height (H)
Normal size:
Inlet: 36.934 mm
Exhaust: 36.893 mm

Service limit:
Inlet: 36.634 mm
Exhaust: 36.593 mm

Camshaft-bridge wear

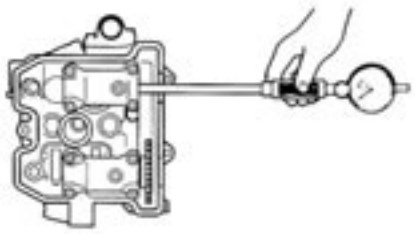
With the camshaft fitted, use the plastic gauge to measure the oil clearance.

Tools
Description:.....plastic gauge

DETAILS
Camshaft-bridge oil clearance (inlet and exhaust)
Service limit: 0.150 mm

Tighten the bridge-bracket screws evenly and in a diagonal sequence, at the specified torque.

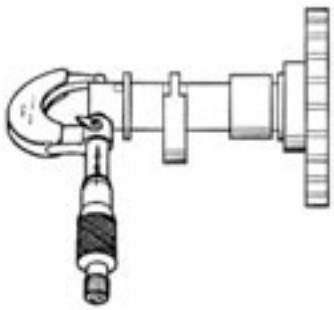
Camshaft-bridge bracket screw:
10 Nm (1 Kgf-m)



NOTE:
Remove the plastic gauge before turning the camshaft.

Remove the camshaft-journal brackets and use the wrap-round ruler to measure the width of the compressed plastic gauge. This measurement should be carried out at the widest point of the compressed plastic gauge. If the camshaft-bridge oil clearance is found to exceed the service limit, measure the bridge-bracket inside diameter and the bridge outside diameter. Change either the camshaft or the cylinder head and the camshaft bracket, whichever is found to exceed the specified value.

Tool
Description:.....lesser-calibre gauge

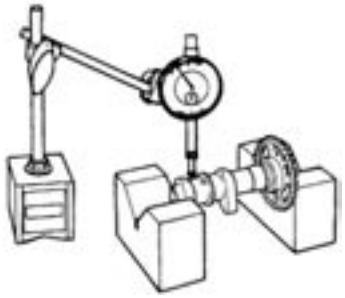


DETAILS
Camshaft-bridge bracket inside diameter (inlet and exhaust)
Normal: 22.012-22.025 mm

Tool
Description:.....micrometer (0-25 mm)

DETAILS
Camshaft-bridge outside diameter (inlet and exhaust)
Normal: 21.972-21.993 mm

Camshaft offsetting



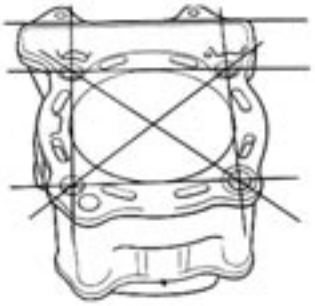
Using tapered blocks to hold the valve, measure the camshaft offsetting with the dial gauge. If the offsetting is found to exceed the service limit, replace the camshaft with a new one.

Tools
Description:.....dial gauge (1/100 mm)
Description:.....magnetic support
Description: Set of tapered blocks (100 mm)

DETAILS
Camshaft offsetting
Service limit: 0.10 mm

CYLINDER

Cylinder deformation

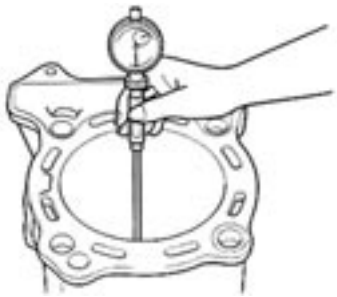


Using a ruler and a feeler gauge, check the surface of the cylinder-block gasket for signs of deformation. Measure the clearance in several places. If any of the clearance measurements is found to exceed the service limit, replace the cylinder block with a new one.

Tool Description:
feeler gauge

DETAILS
Cylinder deformation
Service limit: 0.05 mm (0.002 in)

Inner cylinder wall



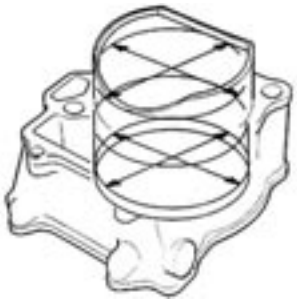
Check the inner cylinder wall for scratches, notches, or any other signs of damage. Measure the cylinder inside diameter at six points.

Tool Description:
cylinder-gauge set

DETAILS
Cylinder inside diameter
FSE400: 90.000 - 90.015 mm
FSE450: 95.000 - 95.015 mm

PISTON AND PISTON RING

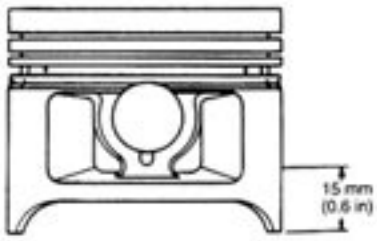
Piston diameter



Use the micrometer to measure the piston diameter at 15 mm from the skirt end. If the piston diameter is found to exceed the service limit, replace the piston with a new one.

Tool Description:
Micrometer (75-100 mm)

DETAILS
Piston diameter
Service limit: FSE400: 89,880 mm
Service limit: FSE450: 94,880 mm



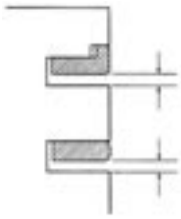


Fig.1

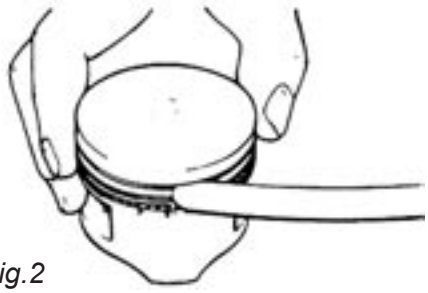


Fig.2

Fig.3

Fig.4

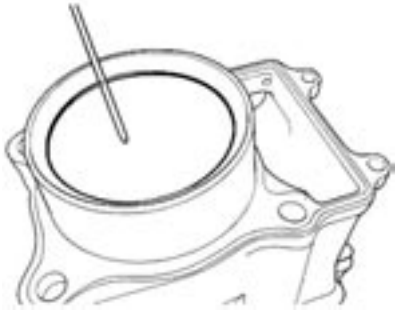


Fig.5

Clearance between piston ring and groove

Using the feeler gauge, measure the side clearances of the rings on pistons 1 and 2. If any of the clearances is found to exceed the service limit, replace the piston and the rings.

Tool Description:
feeler gauge

DETAILS
Clearance between piston ring and groove (Fig.1)
Service limit:
1: 0.18 mm (0.0071 in)
2: 0.15 mm (0.0059 in)

DETAILS
Piston-ring groove width (Fig.2)
Normal:

FSE400	***1º:***	***1,03 mm***
	2º:	***1,22 mm***
FSE450	***1º:***	***1,23 mm***
	2º:	***1,53 mm***

Lubrication: 2,01-2,03 mm

Tool Description:
Micrometer (0-25 mm)

DETAILS
Piston-ring thickness (Fig.3)
Normal:

FSE400	***1º:***	***0,985 mm***
	2º:	***1,19 mm***
FSE450	***1º:***	***1,19 mm***
	2º:	***1,49 mm***

Piston-ring free end opening and piston-ring end opening

Start by measuring the piston-ring free end opening with the vernier calipers, then place the piston ring across the cylinder and measure the ring-end opening with the feeler gauge.

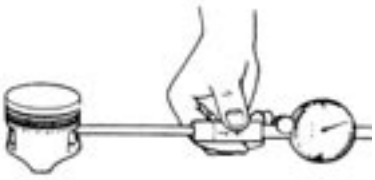
Tool Description:
Vernier calipers

DETAILS
Piston-ring free end opening (Fig. 4)
Service limit:
1: 5.5 mm
2: 9.2 mm

Tool Description:
feeler gauge

DETAILS
Piston-ring end opening (Fig. 5)
Service limit:
1: 0.50 mm
2: 0.50 mm

Piston bolt and inside diameter of pin



Use a small-calibre gauge to measure the piston-bolt inside diameter. If the diameter is found to exceed the service limit, replace the piston with a new one.

Tool Description:
Dial gauge (1/1000 mm)
Tool Description:
small-calibre gauge (18-35 mm)

DETAILS
Piston-bolt inside diameter
Service limit: 20.030 mm

Use the micrometer to measure the piston-bolt outside diameter at three points. If any of the measurements is found to exceed the service limit, replace the piston with a new one.

Tool Description:
micrometer (0-25 mm)

DETAILS
Piston pin outside diameter
Service limit: 19.980 mm

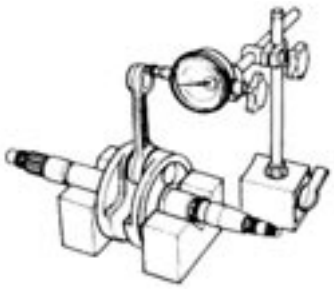
CONNECTING ROD

Connecting-rod foot inside diameter

Use the small-calibre gauge to measure the connecting-rod foot inside diameter. If the connecting-rod foot inside diameter is found to exceed the service limit, replace the connecting rod with a new one.

Tool Description:
Dial caliper

DETAILS
Connecting-rod foot inside diameter
Service limit: 20.040 mm



Connecting-rod deflection and connecting-rod crank end side clearance

The amount of wear at the connecting-rod crank end may be estimated by checking the connecting-rod foot play. This method is also useful in checking the amount of wear shown by the component parts of the connecting-rod crank end.

Tool Description:
magnetic support
Tool Description:
dial gauge (1/100 mm)
Tool Description:
Set of tapered blocks (100 mm)

DETAILS
Connecting-rod deflection
Service limit: 3 mm

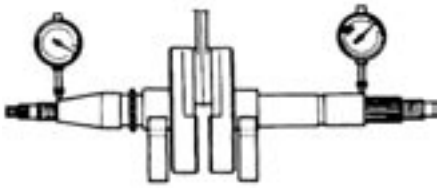
Push the connecting rod aside and measure the side clearance with a feeler gauge. If the clearance is found to exceed the service limit, replace the whole crankshaft with a new one, or bring the deflection and the side clearance found back into the service limit by replacing their worn parts (connecting rod, connecting-rod crank end bearing, crankshaft pin, etc.).

Tool Description:
feeler gauge

DETAILS
Connecting-rod crank end side clearance
Service limit: 1 mm

CRANKSHAFT

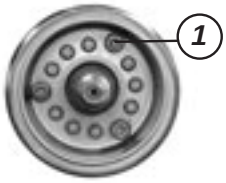
Crankshaft offsetting



Using tapered blocks to hold the crankshaft, measure the amount of offsetting with the dial gauge, as illustrated. If the offsetting is found to exceed the service limit, replace the crankshaft with a new one.

Tool Description:
dial gauge (1/100 mm)
Tool Description:
magnetic support
Tool Description:
Set of tapered blocks (100 mm)

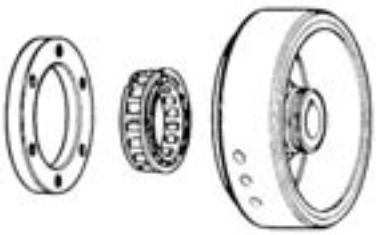
DETAILS
Crankshaft offsetting
Service limit: 0.08 mm



STARTER CLUTCH

Remove the hexagonal screws. (1).

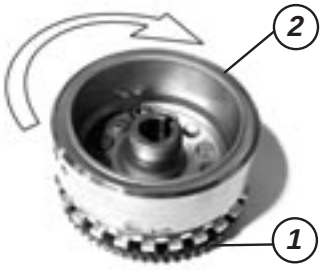
Starter-clutch screw:
26 Nm (2.6 Kgf-m)



Fit the starter clutch in the correct direction, as illustrated.

Apply engine oil to the starter clutch.

Apply LOCTITE to the hexagonal screws and tighten them at the specified torque while holding the rotor with a spanner.



Attach the gear (1) to the starter clutch.

Check to see that the rotor (2) is turning in the direction marked by the arrow, while holding the gear, and make sure that it never turns in the opposite direction.

OIL PUMP

Check all the components.
The screws securing the pump to the engine casing must be fitted with LOCTITE and given a specific torque.

Oil pump: 10 N.m (1.0 kgf-m)

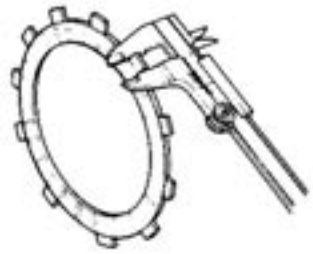
CLUTCH

Clutch-driving discs

Measure the thickness of the clutch-driving discs with vernier calipers. If any of the clutch-driving discs is found to exceed the service limit, replace all the clutch discs.

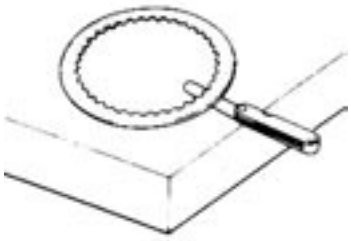
Tool Description:
Vernier calipers

DETAILS
Driving-disc thickness
Service limit: 2.62 mm



DETAILS
Driving-disc hook width
Normal: 13,9 mm
Service limit: 13,5 mm

Clutch driven discs



Using the feeler gauge, measure the amount of deformation shown by the clutch driven discs. If any of the clutch driven discs is found to exceed the service limit, replace all the clutch discs.

Tool Description:
feeler gauge

DETAILS
Driven-disc deformation
Service limit: 0.10 mm

Clutch-spring unsupported length

Measure the unsupported length of each clutch spring with the vernier calipers. If any of the springs is found to exceed the service limit, replace all the springs.

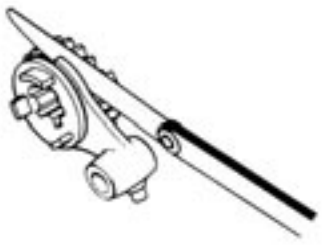
Tool Description:
vernier calipers

DETAILS
Clutch-spring unsupported length
Service limit: 49.9 mm

SHIFTER FORKS AND GEAR

Clearance between fork and fork groove

The amount of clearance for each shifter fork plays an outstanding role in the achievement of a smooth, positive operation of the gearbox. Use the feeler gauge to measure the clearance of each fork in the groove of its gear. If the clearance is found to exceed the specified value, replace the fork, its gear, or both.



Tool Description:
feeler gauge
Tool Description:
vernier calipers

DETAILS
Clearance between fork and fork groove
Service limit: 0.50 mm

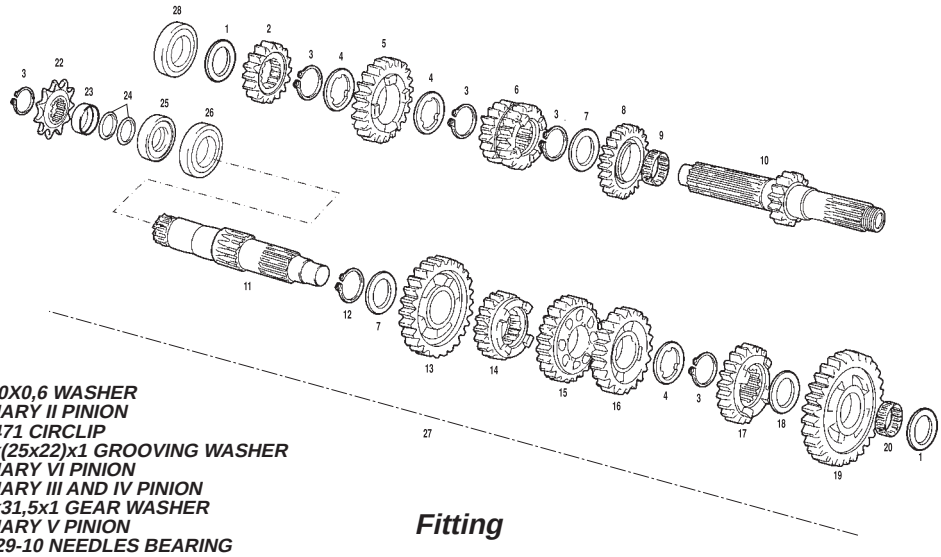
DETAILS
Shifter-fork groove width
Normal: 4.8-4.9 mm

DETAILS
Shifter-fork thickness
Normal: 4.6-4.7 mm

TRANSMISSION

Disassembly

Detach the transmission gears as illustrated.



1 18X40X0,6 WASHER
2 PRIMARY II PINION
3 DIN 471 CIRCLIP
4 31,5x(25x22)x1 GROOVING WASHER
5 PRIMARY VI PINION
6 PRIMARY III AND IV PINION
7 25,2x31,5x1 GEAR WASHER
8 PRIMARY V PINION
9 K25-29-10 NEEDLES BEARING
10 PRIMARY AXIS
11 SECUNDARY AXIS
12 DIN 983 CIRCLIP
13 SECUNDARY II PINION
14 SECUNDARY VI PINION
15 SECUNDARY III PINION
16 SECUNDARY IV PINION
17 SECUNDARY V PINION
18 20,8x29x1 GEAR WASHER
19 SECUNDARY I PINION
20 K20x24x10 NEEDLES BEARING
22 Z13 EXIT PINION
23 GEAR EXIT SEAL
24 EXIT PINION SEAL
25 30X40X7 SEAL
26 GEAR 6205 BEARING
27 GEAR SET
28 GEAR 6305 BEARING

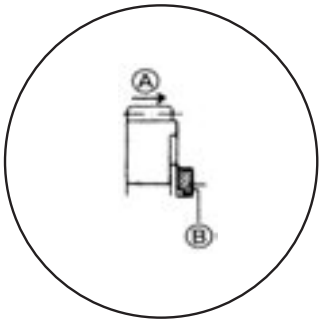
Fitting

Reverse the disassembly operations to fit the transmission. Pay special attention to the following points:

NOTE:
Before fitting the gears, apply engine oil to the inner surface of each gear and bushing.

CAUTION!
Never re-use a spring ring. Elastic rings detached from their shaft must be discarded and replaced with new ones.
When fitting a new spring ring, expand the end opening just enough for the ring to slide along the shaft.
After fitting a new spring ring, check to see that its is fully settled within its groove and securely attached.

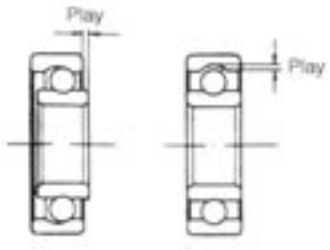
NOTE:
When reassemblying the transmission, pay special attention to the location and position of washers and spring rings. The sectional view shows the correct positions for gears, washers and spring rings.



When fitting a spring ring, attention must be paid to its direction (fit it facing the drive side).

The rounded face must be fitted against the gear surface.

(A) Drive
(B) Sharp edge



BEARINGS

Wash the bearings with a solvent and lubricate them with motor oil before checking them. Check to see that the inner guide ring turns smoothly. Any bearing that does not turn smoothly or noiselessly, or that shows signs of any anomaly, is deffective and must be replaced with a new one as follows.

Gearbox input shaft RH bearing

Remove the RH bearing on the gearbox input shaft (1) using the special tool provided.

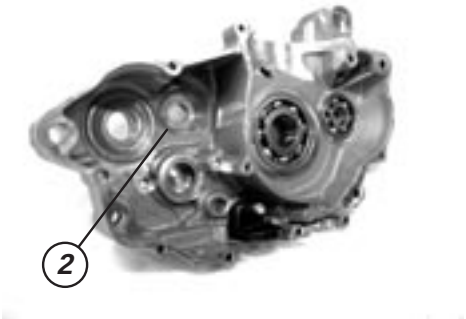
Tool Description:
bearing pulling device set

CAUTION!
Replace the removed bearing with a new one.

Fit the RH bearings on the gearbox input shaft using the special tool provided.

Tool Description:
bearing fitting set

Gearbox input shaft LH bearing



Remove the LH bearing on the gearbox input shaft (2) using the special tool provided.

Tool Description:
bearing pulling device
Tool Description:
plexor

CAUTION!
Replace the removed bearing with a new one.

Fit the LH bearing on the gearbox input shaft using the special tool provided.

Tool Description:
bearing fitting set

Gearbox output shaft bearings

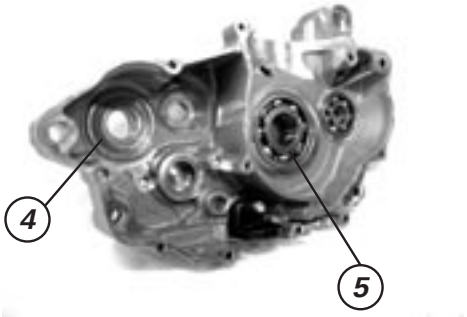
Remove the RH (3) and LH (4) bearings from the gearbox output shaft using the special tool provided.

Tool Description:
bearing pulling device set

CAUTION!
Replace the removed bearings with new ones.

Fit the RH and LH bearings on the gearbox output shaft using the special tool provided.

Tool Description:
bearing fitting set



Crankshaft bearings

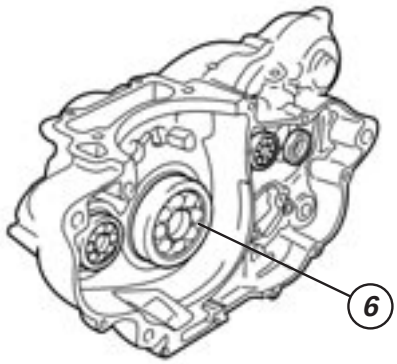
Remove the RH (5) and LH (6) bearings from the crankshaft using the special tool provided.

Tool Description:
bearing pulling device set

CAUTION!
Replace the removed bearings with new ones.

Fit the RH and LH bearings on the crankshaft using the special tool provided.

Tool Description:
bearing fitting set



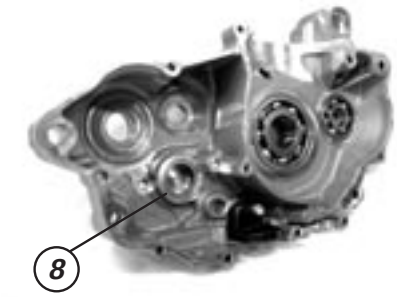
Gearbox desmodromic device RH bearing

Remove the RH bearing from the gearbox desmodromic device (7) using the special tool provided.

CAUTION!
Replace the removed bearing with a new one.

Fit the RH bearing on the gearbox desmodromic device.

Gearbox desmodromic device LH bearing

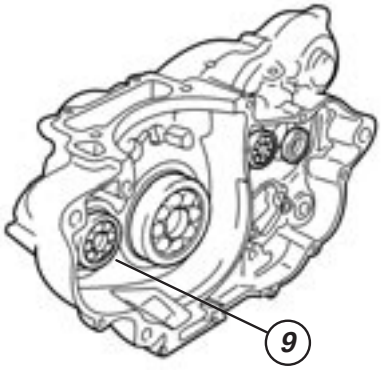


Remove the LH bearing from the gearbox desmodromic device (8) using the special tool provided.

CAUTION!
Replace the removed bearing with a new one.

Fit the LH cam bearing on the gearbox desmodromic device.

Rocker shaft RH bearing



Remove the RH bearing from the rocker shaft (9) using the special tool provided.

Tool Description:
bearing pulling device set

CAUTION!
Replace the removed bearing with a new one.

Fit the RH bearing on the rocker shaft.

Tool Description:
bearing fitting set

Rocker shaft LH bearing

Remove the LH bearing from the rocker shaft (10) using the special tool provided.

Tool Description:
bearing pulling device set
Tool Description:
plexor

CAUTION!
Replace the removed bearing with a new one.

Fit the LH bearing on the rocker shaft.

Tool Description:
bearing fitting set

SEALS

A damaged seal lip may cause air/petrol-mixture or engine-oil leaks.

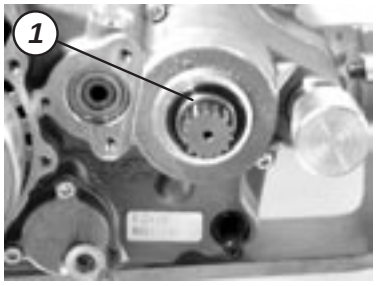
Check the seals for signs of wear or damage. If any seal is found to be deffective, replace it with a new one.

Fit the seals on the crankcase, the clutch cover. Pay special attention to the following points:

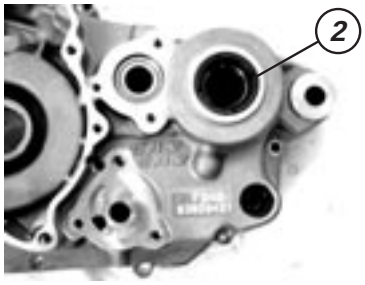
CAUTION!
Replace the removed seals with new ones.

Apply grease on the seal lips.

Gearbox output shaft seal



Remove the bushing (1).



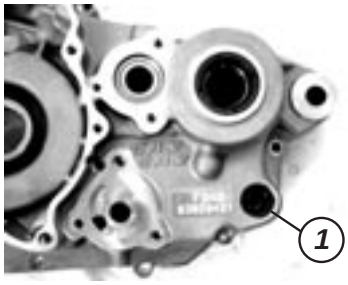
Remove the seal from the gearbox output-shaft in the LH crankcase (2), using the special tool provided.

Tool Description:
seal pulling device

CAUTION!
Replace the removed rertainer with a new one.

Slowly, fit the gearbox output-shaft seal in the LH crankcase, using the special tool provided.

Tool Description:
seal fitting set

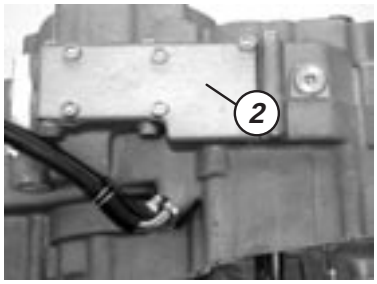


Gearbox output shaft seal

Slowly, remove the seal from the gearbox output-shaft in the LH crankcase (1), using the special tool provided.

Tool Description:
seal pulling device

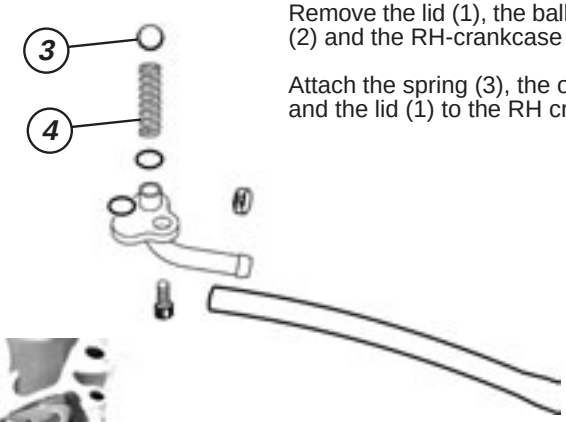
CAUTION!
Replace the removed seal with a new one.



Slowly, fit the gearbox output-shaft seal in the LH crankcase, using the special tool provided.

Tool Description:
seal fitting set

Oil check valve



Remove the lid (1), the ball in the oil check valve (2) and the RH-crankcase spring (3).

Attach the spring (3), the oil check-valve ball (2) and the lid (1) to the RH crankcase.

Cleaning the oil filter and the crankshaft hollow strip

Remove the oil filter from the RH crankcase.

Clean it, without detaching the filtering strip.

CAUTION!
If the filtering strip is found to be defective, replace the filter with a new one.

Detach the crankshaft hollow strip and check to see that it keeps flat and in good condition.

CAUTION!
If the hollow strip is found to be defective, replace the strip with a new one.

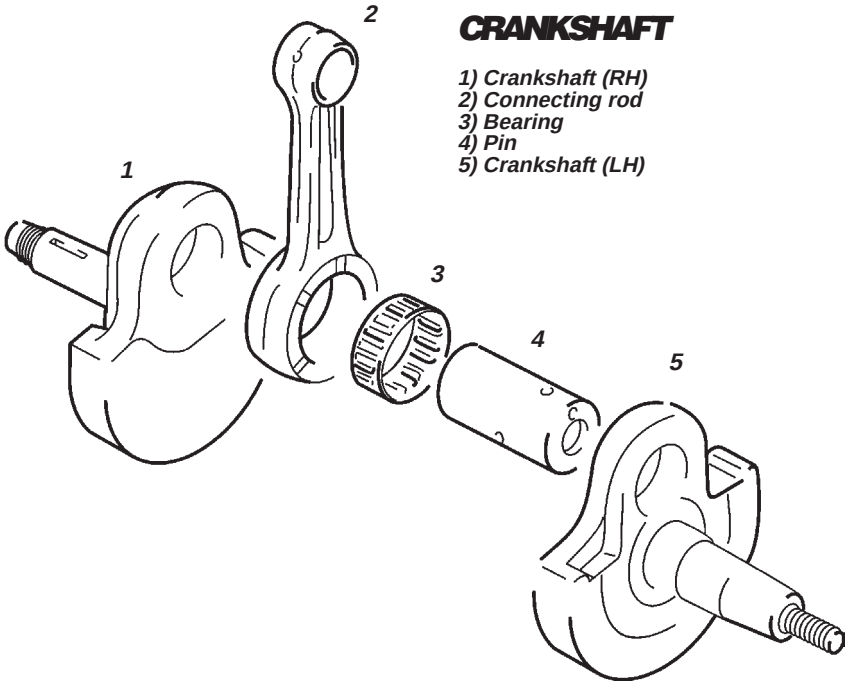
GASGAS

Engine Assembly

Engine Assembly

Assembly again the engine in the opposite order of the disassembly.
Pay special attention to the following points:

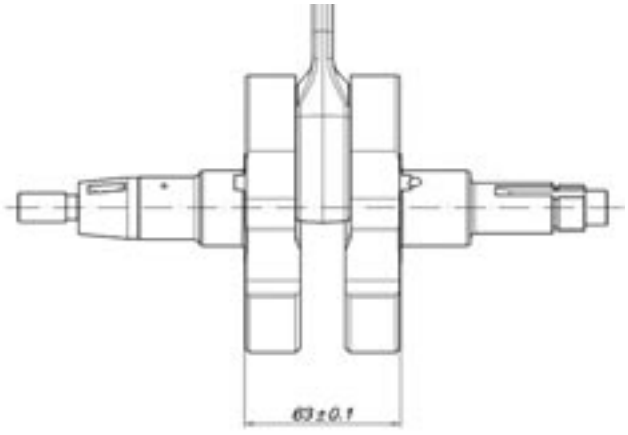
CAUTION:
Before to assemble the engine, apply motor oil to all the mobile pieces.



CRANKSHAFT

1) Crankshaft (RH)
2) Connecting rod
3) Bearing
4) Pin
5) Crankshaft (LH)

Define the width between crank webs by referring to the figure during crankshaft reassembly.



DETAILS
Width between crank webs
Normal: 63 mm. ± 0.1 mm

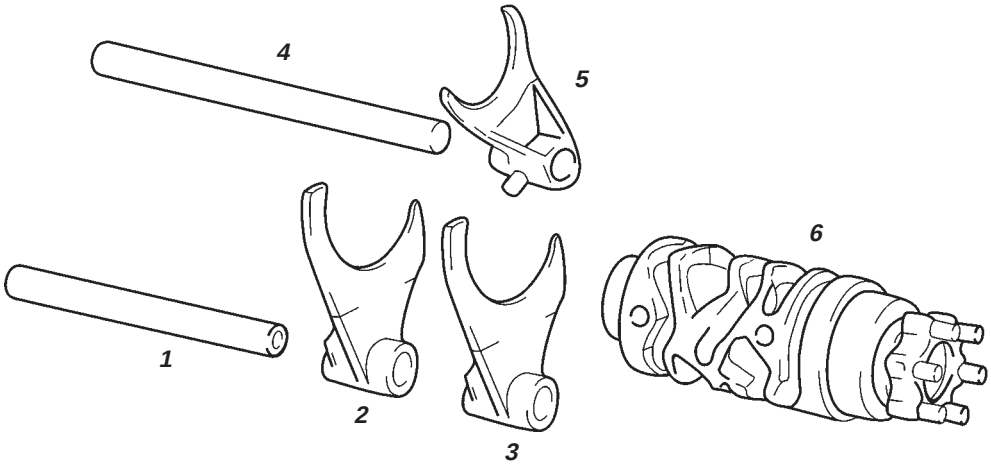
When attaching the crankshaft to the crankcase, use the special tools provided to pull from its LH end towards the crankcase.

Tool Description:
crankshaft fitter
Tool Description:
adaptor

CAUTION!
Do not attach the crankshaft to the crankcase by tapping it into position with a plastic hammer. Always use the special tool provided, otherwise the precision of the crankshaft alignment may be impaired.

DESMODROMIC DEVICE AND SHIFTER FORKS

1) Shifter-fork shaft
2) No. 1 shifter fork
3) No. 2 shifter fork
4) shifter-fork shaft
5) No. 3 shifter fork
6) Desmodromic device



Fit the shifter forks into the shifting grooves, in their correct positions and directions.

Fit the shafts of the shifter forks.

NOTE:
After fitting the shafts of the shifter forks and the forks, check to see that the gears are engaging normally.

Place the transmission gears in neutral.

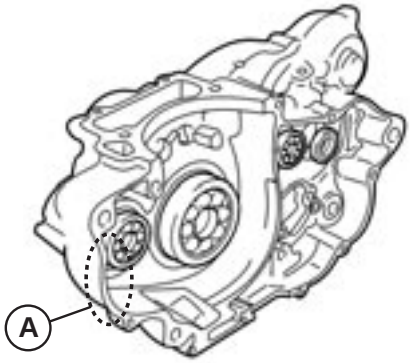
CRANKCASE

Reverse the above operations to assemble the crankcase. Pay special attention to the following points:

Totally remove the sealer and oil stains from the contact surface of both the RH and LH crankcases.

Prior to fitting the sump filter, wash it with solvent and then dry it with compressed air.

Attach the centering devices to the LH crankcase.



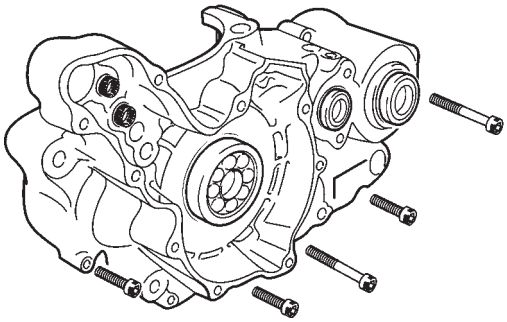
Apply motor oil to the connecting-rod crank end and to the transmission gears.

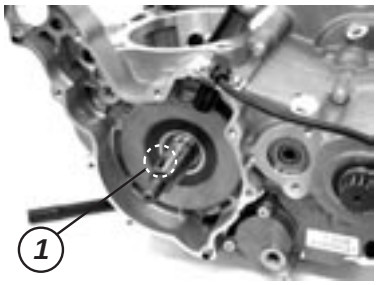
Should the engine feature an oil sump gasket, replace the gasket. Otherwise, with no sump gasket, apply silicone on the right sump contact surfaces and to the (A) parts of both sumps, as indicated in the picture.

Tighten the crankcase screws at the specified torque.

Crankcase screw 11 Nm (1.1 Kgf-m)

After tightening the crankcase screws, check to see that the crankshaft, the jackshaft and the transmission shaft are turning smoothly. If you notice that there is a considerable degree of resistance, try to improve the turning of the shafts by tapping them with a plastic mallet.

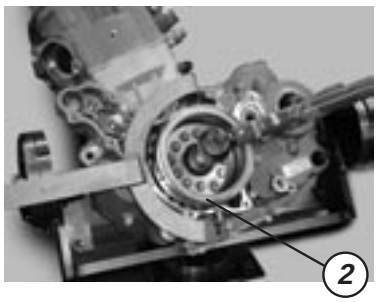




STARTER CLUTCH AND ALTERNATOR ROTOR

Remove the grease from the tapered area of the crankcase and the alternator rotor.

Fit the linchpin (1) and the alternator rotor (2).

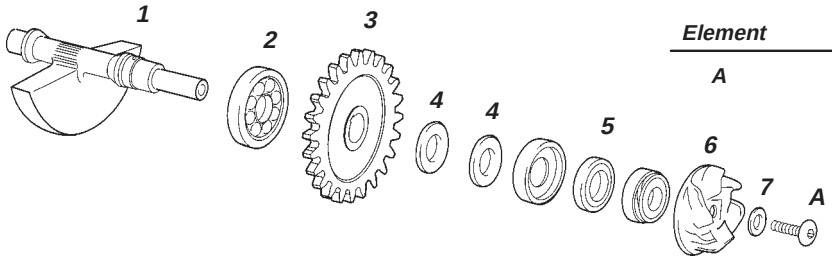


Use a 17-mm spanner to tighten the alternator-rotor nut at the specified torque.

Alternator-rotor nut:
100 Nm (10 Kgf-m)

ROCKER SHAFT

1) Rocker or vibration-absorbant shaft
2) Bearing
3) Rocker-shaft driven gear
4) Washer
5) Water-pump retainer
6) Water-pump turbine
7) Washer
A) Rocker-shaft nut



Element	Nm	Kgf-m
A	10	1

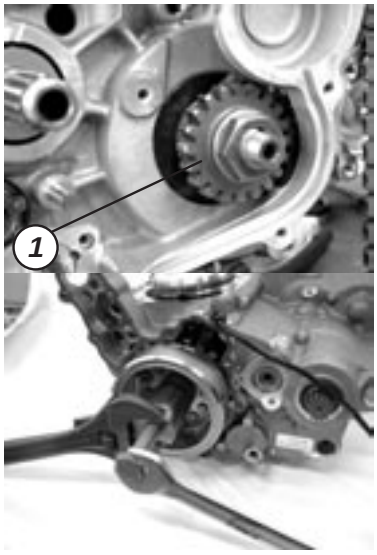
When fitting the drive gear to the rocker shaft, align the pin with the groove.

Attach the rocker-shaft driven gear by aligning the matching marks.

Tighten the rocker-shaft screw at the specified torque.

Compensating-shaft screw: 10 Nm (1 Kgf-m

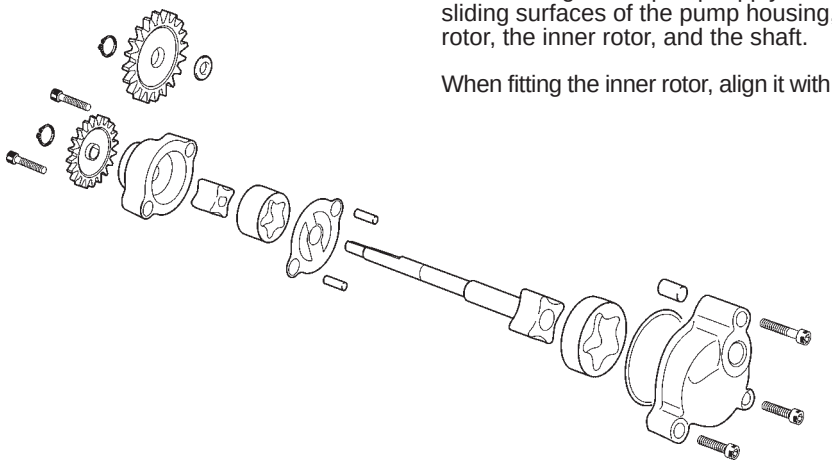
INPUT DRIVE GEAR



After fitting the linchpin, attach the input drive gear (1) by holding the alternator rotor with the 17-mm spanner and by tightening the nut on the input drive gear at the specified torque.

Input drive-gear nut
110 Nm (11 Kgf-m)

OIL PUMP



Before fitting the oil pump, apply motor oil to the sliding surfaces of the pump housing, the outer rotor, the inner rotor, and the shaft.

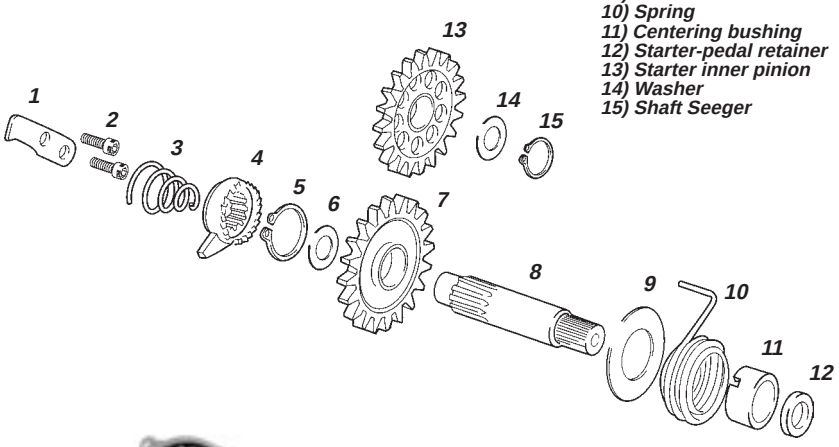
When fitting the inner rotor, align it with the groove.

Apply a small amount of LOCTITE to the threaded areas of the screws securing the oil pump, and tighten them firmly.

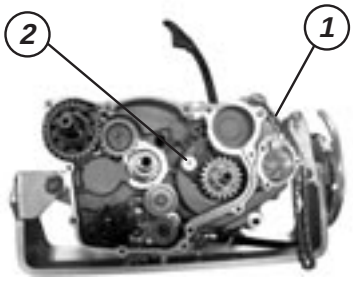
When fitting the oil-pump driven gear, align it with the groove.

STARTING PAWL

1) Starting-pawl plate
2) 5x15 Allen
3) Spring
4) Starting-pawl plate
5) 20 Seeger
6) Washer
7) Starting pinion
8) Starting shaft
9) Washer
10) Spring
11) Centering bushing
12) Starter-pedal retainer
13) Starter inner pinion
14) Washer
15) Shaft Seeger



Fit the pedal-operated starter shaft assembly and attach the spring end to the crankshaft protuberance.



CAMSHAFT TIMING CHAIN

Attach the camshaft timing chain (1) to the pinion.

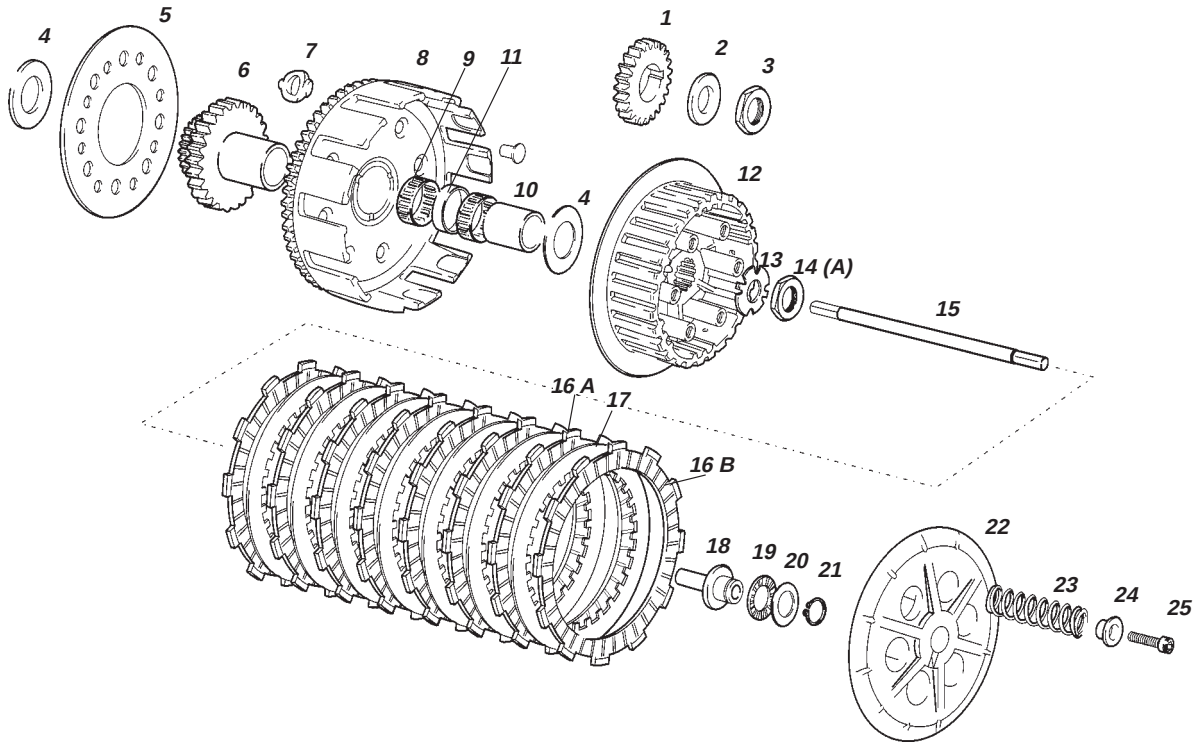
Tighten the screw securing the camshaft timing-chain idler (2) at the specified torque.

Screw securing the camshaft transmission-chain idler. 10 Nm (1 Kgf-m)

CLUTCH

1) Crankshaft pinion
2) 20/125 bevelled washer
3) Crankshaft pinion lock nut
4) 22.1x42x2.8 clutch-drum washer
5) Clutch crown-gear washer
6) Drum crown-gear pinion
7) Silentblock rubber
8) Clutch-drum crown gear assembly
9) Clutch-drum bearing
10) Clutch-drum bushing
11) Bushing
12) Clutch hub
13) Clutch-seal washer
14) Clutch-hub lock nut
15) Clutch rod
16 A) Driving disc (7 items)
16 B) Driving disc (1 item)
17) driven disc (7 items)
18) Clutch mushroom
19) Exhaust-valve needle cage
20) Needle plate and exhaust-valve
21) Clutch 15 shaft Seeger
22) Clutch press
23) Clutch spring
24) Aluminium clutch spring bushing
25) Susp cart clutch ta. 6x25 Allen

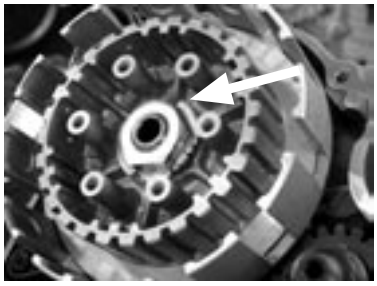
Element	Nm	Kgf-m
A	70	7



Holding the clutch hub with the special tool provided, tighten the clutch-hub nut at the specified torque.

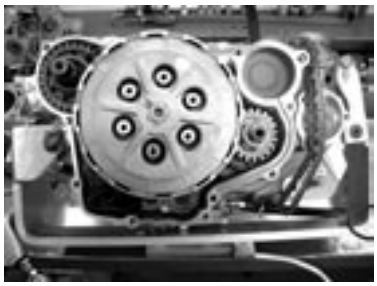
Tool Description:
Clutch-hub holder

Clutch-hub nut:
70 Nm (7 Kgf-m)

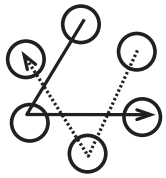


Bend the washer tongue firmly.

Fit the clutch driving discs and driven discs into the clutch hub, one by one and in the prescribed order.



Tighten the screws on the clutch-plate springs in a diagonal sequence, as illustrated.



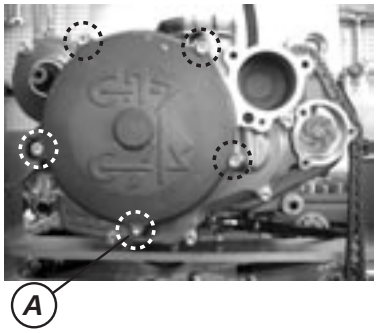
CLUTCH COVER

Fit the centering devices (1) and a new seal.

CAUTION!
Use a new seal, to prevent oil leaks.

Tighten the screws on the clutch cover firmly.

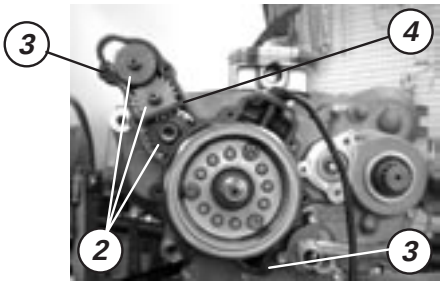
CLUTCH-DISC COVER



Tighten the screws on the clutch-disc cover firmly.

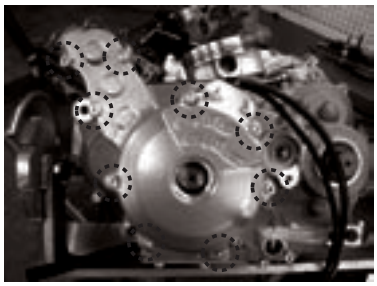
NOTE:
Fit the new seal and the screws (A) on the clutch-disc cover, as illustrated.

ALTERNATOR-ROTOR COVER

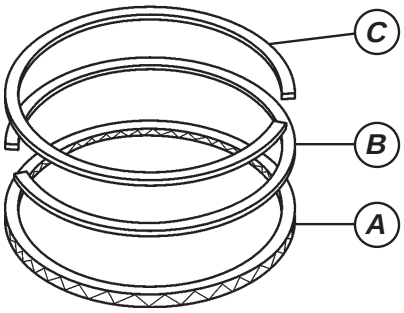


Fit the starter driven gears (2), the centering devices (3) and the new seal (4).

CAUTION!
Use a new seal, to prevent oil leaks.



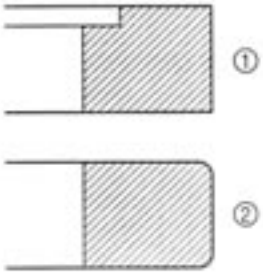
Tighten the screws on the alternator-rotor cover firmly, always diagonally to each other.

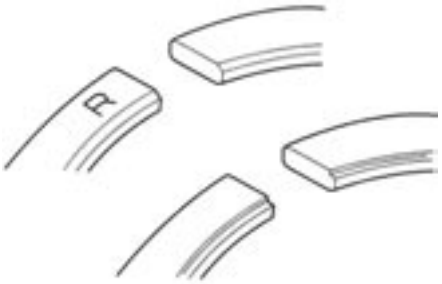


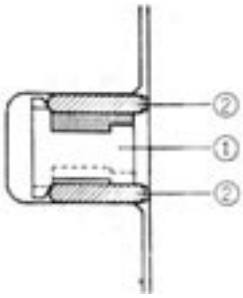
PISTON RINGS

Start by fitting the lubrication ring, followed by the 2nd ring and finally by the 1st ring.

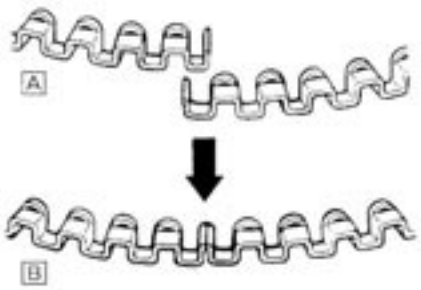
NOTE:
Piston rings 1 (1) and 2 (2) have different shapes. Piston rings 1 and 2 must be attached with their marks facing upwards.





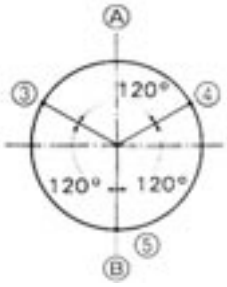


Start by fitting a spacer (1) into the lubrication-ring groove, and then fit both side guides (2). The spacer and the side guides have no specific top and bottom. They may be fitted in any position.



CAUTION!
When fitting the spacer, prevent its two ends from overlapping in the groove.

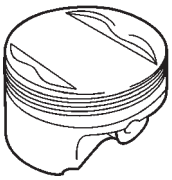
A) Wrong
B) Right



Place the piston-ring openings as illustrated. Before fitting the piston into the cylinder, check to see that the openings are properly positioned.

A) Exhaust side
B) Inlet side
3) 2nd ring and lower side guide
4) Upper side guide
5) 1st ring and spacer

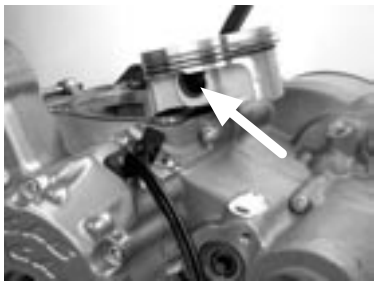
PISTON AND CYLINDER



Reverse the above operations to install the piston and cylinder.

NOTE:
Fit the piston with the mark on its crown facing the exhaust side.

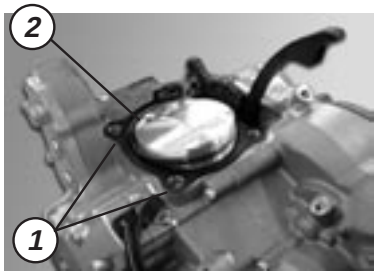
Apply a molybdenum-oil solution to the piston bolt and the connecting-rod foot.



Cover the cylinder base with a clean cloth to prevent the piston-bolt spring ring from falling into the crankcase. After that, use long-nose pliers to attach the piston-bolt spring ring.

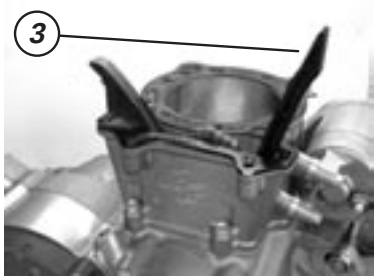
CAUTION!
Use a new piston-bolt spring ring to prevent it from breaking if bent.

Apply motor oil to the sliding surface of the piston and the connecting-rod crank end.



Attach the centering pins (1) and a new seal (2) to the crankcase.

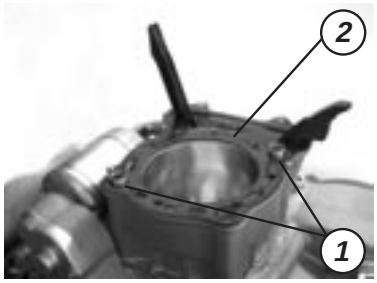
CAUTION!
Use a new seal, to prevent oil leaks.



Hold the piston rings with their sections properly positioned, and attach them to the cylinder. Check to see that the rings remain properly held by the cylinder skirt.

NOTE:
When fitting the cylinder, tighten the camshaft driving chain after attaching it. The camshaft driving chain must not get jammed between its pinion and the crankcase when the crankshaft is turning.

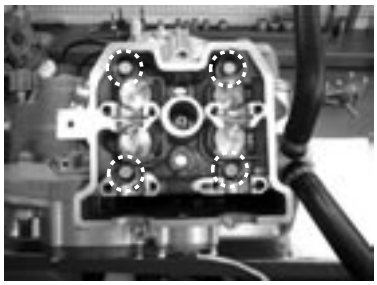
NOTE:
The crankcase features a moulded bracket for the lower end of the camshaft driving-chain guide. Check to see that the guide (3) fits correctly, as otherwise both the chain and the guide may become jammed.



CYLINDER HEAD

Attach the centering pins (1) and a new cylinder-head gasket (2).

CAUTION!
Use a new cylinder-head gasket, to prevent petrol leaks.

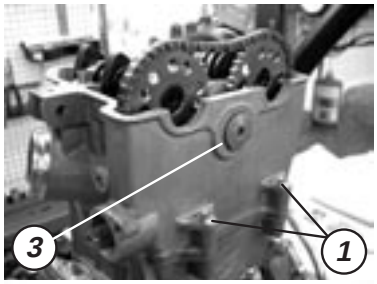


With the cylinder head properly settled on the cylinder, secure the cylinder head by tightening the screws in a diagonal sequence. Tighten the cylinder-head screws at the specified torque.

Cylinder-head screw:
Initial: 25 N, (2.5 kgf-m)
Final: 46 N, (4.6 kgf-m)

NOTE:
Apply motor oil to the threaded areas of the cylinder-head screws and their washers.

Position the washers with their rounded faces upwards.

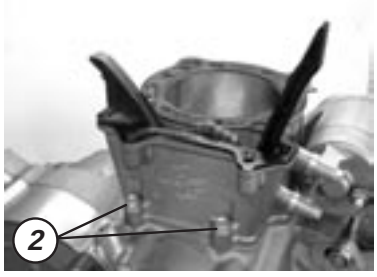


After tightening the cylinder-head screws at the specified torque, tighten the cylinder-head screws (1) and the cylinder screws (2) at the specified torque.

Cylinder-head screw: 10 N, (1 kgf-m)
Cylinder screws: 10 N, (1 kgf-m)

Tighten the cylinder-head side screw (3) at the specified torque.

Cylinder-head side screw: 14 Nm (1.4 Kgf-m)



CAMSHAFT / AUTOMATIC DECOMPRESSOR ASSEMBLY

Position the crankshaft with the piston at inner dead-centre (P.M.S.).

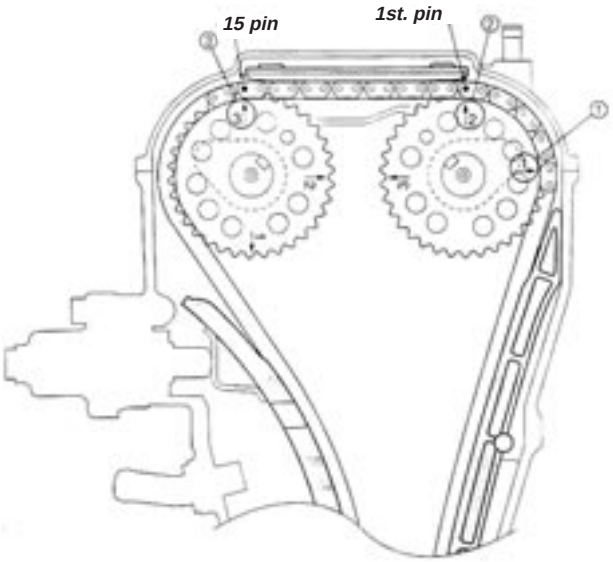
CAUTION!
If the crankshaft turns without lifting the camshaft driving chain, the chain will become jammed between the crankcase and the pinion.

NOTE:
Just a moment before attaching the camshaft to the cylinder head, apply a molybdene-oil solution to the camshaft journals and to the cam surfaces. Also, apply motor oil to the camshaft-journal brackets.

Place each camshaft in the correct position.

NOTE:
Camshafts marked "EX" belong in the exhaust side, and camshafts marked "IN" belong in the inlet side.

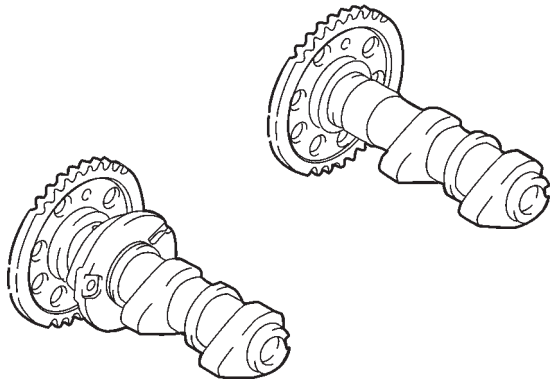
Having the camshaft with the piston at inner dead-centre position (P.M.S.), hold the camshaft firmly and slightly pull the chain upwards to remove any clearance between the camshaft-chain driving pinion and the exhaust-camshaft pinion.



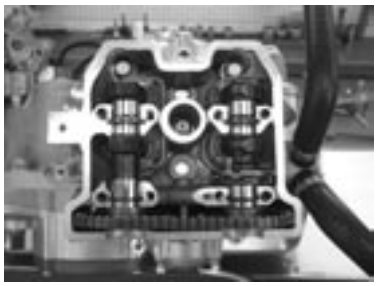
The exhaust-camshaft pinion bears an arrow marked "1" (1). Turn the exhaust camshaft in such a manner that the arrow becomes aligned with the surface of the cylinder-head gasket. Attach the camshaft driving chain to the exhaust-camshaft pinion.

A second arrow marked "2" (2) must now be pointing upwards. Starting with the link pin situated just above the arrow marked "2" (2), count up to 15 link pins (moving from the exhaust-camshaft side towards the inlet-camshaft side).

Attach link pin 15 to the chain with the arrow marked "3" (3) on the inlet pinion. Refer to the following illustrations.



NOTE:
The camshaft chain must now be fitted to all three pinions. Be careful not to move the crankshaft before the camshaft-journal brackets and the camshaft-chain idler are properly secured.



Fit the centering pins.

Place the brackets of the camshaft journals and the chain guide in the correct position.

NOTE:
Camshaft-journal brackets marked "EX" belong in the exhaust side, and camshaft-journal brackets marked "IN" belong in the inlet side.

Tighten the screws on the camshaft-journal brackets at the specified torque.

Camshaft-journal bracket screw:
10 Nm (1 Kgf-m)

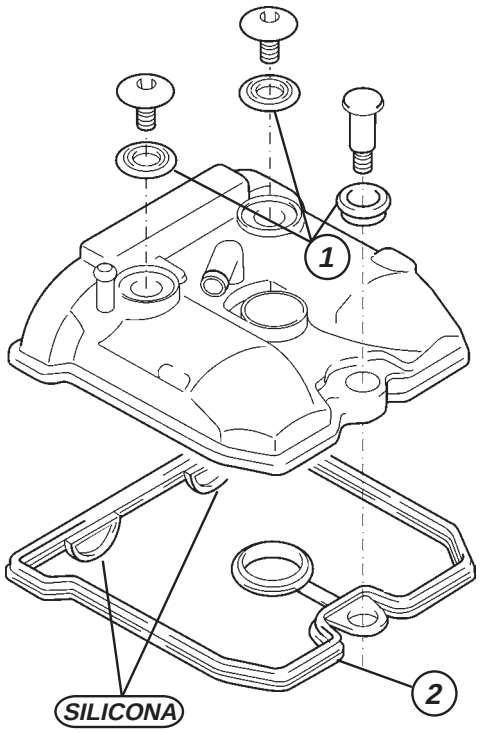
Once the camshaft journals have been fitted you must proceed to the valve clearance adjustment.

Tool ref.:
Thickness gauge

DATA:
Exhaust valves: 0.25 mm
Intake valves: 0.15 mm

Using the thickness gauge, the clearance between the camshaft and the valve's top cup should be checked. If the clearance does not correspond to the one expressed in DATA, the valve shim must be changed by another one that corresponds to the adequate setting.

CYLINDER-HEAD COVER



Totally remove any oil from the contact surfaces of the cylinder head and its cover.

Apply silicone to the end plugs of the cylinder-head cover joint, as illustrated.

Tool Description:
Silicone

NOTE:
When tightening the screws on the cylinder-head cover, the piston must be in the inner dead-centre position of the compression stroke.

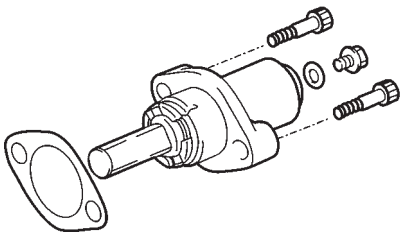
Apply motor oil to both faces of the washer (1).

Tighten the screws on the cylinder-head cover slightly, in a diagonal sequence, and then tighten them at the specified torque.

Cylinder-head cover screw:
Initial: 10 N, (1 kgf-m)
Final: 14 N, (1.4 kgf-m)

CAUTION!
Use new washers (1) and a new rubber seal (2).

CAMSHAFT DRIVING CHAIN IDLER



Attach the camshaft driving chain idler. Pay special attention to the following points:

Apply motor oil to the pushing rod.

Using a flat-pointed screwdriver, turn the adjusting screw clockwise until the pushing rod becomes locked.

Attach a new seal to the body of the chain idler.

CAUTION!
Use a new seal, to prevent oil leaks.

Attach the camshaft driving-chain idler to the cylinder and then tighten both Allen screws at the specified torque.

Camshaft chain tension-adjusting screw. 10 N, (1 kgf-m)

Using a flat-pointed screwdriver, turn the adjusting screw anticlockwise until the pushing rod becomes unlocked.

Tighten the screw securing the bracket of the camshaft-chain idler spring, at the specified torque.

Screw securing the bracket of the camshaft-chain idler spring. 8 Nm (0,8 Kgf-m)

GASGAS

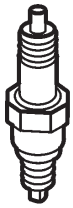
Regular Maintenance

SPARK PLUG

Inspection after 30 hours' operation.
To be replaced after 60 hours' operation.

Detach the fuel tank.
Detach the spark-plug arm and remove the spark plug.

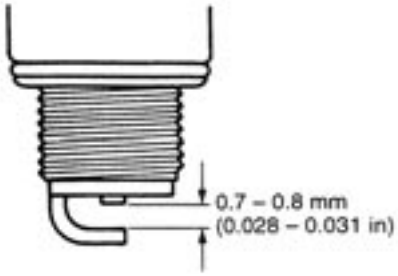
	COLD	*STANDARD*	*HOT*
NGK	CR9E	CR8E	CR7E
DENSO	U27ESR-N	U24ESR-N	U22ESR-N
	U31ESR-N		



Cinder buildups

Check the spark plug for cinder.

Remove any cinder buildups with a spark-plug cleaning tool, or use a point-ended tool.



Spark-plug tolerance

Use a thickness gauge to measure the tolerance.

If the spark plug is found to be out of tolerance, adjust the tolerance.

DETAILS:
Standard: Tolerance: 0.7 - 0.8.
Tool:
Thickness gauge.

Electrode

Check the condition of the electrode.

If the electrode is found to be extremely worn or burned, replace the spark plug with a new one.

The spark plug must also be replaced if it has a broken insulator, a damaged thread, etc.

CAUTION!
Check the size and length of the thread when replacing a spark plug. If the spark-plug neck is too short, cinder will build up within the spark-plug cavity and this may damage the engine.

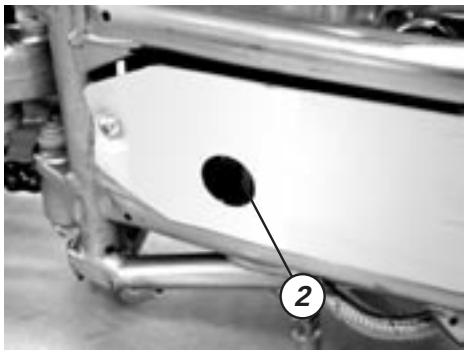
Spark-plug fitting

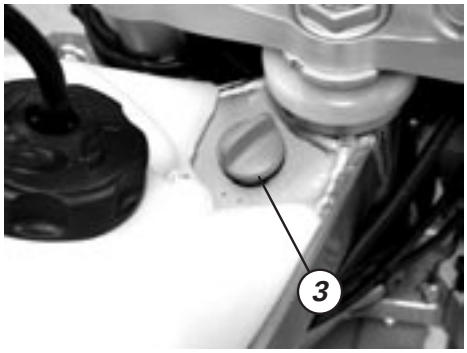
CAUTION!
In order not to damage the cylinder-head thread, start by screwing in the spark plug by hand, and then use the spark-plug spanner to tighten it at the specified torque.

Torque for tightening the spark plug:
11Nm (1.1 Kgf-m, 8.0 lb-ft).

ENGINE OIL AND OIL FILTER

To be initially replaced after 5 hours' operation and then every 60 hours.





The oil must be replaced with the engine still hot The oil filter is to be replaced with the same frequency as the engine oil.

Engine-oil replacement

As the engine oil is within the crankcase, by removing the screws (1) on the chassis we can also unscrew the oil-reservoir filling plug (3). This should drain the oil contained in the engine.

When the oil has been drained, insert and tighten the screws at the specified torque and pour a new supply of oil through the filling hole. Every time the oil is renewed (without replacing the filter) the engine will hold about 1.7 L (1.8 US qt, 1.5 Imp qt) of oil. Use API-compliant SF- or SG-grade motor oil with a SAE 10W-40 viscosity rank.

ENGINE-OIL DRAINING
In the crankcase (1): 21 Nm (2.1 Kgf-m, 15.0 lb-ft)
In the chassis (2): 18 Nm (1.8 Kgf-m, 13.0 lb-ft)

CAUTION!
When inserting the seal-screw (2), position the seal as illustrated.

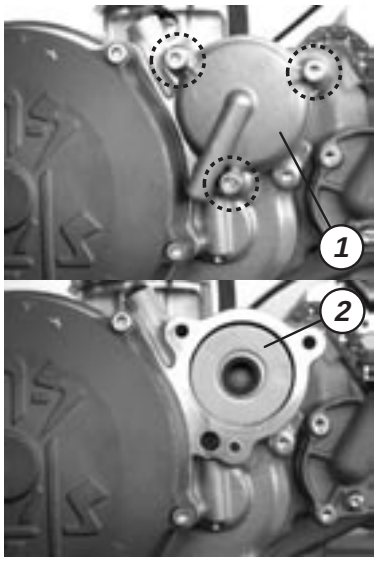
To check the oil level, place the motorcycle in its operating position.

Attach the oil-reservoir plug (3).

Start the motorcycle engine and keep it ticking over for 3 minutes.

Cut the engine, wait for 3 minutes and then use the dipstick (4) to check the oil level. The oil level should reach between level marks "L" and "F".

NOTE: The oil in the engine expands and its level rises when hot.



Oil-filter replacement

Follow the same procedure as for replacing the engine oil.

Remove the oil-filter lid (1) and the oil filter (2)

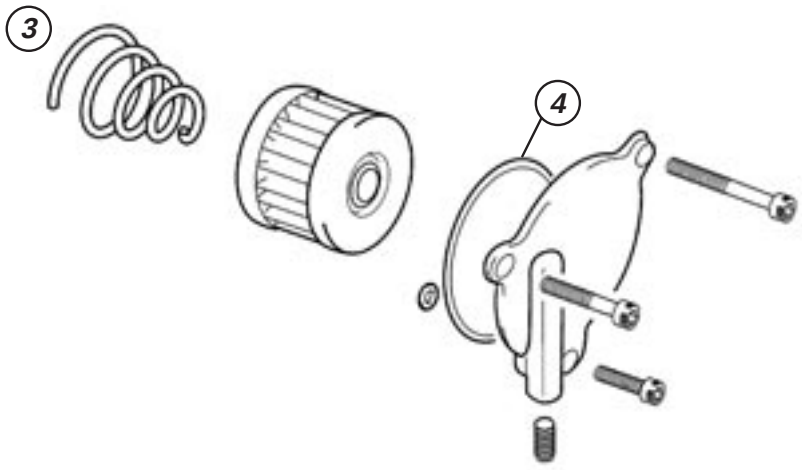
Replace the filter with a new one.

NOTE: Before fitting the oil-filter lid, make sure that the spring (3) and a new O-ring seal (4) have been attached correctly.

Check to see that the O-ring seal (5) behind the filter has been positioned correctly.
Replace the oil-filter lid and tighten the lock nut.
Replace the supply of new oil in the engine and check the oil level as described for the oil-replacement procedure.

DETAILS:
Engine oil capacity
Oil replacement: 1.7 L (1.8 US qt, 1.5 Imp qt)
Oil and filter replacement: 1.8 L (1.9 US qt, 1.6Imp Imp qt)
Engine inspection: 1.9 L (2.0 US qt, 1.7 Imp qt)

CAUTION!
When fitting the oil filter, make sure that it has been installed as illustrated above. Improper filter fitting may result in damage to the engine.



ENGINE OIL PIPEWORK

To be initially inspected after 5 hours' operation and then every 30 hours.

Check to see that no engine-oil pipes show signs of damage or leaks. If any kind of damage is found, replace the pipes with new ones.

Check compression

A cylinder with the proper compression means that conditions inside the cylinder are good. Decisions to check cylinders are usually based on the results of cylinder-compression measurements. Inspections carried out by dealers should include a cylinder-compression check.

Compression DETAILS:
Standard: 1000 Kpa (10.0 Kgf/cm^2)

Low compression may indicate some of the conditions below:

- Cylinder walls excessively worn out.
- Worn out piston or rings.
- Rings stuck in their seats.
- Valve seats in bad condition.
- Cylinder head may be broken or have other defects.

NOTICE: When compression is low, verify the engine for the conditions listed above.

Compression-check procedure

NOTE:
Before checking the engine compression, make sure that the cylinder-head screws have been tightened at the specified torque, and that the valves have been properly adjusted.

Warm up the engine before commencing the compression check..

Make sure that the battery is fully charged.

Carry out the compression measurement as follows:

- Remove the spark plug.
- Insert the pressure gauge into the thread that would take the spark plug in the cylinder head. Make sure that the connection has been properly carried out.
- Keep the butterfly valve in the fully open position.
- Press the start button and have the engine running for a few seconds.
- Record the highest pressure-gauge readout.

Tool Description:
Pressure gauge
Adaptor

Oil-pressure check

Check the oil pressure regularly. This should provide useful information on the condition of the engine moving parts.

DETAILS:
Oil pressure:
Up 40 Kpa (0.4 Kgf/cm, 5.7 psi) at 3000 rpm
Up 140 Kpa (1.4 Kgf/cm, 19.9 psi)

Low or high pressure may indicate some of the conditions below:

Low oil pressure:

- Clogged oil filter.
- Leaking in oil ducts.
- Damaged ring seal.
- Defective oil pump.
- A combination of the defects above.

High oil pressure:

- Oil viscosity too high.
- Blocked oil ducts.
- A combination of the defects above.

Oil-pressure check procedure

Attach a tachometer to the high-voltage cable.

Remove the plug from the main oil circuit.

Warm up the engine as follows:
Summer: 10 minutes at 2000 rpm.
Winter: 20 minutes at 2000 rpm.

After warming up the engine, incrase the turning speed to 3000 rpm (check the tachometer) and record the oil-pressure readout from the tachometer.

Tool Description:
Pressure gauge.
Adaptor.

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Notes

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