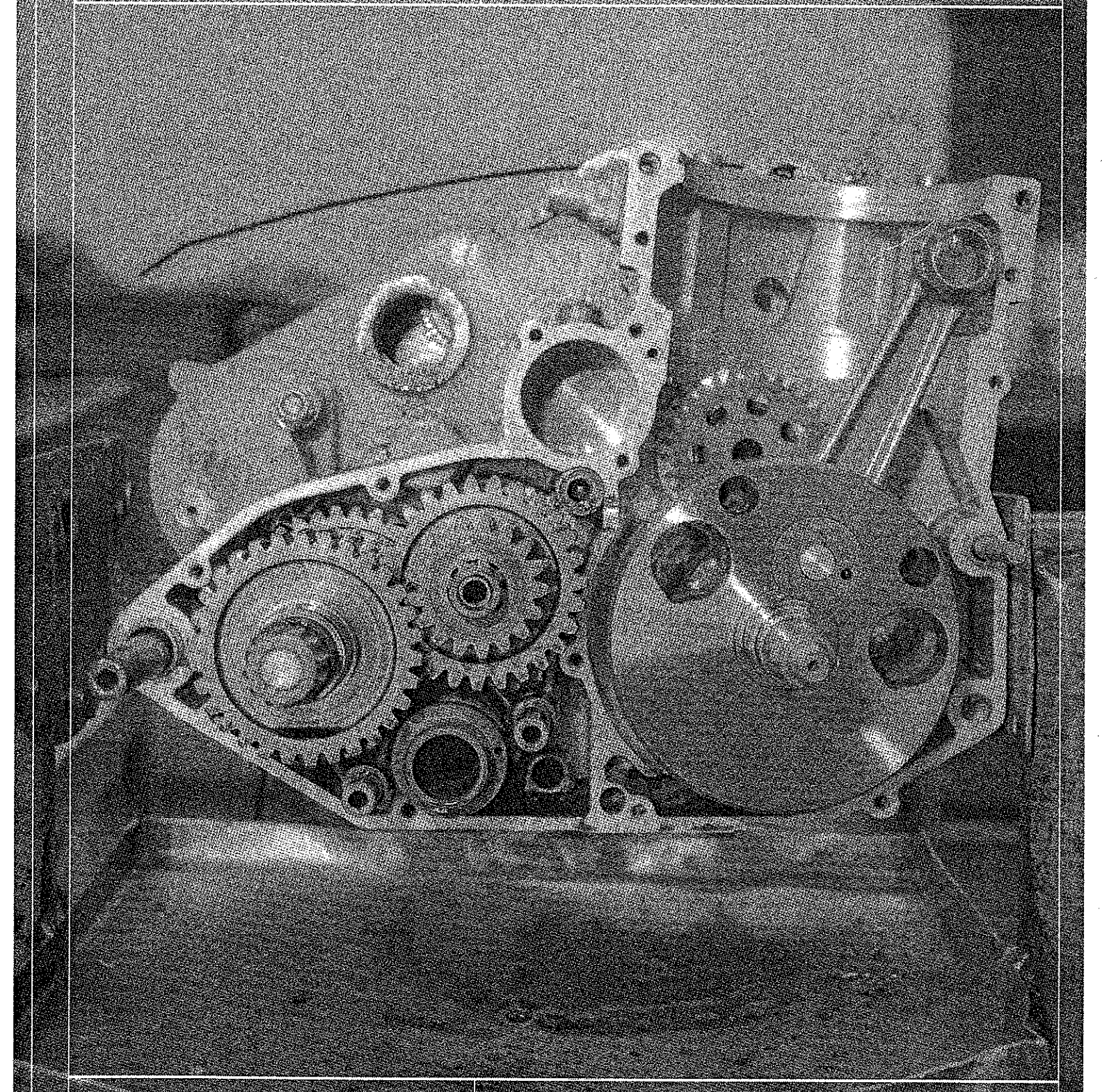
#06 WORKSHOP

Engine Service 2001-2003



HUSABERG
4 STROKE FORCE

Part no. 190 135-04

INDEX

SUBJECT/MODEL	FE 400 e	FE 501 e	FE 650 e	FS 400 e	FS 650 e	FS 450 c	FS 650 c	FC 450/6	FC 550/4	FC 550/6	FC 450 e	FX 450 e	FX 650 e
Displacement	399cc	501cc	644cc	399cc	644cc	449cc	644cc	449cc	550cc	550cc	449cc	449cc	644cc
Bore x Stroke (mm)	92 x 60,1	95 x 70,7	100 x 82,0	92 x 60,1	100 x 82,0	100 x 57.2	100 x 82,0	100 x 57.2	100 x 70,7	100 x 70,7	100 x 57.2	100 x 57.2	100 x 82,0
Compression ratio	12,5:1	11,8:1	11,0:1	12,5:1	11,0:1	-	11,0:1	-	12,7:1	12,7:1	-	-	11,0:1
Start system	Electrical and kick-starter					Kick-starter					Electrical and kick-starter		
Decompression system	Three separate ones; one activated by the kickstart lever, one activated by the camshaft and one activated by a lever on the handlebar												
Decomp. cable clearance	2mm ± 1mm / 0,08 in ± 0,04 in.												
Engine	Liquid cooled single cylinder 4-stroke, SOHC-4 valves, counter balancer												
Valve clearance	Intake and Exhaust: 0,10mm / 0,004 in.												
Lubrication system	Orbit oil pump and reed valve controlled. High pressure jet spray of piston and connecting rod, pressure lubrication of connecting rod bearing and rocker arms. Oil screen and micro filter												
Engine oil	1,0 Litre Synthetic SAE 5W-50 API SG/CF (minimum SAE 10W-50)												
Ignition system	SEM Dynamic Force Control, DFC™, Dual Ignition Curves; High & Low. A load sensitive digital system with six sensors												
Spark plug - Spark plug gap	NGK DCPR8E - 0,6 mm / 0,025 in.												
Alternator	12 V 70 + 70 W					Not available					12 V 70 + 70 W		
Air intake system	Single foam filter												
Carburettor (DELLORTO)	PHM 38	PHM 40	PHM 40	PHM 38	PHM 40	-	PHM 40	-	PHM 40	PHM 40	-	-	PHM 40
Fuel	RON 98 (octane), unleaded												
Exhaust system	Chrome plated steel pipes, 2 into 1 collector, Aluminium/steel silencer. USA versions, except FC and FSc models, equipped with spark arresters												
Coolant	1,3 Litre of 50% Anti-freeze, with corrosion inhibitor, and 50% water												
Clutch	Hydraulic, 7 friction- and 8 mating plates in oil bath												
Clutch hydraulic oil	Mineral oil SAE 2-7W												
Wear limit clutch discs	19,6 mm / 0,772 in.												
Primary transmission	Spur gears, ratio 29/78 - 2,690												
Gearbox	6-speed	6-speed	6-speed	6-speed	6-speed	6-speed	6-speed	6-speed CR	4-speed	6-speed CR	6-speed CR	6-speed	6-speed
Ratios	1st: 14/33 - 2,357 2nd: 17/30 - 1,765 3rd: 19/26 - 1,368 4th: 23/25 - 1,087 5th: 24/22 - 0,917 6th: 27/20 - 0,741 (6th CR: 25/21-0,840)												
Secondary transmission	D.I.D. 520 O-ring chain												
Sprockets front/rear	13/48	15/48	15/42	15/42	15/42	13/48	15/42	13/48	15/42	15/48	13/48	13/48	15/42
Wear limit drive chain	272 mm - 18 chain reels (tensioned, center distance between reels)												
Frame	Heat treated BTR / 25CrMo4 steel												
Caster	28,5°												
Weight (dry)	109,8 kg	110,1 kg	110,9 kg	111,9 kg	113,1 kg	-	106,8 kg	-	103,5 kg	103,9 kg	-	-	110,4 kg
	242 lb.	243 lb.	244 lb.	247 lb.	249 lb.	-	235 lb.	-	228 lb.	229 lb.	-	-	243 lb.

MODEL/SUBJECT		Main jet	Needle jet	Needle	Needle clippos.	Pilot jet	Throttle	Float valve	Start jet	Mixture screw
Exploded view number		# 6	# 4	# 3	# 26	# 7	# 2	# 9	# 8	# 33
Enduro	FE 400 e	185	DR270	K 51	#2	33	40	300	45	2 turns
	FE 501 e	185	DR272	K 51	#3	35	40	300	45	1½ turns
	FE 650 e	190	DR272	K 51	#3	40	40	300	45	1½ turns
Enduro ECE	FE 400 e	110	DR266	K 51	#2	48	40	300	45	½ turn
	FE 501 e	110	DR264	K 35	#4	33	40	300	45	½ turn
	FE 650 e	100	DR266	K 51	#3	33	40	300	45	½ turn
Enduro USA	FE 400 e	190	DR270	K 51	#3	38	40	300	45	2 turns
	FE 501 e	195	DR268	K 35	#3	33	40	300	45	1½ turns
	FE 650 e	195	DR270	K 35	#3	33	40	300	45	1½ turns
Super Motard Street	FS 400 e	185	DR270	K 51	#2	33	40	300	45	2 turns
	FS 650 e	190	DR272	K 51	#3	40	40	300	45	1½ turns
Super Motard Street ECE	FS 400 e	110	DR266	K 51	#2	48	40	300	45	½ turn
	FS 650 e	100	DR266	K 51	#3	33	40	300	45	½ turn
Super Motard Street USA	FS 400 e	190	DR270	K 51	#3	38	40	300	45	2 turns
	FS 650 e	195	DR270	K 35	#3	33	40	300	45	1½ turns
Super Motard Competition	FS 450 c	-	-	-	-	-	-	-	-	-
	FS 650 c	190	DR272	K 51	#3	40	40	300	45	1½ turns
Cross Country	FX 450 e	-	-	-	-	-	-	-	-	-
	FX 650 e	190	DR270	K 51	#3	33	40	300	45	1½ turns
Motocross	FC 450	-	-	-	-	-	-	-	-	-
	FC 550	190	DR272	K 51	#3	33	40	300	45	1½ turns
	FC 450 e	-	-	-	-	-	-	-	-	-

1 GENERAL INFORMATION

Please read and observe the following:

Warning

If the engine must be running during any maintenance, make sure that the area is properly ventilated. Never run the engine in a closed area though the exhaust fumes are posionous and thus hazardous to your health and life if not properly ventilated.

Warning

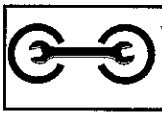
Although the battery is of a sealed construction, please take care. The electrolyte contains sulfuric acid and you must protect your eyes, skin and clothing if such fluid is assumed to be leaking or likewise exposed. In case of contact, wash and flush thoroughly with water and contact medical help if needed, especially if your eyes have been exposed to the fluid.

Warning

Fuel is extremely flammable and explosive under certain conditions. Do not smoke or expose the fuel to open fire or sparks.

Service conditions:

1. Always use original Husaberg parts.
2. Use the special Husaberg tools when required.
3. Install new gaskets, o-rings, circlips etc whenever possible.
4. Always clean all parts thoroughly before assembly.
5. All screws, nuts and bolts etc. are in the metric system. Do not use incorrect tools.
6. Never warm any aluminium part for more than 30 minutes due to the heat treatment.



This symbol means that it is possible, although not always recommendable, to perform the specific service without removing the engine out of the frame.

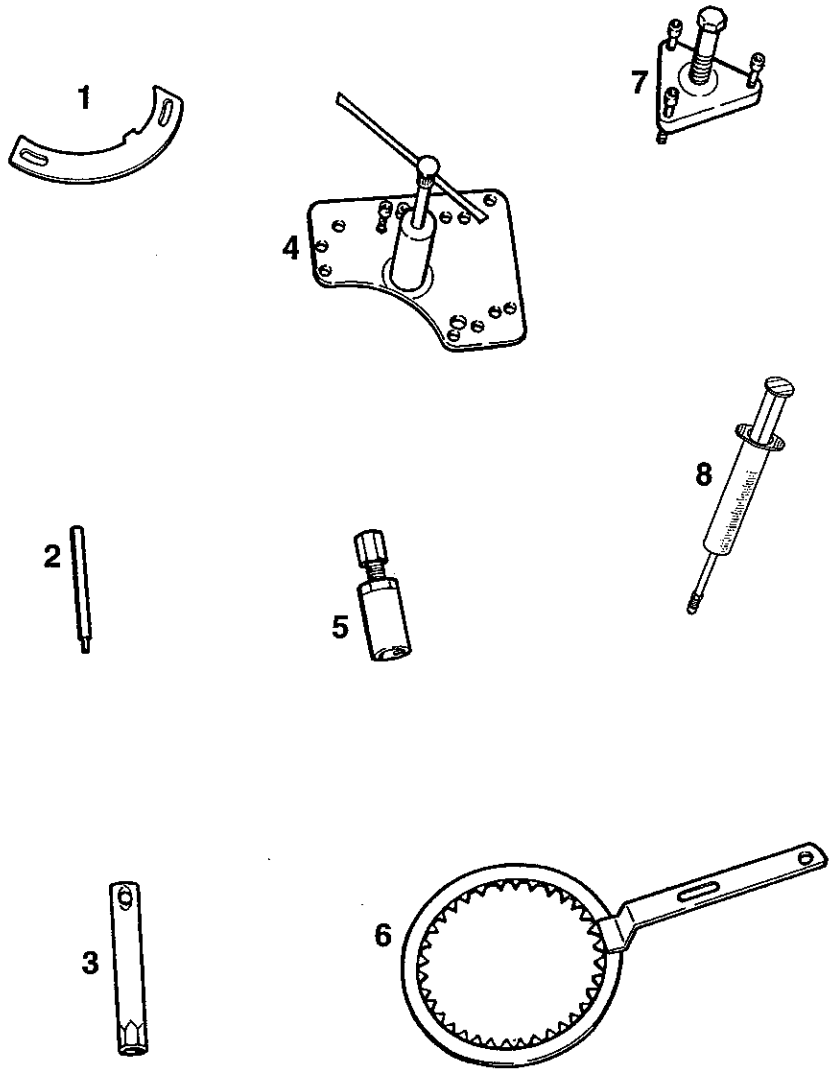
The material and information included in this Workshop Manual are all of the latest editions available at the time of the printing.

Husaberg Motor AB reserves the right to make changes regarding the products at any time without prior notice.

This Workshop Manual is subject to corrections without prior notice.

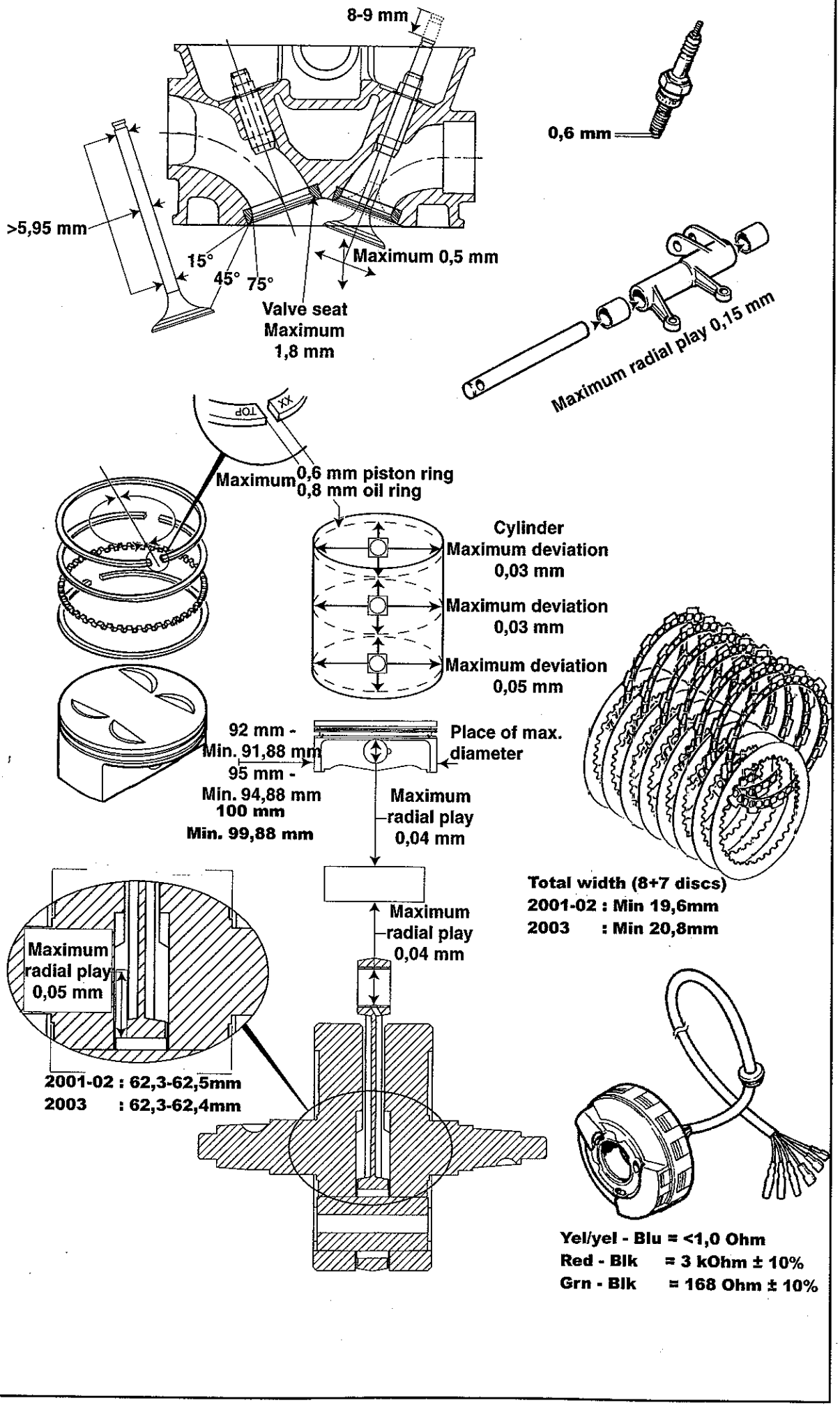
HUSABERG
(4 STROKE FORCE)
Endurovägen, S-695 72 SWEDEN
www.husaberg.se
force@husaberg.se

Special tools:



1	270 030-01	Holding tool flywheel 99-
2	270 012-01	Drift removing valve guide
3	270 001-01	Sparkplug wrench
4	270 011-02	Puller crankcase
5	270 028-01	Puller flywheel 99-
6	270 007-01	Holding tool
7	270 005-01	Puller clutch
8	270 032-01	Air bleed syringe clutch

2 LIMITS OF TOLERANCE



MAINTENANCE SCHEDULES

Engine - FC, FSc and FX models

Please observe: Riding under hard conditions demands more frequent maintenance

REGULAR

SUBJECT / HOURS	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
Engine oil	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
Oil screen	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Oil microfilter		R		R		R		R		R		R		R		R		R		R
Reed valve										I/C										I/C
Coolant liquid *																				R
Spark plug (incl. cap)					I					R					I					R
Alternator/Ignition **										I										I
Valve clearance					I					I					I					I
Valves incl. guides & sealings										I										I
Valve springs										R										R
Timing chain										I										R
Piston incl. rings & pin										I										R
Cylinder lining										I										I
Connecting rod										I										R
Crankshaft pin										I										R
Clutch mechanism incl. discs					I					I					I					I
Clutch centre					I					I					I					I
Carburettor ** / ***					I/C					I/C					I/C					I/C
Kickstart mechanism					I					I					I					I
Gearshift mechanism					I					I					I					I
EL: Freewheel mechanism					I					I					I					I

BEARINGS

Connecting rod										R										
Crankshaft										R										R
Gearbox main shaft										I										R
Gearbox secondary shaft										I										R
Shift drum										I										I
Camshaft										R										R
Clutch pressure plate										I										R
Clutch basket					I					I					I					I
Kickstart gear wheel										I										I
Intermediate gear wheel										I										I
Rockerarms										R										R
Intermediate shaft counter bal.										I										R
Counter balancer										R										R

BUSHINGS

Connecting rod										I										
Kickstart shaft										I										I
Clutch pushrod (In gearshaft)										I										I

C: Clean - I: Inspect - R: Replace

* Maximum 12 months interval - ** Clean whenever the engine has been washed - *** I(R): Especially needle and needle jet

MAINTENANCE SCHEDULES

Engine FEe and FSe models

Please observe: Riding under hard conditions demands more frequent maintenance

SUBJECT / HOURS	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200
REGULAR																				
Engine oil	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
Oil screen	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Oil microfilter	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
Reed valve										I/C										I/C
Coolant liquid *																				R
Spark plug (incl. cap)					I					R					I					R
Alternator/Ignition **					I					I					I					I
Valve clearance			I			I				I			I			I				I
Valves incl. guides & sealings										I										I
Valve springs										R										R
Timing chain incl. tensioner										I										R
Piston incl. rings & pin										I										R
Cylinder lining										I										I
Connecting rod										I										R
Crankshaft pin										I										R
Clutch mechanism incl. discs					I					I					I					I
Clutch centre					I					I					I					I
Carburettor ** / ***					I/C					I/C					I/C					I/C
Kickstart mechanism					I					I					I					I
Gearshift mechanism					I					I					I					I
EL: Freewheel mechanism					I					I					I					I
BEARINGS																				
Connecting rod										R										
Crankshaft										R										R
Gearbox main shaft										I										R
Gearbox secondary shaft										I										R
Shift drum										I										I
Camshaft										R										R
Clutch pressure plate										I										R
Clutch basket					I					I					I					I
Kickstart gear wheel										I										I
Intermediate gear wheel										I										I
Rockerarms					R					R					R					R
Intermediate shaft counter bal.										I										R
Counter balancer										R										R
BUSHINGS																				
Connecting rod										I										
Kickstart shaft										I										I
Clutch pushrod (In gearshaft)					I					I					I					I

C: Clean - I: Inspect - R: Replace

* Maximum 12 months interval - ** Clean whenever the engine has been washed - *** I(R): Especially needle and needle jet

CARBURETTOR

Dellorto PHM 38/40

Remove the carburettor from the intake manifold and the airfilter tube.
Unscrew the bolt (Fig. 4A-1) holding the fuel inlet pipe (Fig. 4A-2) and the fuel filter (Fig. 4A-3). Thoroughly clean the filter and the surrounding areas.

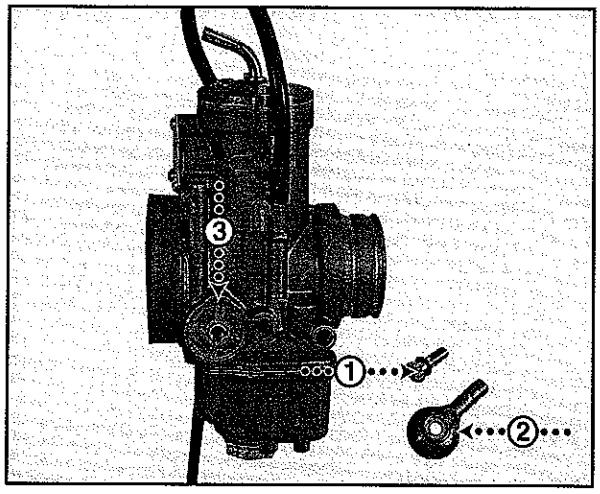


Fig. 4A

Unscrew the choke lever (Fig. 4B-1) from the choke housing (Fig. 4B-2). Thoroughly clean and lubricate the choke lever; both the lever shaft as well as the piston, and the inside of the housing.
Check that all three screws are fastened (Fig. 4B-3).
Check the positions of the idling screw (Fig. 4B-4) and the mixture screw (Fig. 4B-5) according to the instructions in the Owner's Manual.
See Section 1 for standard jettings.

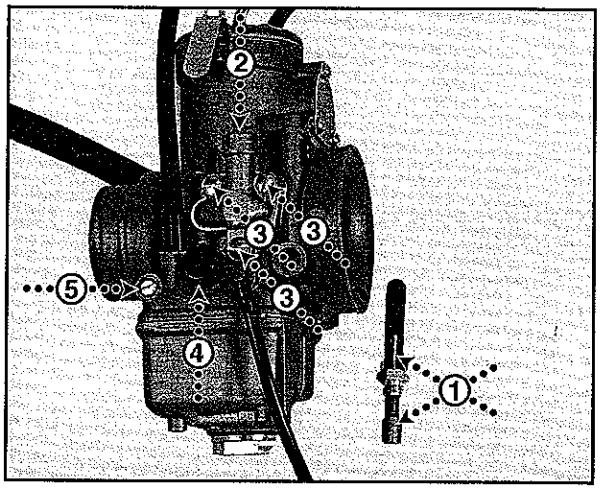


Fig. 4B

Dismantle the throttle cover and check the o-ring for any damage or deterioration (Fig. 4C-1).
Unscrew the wire nipple (Fig. 4C-2) from the throttle (Fig. 4C-3) and disconnect the wire (Fig. 4C-4) and the spring. Check the throttle for any deterioration.
Push out the needle and check the condition of the needle, especially at the surface as shown (Fig. 4C-5) and at the needle clip position (Fig. 4C-6).
Check the inner of the wire tube, especially at the position shown (Fig. 4C-7). The wire might create a rough jag into the inner of the tube and thus causing damages to a wire.
Clean the inside of the carburettor (Fig. 4C-8).
Make sure that both of the ventilation tubes are positioned as shown (Fig. 4C-9).

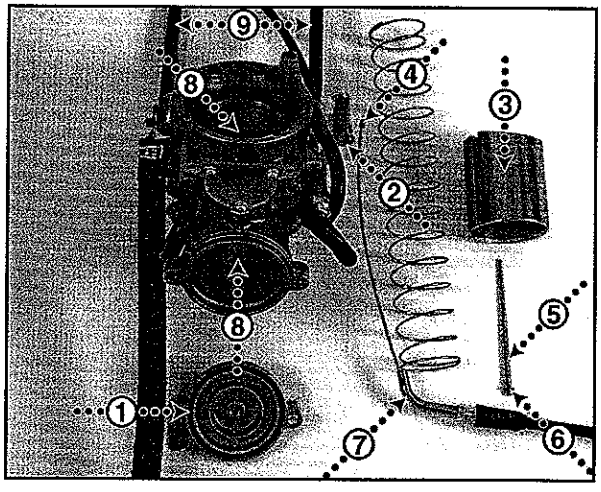


Fig. 4C

Unscrew the bottom plug (Fig. 4D-1) and remove the float chamber (Fig. 4D-2). Check the sealing of the plug and the o-ring of the chamber for any damages or deterioration.
Check the carburettor floats (Fig. 4D-3) for any leakages.
Check and clean the main jet (Fig. 4D-4), the needle jet (Fig. 4D-5, positioned underneath the main jet seat), the float valve and the float valve seat (Fig. 4D-6), the pilot jet (Fig. 4D-7) and the start jet (Fig. 4D-8).

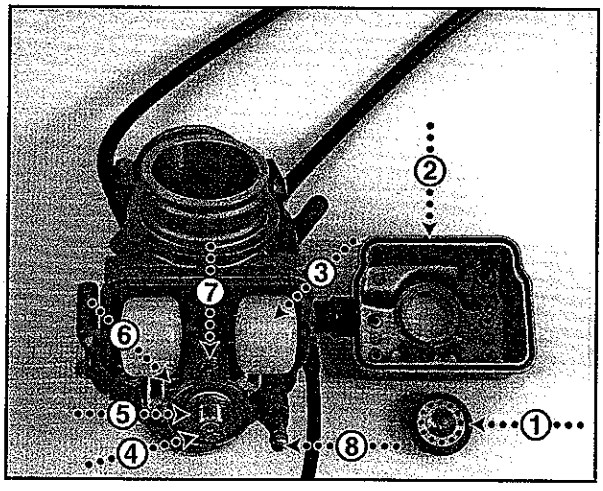


Fig. 4D

Check and clean the mixture screw (Fig.4E-1). Check the condition of the o-ring, the washer and the spring. Repeat the check regarding the idling screw (Fig. 4E-2).
Unscrew the two screws of the venturi (Fig. 4E-8) and remove the venturi.
By using compressed air, clean off the air ducts (Fig. 4E-3, 4, 5 and 6). Proceed with the needle jet tube (Fig. 4E-7).
Check the o-ring of the venturi (Fig. 4E-8) for any damage or deterioration.

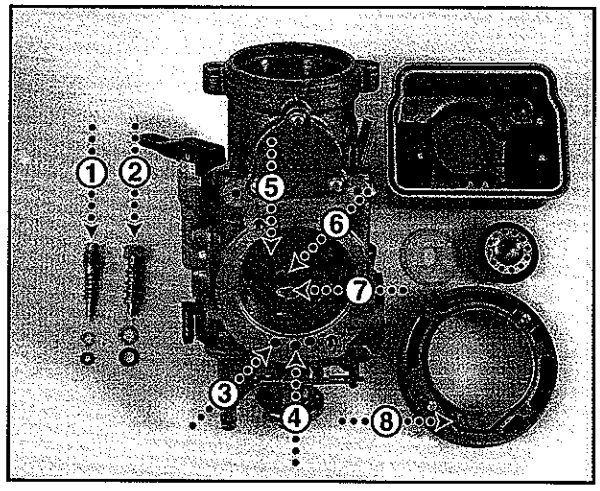


Fig. 4E

Two versions of float chambers are being used in the production; Type A and Type B. This being the only difference besides the various configurations of the jetting depending on model.

Check and clean the airfilters according to the maintenance schedule or more often if used under hard conditions.
Check the airfilter tube for any cracks or deterioration.

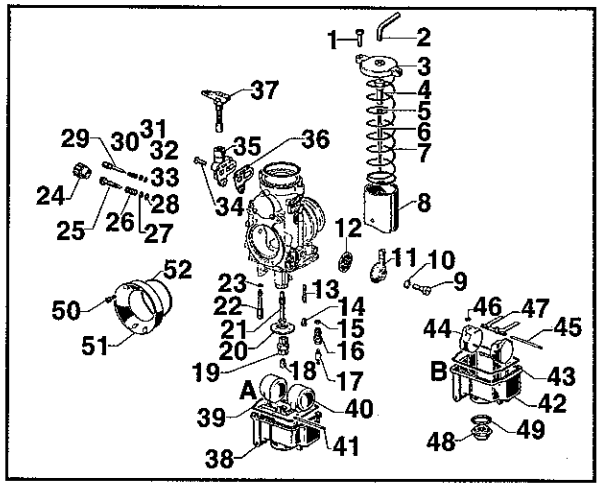


Fig. 4F

DISASSEMBLY OF ALTERNATOR/IGNITION

Unscrew the three screws of the flywheel cover and remove the cover including the stator. If the stator is going to be dismounted disconnect the wiring harness of the alternator/ignition from the main wiring harness and the ignition coil.
Attach the flywheel holder (Fig. 5A-1, Article No. 270030-01) into one of the slots in the flywheel and by using two of the flywheel cover screws (Fig. 5A-2). Unscrew the flywheel nut, clockwise (Fig. 5A-3), and remove the nut.

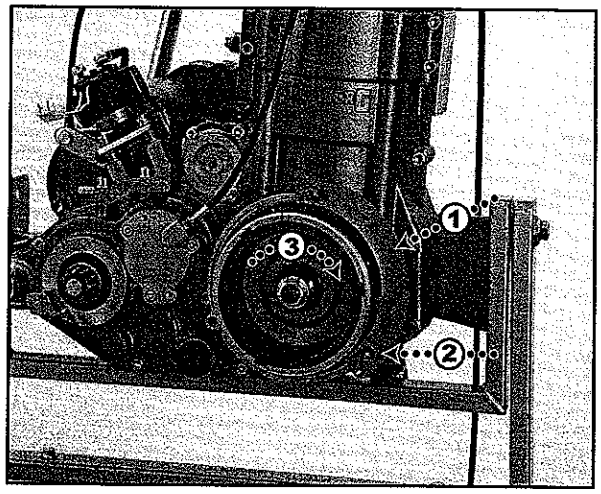


Fig. 5A

Release the flywheel from the crankshaft by using the flywheel puller (Fig. 5B-1, Article No. 270028-01). Be careful not to lose the woodruff ke.

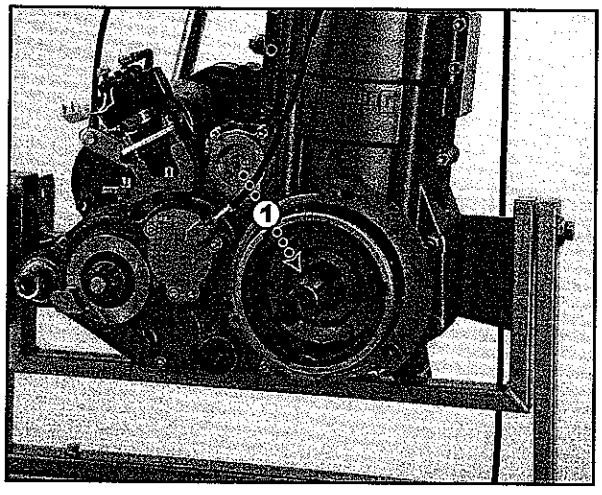


Fig. 5B

Unscrew the three screws of the stator (Fig. 5C-1) and remove the stator.

If the stator is presumed to be of malfunction check each wire of the stator with an ohmmeter:

Plus (+)	Minus (-)	Value
Red	Black	3 kOhm ±10%
Green	Black	168 Ohm ±10%
Yellow/Yellow*	Blue	<1,0 Ohm

* The two yellow wires to be connected in parallel

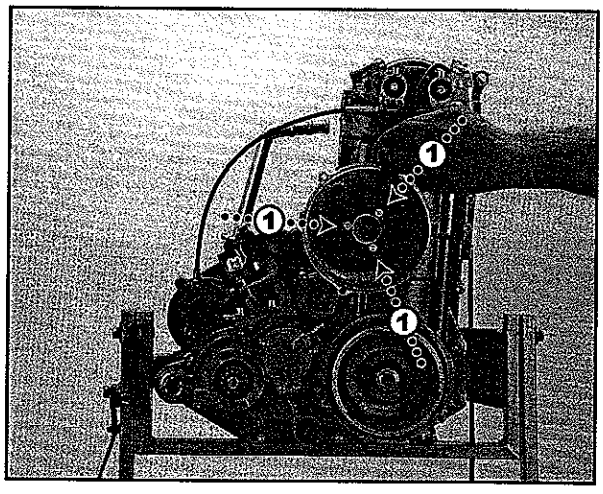


Fig. 5C

Check the inside of the flywheel, the woodruff key, the stator and the oil seal of the crankshaft for any damages or deterioration.
Thoroughly clean the inside of the flywheel and the outer of the stator.
Check the condition of the spark plug and set the gap to 0,7mm.
Check the condition of the spark plug cap, look especially for any cracks.
Each Yellow cable from the alternator provides 70W of output attached to the main electrical system.

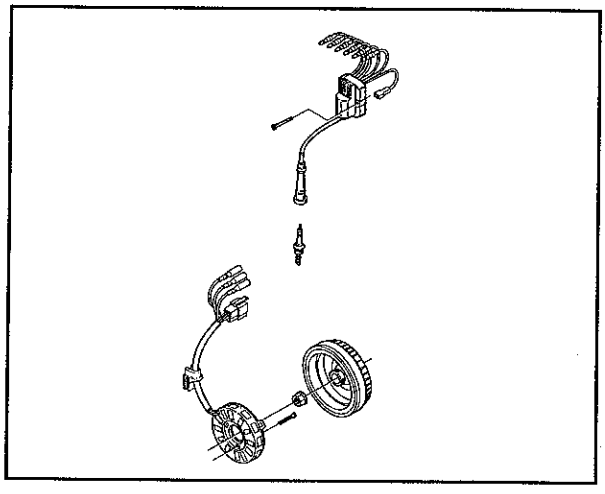


Fig. 5D

ASSEMBLY OF ALTERNATOR/IGNITION

Thoroughly clean the inside of the flywheel cover and the stator.
Install the stator into the flywheel cover with the three screws (Fig. 5C-1), use a threadlock liquid, torque 8 Nm.
Install the woodruff key (Fig. 5E-1) with the flat surface of the key in alignment with the crankshaft cone.
Install the flywheel onto the crankshaft cone and woodruff key.

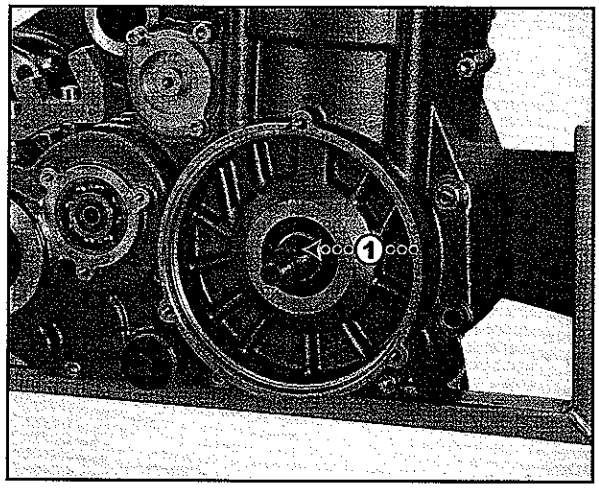


Fig. 5E

Attach the flywheel holder (Fig. 5F-1) into one of the slots in the flywheel and by using two of the flywheel cover screws (Fig. 5F-2).
Screw on the flywheel nut, counter-clockwise (Fig. 5F-3), torque 50 Nm.
Install the flywheel cover including the stator with the three screws.
Attach the wiring of the stator to the main wiring harness and the ignition coil.

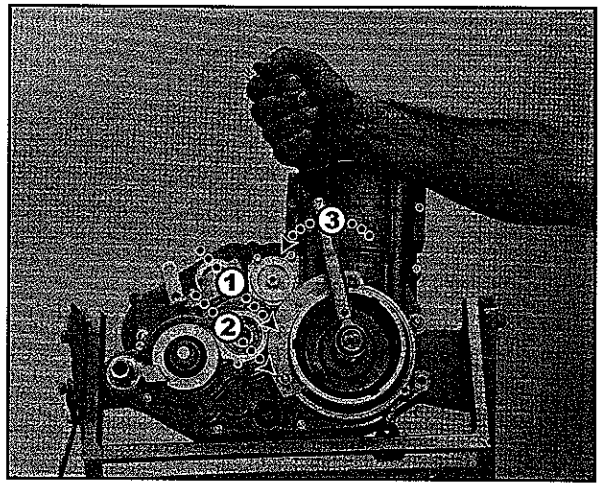


Fig. 5F

IGNITION TIMING

Put the engine in TDC (Fig. 5G-1).
Remove the inspection cover and check the position of the marks on the flywheel and the stator (Fig. 5G-2).

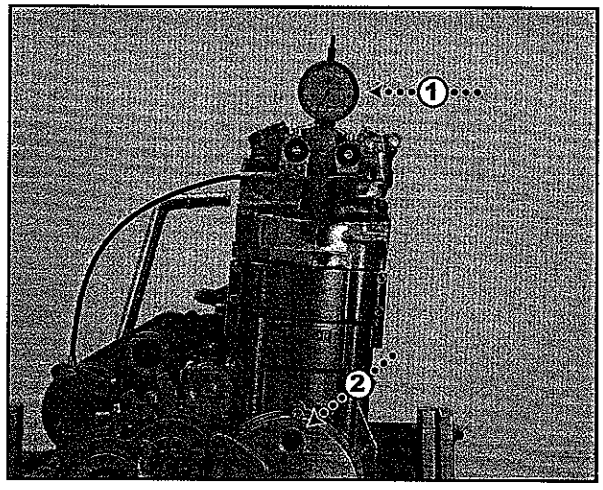


Fig. 5G

The ignition is properly set if the right mark on the flywheel (Fig. 5H-3) is aligned with the mark on the stator (Fig. 5H-1).
On the older engine different marks were used on e-start and kickstart engines but this is not the case on this engine.
If the ignition needs to be adjusted, remove the cover, slightly undo the three screws of the stator (Fig. 5C-1) and adjust the stator.
Tighten the screws and covers.

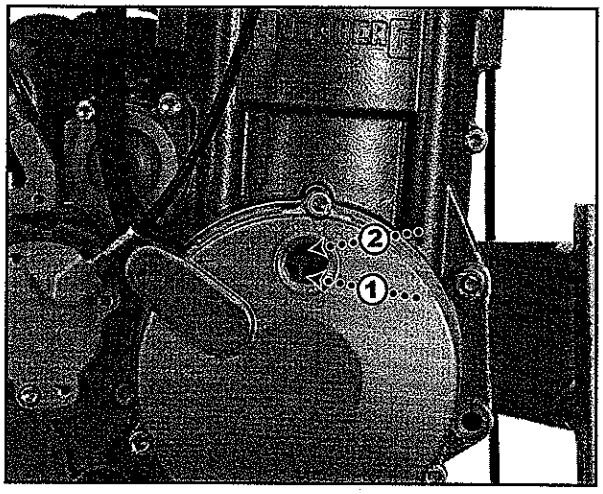


Fig. 5H

DISASSEMBLY OF OIL FILTERS

Drain the engine oil by unscrewing the oil drain plug (Fig. 6A-1). The oil screen (Fig. 6B-1) may either follow the oil drain plug or still be positioned within the crankcase when the drain plug is removed.
Unscrew the two screws (Fig. 6A-2) of the micro filter cover (Fig. 6A-3).

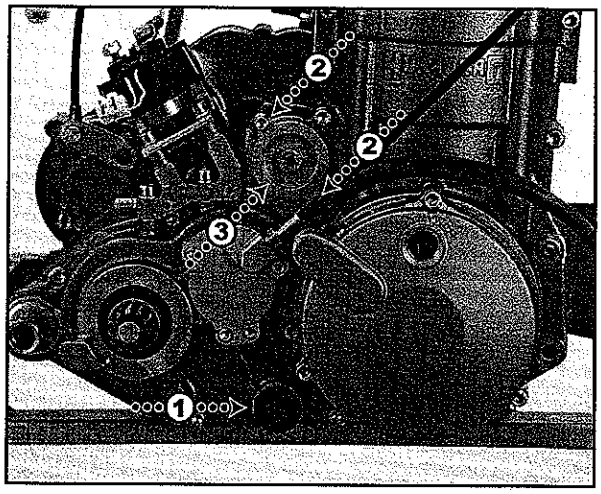


Fig. 6A

Remove the oil screen (Fig. 6B-1) by just pulling it out of the crankcase.
Remove the micro filter cover by screwing in one M6 screw into the center of the cover and use the screw as a puller (Fig. 6B-2).

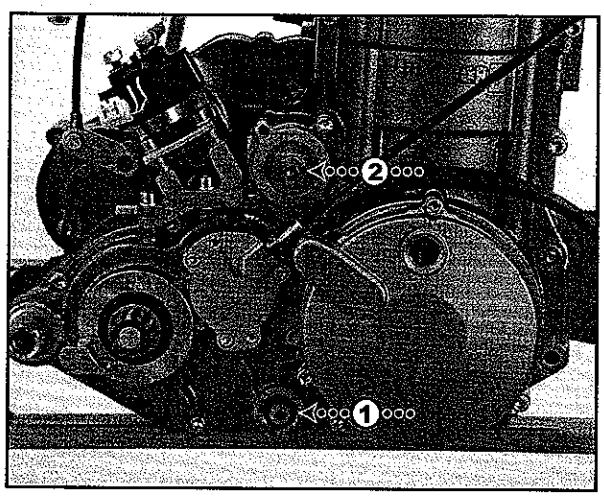


Fig. 6B

If not accompanied by the filter cover, pull out the filter (Fig. 6C-1).
Check the conditions of the o-rings of the filter cover (Fig. 6C-2) and replace them if they show any signs of deterioration.

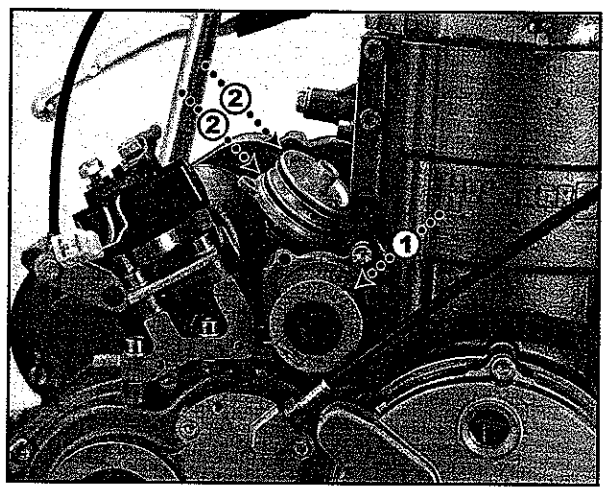


Fig. 6C

Check the oil drain plug for any damages, especially in regards to the thread. Make the same check regarding the thread within the crankcase half.
Check the sealing washer of the drain plug (Fig. 6D-2) and the o-rings on the oil screen (Fig. 6D-4) for any damages or deterioration.
Thoroughly clean the oil screen (Fig. 6D-3).
Replace the micro filter (fig. 6D-7).

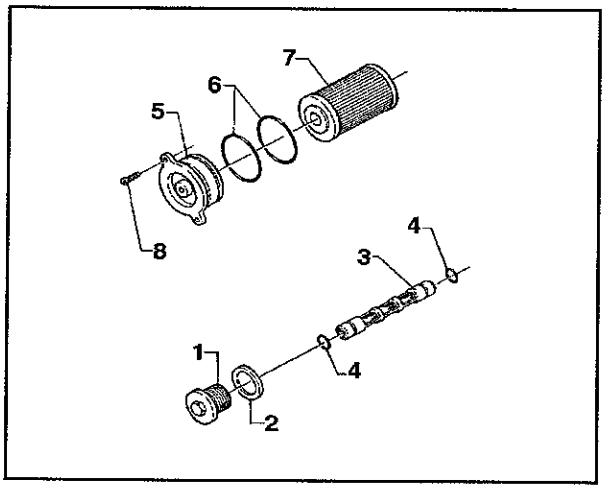


Fig. 6D

ASSEMBLY OF OIL FILTERS

Thoroughly clean the inner surfaces of the location of the micro filter within the crankcase.
Clean the filter cover and the oil duct drilled through the filter cover (Fig. 6E-1).
Lubricate the oil sealing within the gable of the filter (Fig. 6C-1) and the two o-rings of the cover (Fig. 6C-2).
Gently insert the cover into the filter through the oil sealing (Fig. 6E-2).
Install the filter and cover into the crankcase.
Screw on the two screws, torque 5 Nm.

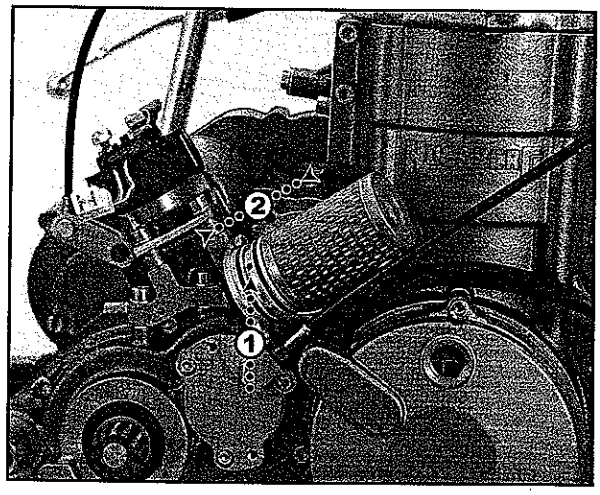


Fig. 6E

Thoroughly clean the inner surfaces of the location of the oil screen within the crankcase and the oil drain plug.
On engines fitted with magnet plug (Fig. 6A-2), the plug and its seat must be cleaned. Tighten the magnet plug to 12 Nm.
Lubricate the two o-rings at the both ends of the oil screen and insert the oil screen into the oil drain plug (Fig. 6F-1).
Gently push the oil screen and drain plug into the crankcase until the oilscreen fits into the machined position within the crankcase. Screw on these into the bottom position, torque 12 Nm.
Fill the engine with the adequate quantity of oil.

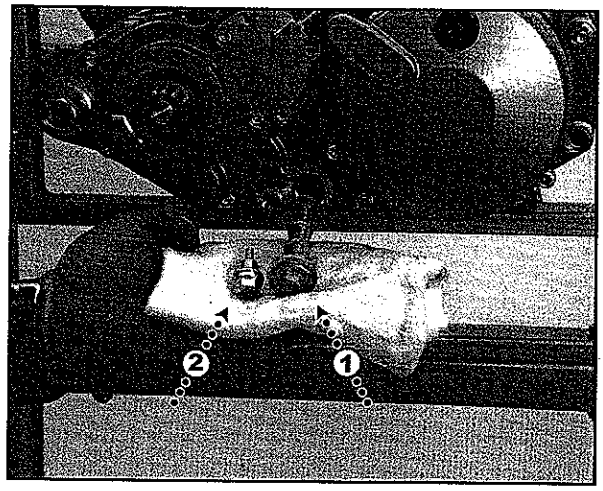


Fig. 6F

REED VALVE

The reed valve (Fig. 6G-2) is a subject of inspection and cleaning every 100 hours in order to avoid any disturbances.
Drain the engine oil, remove the kickstart lever, gearshift lever and the transmissission cover (see Section 7A).
Unscrew the two screws holding the reed valve support (Fig. 6G-1) and detach the support and the reed valve. Be careful not to damage the screws though they are fastened with a threadlock liquid.

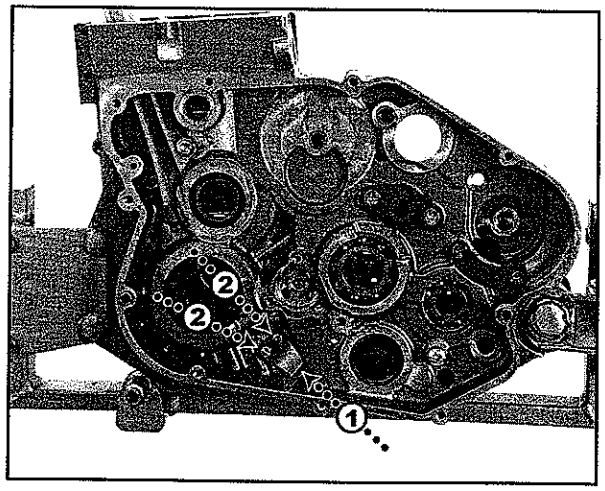


Fig. 6G

Inspect the reed valve (Fig. 6H-1) and the reed valve support (Fig. 6H-2) for any damages or deterioration.
Clean the parts and attach them onto the crankcase, using a threadlock liquid on the screws, torque 5 Nm.
Refit the transmission cover, kickstart and gearshift lever (see Section 7A).
Fill the engine with the adequate quantity of oil.

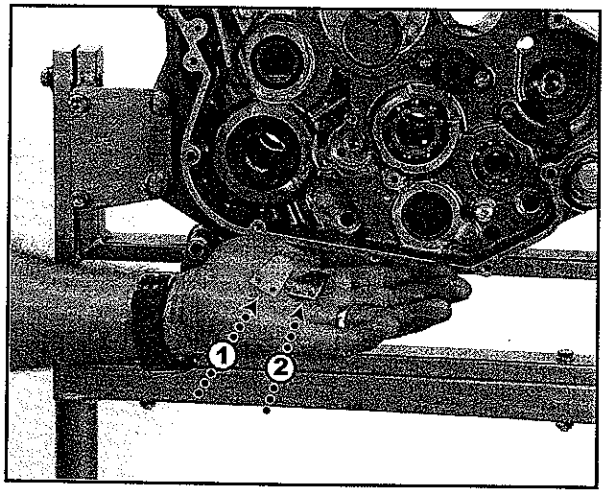


Fig. 6H

DISASSEMBLY OF OIL PUMP

Drain the engine oil.
Remove the kickstart lever, gearshift lever, transmission cover and the clutch (see Section 7A).
Remove the circlip (Fig. 6I-1) and the washer (Fig. 6I-2) in order to release the drive gear of the oil pump (Fig. 6I-3). Be careful not to lose the lock pin underneath the drive gear (Fig. 6J-1).

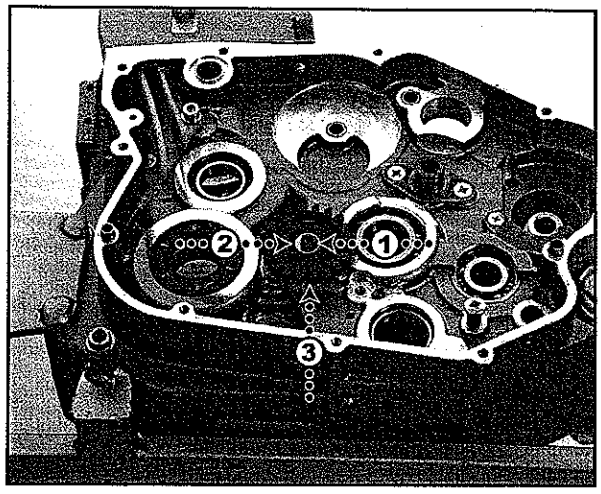


Fig. 6I

Remove the lock pin (Fig. 6J-1) and the washer (Fig. 6J-2) from the oil pump shaft (Fig. 6J-3).
Unscrew the three screws holding the oil pump cover and remove the cover. Be careful not to damage the screws though they are secured with a threadlock liquid.
The cover is normally followed by the oil pump shaft and the inner rotor (see below).

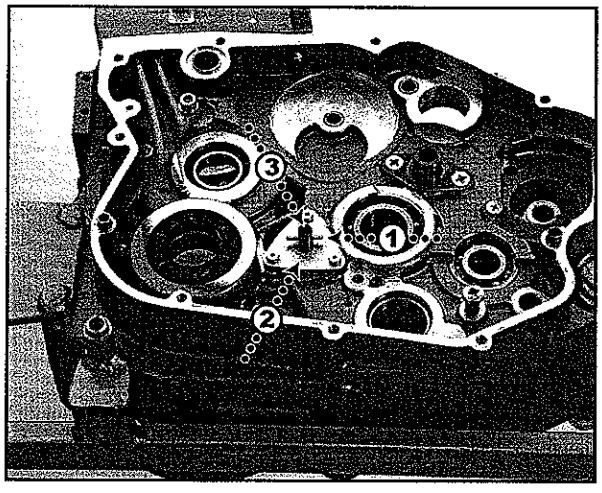


Fig. 6J

Remove the oil pump shaft (Fig. 6K-1) and the inner rotor (Fig. 6K-2) attached to the shaft by a lock pin (Fig. 6L-8).
Remove the outer rotor (Fig. 6K-3).

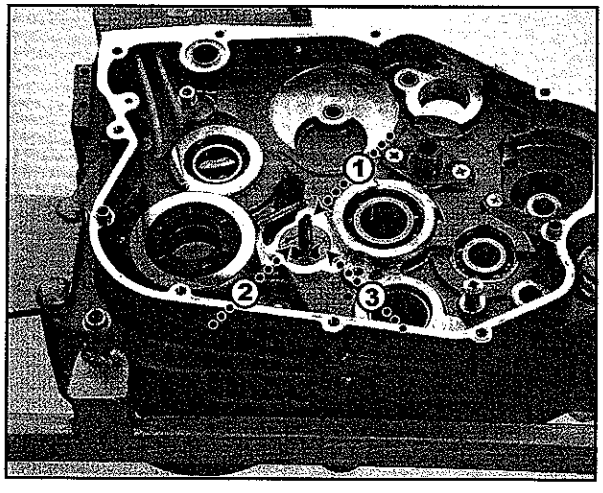


Fig. 6K

Check the inner and outer surfaces of the oil pump housing for any damages or deterioration.
Check the conditions of the inner and outer rotors for any damages or deterioration.
Check the oil pump shaft for any damages or deterioration especially at the position of the oil pump cover.

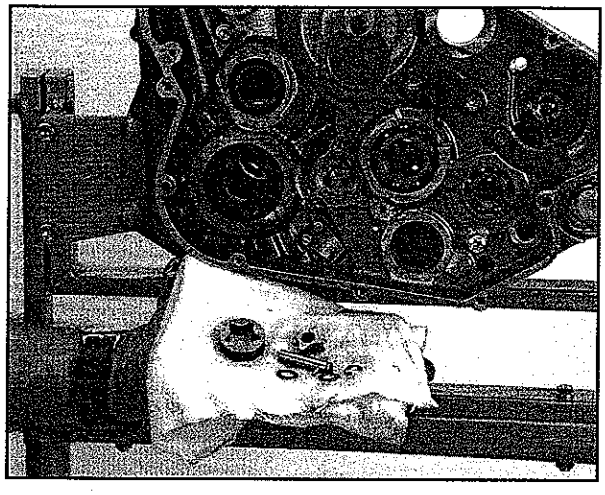


Fig. 6L

ASSEMBLY OF OIL PUMP

Insert the outer rotor into the oil pump housing, the marks on the rotor facing inwards (Fig. 6M-1).
Position the inner rotor onto the oil pump shaft with the lock pin (Fig. 6L-8), the marks on the inner rotor (Fig. 6M-2) and the lock ring spline on the shaft (Fig. 6M-3) facing outwards.

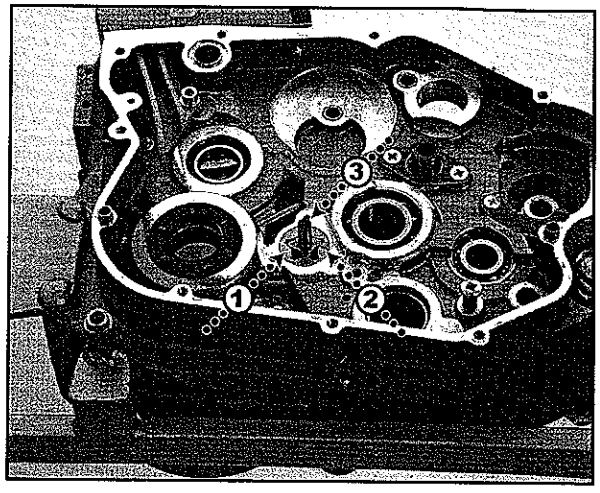


Fig. 6M

Thoroughly clean the inner surface of the oil pump cover and the sealing surface around the oil pump rotors.
Add a thin layer of silicone onto the sealing surface around the rotors.
Put on the oil pump cover onto the shaft, the mark on the cover and the crankcase half should align (Fig. 6N-1).
Screw on the three screws, using a threadlock liquid. torque 5 Nm.
Put one washer (Fig. 6N-2) onto the shaft and then insert the lock pin (Fig. 6N-3) into the shaft.

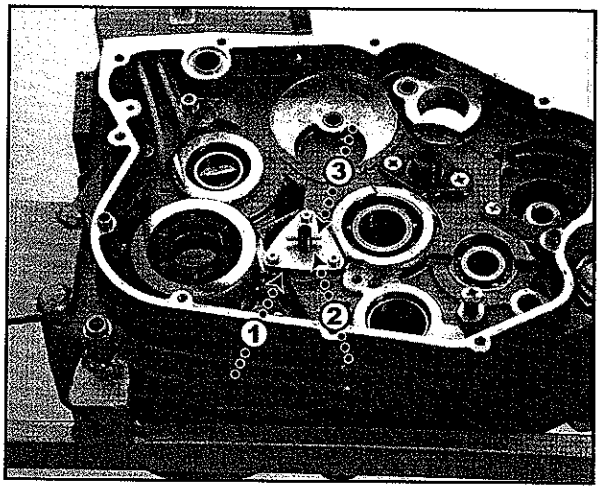


Fig. 6N

Put the drive gear (Fig. 6O-1) onto the shaft, be careful to align the spline on the backside of the drive gear with the lock pin on the shaft.
Place one washer (Fig. 6O-2) onto the shaft and then lock the whole device with a new circlip (Fig. 6O-3).
Install the clutch, the transmission cover, the kick-start and the gearshift lever (see Section 7A).
Fill the engine with the adequate quantity of oil.

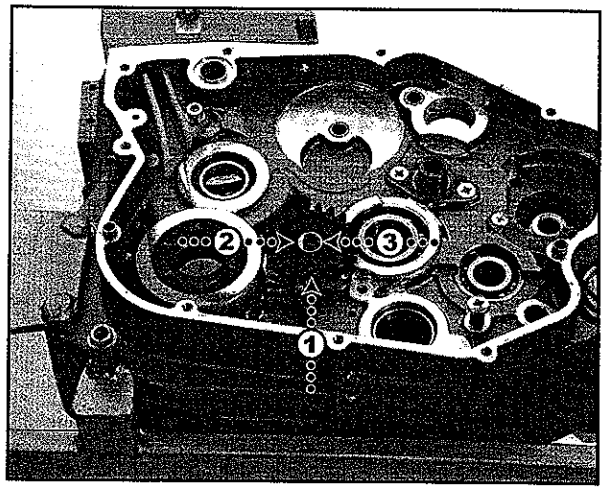


Fig. 6O

DISASSEMBLY OF WATER PUMP

Drain the coolant liquid from the cooling system by removing the hose connected to the water pump cover.
Unscrew the three screws (Fig. 7A-1) of the water pump cover (Fig. 7A-2) and remove the cover.

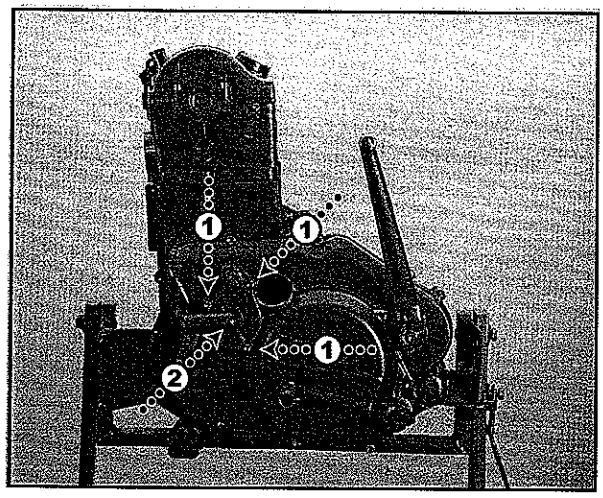


Fig. 7A

Remove the circlip (Fig. 7B-1) holding the water pump impeller (Fig. 7B-2) and gently remove the impeller.
Soft mouthed pliers might be needed (Fig. 7C).
Be careful not to lose the impeller pin (Fig. 7D-1).
Inspect the surfaces of the driveshaft end and the inner of the water pump housing.

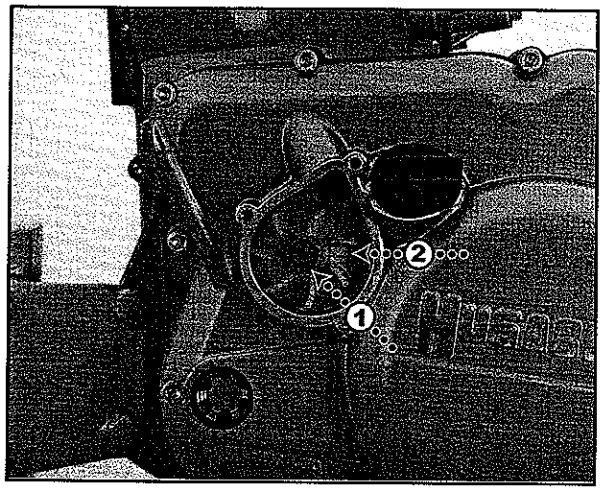


Fig. 7B

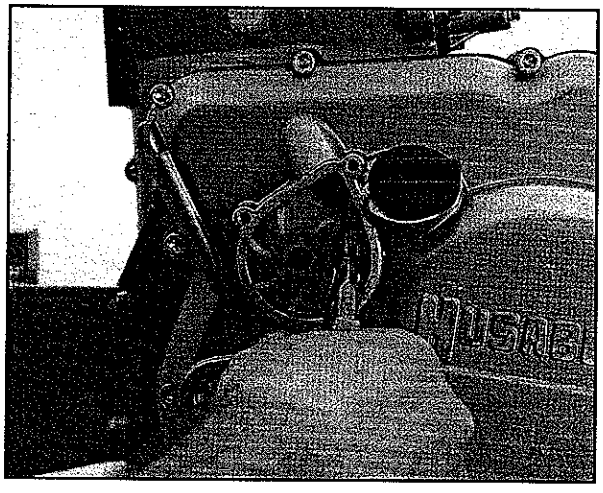


Fig. 7C

ASSEMBLY OF WATER PUMP

Install the impeller pin (Fig. 7D-1).
Align the spline on the backside of the impeller with the pin and gently push the impeller onto the shaft and the pin.
Secure the impeller with a new circlip.
Put on a new gasket and the cover and screw on the three screws, torque 5 Nm.
Refit the hose and fill the cooling system with the adequate level of coolant liquid.

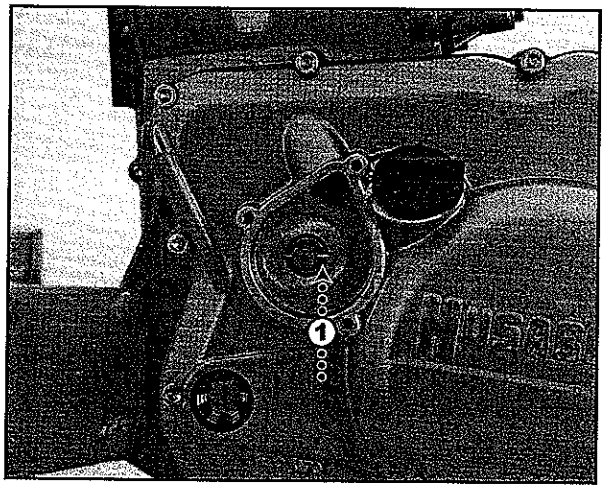


Fig. 7D

DISASSEMBLY OF CLUTCH

Drain the engine oil and the coolant from the cooling system.
Remove the water pump impeller.
Remove the kickstart lever and the gearshift lever.
Unscrew the ten screws of the transmission cover.
Please note that the two screws in the front and the rear (Fig. 7E-1) are slightly longer than the other ones.
Gently remove the cover without making any damages to the sealing surfaces of the cover and the crankcase half.

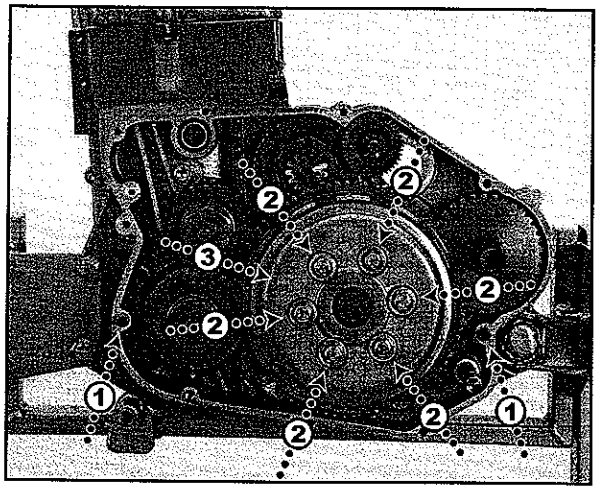


Fig. 7E

Unscrew the six screws (Fig. 7E-2) holding the clutch pressure plate crosswise in order to prevent the friction- and mating plates to either jam or warp. Remove these six screws including retainers and springs.
Remove the pressure plate (Fig. E-3) and the push rod (Fig. 7F-1).
Remove the clutch discs and the push rod.
Remove the circlip (Fig. 7F-2) on the main gear shaft, holding the clutch hub (Fig. 7F-3) and the clutch outer (Fig. 7F-4).

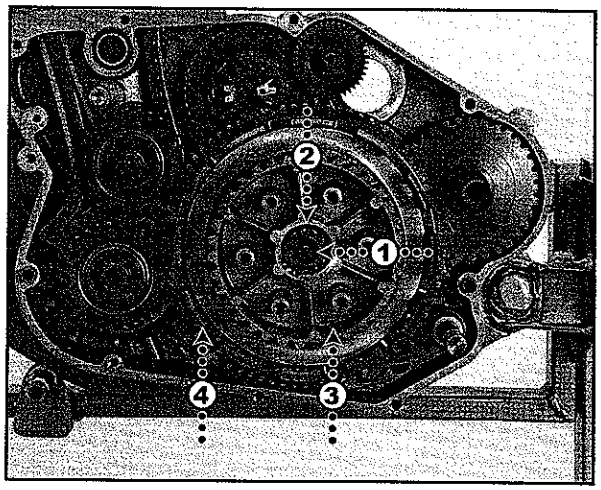


Fig. 7F

Place a suitable bolt (M10x20 mm for instance) in the pushrod channel of the main gear shaft. Attach the universal puller (Fig. 7G-1, Art.No. 270011-02) to the clutch hub with three of the previously removed screws. Screw on the center bolt of the puller towards the bolt-head of the previously placed bolt.
Remove the washer in between the clutch hub and the clutch outer. Remove the clutch center including the bushing (2001) or needle bearings (2002-2003) and the washer underneath the clutch center.

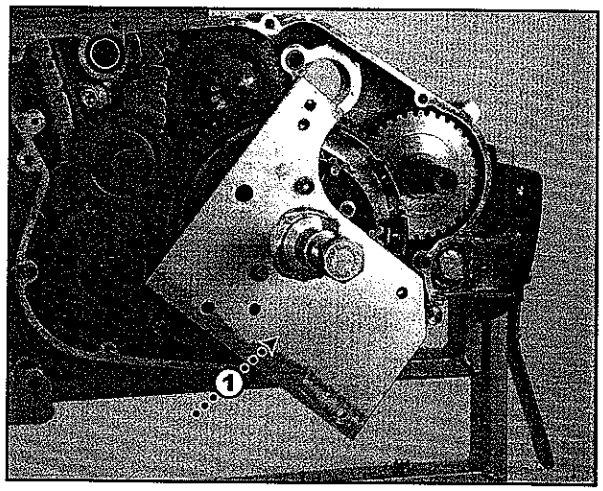


Fig. 7G

Check the bushing (2001) or needle bearings (2002-2003) (Fig. 7H-3) and the two washers (Fig. 7H-1,2) for any damages or deterioration.
Check the splines on the main gear shaft.
Check the main shaft bearing for any deterioration or damages.

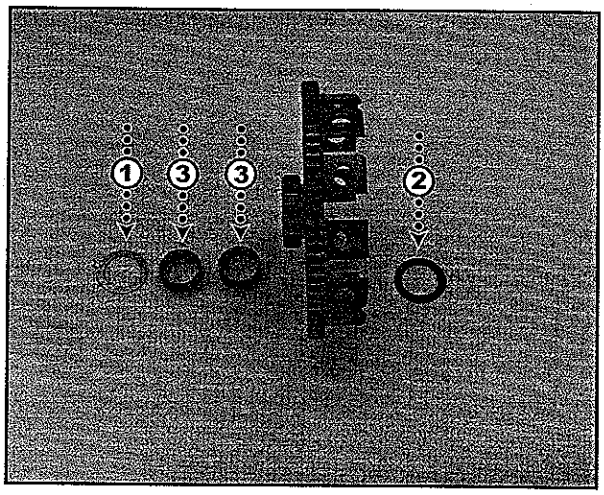


Fig. 7H

Pressure plate 2001-2002.
Check the pressure plate (Fig. 7I-1) with its bearing (Fig. 7I-2) and pressure sleeve (Fig. 7I-3) in regards to any damages.

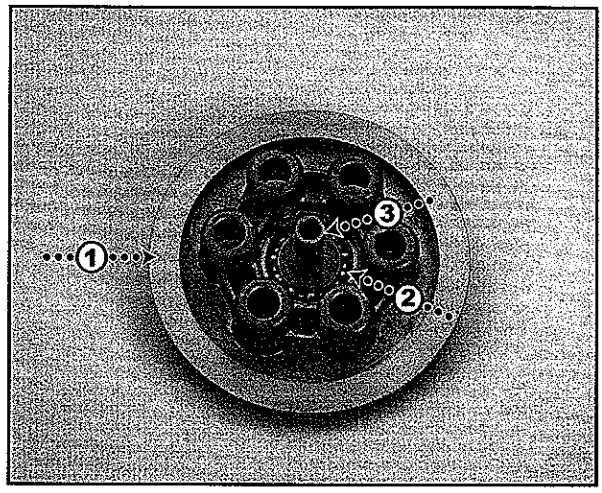


Fig. 7I

Pressure plate 2003.
Check the pressure plate (Fig. 7J-1) in regards to any damages. Also inspect the pressure bearing unit with its sleeve (Fig. 7J-2), bearing (Fig. 7 J-3), support washer (Fig. 7J-4) and locating clip (Fig. 7J-5).

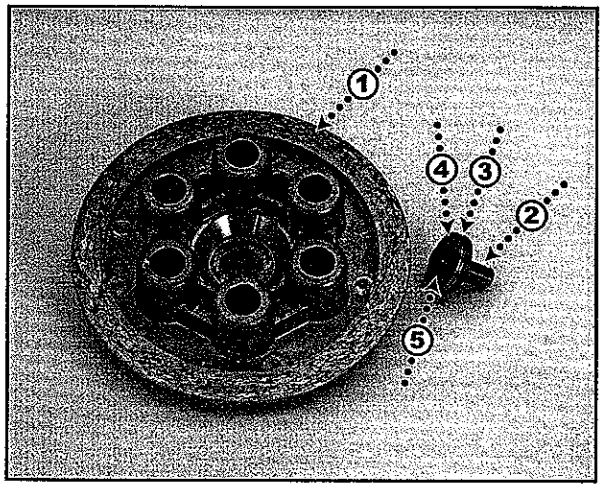


Fig. 7J

Clutch discs 2001-2002.
Check the friction discs (Fig. 7K-1) and mating plates (Fig. 7K-2) in regards to any damages or skewness. The friction discs have to be replaced if the whole package of friction- and mating plates measures below 19,6 mm provided that the mating plates show no signs of skewness.

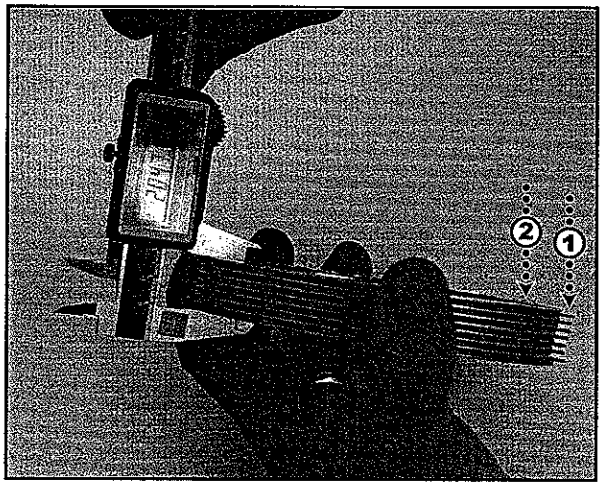


Fig. 7K

Clutch discs 2003.
Check the discs for any damage or skewness and measure the thickness as stated above. The min thickness is 20,8 mm for the 2003 plates.
Mind that the mating plates has different dimensions on the 2003 clutch. The four thick ones (1.4 mm) shall be placed in the middle (Fig. 7L-1) and two thin ones (1.0 mm) shall be placed to the inner and outer sides (Fig. 7L-2).

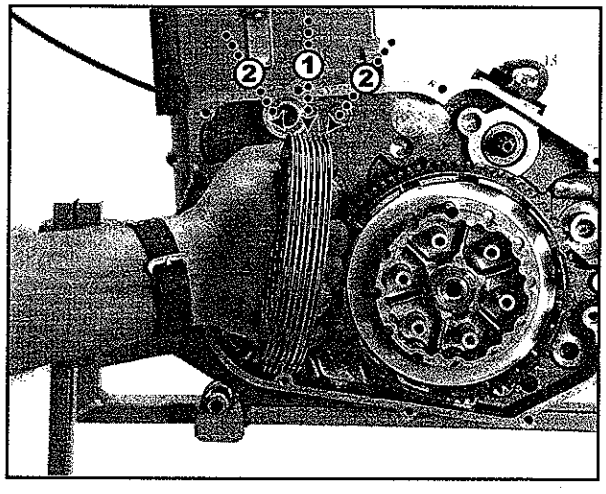


Fig. 7L

ASSEMBLY OF CLUTCH (Models with grooves in clutch centre)

Place one of the two washers and the bushing (2001 models) or the two needle bearings (2002 models) on the main shaft.
Put the clutch outer basket (Fig. 7M-1) onto the main shaft and the second washer (Fig. 7M-2) onto the main shaft towards the basket.

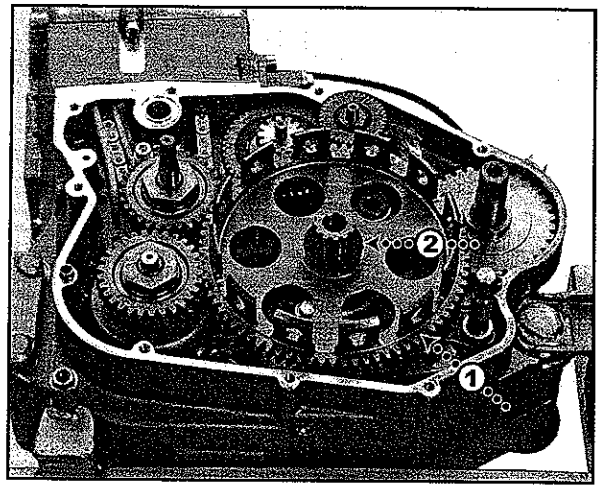


Fig. 7M

Slide the clutch hub (Fig. 7N-1) onto the main shaft. The 2001-2002 clutch shoult normally not need heating.
Using a suitable sleeve/socket ontop of the center of the hub and a mallet, drive the hub to its bottom position. Secure the kickstart mechanism before tapping onto the clutch hub in order to prevent damages or dislocation of the kickstart mechanism.
Lock the clutch hub onto the main shaft with a new circlip (Fig. 7N-2).

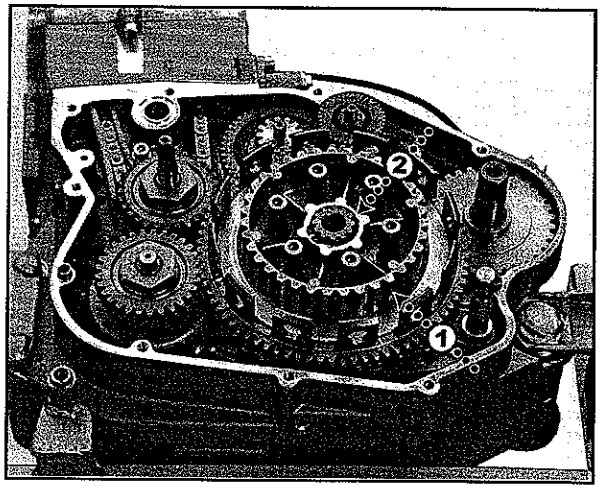


Fig. 7N

Place the friction discs and the mating plates into the clutch, starting with one mating plate, followed by one friction disc, then a mating plate and so on. The 8th mating plate(Fig. 7O-1) being the last one.
Slide the push rod (Fig. 7O-2) through the main shaft and fit the pressure plate (Fig. 7P-1).

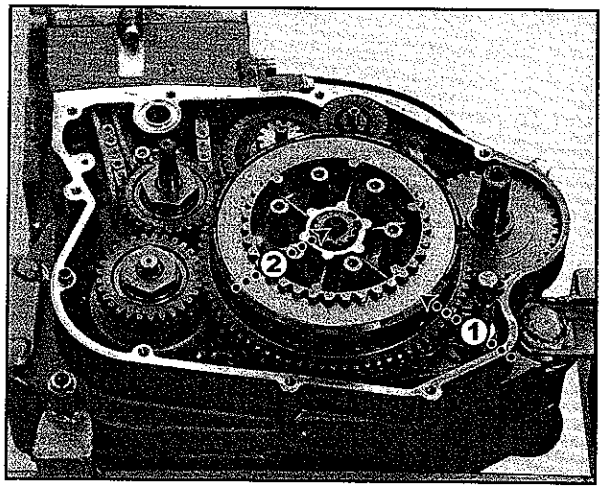


Fig. 7O

Put the springs, the spring retainers (Fig. 7P-2) and the screws (Fig. 7P-3) into the slots of the pressure plate. Tighten the pressure plate crosswise (Fig. 7P-A,B,C), torque 10 Nm.
Make sure that both of the guide bushings (Fig. 7P-4) are in straight and fixed positons. Put a new gasket onto the crankcase half. Check the sealings in the transmission cover; kickstart shaft and gearshift shaft, for any damages or wearness.
Slide the cover over the shafts and the guide bushings towards the crankcase half. Screw on the six screws, torque 10 Nm.

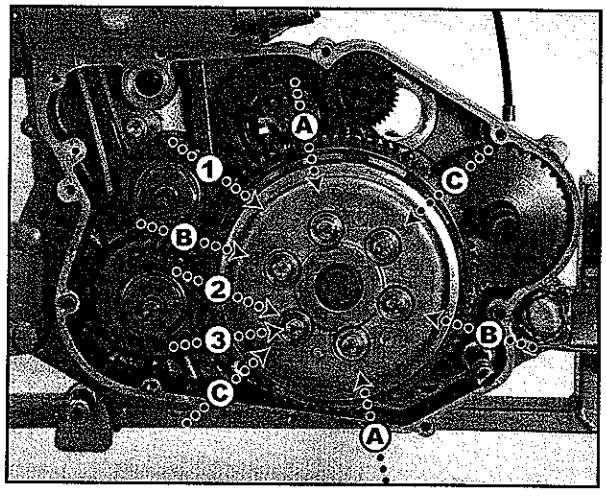


Fig. 7P

ASSEMBLY OF CLUTCH (Models with traction sleeves)

Fit the inner, flat, washer (Fig 7H-1) towards the primary shaft bearing and slide the two needle bearings (Fig. 7H-2) and clutch outer basket (Fig 7Q-1) on to the shaft.
Then fit the two locating clips' (Fig. 7Q-2) in the groove on the primary shaft (A dot of grease in the groove will help holding the clips) and fit the securing washer on the clips with the flange facing inwards.

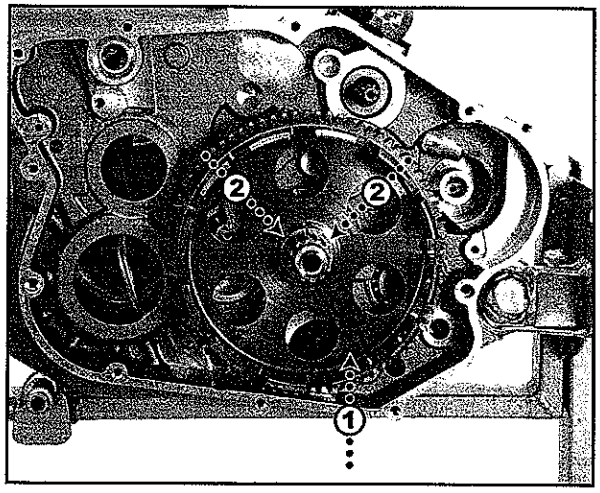


Fig. 7Q

IWarm the clutch centre (Fig. 7R-1) to approximately 100 deg in an oven or likewise. Slide it on to the primary shaft until it bottoms on the securing washer.
Fit the lock washer (Fig. 7R-2) with its pre-bent lug facing the machined flat surface on the hub of the clutch centre. Srew on the nut (Fig. 7R-3) and tighten it to 30 Nm. Bend the two straight lugs (Fig. 7R-4) to flat surfaces on the nut to prevent rotation.

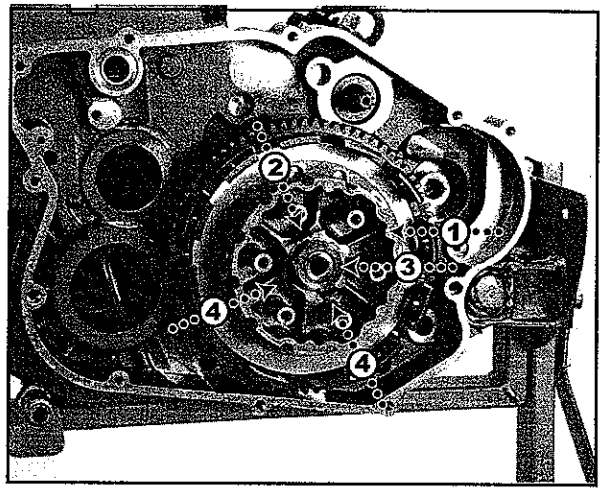


Fig. 7R

The easiest way to assemble the pack of friction and mating plates is to use only one traction sleeve (Fig. 7S-1) to locate the mating plates (Fig. 7S-2).
Begin with one mating plate, friction plate, mating plate and so on until you end with a mating plate.
Mind that the mating plates are of two different thicknesses. The four thick ones (1.4 mm) shall be placed in the middle, with two thin (1.0 mm) on inside and outside.

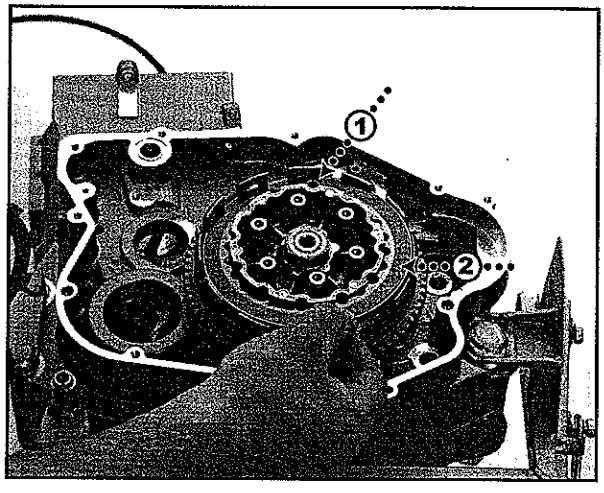


Fig. 7S

Finally slide in the remaining eleven traction sleeves (Fig. 7T-1), the push rod and the pressure plate with its bearing. Put the springs, spring retainers and screws as on the other clutch (Fig. 7P). Tighten the screws crosswise to 10 Nm.

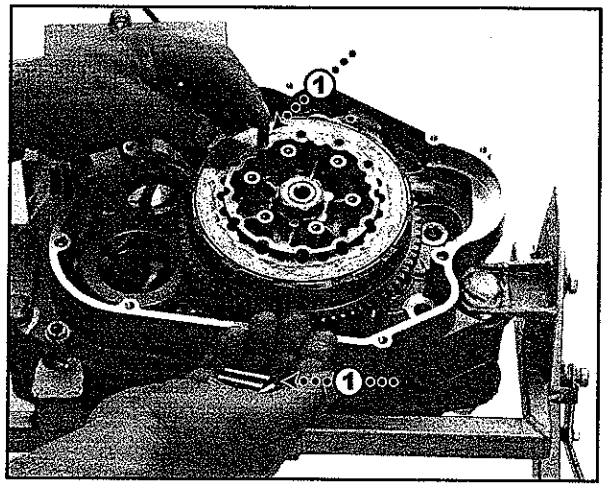


Fig. 7T

DISASSEMBLY OF GEARSHIFT MECHANISM

Drain the engine oil.
Dismantle the kickstart lever, the gearshift lever, the transmission cover and the clutch according to Section 7A.
Unscrew the bolt holding the gearshift location lever (Fig. 7U-1) and remove the bolt, the washer (Fig. X-1), the lever (Fig. 7X-2), the spring (7X-3) and the sleeve (Fig. 7X-4) attached to the lever.

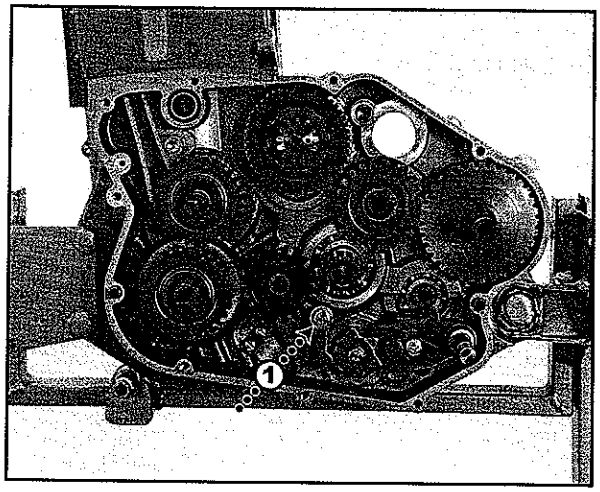


Fig. 7U

Unscrew the bolt holding the gear position star (Fig. 7V-1). Remove the bolt, the washer (Fig. 7X-5) and the position star (Fig. 7X-3).
Detach and remove the hair pin spring (Fig. 7V-2) including the sleeve (Fig. 7V-3).
Lift off the gearshift shaft including the gear selection plates from the crankcase half.

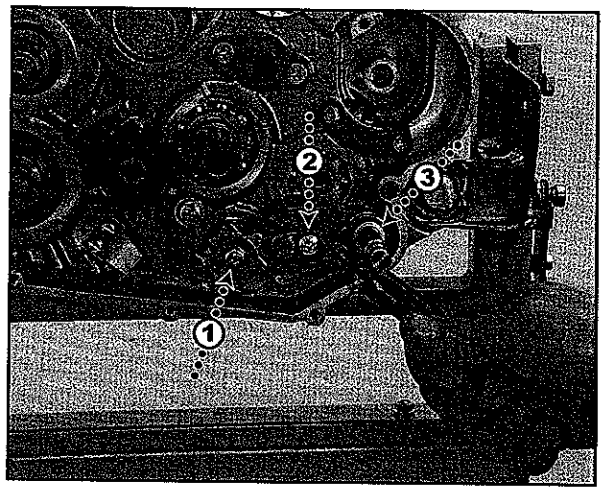


Fig. 7V

Check the gearshift location lever (Fig. 7X-2), position star (Fig. 7X-3) and the pins for any damages or deterioration.
Carefully check the surfaces of the both the upper gearshift selection plate (Fig. 7X-6) and the lower one (Fig. 7X-7). Grind off any sharp edges and check that both plates are totally even and in alignment with each other. The upper selection plate should, without any friction, easily slide across the lower selection plate (Fig. 7X-8).

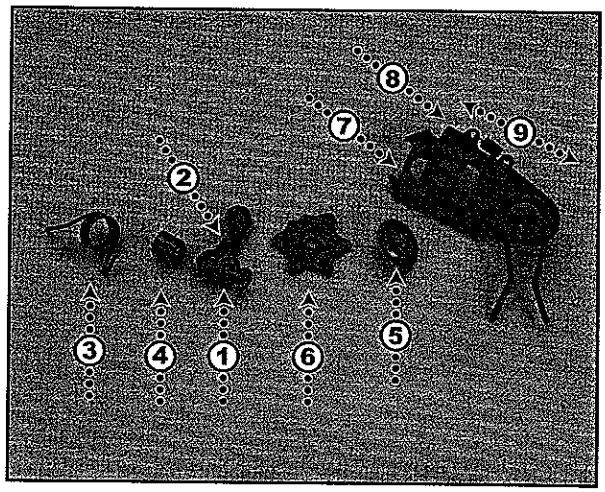


Fig. 7X

Each gear position as shown in Figure 7Y, 0-6. The figure 0 representing the position of the neutral, the figure 1 = 1st gear and so on. Please notice that the pin with a flat surface (Fig. 7Y-0) is the position of the neutral position in the position star (Fig. 7X-6).

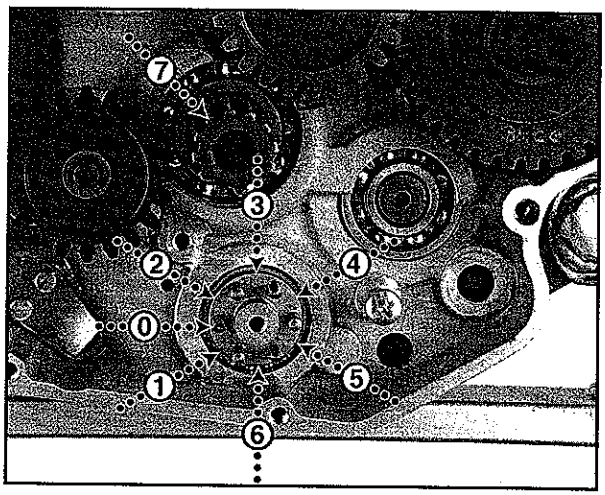


Fig. 7Y

ASSEMBLY OF GEARSHIFT MECHANISM

Install the gearshift shaft including the selection plates and the attachment spring.
Slide the sleeve and the spring onto the shaft and install the hair pin spring into its position. Please note that the bent part of this spring should be in the position as shown (Fig. 7Z-1).
Make sure that the flat-ended pin on the selector drum (Fig. 7B-2) is placed in its frontmost position. This puts the gearbox in neutral. Install the gear position star (Fig. 7AA-1) with the seat for neutral by the flat-ended pin.

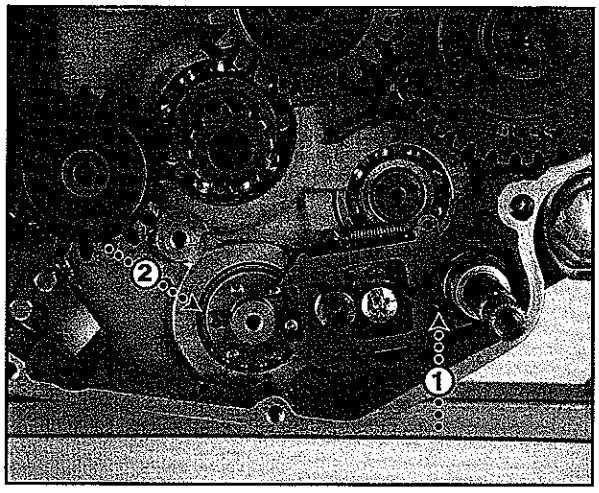


Fig. 7Z

Install the gearshift location lever including sleeve and spring (Fig. 7AA-2) by positioning the straight part of the spring into its position in the crankcase half, screw the bolt in a few turns, slide the lever, clockwise, over the position star and place the wheel of the lever into its final position in the star. Please observe that the chamfered edge of the sleeve should be facing outwards and towards the lever.
Check that the play; equal to none, and the resistance of the hair pin spring (Fig. 7AA-3) is exactly the same in both directions. If an adjustment is needed, turn the gearshift shaft as shown (Fig. 7AA-A), use a plier, gripping both ends of the spring, adjust the part of the spring needing an adjustment towards the other.

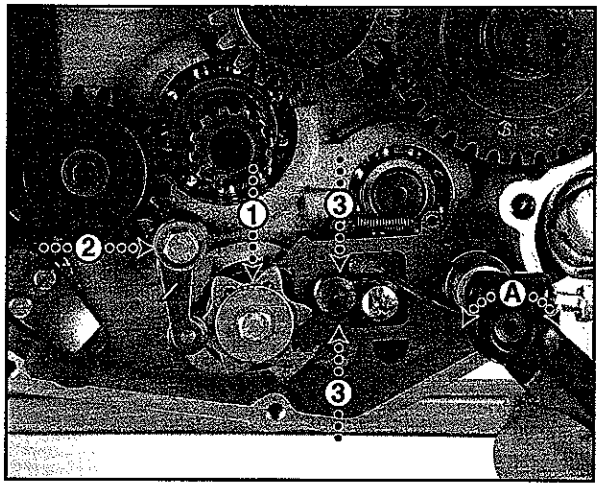


Fig. 7AA

Install the clutch according to section 7A, transmission cover, kickstart and gearshift lever according to section 7CD.Fill the engine with the adequate quantity of oil.

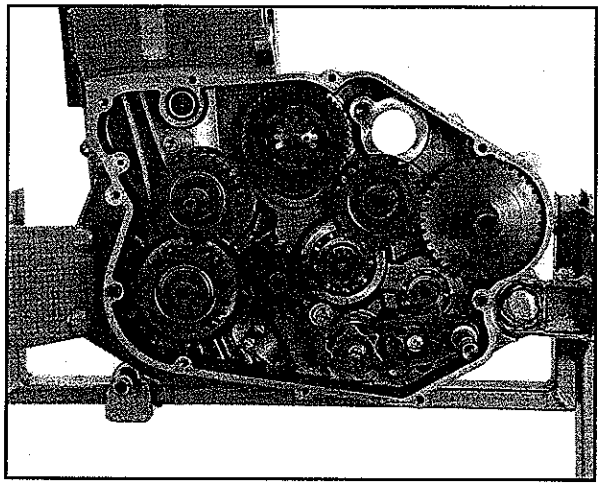


Fig. 7AB

DISASSEMBLY OF KICKSTART MECHANISM

Drain the engine oil.
Dismantle the kickstart lever, the gearshift lever, the transmission cover and the clutch according to Section 7A.
Remove the kickstart shaft (Fig. 7P-1) including the attached kickstart gear wheel (Fig. 7P-2) by just pulling the shaft straight out from the crankcase half. Most likely is also the spring on the inside of the gear wheel accompanying the shaft and the gear wheel when pulled out.

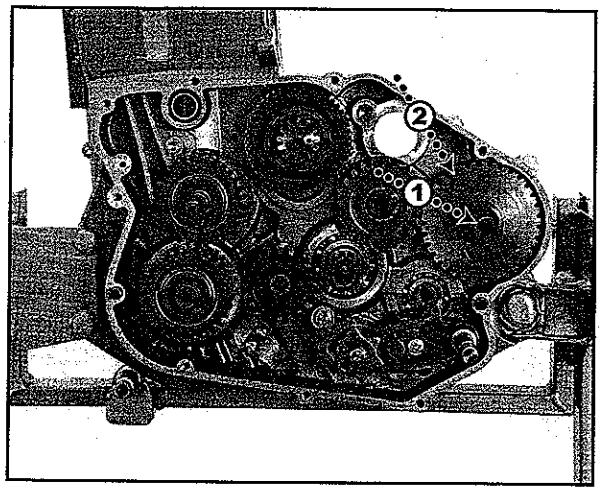


Fig. 7AC

The function of the kickstart mechanism:
When the kickstart lever is activated the kickstart engagement key (Fig. 7Q-1) is engaged into the gear ring of the kickstart gear wheel (Fig. 7Q-2) and thus the gear wheel turning the intermediate gear wheel (Fig. 7Q-3). The kickstart mechanism is brought back to its home position, when released, by the spring (Fig. 7Q-6). The engagement key is when resting towards the engagement sledge (Fig. 7Q-8) which is acting as both a stop and a device de-activating the engagement key from the gear ring of the kick-start gear wheel.

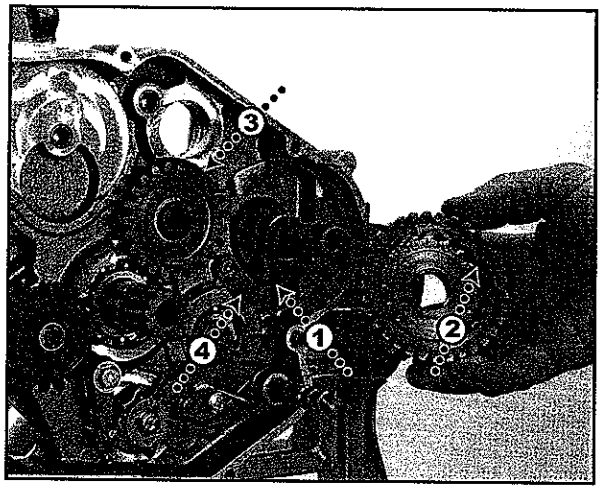


Fig. 7AD

Check the bushing in the transmission cover (Fig. 7S-1), the kickstart gear wheel (Fig. 7S-2), the bearing (Fig. 7S-3) and the kickstart shaft (Fig. 7S-4) for any damages or deterioration. Especially the surface and edge on the decompression device (Fig. 7R-4, 7) and the surface of the decompression lever (Fig. 7R-5). Grind off any rough scratches on the lever's front edge and the surface on the bottom of the lever.
The engagement key (Fig. 7S-6) should be replaced if it shows significant wear on the surface facing towards the gear ring on the kick start gear wheel.
Check the engagement sledge (Fig. 7S-8) for any deterioration or damages.

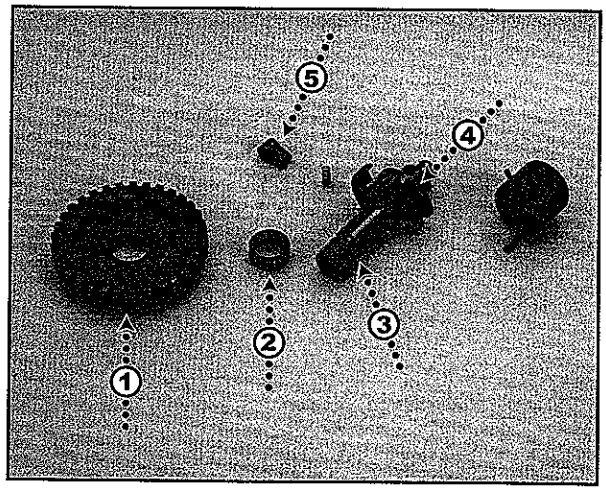


Fig. 7AE

Function of the decompression device:
When the kickstart lever is activated from the very top of the orbital path (Fig. 7AF-1) the decompression device (Fig. 7AF-2) lifts the decompression lever (Fig. 7AF-3). When the kickstart mechanism is brought back the chamfered edge of the decompression device (Fig. 7AF-4) pushes the decompression lever back towards the crankcase half thus letting the kickstart mechanism return to its home position.

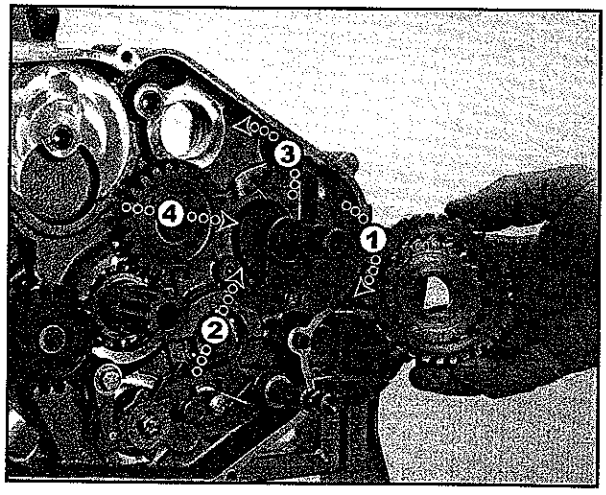


Fig. 7AF

ASSEMBLY OF KICKSTART MECHANISM

Install the spring as shown. The bent part of the spring (Fig. 7AG-1) gripping into the slot of the crankcase (Fig. 7AG-2) and the straight part of the spring (Fig. 7AG-3) facing outwards from the crankcase half.

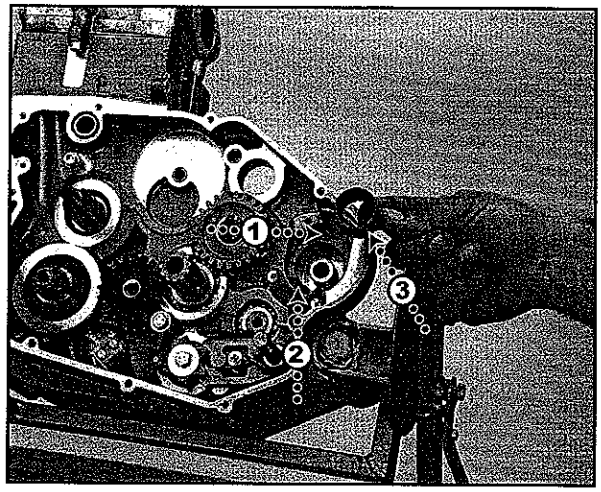


Fig. 7AG

Install the kickstart shaft into the machined hole of the crankcase with the spring fitted in the hole as shown (Fig. 7AH-1).
Turn the kickstart shaft, with the help of the kickstart lever or other suitable tool (Fig. 7AH-2), clockwise and by pushing the shaft into its seat, until the engagement key (Fig. 7AH-3) hooks up on the the engagement sledge (Fig. 7AH-4) and the shaft bottoms in its seat.

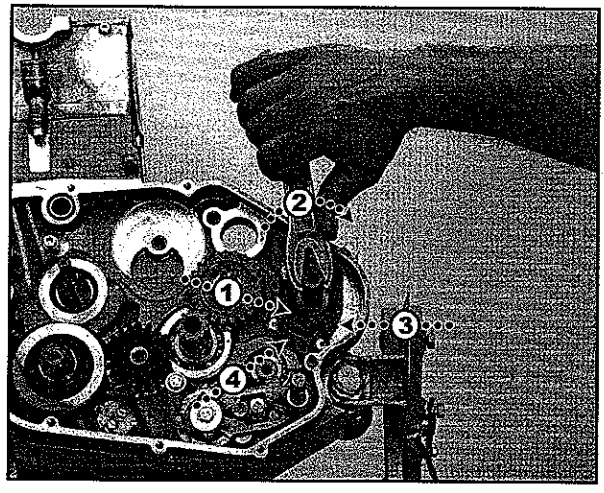


Fig. 7AH

Install the needle bearing (Fig. 7AI-1) and the kickstart gear wheel (Fig. 7AI-2) onto the shaft and within the cogs of the intermediate gear wheel (Fig. 7AI-3). Install the clutch according to section 7A.

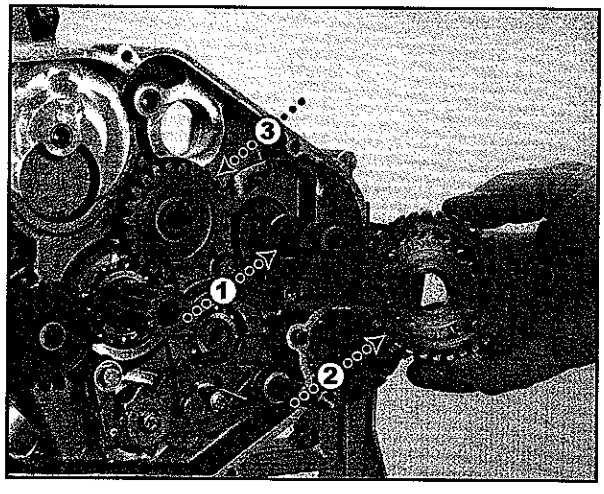


Fig. 7AI

Before fitting the transmission cover a thin layer of silicone or other gasket paste muste be appilied to the mating surfaces on both crankcase and transmission cover. This is needed on the rear end between point A and B.

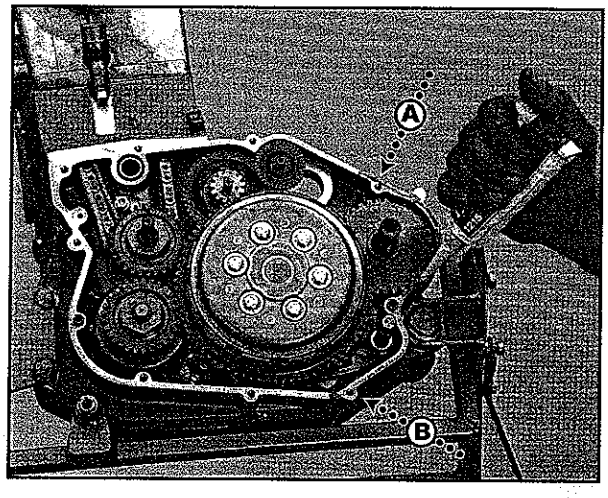


Fig. 7AJ

ELECTRIC STARTER

Attach the gearshift lever in prefered position. Slide the kickstart lever onto the shaft in a position, the lever facing outwards, just slightly touching the kick starter stop knob (Fig. 7AK-1). You should have to bend the lever slightly backwards to be able to fold it in, otherwise necessary rotary angle is lost and the bike might be difficult to start.
Add some threadlock liquid to the screws of the levers and tighten the screws using a torque of 10 Nm.
Fill the engine with the adequate quantity of oil.

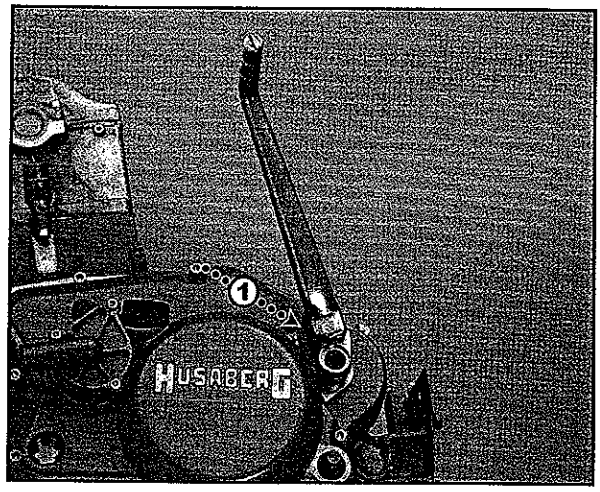


Fig. 7AK

DISASSEMBLY OF ELECTRIC STARTER

Remove the ground cable from the battery. Then remove the feeder cables from the starter relay (Fig. 8A-1) and the socket (Fig. 8A-2) from the cable harness. Pull the relay and rubber sleeve (Fig. 8A-3) from its plate. Remove the two M6 screws (Fig. 8A-4) and lift off the relay plate.

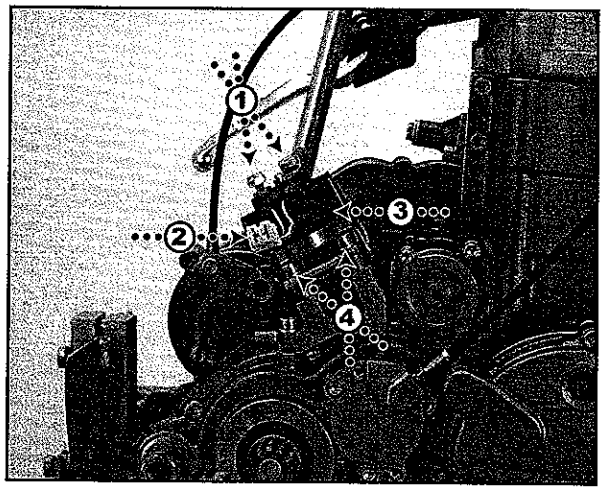


Fig. 8A

By slightly turning the starter motor back and forth (Fig 8B-A), pull it out of its seat in the left crankcase half. Be careful not to damage the o-ring placed around the motors nose. When the motor back plate meets the motor support (Fig. 8B-1) it can be lifted out.

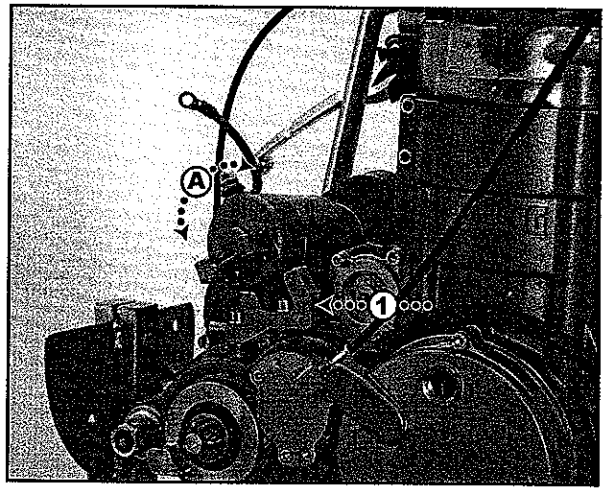


Fig. 8B

8

ELECTRIC STARTER

The rotation of the starter motor is transmitted over a reduction gear (Fig. 8C-1) and a free wheel gear (Fig 8C-2) to the clutch. The reduction gear can be pulled straight out of the crankcase. To gain access to the free wheel the clutch has to be removed according to section 7A. Then pull the free wheel unit out holding the outer gear.

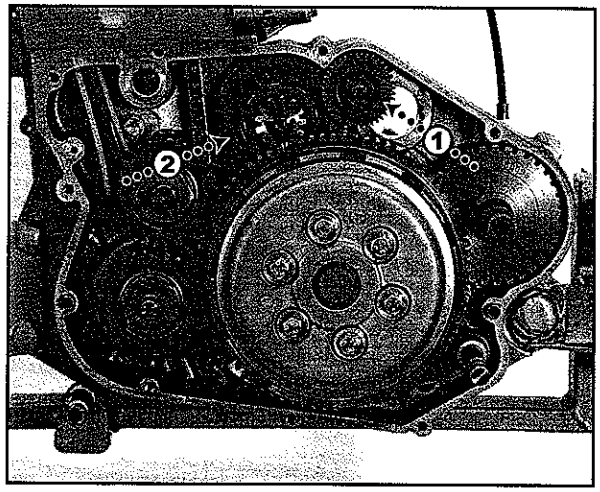


Fig. 8C

Early reduction gears are from a solid design. Check the teeth (Fig. 8D-1) and shaft ends (Fig. 8D-2) for damages and deterioration. Also check the needle bushings in both ckankcase and transmission cover. Later engines (Mid 2002 and on) has a friction slip-clutch built in, to avoid damage to the starter motor at backfire. It is recommended to fit a friction gear if replacement is required.
The friction gear can not be dismantled so if it has lost its torque (9-15 Nm is acceptable), the whole unit must be replaced.

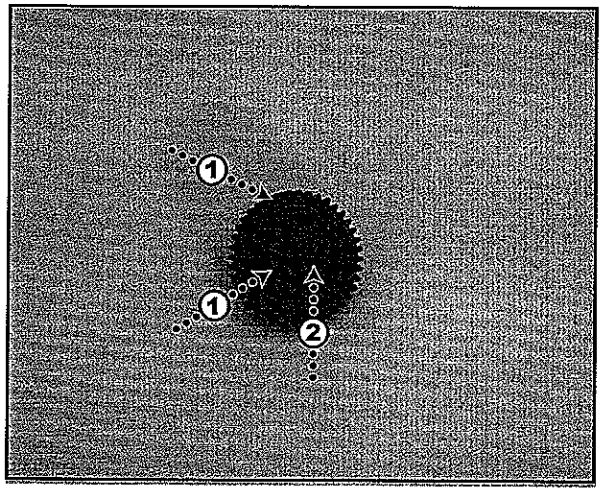


Fig. 8D

The freewheel consists of inner and outer gear, clutch unit and needle bearing. Check the surface of the outer gear (Fig. 8E-1) and the surface och the inner gear (Fig. 8A-2) for damage or deterioration. On the clutch unit special care must be taken on the mating surfaces (Fig, 8E-3) between "roller" and the surfaces of the gears.If flat surfaces occur in the "rollers", the clutch might slip and the freewheel will just spin.

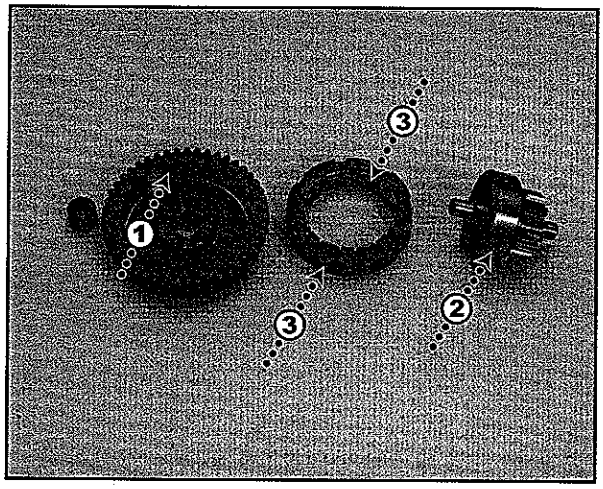


Fig. 8E

VALVE ADJUSTMENT

Put the engine in TDC position on compression stroke (see Section 5). Unscrew the two screws of each valve adjustment cover (Fig. 9A-1) and remove the covers including the gaskets.

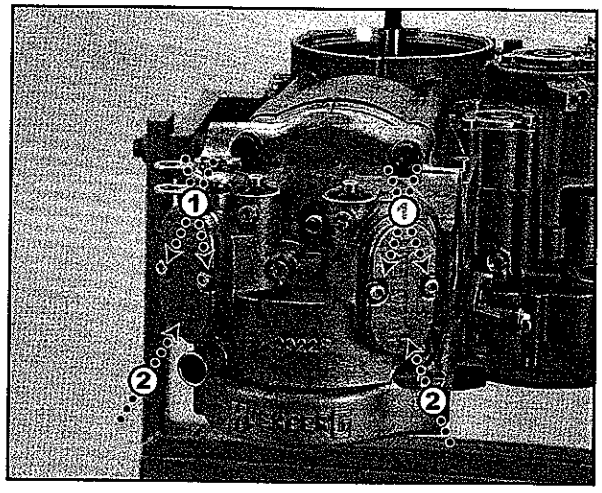


Fig. 9A

With the use of a feeler gauge check the play of each four valves in between the feet of the adjustment screws and the top of the valve stems. Valve clearance should be 0,10 mm.
With some experience this clearance can be obtained by setting the adjustment screw slightly against the valve stem and then back it out by turning the screw 1/8 of a revolution counterclockwise.
(One full revolution of the screw equals 0,75mm)
If an adjustment is needed release the lock nut (Fig. 9B-1) and adjust by turning the adjustment screw (Fig. 9B-2).
With the adequate play obtained hold the adjusment screw while tightening the lock nut, torque 12 Nm.

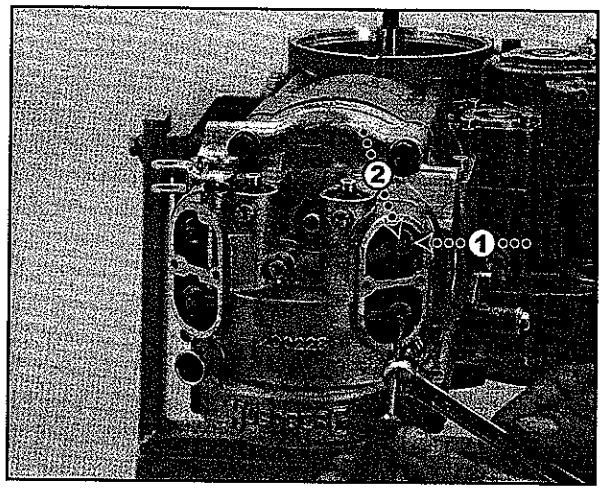


Fig. 9B

Check the axial play (Fig. 9C-1) of the rocker arms. Adequate play should be between 0,05 and 0,1 mm.
If an adjustment is needed release the screw of the rocker arm in question (Fig. 9C-2), push onto the end cap/screw of the rocker arm (Fig. 9C-3) as shown (Fig. 9C-4) and tighten the rockerarm screw, torque 10 Nm.
Check the gaskets and the valve adjustment covers for any damages or deterioration.
Refit the covers and gaskets and screw on the four screws, torque 5 Nm.

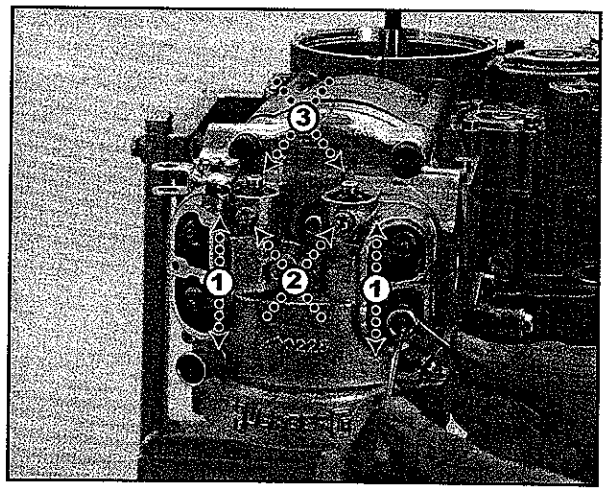


Fig. 9C

DECOMPRESSION ADJUSTMENT

Put the engine in the TDC position on compression stroke (see Section 5).
Check that the decompression cable is well lubricated and runs smoothly.
Check the play of the valve decompression lever (Fig. 9D-1) which should be 2 ±1 mm (Fig. 9D-2).
If an adjustment is needed release the lock nut (Fig. 9D-3) and turn the adjustment screw (Fig. 9D-4).
Tighten the lock nut when the adequate play is obtained.

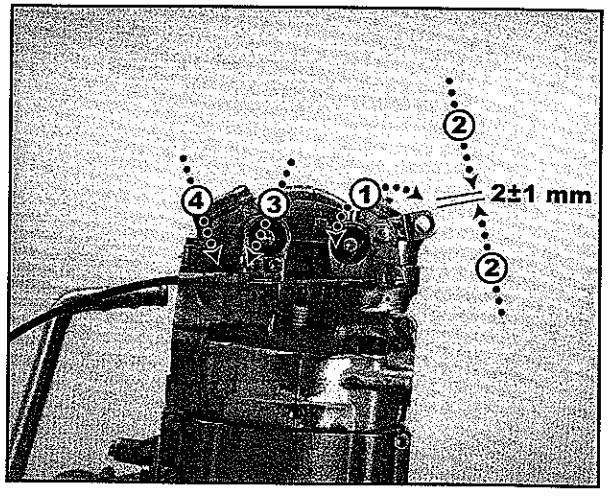


Fig. 9D

DISASSEMBLY OF CYLINDER HEAD

Drain the engine oil and the coolant liquid from the engine.If the engine is within the frame dismantle the carburettor, the spark plug cap and the exhaust pipes (see Section 10A).
Unscrew the two screws (Fig. 9E-1) holding the attachment bracket of the decompression cable.
Lift the cable out of the valve decompression lever (Fig. 9E-2) and remove the cable and the bracket from the cylinder head.

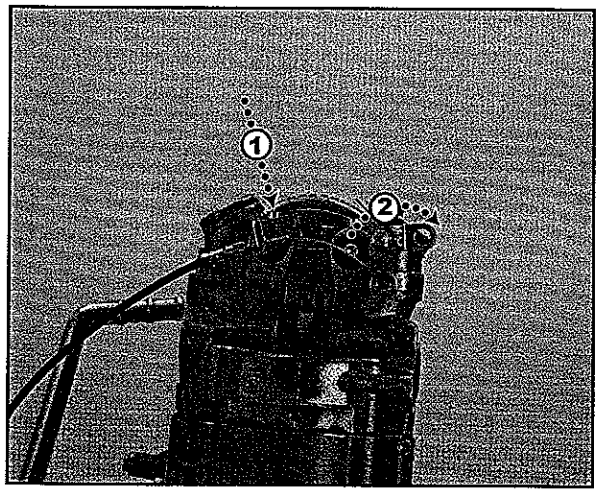


Fig. 9E

Unscrew, cross-wise, the seven screws (Fig. 9F-1, 2, 3) holding the valve cover. It is easiest to remove the center screw last.
Please observe the different lengths of the screws:
Two screws 50 mm (Fig. 8F-1)
Two screws 20 mm (Fig. 8F-2)
Three screws 45 mm (Fig. 8F-3)
Remove the cover.

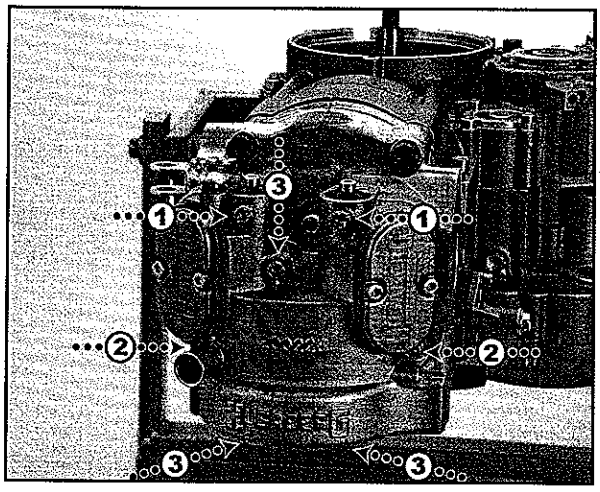


Fig. 9F

Unscrew the center bolt of the timing chain tensioner (Fig. 8G-1) and remove the bolt including the washer and the spring.
Unscrew the two screws of the tensioner (Fig. 8G-2) and remove the tensioner incl. the gasket.
Check the position of the tensioner push rod and if it is within the outer positions make a check of the timing chain and the timing sprockets regarding wear.

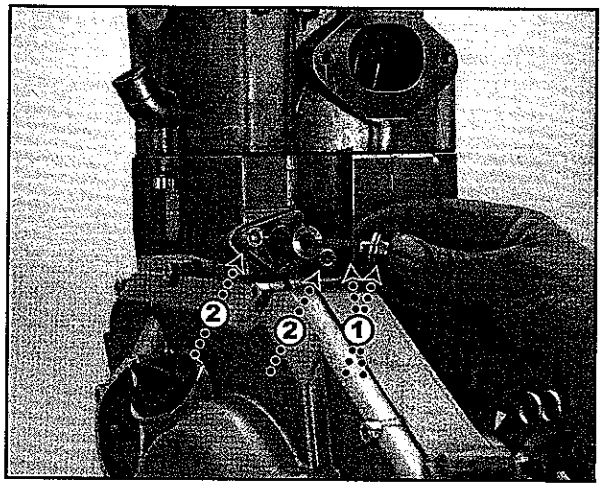


Fig. 9G

The camchain is riveted and can be opened at any link. Use a suitable rivet press (Fig 9H-1, Article No. 270) to remove one link. Be careful not to lose the parts of the link into the engine.
Remove the timing chain from the sprocket. Secure the two ends of the timing chain in order to prevent either ends to fall into the cylinder head or the crankcase.
Lift off the camshaft from the cylinder head.

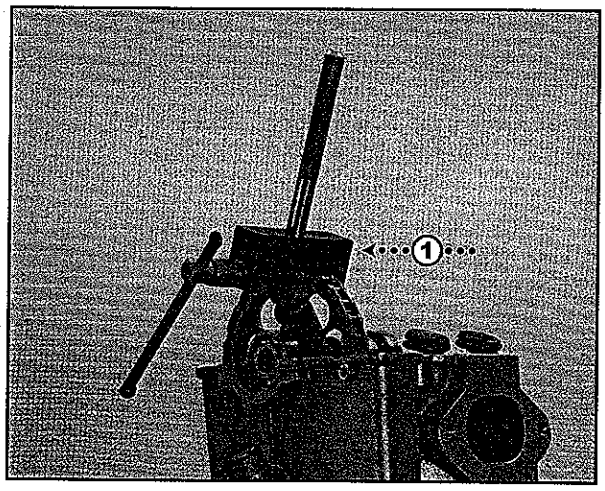


Fig. 9H

Unscrew, cross-wise, and remove the four cylinder stud screws (Fig. 9I-1) and the screw under the coolant pipe (Fig. 9I-2 Hidden).
Lift off the complete cylinderhead. Be careful not to drop the ends of the timing chain (Fig. 9I-3) down into the cylinder or crankcase.

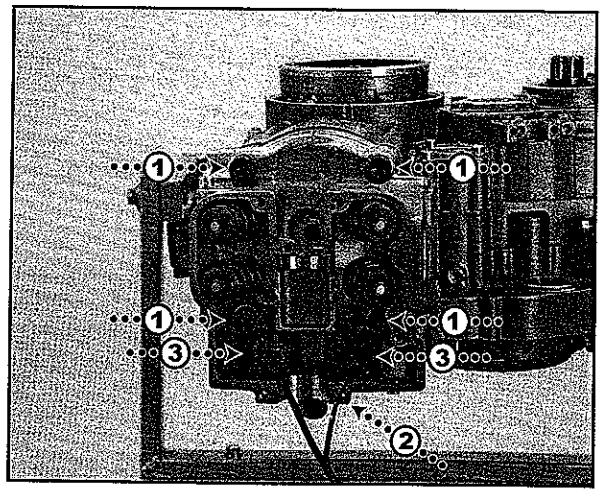


Fig. 9I

Chech the two bearings (Fig. 9J-1) for signs of wear or excessive play.
Check the intake cam lobe (Fig. 9J-2) and the outlet cam lobe (Fig. 9J-3). Both should have smooth and flat surfaces without any signs of deterioration or rough areas.

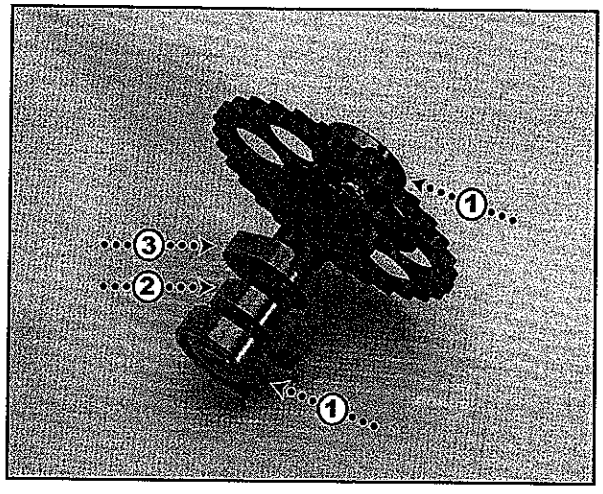


Fig. 9J

By using a suitable valve spring compressor, remove the two valve spring cotters of each valve (Fig. 9K-1), from the valve stems (Fig. 9K-2) and the valve spring retainers (Fig. 9K-3). Mark each valve and the corresponding valve seat.
Lift off the valve springs Fig. 9K-4) and the valve spring washers (Fig. 9K-5) from the cylinder head.
Remove the valve guide seals (Fig. 9K-6).

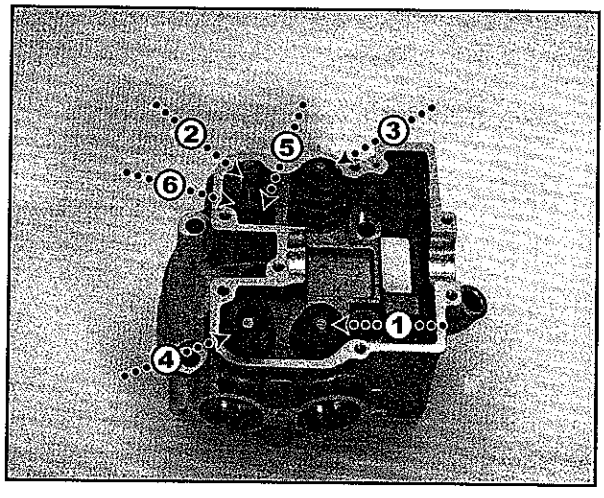


Fig. 9K

Carefully check the surfaces of the valve faces (Fig. 9L-1) and the corresponding surfaces of the valve seats for any damages or deterioration.
Check the valve stems (Fig. 9L-3) and the valve guides (Fig. 9L-4) for any damages or deterioration.

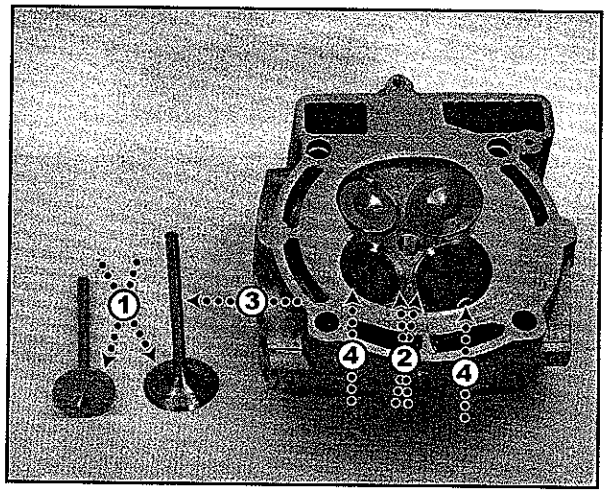


Fig. 9L

Remove the circlip (Fig. 9M-1) and pull out the decompression lever (Fig. 9M-2) including the spring (Fig.9M-3).
Check the decompression lever for any damages or wear. Especially the flat surface facing the exhaust rocker. If anu burr has apperared, the decompression device can be filed to shape while still in place.

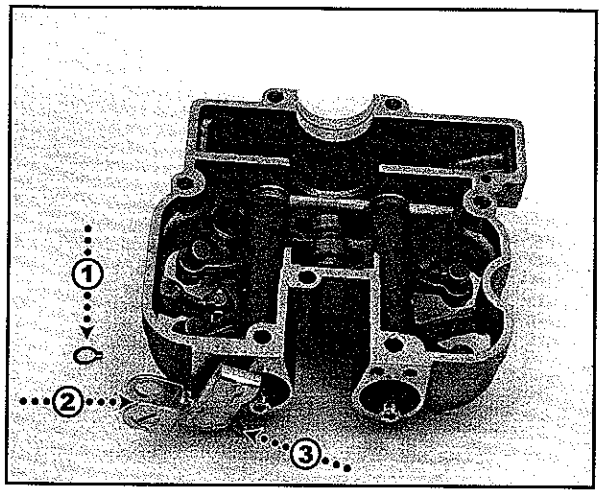


Fig. 9M

Pull out the rockerarm cap ends (Fig. 9N-1), for instance by using a washer and a M5 screw. A bent plier, pressing on the inner end of the shaft can also be used pressing out the complete unit.
Pull out the rockerarm shafts (Fig. 9N-2).
Inspect the rockerarm bearings (Fig.9N-3) and the adjustment screws (Fig. 9N-4) for any damages or deterioration.

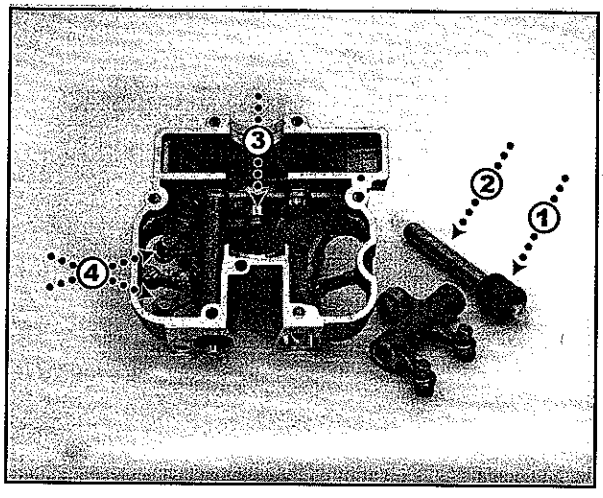


Fig. 9N

Replace the o-ring of the decompression lever (Fig. 9O-1) before installation.
Check the intake rockerarm (Fig. 9O-2) and the outlet rockerarm (Fig. 9O-3) for any signs of damage or deterioration.
Check the four bushings (Fig. 9O-4), one in each end of the rockerarms and the rockerarm shafts (Fig.9OT-5) for any damages or deterioration.
Replace the o-rings (Fig. 9O-6) of the cap ends (Fig. 9O-7) before installation.

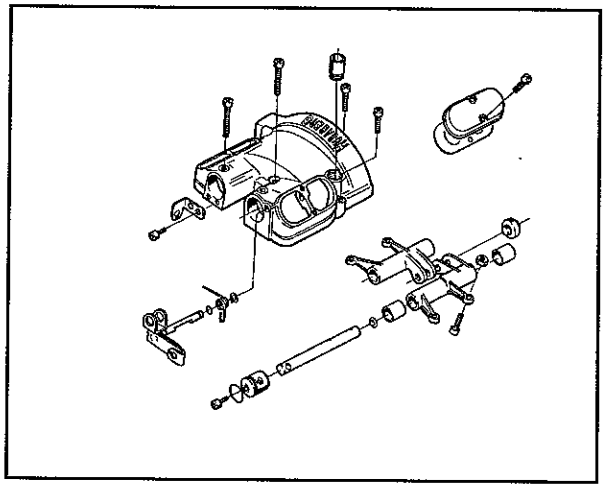


Fig. 9O

Replace the valve guide sealings (Fig. 9R-1) and also the cylinder head gasket (Fig. 9R-2) before installation.

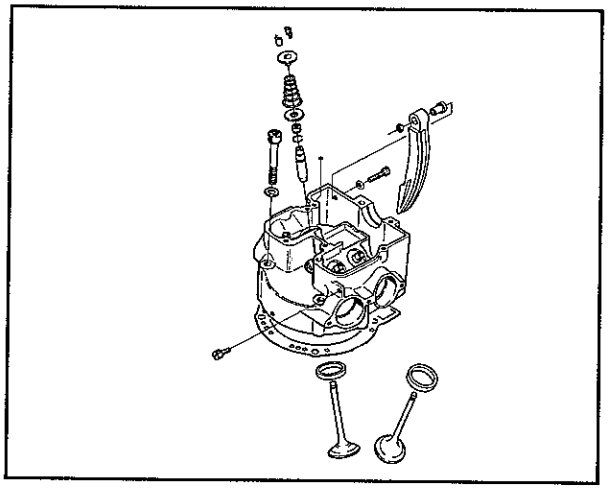


Fig. 9P

ASSEMBLY OF CYLINDER HEAD

Insert the decompressrion device (Fig. 9Q-1) into the slot of the camshaft and upper timing sprocket, slide the spring over the shaft of the device. With the straight end of the spring resting towards the camshaft (Fig. 9Q-2) just twist the spring, counter clockwise, and slide the end of the spring (Fig. 9Q-3) onto the shaft of the device. Secure the device with the spring positioned on the flat surface of the device shaft.

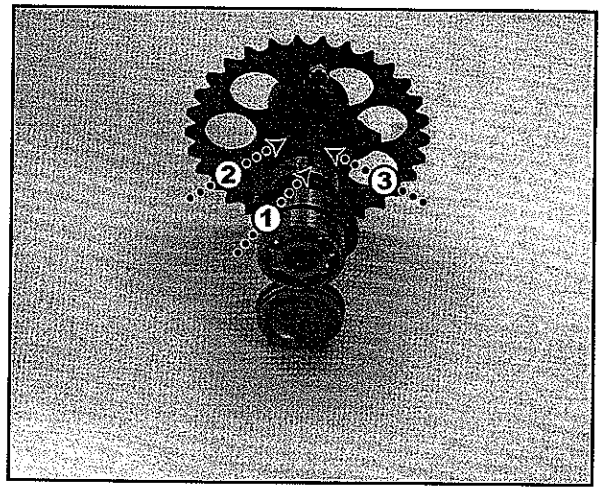


Fig. 9Q

Install the bearing (Fig. 9R-1) onto the camshaft with the help of a press. The bearing should be mounted as far as possible onto the camshaft but the decompression device has to move freely (Fig. 9R-2).

There are two different types of gears. The picture shows the steel gear for late 2002 and 2003. For 2001 a solid alu-gear was used.
On steel gears the stop screw must be fitted with a thick washer (Fig. 9R-3) to avoid breakage of the decompression device.

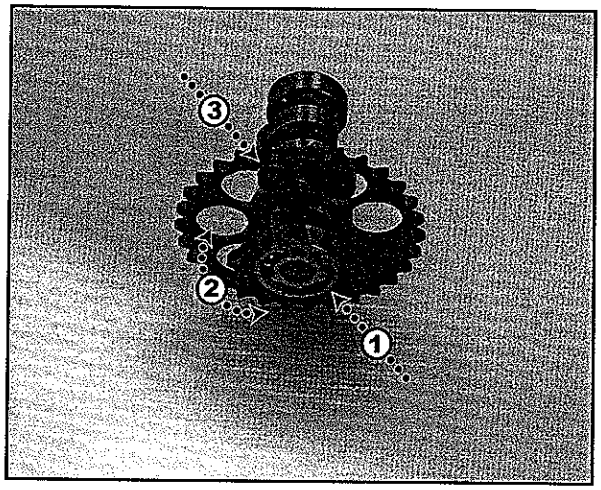


Fig. 9R

Lubricate and insert the two rockerarm shafts into the valve cover and through the two, lubricated, rockerarms (Fig. 9S-1).
Push in the two cap ends (Fig. 9S-2) and screw on the two screws (Fig. 9S-3). Make sure that the screw holes of the cap ends are in alignement with the holes of the cover (Fig. 9S-4).
Lubricate and insert the decompression lever (Fig. 9S-5), including the spring (Fig. 9S-6) into the cover and secure it with a new circlip (Fig. 9S-7).

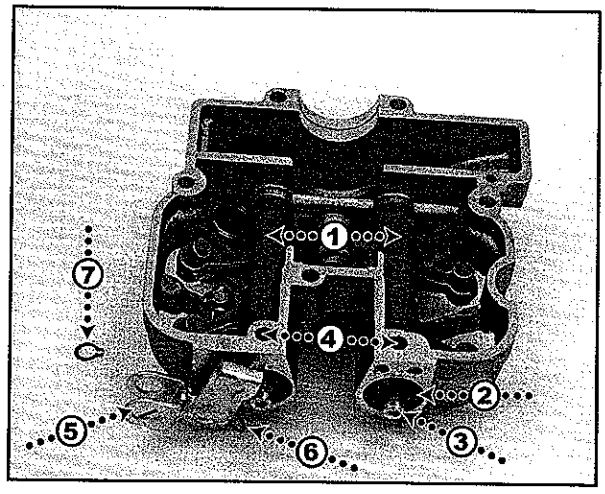


Fig. 9S

Install the four valve guide seals (Fig. 9T-1).
Lubricate the inner of the valve guide seals and slide the valves through the valve guide seals and the valve guides.
Install the valves (Fig. 9T-2) by putting on the valve spring washers (Fig. 9T-3) and the valve springs (Fig. 9T-4) onto the cylinder head and the valves, and by using a suitable valve spring compressor, secure the valves with the spring retainers (Fig. 9T-5) and the two valve spring cotters of each valve (Fig. 9T-6).

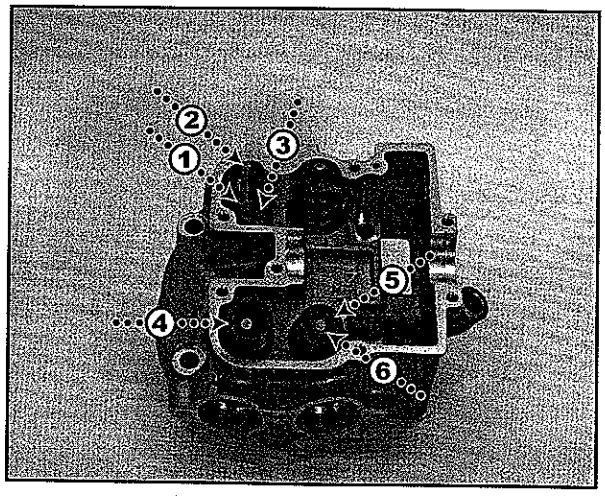


Fig. 9T

Put a new cylinder head gasket onto the cylinder. Make sure that both of the guide dowels on the top of the cylinder are in the accurate positions.
Put the cylinder head onto the cylinder and pull the two ends of the timing chain through the cylinder head. Check that the timing chain is in an accurate position onto the lower timing sprocket.
Put washers onto the four cylinder head bolts (Fig. 9U-1), lubricate the threads and tighten the bolts crosswise to torque 44 Nm.Do not forget the screw under the coolant pipe (Fig. 9U-2), torque 10 Nm.

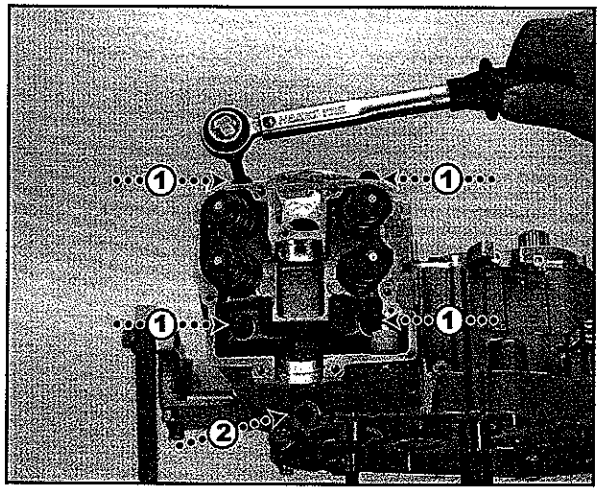


Fig. 9U

Turn the engine/crankshaft into TDC position (Fig. 9V-1). Position the camshaft with the cam lobes facing downwards and one attachment screw of the upper timing sprocket in line with the cylinder (Fig. 9V-2). Put on the timing chain onto the timing sprocket and install the timing chain lock.

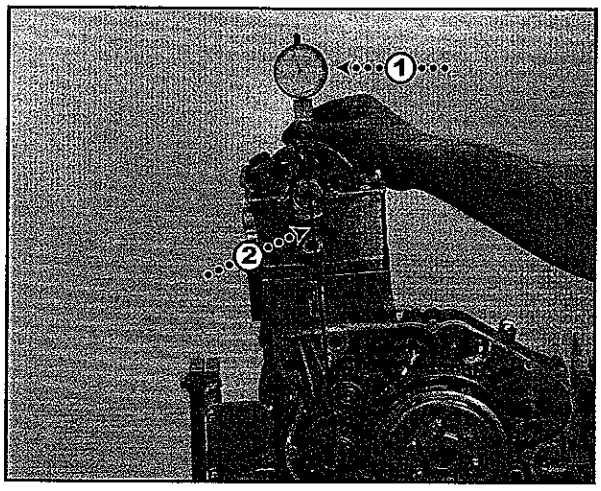


Fig. 9V

Thoroughly clean the sealing surfaces of the cylinder head and add a thin layer of silicone (Fig. 9X-1). Thoroughly clean the valve cover and put it onto the cylinder head.

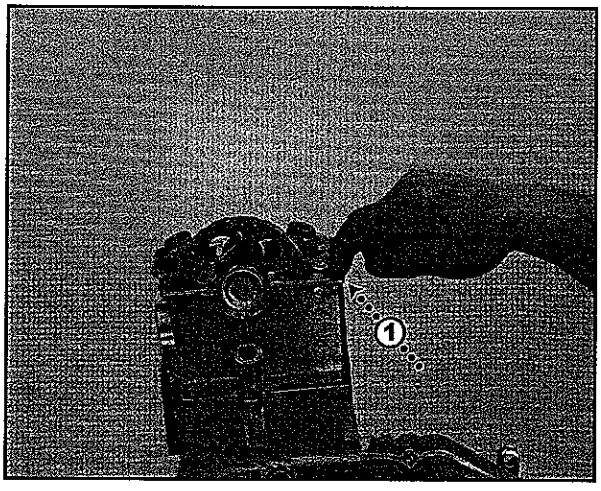


Fig. 9X

Attach the valve cover with the seven screws.
Please observe the different lengths of the screws:
Two screws 20 mm (Fig. 9Y-1)
Three screws 45 mm (Fig. 9Y-3)
Two screws 50 mm (Fig. 9Y-2).
Torque 10 Nm.
Also mind that the decompression lever has to be turned vith the fork lever pointing forward and the flat lever downwards (Fig. 9Y-4).

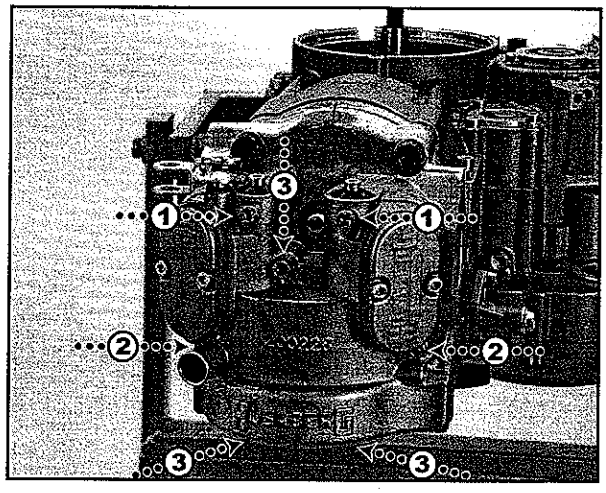


Fig. 9Y

Install the timing chain tensioner and a new gasket. Before installation; press in the spring loaded hook (Fig. 9Z-1) to release the tensioner push rod (Fig. 9Z-2) and push the rod into the bottom position towards the rear part of the tensioner (Fig. 9Z-3).
Push the spring into the tensioner and towards the push rod, put on the washer and the screw and tighten the screw.

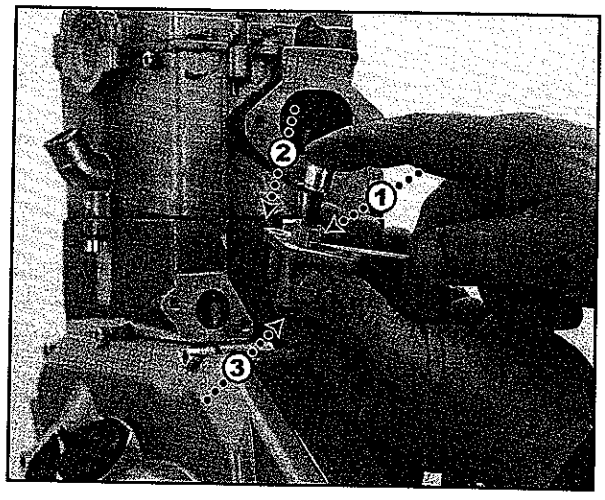


Fig. 9Z

Finally, adjust the valves (see Section 9A). Attach and adjust the decompression cable (see Section 9B).
Install transmission cover, the gearshift lever and the kickstart lever (see Section 7D).
Fill the engine with the adequate quantity of oil and the cooling system with the adequate quantity of coolant liquid.

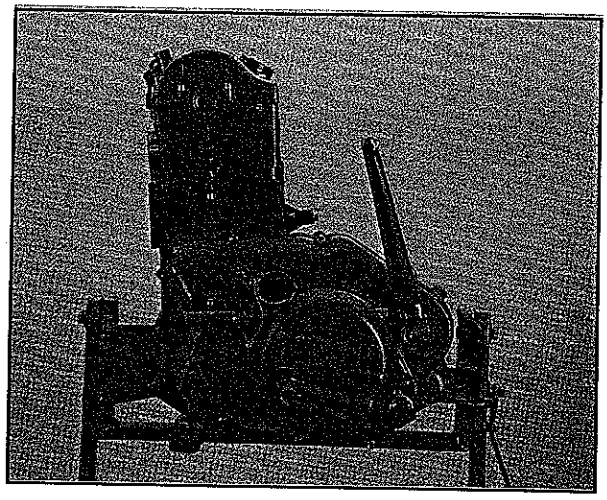


Fig. 9AA

REPLACEMENT OF ROCKERARM ROLLERS

Knock out the pin (Fig. 9AB-1) of the roller using a rod and mallet. Make sure that the rocker arm, and especially the lower ear (Fig. 9AB-2), is well supported to avoid damage.

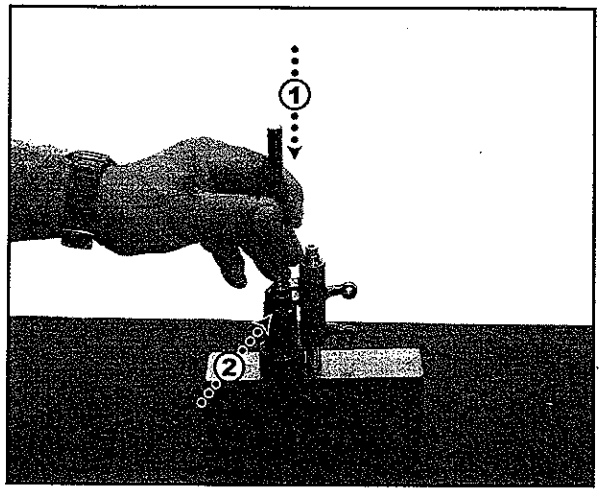


Fig. 9AB

When fitting the new roller, grease the needles to make them stick in the roller, place the roller between the arms and center it with a pin or rod, slightly smaller than the rollers own pin (Fig. 9AC-1).
The easiest way to fit the new pin is to turn the rocker arm and knock the pin from the side that allready is damaged. That way you only have to deform one ear to lock the pin.

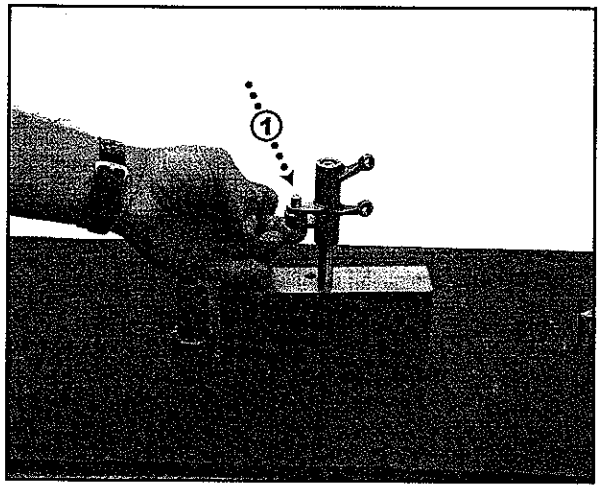


Fig. 9AC

Using a pointed tool, knock dents in the rocker arm ear to press material over the end of the pin. Two dents are sufficient.

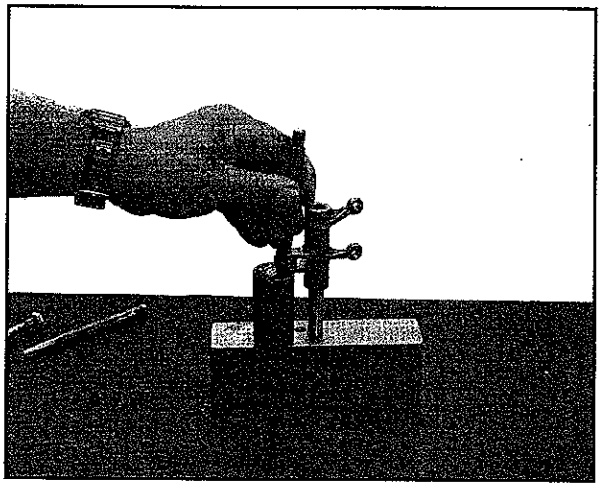


Fig. 9AD

Measure the rollers axial play. It should be between 0,3 and 0,5 mm to let oil in to the needles.

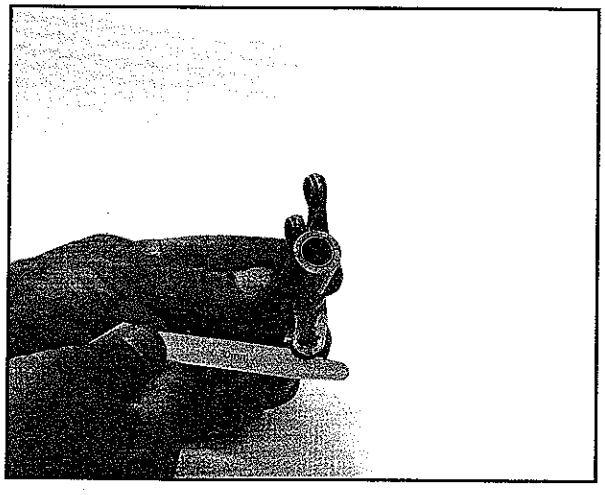


Fig. 9AE

10-B CRANKSHAFT & GEARBOX

DISASSEMBLY OF CRANKCASE

Dismount the engine from the frame.
Dismantle the cylinder head (See section 9D).
Dismantle the kickstart lever, the gearshift lever and the transmission cover (see Section 7A).
Use another primary gear wheel (Fig. 10A-1), or part thereof, in order to block the crank shaft while unscrewing the nut of the primary gear wheel (Fig. 10A-2). Use the same method for the nut of the balancer drive wheel (Fig. 10AI-3).

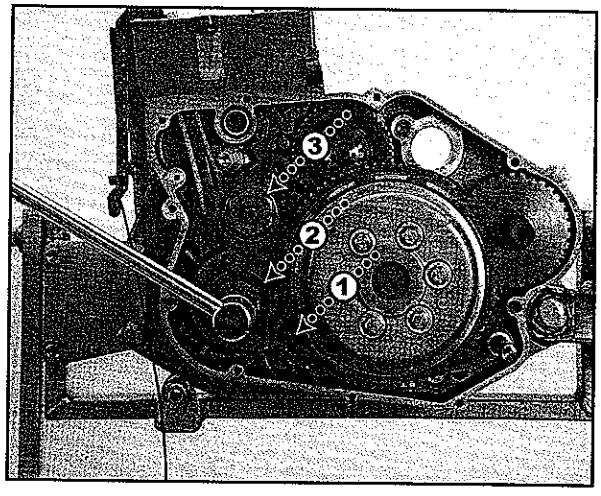


Fig. 10A

Dismatle the clutch (see Section 7A) and remove the oil connection nozzle (Fig 10B-1) before attaching a spanner to the crankshaft end.

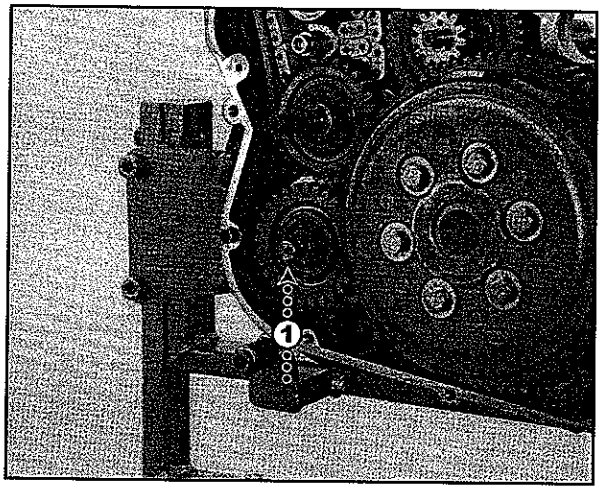


Fig. 10B

Remove the primary drive gear (Fig. 10C-1), the lower timing sprocket (Behind primary gear) and the balancer drive gear (Fig. 10C-2) by using a suitable spanner (Fig. 10C-3).
Dismantle the gear shift mechanism (see Section 7B), the kickstart mechanism (see Section 7C), the electric start free wheel (see section 7 D).

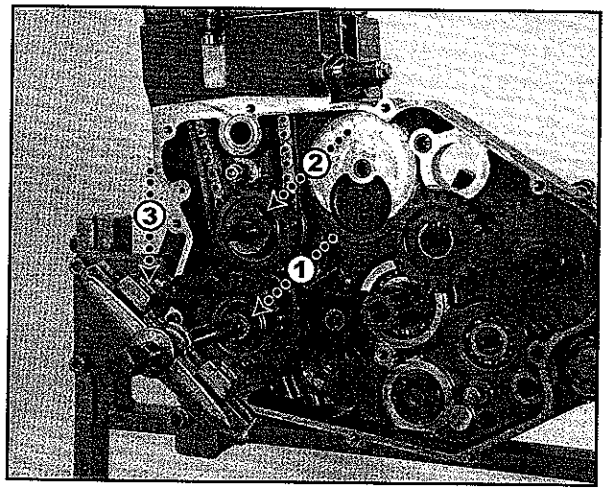


Fig. 10C

Remove the alternator/ignition (see Section 5) and the oil filter (see section 6).
Unscrew the twelve screws of the right crankcase half (Fig. 10D-1) and any screw or bolt holding the crankcase halfs within any engine stand (Fig. 10D-2).

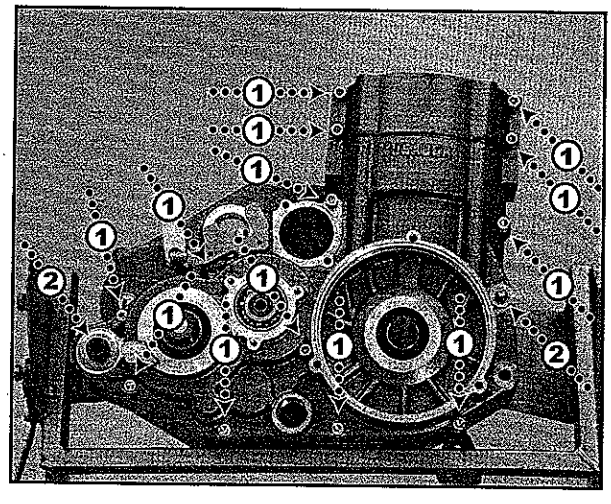


Fig. 10D

10

Attach a crankcase puller (Fig. 10E-1, Article No. 270011-01) to the crankcase by using three M6x20 screws (Fig. 10E-2).
While screwing in the center bolt of the crankshaft puller; gently tap on the secondary shaft and, if any engine stand is used, also tap on the attachment tube of the stand (Fig. 10E-3). Be careful to have the two crankcase halfs aligned all time during the operation.
Lift off the right crankcase.

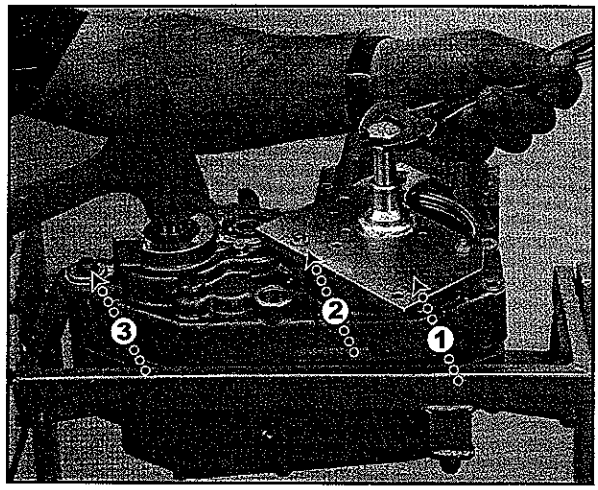


Fig. 10E

6-speed gearbox: Pull the two shift fork shafts (Fig. 10F-1) out of the left crankcase half and move them aside along with the shift forks, thus freing the shift drum (Fig. 10F-2).

4-speed gearbox: Pull out the single shift fork shaft (Fig. 10F-1) out of the left crankcase half and the two shift forks.

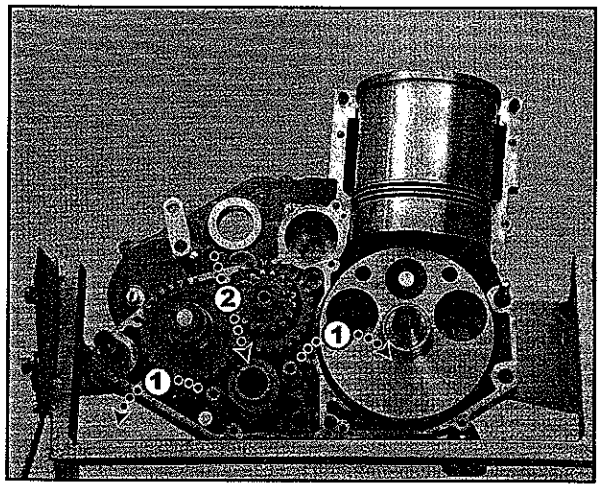


Fig. 10F

Lift out the shift drum (Fig. 10G-1). The shift drum might need to be gently knocked out from the transmission side of the crankcase half in order to release it from the crankcase.
Lift out the three (4-speed: two pcs) shift forks (Fig. 10G-2).
The shift forks may also be lifted out together with the complete gear shafts, the main shaft (Fig. 10G-3) and the secondary shaft (Fig. 10G-4).

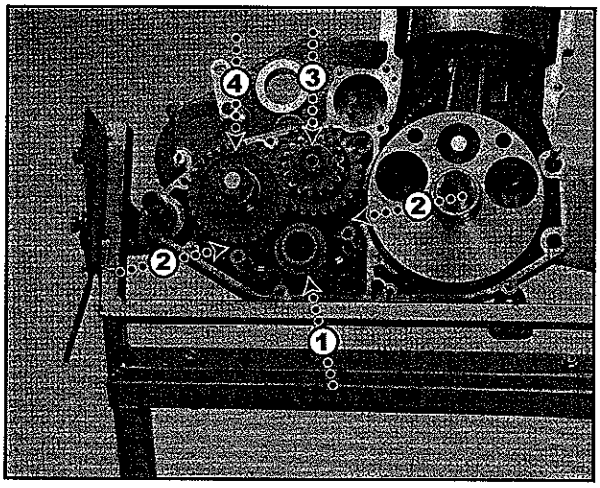


Fig. 10G

Both gearshafts, including all gear wheels, are to be lifted out at the same time. The main shaft might need to be knocked out from the transmission side of the crankcase half.

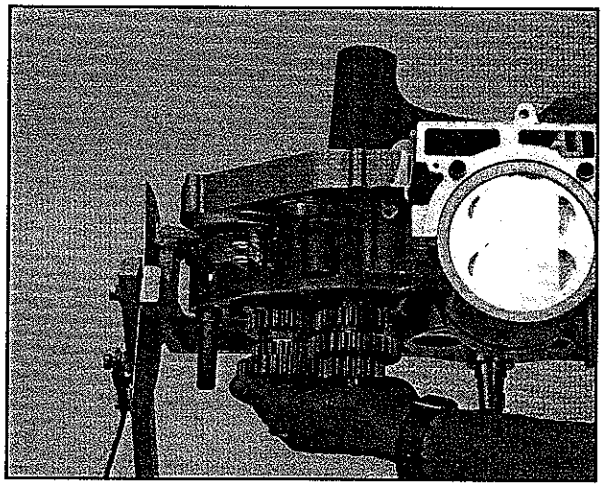


Fig. 10H

10-B CRANKSHAFT & GEARBOX

Check inner surfaces of the shift forks (Fig. 10V-1) and the shiftfork shafts (Fig. 10V-2, 3) for any damages or deterioration.
Check the grooves in the shift drum (Fig. 10V-4) for any damages or deterioration. Check that the gear positioning surfaces in the grooves are flat.
Check the condition of the o-ring (Fig. 10V-5).
Check the dogs of each gear wheel and the corresponding slots for any damages or deterioration. Especially regarding the gear wheels on the secondary shaft.
Check the bearings (Fig. 10V-6, 7, 8, 9, 10, 11) and rollers (Fig. 10V-12) for any damages or deterioration.

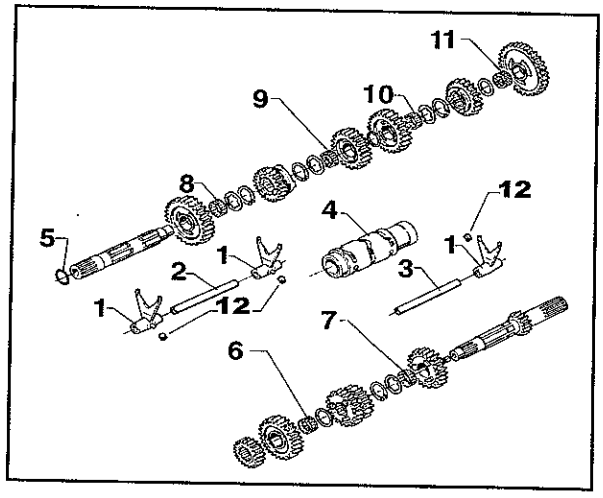


Fig. 10I

Attach the crankcase puller (Fig. 10J-1, Article No.270011-02) to the crankcase by using three M6x25 screws (Fig. 10J-2).
While screwing in the center bolt of the crankshaft puller, hold the crankshaft firmly during the operation.
Support the cylinder liner (Fig. 10J-3) as the crankshaft is pressed out.

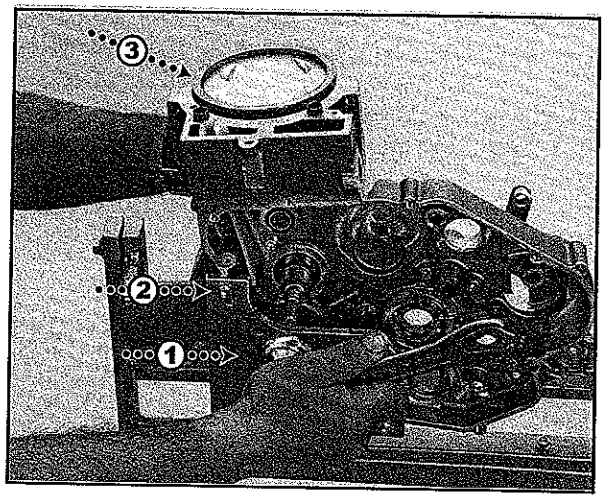


Fig. 10J

Mind that the complete assembly - crankshaft, counterbalancer, connecting rod and piston with cylinder liner - comes out as one item.
Lift out the crankshaft when it is released from the bearing within the crankcase half.

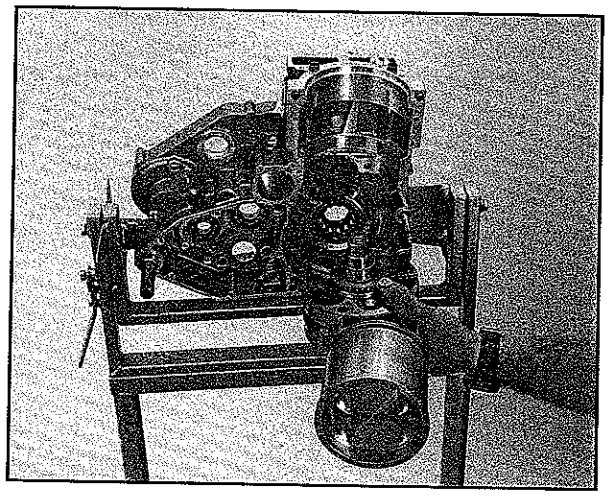


Fig. 10K

Remove the counter balancers drive shaft (Fig. 10L-1) by tapping it with a soft mallet from the left side.
The pressure relief valve (Fig. 10L-2) is normally not any subject to either cleaning or dismantling but if needed; remove the circlip out of the housing in order to remove the washer , the spring and the steel ball.
Install all pieces in the exact and adequat position within the housing and by using a new circlip.
If the housing has been removed use a threadlock liquid in order to secure it into the crankcase half.

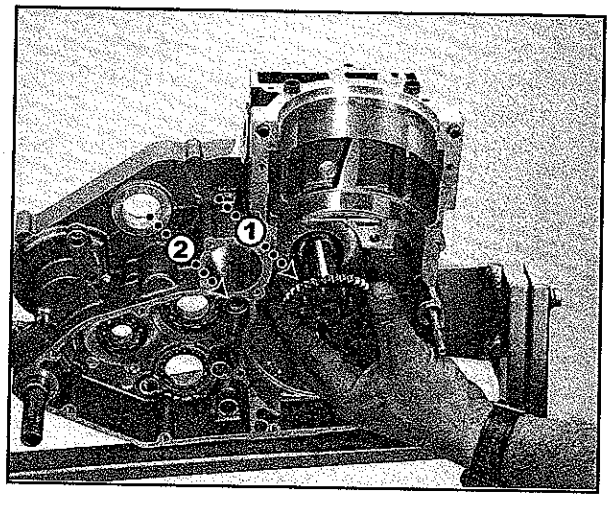


Fig. 10L

10

Thoroughly clean and check all machined surfaces for any damages or deterioration.
By using compressed air; thoroughly clean the oil duct from the oil pump to the oil filter housing (Fig. 10M-1) and the duct from the oil screen housing (Fig. 10M-2) to the pump in both directions.
This also goes for the hole from the oil filter to the crankshaft housing (Fig. 10M-3). Blow from the crankshaft side towards the filter since the hole is more narrow at the crankshaft end.
Check the two rear flange bushings (Fig. 10N-1) and the four front flange bushings (Fig. 10N-2) for any signs of damage or deterioration.

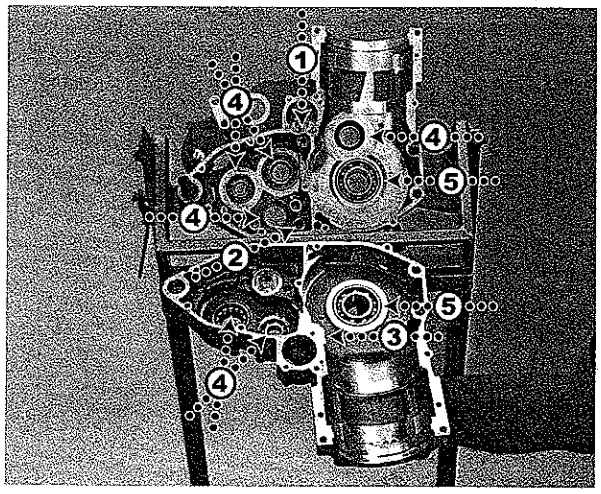


Fig. 10M

Check the crankshaft bearings (Fig. 10M-5/10N-3) and the six other bearings (Fig. 10M-4) in the crankcase halves for any signs of damage or deterioration. Crank shaft has ball bearings for models 2001-2002 (Fig. 10N) and roller bearings for model 2003 (Fig. 10M). If a replacement is needed; heat up the crankcase half to 200°C and space out the bearings by tapping gently on the backside of the bearings and the crankcase half. The new bearings should be installed while the crankcase half still is hot and thus easy to fit into the adequate bottom positions.
Check all sealings for any damages or deterioration.

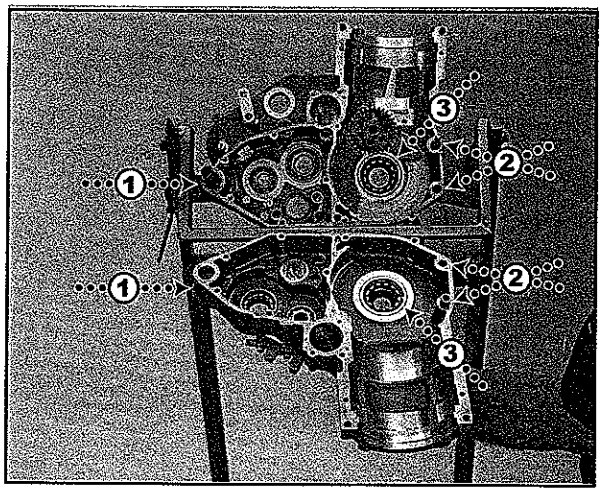


Fig. 10N

The transmission has been modified with different tooth profile between 2001 and 2002. The easiest way to determine how an engine is built is to look at the counter balancers' drive shaft. The early shaft (left) has a straight surface and the newer (right) has a diameter change between the position for the timing sprocket and the drive gear.

Following gears are *not* interchangeable between 2001 and 2002/2003.
Counter balancer, balance drive shaft, drive gears on balancer drive shaft and crank shaft, and also the outer clutch basket.

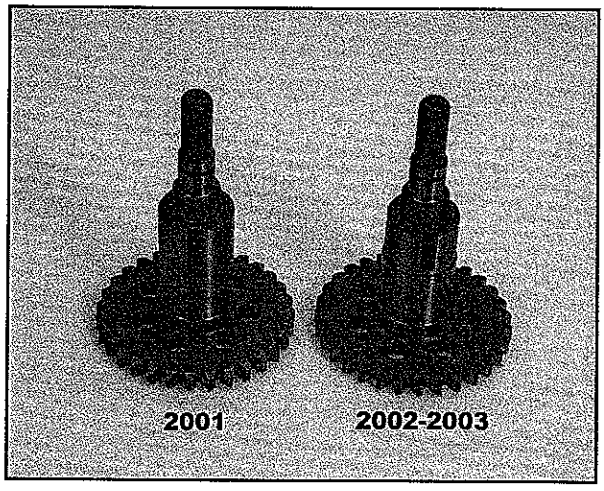


Fig. 10O

Counter balancers has also been subject to changes. Part from tooth profile the bearings has changed during the model year 2002. The left balancer is fitted with a single bearing and the right balancer has two bearings next to each other.

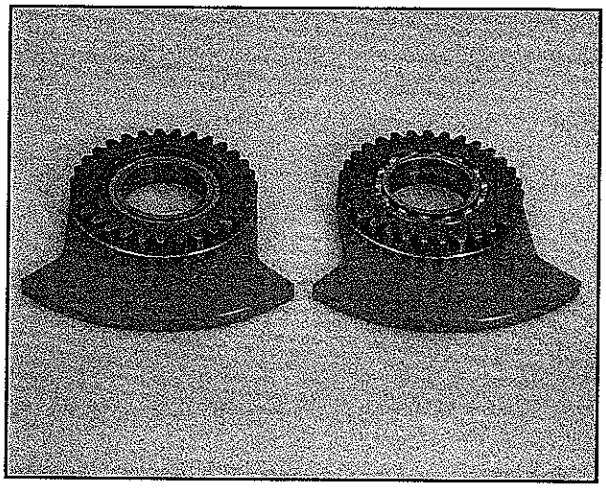


Fig. 10P

10-B CRANKSHAFT & GEARBOX

Dismantle the crankshaft by using a hydraulic press onto the crank pin (Fig. 10Q-1). Always press the crankpin (Fig. 10Q-2) out of the crankshaft counter weight from the outer side of the weight.

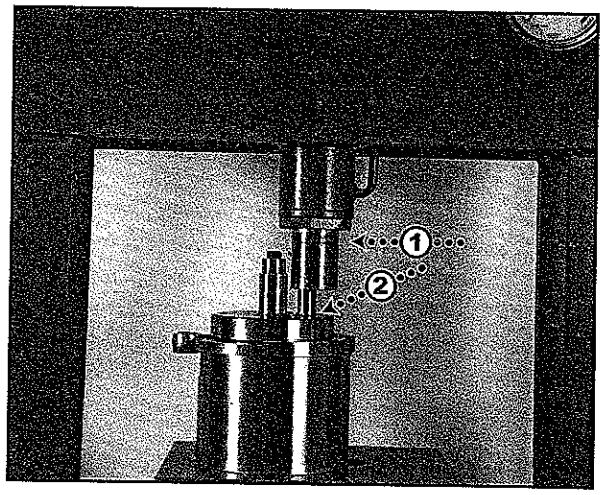


Fig. 10Q

Check the inner surface of the connecting rod (Fig. 10R-1) for any signs of damages or deterioration. The surface should be totally without any edges or level differences.
Check the crank pin (Fig. 10R-2) for any damage or deterioration. The surface should be totally flat without any edges or level differences.
Always install a new connecting rod bearing (Fig. 10R-3) whenever the crankshaft has been dismantled.

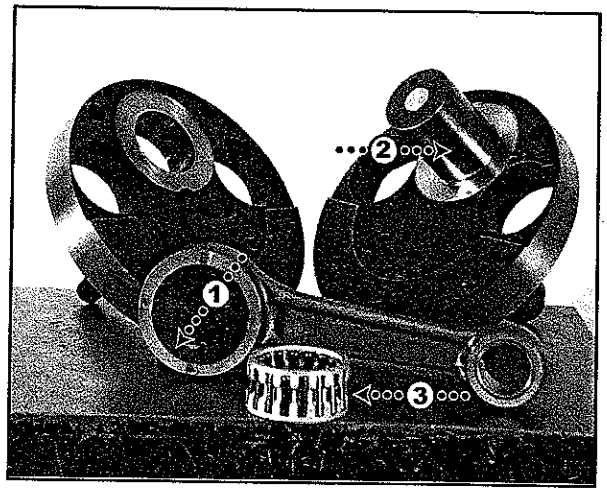


Fig. 10R

Assemble the crankshaft by using a hydraulic press. Press the crank pin into the counter weight as shown. Make sure that the counter weights are aligned (Fig. 10S-1) before pressing the crank pin into position (Fig. 10S-2).

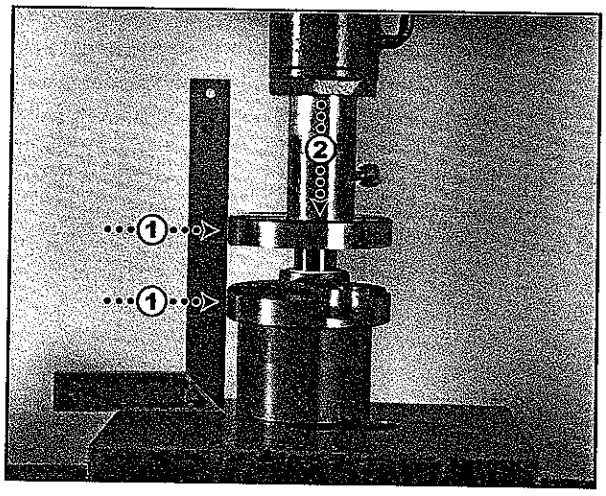


Fig. 10S

10

Measure the width (Fig. 10T-1) of the crankshaft during the operation to avoid pressing to a too narrow width. Make sure the width is measured on the bearing seat (Fig. 10T-2). The width shall be as follows.

01-02: Ball bearings. One balance bearing $62,5\ ^{+0}_{-0,15}$

01-02: Ball bearings. Two balance bearings $62,3\ ^{+0}_{-0,15}$

03: Roller bearings. Two balance bearings $62,3\ ^{+0,1}_{-0}$

Before installing the 2003 crankshaft, make sure it gets a clearance of 0,25-0,30mm on 400-550cc engines and 0,30-0,35mm on 650cc engines. Measure between the bearings in the block prior to assembly.

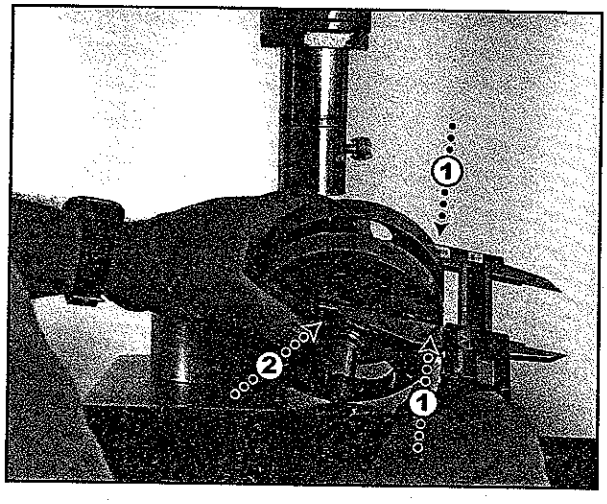


Fig. 10T

Put the crankshaft onto the measuring jig. While rotating the crankshaft (Fig. 10U-1) the two dial test indicators together (Fig. 10U-2, 3) should not show a variation larger than 0,03 mm.
If the limit of tolerance is passed the crankshaft has to be adjusted according to normal procedures.

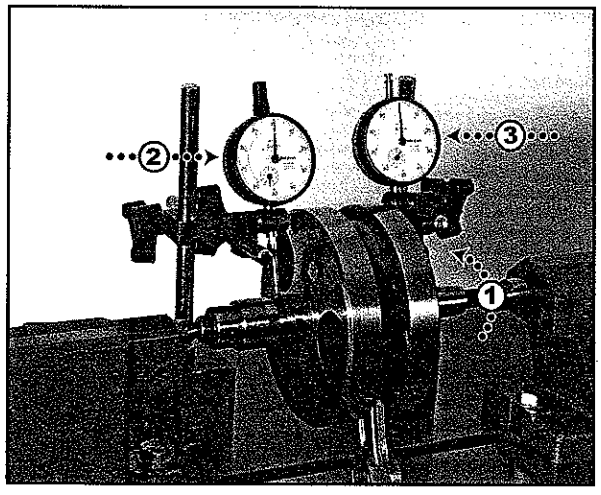


Fig. 10U

ASSEMBLY OF CRANKCASE

Lubricate the bearing for the counter balancer drive shaft and put the driveshaft into the bearing. A slight tapping with a mallet might be required.
Lubricate the crankshaft bearing including the surface of the inner ring and the bearing surfaces of the transmission/left end of the crankshaft.
When fitting the balancer to the crankshaft, make sure the balancer bearings are secured with threadlock to the crankshaft surface.
Make sure that the marked dot on the balancer drive shaft (Fig. 10V-1) corresponds to the marking on the gear of the balancer (Fig. 10V-2).

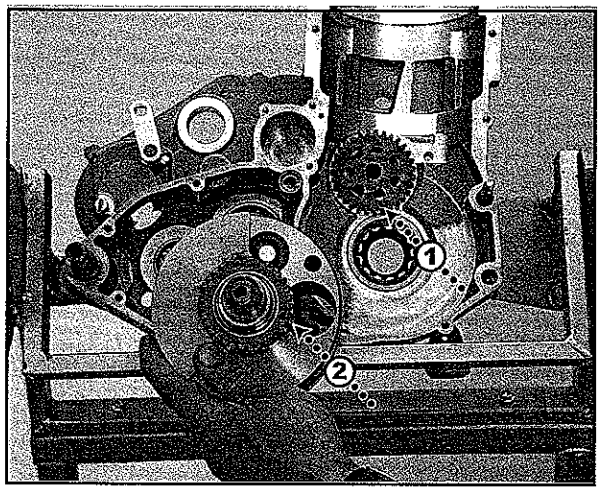


Fig. 10V

With the connecting rod facing up, slip the complete piston/liner-unit (Fig. 10X-1) over the rod. The cylinder liner must have its machined opening facing up.
Press the gudgeon pin (Fig. 10X-2) to the circlip on the far side and put in the remaining circlip on the near side.
Lubricate the two machined positions of the shift shafts (Fig. 10X-3).
Lubricate the bearings of the main shaft, of the secondary shaft and of the shift drum (Fig. 10X-4).

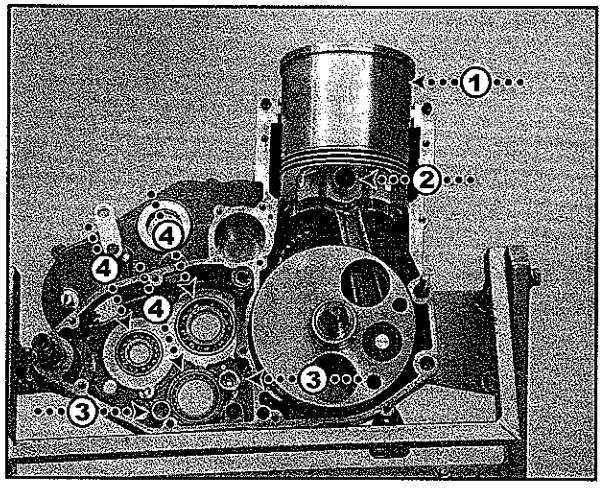


Fig. 10X

Before pressing the liner to its bottom position, turn it 180 degrees and make sure that the opening is straight to the left. The front and rear edges (Fig. 10Y-1) can be aligned with reinforcemets in the casting of the left crankcase half. Then press the liner so that the rim bottoms in it seat.

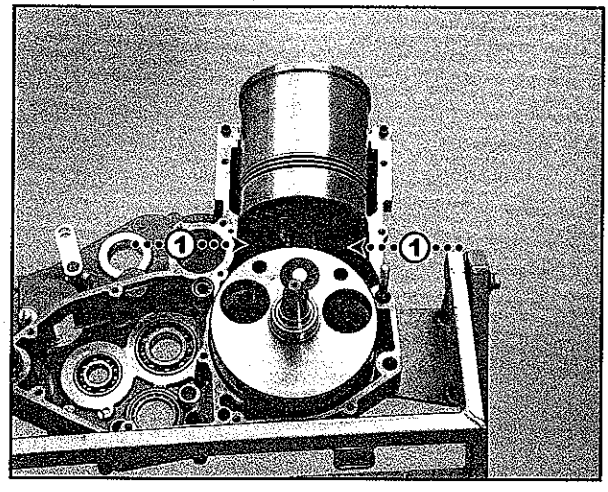


Fig. 10Y

10-B CRANKSHAFT & GEARBOX

While holding the shafts, aligned (Fig. 10Z-1), put in the main shaft and the secondary shaft into their positions in the crankcase half. Gently tap, alternately, onto the shafts until the accurate position is reached.

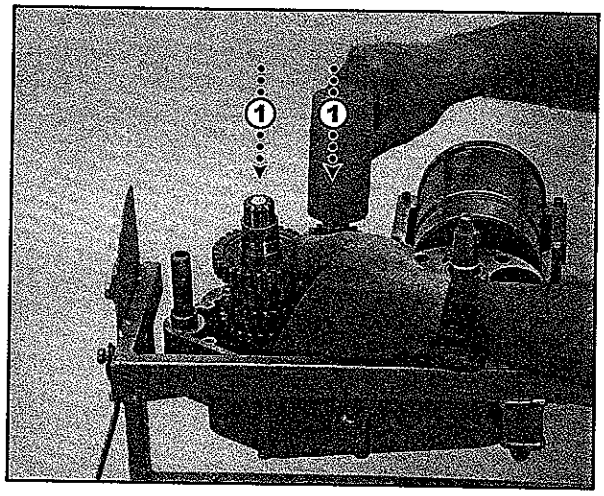


Fig. 10Z

6-speed gearbox: Slide the shift fork of the main shaft (Fig. 10AA-1) into the spline of the double/3-4th gear wheel.

4 & 6-speed gearboxes: Slide the lower shift fork of the secondary shaft (Fig. 10AA-2) into the spline of the second gearwheel from the bottom and the upper shift fork (Fig. 10AA-3) into the spline of the second gear wheel from the top.

Slide the shift drum (Fig. 10AA-4) into the bearing and gently tap it into position towards the bearing.

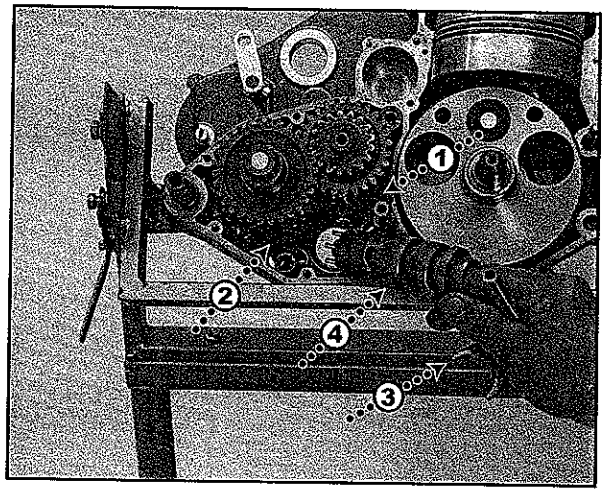


Fig. 10AA

Slide the shift fork shaft of the secondary shaft (Fig. 10AB-!) into the shift forks and by turning the shift drum (Fig. 10AB-A) and by lifting the gear wheels in question (Fig. 10AB-B) position the two shift forks into the splines of the shift drum and the shift shaft into the crankcase.
6-speed gearbox: Repeat the operation with the shift fork shaft and the shift fork of the main shaft (Fig. 10AB-2).
Lubricate the o-ring of the oil screen and push it into position in the crankcase half.

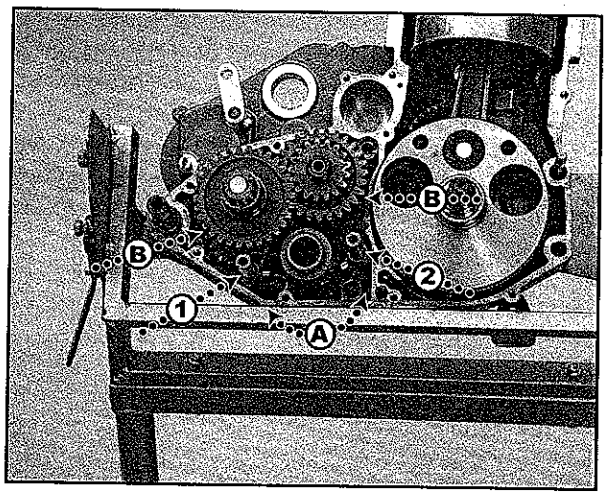


Fig. 10AB

10

Thoroughly clean the sealing surfaces of the crankcase half and add a thin layer of silicone or gasket paste (Fig. 10AC-1). Make sure that both the rear dowl and the front dowl are in a firm and straight position into the left crankcase half.
Thoroughly clean the sealing surfaces of the right crankcase half.
Lubricate all bearings and positions of shafts in the right crankcase half.
In order to prevent any damages to either the bearing or the sealing of the secondary shaft; a thin tube, or likewise, could be placed into the bearing and the sealing before putting the right crankcase half onto the left one.

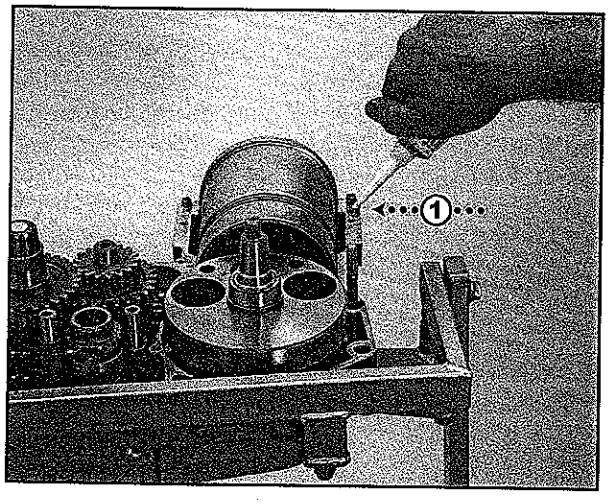


Fig. 10AC

When the crankcase halfs are fully installed towards each other; put the o-ring of the secondary shaft (Fig. 10AD-1) onto the shaft, place the spacer of the sprocket (Fig. 10AD-2), the groove towards the o-ring, onto the shaft and slide the spacer onto the o-ring and fully towards the bearing of the secondary shaft.

Attach the thirteen screws (Fig. 10AD-3) into the crankcase half and, crosswise, tighten the screws, torque 10 Nm.
Install the alternator/ignition (see Section 5) and the oil drain plug (see Section 6A).

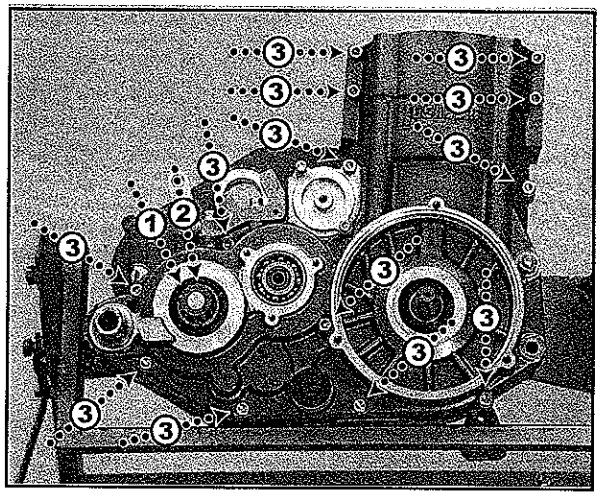


Fig. 10AD

Warm the lower timing sprocket (Fig. 10AE-1) to 200°C and slide it onto the crankshaft (Fig. 10AE-2). Use a socket, or likewise, with a center hole just wider than the crankshaft and the woodruff key and an outer diameter fit to the center of the sprocket, and a suitable rubber mallet in order to position the sprocket onto and towards the crankshaft.
Slide the timing chain through the return guide (Fig. 10AE-3), around the sprocket and up thruoghinto the channels of the crankcase half, the chain guide and the tensioner (Fig. 10AE-3) .
Install the cylinder head (see Section9D), the kick-start mechanism (see Section 7C), the gearshift mechanism (see Section 7B) and the clutch (see Section 7A).

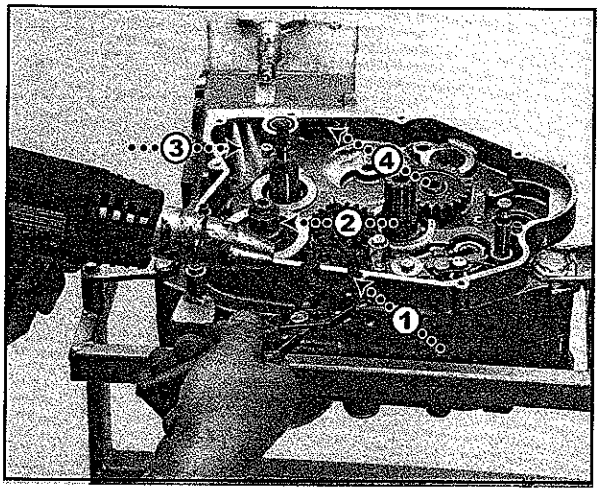


Fig. 10AE

Put the primary gear wheel (Fig. 10AF-1) onto the crankshaft, screw on the nut (Fig. 10AF-2) slightly. Turn the crankshaft to a position where the marking dots (Fig. 10AF-3) faces the balancer drive shaft. Put the balancer drive gear (Fig. 10AG-4) onto the balancer drive shaft. Before entering the woodruff key, turn the shaft so the marking dot (Fig. 10AF-5) is placed between the dots on the primary gear. Screw on the nut (Fig 10AF-6) slightly to secure the gear.

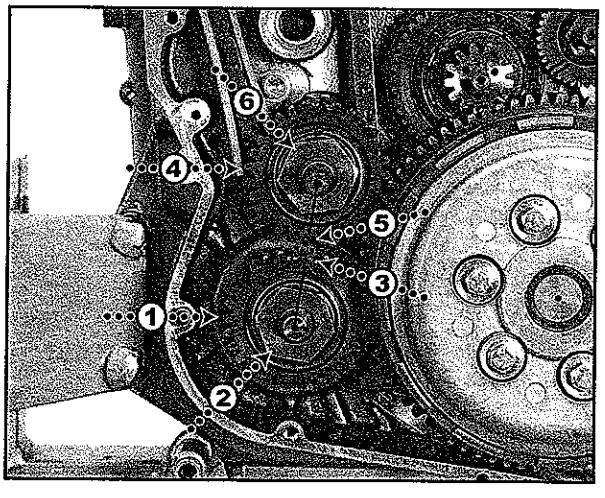


Fig. 10AF

Tighten the nut, thus pushing the primary gear wheel (Fig. 10AG-1) onto the crankshaft and into position, torque 110 Nm. Use a separate gear, or segment thereof (Fig. 10AG-2) as counterforce. Also tighten the counter balancer gearwheel (Fig. 10AG-3), torque 80 Nm.
Install the transmission cover, the kickstart lever and the gearshift lever (see Section 7A).
Install the engine into the frame.

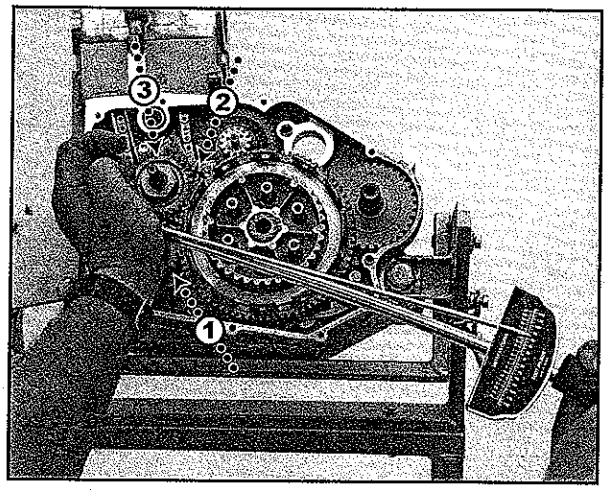
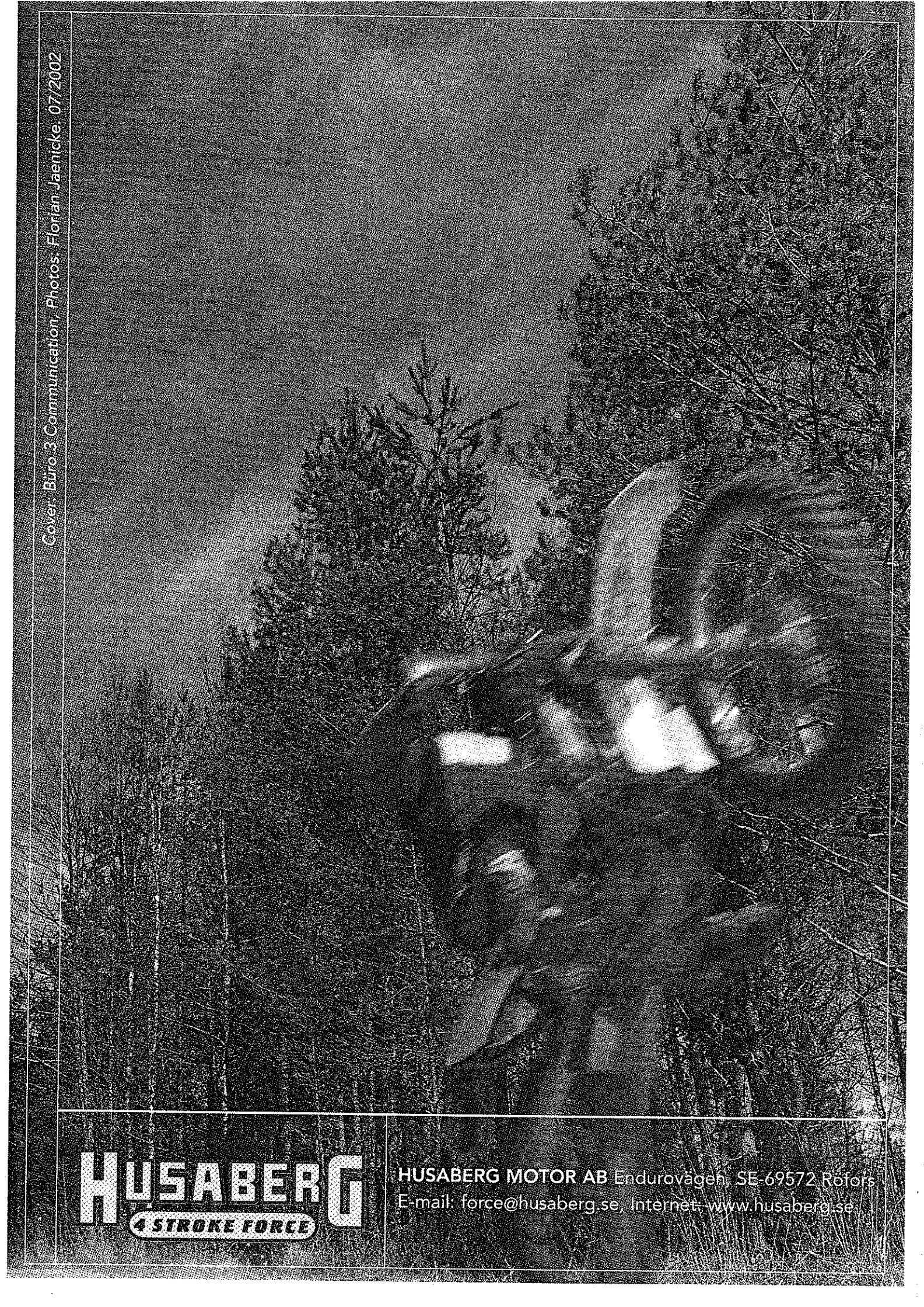


Fig. 10AG

NOTES



Cover: Büro 3 Communication, Photos: Florian Jaenicke, 07/2002

HUSABERG 4 STROKE FORCE

HUSABERG MOTOR AB Endurovägen, SE-69572 Röfors
E-mail: force@husaberg.se, Internet: www.husaberg.se