
WORKSHOP MANUAL

DERBI 125c.c. 4T

This manual has been prepared by **DERBI NACIONAL MOTOR, S.A.U.** sociedad Unipersonal for use by concessionaires and **DERBI** sub-agency workshops. It is assumed that persons using this work for the maintenance and repair of **DERBI** vehicles will have a basic grounding in the principles of mechanics and the necessary technical methods used in the repair of such vehicles. Major variations in the technical specifications of the vehicles or in specific repair operations will be communicated by means of updates to this manual.

Nevertheless, completely satisfactory work cannot be performed without the necessary installations and tools: for this reason we strongly recommend that you consult the pages in this manual which refer to specific tools and equipment.

Information in this manual which is of particular importance is indicated by the following notes:

N.B. This indicates a note which gives key information for performing the procedure more easily and clearly.

Caution! This indicates specific procedures which should be followed to avoid causing damage to the vehicle.

Warning!!!

This indicates procedures which should be followed to avoid possible injury to the person carrying out the repairs to the vehicle.

All data may be changed without prior notice.

Derbi declines all responsibility for the use of non-original parts and accessories which have not been tested and approved.

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GENERAL INFORMATION

SAFETY REGULATIONS

If it is necessary to work on the vehicle with the engine running, make sure that the environment is well ventilated, if necessary using a suitable exhaust system. Never run the engine in closed places since the exhaust gases are toxic.

The engine and exhaust system components heat to very high temperatures and may remain hot for some time after the engine has been switched off. Wear insulated gloves to work on these components, or wait until the engine and exhaust system cool down.

Used engine oil can cause skin cancer if it remains in contact with the skin for a long time. Although this is very improbable unless handling used oil every day, it is advised to wash your hands with soap and water as soon as possible after handling used oil.

Used engine oil contains substances that are harmful for the environment. Dispose of used oil in a manner that respects nature and is in accordance with current legislation.

The battery electrolyte contains sulphuric acid. Protect your eyes, clothes and skin. Sulphuric acid is highly corrosive; if it comes into contact with the eyes or skin, wash with plenty of water and go immediately to a doctor.

The battery produces hydrogen which can be highly explosive. Do not smoke and avoid naked flames and sparks near the battery, especially when recharging it.

Petrol is very inflammable and under some conditions can explode. Do not smoke in the work area and keep clear of naked flames and sparks.

GENERAL INFORMATION

MAINTENANCE RULES

Use original DERBI spare parts and lubricants recommended by the manufacturer. Spare parts other than originals or that does not conform can damage the vehicle.

Only use the special tools designed for this vehicle.

Always use new seals, seal rings and split pins when assembling.

After disassembly, clean the components with non flammable solvent or that has a high flash point. Lubricate all working surfaces before reassembling, except for the bevel pairs.

After reassembly, check that all the components have been installed correctly and operate perfectly.

For disassembly, overhaul and reassembly operations, only use tools with metric measurements. The metric screws, nuts and bolts are not interchangeable with English measurement couplings. The use of unsuitable tools or couplings could damage the vehicle.

When working on the vehicle electrical system, check the correct assembly of the electrical connections, especially those connecting to earth and to the battery.

VEHICLE IDENTIFICATION

Vehicle	Frame prefix	Engine prefix
SENDA 125 SM SENDA 125 R 4T	VTHSC2A1A ¿ H x x x x x SM VTHSC1A1A ¿ H x x x x x R	JD09E - xxxxxxxx



TECHNICAL SPECIFICATIONS SM SENDA 125 R4T

Engine	Single cylinder 4T EURO 2
Bore x Stroke	56.5 x 49.5
Cylindre capacity	124 c.c.
Carburator	KEIHIN 22
Cooling system	Air cooled
Starting system	Electrical start
Compression ratio	11:1
Maximum power	12 HP/8.500 rpm
Fuel	Unleaded petrol
Lubrication system	Wet sump
Ignition	C.D.I.
Spark plug	NGK DPR8EA
Primary transmission	Gear assembly
Clutch	Multidisc
Gear box	5 speed
Front suspension	Hydraulic fork 41 mm. 195 mm. travel
Rear suspension	Monoshock 170 mm. travel
Tyres	110/80x17 130/70x17"
Front brake	Hydraulic 300 mm. disk
Rear brake	Hydraulic 220 mm. disk
Battery	12V 8Ah
Wheelbase	1.425 mm.
Maximum height	1.220 mm.
Total length	2.130 mm.
Maximum width	805 mm.
Fuel tank	7,5 L.

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LUBRICATION

Values in mm

PART		STANDARD VALUE	LIMIT VALUE
Engine oil capacity.	Oil pan.	1,0 litres	-
	Complete lubrication system.	1,2 litres	-
Recommended oil.		SELENIA HI SCOOTER oil 4T Service classification API SG or higher. Viscosity: SAE 20W-50	-
Oil pump rotor.	Clearance between outer and inner rotors.	0,15	0,20
	Clearance between pump casing and outer rotor.	0,15 - 0,21	0,35
	Rotors end float.	0,03 - 0,12	0,15

FUEL CONSUMPTION

Values in mm

PART		STANDARD VALUE	LIMIT VALUE
Carburettor identity code.		PDC3F	-
Main jet.		# 95	-
Slow running jet.		# 38 x 2	-
Needle clip position.		Third notch from the top.	-
Flow adjustment screw opening.	Initial	Unscrew by 2 turns.	-
	Final	See procedure on page 35.	-
Float level.		14,0	-
Engine idling speed.		1400 ± 100 rpm	-
Gas knob clearance.		2,0 - 6,0	-

HEAD AND VALVES

Values in mm

PART			STANDARD VALUE	LIMIT VALUE
End of compression pressure.			1.373 ± 98 kPa; 14,0 ± 1 kgf/cm² at 600 rpm.	-
Head off-level.			-	0,10
Valve, valve spring, valve guide.	Valve clearance when cold.	Intake	0,1 ± 0,02	-
		Exhaust	0,1 ± 0,02	-
	Valve spring free length.	Internal	39,20	38,00
		External	44,90	43,50
	Valve stem outer diameter.	Intake	5,450 - 5,465	5,42
		Exhaust	5,430 - 5,445	5,40
	Valve guide inner diameter.	Intake	5,475 - 5,465	5,50
		Exhaust	5,475 - 5,465	5,50
	Clearance between stem and guide.	Intake	0,010 - 0,035	0,08
		Exhaust	0,030 - 0,055	0,10
Width of seal surface.		1,10 - 1,30	1,50	
Rocker / Pin.	Rocker hole inner diameter.		12,000 - 12,018	12,05
	Pin outer diameter.		11,966 - 11,984	11,93
	Clearance between rocker and pin.		0,016 - 0,052	0,08
Camshaft.	Height of cam lobe.	Intake	31,402 - 31,582	31,10
		Exhaust	32,082 - 31,262	30,70
	Eccentricity.		-	0,03

CYLINDER AND VALVES

Values in mm

PART			STANDARD VALUE	LIMIT VALUE
Cylinder.	Inner diameter.		56,500 - 56,510	56,60
	Taper.		-	0,08
	Ovalising.		-	0,05
	Deformation.		-	0,05
Piston, piston rings, crank pin.	Piston assembly direction.		'IN' marking facing intake side	-
	Piston outer diameter.		56,470 - 56,490	55,42
	Measuring point on piston outer diameter.		13 mm from lower edge	-
	Hole diameter of crank pin on piston.		15,002 - 15,008	15,04
	Crank pin outer diameter.		14,994 - 15,000	14,96
	Clearance between piston and crank pin.		0,002 - 0,014	0,07
	Clearance between piston ring and throat.	1 st	0,015 - 0,45	0,09
		2 nd	0,015 - 0,45	0,09
	Clearance at end of piston ring.	1 st	0,10 - 0,25	0,5
		2 nd	0,20 - 0,35	0,5
Oil ring		0,20 - 0,70	0,9	
Clearance between cylinder and piston.			0,01 - 0,04	0,15
Connecting rod small end inner diameter.			15,010 - 15,028	15,06
Clearance between connecting rod and crank pin.			0,010 - 0,036	0,10

CLUTCH AND GEARBOX LEVERS

Values in mm

PART		STANDARD VALUE	LIMIT VALUE
Clutch lever clearance.		10,0 - 20,0	-
Clutch spring free length.		34,6	32,5
Thickness of friction discs.		2,92 - 3,08	2,70
Metal discs distortion.		-	0,20
Clutch bell guide.	Inner diameter.	19,983 - 19,996	20,02
	Outer diameter.	27,959 - 27,980	27,93
Outer diameter of main shaft on the clutch bell guide.		19,967 - 19,980	19,92

CRANKCASE / GEARBOX / MAIN SHAFT

Value in mm

PART			STANDARD VALUE	LIMIT VALUE
Main shaft.	Eccentricity.		-	0,10
	Connecting rod big end free float.		0,05 - 0,30	0,50
	Connecting rod big end radial clearance.		0 - 0,008	0,05
Gearbox fork, gearbox fork pin.	Gearbox fork hole diameter.		12,000 - 12,018	12,05
	Fork end thickness.		4,93 - 5,00	4,70
	Pin outer diameter.		11,976 - 11,994	11,90
Gearbox.	Gear inner diameter.	M3	20,020 - 20,041	20,07
		M5	23,020 - 23,041	23,07
		C1	19,520 - 19,541	19,57
		C2	23,020 - 23,041	23,07
		C4	20,020 - 20,041	20,07
	Bushing outer diameter.	M5	20,559 - 20,580	22,93
		C1	19,479 - 19,500	19,43
		C2	22,979 - 23,000	22,93
	Bushing inner diameter.	M5	20,020 - 20,041	20,20
		C1	16,516 - 16,534	16,60
		C2	20,000 - 20,021	20,10
	Clearance between gear and bushing.	M5	0,015 - 0,057	0,10
		C1, C2	0,020 - 0,062	0,10
	Clearance between gear and shaft.	C1	0,032 - 0,065	0,10
		C2	0,013 - 0,047	0,10
	Main shaft outer diameter.	M3, clutch bell guide.	19,959 - 19,980	19,91
		Bearing seat.	14,978 - 14,989	14,91
	Countershaft outer diameter.	Bushing C2, C4	19,974 - 19,987	19,91
		C1	16,469 - 16,484	16,41

BATTERY AND CHARGING SYSTEM

Values in mm

PART			SPECIFICATIONS
Battery.	Capacity.		12V - 6 Ah
	Current dispersion.		0 mA max.
	Voltage (20°C).	Charge completion.	Over 12,8V
		To be charged.	Under 12,3V
	Charging current.	Slow charge.	0,7A / 5 - 10 h
		Fast charge.	5,0A / 1,0 h
Alternator.	Power.		200W at 5000 rpm.
	Charge coil resistance (20°C).		0,1 - 1,0 Ω
Voltage adjusted by regulator/rectifier.			14,0 - 14,8V at 5000 rpm.

IGNITION SYSTEM

Values in mm

PART		SPECIFICATIONS
Spark plug.	NGK.	DPR8EA9.
	DENSO.	X24EPR-U9
	Distance between electrodes.	0,8 - 0,9 mm.
Ignition coil peak voltage.		100 V minimum.
Pulse generator peak voltage.		0,7 V minimum.
Ignition timing (mark «F»).		15° before TDC at 1400 rpm.
Ignition advance.	Start.	1800 ± 150 rpm.
	End.	3450 ± 150 rpm.
Maximum ignition advance.		32° before TDC

TORQUES

TYPE OF FASTENING	TORQUE in Nm (Kgm)
5 mm screw and hexagonal nut.	5 (0,5)
6 mm screw and hexagonal nut.	10 (1,0)
8 mm screw and hexagonal nut.	22 (2,2)
10 mm screw and hexagonal nut.	34 (3,5)
12 mm screw and hexagonal nut.	54 (5,5)
5 mm screw.	4 (0,4)
6 mm screw.	9 (0,9)
6 mm flanged screw (8 mm head).	9 (0,9)
6 mm flanged screw (10 mm head).	12 (1,2)
8 mm flanged screw and nut.	26 (2,7)
10 mm flanged screw and nut.	39 (4,0)

The torque values indicated in the next table only refer to the more important fastening elements.
All other fastening elements are to be tightened to the standard torques indicated in the following table.

ENGINE

PART	QUANTITY	Thread diameter (mm)	torque in Nm (Kgm)	NOTES
Lubrication:				
Oil drain screw.	1	36	15 (1,5)	Note 2
Centrifugal filter rotor cap screw.	3	5	5 (0,5)	
Centrifugal filter securing ring nut.	1	16	83 (8,5)	
Oil pump screw.	2	6	10 (1,0)	
		4	3 (0,3)	
Cylinder head and valves:				
Spark plug.	1	12	18 (1,8)	Note 3 Note 2 Note 2
Valve access hole cover.	2	36	15 (1,5)	
Valve clearance adjusting lock nut.	2	6	14 (1,4)	
Cylinder head cover nut.	4	8	26 (2,7)	
Cylinder head cover screw.	4	6	12 (1,2)	
Camshaft gear screw.	2	6	12 (1,2)	
Cam chain tensioner Alien screw.	2	6	12 (1,2)	
Cam chain tension screw.	1	6	4 (0,4)	
Cam chain tensioner shoe screw.	1	8	10 (1,0)	
Clutch and gear change:				
Clutch disengagement plate screw.	4	6	12 (1,2)	Note 2,4
Clutch hubs securing nut.	1	16	83 (8,5)	
Selector drum stop arm screw.	1	6	12 (1,2)	
Gear change pedal screw.	1	6	16 (1,6)	
Alternator and starter motor:				
Timing inspection cap.	1	14	10 (1,0)	Note 3
Camshaft access hole cap.	1	30	8 (0,8)	Note 3
Flywheel screw.	1	10	74 (7,5)	Note 2
Pulse generator Alien screw.	2	5	5 (0,5)	Note 1
Single direction clutch Torx screw.	6	6	16 (1,6)	Note 1
Sump / gearbox / camshaft:				
Main shaft bearing positioning plate screw.	2	6	12 (1,2)	Note 1

NOTE:

1. Apply sealant to the threads.
2. Lubricate threads and seats.
3. Lubricate O-ring.
4. Rivet.

SPECIAL TOOLS

DESCRIPTION	TOOL CODE	EQUIPMENT	SECTION
Float level checking tool.	19.1.20353	C	4
32 x 35 mm adapter.	19.1.20357	I	10
42 x 47 mm adapter.	19.1.20359	I	10
52 x 55 mm adapter.	19.1.20360	I	10
20 mm guide.	19.1.20363	I	10
Wrench to adjust flow adjustment screw.	19.1.20367	C	4
Handle for adapters.	19.1.20376	I	10
Valve springs compressor insert.	19.1.20382/10	I	6
Valve springs compressor.	19.1.20382	I	6
Flywheel stop wrench.	19.1.20403	I	9
24 mm wrench for ring nuts.	19.1.20404	I	3-8
Crankshaft stop.	19.1.20405	I	3
Flywheel extractor.	19.1.20406	I	9
Punch to remove/refit valve guide.	19.1.20407	C	6
72 x75 mm adapter.	19.1.20408	I	10
Multimeter adapter.	19.1.20409	C	12
45° cutter Ø 27.5 mm.	19.1.20411	C	6
15 mm guide.	19.1.20412	I	10
45° cutter Ø 33 mm.	19.1.20413	C	6
28 mm guide.	19.1.20404	I	10
32° cutter Ø 30 mm.	19.1.20415	C	6
32° cutter Ø 33 mm.	19.1.20416	C	6
60° cutter Ø 30 mm.	19.1.20417	C	6
Valve clearance adjustment wrench.	19.1.20418	I	2-6
Valve seat cutters support.	19.1.20419	C	6
Valve seat reamer.	19.1.20420	C	6
Clutch stop wrench.	19.1.20421	I	8
15 mm clamp.	19.1.21467/13	I	10
Ø 41 x 45 mm bell.	19.1.21467/30	I	10

C: Recommended

I: Essential

EMISSIONS CONTROL SYSTEM

Emission sources

The combustion process produces carbon monoxides and hydrocarbons. It is very important to control the hydrocarbons because; under certain conditions they can form photochemical pollution when exposed to sunlight. The carbon monoxide does not react in the same way, but it is toxic.

In order to reduce the carbon monoxide and hydrocarbon emissions a fuel supply system is used with a weak mixture and other systems.

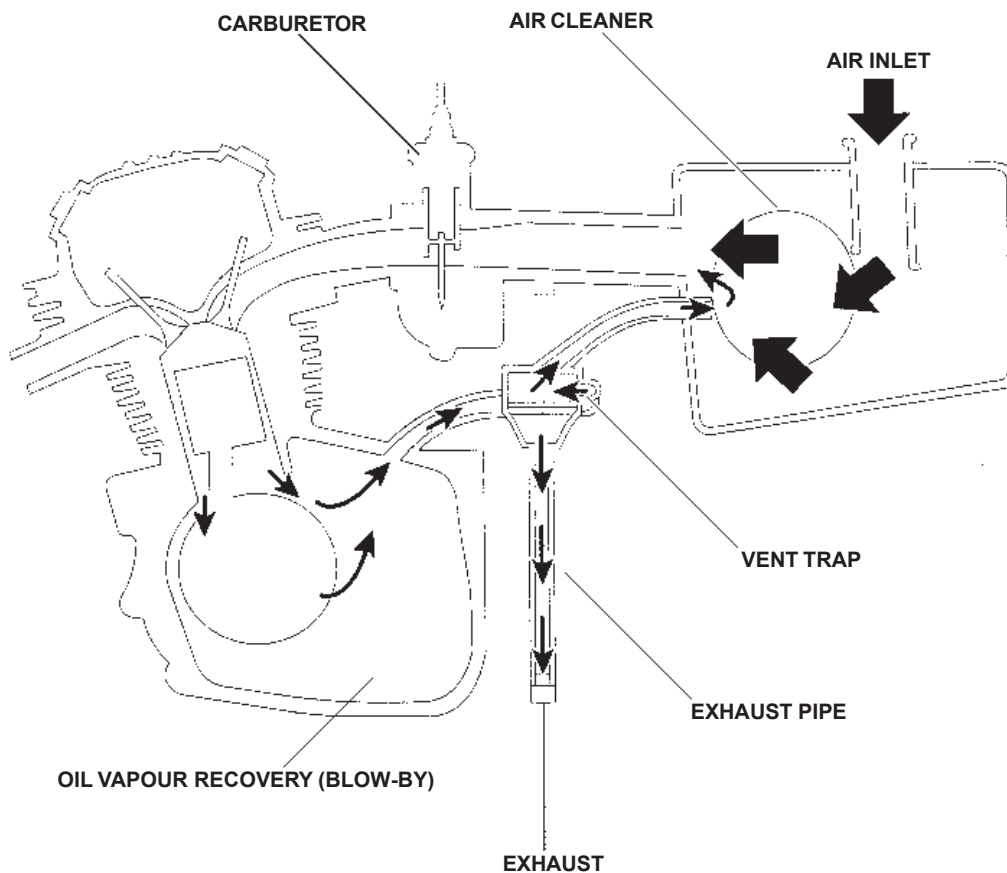
Emission control at exhaust

The system to control the emissions at exhaust consists of weak mixture adjustment. No adjustments are included, except that for idling, which is through the carburettor gate valve stop screw.

Sump emissions control system

The engine is fitted with a closed loop system that sends the vapours from the sump into the air cleaner and then to the combustion chamber.

The condensed vapours accumulate in a collection tank and the relevant exhaust pipe, which is to be periodically emptied. Presence of oil in the exhaust pipe should be checked more frequently if the vehicle is used at high speed or in the rain.



DISASSEMBLING THE FRONT SUSPENSION SENDA 125 R/SM. 4T

- Disassemble the suspension tubes from the drive plate, loosening the screws on its clamps.

- Fix the suspension tube in a vice, protecting its jaws with soft metal cushioning so as not to scratch or damage the tubes, and loosen the top locking cap.



- Remove the top locking cap, as well as the preload washer and the suspension spring.



- Have a container available in which to empty the hydraulic oil from each tube so as to measure it (pump the tube-leg-fork unit to ensure it is completely empty).



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- Remove the oil seal dust cap and its safety circlip.



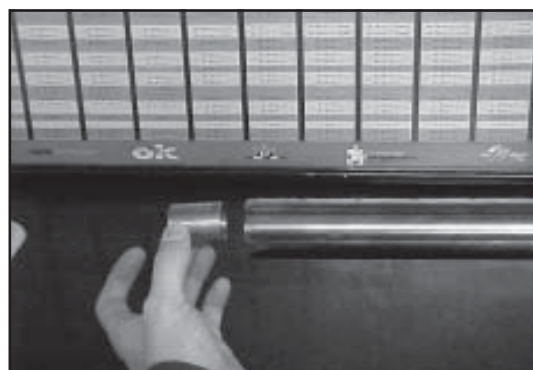
- Access the Allen screw located at the base of the fork leg and loosen it to free the hydraulic unit and the tube.



- Firmly separate the tube and the fork leg.



- Remove the hydraulic unit aluminium support cap on the inside of the fork leg.



- Then remove the hydraulic unit from the top of the suspension tube.



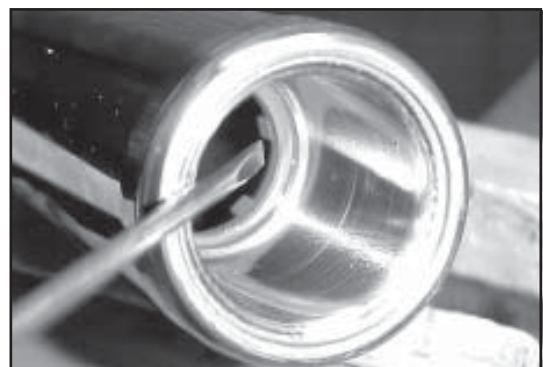
- Secure the fork leg in a vice with soft metal cushioning in its jaws and place a cloth over its mouth so as not to damage it, Then remove the oil seal using a lever. Replace this whenever the unit is disassembled.



- Clean and degrease all of the components of the front suspension in order to be able to check them.

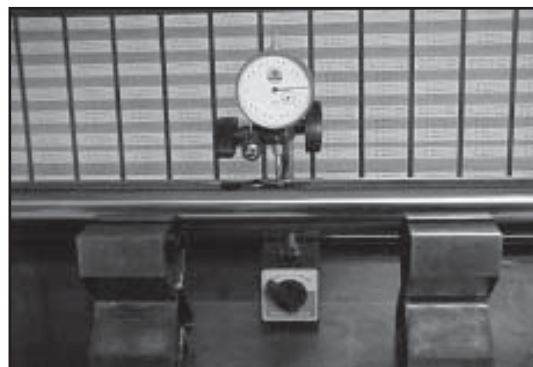


- Check the level of wear of the suspension tube guide bushing. Replace when over 30% of its total surface area is damaged.



-
- Using X-shaped blocks and a dial gauge installed on a fixed support, ascertain the level of misalignment of the tube.

Service limit: 0.4 mm.



- Check the length of the suspension spring and also for deformities and/or lack of parallelism.



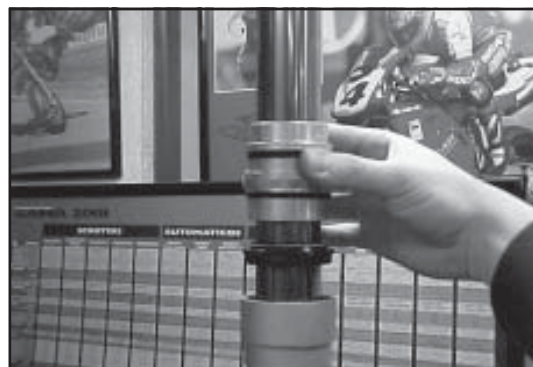
- Control the condition of the rebound spring and the nylon guide bushing of the hydraulic unit, as well as the O-ring. Replace them where deformed or showing signs of damage.



Clean and degrease all of the parts comprising the unit before re-assembling.



Re-assemble the unit, paying particular attention to tightening the hydraulic unit on the fork leg, as well as the assembly of the oil seal, placing a small amount of suspension oil on its lips and inserting it with the help of an appropriate tool. Replace the hydraulic oil and do not forget to insert the preload bushing between the spring and the cap.



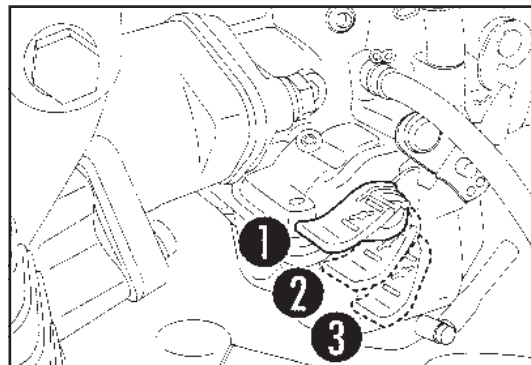
SUSPENSION	Free spring length (mm.)	cm ³ oil/tube	Oil type
PAIOLI	848 ± 3	435 C.C.	Sae 7,5 W

MAINTENANCE

STARTER LEVER ON CARBURETTOR

Check that the starter lever is functioning properly. The starter lever must be easy to manage and remain in position.

1. Starter engaged.
2. Starter partially engaged.
3. Starter not engaged at all.



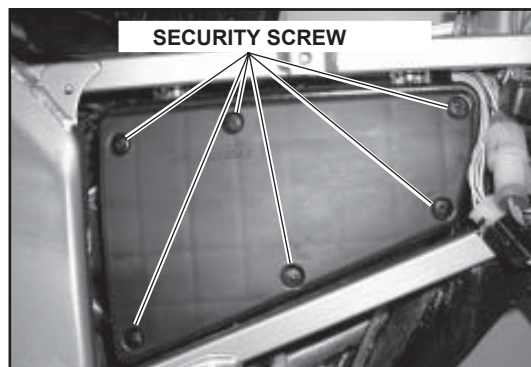
AIR CLEANER REPLACEMENT

Note: If the vehicle is used in the rain or on dusty roads, check and replace the air cleaner more frequently than indicated in the Scheduled Maintenance table given in the Owner's Manual.

Disassembly

Proceed as follows:

- Place the vehicle on the side stand to remove the left-hand panel, remove the seat and the 2 panel screws.
- Loosen the six filter cover securing screws and remove it.



- Remove the air filter foam, wash in a mixture of soap and water, then drain and dry completely before impregnating it with special oil for filters and reinstalling.

Assembly

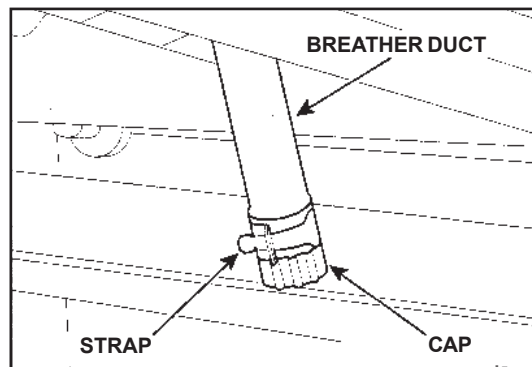
- Proceed in reverse order to disassembly.
- Fit the left-hand side panel.

BLEEDING THE SUMP

Note: Carry out this operation more frequently than indicated in the Scheduled Maintenance table if the vehicle is used in the rain at high speed, or after washing, or if the vehicle has fallen over. Carry out this operation if the level of deposits can be seen in the transparent section of the breather duct.

To clean proceed as follows:

- set the vehicle on the kickstand; open the strap and take off the breather duct cap; drain off the deposits and impurities, refit the cap and set the strap back in place.



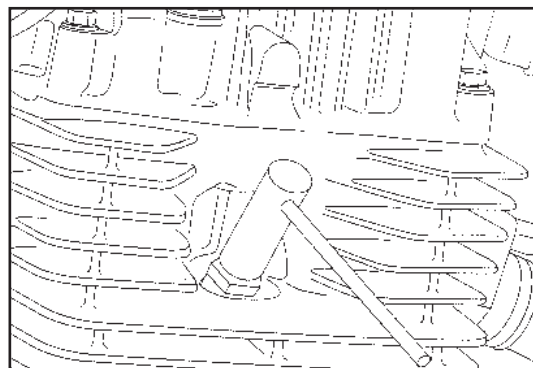
SPARK PLUG

Removal

Disconnect the spark plug cap.

Note: before removing the spark plug use compressed air to remove any dirt at the base. Make sure no impurities enter into the combustion chamber.

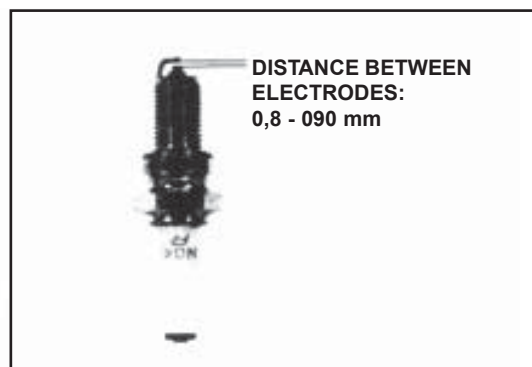
- Remove the spark plug using the special wrench in the tool kit or an equivalent.
- Inspect or replace the spark plug as described in the Scheduled Maintenance table.



Check

Make these checks and if necessary replace the spark plug:

- Damaged insulation.
- Worn electrodes.
- Burns, discolouring:
- Dark / light brown colour indicates that the spark plug is in good condition:
- A very pale colour indicates an ignition system problem or a weak mixture;
- A wet spark plug or black sooty deposits indicate that the mixture is too rich.
- Clean the plug electrodes with a metal brush
- Use a thickness gauge to measure the distance between the centre and side electrodes. If necessary adjust the distance bending the side electrode with care.



Distance between electrodes: 0.80 - 0.90 mm

Assembly

To avoid damage to the head, screw the spark plug in by hand, then lock it with the wrench to the specified torque.

Torque: 18 Nm (1.8 kgm)

VALVE CLEARANCE

Check and adjustment

Note: The valve clearance is to be checked and adjusted with the engine cold (less than 35°C)

Proceed as follows:

- remove the saddle;
- remove the tank after disconnecting the pipe from the tap;
- unscrew the four securing screws and remove the right and left object compartments;
- unscrew the bolt, and then remove the engine upper stand brackets;
- remove the cap from the crankshaft access hole and the timing hole cap;
- use a 14 mm socket wrench and turn clockwise to align the «T» marking to the reference notch on the sump left-hand cover;
- make sure that the piston is at TDC (top dead centre) in the compression stage;
- remove the valve inspection caps;
- check the clearance of both valves loosening the lock nut and the adjustment screw to be able to insert the blade of the thickness gauge between the latter and the valve stem;
- tighten the adjustment screw and at the same time withdraw the thickness gauge blade outwards until a slight resistance is felt;

Valve clearance:

Intake / Exhaust: 0.1 ± 0.02 mm

- Keeping the adjustment screw in position, tighten the lock nut to the specified torque, and then take out the thickness gauge blade;

Lock nut torque

14Nm (1.4kgm)

Special tool

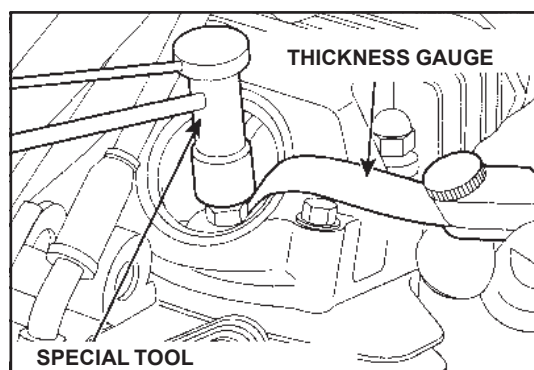
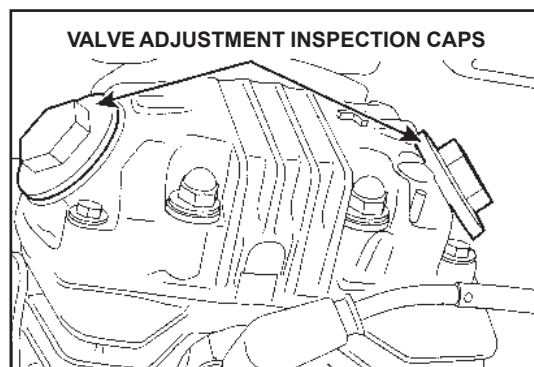
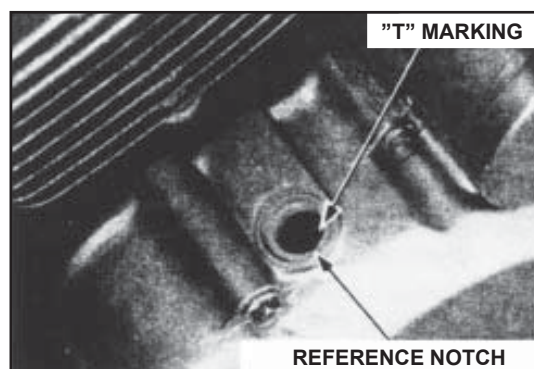
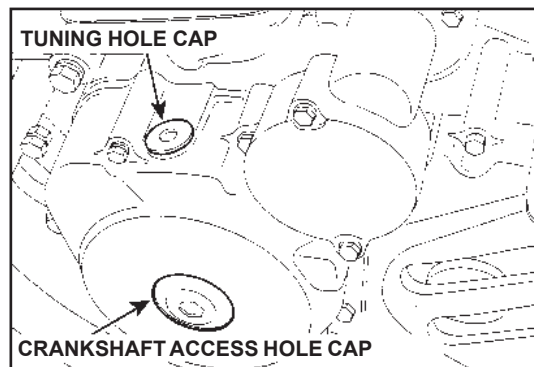
Valve clearance adjustment wrench: 19.1.20418

- lubricate the threads and the valve inspection cap O-rings, then assemble and lock to the specified torque:

Torque:

Valve access hole covers: 15 Nm (1.5 kgm)

- lubricate the relevant O-rings and refit the crankshaft access hole cap and the tuning hole cap;



Torque:

Tuning hole cap: 10 Nm (1.0 kgm)

Crankshaft access hole cap: 8 Nm (0.8 kgm)

ENGINE OIL / OIL FILTER

Note: It is a good practice to periodically check the level and top up if necessary. If the oil level is too high this could reduce performance and interfere with the clutch operation.

On the other hand, if the level is too low it can cause the engine to overheat and shorten the life of some components. If the oil added is of a different brand or of poor quality, the lubricating function of the oil is endangered.

Oil level check

- Support the vehicle on a stand or suitable support in vertical position on a flat surface;
- start the engine and let it run idling for a few minutes to reach operation temperature;
- Switch off the engine and wait 2-3 minutes;
- remove the dip stick and clean the rod with a clean cloth;
- insert the dip stick in the hole without screwing it down;
- remove the dip stick and check the oil level.

If the oil level is below or near the minimum notch on the dip stick, add oil of the prescribed type up to the maximum level notch.

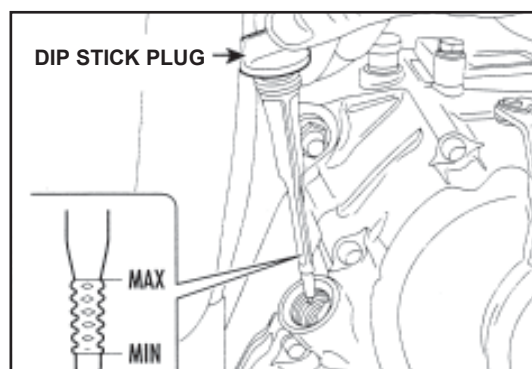
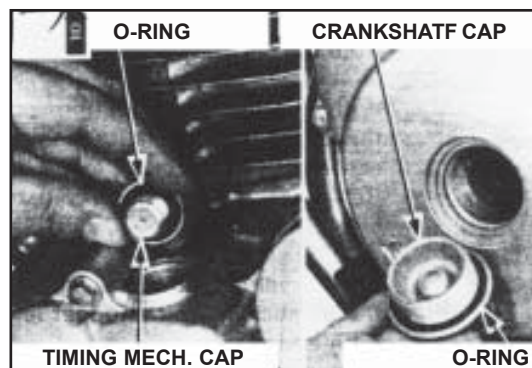
Recommended engine oil:

Oil AGIP CITY 4T

API SJ «DONUT» + JASO MA - PART SYNTHETIC

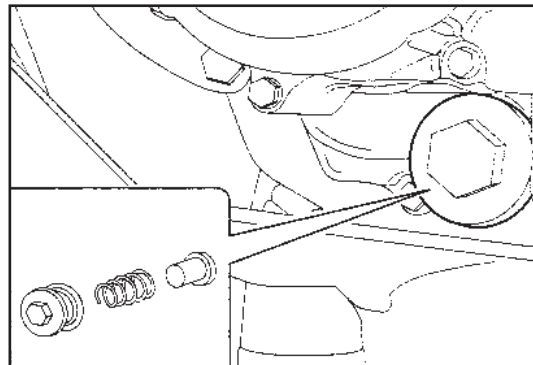
Viscosity: SAE 20W-40

Check that the O-ring on the dip stick is not damaged, then refit in place.



ENGINE OIL/OIL GAUZE FILTER REPLACEMENT

- Start up the engine and let it run idling for a few minutes to reach the normal operating temperature. Stop the engine and wait for at least 10 minutes so that the oil flows back into the oil pan;
- place a vessel under the engine to collect the old oil, and then unscrew the drainage cap together with the gauze filter and its spring. Remove the dip stick;
- After draining off all the oil, check and clean the gauze filter. Make sure that the filter, spring, cap and O-ring are all in good condition refit them then tighten the drainage cap to the specified torque.



Torque: 15 Nm (1.5 kgm)

- Fill with the quantity of oil specified.

Oil change capacity 1.0 litres

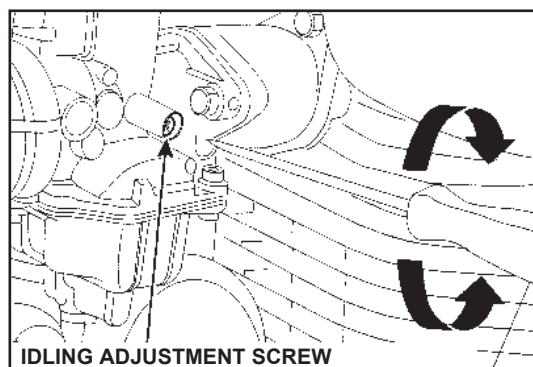
Complete system capacity: 1.2 litres

- Refit the dip stick;
- Start up the engine and let it idle for 2-3 minutes. Switch off the engine and wait for a few minutes, then check that, with the vehicle in vertical position the oil level is at the maximum level notch;
- check there are no oil leaks.

Engine idling speed

Proceed as follows:

- set the vehicle on the kickstand, start up the engine and let it run idling for a few minutes to reach operating temperature;
- check that the twist grip has a clearance of approx. 4 mm;
- After connecting a tachometer, start up the engine and with cross tip screwdriver adjust the idle adjustment screw to obtain the prescribed speed.



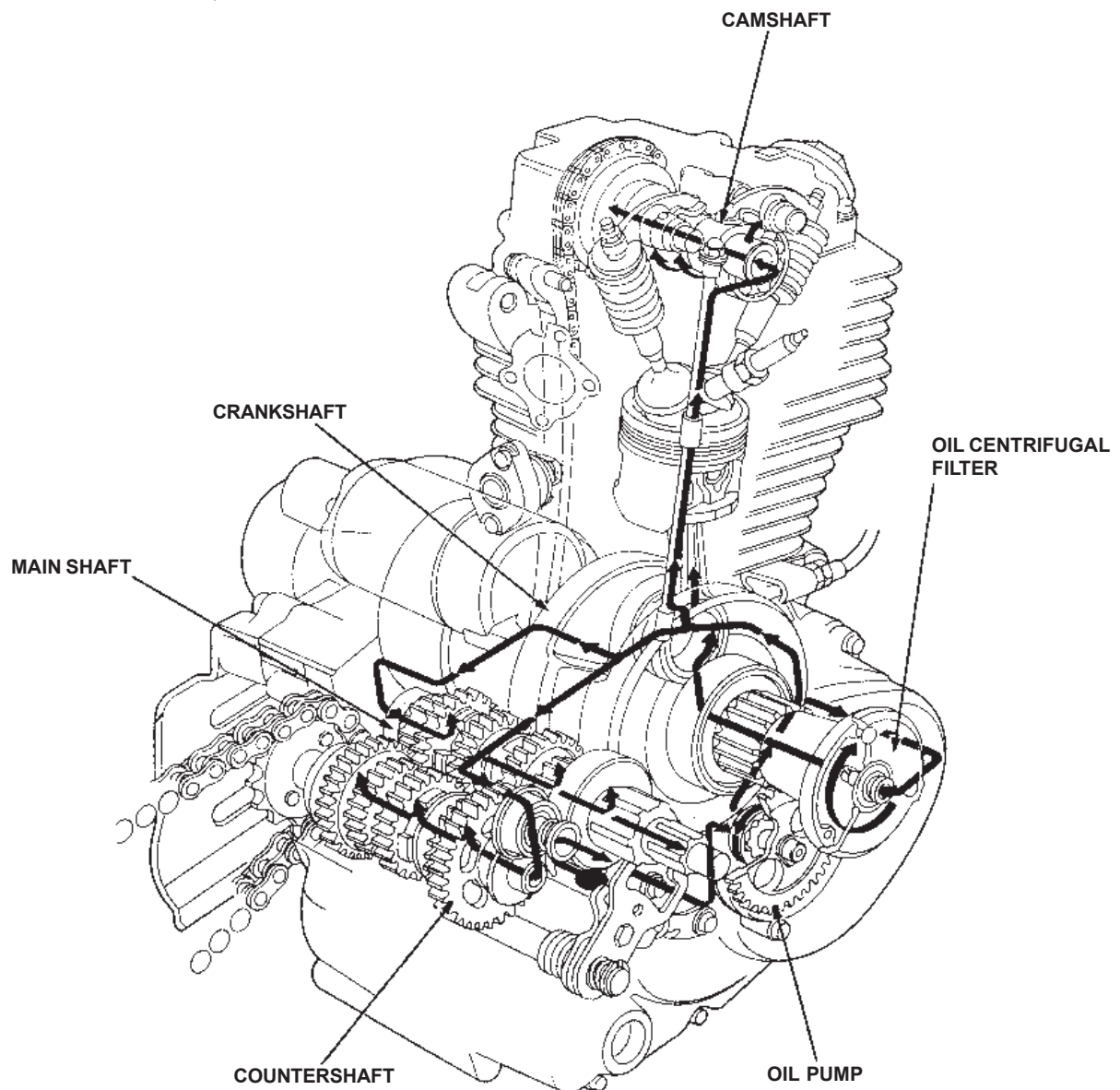
Idling speed: 1400 ± 100 rpm

LUBRICATION

Technical data

Values in mm

PART		STANDARD VALUE	LIMIT VALUE
Engine oil capacity.	Oil pan.	1,0 litres.	-
	Complete lubrication system.	1,2 litres.	-
Recommended oil.		SELENIA HI SCOOTER 4T. oil Service classification API SG or higher. Viscosity: SAE 20W-50	-
Oli pump rotor.	Clearance between outer and inner rotor.	0,15	0,20
	Clearance between pump case and outer rotor.	0,15 - 0,21	0,35
	Rotors end float.	0,03 - 0,12	0,15



PRIMARY TRANSMISSION OIL / GEAR CENTRIFUGAL FILTER

Cleaning the centrifugal filter

- Remove the engine sump right-hand cover;
- remove the screws and centrifugal filter cover;
- deán the cover and inside the centrifugal filter with a deán cloth.

Warning:

Do not use compressed air to clean the filter rotor.

- Check that the cover seal is in good condition then refit it;
- tighten the cover screws to the specified torque.

Torque:

Centrifugal filter rotor cover screws: 5 Nm (0.5 kgm)

- Refit the engine sump right-hand cover.

Centrifugal filter removal

- Remove the engine sump right-hand cover;
- remove the screws and the centrifugal filter cover;
- lock the primary transmission gear and the clutch bell gear using the special locking tool.

Special tool:

Crankshaft stop tool 19.1.20405

- Remove the securing ring nut, the washer and the base of the centrifugal filter.

Special tool:

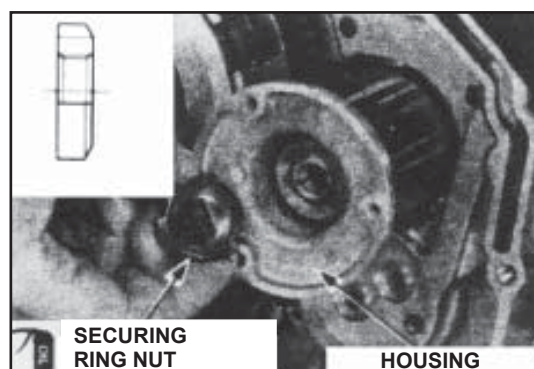
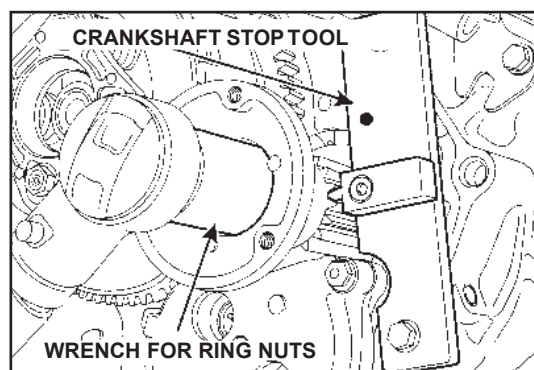
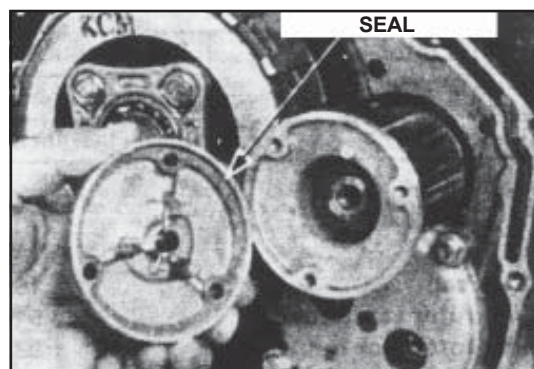
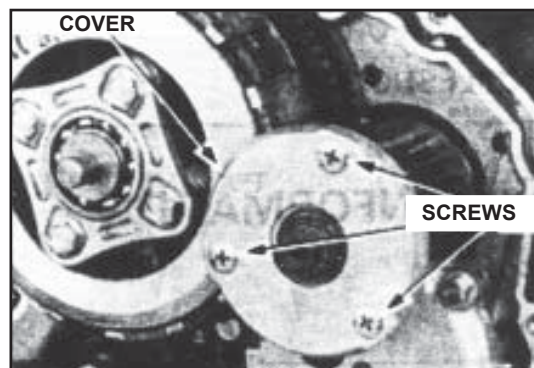
24 mm wrench for ring nuts 19.1.20404

- Remove the crankshaft stop tool.

Note: When refitting take care to fit the ring nut with the countersunk side facing toward the primary gear, lubricate the threads and seat.

Torque:

Centrifugal filter rotor securing ring nut: 83 Nm (8.5 kgm)



OIL PUMP

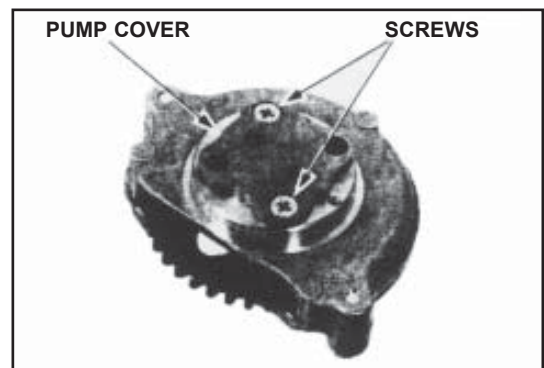
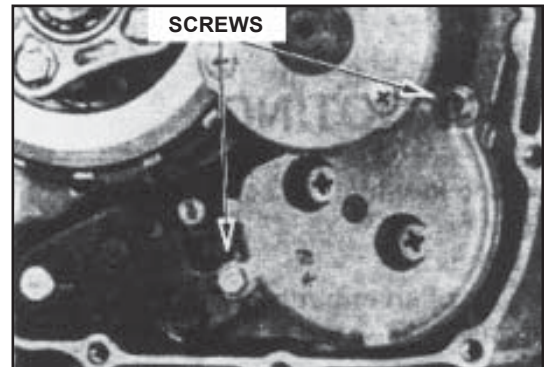
Removal

- Remove the right-hand cover of the engine sump;
- turn the crankshaft by hand to uncover the access holes of the pump securing screws;
- remove the oil pump unscrewing the two cross head screws.

Note: If you have difficulty in removing the complete pump casing, first remove the cover and the gear after removing the two 8 mm hex. head screws.

- Unscrew the two cross head screws on the oil pump cover.

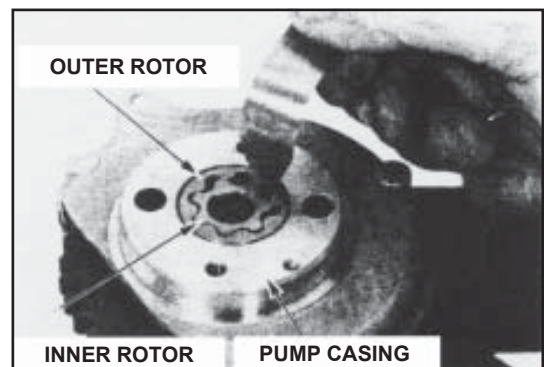
Note: When checking this component take measurements in several points and compare the highest reading with the wear limit value. If any component of the oil pump is worn over the tolerance limits replace the whole oil pump unit.



Clearance between pump case and outer rotor

- Fit the inner rotor and outer rotor in the pump casing;
- fit the control shaft correctly;
- measure the clearance between the pump casing and the outer rotor using a thickness gauge.

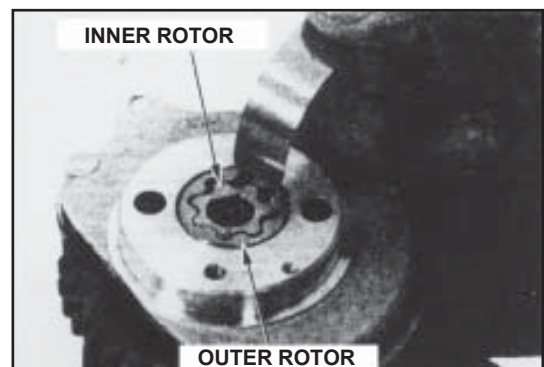
Wear limit: 0.35 mm



Clearance between outer and inner rotors

- Fit the inner rotor and outer rotor in the pump casing;
- fit the control shaft correctly;
- measure the clearance between the outer and inner rotors using a thickness gauge.

Wear limit: 0.20 mm



Rotor end float

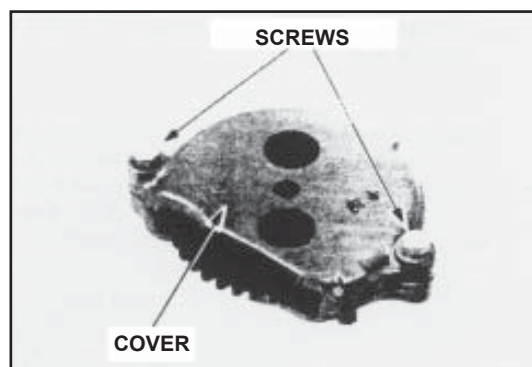
- Fit the inner rotor and outer rotor in the pump casing;
- measure the end float between the rotors and the pump casing using a thickness gauge and a reference ruler.

Wear limit: 0.10 mm

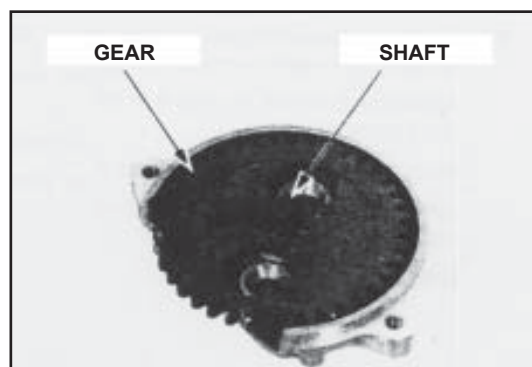


Oil pump disassembly

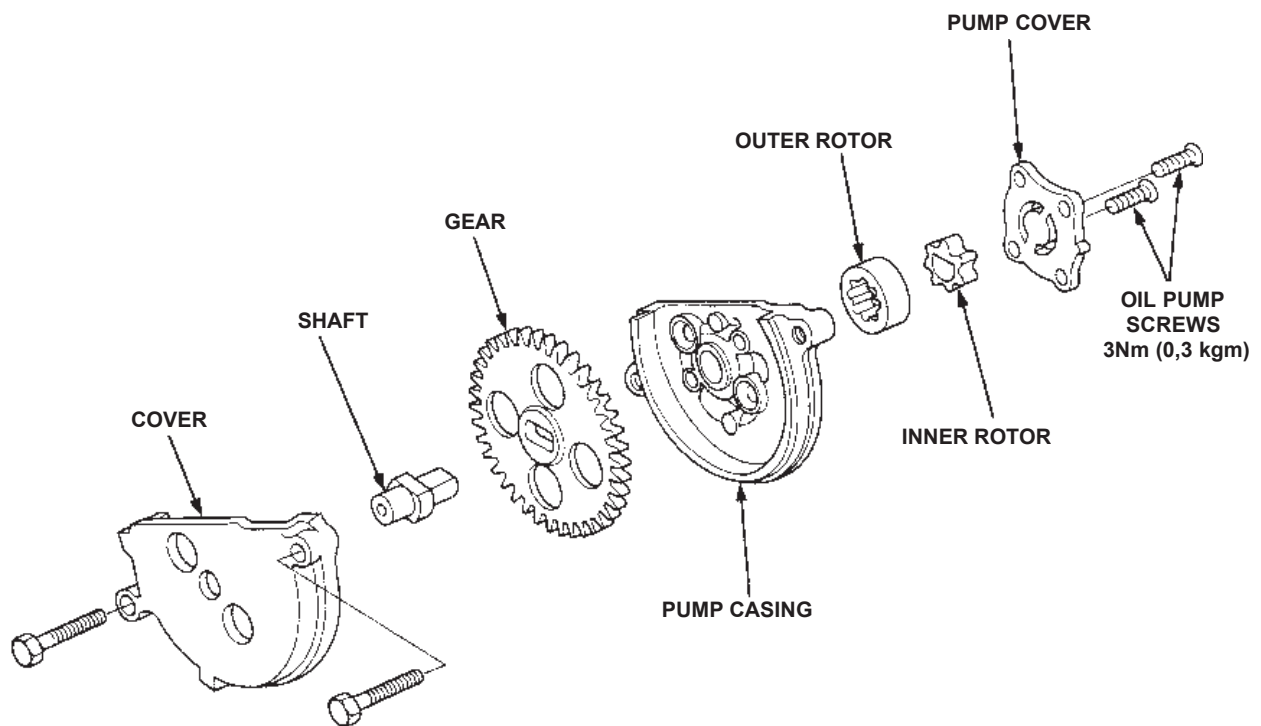
- Remove the oil pump cover unscrewing the two 8mm hex. head screws;



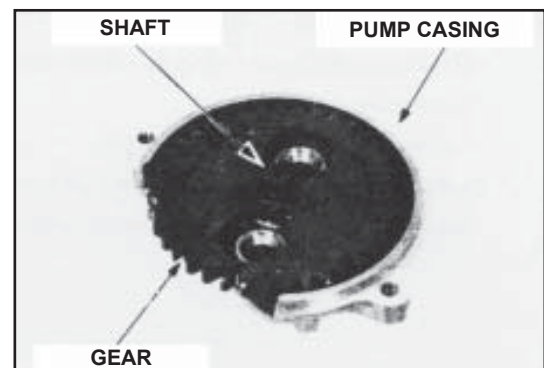
- make a visual check on the gear shaft and the cover.



ASSEMBLY

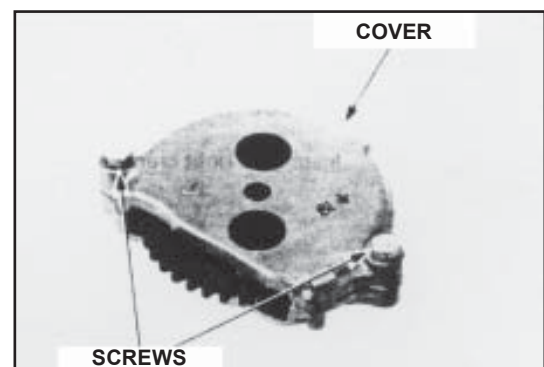


- Fit the shaft and pump gear in the pump casing;

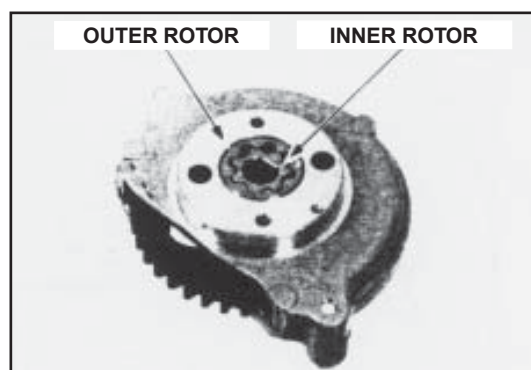


- Fit and tighten the gear cover

Torque: 10 Nm (1,0kgm)



- Fit the outer and Inner rotors;

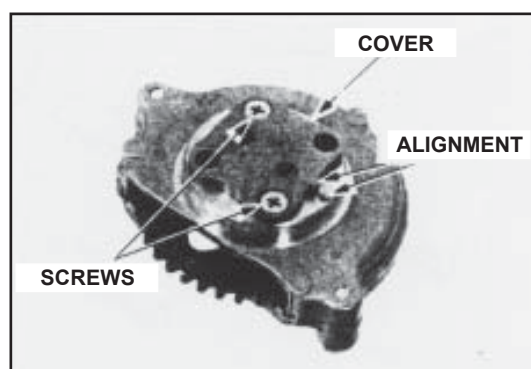


- Fit the pump cover;
- tighten the screws to the specified torque.

Torque: 3 Nm (0,3 kgm)

Note: When assembling align the protrusion on the cover with the reference point on the pump.

- Check functioning.

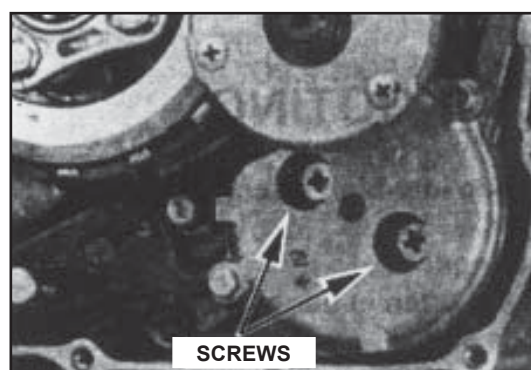
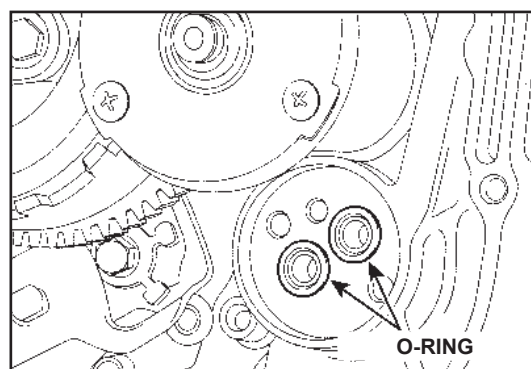


Installation

- Fit new O-rings on the engine sump.
- Fit the oil pump.
- Tighten the screws to specified torque.

Torque: 10 Nm (1,0 kgm)

- Fit the engine sump right-hand cover.



FUEL CONSUMPTION

Technical data

Values in mm

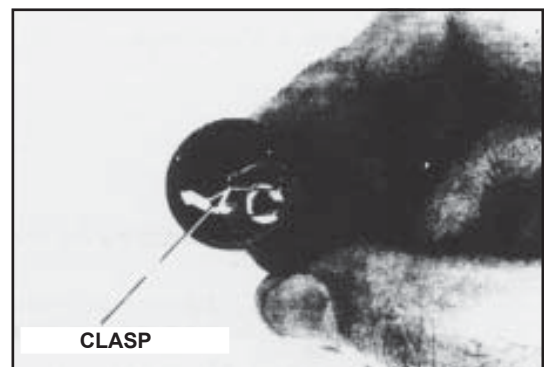
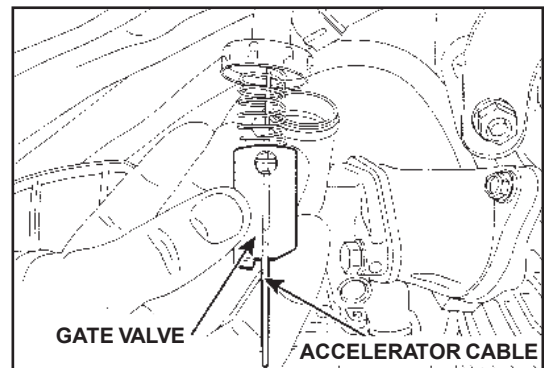
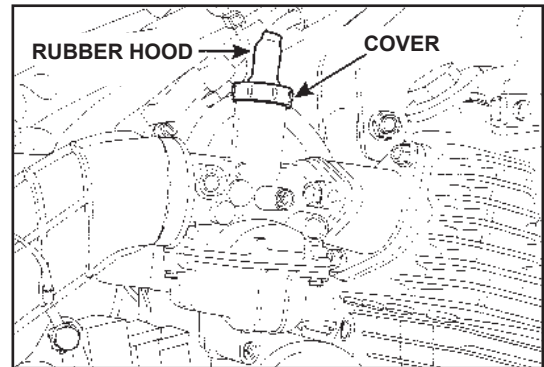
PART		STANDARD VALUE	LIMIT VALUE
Carburettor code.		PDC3F	-
Main jet.		# 95	-
Slow running jet.		# 38 x 2	-
Needle clasp position.		Third notch from the top.	-
Flow adjustment screw opening.	Initial	Unscrewed by 2 turns.	-
	Final	See procedure on page 35.	-
Float level.		14,0	-
Engine idling speed.		1400 ± 100 rpm	-
Twist grip clearance.		2,0 - 6,0	-

CARBURETTOR REMOVAL

Gate valve

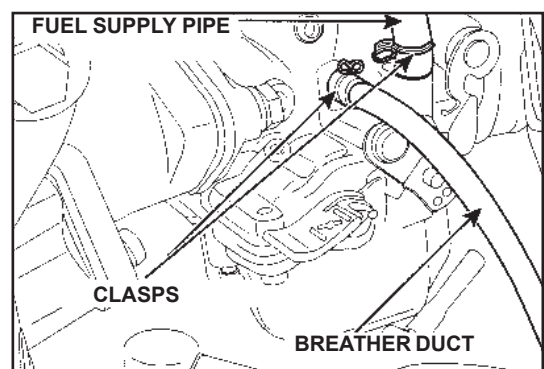
Proceed as follows:

- remove the saddle, the tank and the right-hand objects compartment;
- unscrew the upper cover then remove it from the carburettor body together with the gate valve;
- press the valve spring and disconnect the accelerator cable;
- remove the needle clasp and the needle;
- check that the gate valve and the needle are not scored, worn or damaged.

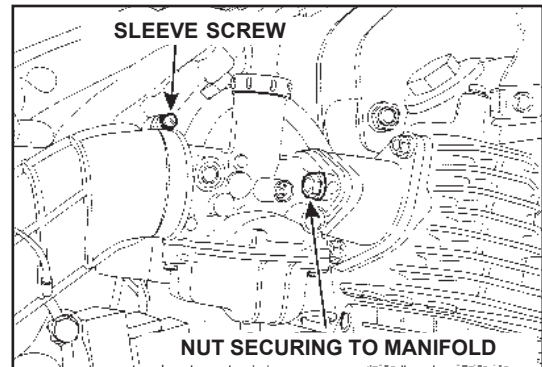


Carburettor body

- Loosen the drainage screw and drain off the fuel from the chamber into a suitable container;
- loosen the clasp and disconnect the fuel supply pipe and the breather duct from the carburettor.

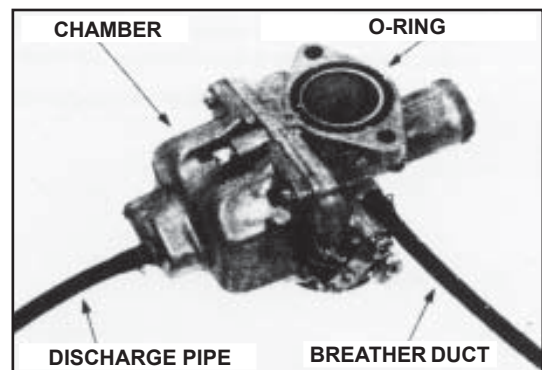


- loosen the screw of the air cleaner sleeve supporting strap;
- remove the two nuts and the carburettor body from the intake manifold;

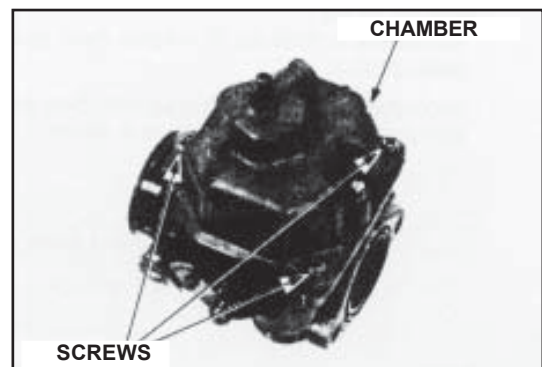


Carburettor removal

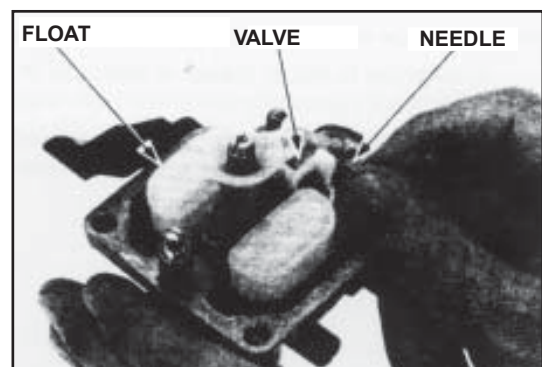
- Loosen the clasp and disconnect the discharge pipe;
- check that the manifold O-ring is not damaged, if it is, replace it;



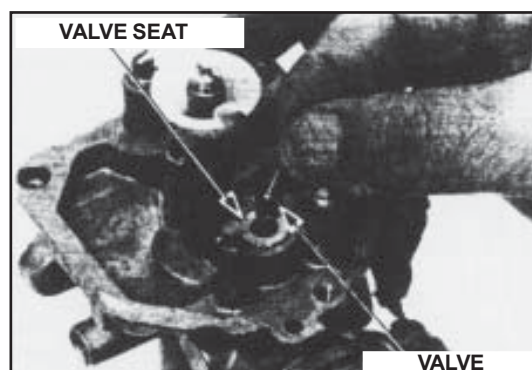
- remove the screws and the chamber;



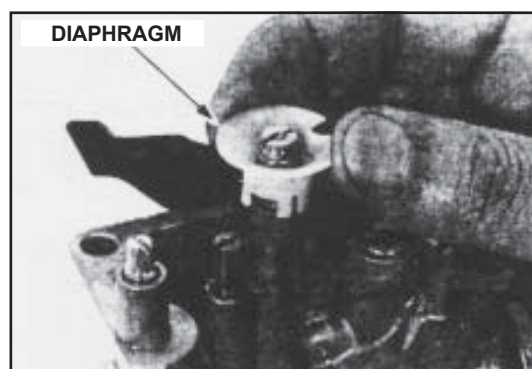
- remove the float pin, the float and its valve;
- check that the float is not damaged;



- check the float valve set for scores or damage;
- inspect the float valve tip where it contacts the seat and ensure there is no wear;
- replace the valve if the tip is worn or damaged;
- Check the operation of the float valve;



- Remove the diaphragm;



- remove these parts:

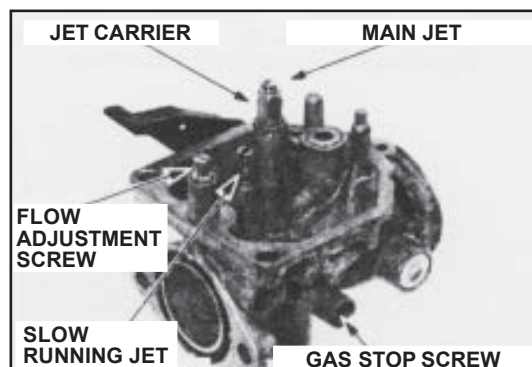
Main jet

Diffuser with spray nozzle

Slow running jet

Gas stop screw;

- tighten the flow adjustment screw and take note of how many turns are required to reach contact with the seat;
- remove the flow adjustment screw and the spring.

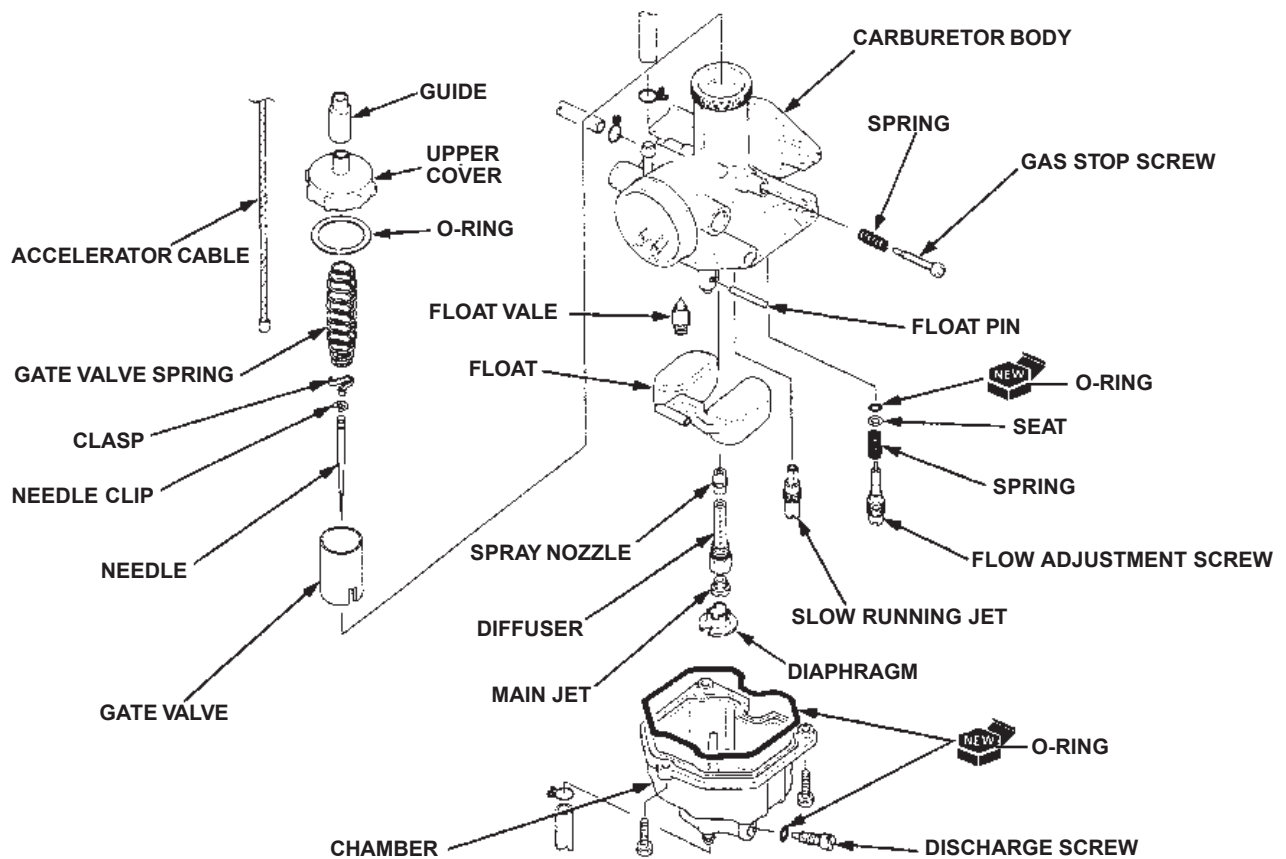


Warning:

The flow adjustment screw must not be screwed down fully to avoid damaging its seat.

- Check the jets for damage and if necessary replace.

CARBURETOR ASSEMBLY



- Blow compressed air into each air and fuel passage in the carburettor body;



- refit the following parts:
Gas stop screw
Slow running jet
Spray nozzle with diffuser
Main jet.

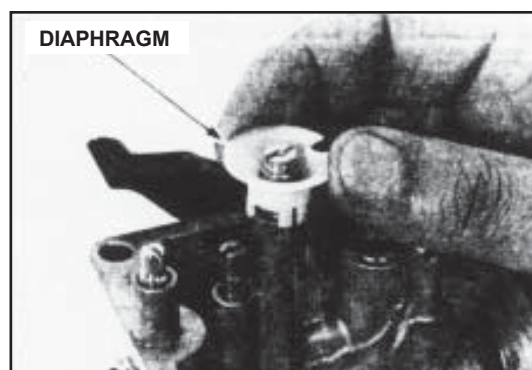
Warning:

Handle the jets with care. They can easily become scored or scratched.

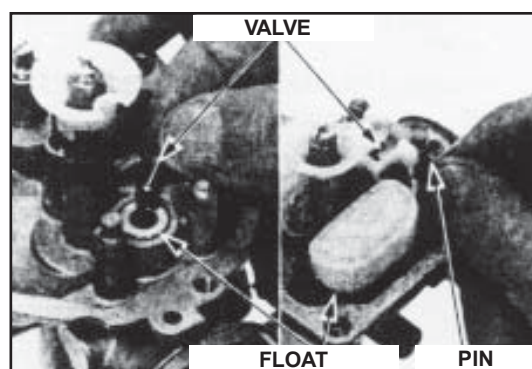
- Refit the flow adjustment screw and bring it to the original



- refit the diaphragm using the assembly reference;



- fit the float and valve into the carburettor body, then insert the needle in the carburettor body and the float.



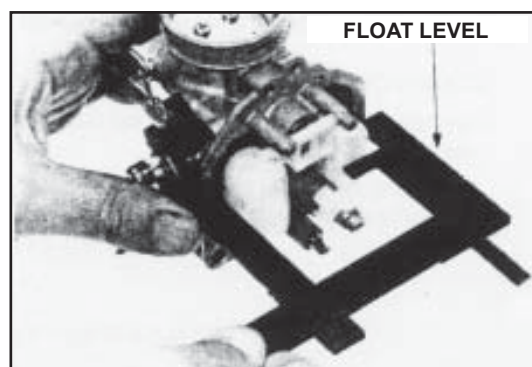
Float level check

With the float valve inserted and the float arm just touching the valve, measure the level of the float using the special tool as shown in the figure.

Float level: 14 mm

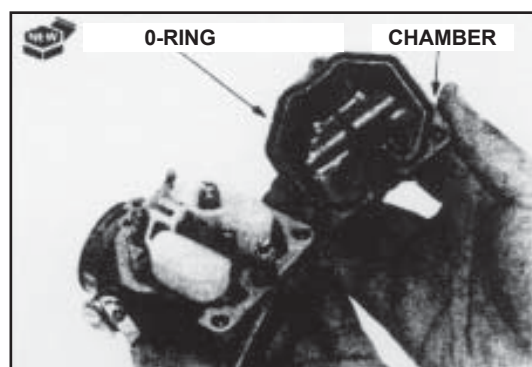
Special tool:

Float level checking tool..... 19.1.20353

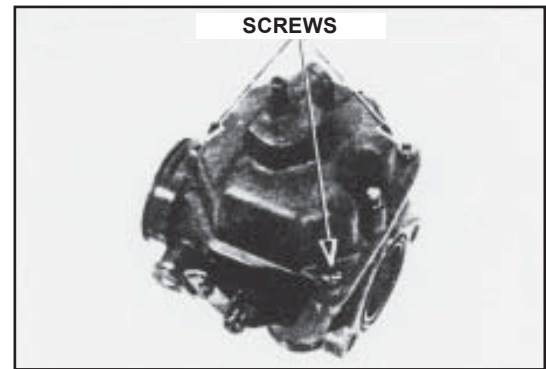


If the float level is not within specifications replace the complete float and the float valve;

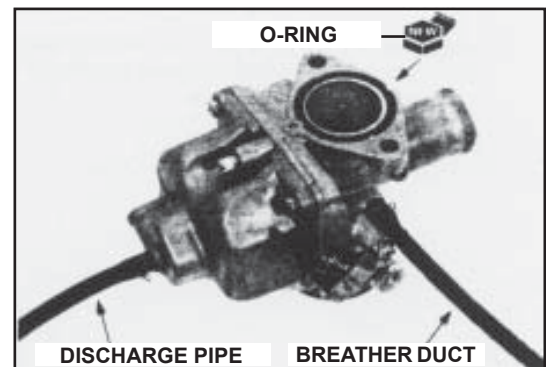
fit a new O-ring in the chamber;



- fit the chamber and tighten the screws;



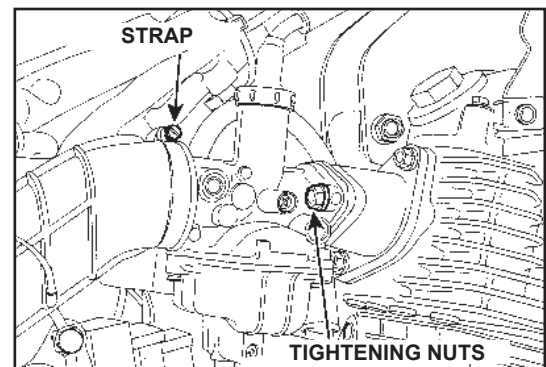
- connect the breather duct and the discharge pipe as shown;
- fit a new O-ring in the carburettor body seat.



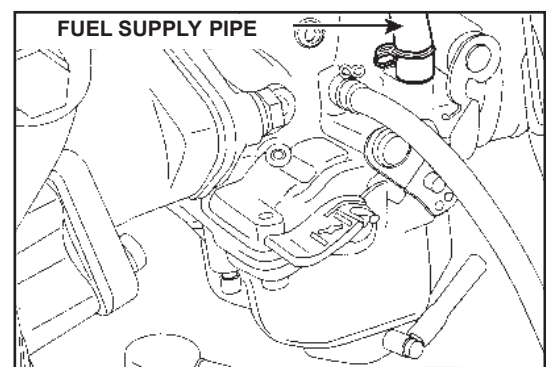
CARBURETTOR INSTALLATION

Carburettor body

- Fit the carburettor body onto the intake manifold and tighten the nuts down fully;
- fit the air cleaner manifold tightening it with the relevant straps;



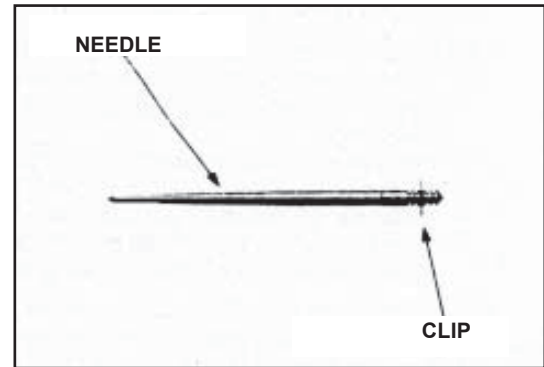
- connect the fuel supply pipe.



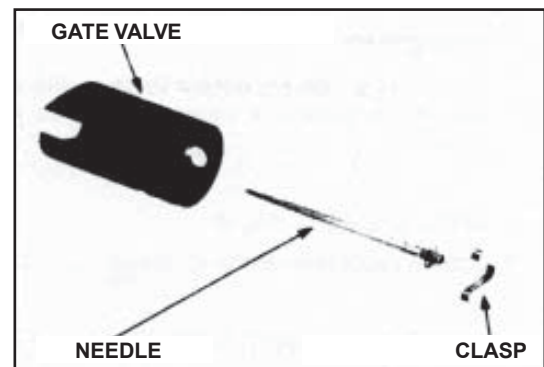
Gate valve

- Fit the clip on the needle.

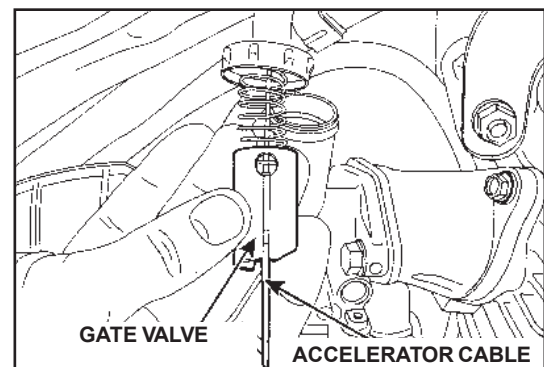
Standard position: Third notch from the top.



- Fit the needle in the gate valve and fasten it with its clasp;



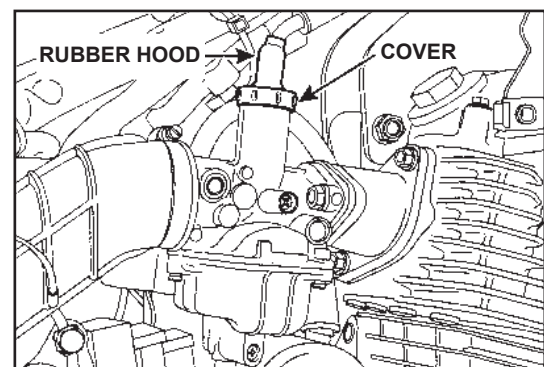
- connect the accelerator transmission to the valve keeping the cable inside the spring;
- fit the gate valve in the carburettor body aligning the internal reference (on the carburettor body) with the groove on the valve;



- lock the carburettor upper cover then fit the rubber hood;

After installing the carburettor, make these checks:

- Twist grip clearance.
- Engine idling speed.
- Flow adjustment screw regulation.



FLOW ADJUSTMENT SCREW

Note: The flow adjustment screw has been set in the factory and does not require any type of adjustment unless it has to be replaced or the carburettor is overhauled.

To have an accurate adjustment the engine should be at normal running temperature.

Use a rev counter with a scale division of 50 rpm (or less) so as to be able to measure accurately any variations within 50 rpm OF less.

- Turn the flow adjustment screw clockwise until a certain resistance is felt when it contacts its seating. Unscrew the screw by the number of turn's equivalent to the specified value.

Warning:

Do not use excessive force on the flow adjustment screw; otherwise you could damage its seating.

Special tool:

Flow screw adjustment wrench 19.1.20367

Initial opening: 2 turns

- Warm the engine to the normal operating temperature;
- turn off the engine and connect the rev counter;
- switch on the engine and adjust the idling rotation speed through the gas stop screw.

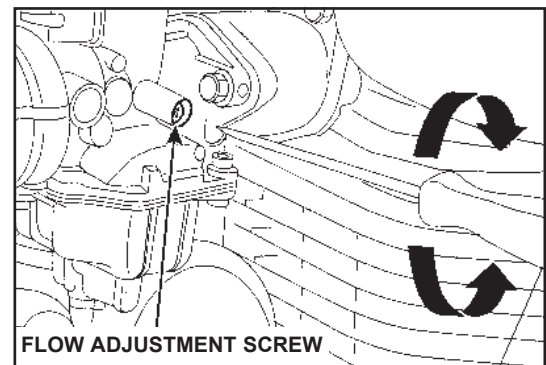
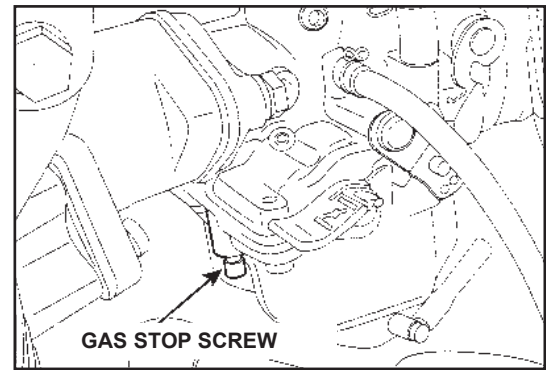
Idling rotation speed: 1400 ± 100 rpm

- Slowly turn the flow adjustment screw until the maximum rotation speed possible is obtained;
- adjust the idling rotation speed again through the gas stop screw;
- use the flow adjustment screw to reduce the rotation speed to 100 rpm;
- unscrew the flow adjustment screw by 5/8 of a turn;

Final opening: + 5/8 of a turn starting from the position found in the previous step.

- Adjust the idling rotation speed again through the gas stop screw.

Note: To obtain a more precise adjustment use the exhaust gas analyser. When the carburation is correct the carbon oxide percentage is 3.5 ± 0.5 .



ENGINE REMOVAL AND REFITTING

GENERAL

Before removing or refitting the engine support the vehicle with a suitable stand.

To remove or refit the engine a jack or other suitable lifting equipment is necessary.

These parts can be serviced with the engine on the frame:

- Oil pump (Chapter 2).
- Clutch/ gear change pedal (Chapter 8).
- Alternator (Chapter 9).
- Starter motor (Chapter 12).

For the following parts the engine must be removed from the frame:

- Cylinder head and valves (Chapter 6).
- Cylinder and piston (Chapter 7).
- Crankshaft and gearbox (Chapter 10).

Technical data

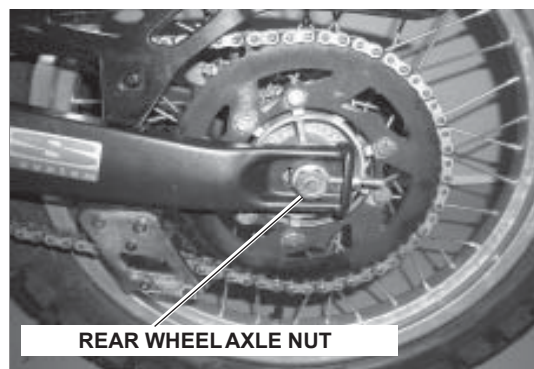
Values in mm

PART		SPECIFICATIONS
Engine oil capacity.	Oil pan.	1,0 litres.
	Complete lubrication system.	1,2 litres.
Recommended oil.		Oil AGIP CITY 4T API SJ «DONUT» + JASO MA - PART SYNTHETIC SAE Viscosity: SAE 20W-40
Idling speed.		1400 ± 100 r.p.m.

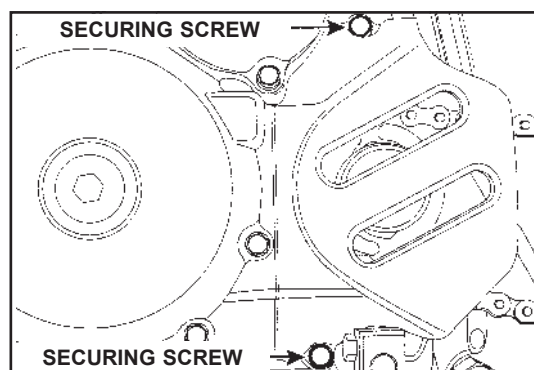
TRANSMISSION PINION

Removal

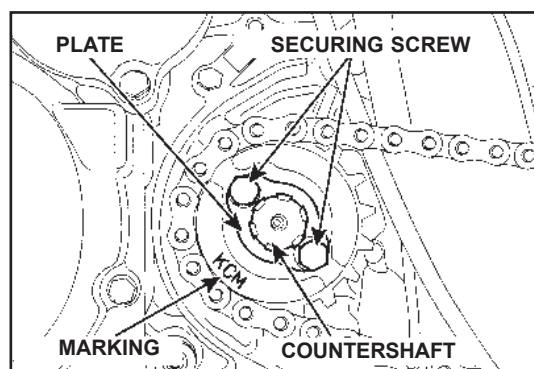
- Loosen the rear wheel axle nut;
- remove the chain tightener from the restraining tooth, or bring it to minimum distance position;
- push the rear wheel completely forward to slacken the transmission chain as much as possible;



- unscrew the two screws and remove the pinion cover;



- engage the 1st speed and remove the pinion fastening plate screws;
- remove the plate turning it until the teeth are aligned with those of the gearbox countershaft.



Installation

To refit follow the removal procedure in reverse order paying attention to the following:

- the pinion is to be fitted on the gearbox countershaft with the marked side facing outwards;
- adjust the transmission chain tensión.

Torques:

Rear wheel axle nut..... 70 - 80 Nm (7,0 - 8,0 kgm)

Pinion cover..... 4 - 7 Nm (0.4 - 0.7 kgm)

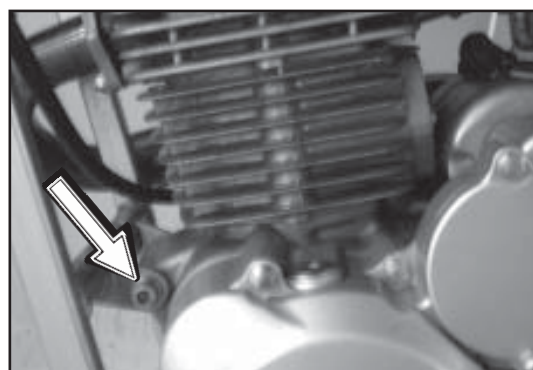
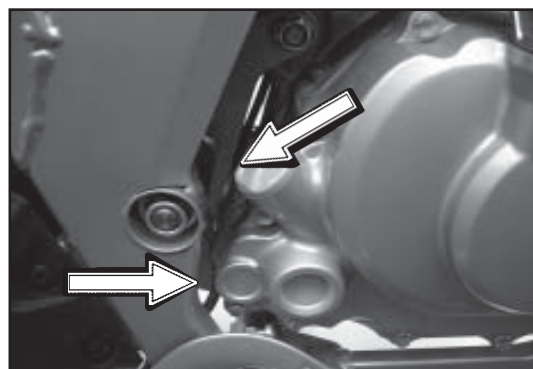
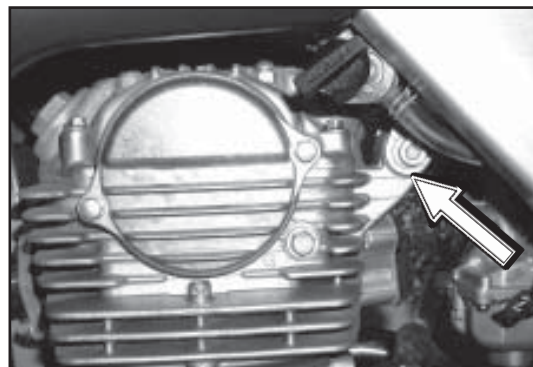
ENGINE REMOVAL

Remove the following parts:

- Side coverings;
- Saddle;
- Tank;
- Right-hand and left-hand objects compartment and brackets;
- drain off the engine oil and collect it in accordance with current legislation;
- disconnect the battery negative cable from its terminal and remove the electrical connections from the starter motor (stator, pick-up connector, starter motor power supply);
- remove the transmission pinion;
- disconnect the spark plug cap;
- remove the exhaust manifold and the entire silencer, disconnect the oil vapours recovery piping and the carburettor;
- disconnect the clutch cable and the gear selection levers from the gearbox;
- support the engine with suitable lifting equipment;
- remove the bolt and bracket of the engine head upper stand taking care not to lose the washers;
- remove the four bolts and brackets (one on each side) of the engine front stand taking care not to lose the washers;
- remove the two bolts of the engine rear stand taking care not to lose the washers;
- move the engine with care removing it from the right side of the frame.

Warning:

When removing work with care making sure that the engine comes away without meeting obstructions, take care not to damage the components, frame or the engine itself.



Engine installation

- Support the engine with suitable lifting equipment;
- To install the engine follow the removal procedure in reverse order.

Note: *Tighten all the engine securing bolts first by hand, and then lock to the specified torque.*

Torque:

Engine

Head upper stand: 20 - 25 Nm (2.0-2.5 kgm)

Engine

Front stand bolts: 20 - 25 Nm (2.0-2.5 kgm)

Engine

Rear stand bolts: 32 - 40 Nm (3.2 - 4.0 kgm)

CYLINDER HEAD AND VALVES

SERVICE INFORMATION

General

This section describes the maintenance operations for the cylinder head cover, engine head, camshaft and rockers.

To service these parts, remove the engine from the frame and work at the bench.

Head and valves

Values in mm

PART			STANDARD VALUE	LIMIT VALUE
End of compression pressure			1.373 ± 98 kPa; 14,0 ± 1 kgf/cm2 a 600 rpm	-
Head off-level			-	0,10
Valve, valve spring, valve guide	Valve clearance when cold	Intake	0,1 ± 0,02	-
		Exhaust	0,1 ± 0,02	-
	Valve spring free length	Internal	39,20	38,00
		External	44,90	43,50
	Valve stem outer diameter	Intake	5,450 - 5,465	5,42
		Exhaust	5,430 - 5,445	5,40
	Valve guide inner diameter	Intake	5,475 - 5,465	5,50
		Exhaust	5,475 - 5,465	5,50
	Clearance between stem and guide	Intake	0,010 - 0,035	0,08
		Exhaust	0,030 - 0,055	0,10
Width of seal surface		1,10 - 1,30	1,50	
Rocker / pin	Rocker hole inner diameter		12,000 - 12,018	12,05
	Pin outer diameter		11, 966 - 11,984	11,93
	Clearance between rocker and pin		0,016 - 0,052	0,08
Camshaft	Height of cam lobe	Intake	31,402 - 31,582	31,10
		Exhaust	31,082 - 31,262	30,70
	Eccentricity		-	0,03

COMPRESSION MEASUREMENT

- Warm the engine to reach normal operating temperature;
- switch off the engine, disconnect the spark plug cap, and remove the spark plug;
- unplug the ignition control connector;
- fit the pressure gauge connection accessory in the spark plug hole;
- connect the gauge to the accessory;
- open the accelerator fully and run the engine with the starter motor.

Note: Run the engine until the valves on the gauge become stable. Usually the maximum value is reached within 4 - 7 seconds.

Standard value: 1373 ± 98 kPa; 14.0 ± 1.0 kgf/cm² at 600 rpm

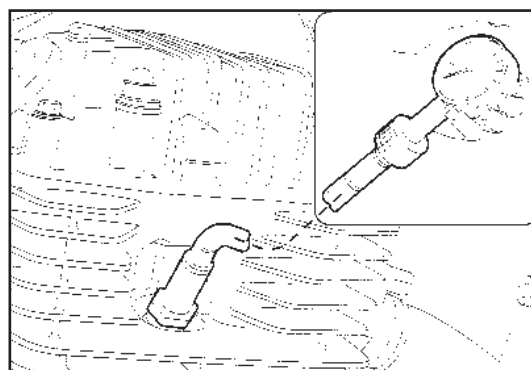
If compression is higher there are carbon deposits on the combustion chamber or the piston crown.

If the compression is lower, pour 3-5 c.c. of new engine oil into the cylinder through the spark plug hole then check the compression again.

If the compression increases in relation to the previous reading, check the cylinder, the piston and the piston rings. The problems could be:

- Worn piston ring.
- Worn cylinder and pistons.

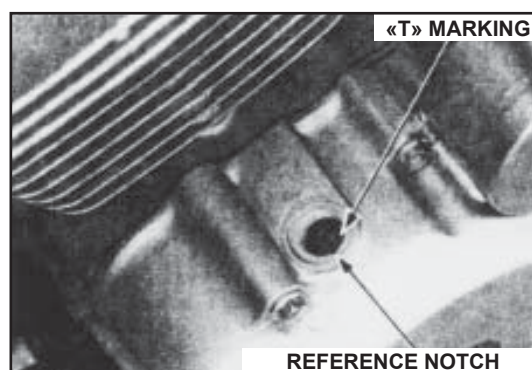
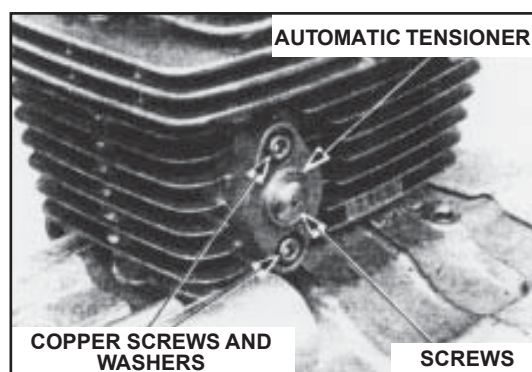
If the compression remains the same, check the valve seals, the tightness of the head and the state of the head gasket.



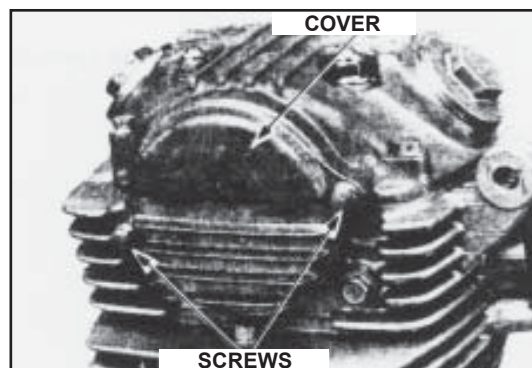
HEAD COVER AND CAMSHAFT REMOVAL

Remove the following:

- Engine from frame.
 - Starter motor.
 - Securing screws of the driving chain automatic tensioner, washer and gasket.
 - Valve hole covers.
-
- Align the «T» marked on the flywheel to the reference notch on the left crankcase cover rotating the crankshaft anticlockwise; remove the cap on the left crankcase using a 14 mm. socket wrench;

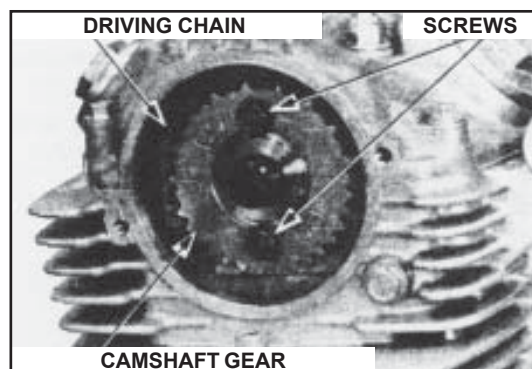


- Remove the two caps from the rockers and check there is sufficient clearance to ensure the piston positions correctly at the end of the compression stage;
- If the piston does not reach the TDC of the compression stage rotate the crankshaft anti-clockwise by 360° and check again;

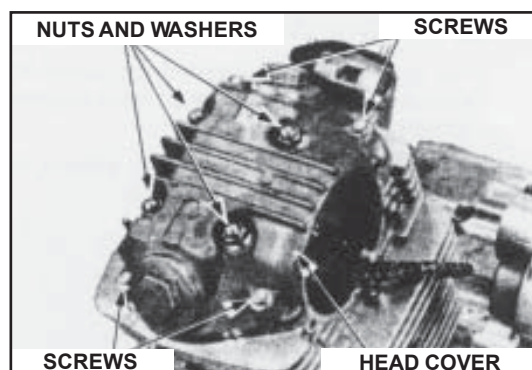


- remove the camshaft gear cover;
- remove the camshaft gear securing screws;
- remove the camshaft gear from the flange, and then remove the driving chain from the gear;

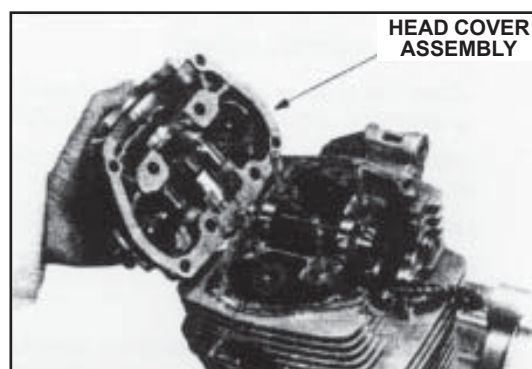
Note: Support the driving chain so that it does not fall into the crankcase;



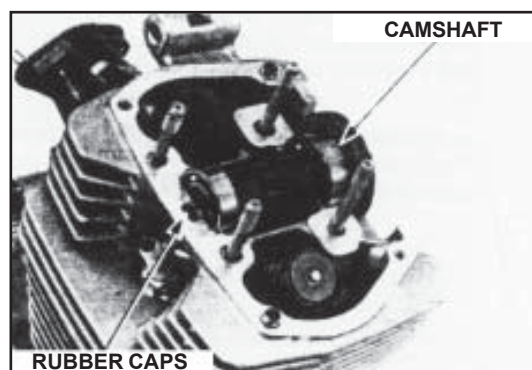
- loosen the four head cover screws and head securing screw;
- Gradually remove the flanged nuts and seal rings from the head cover in crosswise sequence;



- Remove the head cover assembly;



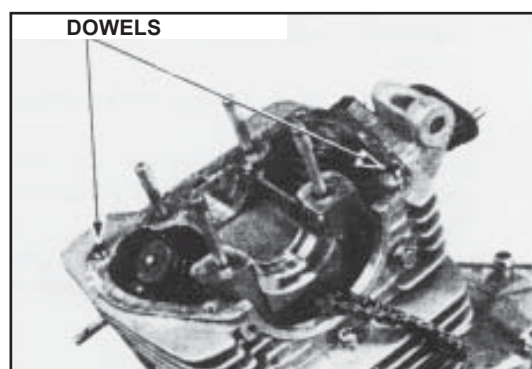
- remove the camshaft;
- remove the rubber caps. Take care not to lose them;



- remove the dowels.

Note: *It is not necessary to remove the dowels if they have been driven in under pressure.*

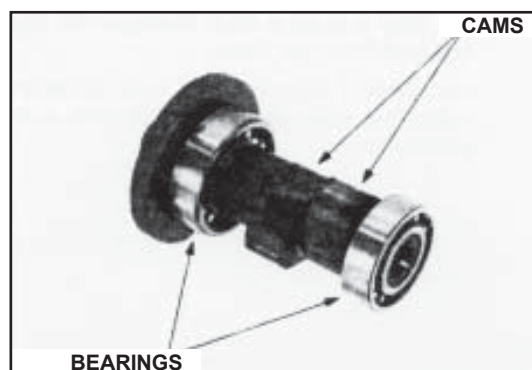
Remove all traces of sealant from the head and cover mating surfaces.



Camshaft inspection

- Rotate the outer tracks of the camshaft bearings: the bearings must turn smoothly and silently.

Check also that the inner tracks do not have clearance in relation to the camshaft.



Height of the cam

- Check for scoring or signs of insufficient lubrication on the cam surfaces;
- measure the height of each cam using a micrometer.

Wear limits:

Intake: 31.10mm

Exhaust: 30.70 mm

Note: *If the cams are worn or damaged, check the rocker support shoes.*

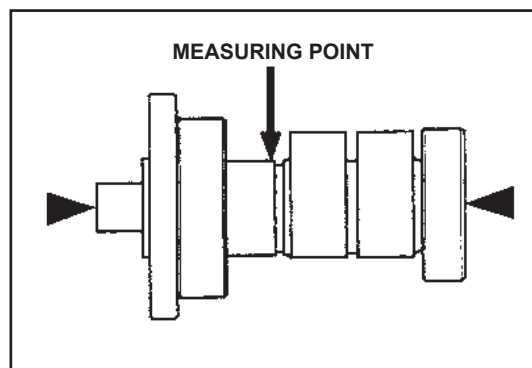


Camshaft eccentricity

- Support the two ends of the camshaft on V blocks and check the eccentricity of the camshaft with a dial gauge.

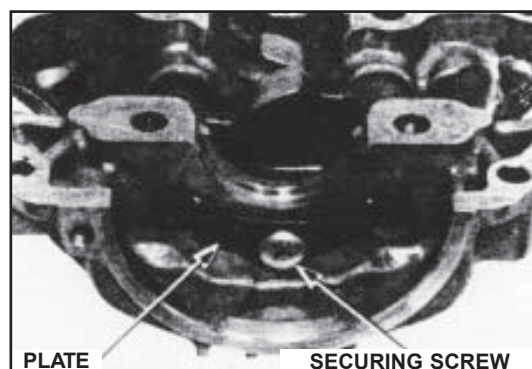
The total eccentricity corresponds to half of the reading on the dial gauge.

Wear limit: 0.05 mm



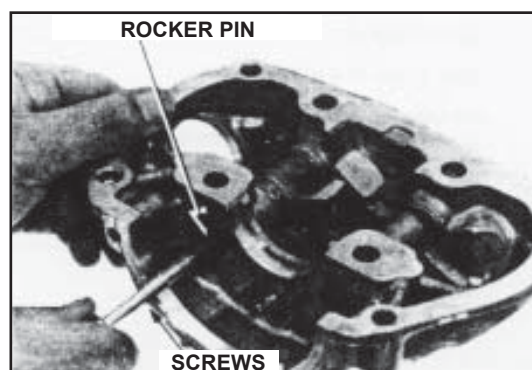
HEAD COVER DISASSEMBLY

- Unscrew the securing screw and remove the pins stop plate;



- remove the rocker pins by inserting a 6mm screw in the threaded end and pulling to withdraw it as shown in the figure;
- remove the rockers.

Note: Take note of the assembly positions on the intake side and exhaust side to avoid confusing the parts when refitting.



Rocker and rocker pin

- Check that the rocker shoe is not worn or damaged and check that the oil hole is not clogged;
- check that the contact surface of the valve clearance adjustment screw is not worn or damaged;



- measure the inner diameter of each rocker.

Wear limit: 12.05mm

- measure the pin outer diameter of each rocker.

Wear limit: 11.93mm

- check the pin for wear or damage and calculate the clearance between pin and rocker.

Wear limit: 0.08 mm

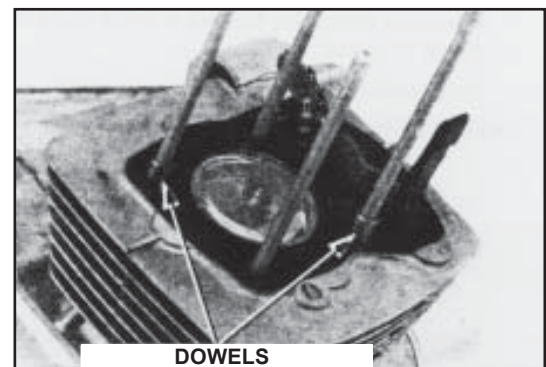
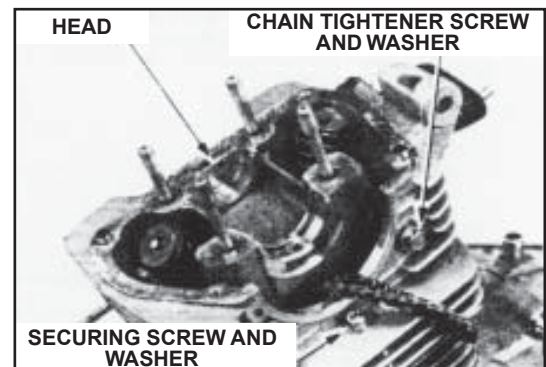
If necessary replace the rocker and/or the rocker pin.



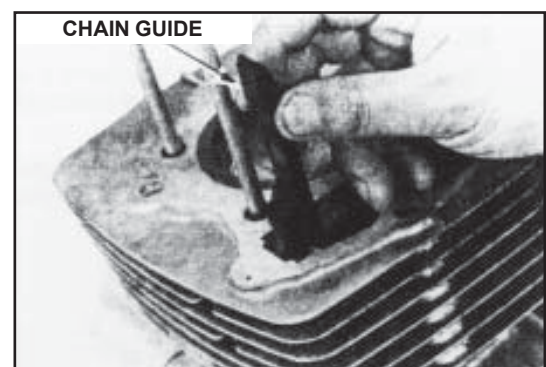
HEAD REMOVAL

Remove these parts:

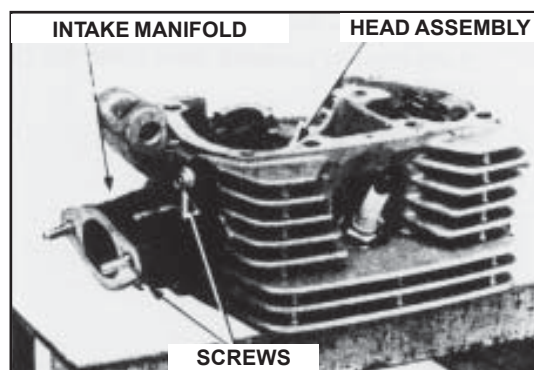
- Head cover.
- Head securing screw and washer.
- Chain tightener screw and washer.
- Head.
- Driving chain tightener.
- Seal.
- Two dowels;
- remove all residues of the seal from the head and cylinder mating surfaces;



- remove the driving chain guide;



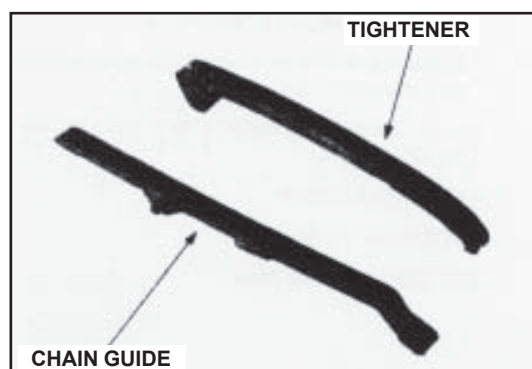
- Loosen the screws and remove the intake manifold;



- check that the tightener and guide of the driving chain show no signs of damage or excessive wear;

HEAD DISASSEMBLY

- Before removing the parts, mark them to ensure correct reassembly;
- Install the valve springs compressor on the valve and compress the spring;



Special tool:

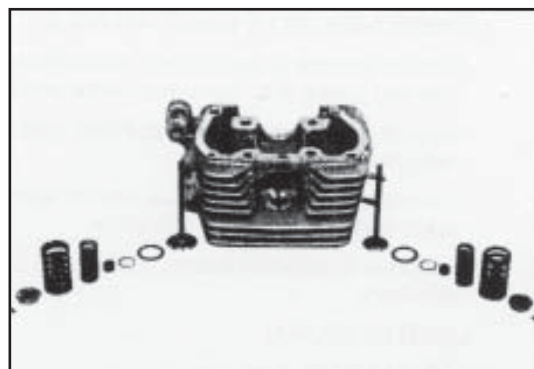
Compressor for valve springs 19.1.20382

Compressor insert..... 19.1.20382/10

Warning:

To prevent the loss of spring elasticity, do not compress them more than the amount necessary to remove the half-cones.

- remove the valve spring compressor, and then remove the plates, the springs and the valves;
- remove the oil seal and the valve seats;



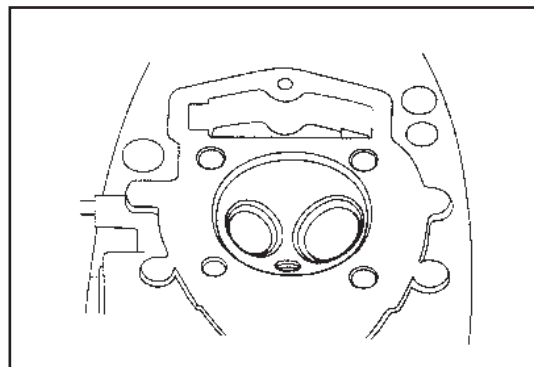
Note: *do not re-use the valve stem oil seals.*

- Remove any carbon deposits from the combustion chamber and clean the head plane surface

Warning:

Take care not to damage the head plane surfaces and the valve seats.

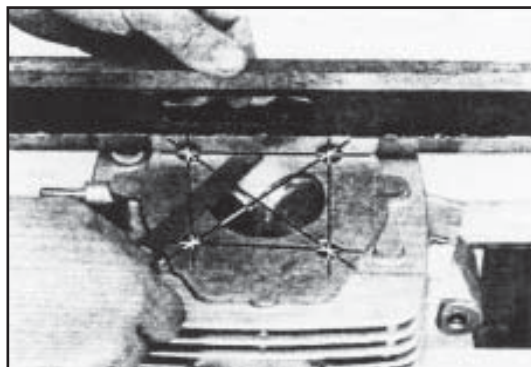
- Check that the spark plug hole and the valve ducts are not cracked.



Head inspection

- Check the head flatness with a ruler and a thickness gauge.

Warpage limit: 0.10 mm



Valve spring inspection

- Check that the valve springs are not strained or damaged;
- measure the free length of the internal spring and the external spring.

Wear limit:

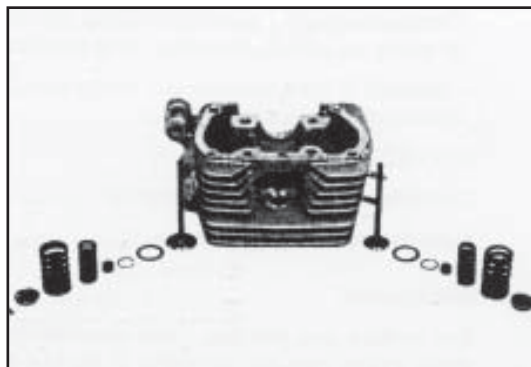
Internal: 38.00 mm

External: 43.50 mm



Valve stems and guide inspection

- Check that the valves are not bent or burnt and that there is no sign of scoring or irregular wear;
- insert the valves into their original positions in the head;
- check that each valve slides smoothly in the guide without resistance;
- measure the outer diameter of the stem of each valve and make a note of the valve.



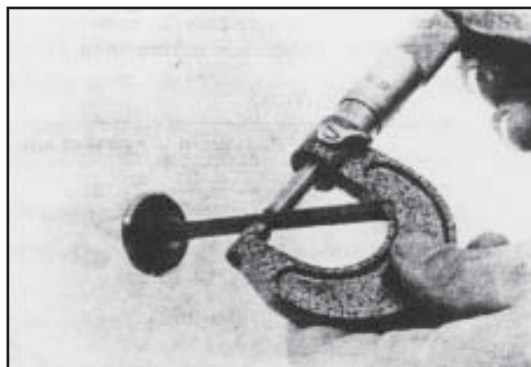
Wear limit:

Intake: 5.42 mm

Exhaust: 5.40 mm

- Before measuring the valve guide, remove any carbon deposits with a reamer;
- insert the reamer from the camshaft side and always rotate it clockwise.

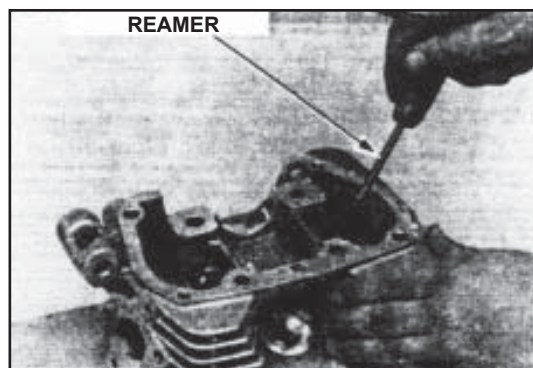
Note: Take care not to slope the reamer in the guide: If the operation is not carried out correctly, oil will seep out from the valve stem oil seal. There could result an incorrect contact between the valve and seat, which cannot be adjusted by grinding. When inserting and removing the reamer, always rotate it clockwise, never anti-clockwise.



Special tool:

Reamer for valve guides (INTAKE/EXHAUST)
19.1.20420

Measure the inner diameter of each valve guide and make a note of the value.



Wear limits:

Intake/Exhaust: 5.50 mm

Subtract the stem outer diameter value of each valve from the inner diameter of its guide to obtain the clearance between stem and guide.

Wear limits:

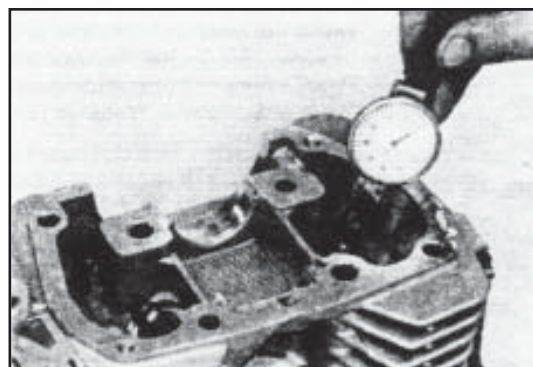
Intake: 0.08 mm

Exhaust: 0.10 mm

If the clearance between stem and guide is over the service limit, calculate whether a new guide with standard dimensions would bring the clearance back into tolerance.

If it would, replace the guide and ream the hole.

If the clearance between stem and guide is still over the service limit, replace the valve as well.



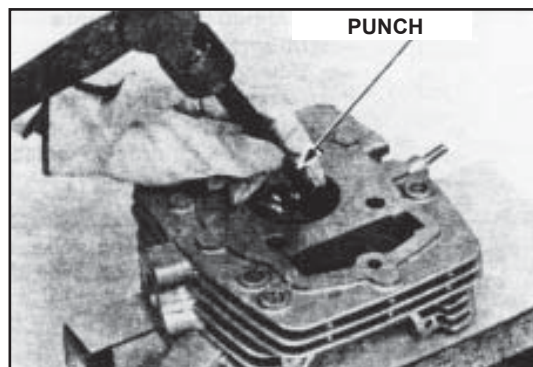
Note: Inspect and grind the valve seats whenever the guides are replaced (see next page).

Valve guide replacement

Note: To ensure a uniform contact of the valves the seats must also be reamed when replacing the guides.

- cool the valve guides in the special freezer for about an hour;
- heat the head in a suitable oven to 130-140°C. Do not heat the head to temperatures over 150°C. To check that the head has reached the correct temperature use a suitable sensor.

Wear insulating gloves to prevent burns when handling the head after heating.

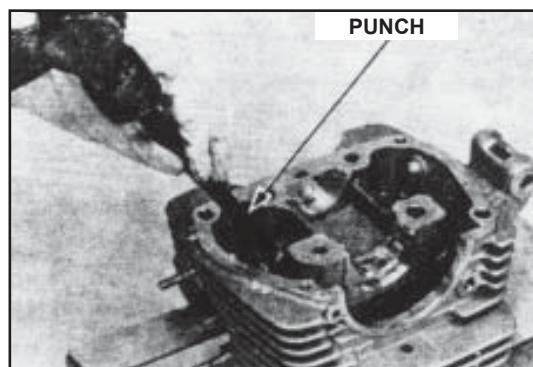


Warning:

Never use direct fire to heat the head, which would cause deformation.

Disassembly

- Support the head and remove the valve guides working from the combustion chamber side.



Special tool:

Punch to remove/refit
Valve guid 19.1.20407

Installation

- Insert the new guide from the head camshaft side fitting to the correct height while the head is heated to the indicated temperature.

Note: When refitting a new guide always use a new O-ring.

Do not swap over the intake guide with the exhaust guide.

- leave the head to cool to room temperature then ream the new guides.

Special tool:

Valve guides reamer (INTAKE/EXHAUST)-!
9.1.20420

Note: When reaming take care not to slant the reamer in the guide. If this should happen the valve will slope when fitted causing oil to seep out from the valve stem oil seal and an uneven contact between the valve and its seat, also preventing any grinding on the valve seat.

Insert the reamer from the combustion chamber side and always rotate it clockwise.

- after reaming and grinding the valve seat, thoroughly clean the head to remove all metal particles.

Valve seal surfaces inspection

- Carefully clean any carbon deposits from the valves;
- apply a thin film of Prussian blue on each valve head.
- Bring the head to its seat several times using a manual grinding tool, without rotating the valve, so as to obtain a clear marking;
- remove the valve and inspect the head.

Note: If the valve head is burnt or very worn, or the contact with the seat is not uniform, replace the valve.

Make these checks on the valve head:

Irregular width of the seal surface:

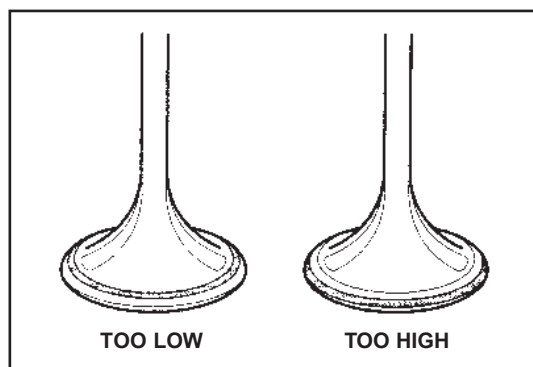
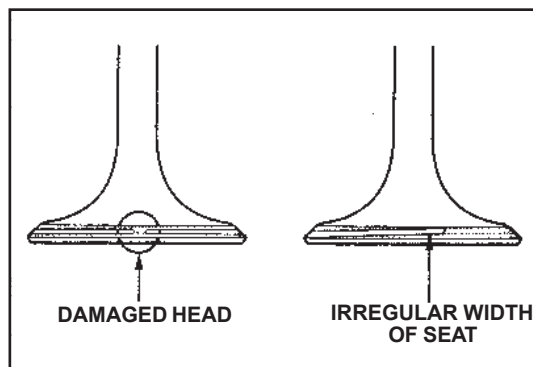
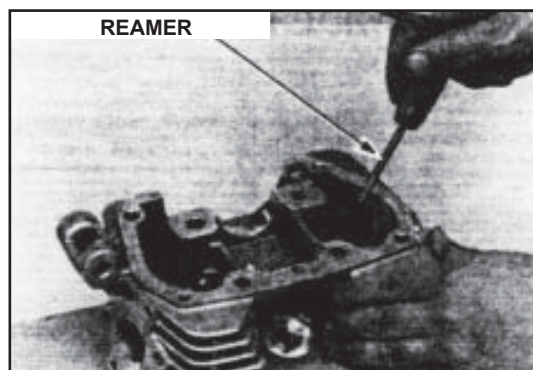
- Bent or cracked valve stem;
- Replace the valve and grind the seat.

Damaged head:

- Replace the valve and grind the seat.

Seal surface too high or too low:

- Grind the seat.



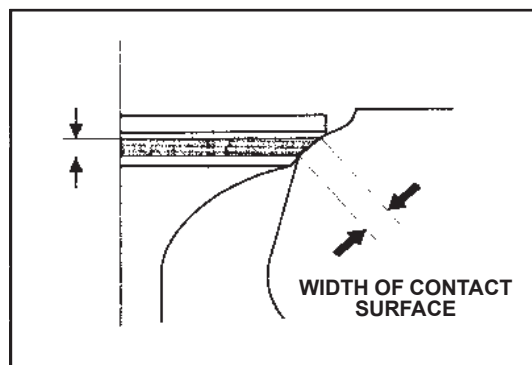
Check the width of the seal surface.

The width of the seal surface must be that specified and be uniform around the entire circumference.

Standard value: 1.10-1.30 mm

Service limit: 1.5 mm

If the width of the seal surface is not to specification, grind the seat.

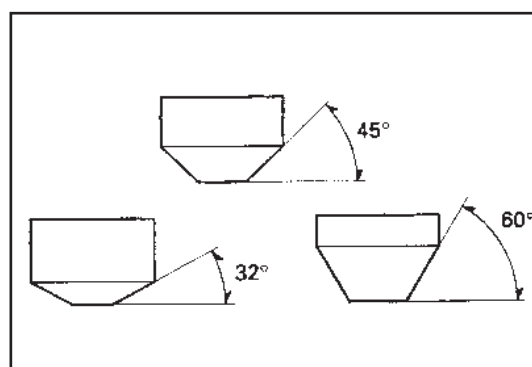


Grinding the seal surface

Note: Follow the instructions of the reamer manufacturer.

The valve seal surfaces are to be ground each time the guides are replaced.

Do not remove more material than necessary.

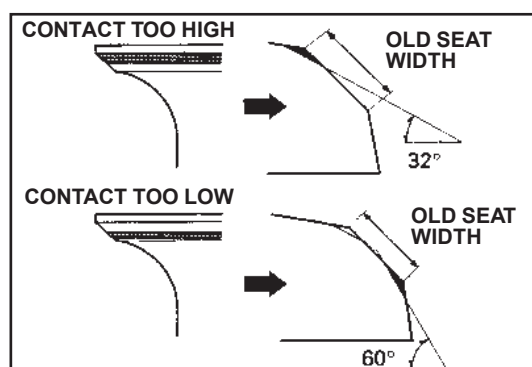


If the seal surface is too high on the valve, the seat must be lowered using a flat 32° cutting tool.

If the seal surface is too low on the valve, the surface must be raised using a 60° internal cutting tool.

Finish the seat to specification using a 45° finishing cutting tool.

- With the 45° cutting tool remove any remaining protrusions or flaws from the seat;



Special tool

45° cutting tool with 27.5 mm diameter..... 19.1.20411

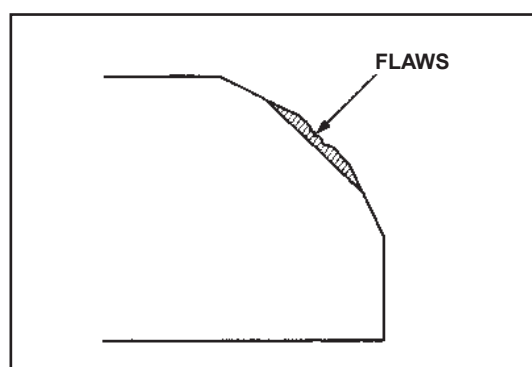
45° cutting tool with 33 mm diameter..... 19.1.20413

32° cutting tool with 30 mm diameter..... 19.1.20415

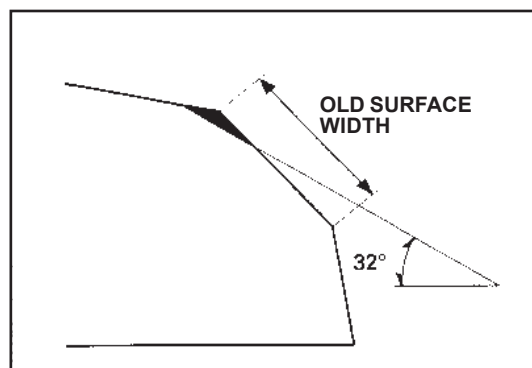
32° cutting tool with 33 mm diameter.... 19.1.20416

60° cutting tool with 30 mm diameter..... 19.1.20417

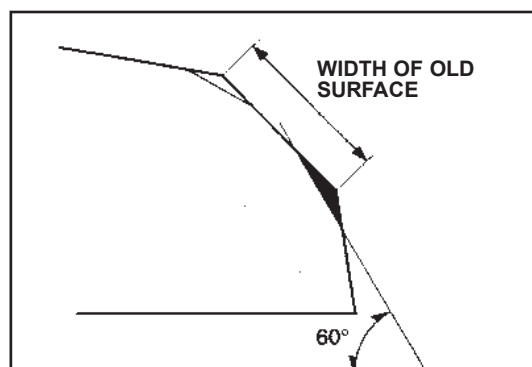
Cutting tool support..... 19.1.20419



- Remove 1/4 of the material from the upper part of the seat using a 32° cutting tool.



- remove 1/4 of the material from the lower part of the seat using a 60° cutting tool;



- cut the seat to the appropriate width using a 45° cutting tool;

- check that all flaws are removed.

Once the seats have been cut, proceed to grind.

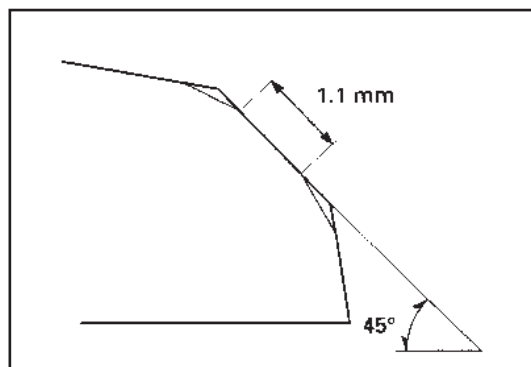
Warning:

Excessive grinding pressure can deform or damage the seat.

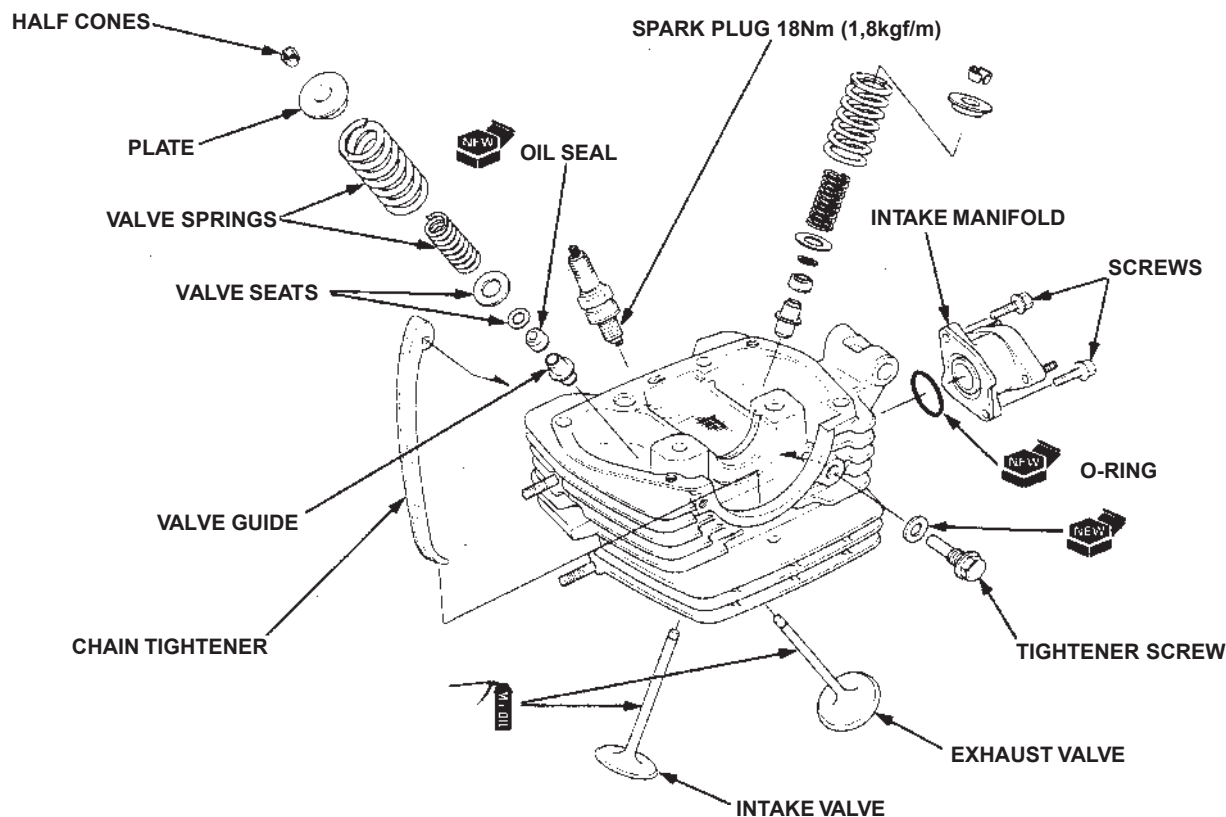
To avoid irregular wear of the seat, change the grinding tool angle frequently.

The grinding compound can cause damage if it penetrates between the valve stem and guide.

- After milling the seat, apply a grinding compound to the valve seal sealing surface and grind under slight pressure.
- After grinding remove all traces of compound by washing the head and the valve;
- When finished, check the seal surfaces again between the valve and its seat.



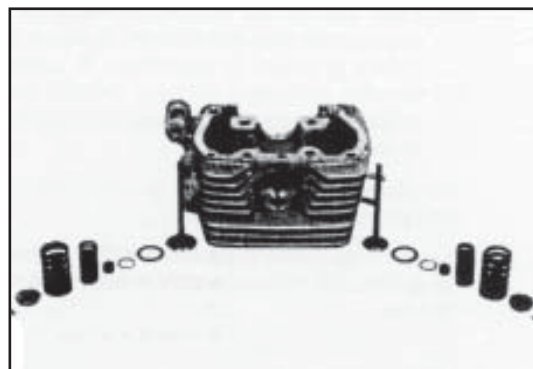
HEAD ASSEMBLY



- Fit the seats of the springs and the new valve stem oil seals;
- lubricate the valve stems and the inner surfaces of the valve guides using bisulphide or molybdenum oil;
- fit the valves in the guides.

Note: To avoid damaging the valve stem oil seal, rotate the valve slowly while assembling.

- Fit the valve springs with the more tightly wound coils toward the combustion chamber;
- fit the valve spring plates;
- Fit the valve springs compressor on the valve and compress the springs.

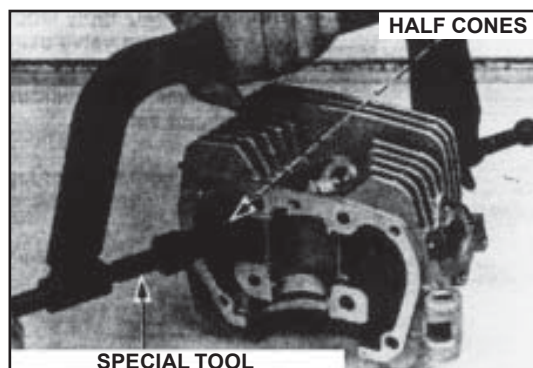


Special tool:

Compressor for valve springs 19.1.20382
Compressor inserts 19.1.20382/10

Warning:

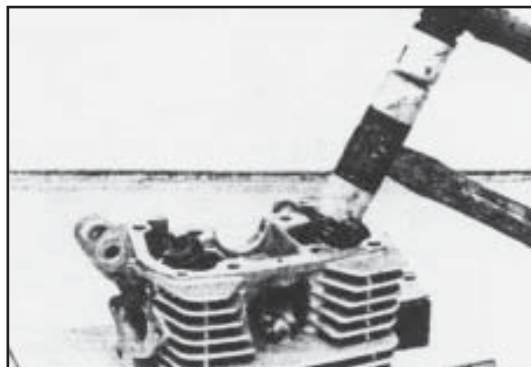
To prevent the loss of spring elasticity, do not compress them more than the amount necessary to insert the halfcones.



- grease the valve half cones and fit in place;

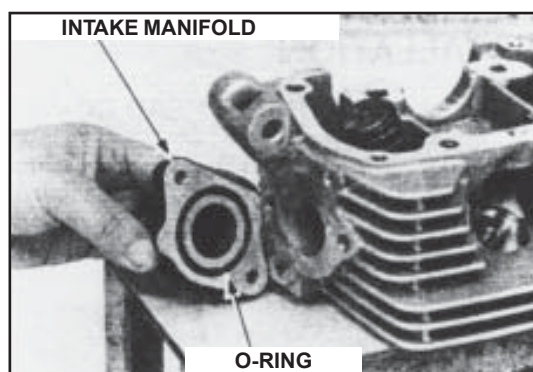
Note: Support the head so that the valve heads are not damaged by other contacts.

- Position the half cones in their seats using two plastic hammers, as shown in the figure. Hold one hammer on the valve stem and tap lightly with the other hammer.



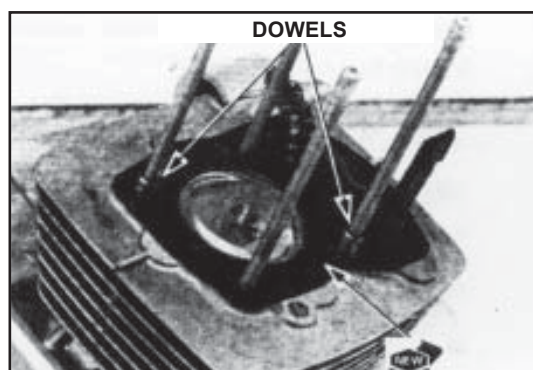
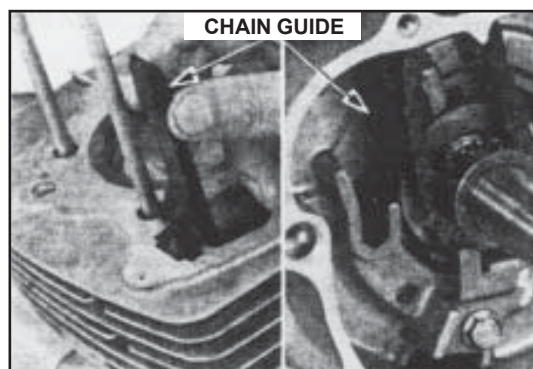
HEAD INSTALLATION

- Fit the intake manifold;
- fit a new O-ring and lock the screws down fully.



Note: Take care not to damage the cylinder mating surfaces when cleaning. Before cleaning the cylinder mating surface cover the cylinder hole with a clean cloth to prevent dust or dirt entering the engine.

- Remove any residue of the seal from the cylinder mating surface;
- fit the driving chain guide, aligning the tab with the groove on the cylinder;
- ensure that the end of the guide is correctly inserted into the crankcase;
- fit the dowels and a new seal;



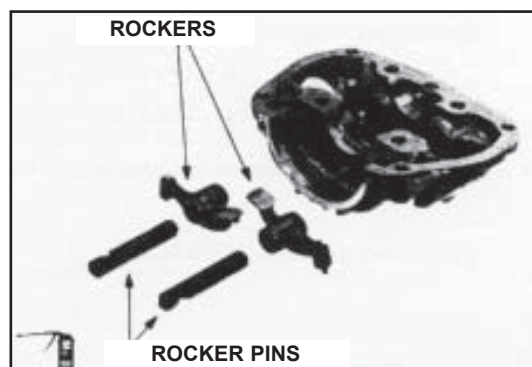
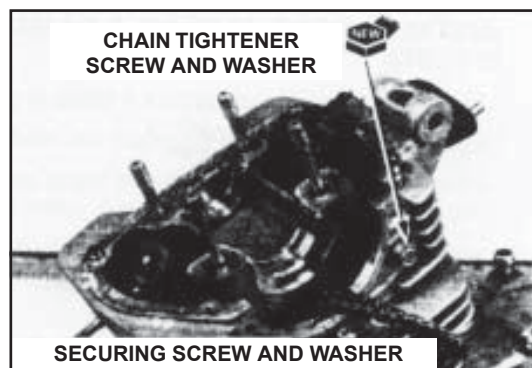
- Tit the head;
- fit and tighten the head securing screws, but not fully, inserting the relevant washer;

- fit a new seal washer and the chain tightener pin screw inserting it in the hole. Tighten the screw to the specified torque.

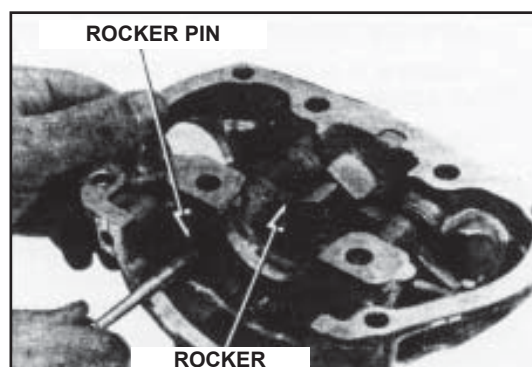
Torque: 10Nm (1.0kgm)

HEAD COVER ASSEMBLY

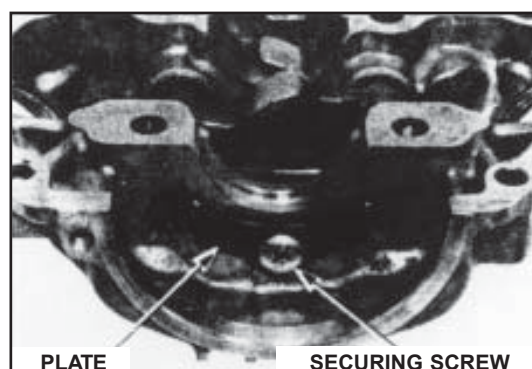
- Lubricate the rocker pins;



- fit the rockers and relevant pins in the head cover;

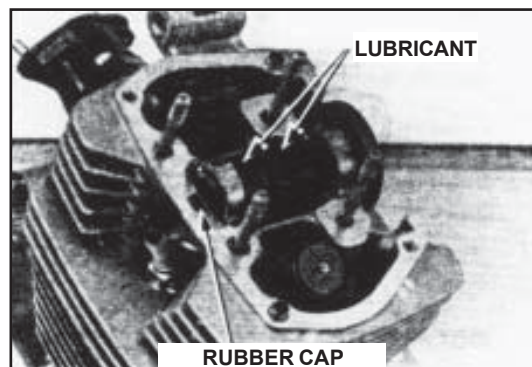


- position the pins and fit the securing plate. Tighten the securing screws down fully.



CAMSHAFT AND HEAD INSTALLATION

- Fit the dowels and rubber caps.
Lubricate the cams and bearings of the camshaft;
- fit the camshaft in the head, positioning it with the cams facing downwards, as shown;
- pour new oil in the cylinder head oil compartment to cover the cams;

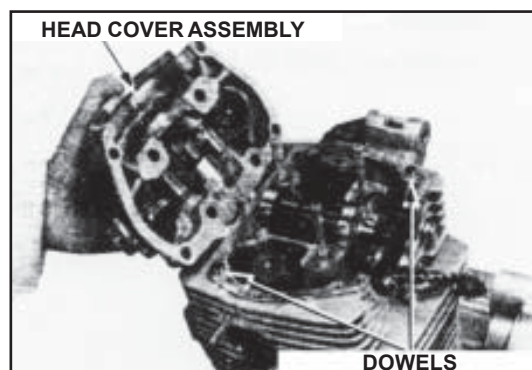


- apply sealant on the head cover mating surfaces.

Warning:

Do not apply sealant on the oil passage.

- Fit the cover on the head.

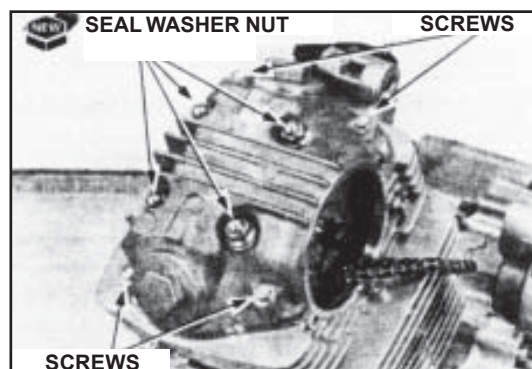


- lubricate the blind nut threads;
- fit new seal washers, the blind nuts and flanged screws;
- tighten the nuts gradually in cross wise sequence.

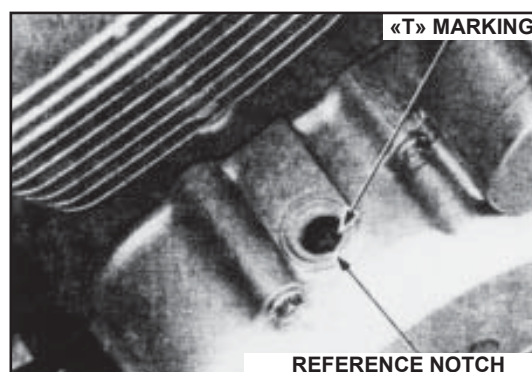
Torque: 26 Nm (2.7 kgm)

- Gradually tighten the flanged screws and the screw on the head in crosswise sequence.

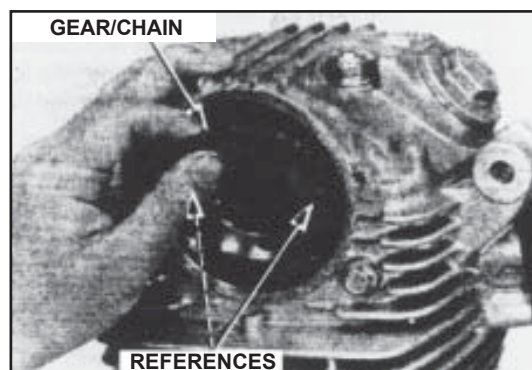
Torque: 12 Nm (1.2 kgm)



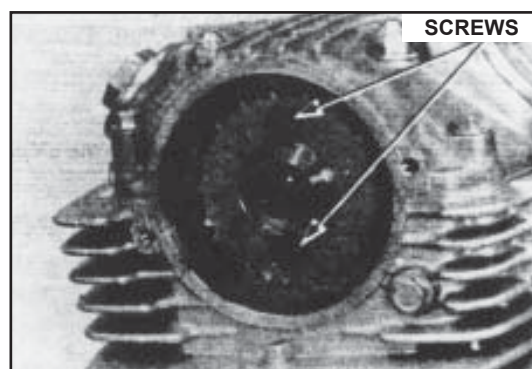
- Align the «T» marking on the flywheel with the reference notch on the left crankcase cover.



- fit the camshaft gear with the phase adjustment references facing outwards;
- fit the driving chain onto the gear as shown;



- align the two phase adjustment lines on the gear of the camshaft with the mating surface between head and cover, without rotating the crankshaft;
- lubricate the camshaft gear screws and fit in place. Tighten the screws to the specified torque.



Torque: 12 Nm (1.2 kgm)

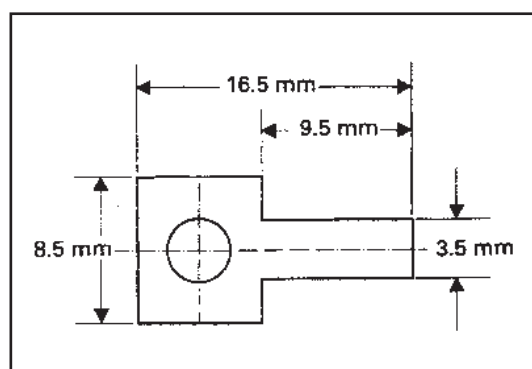
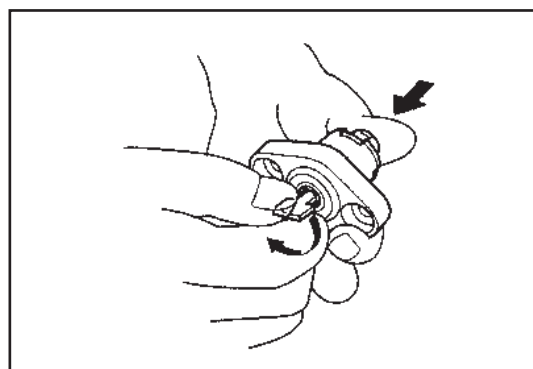
Note: The tooth shaped references are for other versions.

Chain tightener installation

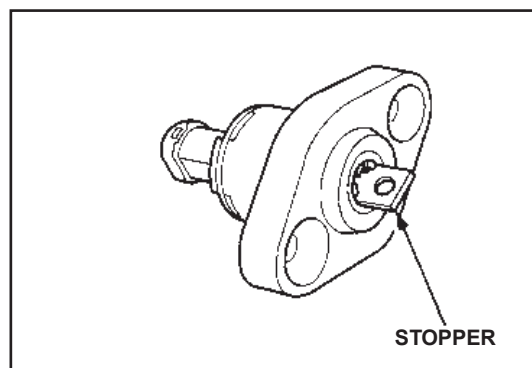
- remove the threaded cap;

Check functioning of chain tightener:

- The chain tightener stem must not enter into the body when pressed.
- The chain tightener stem must enter into the body of the tightener when the internal control is moved clockwise with a screwdriver.
- The stem must come out from the body as soon as the screwdriver is released.
- Prepare a stopper for the chain tightener stem using a thin piece of steel (thickness 0.8 mm) using the diagram on the side for reference;



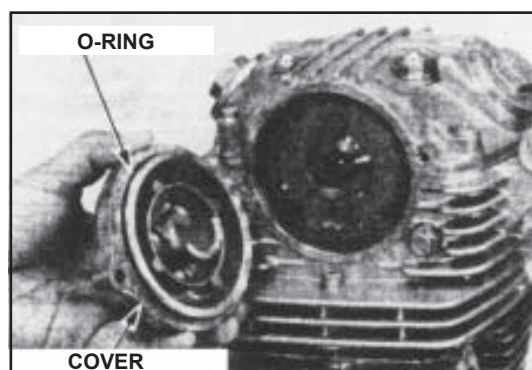
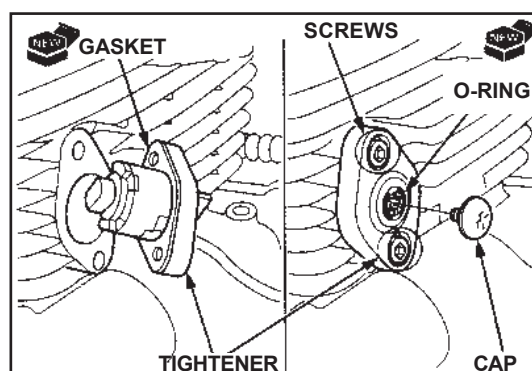
- turn the chain tightener control clockwise so that the stem enters into the tightener body. Hold in this position inserting the stopper in the slots nearest to the position obtained;



- fit a new gasket on the chain tightener;
- refit the chain tightener and tighten the securing screws with their copper washers;
- remove the stopper from the chain tightener;
- fit the cap with a new O-ring and tighten.

Torque: 4 Nm (0.4 kgm)

- Ensure that the reference notches are aligned with the upper surface of the head when the «T» mark is aligned with the reference notch on the crankcase cover;
- fit a new gasket and a new O-ring on the camshaft gear cover;
- fit the camshaft gear cover with the oil compartment down as shown in the figure, and clamp down the cover screws;
- check the valve clearance;
- lubricate the O-rings of the valve covers with clean engine oil;
- fit and tighten the valve covers;



Torque: 15 Nm (1.5 kgm)

- fit and tighten the phase adjustment hole cap and the crankshaft hole cap;

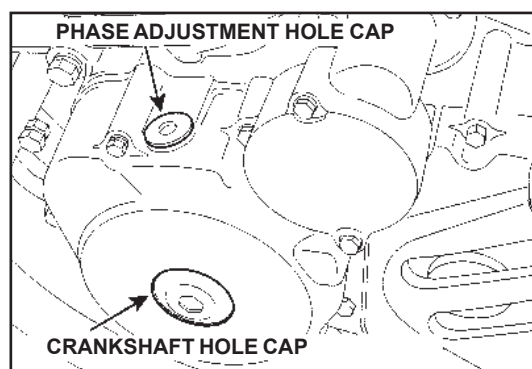
Torque:

Phase adjustment hole cap: 10 Nm (1.0 kgm)

Crankshaft hole cap: 8 Nm (0.8 kgm)

- refit the following:

- Starter motor.
- Engine.



CYLINDER AND PISTON

SERVICE INFORMATION

General

This section describes the maintenance operations for the cylinder and piston.

When disassembling, mark the various components to ensure correct assembly later.

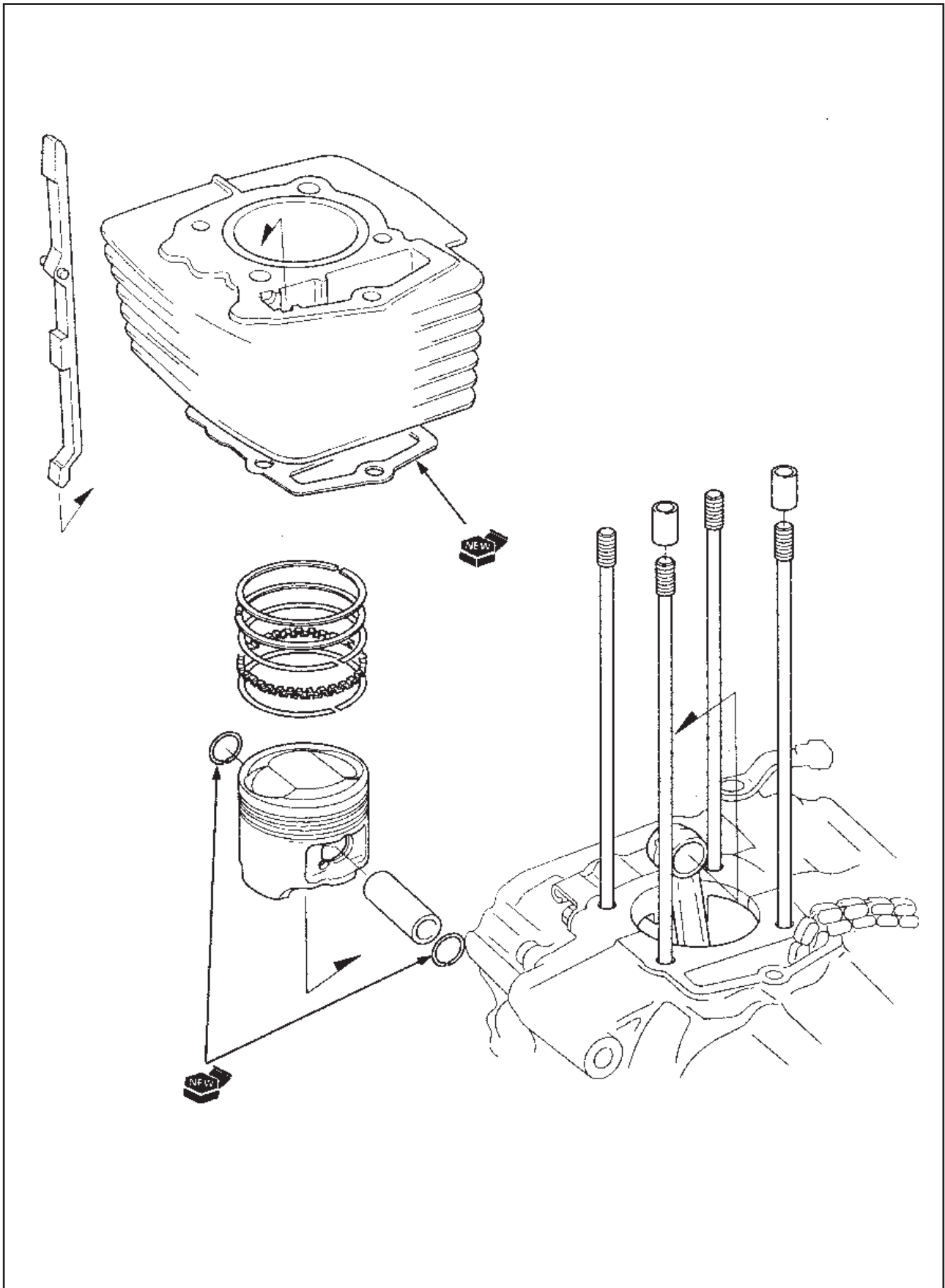
Before inspection, clean all the components with solvent and dry them with compressed air.

When removing the cylinder from the crankcase take care not to damage the mating surfaces.

Specifications

Values in mm

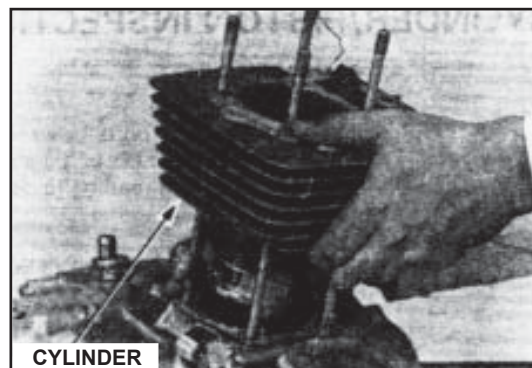
PART			STANDARD VALUE	LIMIT VALUE
End of compression pressure.			1.373 ± 98 kPa; 14,1 ± 1kgf/cm² a 600 rpm	-
Head off-level.			-	0,10
Valve, valve spring, valve guide	Valve clearance when cold.	Intake	0,1 ± 0,02	-
		Exhaust	0,1 ± 0,02	-
	Valve spring free length.	Internal	39,20	38,00
		External	44,90	43,50
	Valve stem outer diameter.	Intake	5,450 - 5,465	5,42
		Exhaust	5,430 - 5,445	5,40
	Valve guide inner diameter.	Intake	5,475 - 5,465	5,50
		Exhaust	5,475 - 5,465	5,50
	Clearance between stem and guide.	Intake	0,010 - 0,035	0,08
		Exhaust	0,030 - 0,055	0,10
Width of seal surface.		1,10 - 1,30	1,50	
Rocker / pin	Rocker hole inner diameter.		12,000 - 12,018	12,05
	Pin outer diameter.		11,966 - 11,984	11,93
	Clearance between rocker and pin.		0,016 - 0,052	0,08
Camshaft	Height of cam lobe.	Intake	31,402 - 31,582	31,10
		Exhaust	31,082 - 31,262	30,70
	Eccentricity.		-	0,03



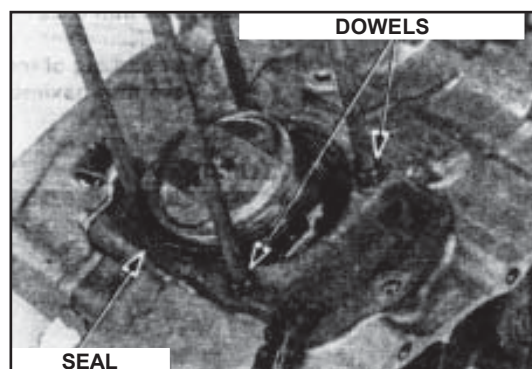
CYLINDER AND PISTON REMOVAL

Cylinder

- Remove the head and cylinder;



- remove the cylinder seal and dowels.

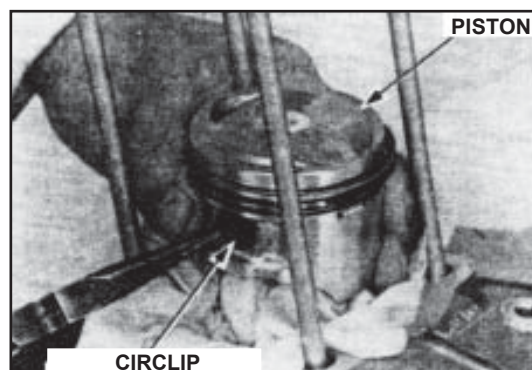


Piston

Using pliers remove the circlip from the piston pin, take out the pin and remove the piston.

Warning:

Cover the crankcase hole to prevent the circlips dropping in.



CYLINDER AND PISTON INSPECTION

Cylinder

- Check that the cylinder is not worn or damaged;
- Measure the cylinder inner diameter along the X and Y axes at three different levels;
- use the highest reading to determine the cylinder wear.

Wear limit: 56.6 mm

Calculate the clearance between piston and cylinder.

Use the highest reading to determine the clearance.

Refer to the next page to measure the piston outer diameter.

Wear limit: 56.4 mm

- Calculate the taper and ovalising on three different levels along axes X and Y using the highest reading.

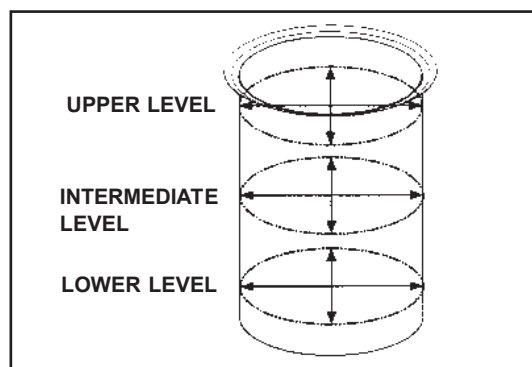
Wear limit:

Taper: 0.06 mm

Ovalising: 0.05 mm

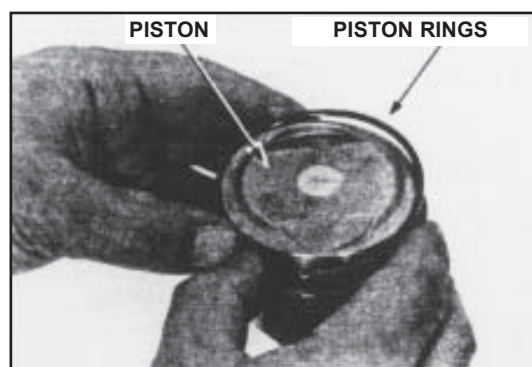
- Using a reference ruler and a thickness gauge check that the upper surface of the cylinder is not misshapen placing the ruler in the intersections shown in the figure.

Wear limit: 0.05 mm

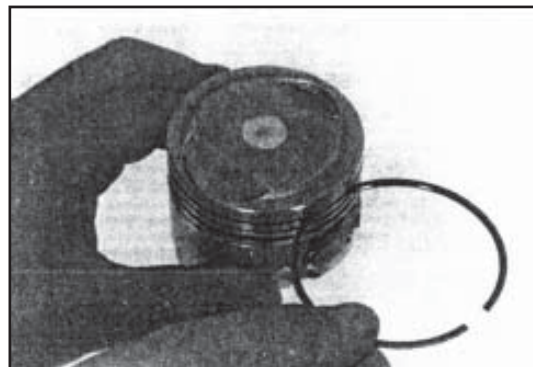


Piston

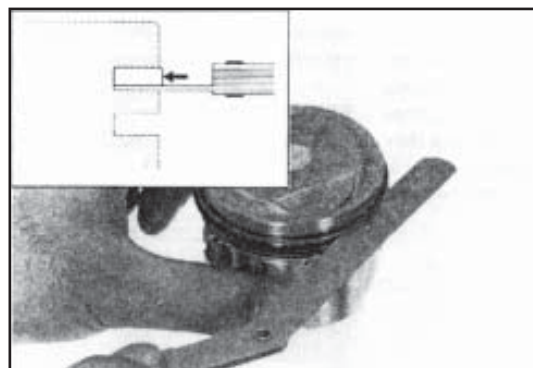
- Remove the piston rings taking care not to damage them;



- using an old piston ring, remove any carbon deposits that have accumulated in the piston grooves;



- fit the piston rings in their places for the moment with the surface marking facing upwards;
- measure the clearance between piston ring and seat on the piston using a thickness gauge blade inserted between them as shown in the figure.

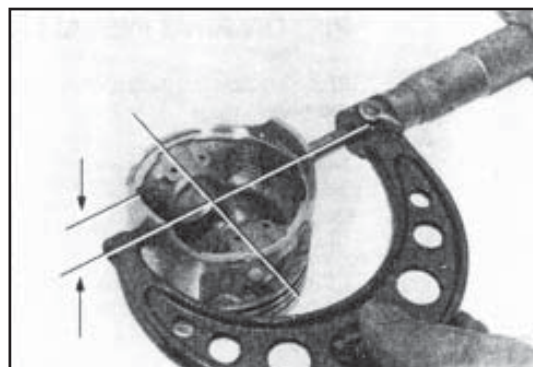


Wear limits:

Upper ring: 0.09 mm

Second ring: 0.09 mm

- Check that the piston is not worn or damaged;
- measure the piston diameter at 13 mm from the lower edge and at 90° to the piston hole axis.



Wear limit: 56.4 mm

- Measure the diameter of the pin seat on the piston in the directions shown in the figure.

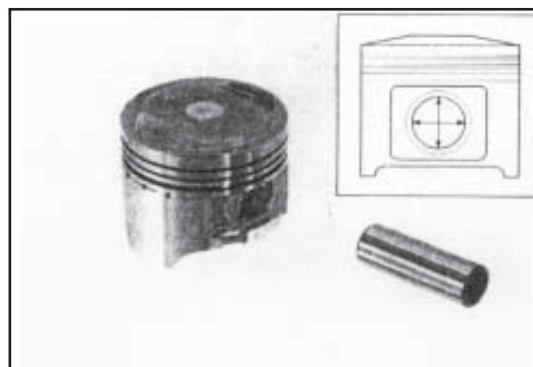
Wear limit: 15.04 mm

- Measure the pin outer diameter.

Wear limit: 14.96 mm

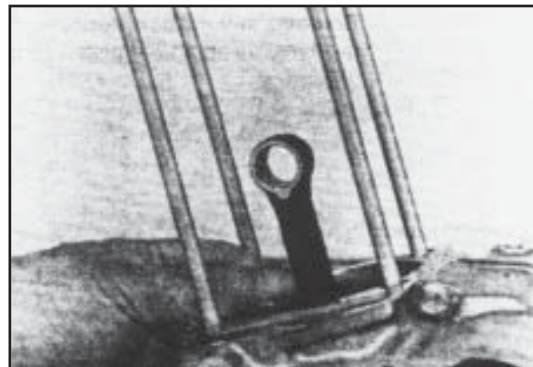
- Calculate the clearance between piston and pin.

Wear limit: 0.070 mm



- Measure the connecting rod small end inner diameter.

Wear limit: 15.06 mm



- Measure the wear on the piston rings finding the distance between the ends with the rings inserted in the cylinder;
- insert the piston ring into the base of the cylinder so that it is perpendicular to this and measure the clearance between the ring ends;
- to ensure that the piston rings remain perpendicular, push them into the cylinder with the upper part of the piston;

Wear limit:

Upper ring: 0.5 mm

Second ring: 0.5 mm

Installing the piston rings onto the piston

- Clean the piston grooves and fit the piston rings.

Note: Lubricate the piston rings.

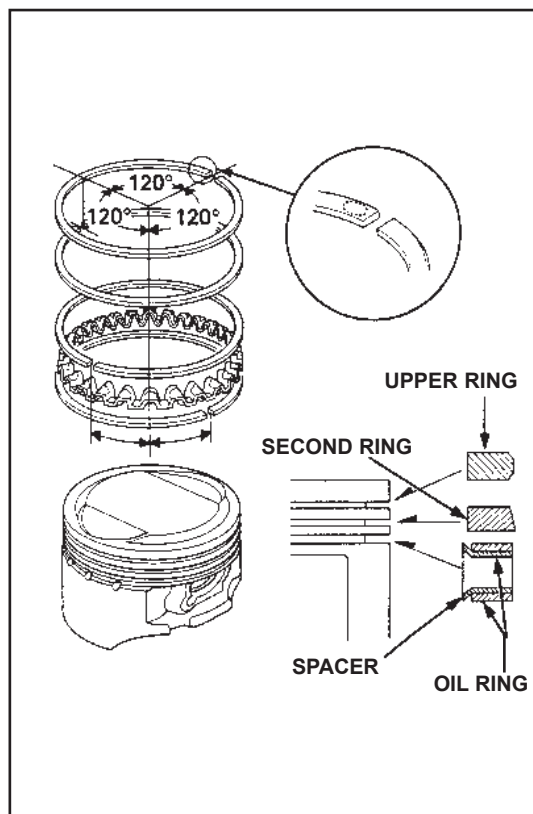
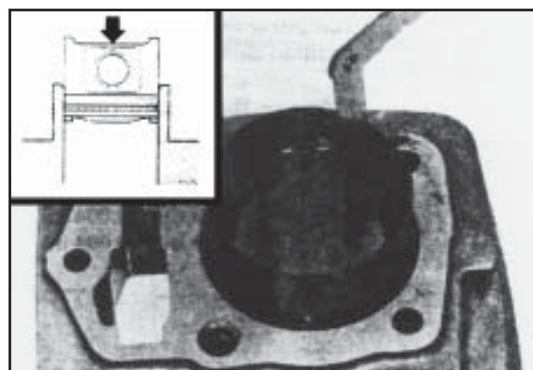
Take care not to damage the rings or the piston.

Fit the piston rings with the marking facing upwards.

Do not exchange the upper ring with the second ring;

the upper ring is narrower than the second one.

- Stagger the piston ring openings by 120°.
Do not align the oil ring side guide openings;
- after fitting the rings, check they can turn freely in the grooves.

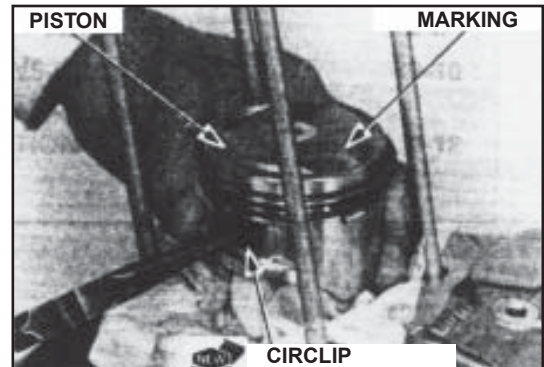


INSTALLING THE CYLINDER AND PISTON

Piston

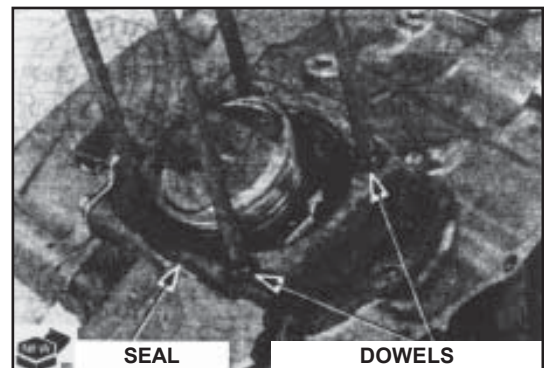
- Lubricate the piston pin outer surface;
- fit the piston with the «IN» marking facing the intake valve;
- fit the piston pin and lock it in place with two new circlips.

Note: Do not align the opening between the two ring ends with the cavity on the piston.

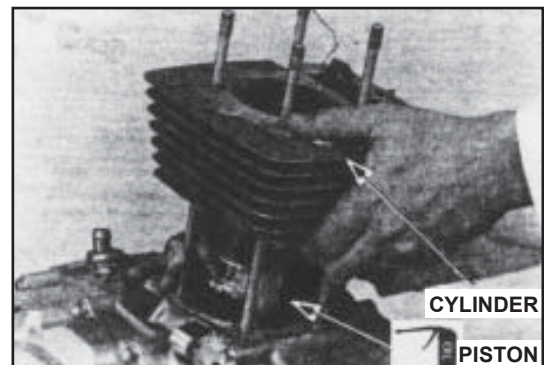


Cylinder

- Remove any seal residue from the crankcase surface;
- fit the dowels and a new seal;



- when fitting in place, take care not to damage the piston rings;
- lubricate the cylinder and piston with a film of engine oil and refit the cylinder;
- install the engine head.



CLUTCH AND GEARBOX LEVERS

SERVICE INFORMATION

General

Maintenance on the clutch and gear change linkage can be carried out with the engine on the frame.

The viscosity, engine oil level and the addition of any type of oil additives may affect clutch disengagement. No additives should be added to the oil. If the clutch does not disengage or jams, check the viscosity and level of the oil before operating on the clutch.

Remove all traces of old gaskets from the mating surface of the right crankcase cover.

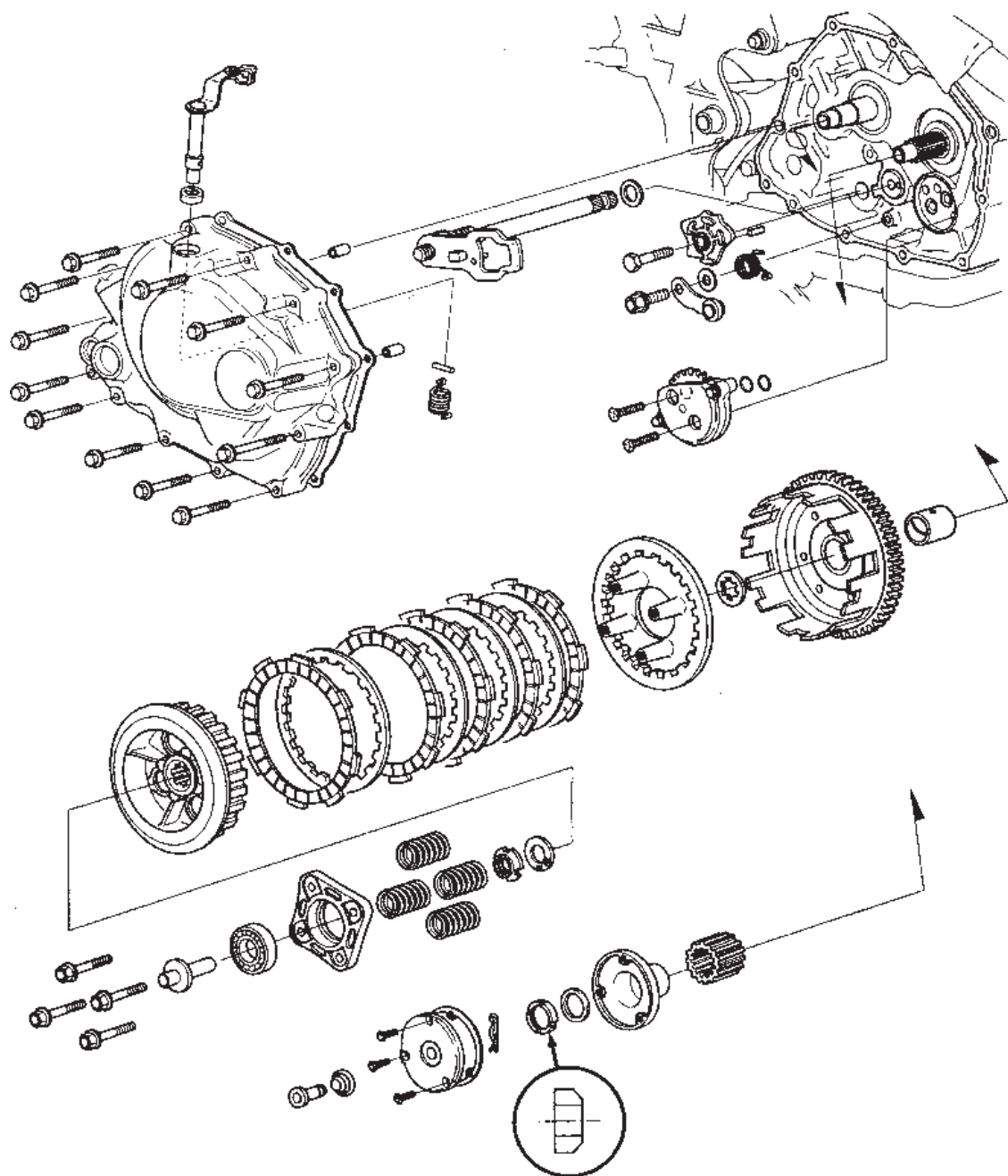
Take care not to damage the crankcase cover mating surface.

To work on the gearbox, separate the two crankcase guards.

Specifications

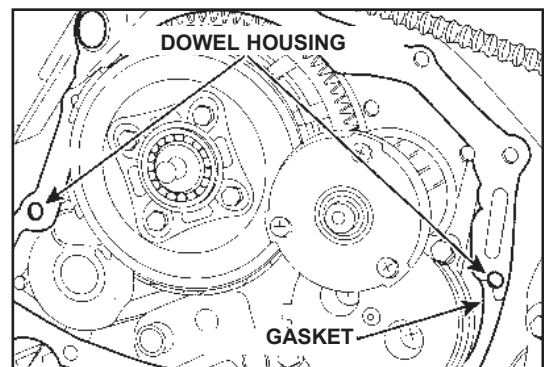
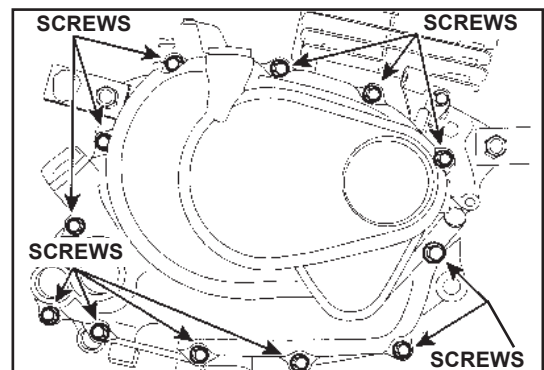
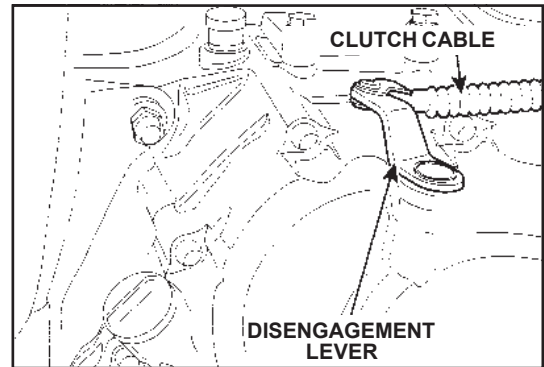
Values in mm

PART		STANDARD VALUE	LIMIT VALUE
Clutch lever clearance.		10,0 - 20,0	-
Clutch spring free length		34,6	32,5
Thickness of friction discs.		2,92 - 3,08	2,70
Metal discs deformation.		-	0,20
Clutch bell guide.	Inner diameter	19,983 - 19,996	20,02
	Outer diameter	27,959 - 27,980	27,93
Outer diameter of main shaft on the clutch bell guide.		19,967 - 19,980	19,92



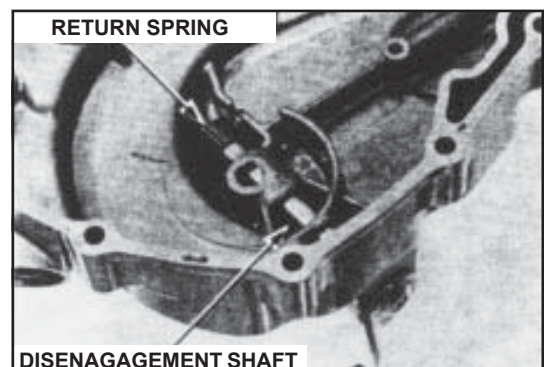
RIGHT-HAND ENGINE GUARD REMOVAL

- Drain off the engine oil;
- release the brake light indicator control spring from the brake pedal then, without detaching the transmission, remove the pedal/supporting bracket assembly by unscrewing the two socket hex head screws on the edges of the chrome-plated bracket;
- disconnect the clutch cable from the disengagement lever;
- remove the screws and the right-hand guard;
- remove the dowels and the gasket.

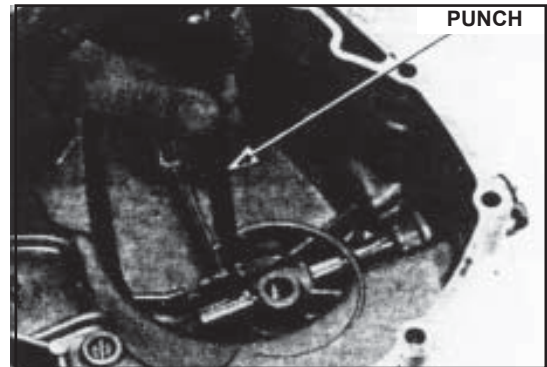


Diassembly

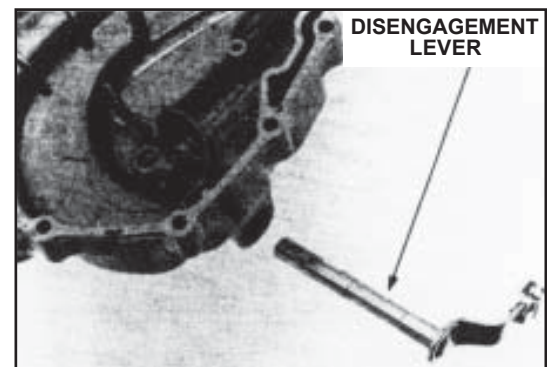
Remove the clutch disengagement shaft return spring;



- Make a note of the protrusion and the assembly direction of the spring pin in relation to the disengagement lever shaft;
- Drive the spring pin in completely so as to be able to extract the shaft from the cover.
Use a 3 mm punch;

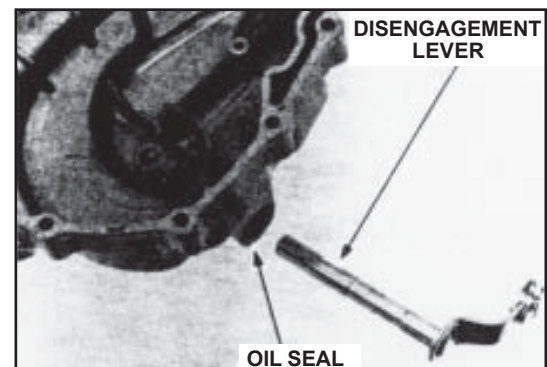


- Remove the clutch disengagement lever.



Inspection

- Check the wear on the oil seal and if necessary replace it from inside the cover;
- check that the clutch disengagement lever is not damaged or bent;
- check the spring: if it is strained or damaged replace it;
- grease the clutch disengagement sliding surface and the oil seal;



CLUTCH REMOVAL

- Remove the right engine guard cover;
- remove the oil centrifugal filter rotor;
- loosen the screws of the clutch disengagement plate in a crosswise sequence making two or three steps to do so;
- remove the disengagement strut, plate, bearing and clutch Springs;
- lock the pressure plate with the clutch hub stop wrench and loosen the hub locking nut;

Special tool:

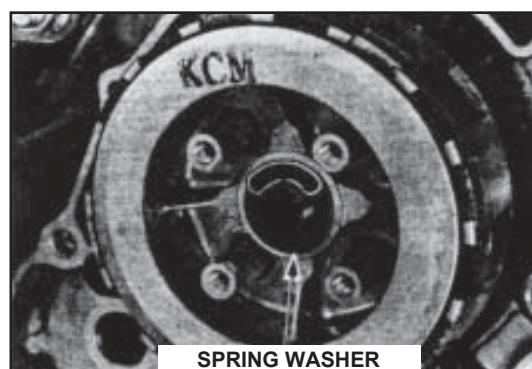
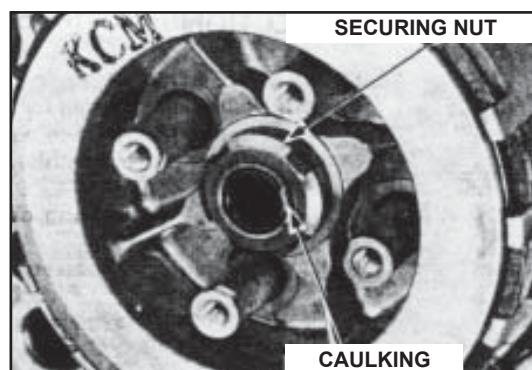
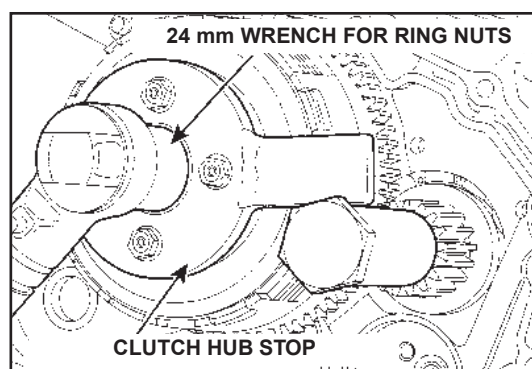
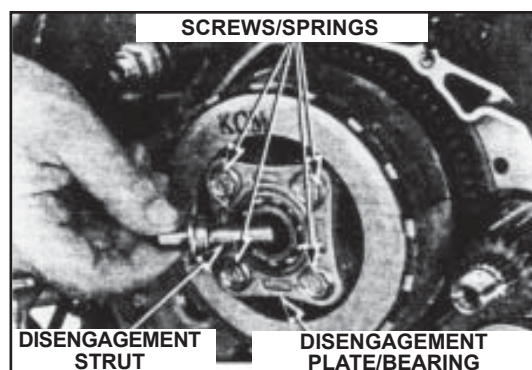
Clutch hub stop	19.1.20421
24 mm wrench for ring nuts	19.1.20404

- Uncaulk the clutch hub nut.

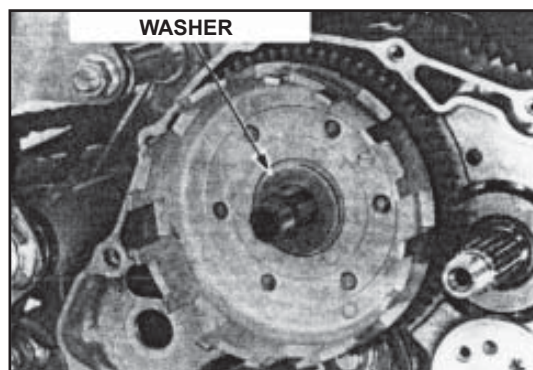
Warning:

Do not damage the main shaft thread.

- Remove the clutch hub nut and spring washer;
- remove the clutch hub, friction discs, metal discs and pressure plate;



- Remove the washer and clutch bell;



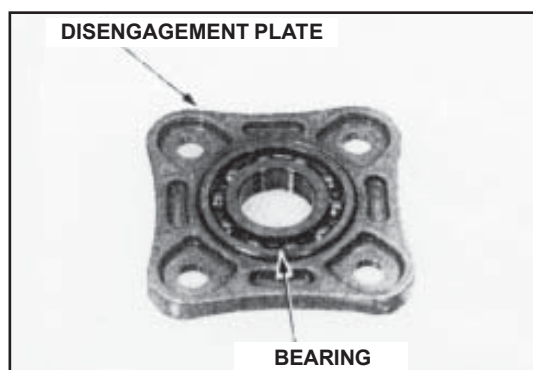
- Remove the clutch bell guide.



INSPECTION

Disengagement plate bearing

- Check that the disengagement plate bearing is not damaged. The bearing must rotate smoothly and silently without clearance;
- check that the outer race of the bearing makes with the plate hole without too much clearance. If necessary, replace the bearing.



Clutch springs

- Measure the free length of the clutch springs.
If even one spring is out of the wear limit, replace all the springs.

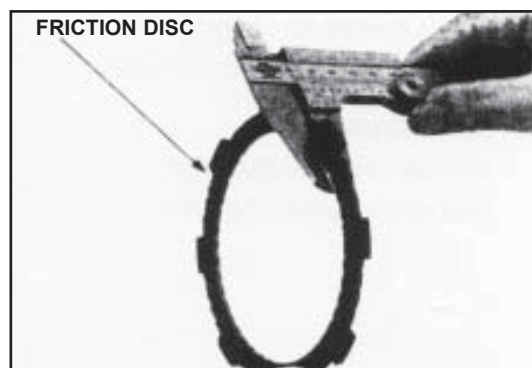
Wear limit: 32.5 mm



Friction disc

- Check the surfaces of the friction discs and measure the thickness. If even one friction disc is not within the wear limit, replace all discs.

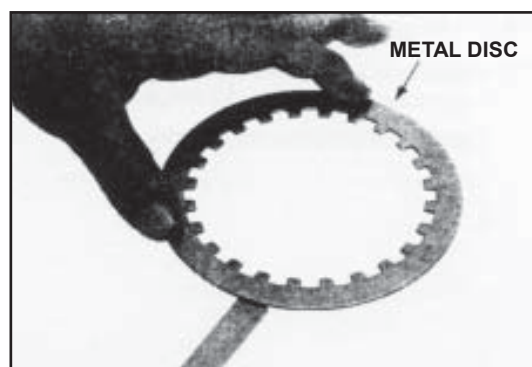
Wear limit: 2.70mm



Metal discs

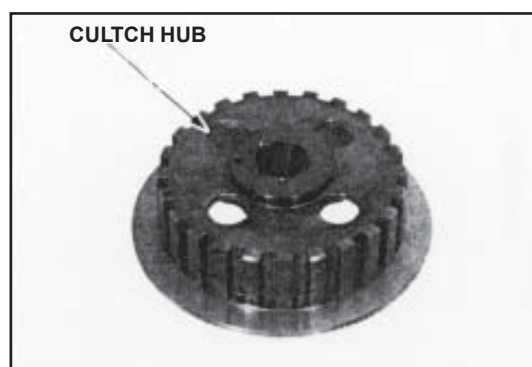
- Check the surfaces of the disks and look for any misshaping by placing the discs on a flat surface and using a thickness gauge. If even one metal disc when measured with the thickness gauge is out of tolerance, replace all discs.

Wear limit: 0.20 mm (warpage)

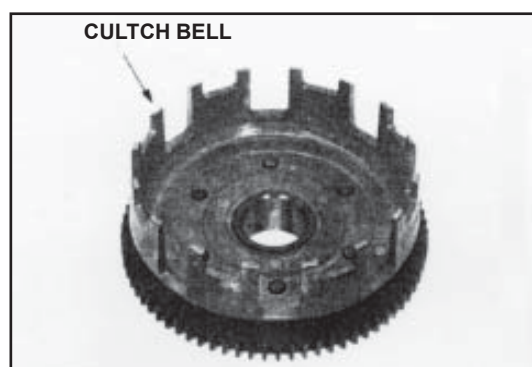


Hub and clutch bell

- Check that the hub and the clutch bell have no surface flaws or signs of irregular wear caused by the clutch discs;



- check that the main transmission driven gear teeth are not worn or damaged. Check that the discs have not damaged the disc housings.



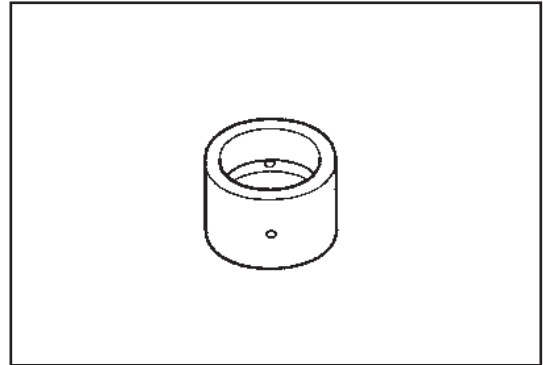
Clutch bell guide

- Measure the clutch bell guide.

Wear limit:

Inner diameter: 20.02 mm

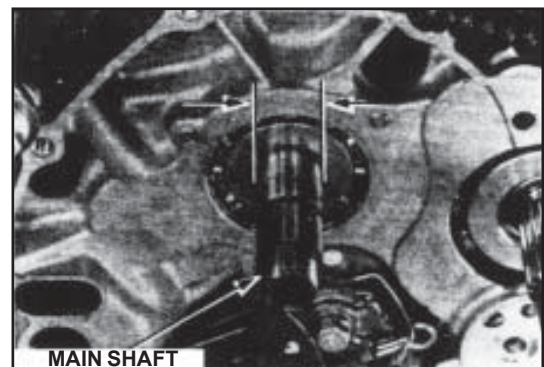
Outer diameter: 27.93 mm



Main shaft

- Measure the outer diameter of the main shaft near the clutch bell guide.

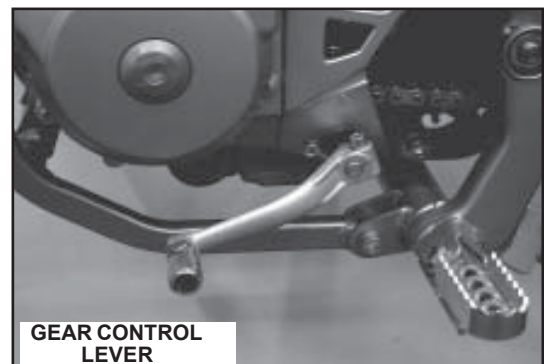
Wear limit: 19.92 mm



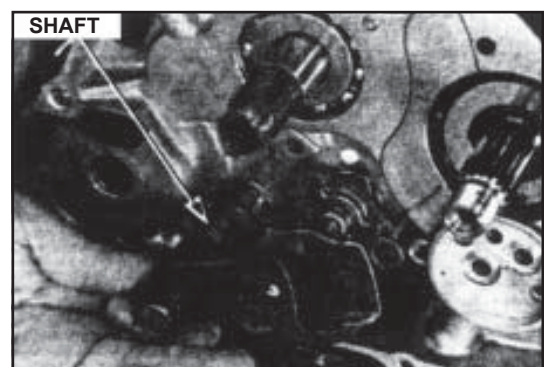
GEAR CHANGE LINKAGE

Removal

- Remove the gear change lever:

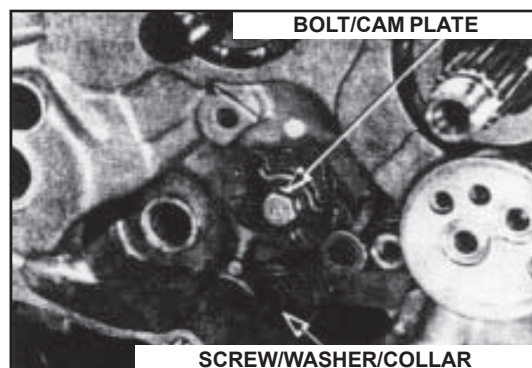


- remove the gear control shaft from the crankcase;



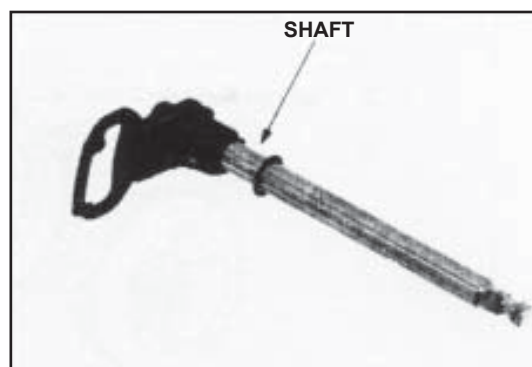
- remove the screw, washer, selector drum stop catch, collar and spring;
- remove the screw, gear cam plate and location dowel.

Note: before loosening the screw bring the selector drum to the end of rotation.



Inspection

- Check that the gear control shaft is not worn or damaged;
- check that the return spring is not strained or damaged.

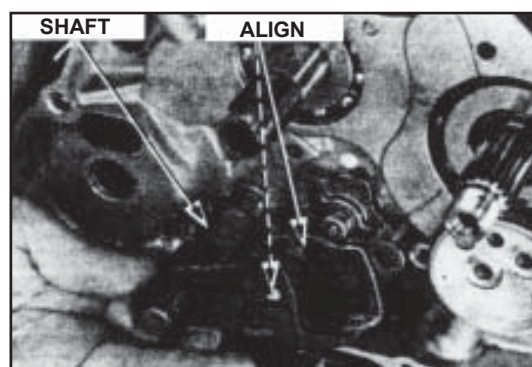


Installation

- Follow the disassembly operations in reverse order.

Note: Fit the gear control shaft aligning the ends of the return spring with the guard positioning support.

- Refit the gear change lever idler and rod and tighten the screw to the specified torque.



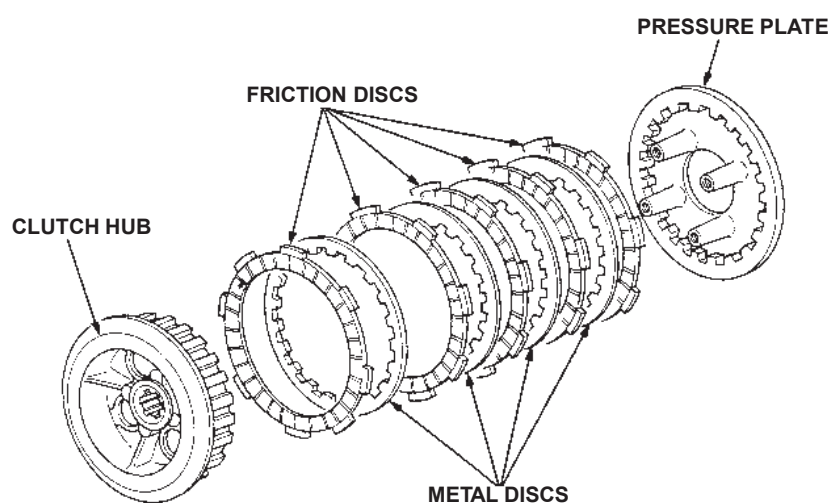
Torque: 16Nm(1.6kgm)

- Check the overhang between the pedal crank and the gear change lever.

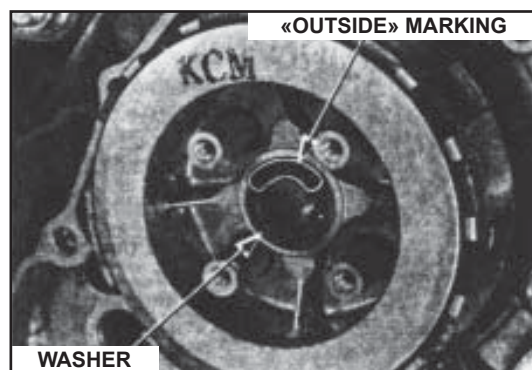
CLUTCH INSTALLATION

- Lubricate the clutch bell guide outer surface with molybdenum bisulphate oil;
- refit the guide, clutch bell and the thrust washer on the main shaft;
- refit the clutch bell;
- refit the thrust washer on the main shaft;
- refit the pressure plate, friction discs, metal discs and clutch hub as one assembly in the clutch bell.

Note: Fit the four metal discs and five friction discs in alternating sequence, starting with a friction disc.



- Fit the clutch assembly on the main shaft;
- fit the washer and a new spring washer with the side marked «OUTSIDE» outwards;
- fit a new nut to secure the clutch hub.

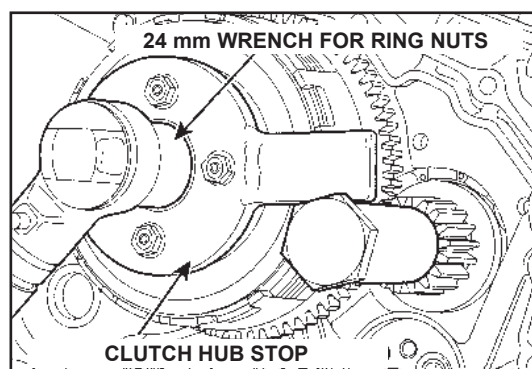


- Use the special tool to hold the pressure plate firm and tighten the clutch hub nuts to the specified torque.

Special tool:

Clutch hub stop	19.1.20421
24 mm wrench for ring nuts	19.1.20404

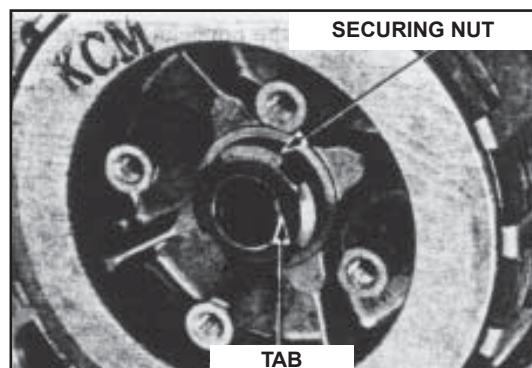
Torque: 83Nm (8.5 kgm)



- bend the tab of the locking nut into the groove on the main shaft;

Warning:

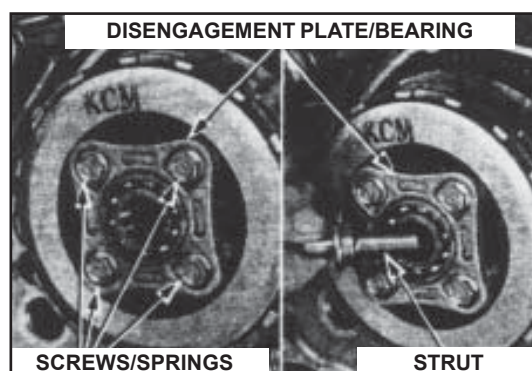
Take care not to damage the main shaft thread.



- Fit the clutch springs and disengagement plate with its bearing;
- fit and tighten the disengagement plate screws in crosswise sequence proceeding in several steps

Torque: 12Nm(1.2kgm)

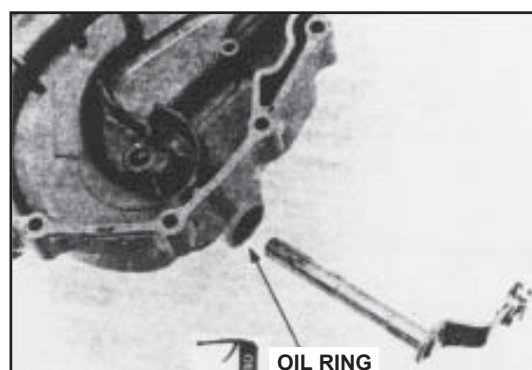
- Insert the disengagement strut.



ENGINE GUARD INSTALLATION

Assembly

- Follow the disassembly operations in reverse order taking care to lubricate the sliding surfaces and the seal ring and to align the ends of the strut with the groove on the clutch disengagement lever.

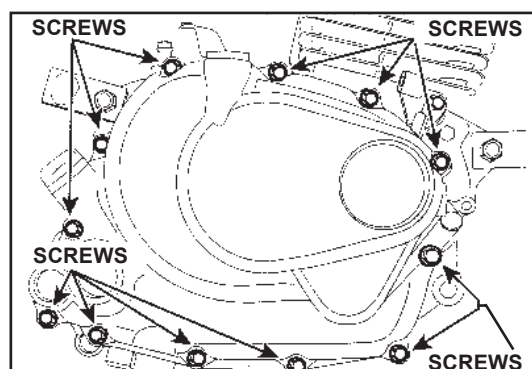


Installation

- Install the engine guard following the disassembly operations in reverse order.

Note: Use a new gasket on the guard and tighten the screws in crosswise sequence proceeding in several steps.

- Fill with engine oil, adjust the clutch and the rear brake pedal.



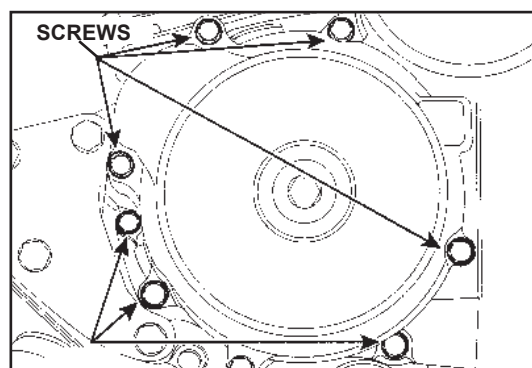
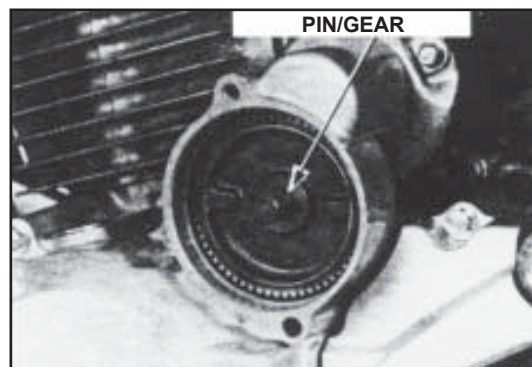
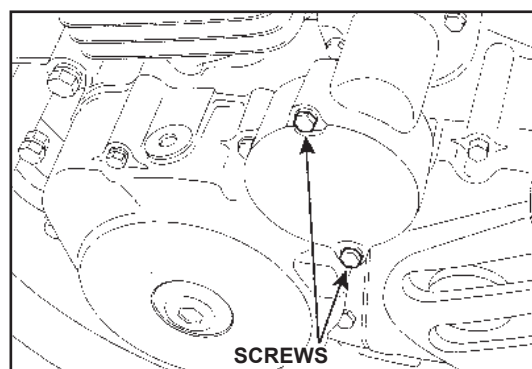
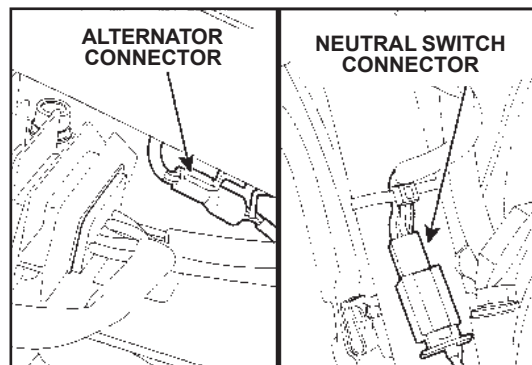
ALTERNATOR AND STARTER FREE WHEEL

LEFT-HAND GUARD REMOVAL

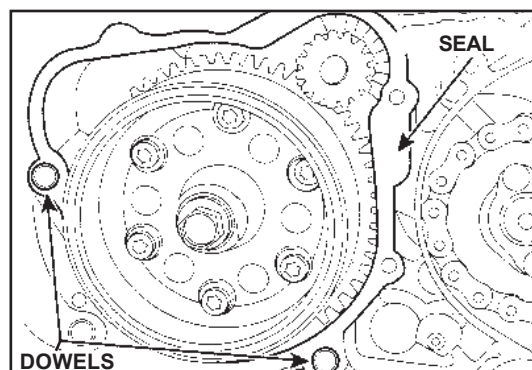
- Drain off the engine oil;
- remove the carburettor tank;
- disconnect the battery terminals;
- disconnect the three-phase alternator connector, the pulse generator and the neutral switch cable three-pole connector;
- remove the starter motor reduction gear cover;
- check the O-ring for wear;
- remove the reduction gear pin and the starter reduction gear;
- place a container under the left guard to collect the engine oil, then unscrew the left guard in cross-wise sequence in several steps;
- remove the seven screws and the left guard.

Warning:

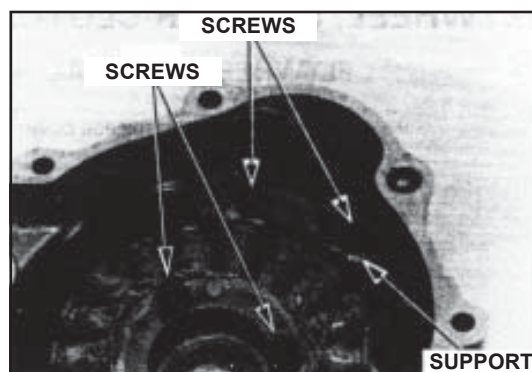
The left-hand guard (stator) is magnetically coupled to the flywheel. Take care when removing it.



- Remove the seal and the dowels;

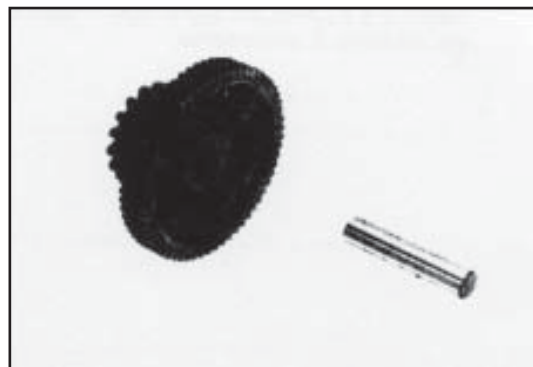


- remove the screws, wiring harness support and pick-up from the left sump;
- remove the wiring guide and the cable fairlead rings;
- remove the screws and the stator from the crankcase left cover.



Reduction gear inspection

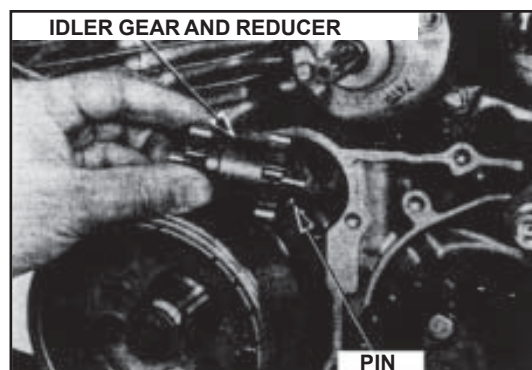
- Check that the teeth are not excessively worn or faulty and do not show visible signs of insufficient lubrication.



FLYWHEEL AND STARTER FREE WHEEL

Flywheel and starter free wheel

- Remove the left guard;
- remove the starter motor idler gear and its pin.

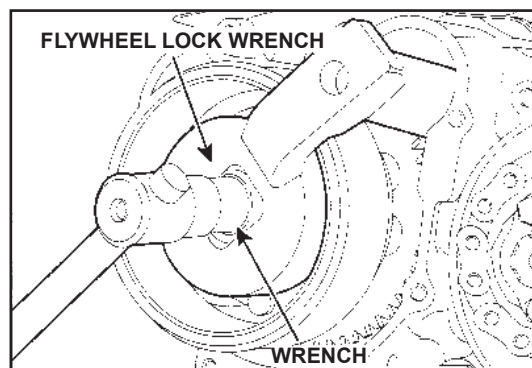


Warning:

Remove the flywheel securing screw and washer holding the flywheel still with the special lock wrench.

Special tool:

Flywheel lock wrench..... 19.1.20403

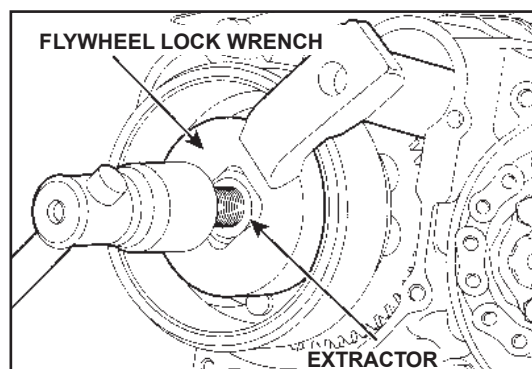


- Remove the flywheel with the special extractor.

Special tool:

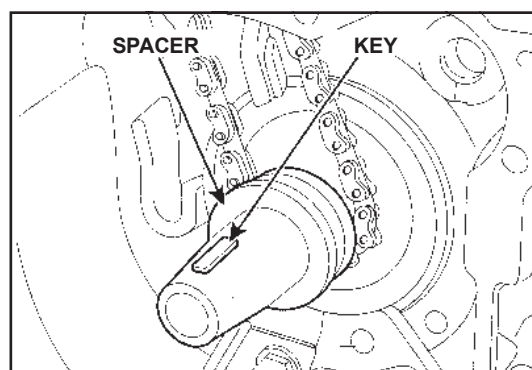
Flywheel extractor..... 19.1.20406

Flywheel lock wrench..... 19.1.20403

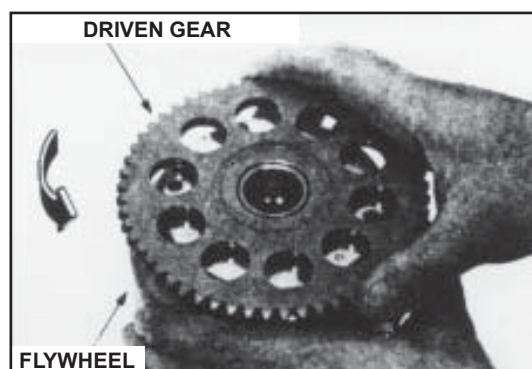


- Remove the spacer and the key from the crankshaft;

Note: When removing the key, take care not to damage the groove of the key or the crankshaft.

**Driven gear and starter free wheel removal**

- Check that the driven gear rotates smoothly in one direction and locks in the other;
- remove the driven gear from the flywheel rotating it anticlockwise.

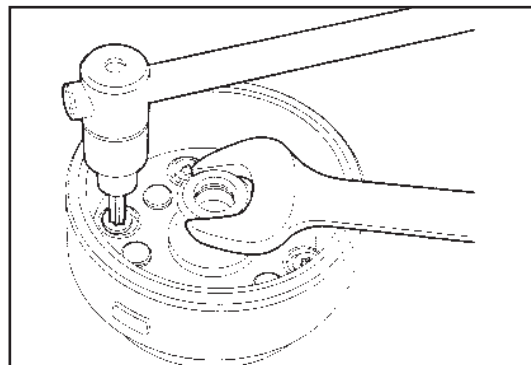


Note: Do not remove the free wheel housing or the unidirectional free wheel unless this is necessary to inspect them.

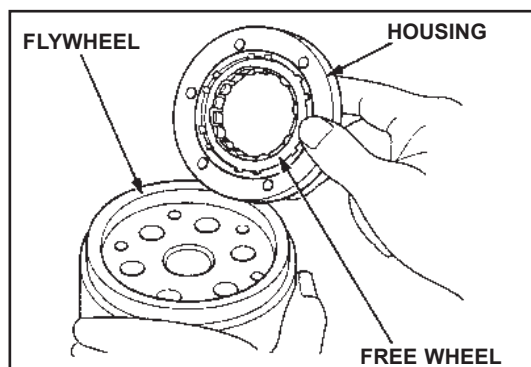
- Remove the unidirectional starter free wheel torx profile screws holding the flywheel still with a wrench.

Special tool:

Flywheel lock wrench..... 19.1.20403



- Remove the free wheel and its housing from the flywheel.



STARTER FREE WHEEL INSPECTION

Unidirectional free wheel

- Check that the unidirectional free wheel stop punch has no signs of excessive wear, damage or irregular movement.

Free wheel housing

- Check that the internal contact surface with the free wheel is not damaged.

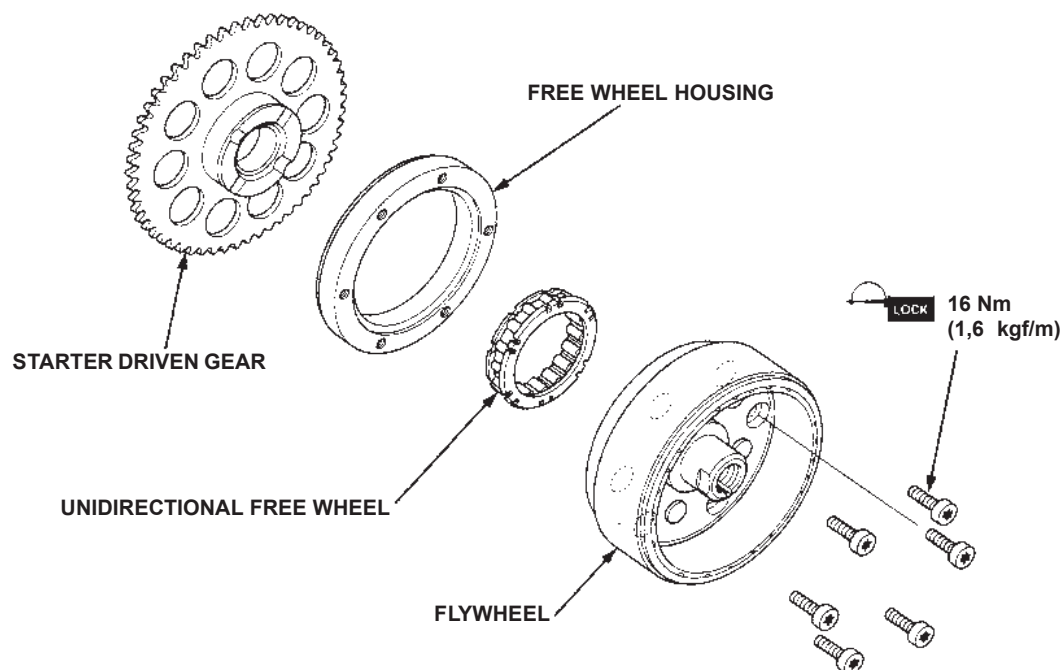
Note: If the spring has moved out from the unidirectional free wheel groove, fit a new free wheel unit (free wheel and spring).

Starter driven gear

- Check that the rollers contact surface is not damaged.



DRIVEN WHEEL AND STARTER FREE WHEEL INSTALLATION



- Refit the parts following the removal procedure in reverse;

Note: Fit the unidirectional free wheel in its housing with the flanged side toward the flywheel.

If the spring has moved out from the unidirectional free wheel groove, fit a new free wheel unit (free wheel and spring).

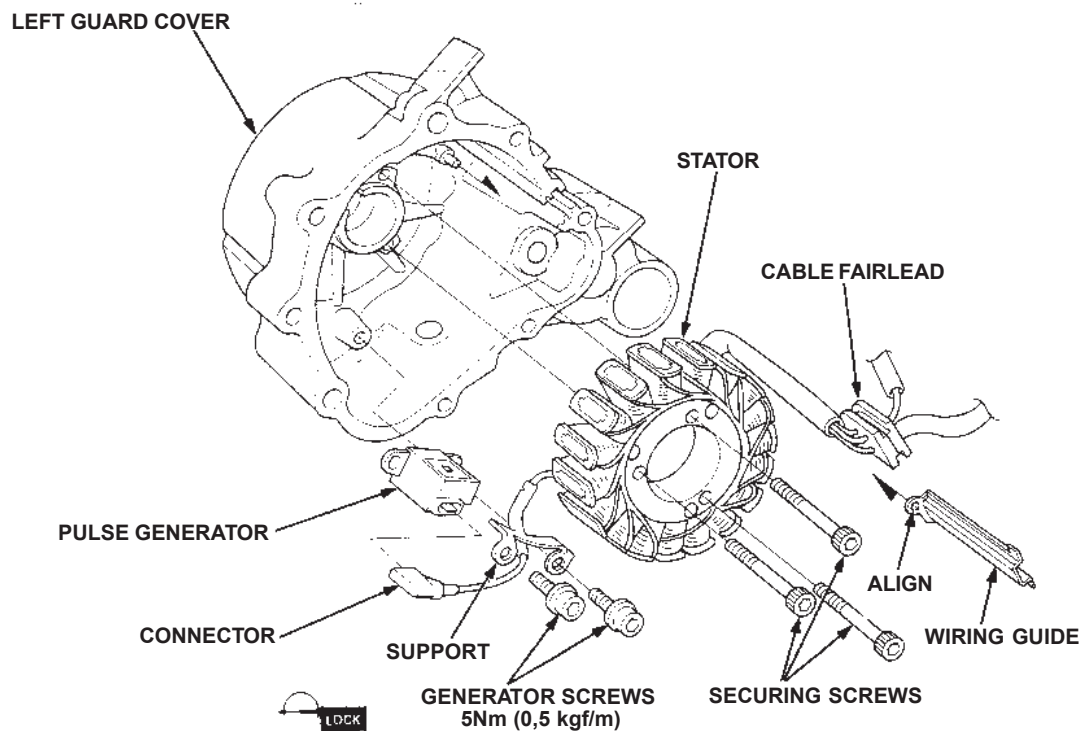
Apply loctite 242 to the torx screws before tightening to torque;

Torque: 16Nm (1.6kgm)

When refitting the flywheel remember to lubricate the thread and securing screw washer with engine oil.

Torque: 74 Nm (7.5 kgm)

LEFT GUARD INSTALLATION



- Refit the parts following the removal procedure in reverse;

Note: When assembling, clean the screw threads and apply loctite 242.

Take care not to pinch the electrical connection cables.

CRANKCASE/GEARBOX/CRANKSHAFT

SERVICE INFORMATION

General

To service the crankshaft and gearbox the engine must be removed from the vehicle and the following parts removed at the bench:

Alternator and starter motor free wheel (Chapter 9).

Clutch and gear change linkage (Chapter 8).

Cylinder head (Chapter 6).

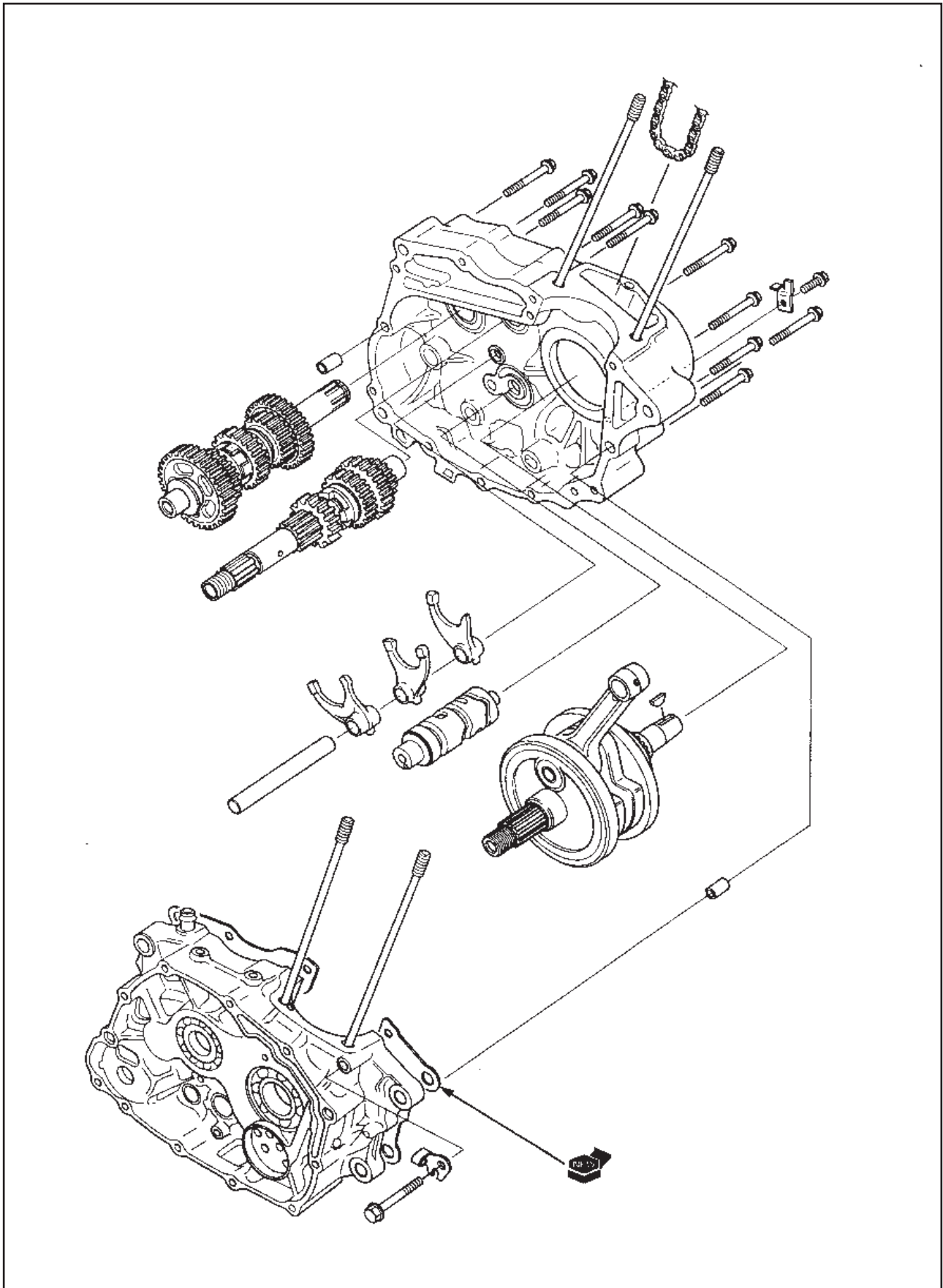
Cylinder and piston (Chapter 7).

Oil filter rotor and oil pump (Chapter 3).

Specifications

Values in mm

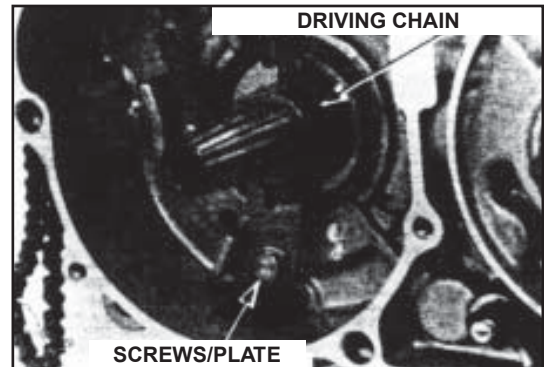
PART			STANDARD VALUE	LIMIT VALUE
Crankshaft.	Eccentricity.		-	0,10
	End float.		0,05 - 0,30	0,50
	Radial clearance.		0 - 0,008	0,05
Gearbox fork, gearbox fork pin.	Gearbox fork bore diameter.		12,000 - 12,018	12,000 - 12,018
	Fork ends thickness.		4,93 - 5,00	4,93 - 5,00
	Pin outer diameter.		11,976 - 11,994	4,70
Gearbox.	Gear inner diameter.	M3	20,020 - 20,041	11,90
		M5	23,020 - 23,041	20,07
		C1	19,520 - 19,541	23,07
		C2	23,020 - 23,041	19,57
		C4	20,020 - 20,041	23,07
	Bushing outer diameter.	M5	20,559 - 20,580	20,07
		C1	19,479 - 19,500	22,93
		C2	22,979 - 23,000	19,43
	Bushing outer diameter.	M5	20,020 - 20,041	22,93
		C1	16,516 - 16,534	20,20
		C2	20,000 - 20,021	16,60
	Clearance between gear and bushing.	M5	0,015 - 0,057	20,10
		C1, C2	0,020 - 0,062	0,10
	Clearance between gear and shaft.	C1	0,032 - 0,065	0,10
		C2	0,013 - 0,047	0,10
	Main shaft outer diameter.	M3, clutch bell guide.	19,959 - 19,980	19,91
		Bearing.	14,978 - 14,989	14,91
	Countershaft outer diameter.	Bushing C2, C4.	19,974 - 19,987	19,91
		C1	16,469 - 16,484	16,41



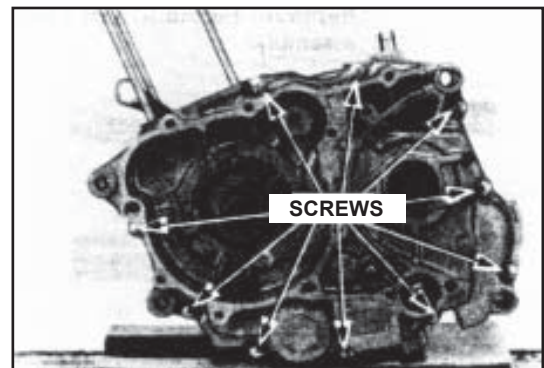
CRANKCASE SEPARATION

Note: It is assumed that the items listed in the «General» section have been removed from the engine.

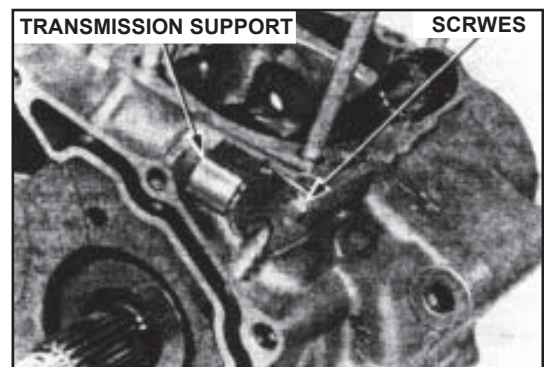
- Remove the screw, guide plate and driving chain;



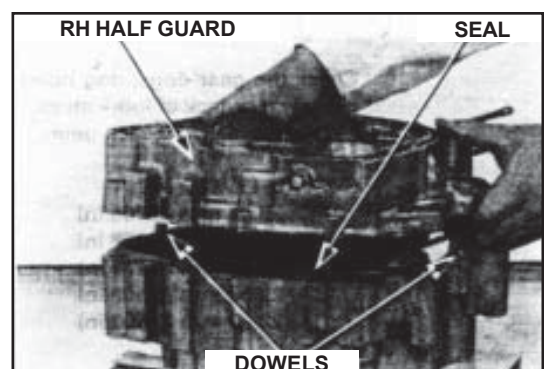
- loosen the eleven crankcase screws in crosswise sequence, in 2 or 3 steps to avoid misshaping the guard;
- remove the left half guard screws;



- remove the clutch cable support screw;



- separate the two crankcase guards placing the left one below, as shown in the figure;
- remove the seal and the dowels;



GEARBOX

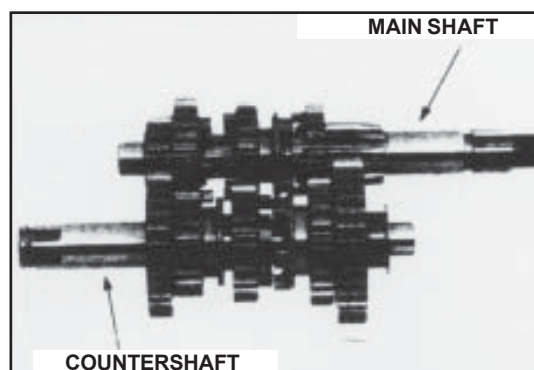
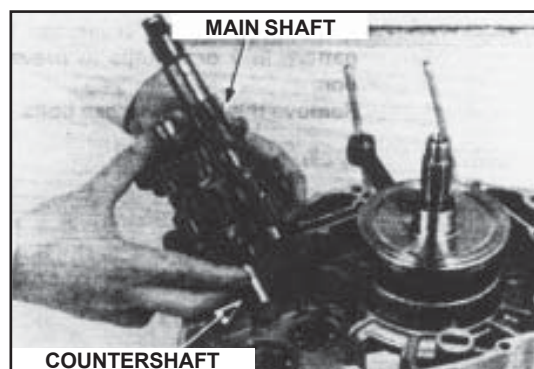
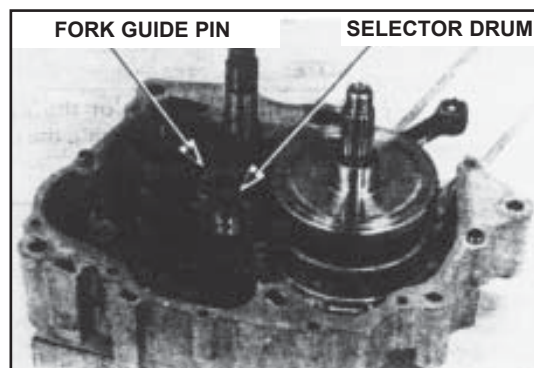
Removal/disassembly

Remove the following:

- Selector forks guide pin.
 - Selector fork R (right).
 - Selector fork C (central).
 - Selector fork L (left).
 - Selector drums.
-
- Remove the main shaft and countershaft as a single Assembly;
-
- At the bench disassemble the main shaft and countershaft;

Note: Arrange the dismantled parts in order and label them for easier assembly later.

Take care not to damage the parts while disassembling;



Inspection

Check that the engaging teeth, the engaging teeth cavity and the gear teeth do not show signs of abnormal wear or insufficient lubrication.
Measure the inner diameter of each gear.

Wear limits:

M3: 20.07 mm

M5: 23.07 mm

C1: 19.57 mm

C2: 23.07 mm

C4: 20.07 mm

- measure the inner and outer diameter of each bushing;

Wear limits:

M5: OD: 22.93 mm
 ID: 20.20 mm

C1: OD: 19.43mm
 ID: 16.60 mm

C2: OD: 22.93 mm
 ID: 20.10mm

- calculate the clearance between gear and bushing.

Wear limits: M5, C1, C2 :0.10 mm

Main shaft:

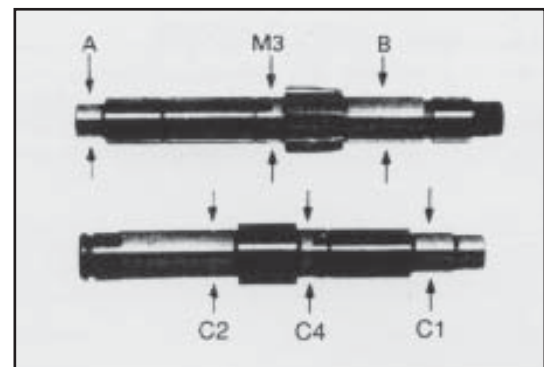
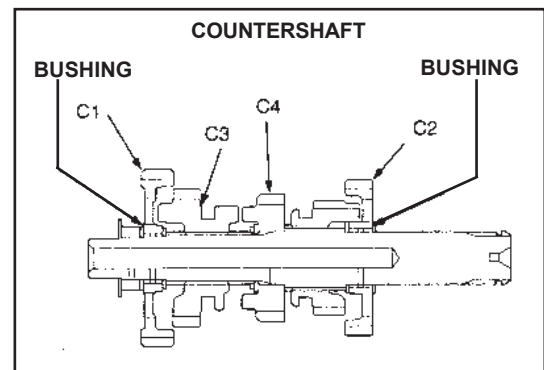
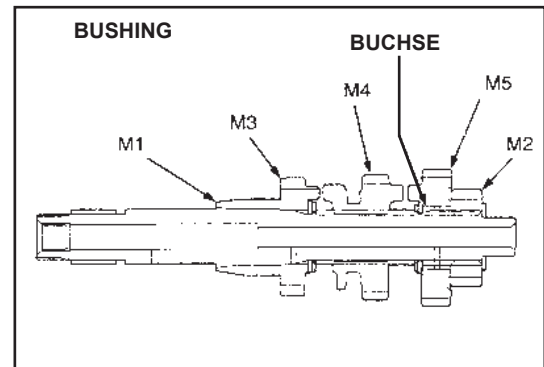
Gear bushing M3 / pin B: 19.91 mm

Pin A: 14.91 mm

Countershaft:

Gear bushing C2 / C4:19.91 mm

Gear bushing C1:16.41 mm



- check that there are no signs of damage or wear on selector fork and fork pin;
- measure the inner diameter of the selector fork.

Wear limit: 12.05 mm

- Measure the selector fork end thickness.

Wear limit: 4.70 mm

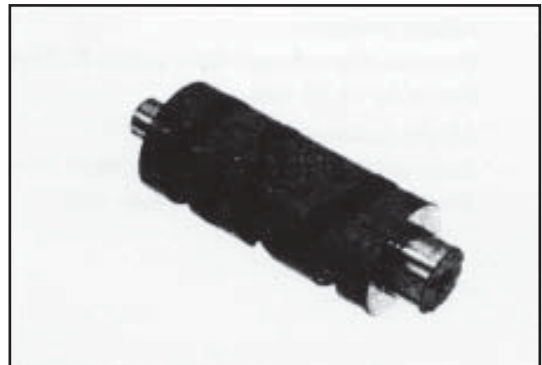


- Measure the outer diameter of the selector fork pin.

Wear limit: 11.90 mm

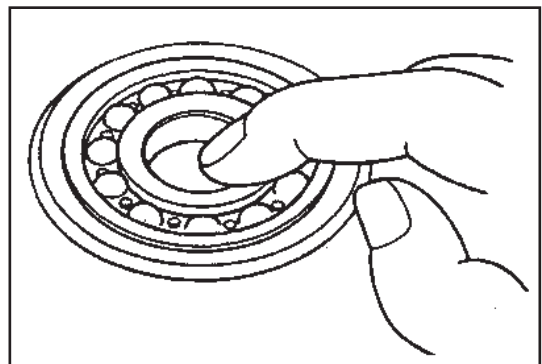


- Check the selector drum grooves are not worn or damaged.



Gearbox bearings

- Check that the gearbox bearings rotate smoothly and silently and that the bearing outer track has no clearance in the seat in the crankcase.
Replace the bearing if faults are found.



ASSEMBLY/INSTALLATION

Main shaft

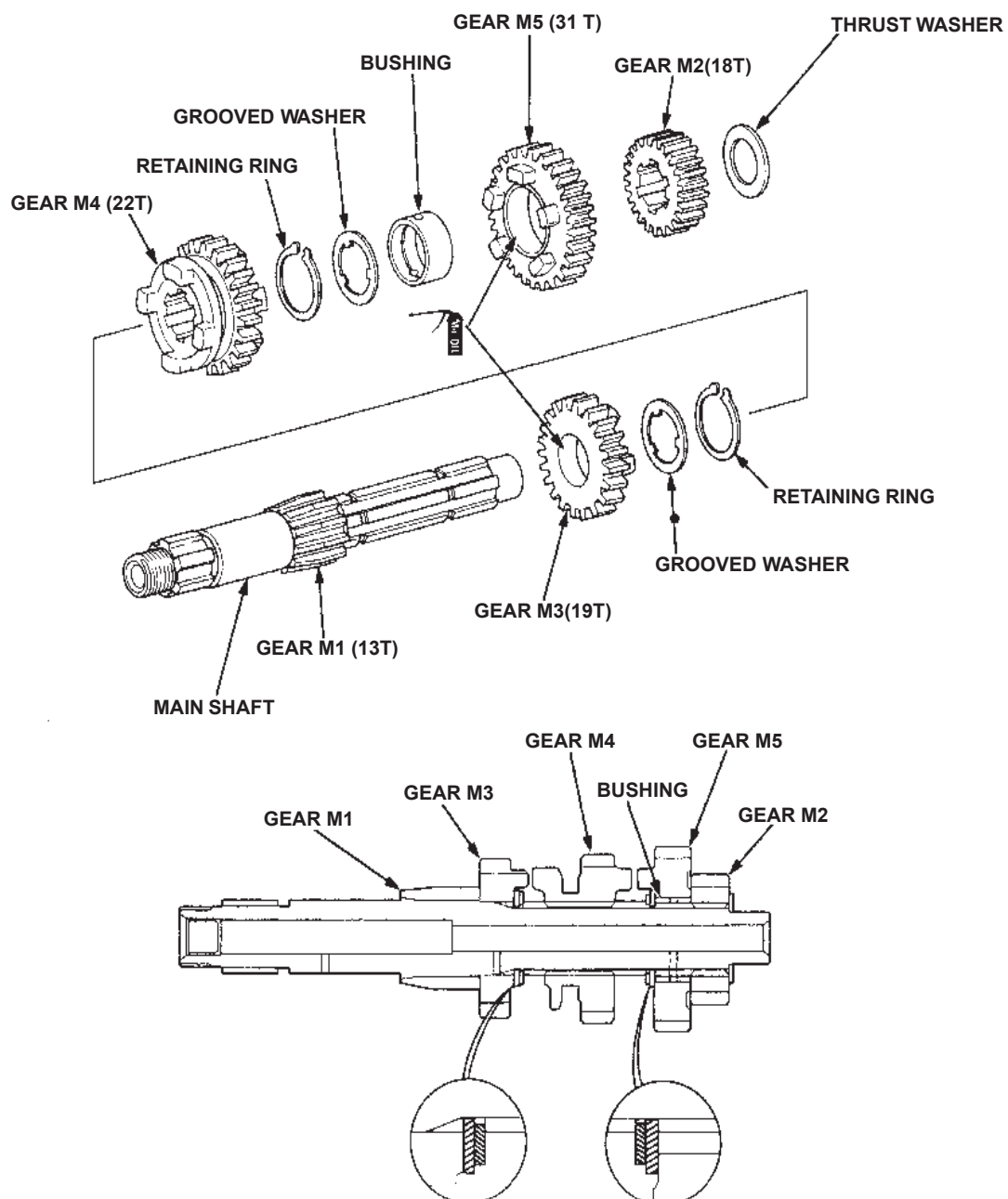
Note: Lubricate the selector drum grooves.

Always fit the thrust washers and retaining rings with the chamfered edge on the opposite side to the thrust load.

After fitting the retaining ring, open it slightly and rotate it in its groove to check it is fitted properly. Do not re-use the retaining rings. A used retaining ring could turn freely in the groove since it has become too loose.

Align the retaining ring opening with the groove on the grooved washer.

Align the oil passage holes on the shafts and the bushings.

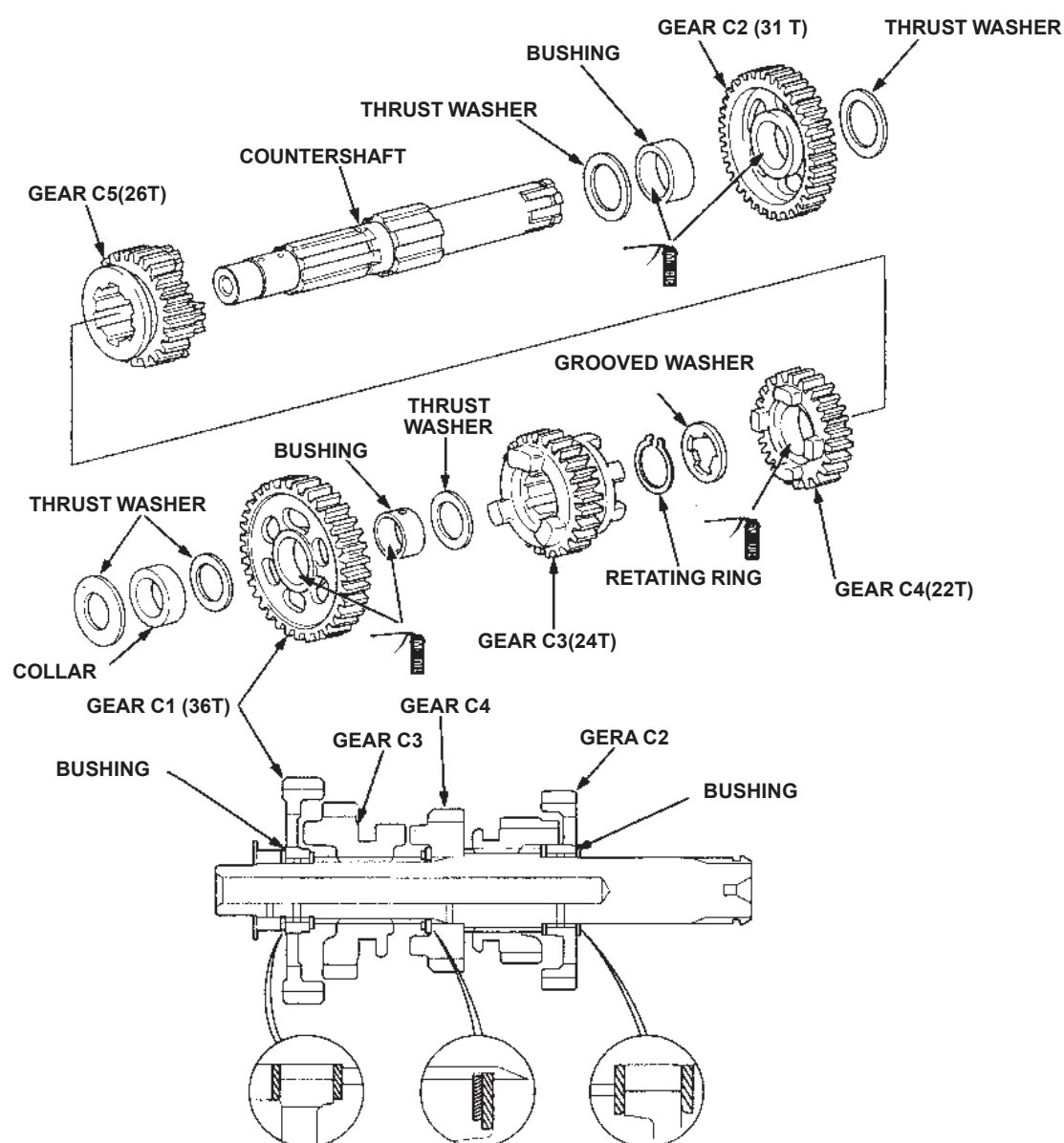


Countershaft

Note: Check that the gears rotate freely on the shaft.

Fit the washers and retaining rings with the chamfered edge toward the thrust load side. Do not reuse the old retaining rings. A used retaining ring could turn freely in the groove.

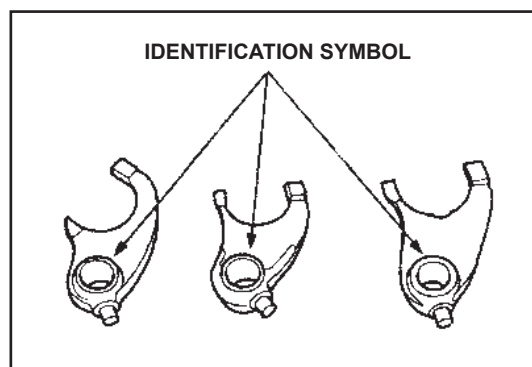
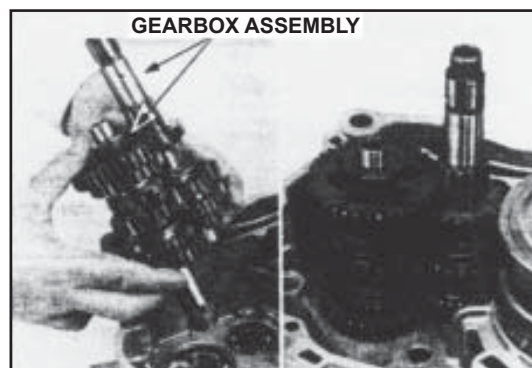
Check that the retaining rings are well fitted in the grooves. Align the retaining ring opening with the openings on the grooved washers.



Lubricate these parts with oil for transmissions:

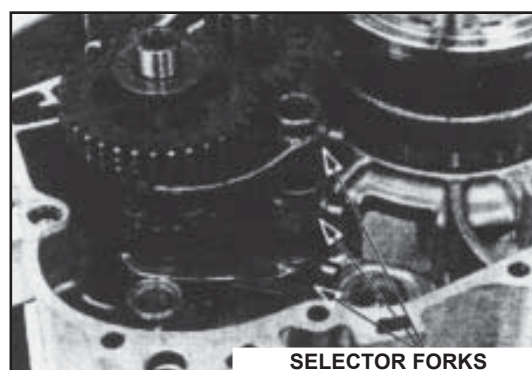
- Main shaft.
- Countershaft.
- Gears.
- Main shaft bearing.
- Countershaft bearing.
- Selector drums bearing
- Mesh the main shaft gears and the countershaft gears and fit the assembly in the left half guard.
- Fit the selector forks in the gearbox gear grooves.

Note: Each selector fork has an identification symbol. «R» is the right selector fork, «L» the left one and «C» the central one.

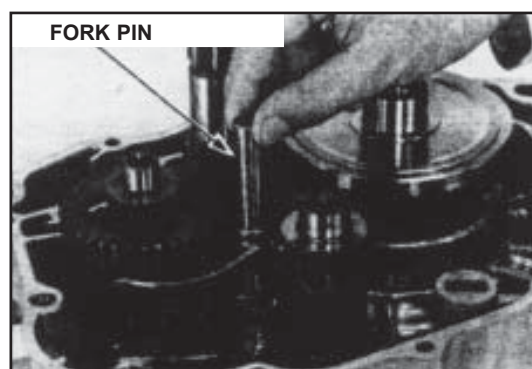


Lubricate these parts with oil for transmissions:

- Selector drums guide grooves.
- Fork ends and guide pins.
- Selector fork sliding surfaces.
- Selector forks shaft.
- Fit the selector forks in the gearbox gear grooves;



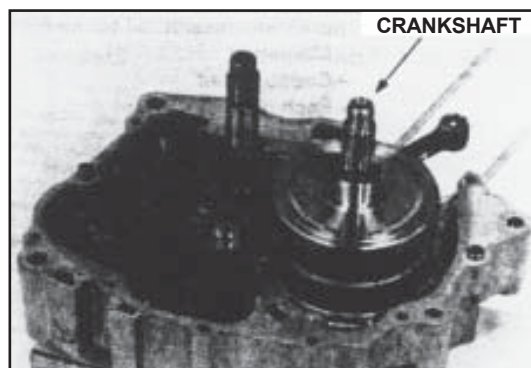
- fit the selector drum aligning the selector fork guide pins in their grooves;
- insert the pin in the selector forks and the sump.



CRANKSHAFT

Removal

- Separate the crankcase;
- remove the gearbox.



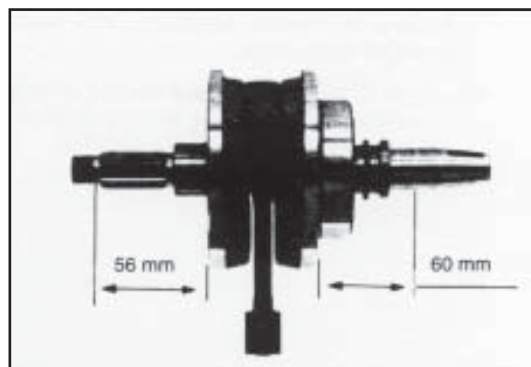
INSPECTION

- Place the crankshaft on the special tool;

Special tool:

Crankshaft stands..... 19.1.20074

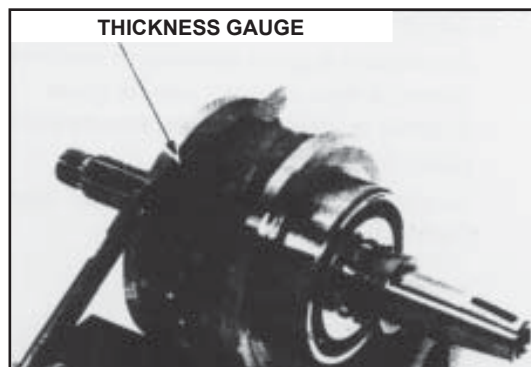
- Place the dial on the crank pin and rotate the crankshaft by two turns finding any straightness errors.



Limit: 0.1 Omm

- use a thickness gauge to measure the end float between the connecting rod big end and the crankshaft counter- weight.

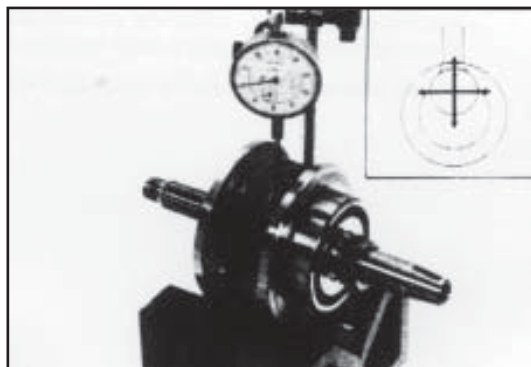
Wear limit: 0.50 mm



- Measure the radial clearance at the connecting rod big end, in two points, in the directions indicated by the arrows.

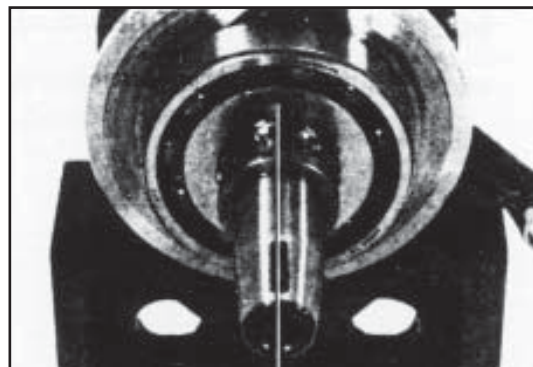
Wear limit: 0.05 mm

- check that the bearings rotate smoothly and silently and that the bearing outer track has no clearance in the seat in the crankcase. If faults are found, replace the bearing.



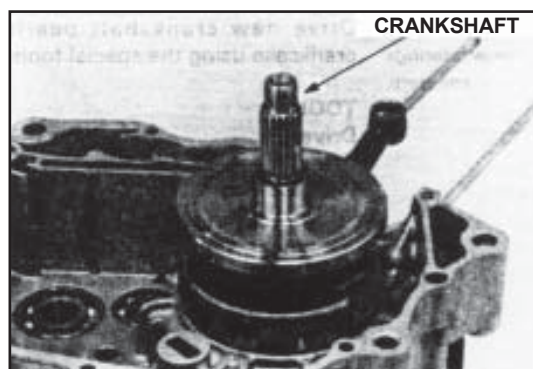
Bearings replacement

- If the driving chain gear is replaced, align the centre of the meshing tooth with the centreline of the key groove as shown in the figure.



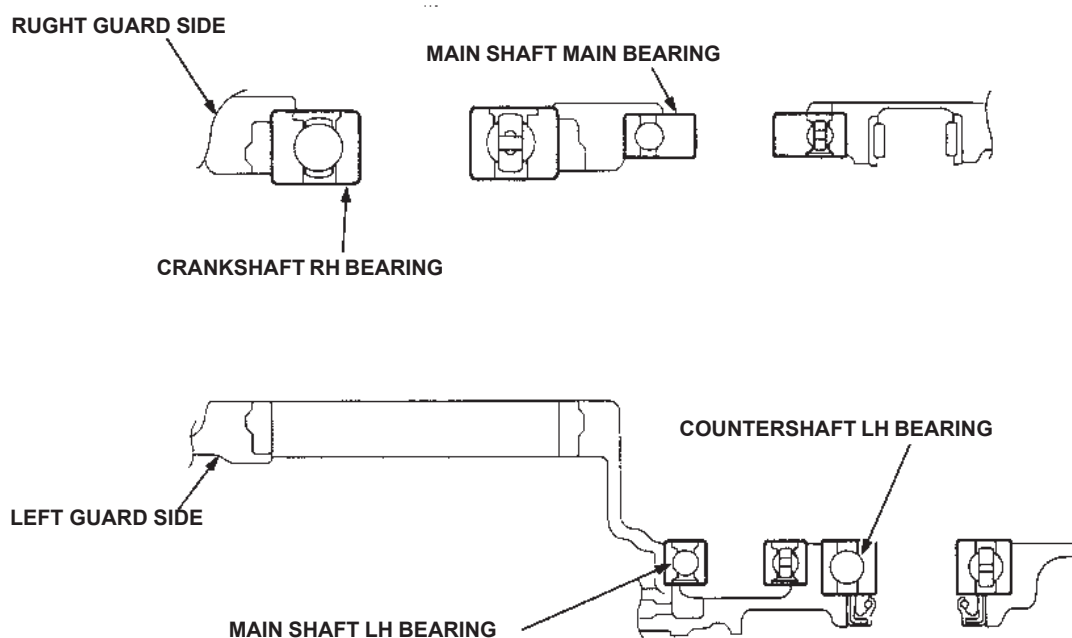
Installation

- fit the crankshaft in the left guard;
- install the gearbox;
- assemble the crankcase.



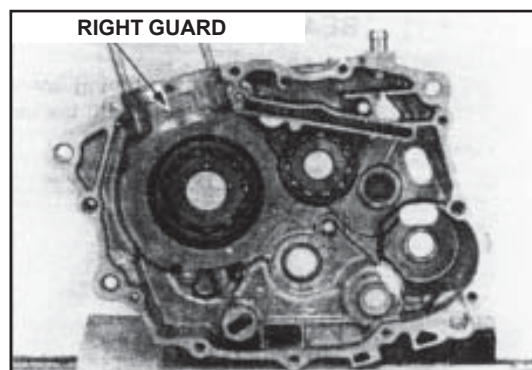
CRANKCASE BEARINGS REPLACEMENT

Oil seal and bearings position un crankshaft



Crankshaft bearing

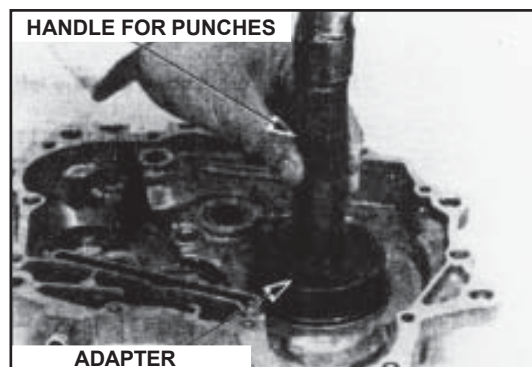
- Remove the bearing from the guard;



- insert the new bearings following a perpendicular line to the guard using the special tools listed below.

Special tools:

Handle for punches.....	19.1.20376
Adapter, 72 x 75 mm	19.1.20408
Guide, 28 mm	19.1.20414



GEARBOX BEARINGS

Right guard

- Remove the main shaft bearing;
- fit the new bearings following a line perpendicular to the Guard using the special tools listed below.

Special tools:

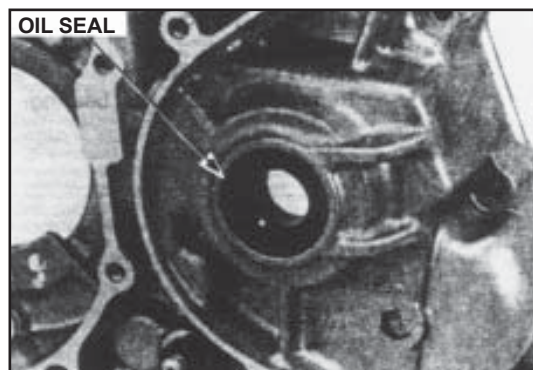
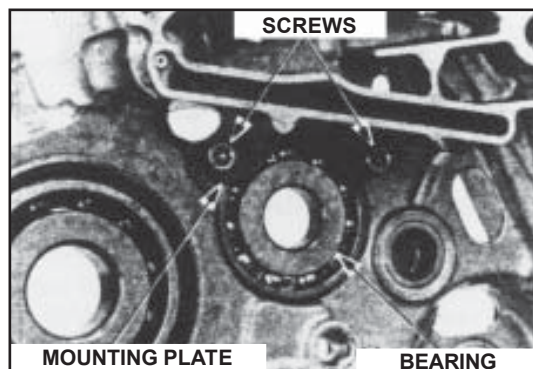
Main shaft bearings:

Adapter, 52 x 55 mm	19.1.20360
Guide, 20 mm	19.1.20363
Punch handles	19.1.20376

Note: Apply loctite 242 on the closing plate securing screw threads.

Left guard

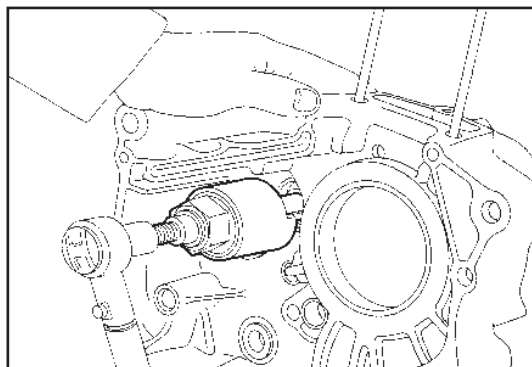
- Remove the countershaft oil seal;



- remove the main shaft bearing using the special tools listed below.

Special tool:

- Bearings extractor, 15 mm 19.1.21467/13
- Bell 19.1.20467/30
- Fit the new bearings following a line perpendicular to the guard using the special tools listed below.



Special tool:

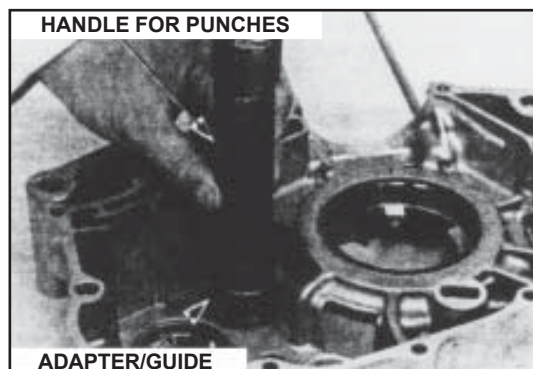
Note: Fit the bearing with the closed side toward the half sump.

Main shaft bearings:

Handle for punches	19.1.20376
Adapter, 32 x 35 mm	19.1.20357
Guide, 15mm	19.1.20412

Countershaft bearings:

Handle for punches	19.1.20376
Adapter, 42 x 47 mm.....	19.1.20359

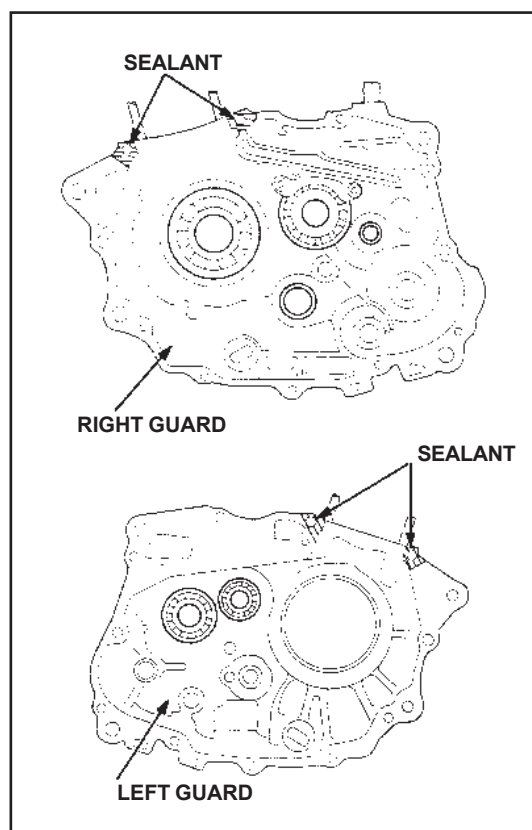


CRANKCASE ASSEMBLY

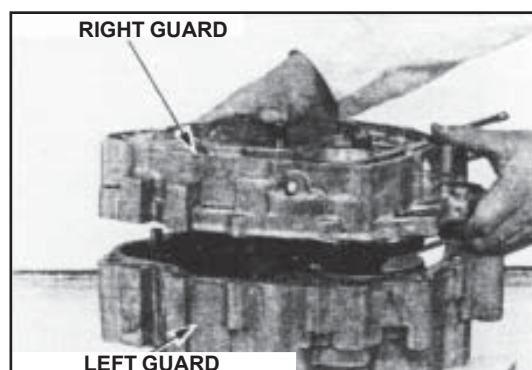
- Clean the crankcase mating surfaces.

Note: After cleaning lubricate the crankshaft bearing and other contact surfaces with clean engine oil.

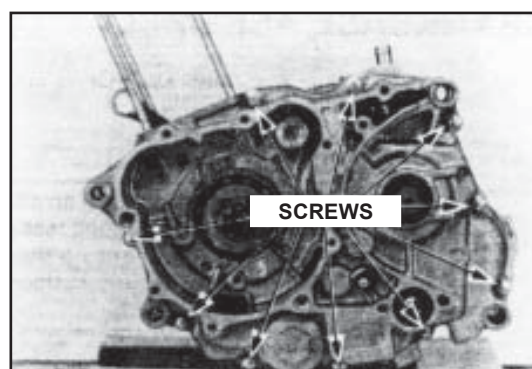
- Fit the crankshaft;
- fit the gearbox;
- apply the prescribed sealant on the crankcase mating surfaces (see drawing);



- after fitting the dowels and a new seal on the left guard fit the right and left guards together making sure that the seal remains in position;



- insert and tighten the crankcase screws in a crosswise sequence in 2-3 steps;
- fit in sequence the clutch cable support, the chain and the driving chain guide plate.



IGNITION SYSTEM

SERVICE INFORMATION

General

Warning:

Some components can become damaged by connection and disconnection of terminals or connectors with ignition and power on.

When checking the ignition system, always follow the steps given in the troubleshooting procedures.

The spark advance cannot be adjusted because it is not possible to operate on the ignition control unit (ICM). If the spark advance is not correct check the system components and replace those found faulty.

If the control unit is dropped it could be damaged. Moreover, if the connectors are unplugged while current is passing, the resulting over voltage could damage the unit. Always disconnect the ignition switch before working on the control unit.

Very often ignition faults are caused by oxidised connectors or incorrect connections. Check all connections before proceeding. Check that the battery is sufficiently charged. If the battery is very low the starter motor rotates the engine too slowly and the spark plugs do not produce sparks.

Only use spark plugs with the correct heat rating. The use of spark plugs with the wrong heat rating can damage the engine.

Ignition system

Values in mm

PART		STANDARD VALUE
Spark plug.	NGK.	DPR8EA9
	DENSO.	X24EPR-U9
	Distance between electrodes.	0,8 - 0,9 mm.
Ignition coil peak voltage.		100 V minimum.
Pulse generator peak voltage.		0,7 V minimum.
Ignition timing (marked «F»).		15° before PMS at 1400 rpm.
Spark advance.	Start.	1800 ± 150 rpm.
	End.	3450 ± 150 rpm.
Maximum advance.		32° before TDC.

Controlar los conectores de cuatro polos de la centralita

Check the battery negative terminal	With an ohmic tester check that the battery negative is present on the black cable of the connector.	In negative case, check the wiring and connections since the black cable is a direct system earth.
Check the pulse generator resistance	Check the pulse generator resistance placing the tester terminals between the black and the blue cables.	The resistance should be approx. 330 Ohm, if it is not, check the wiring and/or replace the pulse generator.
Check the H.T. coil resistance	Primary Check the primary resistor of the H.T. coil, inserting the tester terminals between the black and the white-blue cables of the control unit connector.	The resistance should be approx. 0.5 Ohm, if it is not, check the wiring and the coil. If necessary, replace.
	Secondary Check the secondary resistor of the H.T. coil inserting one tester terminal on the spark plug cap contact and the other on the black cable of the 4-pin connector.	The check includes checking the spark plug cap and the H.T. cable; the resistance value should be approx. 8,000 Ohm. If it is not, check the relevant components.
If all these tests give good results, the fault is probably on the control unit. Try replacing it with one that you are certain is in good working order.		
As an alternative to the above tests, and for a more accurate verification of the ignition components (low power or irregular spark, etc.) the following volumetric checks can be carried out.		
Pick-up peakvoltage check	Disconnect the control unit 4-pin connector and press the start button to carry out the test at engine start speed.	Use the multimeter adapter, dwg 19.1.20409, to measure the peak voltage of the pulse generator between the black and blue cables as described on page 11-9. Minimum value: 0.7 V.
H.T. coil peakvoltage check	Connect all the ignition system terminals and start the engine.	Measure the peak voltage by inserting the positive terminal on an earth point or on the black cable and the negative terminal on the white-blue cable as described on page 11-7. Minimum value 100V.

IGNITION SYSTEM INSPECTION

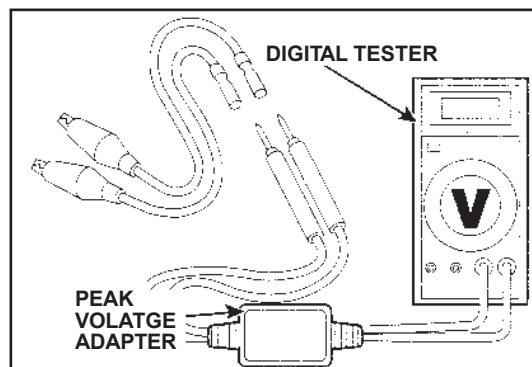
Note: Use a tester with a minimum impedance of 10 M Ω /DCV.

The displayed value may vary according to the tester internal impedance.

Special tools:

Peak voltage adapter..... 19.1.20409

Digital tester..... 19.1.20331

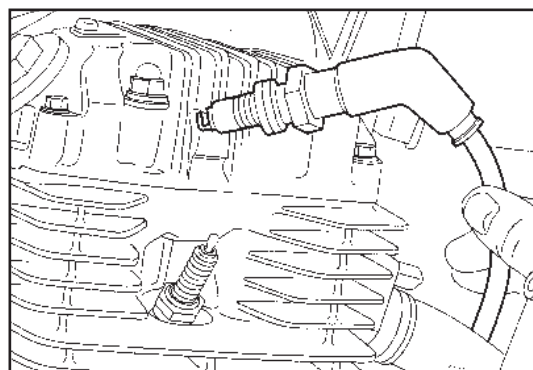


Ignition primary voltage check

Note: The system must be correctly connected to give credible results.

Check the cylinder compression and check that the spark plug is correctly installed.

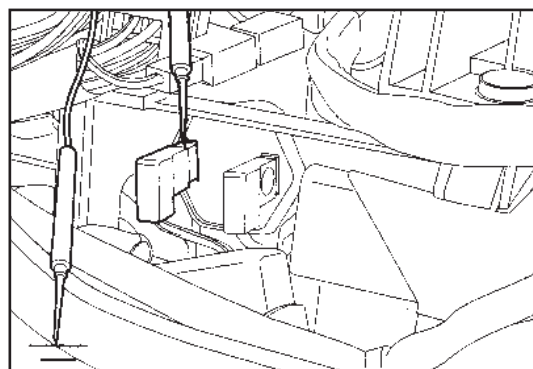
- Rest the vehicle on the kickstand;
- disconnect the spark plug cap fitted in the head, then connect a spark plug in perfect condition to the cap. Earth the one on the cylinder to make a spark test;
- remove the right-hand side object compartment and the tank so as to have access to the ignition coil;
- using the special tool caps make the connection as shown in the figure; positive cap to earth, negative to ignition coil white/blue terminal;



Note: Do not disconnect the ignition coil primary wire.

Warning:

To avoid electric shocks, do not touch the spark plug or tester caps.



- set the emergency switch on speed C and check that the gear is on idle;
- check that there is the battery initial voltage.
If there is no battery voltage make the tests listed in the troubleshooting table at the beginning of this section;
- run the engine with the starter motor and find the ignition coil primary voltage.

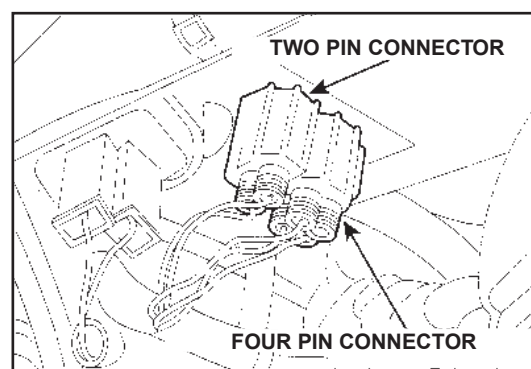
Minimum peak voltage: 100 V

Note: Although the values measured may differ from one ignition coil to another, they can be considered normal providing they are over the standard value.

Pulse generator peak volatge check

Note: The system must be correctly connected to give credible results.
Check the cylinder compression and check that the spark plug is correctly installed.

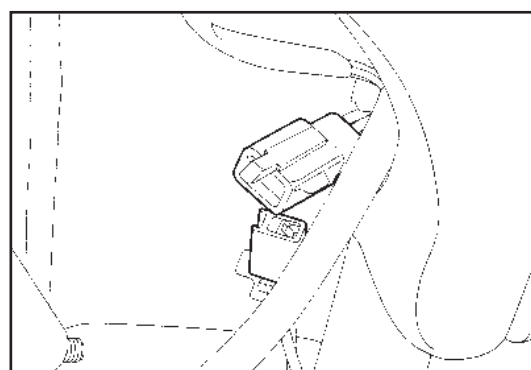
- Remove the ignition control unit (ICM);
- disconnect the ignition control unit (ICM) 4-pin connector;
- connect the peak voltage adapter on the wiring side of the 4-pin connector.



Special tool:

Peak voltage adapter (19.1.20409) with digital tester dwg.19.1.20331 (minimum impedance 10 MΩ/DCV).

- with the caps of the special tool make these connections: positive cap to blue wire, negative cap to black wire of 4-pin connector;
- set the emergency switch on speed C and check that the gear is on idle;
- run the engine with the starter motor and find the ignition coil primary voltage.



Minimum peak volatge: 0.7V

- If the peak voltage is less than the standard value, check the pulse generator three-pin connector;
- with the caps of the special tool make these connections: positive cap to yellow/blue wire, negative cap to green wire of 3-pin connector or to vehicle earth;
- set the emergency switch on speed C and check that the gear is on idle;
- run the engine with the starter motor and find the ignition coil primary voltage.

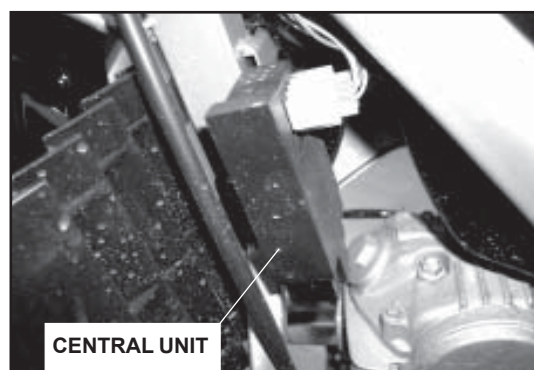
Minimum peak volatge: 0.7V

- compare the values found on the control unit (ICM) 4-pin connector and on the pulse generator 3-pin connector;
- if the value found on the pulse generator is normal, but not that found on the ignition control unit (ICM): open circuit on the wires from the pulse generator to the control unit;
faulty contact on the pulse generator three-pin connector;
- If both values are faulty:
Probably the pulse generator is faulty.
Check and proceed with the troubleshooting procedure given at the beginning of this section.
To replace the pulse generator see Section 9.

IGNITION CONTROL UNIT (ICM)

Removal/installation

- Remove the seat and the left-hand side cover, disconnect the battery terminal and the four and two-pole connections to the central unit.
- To assemble, carry out the same operations for disassembly in reverse order.

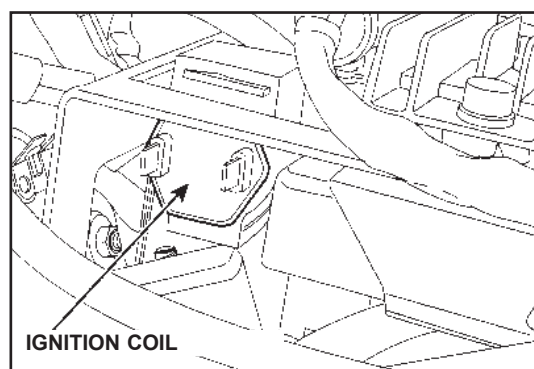


IGNITION COIL

Removal/installation

- Disconnect the spark plug hood and remove. Disconnect the terminals corresponding to the primary circuit cables and the start coil.

To assemble, carry out the same operations for disassembly in reverse order.

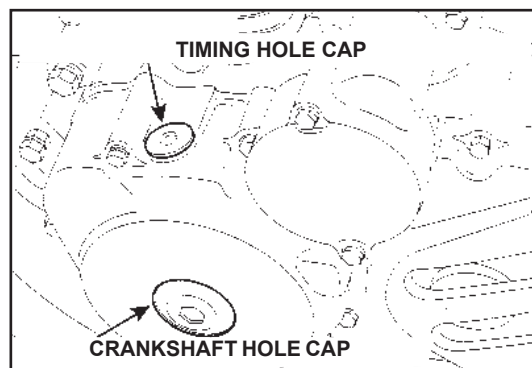


Note: Connect the primary wires in the original positions (earth wire to green connector).

Spark advance

Note: Before starting, read carefully the instructions provided by the stroboscopic lamp manufacturer.

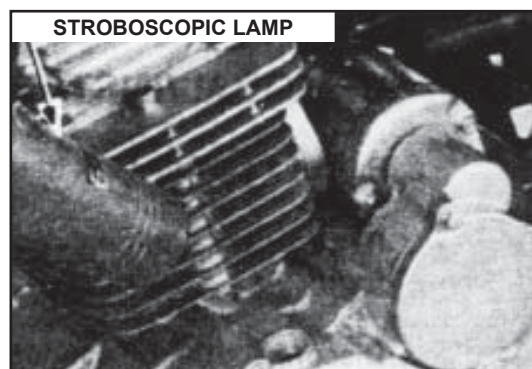
- Bring the engine to normal running temperature;
- remove the timing hole cap;



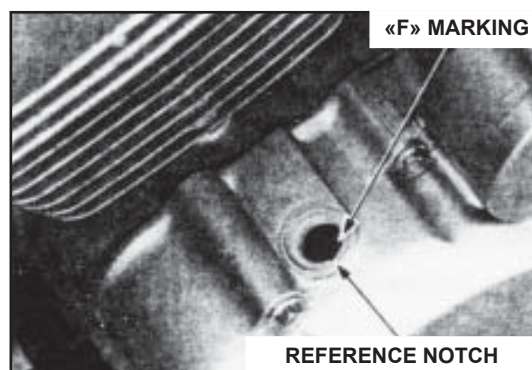
- connect a stroboscopic lamp to the ignition cable;
- start the engine and let it idle.

Idling speed: 1400 ± 100 rpm.

Note: Use a transparent cap to avoid oil spillage.



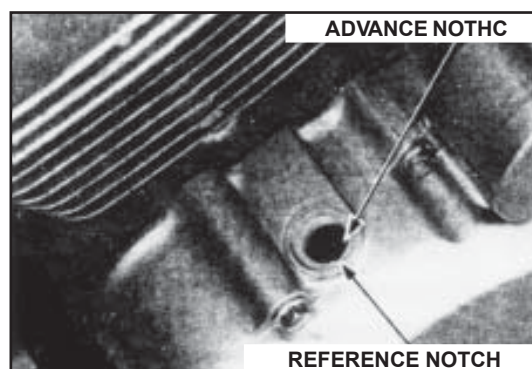
- The ignition timing is correct if the «F» marking on the flywheel aligns with the reference notch on the left sump cover;



- increase the engine rpm through the gate valve stop knob;

Timing is correct if the advance notch on the flywheel aligns with the reference notch on the left sump cover;

- The reference corresponds to 32° and should be aligned at over 3450 ± 150 rpm;
- lubricate a new O-ring with engine oil and fit it in the groove of the timing hole cap, then lubricate the thread and surface of the cap flange. Tighten to specified torque.



Torque: 10 Nm(1.0kgm)

START-UP SYSTEM

SERVICE INFORMATION

General

Important note:

Always disconnect the ignition switch before operating on the starter motor. The motor could suddenly start up causing serious hazards for the operator.

Specifications

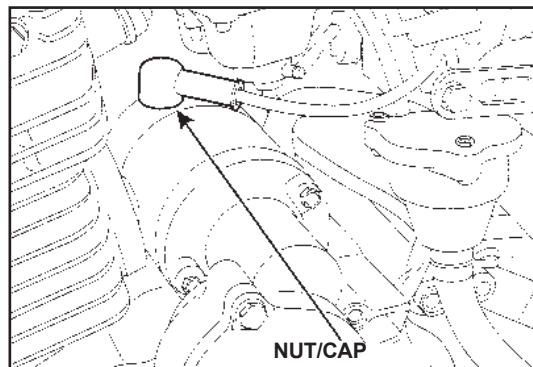
Values in mm

PART	STANDARD VALUE	WEAR LIMIT
Length of starter motor brushes	12,5 - 13,0	8,5

STARTER MOTOR

Removal

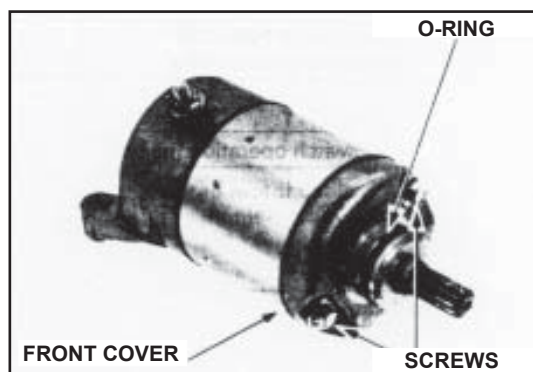
- Remove the rubber cap and starter motor cable nut;
- disconnect the starter motor cable;
- remove the screws and earth cable;
- remove the starter motor from the right-hand side.



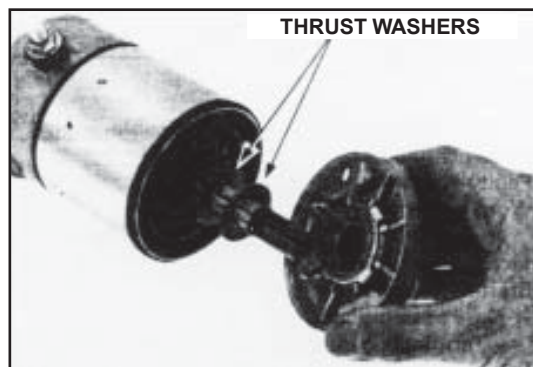
Disassembly

Note: Make a note of the number and positions of the shims and washers.

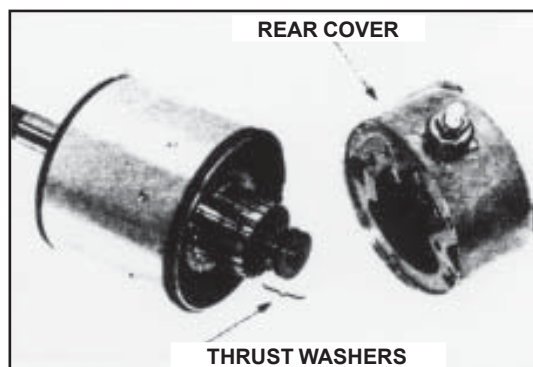
- Remove the screws, front cover and O-ring;



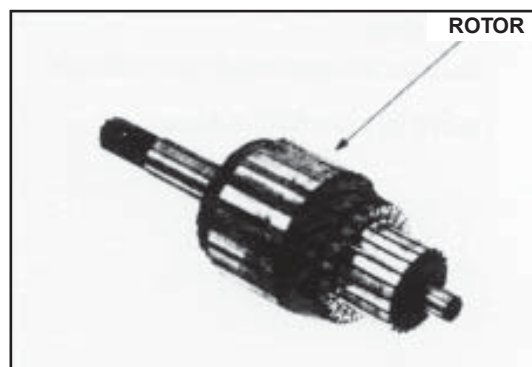
- remove the thrust washers;



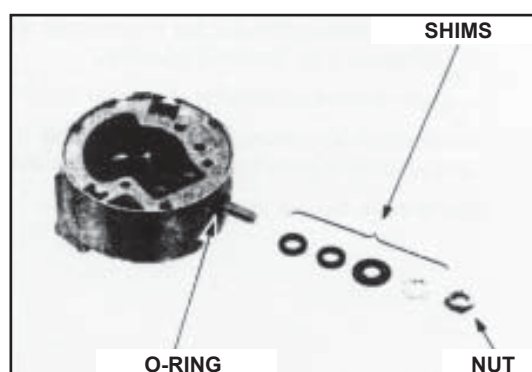
- remove the rear cover;
- remove the thrust washers;



- Remove the rotor-



- Remove the terminal nut;
- Remove the washer, shims and 0-ring;

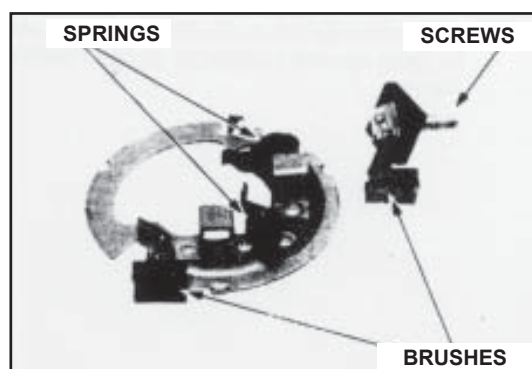


- Remove the brush holder.



Brush holder disassembly

- Remove the positive brush terminal securing bolt with the washers and 0-ring. Remove the brush holder, the brushes and the springs.



Inspeccion

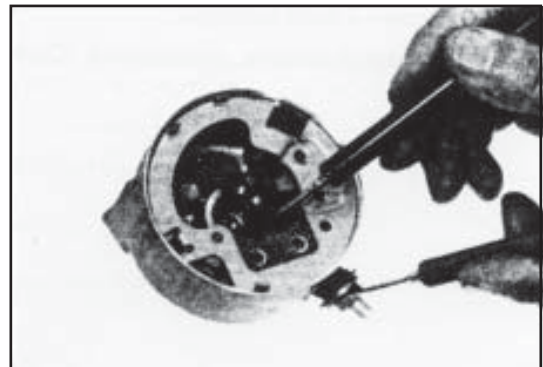
- Measure the length of each brush;

Service limit: 8.5 mm



- check the continuity between the starter motor terminal and the positive brush;
- It must be continuous;
- check the continuity between the starter motor terminal and the starter motor casing.

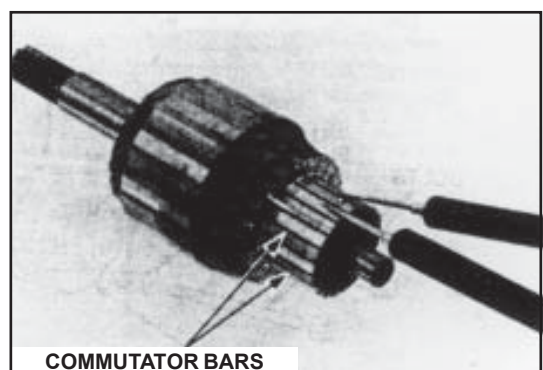
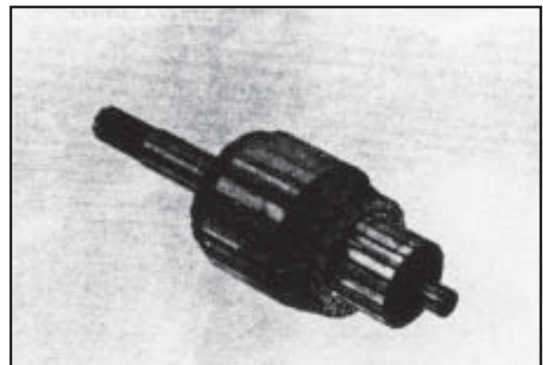
This must not be continuous.



- check that the commutator is not damaged or excessively worn.
Replace the rotor if necessary;
- check there are no metal deposits between the commutator bars.

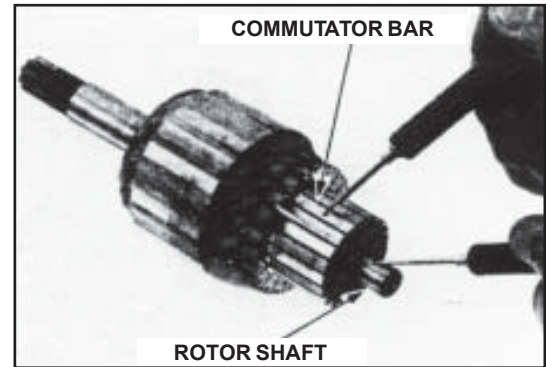
Note: Do not use emery paper or glass paper on the commutator.

- check that the commutator bars are not discoloured.
Replace the rotor if necessary;
- check whether there is continuity between contiguous bars.;
There should be continuity. If there is not, replace the rotor;



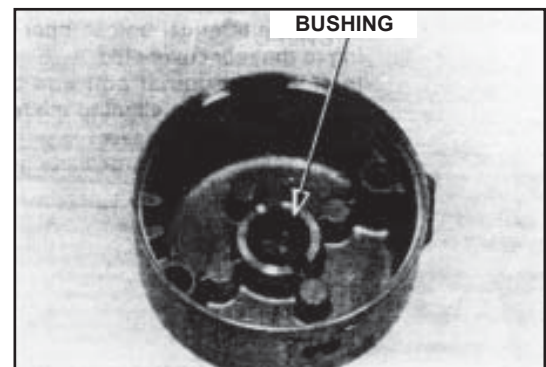
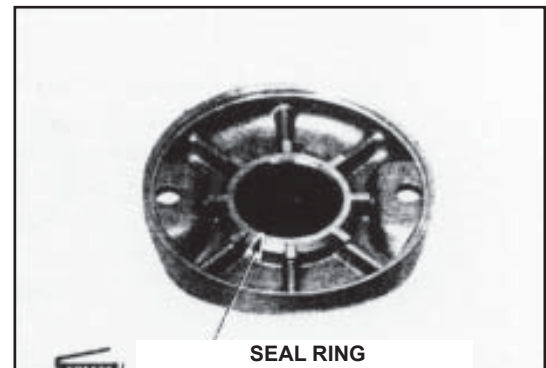
COMMUTATOR BARS

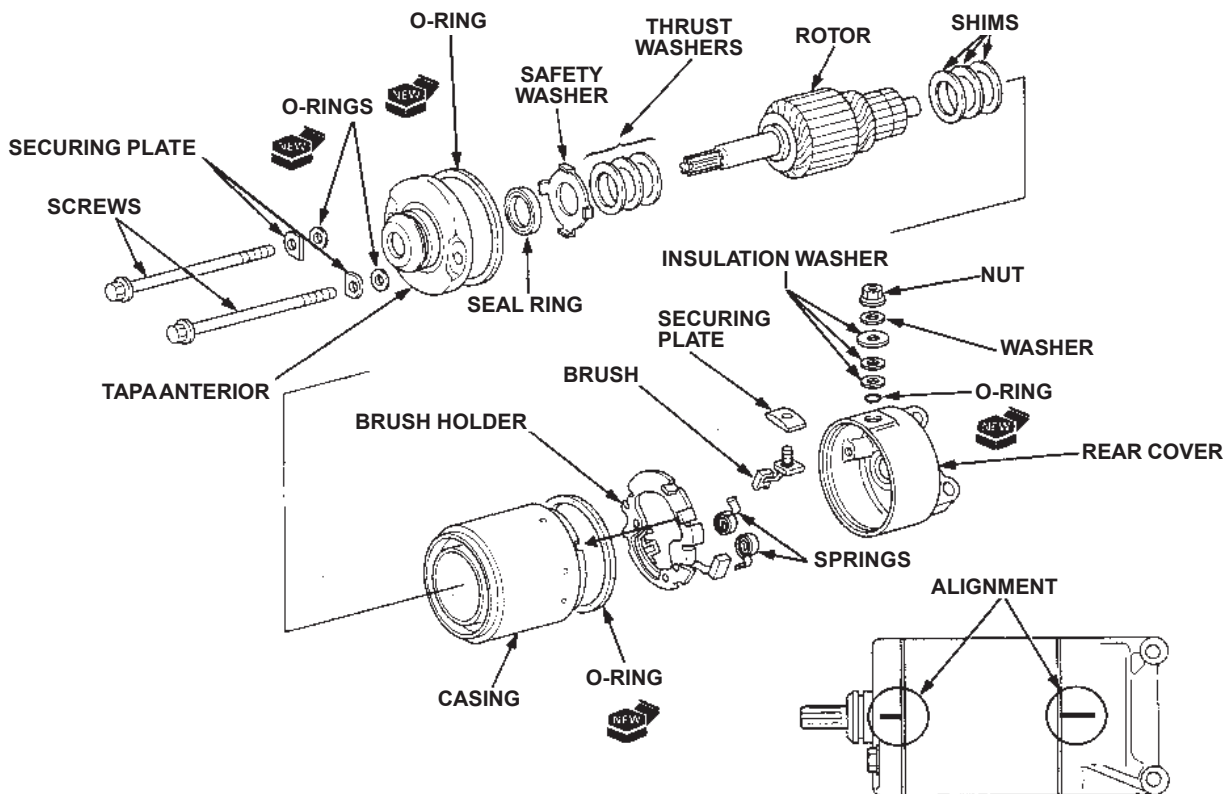
- check whether there is continuity between each separate bar and the rotor shaft.
There should not be continuity. If there is, replace the rotor;



- check that the seal ring is not worn or damaged;
- grease the seal lip;
- fit the circlip on the front cover.

Note: Position the seal ring lip on the pinion side.





Brush holder assembly

Follow the assembly procedure in reverse taking care to:

- fit the terminal bolt stop with the tabbed side toward the rear cover;
- fit the terminal bolt and brush holder in the starter motor casing, aligning the terminal bolt with the hole on the starter motor casing;
- align the notch on the motor casing with the brush holder tab;
- fit the same number of shims in the same positions;
- take care that the magnet does not pull the rotor against the starter engine casing;

Important note:

If the magnet pulls the rotor against the motor casing the coil could become damaged.

- Fit the same number of thrust washers in the same positions.

Important note:

When fitting the front cover take care not to damage the oil seal lip with the induction shaft.

Installation

- Follow the removal procedure operations in reverse order.



STARTER RELAY

Inspection

Note: Before checking the relay checks the battery.

- Remove the right-hand side panel and the right-hand object compartment;
- set the gear in neutral;
- bring the ignition switch to ON and the emergency switch onC;
- press the starter button;
- If the starter relay triggers, the coil is in order;
- If the relay does not trigger check it, following the procedure below.

Earth circuit

- Disconnect the starter relay 4-pin connector;
- check if there is continuity between the white/purple wire (earth circuit) and the earth;
- If there is continuity when the gear is on neutral or the clutch is disengaged and the kickstand is raised, the earth circuit is in order (when idling there is resistance due to the diode).

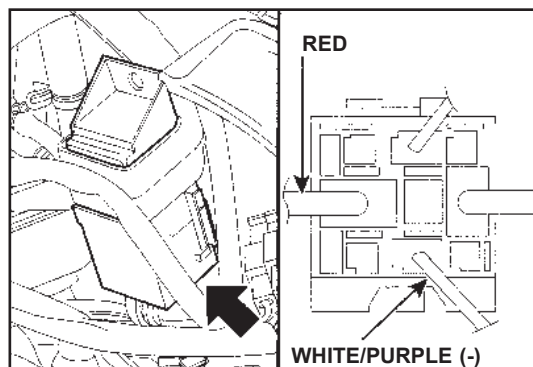
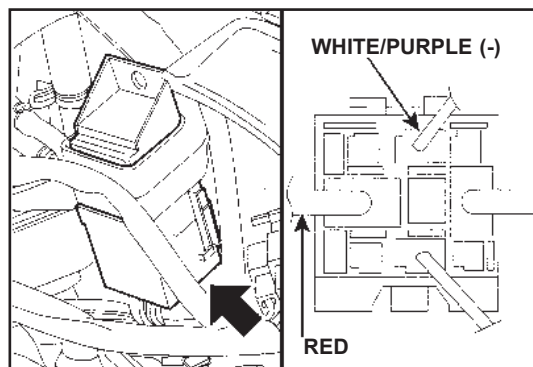
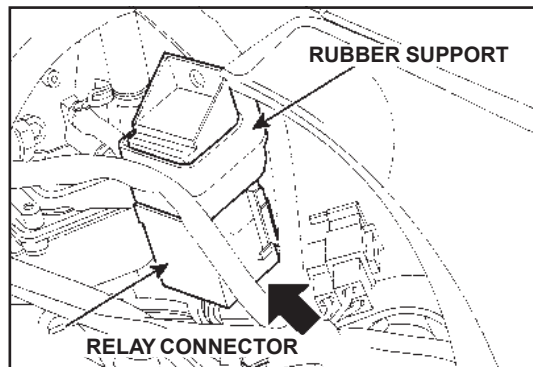
The earth circuit can also be checked by finding the voltage between the red wire (+ BAT) and white/purple wire (- CONSENTS). The circuit is efficient when voltages are found that are slightly lower than those of the battery.

Starter relay voltage

- Connect the starter relay 4-pin connector;
- set the gear to neutral;
- measure the voltage between the white/purple wire (+) and the earth on the starter relay 4-pin connector;
- If the battery voltage is only found when the starter button is pressed and the emergency switch is on C, the circuit is in order.

Removal/installation

- Remove the left side object compartment;
- disconnect the starter relay 4-pin connector and remove it after freeing it from the rubber support;
- to refit, follow the procedure in reverse.

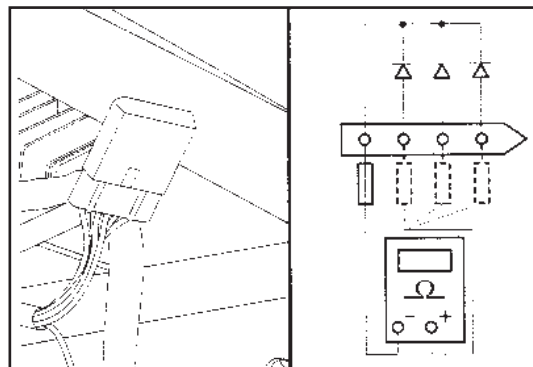


DIODES GROUP

Inspection

- Remove the tank;
- check if there is continuity between the diode terminals. If there is continuity a slight resistance value will be recorded;
- if there is continuity in one direction only the diode is functioning correctly. If this is not the case, replace the diode group.

Use a digital tester (dwg 19.1.20331) to check the continuity of the separate diodes keeping the negative terminal in the position shown in the figure.



SISTEMA ELÉCTRICO

